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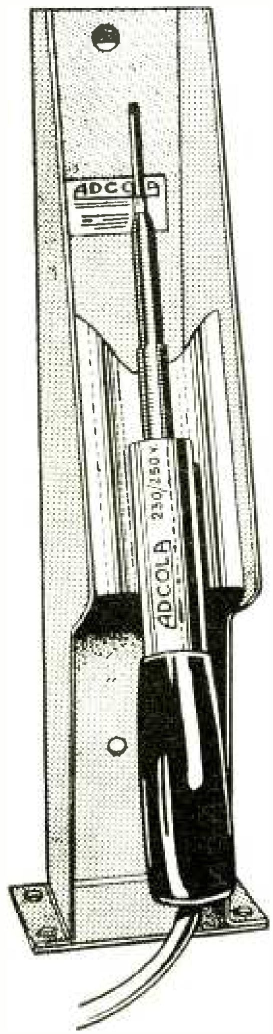

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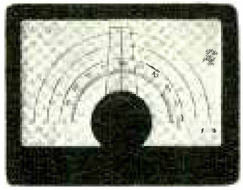

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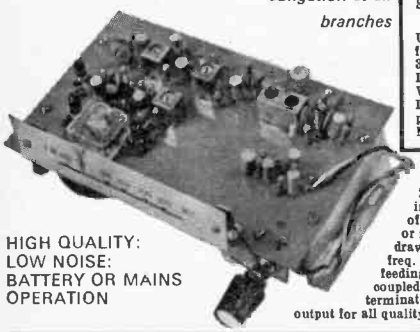

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			3in.	600ft.	8/6

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6K7G	2/8	19AQ5	5/6	EBC33	7/6	EY86	7/6	PY33	7/6	UM80	9/6
6K7GT	5/9	20D1	8/9	EBC41	9/6	EY88	8/6	PY80	5/9	UY21	8/9
6K8GT	9/6	20F2	9/6	EBC91	6/9	EZ40	7/6	PY81	5/9	UY41	7/-
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100mA (3 for 6/6) **2/9** 500mA (3 for 12/6) **5/-**

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Factory fresh less Cartridges.

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AT6 Mk.IIA **9 gns**

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(De Luxe Heavy Turntable).

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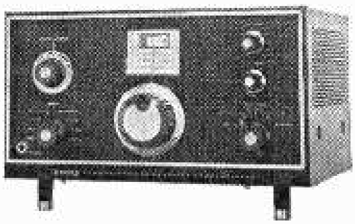
COMMUNICATION RECEIVERS

NOW AVAILABLE FOR THE FIRST TIME IN GREAT BRITAIN—TWO NEW

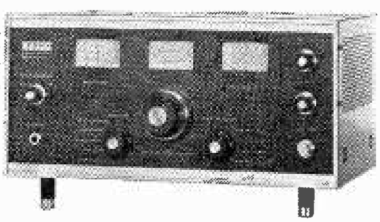
TRIO RECEIVERS



MODEL JR-500SE

This high performance receiver is made especially to cover the amateur bands and utilises a crystal controlled double heterodyne circuit for extra sensitivity and stability. Brief spec.: Covers all the amateur bands in 7 separate ranges between 3·5 and 29·7 Mc/s. Circuit uses 7 valves, 2 transistors and 5 diodes plus 8 crystals; output 8 and 500 ohm and 500 ohm phone jack. Special features: Crystal controlled oscillator ● Variable BFO ● VFO ● AVC ● ANL ● S meter ● SSB-CW ● Stand-by switch ● Special double gear dial drive with direct reading down to 1 kHz ● Remote control socket for connection to a transmitter. Audio output 1 watt. For use on 115/250 V A.C Mains. Superb modern styling and control layout—finished in dark grey. Cabinet size 7 × 13 × 10in. Weight 18 lbs. Fully guaranteed, complete with instruction manual and service data.

LASKY'S PRICE £61.19.0 Carriage and Packing 12/6.



MODEL 9R-59DE

Brief spec.: 4 band receiver covering 550 Kc/s to 30 Mc/s continuous and electrical band spread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. Special features: SSB-CW ● ANL ● Variable BFO ● S meter ● Sep. band spread dial ● IF frequency 455 Kc/s ● Audio output 1·5 W ● Variable RF and AF gain controls. For use on 115/250 V A.C. Mains. Beautifully designed control layout finished in light grey with dark grey case, size: 7 × 15 × 10in. Weight 19 lbs. Fully guaranteed, complete with instruction manual and service data.

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HUGE PURCHASE OFFER

DEFINITELY THE MOST AMAZING BARGAIN OF THE YEAR!!!

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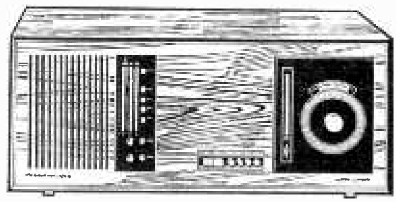

MUSIC CENTER MODEL 5001 COMBINED 126 TRACK TAPE RECORDER AND VHF/MW/LW/SW RADIO

An incomparable piece of equipment—combining 126 track tape recorder and 4 band radio in one unit of outstanding modern design. The recorder section of the Music Center gives an almost unbelievable 46 hours continuous unrepeated playing time—that's right 46 hours on 126 tracks.

Brief spec.: TAPE section: 20 transistor and 9 diode circuit, a wide magnetic tape records 126 separate tracks of 22 minutes each. Every track is able to record/replay instantly and runs from track one to 126 completely automatically so that you need not touch the machine for the total 46 hours record/replay time. Rewind time for each 22 minute track only 25 seconds. Tape speed 10·5 cm./sec. Frequency response 14–40,000 Hz. Inputs for direct recording from VHF, external microphone, record player. Pause control. RADIO/AMPLIFIER Section: 7 transistors and 6 diode circuit, 4 bands VHF/Medium/Long/Short with exclusive "Auton control" which takes over the precise tuning into the station required. Bass and Treble controls. Output 10 watts. Built-in 10in. speaker and tweeter. Sockets for extension speakers. Beautifully finished dark polished wood cabinet size 31 × 13 × 11in. Brand New, Boxed and fully guaranteed.

Lasky's huge purchase enables us to offer this amazing equipment at a fantastic saving. Value over £200.

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IDEAL FOR CLUBS, DISCOTHEQUES AND ESPECIALLY THE HI-FI ENTHUSIAST

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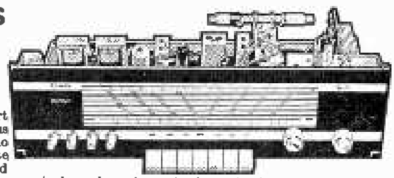

Long, medium and short wave bands coverage, plus VHF/FM multiplex. Piano key wave change, separate fly wheel tuning on AM and FM, bass, treble and balance controls, and magic eye tuning indicator. Ferrite rod aerial. The very latest printed circuitry. Output 5 watts per channel. Complete with multiplex decoder. 5 valves, line-up: ECC85, ECH801, ECC83, ELL80, EAF801. Full vision tuning scale size: 21 × 6 ins. Overall dimensions: 21 × 6½ × 8ins. Made to very highest standards.

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ALSO AVAILABLE WITHOUT MULTIPLEX £33.12.0 C. & P. 8/6.

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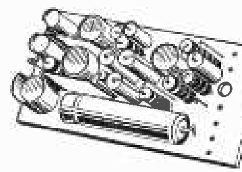

Incorporating the very latest circuitry to provide high sensitivity and good quality in conjunction with extreme small size and compactness. High quality Newmarket transistors used throughout. All designed to operate on 9v. miniature battery

Add 1/- on each for Post and Packing

TYPE LRPC 1. 3 transistor. Input sens. 50mV. Output 150mW. Output imp. 40 Ω. Size 2 × 1 × ¾in. ...... PRICE 27/6

TYPE LRPC 4. 5 transistor. Input sens. 150mV output 330mW output imp. 15 Ω. Size 2½ × 1¼ × ¾in. ...... PRICE 18/–

TYPE LRPC 5. 6 transistor. Input sens. 8mV output 3W output imp. 3 Ω. Size 5½ × 1½ × 1in. ...... PRICE 59/6

LRPC 9. High to Low input matching pre-amplifier. Input imp. 1 meg ohm output imp. 2 k/ohms. Size 1½ × 1¼ × ¾in. ...... PRICE 10/6

LRPC 10. Magnetic tape replay preamp. designed so that a 450 mH head can be matched into any of the audio amp. modules listed above. Size 2½ × 1½ × ¾in. .... PRICE 10/6

Note the **LRPC 9** and **10** are ideal for use with the **LRPC 1, 4** or **5** and are available at the reduced price of 7/6 if bought with the **LRPC 4**.

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Permeability tuned—covering 87 to 108 Mc/s. For use with one ECC85 valve. In metal case size 3 × 2½ × 1½in. Circuit supplied.

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Lasky's Radio

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 × 6½ × 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.

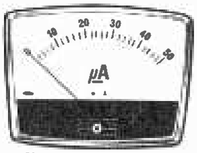
LONG WAVEBAND COVER FOR THE SKYROVER

A simple additional circuit provides coverage of the 1100/1950M. bands (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.

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 × 2½in. (illustrated)

1 mA DC	32/6	100µA	47/6
5mA DC	32/6	500µA	37/6
300 V DC	32/6	1mA S Meter	39/6

Type MK-38A 1⅝in. square

1 mA DC	22/6
5 mA DC	22/6
300V DC	22/6
100µA	29/6
500µA	27/6
1 mA S Meter	29/6

Type MK-45A 2in. square

1 mA DC	25/-
5 mA DC	25/-
300V DC	25/-
500µA	25/-
1 mA S Meter	35/-

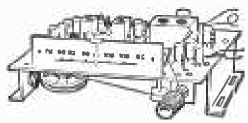
Type KR-65 3½ × 3in.

1 mA DC	36/-
5 mA DC	35/-
300 V DC	35/-
100µA	49/6
500µA	42/6
1 mA S Meter	39/6

Type MK-65A 3in. square

1 mA DC	36/-
5 mA DC	35/-
300 V DC	35/-
500µA	39/6
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 × 4 × 2½in. Operates from any 9v. D.C. source. Full data and circuit supplied.

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

MULTIPLEX ADAPTOR MODEL A1005M

Now you can enjoy stereo sound with the model A1005 FM Tuner above. Brief spec.: MPX input sensitivity 100mV. Output 150mV. Self powered by a 9v. battery. 4 transistor. and 6 diode circuit. Size 5½ × 2 × ¾in. Also suitable for use with other FM tuners with MPX input.

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PACKAGE PRICE FOR A1005 AND A1005M IF BOUGHT TOGETHER **11 GNS.** Post 5/-.

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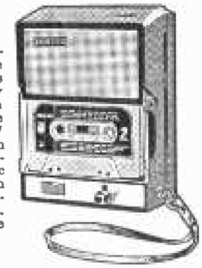
SPECIAL INTEREST ITEMS!

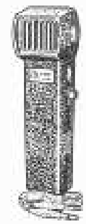
JUST ARRIVED — FANTAVOX TAPE CASSETTE PLAYER



This machine is the first of its type and is designed specifically to replay pre-recorded tape cassettes made for the PHILIPS and other cassette systems. The cassette is simply slipped into the machine and is immediately ready to play. Each cassette gives over 40 minutes play (twin track), no loss of time in rewinding—simply turn cassette over. Constant tape speed 1⅞ i.p.s. Only two controls off/play and vol. Fully transistorised, powerful vol., built in speaker, socket for personal earpiece. Operates on 6 penlight batteries. Very attractively styled shockproof plastic cabinet size 6½ × 4½ × 2in. with wrist strap. Complete with earpiece and batteries. There are now over 200 musicassette titles available: jazz, pop, shows and classics. This machine allows you to play the music of your choice anywhere—anytime.

LASKY'S PRICE **£8.19.6** Post 5/-

NEW VOICE ACTUATED MICROPHONE



MODEL B 5001

This new voice actuated microphone is designed for use with tape recorders with facilities for remote control. The microphone is fitted with a three position switch allowing normal hand remote control, voice sensitivity action and off. The degree of voice or sound level required to operate the recorder can be adjusted. The microphone is self powered by one 9V (PP3 type) battery giving 6 to 10 hrs. operating time. Super sensitive 6 transistor circuit. Strong black plastic case. Length 7½in. Designed for hand held use or lying flat. Fitted with 2·5 and 3·5 mm. plugs for fitting polarised sockets.

LASKY'S PRICE **£6.19.6** Post 3/6

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LASKY'S PRICE **£9.19.6** Post 5/-

6 × 4in. elliptical 8Ω dynamic speaker 17/6 extra—Post FREE.

SPECIAL OFFER—LOCKING CAR AERIAL Model 83003 five section 402 extension 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. Post Sep. 2/6.

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3¼in.	Triple play, 600ft. Mylar	10	0	5¾in.	Triple play, 2400ft. Mylar	45	0
4in.	Triple play, 900ft. Mylar	17	6	7in.	Standardplay, 1200ft. Acetate	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
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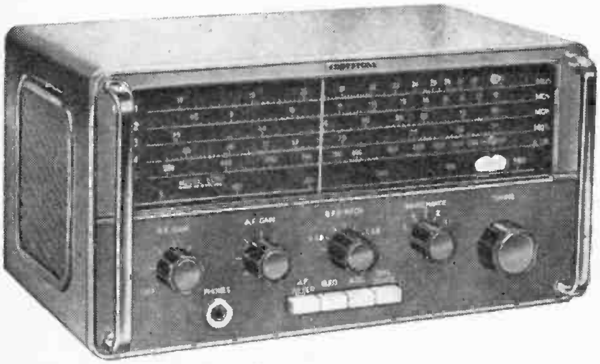

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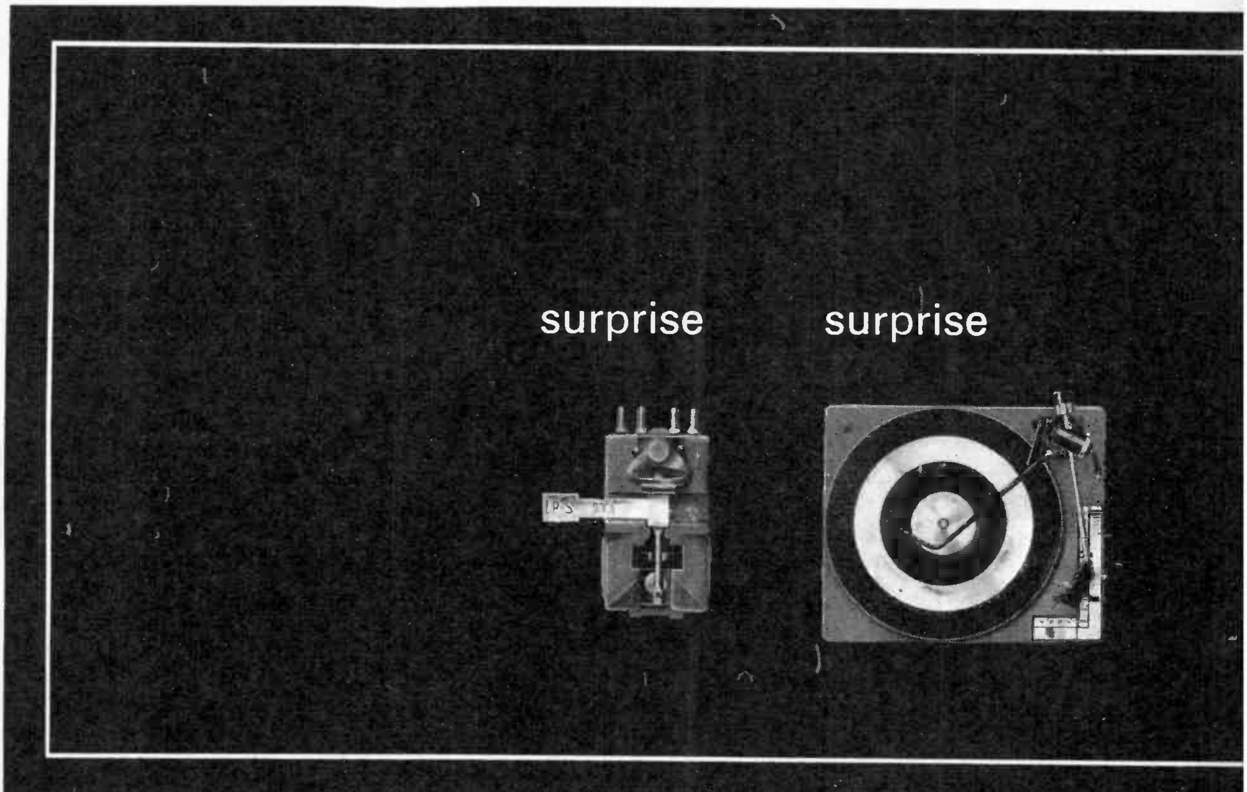

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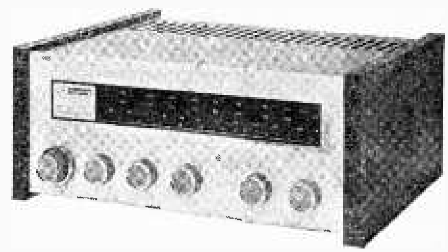

127 STEREO TUNER-AMPLIFIER (illustrated)	£40.1.6
127M MONO TUNER-AMPLIFIER	£29.18.9
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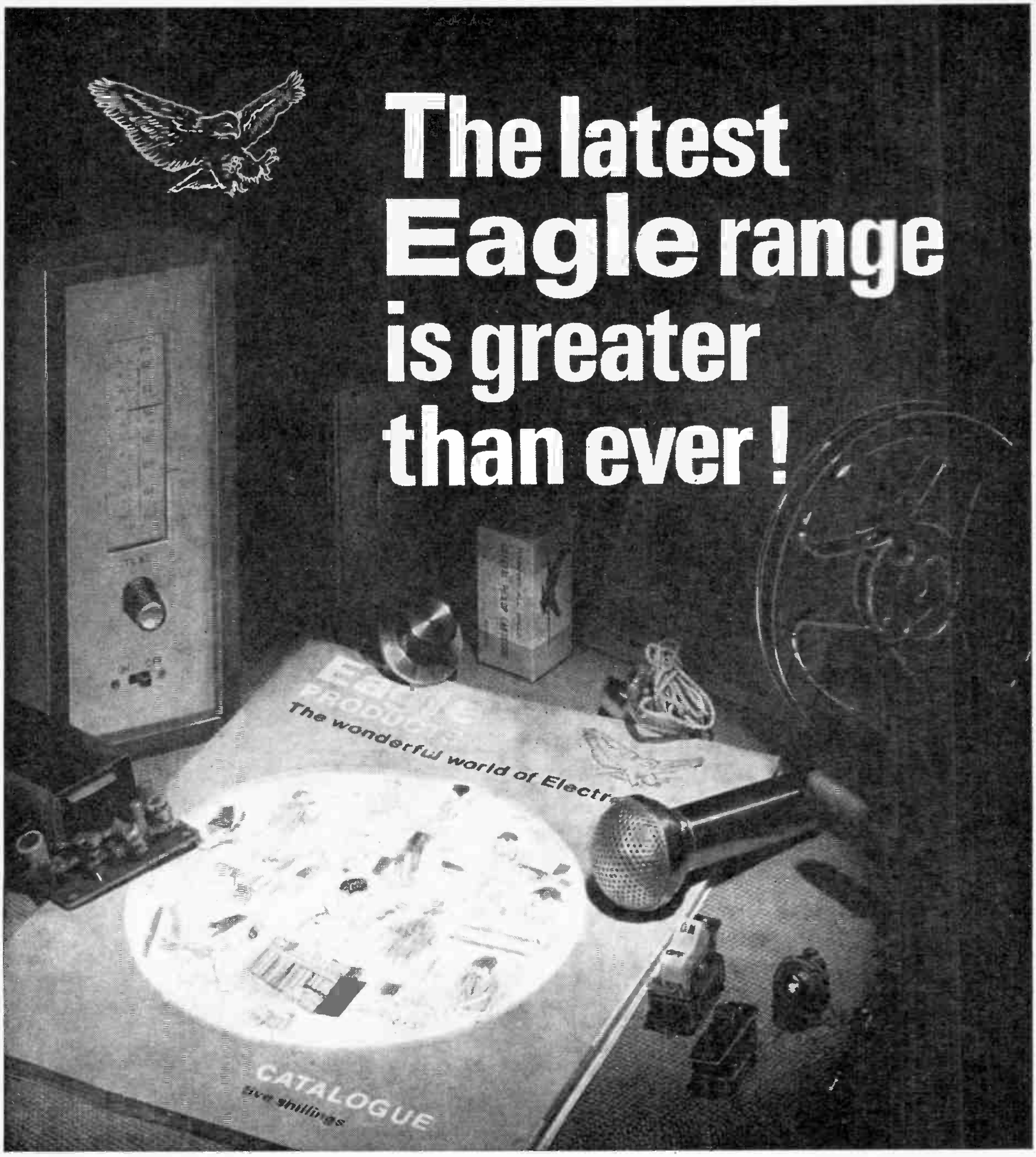
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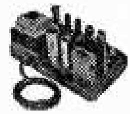
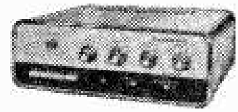


9+9W STEREO AMP. S-99



TRANSISTOR MIXER. MODEL TM-1. Four channels. Battery operated. Kit **£11.16.6.** Assembled **£16.17.6**

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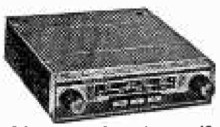

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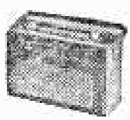
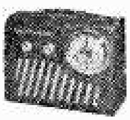


Oxford



UXR-1

"OXFORD" LUXURY PORTABLE Model UXR-2. 7 transistor, 3 diode circuit. 7″ x 4″ LS. Push button LW/LM and Tone. Specially designed for use as a domestic or personal portable receiver. Many features, including solid leather case. **Kit £14.18.0** incl. P.T.

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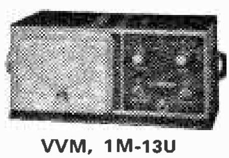
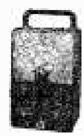


VVM, 1M-13U

DE LUXE LARGE-SCALE VALVE VOLTMETER. Model 1M-13U. Circuit and specification based on the well-known model V-7A but with many worth-while refinements, 6″ Ernest Turner meter. Unique gimbal bracket allows operation of instrument in many positions. Modern styling. **Kit £18.18.0 Assembled £26.18.0**



V-7A

VALVE VOLTMETER. Model V-7A. 7 voltage ranges d.c. volts to 1,500 A.C. to 1,500 r.m.s. and 4,000 peak to peak. Resistance 0·1Ω to 1,000MΩ with internal battery. D.C. input resistance 11MΩ. dB measurement, has centre-zero scale. Complete with test prods, leads and standardising battery. **Kit £13.18.6 Assembled £19.18.6**

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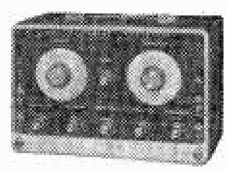


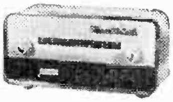
HFW-1

TV ALIGNMENT GENERATOR. Model HFW-1. Covers 3·6 Mc/s—220 Mc/s with 0-42 Mc/s max. sweep width. Stable all-electronic sweep circuit. Built-in marker oscillators—5 Mc/s crystal and 20 to 60 Mc/s variable. AGC circuit. Positive action return trace blanking. Kit **£38.18.0.** Assembled **£49.15.0.**

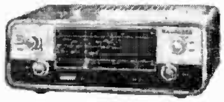
TRANSISTOR POWER SUPPLY. Model IP-20U. Up to 50V, 1·5A output Ideal for Laboratory use. Compact size. **Kit £35.8.0 Assembled £47.8.9**

Prices and specifications subject to change without notice

VALVE TUNERS



TUNERS
←FM
AM/FM→



★**HI-FI FM TUNER. Model FM-4U.** Covers 88-108 Mc/s. Flywheel tuning. Pre assembled and aligned. R.F. tuning unit (£2.15.0 incl. P.T.) with I.F. output of 10·7 Mc/s and I.F. amplifier unit, with power supply and valves (£13.13.0). For free standing or cabinet mounting. Total Kit **£16.8.0**

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★ Models available in two units for your convenience.

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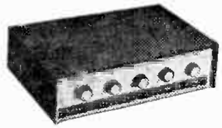
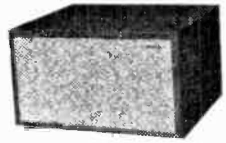


STEREO AMPLIFIER, TS-23



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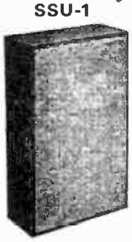
SSU-1



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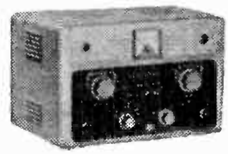

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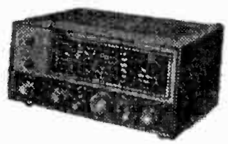

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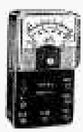

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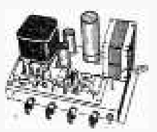

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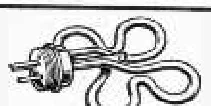

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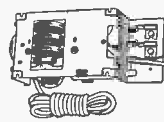

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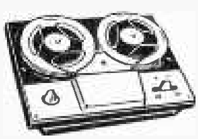

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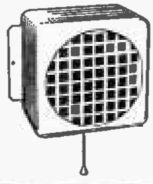

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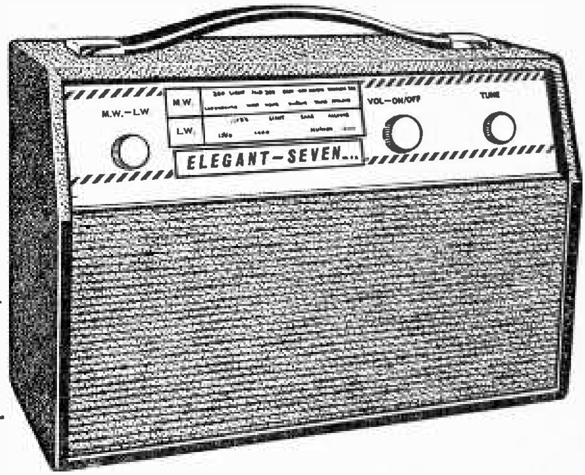

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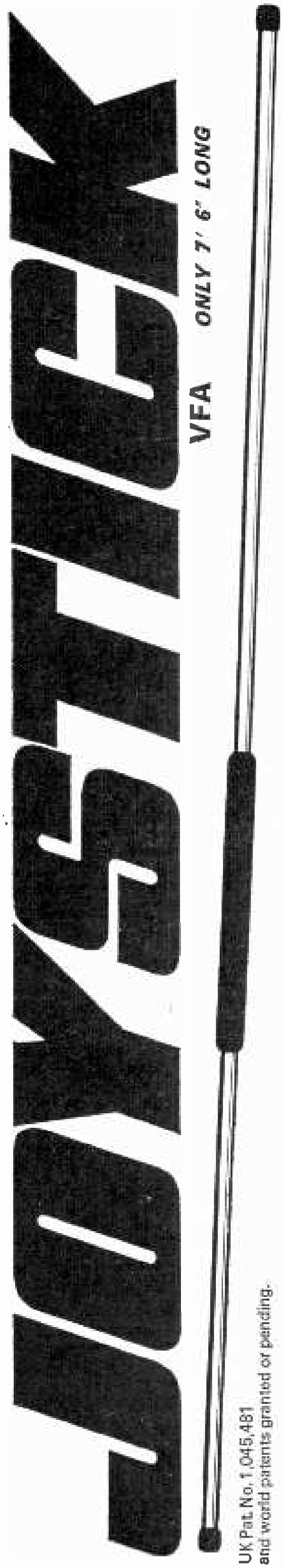

'CONTACT' THE DX'ers MAGAZINE

published by The World Communications Club of Gt. Britain,

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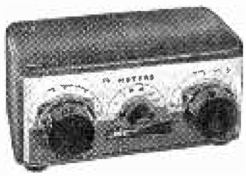
He uses a JOYSTICK V.F.A!



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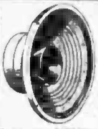
AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS



Heavy cast construction. Latest high efficiency ceramic magnets. Treated Cone surround giving low fundamental resonance. "D" indicates Tweeter Cone providing extended frequency range. Impedance 3 or 15 ohms. Response 40-18,000 c.p.s.

HF510 5in. 8 watt	49/9	HF120	12in. 15 watt	69/9
HF800D 8in. 8 watt	59/9	HF120D	12in. 15 watt	79/9
HF811D 8in. 10 watt	£4.19.9	HF126	12in. 15 watt	89/9
HF101D 10in. 15 watt	£5.19.9	HF126D	12in. 15 watt	5 gns.
		HF127D	12in. 30 watt	9 gns.

RECORD PLAYING UNITS

All types available on Credit Terms. Ready for plugging in to Amplifier or Tape Recorder.

RP2 Consisting of Garrard SP25 fitted Goldring CS90 high compliance ceramic Stereo/Mono ctrge with diamond stylus. Only plinth & cover. Normally £25. Carr. 15/- **$19\frac{1}{2}$ Gns.**

RP3 As above but with Goldring Lenco GL68 Transcription unit and CS90 Cartridge Normally over £33. Carr. 15/-. ONLY **$26\frac{1}{2}$ Gns.**

AUDIOTRINE PLINTHS

for Record Playing units. Teak finish cut for Garrard 1000, 2000, 3000, AT6 Mk 2, AT60, SP25 or Goldring GL68. Available with clear Perspex cover as illustrated. **66/-** Complete **£5.19.11**

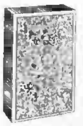
HIGH FIDELITY LOUDSPEAKER UNITS

Cabinets of latest styling Satin Teak or Walnut, acoustically lined (and ported where appropriate). Credit terms available on all units.

The DORSET Size 16 x 11 x 9in. Response 45-18,000 c.p.s. Rating 10 watts. Fitted Audiotrine HF811D speaker. Impedance 3 or 15 ohms. Carr. 9/6 **£8.19.9**

The DORCHESTER Size 24 x 15 x 10in. Fitted Audiotrine HF101D Speaker Rating 15 watts. Impedance 3 or 15 ohms. Frequency Response 30-20,000 c.p.s. Carr. 15/- **$12\frac{1}{2}$ Gns.**

The GLOUCESTER Size 25 x 16 x 10in. 12in. High flux 12,000 line speaker. Cross-over unit and Tweeter. Rating 10 watts. Smooth response 40-20,000 c.p.s. Impedance 15 ohms. Carr. 15/-. **$12\frac{1}{2}$ Gns.**

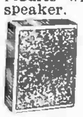


The BRONTE Size 22 x 15 x 9in. Fitted Wharfedale Super 8 RSDD or Audiotrine HF 815D Speaker, with Roll surround and dual cone, Rating 6/10 watts. Impedance 3 or 15 ohms. Carr. 16/6. **13 Gns.**

HI-FI LOUDSPEAKER ENCLOSURES

All types of pleasing modern design acoustically lined and ported and beautifully finished in light Teak or Walnut veneer. Credit terms available

JE8. Size 20 x 11 x 8in. Gives pleasing results with any 8in. Hi-Fi speaker. Carr. 7/6 **£4.19.9**



SE8. For optimum performance with any Hi-Fi 8in. speaker. Size 22 x 15 x 9in. Carr. 7/6 **£5.19.9**

SE10. For outstanding results with 10in. Hi-Fi Speaker. Size 24 x 15 x 10in. Carr. 10/- **£6.19.9**

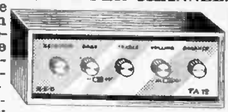
SE12. For outstanding performance with any 12in. Hi-Fi speaker. Cut for tweeter Size 25x16x10½in. **8 Gns.** Carr. 10/-

LINEAR TAPE PRE-AMPLIFIER. Type LP/1 Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback. EM84 Recording Level Indicator, Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier suitable most Tape Decks. Terms available. **$10\frac{1}{2}$ Gns.**

LINEAR SOLID STATE UNITS IN STOCK

R·S·C TA12 13 WATT STEREO AMPLIFIER

FULLY TRANSISTORISED, SOLID STATE CONSTRUCTION HIGH FIDELITY OUTPUT OF 6·5 WATTS PER CHANNEL.



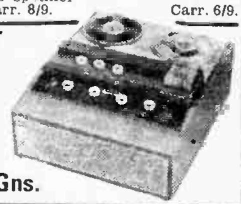
Designed for optimum performance with any crystal or ceramic Gram P.U. cartridge, Radio Tuner, Tape Recorder, 'Mike' etc. ★ 3 separate switched input sockets on each channel ★ Separate Bass and Treble controls ★ Slide Switch for mono use ★ Speaker Output—3-15 ohms ★ For 200-250v. A.C. mains ★ Frequency Response 30-20,000 c.p.s. —2dB ★ Harmonic Distortion 0·3% at 1000 c.p.s. Hum and Noise —70dB ★ Sensitivities (1) 300mV (2) 100mV (3) 100mV (4) 2mV ★ Handsome brushed silver finish Facia and Knobs. Complete kit of parts with full wiring diagrams and instructions. Factory built with 12 mth gntee 14 Gns. Or Deposit 55/- and 9 mthly. pymts. 31/-. (Total £16.14.0) Teak finished cabinet as illustrated £3.13.6. extra. **11 GNS.** Carr. 10/6

Inc. Garrard SP25 Player Unit. Fitted Goldring CS90 high compliance ceramic cartridge with diamond stylus. TA 12 Stereo Amp. Plinth and Cover and Pair of Dorset Speaker Units. Total £56. Ready to use. Or Deposit £5.3.2 and 9 mthly. pymts. £5.3.2. (Total £51.11.8) **44 Gns.** Carr. 25/-.

AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit and Tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. Or **Senior 20 watt** inc. HF126 speaker 7 Gns. Carr. 8/9. **5 Gns.** Carr. 6/9.

AUDIOTRINE HI-FI TAPE RECORDER KIT



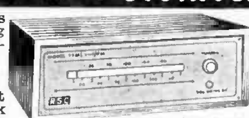
REALISM AT INCREDIBLY LOW COST: CAN BE ASSEMBLED IN AN HOUR. Please send S.A.E. for leaflet.
ONLY 4 PAIRS OF SOLDERED JOINTS PLUS MAINS. Incorporating latest Magnavox Tapedeck. High Quality Tape Amplifier with switched equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool. Reel of Best Quality Tape and handsome Portable Cabinet of latest styling, finished dark grey leathercloth. Size 14¾ x 17 x 8½in. and circuit. Purchased separately would total approx. £34. Performance equal to units in the £50-£60 class. **Deposit 4 gns.** and 9 mthly paymts 59/6 (Total 29¾ gns.) 4 Track Model 3 gns. extra. Carr. 19/6. **$26\frac{1}{2}$ Gns.**

R.S.C. TA6 6 WATT HIGH FIDELITY SOLID STATE AMPLIFIER

200-250v. AC mains operated Frequency Response 30-20,000 cps -2dB. Harmonic Distortion 0·3% at 1000 cps. Separate Bass and Treble 'lift' and 'cut' controls. 3 input sockets for Mike, Gram, Radio or Tape, Input Selector Switch. Output for 3-15 ohm speakers. Max. Sensitivity 5mV. Fully enclosed enamelled case, 9¼ x 2¾ x 5¼ins. Attractive brushed silver finish facia plate 10¼ x 3¼ins. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. Or factory built with 12 months guarantee £7.19.11. Carr. 7/6. **6 Gns.**

R.S.C. TFM1 TRANSISTORISED VHF/FM RADIO TUNER

Total cost of parts with detailed wiring diagrams & instructions. Carr. 10/- **$12\frac{1}{2}$ Gns.** Or factory built 15¾ Gns. Or in Teak finished cabinet as illustrated 19¾ Gns. Terms: Deposit £5 and 9 monthly payments 39/-. Total £22.11.0.



★High-sensitivity ★200-250v. A.C. Mains operation. ★Sharp. A.M. Rejection ★Drift-free reception. ★Output ample for any amplifier (approx. 500 m.v.). ★Simple alignment instructions. ★Output available for feeding tuning meter. ★Output for feeding Stereo Multiplexer. ★Tuner head using silicone Planar Transistors. ★Designed for standard 80 ohm co-axial input. Made to visually match our Super 15 and 30 amplifiers and of the same high standard of perform'ce and reliability. The pre-wired tuning head facilitates speed and simplicity of constrctn. Printed circuitry. Only first grade transistors and compon'ts used. A quality product at half the cost of comparable units. Stereo version Kit 19¾ Gns. Assembled **$25\frac{1}{2}$ Gns.** Carr. 10/-

R.S.C. SUPER 15 HI-FI AMPLIFIER

SOLID STATE CONSTRUCTION

SPECIFICATIONS COMPARABLE WITH UNITS AT ALMOST TWICE THE COST

FULLY TRANSISTORISED 200/250v. A.C. Mains.
OUTPUT 10 WATTS R.M.S. cont. into 15 ohms.
15 WATTS R.M.S. cont. into 3-4 ohms.
LATEST MULLARD TRANSISTORS. AD149, AD149, OC127Z, OC81Z, OC44, OC44, OC81Z OC44, AC107.
5 POSITION INPUT SELECTOR SWITCH
EQUALISATION to Standard R.I.A.A. and C.C.I.R. Characteristics for Gram and Tape Heads.
FULL TAPE MONITORING FACILITIES.
SENSITIVITIES: Magnetic P.U. 4 mV. Crystal or Ceramic P.U. 400 mV. Microphone 4.5 mV. Tape Head 2.5mV. Radio/Aux or Ceramic P.U. 110 mV.
FREQUENCY RESPONSE: ±2dB 20-20,000 c.p.s.
TREBLE CONTROL: +15dB to —14dB at 10Kc/s. **NEG FEEDBACK:** 52dB.
BASS CONTROL: +12dB to —15dB at 50 c/s. **HUM LEVEL:** —75dB.
HARMONIC DISTORTION at 10 Watts 1,000 c.p.s. 0.25%.
Complete Kit of parts with full constructional details and point to point wiring diagrams. Carr. 12/6 **$11\frac{1}{2}$ Gns.**
Supplied factory built 15¾ Gns. Carr. 12/6. Terms: Deposit 49/- and 9 monthly payments 35/- (Total £18.4.0). Or fitted in beautiful walnut or Teak veneered cabinet as illustrated. 4 Gns. extra.
ALL COMPONENTS ETC. ARE OF A HIGH STANDARD AND SUPPLIED BY LEADING BRITISH MANUFACTURERS.

R.S.C. SUPER 30 STEREO AMPLIFIER

A DUAL CHANNEL VERSION OF THE SUPER 15. Employing Twin Printed Circuits. Close tolerance Ganged Pots. Matched Components. **CROSS TALK:** —52dB at 1,000 c.p.s.
CONTROL: 5 position Input Selector. Bass Control. Treble Control. Volume Control. Balance Control. Stereo/Mono Switch. Tape Monitor Switch. Mains Switch. **INPUT SOCKETS** (Matched Pairs). (1) Magnetic P.U. (2) Ceramic or Crystal P.U. (3) Radio/Aux. (4) Tape Head/Microphone. Operation of the Input Selector Switch assures appropriate equalisation. Rigid 18 s.w.g. Chassis. Size approx. 12in. wide, 3in high and 8in. deep. Neon Panel indicator. Attractive Facia Plate and Spun Silver Matching Knobs. Above facilities, etc., except for Ganging and Balance Control, apply also to Super 15.
THESE UNITS ARE EMINENTLY SUITABLE FOR USE WITH ANY MAKE OF PICK-UP OR MICROPHONE (Crystal, Ceramic, Magnetic, Moving Coil, Ribbon). CURRENTLY AVAILABLE SUPERB SOUND OUTPUT QUALITY CAN BE OBTAINED BY USING WITH FIRST RATE ANCILLARY EQUIPMENT. All required parts, point to point wiring diagrams and detailed instructions. Carr. 15/- **19 Gns.**
Unit factory built 26¾ Gns. or deposit 83/9 and 9 monthly payments 59/3. (Total £30.17.0). Fitted cabinet as Super 15 30 Gns. Carr. 15/- or Deposit £4.15.6 and 9 monthly payments 67/- (Total £34.18.6). *Send S.A.E. for leaflet*

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MAIL ORDERS TO: 102 Henconner Lane, Bramley, Leeds 13. No C.O.D. under £1. Terms C.W.O. or C.O.D. Postage 4/6 extra under £2. 5/9 extra under £5. Trade supplied. S.A.E. with enquiries please. Hi-Fi Catalogue 4/6.
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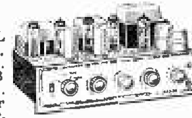
STEREO/TEN HIGH QUALITY AMPLIFIER

5 watts high quality output on each channel. Sensitivity 50 millivolts. Suitable all crystal or ceramic stereo heads. Ganged Bass and Treble Controls. Valves ECC83, (2) EL84, (2) EZ81. For 2-3 ohm speakers. Complete kit with full wiring diagrams and instructions. Or supplied factory assembled with 12 months' guarantee for 11 gns. Carr. 11/6 **£8.15.0**
Terms: Dep. 36/- and 9 monthly payments 25/- (Total £13.4.9).

R.S.C. STEREO/20 HI-FI AMPLIFIER



PROVIDING 10/14 WATT ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL. SUITABLE FOR "MIKE", GRAM. RADIO OR TAPE. (7) valves ECC83, (2) ECL86, (4) EZ81. **Frequency Response:** +2dB 30-20,000 c.p.s. **Hum Level:** 65dB down. **Sensitivity:** 20 millivolts max. **Harmonic Distortion:** 0·2%. ★**Four-position tone compensation and Input Selector Switch.** ★**Stereo/Mono switch.** ★**Neon panel indicator.** ★**Handsome Perspex Frontplate.** ★**Separate Bass "Lift" and "Cut" controls.** Output transformers are high-quality sectionally wound. Outputs for 3 and 15 ohm speakers. Complete set of parts, point-to-point wiring diagrams and instructions. Or factory assembled with our usual 12 months guarantee 19 gns. Or Deposit £3 and 9 monthly payments 43/2 (Total £22.8.6). *Send S.A.E. for leaflet.* Carr. 12/6. **14 Gns.**

R.S.C. 4/5 watt A5 HIGH GAIN AMPLIFIER

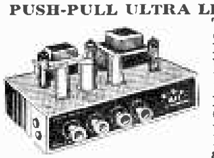
A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Suitable for all crystal or ceramic P.U. heads and practically all "mikes". Separate Bass and Treble controls. Hum level 71dB down. Negative Feedback 15dB. Reserve power supply 300v 25 m.a., 6.3v. 1.5a for Radio Tuner etc. For A.C. mains 200-250v. Speaker output 3 ohms. Complete Kit with point-to-point wiring diagrams and instructions. **£4.17.9**
Or assembled ready for use 6 gns, plus 5/9 carr.

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. Hum level —70dB. Frequency response ±3dB 30-20.000c/s. Sectionally wound output transformer. 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. Supplied factory built with EL34 output valves. 12 months guarantee for 15 gns. Twin-handled perforated cover 25/-. Send s.a.e. for leaflet. **TERMS: Deposit 48/-** and 9 monthly payments of 33/7 (Total £17.10.3). **12 Gns.** Carr. 12/6

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 allowing mixing of "mike" and gram. etc., etc. High sensitivity. Valves ECC83, ECC83, EL84, EL84, EZ81. High quality sectionally wound output transformer 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** 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 3 and 15 ohm speakers. Full instructions and point-to-point wiring diagrams (or factory built £11.15.0). Metal cover with 2 handles available for 25/-. **TERMS ON ASSEMBLED UNITS** Deposit 36/6 and 9 monthly payments of 25/9 (Total £13.8.3). Send S.A.E. for leaflet. **£8.15.0** Carr. 11/6
R.S.C. A11T TRANSISTORISED VERSION of above complete kit 9 gns. Carriage 9/6.

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.

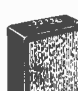
★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION consisting of a FANE HIGH FLUX 12in. 30 watt unit PLUS a FANE 12in. 20 watt unit with extended frequency response.
★ 4 Jack inputs and two Volume Controls for simultaneous use of up to 4 pick-ups or "mikes". ★ Cabinets covered in two-tone Rexine/Vynair with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

49½ Gns. 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.
Carr. 30/- Or dep. £7.17.6 and 9 mthly pymts 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. and 9 monthly payments of 43/7 **19½ Gns.** Carr. 15/- (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. Extra Heavy Duty Speakers. **99 Gns.** Carr. £3

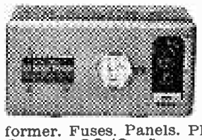
SELENIUM RECTIFIERS F.W. (Bridged)

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.

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.

R.S.C. 6/12v. CAR BATTERY CHARGERS



Kits consist of Enamelled steel case, Ammeter, Rectifier. Transformer. Fuses. Panels. Plugs and Leads.
2 amp 39/9, 4 amp. with variable charge rate sel. **49/9**
6 amp heavy duty with variable charge rate sel. **69/9**
All types 200-250 A.C. mains. Ready built 10/- extra.

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**

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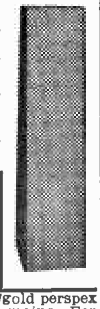
New branches now open—see addresses

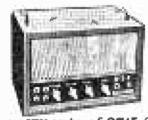
R.S.C. COLUMN SPEAKERS



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 C412, 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).

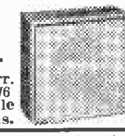
30 WATT HI-FI AMPLIFIER

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



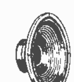
In teak veneered cabinets.
10 Watt Model. Gauss 12,000 lines. 3 or 15 ohms. Carr. 7/6 **5 Gns.**
20 Watt Model. 15 ohm. Size 18x18x10in. Gauss 12,000 lines. **8 Gns.** Carr. 10/6
Rexine covered £1 extra. **Terms available**
30 Watt Model. Rexine covered **10 Gns.**

LOUDSPEAKERS

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

12in. 20 watt DUAL CONE Heavy Duty **£5.11.9** Carr. 6/9
12in. HEAVY DUTY 30 watts 7 GNS. Carr. 10/- Normally £13 approx.
15in. EXTRA HEAVY DUTY 40 watts 12 GNS. Carr. 15/-
Massive units. Gauss 17,000 lines. Usually **18 Gns.**

FANE 'POP' 100 18" 100 Watt



Post Free **19 Gns.**
Extra heavy duty speaker. Fantastic power handling. Guaranteed 2 years.

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**

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.**

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R.S.C. MAINS TRANSFORMERS

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

MIDGET CLAMPED TYPE 2½ × 2½ × 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.

PRACTICAL WIRELESS

VOL 43 NO 8
issue 730

DECEMBER 1967

TOPIC OF THE MONTH

Amateur Radio Exhibition

IN HIS opening address at the R.S.G.B. International Radio Engineering and Communications Exhibition at the Royal Horticultural Society's New Hall on September 27, Dr. J. A. Saxton touched on several points which have an important bearing on all who have made amateur radio their hobby.

Dr. Saxton, in recalling that amateur radio has been dubbed "the greatest of scientific hobbies", commented that many of the exhibits made by amateurs were of a standard of which even professionals would be proud. He also stated that amateurs continue to contribute towards many achievements, one of the strengths of the movement and a guarantee of a fresh look at many problems. For let it be remembered that the amateur is not always so aware in his "ignorance" about the "impossible", but merely attempts to solve a problem in his own way, unimpaired by facts and figures which might hinder the more professional approach.

He went on to express pleasure at the international aspects of amateur radio and how enthusiasts are keeping up to date with advancing techniques, thus making a valuable contribution to radio engineering and research. He cited in particular the extensive investigations during the IQSY programme, the R.S.G.B. v.h.f. beacon service (which is used not only by amateurs but by professional organisations) and the investigations being made to follow the lead of American amateurs in producing their own satellite.

He concluded that it was important for amateurs everywhere to foster and develop this kind of experimental enquiring kind of activity and we would go all the way with him in this sentiment. For while most P.W. readers regard amateur radio as a personal, stimulating and relaxing hobby, the interchange of ideas, contacts with other enthusiasts and new lines of experiment are the ingredients which will lend added purpose and ultimately strengthen our mutual interests.

Furthur details and photographs of the R.S.G.B. Exhibition are given in our News and Comment section on page 564.

W. N. STEVENS—*Editor*

NEWS AND COMMENT

CONSTRUCTIONAL

OTHER FEATURES

JANUARY ISSUE WILL BE PUBLISHED ON DECEMBER 8th

NEWS AND COMMENT...

R.S.G.B. EXHIBITION

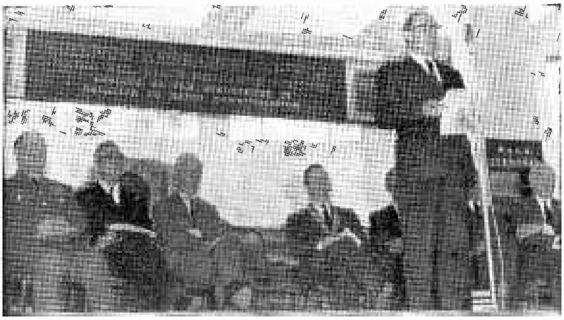


Photo by permission of Radio and Space Research Station

At the International Radio Engineering and Communications Exhibition at the Royal Horticultural New Hall, Westminster, London, SW1, on September 27–30, 1967, the central feature was the Radio and Space Research display by the Science Research Council. This exhibit demonstrated studies of the atmosphere in relation to radio communications, the effect of the lower atmosphere was illustrated by a working model of a microwave refractometer. There was also a model of the new 25-metre diameter steerable aerial recently commissioned at Chilbolton in Hampshire which is being used to study radio propagation of radio waves through space and the earth's atmosphere.

Dr. J. A. Saxton, Director of the Radio and Space Research Station, opened the Exhibition at 12 noon on Wednesday, September 27th together with other Government and Armed Services officers who also supported the exhibition. (See picture above).

The General Post Office, Royal Signals, Royal Navy and Royal Air Force displayed their latest equipment and working test equipment for today's services.

Colour television was displayed by Bush Radio.

Manufacturers of communication short-wave receivers and transmitters from several countries showed the latest models with s.s.b. and v.h f. and a wide range of aerials, components and test gear.

Demonstrations of transmitting and receiving television and experimental equipment, a Radio Teleprinter station, and mobile equipment were working daily.

Below is a view of the PRACTICAL WIRELESS stand.

RADIO 1, 2, 3 AND 4—AN EXPLANATION

Revolution came to BBC radio recently. From now on it's Radio 1, Radio 2, Radio 3 and Radio 4.

The Light Programme divides into two stations. Radio 1 on 247 metres medium wave is the new pop music network. Radio 2 is the Light as it used to be, but joining Radio 1 at certain times. It's on 1500 metres long wave.

Radio 3 (464 metres and 194 metres) is the new title for the Third Programme and the Music Programme. Radio 4 is the new title for the Home Service.

With the exception of Radio 1, all the networks can also be heard on v.h.f.

THE BAKER "MAJOR MODULE"

The "Major Module" is the latest loudspeaker design by Baker Reproducers Ltd.

Its use is not limited to home hi-fi, it has a maximum power rating of 20 watts and is therefore ideal for theatres, halls, schools, discotheques, etc.

The unit comprises a 12in. Baker "Major" loudspeaker and a high efficiency tweeter, both mounted on a wooden baffle, size 19 x 12½in. ready for housing in any convenient enclosure or conversion of existing cabinets, furniture, etc. The 12in. "Major" speaker has a bass resonance of 40—50c/s., and overall response of 30–17,000 c/s. The built-in concentric centre cone maintains the necessary balance between bass, middle and treble to produce faithfully your favourite music.

Complete kit is £10 19s. 6d. or fully assembled and £12 10s. post free.

BRITISH SCIENTIFIC ACHIEVEMENTS EXHIBITION

The Marconi Company, with a view to expanding its Eastern European markets, was showing a variety of data transmission equipment and microelectronic components at the British Scientific and Technological Achievements Exhibition, which opened in Warsaw on Saturday, October 7th. Marconi has previously sold Marconidata data transmission equipment in Czechoslovakia, and plans demonstrations for Hungary, Rumania and Bulgaria.

The exhibition was held to illustrate a number of themes, selected largely by the Polish authorities. Marconi were represented in two of them; Data Transmission and Planar Techniques. In the Data Transmission section the Company provided a working demonstration of the direct transmission of medium speed data over telephone lines, using the Marconidata H6010 series.

In the Planar Techniques section the Company showed a 16mm. colour film of the process involved in its own production of silicon microcircuits. In addition, the predominantly technical audience were able to inspect such microcircuits in detail, through a Marconi binocular microscope.

NEWS AND COMMENT...

LATEST EDDYSTONE BROADCAST RECEIVER

The latest Eddystone broadcast receiver, Model EB36, is now in full production at the Birmingham works of Eddystone Radio. Fully transistorised, this receiver covers Range 1, 8·5Mc/s to 22Mc/s; Range 2, 3·5Mc/s to 8·5Mc/s; Range 3, 1·5Mc/s to 3·5Mc/s; Range 4, 550kc/s to 1500kc/s; Range 5, 150kc/s to 350kc/s.

For 15dB signal-to-noise ratio, sensitivity is better than 5 microvolts on ranges 1 to 3, and better than 15 microvolts on ranges 4 and 5.

The bandwidth is 5kc/s at the 6dB points and 25kc/s at the 40dB points.

The image rejection is approximately 50dB at 2Mc/s and 15dB at 18Mc/s. Breakthrough at the i.f. of 465kc/s is at least 85dB down on ranges 1 to 3 and greater than 65dB down on ranges 4 and 5. Audio output is up to 750mW.

The price of the EB36 (ex works) is £45. In the UK, purchase tax brings this to £54 5s. 7d.

Photograph shows finished receiver during final testing, before leaving the Eddystone Works in Birmingham.

CALLING ALL DX-ERS

BBC World Radio Club, a weekly 15-minute programme, began in the BBC World Service on July 1st, and within three weeks it had over 1,000 members. Membership is open to anyone who writes in. But as the producer John Pitman says, "If you want to have a real stake in the programme, why not write a letter to tell us how to run it". From October, World Radio Club is broadcast in the BBC World Service on Saturdays at 0745 GMT, Mondays at 0245 GMT, and Tuesdays at 1245 GMT. In addition it is broadcast in the North American Service for the first time; in October on Thursdays at 1615 GMT, and in November and December at 1715 GMT.

World Radio Club helps the listener to improve reception, suggests the best sort of equipment, talks about the world of radio communication, and contains regular news for DX-ers and an invitation to DX-ers in other countries to submit tapes of their experiences. With the BBC's technical resources behind it, it is able to cover a wide field. Recent topics have included the BBC's Monitoring Service, the BBC Relay Station at Ascension Island, the implications of sunspots, maximum, forecasts of propagation conditions, a series on aerials ranging from the simple to the sophisticated.

GUIDE TO BETTER R.F. COMMUNICATIONS DESIGNS

Motorola's Semiconductor Products Division has compiled a new, comprehensive R.F. Circuit Design Library booklet containing actual circuit design and testing information from Motorola's r.f. applications engineering staff. The 150-page volume includes 10 authoritative applications, notes describing the use of basic techniques for r.f. design, plus specific r.f. applications useful to the communications circuit designer.

Besides application information, the handy guide book also includes "highlight specifications" for Motorola r.f. amplifier transistors (germanium and silicon—both large and small signal devices) to assist the r.f. circuit design engineer in selecting the proper device for every application.

Some of the topics covered in this "all-in-one" r.f. communications guide include, "What's and Why's about Y-Parameters", "Systemising R.F. Power Design", "R.F. Small Signal Design Using Admittance Parameters", and "A 50 Watt, 50Mc/s Solid-State Transmitter".

The convenient loose-leaf binding makes the addition of new r.f. design materials both easy and practical.

The R.F. Circuit Design Library is available from Motorola Semiconductor Products Inc., York House, Empire Way, Wembley, Middlesex.

R.S.G.B. NATIONAL MOBILE RALLY

By permission of His Grace the Duke of Bedford, the 1967 R.S.G.B. National Mobile Rally was held at Woburn Abbey on September 10th. There was the usual car park with the wonderfully fascinating array of whip aerials.

Talk-in stations were GB2VHF and GB3RS on 2m, 4m and 160m, and the Radio Amateur Emergency Network had their time cut out manning a station in a beautifully equipped caravan which doubled up as a "mobile shack".

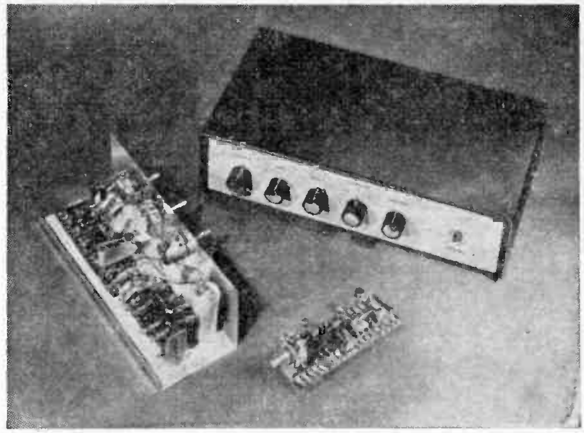
There were the usual bargain-tents there and many people walked away with a great assortment of equipment really feeling that their visit had been made worth while.

Once again this year, XYL's, YL's and the kids were able to amuse themselves with the facilities offered at Woburn, with the Woburn Safari Service and the fairground, etc.

The picture shows one of the bargain stands at the Rally.

ADAPTABLE LOW COST hi-fi SYSTEM

COVER SUBJECT



W. CAMERON **PART 1**

THE amplifier described here has been developed around low cost transistors. It has a useful one watt output in its basic form, or used as a driver can provide up to 15 watts from the power amplifier described later.

Construction has been made as simple as possible, so some of the finer points of rather complicated HI-FI systems have been avoided, whilst retaining the main considerations of excellent frequency and transient response, low distortion and correct matching.

All of the components are standard and readily obtainable. Construction is made on tag-board to obviate the necessity of a printed circuit, and to make building as straightforward as possible.

The circuit is based on the now almost standard arrangement of transformerless output from a complementary pair of transistors. Transistors specified are supplied as a package consisting of a driver transistor and matched pnp and npn output transistors.

Other transistors which are near equivalents may be used, but some resistor values may have to be altered to secure optimum performance to obtain freedom from crossover distortion. This may be difficult, unless the facility of an audio generator and oscilloscope is available.

The amplifier in constructed in three stages. The first is the basic amplifier which on its own will be found extremely useful as a general purpose amplifier. It can be powered from a supply of 9V to 12V (battery or mains) and is designed to feed into a loudspeaker load of 10 to 15 ohms.

The frequency response is within 3dB over the range 30c/s to 50kc/s.

The output power is nominally 1 watt with a 12V supply, being 1·2 watts into a 10 ohm load and 900mW into 15 ohms. Determining output power with transformerless output stages will be discussed later.

The second stage of construction adds a preamplifier stage and tone controls, discusses input and impedance considerations, and completes the 1 watt version of the amplifier.

The final stage shows how the amplifier can be used as a driver, and adds a pair of power transistors to provide an output of 5 or 15 watts into speaker loads of 15 or 3 ohms respectively.

Methods of determining power output are con-

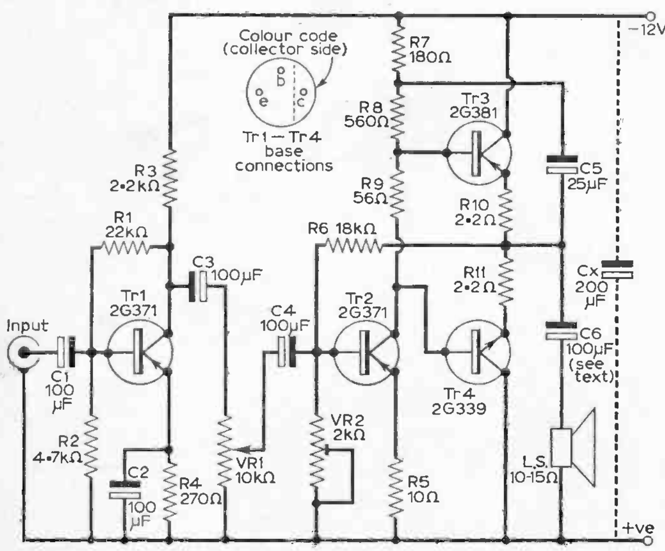


Fig. 1 (left): Circuit diagram of the basic amplifier. Cx is required when a battery is used to provide the power supply.

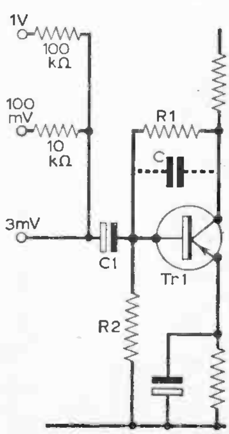


Fig. 2 (right): Resistors in series with the input give a choice of input impedance and sensitivity. Tone correction can be effected by shunting R1 with a capacitor C.

sidered and a mains power supply unit will be described.

BASIC AMPLIFIER

This unit is a complete amplifier in its own right.

The input impedance is approximately 350 ohms and sensitivity for full output is 3mV rms, which makes it suitable for direct connection to a low impedance microphone or magnetic pick-up, with an impedance of 350 ohms or less.

The input impedance can be raised by inserting a resistor in series with the input. The value of resistor added to the input impedance will then determine the resulting input impedance, and will also reduce the sensitivity by the same ratio. By this means it can be fed from a tuner or other device intended to feed into 10kΩ to 100kΩ, and with an output of 100mV to 1 volt rms (Fig. 2).

A crystal pick-up may be connected to the 100kΩ input with some loss of bass although this can be improved by shunting R1 (22kΩ) with a capacitor of 2000—3000pF. With a high output crystal a higher value of series resistor may have to be used, to prevent overloading the first stage.

The first stage Tr1 has considerable negative feedback applied from collector to base via R1. This is necessary to maintain high quality at all volume control settings, as varying the control presents a varying load to the collector of Tr1 due to the low base impedance of Tr2.

The preset control VR2 is to set the centre voltage, i.e. the voltage at the junction of R10 and R11, to half the l.t. If the constructor does not possess a voltmeter, VR2 should be replaced with a fixed resistor of 1·5kΩ, with perhaps a small loss in maximum output from the amplifier.

R8 is the collector load of Tr2. It is returned via C5 to the emitters of Tr3 and Tr4, and thus the a.c. signal is applied between the base and emitter of each output transistor. Without it degeneration would be present, considerably reducing the gain of the output transistors, and hence the audio output. R6 provides base bias for Tr2 and also d.c. and a.c. feedback.

The resistor R9 is small enough compared to R8 to have negligible effect on the load resistor, but provides a small voltage difference between bases to bias the output transistors correctly and prevent crossover distortion.

The loudspeaker is isolated from d.c. by the coupling capacitor C6. The value of C6 really depends on how good the loudspeaker is.

With a speaker of the type used in ordinary domestic equipment 100μF is sufficient. On the other hand, if the constructor is fortunate enough to possess a high quality speaker with a response down to 20 or 30c/s C6 should be 1,000μF, as with this value the amplifier response is only 3dB down at 30c/s, compared to 10dB down with 100μF.

★ components list

Resistors:

R1	22kΩ	R7	180Ω
R2	4·7kΩ	R8	560Ω
R3	2·2kΩ	R9	56Ω
R4	270Ω	R10	2·2Ω
R5	10Ω	R11	2·2Ω
R6	18kΩ	All 10% ½W.	

Capacitors:

C1	100μF	C5	25μF
C2	100μF	C6	100–1000μF (see text)
C3	100μF		
C4	100μF	CX	200μF

All 12V min. working electrolytics

Semiconductors:

		near equivalents
Tr1	2G371	OC71, AC155
Tr2	2G371	OC71, AC155
Tr3	2G381	OC81, AC154
Tr4	2G339	AC127, AC157

Miscellaneous:
VR1 10kΩ log, VR2 2kΩ skeleton preset, 18 way group panel, connecting wire, sleeving, etc.

CONSTRUCTION AND TESTING

The actual construction needs little comment. All soldered joints should be perfect. There must be no suspicion of "dry" or high resistance joints.

When construction is completed, it is most advisable to check every component connection. A single mistake in the driver or output sections could very easily destroy one or both output transistors.

Connect a 15 ohm speaker to the amplifier output and set VR2 to about two thirds toward maximum (so that about 1.5kΩ is in circuit). Connect the supply leads in the correct polarity to a 9 volt battery. With a voltmeter connected between positive

—continued on page 614

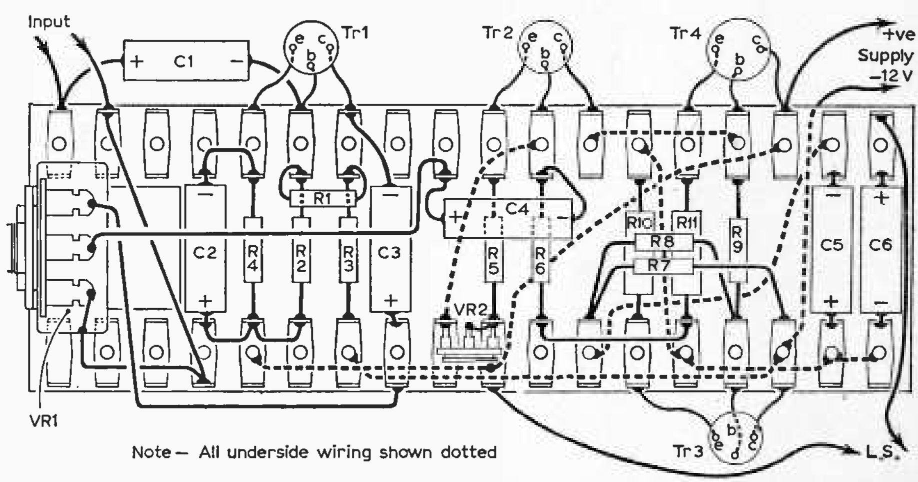
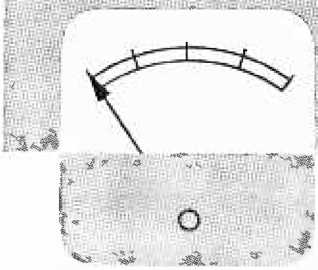


Fig. 3: Basic amplifier wiring on the group panel.



MOVING COIL METERS
AND THEIR REPAIR

J. LAW

A TEST meter is a must with all radio constructors and the price ranges and types available are legion. The old faithfuls Avo and Taylor are still perhaps the most popular but European and Japanese meters have in recent years become available at very reasonable prices and ex-Service meters can still be bought cheaply.

All test meters can be relatively easily damaged, both electrically and mechanically. What engineer has not at some time or other dropped a meter accidentally, or overloaded it and winced as the pointer banged against the stop pin? Fortunately a damaged meter can usually be repaired given a steady hand and good eyesight. An understanding of how a meter works helps in diagnosing the trouble.

The popular voltage and current meters used by radio constructors incorporate a moving-coil unit. This is basically a coil of fine wire suspended in end bearings and secured fore and aft by coiled balance springs. The coil is in a magnetic field and supports a pointer as shown in Fig. 1. Current passing through the coil reacts with the magnetic field and the coil rotates. The deflection is proportional to the strength of the current and the pointer traverses a calibrated scale giving a reading according to the range being measured.

Voltage ranges are determined by adding resistors in series with the coil; current ranges by paralleling resistors across the coil. Resistance can be measured by adding a battery in series with the coil and a resistor of sufficient value to move the pointer to the end of the scale when the test leads are shorted together.

Note that irrespective of whether voltage, current or resistance is being read in the scale *it is the current passing through the coil which operates the meter.* Each type of meter requires a specified current to deflect the pointer fully across the scale.

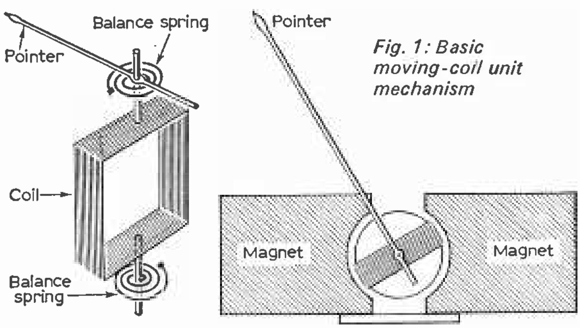


Fig. 1: Basic moving-coil unit mechanism

Connections to coil taken through balance springs

Coil suspended in magnetic field

This current, which gives full scale deflection (f.s.d.), is a measure of the quality of the meter. A cheap meter may require 1mA to give f.s.d. whilst an Avo Minor takes only 0·1mA and the Avo Model 8 only 50μA. Thus the better meters consume less power in use. F.S.D. on the lowest current range coincides with the consumption figure. The lowest range on the Avo Minor is 0·1mA and that on the Avo Model 8 50μA. It is this figure which determines the resistor values for the different ranges in a meter. Fig. 2 shows a typical meter circuit.

MECHANICAL FAULTS

Mechanical damage is usually the result of dropping the meter. The case may fracture, the glass break or loosen in its mounting, the pointer bend or, in extreme cases, the coil spring connections break or the pivots jump out of their bearings. The only tools required are a selection of tweezers, preferably non-magnetic, jeweller's screwdrivers and watch glass, small pointed pliers, a fine sewing needle, some pointed matchsticks and a soldering iron. It is essential to keep the movement clear of metal filings and absolute cleanliness is necessary. Work on a clean sheet of white paper and have a few shallow containers for screws etc.

To check a suspect meter hold it under a good light and rock it so that the pointer moves across the scale and returns to the rest position. This will check the freedom of the pointer, the balance of the bearings and the hair springs. If the action is jerky or sluggish there is clearly a mechanical fault present. To take the movement out of the case remove the securing screws around the side or

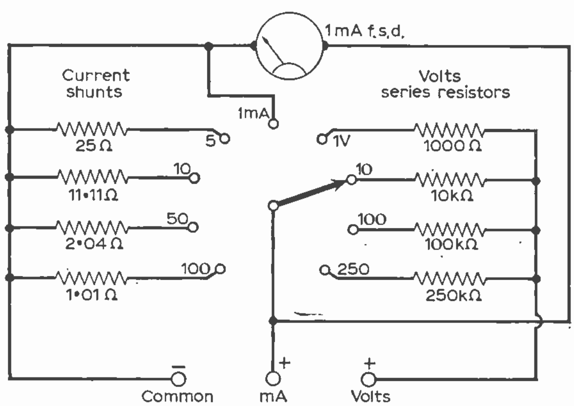


Fig. 2: Typical meter circuit using 1mA f.s.d. unit.

bottom. One may be buried under the maker's wax seal. Ensure that all the tiny screws are placed in a safe container.

After removal any damage to the case can be repaired with Araldite. A loose glass can foul the pointer; it should be removed, the frame scraped clean and the glass secured with Evo-Stik. Check the zero adjusting knob and ensure that the stop pin is in place. If loose it can be stuck with Evo-Stik also. If missing it can be replaced with a piece of copper wire.

Having taken the movement from its case check the pointer freedom by blowing gently across it. If still catching it may be fouling the scale plate. The pointer is made of thin aluminium and is very fragile. It can be worked gently with tweezers to raise it free of the scale. If bent sideways as a result of an overload care must be taken not to over-correct the bend or the pointer may break off. Should this happen a satisfactory substitute can be made from a nylon brush bristle. This must be thin enough not to obscure too great a width on the scale but stiff enough not to flex. Evo-Stik will secure the bristle to the pointer support.

If clear of the scale plate check the pointer movement again. It should move freely to the far stop pin and return smoothly to rest. Occasionally a pointer fouls the scale because of excessive slackness in the pivot bearings. The pivots move in cups like a watch balance wheel and these can be screwed up to allow for wear. A fine jeweller's screwdriver will tighten them. It is not essential for the pivots to be a tight fit in the bearings—only sufficient to ensure smooth movement of the pointer.

Dropping a meter can result in fouling of the turns in the balance springs. Inspection with the watch-maker's glass will confirm this fault. Usually gentle manipulation with a fine needle will result in the coils dropping into their correct position again. If the fall has caused the end of a spring to break away from its anchor point it can be re-soldered. For this operation speed is essential as prolonged heat will destroy the temper of the spring. Six turns of 12s.w.g. copper wire would around the bit of the soldering iron will give a bit small enough for this delicate job. Ensure that the iron gets really hot and use low melting point solder. Clean the end of the spring and the anchor point with Thawpit, dab a minute spot of flux on both surfaces, gently position the end of the spring with tweezers and apply the iron and solder swiftly. Three hands are a help!

Before reassembly into the case check the condition of the ohms battery: if in doubt replace it. Inspect the spring contacts for corrosion. Brasso will remove any and a spot of electrolube grease will protect them for the future. Electrolube on the switch contacts will obviate high-resistance contacts, which can be troublesome on the low ranges. Ensure that the zero setting knob functions—the pin sits in the cut-out in the pointer base.

ELECTRICAL FAULTS

Electrical breakdown in a meter is usually the result of overloading. Expensive meters like the Avo Model 8 and 9 have overload cut-out devices which protect the movement. Others have fuses in the low ranges, but the cheaper meters have no protection. Having removed the movement from its case check for fuses (wishful thinking). Signs of overload damage include the smell of burnt shellac or Bakelite, blackened or broken resistors or shunt coils, distorted balance springs or even a burnt out coil. Serious damage requires the return of the meter to the makers for professional attention.

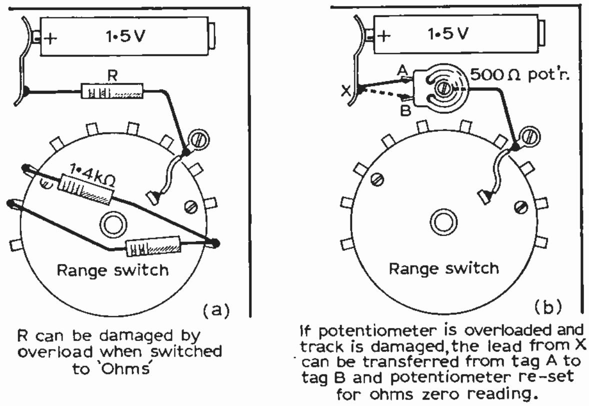
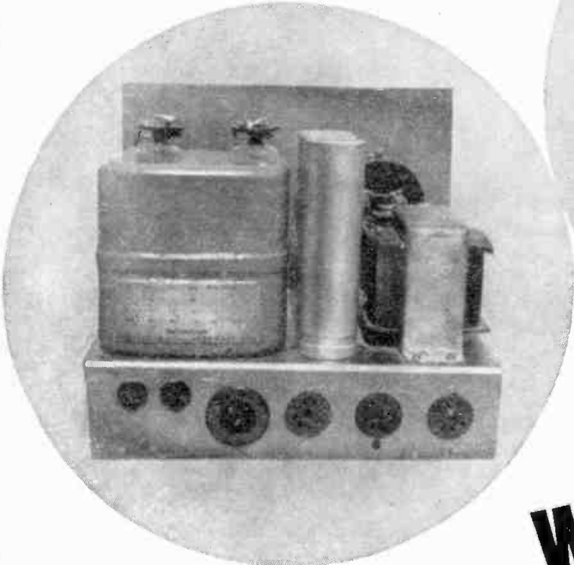


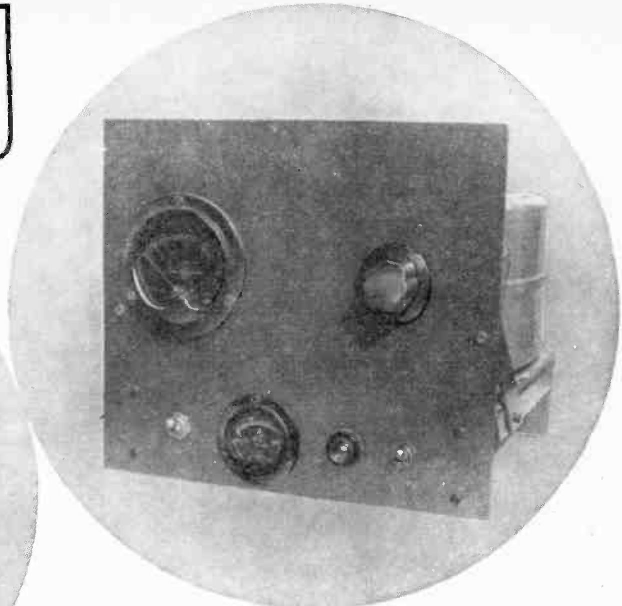
Fig. 3: Avo Minor layout. (a) Location of R; (b) replacing R.

If, however, the damage is clearly a burnt out resistor this can be replaced. The original value may be obliterated but can often be deduced. First ascertain the range the meter was switched to when the damage occurred. As a practical example assume the meter to be the popular Avo Minor. If switched to the ohms range and accidentally connected to the h.t. supply the resistor shown in Fig. 3 (a) will burn out. Given a circuit diagram, of course, its value can soon be determined. A careful study of the layout and switching would also enable the value to be ascertained, but it can be deduced by simple trial and error. Remove the damaged resistor and mark the terminal points with nail varnish for future identification. Join the meter leads together, check that it is still switched to ohms and bridge the marked terminal points with a high resistor, say 10kΩ. A minute movement of the pointer will be seen. Now try a 1kΩ resistor; the pointer will move farther across the scale. 500Ω takes it beyond the centre and with a 100Ω resistor the pointer just about reaches zero. Thus the required value is around 100Ω. A preset 500Ω miniature potentiometer can be used to replace the damaged resistor and adjusted to give the exact value required, i.e. to give zero reading on the ohms range. One incidental advantage of using a potentiometer of this value instead of around 100Ω is that if the same accident occurs again the lead can be transferred from the fixed terminal in use to the vacant one and the rotor reset as in Fig. 3 (b). Two replacements for the price of one!

Many of the ex-Service meters still available are good value for money but must be carefully checked before purchase. They may have been in bulk storage for years or damaged in service and patched up or even scrapped as beyond repair. The pivots and bearings may be corroded with age, resulting in a rough movement. Internal batteries can leak and spread corrosion over the unit. If the price is right, however, there are still bargains about; but if the meter is defective be sure you can put it right before parting with your money. The information given above should help. ■

GENERAL PURPOSE PSU





WITH AUTO CUT-OUT

N. S. NEWELL

A GENERAL purpose stabilised power supply is an invaluable asset not only for the serious experimenter, but also the active amateur constructor who may not wish to build a separate power supply for each unit.

The unit to be described was built by the author for all his valve equipment and may be used with anything from a small one valve receiver to a 60W transmitter. Regulated and unregulated outputs are available and an automatic cut-out device included in the ground line dispenses with the need to replace fuses each time an overload current or short circuited output occurs.

No specialised components are used in the construction and spares from the "junk box" may most readily be pressed into service. If every item is bought new, the total cost would be approximately £15. However, the author constructed his supply for a mere £5 and this included buying mains transformer, relay, meter movements and choke.

Circuit Description

A conventional full wave rectifier (Fig. 1) gives a smoothed but unregulated output voltage which is fed on to the anodes of V2 and V3 connected in parallel. These valves are acting as cathode followers and having a high GM consequently have a low output impedance. This is approximately $= \frac{m}{Gm}$ (where m is the gain and is close to unity).

Specifications:

H.T. output voltage	550V unregulated; 200V-430V variable regulated
Maximum output current	200mA
Minimum current to operate cut-out	230mA
L.T. supplies	6.3V at 6A
Output impedance	Less than 1Ω

Stabilisation is achieved by including a d.c. amplifier V4 fed from the cathodes of V2 and V3. The anode of V4 is directly connected through parasitic stopper resistors to the control grid of V2 and V3 and hence the voltage across the load resistor R11 will be the bias voltage for the series valves. The stabilising circuit works as follows.

A certain proportion of the voltage across C2 appears across V2 and V3. The remainder appears at the output terminals and is dropped through the external load. If an increasing load is applied (i.e. more current is drawn) the voltage at terminal 4 will tend to fall causing a rise in potential across V2 and V3. However, a resistor chain formed by R7, R8, R9 and R10 connected across the output sets the bias on the d.c. amplifier, and since the cathode of V4 is held at a steady potential by V5, any change in the output voltage will affect the bias of the d.c. amplifier. This change in the bias conditions will be amplified by V4 and a corresponding change will appear at V4 anode. This change will also appear on the control grids of V2 and V3 causing these valves to conduct more and hence return their voltage drop to normal. This in turn causes the output voltage to return to normal. A decreasing load also causes the same chain of events in a negative sense and so stabilisation of the output voltage is achieved.

The 30Ω resistor R1 in the ground line was chosen for the relay shunt, as, for an overload current of 230mA, the volt drop across it would be the minimum firing voltage of the relay. The paralleling effect of the relay coil which was 1kΩ may be neglected. When the relay fires it does two things. First it disconnects the ground line and secondly it switches its coil on to a 47kΩ (R2) resistor which provides sufficient current to remain in the ON condition. A quick switch on and off at the mains switch will return conditions to normal once again providing the fault is removed or rectified.

If a different relay is used a new value of hold on resistance may be required and this may be calculated as follows:—

$$\underset{(k\Omega)}{\text{R hold on}} = \frac{\text{Voltage of unstabilised supply (V)}}{\text{relay minimum hold-on current (mA)}}$$

This gives a maximum value for R and it is advisable to use a slightly lower value than this. Fig. 4 shows a method of determining the relays minimum firing voltage and hold-on current. The 10kΩ resistor should be set to maximum and gradually decreased. When the lamp lights the value of V_{RL} should be noted and hence knowing the resistance of the relay coil I_{RL} may be calculated

$$\text{thus } I_{RL} = \frac{V_{RL}\,(\text{min})}{R\,(\text{coil})}.$$

These are simple Ohm's Law calculations and should cause no difficulty.

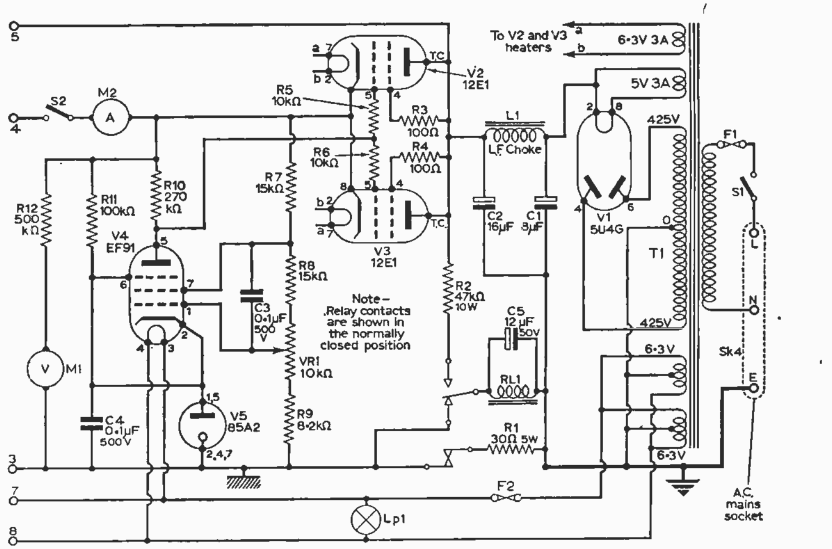


Fig. 1: Complete circuit of the stabilised power unit.

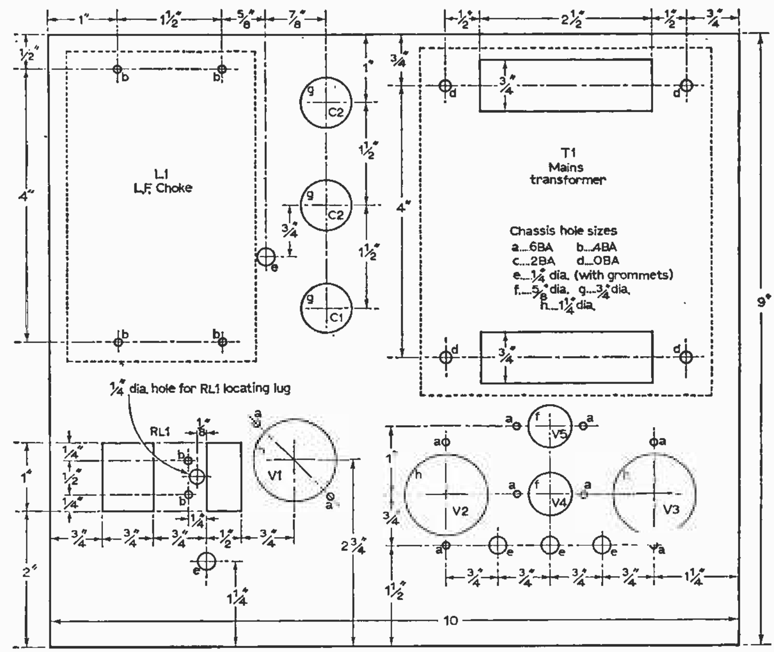


Fig. 2: Above-chassis view and drilling dimensions.

Construction and Testing

The chassis will be required to be rigid and strong and nothing less than 16s.w.g. aluminium or 18s.w.g. steel will do. The mains transformer is mounted first, the appropriate holes having first been drilled and filed to shape. Having mounted the transformer, preferably with the terminals underneath the chassis other large components may be fitted, holes being drilled to suit.

The valveholder holes are made using chassis punches or by drilling a series of small holes along the inside periphery of the hole circumference and punching out.

All wiring should be direct and kept as close to the chassis as possible. Pairs of wires or cables carrying alternating current should be twisted together to minimise mains hum.

The parasitic stopper resistors R5 and R6 should be wired as close to the valve holder pins.

The only test applicable to this type of unit providing all is working properly, is that to determine the output impedance and this may be done as follows:

A variable load resistor capable of carrying up to 250mA at 300V is placed across the output ter-

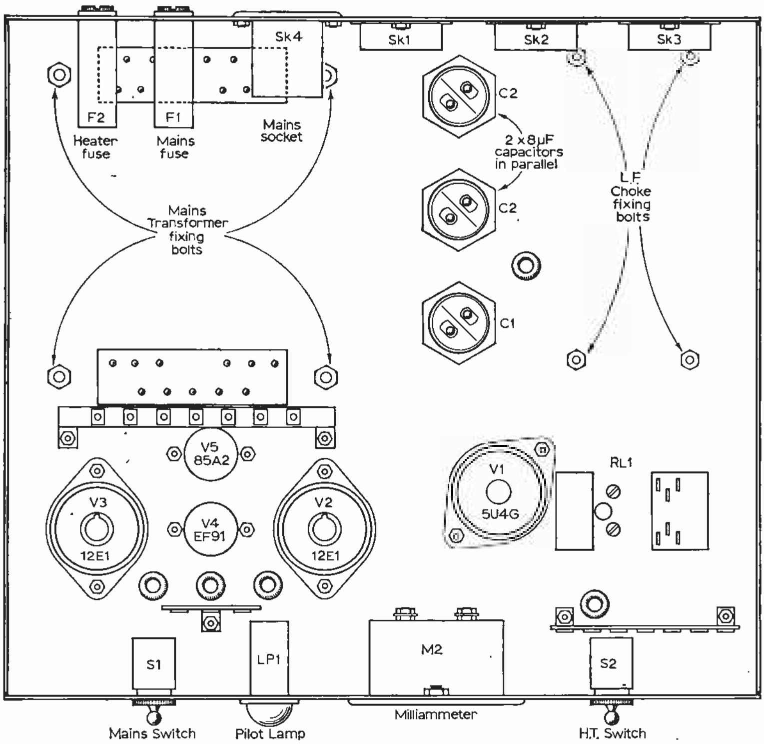


Fig. 3: Under-chassis component layout.

minals at one output socket and adjusted to maximum resistance. The unit is switched on and allowed to warm up. The voltage is then set to 300V and the voltmeter reading noted along with the current drawn from the supply. The output is switched off and the voltmeter reading again noted thus:—

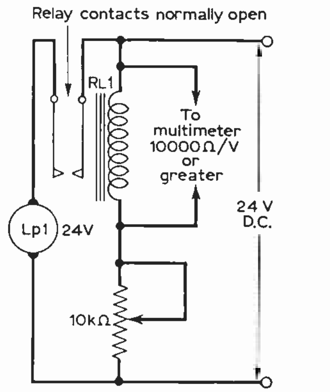


Fig. 4: Method for determining relay firing voltage.

Output impedance

$$(M) = \frac{\text{Difference in voltmeter readings}}{\text{current drawn by load (amps)}}$$

This test may be carried out at different load currents and different voltage settings and an average taken.

Having found the output impedance all that remains is to test the effectiveness of the cut-out. This may be done by varying the load resistor and reducing its value until the cut-out fires, thus the current indicated on the ammeter just before the cut-out operated will be the cut-out firing current. This may be adjusted to suit by suitable value of R1.

★ components list

Resistors: (all 10% tolerance)

R1	30Ω 5W	R9	8·2kΩ 2W
R2	47kΩ 10W	R10	270kΩ 1W
R3	100Ω 1W	R11	100kΩ 1W
R4	100Ω 1W	R12	Multiplier resistor for M1. This is 500kΩ 1W for f.s.d. of 1mA.
R5	10kΩ ¼W		
R6	10kΩ ¼W		
R7	15kΩ 2W		
R8	15kΩ 2W		
VR1	10kΩ w.w. 2W		

Capacitors:

C1	8μF 600V paper
C2	2 x 8μF 600V electrolytic (connected in parallel)
C3	0·1μF 500V paper
C4	0·1μ F 500V paper
C5	12μF 50V paper

Valves:

V1	5U4G
V2	12E1
V3	12E1
V4	EF91
V5	85A2

Transformers:

T1 450—0—450V 200mA, 6·3V 3A, 6·3V 3A, 6·3V 4A, 5V 3A

Inductors:

L1 10H 250mA choke

Meters:

M1 0—1mA f.s.d.
M2 0—300mA f.s.d.

Miscellaneous:

RL1 P.O. Relay 24V 1000Ω, 2 change-over contacts or similar; S1 s.p.s.t. on-off; S2 s.p.s.t. on-off; F1 2A fuse and holder; F2 10A fuse and holder; Lp1 6·3V 0·1A dial lamp and holder, etc. ■

practically wireless commentary by HENRY

No. 39

Everything is Relative

A FRIEND described a family bust-up caused by his enthusiastic account of an archeological "dig". Apparently, his dear Aunt disbelieved, on religious grounds, in the existence of anything B.C. Talk of radium measurement, atomic "half-life" or any scientific method of proof simply bounced off the closed door of Auntie's mind, and my friend, who likes all his T's crossed nearly had his eyes dotted into the bargain.

Nearly had his eyes dotted

How would Auntie have dealt, we wonder, with Mr. H. J. Hofman, who recently described a few worm-like fossilised objects found when a new road was being blasted north of Lake Huron, in Canada? The geological survey dated them some 2.000 million years old.

Which is something of a turn-up for the *Rhysonetron**, for the previous record for metazoa was some 700 million years. Next time your bus is twenty minutes late, think of *that* time-gap.

Nearer our watching brief, but still in the controversial world of relative matters is the question of the sonic boom. With an allergy to aircraft that dates back to the time a burly Sergeant pushed him from one in the belief that technical types attached to infantry battalions should learn the hard way, Henry watches "progress" with a wary eye. But some of the arguments make one wonder just what constitutes a noise nuisance.

To the ham searching the 15-metre band for an elusive DX signal, the hash from a neighbour's hair-dryer is more annoying than a psychedelic love-in at the local discotheque.

Silence itself is relative. Peter Black described silence as being *"measurable by the small noises that can be heard in it"*. Whether it is a dripping tap in the wee small hours, a transistor radio on the beach or a concert-goer's cough, it is not the *amount* of noise but the character of the sound and its timing that causes the bother,

Professor Gavreau of the Electro-Acoustical Laboratory of the French National Centre for Scientific Research has been investigating *infra-sound*, those frequencies just below the audible limit: e.g., the feeling of an organ pedal-note that trembles around us without actually being heard.

Anyone who has been jolted out of a clinch on the boat-deck when an ocean liner's siren sounded knows the feeling of low-frequency blast. Professor Gavreau built a giant siren and fed it from a compressed-air hose and very nearly put his whole staff in hospital on the first test! *"All of us were sick for hours,"* he explained. *"Everything in us was vibrating—stomach, heart, lungs. People in the other laboratories were sick too. They were very angry"*.

The Professor went on to develop a 78-ft. organ pipe giving off sounds down to 3½c/s. The most dangerous was 7c/s.

As one might have guessed, this march of progress is being turned to military ends. They are working on a whistle 18 feet across the mouth, mounted on a truck, with

A dripping tap in the wee small hours

a fan turned by an aero-engine. This should give 10,000 acoustic watts.

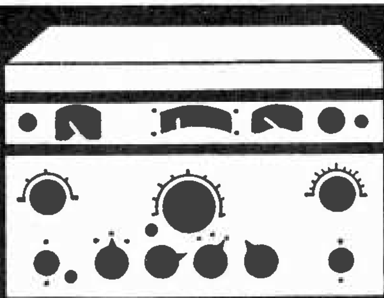
"Should give. . ." The trouble is that they are afraid to test it, for this particular death-ray which would kill a man five miles away would do as much for its operator. So they are working on a means of focusing by propagating complementary sound-waves backwards, cancelling out the danger frequencies and protecting anyone in the rear.

Which brings us back to Peter Black. He argues that *"noise should be turned off at source. Isn't all noise formed by sound waves? And aren't they all different frequencies? Then why can't we have some gadget excluding the jets and letting in the bees?"*

There is an idea here. If Prof. Gavreau can turn his sound waves inside out to cancel their lethal effect, could not something be done with a cancellation baffle on the exhaust of an aero-engine? Noise-cancellation is not startlingly new and one circuit in a video tape recorder takes the noise peaks from a waveform, inverts them, delays the original signal minutely and feeds the inverted noise back in the right proportion to cancel the original.

Oh, the relative nuisance of noise! *"What's that you said? Lovely music? Sorry, can't hear you for the horrible row the band is making."*

**The word means "a wrinkled spindle". This column is nothing if not educational.*



GUIDE TO SURPLUS COMMUNICATIONS RECEIVERS

K. ADKINS

PART 5

The R206

This receiver has some features in common with the R107, including size and weight. The latter has made it rather unpopular. It was probably first manufactured about twenty years ago. It has a fine specification.

The R206 covers 550kc/s-30Mc/s in six turret switched ranges. It contains 11 valves, including a separate oscillator stage and b.f.o. The i.f. bandwidth has three switched positions of 700c/s, 2·5kc/s or 8kc/s. There is also a 900c/s filter switch. The circuit includes a transient interference limiter.

There is a two speed, backlash free tuning control, and also a fine oscillator vernier tuning control. Other controls are: frequency range selector, aerial trimmer, l.f. gain, h.f. gain, a.g.c. switch and b.f.o. control. Sockets are provided for aerial, earth, muting, and headphone and line outputs. The overall size is 25in. x 13in. x 13½in.

The set requires an external power supply. The power unit (normally available with the set) operates from 100 to 250V a.c. or 12V d.c., and includes a loudspeaker.

Modifications: The set does not require modification, but an "S" meter would be a useful addition.

Availability: A very limited quantity of these receivers, condition unknown, were available in 1960, at £29 10s., with power unit. In late 1961, another batch of the Mk. 2 appeared in grade 2 condition at £25, including power unit. They were available for approximately one year, and by the end of 1962 the price had been reduced to £16, although the last few may have been in inferior condition.

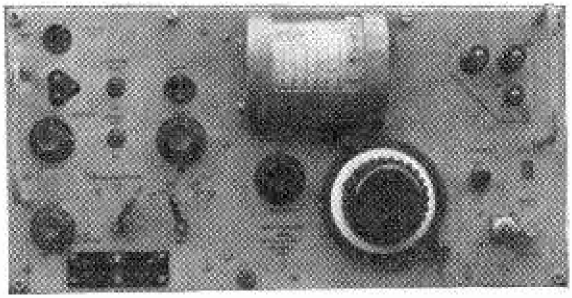
In 1963 another release of the R206 Mk. 2 in grade 2 condition was made, again at £25, inclusive of power unit. These lasted about a year, and the price was reduced to £20 10s. in mid-1964. None have been released since, as far as can be ascertained. It is believed that R206 manuals are unobtainable.

The R208

The R208 is a little known receiver, and is not easily obtainable. It covers 10—60Mc/s in two bands. The circuit includes one r.f. stage and a b.f.o. The i.f. is 2Mc/s. It has 6 valves: 2 of 6K8G, 2 of EF39, 1 7Q6G, and 6V6G.

A 6½in. speaker is built in, and a phone jack is provided. It has a Muirhead reduction drive.

An a.c. mains power unit is built into the set, and also a 6-volt vibrator pack. Metal rectifiers are a feature of the a.c. power unit. The set is completely self-contained.



R208. Photograph by courtesy of Messrs. A J Thompson

Modifications: The main disadvantage is the wide bandwidth, making it unsuitable for serious listening. This is a result of the high i.f., and unfortunately there is nothing that can be done about this, apart from adding a "Q"-fiver (i.e., an amplifier of lower intermediate frequency after the 2Mc/s, thus converting the receiver into a double superhet, although it is not known whether this has been previously attempted with the R208. If the owner is contemplating carrying out this modification then it would probably be worthwhile replacing the front end with a miniature valve (or adding a pre-selector), and adding an "S" meter.

As it would be a long process to bring the specification of their receiver up to an acceptable standard it is impossible to recommend this receiver to the serious user, particularly in view of its size and weight.

Availability: Some R208's were available before 1960. In 1960, a limited number in grade 2 condition were on sale for about £8. Since then, none have been available, although it may be possible to obtain one secondhand. R208 manuals probably exist in small numbers.

The R209

The R209 was manufactured for the British Army, and is of quite recent design. It has certain physical similarities with the R216. It has been released in small quantities, and has a good specification although it is not well known. It covers from 1—20Mc/s, and will receive a.m., f.m., and c.w. signals. There are 10 miniature valves, and the set is hermetically

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		1-0-1mA	22/6	500mA	22/6	300V D.C.	22/6
		1mA	22/6	750mA	22/6	500V D.C.	22/6
		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
50μA	32/6	20mA	22/6	3V D.C.	22/6	150V A.C.	22/6
100μA	29/6	50mA	22/6	10V D.C.	22/6	300V A.C.	22/6
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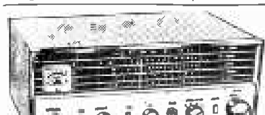
HAM-1, 4 BAND COMMUNICATION RECEIVER



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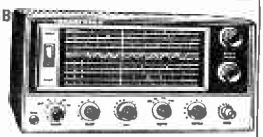
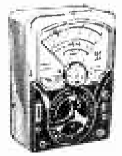
NEW LAFAYETTE MODEL HA-700 AM/CW/SSB AMATEUR COMMUNICATION RECEIVER



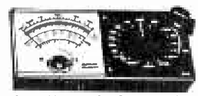
8 valves, 5 bands incorporating 2 MECHANICAL FILTERS for exceptional selectivity and sensitivity. Frequency coverage on 5 bands 150–400 Kc/s., 550–1,600 Kc/s., 1·6–4·0 Mc/s., 4·8–14·5 Mc/s., 10·5–30 Mc/s. Circuit incorporates R.F. stage, aerial trimmer, noise limiter, B.F.O., product detector, electrical bandspread, S meter, slide rule dial. Output for phones, low to 2 KΩ or speaker 4 or 8 ohms. Operation 220/240 volt A.C. Size 7⅞in. × 15in. × 10in. Supplied brand new and guaranteed with handbook 36 GNS. Carr. 10/-. S.A.E. for leaflet.

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



NEW MODEL 500. 30,000 o.p.v. With overload protection, mirror scale 0/·5/1/2·5/10/25/100/250/500/1,000v. D.C. 0/2·5/10/25/100/250/500/1,000v. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60K/6 Meg./60 Meg. Ω. £8/17/6. Post Paid.

PROFESSIONAL 20,000 o.p.v. LAB. TYPE MULTITESTER



With automatic overload protection, mirror scale. Ranges: 1/10/50/250/500/1,000 volts. D.C. and A.C. 0–500 μA, 10 mA, 250 mA. Current: 0/20K, 200K, 2 megohm. Decibels: —20 to +22dB. £5/10/0. P. & P. 2/6.

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6in. full view meter. 2 colour scale. 0/2·5/10/250/1,000/5,000v. A.C. 0/25/12·5/10/50/250/1,000/5,000v. D.C. 0/50μA/110/100/500 mA 10 amp. D.C. 20K/200K/20 Megohm. £12/19/6. P. & P. 5/-.

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It has the fullest capacity for checking on A, B and Ico. Equally adaptable for checking diodes, etc. Spec.: A: 0·7–0·9967. B: 5–200, Ico: 0·50 microamps 0–5mA. Resistance for diode 200 Ω – 1 Meg. Supplied complete with instructions, battery and leads. £5.19.6. P. & P. 2/6.

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6 TRANSISTOR HIGH QUALITY TUNER, SIZE ONLY 6in. × 4in. × 2½in. 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. £6/10/0. P. & P. 2/6.

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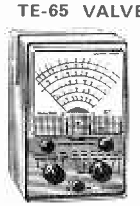
Model 22 P.S.U. 0–15v. D.C. £14. Model 30 Audio Generator 10 c/s–100 Kc/s £19/10/0. Model 31 R.F. Generator 150 Kc/s.–350 Mc/s. £12/10/0. Model 27 Signal Generator 150 Kc/s. –350 Mc/s. £10/10/0. Model 62 C.R. Bridge £9. Model 66 Inductance Bridge £18. Model 61 P.S.U. 0·5–15v. D.C. £6/10/0.

TE-65 VALVE VOLTMETER



High quality instrument with 28 ranges. D.C. volts 1·5–1,500v. A.C. volts 1·5–1,500v. Resistance up to 1,000 megohms. 220/240v. A.C. operation. Complete with probe and instructions, £15. P. & P. 6/-. Additional Probes available: R.F. 35/- H.V. 42/6.

TYPE 13A DOUBLE BEAM OSCILLOSCOPE BARGAINS!

A high quality instrument, offered at a fraction of original cost. Timebase 2 c/s–750 kc/s. Separate Y1 and Y2 amplifiers up to 5·5 Mc/s. Built-in calibrators at 100 kc/s and 1 mc. Operation for 115/250v. A.C. Available in excellent condition, fully tested and checked £22/10/0. Carr. 30/-.

TE-20RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s—260 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator. Operation 200/240v. A.C. Brand new with instructions £12/10/0. P. & P. 7/6. S.A.E. for details.

LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYSER

2 P.F. – 2,000 MFD. 2 ohms 200 megohms. Also checks impedance turns ratio, insulation, 200/250 v. A.C. Brand New £15. Carr. 7/6.

TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20 c.p.s. to 200 kc/s on 4 bands. Square: 20 cps to 30 kc/s. Output impedance 5,000 ohms, 200/250 v. A.C. Supplied brand new and guaranteed with instruction manula and leads, £15. Carr. 7/6.

ARF-100 COMBINED AF-RF SIGNAL GENERATOR

AF. SINE WAVE 20 – 200,000 cps. Square wave 20–30,000 cps. O/P. **HIGH IMP.** 21 v. P/P 600Ω 3·8 v. P/P. TF. 100 kc/s–300 Mc/s. Variable R.F. attenuation Int/Ext. Modulation. Incorporates dual purpose meter to monitor AF output and % mod. on R.F. 220/240v. A.C. £27/10/0. Carr. 7/6.

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1,000 v. P.I.V. 5 amp	7/6
400 v. P.I.V. 6 amp	5/6
400 v. P.I.V. 8 amp	7/6
1,000 v. P.I.V. 650mA	6/6
800 v. P.I.V. 500mA	5/6
800 v. P.I.V. 5 amp	7/6
400 v. P.I.V. 500mA	3/6
70 v. P.I.V. 1 amp	3/6
150 v. P.I.V. 165mA	1/-
150 v. P.I.V. 25 amp	19/6
700 v. P.I.V. 100 amp	49/6
400 v. P.I.V. 3 amp (S.C.R.)	7/6
100 v. P.I.V. 5 amp (S.C.R.)	13/6
200 v. P.I.V. 5 amp (S.C.R.)	15/6
400 v. P.I.V. 5 amp (S.C.R.)	17/6

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Radio Engineers Required

Must be experienced and able to service all types of equipment, including Military receivers and test equipment. Well paid and permanent position for suitable applicants. References required. Telephone or write for appointment.

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sealed for use in adverse climatic conditions. Provision is made for the use of rod, open wire or dipole antennae. The R209 contains a built-in speaker, and headphone output is also provided.

The set contains an internal vibrator power supply unit for operation from 6V d.c. If the power unit has been designed for operation from a.c. mains, this set would no doubt have become very popular. It weighs 23 lb., and measures: length 12in., width 8in. and depth 9in.

Modifications: Replacement of the 6 volt vibrator power supply with an a.c. mains unit is the obvious modification. The set will operate perfectly satisfactorily, however, from a 6 volt d.c. source such as a car battery without any modification.

Availability: A batch of R209's were released for the first time early in 1961. They were in grade 1/2 condition, and were sold for about £23 or £24, including headphones and supply leads. The same batch was available until late 1964 or early 1965.

R209's have again become available quite recently, and it is believed that they can be obtained at the present time for about £15 or £20. Manuals are not available.

The R216

A relatively recent piece of equipment, built for the British Army, this is a magnificent receiver, and unfortunately, difficult to obtain. It is a v.h.f. general coverage receiver for the reception of a.m., f.m. and c.w. between 19 to 157 Mc/s in five turret switched ranges.

One of the many attractive features is the superb film strip tuning scale, which gives a scale length of eight feet on each band. The set contains 16 miniature valves, is hermetically sealed and pan-climatic.

Other features include two r.f. and four i.f. stages (i.f. is 4·86 Mc/s), two crystal calibrators (5 Mc/s and 1 Mc), a noise limiter, r.f. and i.f. gain controls. The deviation ratio on f.m. is switched for either 50kc/s or 120kc/s. Output is for 600Ω line or 150Ω headphones. The set weighs 25 lb. and its size is $8\frac{1}{2} \times 12\frac{1}{2} \times 9$in.

The matching mains power unit (metered) is for 110/200/250V a.c., and weighs 20 lb.

Modifications: Unnecessary.

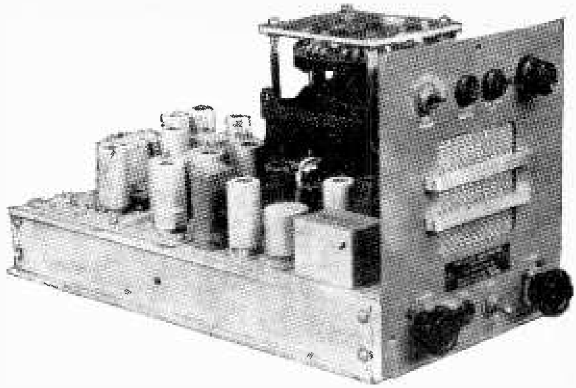
Availability: A small quantity in grade 1 were released in May 1964. They were all sold within a month or two. The price of £29 10s. included the power unit, all connecting leads, and circuit diagram. A few have since re-appeared on the secondhand market at prices up to £35.

The R220

This is a crystal controlled v.h.f. receiver, made by Marconi. The set will receive on one channel in the frequency range 60 to 100 Mc/s.

The R220 is of quite recent design, and contains 14 miniature valves—3 6AK5, 1 EF91, 3 EF92, 2 EB91, 2 12AT7, 1 QS70/20, 1 EL91, 1 5U4G. The circuit is a double superhet. The set contains an internal stabilised a.c. mains power unit for operation from 230 to 250V, and also an internal speaker and is therefore completely self-contained. Some were available in pairs fitted in a special cabinet.

Modifications: Although the limitation of single channel reception obviously makes it unsuitable for



R220. Photograph by courtesy of Charles Britain Radio.

amateur band reception, it is believed that some R220's were sold with instructions for modifying the set to continuous tuning. When this has been done, the set would probably give quite a good account of itself on the 70Mc/s or 144Mc/s amateur bands.

Availability: The R220 was first available in late 1963 in grade 1 condition for about £4 singly, or for £7 10s. in the twin version. At these prices, and for this condition, the set is very good value. They were available until mid-1964, but some have again become available for a similar price in recent months.

Most have been supplied with circuit diagrams, but not manuals. Manuals will probably be unobtainable for some time, as this receiver is quite a recent arrival on the surplus market.

The R1132, R1392, P104

These three v.h.f. receivers are all basically the same. The R1132 and R1392 are R.A.F. receivers, but the P104 is believed to originate from another branch of the services.

The frequency range is approximately 90 to 150Mc/s. The R1132 and P104 are crystal controlled; the R1392 is fully tunable.

The following details will refer to all three receivers, although there may be some minor differences in the circuitry, and the exact number of valves may vary.

The receiver has 14 valves, including r.f., three i.f., b.f.o., a.g.c. and audio. The i.f. is 5Mc/s. Panel controls include separate r.f. and oscillator tuning, r.f. and audio gains, b.f.o. control and switchable a.g.c. A meter is provided for monitoring the oscillator and audio signals. It requires an external power unit supplying 250V at 80mA and 6·3V at 4A.

The set is rather large, 19 x 10 x 10in. and this has made the receiver rather unpopular, especially as the circuit design is now obsolete.

Modification: As previously mentioned, it is believed to be a simple modification to convert the crystal controlled versions to continuous tuning.

This receiver, although fairly suitable for fixed frequency operation in the frequency range covered, can hardly be recommended for amateur use. For serious operation on the 144Mc/s amateur band, the sensitivity required can only be provided by the use of modern circuits and modern valves. No doubt

—continued on page 610

LETTERS...

Infinite baffle

Mr. Lymath's letter amused me; maybe I remember my youth too well. I can imagine what's going to happen to a few chimneys around the Spring!

What prompted this letter was a similar case here.

The only difference was that a ventilating shaft had been bricked up.

I had to do a visit to a sick person nearby and, just before entering my car to return home, my ears caught the sounds of music from the house opposite. Never before, and never (so far) since, have I ever heard such fantastic bass.

It was impossible to resist the temptation to call at the house.

The owner's wife let me in, and I was allowed to wait the arrival of her husband.

The shaft was about 15ft. high, square in cross section, each side measuring about four feet.

The base of the shaft had been bricked up, an opening for a 15in. speaker provided, about 2ft above floor level, and a separate tweeter fed through a suitable network, was resting on a ledge above the bricked up portion.

The amplifier used to drive this column was a home brewed job, using two 6L6's in push-pull. The pick-up was an Acos.

The owner, connected with the radio business, gave me a demonstration of the amplifier's ability by choosing a record with plenty of bass, and turning up the loudness control.

The sitting room was not large by some standards . . . about 11ft. wide and about 22ft. long; it was really a dining-cum-sitting room, with only a small divider.

With the unit delivering a healthy output, it was literally possible to rattle the windows and start the little glass objects on the divider walking to their destruction.

There is a much shorter shaft in my house, and many times I have looked up it, and had ideas about indulging in a little brick and mortar work but have so far contented myself with the two 9 cu. ft. speaker enclosures recently installed.—**Hugh Wagner** *(Malaya).*

Anyone interested ?

I have been a subscriber to P.W. from 1937 (as a matter of fact since 1935) but some copies have been destroyed. I might say your periodical has given me great pleasure through the years and although I am nearly 72 I still look forward to receiving it.

I have for disposal all copies from 1940 to 1960 in dozens, will send to anyone for generous postage. If no answer to this in a reasonable time, they go in the fire.—**L. Fenton** *(25 Queen Street, East Ardsley, Wakefield, Yorkshire).*

Phonetics

How can you suggest that N.A.T.O. Services might adopt the phonetic alphabet as used by amateurs. Your comment page 477 Nov. 1966.

Whilst listening today to v.h.f./I.A.R.U. one station alone gave three different call signs: George 3 John Fox, Golf 3 John Fox, Golf 3 Juliet Florida.

Such inconsistency could probably create havoc if used internationally.

Incidentally G3ODY/Portable, operating from the Brightling area, used N.A.T.O. phonetics consistently and was perfectly understandable.

I was listening to a R1392 converted to manual tuning, with a loft mounted dipole, and logged quite a few more.

Being a newcomer to v.h.f. band it was most interesting.—**L. Woodgate** *(Robertsbridge, Sussex).*

Get those elusive issues !

I am soon to retire and move into a smaller house. I have Practical Wireless from No. 1 onwards of the series which commenced in 1950 I think, and up to December 1965.

I would be willing to sell these in bundles of 12 at reasonable cost. If inquirers would state the dates in which they are interested I would try to include them. I may add that many are complete with blue-prints.—**R. J. Morris** *(The Manse, 54 Eastfield Avenue, Melton Mowbray, Leicestershire).*

My experience of kits

Two months ago I wrote to one manufacturer asking if they could supply a kit of transistors, and the price. These were for some equipment to their design I had seen in a brochure they published, in which it was said that kits of transistors were available. I had the other components necessary for making the equipment.

They replied that they could supply the kit but did not mention the price. They also suggested that I approach another firm who they said could supply, from which I got the impression they preferred I should obtain my needs from this second source. I wrote to the concern specified who in turn sent me a lot of literature on equipment in which I was not interested and about which I had not inquired, but they said they would send me details of the equipment I had written about when it arrived from the printers. In due course it arrived, saying that completely wired and tested kits only could be supplied. No mention of the kit of transistors I had asked about originally, or their cost. I have had to write again to the manufacturers of the transistors to see if they can now supply the kit I require, and of course I have again had to ask them the price. Consequently, for two months I have not been able to proceed with the construction of the equipment because I am without the transistors.

Also, at the same time three months ago, I wrote to another manufacturer asking for information on the characteristics of two types of ferrite pot cores. They have not bothered to reply, and I am beginning to think this is because the nature of the inquiry suggested I intended to use, if possible, some cores on hand instead of buying new ones.

It would seem that if such inquiries are read at all, insufficient attention is paid to them before giving an answer, for half an answer or none at all merely involves one in more letters, unnecessary additional postage, and needless delays.—**W. E. Thompson, G3MQT** *(St. Leonards-on-Sea, Sussex).*

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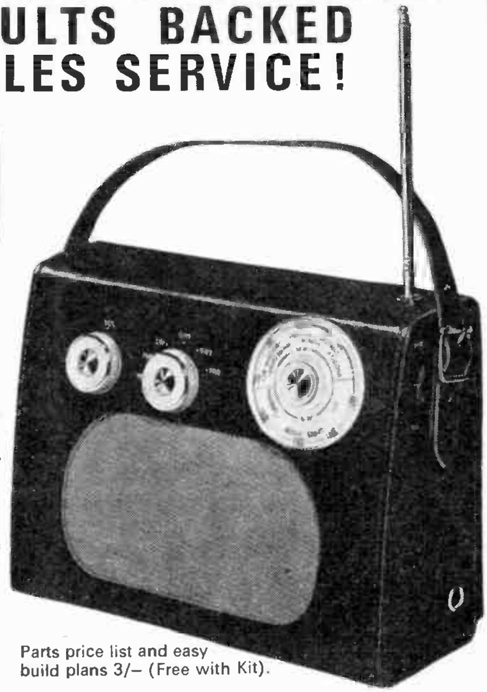
- Powerful push pull output.
- 7 transistors and two diodes including Philco Micro-Alloy R.F. Transistors.
- Famous make 7in. x 4in. P.M. speaker for rich-tone volume.
- Air spaced ganged tuning condenser.
- Separate on/off switch, volume control, wave change switches and tuning control.
- Attractive case with hand and shoulder straps. Size 9in. x 7in. x 4in. approx.
- First grade components.
- Easy to follow instructions and diagrams make the Roamer 7 a pleasure to build with guaranteed results.



Total building costs **£5.19.6** P. & P. 5/6

Parts price list and easy build plans 3/– (Free with Kit).

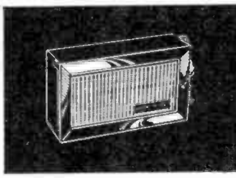
TRANSONA FIVE

MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE

Attractive case with red speaker grille. Size 6½ x 4½ x 1½in. Fully tunable. 7 stages—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone super dynamic 3in. speaker, all first grade components. Easy build plans and parts price list 1/6. (FREE with kit).

Total building costs **42/6** P. & P. 3/6

POCKET FIVE



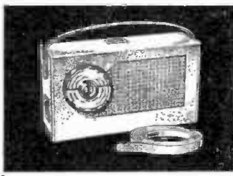
TWO WAVEBAND PORTABLE WITH 3in. SPEAKER

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 Luxembourg, etc. 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).

POCKET FIVE Medium and Long Wave version with miniature speaker ONLY 29/6. P. & P. 3/6.

Total building costs **39/6** P. & P. 3/6

MELODY SIX



TWO WAVEBAND PORTABLE WITH 3in. SPEAKER

Handsome leather-look case size 6¾ x 3¾ x 1¾in. 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).

Total building costs **59/6** P. & P. 3/6

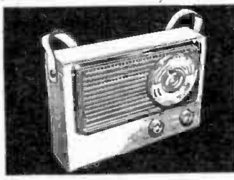
MELODY MAKER 6

THREE WAVEBAND PORTABLE WITH 3in. SPEAKER

Smart pocket size case, 6½ x 3¾ x 1½in. with gilt fittings. Fully tunable over both Medium and Long Waves with extra M.W. band for easier tuning of Luxembourg, etc. 8 stages—6 transistors and 2 diodes, top grade 3in. speaker, 2 R.F. stages for extra boost, high "Q" ferrite rod aerial. Easy build plans and parts price list 2/- (FREE with kit).

Total building costs **69/6** P. & P. 3/6

ROAMER SIX

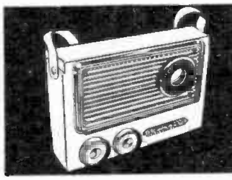


SIX WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case with gilt fittings, size 7½ x 5½ x 1¾in. World wide reception. Tunable on Medium and Long waves, two short waves, Trawler Band Plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short waves. All top grade components, 8 stages—6 transistors and 2 diodes including Philco Micro-Alloy R.F. Transistors etc. (Carrying strap 1/6 extra.) Easy build plans and parts price list 2/- (FREE with kit).

Total building costs **79/6** P. & P. 3/6

SUPER SEVEN



THREE WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case size 7½ x 5½ x 1¾in., wth gilt fittings and carrying strap. The ideal radio for home, car or outdoors. Covers Medium and Long Waves and Trawler Band. Special circuit incorporating 2 R.F. Stages, push pull output, ferrite rod aerial, 7 transistors and 2 diodes, 3in. speaker (will drive larger speaker) and all first grade components. Easy build plans and parts. Price list 2/- (FREE with kit).

Total building costs **69/6** P. & P. 3/6

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midget TRANSISTOR TRANSMITTER

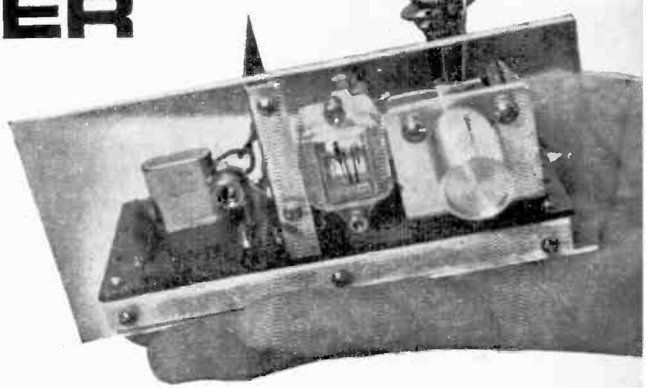
D.L.GIBSON
G3JDG

SOME years ago when transistors were first made available to the amateur constructor, their price was very high and their frequency response very low. To use these devices for transmission was quite impossible and they were restricted to audio and r.f. stages in simple m.w. receivers. Even then these transistors often required specialised circuitry in the form of carefully calculated feed-back networks to neutralise them. Some years later devices became available which could be used for transmission but again problems arose. The price of such devices was one big stumbling block together with a lack of circuitry and information about how they would behave in various configurations. Today all these arguments are groundless, and any experimenter with a transmitting licence can afford to play with solid state transmitters.

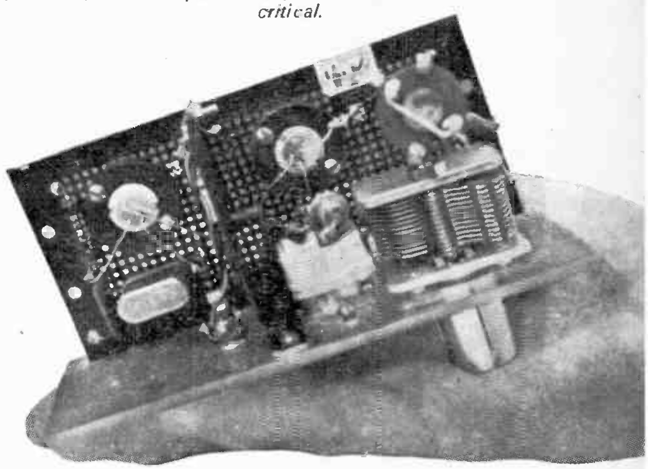
Transistors offer a very efficient means of generating r.f. and, in the writer's opinion, are far superior to valves in this application. In the case of topband, 1·8—2·0Mc/s, one might consider that a sensible choice of valve for the p.a. stage would be a 6BW6 perhaps driven by an EF80 crystal oscillator. The heater current alone of these two valves is 750mA. This is merely to keep the valves alight and this power is completely wasted on receive. The power continually wasted in this mythical but not unpractical transmitter would be 4·7 watts (6·3V x 750mA). Transistor devices on the other hand require no heater voltage, and current can be switched off when receiving.

Considering actual r.f. power itself which, after all, is the business end of any rig. Doubling the power results in an increase of one "S" point and, by the same token, reducing power by half results in a signal decrease of one "S" point at the receiving end all things being equal. Let us consider a fairly local signal say 20 miles on topband. If the signal report is S9 for 10 watts input, then reducing the power to 5 watts will result in an S8 report. Reducing power still further to 2·5 watts will still bring an S7 report which is very easily readable other things being equal. Reducing the power to 1·25 watts will result in an S6 signal again still quite readable. This point should be noted by those running 807 p.a's on topband. The consumption of the heaters alone for this valve is 900mA resulting in a waste of power of some 5·67 watts and by our

★ This unit might easily cause television and broadcast interference, and must not be operated unless the user holds a Transmitting Licence. Details of the Licence are obtainable from the Radio Services Dept., Radio Branch, G.P.O., St. Martin's-le-Grand, London, E.C.1.

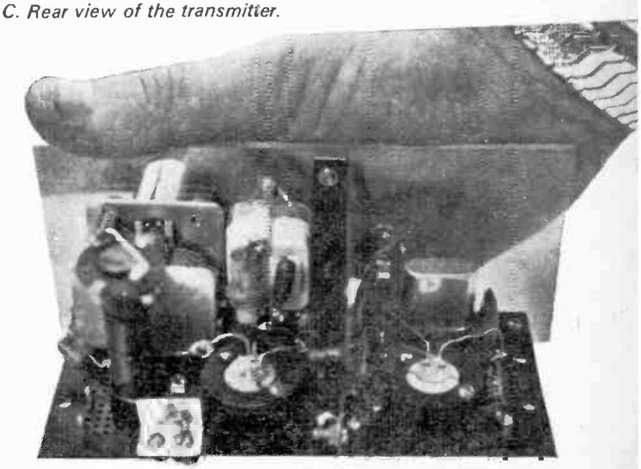


A. View of the front panel. The positioning of the key jack is not critical.



B. The prototype as seen from above.

C. Rear view of the transmitter.



reckoning above, this sort of power can bring us an S8 signal report!

Thinking along these lines the writer thought it might be a useful idea to design a transistor transmitter of low power (and therefore low current drain on the battery) which could be used on topband. Transistors are now available which can deliver the full permitted output on 160 metres—10 watts, and these are now quite reasonably priced and well within the range of the average constructor. In fact three of the devices used in the transmitter to be described, when wired in parallel, will provide 10 watts—and they will not guzzle precious heater current either.

CIRCUITRY

The circuit of the midget transmitter is shown in Fig. 1. This is the complete circuit, you don't need any extras like power units or linears etc. Just a morse key, an aerial and you're in business. The transmitter will modulate and results on the station receiver sound good with clean speech. For local nets and cross-town natters this type of rig would prove very useful and certainly very economical. It will require approximately 500mW to modulate it and in the writers case this was provided by a small commercially built amplifier intended for a small tape recorder. It has 2 OC81's in push-pull in the output stage.

The transistors are both Mullard type BFY51 currently available for as little as 5s. each. The figures for this device are shown in the table. The values

V_{CB}	V_{CEO}	I_{CM}	I_C (Av) max	h_{FE} @ I_C		f_T	T_j max	P_{TOT} max $T = 25°C$
60V	60V	1000 mA	1000mA	>40	150 mA	50Mc/s	200 °C	800 mW

Relevant characteristics of the BFY51 transistor.

shown in Fig. 1 proved optimum in the prototype and the output appeared to be unaffected when changing the p.a. transistor for another BFY51. Capacitor C1 was varied but 150pF gave greatest output.

To secure maximum efficiency from transistor transmitters it is important that the input and output impedances are matched. This has *not* been done in Fig. 1 regarding the input to Tr2. The output from Tr1 is fed to a capacitive tap formed by C2/C3. Increasing C2 reduced the output from Tr2 and reducing the value of C3 also gave less output. For those interested in matching these impedances more closely the circuit of Fig. 2 is suggested as a line of experiment. Here the impedance of the collector is matched by the capacitive tap formed by C and C′, while the base impedance of Tr2 is matched by using the coil as an auto-transformer and tapping up it until optimum position is found. The values of L, C and C′ should be chosen so that the circuit is resonant at the crystal frequency.

CRYSTALS

The crystal used was an HC6U series type on 1819·8 kc/s. The circuit functions just as efficiently with a 10x type on 1900kc/s and with the large 10XJ on 1950kc/s. A 3·5Mc/s FT243 also gave a very healthy output and by tuning the p.a. to 3·5 Mc/s the rig could be used on eighty metres. A simple switching arrangement could be added to switch crystals and also switch L2 thus making this a two-band rig. As it stands the oscillator circuit appears unsuitable for 7Mc/s and two crystals (7010 and 7040kc/s) refused to oscillate, although alteration of the circuit values might remedy this.

The p.a stage is in grounded or common emitter configuration and will function well at 8Mc/s. Using two BFY51's in parallel in grounded base will provide 3 watts at 30Mc/s, thus a QRP (lower power) transmitter for all six amateur bands is a practical possibility. Even in common base configuration a pair in parallel can give some 7dB gain at 30Mc/s.

The output or tank circuit consisting L2/VC1 is unusual in that it is series tuned. Various arrangements were tried—parallel tuning with link coupling etc., and although a pi-tank gave approximately 10% greater output than the arrangement shown it did require an extra twin-gang loading capacitor with a subsequent rise in the size of the chassis. For those who do not mind this increase in size the pi-tank is recommended.

The tank coil was wound on a piece of ferrite rod broken from a defunct transistor receiver. This

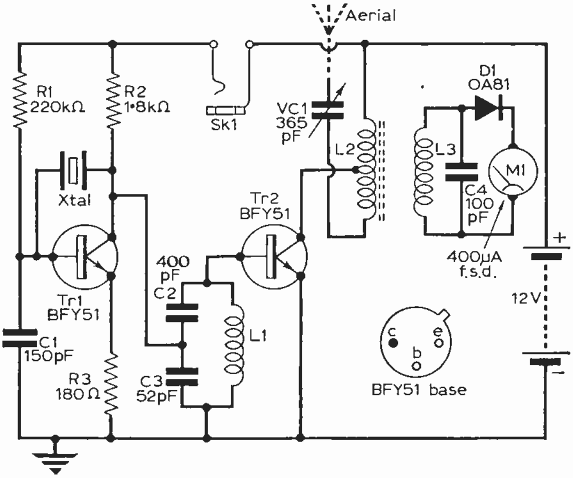


Fig. 1: Complete circuit diagram of the midget transmitter.

allows a very small coil to be made and saves a good deal of space. A "normal" type tank coil was tried i.e., wound on a 1¼in. former, but substituting the ferrite coil made no significant difference and thus the latter was used. In theory, since the ferrite has far less turns, the "Q" of the coil should be higher since there is less wire and thus less resistance. However it would be even better to use a toroidal core thus eliminating the surrounding magnetic field at the same time.

KEYING

Keying the oscillator is generally regarded as bad practice. However the oscillator only draws some 5—6mA and thus arcing at the key contacts is virtually negligible. This very low current is aided by avoiding the more common arrangement of a bleeder network to supply the base bias for Tr1. Keying the p.a. would mean breaking 100mA and although this has not been tried it might give superior keying. The characteristics of the keyed oscillator were examined on an oscilloscope and displayed the waveform shown in Fig. 3. There were a few whiskers on the original trace but this was found to be due to dirty key contacts. The shape is rather soft on break but no detrimental reports have been receved to date. Due to this wave-shape and reports received, the insertion of key-click filters and the like were deemed unnecessary.

The p.a. stage operates in class B/C, that is, with no drive applied it is automatically cut-off and draws no current. By keying the oscillator therefore, in the key-up condition the entire rig draws no current from the battery and the transmitter is thus very economical to run. Using valves it would be necessary to key both stages and by the same token large currents would be present at the keying con-

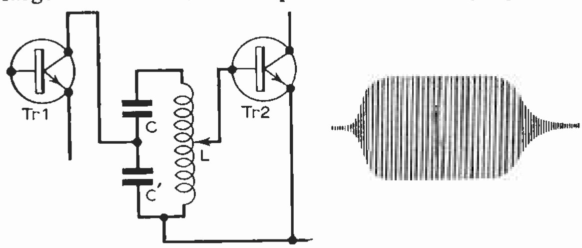


Fig. 2: Suggested lines of experiment for matching Tr1 output and Tr2 input. Left, the keying waveform of the prototype as seen on the oscilloscope.

tacts with a much greater tendency to arcing and key-clicks. Also, if valves had been used, even if both stages were cut-off during key-up periods, the heaters would still draw power, they would do this on receive too.

Regarding the class B/C operation of the p.a. stage. Some authors advocate the use of a low value resistor in the base-emitter circuit (suitably by-passed) in order to ensure that when drive is applied the p.a. stage is biased to true class C, the r.f. drive applied supplying the extra bias. However, inserting various resistors even as low as 1 ohm in the circuit of Fig. 1 resulted in a decrease in output and this idea was abandoned as the rig works very well without these extra components anyway.

It is important to appreciate that the only tuned circuit in the rig is the p.a. tank components and because of this the use of an a.t.u. is strongly recommended. This transmitter could easily cause t.v.i. and b.c.i. if suitable precautions were not taken although many contacts were made with the rig as is i.e., with no a.t.u. In this respect the pi-tank referred to earlier would prove advantageous.

The current consumption of the rig with key down is nominally 106mA, the c.o. and p.a. stages drawing 6mA and 100mA respectively representing a d.c. input to the p.a. of 1200mW or 1·2 watts. The aerial used was extremely poor consisting of 70ft. end-fed wrapped around the house and terminating in a wooden peg 2ft. off the ground. At its highest point the antenna is barely 15ft. above ground. The earthing system likewise left much to be desired—a single wire 10ft. long soldered to a 12in. copper pipe ⅜in. diameter. Using this set up and no a.t.u. the best QSO to date was a 569 on c.w. from Portsmouth, a distance of some 90 miles. Many other QSO's have been made over shorter distances and the best on phone was a 5 and 7 from 10 miles.

CONSTRUCTION

Building any unit is largely a matter of individual taste and is sometimes also influenced by components which are already to hand. For this reason the positioning of the pins on the perforated board as shown in Fig. 3 should be taken only as a guide for the approximate positioning of the components. This is one of the advantages of using perforated board construction in that individual components can be laid in position on the board and the pins then placed to suit them. The pins are tapped into the holes until they are approximately halfway through. Having laid all small components on the board and attached them to their relevant pins the crystal holder and transistor heat sinks should be bolted to the board. Holes for the bolts are easily drilled with a 6BA clearance drill, and the two holes for the crystal holder tags can be made by cutting the board with a sharp pen-knife using a rocking action. When all board-mounted components are fixed and wired the p.a. coil may be mounted as shown in Fig. 4.

The front panel should now be cut and drilled as in Fig. 5. It is important to make the cut-out and fixing holes for the meter exact. The meter is held in position by two 6BA nuts and bolts, and the heads of the bolts must be filed flat on one side

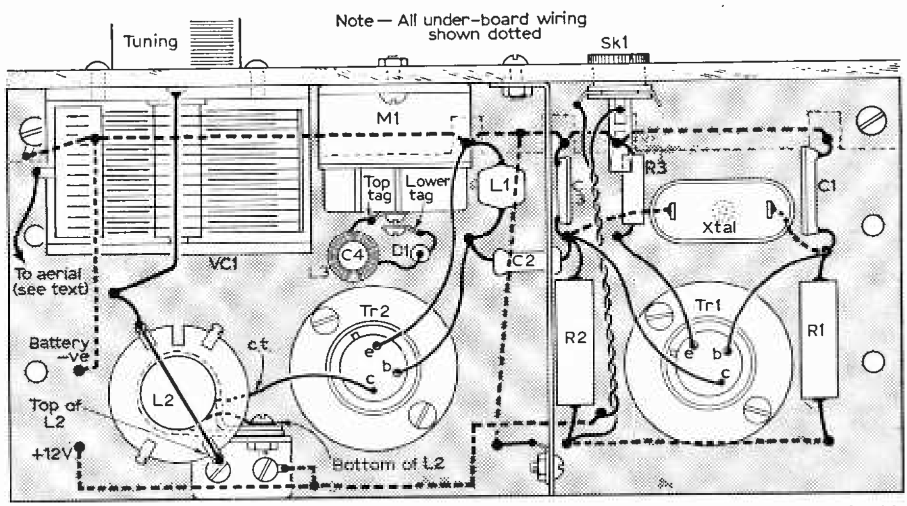
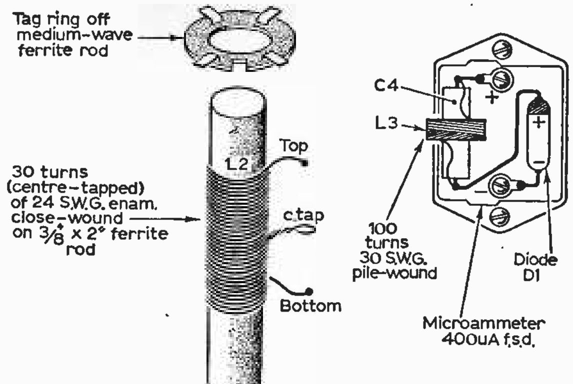


Fig. 3: Layout above chassis and wiring diagram. The dotted lines depict wiring on the underside of the chassis.

in order to clear the plastic body of the meter. Alternatively, smaller bolts could be used but these were not to hand when the prototype was built. Note that the bolt holes in the meter are only thin Perspex and therefore very fragile. It is thus very important to avoid any undue strain on them as they fracture very easily. Make the cut-out for the meter face first, then put the meter in place and accurately mark the exact position for the holes. This is easy because they can be clearly seen through the Perspex front panel. The same method



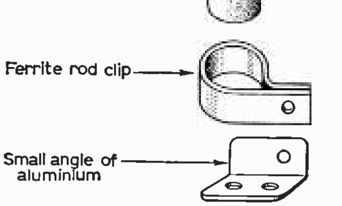
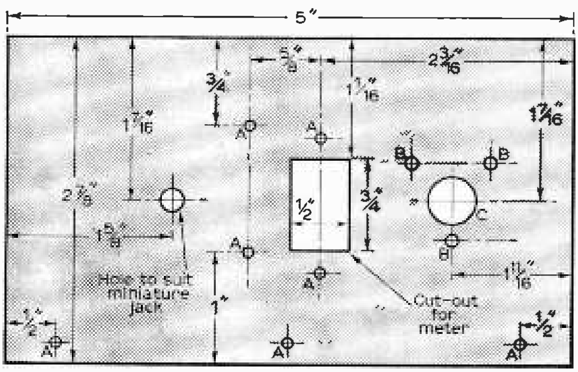


Fig. 4: Construction of the p.a. coil, and positioning of the components around the meter.

Fig. 5: Dimensions and drilling details for the front panel. Note: Care is required when drilling perspex.



Hole sizes—A...6BA clearance B....4BA clearance C.... 9/16 dia.

of mounting and drilling applies to the p.a. tuning capacitor. Drill and/or file the large hole for the spindle first, fit the capacitor into this hole, and then mark the exact position of the mounting bolt holes. Before bolting the p.a. tuning capacitor to the front panel, solder a six inch wire from the bottom lug and bend it out to the rear. This wire will go directly to the top of the p.a. coil. It will not be possible to reach this lug after the front panel is bolted to the perforated board.

With the meter, p.a. tuning capacitor and key jack mounted, the front panel may now be bolted to the board by means of the small strip of angled aluminium. The next step is to solder the floating wire from the lower lug of VC1 to the top of the p.a. coil. Next, wire a pair of twisted insulated wires between the key jack and the appropriate pins on the board.

Check all wiring and when this is in order turn the board over and complete the "under-chassis" wiring as per Fig. 3. This is carried out with 18s.w.g. tinned wire although it might be an idea to use sleeving too. When all other component wiring is completed the transistors may be wired in. They should be orientated as shown and care taken to ensure that the collector and base leads of Tr1 are kept apart. Sleeving would be a sensible precaution. The transistor leads require no pruning except for the collector lead of Tr2.

Check the transistor leads after wiring. Counting clockwise from the pip the first lead is emitter, then base, and finally collector. This is easy to spot because the collector lead is connected directly to the case.

It is possible to run the rig on 6 volts at greatly reduced efficiency although for initial tuning up this is a sound idea. The transmitter is tuned up by means of a built-in field strength meter or perhaps more accurately an r.f. probe. The particular meter used has an f.s.d. of 400μA. If this had been inserted in series with the p.a. collector supply it would have meant finding a suitable resistor to shunt it with. Also, using that method would have required tuning for a dip in the meter reading at resonance. It was decided to use the arrangement shown partly because of the shunt problem, and partly because as shown, it can be tuned for peak output to coincide with peak reading on the meter.

TUNING

A separate meter set to read 200mA should be inserted in the positive supply lead. With power applied but the key up this meter should read zero current. This is because the power supply lead to Tr1 is broken by the key lead, and Tr2 is cut-off and will thus draw no current. Pressing the key down should result in the mA meter immediately reading around 150mA and the front panel μA meter should also give some indication. *Do not* depress the key for more than a couple of seconds at a time on tune-up, just long enough to read the current on the mA meter. With the key depressed the p.a. tuning capacitor is swung from minimum to maximum observing the μA meter on the front panel. At some point the meter should peak. This peak reading (or dip on the mA meter in the positive supply lead) will probably be very slight. The type of aerial will have a direct bearing on this, and, dependent upon the length or impedance, might require either a series or parallel capacitor wired with VC1.

—continued on page 609

★ components list

Capacitors:

- C1 150pF silver mica
- C2 400pF silver mica
- C3 52pF silver mica
- C4 100pF tubular ceramic
- VC1 365pF variable Jackson

Semiconductors:

- Tr1 BFY51 } Mullard
- Tr2 BFY51 } Mullard
- D1 OA81 } Mullard

Resistors:

- R1 220kΩ
- R2 1·8kΩ
- R3 180Ω

Coils:

- L1 2·5mH r.f.c.
- L2, L3 see text and figs.

Miscellaneous:

Crystal and holder to suit; Two TO-5 finned heat sinks; 12 volt battery; Meter—400μA f.s.d.; Miniature jack socket; Perforated board 4¾ x 2¼in.; Pins for board; Perspex 5¼ x 2¼in.; Plastic knob; 6BA and 4BA nuts and bolts; Aluminium 2½ x 2in.; Angled aluminium 4⅝ x 5/16in.; wire, solder tags etc.

SEMICONDUCTOR AUDIO

PART 2

R. LEYLAND

STABILITY has to be closely maintained in a transformerless amplifier, and the greater effect of component tolerances makes setting-up procedures necessary in some cases. One aspect is stability of the quiescent voltage. Drift tends to be amplified with direct coupling, but an amplifier that is intended only for a.c. signals can easily overcome this by reducing d.c. amplification to the minimum by means of heavy negative feedback, decoupled so that it takes effect only below the a.f. range.

Many transformerless amplifiers have only a single voltage-amplifying stage, which can be stabilised in the usual way with a capacitively-decoupled emitter resistor. The base bias network is often connected to the mid-point of the output stage (see Fig. 5) to improve the stabilising. Decoupling is usually omitted from this network, as it also serves to provide some a.c. negative feedback. Additional a.c. feedback, if required, can be applied more directly from the loudspeaker via a resistor.

PRESET ADJUSTMENTS

To accommodate the maximum signal, the quiescent voltage at the mid-point of the output stage requires to be centred approximately between the positive and negative of the d.c. supply. Component and transistor tolerances will affect this and some variation will occur due to changes in temperature and supply voltage. In the manufacture of amplifier modules, selective assembly makes it possible to take up the component spreads.

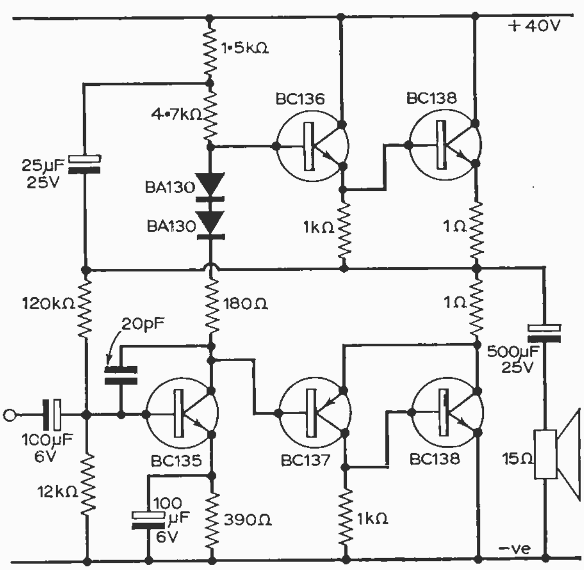


Fig. 5: 10-watt amplifier using AF10 silicon transistor package. Each output transistor requires 80 sq. cm. of 16 s.w.g. aluminium for adequate heat dissipation.

A variable resistance can be included at the input to the amplifier for bias adjustment, so enabling the quiescent voltage at the output to be set to accommodate the maximum output. It can afterwards be replaced by a fixed resistor of the appropriate value, or the preset variable resistance can be retained in the amplifier.

Silicon transistors have lower leakage currents, and by using resistors of ± 5% tolerance it is possible, with a matched set of transistors, to dispense altogether with amplifier adjustments. Straightforward construction, without need to use test instruments, is an advantage, but preset adjustments allow precise settings of quiescent conditions to be made.

An amplifier can also be made self-adjusting by introducing a voltage reference into the d.c. stabilising loop. In the amplifier of Fig. 6, this is provided by the resistors in the base circuit of the AC127 predriver stage. In addition to amplifying the a.c. input signals, the predriver stage compares the direct voltage level at the mid-point of the output stage (linked by the 1·2kΩ feedback resistance to the emitter of the predriver stage) with the d.c. reference voltage at its input. The d.c. loop gain of the circuit is large and the quiescent output voltage is therefore closely tied to the voltage set by the potential-dividing resistors at the input. There is an advantage in using silicon transistors in this circuit, although germanium transistors have been used throughout, and are suited to the output stage with a low-voltage supply.

CROSSOVER DISTORTION

Stabilising the quiescent *voltage* level does not also stabilise the quiescent *current* of the ouput transistors, which depends on the bias potential in the base circuit of the output transistors.

In one type of transformerless amplifier, the π-mode Class AB, an extra d.c. feedback loop is used to stabilise the average current at a constant level, thus making compensating diodes or thermistors unnecessary. The d.c. from the supply is constant, but transistor dissipation is increased.

It is not possible to stabilise the average current in a Class B output stage, and other methods must be used to compensate for the effects of temperature and other variations upon the small quiescent current.

Sufficient quiescent bias must be maintained in a Class B amplifier to prevent crossover distortion. This type of distortion, when it occurs, is especially noticeable at small amplitudes of signal where most forms of distortion are at a minimum. A discontinuity at the crossover point between the output transistors tends to set off an oscillatory response in the inductance of the loudspeaker, although this is less severe than with transformer coupling, where bifilar windings are sometimes used to reduce leakage inductance.

The amount of quiescent current necessary can be minimized by using matched high-gain output transistors, and also through the application of heavy negative feedback to linearize the output stage in the crossover region.

Some allowance is necessary for a decrease of quiescent current at low temperature, or with a drop in supply voltage, and there is also the effect of component spreads, so an adequate minimum has to be ensured. It should be reasonably small, however, for reasons of current economy, and to avoid the risk of thermal runaway.

Typical quiescent currents when cool are 3—10mA with small germanium transistors, and 5—25mA with power transistors. Large signals, especially continuous sinewave test signals, cause heating of the output transistors, and the quiescent current may increase considerably. The use of a large heat sink helps to reduce this variation.

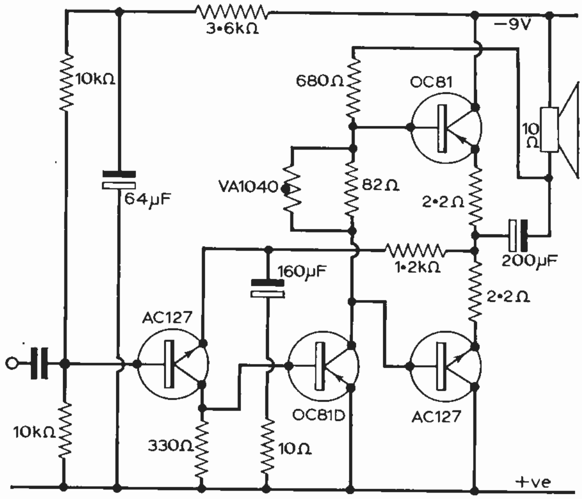


Fig. 6: 500mW amplifier using LFK4 germanium transistor package. Each output transistor requires 12·5 sq. cm. of 18 s.w.g. aluminium for adequate heat dissipation.

THERMAL STABILITY

In the original form of single-ended output stage, consisting of a matched pair of transistors of identical type, the quiescent voltage depends on the upper transistor, and the quiescent current on the lower transistor. In the complementary and quasi-complementary arrangements, the quiescent current is controlled by the potential difference between the bases of the complementary pair of transistors. This bias voltage is developed by the current of the driver stage flowing in the resistance of the components in the base circuit of the complementary transistors, and can be varied independently of the mid-point voltage.

A variable resistance can be included between the bases of the complementary output (or driver) transistors to enable transistor and other component spreads, which could alter the value of the quiescent current in the output stage, to be taken up. With germanium transistors there is an especial risk of thermal runaway if the forward bias on the output stage is increased too far, so the preset control should only permit a small range of adjustment. It can be replaced by the appropriate value of fixed resistor after setting up, although it might be difficult to select a close enough value. Adherence to a good design should exclude the risk of thermal runaway, but it is a possibility, requiring care while setting up the amplifier, to avoid any broken connections and also to avoid short-circuiting the amplifier output.

Small resistors inserted at the emitters of the output transistors, by reducing the rate at which the quiescent current increases with temperature, assist in maintaining thermal stability. These should be non-inductive, and fuses have been used for the purpose in some amplifiers to give additional protection against thermal runaway. Alternatively the resistances can be made from enamelled Constanton wire: 3½in. of 34s.w.g. will give 1 ohm, and can be doubled to make it non-inductive. Resistances made of copper wire would give negligible temperature compensation, since the emitter resistors have only a small potential drop under quiescent conditions. A fraction of the output power is lost in them, so the values are often 1 ohm or less for output powers above 1W.

BIAS COMPENSATION

Forward-conducting junction diodes (BA130 in Fig. 5) may be used to provide a bias more stable than could be derived from a resistance in the base circuit of the complementary transistors. The diodes can have characteristics similar to the base-emitter junctions of the transistors, and compensate for variations in the base-emitter potential of the transistors caused by supply voltage and temperature changes. The variation in potential of the base-emitter junction occurs also in the diode and the change in quiescent base current is thus minimized.

With germanium transistors, gold-bonded diodes and germanium junction diodes are used as compensating elements, and have a forward drop of about 0·4V. Silicon junction diodes, with their larger forward drop of 0·7V, are especially suitable with silicon transistors. Instead of miniature diodes, transistors, connected as diodes, with the base and collector leads joined together, can be employed.

Temperature compensation by the diodes will only be adequate if their temperature is equal to the junction temperature of the transistor. Attempts are made to mount them close to the transistor in clips on the heat sink. This is not entirely practicable with miniature diodes.

A thermistor (VA1040, Fig. 6) is more sensitive to temperature changes and, included in the bias network as an alternative to diodes, can, if suitably chosen to have the required resistance when carrying the current of the driver stage, give effective compensation for changes in ambient temperature. Disc-type thermistors can be used. The characteristic does not match the base-emitter junction of the transistor and cannot give precise temperature tracking with it. It is not therefore mounted on the heat sink.

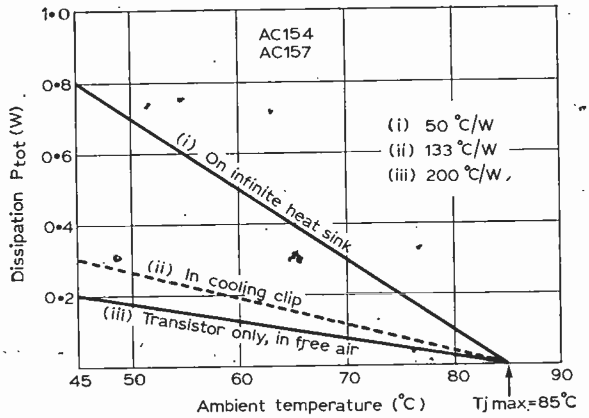


Fig. 7: Small germanium transistor derating characteristic.

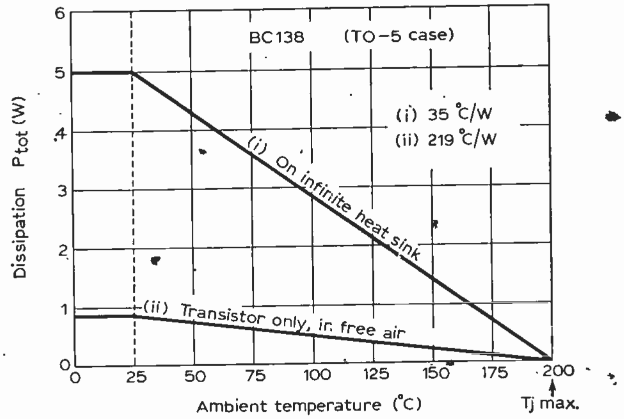


Fig. 9: Medium power silicon transistor derating characteristic.

A preset variable resistance can be included with diodes or thermistors to take up component and transistor spreads, enabling the quiescent current to be set at a particular value.

TRANSISTOR DISSIPATION

In Class B amplifiers, maximum dissipation in the output transistors occurs at 40% of full drive. An estimate of the maximum dissipation in each of the output transistors can be made from

$$P_{tot} \simeq \frac{V_S^2}{32(R_L+R_E)},$$

where V_S is the voltage of the amplifier supply, R_L the loudspeaker impedance, and R_E the value of the emitter resistors.

Individual types of transistor may differ in their ratings, even if outwardly of the same construction. Data on small transistors gives the maximum dissipation in free air at 25°C, while for power transistors it is often at a case temperature of 45°C.

Complete information on maximum dissipation is expressed as a derating characteristic. An example for a small germanium transistor is shown in Fig. 7. The junction temperature for this transistor must be limited to a value, Tj max, of 85°C. At 85°C ambient temperature, therefore, the dissipation must be zero. When the maximum dissipation at some other ambient temperature is given, e.g., 25°C, the two points thus obtained can be joined to yield a straight line graph. This enables the dissipation at any ambient temperature to be found that will raise the junction temperature to 85°C, the absolute limiting value.

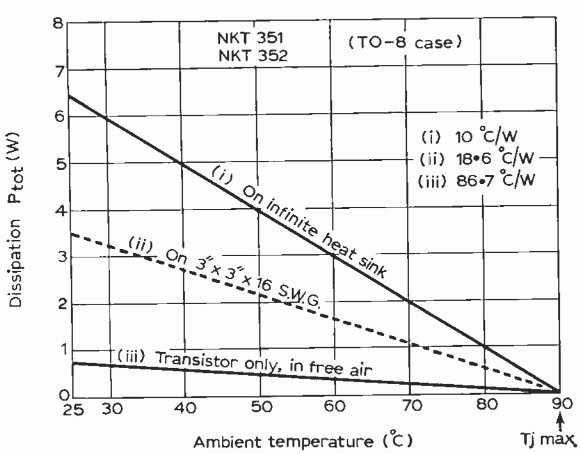


Fig. 8: Medium power germanium transistor derating characteristic.

Each straight line graph in Fig. 7 has a different slope, and is for a different value of thermal resistance. The graph (i) is for the transistor casing at ambient temperature, i.e., for zero heat sink resistance: the transistor can be imagined to be on an infinite heat sink.

The lowest characteristic (iii) is for the transistor in free air, when the only heat sink is the transistor case itself. The thermal resistance is then at its highest value.

An intermediate line, (ii), shown dotted, is the characteristic for the transistor mounted on a particular heat sink. It is not reliable to specify the thermal resistance of the heat sink by itself, because the effective value depends very much on the area contacted by the transistor. The same heat sink may yield different thermal resistance values for a small transistor and for a large power transistor, and if the heat sink is small, heat loss between the transistor and the surrounding air may also influence the value obtained.

The derating characteristic of a small silicon power transistor of TO-5 construction is shown in Fig. 9, and it can be seen that the power-handling capacity is much higher, because Tj max is 200°C; and that the internal thermal resistance is rather lower because, in a power transistor, the collector is internally connected to the metal of the case.

Power transistors of TO-3 construction have a thick copper mounting-plate, and this substantial construction can provide an internal thermal resistance as low as 1°C/W. There is also an appreciable area of thermal contact with the heat sink, which should result in more definite values for heat sink thermal resistance.

Germanium high power transistors have this form of construction, and have the advantage of a lower saturation voltage and better linearity than silicon transistors, but require larger heat sinks and are more prone to thermal runaway.

To be continued

INTEGRATED CIRCU

THE current revolution in the field of industrial electronics resulting from the introduction of the integrated circuit could not for long fail to have an impact on the amateur enthusiast's activities, and over the next few years it is inevitable that the pages of this magazine will reflect this fact. Originally the manufacturers concentrated on the production of units for logic applications, for computers and control systems, since these promised the opportunity for the very large volume sales required to justify the effort in development and tooling up that each type of integrated circuit represents. However, it was equally inevitable that this method of fabricating complete circuits in a single chip of semiconductor no larger than one conventional transistor would eventually be extended to linear circuits, and units appear which could be immediately applied as i.f. amplifiers, etc. From the manufacturer's point of view there is the advantage that the product will be in demand for the foreseeable future, as there seems little prospect of a further development to bypass the I.C., so that production of a standard module may be planned on a long-term basis. There is also the point that labour costs involved in the production of an I.C. are not significantly greater than those for single planar transistors, so that there is an opportunity to nullify the advantage of cheap labour held by manufacturers of domestic electronic gear in the Far East.

Considering these facts, R.C.A. in the U.S.A. began the development of an I.C. suitable for use as an i.f. amplifier in television sets, and this is now available at a very moderate price from the U.K. subsidiary of the parent firm. Following American TV practice, the unit is designed to handle an f.m. signal, at a frequency of 4.5Mc/s. However, as it is not yet feasible to incorporate inductive elements into an I.C., the frequency-selective circuit is external to the I.C. itself, so that if a conventional 10.7Mc/s i.f.t. were used, the unit would function satisfactorily at the higher frequency, with a drop in gain of a mere 7dB, from 70 to 62dB. Furthermore, the manufacturer was able to provide not only the i.f. amplifier, but also a.m. and noise limitation, with an f.m. detector and audio preamplifier facilities in the one unit. The unit therefore appeared ideal for a low cost solid state f.m. tuner, and this article reports on the writer's success with such an exercise.

The Integrated Circuit

First, a short consideration of the circuit evolved by the R.C.A. engineers. It is a monolithic silicon unit, that is, all the functions of the circuit are achieved within a single slice of silicon, whose properties were modified by diffusing traces of other

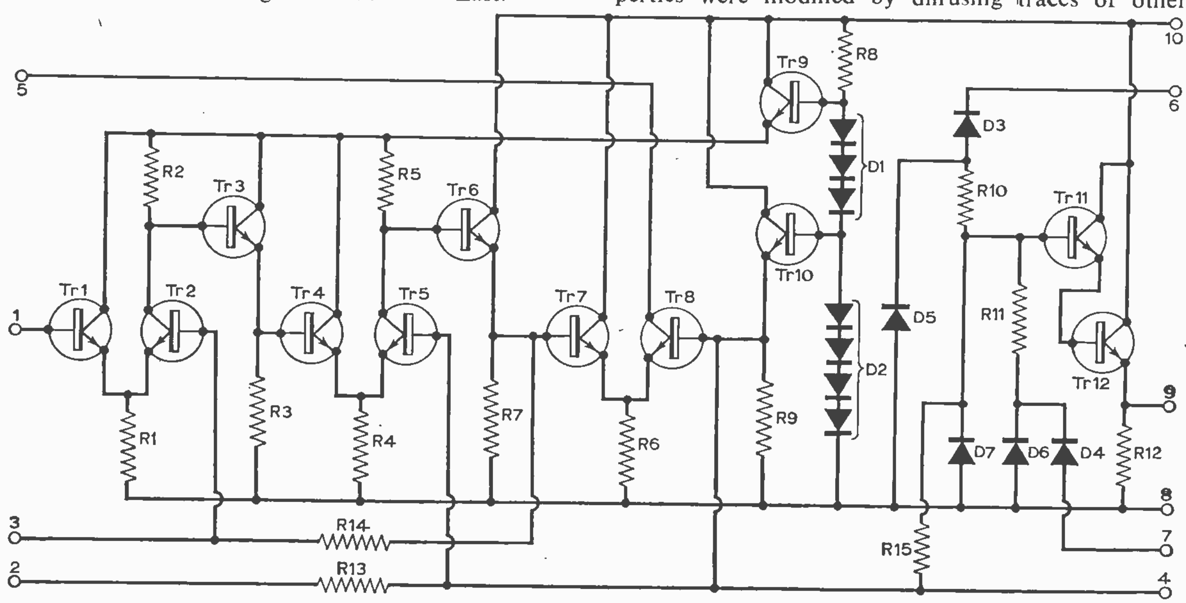


Fig. 1: Equivalent circuit in discrete components of the R.C.A. integrated circuit. Note that the component numbering is not related to the component numbering in Fig. 2.

IT f.m. tuner

L. McNAMARA, B.Sc.
A. J. McEVOY, B.Sc.

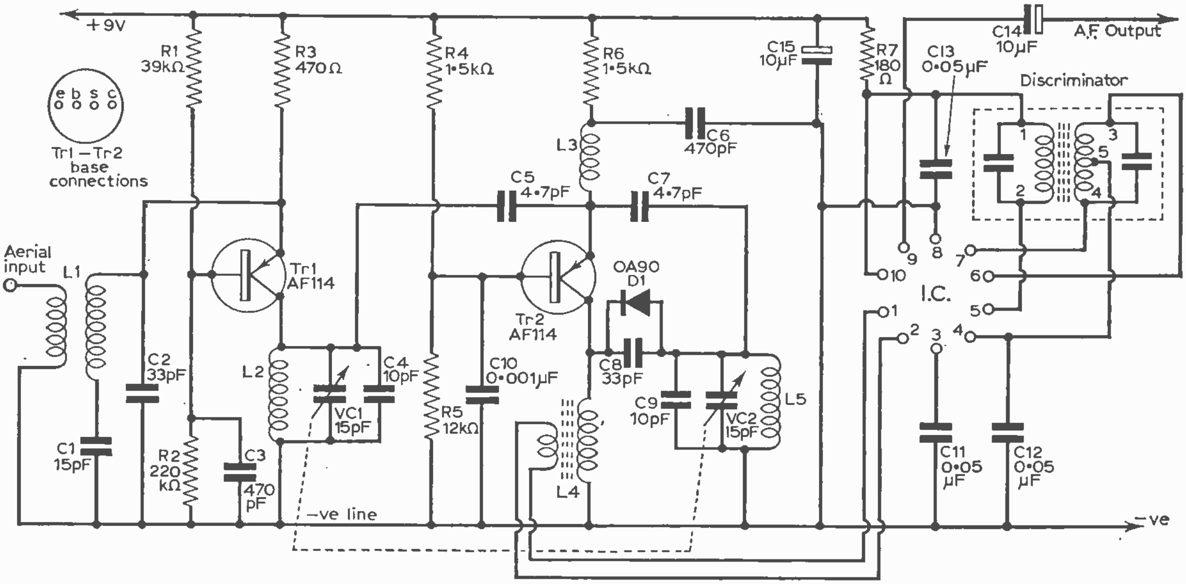


Fig. 2: The complete tuner circuitry. As the output goes to the "barrel" of the jack plug, note that the mounting screw must be insulated from the aluminium panel, e.g. by plastic washers.

★ components list

Resistors:

- R1 39kΩ
- R2 220kΩ
- R3 470Ω
- R4 1·5kΩ
- R5 12kΩ
- R6 1·5kΩ
- R7 180Ω

(All 10% $\frac{1}{4}$W)

Capacitors:

- C1 15pF 5% silver mica
- C2 33pF 5% silver mica
- C3 470pF ceramic
- C4 10pF 5% silver mica
- C5 4·7pF 5% silver mica
- C6 470pF ceramic
- C7 4·7pF 5% silver mica
- C8 33pF 5% silver mica or ceramic
- C9 10pF 5% silver mica
- C10 0·001μF min. paper
- C11 0·05μF min. paper
- C12 0·05μF min. paper
- C13 0·05μF min. paper
- C14 10μF 6V electrolytic
- C15 10μF 12V electrolytic
- VC1/VC2 15+15pF twin gang with s.m. drive

Semiconductors:

- Tr1 AF114
- Tr2 AF114
- D1 OA90

Inductors:

- L1 Aerial coil, blue spot v.h.f. (0·5cm. dia. former).
- L2 9 turns, solid core insulated wire wound on a $^7/_{64}$in. drill to control diameter.
- L3 5 turns as above.
- L4 1st i.f.t., orange spot, 10·7Mc/s (0·5cm. dia. former).
- L5 8 turns as L2.

Discriminator 10·7Mc/s ratio detector transformer.
Henry's Radio Ltd. can supply L1 and L4, alternatively they can also supply L2, L3, L5 and discriminator; these are described as R.F. coil/code red; reactor coil—enamel wires; Osc. coil—code black; Discriminator transformer—code yellow.

Note re coils:

L1; aerial winding is nearer the flanged end of the former.
L4; end of the larger winding to Tr2, bottom end of the smaller winding to 1 inch on I.C. i.e. to B on circuit board.
The integrated circuit CA3014, is available from R.C.A., Great Britain, Ltd., Lincoln Way, Windmill Rd., Sunbury-on-Thames, Middlesex: price 25/– plus post and packing.

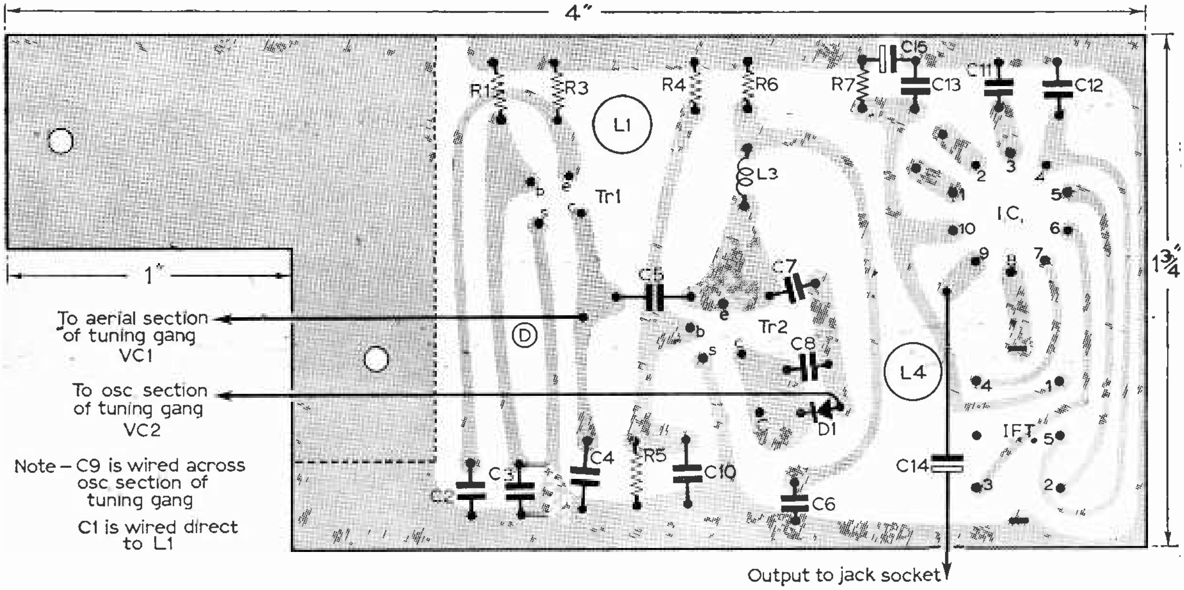


Fig. 3: Printed circuit layout showing position of components. Note that R2 is mounted on the copper side.

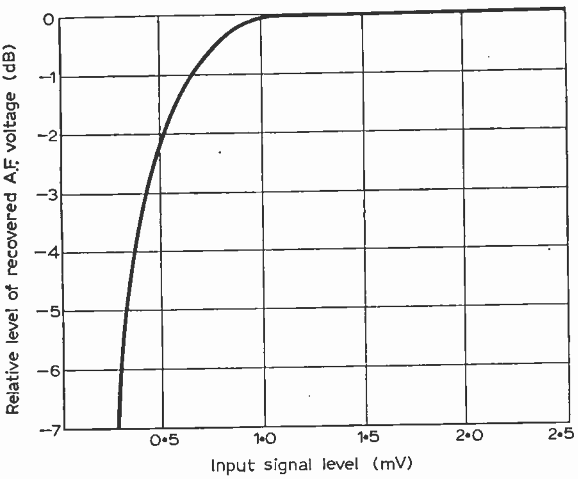


Fig. 4: Relates recovered audio signal to input signal. (10·7Mc/s).

elements into it at carefully chosen locations, so that various parts acted equivalently as the discrete components shown in the circuit of Fig. 1 would. This chip is mounted in a transistor-type can conforming to the international TO-5 standard, with ten leads instead of the usual three. Though R.C.A. have perfected the technique of incorporating the two varieties of transistor, p-n-p and n-p-n, in the one chip, this particular unit employs only n-p-n types. The first eight transistors are equivalent to a three stage wide-band amplifier. The input is applied to the base of Tr1, which operates in the emitter follower mode. Its output is developed across R1 and therefore passes into the common-base amplifier, Tr2. Tr3 may be regarded as an emitter follower, matching into a second three transistor amplifier system operating in a manner similar to Tr1-Tr3. Alternatively, the circuit may be analysed by regarding Tr3 and Tr4 as a super alpha pair, coupled through Tr5 to a similar pair, Tr6 and Tr7. Either way, the amplified signal appears across R8, and enters the emitter of Tr8, a further common-base amplifier, which is loaded by the frequency-selective discriminator transformer, connected to pin 5 of the I.C. The twin outputs of this transformer re-enter the I.C., being connected to the detector diodes D3 and D4 through pins 6 and 7. The resulting audio is applied to the two transistor preamp, with a high-level audio output appearing at pin 9.

Design Procedure

Perhaps the most interesting aspect of the design, however, is the procedure adopted to bias the transistors, ensuring that each is operated to best advantage with a d.c. supply of between 5.5 and 10 volts. There is also the question of decoupling, as both i.f. and a.f. circuits are operating from a common supply and inside the one I.C. Tr10 establishes a constant voltage across R9, and from this point transistors Tr5, Tr8 and Tr11 are biased. An external capacitor between pin 4 and earth decouples this bias supply. Tr1 also receives its base current from this line, through R14 and secondary winding of the tuned input transformer L4 (the 1st i.f.t. of the tuner). Tr2 and Tr7 are biased separately, being held at the potential of the emitter of Tr6, and decoupled by the external capacitor from pin 3. Tr9 is an active decoupling element for the d.c. supply line to the other transistors of the i.f. amplifier chain, i.e. Tr1 to Tr5. The audio output of the detector appears across diode D7, and therefore has some effect on the level of the bias line originating with Tr10. Naturally, with such a high gain, the amplifier will "clip", but whereas this would result in intolerable distortion in an a.m. tuner, in an f.m. line up it is a definite advantage, and would have to be added were it absent, since it results in the suppression of a.m. signals and the elimination of impulsive interference. As a result the a.m. rejection of the circuit is greater than 50db, and this limiting action is initiated by all input signals of an amplitude greater than 300μV. Fig. 4 is a graph relating the recovered audio signal to the input signal, and confirms the efficiency of the limiting action.

The circuits of the r.f. and frequency changer stages are conventional. AF114 p-n-p transistors were available, and it was decided to use them, rather than to attempt a completely new design for the front end with planar silicon n-p-n's at the same time as I.C.'s were introduced for the rest of the tuner, even though they would have been more compatible with the negative earth circuitry of the I.C. The signal is applied to the emitter of the r.f. amplifier Tr1 from a broadly tuned transformer, with the dipole aerial across its primary winding. This transistor operates in the common base mode, to avail of the better high frequency performance of a transistor in this configuration. There is a rejector circuit in the collector load of Tr1, tuned by one section of the gang, which directs the signal through a capacitor to the emitter of Tr2. This is a self oscillating mixer, with the oscillator frequency set by a tuned filter in the collector circuit, with feedback from the collector to the emitter through C7. A clamp diode, as well as the capacitor C8, is used to feed the filter from the transistor collector. The collector current actually flows through the primary of an untuned first i.f.t., inducing in the secondary the i.f. signal which enters the I.C.

Construction

We may now proceed to the actual construction of the tuner. As is well known, layout can be very critical at high frequencies, due to the small capacitances involved in the tuned circuits, so that the effect of strays and hand capacitance is much more severe than in the a.m. bands. Therefore it is recommended that the printed circuit technique be adopted, and the pattern of Fig. 3 closely adhered to in painting the copper laminate preparatory to etching away the excess copper in a bath of $FeCl_3$ (ferric chloride) solution, in accordance with the procedure often described in these pages. "Cir-Kit" self-adhesive copper foil may be used as an alternative, though the above warning that the writers will not be responsible for poor results if the conductor pattern is not accurately observed, applies here too. When the etching process is complete, and the paint removed, the component mounting holes are drilled, also observing the diagram, Fig. 3. For the aerial and first i.f., larger holes are drilled to accept the ends of the coil formers, which are then firmly fixed in position with polystyrene cement. The connecting wires from these coils are left at the length as supplied by the makers, and soldered to the appropriate circuit board conductors without being cut. This is because these components are fairly accurately prealigned, and this may be disturbed if the wiring is altered. The ratio transformer, also prealigned, is next mounted on the circuit board, then the tuning capacitor. The smaller components, resistors, transistors, diode and capacitors, are soldered into position so that the tuning capacitor has a free swing and the complete assembly is even and neat. Components are mounted on as short leads as possible to minimise stray capacitance, e.g. the transistors should not have more than ¼in. of wire for each electrode beyond the seals of the cans. The leads to the integrated circuit must be inserted with care, and the more accurately the circle of ten holes for it is drilled, the more convenient the mounting operation becomes. Pin 10 is clearly marked by the spigot, and the orientation of this guideline should be checked before applying the soldering iron to the pins—this item is very difficult to remove from the board undamaged if any mistake is made. There is no need to resort to

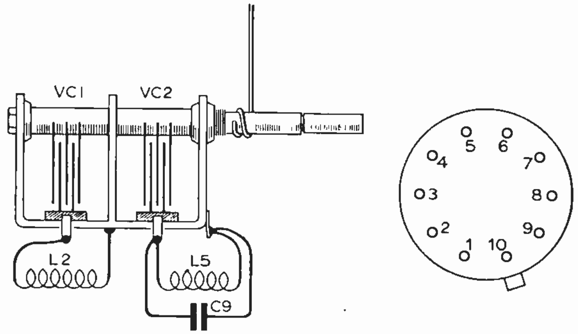


Fig. 5: (left) tuning gang assembly and (right) pin connections for the R.C.A. intregated circuit CA3014.

the excessive precautions recommended in the early days of transistor circuitry; care as normally given to an expensive component, and reasonable skill with a hot clean iron and good solder are all that is required. Anyway, the I.C. is a silicon component, and as such is very rugged and tolerant of heat.

Fitting the Coils

Figure 5 illustrates the mounting of the coils, L2 and L5, and also C10, on the tuning capacitor. Note that R1 and C1 are not mounted on the circuit board in the usual fashion; R1 is soldered to the foil side of the board, close up to the copper, while C1 goes from the earth side of C2 to the aerial coil. The illustration shows how this component is placed on top of C2, so that they use a common connection to the earth line. The audio output is taken from pin 7 of the I.C. through a capacitor, the other terminal of which is later taken to a jack socket on an aluminium panel. The primary purpose of this panel is to screen out hand capacitance when tuning the set, and the circuit is now ready to be

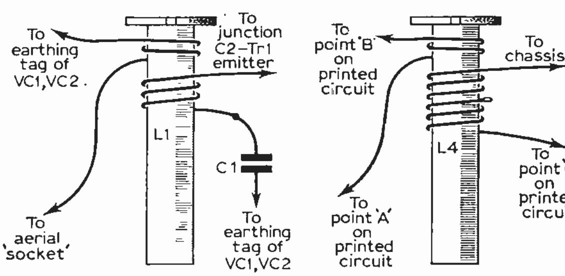


Fig. 6: (a) Aerial coil (L1) connections and (b) the 1st i.f.t. (L4) connections.

fitted on to it. It is folded from a sheet of 16 gauge aluminium, 9½ x 2in.; and incorporates at one end a battery compartment 2 x 1 x 1in. for a PP4 9-volt battery. It is attached to the printed circuit and earthed to it by screws fitting the tapped holes in the front of the tuning capacitor. Before fitting, it is drilled to take a coax socket for the aerial, a 3.5mm. jack socket for the audio output as mentioned above, and also clearance holes to permit access to the cores of the coils for purposes of alignment. The writers intend to use the prototype as a tuner and for test purposes only, so no volume or tone controls were fitted, and the output jack was arranged to serve at the same time as the on/off switch, by a simple modification to the spring contact incorporated in it; when a plug is inserted, this contact, which carries the positive battery line, is pressed upwards by the tip of the plug and makes contact with a fixed terminal and so connects with the circuit of the tuner. Three of the coils used in the front end of the tuner are merely small spills of wire, and the table gives winding data for these; if a constructor does not feel confident in winding them, the table of parts specifies equivalents available.

Alignment and Testing

The tuner is now ready for test and alignment. The circuit has a current drain of approx. 15mA. from a 9 volt source, and if the current is significantly above this level the circuit should be checked for shorts before proceeding further. If the coils are wound as instructed, they will be close to alignment already, and of course the aerial coil and ratio transformer, 1st i.f.t. and aerial coil are supplied pre-aligned, as noted above. Therefore when an aerial is inserted some activity should be observable on the band, and in fact the writer's prototype operated fairly well first time, even though located at a distance of 20 miles from the "local" station.

Correct Tracking

Proper tracking is obtained by stretching out L5 until the stations fall in the desired portion of the swing of the tuning capacitor. The setting of the aerial coil can then be adjusted for best quality of reception, and the length of L3 may be found to have some similar effect. It may also prove advantageous to try the settings of the i.f.t. and ratio detector, though without a wobbulator it is not possible to fix accurately the bandwidth of these coils at the specified 250kc/s. In the prototype, satisfactory reception proved possible on a short "throw out" aerial, though, of course, there was an undoubted advantage in a proper dipole. In fact, in an area of strong signal, it is possible to insert an earphone into the output socket, and use the tuner as a personal portable. Therefore, the writers are pleased to report that, although the project began as a design exercise, the result is a tuner with few equals in performance among the kits currently available, and no challenger for simplicity of construction or economy, costing under £4 to make.

Thanks are extended to Messrs. R.C.A. Great Britain Ltd. for co-operation, especially in regard to the diagrams. ■

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequencies in kc/s

THE BROADCAST BANDS

by JOHN GUTTRIDGE

EUROPE

Albania: *Radio Tirana* (Rue Ismail Quemal, Tirana) has replaced 9,715 by 11,715 for the 2200-2330 English TX.

Andorra: *Radio Andorra* (Obispo Catala 42, Barcelona 17, Spain) has now moved its second m.w. TX to 701 from 718. The s.w. outlet is now reported as 6,190.

Austria: *Osterreichischen Reudfunk* (P.O. Box 700A, 1040 Vienna) has made following changes: 6,155 additionally on air 1300-1800; 7,245 additionally on air 2000-2200; 11,850 replaces 11,785 at 1300-1500. The 2300-0200 TX on 9,770 re-timed at 0000-0200, and this frequency additionally used 1000-1300; the 1900-2200 TX or 15,210 re-timed to 1800-2100; 17,730 replaced by 17,800 at 1400-1600; extra TX at 2300-2400 on 15,360.

German Federal Republic: *Deutschlaedfunk* (Koln-Marienburg, Lindenalle 7) now has foreign service TX on 1,268 as follows: English 1900-1930, 2000-2030; Dutch 2030-2100; Danish 2100-2120; Norwegian 2120-2140; Swedish 2140-2200. At other times the home German programme is carried.

Great Britain: *BBC* (*CEXB*, Bush House, London, W.C.2) transmits in German to Europe at 1945-2100 on 9,600/6,195. At 1945-2045 there is Hungarian on 6,180. A further Hungarian TX is aired at 2200-2215 on 6,125.

Greece: *Radio Athens* (Mourouzi Street 16, Athens 138) reported with English at 1830 and French 1835 on 9,605/11,720.

Holland: *Radio Nederland* (P.O. Box 222, Hilversum) has replaced 21,570 by 9,525 for the 0730-0820 English TX. Other outlets remain 11,730/9,715.

Voice of America: *Munich relay* (Washington, DC, 20547, USA) noted with Lithuanian at 1530 on new outlet of 9,660.

Norea Radio: (Grensen 19, Oslo 1) has a programme in Norwegian at 1700-1730 on 9,630 over TX of Trans-World Radio, Monte Carlo.

Portugal: *Radio Lisbon* (Rua Quelhas 21, Lisbon). Opinions differ as to the 16 m.b. frequency used for the 0700-0900 English TX. It is variously given as 17,740, 17,890 and 17,895. All agree on 21,495 for the 13m.b. TX.

Roumania: *Radio Bucharest* (P.O. Box 111, Bucharest). Frequency changes have been made for the following transmissions: 1930-2030 11,940/9,570; 2230-2300 9,570/7,195; 0130-0230 9,510/9,570/11,725/11,810/11,940/15,250; 0300-0330 and 0430-0500 9,510/9,570/9,590/11,725/11,810/11,940/15,250.

Spain: *Radio Nacional de Espana* (General Yague 1, Madrid) appears to have a new schedule. The station has been noted on 9,370 at 2030 in Spanish; or 9,360 at 2030 in Hungarian; or 7,105 at 1500 in Spanish; on 6,140 at 1900 in Spanish; on 6,130 at 1930 in French and at 2100 in Spanish.

USSR: *Radio Moscow* (Moscow) noted as follows: on 11,785 in Norwegian at 1945; 11,755 Turkish 1030; 11,630 Russian 1900; 9,640 *1600; 9,620 *1800; 9,550 Spanish 1815; 9,500 Turkish 1545; 9,490 Russian 1600; 9,470 Arabic 1800; 7,340 Russian 1930; 7,100 Russian 1815. *Language unknown.

Radio Kiev: (*Ukrainske Radio*, Radio Centre, ul Khreshchatik 24, Kiev) has English Mondays, Thursdays and Saturdays 1900-1930 11,730/11,760/12,020; 2230-2300 1,240; 0030-0100 and 0430-0500 11,750/12,030/9,810/9,710/9,680. In German Tuesdays and Fridays 1910-1930 9,740/11,730/11,760.

AFRICA

Algeria: *Radiodiffusion*—Television Algerienne (21 Boulevard des Martyrs, Algiers) now transmits in French 0630-0830 6,080; 1200-1500 11,835/11,715; 1500-1700 9,510; 1700-2300 6,080.

Libya: *Libya Broadcasting and TV Service* (P.O. Box 333, Tripoli, P.O. Box 274, Benghazi) transmits over 5,965 at 0500-0900 and 1800-2100 and over 9,565 at 1100-1700.

Nigeria: *Nigerian Broadcasting Corporation* (Broadcasting House, Lagos) reported around 0600-0700 on further new outlet of 15,365.

Biafra: *Radio Biafra* reported to have external service in French at 0725 and 1830-2000, and English 2100-2130 over 4,855.

Senegal: *Radiodiffusion du Senegal* (B.P. 1765, Dakar) reported in French 1530-1600 on 21,685.

ASIA

China: *Radio Peking* (Broadcasting Administration, Fu Hsin Men, Peking) has been noted as follows: on 11,675 in German at 1820; 9,575 Russian 1930; 9,490 *1600; 9,480 Hindi 1600; 7,620 Italian 2050; 7,075 German 1845; 6,620 Russian 1900; and 6,560 French 1915. *Language unknown.

China (Taiwan): *Broadcasting Corporation of China* (Ren Ai Road, Taipei) now uses 7,120/9,655/9,685/11,825/17,890 for the 1030-1100 English TX.

Indonesia: *Radio Republik Indonesia* (P.O. Box 157, Djakarta). The home service in Indonesia can be heard in the afternoon on YDF, 6,045 until close down at 1600.

Pakistan: *Radio Pakistan* (Broadcasting House, Bunder Road, Karachi) now uses 11,750/15,134 for the 1945-2030 transmission in English to Europe.

Contributors this month were Roy Patrick, R. J. Warner, A. E. Roxburgh, A. G. Clarke, Swiss Broadcasting Corporation, Radio Sweden, International Short Wave Club. Many thanks go to all of them.

DOWN in the forest something stirred—so the song goes anyway. This past month on the amateur bands has echoed this refrain and, I am pleased to report, all bands have offered some very good openings.

On topband the Europeans have been in evidence on c.w. and reports of the odd W have come in. Several listeners logged some good DX on 7Mc/s and it looks quite a promising band to watch this Winter. Fourteen and twenty one Mc/s have supplied some very nice long-haul stuff and at times have positively hummed.

Surprise surprise, ten metres is "at it" again. By next year we should have some really good openings on this band. Now is the time to start thinking about a ground plane for Ten, this will give all-round reception and would be well worth the effort to erect.

H.F. BANDS

Some people reading this page are, perhaps, just starting on short wave listening and all these funny little numbers are a bit confusing. The first two or three letters and/or numbers in a callsign fix the country in which the station is situated. You can get a "Countries List" from the R.S.G.B. which helps enormously, but just for fun let's take the first log this month and list the countries heard rather than a long list of callsigns.

R. Street (Surrey) has a t.r.f. receiver (0-V-2), and a 110ft. long wire aerial. On 20 metres (14Mc/s) he heard amateur stations transmitting from—Clipperton Island, Korea, Panama City, Virgin Islands, Canal Zone, Guantanamo Bay, Australia, South Orkney Islands, Hong Kong, Laos, Venezuela, New Zealand and Singapore.

Incidentally, with a "Countries List" and a cheap map of the world you can learn quite a bit of geography in a very short time, and have fun while you're doing it.

R. King (Yorks.), R1155, a.t.u. (good lad), 36 ft. vertical and 66ft. l.w. says that the best time to listen on twenty metres for the Far East is from 1500 on, with Australian and New Zealand stations coming in between 0500 and 0800. On twenty metre phone Richard logged—CR61K,OL7MP, DU1FH, EA3NA, EP2BQ, ET3VRJ, F3KW, FG7XD, FP8CA, HB9UT, HK3RQ, HKØAI, HP1JC, HS4AK, HV3SJ, I1WX, K1HVV, K2RFZ/MM, K4AIM, K5QHS, K9CFV, KH6FIL, KL7WAH, KR6KN, KZ5MB, LU7ABV, OD5CN, OE1GWA, OHØNI, PX1NV, PY3HT, TG9EP (Guatemala), TI2CJ, UA9KAJ, UW9WR, UL7JA, VE2DE, VK2ID, K1DEU/P/VE8, VK3NW, VK5CV, VP8IE, VQ8CCR, W6MBA, W7HQC, XW8AX, ZL1AQE, ZL3UI, ZL4BX, ZS5GY, ZS6BAD, 3A2CP, 5L2KG, 7XØAH, 9H1AG, 9K2BY, 9N1MM, 9Y4VT.

L. Rowland (Cheshire), Trio 9R-59, 150ft. l.w. claims the bands are very busy. This statement is backed up by his log for 15 metres—CE3PR, CE4ZN, CEØAE (Easter Is.), CN8BB, CO8RA, CP1AW, CR6YZ, EA8CB, HC1XC, HI3XCH, JA1BB, JA2EDG, JA3NUC, JA4EVI, JA6BCE, JAØBFM, K7OYJ, KG6SF, KL7DTA, KP4IB, KV4CX, LU5AH, LU7PK, MP4BGE, MP4PBA, OD5BZ, OX5BW, PY1CAD, PY2SD, PY4UK, SVØWB, TF2WKM, TN8AA, UA9OW, VP9FB, VS9MB, VU2BK, W6GMM, W7BWE, WA7EYP, XW8EZ, YA1FV, YV1EJ, ZC4AK, ZD8BIL, ZL1AH, ZS5KS, ZS6DB, 4U1ITU, 4X4RW, 5Z4DQ, 6W8EX, 7Q7BM, 9H1AM, 9M2JSW, 9V1NV. All these on s.s.b.

On ten metres South America and Africa are in evidence plus most of Europe.

R. Burt (Essex), Lafayette HA-63A plus a 90ft. l.w. heard these on Ten—CT2AO, CT1IW, DL's, EA8CR, FG7XC (Guadeloupe), K's, OK, ON, PY2DBU, W's, YO9CN, ZC4MO, ZS1JA, 4X4BL, 5H3KJ.

A. Darragh (Yorks.), AR88D, 33ft. l.w. logged these on Ten s.s.b.—CR7FM, PY1CAD, PY2DSG, UA3WD, UF6ACR, UP2NX, VK6SR, VK9TC, ZC4AK, ZS1FF, ZS6AW, ZS6U, ZS6VIG, ZS9JM, 5N2ABF, 9J2DT.

R. Spencer (Yorks.), Hallicrafters SX111, " . . . triangular shaped long wire" listened on Ten s.s.b. for—CR7CZ, CR7ER, CR7FM, CX9CX, FH8CD, LU8DKA, OD5EP, OH2AM, OK1MP, PY1CAD, PY4MV, PY9HL, SM5SI, UF6ACR, VQ8CHR, VQ9TC, ZC4MO, ZE2JA, ZS6U, 4X4BL, 4X4DH, 5H3KJ, 5L2KG, 5N2ABF, 5Z4AA, 5Z4KN, 9J2GT, ZD7DI.

L.F. BAND

Down to 40 metres again, but look what's been about, and you missed it too!

F. Simpson (Yorks.), HA700, heard these on phone—CN8BC, K1UBE, K3BDU, KP4AEB, PY7LAK, PY8QQ, VP1RA, VK2AVA, W1EFG, W2TXP, W3PHL, W4TUT, WA1DXN, WB2PDA, YV1BI, YV7DQ, ZL2BCG.

A. Milewczyk (Manchester), Lafayette KT340, 70ft. l.w. managed these on s.s.b.—CN8AW, K1HRT, OH3QA, PAØGKO, PY4BLH, PY7ACN, PY7AST, PY7AUT, PY7LAK, PZ1CF, W1AK, W3FPB, W3OYY, W3PHL, W8QGP/P/4, ZD7KH (St. Helena).

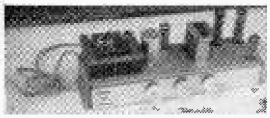
D. Henbry (Sussex), HA500, 14Mc/s dipole at 25ft., managed these on 40 s.s.b.—CN8AW, CN8BV, PX1IE, PY7AST, PY7GV, PZ1CF, VK2AVA, ZB2AP, 9H1AM.

CONTESTS

Now that the Mobile Rally season has finished we'll just have all those lovely contests to get into. There are four of them this month that I know of. These are—November 11/12th, R.S.G.B. 7Mc/s c.w. contest; 12th, OK DX contest, this one is c.w. too; 18/19th, Top Band contest; 25/26th, CQ World Wide DX contest (c.w.). On December 3rd, there's the 70Mc/s c.w. contest.

LOGS

Sorry to say that at least 50% of the logs received this month were not usable. They left out the information needed to make them of any use at all. Things like the mode, whether c.w., s.s.b., or a.m. Several logs were very good indeed but were not in alphabetical order and there just isn't time this end to stop and sort out a huge pile of callsigns no matter how good the log is. If you do send in a log, please put it in alphabetical order with the date, callsigns, frequency or band, time GMT, the receiver, aerial etc.



8 WATT, PUSH-PULL OUTPUT AMPLIFIER, 200-250 Volts A.C. EZ80, ECC83, 2—EL84. Bass, treble, vol/on-off. £5.15.0 (7/6 P. & P.) Size 12 x 3½ x 5in. high.

20 ELEMENT MAST CLIPPING BBC-2 OUTDOOR AERIAL. State Station required 55/- (7/6 carr.). BBC-2 Coax Cable 1/6 yd.

6 TRANSISTOR "SUPER SIX". M.W. and L.W. kit, £4 (5/- P. & P.). Wooden cabinet 11 x 7½ x 3½in. All parts may be purchased separately.
3½in. 10,000 line speaker, or 7 x 4in. 6000 line.

TESTED AND ASSEMBLED I.F. TRANSISTOR STRIP. 3 IFs (double tuned), osc., diode, 3—AF117, P.C. board 4½ x 2½in., 470KHZ, 25/- (2/6 P. & P.).

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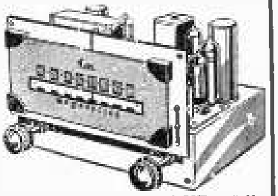

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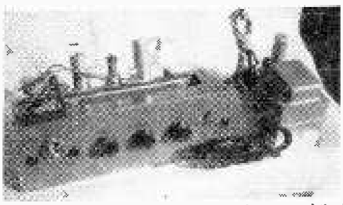

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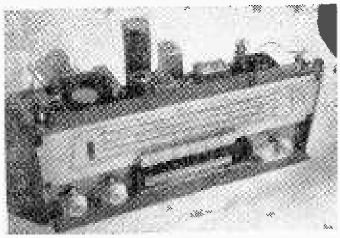

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P.W. DATA RULE

PART 2

by I. J. KAMPEL

FULL instructions concerning the use of the PRACTICAL WIRELESS Data Rule appeared in last month's issue, together with the free copy of the rule. These instructions were sufficient to enable anyone with experience of slide rule scales to make full use of the rule. There now follows a short series of articles which will explain its use more fully, enabling even the beginner to take full advantage of this rule.

For those who did not purchase last month's issue of PRACTICAL WIRELESS, the Data Rule is available from the PRACTICAL WIRELESS Blueprint Department, price 5s.

Let us begin with a definition. A linear scale is one in which the divisions of the scale are separated by equal distance, i.e., starting at 1 the distance between 1 and 2 will be the same as the distance between 2 and 3 and identical to the distance between 3 and 4 and so on all along the length of the scale (two linear scales are shown in Fig. 1).

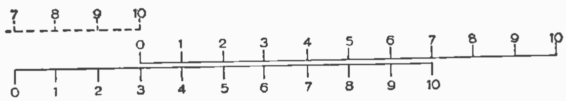

Fig. 1: Slide rule with two linear scales. This scaling is not practicable as explained in the text.

A logarithmic scale is quite different. The divisions get closer together as one moves along the scale. Thus the distance separating 1 and 2 on the scale will be larger than the distance between 2 and 3. Similarly the distance between 3 and 4 will be less than that between 2 and 3 and so on along the length of the complete scale.

Slide rules use logarithmic scales although at first sight it might appear far simpler to stick to linear ones. However it will be appreciated that it is far easier to add and subtract than it is to multiply and divide. This applies particularly when the numbers involved are not simple single digits but consist of several digits. For example to multiply 3·087 by 2·981. Adding these two numbers would be easier than multiplying them.

By using logarithms we can avoid multiplication and division by automatically converting them to simple addition and subtraction respectively. To use logarithms or logs as they are commonly known we find the log (from log tables) of the two numbers we wish to multiply and simply add these two logs together. The resultant number is looked up in a table of antilogs and the answer given opposite.

Similarly to divide any two numbers we can find their logs, subtract these logs, and look up the antilog of this number in tables for the answer to the problem. Some might doubt that all this business with tables is really so very much quicker than multiplying and dividing by longhand. But consider a problem like $3{\cdot}8^{-2} \times 56{\cdot}14^{4}$. This is far simpler with logs than it is to work out by longhand multiplication.

The slide rule, with its log scales is compact and quite easy to use once the principle of operation has been grasped. Instead of looking up the logs of numbers in the log tables, adding or subtracting these and then looking up the antilog to find the answer, the slide rule does all this in one go. It is only necessary to set the rule and read off the answer direct.

ANALOGUE CALCULATIONS

Analogue methods of calculation give close approximations to given calculations, and in usual slide rule scale lengths, three-significant figures is normally all that is expected. Figure 1 illustrates the basic principle of operation.

Here two linear scales are shown, scaled identically from 0 to 10. To perform addition, for example 3+5, place the zero of the upper scale adjacent to the 3 of the lower scale, and read the answer, 8, in the lower scale, opposite the 5 in the upper scale. Obviously, all this process does is to count five along from the 3, thus giving 8. Since the upper 0 is aligned with the lower scale 3, the rule is set for all additions of the form 3+n, where "n" is any other number.

A problem arises when we go off the lower scale length, as in the case of 3+9 for example, for there is nothing below the upper scale 9. In this example, the rule should be reset, with the other scale end opposite the lower scale 3, i.e., the upper scale 10 aligned with the lower scale 3, and then opposite the upper scale 9 (shown dotted in figure), we see 2 in the lower scale. It is necessary to correct for the scale reset, and since the scale is 10 units long, 10 must be added to this result, giving the answer 10+2, or 12.

Had we wished to add two numbers that were not whole numbers, for example 2·59+3·76, in this case, the upper scale 0 would be set opposite 2·59 in the lower scale, and with more subdivisions than in the figure (this is not too difficult to estimate), then we may read the answer, 6·35, in the lower scale opposite 3·76 in the upper scale. The practical use is thus more obvious with awkward numbers.

Subtraction is simply the reverse process, and had our sum been 6·35−3·76, we would place the 3·76 of the upper scale opposite the 6·35 of the lower scale, and read the answer, 2·59, in the lower scale, opposite the end mark of the upper scale.

It is not usually practical to actually use this principle for addition and subtraction, for they are relatively simple computations. The same principle applied for multiplication and division, however, would obviously be a great deal more useful. This is possible, by firstly converting our numbers to logarithms.

LOG TABLES

Suppose that the required calculation is a very simple case, 2×4. Now using log tables, this is represented as follows. Using log tables we find that the log of 2 is 0·3010, and the log of 4 is 0·6021. Remembering that when we use logs multiplication becomes simple addition we proceed as follows:

$$2 \times 4 = \log 2 + \log 4 = 0{\cdot}3010 + 0{\cdot}6021 = 0{\cdot}9031.$$

Now we turn to our table of antilogs and look up 0·9031 and we find the answer is 8.

By converting the 2 and the 4 into logarithms we have reduced the calculation to an addition, and thus the above principle can be employed. Now we might look up the logs from the tables, then add these values with linear scales, returning to antilog tables for the answer, however this is obviously far too cumbersome, and would take far too long. The next improvement would be to put a scale next to the linear scale, giving the appropriate log conversion, i.e., a log scale adjacent to, and aligned with the linear scale. We could then easily transform the number to its log value, add the log values as shown before for linear addition, and then read the answer from the linear scale, adjacent to the log scale answer.

The more efficient method, however, is to eliminate the linear scale altogether, just leaving the log scale, but scaled in terms of the linear numbers it represents. Figure 2 represents two log scales as described, corresponding to the L and M scales on the Data Rule. Now we perform the addition process to multiply, and the figure shows how the example 2×4 is carried out. Place the end mark, or 1 of the upper scale, opposite the 2 of the lower scale, and read the answer 8, in the lower scale, opposite 4 in the upper scale.

Fig. 2: Multiplication using logarithmic scales.

Obviously this is very much simpler than long multiplication of a more involved calculation, such as $5{\cdot}42 \times 2{\cdot}8$ for example. By long multiplication, we obtain the correct answer of 15·176. Now, by logarithms (four figure) we can only expect to get the first three significant figures, and achieve this in the same manner as before, i.e.:

$$\log 5{\cdot}42 + \log 2{\cdot}8 = 0{\cdot}7340 + 0{\cdot}4472 = 1{\cdot}1812$$

To obtain the answer we take the antilog of this, remembering that the "1" indicates the power of 10, and looking only for the "·1812" portion in the antilog table, thus: antilog $1{\cdot}1812 = 15{\cdot}18$, which must be corrected to 3 significant figures, giving 15·2, the same as the long multiplication answer, also corrected to 3 significant figures. To do the same calculation with the slide rule, and again obtain the 3 significant figures answer, set the appropriate end mark of the upper scale, in this case the 10, opposite the 5·42 position in scale M, and read the answer, as presented on the rule, 1·52, opposite 2·8 in scale L. Note that the significant figures are correct, but that the decimal point is not correct.

DECIMAL POINTS

In any calculations on the slide rule, allowance must be made for the fact that if every individual *possible* number had to be represented on the rule, the rule would be of infinite length, and would consist of an infinite number of log cycles, identical to the one shown in the figure, all placed end to end, increasing by a power of ten at every cycle end. We get over this problem by accepting that the slide rule will only give us the significant figures, and we must use common sense to place the decimal point. A quick calculation that will in no way strain the mind is all that is necessary, and

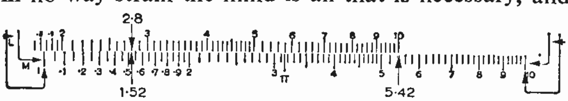

Fig. 3: Example of multiplication using the data rule.

to do this, we round-off the numbers to be multiplied, and thus do a rough calculation to get an idea of the order of the magnitude of the answer. In our example we have to multiply 5·42 by 2·8. Roughly, then, let us mentally work out, say 5×3, giving 15. We know that the answer will be round about 15, thus the correct answer must be 15·2. The other nearest possibilities, namely 1·52 and 152 are obviously outrageous.

Thus the L and M scales of the data rule may be used to rapidly multiply two numbers together. In the previous example, with linear scales, it was shown that the reverse process for addition was the correct procedure for subtraction. The same applies with the logarithmic scales for division, since we subtract logarithms to divide.

DIVISION

Consider the following example:

$$70{\cdot}4 \div 3{\cdot}2$$

Now when we convert to logs division becomes simple subtraction thus:

$$70{\cdot}4 \div 3{\cdot}2 = \log 70{\cdot}4 - \log 3{\cdot}2$$

looking up 70·4 in log tables we find that this is 1·8476 and the log of $3{\cdot}2 = 0{\cdot}5051$ therefore the complete calculation reads:

$$70{\cdot}4 \div 3{\cdot}2 = \log 70{\cdot}4 - \log 3{\cdot}2 = 1{\cdot}8476 - 0{\cdot}5051 = 0{\cdot}3425.$$

We look up the antilog of 0·3425 in the antilog tables and find the answer is 2·20. (This is correct to 3 significant figures.) Using the rule, place 3·2 in scale L opposite 70·4 in scale M, and read answer, 2·20, opposite 1 of scale L.

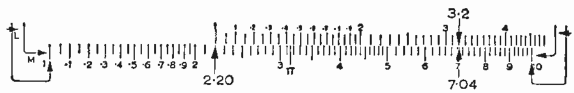

Fig. 4: Example of division. Although 7·04 is set, this is regarded mentally as 70·4.

The equivalent scales on a conventional slide rule are far more convenient to use than on the data rule when it comes to longer calculations, perhaps consisting of several multiplication and division steps, due mainly to the luxury of a cursor, a sliding piece of perspex with a line marked on it. This line may be set up anywhere on the rule to assist the user in longer calculations, and to remind him of an intermediate answer in a longer calculation. Obviously a cursor is not practical with this calculator, however, it must be stressed that although the L and M scales enable ordinary multiplication and division, their main purpose is for units conversion, and this will be dealt with fully in another article. For inter-units conversion, the Data Rule does provide a luxury that the conventional slide rule does not—a fixed decimal point, and direct conversion between many electrical units.

COMPLEX OPERATIONS

With a mathematical slide rule complete with cursor the following problem would resolve merely to moving the cursor and slide about and reading off the answer direct with no mental arithmetic at all other than placing the decimal point.

$$\frac{22{\cdot}7 \times 678 \times 34{\cdot}015 \times 92{\cdot}501}{3{\cdot}02 \times 0{\cdot}45 \times 346 \times 0{\cdot}89}$$

Imagine working this out by long division and multiplication!

For those who would like to study the mathematical slide rule further, a trip to the local library should be fruitful since many books have been written on the subject, or a book may be purchased, such as *Slide Rule Manual*, published by George Newnes, price 8s. 6d.

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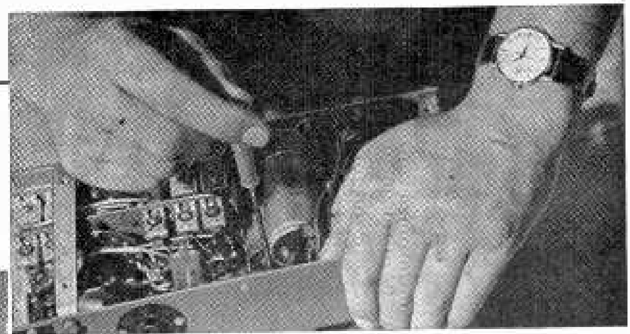

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4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole, 6 way—1 pole, 12 way. All at 3/6 each 36/- dozen, your assortment.

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An Instant Thermostat. Simply push it into 15A wall socket and plug your fire or other appliance into it. Knob setting. Will save its cost in a season. Normally 39/6. We offer at 19/6. plus 2/- post.
15A Socket 4/6 extra

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ACY21	6/-	OC20	12/6	OC139	8/6
ACY22	4/6	OC22	10/-	OC140	12/6
AF114	4/-	OC23	8/-	OC170	5/-
AF115	4/-	OC24	15/-	OC171	4/-
AF116	4/-	OC25	8/-	OC200	9/-
AF117	4/-	OC26	7/6	OC201	12/6
AF118	4/-	OC28	8/-	OC202	13/6
AF139	12/6	OC29	17/6	OC203	12/6
AF186	17/6	OC35	10/-	OCP71	15/-
AFZ12	15/-	OC36	15/-	ORP12	8/6
ASZ21	15/-	OC38	12/6	ORP60	10/-
BC107	14/6	OC42	6/6	SBO78	6/6
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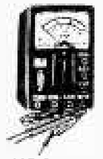
Sub-miniature glass encased—only approx. ⅛in. long wire ended.
400mA, ·50v. 1/6 100v. 2/6 200v 4/6

FLUORESCENT CONTROL KITS

Each kit comprises seven items—Choke, 2 tube ends, starter, starter holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A.—15-20 w. 19/6. Kit B—30-40 w. 17/6. Kit C—80 w. 17/6. Kit D—125 w. 22/-. Kit E—65 w. 19/6. Kit MF1 is for 6in., 9in. and 12in. miniature tubes 19/6. Postage on Kits A and B 4/6 for one or two kits then 4/6 for each two kits ordered. Kits C, D and E 4/6 on first kit then 3/6 for each kit ordered. Kit MF1 3/6 on first kit then 3/6 on each two kits ordered.

11 RANGE TEST METER

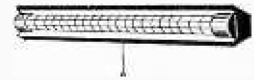


For checking car electrics, radio, TV, ignition systems, household lighting etc. Measure AC/DC volts. DC current. Resistance. Will last a lifetime. 39/6. P. & P. 3/6.

HURSEAL AUTOMATIC TIME SWITCH

12 hour. 15A to control heating, lighting, radio, immersion heaters, etc. Regular price £4.4.0. Limited quantity 39/6. P. & P. 3/-.

INFRA-RED HEATERS

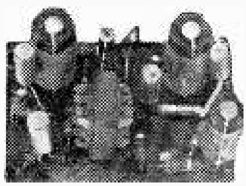


Make up one of these latest type heaters. Ideal for bathroom, etc. They are simple to make from our easy-to-follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watts element, all parts, metal casing as illustrated, 19/6, plus 3/6 post and insurance. Pull switch 3/- extra.

DRILL CONTROLLER

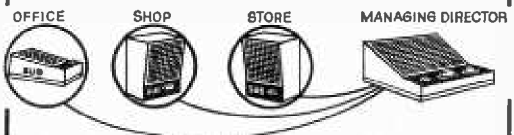
Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by fingertip control. Kit includes all parts, case, everything and full instructions. 19/6, plus 2/6 post and insurance. Or available made up 32/6.

750mW TRANSISTOR AMPLIFIER



4 transistors including two in push-pull input for crystal or magnetic microphone or pick-up—feed-back loops—sensitivity 5mV. Price 19/6. Post and insurance 2/6. Speakers: 3in. 12/6, 5in. 13/6, 6 x 4in. 14/6.

THIS MONTH'S SNIP INTERCOM BARGAIN



Will save time and improve efficiency. Ideal in home—office—shop—surgery, etc. Complete outfit comprises Master unit and three substations each of which can call the master and have full two-way working. No wiring problems as subs fitted with 60ft. twin flex and they plug into sockets. Also included is packet of staples—and battery. Nothing else to buy—£4.19.6, plus 4/6 post and insurance.

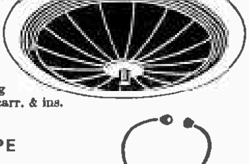
GARRARD AUTO RECORD PLAYER Model 2000

This is one of the latest products of the World's most experienced maker of fine record reproducers. Its superior features include—automatic playing of up to 8 mixed size records—stopping and starting without rejecting—manual playing—pick-up pivots to give low stylus pressure—large diameter turn-table for max. stability adjustments include pick-up height—pick-up dropping position and stylus pressure. Size is 13½ x 11¾in. clearance 4⅝in. above. 2½in. below—fitted with latest hi-compliance cartridge for stereo—and mono. L.P. and 78. Supplied complete with mounting template and service sheet. Offered this month at the Special Snip price of £6.19.6 plus 7/6 carriage and insurance.

THE VECTRONOME CAPSTAN DRIVEN TAPE RECORDER

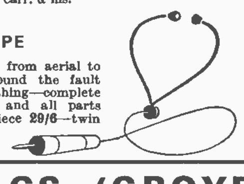
This is a truly portable, self-contained instrument with built-in microphone and loudspeaker using a 5-transistor amplifier with P.P. output and suitable for operation from mains or by chargeable batteries. Tape capacity is 25 minutes on easily changed spools. A tape position indicator gives quick reference to any part of dictation. Recording level is automatically pre-set during dictation and can be adjusted to suit operator. Interlock prevents unintentional erasures. Tape speed controlled by fly wheel driven capstan. Very portable in neat case with carrying handle, overall size of which is approximately 6¾ x 7½ x 2 in. Price with tape, nickel cadmium rechargeable batteries and mains battery charger £9.19.6 (rather less than ⅓ original price). Postage and insurance 7/6. Unused and in perfect working order.

CIRCULAR FLUORESCENT



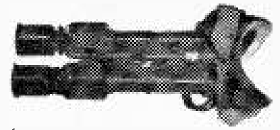
Brings sunshine into your home. 150 watts of light but uses only 40 w. Beautiful fittings with glass, non-plastic centre, fluorescent tube and choke control. Regular price £4.15.0. Special budget price 69/6, plus 8/6 carr. and ins. Please state colour of glass centre, white, pink, blue, red, black, yellow or cream. Also whether plug into lamp holder or ceiling mounting model. 80 watt model 99/6. 10/- carr. & ins.

RADIO STETHOSCOPE



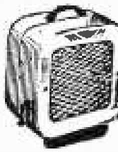
Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault use it on Radio, TV, amplifier anything—complete kit comprises two special transistors and all parts including probe tube and crystal earpiece 29/6—twin stetoset instead of earpiece 7/6 extra—post and ins. 2/9.

See in the Dark INFRA-RED BINOCULARS



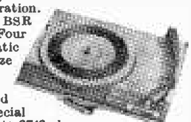
These infra-red binoculars when fed from a high voltage source will enable objects to be seen in the dark, providing the objects are in the rays of an infra-red beam. Each eye tube contains a complete optical lens system as well as the infra-red cell. These optical systems can be used as lenses for T.V. 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.

2½ kW FAN HEATER

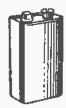


3 heat positions to suit changes in weather: 1kW, 1½kW and 2½kW; also blows cold for summer, has thermostatic safety cut-out. Proper price £5.17.6. Yours for only £3.15.0, plus 7/6 post and insurance.

G.U.7 RECORD PLAYER



BSR Record Player for normal mains operation. This is the famous BSR Model G.U.7. Four speeds with automatic stop. Plays any size of record and is complete with stereo cartridge and sapphire stylus. Special snip price this month 67/6 plus postage and insurance 6/6.

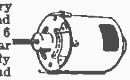


PP3 Eliminator. Play your pocket radio from the mains! Save £s. Complete component kit comprises 4 rectifiers—mains dropper resistances, smoothing condenser and instructions. Only 6/6 plus 1/- post.

WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. 10/- post free.

9 VOLT PRECISION MOTOR



Intended for driving battery operated tape recorders and record players. Laminated, 5 Pole armature with Brush Gear and rapid start switch. Normally 25/-. Our price 7/6, plus post and insurance 1/6.

THERMOSTATS

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

Type "B" 15 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 50–550°F. Internal screw alters the setting so this could be adjustable over 30° to 1000°F. Suitable for controlling furnace, oven kiln, immersion heater or to make flame-start or fire alarm. 8/6 plus 2/6 post and insurance.

Type "D". We call this the Ice-stat as it cuts in and out at around freezing point. 2/3 amps. Has many uses, one of which would be to keep the loft pipes from freezing, if a length of our blanket wire (16 yds. 10/-) is wound round the pipes. 7/6. P. & P. 1/1.

Type "E". This is standard refrigerator thermostat. Spindle adjustments cover normal refrigerator temperatures. 7/6 plus 1/- post.

Type "F". Glass encased for controlling the temp. of liquid—particularly those in glass tanks, vats or sinks—thermostat is held (half submerged) by rubber sucker or wire clip—ideal for fish tanks—developers and chemical baths of all types. Adjustable over range 50° to 150°F. Price 18/- plus 2/- post and insurance.

MAINS TRANSISTOR POWER PACK

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 100 mfd. condensers and instructions. Real snip at only 14/6, plus 3/6 postage.

Where postage is not definitely stated as an extra then orders over £3 are post free. Below £3 add 2/9. Semi-conductors add 1/- post. Over £1 post free. SAE with enquiries please.

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A final reminder that when a required number is off the scale on the L and M scales, it is only necessary to reset the L scale, so that the opposite end mark (1 or 10) is adjacent to the number that the present end mark (10 or 1) is adjacent to in the M scale.

RECIPROCALS

The reciprocal of a number, "n", is defined as $\frac{1}{n}$. Thus, the reciprocal of 2 is $\frac{1}{2}$ or, converting to a decimal, 0·5. The reciprocal of 8 is $\frac{1}{8}$ or in decimal form 0·125 etc. A reversed log scale opposite a normal log scale in fact gives reciprocals in decimal form at adjacent points, and, as with multiplication and division, the decimal point is placed by inspection. Thus, to obtain the reciprocal of a number it is only necessary to look at the scale in direct line with the number in Scale L, the Z scale giving the required reciprocal. To enable the line to be taken from one scale to the next with greater accuracy, simply align the number in Scale L with one of the end marks of scale M, the reciprocal then being given opposite the appropriate mark in the incomplete Scale Y. Thus, reciprocal of 2 may be found by placing the 2 in scale L opposite the 1 of scale M, and reading off 5, corrected mentally to 0·5, opposite the mark in Y.

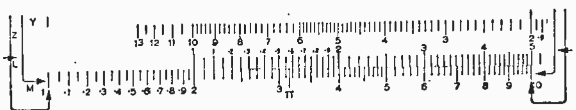

Fig. 5: Uses of the reciprocal scale.

For those likely to use a slide rule after this, a useful point to note is that if we have a calculation of the form $z \div y$, another way of expressing this is to convert one number to its reciprocal and multiply, thus giving: $z \times 1/y$. Similarly, a calculation of the form $z \times y$ could be expressed as $z \div 1/y$ i.e, take the reciprocal of one number and now multiply, for a previous division, or *vice-versa*. For example let $z = 8$, and let $y = 4$. Then $z \div y$ = answer i.e. $8 \div 4 = 2$. Using the other method $z = \frac{1}{y}$ we have $8 \times \frac{1}{4} = 2$. The use of this comes in long calculations on the slide rule, where alternate multiplication and division is the quickest approach, and to achieve this, the habit of using a reciprocal, where necessary, soon comes automatically. This is, of course, only done when a reciprocal scale is provided on the slide rule, and, for example, instead of placing an end mark against a number in the middle of a calculation, it may be more convenient to place the reciprocal of the number, in the reciprocal scale, opposite the number. The simple proof that this will work is offered at any slide setting, when it will be seen that whatever the scale L end mark points to on scale M, this number is also adjacent to the mark in Y, read off in scale Z. The "end mark" is of course either the 1 at one end of a scale or the 10 at the other depending which end mark is being used for a particular calculation.

For instance, increase 10 by $5\% = 10·5$ i.e., $\frac{105}{100} \times \frac{10}{1} = 10·5$

COMPONENT TOLERANCE

Usual component tolerance ratings are 1, 2, 5, 10 and 20 per cent. Now this may be positive or negative, but in all cases, each of these tolerances uses a constant portion of scale length to compute the tolerance. The reader will be familiar with the fact, for example, that to increase a number by 5% it is only necessary to multiply that number by $\frac{105}{100}$ or 1·05. Similarly to increase a number by 10% we multiply that number by $\frac{110}{100}$ viz. Increase 20 by 10% = 22. $\frac{110}{100} \times \frac{20}{1} = 22$

This process will be carried out on the reciprocal scale Z in conjunction with the small Component Tolerance Scale immediately above it in red.

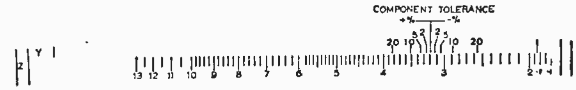

Fig. 6: The component tolerance scale.

To give the +5% tolerance, it is only necessary to mark the length representing the log of 1·05 next to the appropriate log scale. This length is shown between the central line of the tolerance scale, and the indicated +5%. Verify this by placing the 1 of Scale Z opposite the central mark, and the +5% mark is seen to be opposite 1·05 on Scale Z. In a similar manner, to give the —5% mark on the scale, the scale length representing 0·95 must be marked off, and with the slider set as described above, it will be seen that —5% is adjacent with 0·95 in Scale Z. The rest of the tolerance scale is similarly constructed. The ± 1% marks can easily be estimated. Decimal points are placed by inspection. An example of how the scale is used in practice is shown with the aid of Fig. 6.

Say, for example, a resistance of 320 ohms is required, with a tolerance specified of ±5%. Now 320 ohms is not a preferred value of resistance, but by setting 3·2 in scale Z opposite the central mark of the tolerance scale, we can read off the limiting values of resistance at a tolerance of ±5%. Thus it is seen that the preferred resistance value of 330 ohms is within the tolerance.

LOG SCALE

It has already been shown that the scales represented by L and M are log versions of a linear scale. Thus, a linear scale adjacent to the log scale allows conversion between the two, as shown in Fig. 7. On our slide rule the linear scale is not adjacent to the L scale but is drawn to project in the windows K and H higher up on either side of the rule. The red arrows and lines at either end of the M scale are the lining up points to couple the L scale with the K and H windows. Thus the drawing in Fig. 7 is for clarity only, the actual arrangement being shown in Fig. 7b.

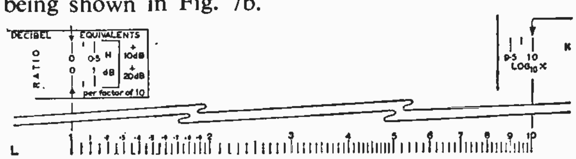

Fig. 7: Log x, or decibel power ratio.

The log scale has been marked in terms of linear numbers, and thus the linear scale is marked in terms of log numbers. Thus log x is read on the linear scale, opposite x on the log scale. It is thus seen that log 2 is 0·301 to 3 sig. figs. reading the 2, in the figure, in scale L, and the log value, 0·301, in scale K. On the rule this alignment of scales is automatic, if the number "x" is set in scale L, opposite the 10 mark in scale M, as indicated by the arrows on the rule. The log x value is then obtained from window K, opposite the arrow. The window only provides, to three significant figures, the part of the logarithm that would be obtained from the log tables. The positive portion of the logarithm, the portion preceding the decimal point, technically known as the *mantissa,* is obtained by inspection, in the normal manner. Thus, log 20 is read off as 1·301, and similarly log 0·2 as $\overline{1}\cdot 301$.

DECIBEL EQUIVALENTS

Amplifier gain is frequently expressed in terms of decibels, where a decibel is approximately the smallest change in sound that the ear can detect. A power ratio, that is the ration of output power to input power, may be expressed as N dB (decibels), where N dB $= 10 \log \frac{P_{out}}{P_{in}}$ That is to say that the decibel ratio is expressed in terms of the logarithm of the power ratio, and the $\times 10$ factor, always applied since this is a constant in the expression, lifts the log value sufficiently high to be a little more manageable. Thus, if input and output powers are known, then P_{out} divided by P_{in} is simply calculated by the division method, using scales L and M, and the answer to this calculation can then be converted to a log value by using the log scale. It is then only necessary to multiply by 10 to get the final decibel equivalent of the power ratio. It should be mentioned here that to be technically correct, this is only the correct procedure if the input and output impedances of the system are identical.

Let us take an example where the input power of an amplifier is 100mW, and the output power is 3W. Now the power ratio is thus $\frac{3\cdot 0}{0\cdot 1} = 30$ Thus, N dB = 10 log 30. The mantissa is seen to be 1.

To get the complete log value, the process is as in the case of getting a normal log, however, for clarity, a separate window has been provided for decibel calculations (bottom section of the window used for voltage and current ratio conversions to decibels), window H. This achieves exactly the same thing, however, on the same scale, the only difference being that the power ratio is set in scale L, opposite the 1 of scale M.

In the example, set 3 in scale L opposite the 1 of scale M, and read off approximately 4·8 in window H, opposite the arrow, in the upper portion of the window. The note on the upper portion of the window, to the left, signifies the upper scale for POWER ratios. The precise value is 4·77, however the 4·8 should be near enough. The full logarithm is thus 1·48, and then, for the final answer, we multiply by 10, giving 14·8 dB.

To enlarge upon this, if the power ratio is between 1 and 10, the decibel equivalent is given directly in scale H. If the ratio is greater than 10, then add 10dB for every factor of 10, as indicated to right of the window. Thus, to repeat the previous example, when using the rule, and forgetting the formula, set the ratio of 30 as a number between 1 and 10, times an appropriate factor of 10, i.e., $3\cdot 0 \times 10^1$. There is thus a single factor of 10 involved in the answer.

Set 3 in scale L opposite 1 of scale M and read off 4·8 in window H, for the power ratio portion of the dB scale. Now, since there is a single factor of 10 operating, add 10dB to the computed answer of 4·8dB, giving the correct result of 14·8dB.

dB TO POWER

Another example, of the reverse procedure, will now be given. Let us convert the decibel equivalent of 35dB into a power ratio. The reverse procedure applies. We see that three multiples of 10 must apply, thus we take 30 from the original 35 to give us a number between 0 and 10 on the decibel scale, namely 5dB. 5dB opposite the arrow in window H indicates the ratio 3·16 in scale L, following the indicating arrow, and we then simply multiply this by the three factors of ten, i.e. the power ratio is $3\cdot 16 \times 10^3$, or 3,160. Conversion to decibel equivalents of voltage and current ratios is basically the same as for power ratios, however the formula is now N dB $= 20 \log \frac{V_{out}}{V_{in}}$ or $20 \log \frac{I_{out}}{I_{in}}$

Fig. 8 thus shows the linear scale required adjacent the log scale for this conversion. Again the H scale is shown adjacent to the L scale for clarity only, on the rule the H scale is in the large right hand window and is used in conjunction with the L scale as advised.

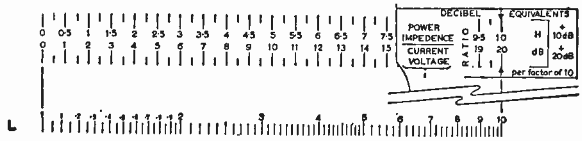

Fig 8: Decibel current/voltage ratios.

The voltage or current ratio may be computed using L and M scales, and the ratio obtained is then set opposite the 1 of scale L, as before, but the lower scale in window H is now employed, giving direct decibel readings, this time for 0—20 dB, but again being the decibel exact equivalents for ratios between 1 and 10. As before, convert to ratio form as previously described, but now, instead of adding 10dB for every factor of 10, add 20dB, as note to right of window H reminds.

Thus, the decibel equivalent of the current or voltage ratio 17·8 is obtained as follows. Place 1·78 in scale L opposite appropriate mark, (taking the ratio in the form $1\cdot 78 \times 10^1$), and read off 5dB in lower portion of scale in window H. Now adding 20dB for every factor of 10, since there is only one factor, this gives the final answer of 25dB.

IMPEDANCE CORRECTION

The previous decibel equivalents have assumed identical input and output impedances. To correct this figure if this is not the case, complete the first stage with power, voltage or current ratio as before, and then add to the decibel figure thus obtained, the decibel figure obtained from the following expression:

$$N_z \text{ dB} = 10 \log \frac{Z_{in}}{Z_{out}}$$

Scales L and M can be utilised to get the impedance ratio, and obviously the upper portion of the scale in window H is used for the evaluation of the rest of the expression, where the procedure previously used for power ratios is adopted, as reminded by IMPEDANCE at the upper-left of window H.

To be continued

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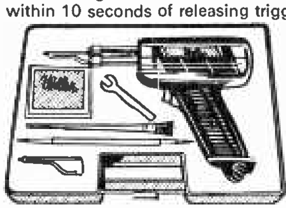

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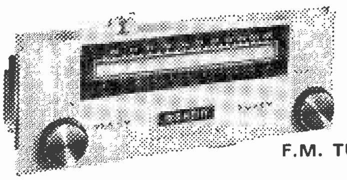

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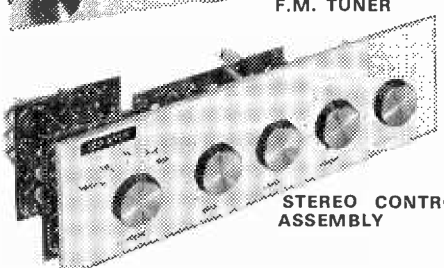

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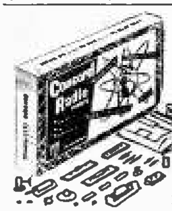

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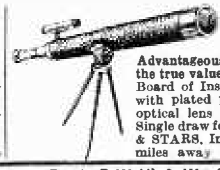

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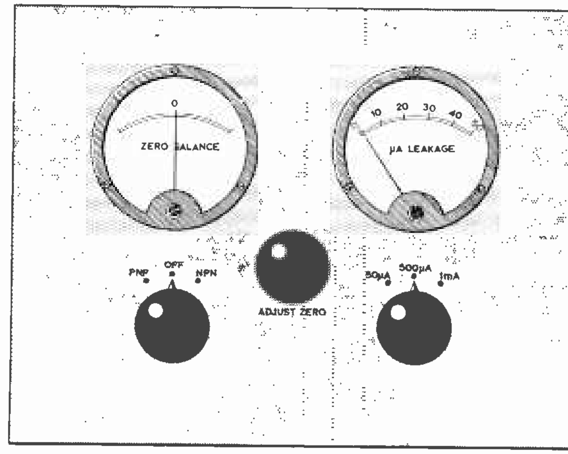


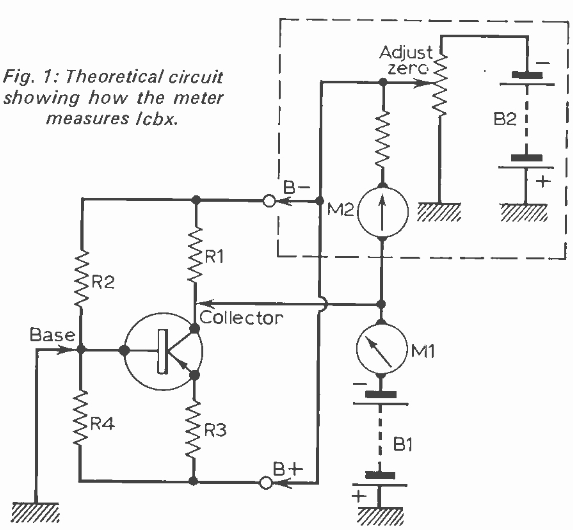
IT has been found that whilst repairing transistor radio sets, especially the miniature type, nothing is more infuriating than to suspect a particular transistor of being faulty, and be unable to remove it for testing, in case other components and the printed circuit are damaged.

The test unit to be described here enables a simple test to be carried out whilst the transistor is still connected to the components. The test is the leakage current, Icbx, between collector and base. This test is similar to Icbo, where the former has the emitter connected and the latter has it disconnected.

Figure 1 shows the basic circuit diagram of the unit; it can be seen that if the part within the dotted lines were not present, the current would flow from the collector via R1 and R2 to earth and from the collector to the base, and from the collector to the emitter through R3 and R4 to earth. The circuit within the dotted lines balances the potentials at R1, R2 junction and R3, R4 junction with that appearing at the collector, therefore no current can flow in R1 from the battery B1. The meter M1 will then indicate only the current from collector to base.

Referring to Fig. 2, the battery B2 supplies the voltage via the control VR1, this is adjusted until M1 shows no reading at all. The more accurate the zero adjustment is the more accurate the measurement.

Fig. 1: Theoretical circuit showing how the meter measures Icbx.



Both of the batteries are reversible by S1, this enables pnp or npn types to be tested. The circuit has been devised to test mainly germanium transistors, the silicon types have leakage currents well below the range of this unit.

Diodes D1, D2 and D3 protect the meters against large currents by conducting if the voltage dropped by R1 + M1 or R2 + M2 exceeds 150mV. R1 and R2 are selected to suit the meter obtained, the

★ components list

Resistors:

- R1 — see text
- R2 — see text
- R3 (shunts) — see text
- R4 (shunts) — see text

Diodes:

- D1 OA200
- D2 OA200
- D3 OA200

Miscellaneous:

M1 50μA meter, M2 50-0-50μA centre zero meter, S1 4 pole 3 way switch, S2 1 pole 3 way switch, B1-B2 6 volt battery, (PP1), VR1 1kΩ wire wound potentiometer, four crocodile clips, etc.

TABLE 1

Code	Icbo(μA)	Icbx(μA)
OC71	18·0	36·0
OC72	6·0	12·0
OC45	6·0	12·0
OC83	10·0	20·0
OC84	10·0	20·0
AF118	1·5	4·0
AF127	1·3	3·0
AC153	8·0	18·0
ACY19	10·0	20·0
ASY26	3·0	7·0
NKT211	10·0	20·0
NKT239	10·0	20·0
2N2613	4·0	8·0

resistance of the meter should be determined and the total made up to 2kΩ. The current range shunts are determined from the formula Rm(Im/Is) where Im is the current through the meter (50µA) Is is the current through the shunt (450µA for the 500µA range) and Rm is the resistance of the meter.

The circuit of Fig. 2 may be modified by additional switching such that a single meter may be used for both positions; if this is done then a resistor (R5) must replace the meter which is out, see Fig. 3.

M1 should be a centre zero meter, but a normal meter may be used and a reverse meter switch provided.

The circuit may be checked by placing a resistor from the collector lead to the base, a value of 240kΩ is suggested as this will give a half scale reading on M2. Two more resistors are then connected, one from B— to collector and the other from B+ to base, the control VR1 is then adjusted until M1 reads zero, M2 should still read 25µA within 20%.

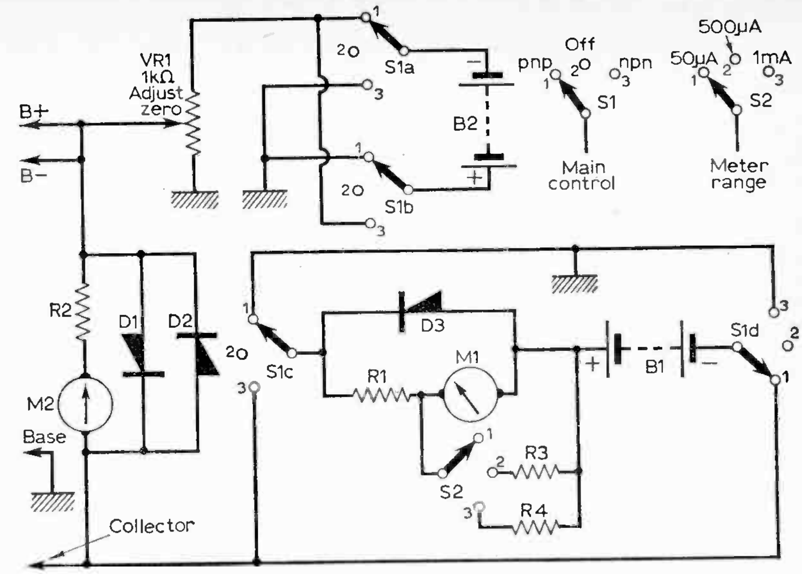


Fig. 2: Basic circuit of the unit.

USING THE UNIT

Table 1 gives a list of transistors widely used in commercial and home constructed radio sets. The majority of transistor specifications give Icbo tests at 6V, and this value has been chosen here. The table gives specification values for Icbo and the expected maximum reading on this unit.

The battery should be removed from the radio set and the B— and B+ leads connected, if there is any series resistance (decoupling) in the battery leads, this should be short circuited. The base and collector leads are then connected, and the type of transistor (pnp or npn) selected, this will switch on the unit. M1 and M2 should now deflect; adjust VR1 until M1 reads zero, M2 will now read the leakage current.

When the collector load resistance is small, for example an i.f. transformer coil, it becomes more difficult to zero M1, as the small current through the load produces only a small voltage to drive M1 meter. Extra care should be taken when checking such stages. ■

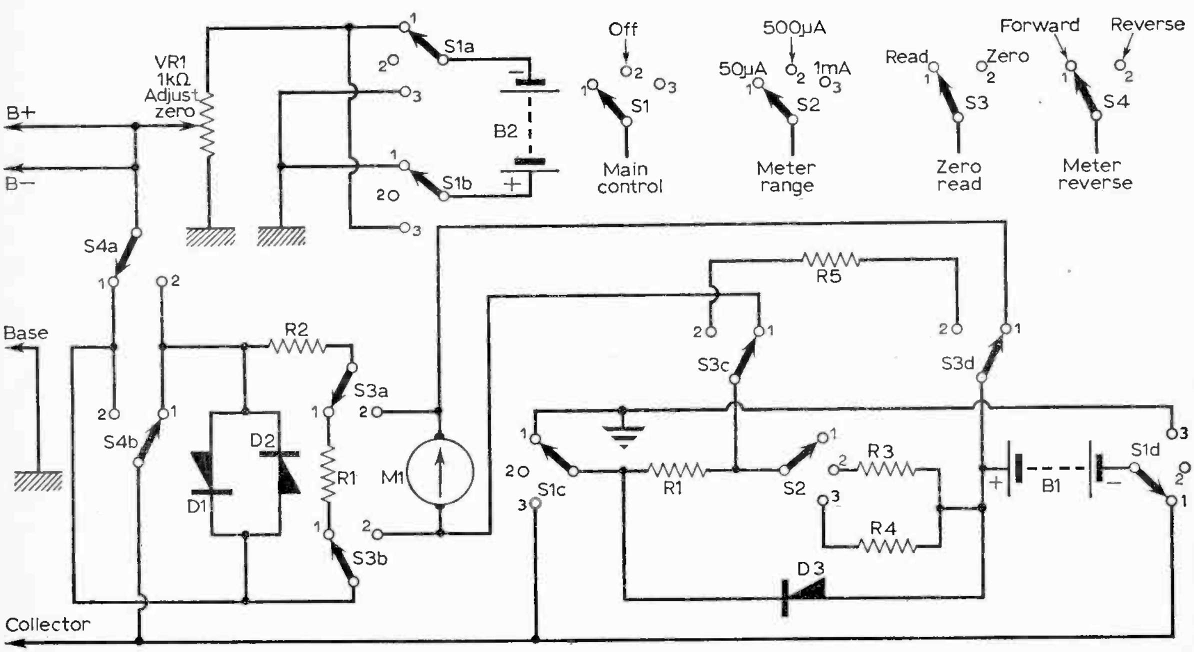


Fig. 3: Modified version using one meter only.

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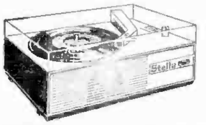

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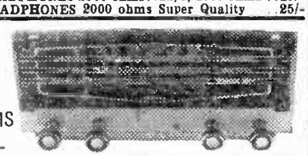
1½ × ⅜in. 6/6: ACOS 1⅜ × ⅜in. 8/6
MOVING COIL MIKE with Remote Control Switch .. 19/6

ALL PURPOSE HEADPHONES

MOVING COIL HEADPHONES 100 ohms (ex. Govt.) 12/6
H.R. HEADPHONES 2000 ohms .. 12/6, 4000 ohms .. 15/-
H.R. HEADPHONES 2000 ohms Super Quality .. 25/-

1967 GRAM CHASSIS



Post 5/-

Three Wavebands: Long.. Med. Short. Gram. Five Valves: ECH81, EF89, EBC8, EL84, EZ80. 12-month guarantee. A.C. 200-250 v. Ferrite Aerial 5 watts 3 ohm. Chassis 13½in. × 7in. × 5in. dial size 13in. × 4in. Two pilot Lamps. Four Knobs. Aligned calibrated. Chassis isolated from mains **£10.10**
DE LUXE STEREO GRAM CHASSIS V.H.F., MW, SW 19-50m. SW 60-180m. Magic eye, push buttons, 6 valve plus rect. Size 15 × 7½ × 6in. high. **£19.19**

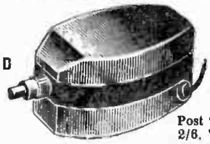
TAPE DECK AMPLIFIERS FOR B.S.R. T.D.2 ETC. With Pre Amplifier. Oscillator, all valves, "magic eye" tuning indicator. 3 watt 3 stage amplifier especially built for B.S.R. T.D.2 Tape Deck. Bolts directly to tape deck chassis. Inputs for mike and radio/gram. Output 3-5 ohms. A.C. 200/250v. Ready built. PRICE £7.19.6. Carriage and Insurance 5/6.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides, 7 × 4in., 5/6; 9 × 7in., 6/6; 11 × 3in., 6/6; 11 × 7in., 7/6; 13 × 9in., 9/6; 14 × 11in., 12/6; 15 × 14in.. 15/-.
ALUMINIUM PANELS 18 s.w.g. 12 × 12in., 5/6; 14 × 9in., 4/6; 12 × 8in., 3/6; 10 × 7in.. 2/9; 8 × 6in., 2/- 6 × 4in., 1/6.

ALL PURPOSE TRANSISTOR PRE-AMPLIFIER

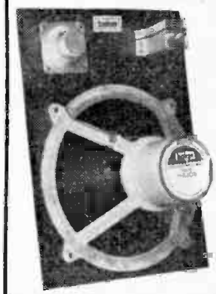
Gain 14:1. 250v. or 9v. input. Ready built with Mu Metal input transformer for Mikes, Pick-Ups, Tuners Instructions and circuit supplied. Post 2/6. **15/-**

THE INSTANT BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER



200/250 v. A.C. Leaflet S.A.E. Post 2/6. **35/-**

BAKER MAJOR "MODULE"



Ideal mono or stereo conversion of existing cabinets, furniture etc. 12in. Baker Major Full range speaker on 19 × 12½in. baffle board with 2½in. tweeter and crossover. Output 20 watts. Response 30-17,000 c.p.s. Impedance 15 ohms. In kit form with instructions

£10.19.6

or fully assembled

£12.10.0 Post Free

'Group 25'	'Group 35'	'Group 50'
12in. 25w. **5 gns.**	12in. 35w. **8½ gns.**	15in. 50w. **18 gns.**

"BONDACOUST" Wadding for Cabinet lining 15/- sq. yd.

Quality Horn Tweeters 3-16kc/s. 10w. 27/6. Crossover 14/6.
LOUDSPEAKERS P.M. 3 OHMS. 2½in., 3in., 4in., 5in., 7in. × 4in., 15/6 each. 8in. 22/6; 6½in. 18/6; 10in. 30/-; 12in. 30/-; (15 ohms 35/-); 10 × 6in. 30/-; 8 × 5in. 21/-; E.M.I. Double Cone 13½ × 8in., 3 or 15 ohm models, 45/-.
SPECIAL OFFER! 8 ohm. 2½ in., 5in.; 80 ohm. 2½in., 2½in., **15/6** 25 ohm. 5in., 6 × 4in., 35 ohm. 3in., 5in., 7 × 4in.. EACH—ANY TYPE. 15 ohm. 3in., 5in., 7 × 4in..
JACK SOCKET Std. open-circuit 2/6. closed circuit 4/6; Chrome Lead Socket 7/6. DIN 3-pin 1/3, 5-pin 1/6: Lead 3/6. Phono Plugs 1/-. Socket 1/-. JACK PLUGS Std. Chrome 3/-; 2.5mm.; 3.5mm. 1/9; DIN 3-pin 3/6; 5-pin 5/-.
WAVE-CHANGE SWITCHES WITH LONG SPINDLES. 2 p. 2-way, or 2 p. 6-way, or 3 p. 4-way 3/6 each. 1 p, 12-way. or 4 p. 2-way, or 4 p. 3-way, 3/6 each.
Wavechange "MAKITS" 1 p. 12-way, 2 p. 6-way, 3 p. 4-way, 4 p. 3-way, 6 p. 2-way. Prices include click spindles. adjustable stops, spacers, etc., 1 wafer, 10/6; 2 wafer, 15/-; 3 wafer, 19/6.
TOGGLE SWITCHES. sp. 2/-; sp. dt. 3/6; dp. 3/6; dp. dt. 4/-.

DE LUXE TAPE SPLICERS Cuts, trims, joins for editing and repairs. With 3 blades. **14/6**

4 CHANNEL TRANSISTOR MICROPHONE MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. **52/6**

DYNAMIC MICROPHONE. Dual impedance. 600 ohm/50k Universal Mtg. 70-12,000 cps. **£6.6.0**

AM TUNER MEDIUM WAVE. Three Transistor Superhet. Ready built. Printed Circuit. Ferrite Aerial. Sizes 5¼ × 3¼ × 1½in. Ideal for Tape Recorders. **79/6**

FM TUNER 88-108 Mc/s Six Transistor. Superhet. Ready built. Printed Circuit. Calibrated slide dial tuning. Size 6 × 4 × 2½ in. **£6.19.6**

3 WATT QUALITY AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control **65/-**

★ RADIO BOOKS ★ (Postage 9d.)

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RESISTORS. Preferred values. 10 ohms to 10 meg. ¼ w., ½ w., 1 w., 20% 3d.; 1½ w. 8d.; 2 w. 1/-; ½ w. 10% 6d.
HIGH STABILITY. ½ w. 1% 10 ohms to 10 meg., 2/-. Ditto 5%. Preferred values 10 ohms to 22 meg.. 9d.

WIRE-WOUND RESISTORS: 5 watt / 10 watt / 15 watt — 0.5 to 8.2 ohm 3 w., 10 ohms to 6,800 ohms — 1/6 / 1/9 / 2/-
10K, 15K, 20K, 25K, 68K, 10W. 3/-

MAINS DROPPERS. Midget. With sliders. 0.3 a., 1 K.. 0.2 a., 1.2 K., 0.15 a., 1.5 K., 6/- each.
LINE CORD 100 ohms ft. twin plus resistance, 1/- ft.

WIRE-WOUND 3-WATT POTS. T.V. Type. Values 10 ohms to 30 K., 3/3, Carbon 30 K. to 2 meg., 3/-.

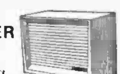
WIRE-WOUND 4-WATT STANDARD SIZE POTS. LONG SPINDLE VALUES 50 OHMS to 100 K., 7/6.

VALVE HOLDERS. Int. Oct. 6d. Mazda Oct. 6d.; B7G. B8A, B8G, B9A. Moulded 9d. Ceramic 1/-. B7G, B9A. Cans 1/-. Valve base plugs B7G. B9A. Int. Oct.. 2/3.

60 ONLY—SANGAMO 3 inch SCALE LABORATORY MOVING COIL METERS

Various calibrations and movements. 100 Microamp 55/-; 1 Milliamp 50/-, etc. Post 5/- extra. Send S.A.E. for list.

BRAND NEW QUALITY EXTENSION LOUDSPEAKER



Cream plastic cabinet. 20ft. lead and adaptors. For any radio, intercom, tape recorder, etc. 3 to 15 ohm. Size: 7½" x 5½" x 3". POST 2/6 **30/-**

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TRANSISTOR STEREO 8+8

A really first-class Hi Fi Stereo Amplifier Kit. Uses 14 transistors giving 8 watts push pull output per channel (16W mono). Integrated pre-amp with Bass, Treble and Volume controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 3 to 15 ohms. Compact design, all parts supplied including drilled metal work, Cir-Kit board, attractive front panel, knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief Specification: Freq. response ±3dB 20–20.000 c/s. Bass boost approx. to +12dB. Treble cut approx. to —16dB. Negative feedback 18dB over main amp. Power requirements at 25V at ·6 amp.

PRICES

Amplifier Kit	**£9 10 0**	P. & P. 4/6.
Power Pack Kit	**£2 10 0**	P. & P. 4/–.
Cabinet (as illus.)	**£2 10 0**	P. & P. 5/6.

(Special offer—**£14.10.0**, post free if all above ordered at same time.)

Circuit diagram, construction details and parts list (free with kit) 1/6 (S.A.E.)

QUALITY RECORD PLAYER AMPLIFIER

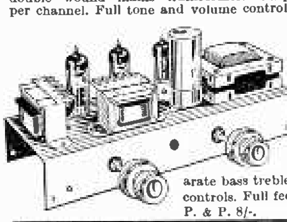
A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, EZ80 valves. Separate Bass Treble and Volume controls Complete with output transformer matched for 3 ohm speaker. Size 7in. w. x 3in. d. x 6in. h. Ready built and tested. **PRICE 69/6.** P. & P. 6/- .
ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. **PRICE 89/6.** P. & P. 7/6.

DE-LUXE QUALITY PORTABLE R/P CABINET

Uncut motor board size 14½ x 12in. Clearance 2in. below, 5½in. above. Will take above amplifier and any B.S.R. or Garrard Autochanger or Single Player Unit (except AT60 and SP25) Size 18 x 15 x 8in. Price **£3.9.6.** Carr. 9/6.

STEREO AMPLIFIER

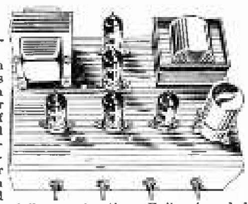
Incorporating 2 ECL86s and 1 EZ80, heavy duty, double wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.



ONLY £4.19.6 P. & P. 8/-

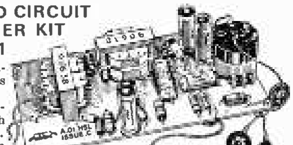
Super De-luxe version with ECL86 valves separate bass treble and balance controls. Full feedback **8 gns** P. & P. 8/-.

10/14 WATT HI-FI AMPLIFIER KIT



A Stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 1/6 (Free with parts). **All parts sold separately.** ONLY **£7.9.6.** P. & P. 8/6. Also available ready built and tested complete with std. input sockets. **£9.5.0.** P. & P. 8/6. Carrying case for above **28/6.** P. & P. 7/6.

HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT
Type TA1



● Peak output in excess of 1½ watts. ● All standard British components. ● Built on printed circuit panel, size 6 x 3in. ● General size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (GET 114 or 81 Mullard OC81D and matched pair of OC81 o/p. ● 9 volt operation. ● Everything supplied, wire battery clips, solder, etc. ● Comprehensive easy to follow instructions and circuit diagram 1/6. (Free with Kit). All parts sold separately.
SPECIAL PRICE 45/-. P. & P. 3/–.
Also ready built and tested, **52/6.** P. & P. 3/–.
A pair of TA1s are ideal for stereo.

BRAND NEW TRANSISTOR BARGAINS

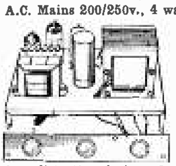
GET 15 (Matched Pair) 15/–; V15/10p, 10/–; OC71 5/–; OC76 6/–; AF117 **7/6.**
Set of Mullard 6 transistors OC44, 2—OC45 OC81D matched pair OC81 **25/–**, ORP12 Cadmium Sulphide Cell **10/6.** All post free.

3-VALVE AUDIO AMPLIFIER HA34

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½in. w. x 4in. d. x 4¾in. h. Incorporates ECC83 EL34, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only **£4.5.0.** P. & P. 6/–.

HSL 'FOUR' AMPLIFIER KIT

A.C. Mains 200/250v., 4 watt, using ECC83, EL84, EZ80 valves.

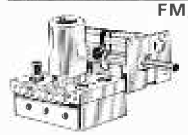


● Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss. ● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar, microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● Chassis size only 7¼in. wide x 4in. deep. Overall height 4¾in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves output transformer (3 ohms only), screened lead, wire, nuts, bolts, solder, etc. (No extras to buy). **PRICE 79/6.** P. & P. 6/-.
Comprehensive circuit diagram, practical layout and parts list 2/6 (free with kit).
This kit although similar in appearance to HA34 employs entirely different and advanced circuitry.

BRAND NEW T.V. U.H.F. TUNER AND SOUND AND VISION I.F. PANEL

By world famous maker. Suitable for use in conversion of TV sets to BBC2 (625 line reception). OFFERED (less valves) AT THE BARGAIN PRICE OF ONLY **27/6.** Post paid. (The components are worth far more than our price for the complete unit and due to the very high value we regret that no correspondence can be entered into regarding this item.)

FM/AM TUNER HEAD



Beautifully designed and precision engineered by Dormer and Wadsworth Ltd. Supplied ready fitted with twin ·0005 tuning condenser for AM connection. Prealigned FM section covers 86–102 Mc/s. I.F. output 10·7 Mc/s. Complete with ECC85 (6L12) valve and full circuits diagram of tuner head. Another special bulk purchase enables us to offer these at 27/6 each. P. & P. 3/–. Order quickly! Limited number also available with precision geared 3:1 reduction drive, **30/-.** P. & P. 3/

MATCHED PAIR AM/FM I.F.'s

Comprising 1st I.F. and 2nd I.F. discriminator (465kc/s /10·7Mc/s). Size 1 x 1¼ x 2½in. high. Will match above tuner head. **11/-** pair. P. & P. 2/-.

SPECIAL PURCHASE! TURRET TUNERS

By famous maker. Brand new and unused. Complete with PCC84 and PCF80 valves 34-38 Mc/s I.F. Biscuits for Channel 1 to 5 and 8 and 9. Circuit diagram supplied. **ONLY 25/-** each. P. & P. 3/9.

GORLER F.M. TUNER HEAD

88–100 Mc/s, 10·7 Mc/s I.F. **15/-** plus 2/- P. & P. (ECC85 valves **8/6** extra).

TWIN TELESCOPIC AERIAL. Comprising two 3-section heavily chromed rods. Closed 12in. each extending to 32in. Completely adjustable from vertical to horizontal. Supplied complete with universal mounting bracket, coax lead and plug. Suitable for F.M. or TV. **12/6.** P. & P. 2/6.

6-WAY NON-TANGLE TELEPHONE CABLE. Latest spring back coil type, extends 12in. to 4ft. 6in. ONLY **6/-** each. P. & P. 1/6.

S.T.C. SILICON AVALANCHE HALF-WAY RECTIFIERS. Type RAS. 508 AF. 6 amps. 960 P.I.V. 1in. long × ⅜in. dia. approx. List **50/-** OUR PRICE **8/6.** Post Free.

4-SPEED PLAYER UNIT BARGAINS

Mains Models. All brand new in maker's original packing.

SINGLE PLAYERS

B.S.R. TU/12................**£3.9.6** Carr. 5/6.
GARRARD SP25 De Luxe ..**£10.19.6** Carr. 5/6.
B.S.R. GU7 with unit mounted pickup arm. **£4.18.8** Carr. 5/6.

AUTO CHANGERS (Carr. 6/6 on each)

Latest B.S.R. UA25 Super Slim................**£6. 2.6**
GARRARD 1000 with Hi-Fi cartridge..........**£6.19.6**
GARRARD 2000 **£7.10.0.** GARRARD 3000 **£8.15.0**
LATEST GARRARD AT60 Mk. II **£12.0.0**
All the above units are complete with mono head and sapphire stylus or can be supplied with compatible stereo head for 12/6 extra.

BRAND NEW CARTRIDGE BARGAINS

ACOS GP 69/1 MONO CARTRIDGE. For E.P. and L.P. Complete with stylus. **ONLY 12/6.** P. & P. 1/–.

SONOTONE 9TAHC COMPATIBLE STEREO CARTRIDGE with diamond stylus **50/-** or with sapphire stylus **40/-.** P. & P. 1/- each.

BRAND NEW 3 OHM LOUDSPEAKERS

5in., **12/6**; 6½in. **15/-**; 8in. **22/6**; 10in. **27/6**; 7in. x 4in. **16/-**; 10in. x 6in. **27/6.**
E.M.I. 8in. x 5in. with high flux magnet, **21/-.**
E.M.I. 13½ x 8in. with high flux ceramic magnet, **42/-** (15 ohm **45/-**). P. & P. 5in. 2/-, 6½ & 8in. 2/6, 10 & 12in. 3/6 per speaker.

35 OHM SPEAKERS

3½in.**12/6**; 7 x 4in. **21/-.** P. & P. 2/- per speaker.

E.M.I. PLASTIC CONED TWEETERS, 2½in. 3 ohm. Limited number **12/6** each. P. & P. 1/6.
BRAND NEW HEAVY DUTY 12in. SPEAKERS. Response 45 c/s—13 Kc/s. 1½in. voice coil. Available in 3 or 15 ohms. Guaranteed full 15 watts British rating. Heavy cast aluminium frame. These are current production by world famous maker and as they are offered well below list price we are not permitted to disclose the name. LIMITED NUMBER ONLY. UNREPEATABLE at **89/6.** P. & P. 5/-. Also 25 watt Guitar Model available at **£5.5.0.** And 35 watt Guitar Model **£8.8.0.**

VYNAIR AND REXINE SPEAKER AND CABINET FABRICS. Approx. 54in. wide. Usually **35/-** yard. Our PRICE **13/6** per yard length. P. & P. 2/6 (min. one yd.). S.A.E. for samples.

LATEST COLLARO MAGNAVOX 363 TAPE DECK DE LUXE. Three speeds, 2 track, takes up to 7in. spools. 10 gns. Plus 7/6 Carr. & ins. on each (Tapes extra).
QUALITY PORTABLE TAPE RECORDER CASE. Brand new. Beautifully made. Only **49/6.** P. & P. 8/6.
Dual Purpose Bulk Tape Eraser and Tape Head Demagnetiser 35/-. P. & P. 3/-.
ACOS CRYSTAL MIKES. High imp. for desk or hand use. High sensitivity, **18/6.** P. & P. 1/6.
ACOS HIGH IMPEDANCE CRYSTAL STICK MIKES. Listed at 42/-. OUR PRICE **21/-.** P. & P. 1/6.

NEON A.C. MAINS INDICATOR. For panel mounting, cut out size 1¼ x ⅝ x ¾in. deep inc. terminal. White case with lens giving brighter light. For mains 200/250v. **2/6** each. P. & P. 6d. (6 or more post free).

VIBRATORS. Large selection of 2, 4, 6, 12, 24 and 32 volt. Non sync **8/6**; Sync **10/-.** P. & P. 1/6 per vibrator. S.A.E. with all enquiries.
MAINS TRANSFORMER. For transistor power supplies. Tapped pri. 200-250 v. Sec. 40-0-40 at 1 amp (with electrostatic screen) and 6.3 v. at .5 amp for dial lamps etc. Drop thro mounting. Stack size 1¼ x 3¾ x 3½in. **27/6.** P. & P. 4/6.
MAINS TRANSFORMER. For Transistor power supplies. Pri. 200/240 v. Sec. 9-0-9 v. at 500 mA, **11/-.** P. & P. 2/6.
MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS. Stack size 1¼ x 1¼ x ⅞in. Output trans. tapped for 3 ohms and 15 ohm output. **10/-** pair, plus 2/- P. & P.
7–10 watt OUTPUT TRANSFORMERS to match pair of ECL 86's in push-pull to 3 ohm output. ONLY **11/-.** P. & P. 2/6.
10-12 watt OUTPUT TRANSFORMERS. Size 2¼ x 2in. Clamp fitting. For two EL84's in push pull. State 3 or 15 ohm impedance. **12/6** P. & P. 2/6.

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Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station.

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PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.

? YOUR QUESTIONS ANSWERED ?

UNMARKED ZENERS

I have bought a number of zener diodes which are not marked in any way, and I would like to discover the nominal voltage of these units. The dissipation of them does not really interest me. Is there any way of finding out the voltage of zeners?—L. T. Roberts (Liverpool, 14).

To test your zener diodes, first assess their maximum probable safe dissipation. To do this, look up zener diodes in data books and compare the physical size of those you have with those listed. You will then need a low voltage variable stabilised power supply and a resistor. The resistor should be chosen so that when the power supply is delivering its maximum voltage (say 20) the maximum current which can flow through the resistor when placed across the terminals of the supply is less than the current which when flowing through one of your zener diodes of that voltage would result in its maximum safe dissipation. The resistor must of course be of adequate wattage rating.

To test a diode, connect it in series with the resistor across the supply with the output at zero. The diode must be reverse-connected. Monitor the voltage across it as the output voltage from the supply is increased. When the voltage across it steadies even though the output voltage is still increasing, this is the zener voltage at the particular current flowing. Books in your local lending and reference libraries will deal with more comprehensive tests.

BACKGROUND HISS

I recently purchased an integrated mono amplifier for use with a record deck. This gives very satisfactory reproduction but there is a loud background hiss which would not be obtrusive in a large room or hall, but is a nuisance in ordinary domestic conditions at low volume. Is there any way to reduce this effect without sacrificing upper frequencies too drastically?—S. Reed (Wanstead, London, E.11).

The hiss you mention is probably due to noise developed in the anode and screen resistors of the first valve in the amplifier. It is essential that such resistors in the early stages of amplifiers be of the low-noise type. If you wish to renew the resistors, then we suggest you use a type such as the Radiospares "metal oxide". These resistors are available from a number of our advertisers.

TUNER/DECODER CONNECTIONS

Would you please let me know the method of connecting a negative earth f.m. tuner to a positive earth decoder.—R. Townsend (London, E.17).

If your f.m. tuner and your decoder feature their own power supply units then you can connect the output from the tuner direct to the input of the decoder. If, for example, the units are both transistorised and are to use a common power supply, then care must be taken to avoid short-circuiting the power supply. The way out of this is to omit the "earth" connection between the tuner and the preamp or input section of the decoder. Just joint the audio lead to the decoder. No harm can then result provided that there is a capacitor in series with the audio lead somewhere. The "earth" connection will automatically be provided by the common power supply, although it would be a good idea to connect a $0{\cdot}1\mu F$ capacitor across the negative and positive lines of the tuner unit.

Midget Transistor Transmitter

continued from page 584

In the prototype, with no a.t.u. and a 70ft. end-fed wire, the system required a 470pF capacitor wired in parallel with VC1 and the peak on the front panel meter was very slight indeed as was the dip on the mA meter. The mA meter was an AVO set to the 1000mA range and a meter with an f.s.d. of, say, 200mA would doubtless make the slight dip far easier to read. The final current in the prototype was 104mA for Tr2 representing 1200mW or 1·2 watts input. Tr1 consumed only 6mA.

MODIFICATIONS

The transmitter could be much smaller. A heat sink is not really a necessity for Tr1 although it does anchor the transistor firmly in place. The two heat sinks could be mounted on either side of the screen and fixed with two common bolts. This would save some space but heat from Tr2 might be conducted to Tr1. This should not prove troublesome because the heat involved is small and the screen itself will act as a large heat sink, also, Tr1 is crystal controlled so frequency should remain reasonably stable. VC1 might be made a pre-set or even a fixed capacitor—L2 being adjusted to resonate at the particular crystal frequency.

It would be practical to add another BFY51 in parallel with Tr2, use the crystal oscillator stage as a tuned buffer and add a v.f.o. This would make a very useful topband transmitter and inputs of 3—4 watts would be easily possible without danger to the p.a. transistors.

The prototype has only one fault and that is hand-capacity effects on VC1. This is not too troublesome since once VC1 is set it doesn't require further adjustment unless the crystal is changed and even then the front panel could be calibrated and pre-set marks made for VC1 on initial tune-up.

Alternatively the cure might be to either use a different p.a. output configuration, or mount VC1 at the back of the board and use an insulated rod plus a coupler, bringing L2 to the front.

The front panel must not be aluminium or indeed any conducting material otherwise it will short the frame of VC1 to earth. Alternatively if the angled aluminium was not earthed and VC1 insulated from the front panel by the insulated rod and coupler arrangement then a metal front panel duly earthed would be in order. Sk1 would also need to be insulated.

A good deal of fun can be had from QRP working. Every contact is an achievement. It is especially pleasing to picture the other chap's face when you are working him on a rig which draws less current than his p.a. valve heaters alone. See you on 160 metres? ■

GUIDE TO COMMUNICATIONS RECEIVERS

—continued from page 577

the front end of this receiver could be replaced by a modern circuit and other extensive modifications made, but the amount of work involved would hardly justify the end result.

Availability: Large numbers have been released. Grade 1 P104's were available in 1960 for £5, power units £3 extra. R1132's in grade 3 condition were available at the same time for about £7, hardly a bargain.

R1392's were available in 1961 in grade 2 for between £4 and £7.

None was available in 1962 and 1963, but in 1964 another batch of P104's were released, in grade 2 at £3 10s. 1392's were also available at about £7, during late 1964.

Manuals probably exist in small quantities.

LETTERS...

Infinite baffle mods

Regarding Mr. Lymath's letter on p. 364 of the September issue. The troubles he mentions simply do not happen. Nor are his figures correct for a *closed* pipe!

I have been using 28ft. chimney loading for a long time, and with a Wharfedale 12in. 16-20,000 c/s loudspeaker unit and no special precautions.

The resonances are inappreciable, largely, I suppose, because the pipe is uneven in structure internally and is highly damped by remaining soot etc. so that the supposed harmonics are flattened beyond recognition.

I gave the theory in my 1957 book *The Gramophone Handbook* and wrote a further article about the use of a chimney loudspeaker as a third (Dynaco) stereo channel in *The Gramophone* in 1965.—**Percy Wilson** *(Oxon).*

The last word

May I add yet another one of the famous "last words" on the R.A.E. Like Mr. Webster I am very tired of these miserable bleatings about this exam. Quite frankly the standard required in the theory is extremely low; how can anybody call Amateur Radio their "hobby" if they can't be bothered to reach this standard. I can well imagine the QSO's mentioned by Mr. Webster.

I passed the first section by a similar method to Mr. Webster in 18 months but in spite of this I have been nine years trying to reach the required standard in the Morse test and am still unsuccessful. I'm not bleating, I'll be all the more proud of my ticket when I get it.—**D. J. Tivey** *(Sunbury on Thames, Surrey).*

International short wave club

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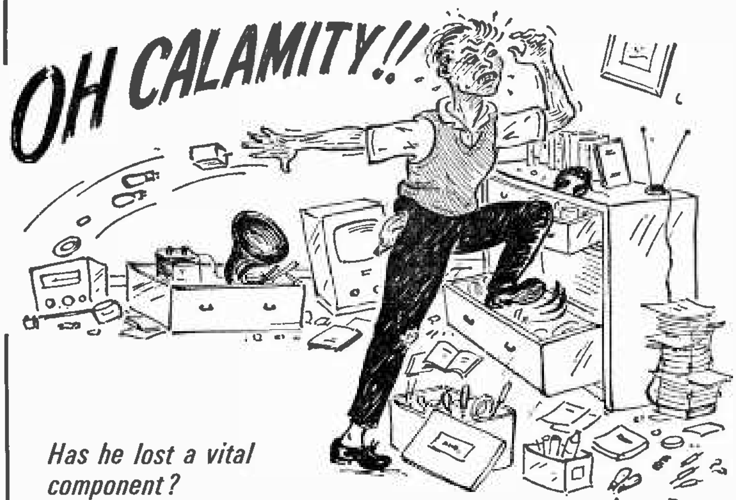

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2µF	..	350v	1″×½″	W.E.	2	0
2µF	..	500v	1¼″×½″	W.E.	2	6
4µF	..	25v	1″×½″	W.E.	1	6
4µF	..	150v	¾″×⅜″	W.E.	1	6
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5µF Rev		20v	1½″×⅝″	W.E.	2	6
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8µF	..	500v	1½″×⅝″	W.E.	3	0
10µF	..	6v	¾″×⅜″	W.E.	1	6
10µF	..	50v	¾″×⅜″	W.E.	1	6
10µF	..	150v	1″×½″	W.E.	1	9
10µF	..	300v	1¼″×½″	W.E.	2	0
16µF	..	250v	1½″×⅝″	W.E.	2	0
16µF	..	350v	1¾″×1″	W.E.	3	0
16µF	..	500v	1¾″×1″	W.E.	2	0
25µF	..	12v	¾″×½″	W.E.	1	6
25µF	..	25v	¾″×½″	W.E.	1	6
25µF	..	50v	1″×½″	W.E.	1	9
30µF	..	6v	¾″×⅜″	W.E.	1	6
30µF	..	10v	¾″×⅜″	W.E.	1	6
32µF	..	150v	1½″×⅝″	T.1.	2	6
32µF	..	350v	2″×1″	T.3	3	6
32µF	..	450v	1⅜″×1″	W.E.	4	6
32µF	..	500v	2″×1⅜″	T.2	4	6

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50µF	..	12v	⅜″×⅞″	W.E.	1	6
50µF	..	25v	1″×½″	W.E.	1	6
50µF	..	50v	1¼″×½″	W.E.	1	9
50µF	..	275v	1½″×1″	T.1	3	0
50µF	..	350v	2″×1″	T.1	3	6
64µF	..	450v	2″×1⅜″	T.1	4	6
100µF	..	15v	1″×⅜″	W.E.	1	6
100µF	..	25v	1″×½″	W.E.	1	6
100µF	..	50v	1¼″×⅝″	W.E.	2	6
100µF	..	100v	1¾″×¾″	T.1	4	0
100µF	..	250v	3″×1″	T.1	4	6
100µF	..	350v	3″×1″	T.2	5	0
100µF	..	450v	3″×1⅜″	T.2	7	6
125µF	..	500v	4″×1⅜″	T.2	9	0
200µF	..	275v	2″×1⅜″	T.2	6	0
200µF	..	350v	3″×1⅜″	T.2	7	6
250µF	..	12v	1″×⅜″	W.E.	2	6
250µF	..	18v	1″×½″	W.E.	2	6
250µF	..	25v	1¼″×⅝″	W.E.	3	0
250µF	..	50v	1¾″×¾″	W.E.	4	6
350µF	..	12v	1¼″×⅝″	W.E.	2	6
350µF	..	25v	1½″×¾″	T.1	3	0
400µF	..	15v	1½″×⅝″	W.E.	3	0
400µF	..	30v	1¾″×¾″	W.E.	3	6
400µF	..	50v	1¾″×1″	W.E.	4	0
400µF	..	275v	4″×1⅜″	T.2	9	0
500µF	..	6v	1¼″×½″	W.E.	1	6
500µF	..	15v	1¼″×⅝″	W.E.	2	6
500µF	..	25v	1½″×¾″	W.E.	3	6
1,000µF	..	15v	2″×¾″	W.E.	3	9
1,000µF	..	18v	1¼″×¾″	W.E.	3	9
1,000µF	..	25v	1¾″×1″	W.E.	4	6
1,000µF	..	50v	2″×1⅜″	T.2	7	6
1,500µF	..	25v	1½″×⅜″	W.E.	5	6
1,500µF	..	50v	3″×1″	W.E.	7	6
2,000µF	..	25v	3″×1″	T.2	6	0
2,000µF	..	50v	2½″×1⅜″	T.2	9	0

				s.	d
2,500µF ..	30v	3″×1⅜″	T.2	7	6
2,500µF ..	50v	4″×1⅜″	T.2	10	0
4,000µF ..	25v	3″×1⅜″	T.2	9	0
5,000µF ..	25v	3″×1⅜″	T.2	10	0
10,000µF	25v	4″×1¾″	T.2	27	6
30,000µF	30v	4½″×2½″	T.2	45	0
32×32µF	350v	2½″×1″	T.3	4	6
50×50µF	350v	2″×1⅜″	T.3	6	6
60×100µF	275v	2″×1⅜″	T.2	6	0
60×250µF	350v	4″×1⅜″	T.2	12	6
100×100µF	150v	3″×1″	T.3	4	6
100×200µF	275v	4″×1⅜″	T.2	9	6
150×200µF	350v	4″×1½″	T.2	12	6
250×250µF	325v	4½″×1½″	T.2	14	0

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T.2 Single end tag termination
T.3 Single end tag termination Twist prong fixing.

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8×16µF	450v	2″×1″	T.1	4	6
16×16µF	275v	2″×¾″	T.1	4	0
16×16µF	450v	2″×1″	T.1	4	6
16×32µF	275v	1¾″×1″	T.1	4	-0
32×32µF	275v	2″×1″	T.3	4	0
50×50µF	300v	2″×1⅜″	T.2	4	6
50×150µF	300v	3½″×1″	T.2	6	6
60×250µF	275v	4″×1⅜″	T.2	9	0
80×40µF	450v	4″×1⅜″	T.2	12	6
100×100µF	275v	3″×1⅜″	T.2	6	6
100×400µF	275v	4½″×1½″	T.2	13	6
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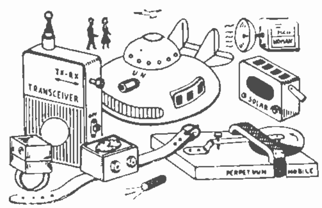

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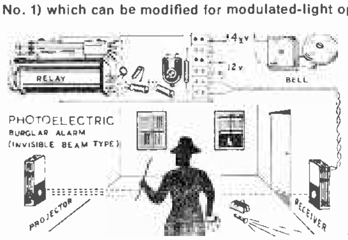

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CLUB SPOT

No. 18 RODING BOYS' SOCIETY

G3SRE

HOW does a boys' club start? Especially one devoted to the advancement of scientific interests. No doubt it is one of two things which starts off an organisation to enable young people to meet for common goals and enjoyment. The most obvious is the person with the idea and means to establish it in practice, who patrons some group or scheme. The other is a vague feeling of need in the young people themselves.

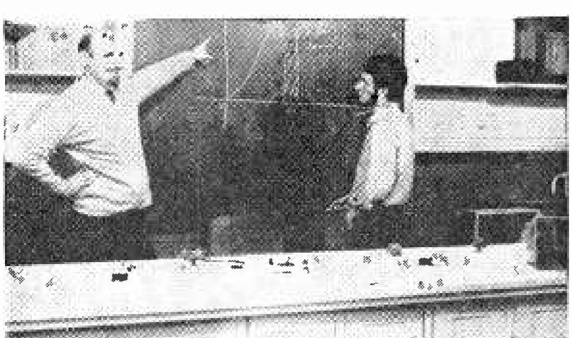
The Roding Boys' Society was a gradual development from the latter situation. At a time when a truly popular interest in scientific things by boys appears to be at a low ebb (compare practical articles in boys' papers during the '20s and '30s), the boys of the R.B.S. show that interest and creativity is still possible when the dry unreal cramming in most school situations is lifted.

The start of the Roding Boys' Society took place in 1961, when half a dozen keen boys in the Wanstead and Woodford Radio Society came to the "Junior Section" meetings, began because of objections by some older members to "kids' stuff" and high spirits at club meetings.

During August 1961 the first camp and expedition was organised and this established the group. Soon after, the now growing band of young members changed the name to Roding Boys' Society . . . the River Roding flowed nearby. It was at this time that the senior section ceased to function.

With Ken. Smith, G3JIX, as the leader, the group's character developed, and the R.B.S. now followed the lines of interest of the various members. Papers were read, and visitors were soon challenged to prepare and read a short account of their first scientific topic. This contribution usually took place at the time of their election to membership.

During 1962, an attempt was made to organise



G3JIX and G3TAJ lecturing at a Club meeting.

Members' display during an exhibition. On the right is Ron, G3TAJ.

a weekend radio course for youth at an Essex County residential youth centre, but out of the whole county, so few boys applied that two-thirds were R.B.S. members. The time had not yet arrived for successful social projects for boys, in radio hobby work at least. The first club R.A.E. course was launched during 1962, and the club went ahead with its own call, G3SRE (*S*cience and *R*adio *E*xperimenters.) News began to arrive about Old Members. One was now in Australia. The second camp and expedition was held, this time farther along the River Lea valley, at a site we have continued to use ever since.

1963 saw Ron, G3TAJ, on the air, and the R.B.S. headquarters took on the character of a laboratory-workshop. The Test Equipment Bay was conceived, the idea being to set this up as a centre for any boy or amateur to calibrate and align his equipment, with expert advice and assistance. We hoped this service would be the first of many outward-looking projects in which the boys could become involved.

During 1963 pressure was brought to bear for us to enter the Radio Communications Exhibition with a stand. This became a powerful all-pervading project, demanding a great effort from all concerned. But it was a success. We met many old friends, and made many new ones at the exhibition. Many young visitors were obviously encouraged to know what boys could do, and went back to their various localities carrying seeds of the Youth Amateur Radio idea. Although little seems to have developed (due to lack of leaders apparently) many letters have been received telling of encouragement and ideas.

The Press began to report our activities, and the R.B.S. found itself becoming known by a wider circle. The R.S.G.B. was convinced at the time for work to be started among boys, and the Education Committee was set up with the R.B.S. Leader as a member. Also the associate members' page began to appear in the Bulletin of the R.S.G.B. as a direct result of the work of our small group. Mr. Jan Foster of the London Federation of Boys' Clubs saw our stand—and we were straightaway earmarked for a further exhibition a month or two later, at a London boys' club.

Letters began to arrive from overseas readers of the Journals, and it was an important privilege to correspond with these young enthusiasts around the world.

1964 passed roughly as the previous years, with the camp and exhibition work taking up much energy. A number of RAE passes were obtained in the May examination. Around the beginning of 1965, correspondence with Mr. Black, organiser of the Youth Radio Scheme in Australia, began. Many interesting exchanges have taken place since. The Australian scheme is nationwide, and many boys receive great help in their radio experimenting.

During April, a visit to the Science Museum was organised. Readers of "P.W." and "P.E." were invited and the outing was very successful, as reported in the July '65 issue of *Practical Electronics*. Later, in September, the "Ollerton Venture" took place. The Newark (Notts) Radio Society organised this weekend conference for youth leaders, to interest them in Radio Hobbies for Young People, and G3JIX gave an illustrated talk on the work of the R.B.S. It was here that we met and exchanged friendship links with a most enthusiastic group of boys, the "Mount Radio Club" a school group in Newark.

The first award of the "Roding Trophy" was received during 1965 by Clive Bennis. He is now at teachers training college. This trophy was given to the R.B.S. by our old friend and supporter Percy Mourton, G8QU. Finally, this hectic year 1965, would not be complete without a mention of the

Typical group of members during a meeting.

London Federation of Boys' Clubs adventure training ground at Hindleap Warren in Sussex. It was here that the R.B.S. set up and operated an amateur radio station in the log cabin built by the boys of the London Fed. This was over the weekend of the official opening. Thus an inroad was made for amateur radio to forge ahead as a boys' club activity in the Fed. After the Christmas social for parents and members, we entered 1966. This was to be the year in which the greatest changes of all were to occur in the work of the R.B.S. After a period of difficulties and inactivity, the change to new and larger headquarters became possible. This also led to the R.B.S. establishing a much more businesslike and professional relationship with the Education Authority and Youth Service.

Do we have any ideas that we feel you share? Yes. For instance, we think that radio and television should offer a little more in the way of programmes for electronically minded people. Where are the men who would lead a group of boys in forming their own local group? We are still surprised so little is evident in this country regarding club work.

We hope we can still co-operate in various projects, from helping a fellow enthusiast with his technical problems, to the W.V.S. in fixing up a radio for an old or blind person. In particular, we wish all boys everywhere "73 and good listening through 1967".

LOW COST HI-FI SYSTEM

—continued from page 567

and the junction of R10 and R11 adjust VR2 to give a reading of 4.5 volts.

The current consumption of the amplifier should now be checked. It should be 10 to 12mA with a 9 volt supply and 12 to 15mA with 12 volts. This is the quiescent current. It will rise to approximately 100mA on peaks of signal.

The amplifier is now ready for use.

The speaker can have an impedance greater than 15 ohms, with a reduction in output power, but must not be less than 10 ohms.

For its full rated output, the amplifier should be connected to a 12 volt supply. On 9 volts the output will be approximately 600mW.

HEAT SINK

On 12 volts it is necessary to use a heat sink on the output transistors. This is made with a piece of aluminium 20 s.w.g. and size 3$\frac{1}{8}$ x $\frac{3}{4}$in. The ends may be bent into shape round suitably sized twist drills. To effect a good heat transfer, the transistors should be smeared with silicon grease.

If the 2G339 transistor has an insulating sleeve fitted, it is advisable to leave this on, as this transistor has its base internally connected to the case. The sleeve will not drastically affect the heat transfer provided it is smeared with silicon grease.

CHASSIS DETAILS

If a suitable chassis is not readily available one may be purchased from H. L. Smith & Co. Ltd., quoting the following specifications. Material 16 s.w.g. aluminium. Chassis type N length 10in., width 9in., depth 2$\frac{1}{2}$in., flange $\frac{1}{2}$in. The cost will be 16s. 3d. including postage and package.

Also if a front plate is required the dimensions are:— 16 s.w.g. front plate 10$\frac{1}{2}$ x 9in.

The cost will be 3s. 6d. extra to the cost of the chassis, i.e. total cost 19s. 9d.

to be continued

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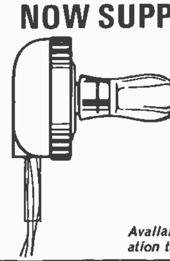

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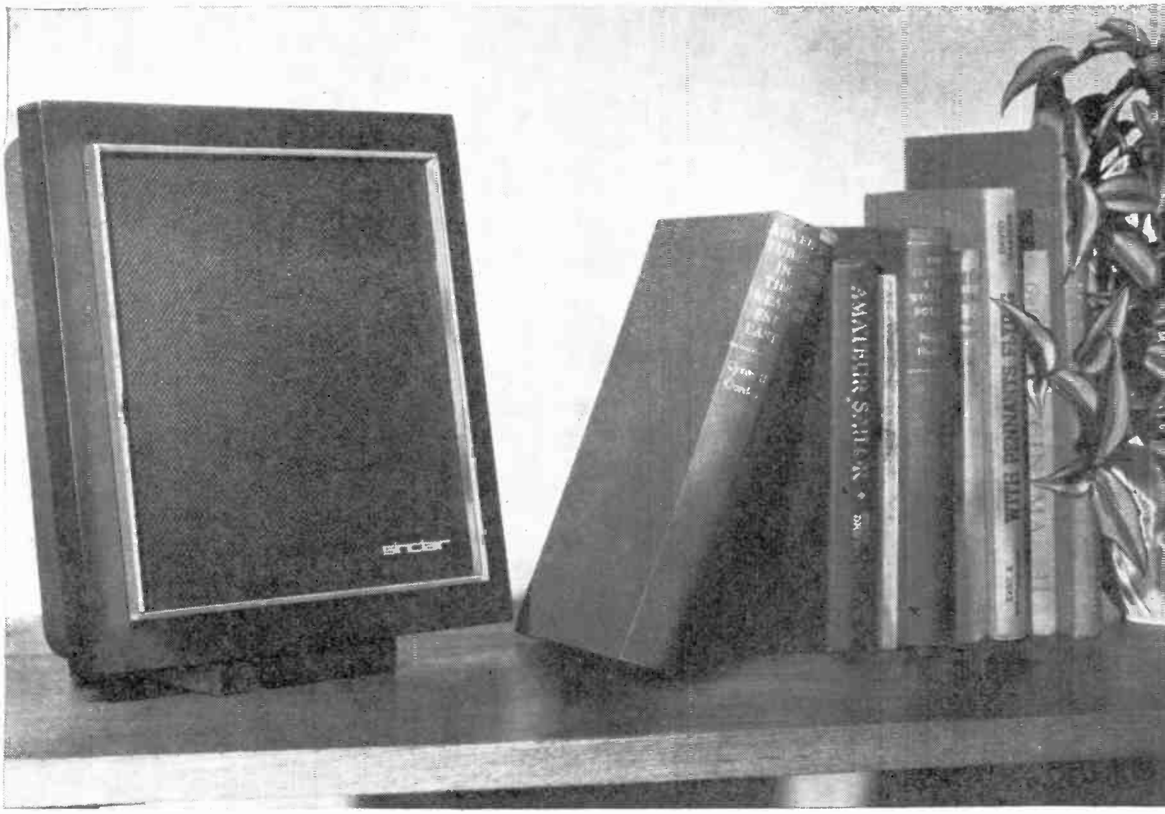

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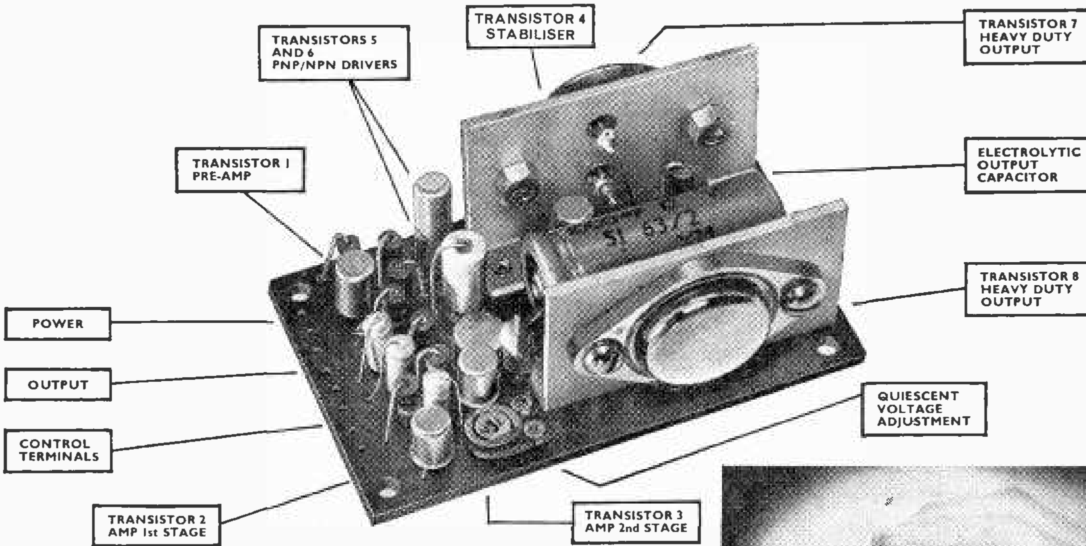

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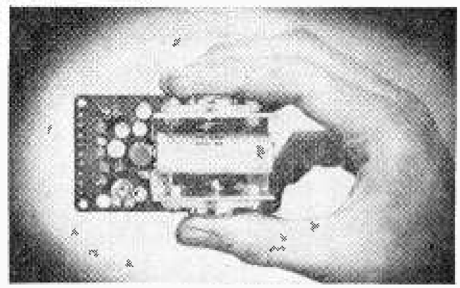

TECHNICAL DETAILS

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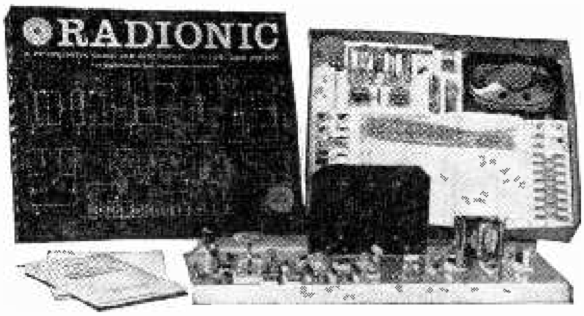

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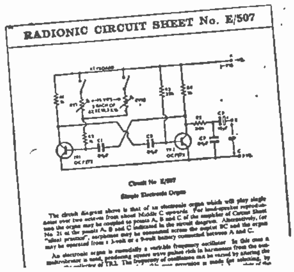
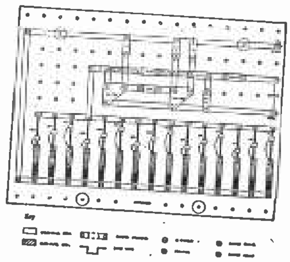


Theoretical Circuit



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EB91	2/3
EBC3	20/6
EBC33	6/-
EBC41	7/3
EBC81	6/3
EBC90	3/9
EBC91	5/-
EBF80	5/9
EBF83	7/-
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	12/6
ECC807	19/9
ECF80	7/-
ECF82	6/9
ECF86	8/6
ECF804	24/-
ECH3	23/3
ECH21	9/6
ECH33	22/3
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
EZ80	3/9
EZ81	4/3
EZ90	3/6
FW4/500	6/6
FW4/800	8/6
GZ30	7/6
GZ32	9/-
GZ33	12/6
GZ34	10/-
GZ37	14/6
H30	5/-
HABC80	9/3
HL2	7/6
HL13C	4/-
HL22	10/6
HL23DD	5/-
HL41	3/9
HL41DD	19/6
HL42DD	8/-
HL133DD	9/6
HN309	26/6
HVR2	8/9
HVR2A	8/9
IW3	5/6
IW4/350	5/6
IW4/500	6/-
KBC32	20/5
KF35	12/6
KL35	11/6
KLL32	21/7
KT2	5/-
KT8	15/-
KT32	4/9
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	8/6
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
PCF808	12/6
PCL81	9/-
PCL82	6/3
PCL83	8/6
PCL84	7/-
PCL85	8/3
PCL86	8/-
PCL88	15/-
PEN45	7/-
PEN45DD	19/6
PEN46	4/-
PEN383	9/6
PEN384	11/6
PEN453DD	19/6
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/-
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
RK34	7/6
S130	25/-
SP4B	19/6
SP13C	12/6
SP42	12/6
SP61	2/-
TDD2A	12/6
TDD4	7/6
TH4B	10/-
TH21C	10/6
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/-
UCC85	6/6
UCF80	8/3
UCH21	9/-
UCH42	8/6
UCH81	6/-
UCL82	7/-
UCL83	8/9
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/-
UU8	16/6
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	12/6
U26	11/-
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	12/-
U251	12/6
U281	8/9
U282	12/3
U301	12/6
U329	12/6
U403	6/6
U404	6/-
U801	18/-
U4020	6/-
VMP4G	17/-
VP2	3/6
VP2B	9/6
VP4	14/6
VP4A	14/6
VP4B	11/-
VP13C	7/-
VP23	2/6
VP41	5/-
VR75	21/-
VR105	5/-
VR150	5/-
VT61A	7/-
VT501	3/-
VU111	6/-
VU120	12/-
VU120A	12/-
VU133	7/-
W42	11/-
W61M	24/6
W63	10/6
W76	3/6
W77	2/6
W81M	6/-
W101	26/2
W107	10/6
W729	10/-
X24	16/6
X41	10/-
X61	6/-
X63	7/6
X64	5/6
X65	5/6
X66	7/6
X76M	7/9
X79	40/9
X81M	29/1
X101	29/1
X109	26/-
Y63	5/-
Y65	5/-
Z63	4/9
Z66	7/3
Z77	3/3
Z329	11/6
Z729	6/3
Z759	23/-
Transistors and diodes	
2G225	10/6
2N404	6/-
AA120	3/-
AA129	3/-
AC107	3/6
AC113	7/-
AC114	8/-
AC126	2/-
AC127	2/-
AC128	2/-
AC154	6/-
AC155	6/6
AC156	4/-
AC157	10/6
AC165	5/-
AC166	5/-
AC167	12/-
AC168	7/6
AC169	6/6
AC176	11/-
AC177	5/6
AD140	8/-
AD149	8/-
AF102	18/-
AF114	4/-
AF115	3/-
AF116	3/-
AF117	3/4
AF118	3/-
AF119	3/-
AF124	7/6
AF125	3/6
AF126	7/-
AF127	3/6
AF139	27/6
AF178	10/-
AF179	13/6
AF180	9/6
AF181	14/-
AF186	20/-
AFZ12	5/-
ASY27	10/-
ASY28	8/-
ASY29	10/-
AY100	26/-
BA115	2/8
BA116	9/-
BA129	2/6
BA130	2/-
BCY10	5/-
BCY12	5/-
BCY33	5/-
BCY34	5/-
BCY38	5/-
BCY39	5/-
BCZ11	3/6
BC107	10/-
BC108	5/-
BC113	5/-
BC115	3/-
BC116	5/-
BC118	4/6
BD119	9/-
BFY50	5/-
BFY51	4/6
BFY52	5/-
BF154	5/-
BF159	5/-
BF163	4/-
BF167	2/6
BF173	2/6
BF184	2/-
BY100	3/6
BY101	11/6
BY105	11/6
BY114	8/-
BY234	4/-
BY236	4/-
BY238	4/-
BYZ12	5/-
BYZ13	5/-
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/-
GET105	18/-
GET111	15/6
GET113	4/-
GET114	4/6
GET115	17/-
GET116	7/6
GET118	4/6
GET119	4/6
GET573	8/6
GET587	8/6
GET872	10/-
GET873	4/6
GET874	23/6
GET882	10/-
GET887	4/6
GET889	4/6
GET890	4/6
GET896	4/6
GET897	4/6
GET898	4/6
GEX13	3/6
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
OA47	2/-
OA70	3/-
OA73	3/-
OA79	1/9
OA81	1/9
OA85	3/-
OA86	4/-
OA90	2/6
OA91	1/9
OA95	1/9
OA182	2/-
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/-
OC19	25/-
OC22	5/-
OC23	7/-
OC25	5/-
OC26	5/-
OC28	5/-
OC29	16/6
OC30	7/-
OC35	10/-
OC36	7/6
OC38	11/6
OC41	5/-
OC42	6/9
OC43	12/6
OC44	2/-
OC44PM	8/3
OC45	1/9
OC45M	3/-
OC46	3/-
OC65	22/6
OC66	25/-
OC70	2/3
OC71	2/-
OC72	2/-
OC73	16/-
OC74	3/-
OC75	2/-
OC76	3/-
OC77	3/4
OC78	3/-
OC78D	3/-
OC79	3/-
OC81	2/-
OC81D	2/-
OC81M	5/-
OC82	2/3
OC82D	2/6
OC83	2/-
OC84	3/-
OC123	4/6
OC139	12/-
OC140	19/-
OC169	3/9
OC170	2/6
OC171	3/4
OC172	4/-
OC200	6/6
OC201	23/-
OC202	5/6
OC203	5/6
OC204	10/6
OC206	10/6
OC812	8/-
OCP71	27/6
ORP12	15/-
TS2	12/6
TS3	15/-
8X641	10/-
V10/15A	12/-
XA102	19/6
XA103	15/-
MAT100	7/9
MAT101	8/6
MAT120	7/9
MAT121	8/6
P346A	2/-
ZE12V7	1/9

MATCHED TRANSISTOR SETS 1—OC44 and 2—OC45 8/6; 1—OC81D and 2—OC81 8/6; 1 OC82D and 2—OC82 8/6; Set of three—OC83 (GET118/119) 8/6; 1—GET874P sleeved yellow, 1—GET873P sleeved white (1st I.F.) 1—GET873P sleeved blue (2nd I.F.) 8/6; LP15 package (AC113, AC154, AC157, AA120) 15/6; AF10 package (BC135, BC136, BC137, 2—BC138, 2—BA130) 17/6. Postage 6d. per set.

S.T.C. 1 watt Zener diodes. 2·4v: 2·7v: 3·0v: 3·6v: 4·3v: 13v: 16v: 18v: 30v. All 3/6d. each.

WE REQUIRE FOR PROMPT CASH SETTLEMENT ALL TYPES OF ABOVE GOODS LOOSE OR BOXED, BUT MUST BE NEW

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DK92 7/6
DK96 6/6
DL63 8/-
DL92 4/-
DL93 4/-
DL94 5/9
DL96 7/-
DLS10 9/6
DX87 6/9
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E92CC 5/-
E180CC 7/-
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E1148 2/6
E2134 6/-
EA50 1/-
EABC80 5/9
EAC91 3/6
EAF42 8/-
EB91 3/-
EBC33 6/-
EBC41 8/6
EBC81 5/-
EBF80 6/6
EBF83 7/6
EBF89 6/9

EC53 12/6
EC70 4/-
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ECC83 5/6
ECC84 5/6
ECC85 4/9
ECC86 7/-
ECC91 3/6
ECC189 6/6
ECF80 6/6
ECF82 6/6
ECH35 11/-
ECH42 9/-
ECH81 5/-
ECH83 7/6
ECL80 6/-
ECL82 6/-
ECL83 9/6
ECL86 8/-
EF36 3/4
EF37A 7/-
EF40 8/-
EF41 9/-
EF50 4/9
EF80 4/6
EF81 6/-
EF85 4/6
EF86 6/-
EF89 5/-
EF91 3/6
EF92 2/6
EF95 5/-
EF183 6/6
EF184 5/3
EH90 7/-
EL31 15/-
EL32 3/9
EL34 9/6
EL36 5/-
EL38 17/6
EL41 8/-
EL42 9/6
EL50 8/-
EL81 8/-
EL84 4/3
EL85 7/6
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EL95 5/-
EL360 22/-
EM31 5/-
EM80 7/-
EM81 7/-
EM84 6/3
EN92 6/-
ESU74 80/-
EY51 7/-
EY86 6/6
EY91 3/-
EZ40 7/-

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EZ80 5/-
EZ81 4/6
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KT67 45/-
KT71 7/6
KT76 7/-
KT88 24/6
KTZ63 7/-
L63 6/-
MH41 8/-
MHLD6 10/-
ML6 6/-
N34 8/-
N78 15/-
OA2 5/9
OB2 6/-
OB3 7/-
OC3 6/-
OD3 6/-
OZ4A 5/-
P41 4/-
PABC80 7/6
PC86 9/-
PC88 9/-
PC97 7/6
PC900 8/6
PCC84 5/6
PCC89 10/-
PCC189 10/6
PCF80 6/3
PCF82 6/-
PCF84 8/-
PCF86 7/6
PCF801 8/6
PCF802 9/-
PCF805 11-
PCF808 13-
PCL81 9/-

PCL82 7/-
PCL83 8/6
PCL84 7/-
PCL85 8/-
PCL86 8/-
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PL36 9/-
PL38 16/-
PL81 7/-
PL82 7/-
PL83 6/-
PL84 6/6
PL500 13/6
PX4 14/-
PX25 12/6
PY33 8/6
PY80 5/6
PY81 5/6
PY82 5/-

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SU2150A 10/-
S11E12 10/-
TDOX-20 70/-
TP22 5/-
TP25 5/-
TT11 5/-
TT15 35/-
TTR31 45/-
TZ40 40/-
TZO520 4/-
TZ20 16/-
U12/4 8/-
U18 8/-
U25 14/-

UL41 9/-
UL84 5/6
UU5 7/-
UU9 6/6
UY21 9/-
UY41 6/6
UY85 5/-
V246A/1K 190/-
VLS631 35/-
VP23 2/6
VP133 9/-
VR99 7/6
VR105/30 6/-
VR150/30 6/-
VU39 8/-
W118 10/-

1LH4 4/-
1N21 3/6
1N21B 4/-
1N43 4/-
1N70 4/-
1S4 5/-
1S5 4/6
1T4 3/-
2A3 5/-
2D21 5/-
3A4 4/-
3A108A 35-
3A146J 55/-
3A/167/M 55/-
3B7 5/-
3B24 14/-
3D6 3/-
3E29 50/-

5Y3WGTB 9/-
5Z4G 6/6
6AB6 4/-
6AC7 3/-
6AG5 2/6
6AG7 6/-
6AH6 10/-
6AJ7 2/-
6AK5 5/-
6AK7 6/-
6AK8 5/9
6AL5 3/-
6AL5W 7/-
6AM5 2/6
6AM6 4/-
6AQ5 5/6
6AQ5W 9/-
6AS6 5/-

6C5G 2/6
6C5GT 6/-
6C6 4/-
6C8G 5/-
6CH6 7/-
6C21 80/-
6CL6 9/-
6CW4 12/-
6S28 13/-
6D6 3/-
6F5GT 8/-
6F6G 4/-
6F7 6/-
6F8G 5/-
6F12 4/-
6F13 5/-
6F14 5/-
6F32 3/-
6F33 15/-

TRANSISTORS, ZENER DIODES etc.

OA5 3/-
OA10 3/-
OA47 2/6
OAT9 2/6
OA81 2/-
OA90 2/-
OA200 2/6
OA202 3/6
OA210 7/6
OA211 9/6
OAZ200 11/-
OAZ201 10/-
OAZ202 to OAZ206 6/6
OAZ207 9/6
OAZ208 to OAZ213 6/6
OAZ223 to OAZ225 10/-
OC16 15/-
OC22 10/-
OC23 12/6
OC24 15/-
OC25 7/6
OC26 6/-

OC28 12/6
OC35 10/-
OC70 4/-
OC71 3/-
OC72 5/-
OC73 6/-
OC76 5/-
OC81D 3/-
OC82 5/-
OC139 7/6
OC169 5/-
OC170 5/-
OC200 7/6
OC201 10/-
OC202 12/6
OC203 10/6
OC204 17/6
OC205 12/6
OC206 17/6
IN21 3/6
IN21B 5/-
IS111 4/-
IS113 4/6
IS115 6/-
2N585 7/6
2N1040 20/-
2N1090 7/6
2N1091 9/6

2N1306 7/6
2N1307 7/6
AAZ18 4/-
AC107 10/-
AC126 6/6
AC127 7/6
AC128 6/6
AC176 7/6
ACY17 8/6
ACY18 5/6
ACY19 6/6
ACY20 5/-
ACY21 6/-
ACY22 3/6
ACY28 4/6
AD140 16/-
AD149 16/-
AEY11 15/-
AEY12 12/6
AF102 18/-
AF114 6/6
AF115 6/-
AF116 6/6
AF118 10/-
AF124 7/6
AF125 6/6
AF126 6/-
AF127 6/-

AF139 10/-
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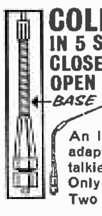

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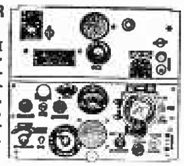

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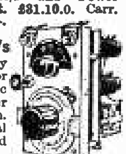

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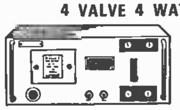

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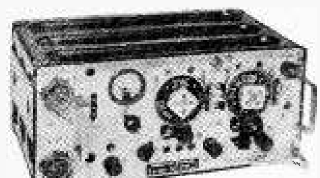

This set is made up of 3 separate units; (1) a two valve amplifier using a 6V6 output valve; (2) (some only, not built in the very latest models) a V.H.F. transreceiver covering 229–241 Mc/s using 4 valves; (3) the mainshort wave transmitter/receiver covering in two switched bands, just below 2·Mc/s–4½ 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/-.
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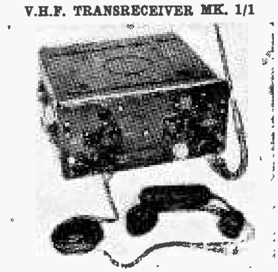
V.H.F. TRANSRECEIVER MK. 1/1



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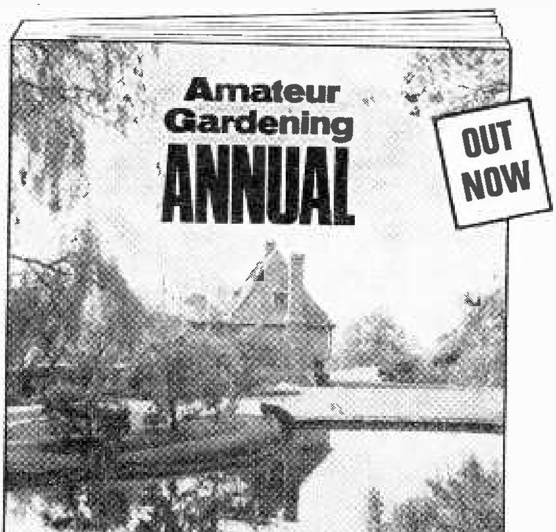

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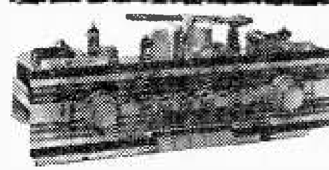

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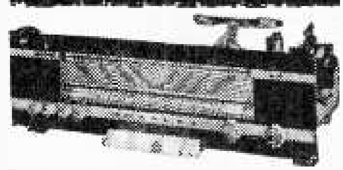

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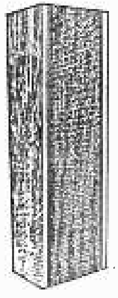

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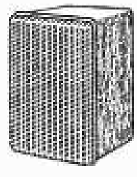

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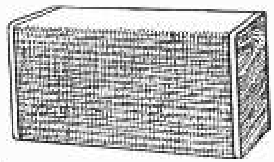

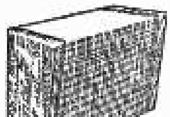

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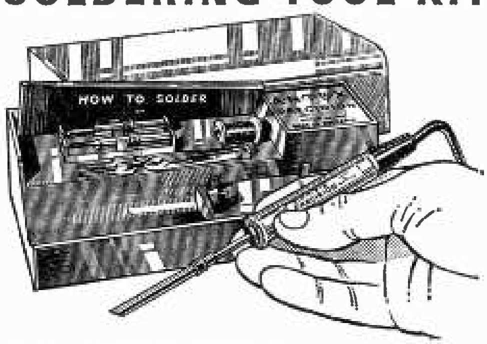

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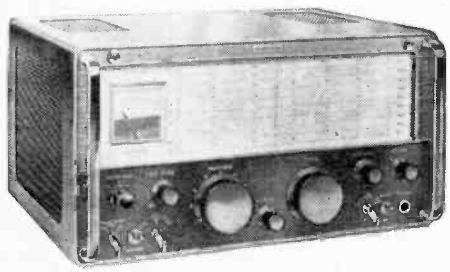

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PRACTICAL WIRELESS, DECEMBER 1967

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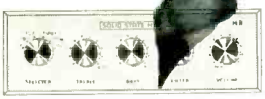

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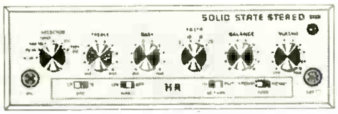

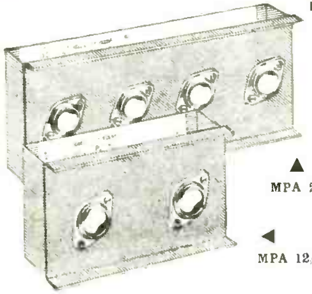

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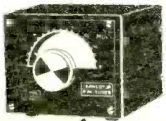

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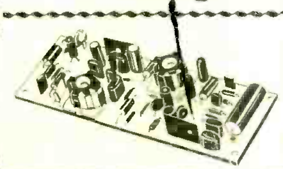

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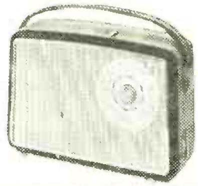

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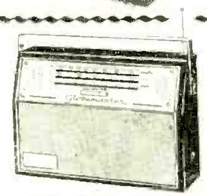

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