PRACTICAL WIRELESS

APRIL 1969

3'0

FREE INSIDE

THE P.W. 'DOUBLE 12'

HI-FI STEREO AMPLIFIER

WEYRAD

COILS & TRANSFORMERS FOR CONSTRUCTORS

Special versions of our P50 Series are now available for AF117 or OC45 Transistors. They can be used in the standard superhet circuit with slight changes in component values.

Oscillator Coil	P50/1AC (For OC45)	P50/1AC	(For AF117)	5/4
1st I.F. Transformer	P50/2CC (For OC45)	P51/1	(For AF117)	5/7
2nd I.F. Transformer	P50/2CC (For OC45)	P51/2	(For AF117)	5/7
3rd I.F. Transformer	P50/3CC (For OC45)	P50/3V	(For AF117)	6/–

Rod Aerial	RA2W	12/6
Driver Transformer	LFDT4/1	9/6
Output Transformer	OPT1	10/6
Printed Circuit	PCA1	9/6

I.F. TRANSFORMERS FOR "PRACTICAL WIRELESS" CIRCUITS

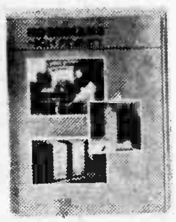
Components for several receivers are available, including the following for the "Clubman".

T41/1E	1st I.F. Transformer	7/6
T41/2E	2nd I.F. Transformer	7/6
T41/3T	3rd I.F. Transformer	10/6
T41/3T	B.F.O. Coil	10/6

Details of these and our other components are given in an illustrated folder which will be supplied on request with 4d. postage please.

WEYRAD (ELECTRONICS) LIMITED
SCHOOL STREET, WEYMOUTH, DORSET

GOODMANS HIGH FIDELITY MANUAL



A Guide to full listening enjoyment

The Manual is much more than a catalogue of Goodmans High Fidelity Loudspeakers—it contains informative articles, including advice on stereo, special beginners page, and full cabinet drawings. You'll find it interesting as well as informative.

The Perfect Combination

MAXAMP 30

TRANSISTORISED STEREOPHONIC HIGH FIDELITY AMPLIFIER 15 + 15 watts · Silicon solid state · Integrated pre-amplifier · Negligible distortion · **£54.**

STEREOMAX

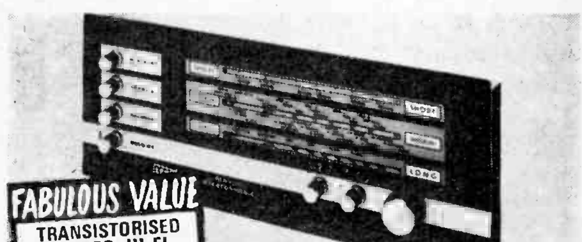
MATCHING AM/FM STEREOPHONIC FM TUNER
Transistorised · Outstanding specification · Stereo de-coder (optional) **£65.5.0** + £17.5.5 P.T.

Both MAXAMP 30 and STEREOMAX have polished wood cases ($10\frac{1}{2}$" x $5\frac{1}{2}$" x $7\frac{1}{4}$" deep) in Teak or Walnut to order.

Full specifications of the Maxamp 30 and Stereomax are given in the High Fidelity Manual—send the coupon for your FREE copy—or pay an early visit to your Goodmans dealer.

FREE Please send Hi-Fi Manual together with name and address of my nearest Goodmans dealer.
Name ....
Address ....
.... PW4

GOODMANS LOUDSPEAKERS LTD
AXIOM WORKS · WEMBLEY · MIDDLESEX. Tel: 01-902 1200



FABULOUS VALUE

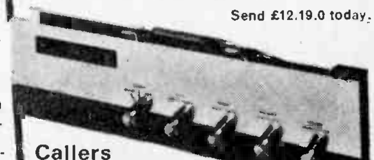
TRANSISTORISED STEREO HI-FI RECORD PLAYER

Build your own Hi-Fi Record Player with the Serenade fully transistorised amplifier which comes complete with 2-10" x 6" speakers and the latest BSR 4 Speed Stereo/Mono Record Changer.
Advanced solid state amplifier only $4\frac{1}{2}$" deep, 14 transistors plus 4 diodes, separate Bass and Treble—10 watts total power. Frequency response 50-15,000 c/s.
EASY TO INSTALL
NO TECHNICAL KNOWLEDGE REQUIRED
Only **28** Gns. +P&P 17/6
H. P. terms available. Dep. £9.16.0 & 12 monthly payments of 36/9 (Total H.P. £31.17.0). Send £10.13.6 today.
Amplifier available separately at only 16 Gns.

FANTASTIC BARGAIN OFFER!

"TRANSCONTINENTAL"
FULLY TRANSISTORISED STEREOPHONIC RADIOGRAM CHASSIS

Complete with 2-10" x 6" speakers and the latest BSR Mono/Stereo Record Changer—a complete radiogram at half normal price ONLY
10 Watts Total output
17 Transistors & 10 diodes **$34\frac{1}{2}$** GNS. P&P 17/6
EASILY FITTED NO TECHNICAL KNOWLEDGE NECESSARY
H.P. available £12.1.6 dep. plus 18 monthly payments of 32/- (Total H.P. £40.17.6).
Send £12.19.0 today.



Callers Welcome

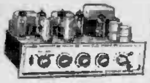
POST THIS COUPON NOW!
PLEASE SEND ME FREE DETAILS OF YOUR RANGE
Name ....
Address ....

LEWIS radio 100 CHASE SIDE, SOUTHGATE. Dep. P469 LONDON, N.14. TELEPHONE PAL 3733/9666

THE 'YORK' HIGH FIDELITY 3 SPEAKER SYSTEM

★ Moderate size, only 25 x 14 x 10in. Complete Kit **19 Gns.**
★ Response 30-20,000 c.p.s. Impedance 15 ohms.
★ Performance comparable with units costing considerably more. Carr. 12/6
Consists of (1) 12in. 15 watt Bass unit with cast chassis. Roll rubber cone surround for ultra low resonance, and ceramic magnet. (2) 3-way quarter section series cross-over system. (3) 8 x 5in. high flux middle range 'speaker. (4) High efficiency tweeter. (5) Measured weight of woollen acoustic damping material. (6) Teak veneered cabinet. (7) Circuit and full instructions.
DEMONSTRATIONS AT ALL BRANCHES.

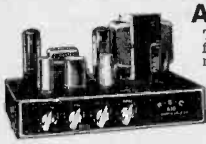
R.S.C. STEREO/20 HI-FI AMPLIFIER



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:** 30 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 and Treble controls.** Output transformers are high quality sectionally wound. Outputs for 3 and 15 ohms speakers. Complete set of parts, point-to-point wiring diagrams and instructions. Or factory assembled with our usual 12 mths' gntee **19gns.** Or Dep. **£4.10.0** and 9 monthly payments **£2** (Total **£22.10.0**). *Send S.A.E. for leaflet.*

15 Gns. Carr. 12/6

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



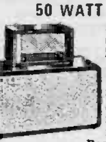
Highly sensitive. Push-Pull high output, with Pre-amp./Tone Control Stages. Performance figures of factory built units: Hum level —70dB. Frequency response ±3dB 30-20,000c/s. Sectionally wound output transformer. All high grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Sensitivity 36 mV so that almost **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 with point-to-point wiring diagrams and instructions. Carr. 12/6 **14 Gns.** Twin-handled perforated cover **27/6.** Supplied factory built with EL34 output valves. 12 months' guarantee for **17 gns. TERMS: Deposit £5.14.0** and 9 monthly payments of **31/3** (Total **£19.15.3**). Send S.A.E. for leaflet.

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. 5 valves—ECC83 (2), EL84 (2), EZ81. High quality sectionally wound output transformer. IND. BASS AND TREBLE CONTROLS. Frequency response ±3dB 30–20,000 c/s. Hum level —60dB. SENSITIVITY 40 millivolts. Suitable for Crystal or Ceramic PUs, all types "mikes". For Musical Instruments such as String Bass, Electronic Guitars etc. Size approx. 12 x 9 x 7in. For AC mains 200-250v. 50 cps Output for 3 and 15 ohm spkrs. SAE for leaflet. Complete kit. **9 Gns.** Full instructions and point-to-point wiring diagrams. Carr 11/6 (or factory built **12 Gns.**) Twin handled metal cover **27/6.** TERMS ON ASSEMBLED UNITS. Deposit **87/6** and 9 monthly payments of **22/-.** (Total **£14.5.6**).

RSC A11T TRANSISTORISED VERSION of above complete kit **9 Gns** (Assembled **13 Gns**)

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



An exceptionally powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape.
Peak O/P rating.
★ Two extra heavy duty 12in. Loudspeakers.
★ Four Jack inputs and two Volume Controls for simultaneous use of up to four pick-ups or "mikes". Bass and Treble controls.
52 Gns. Carr. 30/- or dep. **£10.1.9** and 9 monthly payments of **£5.11.9.** (Total **57½ gns.**). Send S.A.E. for leaflet.
Also B20 Bass inc. 15in. 25w Spkr. 29½ gns. G15 inc. 12in. 20w Spkr. 19½ gns.

R.S.C. BATTERY/MAINS CONVERSION UNITS

Type BM1 An all-dry battery eliminator. Size 5½x4½x2in. approx. Completely replaces batteries supplying 1·5v. and 90v. where A.C. mains 200/250v. 50c/s is available. Complete kit with diagram **49/11** or assembled **59/11.**

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. MAINS TRANSFORMERS

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

MIDGET CLAMPED TYPE 2½ × 2½ × 2¾in.

250v., 60mA, 6·3v. 2a.	15/11
250-0-250v., 60mA 6·3v. 2a.	16/11

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6·3v. 2a., 0-5-6·3v. 2a.	21/9
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	37/9
300-0-300v. 100mA. 6·3v. 4a., 0-5-6·3v. 3a.	37/9
300-0-300v. 130mA, 6·3v. 4a., c.t., 6·3v. 1a. For Mullard 510 Amplifier	45/9
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	37/9
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a.	47/9
425-0-425v. 200mA, 6·3v. 4a., c.t., 5v. 3a.	69/9
425-0-425v. 200mA. 6·3v. 4a., 6·3v. 3a., 5v. 3a.	75/-
450-0-450v. 250mA, 6·3v. 4a., c.t., 5v. 3a.	87/9

TOP SHROUDED DROP-THROUGH TYPE

250-0-250v. 70mA, 6·3v. 2a., 0-5-6·3v. 2a.	21/9
250-0-250v. 100mA, 6·3v. 3·5a.	25/9
250-0-250v. 100mA, 6·3v. 2a, 6·3v. 1a.	26/9
350-0-350v. 80mA, 6·3v. 2a., 0-5-6·3v. 2a.	27/9
250-0-250v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	37/9
300-0-300v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	37/9
300-0-300v. 130mA, 6·3v. 4a.. 0-5-6·3v. 1a. Suitable for Mullard 510 Amplifier	44/9
350-0-350v. 100mA, 6·3v. 4a., 0-5-6·3v. 3a.	37/9
350-0-350v. 150mA, 6·3v. 4a., 0-5-6·3v. 3a.	45/11

FILAMENT or TRANSISTOR POWER PACK Types 6·3v. 1·5a. **7/9;** 6·3v. 2a. **8/9;** 6·3v. 3a. **10/9;** 6·3v. 6a. **21/9;** 12v. 1a. **8/9;** 12v. 3a. or 24v. 1·5a. **21/9;** 0-9-18v. 1½a. **17/9;** 0-12-25-42v. 2a. **29/9.**

CHARGER TRANSFORMERS 0-9-15v. 1½a. **14/11;** 2½a. **17/9;** 3a. **19/11;** 5a. **23/9;** 6a. **27/9;** 8a. **33/9.**

AUTO (Step UP/step DOWN) TRANSFORMERS

0-110/120v. 200-230-250v. 50-80 watts	15/9
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	8/9
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω	12/9
Push-Pull 10 watts 6V6 ECL86 to 3, 5, 8 or 15 Ω	22/9
Push-Pull EL84 to 3 or 15 Ω 10-12 watts	21/9
Push-Pull Ultra Linear for Mullard 510, etc.	39/9
Push-Pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω	85/9
Push-Pull 20 watt high quality sectionally wound EL34, 6L6, KT66 etc. to 3 or 15 Ω	59/9

SMOOTHING CHOKES
150mA, 7-10H. 250 Ω **12/9;** 100mA. 10H. 200 Ω **10/9;** 80mA. 10H. 350 Ω **8/9;** 60mA. 10H. 400 Ω **4/11.**

BLACKPOOL

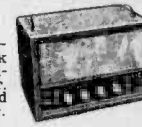
AGENT APPOINTED O. & C. ELECTRONICS 227 CHURCH ST.

R·S·C HI-FI CENTRES LTD.

R.S.C. COLUMN SPEAKERS

Covered in two-tone Rexine/Vynair, ideal for vocalists and Public Address, 15 ohm matching. **C57 15 watts** inc. five 7 x 4in. speakers **£7.19.11.**
Type C48S, 30 watts. Fitted four 8in. high flux 8 watt speakers. Overall size approx. 42 x 10 x 5in. Or deposit **65/-** and 9 mthly pmts **34/9** (Total **£18.17.9**) Carr. 10/-. **16 Gns.**
Type C412S, 50 watts. Fitted four 12in. 11,000 line 15 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/-. Or Deposit **£4.13.6** and 9 monthly payments of **52/6** (Total **£28.5.0**). **24 Gns.**

30 WATT HI-FI AMPLIFIER



for Guitar, Vocal or Instrumental Group
A 2 or 4 input. 2 vol. control Hi-Fi unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/gold perspex facia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Deposit **3 gns.** and 9 mthly payments of **39/8** (Total **£21**). **18 Gns.** Carr. 12/6

12in. HIGH QUALITY LOUDSPEAKERS

In Teak or Afrormosia veneered Cabinets
15 Watt 11,000 lines 3 or 15 ohms. Carr 7/6 **£5.15.0** 20 Watt 10,000 lines 3 or 15 ohms. Carr 8/9 **£8.19.9**

LOUDSPEAKERS

Limited number of heavy duty units at well below list prices. Brand new, guaranteed. Terms available over £8. Carr. 10/- extra.

12in. 30 watt 6-8 ohms	12in. 30 watt 15 ohms impedance	15in. 40 watt 15 ohms
Normally approx. £12 **£6.19.9**	Normally £10.10.0. **£6.19.9**	Extra heavy duty **10 Gns.**

FANE 'POP' 100 LOUDSPEAKER

18" 100 Watt
Fantastic power handling. Guaranteed 2 years. POST FREE **19 Gns**

ARMSTRONG UNITS CLEARANCE

Stereo Amplifier 222	**Our Price £25**
AM/FM Tuner-Amp 227M	**Our Price £35**

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 **28/11.** Or assembled **39/11.** **24/11**

CLEARANCE LINES

HIGH QUALITY 8" x 3" LOUDSPEAKERS 10000 Gauss 3 ohm only **11/9**

14 WATT HI-FI AMPLIFIERS High sensitivity. Two separate Jack inputs. Two vol. controls for mixing purposes. Separate Bass and Treble Controls. Valves ECC83, ECL86, ECL86, EZ80. Output for 15 ohm Loudspeaker. 200-250v 50 c.p.s. A.C. mains operation. Size approx. 8 x 8 x 6in. Factory built and fully guaranteed. Limited number to clear at **£6-19-11** Carr. 10/-

EXTENSION 'SPEAKERS 29/9 Cabinet size 12 x 8 x 5in. attractive grey lizard skin finish. Fitted high flux 6½in. 5w. 3 ohm speaker.

EMI PLAYER TURNTABLES with P.U. 4 speed. Turnover cartridge. Limited number. Mono **59/9** Stereo **69/9**

PHONE AMPLIFIERS Speak and listen with both hands free. Standard dry battery operated. Attractive black moulded case. **59/9**

1 WATT TRANSISTOR AMPLIFIERS for 3-5 ohm loudspeakers. Miniature size. Brand new boxed. **37/9**

PRINTED CIRCUIT KITS for making printed circuits. Complete with 72 square ins. laminated board and necessary fluids. **12/9**

J.B. VHF/FM DIAL & DRIVE ASSEMBLIES Complete with escutcheon. Size 7" x 4½". Escutcheon 7½" × 2¼". ONLY **9/9**

TAPE RECORD/PLAYBACK AMPLIFIERS 4 watts output. Magic Eye Recording level indicator. For 3 ohm L/S. All normal facilities. Less Facia plate. For 200/250 A.C. mains. Carr 8/6. **£7.19.11**

HEAVY DUTY 15in. 40 WATT LOUDSPEAKERS in substantial Rexine/Vynair covered cabinet. Carr. 15/- ONLY **14 Gns.**

MINI-8 HI-FI LOUDSPEAKER UNITS Teak veneered cabinet. size 9½ x 6½ x 7½in. Peak power handling 8 watts 3 ohms or 15 ohms. **Clearance Price** **59/11**

JASON VHF/FM TUNER DESIGNS

All parts **FMT1 5 Gns. FMT2 £6.19.11. JTV2 9½ Gns.** Please state channel

STEREO/TEN HIGH QUALITY AMPLIFIER

5 watts high quality output on each channel. Sensitivity 50 millivolts. Suitable all crystal or ceramic stereo cartridges. Ganged Bass and Treble Controls. Valves ECC83 (2), EL84 (2), EZ81. For 2-3 ohm speakers. Assembled with 12 months' guarantee Carr. 11/6 **£11.19.6**

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

Complete kit of parts incl. Ammeter and Circuit.
4 amp with variable charge rate selector **49/9**
6 amp heavy duty with variable charge rate selector **69/9**
All types 200-250v. A.C. mains. Ready built 10/- extra.

SENSATIONAL R.S.C. HIGH FIDELITY STEREO PACKAGE OFFERS

"PACKAGE 3" 30 WATT SYSTEM
★ Goldring Transcription Turntable on Plinth
★ Shure Magnetic Pick-up Cartridge
★ Super 30 Amplifier in cabinet
★ Pair of Stanton Loudspeaker Units
Special inclusive price. Fully wired units ready to "plug-in". Carr. 25/-. **85 Gns.** plus small P.T. surcharge
TERMS AVAILABLE ALL PACKAGE OFFERS

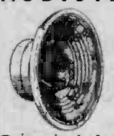
Matched for optimum performance. Send for coloured brochure showing other money saving offers.

Illustrated with TFMI Mk II Tuner fitted
EXTREMELY ATTRACTIVE AND VERSATILE PLINTHS finished in Teak or Afrormosia veneer. Tinted Perspex "hinged" cover with satin chrome handle.

"PACKAGE 2" 30 WATT SYSTEM
★ Garrard SP25 Mk II Turntable on Plinth
★ Goldring CS90 Ceramic P.U. Cartridge
★ Super 30 Amp. in cabinet.
★ Pair Stanton Speaker Units **75 Gns.** Carr. 25/-
Special inclusive price. Fully wired units ready to "plug-in" Plus small P.T. surcharge

"PACKAGE 1" 13 WATT SYSTEM
★ Garrard SP25 Mk II 4 sp player unit on plinth
★ Goldring CS90 Ceramic P.U. Cartridge
★ TA12 Amplifier in cabinet
★ Pair of Dorset Loudspeaker Units Special inclusive price. **49½ Gns.**
Plus small P.T. s'charge Or Dep. £10 and 9 monthly payments £5.4.0. (Total £56.16.0.) Perspex cover 3gns. extra.

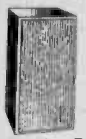
AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS



Heavy construction. Latest high efficiency ceramic magnets. Treated Cone surround giving low fundamental resonance. "D" indicates Tweeter Cone providing extended frequency range 40-15,000 c.p.s. Impedance 3 or 15 ohms. Please state choice. Exceptional performance at low cost. Prices include carriage.

				HF100D	10"	15W	£5.15.0
HF510L	5"	10W	57/9	HF120	12"	15W	69/9
HF801D	8"	8W	57/9	HF120D	12"	15W	79/9
HF811D	8"	10W	4 gns.	HF126	12"	15W	89/9
HF102D	10"	8W	59/9	HF126D	12"	15W	5 gns.

HIGH FIDELITY LOUDSPEAKER UNITS
Cabinets latest style Satin Teak or Afrormosia veneer. Acoustically lined or filled woollen damping. Ported where appropriate. Credit tms available.



DDRSET Size 16 x 11 x 9in. Range 45-15,000 c.p.s. Rating 8–10 watts. Fitted High flux 8in. Dual Cone speaker. Imp. 3 or 15 ohms. **£8.19.9** Inc. Carr.

STANTON IIIS Size 18x11x10in. Rating 10 watts. Incorporating Fane 803b speaker with roll rubber cone surround and 15,000 line magnet. High flux tweeter. Handsome Scandinavian design cabinet. Range 30–20,000 c.p.s. Impedance 3 or 15 ohms. Gives smooth realistic sound output. **16 Gns.** Inc. carr.

GLOUCESTER Size 25 x 16 x 10in. 12in. High flux 12,000 line speaker. Cross-over unit and Tweeter. Rating 10 watts. Frequency range 40–20,000 c.p.s. Impedance 15 ohms. **12½ Gns.**

E2 EQUIPMENT CABINET

Size 17" wide 14¼" deep 11¼" high. Cut for TA12, Super 15, Super 30 and other amplifiers. 'Hinged' perspex cover. Satin Teak or Afrormosia veneer finish. Price inc. carr. **8 Gns.**

MOTOR BOARDS cut for Garrard Turntables and many other units. Price **12/9**

RECORD PLAYING UNITS

Money saving units. Ready to plug into Amplifier or Tape Recorder.

RP2 Consisting of Garrard SP25 Mk II (with heavy turntable) fitted Goldring CS90 high compliance ceramic Stereo/Mono cartridge with diamond stylus. Mounted on Plinth. Inc. Perspex cover. Carr. 15/-. Plus 8/7 P.T. surcharge. **22 Gns.**

RP3 As above but with Goldring Lenco GL68 Transcription unit and CS90 Cartridge. Supplied with Perspex Cover. Carr. 21/-. **£28** Inc. P.T. surcharge

R.S.C. PLINTHS

for Record Playing units. Teak finish cut for Garrard 1000. 2000. 3000, AT6, AT60, SP25 or Goldring GL68. **59/9** Available with clear Perspex cover as ill. Inc. Carr. **6 Gns.** Perspex cover sold separately at 3 Gns. Limited number of covers slightly damaged but repaired by makers. 39/9

INTEREST CHARGES REFUNDED on Credit Sales settled in 3 months.

BLACKPOOL AGENT APPOINTED See other page

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) 50mV (3) 100mV (4) 2mV Output rating I.H.F.M. ★ Handsome brushed silver finish Facia and Knobs. Complete kit of parts with full wiring diagrams & instructions. **12½ GNS.** Carr. 7/9 Factory built with 12 mth gntee **16 GNS** or Deposit **£4.16.0** and 9 mthly pymts **31/6** (Total £18.19.6). Or in Teak or Afrormosia veneer housing **19 Gns.** Dep. £4.19.0 and 9 mthly pymts 39/-. (Total £22.10.0.)

AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 12,000 line 10 watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **5 Gns.** Carr. 5/9
Or **Senior 15 watt** inc. HF 126 15,000 line Speaker 6 Gns. Carr. 6/6

HI-FI SPEAKER ENCLOSURES

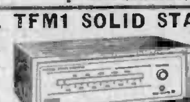
Teak or Afrormosia veneer finish. Modern design. Acoustically lined and ported. Inc. carr.
JE8 Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi 'speaker. **4 Gns.**
SE8 For optimum performance with any 8in. Hi-Fi 'speaker. Size 22 x 15 x 9in. **5 Gns.**
SE10 For outstanding results with 10in Hi-Fi 'spkr Size 24 x 15x10in. **£5.10.0**
SE12 For exclnt prfmnce with 12in Hi-Fi 'spkr and Tweeter. Size 25 x 16 x 10¼in. **6 Gns.**

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

200-250v. AC mains operated Frequency Response 30–20,000 c.p.s. —2dB. Harmonic Distortion 0·3% at 1,000 c.p.s. 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 5½in. Attractive brushed silver finish facia plate 10¼ x 3¼in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. Carr. 7/6 **6 Gns.** Or factory built with 12 months guarantee. 8 Gns.

R.S.C. TFM1 SOLID STATE VHF/FM RADIO TUNER

Total cost of parts with detailed wiring diagrams & instructions. Inc. Carr. **14 Gns.** Or factory built **16¼ gns.** Or in Teak finished cabinet as illustrated **19¼ gns.** Terms: Deposit £5 and 9 monthly payments £2. Total £23.



★ **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 silicon Planar Transistors.** ★ **Designed for standard 80 ohm co-axial input.** Visually matching our Super 15 and 30 amplifiers and of the same high standard of performance and reliability. The pre-wired tuning head facilitates speed and simplicity of construction. Printed circuitry. Only high grade transistors and components used. A quality product at considerably less than the cost of comparable units. Stereo version, all parts 20 gns. Inc. carr. Assembled 22¼ gns. inc. carr.

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

SOLID STATE CONSTRUCTION

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.
TRANSISTORS. 9 current types of high quality by leading manufacturers.
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 2·5 mV. Radio/Aux or Ceramic P.U. 110 mV.
FREQUENCY RESPONSE: ±2dB 20–20,000 c.p.s.
TREBLE CONTROL: +15dB to —14dB at 10 Kc/s. **NEG FEEDBACK:** 52dB.
BASS CONTROL: +17dB to —15dB at 50 c/s. **HUM LEVEL:** —75dB.
HARMONIC DISTORTION at 10 Watts 1,000 c.p.s. 0·2%.
Complete Kit of parts with full constructional details and point to point wiring diagrams. Carr. 12/6 **11½ Gns.**
Supplied factory built 15¼ **Gns.** Carr. 12/6. Terms: Deposit **4 Gns.** and 9 monthly payments 31/1 (Total £18.3.9). Or in Teak or Afrormosia veneer housing as illustrated. **19 Gns.**
ALL COMPONENTS ETC. ARE OF A HIGH STANDARD AND SUPPLIED BY LEADING MANUFACTURERS.

SPECIFICATIONS COMPARABLE WITH UNITS COSTING CONSIDERABLY MORE

R.S.C. SUPER 30 STEREO AMPLIFIER

A DUAL CHANNEL VERSION OF THE SUPER 15. Employing Twin Printed Circuits. High quality 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/- **21 Gns.**
Unit factory built **28 Gns.** or deposit £7.5.0 and 9 monthly payments 56/3. (Total **£32.13.3**). Or in veneered housing **31 Gns.** Carr. 15/- or Deposit £7.3.6 and 9 monthly paymts 64/- (Total £35.19.6). *Send S.A.E. for leaflet.*

BRADFORD 10 North Parade. (Half-day Wed.) Tel. 25349
BRISTOL 14 Lower Castle St. (Half-day Wed.) Tel. 22904
BIRMINGHAM 30/31 Gt. Western Arcade opp. Snow Hill Station 021-236-1279 (Half-day Wed.)
DERBY 26 Osmaston Rd. The Spot (Half-day Wed.) Tel. 41361
DARLINGTON 18 Priestgate (Half-day Wed.) Tel. 68043
EDINBURGH 133 Leith St. (Half-day Wed.) Tel. Waverley 5766
GLASGOW 326 Argyle St. (Half-day Tues.) Tel. CITy 4158 403 Sauchiehall St. (Opp. Locarno) (Half-day Tues.) Tel. 332-1572
HULL 91 Paragon Street. (Half-day Thursday) Tel. 20505

R·S·C HI-FI CENTRES LTD.

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.

Open all day Sats. except High Holborn

LEICESTER 32 High Street. (Half-day Thurs.) Tel. 56420
LEEDS 5-7 County (Mecca) Arcade, Briggate (Half-day Wed) Tel 28252
LIVERPOOL 73 Dale St. (Half-day Wed.) Tel. CENtral 3573
LONDON 238 Edgware Road, W2 (Half-day Thurs.) Tel. PAD 1629 96 High Holborn, WC1. Tel. HOL 9874 (Half-day Sat.)
MANCHESTER 60A Oldham Street (Half-day Wed.) Tel. CENtral 2778
MIDDLESBROUGH 106 Newport Rd (Half-day Wed) Tel. 47096
NEWCASTLE UPON TYNE 41 Blackett Street (Opp. Fenwicks Store) (Half-day Wed.) Tel. 21469
SHEFFIELD 13 Exchange Street (Castle Market Bldgs.) (Half-day Thursday) Tel. 20716

Bargain—Car Radios. Our Price 9 gns. Negative or positive earth (switched) fully transistorised (12v) medium and long waves. Speaker and fitting kit supplied at no extra cost. P/P 5/-.

DULCI HI-FI UNITS
The Dulci range of tuners and amplifiers offer exceptional quality at a sensible price.
Amplifiers: 207 and 207M. **Tuners**: FMT7 and FMT7s.
SEND NOW FOR FULL DETAILS

Sonotone 9TA and 9TA/HC. Diamond Cartridge brand new, boxed in manufacturers' carton **49/6** + 2/6 p/p. **Acos** GP 91-1 and GP 91-3 stereo compatible cartridges, new in sealed manufacturers' cartons **22/6** + 2/6 p/p.

TRIO Stereo Moving Magnet Cartridge Model AD76K. Diamond Stereo LP Stylus. Frequency response 20-20,000 c/s output. 7mv tracking pressure 2 grammes ± 0.5 grm. Fully guaranteed. Price **85/-** p/p free.

BASF TAPE 25% OFF

5″	600ft.	14/-	900ft.	19/-	1200ft.	30/-
5¾″	900ft.	19/-	1200ft.	24/-	1800ft.	39/-
7″	1200ft.	24/-	1800ft.	35/-	2400ft.	57/-

P. & P. 2/- per reel.—over £5 FREE

●Bargain—Changer decks at lowest prices ever

	GARRARD	
Beautiful teak	1025	£8.0.0.
plinth and perspex	2025	£8.10.6.
cover to suit	AT60 Mk. II	£12.19.6.
these units	SP25 Mk. II	£12.0.0.
5 Gns. P. & P. Free	3500 with Son 9TA.HC diam. cart.	£10.19.6.

Add 10/- p/p for each Garrard unit

HI-FI SPEAKER K12TC—12in. 12 watt

Offers an exceptionally smooth and extended response, with very low level of distortion from the specially designed twin diaphragms.
Frequency Response: 30-16,000Hz.
Impedance: 15-160Hm.

OUR SPECIAL PRICE PLUS P. & P. 6/6 **97/6**

SPEAKER ENCLOSURES
Type: INFINITE BAFFLE
Model 8: 8″ plus 3″ tweeter
Model 138: 13″ x 8″ EMI
Both £4.19.6 each
Model 1012: 10″ or 12″ plus 4″ tweeter
£7.19.6
All enclosures are in oiled teak, fully built.
Please add 8/- p. & p. on each enclosure

The greatest HI-FI Budget system to-day—can't be beaten—price or quality anywhere—look at these great features—then compare.

	£	s.	d
Teleton F2000 tuner amp. AM-FM with multiplex decoder and A.F.C.—2 x 5w channels R.M.S. Bass Volume Treble Balance controls, a truly outstanding unit	43	1	0
Garrard SP 25 Mk II Transcription deck	15	11	11
Teleton SA 1003 matching speaker enclosures	9	5	0
Sonotone 9 TA Diamond Cartridge	4	2	0
Plinth and Perspex cover	7	0	0
	£78	19	11

Exclusively offered by WALDON at the remarkably low price of 63 gns.

●Bargain—Speakers, Hi-Fi—The Baker Selhurst Stalwart. 12in. round, 15 watt rating, 12,000 lines gauss, 15 ohms, response 45-13,000c/s. Bass resonance 40-50c/s, solid aluminium chassis.
Our price £5.9.6.
p/p 6/6

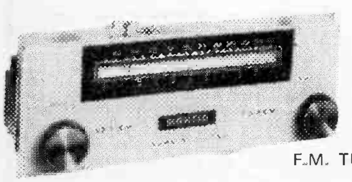
● Bargain — Speakers, Hi-Fi — The Baker Selhurst Guitar Group 25, 12in. round, 25 watt rating, 12,000 gauss, 15 ohms, response 30-10,000 c/s, solid aluminium chassis, heavy duty cone.
Our price £5.9.6.
p/p 6/6

E.M.I. HI-FI SPEAKERS
SET 450: 13 x 8 with two built-in tweeters and cross-over unit. **Our Price** 69/6. 3 or 15 ohm, 10w, 40-13,000 Hz.
SET 850: 6½″ bass plus 3¾″ tweeter and cross-over unit. 8 ohm, 10w, 65-20,000 Hz. 79/6.
SET 250: 5″ heavy duty bass plus 3″ tweeter and cross-over unit. 8 ohm, 6w, 80-20.000 Hz. 65/-.
Add 5/6 p/p for each speaker set

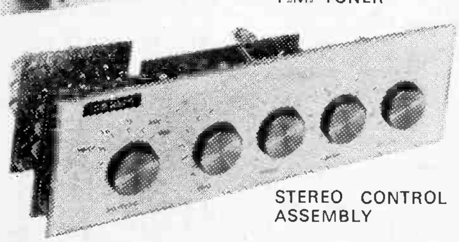
WALDON ELECTRONICS Atlas House, Chorley Old Rd., Bolton. Bolton 45628.

MARTIN IS HIGH-FIDELITY

The first and still the most satisfactory unit assembly system



F.M. TUNER



STEREO CONTROL ASSEMBLY

For many years now Martin Electronics have been producing highly efficient and dependable prefabricated module-type units for simple assembly into reasonably priced high fidelity systems. Many purchased at the time of the introduction of the Martin Audiokit system are in regular use to this day, completely justifying our claims for years of trouble-free service. No system gives you wider flexibility in the choice of units available than Martin and all equipment conforms precisely to stated specification. When new units are introduced, they are designed for adding to those produced so far, making it easy and economical to extend and improve your existing Martin Audiokit set-up. Anyone can assemble Martin equipment with ease and the foreknowledge that when finished, he will be in possession of a true hi-fi assembly of the very best kind which looks and sounds completely professional in every way—and MARTIN AUDIOKITS remain as ever, the units that have true add-on ability.

AMPLIFIER SYSTEMS • TUNERS • RECORDERS

MARTIN HIGH-FIDELITY AUDIOKITS *cover the widest possible range of requirements. They are available for Mono, and can be doubled up for conversion to stereo, or as complete stereo units. 3 ohm and 15 ohm systems. Special pre-amp for low output pick-ups—escutcheon panels to suit the arrangement you choose. Tuner is styled to match.*

UNITS INCLUDE:
- 5-stage input selector
- Pre-amp tone controls
- 10 watt amp. (3 ohms)
- 10 watt amp. (15 ohms)
- Mains power supply
- F.M. Tuner

Start by sending for leaflets at once

Trade enquiries invited

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

MARTIN ELECTRONICS
154 High Street, Brentford, Middlesex
Please send Audiokit Hi-Fi/F.M. Tuner/Recordakits Leaflets. (Strike out items not wanted)

Name ....

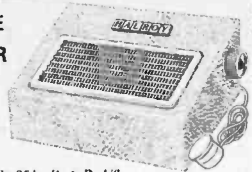
Address ....

....

PW4

EXCLUSIVE PURCHASE!

PORTABLE AMPLIFIER UNIT



BY WELL-KNOWN BRITISH MAKER

A luxury unit at a bargain price. Only 35/-. P. & P. 4/6.
Designed as a Telephone Amplifier but can be used in many different ways—a booster amplifier for transistor radios, a baby alarm, intercom, paging system etc., etc. High gain four transistor amplifier unit housed in attractive leathercloth covered wooden cabinet with upward facing 3in. high flux P.M., speaker covered by neat plastic grille. Fitted 3·5mm jack socket and volume/on/off control. Size 7 × 4¾ x 3¼in. high. Operates on standard PP6 or VT6 battery. Supplied complete with telephone pick-up induction coil fitted suction pad, lead and 3·5mm jack plug.

OUR SPECIAL PRICE ... **35/-** P. & P. 4/6.

Or as above with 3·5mm plug and DLR5 unit for use as sensitive microphone for baby alarms, communication systems etc. Will operate over distances of up to 200ft. or more when connected with twin flex or bell wire.

PRICE **40/-** P. & P. 4/6
(Batteries and flex not included.)

BRAND NEW 3 OHM LOUDSPEAKERS
5in. 14/-; 6½in. 18/6; 8in. 27/-; 7 × 4in. 18/6; 10 × 6in. 27/6. E.M.I. 8 × 5in. with high flux magnet 21/-. E.M.I. 13½ × 8in. with high flux ceramic magnet 42/- (15 ohm 45/-). E.M.I. 13 × 8in. with two inbuilt tweeters and crossover network. 3 or 15 ohms 4 gns. P. & P. 5in. 2/-, 6½ & 8in. 2/6, 10 & 12in. 3/6 per speaker.
BRAND NEW. 12in. 15w. H/D Speakers, 3 or 15 ohms. Current production by well-known British maker. Now with Hiflux ceramic ferrobar magnet assembly £5.10.0. P. & P. 5/-. Guitar models: 25w. £6.0.0 35w. £8.0.0.
E.M.I. 3½in. HEAVY DUTY TWEETERS. Powerful ceramic magnet. Available in 3 or 8 ohms 15/- each; 15 ohms 18/6 each. P. & P. 2/6.
12in. "RA" TWIN CONE LOUDSPEAKER. 10 watts peak handling. 3 or 15 ohm, 35/-. P. & P. 3/6.
35 OHM SPEAKERS
3½in. 12/6; 7 × 4in. 21/-. P. & P. 2/- per speaker.

TYNAIR AND REXINE SPEAKERS AND CABINET FABRICS app. 54in. wide. Usually 35/- yd., our price 13/6 yd. length. P. & P. 2/6 (min. 1 yd.). S.A.E. for samples.

LATEST COLLARO MAGNAVOX 363 STEREO TAPE DECK. Three speeds 4 track, takes up to 7in. spools. £16.10.0. Carr. 10/-.
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. OUR PRICE 21/-. P. & P. 1/6.

NEW S.T.C. TYPE 25 MINIATURE RELAYS—12 volt. 4 s/p, c/o contacts. 1 amp rating. Coil resistance 185 ohms. Size approx. ⅞ × 1⅛ × 1¼in. high. 10/- each. P. & P. 1/6.
Also some similar to above but coil resistance 5,800 ohms 48 volt operation. 8/- each. P. & P. 1/6.

SPECIAL OFFER! PLESSEY TYPE 29 TWIN TUNING GANG. 400pF + 146pF. Fitted with trimmers and 6:1 integral slow motion. Suitable for nominal 470 kc/s I.F. Size approx. 2 × 1 × 1¼in. Only 8/6. P. & P. 2/6.

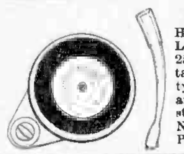
TRANSFORMER BARGAINS

MAINS TRANSFORMER. Primary 200–240V two separate ½ wave secondaries giving approx. 16V at 1 amp and 20V at 1·2 amp; secs. can be connected in series for 36V at 1·5 amp. Ideal for transistor power supplies. Drop through mounting. Stack size 2¾ × 3¼ × ¾in. 15/-. P. & P. 6/-.
MAINS TRANSFORMER. For transistor power supplies. Pri. 200/240v. Sec. 9–0–9 at 500 mA. 11/-. P. & P. 2/6. Pri. 200/240v. Sec. 12–0–12 at 1 amp. 14/6. P. & P. 2/6. Pri. 200/240v. Sec. 10–0–10 at 2 amp. 27/6. P. & P. 3/6.
MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS. Stack size 1½ × 1½ × ¾in. Output trans. tapped for 3 ohm and 15 ohm output. 10/- pair plus 2/-. P. & P.
7-10 watt OUTPUT TRANSFORMERS to match pair of ECL86's in push-pull to 3 ohm output. ONLY 11/-. P. & P. 2/6.
BRAND NEW MAINS TRANSFORMERS for Bridge Rectifier. Pri. 240v. AC. Sec. 240v. at 50mA and 6·3v. at 1·5 amp. Stack size 2¾ × ¾ × 2¼in. 10/6. P. & P 3/6. (Special quotations for quantities).

HIGH GRADE COPPER LAMINATE BOARDS
8 × 6 × $^1/_{16}$in. FIVE for 10/- P. & P. 2/-.

TRANSISTOR STEREO 8 + 8 MK II

Now using Silicon Transistors in first five stages on each channel resulting in even lower noise level with improved sensitivity. 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 25V at ·6 amp.
PRICES: AMPLIFIER KIT £10.10.0; POWER PACK KIT £3.0.0; CABINET £3.0.0. All Post Free.
Circuit diagram, construction details and parts list (free with kit) 1/6. (S.A.E.).



SPECIAL PURCHASE!
E.M.I. 4-SPEED PLAYER
Heavy 8½in. metal turntable. Low flutter performance 200/250 v. shaded motor (90 v. tap). Complete with latest type lightweight pick-up arm and mono cartridge with t/o stylii for LP/78. LIMITED NUMBER ONLY 63/-. P. & P. 6/6.

4-SPEED RECORD PLAYER BARGAINS
Mains models. All brand new in maker's packing.

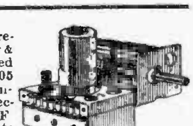
E.M.I. MODEL 999 Single Player with unit mounted pick-up arm and mono cartridge	£5.5.0
B.S.R. UA25 with latest mono compatible cart...	£6.19.6

All plus Carriage and Packing 6/6.
LATEST GARRARD MODELS. All types available 1000 SP25, 3000, AT60 etc. Send S.A.E. for latest Bargain Prices!
PLINTH UNITS cut out for Garrard Models 1000, 1025, 2000, 3000, AT60, SP25. With rigid perspex cover. OUR PRICE 5 gns. complete. P. & P. 8/6.

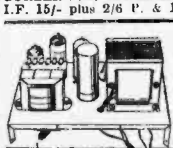
LATEST RONETTE T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. Only 32/6. P. & P. 2/-.
LATEST RONETTE T/O MONO COMPATIBLE CARTRIDGE for playing EP/LP/78 mono or stereo records on mono equipment. Only 30/-. P. & P. 2/-.
SONOTONE 9TAHC compatible Stereo Cartridge with diamond stylus 50/- P. & P. 2/-.
FEW ONLY! ACOS GP69/1. For EP and LP 10/-. P. & P. 2/-.

QUALITY RECORD PLAYER AMPLIFIER MKII
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 7" w. × 3" d. × 6" h. Ready built and tested. PRICE 75/-. P. & P. 6/-.
ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE 97/6. P. & P. 7/6.
DELUXE QUALITY PORTABLE R/P CABINET MKII
Uncut motor board size 14½ × 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 × 15 × 8in. PRICE 79/6 P. & P. 9/6.

FM/AM TUNER HEAD



Beautifully designed and precision engineered by Dormer & 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 circuit diagram of tuner head. Another special bulk purchase enables us to offer these at 27/6 each. P. & P. 3/-.
GORLER F.M. TUNER HEAD. 88–100 Mc/s. 10·7 Mc/s. I.F. 15/- plus 2/6 P. & P. (ECC85 valves, 8/6 extra)



3-VALVE AUDIO AMPLIFIER MODEL HA34
Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½" w. × 4" d. × 4¾" h. Incorporates ECC83, EL84, 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. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. 79/6. P. & P. 6/-.
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, AC128D, matched pair AC128 25/-; Mullard LFH3 Audio Transistor Pack AC128D and matched pair AC128 12/6; ORP12 Cadmium Sulphide Cells 10/6. All post free.

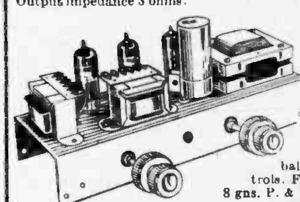
SPECIAL OFFER!

A great opportunity to purchase a first class GENERAL PURPOSE, HIGH GAIN, HIGH SENSITIVITY, PORTABLE AMPLIFIER. Completely self contained and can be used for a variety of purposes, i.e. Intercom. Baby Alarm, Booster unit for transistor radios etc., also ideal for classroom unit etc. Works perfectly with our special offer ACOS Stick Microphone (21/-). Output 1000mW. Uses standard 9 volt battery. Smart two tone carrying case size 12 × 4 × 9in. fitted standard input jack socket. volume controls, 7 × 4in. speaker. Completely built and tested, brand new with full maker's guarantee.

Only 79/6 Post free

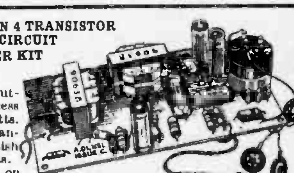
STEREO AMPLIFIER

Incorporating 2 ECL86s and 1 EZ80, heavy duty, double wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete. Output impedance 3 ohms.



ONLY **£5.9.6** P. & P. 8/-.
Super Deluxe version with ECL86 valves, sep. bass, treble and balance controls. Full feedback. 8 gns. P. & P. 8/-.

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 × 3in.
- Generous size Driver and Output Transformers.
- Output transformer tapped for 3 ohm and 15 ohm speakers.
- Transistors (GET114 or 81 Mullard AC128D and matched pair of AC128 o/p).
- 9 volt operation.
- Everything supplied, wire, battery clips, solder, etc.
- Comprehensive easy to follow instructions and circuit diagram 2/6 (Free with Kit). All parts sold separately.

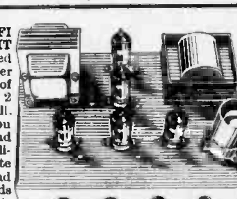
SPECIAL PRICE 45/-. P. & P. 3/-. Also ready built and tested, 52/6. P. & P. 3/-.

HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound mains transformer, EZ80 rectifier and ECL82 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3·5 watts. Volume and tone controls. Chassis size only 7" wide × 3" deep × 6" high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with valves and good quality output transformer. LIMITED NUMBER ONLY.

OUR ROCK BOTTOM BARGAIN PRICE **49/6** P. & P. 6/-

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 3–15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 2/6 (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.

Open all day Saturday
Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station

HARVERSON SURPLUS CO. LTD.
170 HIGH ST., MERTON, S.W.19 Tel.: 01-540 3985
SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

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

BI-PAK SEMICONDUCTORS
500 CHESHAM HOUSE,
150 REGENT ST., LONDON, W.1.

BI-PAK "KING SIZE" SALE

20% OFF THESE KING SIZE TESTED PAKS. NORMAL PRICE 10/-, SALE PRICE 8/-

PAK No.		Price
A14	4 npn germ switching trans marked asst	8/-
A15	20 red spot AF trans pnp factory tested	8/-
A16	16 whitespot RF trans pnp factory tested	8/-
A17	4 OC77 type trans = ACY24, OC309, 2N24A	8/-
A18	4 high current germ switching trans eqvt OC42, CV7042	8/-
A20	3 200mc/s sil planar trans npn BSY27	8/-
A22	5 2G417 trans eqvt AF117 = AF137, NKT677	8/-
A23	3 npn germ trans NKT773 = AC130, AC131, AC153, AC127, 2G339A	8/-
A25	2 drift trans 2N1225, germ pnp 100mc/s RCA = AF118	8/-
A26	6 AF/RF trans OC44/45/81/81D plus 1 diode	8/-
A37	4 OC75 trans type = NKT213, AC125, OC304, 2SB32	8/-
A39	2 OC139 npn germ switching trans = 2N1090, 2SC90, ASY73	8/-
A40	2 Low noise trans sil npn 2N929 = BC107	8/-
A42	5 CT41/45 germ trans pnp = OC71, AC151, AC125, AC122, 2N280	8/-
A43	3 GT31 LF low noise germ trans pnp = AC125, NKT215	8/-
A48	3 Mullard OC76 trans = NKT212, AC151, AC128, OC307	8/-
A52	4 OC72 type trans = NKT212, AC128, OC308	8/-
A56	2 2N708 sil trans 300Mc/s npn = BSY63 = BSY19	8/-
A66	4 AC128 trans pnp high gain = OC82, AC153, AC124, NKT222	8/-
A67	4 AC126 germ trans pnp = AC163, NKT229	8/-
A68	2 OC73 Mullard trans = NKT214, AC126	8/-
A69	7 OC81 type trans British made	8/-
A79	7 OC71 type trans British made	8/-
A81	6 TK220 germ switching tran eqvt OC45	8/-
A82	3 2N1307 pnp switching trans = ASY27	8/-
A83	3 OC170 HF trans type = NKT612, AF124, AF136	8/-
A84	3 AF116 type trans = AF126, AF127, AF113, NKT676	8/-
A88	3 AF117 trans type = NKT677, AF127, AF137, AF113	8/-
A89	3 OC171 HF trans type = AF124, AF134, AF131, NKT613	8/-
A90	3 AC107 germ trans TO-1 case low noise	8/-
A94	5 2N2926 silicon epoxy trans npn mixed gains	8/-
A95	2 GET880 low noise germ trans	8/-
A97	1 AF139 pnp high freq trans ft 700Mc/s	8/-
A98	3 npn trans 1 ST141 & 2 ST140	8/-
A99	4 MADT's 2 MAT100 & 2 MAT120 pnp	8/-
A100	3 MADT's 2 MAT101 & 1 MAT121 pnp	8/-
A101	4 OC44 germ trans AF	8/-
A102	3 AC127 npn germ trans	8/-
A104	5 sil alloy trans like OC200, 2S302, TO-5 pnp	8/-
A106	3 OC84, Mullard trans 1 amp pnp	8/-
B14	4 silicon rectifiers 400 PIV 500mA BY101 = BY114	8/-
B18	4 Top hat silicon rectifiers 100 PIV 750mA	8/-
B44	4 3-amp silicon recs 100-400 PIV unmarked	8/-
B46	2 10-amp silicon rects 100 PIV	8/-
C3	10 ass gold bonded diodes all marked or colour code	8/-
C4	20 gen purpose germ diodes unmarked	8/-
C6	7 CG628 germ diodes = OA91	8/-
C10	3 OA10 diodes Mullard 30 PIV 1-amp	8/-
C14	6 1N914 silicon diodes 75 PIV 75mA	8/-
C15	8 OA95 germ diodes sub-min = 1N69, OA85	8/-
C16	10 OA202 sil diodes sub-min = OA200, OA127, 1N215, 1N463	8/-
C17	8 OA81 diodes = AA117, SD54	8/-
C18	5 OA47 gold bonded diodes = OA180, AAY13, AAY27, FD3	8/-
C19	4 OA5 gold bonded diodes = 1N270, 1N276	8/-
C21	12 OA200 sil diodes sub-min	8/-
C22	3 1S113 sil rect 400 PIV 400mA sub min	8/-
C23	20 1S130 sil diodes 50 PIV sub-min	8/-
C24	4 BY126 sil rect plastic	8/-
C25	3 BY127 sil rects plastic	8/-
C40	4 OA182 gold bonded diodes 100 PIV 550mA	8/-
C45	12 asstd germ diodes all marked	8/-
DO2	3 12V zeners 400mW 5% tol	8/-
DO4	4 zener diodes 250mW 3/12V mixed 5% tol	8/-

"IMPORTANT NOTICE"

Please use Pak No's when ordering, plus description to avoid mistakes. Please send all orders direct to our Warehouse & Despatch Dept. P.O. Box 6, Ware, Herts. Please add 1/- towards post and packing. Overseas add extra for airmail.

BARGAINS GALORE

250 DIODES Sub-Min Glass **10/-**
SIL. GERM and ZENERS IDENTIFICATION CHART FREE
PAK No. XB200

150 TRANS. Mixed AF/RF PAK No. XA100 **10/-**

100 SIL. DIODES **10/-**
DO-7 SIM OA200–OA202 PAK No. XB100
The above devices are untested

BULK TRANSISTOR BUYS

New BI-PAK untested—uncoded

PAK No.		
X1	50 AF TO-5 ACY17-20 Series	10/-
X2	50 AF TO-1 NKT281-AC128 Type	10/-
X3	30 VHF TO-1 AF117-NKT667 Type	10/-
X4	35 AF SO-2 2G371-OC71-75 Type	10/-
X5	50 RF TO-5 NKT126, OC45 Type	10/-
X6	40 AF/RF STC ACY27-30 Etc.	10/-
X7	40 RF TO-1 NKT141/2-OC44/45	10/-
X8	30 VHF TO-5 2G401 Texas AF116	10/-
X9	30 NPN TO-1 AC127 NKT773 Type	10/-
X10	40 Sil. TO-5 PNP OC200, 2S302 Type	10/-
X11	30 RF NPN 2G339, 2N1302	10/-
X12	50 NPN Sil. Planar mixed 2N706 Type	10/-

DEDUCT 10% OFF THESE PRICES

NEW SILICON RECTIFIERS TESTED

PIV	400mA	750mA	1·5A	3A	10A	30A
50	10d	1/-	1/6	2/0	4/8	9/6
100	1/-	1/3	2/6	2/3	4/6	15/-
200	1/3	1/9	2/6	4/-	4/9	20/-
300	—	2/3	3/9	4/6	6/6	22/-
400	2/-	2/6	4/-	5/6	7/6	25/-
500	—	3/-	—	6/-	8/6	30/-
600	2/9	3/3	4/3	6/9	9/-	37/-
800	—	3/6	4/9	7/6	11/-	40/-
1,000	—	5/-	6/-	9/3	12/6	50/-
1,200	—	6/6	7/6	11/8	15/-	—

SCR's
LOWEST PRICE
LARGEST RANGE

PIV	1A	7A	16A	30A
25	—	7/6	—	30/-
50	7/6	8/6	10/6	35/-
100	8/6	10/-	15/-	45/-
200	12/6	15/-	20/-	55/-
300	15/-	20/-	25/-	—
400	17/6	23/-	35/-	80/-
500	30/-	40/-	45/-	95/-
600	—	40/-	50/-	—

10% = 2/- in £, 1/- in 10/-, 6d. in 5/- etc.

BRAND NEW TEXAS GERM. TRANSISTORS
Coded and Guaranteed

PAK No.				
T1	8 2G371A	EQVT.	OC71	10/-
T2	8 2G374	,,	OC75	10/-
T3	8 2G3744A	,,	OC81D	10/-
T4	8 2G381A	,,	OC81	10/-
T5	8 2G382T	,,	OC82	10/-
T6	8 2G344A	,,	OC44	10/-
T7	8 2G345A	,,	OC45	10/-
T8	8 2G378	,,	OC78	10/-
T9	8 2G399A	,,	2N1302	10/-
T10	8 2G417	,,	AF117	10/-

20 AMP (RMS) **SCR's** FLYING LEADS TO-48 Stud
100 PIV 10/– 400 PIV 25/–
200 PIV 15/– 600 PIV 35/–
FULLY TESTED

1½ AMP SCR's TO-5 FULLY TESTED
100 PIV 5/– 400 PIV 8/6
200 PIV 7/– 600 PIV 12/6

25 GERM. TRANS 20/-
ALL KNOWN TYPES
EQVT. LIST INCLUDED
PAK No. T12

20 SIL. ALLOY TRANS
EQVT. OC200-205
TO-5 2S301-304 **20/-**
PNP PAK No. T13

20 SIL. PLANAR TRANS
BC108, 2N706,
2N697 **20/-**
NPN PAK No. T14

30 GERM. DIODES CG62 Eqvt. OA70-79-81 **10/-**
PAK No. T15

20 Germ. Gold Bonded Eqvt. OA47 **10/-**
PAK No. T17

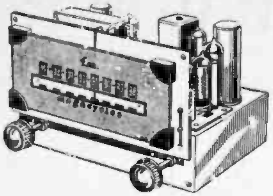
10 OA182 Gold Bonded Diodes. Eqvt. OA5 **10/-**
PAK No. T16

PLASTIC UNIJUNCTION TRANS
Eqvt. 2N2646, UT46, TIS43.
2 for 10/-.
PAK No. T18

EX-COMPUTER BOARDS
Packed with semiconductors and components min. 150.
25 Board **20/-**, add 2/- postage with this **PAK No. EX1.**

ALL PRICES SLASHED
GENUINE REDUCTIONS

BI-PAK GUARANTEE SATISFACTION OR MONEY BACK



VHF/FM TUNER
88–102MHz. Self-powered. Valves ECC85. EF89. 6BW7. ECC82, two diodes and metal rect. 8 x 6 x 5½in. high. Full instruction book, circuit diagrams, etc. **2/6**; free with chassis.
FULLY BUILT **£7.10.0** or as kit **£5**.

FULLY BUILT STEREO AMPLIFIER. 2 × 3 watts, mains trans., metal rect., 2 × UCL82, 2 o.p. trans. for 3 ohm, vol/on-off, tone, balance, chassis type with 3 controls on front. 11 × 3¼ × 4in. high. **£6** (8/- p. & p.).

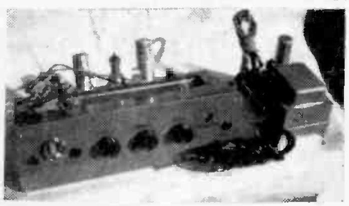
DULCI SOLID STATE TRANSISTOR AMPLIFIER. 2 × 7 watts, radio, tape and gram. inputs. For outputs of 4 to 15 ohms. **£19.19.0** or with input for magnetic cartridges **£23**. S.A.E. for colour leaflet.

Full range of Garrard auto and single record decks usually in stock.

TRANSISTORISED F.M. TUNER A1005. Size 6 × 4 × 2¼in. 3 I.F. stages, double tuned discriminator, cap. tuned, **£6.17.6** post paid, corresponding stereo decoder A1005M **£5** post paid or **£11** the two items if purchased together. 88-108 mc/s.

BUILT PRINTED CIRCUIT BOARD. 8½ × 3in. with osc., 3 i.f. stages, driver trans. ready for output transistors (can be provided at 6/6 extra the 3). Includes OC44, two OC45. A bargain at 30/- post paid.

TAPE AMPLIFIER FOR MAGNAVOX TAPE DECKS — 2 or 4 TRACK



Chassis 12¼ x 5¼ x 4½in. high. Front panel alum and black—12¼ x 4½in. 200–250 A.C. Mains Trans. Off/On-Tone; Vol./Mic; Vol./Gram.; Mic. Input; Gram. Input; Monitor: Valves 6BR7. ECC83, EM84, EL84 and Rect. 2 Track **£10.10.0**; 4 Track **£12** (12/6 p. & p.). Ready for bolting direct to Magnavox deck. 3 speed Magnavox 4 Track tape deck, Type 363. **£16.10.0** carr. paid. 2 × 2 Stereo deck **£20**.

"SUPER SIX" L.W. and M.W. TRANSISTOR RADIO KIT, Mark 2. Complete set parts **£4.2.6** (5/- post). PP6 batt. 2/9 extra. Instructions and list 2/- (free with kit). Superhet; ferrite rod; wooden cab. 9½ x 7½ x 3in. Celestion **4½in. speaker, 6 transistors**, diode, etc.

The "IMMEDIATE" bulk tape eraser and recording head demagnetiser, only **34/-** post paid.

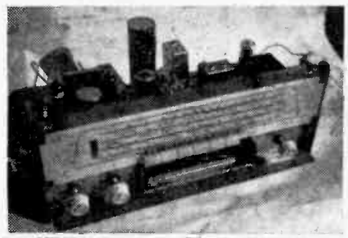
SPEAKERS IN CABINETS. 20 x 15 x 6¼in. Finished Vynair and Rexine, various colours. With E.M.I. 13 x 8in. 3 or 15 ohm speaker **90/-**; with 12in. Elac 15-ohm 15W speaker. **£8.10.0** (post 10/- on either). **Top quality speakers 6 x 4in.** (3 or 15 ohm), **14/6**; 5in. (3-ohm), **12/6**; 4½in. (3 or 10 ohm), **12/6d.**; 7 x 3¾in. (3 ohm), **16/6**; 13 x 8in. (3 or 15 ohm) **42/6** (post 3/6) all others post 1/6 each. 12in. heavy duty Elac Loudspeaker 15 ohm, 20 watt, **£6.6.0** (10/- post).

8 W. PEAK PUSH-PULL OUTPUT AMPLIFIER. 200-250 Volts A.C. EZ80, ECC83, 2—EL84, Bass, treble, vol/on-off, **£7.17.6** (post paid). Size 12 x 3½ x 5in. high. For Record Player, Radio Tuner, etc.
MAINS TRANS. o.p. trans. for 3 ohm.

RADIOGRAM CHASSIS. New production. Size 13¾ x 5½ x 7in. Dial 13 x 4in. gold and brown. Controls beneath dial, Tone. Volume/on/off, MW/LW/Gram. Tuning. Ferrite rod aerial. Valves UY85 rect., UCL82, UBF89, UCH81. Limited quantity. **£9.9.0.** carr. paid.

1½W MAINS GRAMOPHONE AMPLIFIERS. EZ80, ECL82, O.P. Transformer (3 ohm). Vol./On-off and Tone Control. Double wound mains transformer. 2⅝ x 2½ x 2¼in. separate but wired to chassis, 4 x 2½ x 4¾in. over valves **65/-** including 6½in. Speaker (**52/6** less speaker.) (Post 4/6 on either).

6 PUSH-BUTTON STEREOGRAM CHASSIS



M.W.; S.W.1; S.W.2; V.H.F.; Gram; Stereo Gram; Vol; Tone; Mains Trans; 200-250 Volts; 2 o.p. for 3 ohm. Also operates with two speakers on Radio. Chassis size: 15 x 7 x 6¼in. high. Dial silver and black 15 x 3in. 190-550M; 18–51M; 60–187M; VHF 86–100 Mc/s. Valves: ECC85, ECH81, EF89, 2x ECL86, EM84 and Rect. Price **£19.19.0**, carr. paid. With Stereo Decoder fitted **£7.10.0** extra.

GLADSTONE RADIO

66 ELMS ROAD, ALDERSHOT, Hants.

(2 mins. from Station and Buses). FULL GUARANTEE. Aldershot 22240
CLOSED TUESDAY AND WEDNESDAY.

TRANSISTORISED R.F. SIGNAL GENERATOR

STANDARD MODEL 29-S	£20.0.0
XTAL CHECK MODEL 29-X	£27.10.0

SPIN WHEEL TUNING
(ADD SUFFIX -/SPIN) EXTRA **£1.0.0**

U.K. Post and Packing 7/6d.

To: **NOMBREX LTD. - EXMOUTH - DEVON**
Please send leaflets of **MODEL 29** and other **NOMBREX** instruments to:
NAME ....
ADDRESS ....
....
PLEASE ENCLOSE STAMPS 6d. *P.369*

A NEW NOMBREX INSTRUMENT

TO THE SPECIFICATION YOU REQUIRE AT A PRICE YOU CAN AFFORD

STANDARD MODEL 29-S

- 150 KHz to 220 MHz—all on fundamentals.
- Eight clear bandspread scales. Total length 40in.
- Smooth vernier tuning control—ratio $7\frac{1}{2}:1$.
- Magnifier cursor for clarity and accuracy.
- Scale accuracy and discrimination $\pm 1{\cdot}5\%$ or better.
- Unique electronic scale calibration control.
- Rapid spin wheel tuning as optional extra.
- Modulation—variable depth and frequency.
- Variable A.F. signal available externally.
- Provision for external A.F. modulation.
- Stabilized supply for long-term accuracy.

XTAL CHECK MODEL 29-X

Includes all the versatile advanced features of the Standard Model 29-S

AND

Integral Crystal Oscillator providing calibration check points throughout all ranges, for adjustment of scale accuracy to $\pm 0{\cdot}02\%$. The crystal marker signal is available at R.F. socket for use externally.

PRODUCTION RELEASE — FEBRUARY 1969

WE ARE NOW BOOKING SAMPLE AND QUANTITY ORDERS: DELIVERY IN STRICT ROTATION.

TRADE AND EXPORT ENQUIRIES INVITED

OUR CURRENT MODEL 31 WILL CONTINUE TO BE AVAILABLE

There's Something for Everyone in the HEATHKIT Electronic Range . . .

STEREO TAPE RECORDER, STR-1

A complete stereo system including speakers in one compact Transportable. Versatile recording facilities. Powerful output, 4 watts rms per channel.
Kit K/STR-1 £58.0.0 P.P. 10/6

HIGH PERFORMANCE CAR RADIO CR-1

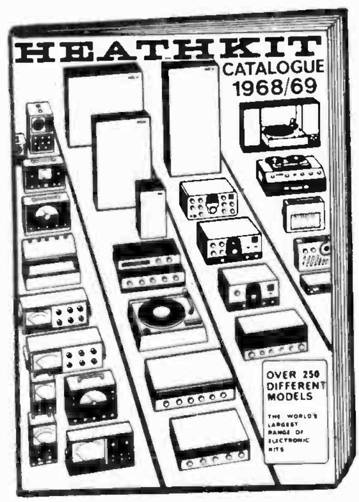
Latest transistor circuit gives powerful output, 4 watts. For 12v pos or 12v neg earth systems.
Kit K/CR-1 (incl. speaker)
£14.12.0 P.P. 4/6

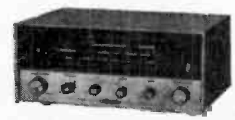
STEREO RECORD PLAYER, SRP-1

A complete stereo system including speakers in one compact portable. Plays mono or stereo records. Cool, crisp, bold sound.
Kit K/SRP-1 £28.6.0 P.P. 10/6

STEREO AMPLIFIER, TSA-12

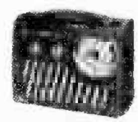
Fully transistorised. Fantastic performance at lowest cost. Many exceptional features.
Kit K/TSA-12 £32.16.0 P.P. 10/6
Cabinet £3.16.0 extra





4 BAND RECEIVER, GR-64

Offers you the exciting world of shortwave at low-cost. Modern styling.
Kit K/GR-64 £22.8.0 P.P. 9/-



UXR-1

UXR-2

TRANSISTOR PORTABLES

UXR-1. The popular choice. Many de-luxe features.
Kit K/UXR-1 leather **£13.8.0** P.P. 4/6
Kit K/UXR-1 colour case **£12.8.0** P.P. 4/6

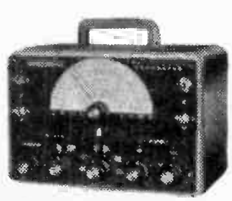
UXR-2. For clean, bold sound. Rugged leather case in black or brown.
Kit K/UXR-2 £15.10.0 P.P. 6/-

PORTABLE VOM, IM-17

The latest solid-state circuit, plus rugged polypropylene case. For homeowners, hobbyists, service.
Kit K/IM-17 £13.12.0 P.P. 6/–

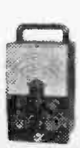
Send for the FREE Catalogue and see for yourself, Today!

This catalogue describes these and many more kits and ready-to-use models for Stereo/Hi-Fi, Domestic Radio, Record Players, Amateur Radio, Short Wave, Test Instruments, Educational, Home Workshop, all at significant savings.



RF SIGNAL GENERATOR, RF-1U

100kHz to 200MHz in six bands. The specification is outstanding for price. A dependable service instrument.
Kit K/RF-1U £13.18.0 P.P. 6/–



VALVE VOLTMETER, V-7A

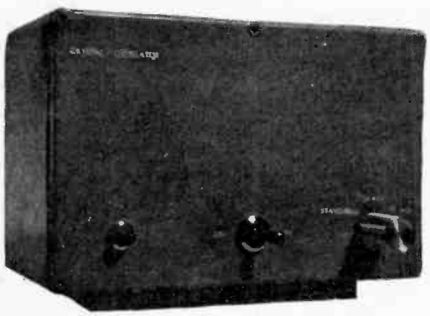
Popular size, 7 AC, DC, ohms range. Popular price.
Kit K/V-7A
£14.16.0 P.P. 4/6

HEATHKIT

To
DAYSTROM LTD., Dept. PW-4, GLOUCESTER, GL2-6EE.
Please send me FREE CATALOGUE ☐
NAME..
ADDRESS..
....
Prices and specifications subject to change without notice

Open the pages of The RADIO CONSTRUCTOR this month for - - -

100/10 Kc/s FREQUENCY SUB-STANDARD UNIT



This unit provides frequency marker points at every 100Kc/s up to 32Mc/s.

Additional features are a switchable 10Kc/s multivibrator and a stabilised h.t. power supply.

The whole unit is attractively housed in an Eddystone diecast aluminium alloy box.

★ ★ ★

Also in this issue

CAR OIL CHANGE INDICATOR
LIGHT SENSITIVE OSCILLATOR
HIGH VALUE OHMMETER

★ ★ ★

Plus detachable

SOUND FREQUENCY/WAVELENGTH TABLE

MARCH ISSUE

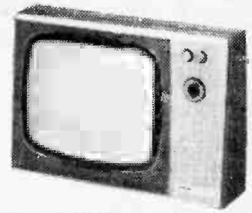
RADIO CONSTRUCTOR

ON SALE NOW 3/-

17in.—£11.10.0
19in. SLIMLINE SOBELL—24 Gns.

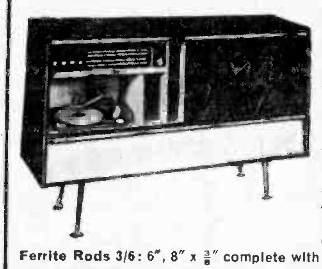
TWO-YEAR GUARANTEE EX-RENTAL TELEVISIONS

FREE ILLUSTRATED LIST OF TELEVISIONS
17″—19″—21″—23″
WIDE RANGE OF MODELS SIZES AND PRICES
DEMONSTRATIONS DAILY



TWO-YEAR GUARANTEED TUBES 100% REGUNNED
14in.—69/6 17in.—89/6
21in. and ALL SLIMLINE TUBES 99/6
EXCHANGE BOWLS. Carr. 10/6
Ex MAINTENANCE TESTED TUBES
17in.—35/-. Carr. 5/- (not slimline)

COCKTAIL/STEREOGRAM CABINET £25



Polished walnut veneer with elegant glass fronted cocktail compartment, padded. Position for two 10in. elliptical speakers. Record storage space. Height 35½in., width 52¾in., depth 14½in. Legs 1 gn. extra.

Speakers 6/6: 2″—75Ω. 2½″—35Ω. P. & P. 2/6. **Acos Mics. 35/- Standard:** Stick Mic. 2 gns. P. & P. 3/6. **Asstd. Condensers:** 10/- for 50. P. & P. 7/6. **Asstd. Resistors:** 10/- for 50. P. & P. 4/6. **Asstd. Controls:** 10/- for 25. P. & P. 7/6. **Transistors:** Mullard matched output kit 9/- OC81D—2 OC81's. P. & P. FREE.

Ferrite Rods 3/6: 6″, 8″ x ⅜″ complete with LW/MW Coils. P. & P. FREE.

TRANSISTOR CASES 19/6. Cloth covered, many colours. Size 9½″x6½″x3½″ P. & P. 4/6. Similar cases in plastic 7/6.

TRANSISTOR RECORD PLAYER CABINETS 19/6. Dim. 11″ x 14½″ x 5¼″. P. & P. 7/6.

SINGLE PLAYER CABINETS 19/6. P. & P. 7/6.

STRIP LIGHT TUBES 3/9 each. 11″ (284 mm.) 230/240 volts, 30 watts. Ideal for cocktail cabinets, illuminating pictures, diffused lighting etc. 6 for £1. P. & P. free.

DUKE & CO. (LONDON) LTD.
621/3 Romford Road, London, E12 Tel. 01-478 6001/2/3

VALVES

SAME DAY SERVICE
NEW! TESTED! GUARANTEED!

SETS 1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94. Set of 4 for 17/6. DAF96, DF96, DK96, DL96, 4 for 26/-.

OZ4	4/6	19BG6G	17/6	DL92	5/9	EL90	5/-	PENA4	12/6	UCC84	7/9
1A7GT	7/6	20F2	13/6	DL94	5/9	EL95	5/-	PEN36C	15/-	UCC85	6/6
1H5GT	7/3	20P3	11/9	DL96	7/-	EM80	5/9	PFL200	12/-	UCF80	8/3
1N5GT	7/9	20P4	18/6	DY86	5/9	EM81	6/9	PL36	9/6	UCH42	9/9
1R5	5/6	25U4GT	11/6	DY87	5/9	EM84	6/3	PL81	7/3	UCH81	6/6
1S5	4/3	30C1	6/9	EABC80	6/6	EM87	7/6	PL82	6/6	UCL82	7/-
1T4	2/9	30C15	13/-	EAF42	8/9	EY51	7/-	PL83	6/6	UCL83	11/6
3S4	5/9	30C18	9/-	EB91	2/3	EY86	6/3	PL84	6/3	UF41	9/9
3V4	5/9	30F5	13/6	EBC33	7/6	EZ40	7/6	PL500	12/-	UF80	7/-
5U4G	4/6	30FL1	12/6	EBC41	8/3	EZ41	7/6	PL504	12/6	UF85	6/9
5Y3GT	5/9	30FL12	14/6	EBF80	6/-	EZ80	4/6	PL508	15/-	UF89	6/3
5Z4G	7/6	30FL14	10/6	EBF89	6/3	EZ81	4/9	PL802	14/6	UL41	9/6
6/30L2	12/6	30L1	6/-	ECC81	3/9	GZ32	8/9	PM84	7/9	UL44	20/-
6AL5	2/3	30L15	14/-	ECC82	4/9	KT32	5/-	PX25	10/6	UL84	6/6
6AM6	3/6	30L17	13/-	ECC83	7/-	KT61	8/9	PY31	5/6	UM84	7/6
6AQ5	4/9	30P4	12/-	ECC84	5/6	KT66	16/-	PY32	10/-	UY41	7/-
6AT6	4/-	30P12	11/9	ECC85	5/-	ME1400	15/-	PY33	10/-	UY85	5/9
6AU6	4/9	30P19	12/-	ECC804	12/6	N78	14/9	PY81	5/3	VP4B	10/6
6BA6	4/6	30PL1	12/6	ECF80	7/-	PABC80	7/-	PY82	5/-	VP1321	21/-
6BE6	4/3	30PL13	14/6	ECF82	6/9	PC86	9/6	PY83	5/9	Z77	3/6
6BJ6	7/-	30PL14	15/-	ECH35	6/-	PC88	9/6	PY88	6/3	Transistors	
6BW6	13/-	35L6GT	8/-	ECH42	10/6	PC96	8/6	PY800	6/9	AC107	3/6
6F13	3/6	35W4	4/6	ECH81	5/9	PC97	8/6	PY801	6/9	AC127	2/-
6F14	9/-	35Z4GT	5/-	ECH84	6/9	PC900	8/3	R19	6/6	AD140	7/6
6F23	13/6	6063	12/6	ECL80	6/9	PCC84	6/-	R20	12/6	AF102	18/-
6K7G	2/6	AZ31	9/-	ECL82	6/9	PCC85	6/6	TH21C	9/9	AF115	3/-
6K8G	4/3	B729	12/6	ECL83	9/-	PCC88	9/9	U25	13/-	AF116	3/-
6L18	6/-	CCH35	10/-	ECL86	8/3	PCC89	10/6	U26	12/-	AF117	3/3
6V6G	5/-	CL33	18/6	EF39	3/9	PCC189	9/9	U47	13/6	AF124	7/6
6V6GT	6/6	CY31	6/9	EF41	9/6	PCF80	6/9	U49	13/6	AF125	3/6
6X4	3/6	DAC32	7/3	EF80	4/9	PCF82	6/-	U52	4/6	AF126	7/-
6X5GT	5/9	DAF91	4/3	EF85	5/6	PCF86	9/3	U78	3/6	AF127	3/6
7B6	10/9	DAF96	6/-	EF86	6/3	PCF800	13/6	U191	12/6	OC26	5/9
7B7	7/-	DF33	7/9	EF89	5/3	PCF801	7/-	U301	13/6	OC44	2/3
7C6	6/9	DF91	2/9	EF91	3/6	PCF802	9/6	U801	18/-	OC45	2/3
7Y4	6/6	DF96	6/-	EF94	4/9	PCF805	9/-	UABC80	6/3	OC71	2/6
10F1	15/-	DH77	4/-	EF183	6/-	PCF806	11/6	UAF42	9/6	OC72	2/6
10P13	15/6	DH81	10/9	EF184	5/9	PCF808	10/6	UB41	6/6	OC75	2/6
12AT7	3/9	DK32	7/6	EH90	6/6	PCL82	7/-	UBC41	7/9	OC81	2/3
12AU6	4/9	DK91	5/6	EL33	8/9	PCL83	9/-	UBC81	7/-	OC81D	2/3
12AU7	4/9	DK92	9/3	EL34	9/6	PCL84	7/6	UBF80	6/-	OC82	2/3
12AX7	4/9	DK96	7/-	EL41	9/6	PCL85	8/3	UBF89	6/9	OC82D	2/6
12K8GT	7/-	DL35	5/-	EL84	4/9	PCL86	8/6	UC92	5/-	OC170	2/6

READERS RADIO
85 TORQUAY GARDENS, REDBRIDGE, ILFORD, ESSEX. Tel. 01-550 7441

Postage on 1 valve 9d. extra. On 2 valves or more, postage 6d. per valve extra. Any Parcel Insured against Damage in Transit 6d. extra.

SEW PANEL METERS

Send S.A.E. for full lists. Other ranges available. Please include postage. Special quotations for quantities.

CLEAR PLASTIC METERS

Type MR.38P. 1 21/32in. square fronts.

50µA	37/-	750mA	25/-
50-0-50µA	35/-	1 amp	25/-
100µA	35/-	2 amp	25/-
100-0-100µA	32/6	5 amp	25/-
200µA	32/6	3V. D.C.	25/-
500µA	37/6	10V. D.C.	25/-
500-0-500µA	25/-	20V. D.C.	25/-
1mA	25/-	50V. D.C.	25/-
1-0-1mA	25/-	100V. D.C.	25/-
2mA	25/-	150V. D.C.	25/-
5mA	25/-	300V. D.C.	25/-
10mA	25/-	500V. D.C.	25/-
20mA	25/-	750V. D.C.	25/-
50mA	25/-	15V. A.C.	25/-
100mA	25/-	50V. A.C.	25/-
150mA	25/-	150V. A.C.	25/-
200mA	25/-	300V. A.C.	25/-
		500V. A.C.	25/-
300mA	25/-	8 meter 1mA.	29/6
500mA	25/-	VU meter	39/6

5mA	37/6	300V. D.C.	37/6
10mA	37/6	15V. A.C.	37/6
50mA	37/6	300V. A.C.	37/6
100mA	37/6	8 meter 1mA.	39/6
500mA	37/6	VU meter	59/6
1 amp	37/6	1 amp A.C.*	37/6
5 amp	37/6	5 amp A.C.*	37/6
10V. D.C.	37/6	10 amp A.C.*	37/6
20V. D.C.	37/6	20 amp A.C.*	37/6
50V. D.C.	37/6	30 amp A.C.*	37/6

Type MR.45P. 2in. square fronts.

50µA	42/6	10V. D.C.	27/6
50-0-50µA	39/6	20V. D.C.	27/6
100µA	39/6	50V. D.C.	27/6
100-0-100µA	35/-	300V. D.C.	27/6
500µA	29/6	15V. A.C.	27/6
1mA	27/6	300V. A.C.	27/6
5mA	27/6	8 meter 1mA.	35/-
10mA	27/6	VU meter	42/6
50mA	27/6	1 amp A.C.*	27/6
100mA	27/6	5 amp A.C.*	27/6
500mA	27/6	10 amp A.C.*	27/6
1 amp	27/6	20 amp A.C.*	27/6
5 amp	27/6	30 amp A.C.*	27/6

Type MR.52P. 2½in. square fronts.

50µA	59/6	100-0-100µA	45/-
50-0-50µA	49/6	500µA	42/6
100µA	49/6	1mA	37/6

Type MR.85P. 4¼in. × 4¼in. fronts.

50µA	69/6	15 amp	49/6
50-0-50µA	59/6	30 amp	49/6
100µA	59/6	20V. D.C.	59/6
100-0-100µA	59/6	50V. D.C.	49/6
200µA	55/-	150V. D.C.	49/6
500µA	52/6	300V. D.C.	49/6
500-0-500µA	49/6	15V. A.C.	49/6
1mA	49/6	300V. A.C.	49/6
1-0-1mA	49/6	8 meter 1mA.	55/-
5mA	49/6	VU meter	69/6
10mA	49/6	1 amp A.C.*	49/6
50mA	49/6	5 amp A.C.*	49/6
100mA	49/6	10 amp A.C.*	49/6
500mA	49/6	20 amp A.C.*	49/6
1 amp	49/6	30 amp A.C.*	49/6
5 amp	49/6		

Type MR.65P. 3½in. × 3¼in. fronts.

50µA	65/-	50V. D.C.	39/6
50-0-50µA	52/6	150V. D.C.	39/6
100µA	52/6	300V. D.C.	39/6
100-0-100µA	49/6	15V. A.C.	39/6
500µA	45/-	50V. A.C.	39/6
1mA	39/6	150V. A.C.	39/6
5mA	39/6	300V. A.C.	39/6
10mA	39/6	500V. A.C.	39/6
50mA	39/6	8 meter 1mA.	45/-
100mA	39/6	VU meter	65/-
500mA	39/6	50mA A.C.*	39/6
1 amp	39/6	100mA A.C.*	39/6
5 amp	39/6	200mA A.C.*	39/6
10 amp	39/6	500mA A.C.*	39/6
15 amp	39/6	1 amp A.C.*	39/9
20 amp	39/6	5 amp A.C.*	39/6
30 amp	39/6	10 amp. A.C.*	39/6
50 amp	39/6	20 amp A.C.*	39/6
10V. D.C.	39/6	30 amp A.C.*	39/6
20V. D.C.	39/6		

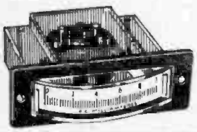
BAKELITE PANEL METERS

Type MR.65. 3½in. square fronts.

25µA	67/6	500mA	32/6	30V. A.C.*	32/6
50µA	45/-	1 amp	32/6	50V. A.C.*	32/6
50-0-50µA	42/6	5 amp	32/6	150V. A.C.*	32/6
100µA	42/6	15 amp	32/6	300V. A.C.	32/6
100-0-100µA	42/6	30 amp	32/6	1 amp A.C.*	32/6
500µA	39/6	50 amp	32/6	5 amp A.C.*	32/6
1mA	32/6	5V. D.C.	32/6	10 amp A.C.*	32/6
1-0-1mA	32/6	10V. D.C.	32/6	20 amp A.C.*	32/6
5mA	32/6	20V. D.C.	32/6	30 amp A.C.*	32/6
10mA	32/6	50V. D.C.	32/6	50 amp A.C.*	32/6
50mA	32/6	150V. D.C.	32/6		
100mA	32/6	300V. D.C.	32/6	VU meter	59/6

*Moving iron, all other moving coil.

"SEW" EDGEWISE METERS



MODEL PE 70. Dimensions 3 17/32 × 1 11/32 × 2⅞in. deep overall. Available as follows:

50 microamp	57/6	500 microamp	49/6
50-0-50 microamp	55/-	1 milliamp	45/-
100 microamp	55/-	300 volt A.C.	45/-
100-0-100 microamp	52/6	VU meter	62/6
200 microamp	52/6	Post extra.	

ECHO HS-606 STEREO HEADPHONES

Wonderfully comfortable. Lightweight adjustable vinyl headband. 6ft. cable and stereo jack plug. 25-17,000 cps. 8 ohm imp. 67/6 P. & P. 2/6.

TRANSISTORISED TWO-WAY TELEPHONE INTERCOM

Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. £6.19.6. P. & P. 3/6.

INTERCOM/BABY SITTER

Transistorised Intercoms, ideal for home/office/workshop etc. 2-way buzzer call system. For desk or wall mounting. Supplied complete with connecting wire, batteries, instructions, 2 station 59/6, P. & P. 2/6. 4 station £6.12.6, P. & P. 5/-.

SINCLAIR EQUIPMENT

Z12 12 watt amplifier, 89/6
PZ4 Power Supply Unit 89/6
Stereo 25 Preamp. £9.19.6
Q14 Speakers £7.19.6
Micromatic Radio Kit, 49/6. Built 59/6.

ALL POST PAID

SPECIAL OFFER

Two Z12 Amps., PZ4 Power Supply, Stereo 25 Preamplifier, £22, or with two Q14 speakers. £37.

NEW SINCLAIR 2000 SYSTEM

35 watt Integrated Amplifier, £29, Carr. 5/-. Self-powered FM Tuner, £25. Carr. 5/-.

GARRARD TAPE MOTORS

Brand new stock as used by famous manufacturer. 200/250V. A.C. Capstan motor 15/-. Fast Forward 10/6. Fast rewind 10/6. P. & P. 3/-. Set of three motors 32/6. P. & P. 5/-.

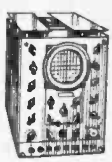
FIELD TELEPHONES TYPE L

Generator ringing, metal cases. Operates from two 1·5V batteries (not supplied). Excellent condition. £4.10.0 per pair. Carr. 10/-.

AVO CT.38 ELECTRONIC MULTIMETERS

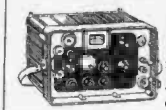
High quality 97 range instrument which measures A.C. and D.C. Voltage. Current. Resistance and Power Output Ranges D.C. volts 250mV–10,000V. (10 megΩ–110 megΩ input). D.C. current 10µA–25 amps. Ohms: 0–1,000 megΩ. A.C. volt 100mV–250V (with R.F. measuring head up to 250 Mc/s) A.C. current 10µA–25 amps. Power output 50 micro-watts–5 watts. Operation 0/110/200/250V. A.C. Supplied in perfect condition complete with circuit lead and R.F. probe. £25. Carr. 15/-.

TYPE 13A DOUBLE BEAM OSCILLOSCOPES



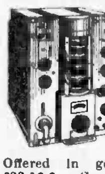
An excellent general purpose D/B oscilloscope. T.B. 2cps–750 Kc/s. Bandwidth 5·5 Mc/s. Sensitivity 33mV/CM. Operating voltage 0/110/200/250V. A.C. Supplied in excellent working condition. £22.10.0. Or complete with all accessories, probe, leads, lid, etc. £25. Carriage 30/-.

AM/FM SIGNAL GENERATORS



Oscillator Test No. 2. A high quality precision instrument made for the ministry by Airmec. Frequency coverage 20–80 Mc/s. AM CW/FM. Incorporates precision dial, level meter, precision attenuator 1µV–100mV. Operation from 12 volt D.C. or 0/110/200/250 volt A.C. Size 12 × 8½ × 9in. Supplied in brand new condition complete with all connectors fully tested. £45. Carr. 20/-.

ADMIRALTY B.40 RECEIVERS

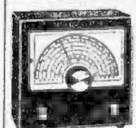


Just released by the Ministry. High quality 10 valve receiver manufactured by Murphy. Coverage in 5 bands 650 Kc/s–30 Mc/s. I.F. 500 Kc/s. Incorporates 2 R.F. and 3 I.F. stages, band-pass filter, noise limiter, crystal controlled B.F.O., calibrator. O/P output, etc. Built-in speaker, output for phones. Operation 150/230 volt A.C. Size 19¼ × 13¼ × 16in. Weight 114 lbs. Offered in good working condition. £22.10.0. Carr. 30/-. With circuit diagrams. A few Brand New £35. Carr. 30/-. Also available B.41 L.F. version of above. 15 Kc/s–700 Kc/s. £17.10.0. Carr. 30/-.

AVOMETERS

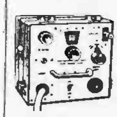
Supplied in excellent condition, fully tested and checked. Complete with prods, leads and instructions.

Model 7 £13.10.0. P. and P. 7/6.



TE-16A Transistorised Signal Generator. 5 ranges 400kHz–30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5¼ × 5¼ × 3½in. Complete with instructions and leads. £7.19.6. P. & P. 4/-.

CLASS D WAVEMETERS



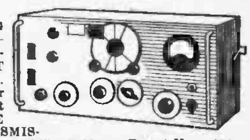
A crystal controlled heterodyne frequency meter covering 1·7–8 Mc/s. Operation on 6 volts D.C. Ideal for amateur use. Available in good used condition. £5.19.6. Carr. 7/6. Or brand new with accessories. £7.19.6. Carr. 7/6.

AUTO TRANSFORMERS

0/115/230v. Step up or step down. Fully shrouded.

150 W.	£1.12.6.	P. & P. 3/6.
300 W.	£2. 7.6.	P. & P. 3/6.
500 W.	£3.10.0.	P. & P. 6/6.
1,000 W.	£5.10.0.	P. & P. 7/6.
1,500 W.	£6.10.0.	P. & P. 8/6.
3,000 W.	£7.10.0	P. & P. 12/6.
7,500 W.	£15 10.0.	P. & P. 20/-.

MARCONI TEST EQUIPMENT



EX-MILITARY RECONDITIONED. TF.144G STANDARD SIGNAL GENERATORS, 85 Kc/s–25 Mc/s, £25 Carr. 30/-. T.F.885 VIDEO OSCILLATOR 0–5 Mc/s, £45 Carr. 30/-. T.F.195M BEAT FREQUENCY OSCILLATOR 0–40 Kc/s. 200/250V. A.C., £20 Carr. 30/-. T.F.142E Distortion Factor Meter, £20 Carr. 20/-. All above offered in excellent condition, fully tested and checked. T.F.1100 VALVE VOLTMETER, Brand New, £50 T.F.1267 TRANSMISSION TEST SET, Brand New, £75 T.F.1371 Wide Band Millivolt Meter. Brand New, £50.

Variable Voltage TRANSFORMERS

Brand new, guaranteed and carriage paid.
High quality construction. Input 230V. 50–60 cycles.
Output full variable from 0·260 volts. Bulk quantities available.
1 amp.—£5.10.0; 2·5 amp.—£6.15.0; 5 amp.—£9.15.0;
8 amp.—£14.10.0; 10 amp.—£18.10.0; 12 amp.—£21.0.0;
20 amp.—£37.0.0.

ADVANCE TEST EQUIPMENT

Brand new and boxed in original sealed cartons.

VM.76 VALVE VOLTMETER
R.F. measurements in excess of 100 Mc/s and D.C. measurements up to 100V. with accuracy of ±2% D.C. range 300 MV to 1 KV. A.C. range 300 MV to 300 V RMS. Resistance ·02–500MΩ. Price £72.

VM.78 A.C. MILLIVOLT METER
Transistorised 1 MV–300V. Frequency 1 c/s to 1 Mc/s. Price £55.

VM.79 UHF MILLIVOLT METER
Transistorised. A.C. range 10 MV–3V. D.C. current range ·01µA–3MA. Resistance 1 ohm–10 megohms. Price £125.

H1B AUDIO SIGNAL GENERATOR
15 c/s–50 Kc/s, sine or square wave. Price £30.

J1B AUDIO SIGNAL GENERATOR
15 c/s–50 Kc/s. Price £30.

J2B AUDIO SIGNAL GENERATOR
As per J1B except fitted with output meter. Price £35.

TT1S TRANSISTOR TESTER
£37.10.0

Carriage 10/- per item.

AMERICAN TAPE

First grade quality American tapes. Brand new. Discount on quantities.

3in. 225ft. L.P. acetate	3/6
3¼in. 600ft. T.P. mylar	10/-
5in. 600ft. std. plastic	8/6
5in. 900ft. L.P. acetate	10/-
5in. 1,200ft. D.P. mylar	15/-
5in. 1,800ft. T.P. mylar	22/6
5¾in. 1,200ft. L.P. acetate	12/6
5¾in. 1,200ft. L.P. mylar	16/-
5¾in. 1,800ft. D.P. mylar	2/6
5¾in. 2,400ft. T.P. mylar	39/6
7in. 1,200ft. std. acetate	12/6
7in. 1,800ft. L.P. acetate	15/-
7in. 1,800ft. L.P. mylar	20/-
7in. 2,400ft. D.P. mylar	25/-
7in. 3,600ft. T.P. mylar	45/-

Postage 2/-. Over £3 post paid.

TAPE CASSETTES

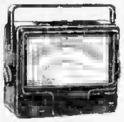
C60–60 minutes	10/3
C90–90 minutes	14/3

Over £2 post paid

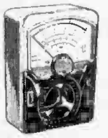
G. W. SMITH
& CO (RADIO) LTD.
3-34 Lisle St., W.C.2
Also see oppos. page

MULTIMETERS for EVERY purpose!

LAFAYETTE DE-LUXE 100KΩ/VOLT "LAB TESTER" Giant 6½in. scale Built-in meter protection 0/·5/2·5/10/50/250/500/1,000V D.C. 0/3/10/50/250/500/1,000V A.C. 0/10/100μA/10/100/500mA/2·5/10A. 0/1K/10K/100K/10M/10MΩ. – 10 to 49·4dB £18.18.0. P. & P. 5/-



LAFAYETTE 57 Range Super 50kΩ/volt Multimeter. D.C. volts 12 mV –1000V. A.C. volts 1·5V –1000V DC current 25μA–10 amp Ohms 0–10megΩ dB –20 to +81 dB. Overload protection. £12.10.0. Carr. 3/6.



NEW MODEL 500 30,000 O.P.V. with overload protection, mirror scale 0/·5/2·5/10/25/100/250/500/1,000v. 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.

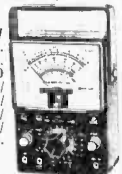
MODEL TE-90 50,000 O.P.V. mirror scale overload protection 0/3/12/60/300/600/1200v. D.C. 0/6/30/120/300/1200v. D.C. ·03/6/60/600mA. D.C. 16K/160K/1·6/16megΩ. –20 to +63dB. £7.10.0. P. & P. 3/-.

MODEL TE-12 20,000 O.P.V. 0/0·6/6/30/120/600/1,200/3,000/6,000v. D.C. 0/6/30/120/600/1,200v. A.C. 0/60μA/6/60/600mA. 0/6K/600K/6Meg./60 Meg.Ω 50pF. 0·2mFd. £5.19.6. P. & P. 3/6.

MODEL TE-10A. 20kΩ/Volt 5/25/50/250/500/2,500v. D.C. 10/50/100/500/1,000 v. A.C. 0/50μA/2·5 mA/250 mA D.C. 0/6K/6 meg. ohm. –20 to +22dB. 10·0, 100mFd. 0·100·0·1mFd. 69/6. P. & P. 2/6.

MODEL PT-34. 1,000 O.P.V. 0/10/50/250/500/1,000v. A.C. and D.C. 0/1/100/500/mA. D.C. 0/100KΩ. **39/6.** P. & P. 1/6.

TE-900 20,000Ω/VOLT GIANT MULTIMETER mirror scale and overload protection. 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. 02K/200K/20 MEG. OHM. £15. P. & P. 5/-.



MODEL AS-100D. 100KΩ/VOLT. 5in. mirror scale. Built-in meter protection. 0/3/12/60/120/300/600/1,200v. D.C. 0/6/30/120/300/600v. A.C. 0/10μA/6/60/300mA/12 amp. 0/2K/200K/2M/200MΩ. –20 to +17dB. £12.10.0. P. & P. 3/6.

PROFESSIONAL 20,000 opv LAB. TYPE Multitester. Automatic overload protection, mirror scale. Ranges: 1/10/50/250/500/1,000 volts. D.C. and A.C. 0–500μA, 10mA, 250mA. Current: 0/20K,200K, 2 megohm, Decibels: –20 to +22dB. £5.19.6. P. & P. 2/6.

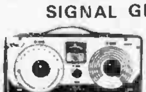
MODEL TE-70. 30,000 O.P.V. 0/3/15/60/300/600/1,200v. D.C. 0/6/30/120/600/1,200v. A.C. 0/30μA/3/30/300mA. 0/16K/160K/1·6M/16 Meg. μ £5.10.0. P. & P. 3/-.

TE-51. NEW 20,000Ω/VOLT MULTIMETER with overload protection and mirror scale. 0/6/60/120/1,200v. A.C. 0/3/30/60/300/600/3,000v. D.C. 0·60μA/12/300mA. D.C. 0/60K/6 meg. ohm. 92/6. P. & P. 2/6.

TE-20D RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s–500 Mc/s on 6 bands. Directly calibrated. Variable R.F. attenuator. audio output. Xtal socket for calibration. 220/240V. A.C. Brand new with instructions. £15. Carr. 7/6. Size 140 × 215 × 170 mm.

ARF-100 COMBINED AF-RF SIGNAL GENERATOR

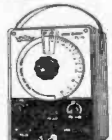


A.F. SINE WAVE 20–200,000 c/s. Square wave 20–30,000 c/s. O/P. HIGH IMP. 21V. P/P600Ω 3·8V. P/P. TF 100 Kc/s–300 Mc/s. Variable R.F. attenuation Int/ext. modulation. Incorporates dual purpose meter to monitor AF output and % mod. on R.F. 220/240V. A.C. £30.0.0. Carr. 7/6.

TE-65 VALVE VOLTMETER

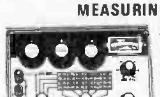
High quality instrument with 28 ranges. D.C. volts 1·5–1,500v. A.C. volts 1·5–1,500v. Resistance up to 1,000 megohms. 220/240v. A.C. operation. Complete with probe and instructions £17.10.0. P. & P. 6/-. Additional probes available: R.F. 35/-. H.V. 42/6.

TY75 AUDIO SIGNAL GENERATOR



Sine Wave 20 CPS–200 Kc/s. Square Wave 20 CPS–30 Kc/s. High and low impedance output. Output variable up to 6 volts. 220/240 volts A.C. Brand new with instructions. £16. Carr. 7/6. Size 210 × 150 × 120 mm.

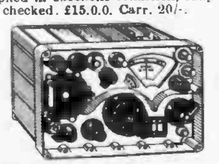
TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE



A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω–11·1 megΩ 6 Ranges ±1%. L. 1μH–111 HENRYS 6 Ranges –2%. C. 10pF ±1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7½ × 5 × 2in. £20. P. & P. 5/-.

R209 MK. II COMMUNICATION RECEIVER

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



NEW CATALOGUE

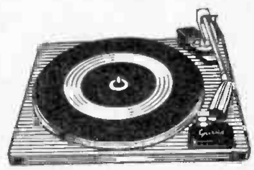
Nearly 200 pages giving full details of a comprehensive range of COMPONENTS, TEST EQUIPMENT, COMMUNICATION EQUIPMENT AND HI-FI EQUIPMENT. Each section greatly enlarged and fully illustrated. Thousands of items many at bargain prices.

Free Discount Coupons Value 10/-

SEND NOW-ONLY 7'6 P&P 1'-

GARRARD

FULL CURRENT RANGE OFFERED BRAND NEW AND GUARANTEED AT FANTASTIC SAVINGS



SRP22 Mono	£6.10.0
SRP22 Stereo	£6.19.6
*1025 Mono	£7.10.0
*1025 Stereo	£7.19.6
*2025 Stereo	£8. 8.0
*2025T/C Mono/Stereo	£8.17.6
*3000 Stereo	£9.19.6
*SP25 MKII	£11.19.6
*SL55	£11.19.6
A70 MK II	£12.10.0
*AT60 MKII	£13.10.0
*SL65	£14.14.0
AP75	£19. 0.0
401	£28. 7.6
SL75	£29. 0.0
SL95	£35. 0.0

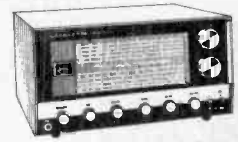
WB4 Bases £3.19.6 Perspex Cover £3.10.0

Carriage/insurance 7/6 extra any model. *Special offer base and cover available for these models at £4.15.0. Carr. 5/-. Full range of Garrard accessories available.

UNR-30 4-BAND COMMUNICATION RECEIVER

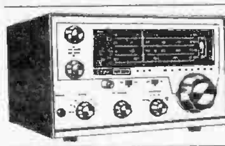
Covering 550 Kc/s–30 Mc/s. Incorporates BFO. Built in speaker and phone jack. Metal cabinet. Operation 220/240V. A.C. Supplied brand new, guaranteed with instructions. Carr. 7/6 **13 gns.**

LAFAYETTE SOLID STATE HA600 RECEIVER

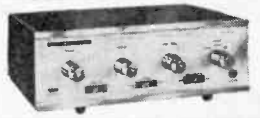


5 BAND AM/CW/SSB AMATEUR AND SHORT WAVE 150 Kc/s 400 Kc/s and 550 Kc/s–30 Mc/s F E T front end ● 2 mechanical filters ● Huge dial ● Product detector ● Crystal calibrator ● Variable BFO ● Noise limiter ● S meter ● 24in. Bandspread ● 230V. A.C./12V. D.C. neg. earth operation ● RF gain control. Size 15in. × 9½in. × 8½in. Weight 18 lbs. EXCEPTIONAL VALUE. £45. Carr. 10/-. S.A.E. for full details.

NEW STAR SR-200 SSB AMATEUR RECEIVER



An exciting new receiver covering 6 amateur bands 160/80/40/20/15/10 metres. Illuminated slide rule dial ● S meter ● Crystal calibrator ● Product detector ● Automatic noise limiter ● RF tuning and gain controls. ● Speaker or phone outputs ● 8 valves, 2 transistors, 2 diodes. 220/240V. A.C. Supplied brand new and guaranteed. £40.0.0. Carr. 10/-.



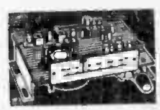
LAFAYETTE LA-224T TRANSISTOR STEREO AMPLIFIER

19 transistors, 8 diodes. IHF music power 30W at 8 ohms. Res. 30–20,000±2dB at 1W. Distortion 1% or less. Inputs: 3 MV and 250 MV. Output: 3–16 ohms. Separate L. and R. volume controls. Treble and bass control. Stereo phone jack. Brushed aluminium, gold-anodised extruded front panel with metal case. 10½ × 3⁵/₁₆ × 7¹³/₁₆in. 115/230v. A.C. £28. Carr. 7/6.

MODEL ZQM TRANSISTOR CHECKER

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 200Ω·1MΩ. Supplied complete with instructions, battery and lead. £5.19.6. P. & P. 2/6.

★ TRANSISTORISED FM TUNER ★



6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6 × 4 × 2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88–108Mc/s. Ready built ready for use. Fantastic value for money. £6.7.6. P. & P. 2/6. Stereo multiplex adaptors 97/6.

TO-3 PORTABLE OSCILLOSCOPE

3in. tube. Y amp. Sensitivity ·1v p-p/CM. Bandwidth 1·5 cps–1·5 MHZ. Input imp. 2 megΩ 25pF. X amp. sensitivity. ·9v p-p/CM. bandwidth 1·5 cps–800 KHZ. Input imp. 2 megΩ 20pF. Time base. 5 ranges 10 cps–300 KHZ. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½lb. 220/240V. A.C. Supplied brand new with handbook. £35.0.0. Carr. 10/-.

G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

OPEN 9 a.m. to 6 p.m. every day Monday to Saturday. Trade supplied.

PRACTICAL WIRELESS

VOL 44 No 12
Issue 746

APRIL 1969

TOPIC OF THE MONTH

Time for review

THE Monopolies Commission has its ever vigilant eye on matters of take-overs and lack of competition, yet it has never looked at radio broadcasting—the attitude seems to be that monopoly by semi-state organisations is no evil.

Before readers draw the conclusion that we are about to change our policy and jump on the bandwagon of the "pirate station lobby" we say straightaway that we will never support anarchy of the airwaves (or anywhere else for that matter). All we are suggesting is that it is time to review the situation on sound broadcasting, to see whether there isn't a good case for the licensing of radio stations independent of the BBC, their revenue obtained by advertising.

We know the arguments against this; that the programme material would descend to the lowest common denominator, that there aren't the available frequencies, that local papers would suffer from the competition for advertisers and that the BBC is doing a grand job anyway. We have said that we are suggesting ideas, not acting as a pressure group, but let us take these arguments one by one, taking the last one first.

There is no need to commit Auntie to euthanasia, she *is* doing a grand job, and independent stations *could* be complementary to the existing four services. There *could* be room for them, on v.h.f., (125 channels are available). Most American cities of any size have at least fifteen f.m. stations, so we could presumably do the same without interference to or from European stations. As for the argument that commercial radio would rob local papers of advertising, this has not been borne out abroad where this has happened, nor were national newspapers hit by the introduction of Independent Television.

We are very lucky in having a body such as the BBC to control our broadcasting services as they stand at the moment, but Auntie can stand competition—she has done it in the past and can do it again. The Conservative Party has pledged to review the situation if they are returned at the next election and the big debate on this subject is likely to grow.

Let's start talking about it now; we welcome readers' comments.

W. N. STEVENS—*Editor*

NEWS AND COMMENT

CONSTRUCTIONAL

OTHER FEATURES

MAY ISSUE WILL BE PUBLISHED ON APRIL 8th

NEWS AND COMMENT...

TRANSISTOR TESTER TT 1

The model TT 1 transistor tester is a portable, battery operated instrument for checking the leakage current and current gain of bi-polar transistors. Its main feature is that current gain may be measured anywhere within the range of 5 microamps to 100 milliamps, ensuring that circuit operating conditions may be reproduced. An expanded scale is provided for indicating leakage current, covering the range 0 to 100 milliamps, mid-scale 100 microamps. All measurements are made with a collector voltage of 9V.

Specification: Measurement facilities—d.c. current gain, Collector-base leakage current, Diode leakage current, Internal battery check. d.c. current gain ranges—10-1000. Collector current ranges—0-100 microamps, 0-1 milliamp, 0-10 milliamps, 0-100 milliamps. Indication—On 3in. moving coil meter and calibrated dial. Polarity—n-p-n and p-n-p. Collector voltage—9V. Power supply—From internal 9V PP7 battery, duration 6 months. Case—Hammer-grey finish with screened front panel, "lay flat" carrying handle and rubber feet. Weight—3 lb. Size—9 x 6 x 3in.

The price is £32. R.M.S. Instruments Limited, 24 Guildford Street, Chertsey, Surrey.

THE RAVENSBROOK STEREO AMPLIFIER

The Ravensbrook is based in many respects on the Ravensbourne design with a nominal output of 10+10 watts.

The whole amplifier is constructed on a single printed circuit board made from high grade fibreglass.

A four-way push-button Input Selector provides selection of disc, tuner and tape inputs. The fourth button provides for mono/stereo operation. In the mono position the left-hand input channel is fed to both speakers. The output from a compatible stereo pickup is connected in parallel for playing mono records.

Total harmonic distortion is less than 0·1% at 10 watts into 15 ohms. 1kHz; and less than 0·25% at 10 watts into 15 ohms. 100Hz-10kHz. Output impedance matching is 8-16Ω.

A low noise pickup input stage using a special low noise p-n-p transistor, in conjunction with a high output second stage, achieves a very wide dynamic range. This avoids distortion on peak recorded passages. Two special quadrifilar wound transformers are used to drive two pairs of high current gain output transistors giving very low distortion. The technique of winding quadrifilar transformers, where all four windings are wound simultaneously, results in maximum coupling and perfectly balanced windings. These transformers are smaller versions of those to be found in the Ravensbourne amplifier. Silicon transistors are used throughout apart from one germanium device which forms part of the regulated power supply.

Recommended UK retail prices: Chassis model £42 10s. Case model £47 10s. Teak case alone £5. Purchase tax 10s. 1d.

Rogers Developments (Electronics) Limited, 4-14 Barmeston Road, Catford, London, S.E.6.

COURSE FOR BEGINNERS AND ADVANCED

Readers might be interested to know that the Leyton Senior Evening Institute, Essex Road, E.10 runs a radio and TV maintenance class on Wednesday and Thursday evenings dealing with the principles and practice of our hobby. This caters for beginners *and* the more advanced.

Enrolment is through the normal evening institute channels, and, although the course started in September, new faces are always welcome.

MOTOROLA DATA BOOK OF ICs

Motorola Semiconductors Limited, York House, Wembley, Middlesex, has announced publication of the first edition of *The Integrated Circuits Data Book.* It contains complete data sheet specifications and other applications and test data for all standard Motorola integrated circuits (both digital and linear) manufactured at the time of publication.

A valuable interchangeability guide to all major manufacturers of digital and linear integrated circuits is included. Manufacturer type numbers are listed in alphanumerical order by product family and cross-referenced to the Motorola direct replacement. A description of the circuit function is also included for each manufacturer's part number.

Other items in the 960-page reference include a digital applications selection guide, arranged by function, for Motorola's eleven logic families, and an alphanumeric index to all Motorola type numbers. Separate sections are devoted to MECL, MHTL, MTTL, MDTL, MRTL, MOS and linear integrated circuit data sheets, plus a 12-gate complex array.

Supplements to *The Integrated Circuits Data Book* will be available, and an updating service subscription coupon printed in each copy gives the subscriber the opportunity of receiving complete data sheet information for all new Motorola IC introductions.

The book can be obtained from The Modern Book Company, 19-21 Praed Street, London, W.2, at a cost of £2 10s. plus 5s. postage and packing.

NEWS AND COMMENT...

WORLD RADIO CLUB AWARD

For nearly 50 years listeners have been reporting to broadcasters on reception of transmissions. In return, the BBC and other broadcasters have sent cards to verify correct reporting, the card issued by BBC External Services being known throughout the world as the "Big Ben" card.

Now, for the first time, the BBC is offering an award to listeners who correctly report on a number of BBC transmissions received from different transmitting sites. The reports will be analysed by BBC engineering staff and the certificates will be issued by the programme, World Radio Club. This award scheme applies to the one frequency schedule period only—2nd March to 3rd May, though there's a possibility that the scheme will be repeated.

To qualify for the award, listeners must give evidence of reception of three BBC transmissions from each of the following: Great Britain and the Atlantic, East Mediterranean and Far Eastern relay stations. These twelve reports (which must be received in one envelope before the end of May) should contain the following information. location, date, time, frequency and a few words about programme content. In return, the award will contain the four verifications required by the serious DXer.

To be eligible for the award, a DXer must be a member of World Radio Club, the programme for DXers and short-wave enthusiasts which is broadcast in BBC World Service on Sundays at 0930 GMT, Thursdays 1245 GMT, Fridays 2345 GMT and on the North American Service on Mondays at 1515 GMT. To become a member you need simply write to World Radio Club, BBC, Bush House, London, W.C.2.

The picture shows Doug. Crawford, the World Radio Club compère.

CONFERENCE DIGITAL SATELLITE COMMUNICATION

A major impact on all aspects of satellite communication over the next five years is expected to result from the introduction of digital techniques, especially pulse code modulation. In recognition of the economic and technical implications of this, Intelsat, the international consortium of over 60 nations is to sponsor a conference entitled "Digital satellite communication". The IEE is to co-sponsor the conference which will be held at Savoy Place, London, W.C.2, from the 25th to 27th November 1969.

The aim of the conference is to provide a forum for the presentation and exchange of information on digital-communication techniques, and the programme will embrace: systems aspects including performance targets and comparisons with analogue systems, coding and modulation, signalling and switching including interface with terrestrial networks, demand assignment and multiple access techniques, error control, interference aspects.

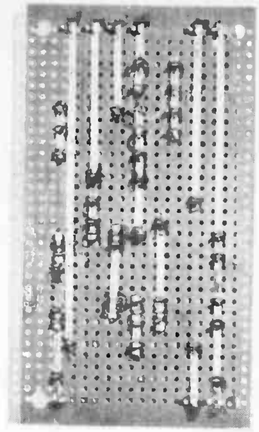
The programme will also include some invited papers from international authorities in this field.

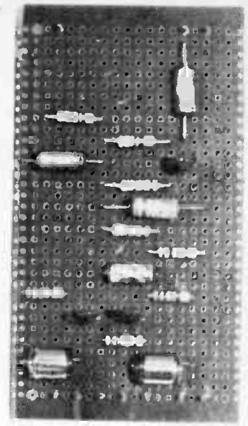
The technical programme committee invite contributions from all nations, and intending authors should submit synopses written in English (preferably) or French of 500 to 1000 words in length by the 1st April 1969.

Further details of the conference and registration forms will be available in due course from the Intelsat-IEE Joint Conference Secretariat, Savoy Place, London, W.C.2, England.

CASSETTES FROM LONDON TO SYDNEY

Fifteen of the cars which completed the London to Sydney Marathon carried the Cassette Car Radio and other Philips car entertaining equipment. They included one of the six official Ford Cortinas, driven by Britain's Roger Clark with Ove Andersson as co-driver, which was all-set to win the marathon before mechanical trouble on the last lap put it into 10th place.





CIR-KIT

HOW TO USE YOUR FREE GIFT TO BEST ADVANTAGE

Like all good inventions, *Cir-Kit* is the kind of product which makes you wonder why it was not invented years ago. It is remarkably simple, cheap and efficient and in this article ways will be described of using your free length of Cir-Kit to its best advantage.

CIR-KIT, which is the invention of Mike Wheals, is produced by his company *"Peak Sound (Harrow) Ltd."*. As you will see from your free sample, it comprises 99·5% pure copper strip one-sixteenth inch wide. This copper strip, which is only two-thousandths of an inch thick, is backed by a layer of special adhesive protected by easily removed silicon release paper. The surface of the copper is covered by a flux assist lacquer making soldering easy.

Being inexpensive and easy to apply, either to plain or matrixed paxolin board, alterations and modifications are quickly carried out.

APPLYING CIR-KIT

If there is not a circuit layout to follow, refer to the theoretical circuit diagram and if necessary decide how you wish the components to be arranged on the board. The overwhelming number of semiconductor circuits are low impedance operated and the layout is therefore relatively unimportant. Normally articles in PRACTICAL WIRELESS give details of whether layout is important and this may be taken as a reliable guide.

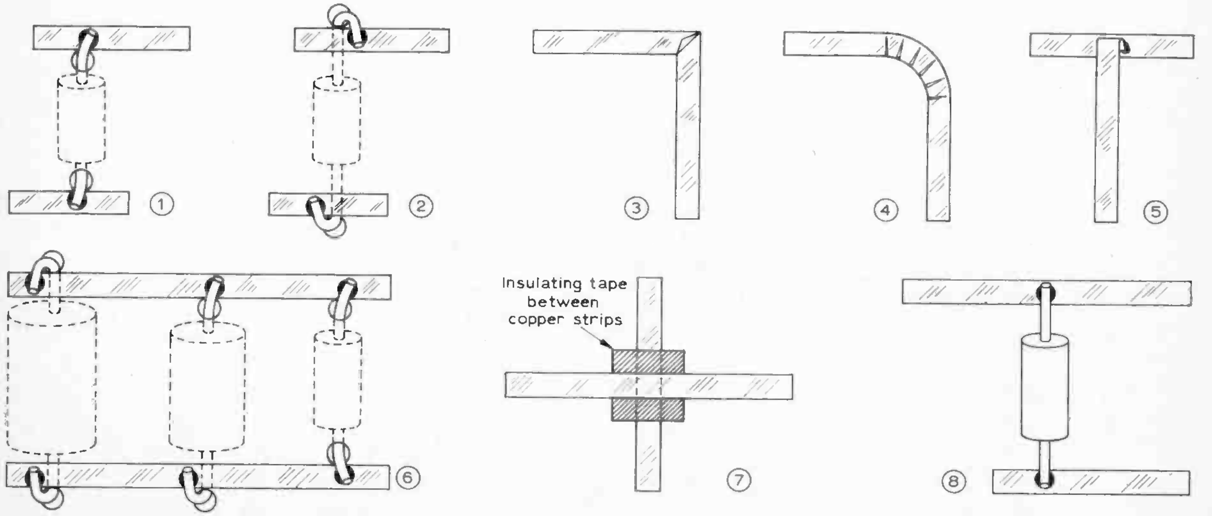
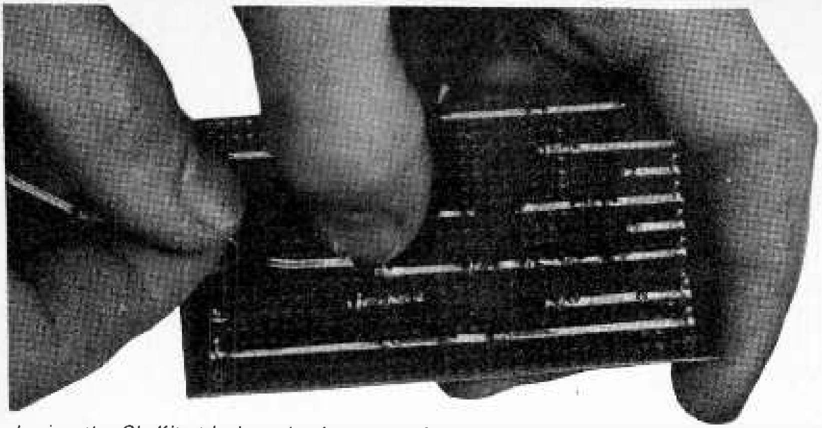


Fig. 1: The component leads should be passed through holes adjacent to the strip; Fig. 2: Leads may be doubled back if convenient; Fig. 3 and 4: Bends or curves are easily incorporated; Fig. 5: T-junctions are made by joining the strips and soldering afterwards; Fig. 6: Components of different sizes may be mounted on two parallel strips by using holes on alternative sides; Fig. 7: Crossovers may be used; Fig. 8: For quick "bread-boarding" components may be mounted on the same side as the copper strips.



Laying the Cir-Kit strip is a simple matter of peeling back the protective backing and pressing it onto the matrix board.

Because of its economical rate of use and its long life the lengths of **Cir-Kit** sold on cards should last the experimenter a considerable time. Another advantage is that the adhesive will be found to strengthen with age making it suitable for both permanent and experimental work.

The length presented is sufficient to enable you to build either the Hi-Fi preamp *or* the tone control for the P.W. Double-12 project described on page 910. ■

A very easy and convenient way to work out the layout is to draw the proposed positions on one-tenth inch graph paper and, using the same pitched matrix board, transfer the final layout to the board. Using one-tenth inch matrix board, the one-sixteenth **Cir-Kit** strip will fit exactly between the holes.

Cir-Kit may of course be used with plain board such as paxolin, but here it will be necessary to drill the required holes with a No. 60 drill, these holes may be either adjacent or through the strip.

ADVANTAGES OF CIR-KIT

One distinct advantage of **Cir-Kit** is that cross-overs can be incorporated in the design; it is only necessary to lay clear adhesive or insulating tape over the strip nearest the board and lay the cross-over strip on top of that. Right-angles and curves are readily made by gently bending the **Cir-Kit** as it is laid.

SOLDERING

Soldering presents no more difficulties than with any other form of wiring. It will however be necessary to bear in mind the rules that apply to good transistor soldering techniques. These are:

1. You should have a hot soldering iron to start with.
2. Low melting point solder should be used.
3. Apply the solder and iron together leaving them there just as long as necessary (one or two seconds is about right as long as the solder has begun to flow).
4. Once the joint has been made ensure that the component is not moved whilst the solder is setting.
5. Too long an application caused by using an iron which is too cool will cause the copper strip to expand and possibly lift off the board.

QUICK BREADBOARDING

When quick experimental circuits are required the **Cir-Kit** strip and the components may be applied to the same side of the board, making alterations and modifications very quick.

POINTS TO REMEMBER

Cir-Kit, exactly as supplied as the free gift, is widely used by industry, research organisations and educational authorities for experimental and development work.

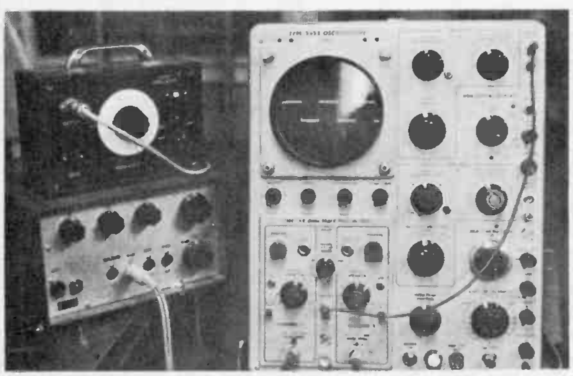
THE P.W. DOUBLE·12 HI-FI AMPLIFIER

HAL MOORSHEAD

PART 1

THE term "High Fidelity" has been grossly misused for a considerable time in some quarters and the amateur constructor may have been very disappointed at some of the results achieved after building amplifiers claiming to fall into this category.

The PRACTICAL WIRELESS "Double-12" was designed as a true hi-fi project, that is its performance had to fall within certain specifications for frequency response, distortion etc. If the electrically measured characteristics are good on an amplifier it follows that the final results when listening to records, tape or f.m. radio will also be good. In addition to being excellent in performance the "Double-12" is easily made from reasonably priced components, all readily available and the associated metalwork and cabinet are as simple as possible, compatible with rigid construction and pleasing appearance.



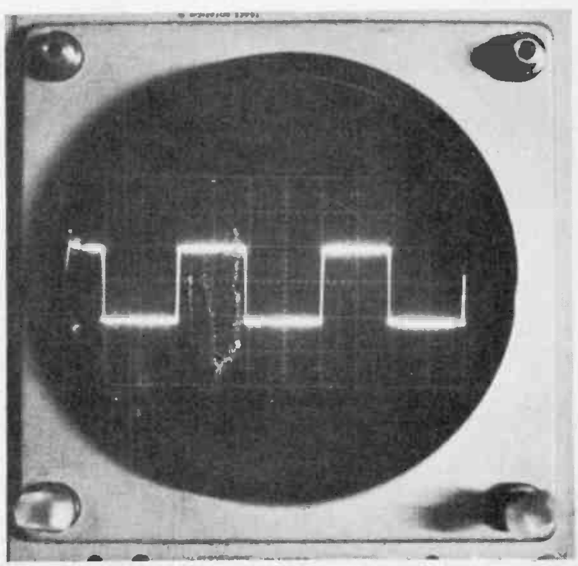
The equipment used for testing the P.W. Double-12.

This month's article deals with the building of the panels for the preamplifier and tone control using the free gift of Cir-Kit presented in this issue. The length supplied is sufficient to build either of these units. Next month we will be describing the connecting of these panels to the controls and the metalwork for the complete preamplifier. The following issue will deal with the main amplifiers and power supply and details of a suggested cabinet.

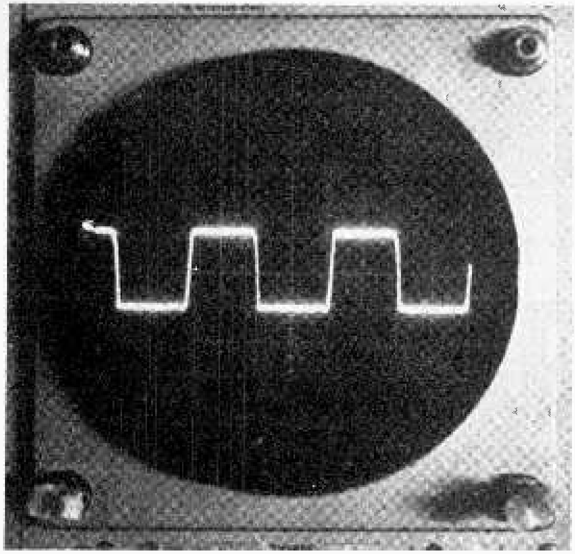
Although this short series will be dealing with a stereo project, there is no reason why it cannot be used for mono and here, of course, only one preamp. and one main amplifier are needed.

Specification

To be considered as hi-fi an amplifier must have sufficient output, and for this reason an output of 12 watts (r.m.s.) was considered necessary. Obviously it is no good having plenty of power if it is distorted and the total distortion at 10 watts is about 0.06% and at 1 watt a tenth of that figure. To provide a wide range of tone control separate bass and treble controls give a 12dB boost or cut at 100c/s and 10kc/s with reference to 1kc/s. With no fre-



A 1kc square wave after having been passed through the entire amplifier.



The very slight slope on the square wave at 10kcs shows that response at this frequency is also very good.

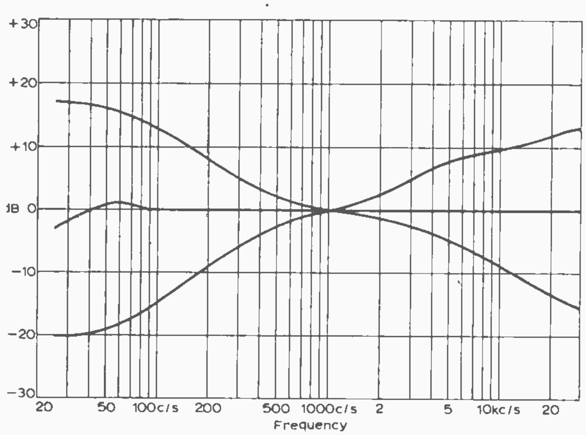


Fig. 1: Graph showing the control of the tone controls. The horizontal line is with both treble and bass controls in the centre position.

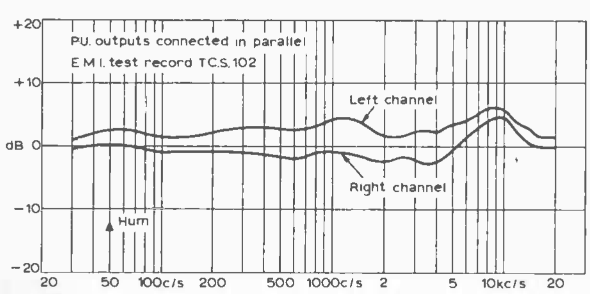
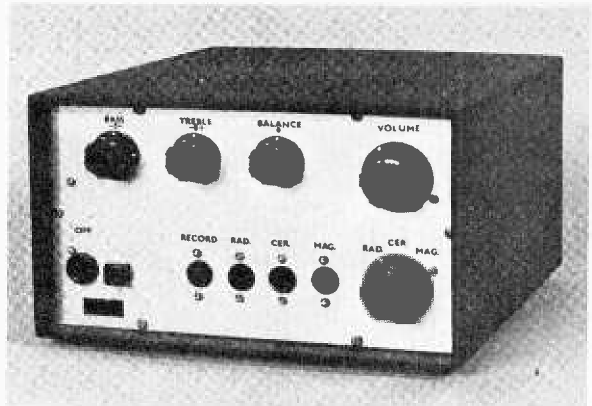


Fig. 2: The equilisation of the unit for a Deram pickup.



The front panel of the completed unit.

quency correction applied the response is within ±3dB between 30c/s and 45kc/s.

An amplifier of this sort needs switched equilisation for magnetic or ceramic cartridges. The output from an f.m. tuner should already be equalised as should the low level output from a tape-recorder and in these cases frequency correction is not needed.

An attractive feature incorporated in the preamplifier is the overload factor, that is the factor by which the input may be overloaded without incurring unacceptable distortion. The following figures give the input sensitivities for full output and the overload figures in parentheses: Magnetic pickup −2·5mV (45mV), Ceramic pickup −25mV (250mV), Radio or auxiliary −60mV (1 volt).

The most severe test that may be applied to an amplifier is to observe on an oscilloscope the reproduction of a square wave. Any deficiencies in the system will show up clearly: photographs of the response at two frequencies show how well the "Double-12" performed.

Preamplifier circuit design

In the preamplifier low-noise silicon transistors were chosen and the plastic encapsulated versions were used, BC169C, these are available for about 2s. 6d. each. The actual types used are not critical and if slightly less gain can be tolerated the following types may be used BC109, BC149, BC172, BC184L, BC151, BC154, 2N930 and 2N3391A. Some of these types are exact equivalents but, as mentioned, others have less gain.

Transistors Tr1 and Tr2 form a directly coupled pair, the base voltage of Tr1 is derived from the emitter of Tr2 through R7, 220kΩ. By using this arrangement a high impedance input can be obtained making matching a simple matter by selecting suitable resistors on the input switch; another advantage of this arrangement is the stabilisation achieved and an improvement in the signal-to-noise ratio.

To obtain the necessary equalisation for the various inputs, negative feedback is taken from the collector of Tr2 through a switched RC network to the emitter of Tr1. In switch position A (magnetic cartridge) the equilisation is within ±1dB over the complete audio range for the RIAA replay curve.

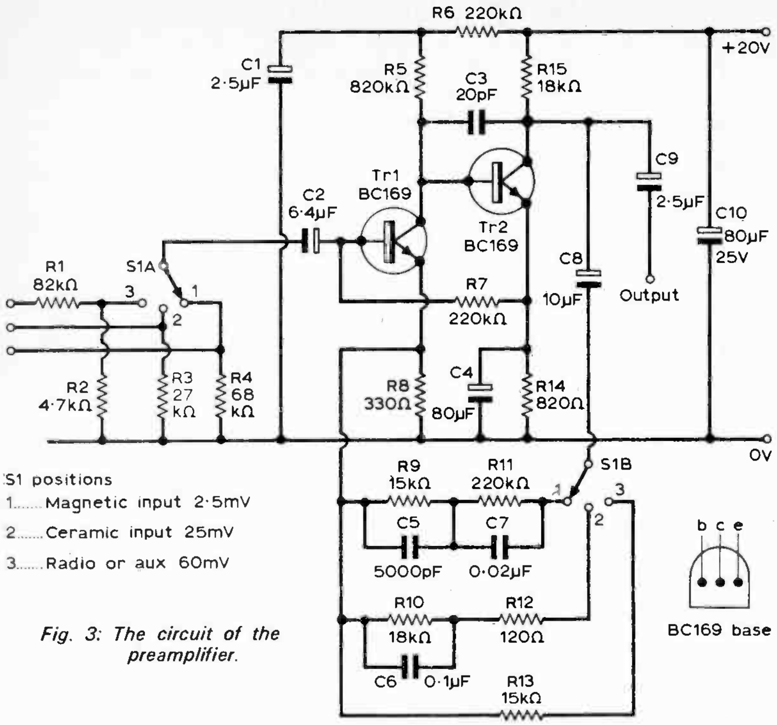


Fig. 3: The circuit of the preamplifier.

For ceramic cartridges the low and high turnover points can be adjusted by altering the input resistor R3. The value shown gives a good response for the Sonotone 9TAHC, while the graph shows the curve for a Deram pickup.

Careful selection of the components in the feedback circuit will give a good signal-to-noise ratio on all inputs (60dB down) and a high overload point (26dB on magnetic pickups).

Tone control circuit design

The tone control is built on a separate board and, in addition to giving wide control over the tone, gives a voltage gain of four times. Linear rather than reverse logarithmic controls are used because of the difficulty of matching such controls. If the tone control is to be used on a monaural system reverse logarithmic controls may of course be used.

The operating point of Tr3 is controlled by R4, R5 and R6, while a.c. feedback is removed by C7. Tone control is achieved by means

★ components list

PRE-AMP

Resistors:

R1	82kΩ	R9	15kΩ
R2	4·7kΩ	R10	18kΩ
R3	27kΩ	R11	220kΩ
R4	82kΩ	R12	120Ω
R5	820kΩ	R13	15kΩ
R6	220kΩ	R14	820Ω
R7	220kΩ	R15	18kΩ
R8	330Ω		
VR1	10kΩlog—Double ganged		

Capacitors:

C1	2·5μF 64V Mullard
C2	6·4μF 25V Mullard
C3	20 or 22pF
C4	80μF 2·5V Mullard
C5	5000pF Mylar film
C6	0·1μF Mylar film
C7	0·02μF Mylar film
C8	10μF 16V Mullard
C9	2·5μF 64V Mullard
C10	80μF 25V Mullard

Transistors:
Two of any of the following silicon types—BC169, BC184, BC149, BC109 in gain groups—high gain are recommended.

Miscellaneous:
Board—0·1in. matrix or plain paxolin 2 x 3¾in. Four-pole Three-way selector switch. Cir-Kit 17in.

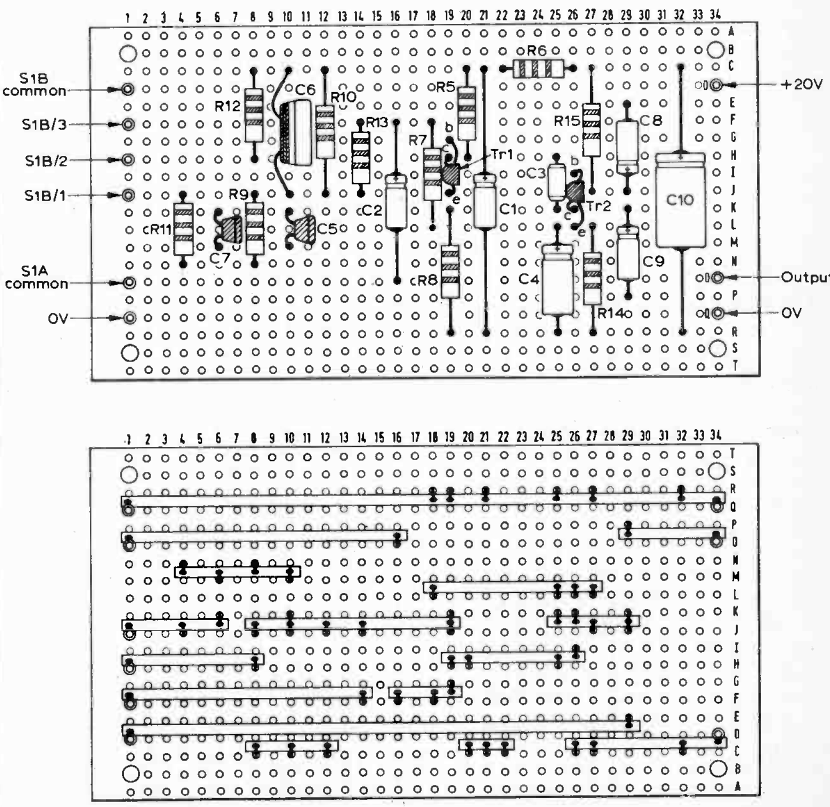


Fig. 4: The component layout of the preamplifier showing the positioning of the Cir-Kit strip.

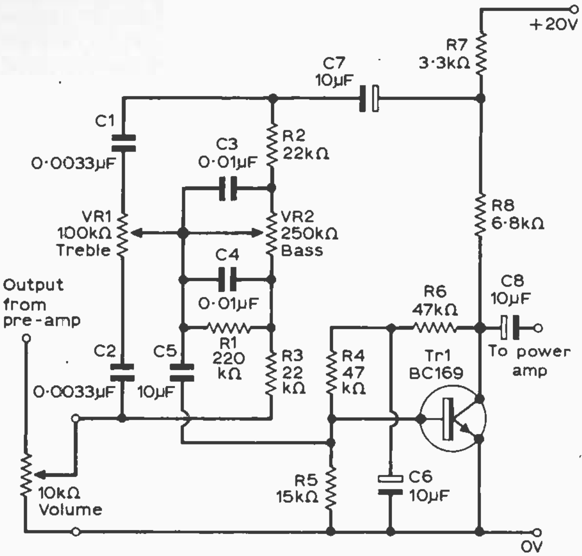


Fig. 5: The circuit of the tone control.

★ components list

TONE CONTROL CIRCUIT

Resistors:

R1	220kΩ	R5	15kΩ
R2	22kΩ	R6	47kΩ
R3	22kΩ	R7	3·3kΩ
R4	47kΩ	R8	6·8kΩ
VR1	Treble 100kΩ linear	VR2	Bass 250kΩ linear

[VR1 and VR2 should be double ganged types for stereo].

Capacitors:

C1	3300pF	C5	10μF 16V
C2	3300pF	C6	10μF 16V
C3	0·01μF	C7	10μF 16V
C4	0·01μF	C8	10μF 16V

Transistor:
BC169C or any of series quoted for preamp.

Miscellaneous:
Baseboard 0·1in. matrix board or plain paxolin 2 x 3¾in. Cir-Kit 17in.

of frequency selective feedback one network giving treble boost and cut, the other providing bass boost and cut. The output from the unit is taken via C8 to the input of the power amplifier, the volume having been controlled at the input to the tone control unit.

Layout considerations

As mentioned in the article dealing with Cir-Kit, layout is uncritical and the one suggested may be altered if desired. No attempt has been made at miniaturisation and the layout roughly follows the circuit diagram. For those wishing to make the units smaller it is perfectly possible to have the preamp and the tone control on one panel for each channel.

The actual assembly of the units should be as described in the introductory article on Cir-Kit, the points made on soldering being observed in construction.

Next month details will be given on the physical layout of the units and the construction of the pre-amplifier as a complete unit.

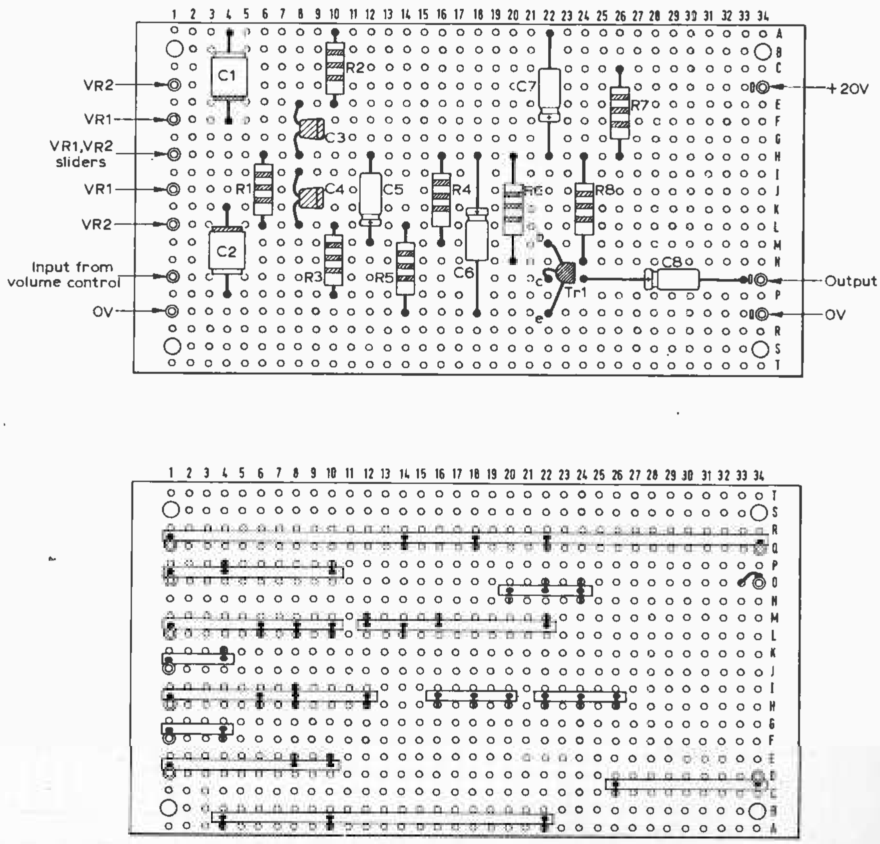


Fig. 6: The arrangement of the components for the tone control panel.

AERIALS

A. J. WHITTAKER

PART 1 — TRANSMITTER AERIALS

THE basic principles of radiation of wireless waves were first investigated by Clerk Maxwell in 1864, and from the general laws of magnetism, he deduced that: "A detachment of electromagnetic energy must occur whenever the current in a circuit changes, i.e., whenever an electron has its velocity altered by the action of an accelerating force."

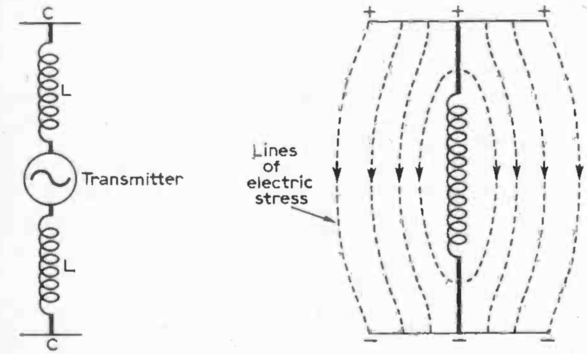


Fig. 1: The electric field with no aerial current.

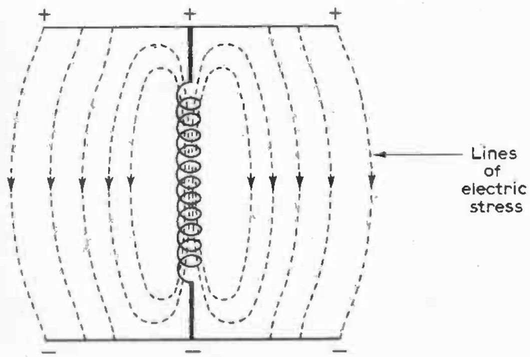


Fig. 2: The start of aerial current coincides with the electrostatic field collapsing.

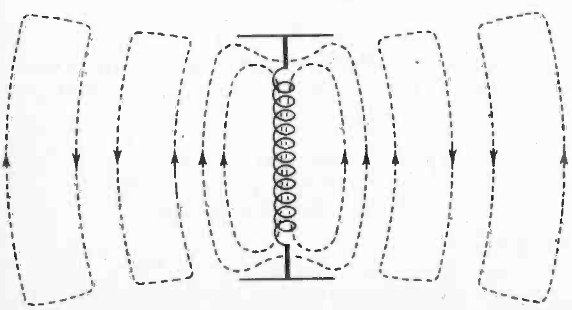


Fig. 3: Energy being radiated from the aerial in cycles. See text for explanation.

This article sets out to give the near-beginner an insight into the design and functioning of aerials, and in particular shows how to juggle the formulae associated with them. Before embarking on the study of theory, however, there are a couple of terms which will crop up frequently that should be explained.

The *polarisation* of the wave is the plane of the electrostatic field of the radio wave which corresponds to the voltage of the wave. Therefore, waves radiated from a vertical aerial have their electrostatic field in a vertical plane, and are said to be vertically polarised. The electromagnetic field, of which the wave is also composed, is at right angles to the electrostatic field, and corresponds to the current of the wave.

Field strength is a measure of intensity and is the voltage developed between the ends of a length of wire, one metre in length, placed with its axis parallel to the axis of polarisation. This voltage is produced partly by the electrostatic field which, in cutting the wire at right angles, induces a voltage in it. As both the electrostatic and electromagnetic fields are in time phase with each other, the induced voltages will add.

Dipole or Hertzian Oscillator

Professor Hertz, in 1880, in a series of classical experiments succeeded in producing waves of the type predicted by Clerk Maxwell. He developed a form of dipole aerial for detecting and radiating electromagnetic oscillations and showed that the waves produced obey the same laws as light waves.

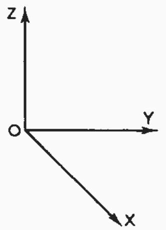
A dipole is a symmetrical aerial, the two ends of which are at opposite potential, with respect to a central earth point. Figure 1 shows the distribution of the electric field when the current in the aerial is zero.

When the moment of maximum potential has passed the electrons will start to flow upwards, constituting an electric current, and giving rise to the electromagnetic field. At this point in time the electrostatic field starts to collapse. Figure 2 illustrates this condition.

Due to the property of electric inertia, summarised by Lenz's and Faraday's Laws "the current in a circuit continues to flow after the potential across the condenser is reduced to zero" and in so doing starts to charge up the capacitor in the opposite direction giving rise to new lines of force in a reverse direction to the previous field. If we regard the collapse of the initial field as lagging a little on the changes in potential which caused it to take place, then it is clear that the new electric field starts to build up before the first one has disappeared. The first disturbance is then forced outwards in the form of closed loops, by the build-up of a new electric field. Figure 3 shows the detachment of radiated energy. The direction of the lines in the inner surface of the first loop, and the outer surface of the second are the same and accordingly mutual repulsion takes place.

In addition to the electric fields, we must regard the circuit as being surrounded by rings of magnetic stress, the intensity of which, at any point, will vary with the current strength and whose direction alternates.

In the immediate neighbourhood of the current carrying wire (aerial) the magnetic lines of force are in the horizontal plane and at right angles in space to the electric flux. This essential space quadrature is maintained in the radiated field. The electric and magnetic inductive fields are in time and space quadrature i.e., 90° out of phase in time and in space at right angles. Figure 4 illustrates.



OZ Oscillating electric field
OX Oscillating magnetic field
OY Direction of propagation at right angles to the wave front

Fig. 4.

When a wave arrives at the surface of another medium and the direction of propagation is perpendicular to the surface, it is then completely reversed and the wave travels back along its original path, but it suffers a 180° phase change. The direction of the magnetic or electric fields will be reversed, but not both. Usually it is the electric field which reverses in direction.

Velocity of Propagation

The amplitude of the electric field "X" measured in electrostatic units is numerically equal to the amplitude of the magnetic field "H" measured in electromagnetic

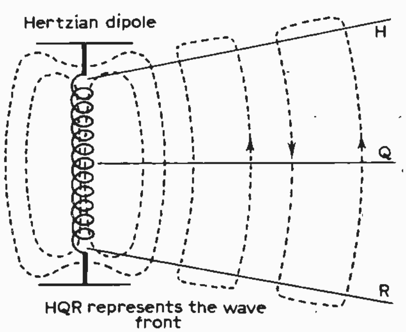


Fig. 5: The wavefront HQR moves out from the source of radiation.

units. When "X" and "H" are expressed in the same fundamental units the relation connecting them is

$$\frac{X}{H}=C \text{ Where "C"}=3.\ 10^{10} \text{ cm/sec}$$

The general formulae in r.m.s. values is "X"=300H.

Polarisation and Wave Front

With reference to Figure 5, all points along the surface, HQR experience the same moving flux at the same time. HQR represents the wave front which is the surface joining together all points that experience the same flux at the same time. The direction of propagation is always at right angles to the wave front. Detached loops move outwards with ever increasing heights, but preserving a constant width.

The frequency with which successive maxima will follow each other is given by,

$$f=c/\lambda$$

or $c=f\lambda$ where λ is the wavelength.

When the electrostatic flux lines are vertical the wave is said to be vertically polarised. This occurs when the transmitting aerial is vertical in space. Conversely when the electric field is horizontal the wave is said to be horizontally polarised. The amplitude of the radiated wave varies inversely as the square of the distance from the transmitter aerial.

Total Power Radiated

Radiation from a dipole may be summed up by assuming it to be placed at the centre of a large sphere, the surface of which will be continually penetrated by outgoing moving fields. The electric and magnetic fields represent a storage of energy evulated from $\frac{1}{2}CV^2$ (energy in capacitive component) and $\frac{1}{2}LI^2$ (energy in inductive component). Both of these may be put in a form more useful and reduced to

$$\text{Energy in electric field}=\frac{KX^2}{8\pi} \text{ per unit volume}$$

$$\text{Energy in magnetic field}=\frac{\mu H}{8\pi} \text{ per unit volume}$$

Since these two energy densities are equal and complementary the total energy density may be written as

$$\frac{KX^2}{8\pi}(I+I) \text{ per unit volume}$$

Having arrived at an expression for "X" at such a distance from the transmitter that the inductive field may be neglected we can add up mathematically the energy flowing through the whole sphere, which gives,

Total power radiated

$$=320\pi\, I^2\, l^2/\lambda^2$$

where l and λ are in the same units and I is in amps.

Radiation Resistance

As the power radiated is proportional to the current squared (I^2) it may be considered that the power is expended in heating a fictitious resistance R such that,

$$I^2R=\frac{I^2(320\pi^2 l^2)}{\lambda^2}$$

$$\text{Whence } R_r=\frac{320\pi^2 l^2}{\lambda^2}$$

This is defined as that fictitious resistance which when multiplied by the square of the aerial current (I^2) measures the power radiated.

Where

R_r . . . Radiation resistance
l . . . half length of dipole
λ . . . wavelength (lambda).

References

Short Wave Radio (Ladner and Stoner)
Admiralty Handbook, Wireless Telegraphy
RSGB Handbook

TO BE CONTINUED

PART 2

LAST MONTH THE BASIC RECEIVER WAS DISCUSSED. THIS MONTH THE ADDITIONAL FEATURES ARE DESCRIBED.

progressive SUPERHET

F. G. RAYER G3OGR

Aligning I.F. Circuits

The i.f. cores will usually need slight adjustment for best results. Each i.f.t. has two cores, one reached from below the other from above. The correct tool should be used or a No. 10 plastic knitting needle, carefully filed to engage the cores. Any of several methods can be used. If a modulated signal of 460kc/s is available from a generator, cores can be adjusted for maximum audio output.

Satisfactory alignment is easily possible without these instruments. Tune in a station and adjust the cores for maximum S-meter reading, or if the S-meter is not fitted, clip voltmeter leads from the i.f. stage cathode to chassis, and put the meter on a 2·5V range. Then adjust for minimum cathode voltage, which corresponds to minimum anode current and maximum a.v.c. voltage. Repeat with a weak signal.

As a.v.c. is derived from the last i.f. anode, the final i.f.t. diode winding is peaked for maximum *audible* output, which will be seen to correspond to a slight dip in a.v.c. voltage or slight rise in cathode current. The i.f.t. cores may be peaked in two positions. With one, the cores are outwards, and separated from each other. With the other, one core is nearer the other, the latter position gives less selectivity and should not be used. This position will not be encountered unless the cores have been rotated considerably or moved unnecessarily.

Coil Trimming and Alignment

Since each waveband is separate from the others, only adjustment of one band will be described in detail.

Switch to Band 2 (medium waves), with the ganged capacitor open, rotate the oscillator trimmer to set the h.f. band end to 1,500kc/s and adjust the grid trimmer for best results. Close the tuning capacitor and rotate the oscillator coil core to set the i.f. band end to 525kc/s. Roughly adjust the grid core for best results.

Repeat these adjustments to make sure coverage will be suitable. The grid circuit is then trimmed at a point a little removed from the h.f. band end, and the grid circuit core similarly adjusted a little clear of the l.f. band end. Signals may be from a generator or stations, with indication of best output by the S-meter or cathode meter.

When the r.f. stage is fitted, note that the panel trimmer peaks for best results near the h.f. end of the band. Leave the trimmer in this position, tune to the l.f. end of the band, and adjust the aerial coil core for best results, re-adjustment of the panel trimmer should only occasionally be necessary. Trimmers and cores should be touched up as necessary later, after all work is finished, with the cover plate fitted, and with weak signals.

In the case of the higher frequency ranges, if primary interest is in amateur band reception, then range 3 can be trimmed at 3·7Mc/s, and the cores adjusted at 1·9Mc/s. Similarly, range 5 can be trimmed at 28Mc/s, and cores adjusted at 14Mc/s, but satisfactory tracking should in any case be found throughout the bands.

Note that on the higher frequencies, second channel responses will become more apparent as frequency increases, this is always so with a receiver of this kind. Bands 1, 2, 3 and 4 should be significantly clear of such effects, but at the h.f. end of band 5 it is easily possible to tune the oscillator circuit to the wrong side of the signal frequency. The oscillator should be at a higher frequency than that of the signal. If a signal generator is used, tune the generator slowly in the l.f. direction, after alignment. If a second response is found at twice 460kc/s (nearly 1Mc/s) below the frequencies the oscillator has been adjusted below the signal frequency. Correct this by adjusting the oscillator coil trimmer to lower capacity, and re-align this band.

Aerial and Earth

Random aerial lengths for any band can be used. An outdoor wire, high and clear of obstructions if possible, is suitable for any frequency, however indoor and short aerials will generally give good results. For maximum short wave efficiency some improved form of aerial is often employed. If the receiver will be employed exclusively with low impedance feeders, aerial coils with low impedance primaries may be fitted instead, and are for 75 ohms. The specified coils are for about 600 ohms, so give good general results with all aerials, including dipoles. Distant stations should normally be received satisfactorily with any reasonable aerial when conditions allow. For maximum possible results with very weak signals, an aerial matching unit may be connected in the usual way.

Fully guaranteed Individually packed VALVES

PERSONAL CALLERS WELCOME

Open 9-12.30, 1.30-5.30 p.m. Thursday 9-1 p.m.

MANY OTHERS IN STOCK include Cathode Ray Tubes and Special Valves. U.K. Orders up to 10/-, 1/-; 10/- to £1, 2/-; over £1, 2/- per £1; over £3 post free. C.O.D. 4/- extra

COLOMOR brand — ALL valves guaranteed

A2134	8/-
AR8	5/-
ARP3	3/-
ARP12	3/6
ARTP1	6/-
ATP4	2/3
AZ31	9/6
BD78	40/-
BL63	10/-
BT35	15/-
BT45	150/-
BT83	35/-
CV102	3/-
CV103	4/-
CV315 (matched pairs)	120/-
CV315 (Single)	50/-
CY31	7/6
D41	3/3
D77	3/-
DA100	£6
DAF90	7/6
DD41	4/-
DET20	2/-
DET25	10/-
DF91	3/-
DF92	2/6
DF96	7/6
DK92	9/-
DK96	8/-
DL63	8/-
DL92	4/-
DL93	4/-
DL94	6/6
DL96	8/-
DL810	12/-
DY86	6/-
DY87	6/6
E80F	18/-
E88CC	8/-
E90CC	8/-
E91H	7/-
E92CC	5/-
E180CC	7/-
E182CC	18/-
E1148	2/6
EA50	1/-
EA76	7/-
EABC80	6/-
EAC91	3/-
EAF42	9/3
EB91	2/-
EBC33	8/-
EBC41	9/-
EBC81	6/6
EBF80	7/6
EBF83	8/6
EBF89	6/-
EC53	8/-
EC70	4/-
EC90	4/-
EC91	8/-
ECC33	12/-
ECC35	15/6
ECC40	10/9
ECC81	4/-
ECC82	4/3
ECC83	5/6
ECC84	6/-
ECC85	5/6
ECC86	8/-
ECC88	7/-
ECC91	4/-
ECC189	9/9
ECF80	6/6

ECF82	6/6
ECH35	11/-
ECH42	10/-
ECH81	5/9
ECH83	8/6
ECL80	7/6
ECL82	6/-
ECL83	10/9
ECL86	8/6
EF36	3/6
EF37A	8/-
EF39	6/-
EF40	9/9
EF41	9/9
EF42	13/6
EF50	4/6
EF80	4/6
EF85	6/6
EF86	6/3
EF89	5/-
EF91	3/-
EF92	2/6
EF95	5/-
EF183	6/6
EF184	7/-
EH90	7/6
EL31	15/-
EL32	3/9
EL34	10/3
EL35	5/-
EL38	24/-
EL41	10/3
EL42	11/-
EL50	8/-
EL81	9/9
EL84	4/9
EL85	5/-
EL91	2/6
EL95	5/3
EL360	22/-
EM31	5/-
EM80	7/-
EM81	8/-
EM84	7/-
EM87	11/-
EN92	5/-
ESU74	80/-
EY51	7/6
EY86	8/6
EY88	8/6
EY91	2/6
EZ40	7/6
EZ41	8/6
EZ80	5/-
EZ81	5/-
FW500	6/-
FW4/800	10/-
G/371K	57/6
G1/370K	20/-
G50/2G	20/-
G120/1B	35/-
GM4	45/-
GU50	28/-
GZ32	9/6
GZ34	11/6
H30	3/6
HL23DD	5/-
HL41	4/-
HVR2	9/-
KT8C	32/6
KT63	4/-

KT66	18/6
KT67	45/-
KT71	7/6
KT76	7/-
KT88	27/-
KTZ63	7/-
L63	6/-
MH4	5/-
MH41	8/-
MHLD6	7/6
ML6	6/-
N34	8/-
N78	15/-
OA2	6/-
OB2	6/-
O3B	7/-
OC3	6/-
OD3	6/-
OZ4A	5/-
P41	7/-
PABC80	7/6
PC86	10/3
PC97	9/-
PC900	9/3
PCC84	6/6
PCC89	9/6
PCC189	10/9
PCF80	6/6
PCF82	6/3
PCF84	9/3
PCF86	9/3
PCF801	9/-
PCF802	9/-
PCF805	12/6
PCF806	14/6
PCF808	14/6
PCL81	9/-
PCL82	7/-
PCL83	10/3
PCL84	8/6
PCL85	8/6
PCL86	8/6
PFL200	13/-
PL36	10/9
PL81	10/9
PL82	8/-
PL83	6/9
PL84	6/6
PL500	13/6
PX4	14/-
PX25	12/6
PY33	9/3
PY80	6/-
PY81	5/6
PY82	5/9
PY83	6/6
PY88	7/-
PY800	9/-
PY801	9/-
QQVO3-10	19/-
QQVO6-40	85/-
QQVO6-40A	100/-
QS150-15	7/6
QS95/10	5/-
QS1200	10/-
QS1202	8/-
QVO4/7	8/-
QQZO4-15	57/6
R10	17/6
R17	8/6
R19	7/6

RG1-240A	28/-
SP61	3/3
STV280/40	60/-
STV280/80	90/-
SU2150A	10/-
TDO4-20	70/-
TP22	5/-
TP25	5/-
TT11	3/-
TT15	55/-
TTR31	45/-
TZ0502	4/-
TZ20	16/-

UU5	7/-
UY21	10/6
UY41	7/-
UY85	5/9
V246A/1K	190/-
VLS631	35/-
VP23	3/6
VP133	9/-
VR99	7/6
VR105/30	6/-
VR150/30	6/-
VU39	7/-
W118	8/-
W119	9/-
X65	5/-

X66	7/6
X76M	7/-
X118	8/-
X145	8/-
Y63	6/6
Y65	4/-
Z800U	29/-
Z801U	25/-
Z900T	12/-
1B22	30/-
1G5GT	6/-
1D8GT	6/-
1G6GT	6/-
1L4	2/6
1LA6	6/-
1LC6	7/-
1LH4	4/-
1R5	6/-

1S4	5/-
1S5	4/6
1T4	3/-
2A3	5/-
2D21	4/9
3A4	4/-
5R4WGA	27/6
3B7	5/-
3B24	14/-
3D6	3/-
3E29	50/-
3Q4	8/-
3Q5GT	6/-
3S4	5/9
3V4	6/6
4D1	4/-
5A173G	5/-

5A174G	5/-
5B251M	40/-
5B252M	35/-
5B254M	40/-
5B/255M	35/-
5R4GY	9/-
5T4	7/-
5U4G	4/6
5V4G	7/6
5X4G	8/6
5Y3GT	5/6
5Y3WGB	15/-
5Y3WGTB	9/-
5Z4G	7/6
6AB7	4/-

6AC7	3/-
6AG5	2/6
6AG7	6/-
6AH6	11/6
6AJ7	3/-
6AK5	5/-
6AK6	12/6
6AK7	6/-
6AK8	6/-
6AL5	3/-
6AL5W	7/-
6AM5	2/6
6AM6	3/-
6AN5	20/-
6AN8	10/-
6AQ5	5/6
6AQ5W	9/-
6AS6	6/-

TRANSISTORS, ZENER DIODES etc.

OA5	3/-
OA7	4/-
OA10	3/-
OA47	2/6
OA70	2/-
OA71	2/-
OA73	2/6
OA74	2/-
OA79	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	8/6
OAZ207	9/6
OAZ208 to OAZ213	6/6
OAZ223 to OAZ225	10/-
OC16	15/-
OC22	10/-
OC23	12/6
OC25	7/6
OC26	6/-

OC28	12/6
OC29	15/-
OC35	10/-
OC36	12/6
OC38	5/-
OC41	6/-
OC42	5/-
OC44	4/-
OC45	3/6
OC70	4/-
OC71	3/-
OC72	5/-
OC73	6/-
OC75	6/-
OC76	5/-
OC81	5/-
OC81D	3/-
OC81DM	3/-
OC82	5/-
OC82DM	3/-
OC83	5/-
OC83B	3/-
OC84	5/-
OC122	10/-
OC139	7/6
OC140	9/6
OC169	5/-
OC170	5/-
OC171	6/-

OC172	7/6
OC200	7/6
OC201	10/-
OC202	12/6
OC203	10/6
OC204	17/6
OC206	17/6
IN21	3/6
IN21B	5/-
IN25	12/-
IN43	4/-
IN70	4/-
2N456A	7/-
2N585	7/6
2N1090	7/6
2N1091	9/6
2N1306	7/6
2N1307	7/6
2S303	10/-
AAZ12	4/-
AC126	6/6
AC127	7/6
AC128	6/6
AC176	7/6
ACY17	8/6
ACY18	5/6
ACY19	6/6
ACY28	4/6
AD140	16/-

AD149	16/-
AEY11	15/-
AEY12	12/6
AF114	6/6
AF115	6/-
AF116	6/6
AF117	5/-
AF118	10/-
AF124	7/6
AF125	6/6
AF126	6/-
AF127	6/-
AF139	10/-
AF178	12/6
AFY19	22/6
ASY26	6/6
ASY28	6/6
ASZ21	12/6
ASZ23	30/-
BC107	6/-
BCY31	8/6
BFY51	5/-
BFY52	5/-
BSY27	6/6
BSY28	5/-
BSY51	7/6
BYZ13	6/-
BYZ15	20/-
BYZ16	15/-

CRS1/10	5/-
CRS1/20	9/6
CRS1/30	10/-
CRS1/35	11/6
CRS1/40	12/6
CRS3/05	6/-
CRS3/20	10/-
CRS3/30	11/6
CRS525/025	15/-
CRS3/40	12/6
C84B	25/-
GET103	4/6
GET115	9/-
GET116	8/6
GET872	6/-
GET880	9/-
GEX54	2/6
GJ6M	4/6
GT43	5/-
GT106	10/-
HG5001	2/-
JK10A	15/-
JK10B	15/-

JK11A	12/6
JK19A	22/6
JK20A	17/6
JK21A	12/6
JK100B	15/-
MAT100	7/9
MAT101	8/6
MPF102	11/-
MPF103	9/6
MPF104	10/-
MPF105	10/6
RAS508AF	12/6
RAS310AF	7/6
XS101	15/-
ZR11	5/-
Z Range Zener diodes	3/6 ea.
Z2A range	7/6 ea.
Z3B Range	5/- ea.
ZL range	5/- ea.
Z8 range	7/6 ea.

U12/14	7/-
U18	6/-
U25	14/6
U26	14/6
U27	8/-
U52	4/6
U81	8/-
U191	14/-
U404	6/-
U801	19/6
UABC80	6/-
UAF42	10/6
UBC41	9/3
UBF80	6/6
UBF89	7/-
UCC85	7/-
UCF80	9/6
UCH42	10/-
UCH81	7/-
UCL82	7/6
UCL83	10/3
UF41	10/6
UF80	7/-
UF89	6/9
UL41	9/9
UL84	6/6

DC MOVING COIL METERS

0–50µA	2¼" round proj.	25/-
100µA	2½" round panel	22/6
200µA	2" round panel sealed	22/6
500µA	2¼" round proj.	20/-
75µ-0-750µA	2" round plug-in	20/-
1mA	2" round panel sealed	27/6
5mA	2" round clip fix panel or proj.	20/-
10–0–10mA	2½" round panel	17/6
0–30mA	2½" round panel	17/6
50mA	2½" square panel	25/-
75mA	2½" plug-in	14/-
100mA	1½" proj.	17/6
100mA	1½" round panel	17/6
100mA	2½" round panel	19/-

29/41ft. **AERIALS** each consisting of ten 3ft. ⅞in. dia. tubular screw-in sections. 11ft. (5-section) whip aerial with adaptor to fit the 7in. rod. Insulated base, stay plate and stay assemblies, pegs, reamer, hammer, etc. Absolutely brand new and complete ready to erect, in canvas bag. £3.9.6. P. & P. 10/6.

FIELD TELEPHONES TYPE "F" housed in portable wooden cases. Excellent for communication in- and out-doors for up to 10 miles. For pair including batteries and 1/6th mile field cable on drum. Completely new, £6.10.0. Slightly used, £5.10.0. Carriage 10/-.

6AS7G	14/-
6AT6	4/6
6AU6	5/9
6AX4	8/-
6B7	5/6
6B4G	15/-
6B8G	2/6
6BA6	4/6
6BA7	12/6
6BE6	5/3
6BJ6	8/6
6BJ7	7/-
6BL7GTA	11/-
6BQ7A	4/-
6BR7	9/-
6BR8	10/-
6BW6	13/6
6BW7	13/-
6C4	3/6
6C5G	2/6
6C5GT	6/-
6C6	4/-
6C8G	6/6
6CH6	7/-
6CL6	9/9

6CW4	13/-
6D6	3/-
6E5	8/-
6EA8	9/-
6EU7	7/-
6F23	13/-
6F5GT	8/-
6F6G	4/-
6F7	6/-
6F8G	5/-
6F12	4/-
6F13	5/-
6F17	5/-
6F32	3/-
6F33	20/-
6G6G	2/6
6H6GT	1/9
6H6M	3/-
6J4WA	12/-
6J5	7/-
6J5GT	5/-
6J6	3/6
6J6W	6/-
6J7G	5/-
6J7M	8/-
6K6GT	8/-
6K7	6/-
6K7G	2/-
6K7GT	4/9
6K8G	4/-
6K8GT	7/3
6K25G	16/-
6L5G	6/-
6L6WGB	12/-
6L7G	4/-
6L34	8/-
6N7G	5/9
6P25	13/-
6S7	7/-
6SA7	7/-
6SA7GT	6/6
6SC7	7/-
6SC7GT	5/-
6SG7	6/-
6SJ7	5/-
6SJ7GT	6/6
6SJ7Y	6/6
6SK7	7/-
6SL7GT	6/6
6SN7GT	6/-
6SQ7GT	7/6
6SS7	2/-
6V6G	3/6
6V6GT	6/-
6V6M	8/-
6X4	4/9
6X5G	5/-
6X5GT	5/6
6Y6G	8/-
6-30L2	14/-
6Z4	5/-
7B7	7/-
7C5	12/6
7C6	6/-
7C7	6/-
7F8W	12/6
7H7	5/6
7Q7	7/-
7V7	5/-
7Y4	9/3
7Z4	4/6
9D6	2/6
10F9	9/-
10P14	17/3
11E2	30/-
12A6	3/6

12AT6	4/6
12AT7	4/-
12AT7WA	6/6
12AU7	4/3
12AV6	5/6
12AX7	6/-
12AX7WA	10/-
12AY7	10/-
12BA6	6/-
12BE6	5/9
12BH7	3/6
12C8	3/-
12E1	17/-
12H6	3/-
12J7GT	6/6
12K7GT	7/6
12K8M	8/-
12Q7GT	5/-
12SC7	7/-
12SG7	4/6
12SH7	3/-
12SJ7	4/-
12SK7	5/6
12SL7GT	7/-
12SN7GT	6/6
12SR7	5/-
13D1	4/-
13D5	5/6
14S7	15/-
19AQ5	5/9
19E2	12/6
19G3	40/-
19G6	20/-
19H4	70/-
20A1	35/-
20P4	20/6
25L6GT	7/3
25Z4G	9/3
25Z5	8/6
25Z6GT	6/-
28D7	6/-
30C15	15/-
30C17	16/-
30C18	15/-
30F5	16/-
30FL1	12/6
30FL12	19/-
30FL13	9/3
30FL14	15/6
30L15	17/3
30L17	17/3
30P12	16/3
30P19	14/-
30PL1	14/-
30PL13	16/-
30PL14	15/-
33A/101K	9/-
35L6GT	8/-
35W4	5/-
35Z3	10/-
35Z4GT	7/6
35Z5GT	6/-
37	4/-
38	4/-
42	5/-
50CD6G	27/6
50EH5	12/-
50L6GT	8/6
57	6/-
58	6/-
59	6/-
75	5/6
76	5/-

77	6/6
78	5/-
80	5/6
81	9/-
83	14/-
84	5/-
85A2	7/6
282A	25
307A	5/6
313C	25/-
357A	70/-
368AS	30/-
393A	27/6
446	8/-
703A	30/-
705A	20/-
715B	50/-
717A	3/-
803	30/-
807	9/-
808	8/-
813	75/-
815	35/-
829B	50/-
832A	45/-
843	5/-
866A	15/-
884	10/-
954	4/6
955	2/6
956	2/-
957	5/-
958A	4/-
991	6/-
1622	17/-
1625	6/-
1629	4/6
2051	5/-
2729	25/-
4043C	35/-
4313C	20/-
5676	10/-
5678	10/-
5696	6/-
5704	9/-
5726	7/-
5933	22/6
6057	10/-
6060	5/6
6064	7/-
6065	8/-
6080	27/6
6146	28/-
8013A	35/-
8020	30/-
9001	3/-
9002	4/6
9003	8/6
9004	2/6
9006	2/6
C.R. Tubes	
E4504/B/16	70/-
O9J	75/-
VCR97	32/6
VCR139A	30/-
VCR517	50/-
VCR517B	55/-
VCR517C	45/-
5CP1	30/-
5FP7	26/7
Photo Tubes	
G816	12/6
6M625	45/-

P. C. RADIO LTD.
170 GOLDHAWK RD., W.12
(01) 743 4946

ALL OVERSEAS ENQUIRIES AND ORDERS
Please address to
Colomor (Electronics) Ltd.
170 GOLDHAWK ROAD, LONDON W12.
Tel.: 01-743 0899

AMAZING MINI·DRILL

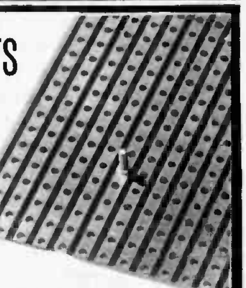
FOR PRECISION MODEL WORK

+ 6 TOOLS

Indispensable for precision drilling, grinding, polishing, etching, gouging, shaping. Precision power for the enthusiast. Shockproof. Completely portable power from 4½ volt external battery. So much more scope with MINI-DRILL. Super Kit (extra power, interchangeable chuck) 79/6, p.p. 2/6. De Luxe Professional Kit with 17 tools 130/- p.p. 4/6. Money ref. g'tee.

MERLIN SUPPLY CO.
Dept. PW2D, Nailsea, Bristol BS19 2LP

BUILD YOUR CIRCUITS on VEROBOARD



—the Universal Wiring Board—
obtainable from your local Retailer

Trade enquiries to:
NORMAN ROSE (ELECTRICAL) LTD.
8 St. Chad's Place, Gray's Inn Road, London, W.C.1

Technical enquiries to:
VERO ELECTRONICS LTD.
Industrial Estate, Chandler's Ford, Hants

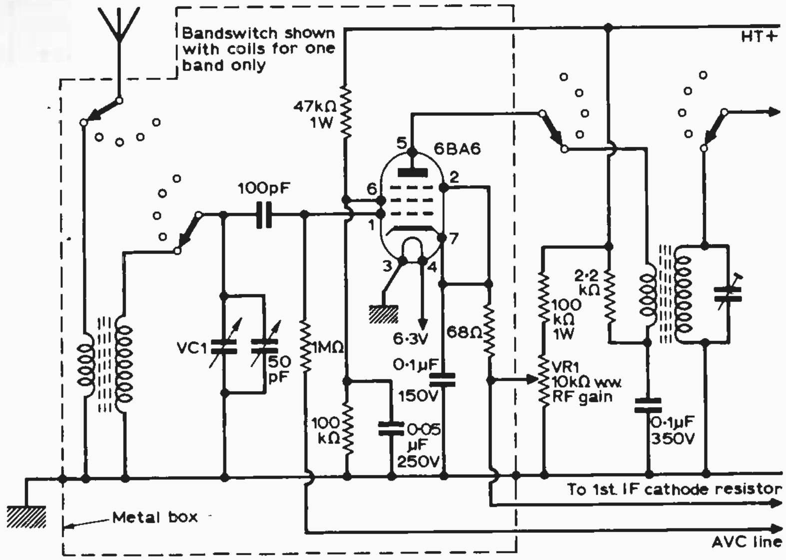


Fig. 6: The circuit of the r.f. stage.

R.F. Stage

The circuit for this is shown in Fig. 6 with an aerial coil for one band only. VC1 is that section of the ganged capacitor nearest the panel and the parallel trimmer is a 50pF air-spaced variable capacitor, the spindle being extended by a short length of ¼in. shaft and a flexible coupler. The shaft runs in a bush fixed to the panel. It was found necessary to wire up the valveholder and associated components first, then fit the trimmer, and afterwards the coils. The circuit is checked on the appropriate band, after wiring in one coil to avoid complicated mistakes, finally add the other coils, checking on each band as it is fitted.

VR1 provides manual control of r.f. gain as this is necessary for very strong a.m. signals, c.w. and s.s.b., and reduced background noise. R.F. and mixer stages must be fitted with screening cans. When the r.f. stage is not present, the primaries of the mixer grid coils are returned to the chassis. This circuit is now by-passed to chassis by the 0·1µF capacitor, and h.t. applied through the primaries from the 2·2kΩ resistor.

The valveholder, with cathode, grid and screen grid components. occupies the first section of the coil box. The valveholder is placed with pin 5 near the runner between this compartment and the central compartment, so that a lead from the anode, pin 5, runs directly through a hole to the band-switch. R.F. stage tuning is satisfactory if the 50pF panel trimmer can be peaked for best results throughout all bands, but aligning the aerial coil cores as explained reduces the need to adjust this.

Additional I.F. Stage

Figure 7 shows the circuit of this stage which is placed between the frequency changer and the existing i.f. amplifier. The primary of i.f.t.1 now supplies the frequency-changer stage with h.t. through the 1·5kΩ resistor by-passed by a 0·1µF capacitor. After fitting the new i.f.t., transfer the mixer anode lead to it.

The 6BA6 anode is now connected to the existing transformer primary and the a.v.c. bias is obtained from the a.v.c. line. The r.f. gain potentiometer controls the cathode voltage of this stage and the r.f. stage. Manual control of the r..f. and first i.f. stages in this way is normally sufficient and the second i.f. stage, to which the S-meter is connected, does not have manual control of cathode bias. When the extra stage has been added, a considerable increase in sensitivity and selectivity should be found; the i.f.t. cores are adjusted for best results, as described previously.

S-Meter

This reads in an upwards direction, employing a cathode bridge circuit shown in Fig. 8. The i.f. valve and 47kΩ resistor are two arms of the bridge, and the cathode resistor and portion of the zero control the other arms. With no signal and thus no a.v.c. voltage the zero potentiometer is adjusted so that no voltage is present across the meter, which consequently reads zero.

When a signal is present, a.v.c. reduces the cathode current. The voltage drop across the cathode resistor

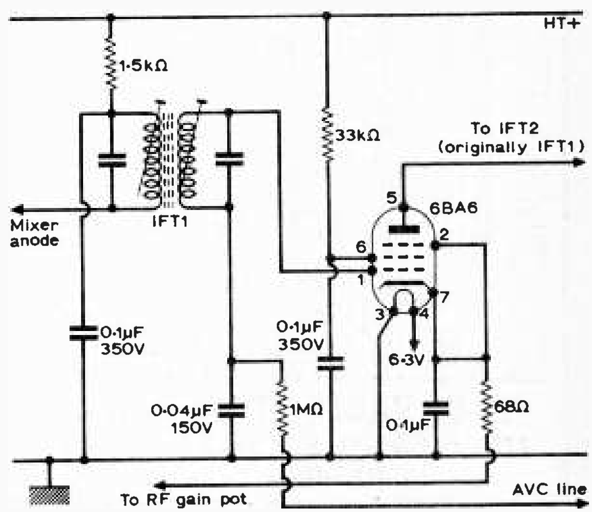


Fig. 7: The circuit of the additional i.f. stage.

falls, and the meter pointer rises in accordance with the signal level. Changing the resistor in series with the meter allows any degree of sensitivity. The values shown give approximately 6dB per S-point. The S-meter is actually a 1mA movement, and a suitable scale can be made for an ordinary milliammeter.

Changes which improve signal strength will raise the meter reading. These include internal adjustments, such as trimming or peaking the panel aerial trimmer or external causes, such as the efficiency of the aerial-earth system. With many transmissions, readings change continuously due to propagation conditions, and this does not indicate a fault.

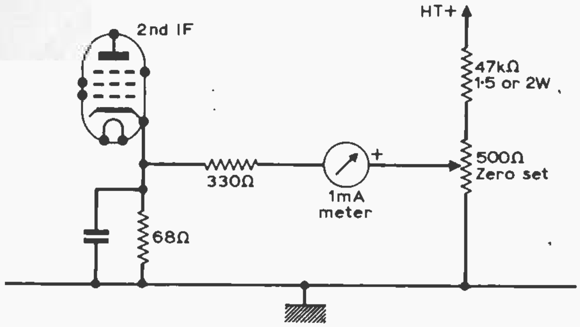


Fig. 8: The S-Meter circuit.

Beat Frequency Oscillator

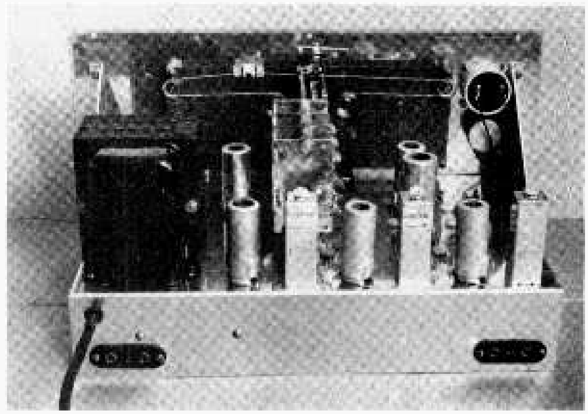
Figure 9 shows the circuit for the b.f.o. which employs a 6C4 triode with large capacitances from anode and grid circuits to earth. The b.f.o. coil, three capacitors, and resistor are ready included in the HSO-460 b.f.o. unit can. The c.w./a.m./s.s.b. switch brings the b.f.o. into action, and its frequency is adjusted by the panel trimmer VC1.

With the 3-position switch in the a.m. position, the b.f.o. is not in use, and a.v.c. operates normally, this is for the reception of voice and other amplitude modulated signals. With the switch in the c.w. position, the automatic volume control circuit is out of use, and the panel r.f./i.f. gain potentiometer must be operated to give the required sensitivity, and especially to reduce the strength of strong signals. The heterodyne control VC1 is rotated above or below the zero beat position, as required for best reception of the code signals.

Reception of S.S.B. Signals

When the switch is placed in the s.s.b. position, the a.v.c. characteristics are changed and the injection level raised to provide carrier insertion. VC1 is adjusted as necessary for upper or lower sideband. For exceedingly weak s.s.b., the c.w. position may be chosen. For strong s.s.b., keep audio gain well up, but reduce r.f. gain with the panel control. The s.s.b. position can be used for very strong c.w.

The valve, b.f.o. coil, and other items occupy space on the chassis near the output stage, Fig. 2. When first testing this stage, tune in a carrier at a.m. for maximum S-meter reading, reduce r.f. gain to give moderate volume only, set VC1 about half closed, switch to c.w., and rotate the coil core for zero beat. VC1 then allows the b.f.o. to be set either above or below the i.f.



Rear view of the completed receiver.

Other Circuits

When the receiver is used with a transmitter in particular, a "standby" switch is often handy. This leaves heaters on, but the receiver mute. A suitable method is to place an on/off toggle switch in the h.t. positive circuit. In some receivers the standby position leaves the r.f. and i.f. circuits operating at very low sensitivity. For this method, the switch may be placed in series with the r.f./i.f. gain control, and have a 47kΩ to 68kΩ resistor in parallel, when this switch is opened, cathode bias then rises to a high value.

Some constructors may favour separate control of a.v.c. for best results in all circumstances, for this purpose, an on/off switch may be connected from the a.v.c. line to chassis. No a.v.c. voltage is then applied to r.f. and i.f. stages with this switch closed.

A jack for phones is often convenient. A jack with open circuiting contacts will automatically disconnect the speaker, when the jack plug is inserted. It is generally satisfactory to feed medium impedance phones from the output transformer secondary. Another method is to feed the phones via a 0·01μF mica capacitor from the output stage anode. As much more power is available than required, a resistor of between 10kΩ and 33kΩ should be included in series with the capacitor. This method is also satisfactory with high impedance phones.

Additional ventilation is provided for the cabinet by a row or two ½in. diameter holes in the back and bottom, and the cabinet is also raised on four feet. Cut-outs are made opposite speaker, aerial and earth sockets. ■

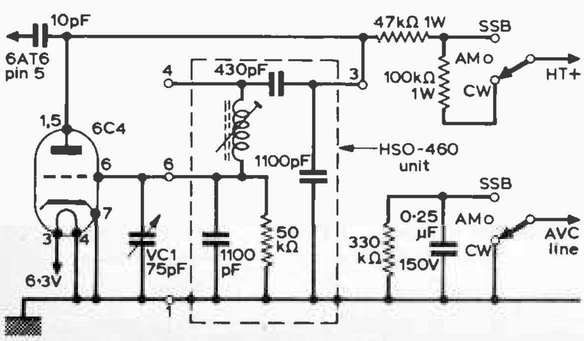


Fig. 9: The beat frequency oscillator.

P.W. GUIDE TO COMPONENTS
Due to pressure on space, Part 5 in this series is held over until the next issue.

AIRCRAFT — PLUS GENERAL V.H.F. TELECOMMUNICATIONS BAND REC.

Listen to the thrills of aircraft, pilots and airports at work. Also Civil Depts., Fire and Ambulance services. Also taxis, Gas and Electricity services. Ideal for receiving 2 metre amateurs. Gives super reception within the range of all transmissions. A fully transistorised receiver covering 108-160Mc/s VHF broadcasts. Robust attractively finished metal cabinet size approx. 7 x 7 x 4in. Operates from a 9 volt internal battery. Internal speaker or headphone output. Price only £8.19.6, carr. and insurance 10/6.

MINIATURE TRANSISTORISED B.F.O. UNIT

This is a miniature transistorised B.F.O. unit, (tunable) that will enable your set to receive C.W. or S.S.B. reception. Compact. Single hole fixing. This small unit will fit anywhere. Ideal for all Ex-Govt. Communication Receivers and most Commercial Types. Complete with fitting instructions. 49/6, post free.

SCOOP PURCHASE TRANSFORMER SALE

Bulk purchase enables us to offer the following transformers at these ridiculously low prices. Made by a famous manufacturer and fully tested and guaranteed. Charger Transformers. 0–9–15V 2A. 9/6 each, p. & p. 2/6. Two for 17/6, post free. Transistor Power Pack Types. 6·3V at 2A, 7/6 each, p. & p. 2/6. 12V at 2A, 12/6 each, p. & p. 2/6.

ONE WATT TRANSISTOR AMPS

For 3-5 ohm speakers. Miniature Brand new and British made. 9 volt operation. Only 37/6, p. & p. 2/6. Suitable 7 x 5in. Moving Coil Loudspeaker in cabinet. Only 17/6, p. & p. 2/6. If purchased together deduct 10/- from total.

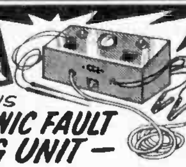
TELEPHONE BARGAIN

The Bargain of the year. Standard type desk telephones complete with dial & cord. Not new but in good condition. Only 15/- each, p.p. 5/-. Two for 30/- post free. Four for 50/- post free. Limited stocks.

RUN YOUR 19 SET TX and RX FROM THE MAINS

We make an excellent power supply unit. Simply plug into your 19 set, and the transmitter and receiver is fully operational. Brand new in attractive louvred steel case. Operates from 200/250V A.C. Only £6.10.0 carriage and ins. 10/-.

CAR BATTERY CHARGER PLUS ELECTRONIC FAULT TRACING UNIT —



A Good start in 1969. Heavy Duty charger for 6/12V batteries. Combines circuit tester, ignition checker, and fault finder. Cuts repair costs. Easy View ammeter calibrater 0-7 with overload indicator. Full accessories plus free fault-finding guide. Isolated, fused and earthed for safety. Ideal home/industrial use. Robust metal cabinet, functional control panel. Should be 6 gns. Genuine bankrupt stocks, now offered at **72/6** p.p. 7/6

19 SET CONTROL UNITS. Brand new and boxed Only 10/-, p. & p. 2/6.
19 SET HEADPHONES AND MIKE. Not new but working. 7/6 per pair, p. & p. 4/6.

TRANSISTORS

All tested and guaranteed

OC44 three for 5/- post free.

OC72 three for 5/- post free.

OC71 three for 4/6 post free.

OC45 three for 3/6 post free.

OC81 three for 5/- post free.

AC128 three for 5/- post free.

BSY 95A three for 10/- post free.

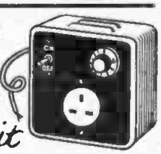
2N706 three for 6/6 post free.

BSY27 300Mc/s silicon 3 for £1 post free.

AIR/SEA RESCUE TRANS/REC.

Compact V.H.F. Trans./Rec. Fits in the pocket. Consists of Mike/Speaker, amplifier, aerial, transmitter and receiver. Were made to operate up to 100 miles depending on terrain. Operates from dry batteries. Completely self-contained. Cost Govt. over £50 each. Regulations state must not be operated in UK so please mention "For Dismantling purposes only" when ordering. Price £2.10.0 each, p. & p. 10/-. Two sets for £5.0.0, post free. Four sets £8, carriage free. Bulk sale of 10 sets £15, carriage £1. Export enquiries invited.

HEAT LIGHT SPEED CONTROL Unit



An electronic unit capable of controlling electrical equipment up to 3,000 watts capacity. Fingertip control of all a.c./d.c. electrical equipment. Suitable for all types of lighting arrangements. Incandescent lamps, spot lamps, arc lamps, floodlights. Makes an ideal dimming unit. Ideal for controlling all types of electric drills and up to 2 h.p. electric motors for all applications. Ideal for all types of electric heaters. Suitable for lathes and power tools. Employs the latest electronic system. Size 6 x 5 x 2in. Louvred metal case in pleasing hammer finish. Attractive front panel. Bargain price £8.19.6 p. & p. 10/-. C.O.D. if required.

HANDY POWER PACK KIT

Consists of Mains, Transformer, Silicon Rectifier, Electrolytics, and choke etc. Also robust chassis and full circuit and instructions. Input 200/250v. AC. Output 250v. 75mA. 6.3v. at 2 amps. Price assembled 32/6. p. & p. 7/6.

GLOBE SCIENTIFIC LTD
DEPT. P.W.24 CAWOODS YARD, MILL STREET, LEEDS 9

ERSIN **Multicore** 5 CORE SOLDER

for quick, easy, reliable soldering

Contains 5 cores of non-corrosive flux, instantly cleaning heavily oxidised surfaces. No extra flux required. Ersin Multicore Savbit Alloy also reduces wear of copper soldering iron bits.

SIZE 5 HANDY SOLDER DISPENSER

Contains 10 ft. coil of 18 s.w.g. Ersin Multicore Savbit Alloy. 2/6 each.

SIZE 15 SOLDER DISPENSER

Contains 21 ft. coil of 60/40 Alloy, 22 s.w.g. Ideal for small components, transistors, diodes, etc. 3/- each.

SIZE 12

Ideal for home constructors. Contains 90 ft. of 18 s.w.g. Ersin Multicore Savbit Alloy on a plastic reel. 15/- each.

BIB MODEL 8 WIRE STRIPPER AND CUTTER

Strips insulation cleanly and quickly, fitted with unique 8 gauge wire selector. Plastic handles. 9/6 each.

From Electrical and Hardware shops. If unobtainable, write to:
Multicore Solders Ltd., Hemel Hempstead, Herts.

BI-PRE-PAK LTD

222-224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX
PHONE: SOUTHEND (0702) 46344

SPECIAL OFFER

Stock Clearance of Manufacturers Rejects. Limited Number UHF/VHF Tuner Units. Consisting of: 2 AF186 Transistors, Tuning Condensers, Coils and Comps etc.:

Price 5/- each

Post and Packing U.K. 2/6.

BRAND NEW PRE-PAKS

No.		Price
B1	50 Unmarked Trans. Untested	10/-
B2	4 Solar Cells inc. Book of Instructions	10/-
B6	17 Red Spot AF Transistors	10/-
B6A	17 White Spot RF Transistors	10/-
B9	1 ORP12 Light Sensitive Cell	9/-
B53	25 Silicon Transistors 400 M/c (New, tested but unmarked)	10/-
B54	40 Silicon Transistors NPN To5 (New, tested but unmarked)	10/-
B55	40 Silicon Transistors NPN To18 (New, tested but unmarked)	10/-
B56	40 Silicon Transistors NPN/PNP (New, tested but unmarked)	10/-
B61	25 BSY26/7 Transistors new, untested	10/-
B62	25 BSY95a Transistors new, untested	10/-
B64	25 BFY50/1/2 Transistors new, untested	10/-
B65	25 BC107/8/9 Transistors new, untested	10/-
B66	150 Germ. Min. Diodes, untested	10/-
C2	1 Unijunction Transistor 2N2160	15/-
A3	25 Mixed Marked and Tested Transistors	20/-
A21	5 Power Transistors, one AD149, one OC26 and three more	20/-

Transistors	Price
AC107	3/-
AC126	2/4
AC127	2/4
AF117	3/6
AC176	4/-
AD149	10/-
BC107-8-9	4/6
OCP71	10/-
BSY95A	3/-
OC22	6/-
OC23	6/-
OC25	7/6
OC26	5/-
OC28	10/-
OC35	5/-
OC36	7/6
OC41	2/6
OC42	3/-
OC44	1/11
OC45	1/9
OC71	2/6
OC72	2/6
OC73	3/6
OC81	2/6
OC81D	2/6
OC83	4/-
OC139	2/6
OC140	3/6
OC200	5/-
OC201	8/-
2N1302 or 3	4/-
2N1304 or 5	5/-
2N1306 or 7	6/-
2N1308 or 9	8/-

★ ALL OUR TESTED SEMICONDUCTORS HAVE A WRITTEN GUARANTEE ★

Send for our FREE lists and catalogue of all our products. Check your own equivalent with our free substitution chart.

Matched Set. NPN/PNP AD161-AD162 Comp. pair Pak B.77. **10/- PR.**

Complementary Set. NPN/PNP Germ. trans., Pak F.3 **2/6 PR.**

NO CONNECTION WITH ANY OTHER FIRM MINIMUM ORDER 10/-. CASH WITH ORDER PLEASE, add 1/- post and packing. OVERSEAS ADD EXTRA FOR AIRMAIL

SATELLITE EARTH STATION

RICHARD COLLINS REPORTS...

PART 1

THE Post Office recently brought a new aerial system into service at its Goonhilly 2 Earth Station, which is Britain's latest space communications station. This aerial system will work with the new Intelsat III satellite.

Goonhilly 2 will maintain a role as an earth station in the expanding system of global communications via Intelsat III satellites in synchronous orbit over the Atlantic, Indian and Pacific oceans.

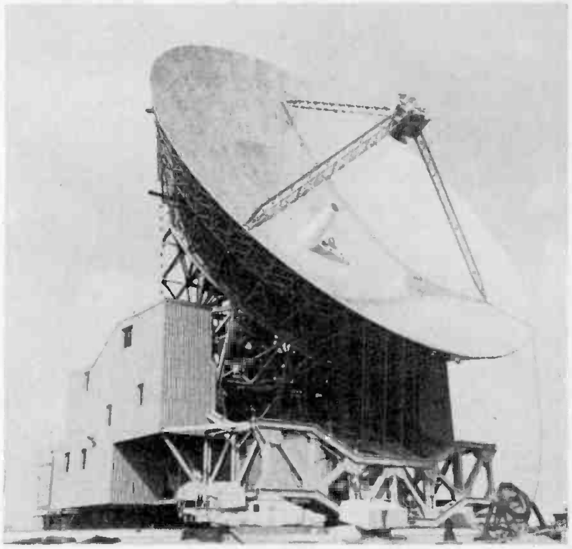
Goonhilly 1 will no longer be required for the service to America. It is being provided with new equipment to enable it to operate with countries to the east of Britain via an Intelsat III satellite (to be launched in the summer) which will be positioned over the Indian Ocean.

400 Phone circuits

The giant 90ft diameter dish aerial will carry up to 400 telephone circuits and a television programme simultaneously. Multiplex equipment has been installed to derive the first group of up to 132 circuits and additional equipment has been installed to bring this up to nearly 400 circuits, eventually providing routes not only to the USA and Canada but also to Africa and the Middle East. As more earth stations become operational the system will expand until by 1971 Goonhilly is expected to be working to 20 countries.

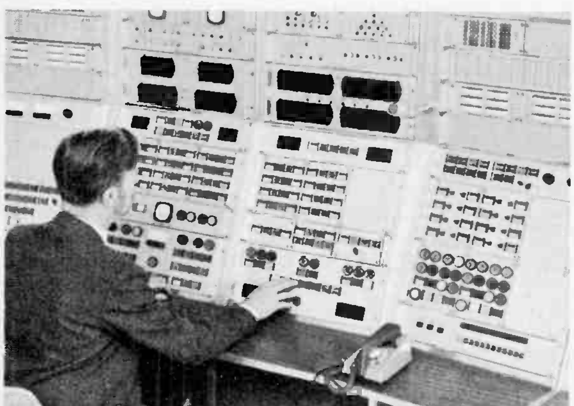
This Goonhilly installation, which meets the technical requirements of the International Telecommunications Satellite Consortium INTELSAT, has been built to a Post Office specification and installed at a total cost, including roads, buildings, etc., of approximately £2m. The Marconi Company of Chelmsford were the main contractors.

The aerial covers a 210° arc in azimuth to enable it to work to either the Atlantic or the Indian Ocean satellites. The entire structure weighs nearly 1,000 tons, which includes the transmitters, receivers and ancillary equipment. It is mounted on a central bearing with two massive bogie units carrying the load at the front of the structure.



The No. 2 aerial.

The 90ft reflector surface consists of a 24ft diameter central section surrounded by two rings of stainless-steel panels with a surface accuracy of 0·020in. r.m.s. Maximum distortion in a wind speed of 70 m.p.h. will be 0·200in.



The control console in the main Goonhilly station building.

The spinning horn

It makes use of a Cassegrain configuration with a spinning horn at the apex of the main reflector. The spinning feed-horn is a feature of Marconi's " mode conversion scanning system " of aerial steering. It introduces a conical scan of the aerial beam only at the frequency of the satellite beacon signal. Thus it avoids unwanted a.m. of the communication carriers or significant degradation of aerial efficiency for either direction of transmission. By this means autotracking can be achieved either by servo-control of the main reflector mounting or, within a range of about ± 20 minutes of arc, by deflection of the sub-reflector. Provision has also been made for control of the aerial manually and for the addition of tape control facilities later if required.

The aerial and telecommunications equipment are controlled and monitored from a suite of consoles in the central building. Each carrier is monitored separately and reserve equipment is switched into use automatically if a disabling fault condition arises. Faults which cause degradation of the service but do not interrupt it can be located and eliminated by manual switching of their component sub-systems without interference with traffic. A separate console enables the television service to be monitored and tested.

TO BE CONTINUED

THE MITE

JULIAN ANDERSON

A MINIATURE THREE TRANSISTOR RADIO WHICH OPERATES EITHER AN EARPIECE OR LOUDSPEAKER

WITH six transistor radios available for under 40s., there are few financial incentives to build a miniature radio, but for the beginner there are few more satisfying projects. The Mite was designed as an easily built, three transistor radio covering the medium waves, the final result being an extremely small and useful radio. The size of the case is $3\frac{1}{2}\times2\frac{3}{8}\times1$in. outside measurements—which from the photograph can be seen to fit easily into the palm of a hand, yet the Mite drives a loudspeaker almost to its limit and has a separate volume control. With careful setting of the regeneration control it will receive Radios 1, 3, 4 and Radio Luxembourg, together with a number of continental stations after dark.

There is nothing very unusual about the circuit shown in Fig. 1, except that it was chosen to operate well within the tolerances of the components chosen. The disadvantage of many projects of this type is that the circuit is built around the actual transistors used in the prototype without a view to someone else copying the circuit. It will be seen that the Mite uses a reflexed OC44 with regeneration, the most sensitive circuit ever developed, signals from this being fed through a conventional volume control into a directly-coupled high gain amplifier. From the circuit it will be seen that the minimum of components are used.

The circuit

Since the Mite is intended primarily for the beginner, a thorough description of how the radio works will help. The radio waves are picked up by the ferrite rod aerial; this rod greatly increases the signal pickup of the coil around it and increases the inductance of it (fewer turns are needed). VC1 is connected in parallel with the coil and forms the tuned circuit, selecting the appropriate frequency; one side of the coil is connected to chassis. A small overwind on the coil picks up the output of the tuned circuit and transforms it from the very high impedance of a tuned circuit to a lower one suitable for feeding into a transistor circuit, a transistor being basically a low impedance device. One side of the overwind is connected directly to the base of the first transistor, an OC44, while the other is connected to chassis via C1. This capacitor avoids a d.c. connection to the base and serves another function, described later.

Tr1 is arranged as a common emitter amplifier, and at the collector the signal is divided three ways. A tiny part of the signal is fed back to the top of the coil via VC2, a variable capacitor made from twisting two wires together, this gives a very low value. This passes again through the stages mentioned above, the result of this is known as regeneration. A second part of the signal is taken off by C2 and is rectified by D2. The arrangement of C1, C2, D1 and D2 is known as a voltage doubler and it not only rectifies the amplified signal but it smooths it and doubles it—how's that for economy! The resulting audio signal (a.f.) is passed through the overwind again and fed back into the base of Tr1 to be amplified again. This is known as reflexing and was very popular in the days of expensive valves and expensive transistors but is less popular today. It is only used here to save components and consequently space.

The amplified a.f. signal now appears at the collector of Tr1 (VC2 and C2 are so small in value that no appreciable amount passes through them) and passes through the r.f. choke, this will pass the a.f. but blocks the r.f. on the two previously described functions.

The a.f. signal is developed across R2 and fed via C3 (which stops d.c. passing through the volume control) and in turn is connected to Tr2 via C4, also arranged as a common emitter amplifier. C4 prevents the base of Tr2 from being d.c. connected to chassis. The output from Tr2 is connected directly to the base of Tr3 which in turn amplifies the signal and develops it across the loudspeaker or earphone. R3, R4 and R5 provide the correct voltages for Tr2 and Tr3 whilst C5 smooths the voltage across R5. C6 smooths the negative line and prevents r.f. and a.f. getting where they don't belong.

To the experienced constructor two points will be noticed. First the mismatch between Tr1 and Tr2; in theory coupling in this manner tends to prevent the first stage from working properly, but due to the low value of C3 the arrangement works perfectly well. The second point is connecting the loudspeaker with no method of transforming. Here again in practice the circuit works perfectly well and the current drain is not excessive (below 15mA).

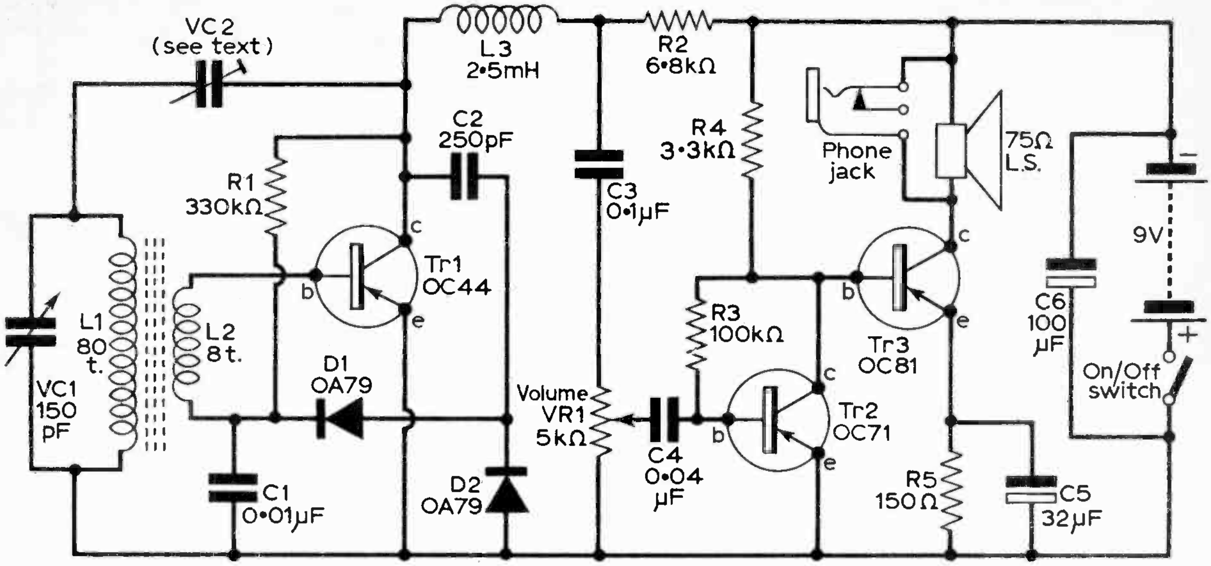


Fig. 1: The circuit of the Mite. All the components except the battery, the loudspeaker and the earphone jack are mounted on a piece of Veroboard. The way in which the circuit is explained in the text.

Component layout

Using transistors, layout is not very important, but for those wishing to use their own arrangement of components two points should be borne in mind. Firstly the ferrite rod should not be near the speaker magnet and secondly the r.f. choke should not be too near the aerial coil or the twisted wires of VC2—other than these two points, layout is not critical.

The ferrite rod

Although the ferrite rod, fitted with aerial and coupling windings can be bought, it is an easy matter to construct one's own. The ferrite slab is $2 \times \frac{5}{8} \times \frac{1}{8}$in.; normally these are sold only in longer lengths although the section is fairly common. The slab is cut to size by filing a "V" shaped groove across one

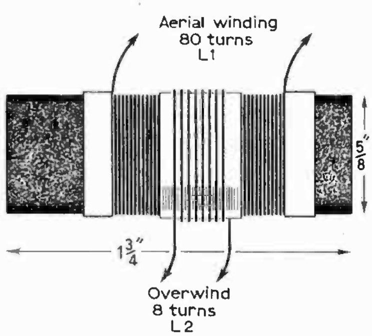


Fig. 2: Details of the ferrite rod aerial.

of the flat surfaces and smartly snapping it at this point, no great care is needed as it will break cleanly.

The windings should be started at one end, a narrow strip of adhesive tape should be bound around this end for about three turns, one end of the wire being trapped in the tape. The wire used should be 34 gauge enamelled copper wire and 80 turns are wound tightly on to the slab, finishing it as mentioned above, trapping the wire in further turns of tape, the details are shown in Fig. 2. The overwind, or coupling wire, should be wound on top of

★ components list

Resistors:

R1 330kΩ
R2 6·8kΩ
R3 100kΩ
R4 3·3kΩ
R5 150Ω
All 10% tolerance, ¼ watt miniature

Capacitors:

C1 0·01μF
C2 250pF
C3 0·1μF
C4 0·04μF
C5 32μF 10v.
C6 100μF 10v.

Transistors:

Tr1 OC44 etc
Tr2 OC71 etc
Tr3 OC81 etc

Miscellaneous:

VC1 150pF+65pF miniature ($\frac{11}{16}$ x $\frac{11}{16}$ x $\frac{7}{16}$in.)
VC2 See text
VR1 5K Semilog with switch—Radiospares
D1, D2 OA79, etc see text
L1, L2 Ferrite slab 2 x ¾ wound m.w. coil with secondary
L3 R.F. choke 2·5mH, see text
Loudspeaker 75Ω, 2¼in. diameter
Miniature jack plug and socket, earphone
9V battery—PP3—see text (Ever Ready)
Two Soap Dishes (Boots)
Veroboard 2⅛ x 2½in. (0·1in. holes spacing)
Battery clips wire etc

this; here eight turns are required, fixed as before. In all cases about 3in. of wire should be left for fixing. Unlike a superhet where the coil has to be adjusted for correct alignment, the coil can be wound directly on to the slab, no movement being required. Where a ferrite rod is bought complete with the required windings the rod will probably have to be shortened; this may be done as detailed. Some aerials available are designed for low capacity tuners and the inductance will be too high. If the correct range is not covered the rod should be shortened further and in extreme cases fitted with part of the coil over the end of the slab.

Choice of components

Miniature components should be used throughout. The tuning capacitor used is readily available as a replacement used for imported radios; similarly the volume control incorporating the on/off switch. The only component that should be chosen with care is the r.f. choke. The particular value (2·5mH) can be quite large and a small one should be used; the value of this component is not critical and may range from 1·5 to 5mH. The diodes used may be of almost any type used for detection.

The knob for the tuning capacitor can be bought from certain suppliers or one intended for certain volume controls can be used, it should be about 1in. in diameter.

Construction

All the components, with the exception of the speaker, the battery and the earphone jack are mounted on a piece of Veroboard which must be cut to the shape shown in Fig. 3. A hacksaw will cut this and it should be filed smooth afterwards. The holes for fixing the board and for the tuning capacitor should be drilled and the laminate strips broken as in Fig. 3, this may be done using a tool marketed by the manufacturers but can also be made by using a drill about ¼in. diameter.

The tuning capacitor and volume control should be mounted first. The volume control will require small wires soldered through the holes in the connections and then these are passed through the Veroboard. The arrangement shown makes the holes in the Veroboard and wire line up quite nicely. The wires are bent over and soldered. The tuning capacitor is fitted to the board by means of two small screws (they must be small to avoid snagging the vanes in the tuning capacitor). Normally these will be 6BA but some versions on the market use a weird foreign thread—here the ingenuity of the constructor will be tested (probably by forcing a screw in!). The connections from the tuning capacitor must be bent to fit into the correct holes; the oscillator section (not used) and earth leads are bent under the body, this does not place any undue strain on them.

The battery wires are fixed next. Battery connections need not be bought as they may be taken from an old PP3 battery etc.; break the metal enclosure at the top and pull away the plastic plate to which the terminals are fitted, cutting away the wire. After this fit the two jumper wires which connect the earth strips.

The other components may now be slipped in, bent over and soldered. Where a component is mounted vertically it should be made as short as possible since height is restricted. For the same reason keep the solder joints neat as some of these rest on the loudspeaker. If this is hard to accomplish, the joints may be filed flat when soldering is completed. The r.f. choke should be mounted after the other parts as these are surprisingly fragile.

The wires to the loudspeaker should next be fitted, followed by the aerial coil. The end not covered by the windings should be laid against the tuning capacitor and a piece of adhesive tape stuck from the bottom of the capacitor body to the underside of the Veroboard. The coil connections can then be wired to the board but do not fix the overwind wires permanently. Finally two pieces of thin, single core insulated wire should be fitted—these make up VC2 when twisted together.

Testing

After wiring the loudspeaker (ignore the earphone socket for the time being), connect the battery. Hey-presto! . . . it doesn't work (unless you are very careful, very lucky or very clever). There should be a "mush" on the loudspeaker—if this is not the case the trouble is in the amplifier circuit—check the wiring. If nothing wrong is found, measure the current consumption by inserting a meter in one of the battery leads, this should read between 7 and 15mA. If it still doesn't work the components must be checked.

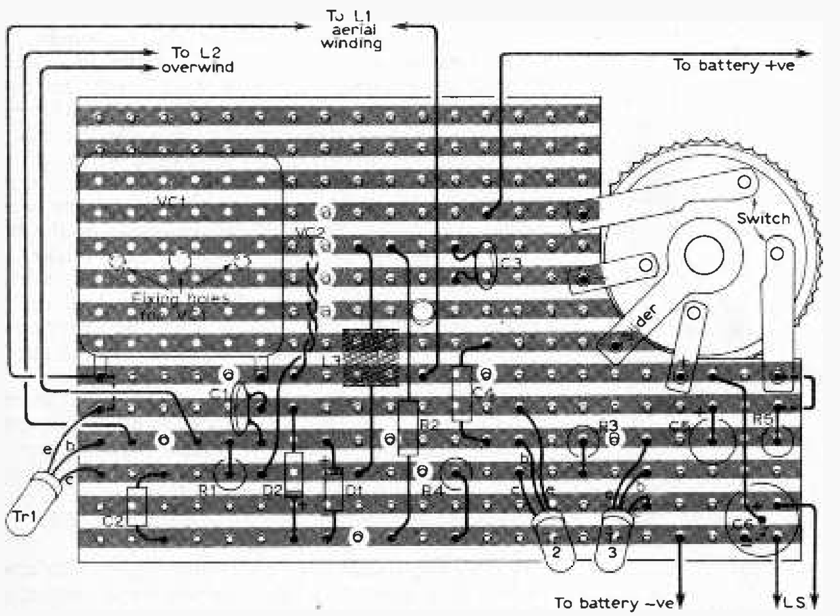


Fig. 3: The layout of the components on the Veroboard panel. The shading shows the breaks in the copper strip.

Assuming there is something on the loudspeaker, work back, prodding a moist finger at the junctions C3/VR1, L3/C3, C1/L3 and the base of Tr1 in that order—in all cases a little plop should be heard. If not, check between the point at which it is not heard and the last point at which results were achieved.

If all is well, check back on the circuit, making certain that the diodes are correctly wired the right way round. When a signal is received, twist the wires making up VC2 together. If there is a whistle after a few turns all is well. If the signal gets weaker or there is no change, reverse the overwind connections and try again. The wires should be adjusted so that there is very nearly a whistle on Radio Luxembourg or the highest frequency (lowest wavelength) that you wish to receive. In this condition the set is working at its peak and there should be a few whistles at the highest frequencies but other stations will be received satisfactorily. (Radio Luxembourg has been received perfectly well on four separate prototypes, it is no idle boast that it can be heard on the Mite.)

Variations

The circuit chosen was not one for individual transistors as is often the case with simple sets of this type. Several OC44s, OC71s and OC81s were tried with only a marginal difference in performance. Almost any similar transistors will work and WHITE and RED spot surplus transistors work perfectly well but here the performance varied (according to the individual transistors). By altering the resistance values virtually any types will work. This is a tedious business but even better performance can be achieved by doing this; an eye, however, should be kept on the current consumption which should not be much over 15mA.

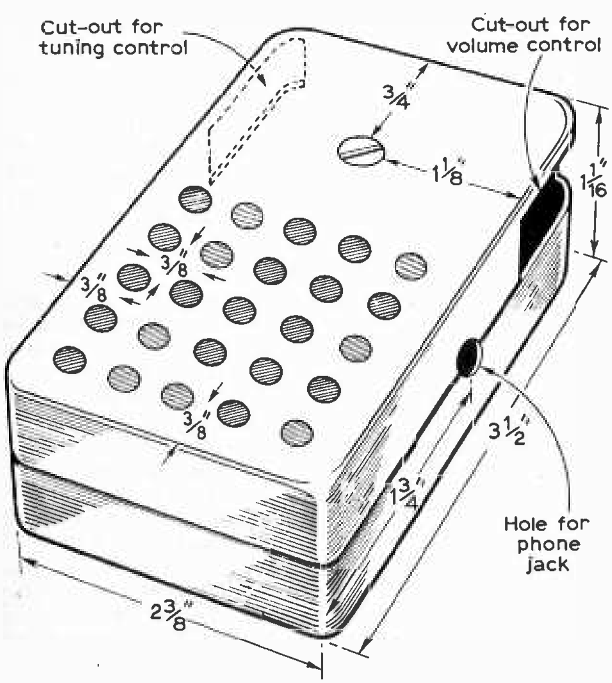
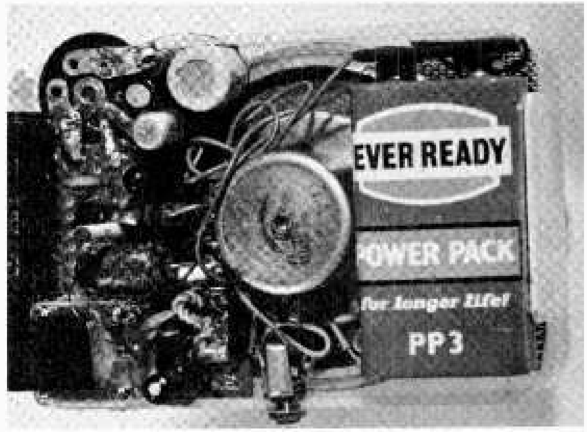


Fig. 4: The case for the Mite is made from the tops of two Boots' soap boxes.



An inside view of the Mite.

The case

The hardest part about building a radio of this sort is the case. Having searched high and low the author found that the tops of two "Boots" soap boxes were perfect when placed back to back. These give the perfect size to hold all the components and they are made from polystyrene, a plastic easily worked and glued.

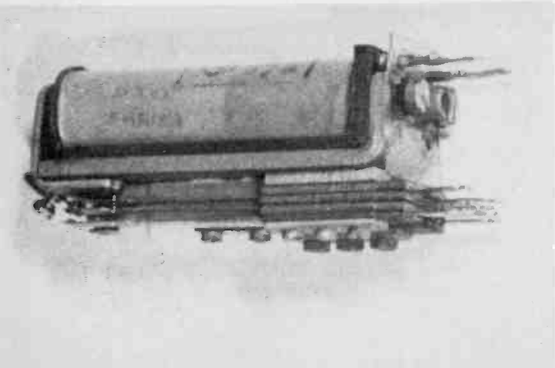
The drilling and shaping of the case are shown in Fig. 4. The loudspeaker holes can be drilled with a normal $\frac{3}{16}$in. drill and the cutouts for the dial and volume controls can be cut out by first scratching the desired shape with a sharp point and then carving out the plastic with the hot bit of a soldering iron. The rough edges can then be filed to shape. If the plastic cracks or breaks it can easily be glued with the cement used for plastic models. Heavy scratches disappear when rubbed hard with metal polish. The case, when finally finished can be painted, but care must be taken with the choice of paint and the best is that used for plastic models.

The loudspeaker is laid over the holes in the case (a piece of expanded speaker metal may be fitted between the speaker and the box itself). The earphone socket is screwed to one through the side of the box. A 1in. 4BA countersunk-head screw should be fitted through the hole provided, this should come just beside the speaker. A small piece of the waste polystyrene should be glued on the inside of the box, beside the screw and opposite the loudspeaker. A small washer can be dropped over the screw and this will rest on the rim of the loudspeaker and on the plastic pad. Two nuts should then be screwed to this, holding the loudspeaker in place. The speaker is a tight fit in the box and will be held securely.

An insulated washer should be fitted over the nuts and the circuit board dropped on, another nut fitted to secure it. The hole in the back should line up and a nut in the form of a screw fitted through the hole will hold the lot together. The jack socket, if fitted as shown, should locate the bottom exactly.

A finishing touch is to cover the tuning condenser knob with a piece of white adhesive paper and mark off the stations.

The Mite should be a very satisfying project for a beginner, relatively cheap and economical on the batteries. ■

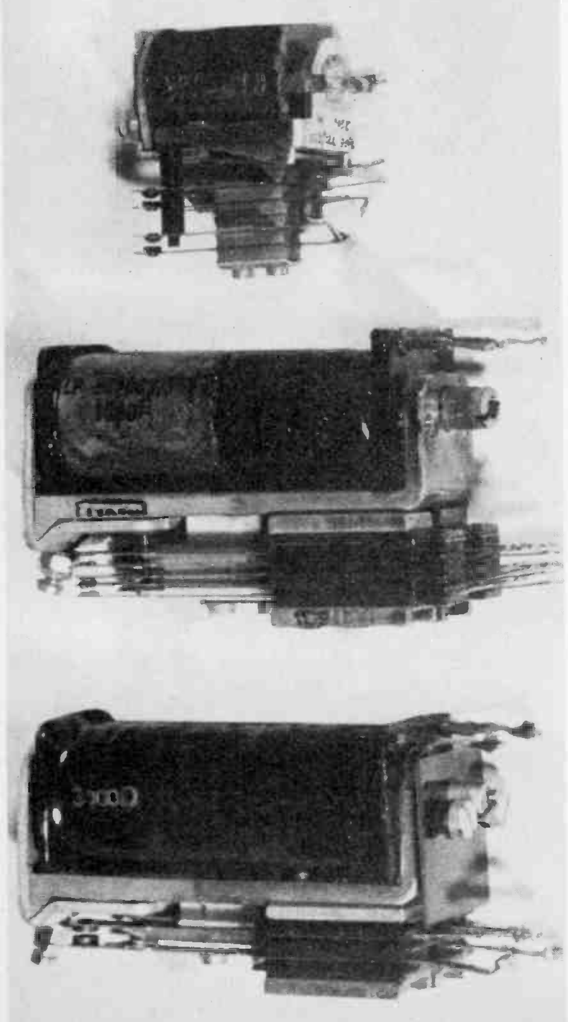


DESPITE the vast number of solid-state devices which are capable of acting as switches, the humble electromagnetic relay over a hundred years old, is still going strong, and in some new forms is still capable of opening up new applications.

In the older forms of relay, there are three quite distinct parts. The *magnetic circuit* consists of a coil of insulated wire wound round an easily magnetised ("soft") core which forms part of a complete circuit of magnetic material when the relay is actuated. When current is passed through the wire, magnetic *flux* (the magnetic equivalent of electric *current)* flows in the magnetic circuit and produces magnetic force at any gap in the magnetic circuit.

RELAYS AND THEIR USES

K. T. WILSON



The *mechanical system* varies considerably from one type of relay to another but always serves the same purpose; to convert the magnetic force at a gap in the magnetic circuit into mechanical force which can open or close switch contacts. In many relays, the mechanical system takes the form of a pivoted *armature*, one arm of which moves to close the magnetic circuit while the other arm operates the contacts.

The *contacts* of the relay perform the job of switching external circuits and are operated by the mechanical system. Various types of switching are possible: all the contacts may close ("make") when the relay operates, all may open ("break"), some may make and some break or all may changeover from one circuit to another. Contacts can also be arranged so that one type of operation takes place before another, where we find the make-before-break changeover, or break-before-make (much more common). The *materials* used for the touching surfaces of the contacts are extremely important, as these determine the life and application of the relay.

Using relays

In both amateur and professional use, there can be few components which are so badly chosen and so poorly used as relays. Much of this misuse is an example of familiarity breeding contempt; relays have been around so long that they are treated as something to be wired in and forgotten. Even a humble resistor must have its values of resistance and wattage calculated before it can be placed in circuit; considerably more effort is needed for the proper use of a relay, and this article outlines the choices which have to be made.

Most of these choices concern the contacts and the coil, for the mechanical system and the shape of the magnetic circuit are chosen by the designer of the relay. These choices affect the sensitivity of the relay, and may decide which type of relay is to be used, but cannot be changed.

The contacts

The number and type of contacts are quickly determined for any application by considering what circuits are to be switched by the relay. The contact materials must then be chosen. An ideal contact material would have negligible resistance, be completely resistant to corrosion and resist damage caused by sparking and excessive current. No ideal contact material exists, as might be expected, and we must in practice choose a material which comes closest to the requirements of a particular relay. These materials are, usually, silver, palladium-silver, silver-nickel or gold.

Silver is the most common contact material in small relays. Since silver has the lowest known resistivity of all metals, the contacts have a very low contact resistance and can therefore pass high currents without any risk of local welding which would cause the contacts to stick together. Silver tarnishes rapidly in the atmosphere, forming a film of poorly conducting silver sulphide, so that relays using silver contacts should have fairly high contact pressures and use quite high contact voltages in order to pierce this film each time the relay is operated. For example, silver contacts would be unsuitable for a sensitive relay switching a low voltage, such as in a model aircraft radio control circuit.

Palladium silver alloy has much higher contact resistance than pure silver, but is not nearly so easily contaminated by sulphide films. Sparking between the contacts does not readily transfer metal from one contact to another, making this a favourite material for inductive circuits.

Silver-nickel has low resistance and is not easily damaged by high currents. It is used for loads where high currents flow when contacts are *made*, for example, lamps (whose resistance is very low at switch-on) and capacitors (which take a high initial charging current).

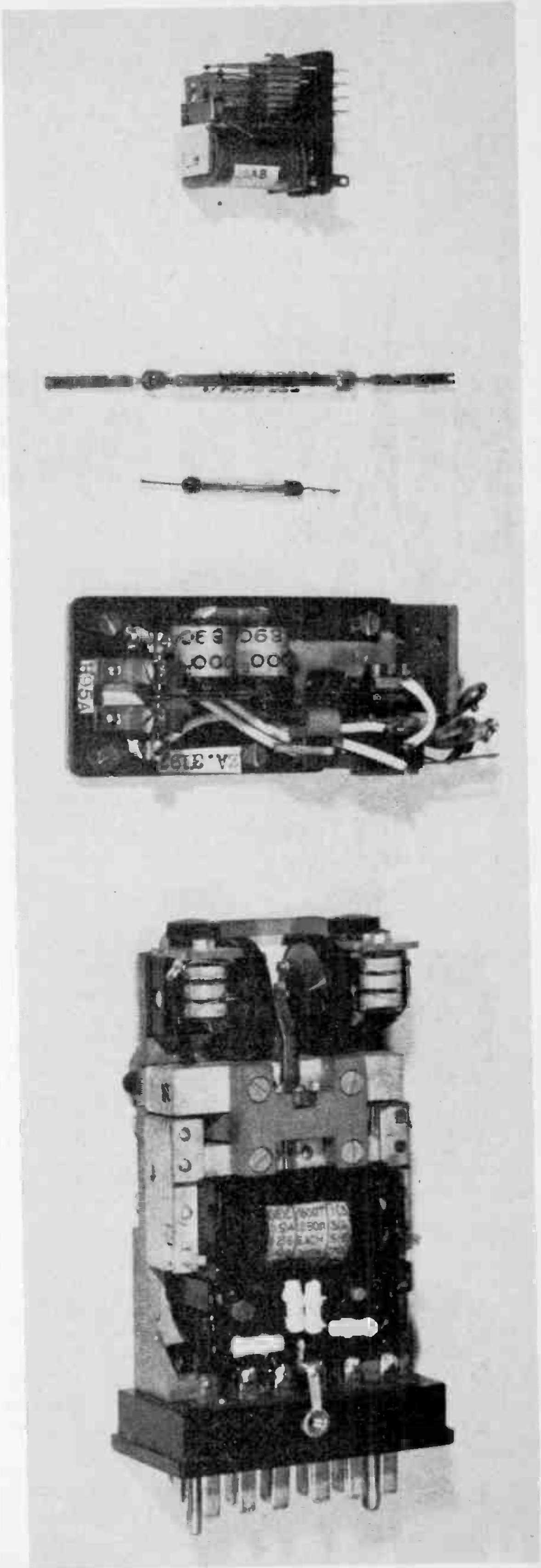
Gold is used as a contact material for switching very low voltages and low currents. The contacts do not corrode in any atmosphere, but are soft and have a short life if any rubbing occurs, so that gold contacts are used only if contact pressures are low and no rubbing action is used.

Voltage and current

The size of the contacts used determines what current rating can be applied to the relay. The voltage rating is decided by the contact material used (which must be resistant to the sparking which occurs when the contacts break), the final separation of the contacts (which must be enough to avoid continuous sparking) and the insulation of the contact leaves. In general, different ratings will be used for a.c. or d.c., for inductive, capacitive or lamp loads.

The highest ratings of current can be used when the contacts are switching a.c. to a resistive circuit, but the voltage rating in this case must be the *peak* voltage, which is 1·4 times the r.m.s. voltage usually quoted for alternating voltage. D.C. resistive loads at low voltages can be used at full rated currents, but high direct voltages require some derating, due to sparking. Sparking is always a problem with direct voltage, since the voltage across the contacts is steady when they break; when alternating voltage is being broken the sparking is always extinguished as the voltage reaches zero before reversing.

A.C. capacitive, lamp and inductive loads require



some derating; d.c. capacitive lamp loads require the lowest ratings quoted as well as choice of contact material which can cope with the surges of current which take place when such circuits are made. D.C. inductive circuits are the worst possible case, because of the back-e.m.f. across an inductor when current is broken. This back-e.m.f. can cause very serious sparking unless some means of suppression is used.

Spark suppression

When an inductive circuit is broken by relay contacts, the sparking due to the back-e.m.f. can be suppressed *either* by using the voltage to charge a capacitor through a resistor or by using a rectifier to bypass the excess voltage. The circuits involved are shown in Fig. 1. When CR suppression is used, the values of C and R are best found by experiment, using an oscilloscope to monitor the voltage across

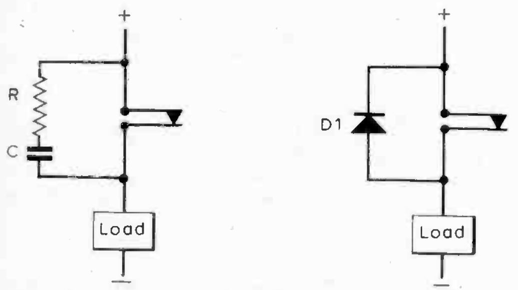


Fig. 1: Spark suppression of relay contacts for inductive loads.

the contacts. As a rough guide, R should be about half of the d.c. resistance of the load and C about half as many μF as the load inductance in Henrys (for example, for a load of 2H and 1k, use 1μF and 500Ω to start with) but these figures are only a starting point. When a rectifier is used for suppression, the only conditions are that the peak current and voltage ratings of the rectifier must not be exceeded. This is very much easier than deciding the correct values for a CR suppression circuit, and the low price of modern semiconductors has made this method the most frequently used.

The operating coil

The purpose of the operating coil of a relay is to provide the magnetic force which operates the mechanical system. To provide the magnetic force, the coil must have a high inductance, but the steady current through the coil is determined by its resistance, and both quantities are of considerable importance in relay operation.

As the current through a relay coil is steadily increased, a value is reached at which the armature completely operates the contacts. This value of current is called the *static pick-up current*, and is the minimum possible current to operate the relay. To be sure of operating the relay, a rather larger current, the *rated operating current* is needed.

When the *rated operating current* is applied to the coil of a relay, the contacts will close within a short time, the *pull-in time*, of applying the current, and, as long as the current is applied the coil will dissipate its *rated operating power*, which is the resistance of the coil multiplied by the square of the rated operating current.

Note carefully that applying excessive current improves pull-in time at the expense of contact bounce. Excessive current usually causes the contacts to come together with such force that they bounce apart again, causing irregular operation. Many cases of faulty relay operation are caused by circuit designers playing safe and specifying much more relay current than necessary.

When the current through the coil is decreased again, it eventually reaches a value, the *static drop-out current*, at which the relay switches back again. The static drop-out current is usually less than the static pick-up current.

Selecting a coil

Where a relay draws current from a mains supply through a switch or through the contacts of another relay, the selection of a coil is fairly easy. The contact arrangement used fixes the steady power which must be dissipated in the coil to ensure that the armature remains pulled over. Divide this operating power by the supply voltage to find the required operating current, and then divide supply voltage by operating current to find coil resistance. The coil is now completely specified. In some cases, makers specify the operating *voltage* so that the correct coil may be chosen without calculation.

When a relay is being driven by a valve or a transistor, the operating current is the important factor. The lowest possible current should be used so that the voltage across the relay (resistance × operating current) is nearly equal to the supply voltage at rated operating power. If a high operating current is used, this is a severe drain on the power pack and causes high dissipation in the valve or transistor. The voltage across the relay is much less than the line voltage, again the power dissipated in the valve or transistor is high. Ideally, a relay switched by a transistor would have practically all the line voltage across the relay coil, leaving only 0·5V across the transistor and at a low current.

The inductance of the coil becomes important when the relay is driven by a transistor. The speed with which a relay can be switched on depends on the mechanical time constant, which cannot be altered, and the electrical time constant L/R (L in Henrys, R in ohms). For a coil of 0·5H and 5Ω this would be 0·1 seconds, or 100mS. This time constant can be reduced by adding resistance *in series* with the coil, but the total voltage across coil and resistor is higher this way, and this method is best used with valve circuits.

When the current through a relay coil is switched off, there will be a surge of voltage across the switch in a direction which tends to keep current flowing. If the "switch" is a valve or a transistor, damage may be done, especially in the case of a transistor, unless the excess voltage can be removed. The problem is the same as that of spark suppression on contacts feeding an inductive load, and is best solved by using a rectifier to remove the excess voltage.

Latching Relays are so designed that when the relay operates, the armature is held by a "latch" which prevents the armature returning when the current through the coil is switched off. The release of the latch may be done mechanically, by pressing a button or lever on the relay (mechanical de-latching) or electrically by means of a second operating coil which operates the latch (electrical de-latching). Any relay may be made to latch electrically by means of the circuit of Fig. 3, which keeps current flowing through the coil even when the actuating switch is off. In this case, however, the current in the coil is not switched off as it would be in the genuine latching relay and the relay must be able to dissipate the heat produced.

Polarised Relays use a permanent magnet in addition to the electromagnetic system. The magnetic effect caused by the current in the coil either adds to or subtracts from (according to direction) the magnetic effect due to the permanent magnet so that several different effects can be obtained.

Double throw polarised relays have contacts which are normally held in one state (open or closed). When current flows in the coil so as to oppose the permanent magnet, the armature switches over, and remains over when current ceases; no switchover takes place if the current aids the permanent magnetism. A biased double throw polarised relay behaves similarly, but the contacts return to the unenergised position when the current in the coil falls below some specified amount. Double throw centre neutral polarised relays have a central rest position. When the coil is energised the armature moves either to left or to right of the central position, according to current direction, making contacts on that side only. When the current is cut off, the armature returns to the central position.

Reed switches are made by sealing two blades of metal into a glass tube. The metal is nickel-iron, which magnetises easily in a magnetic field, and loses its magnetism whenever the field is removed. The reeds are made to overlap within the tube so that a circuit can be made between them when they touch. To keep the contact resistance low, the overlapping areas can be coated with any of the contact materials mentioned earlier. When a magnetic field is applied to the tube, the reeds are magnetised in opposite senses, and the overlapping ends are attracted together, making the contact. When the magnetic field is removed, the nickel iron is demagnetised and its own springiness causes the contacts to separate. The leads to the reed relay form part of the magnetic circuit, and should not be cut to size unless the operating coil can cope with the increased current which may be required to pull the relay in reliably. Two reed switches are illustrated on the second page of this article.

Reed switches have considerable advantages over the conventional relay as far as contact contamination, contact resistance, speed of operation, life and insulation resistance are concerned. The power which must be applied to the coil to operate the reed switch is also low, and the separation of switch assembly from coil assembly also means that reed relays can be made to fit almost any application provided sufficient operating power is available. When a large number of reed relays are to be operated simultaneously, it is usually possible to pack them together into a tubular former, filling in gaps with soft iron wire to concentrate the magnetic flux, and then winding a coil round the whole assembly. The number of turns and operating current required is a matter of cut-and-try, but the circuitry simplification gained may easily make it worthwhile.

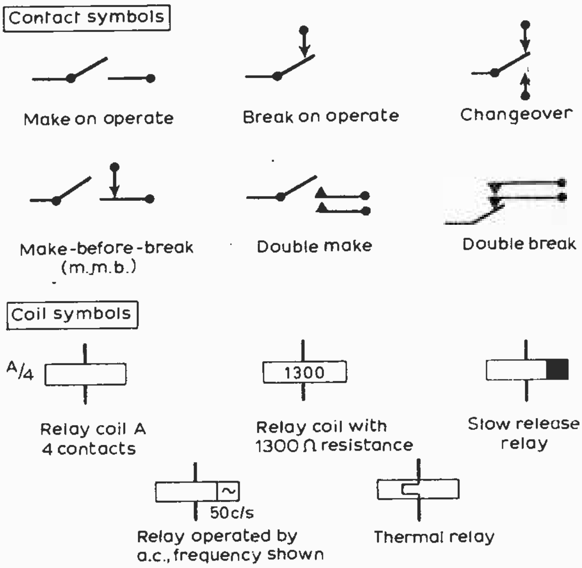


Fig. 2: Symbols for relay contacts and coils. The coils shown are drawn as they would appear in circuit, with their reference numbers such as A/3, which means relay A, 3 contacts. The contacts belonging to relay A are identified in circuit as A1, A2 and A3. All contacts must be shown as though the relay is unenergised.

Relay diagrams and circuits

Figure 2 shows a few of the symbols from BS 3939, 1966 (reproduced by permission of the British Standards Institution, 2 Park Street, London, W.1, from whom copies of the complete standard may be obtained). The symbols are used at the point where they occur in circuit, so that the relay coil may be shown in one place and its contacts at another, the two being linked by their code numbers.

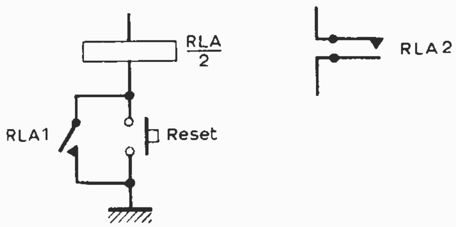


Fig. 3: An electrical latching circuit. When the reset button is pressed RLA/2 is energised, and the coil remains in this state through RLA1 closing. The circuit will not release until the supply voltage is removed.

As an example of the use of the symbols, Figs. 3, 4 and 5 show some useful circuits.

Figure 3 shows a self-latching circuit in which a pair of contacts holds a relay on and interruption of the supply de-energises the relay until it is reset. This type of circuit is found in time delay circuits (particularly in large transmitters where heaters must be on for one minute before h.t. is switched on) where the "reset" switch is a thermal switch. Such an application is shown in Fig. 4.

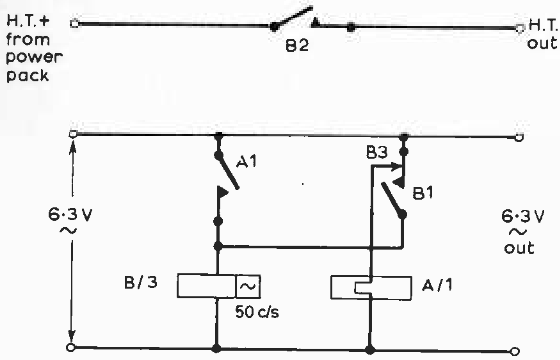


Fig. 4: A method of automatically delaying switch-on of an h.t. line. Notice that the thermal relay A/1 is taken out of circuit when B/2 operates, so that it can cool for the next time it is used.

Figure 5 shows a scale-of-two circuit using relays. This circuit seems to be little known, yet represents a considerable saving over the transistor scale-of-two driving a relay, which is so often used. Each relay coil is fed from a load resistor which must be capable of taking the full voltage of the supply across it.

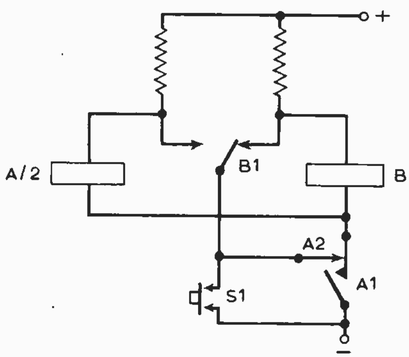


Fig. 5: A relay scale-of-two circuit.

When the operating switch S1 is closed, current flows through S1 and A2 so that A/2 is energised. B/1 is shorted out by the connection through B1 and A2. Since A/2 is energised, A1 closes and A2 opens. When S1 is released, B/1 is no longer shorted and B1 changes over; this has no effect since A2 is open.

When S1 is closed again, A/2 is shorted out through B1 and S1 so that A/2 releases, A2 closes to maintain the short and A1 opens. When S1 is opened again, both relays are de-energised and B1 returns to its initial position. Sequential switching can then be carried out by other contacts on either relay, and sets of "bistable" relays can be used to count in exactly the same way as transistor bistables. Note, however, that in the relay circuit either both relays are on or both are off, unlike the normal transistor circuit.

THE MW COLUMN

MEDIUM Wave stations in West and North Africa are frequently audible in the UK in the late evening. Two regulars from West Africa are Dakar (764) in Senegal, after Sottons leaves the air at 2300hrs GMT (except on Saturday) and Guinea (1403) which does not close down until midnight GMT. Both stations broadcast in French. Also from West Africa is ELBC (630) in Monrovia, Liberia, which comes through with programming in English after Vigra (629) has closed down. There is a nightly news bulletin at 2345hrs. ELBC may appear in some station lists as being on 650 but it is now on 630. The Canary Islands are well represented by three stations; RNE (620) is the easiest but EAK92 (827) *Radio Popular*, Las Palmas, and CES4 (1097) also in Las Palmas can generally be heard. EAK92 is mixed with EAJ1 in Barcelona and CES4 is mixed with EFE14 in Madrid but both stations can peak above the QRM. From Madeira CSB91 (1529) in Funchal is best looked for between 2330hrs and midnight GMT.

Quite a number of stations along the North African coast come regularly. Tangier (1232) is frequently strong at 2330hrs. Oujda (593) and Agadir (935) both in Morocco, are audible about the same hour. From Algeria there is Algiers 1 (980) with the Arabic programme and Algiers 2 (890) with the French programme. Tunis 1 (629) and Tunis 2 (962) are not too difficult around 2300hrs, both stations carrying Arabic programming. Benghazi (674) in Libya is rather more tricky though owing to the amount of QRM but the station peaks above it at times and has been heard at 2200hrs. Further east in Egypt, Batra broadcast the Voice of the Arabs on 620 and the internal Arabic programme on 818. Other Near East stations to be heard during the evening are Aleppo (746) in Syria, Baghdad (760) in Iraq (logged at 2130 hrs) and Jerusalem (677) in Israel. These three stations broadcast in Arabic.

Conditions to North America have been quite good this winter with peaks occurring from 29th November to 1st December and again from 3rd to 5th January. Robert Dinning of Ayrshire, Scotland, has heard CBN (640) at 0100hrs GMT; WNBC (660) 0105hrs; CKCM (620) 1112hrs; WCBS (880) 0117hrs; WINZ (940) 0150hrs; WINS (1010) 0152 hrs; CBA (1070) 0201hrs; WWVA (1170) 0159 hrs; WHAM (1180) 0150hrs; WOWO (1190) 0148hrs; WCAU (1210) 0200hrs; WGAR (1220) 0201hrs and WNEW (1130) at 0030hrs. These loggings were made during the period October 1st to January 4th, using an HRO receiver and either a 380ft V antenna at 50ft or an indoor loop. Thanks for the log Robert, many DXers would like to have your 380-footer. During the peak on 4th-5th January the writer logged WJR (760) Detroit. *The Great Voice of the Great Lakes;* KMOX (1120) St Louis; WOAI (1200) in San Antonio, Texas, using a CR100 receiver and an indoor loop antenna.

CHARLES MOLLOY

HOME WORKSHOP PRACTICE BY P. HAMLEY PART 2

IN the preceding article newcomers to the hobby were given details of a basic tool kit and some suggestions were made about possible sources of supply of components and materials with which to build equipment. It was suggested that dismantling old equipment could be a rewarding pastime, and in this article details of some special techniques which have proved in practice to be useful for dismantling and rebuilding equipment will be given.

Let us assume that an old chassis, practically complete, has been obtained, and is to be stripped for parts. Arrange your chassis on the workbench so that plenty of light falls on it, leaving as much clear space around it as possible. Just before attacking the old veteran, spend a few moments looking at the set and note the short neat wiring. Note the ample provision of anchorage points, the rigidity of the structure and the general cleanliness of the layout. The amateur can learn a great deal from good commercial design simply by looking at it.

This preliminary inspection will reveal parts which obviously have no further useful life, for example resistors which have been overrun and overheated. Components which are fractured, dented, charred or generally tatty should be ignored, although a component should not be discarded simply because it is dirty, this is easily removed and underneath may be a perfectly good part. With a little practice one learns to recognise many defective parts by their appearance.

Having decided roughly which parts are to be salvaged, start by cutting out all resistors with the side-cutting pliers. Keep the leads on all components as long as possible, but don't worry unduly if the leads are quite short as a method will be described of extending these. Do not attempt at this stage to sort resistors into values and ratings because subsequent testing might disclose a fairly high proportion of duds, and time spent sorting now would be wasted.

Having removed all the resistors, start on the capacitors. Here it is a good plan to make a distinction, certainly between electrolytics and other types, and preferably between the mica, paper and polystyrene capacitors.

During these operations remove any useful lengths of hook-up wire and any component which gets in the way. Valves and their bases should be removed carefully before turning the chassis on its back, and in the case of miniature bases it may be necessary to drill out the rivets which attach the base to the chassis. Small transformers, i.f. cans and coils of all descriptions should be carefully taken out, because even if the coils as wound are of no use, the coil formers almost certainly will be.

Diodes, rectifiers, plugs and sockets, fuses and fuse-holders, potentiometers, knobs and switches follow. Special care should be taken in removing grommets which are usually in short supply in the average workshop. Small nuts, bolts and washers, self-tapping screws and speednuts cost over a penny each to buy new and the tedium of removing these from the chassis is made more bearable when one reflects that, at a removal rate of one every five seconds, one is earning about three pounds an hour! Finally, the aluminium chassis is itself dismantled, and panels, brackets, stays and clips recovered.

During the cutting operations, it may be found that the jaws of the side-cutting pliers are frequently too wide to enter the space available for cutting. The writer overcame this problem by purchasing a very cheap pair of long-nosed pliers from a chain store and grinding a cutting-edge at the very tip of each jaw so that when the pliers were closed the ends of the jaws became, in effect, a tiny pair of shears which would work in the smallest space. Used sensibly on small gauges of wire only, the long-nosed cutters provide a very convenient means of reaching otherwise inaccessible bits and pieces.

Cutting is not, of course, the only way to recover the components. Sometimes the joints can be unsoldered, but owing to the professional practice of turning and clenching all leads firmly before soldering the method is not recommended. Printed circuit parts are somewhat easier to remove by unsoldering if they have been dip-soldered on assembly.

THE TESTMETER

Having fully dismantled the set, the various components now have to be tested. This brings us to the question of a workshop test meter; this was not included in the Basic Tools list for the simple reason that the constructor might wish to build his own multimeter. Many designs are available, including several excellent ones published in this journal. Most public libraries will have radio books containing good, simple designs for test meters. The author has built several of these to published designs, all of which worked satisfactorily, but a proprietary test meter will almost always be better than a home-made one.

The "heart" of a test meter is the meter movement, and the quality of this movement will determine the accuracy. Moving coil meters are available, ex-equipment, having full-scale deflection of $500\mu A$, which is quite sensitive, but these meters have no damping at all, and as often as not, do not have jewelled bearings. Furthermore, each meter has to be calibrated to suit the various circuits in which it will work, and this procedure alone calls for a sophisticated test set-up. In addition, the resistors used in a good test meter are very stable, one per cent or better and for the builder to buy these and other items new would largely offset the price advantage.

Finally, it is not at all easy to calibrate to a.c. ranges of a test meter and often the capacity across the meter rectifiers will lead to wildly inaccurate readings. All things considered, a good multimeter will prove to be a lifetime's investment.

Returning to our dismantling exercise, the test meter is set to the ohms range and one by one the resistors are checked, firstly for continuity, and secondly for actual value compared to the colour-coding. Resistors which are somewhat off tolerance are often perfectly useful if they are not to be used in a circuit where their deficiency would affect the operation of the circuit. Resistors which are widely off tolerance should be discarded, because the chances are they would be noisy, and might lead to irritating failures.

Capacitors are checked to ensure no d.c. path, and coils are tested for continuity and insulation from adjacent coils. Electrolytic capacitors cannot be fully tested by static methods, but if their resistance builds up smoothly to a few hundred kΩ they are probably worth a gamble. Rectifiers can be checked for a reasonable ratio between the *go* and *no-go* sides, bearing in mind that in a test meter the positive lead is the source of electrons in the external circuit.

Valve filaments can be tested for continuity using the ohms range of the test meter after referring to a valve data book for pin connections. Care must be taken not to exceed the voltage rating of the valve filament with the meter's own voltage. The only other static test which can be applied to a valve is to ensure that no undesirable d.c. path exists between the various electrodes.

Fuses, switches, lamps, etc. are tested similarly for correct operation, and potentiometers, particularly those of the carbon track type, can be checked for smooth increments.

Eventually it will be found that an hour or so spent snipping, cleaning and testing will be rewarded with several nice piles of usable components, and the remaining scrap is consigned to the scrap bin. The problem of short flying leads remains, however. This is best tackled by preparing a few short lengths of wire, each having one end hooked like a crochet needle. The leads on the component are then similarly hooked, and the extension wire hooks are engaged and clenched firmly with pliers. The union is then soldered, using a heat shunt near the body of the component, a hot, clean iron should be used to get the job done quickly. The writer must have reclaimed thousands of parts in this way over the years, with only a tiny proportion of failures.

MAKING YOUR OWN TOOLS

Earlier it was mentioned that certain tools and accessories could be made at home. Foremost amongst these are the punches of various types. On sale in engineers tool shops, and in certain hardware shops is a type of steel called *Silver Steel*, known by this name because of its chromium content. The steel is sold in thirteen inch lengths in round flat section, and in its normal state is tough, but readily worked by all the usual methods of filing, grinding, turning etc. However, when the steel is heated to a dull cherry red colour, and plunged in water it becomes very hard indeed, and can be used to cut any softer material. Thus it will be evident that if a length of Silver Steel is first formed into the shape of a chisel and then hardened, one has a useful addition to the tool kit.

However, in the fully hard condition, the Silver Steel is far too brittle for most uses and consequently they are always tempered or "let back" before use. The tool is heated, this time away from the cutting edge until a narrow band of colours begins to run away from the area of heating. The colours will be seen to be a pale yellow, dark yellow, light blue, dark blue, cherry red, and bright red. Now the object in tempering is to run the pale yellow just down to the cutting edge, and then immediately dip into clean cold water. The tool is then ready for use, although a little grinding or honing of the cutting edge will probably improve the performance of the tool and extend its life between regrinds.

It should be noted that hardened Silver Steel can be softened by once again heating to a cherry red, and allowing it to cool slowly in air. Because of this, care must be taken when tempering not to overheat the tip of the tool, nor to delay the dipping unduly. The heat treatment of Silver Steel becomes child's-play with a little practice.

The question of heating the Silver Steel to the correct colour is another matter. Those who cook by gas will have no difficulty, using a good fierce flame on the cooker, an open coal fire will also do the trick. Those, who, like the author, live in a central-heated, electric cooker type house will probably have to invest in a blowlamp of some description. The author uses a small paraffin blowlamp, which has so many other uses around the house that it is not really an integral part of the electronics tool kit. The small Butane lamps on sale will produce adequate heat to treat all but the largest steel sections.

Now we have a means of making not only standard tools such as centre punches, chisels, piercing punches, screwdrivers, gouges, scrapers and the like, but also useful specials such as extension Allen keys, socket drives, trepanning tools, boring bars and literally hundreds of others.

Another aid to good construction practice in the workshop is a pair of extension jaws for the vice. These are made from a length of angle-iron obtainable from steel stockholders. Each jaw should be about 8in. in length, and all sides and ends are filed flat and square, and a small radius filed on the

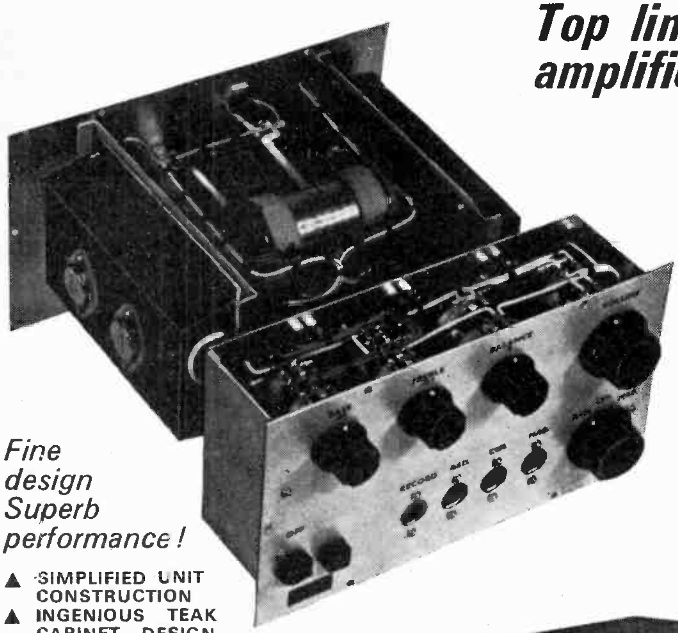
—continued on page 953

P.W. DOUBLE 12

As described in this month's Practical Wireless

Top line integrated hi-fi stereo amplifier featuring

PEAK SOUND "CIR-KIT"



Fine design Superb performance!

▲ SIMPLIFIED UNIT CONSTRUCTION
▲ INGENIOUS TEAK CABINET DESIGN
▲ PROFESSIONAL IN EVERY WAY AND MONEY SAVING TOOI

Peak Sound are indeed proud to be associated with this superb P.W. design and that so much of it is made possible because of Peak Sound products and design techniques. Basically, the "P.W Double 12" demonstrates the value of using "Cir-Kit" in modern circuit board units either for single or prototype examples, but in this instance, Peak Sound have contributed much more to the success of this project. This includes the remarkable power amplifiers, the power pack and the ingeniously styled cabinet which almost assembles itself, it is so simple to build. Read about the "P.W Double 12" in this issue right now. Then when you build this exciting new design be sure you do it with authentic, exact-to-specification Peak Sound kits as described.

"Cir-Kit" is at the heart of building this fine design. Made from almost 100% pure copper with unique adhesive backing, it is the superb circuit builder for all requirements. In 5' spools, $\frac{1}{16}$" wide, 2/- each.

"CIR-KIT" makes it possible!

This is your "P.W. Double 12" shopping list

As you follow through stage by stage with P.W. these are the Peak Sound kits you will require. They are exact to specification. Transistors included.

	£	s	d
2 Spools of "Cir-Kit" at 2/- each		4	0
2 Pre-amp and tone control kits	4	15	0
4 3¾in x 2in "Cir-Kit" matrix boards		7	0
2 PA.12-15 Power Amplifier Kits	7	19	0
2 Heat Sink assemblies		12	0
1 PS.45K 45 volt power supply kit	4	10	0
1 Pack-flat afrormosia teak finished Cabinet kit	2	12	6
5 Controls as specified	2	0	0
TOTAL COST	£22	19	6

Metal work (make or buy), knobs, plugs and sockets, fuses etc. allow £3.0.0.

Go to your Dealer NOW

for your authentic Peak Sound Kits. In case of difficulty, please send direct, giving the name and address of your usual supplier where possible and add 11/- postage for complete assembly, or 5/6 if without power pack.

TRADE ENQUIRIES INVITED

▲ Abridged specification

Formation—Two pre-amp panels, two tone control panels, two power amplifier modules, power supply unit on chassis, housed within teak finished cabinet.

Controls—Bass and treble cut and lift based on Baxandall circuitry/Volume/Balance/ Rotary selector.

Input Sensitivity—Magnetic P.U. (per channel) 2·5mV into 68kΩ. Ceramic P.U.—25mV into 27K. equalised for flat response. Radio/Aux. 60mV. HIGH OVERLOAD FACTOR ON ALL INPUTS.

Frequency Response—20Hz to 30KHz ± 1dB overall.

Output—12 watts per channel into 15Ω (8Ω speakers may be used).

Negative Feedback—43dB over each section.

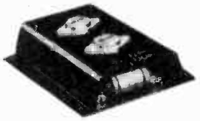
Power required—45V D.C. (supplied by built-in power unit).

Cabinet—Afrormosia teak finish, pack-flat, easy to build kit. Size 9½ x 5¼in. high x 9¾in. deep.

Transistors—Ultra low noise in pre-amp and tone control stages.

PERFORMANCE CHARACTERISTICS, PARTS REQUIRED, ETC., SEE OTHER PAGES IN THIS ISSUE

THESE PEAK SOUND PRODUCTS WILL HELP



PA.12-15 POWER AMPLIFIER

As specified for "P.W. Double 12" and available ready built complete with heat sink for mounting directly into position as described, but can also be used in other applications. Also available as a kit less heat sink and board.

Built **£5.19.6**

Kit (less heat sink, board and "Cir-Kit") **79/6**

Heat sink and baseboard assembly **10/-**

Please add 2/6 p/p either model if ordered direct, or 5/- for two.

ES. 10-15 BAXANDALL SPEAKER

This easy to build loudspeaker provides genuine hi-fi standards by the use of unique equalising principles. Frequency response 60–14,000Hz (100–10kHz ± 3dB). Easy-to-build kit including 18 x 12 x 10in cabinet.

£9.17.6 + £1.2.1 P/Tax

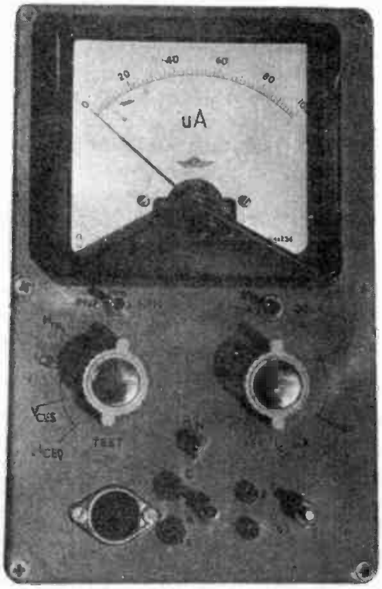
(Carr. 11/6). Leaflet available.

PEAK SOUND (HARROW) LTD., 32 ST JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY, *Phone EGHAM 5316*

In next month's PRACTICAL WIRELESS

HOW TO SOLVE YOUR TRANSISTOR PROBLEMS

Every constructor should have a means of checking transistors and other semiconductors if he is to obtain the best from his equipment. This compact unit to be described next month determines the important parameters and will be invaluable in deciding whether cheap unmarked devices can be used in particular projects.

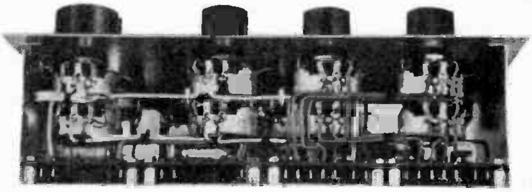


PULSE CIRCUITS IN OPERATION

Transistors are ideal switches, thus lending themselves for use in multivibrators and digital circuitry. Bistable, monostable and astable multivibrators are described in detail in four articles starting next month which will enable those who treat these devices as black boxes to adapt them for different circuit conditions.

THE PW 'DOUBLE-12' HI-FI STEREO AMPLIFIER

Continuing constructional details are given for building this true high fidelity project suitable for a variety of inputs. Next month's PRACTICAL WIRELESS deals with the completion of the preamplifier and the metalwork for the complete unit.



A COMBINED LOUDSPEAKER AND S-METER

Many communications receivers are without a loudspeaker and a signal strength meter. These can easily be put into one cabinet and connected to the receiver. The Author has done this and explains his method in next month's issue.

LOOK OUT FOR THESE IMPORTANT FEATURES NEXT MONTH IN

PRACTICAL WIRELESS

May issue
3/- on sale
Tuesday April 8

ORDER YOUR COPY NOW!

ONE-SIXTY SUPERVERTER

A. S. CARPENTER G3TYJ

CONTINUED FROM MARCH ISSUE

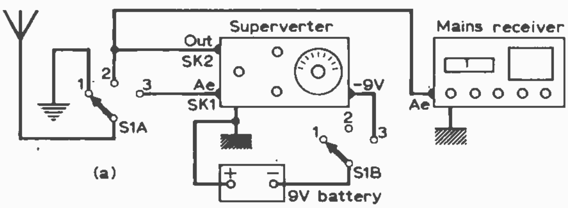
Testing

The Superverter may be tested initially in conjunction with the station receiver switched to the medium waveband and tuned to a quiet spot at the high frequency end of its scale. When a grid-dip oscillator is available it is a simple matter to get T1, T2 and T3 roughly pre-tuned before switch-on; in other cases a signal generator may be used but when no signal frequency setting equipment is available a more tedious "test and try" procedure must be adopted and patience will be required!

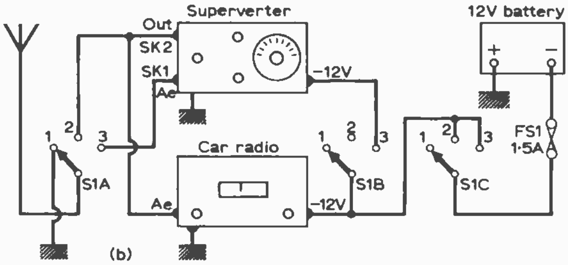
Socket SK2 may be connected initially to the receiver aerial socket via screened lead and an aerial applied to socket SK1. With a 9V battery connected across C3—observing polarity—some noise or signals should be heard as VC1 is manipulated with VR1 at maximum. Immediately any signal is heard—and a weak one is preferred—the tuning should be left and the cores of IFT1 carefully adjusted for maximum received signal strength, attenuating as required by means of VR1. When both cores have been peaked —and they do so quite sharply—they should be left; the receiver tuning should also be left untouched.

It is thereafter a matter of manipulating the cores of T3, T2 and T1 to locate the band centre and when this has been found it should be possible to tune over the whole range of 1800-2000kc/s by using VC1 and peaking as required with the panel control provided. The vanes of VC1 should be almost fully disengaged at the high frequency end of the band but if they are not a slight adjustment to the core of T3 should do the trick. If it is found that the tuning range of VC1 is excessive C11 should be reduced in value; similarly a restricted tuning range can be increased by making C11 larger in value. In either case the core of T3 will need slight readjustment.

When the Superverter is to be used solely for "Top Band"/M phone working, full band coverage due to VC1 is unimportant for few such QSOs take place near the band edges. If no signals can be received TR2 may not be oscillating—although this is unlikely to be the case if the components used in this section are above suspicion and wiring is correct; alignment may be a long way out. Fixed tuning capacitors C1 and C6 may need to be modified slightly but if their values have to be reduced to get on the band either too much core is "in" the coil or insufficient turns have been removed.



S1 = 2-pole, 3-way, rotary switch.
1..... Off – aerial grounded.
2..... Superverter 'Out' but aerial through to main receiver.
3..... Main receiver fed by superverter 'On'.



S1 = 2-pole, 3-way, rotary switch
1..... Off – aerial grounded
2..... Superverter 'Out' car radio 'On' and aerial connected.
3..... Car radio plus superverter 'On' with aerial to superverter.

Fig. 8: Some suggested switch forms.

Switchery

The wiring of the selector switch and SK1 and SK2 must be left to individual requirements but some suggestions are given in Fig. 8, S1 being the appropriate switch.

At Fig. 8a the Superverter is associated with a mains receiver itself not capable of tuning "Top Band" and in this case a small dry battery can be located on the chassis for powering purposes.

In Fig. 8b the Superverter is associated with a 12V car radio both items being powered by the car battery via a fuse. In cars of recent manufacture a single wire supply line is possible the "return" being made through the car frame. A positive earth is supposed. Aerial switching is also shown in Fig. 8.

In Fig. 9 a more elaborate switching system is adopted for a full mobile "Transmit/Receive" function permitting single switch control. The transmitter depicted is the popular "Ten-Five" which was described in the January, 1967 issue of PRACTICAL WIRE

LESS. This transmitter has attracted many praiseworthy reports and has proved an excellent little rig within the range of its capabilities. All legends in Fig. 9 are thus identified with the "Ten-Five" Transmitter.

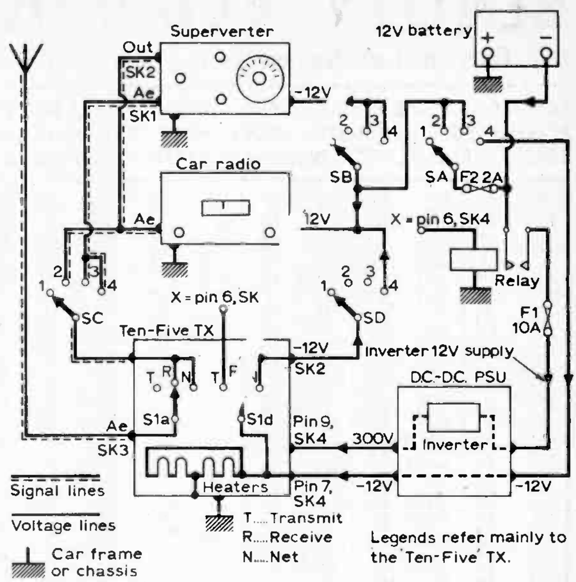
Ganged switches SA, SB, SC and SD (a four-pole, four-way banked rotary component) permit of the following conditions; switch positions are:

1 All units "dead" and the aerial disconnected.
2 Car radio "On" alone via fuse F2. Aerial connected to receiver.
3 Car radio "On" *plus* Superverter "On". Aerial through to the Superverter. Protection by fuse F2.
4 Car radio "On", Superverter "On" via fuse F2 and transmitter switch S1d. Transmitter heaters "On" and aerial through to Superverter via transmitter switch S1a. Looking now at transmitter panel function switch S1d it is seen that when "Transmit" is selected both the Superverter and the car radio receiver "die" instantly for lack of power which is automatically transferred by this switch to the relay coil at "X". The relay operates and 12V d.c. passes via fuse F1 to a d.c.-d.c. transistorised inverter which starts up instantly to provide 300V d.c. for the transmitter. Simultaneously, since transmitter function switches S1a and S1d are ganged together the aerial is applied to the transmitter tank circuit.* Use of a car with positive "earth" is assumed. The functions in this connection can be readily understood if the plan of Fig. 9 is compared with the original "Ten-Five" Transmitter design, the only additional item required being a small transmitter panel-controlled switch connected between tag "T" of S1d and pin 7 of SK4; this switch will provide h.t. for "Netting" purposes.

Tuning other bands

Although it may be possible to make the Superverter tune bands other than "160" this has not been

* Using the "Ten-Five" plus car radio/Superverter current demands from the car battery are: "Transmit", 3·8A; "Net", 2A; "Receive", 0·9A (radio only); 1·5A (Radio plus heaters of transmitter).



Note: A panel-fitted on/off switch is also required between tag 'T' S1d and pin7, SK4 to produce HT for 'Netting' when necessary.

Fig. 9: A complete "Mobile" Transmit/Receive (single switch function) Switching system. The transmitter is the "Ten-Five".

attempted, the aim being to produce a first-class item of equipment for /M working. Some suggestions regarding other bands are included, however, but results obtained are quite problematical.

To tune a different band both r.f. and interstage circuits plus the oscillator section must be adjusted and different coils will be needed. The intermediate frequency—and hence IFT1—remain untouched. Coils for use in the Superverter each require three windings and some suggestions regarding approximate component values required for some amateur bands and utilising ready-made coils by Denco are given in Table 1. It must be again emphasised that values are only calculated and no practical tests whatever have been made. ■

Table 1. *Calculated values are for 1·6Mc/s output—excluding "stray" circuit capacitances.*

Band centre (Mc/s)	T1			T2			T3				
	L µH	Range No.	pF value	L µH	Range No.	pF value	Osc F'cy	L µH	Range No.	pF value	C pin
3·65 (80)	27·2	3B	70	27·2	3Y	70	5·25	66	2W	15	2
								13·6	3W	70	3
7·05 (40)	2·9	4B	175	2·9	4Y	175	8·65	13·6	3W	27	3
14·15 (20)	2·9	4B	39	2·9	4Y	39	15·75	2·22	4W	47	4
21·25 (15)	2·9	4B	20	2·9	4Y	20	22·85	2·22	4W	23	4
29·0 (10)	0·65	5B	47	0·65	5Y	47	30·6	2·35	5W	47	6

Blue=Blue coil. Y=Yellow coil. W=White coil. C pin=Osc. coil chassis pin.
[All coils are miniature transistor types by Denco].

BENTLEY ACOUSTIC CORPORATION LTD.

Suppliers to H.M. Government **38 CHALCOT ROAD, LONDON, N.W.1** Telephone Primrose 9090

ALL GOODS LISTED BELOW, ACTUALLY IN STOCK, ALL GOODS ARE NEW, BEST QUALITY MANUFACTURE ONLY, AND SUBJECT TO MAKERS' FULL GUARANTEE. PLEASE NOTE THAT WE DO NOT SELL ITEMS FROM USED EQUIPMENT NOR MANUFACTURERS' SECONDS AND REJECTS, WHICH ARE OFTEN DESCRIBED AS "NEW AND TESTED" BUT HAVE A SHORT AND UNRELIABLE LIFE.

OA2 5/9
OB2 6/-
OZ4 4/3
1A3 4/6
1A5 5/-
1A7GT 7/-
1C1 5/6
1C2 7/9
1C3 7/-
1C5 4/9
1D5 6/9
1D6 9/6
1FD1 6/-
1FD9 3/9
1G6 6/-
1H5GT 7/-
1L4 2/6
1LD5 5/-
1LN5 8/-
1N5GT 7/9
1P1 7/-
1P10 4/9
1P11 5/6
1R5 5/6
1S4 4/9
1S5 3/9
1T4 2/9
1U4 5/9
1U5 6/9
2A7 12/6
2D13C 7/-
2D21 5/6
2X2 4/9
3A4 3/6
3A5 10/-
3B7 5/-
3D6 3/9
3Q4 6/6
3Q5GT 6/-
3S4 4/9
3V4 5/6
4D1 3/9
5R4GY 8/9
5U4G 4/9
5V4G 7/6
5Y3GT 5/6
5Z3 8/-
5Z4G 6/9
6/30L2 12/6
6A8G 5/6
6AC7 3/-
6AG5 3/6
6AJ5 8/6
6AK5 4/6
6AK6 6/-
6AK8 6/-
6AL5 2/3
6AM4 16/6
6AM5 2/6
6AM6 3/3
6AQ5 4/9
6AR6 20/-
6AT6 4/-
6AU6 5/-
6AV6 5/6
6B8G 2/6
6BA6 4/-
6BE6 4/3
6BG6G 20/5
6BH6 7/6
6BJ6 6/9
6BQ5 4/6
6BQ7A 7/-
6BR7 8/6
6BR8 8/-
6BS7 16/6
6BW6 12/3
6BW7 11/-
6BX6 4/6
6BZ6 6/-
6C4 2/9
6C5GT 6/-
6C6 3/9
6C9 11/-
6CD6G 19/6
6CD7 9/6
6CH6 6/-
6CL6 8/6
6CW4 12/-

6D3 7/6
6D6 3/-
6E5 7/6
6F1 8/9
6F6G 4/-
6F6M 12/6
6F12 3/3
6F13 3/6
6F14 15/-
6F15 9/6
6F17 12/6
6F18 7/6
6F23 12/3
6F24 11/9
6F25 11/9
6F28 10/6
6F32 3/-
6G6G 2/6
6H6GT 1/9
6J5G 3/9
6J5GT 4/6
6J6 3/-
6J7G 4/9
6J7GT 6/6
6K6GT 5/-
6K7G 2/-
6K7GT 4/6
6K8G 3/-
6K8GT 7/-
6L1 19/6
6L6GT 7/9
6L7 12/6
6L18 5/-
6L19 19/-
6LD20 6/6
6N7GT 6/6
6P1 12/-
6P25 12/-
6P26 12/-
6P28 25/-
6Q7G 6/-
6Q7GT 8/6
6R7G 7/-
6SA7GT 7/-
6SA7 7/-
6SC7GT 6/6
6SG7 6/-
6SH7 3/-
6SJ7 6/6
6SK7GT 4/6
6SL7GT 4/9
6SN7GT 4/6
6SQ7GT 6/-
6SS7 3/-
6U4GT 12/-
6U5G 5/-
6U7G 7/-
6V6G 3/6
6V6GT 6/-
6X4 3/6
6X5GT 5/-
6Y6G 8/-
6Y7G 12/6
7A7 12/6
7AN7 6/-
7B6 10/9
7B7 7/-
7C6 6/-
7D6 15/-
7H7 5/6
7R7 12/-
7S7 20/-
7V7 5/-
7Y4 6/6
7Z4 4/6
9BW6 7/-
9D7 9/-
10C1 12/6
10C2 10/-
10D1 8/-
10D2 14/7
10F1 15/-
10F9 9/-
10F18 7/6
10LD3 7/6
10LD11 10/-
10P13 12/-
10P14 12/6
12A6 3/6

12AC6 7/-
12AD6 6/-
12AE6 7/6
12AT6 4/6
12AT7 3/9
12AU6 4/9
12AU7 4/6
12AV6 5/6
12AV7 8/-
12AX7 4/6
12AY7 9/9
12BA6 6/-
12BE6 5/9
12BH7 6/-
12E1 17/-
12J5GT 2/6
12J7GT 6/6
12K5 10/-
12K7GT 5/9
12K8GT 7/6
12Q7GT 4/6
12SA7GT 6/9
12SC7 4/-
12SG7 3/-
12SH7 3/-
12SJ7 4/6
12SK7 4/9
12SQ7GT 7/6
12SR7 5/-
12Y4 2/-
13D1 5/-
13D3 9/-
14H7 9/6
14S7 15/-
18 12/6
19 10/6
19AQ5 4/9
19H1 40/-
20D1 13/-
20D4 20/5
20F2 14/-
20L1 13/-
20P1 17/6
20P3 18/-
20P4 18/6
20P5 18/-
25A6G 7/6
25L6G 5/6
25Y5 6/-
25Y5G 8/6
25Z4G 6/-
25Z5 7/-
25Z6G 8/6
30C1 6/6
30C15 13/6
30C17 12/6
30C18 8/9
30F5 11/9
30FL1 15/-
30FL12 16/-
30FL13 8/-
30FL14 12/6
30L1 6/-
30L15 13/9
30L17 13/-
30P4 12/-
30P4MR 17/6
30P12 13/-
30P19 12/-
30PL1 15/-
30PL13 15/-
30PL14 15/-
30PL15 15/-
35A5 15/-
35D5 11/9
35L6GT 5/9
35W4 4/6
35Z3 10/-
35Z4GT 4/9
35Z5GT 6/-
42 5/-
43 10/-
50B5 6/3
50C5 6/3
50CD6G 41/-
50L6GT 6/-
52KU 14/6
53KU 14/6

72 6/6
77 6/6
78 4/9
85A2 8/6
90AG 67/6
90AV 67/6
90CG 34/-
90CV 33/6
90C1 16/-
150B2 14/6
150C2 5/9
161 15/-
185BT 35/-
301 20/-
302 16/6
303 15/-
305 16/6
306 13/-
807 11/9
956 2/-
1821 10/6
5763 10/-
6060 5/6
7193 10/6
7475 4/-
A1834 20/-
AC2PEN 19/6
AC2PEN/DD 19/6
AC6PEN 4/9
AC/PEN (5) 19/6
AC/PEN (7) 19/6
AC/TH1 10/-
AC/TP 19/6
AC/VP1 12/-
AC/VP2 10/6
ATP4 2/3
AZ1 8/-
AZ31 8/9
AZ41 7/6
B36 4/6
B319 6/-
BL63 10/-
CK506 6/6
CL4 19/6
CL33 18/6
CV6 10/6
CV63 10/6
CV271 12/6
CV428 19/-
CY1 16/4
CY1C 10/6
CY31 7/6
D1 1/3
D41 10/6
D63 5/-
D77 2/3
DAC32 7/-
DAF91 3/9
DAF96 6/-
DCC90 10/-
DD4 10/6
DD41 12/6
DDT4 8/3
DF33 7/9
DF72 30/-
DF91 2/9
DF96 6/-
DF97 10/-
DH30 15/6
DH63 6/-
DH76 4/6
DH77 4/-
DH81 10/-
DH101 25/-
DH107 16/11
DK32 7/-
DK40 10/-
DK91 5/6
DK92 7/9
DK96 7/-
DL33 6/-
DL35 4/9
DL72 15/-
DL75 30/-

DL92 4/9
DL94 5/6
DL96 7/-
DL810 9/6
DM70 6/-
DM71 7/6
DW4/350 8/6
DW4/500 8/6
DY86 5/9
DY87 5/9
E80F 24/-
E83F 24/-
E88CC 12/-
E180CC 8/-
E180F 17/6
EA50 1/6
EA76 13/-
EABC80 6/-
EAC91 3/-
EAF42 8/3
EB34 7/6
EB41 4/6
EB91 2/3
EBC41 8/6
EBC81 5/9
EBC90 4/-
EBC91 5/6
EBF80 5/9
EBF83 8/-
EBF89 6/3
EBL21 11/-
EC52 4/3
EC53 12/6
EC54 6/-
EC70 4/9
EC86 10/3
EC88 10/3
EC92 6/6
ECC31 15/6
ECC32 4/6
ECC33 29/1
ECC34 29/6
ECC35 4/9
ECC40 9/6
ECC81 3/9
ECC82 4/6
ECC83 4/6
ECC84 5/6
ECC85 5/-
ECC88 7/-
ECC91 3/-
ECC189 9/6
ECC804 12/6
ECC807 27/-
ECF80 6/6
ECF82 6/6
ECF86 9/-
ECF804 42/-
ECF805 12/6
ECH21 12/6
ECH35 5/9
ECH42 9/6
ECH81 5/3
ECH83 8/-
ECH84 7/-
ECL80 6/6
ECL82 6/-
ECL83 9/-
ECL84 12/-
ECL85 11/-
ECL86 8/-
ECLL800 30/-
EF22 12/6
EF36 3/6
EF37A 7/-
EF39 5/-
EF40 8/9
EF41 9/-
EF42 3/6
EF50 2/6
EF54 10/-
EF73 6/6
EF80 4/6
EF83 9/6
EF85 5/3
EF86 6/-

EF89 4/9
EF91 3/3
EF92 2/6
EF94 5/-
EF95 4/6
EF97 10/-
EF98 10/6
EF183 5/9
EF184 5/9
EF804 20/5
EH90 6/6
EL32 3/6
EL33 12/-
EL34 9/6
EL35 10/-
EL36 8/6
EL37 17/3
EL41 9/3
EL42 9/9
EL81 8/-
EL83 6/9
EL84 4/6
EL85 7/6
EL86 8/-
EL91 2/6
EL95 5/-
EM71 14/-
EM80 5/9
EM81 6/9
EM84 6/-
EM85 11/-
EM87 7/3
EY51 6/9
EY81 7/-
EY83 8/3
EY84 7/6
EY86 6/-
EY87 6/-
EY88 7/6
EY91 3/-
EZ35 5/-
EZ40 7/3
EZ41 7/3
EZ80 4/3
EZ81 4/6
EZ90 3/6
FC4 12/6
FW4/500 6/6
FW4/800 10/-
GZ30 7/-
GZ32 9/-
GZ33 12/6
GZ34 10/-
GZ37 14/6
H30 5/-
HABC80 8/-
HL2 7/6
HL13C 4/-
HL23 6/-
HL23DD 5/-
HL41 3/9
HL41DD 19/6
HL42DD 8/-
HN309 27/4
HVR2 8/9
HVR2A 8/9
1W3 5/6
1W4/350 5/6
1W4/500 6/-
KT2 5/-
KT8 34/6
KT32 5/6
KT41 19/6
KT44 20/-
KT61 12/-
KT63 4/-
KT66 17/3
KT74 12/6
KT76 7/6
KT88 29/-
KTW61 8/6
KTW62 10/-
KTW63 5/9
KTZ41 6/-
LN309 8/9
LP2 9/6
LZ319 6/6

LZ329 6/6
MHD4 8/3
MHL4 12/6
MHLD6 7/6
MU12/14 4/-
MX40 12/6
N78 38/4
N108 26/7
N152 7/3
N339 25/-
N359 7/3
P61 2/6
PABC80 7/3
PC86 9/6
PC88 9/6
PC95 8/3
PC97 7/9
PC900 8/3
PCC84 6/-
PCC85 6/6
PCC88 9/9
PCC89 9/6
PCC189 9/6
PCF80 6/6
PCF82 6/-
PCF84 8/-
PCF86 8/6
PCF801 7/-
PCF802 9/-
PCF805 8/9
PCF806 11/6
PCF808 12/6
PCL81 9/-
PCL82 7/-
PCL83 8/9
PCL84 7/6
PCL85 8/3
PCL86 8/3
PCL88 15/-
PEN45 7/-
PEN45DD 12/-
PEN46 4/-
PEN383 9/6
PEN384 11/6
PEN453DD 19/6
PENA4 19/6
PEN/DD 4020 17/6
PFL200 12/-
PL33 19/6
PL36 9/6
PL38 19/9
PL81 7/3
PL81A 10/6
PL82 6/6
PL83 6/6
PL84 6/3
PL302 12/-
PL500 12/-
PL504 12/6
PL509 28/9
PL802 15/-
PM84 7/9
PX4 14/-
PY31 6/6
PY32 9/6
PY33 9/6
PY80 5/3
PY81 5/3
PY82 5/-
PY83 5/6
PY88 6/3
PY301 12/6
PY800 6/6
PY801 6/6
PZ30 9/6
QP21 5/-
QQVO3/10 27/6
QS75/20 10/6
QS150/15 9/6
QVO4/7 8/-
R10 15/-
R11 19/6

R12 6/9
R16 34/11
R17 17/6
R18 9/6
R19 6/6
RK34 7/6
SP4 9/-
SP13C 12/6
SP42 12/6
SP61 3/3
TDD4 8/3
TH4B 10/-
TH233 7/-
TP22 5/-
TP25 5/-
TP2620 8/9
TY86F 12/2
UABC80 5/9
UAF42 9/6
UB41 6/6
UBC41 7/6
UBC81 7/-
UBF80 5/9
UBF89 6/9
UBL21 9/-
UC92 5/6
UCC84 8/-
UCC85 6/6
UCF80 8/3
UCH21 9/-
UCH42 9/3
UCH81 6/6
UCL82 7/-
UCL83 9/3
UF41 9/6
UF42 9/-
UF80 6/9
UF85 6/9
UF86 9/-
UF89 6/3
UL41 9/6
UL46 12/6
UL84 6/6
UM80 5/-
UR1C 10/6
UU5 7/-
UU8 14/-
UU12 4/6
UY1N 9/-
UY21 9/6
UY41 6/9
UY85 5/6
U10 9/-
U12/14 7/6
U16 15/-
U17 5/-
U18/20 10/-
U19 34/6
U22 7/9
U25 13/-
U26 11/9
U31 6/-
U33 29/6
U35 16/6
U37 34/11
U45 15/6
U50 5/6
U52 4/9
U76 4/9
U78 3/6
U107 18/3
U191 12/6
U251 16/-
U281 8/-
U282 8/-
U301 11/-
U329 16/-
U403 6/6
U404 7/6
U801 17/6
U4020 6/9
VP4B 10/6
VP13C 7/-
VP23 2/6
VR75 24/-
VR105 5/-
VR150 5/-
VT61A 7/-
VT501 3/-

VU111 7/3
VU120 12/-
VU120A 12/-
VU133 7/-
W42 10/6
W61M 24/6
W63 10/6
W76 5/9
W77 2/6
W81M 6/-
W101 26/2
W107 7/-
W729 10/-
X24 16/6
X41 10/-
X61 5/9
X63 5/6
X64 12/6
X65 5/-
X66 7/6
X76M 7/6
X81M 30/6
X101 29/1
X109 26/-
Y63 5/-
Y65 5/-
Z63 4/9
Z77 3/3
Z329 11/9
Z729 6/-

Transistors and diodes

2G225 10/6
2N404 6/-
2N2297 4/6
2N2369A 4/3
2N3121 50/-
2N3703 3/9
2N3709 4/-
2N3866 20/-
AA120 3/-
AA129 3/-
AAZ13 3/6
AC107 3/-
AC113 5/-
AC114 8/-
AC126 2/-
AC127 2/-
AC128 2/-
AC154 5/-
AC155 6/6
AC156 4/-
AC157 5/-
AC165 5/-
AC166 5/-
AC167 12/-
AC168 7/6
AC169 6/6
AC176 11/-
AC177 5/6
ACY17 3/-
ACY18 3/8
ACY19 3/9
ACY20 3/6
ACY21 3/9
ACY22 3/6
ACY28 4/-
AD140 7/6
AD149 8/-
AF114 4/-
AF115 3/-
AF116 3/-
AF117 2/9
AF119 3/-
AF124 6/6
AF125 3/6
AF126 5/3
AF127 3/6
AF139 11/-
AF178 10/-
AF179 13/6
AF180 9/6
AF181 14/-
AFZ12 5/-
ASY27 8/6
ASY28 6/6
ASY29 10/-
BA115 2/8

BA116 9/-
BA129 2/6
BA130 2/-
BCY10 5/-
BCY12 5/-
BCY33 5/-
BCY34 4/6
BCY38 5/-
BCY39 4/6
BCZ11 3/6
BC107 4/-
BC108 3/6
BC109 4/3
BC113 5/-
BC115 3/-
BC116 5/-
BC118 4/6
BD119 9/-
BFY50 4/-
BFY51 4/-
BFY52 4/6
BF154 5/-
BF159 5/-
BF163 4/-
BF180 12/-
BF181 8/-
BF185 8/-
BTX34/400 40/-
BY100 3/6
BY101 11/6
BY105 10/6
BY114 6/6
BY126 6/6
BY234 4/-
BY236 4/-
BY238 4/-
BYY23 20/-
BYZ10 5/-
BYZ11 5/-
BYZ12 5/-
BYZ13 5/-
BYZ15 35/-
CG12E 4/-
CG64H 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 4/-
GET103 4/-
GET105 18/-
GET113 4/-
GET115 17/-
GET116 6/6
GET118 4/-
GET119 4/-
GET573 7/6
GET587 8/6
GET872 10/-
GET873 3/-
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 7/-
GEX66 15/-
GT3 5/-
M1 2/10
M3 2/10
OA5 5/6
OA9 2/6
OA47 2/-
OA70 3/-

OA73 3/-
OA79 1/9
OA81 1/9
OA85 1/6
OA86 4/-
OA90 2/6
OA91 1/9
OA182 2/-
OA200 1/-
OA202 2/-
OA210 9/6
OA211 13/6
OAZ200 12/-
OAZ201 10/6
OAZ202 9/-
OAZ203 9/6
OAZ204 9/-
OAZ205 9/-
OAZ206 9/-
OAZ207 10/6
OAZ210 7/-
OAZ213 7/-
OAZ224 16/6
OC19 25/-
OC22 5/-
OC23 5/-
OC24 5/-
OC25 5/-
OC26 5/-
OC28 5/-
OC29 23/6
OC30 5/-
OC35 5/-
OC36 7/6
OC38 11/6
OC41 10/-
OC42 6/9
OC43 23/6
OC44 2/-
OC44PM 8/3
OC45 1/9
OC45M 8/-
OC46 3/-
OC65 22/6
OC70 2/3
OC71 2/-
OC72 2/-
OC73 16/-
OC74 2/6
OC75 2/-
OC76 2/6
OC77 2/6
OC78 3/-
OC78D 3/-
OC79 8/-
OC81 2/-
OC81D 2/-
OC81M 5/-
OC82 2/3
OC82D 2/3
OC83 2/-
OC84 3/-
OC123 4/6
OC139 12/-
OC140 19/-
OC169 3/6
OC170 2/6
OC171 3/4
OC172 4/-
OC200 4/4
OC201 5/6
OC202 4/6
OC203 4/6
OC204 5/6
OC205 7/6
OC206 10/-
OC812 8/-
OCP71 27/6
ORP12 15/-
SX1/6 3/6
V10/15A 12/-
MAT100 7/9
MAT101 8/6
MAT120 7/9
MAT121 8/6
ZE12V7 1/9

MATCHED TRANSISTOR SETS 1—OC44 and 2—OC45 8/6; 1—OC81D and 2—OC81 7/6; 1—OC82D and 2—OC82 8/6; Set of three—OC83 (GET118/119) 8/6; LP15 package (AC113, AC154, AC157, AA120) 10/6; 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

ELECTROLYTICS. Can types: 8×8mfd/500v **7/6**; 8×16mfd/500v **7/9**; 16mfd/500v **6/-**; 16×16mfd/500v **8/9**; 16×32mfd/450v **9/9**; 32mfd/500v **8/-**; 32×32mfd/450v **4/9**; 50×50mfd/350v **5/6**; 60×250mfd/275v **9/9**; 50×50mfd/275v **8/6**; 60×250×10mfd/275v **14/3**; 64×100mfd/450v **21/-**; 64×120mfd/350v **8/6**; 100×200mfd/275v **8/-**; 100×200mfd/350v **10/6**; 100×200×60mfd/300v **18/6**; 100×300×100×16mfd/275v **24/9**; 100×400mfd/275v **12/9**; 100×400×16mfd/275v **23/3**; 100mfd/100v **5/6**; 200mfd/350v **12/3**; 200×200×100mfd/350v **27/9**; 1000mfd/50v **9/9**; 2000mfd/50v **13/3**; 5000mfd/25v **15/-**; 5000mfd/50v **27/9**; 8mfd/600v **11/3**; 16×16×16mfd/275v **7/-**; 50×50×50mfd/350v **12/3**; 16mfd/600v **15/9**; 10000mfd/30v **29/6**.
Tubular types: 1mfd/25v **2/-**; 1mfd/500v **2/6**; 2mfd/150v **2/-**; 2mfd/500v **2/9**; 4mfd/150v **2/-**; 4mfd/500v **3/-**; 5mfd/50v **2/-**; 8mfd/150v **2/3**; 8mfd/450v **1/9**; 8mfd/500v **3/6**; 8×8mfd/450v **2/9**; 8×16mfd/450v **3/-**; 10mfd/50v **2/3**; 16mfd/450v **2/6**; 16mfd/500v **4/6**; 16×16mfd/450v **3/6**; 16×32mfd/350v **3/6**; 25mfd/25v **1/6**; 25mfd/50v **2/6**; 32mfd/350v **3/-**; 32mfd/450v **3/6**; 32×32mfd/350v **4/9**; 50mfd/12v **1/6**; 50mfd/25v **1/6**; 50mfd/50v **1/9**; 50mfd/350v **6/-**; 64mfd/450v **9/6**; 100mfd/12v **1/6**; 100mfd/25v **1/6**; 100mfd/50v **2/3**; 100mfd/450v **10/9**.

EXPRESS POSTAL SERVICE! ALL ORDERS DESPATCHED SAME DAY AS RECEIVED

Terms of business—Cash with order only. Post/Packing 6d. per item. Orders over £5 post free. No C.O.D. All orders cleared day of receipt. Any parcel insured against damage in transit for 6d. extra per order. Hours of business, Mon.–Fri. 9.00 to 5.30 p.m. Sats. 9.00 to 1 p.m. Complete list of modern and obsolete valves, resistors, condensers, transformers, potentiometers, microphones, etc. with terms of business 10d. Please enquire for any item not listed with S.A.E. Please note that no enquiries can be answered unless a S.A.E. is enclosed for reply.

practically wireless commentary by HENRY

No. 55

High Places

WHEN Pax led me astray for the fiftieth time, the Editor was good enough to suggest that, though this column was indeed "practically" about wireless matters, some digressions could be excused by the "light-hearted approach."

Sorry, but this month Henry is far from light-hearted, and the cause is much the same as that of No. 50, viz., the skullduggery of the Postmaster-General.

No consolation to know that he will soon be a more powerful knave-in-office either. Calling the Minister of Posts and Telecommunications by any other name would not make his misdeeds smell sweeter. Take the scandalous case of the "increased licence finesse."

Do you remember when the licences went up? That's right, at the turn of the year. Just one day after Henry's renewal date, glory be! So Mrs. Henry went with £5 in her hot and sticky little hand to see her friendly sub-postmaster. He has suddenly become an iron-faced gorgon. No licences can be paid until after 1st January. No, not even of that poor pensioner just before us in the queue who has been saving all year for the exact, exorbitant amount.

It may be all right for us—we can cut down on the *au pair's* chocolates, or spread a little less *foie gras* on the chips—but for the needy that extra pound was a dastardly blow.

Cut down the au pair girl's chocolates.

All right, so it had to be paid. It was due. You want stereo radio, don't you? But somewhere a line had to be drawn. At some date the rise had to be imposed, and if your licence renewal date fell just prior to that line you were dead lucky, chum. Or should have been.

In practice you—and Henry and many others—were not. For the post offices calmly refused to accept the contents of our piggy banks for several days prior to the £6 deadline.

This is sheer sharp practice. What ordinary business would have got away with such a trick? For the benefit of the reader who thought Henry was a disguised manufacturer let me assure you that he is a plain working engineer. Imagine *his* customers' reaction when presented with a repaired radio priced 20% above the estimate—on the grounds that costs would be going up some time in the future! Or, for a more exact parallel, with his wireless set withheld until the price rise came into force. *That* is the sort of trick our lords and masters perpetrate.

There is more to protest about. And I don't mean Citizens' Band, Morse Code tests, pirate radio, local broadcasting or sponsored TV. Not even Pay-TV, which has been dropped with a dull thud of well-bred disapproval and a sneer at would-be entrepreneurs.

Point at issue is Parliament's distaste for communications, *per se*. We could understand a reluctance to reveal the cut and thrust of debate for the dull succession of harangues we visitors to the Strangers' Gallery know it to be. And only a very few members are as photogenic as you and I, Joe. Indeed, the sort of comedians who guffaw at jokes in the class of "Who was that lady . . . ?" would compete rather badly with those wits who send them up for our entertainment. (Will the *real* Mr. Heath please stand up!)

The customer's reaction . . .

But it cannot be denied that many of our public guardians, though wary, can be bold when they get the chance to speak. Some contrive to sound assertive even when reading the fourth paragraph of the fifteenth amendment to the second clause of . . . etc. The performance of others makes one wonder how they ever got elected.

So it is hardly surprising to hear that the House was pretty evenly divided on the subject of being broadcast; even less certain about being ready for television. It seems a wonder that they even permit the shorthand writers to be augmented by that new-fangled device, the tape recorder.

Have you noticed that they want to spend £100,000 on equipment for a pilot scheme of excerpt broadcasts? Considering that the existing sound reinforcement scheme in the Commons is really superb—and I assure you it is—we must beg leave to wonder what they intend to spend this huge whack of public loot upon. Plush seats for the new Minister of Monopolistic Telegraphs perhaps? One correspondent in *Hi-Fi News* last January worked out costs in generous detail and calculated that there was a discrepancy of some £95,000.

No wonder A. W. Benn, Esq., does not want to leave broadcasting to the broadcasters.

LETTERS...

The Editor does not necessarily endorse the views expressed by correspondents.

Another saga?

At the risk of turning the "switch-on thump" into another saga on the scale of that concerning Mr. McFarlane's (Jan. 1968) soldering iron (by the way, why did no one suggest buying a new soldering iron instead of auto-transformers, diodes or whatnots) might I add my practical experiences to those of Mr. Wood (Feb. 1969).

Having read the many letters recommending cures for the switch-on thump, I acquired two electrolytics and proceeded to modify my amplifier as instructed. The result was very interesting: the thump remained unchanged (or did I detect a slight increase?) and the amplifier began to hum at an intolerable level. After some investigation, I decided the thump was caused by charging of capacitors in the driver stages, and cured it effectively by fitting a muting switch to the output. As for the hum, this was cured by restoring the amplifier to its original circuitry.

In conclusion, might I remark that, if Mr. Wood's amplifier does require 2A for full output, the 10Ω resistors if inserted in the power supply line will reduce his output by about 75%, a far more serious drawback than a "thump" once a day.—**P. Gray** (*Oxford*).

The state of things

For several months now I have been following with great interest the replies printed to Mr. Tomlinson's inquiry regarding the definition of solid state.

I think, however, that Mr. Davison's interpretation (P.W. Feb. 1969) is totally unjustified. If solid state devices are to be regarded as devices in which *electrons* flow only through materials only in the solid phase of matter this will still include both transformers and capacitors.

In transformers electrons do not "travel between the poles in almost free air", an alternating flow is set up in the primary winding which creates an alternating magnetic flux which in turn induces electrons to vibrate in the secondary winding. Thus it is only the magnetic flux which travels through "almost free air" and this flux is usually directed and concentrated by laminations of a conducting material in a mains type transformer.

As for capacitors, Mr. Davison must know that capacitors are infinitely resistive to direct currents, the plates becoming charged and finally saturated with electrons from one terminal and exhausted on the other. The only way in which this current can then flow is to reverse the direction of the electron flow and hence reverse the quantity of charge on respective plates. Thus a capacitor will appear to pass an alternating current but resist the flow of direct current.

I can assure Mr. Davison that the only way in which electrons can be made to "jump the gap" is to apply an excessive potential difference to the circuit and cause arcing between either the windings of the transformers or the plates of the capacitor.—**J. G. Owen GW8BFT** (*London, W.*12).

★ ★ ★

As a student of electrical engineering I feel that I should clarify certain misconceptions which Mr. Davison (February edition) appears to have concerning current flow and "solid state".

Firstly, Mr. Davison wrongly assumes that nothing impedes the flow of electrons in a "conventional" circuit. If this is so what is the purpose of resistance, capacitance, inductance, and the other circuit devices?

The vacuum valve does not allow free passage of electrons from cathode to anode. Instead the space charge, caused by emission of electrons from the cathode, provides a barrier to electron flow. This barrier must be overcome by the application of a voltage between anode and cathode. If this was not the case all the electrons emitted from the cathode would arrive at the anode without the application of any potential.

In the case of the transformer, Mr. Davison states that "electrons travel between the poles in almost free air". A transformer is constructed on a closed magnetic circuit (of laminations) and therefore has no poles. Secondly, the transfer of energy from primary to secondary is accomplished by means of a magnetic field produced in the primary winding. If this field varies (i.e. if it is produced by a varying current) then an e.m.f. will be induced in the secondary winding (Faraday's law).

Capacitors are constructed in such a way that electrons cannot flow from one terminal to the other. The dielectric whether air or any other insulating material provides a barrier to current flow. (30,000 volts would be required across a gap in air of 1 centimetre to produce a current!). Current is only assumed to flow in capacitors to assist some calculations even though an electron cannot pass from one terminal to the other through the dielectric.

Thus electrons in conventional circuits do not jump across gaps (except in valves) but only pass through solid material, e.g. copper or carbon.

As far as "solid state" is concerned I can only add to the numerous explanations of this term. I would say that any circuit which uses semiconductor circuitry is "solid state" because the components used to control electron (or hole) flow are made of solid semiconductors such as germanium or silicon.—**L. Macari** (*Lanarkshire*).

Let's end it folks

In the July 1968 issue of PRACTICAL WIRELESS, I posed the question of a definition of "solid state". Subsequent issues produced a most interesting result. I feel that perhaps the Editorial Department would like to call a halt to the discussion and if this is so, I would sincerely like to thank all who have taken part for the views and interest.—**W. J. Tomlinson** (*London, E.*17).

CR100/1328 output

I recently purchased a CR100/1328 receiver from a well-known dealer with the assurance that the output was suitable for 3Ω speaker. This however was found to be for 1,000Ω output. Reference to the circuit shows that the output transformer is identical in all CR100 models and all that is required is to wire the 3Ω speaker to tags 9 and 10 which are not in use, or change over the wires from tags 5 and 6 to 9 and 10.—**S. Wright** (*Kirkcudbrightshire*).

DE LUXE PLAYERS

PORTABLE CABINET As illustrated. To fit standard player or autochanger. **75/-**

RCS AMPLIFIER 3 WATT. Ready made and tested. This is a 2-stage unit using a triode pentode condenser coupled valve giving 3 watts output into a 3 ohm loudspeaker. Tone and volume controls mounted on chassis with knobs. Supplied with loudspeaker and valve UCL82. Frequency response 50-12,000 cps. Sensitivity 200mV. **59/6**

Post 5/6 each item

SINGLE PLAYERS MONO		AUTOCHANGERS MONO	
EMI Junior Mains	£2.19.6	Balfour Auto	£5.19.6
Garrard SRP22	£6.19.6	BSR Superslim UA25	£6.19.6
Garrard SP25 MkII	£14.19.6	UA70 Stereo/Mono	£12.19.6
		Garrard AT60 MkII	£12.19.6
		3000 Stereo/Mono	£12.19.6

All fitted LP/78 stylii and mono pickup crystal complete. Stereo/mono pickups 20/- extra except UA70 and 3000.

GARRARD TEAKWOOD BASE WB.1. Ready out for mounting 1000, 2000, 3000, SP25, AT60. **65/-**
GARRARD PERSPEX COVER SPC.1 for WB.1 **65/-**

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. **£22.10**

PICK-UP ARM Complete with ACOS LP-78 GP67 Stylii 29/6; Xtal GP67 17/6; Stereo Ceramic 35/-. Powerpoint 56 15/-.

CRYSTAL MIKE INSERTS

1¼ × ⅜in. 6/6; ACOS 1¼ × ⅜in. 8/6. BM3, 1" dia. 9/6
MOVING COIL MIKE with Remote Control Switch 19/6

PORTABLE TRANSISTOR AMPLIFIER PLUS DYNAMIC MICROPHONE

Fully portable mini p.a. system. Ideal for Parties, or Baby Alarm, Intercom, Telephone, Record Player, Amplifier, etc. Attractive rexine covered cabinet, 12 × 9 × 4in., powerful 7 × 4in. speaker, four transistor one watt power amplifier plus sensitive microphone. Uses PP9 battery. Brand new in Maker's carton with guarantee.

World Famous make

90/-

Post Free

WEYRAD P50—TRANSISTOR COILS

RA2W 6in. Ferrite Aerial with car aerial coil	12/6	Spare Cores	6d.
Osc. P50/1AC	5/4	Driver Trans. LFDT4	9/6
I.F. P50/2CC 470 kc/s.	5/7	Printed Circuit. PCA1	9/6
3rd I.F. P50/3CC	6/-	J.B. Tuning Gang	10/6
		Weyrad Booklet	2/-

Telescopic Chrome Aerials 6in. extends to 23in. 5/-.
Ferrite Rods Only. 8 x ⅜in. 4/-; 6 x ⅜in. 5/-.

VOLUME CONTROLS

Long spindles. Midget Size 5K. ohms to 2 Meg. LOG or LIN. L/S 3/-. D.P. 5/-. STEREO L/S 10/6, D.P. 14/6. 5K. S.P. Edge type, 5/-.

80 Ohm Coax 8D yd.

BRITISH AERIALITE AERAXIAL AIR SPACED 40 yd. 23/-; 60 yd. 30/-. FRINGE LOW LOSS Ideal 625 lines **1/6** yd.

VEROBOARD 0·15 MATRIX
2½ × 5in. 3/8. 2½ × 3¾in. 3/2. 3¾ × 3¾in. 3/8. 3¾ × 5in. 5/2.
EDGE CONNECTORS 16 way 5/-; 24 way 7/6.
PINS 36 per packet 3/4. FACE CUTTERS 7/6.
S.R.B.P. Board 0·15 MATRIX 2½in. wide 6d. per 1in. 3¾in. wide 9d. per 1in.; 5in. wide 1/- per 1in. (up to 17in.).
S.R.B.P. undrilled $^{1}/_{16}$in. Board. 10 × 8in. 3/-.

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. 6/6; 14 × 9 in. 5/6; 12 × 8 in. 4/6; 10 × 7 in. 3/6; 8 × 6 in. 2/6; 6 × 4 in. 1/6.

Q MAX CHASSIS CUTTER

Complete: a die, a punch, an Allen screw and key
⅜in. 16/- ⅝in. 17/6 1⅛in. 19/6 1⅜in. 24/- 2$^{3}/_{32}$in. 44/3
½in. 16/- 1in. 19/6 1¼in. 20/6 1½in. 29/- 2½in. 57/3
¾in. 16/9 1$^{1}/_{16}$in 19/6 1⅛in. 21/6 2in. 39/- 1in. sq. 36/6

'SONOCOLOR' CINE RECORDING TAPE

5" reel, 900' with LP strobe markings, also cine light deflector-mirror for synchronisation. 14/- each.
UNIVERSAL TAPE CASSETTES C60. OUR PRICE 14/-.

Tape Spools 2/6. Tape Splicer 5/-. Leader Tape 4/6. Reuter Tape Heads for Collaro models 2 track 21/- pair.

"THE INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER

42/6 Post 2/6.

200/250 v. A.C. Leaflet S.A.E.

BARGAIN STEREO/MONO SYSTEM

Attractive Slim PLAYER CABINET with B.S.R. STEREO Autochanger 4 + 4 AMPLIFIER and TWO matched LOUDSPEAKERS Carr. 10/6 **£19.19.6.**
(Only 4 pairs of wires to join).

NEW TUBULAR ELECTROLYTICS				CAN TYPES	
2/350V	2/3	100/25V	2/-	8/600V	9/6
4/350V	2/3	250/25V	2/6	16/600V	12/6
8/450V	2/3	500/25V	4/-	16+16/500V	7/6
16/450V	3/-	8+8/450V	3/6	32+32/250V	3/6
32/450V	3/9	8+16/450V	3/9	50+50/350V	7/-
25/25V	1/9	16+16/450V	4/3	60+100/350V	11/6
50/50V	2/-	32+32/350V	4/6	32+32+32/350V	8/6

SUB.MIN. ELECTROLYTICS. 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 250mF 15V 2/-; 500, 1000mF 12V 3/6; 2000mF 25V 7/-.
CERAMIC. 500V 1pF to 0.01mF, 9d. Discs 1/-.
PAPER 350V-0·1 9d; 0·5 2/6; 1mF 3/-; 2mF 150V 3/-. 500V-0·001 to 0·05 9d; 0·1 1/-; 0·25 1/6; 0·5 3/-. 1,000V-0·001, 0·0022, 0·0047, 0·01, 0·02, 1/6; 0·047, 0·1, 2/6.
SILVER MICA. Close tolerance 1%. 5-500pF 1/-; 560-2,200pF 2/-; 2,700-5,600pF 3/6; 6,800pF-0·01, mfd 6/- each.
TWIN GANG. "0-0" 208pF + 176pF, 10/6; 365pF, miniature 10/-; 500pF standard with trimmers, 9/6; 500pF midget less trimmers, 7/6; 500pF slow motion, standard 9/-; small 3-gang 500pF 18/9. Single "O" 365pF 7/6. Twin 10/-.
SHORT WAVE. Single 10pF, 25pF, 50pF, 75pF, 100pF, 160pF, 200pF, 10/6 each.
TUNING. Solid dielectric. 100pF, 300pF, 500pF, 7/- each.
TRIMMERS. Compression ceramic 30, 50, 70pF, 1/-; 100pF, 150pF, 1/3; 250pF, 1/6; 600pF, 750pF, 1/9; 1000pF, 2/6.

250V RECTIFIERS. Selenium ½ wave 100mA 5/-; BY100 10/-.
CONTACT COOLED ½ wave 60mA 7/6; 85mA 9/6.
Full Wave Bridge 75mA 10/-; 150mA 19/6; TV rects. 10/-.
NEON PANEL INDICATORS. 250v. AC/DC, 3/6.
RESISTORS. Preferred values, 10 ohms to 10 meg. ¼w., ½w., 1w., 20% 3d.; 1½w. 8d.; 2w. 1/-; ½w. 10% 6d.
HIGH STABILITY. ½w. 1%. 10 ohms to 10 meg. 2/-. Ditto 5%. Preferred values 10 ohms to 22 meg., 9d.

5 watt	0·5 to 8·2 ohm 3w.	2/-
10 watt	WIRE-WOUND RESISTORS	2/-
15 watt	10 ohms to 6,800 ohms	2/-

10K, 15K, 20K, 25K, 68K, 10W. 3/-

FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12v. outputs. 1½ amp. 8/9; 2a., 11/3; 4a., 17/6.
CHARGER TRANSFORMERS, P. & P. 5/-. Input 200/250v. for 6 or 12v., 1½ amps., 17/6; 2 amps., 21/-; 4 amps., 30/-.

WIRE-WOUND 3-WATT POTS. T.V. Type. Values 10 ohms to 30K., Carbon 30K to 2 meg. **4/6**
WIRE-WOUND 4-WATT STANDARD SIZE POTS. LONG SPINDLE 50 OHMS to 100 K.. **7/6**

VALVE HOLDERS. 9d; CERAMIC 1/-; CANS 1/-

NEW MULLARD TRANSISTORS 6/- each

OC71, OC72, OC81, OC44, OC45, OC171, OC170, AF117
REPANCO TRANSISTOR TRANSFORMERS
TT45. Push Pull Drive, 9:1 CT, 6/-. TT46 Output, CT8:1, 6/-.
TT49. Interstage 20:1, 6/-; TT52 Output 3 ohms, 4·5:1, 6/-.
TT23/4 PAIR 10W Amp. Transformers and circuit 45/-.

TRANSISTOR MAINS POWER PACKS. FULL WAVE 9 volt 500mA Size 4½ × 2½ × 2in. Output terminals. Switched. Metal case, crackle finish. On/off switch. **49/6**
Half Wave 9 volt 50mA Size 2½ × 1½in. Snap terminals 32/6.
9 volt 500mA TRANSFORMER ONLY. 2½ × 1¾ × 1½in. 10/6.

MAINS TRANSFORMERS

Post 5/- each

250-0-250 50 mA. 6·3v. 2a. Centre tapped	19/6
250-0-250 80mA. 6.3v. 3.5a. 6.3v. 1a. or 5v. 2a.	30/-
350-0-350 80mA. 6.3v. 3.5a. 6.3v. 1a. or 5v. 2a.	35/-
300-0-300v. 120mA., 6.3v. 4a. C.T.; 6.3v. 2a.	45/-
MINIATURE 200v. 20mA., 6.3v. 1a. 2½ × 2 × 1½in.	12/6
MIDGET 220v. 45mA., 6.3v. 2a. 2¾ × 2¼ × 2in.	17/6
HEATER TRANS. 6.3v. 1½a., 8/6; 6.3v. 4a.	12/6
Ditto tapped sec. 1.4v., 2, 3, 4, 5, 6.3v. 1½ amp.	12/6
GENERAL PURPOSE LOW VOLTAGE, Outputs 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, and 30v. at 2a.	30/-
1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60	35/-
3 amp., 0-12v. and 0-18v.	19/6

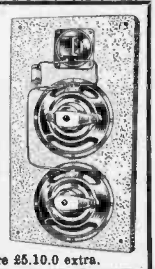
AUTO TRANSFORMERS 0-115-230v. Input/Output. 60w. 18/6; 150w. 30/-; 500w. 92/6; 1000w. 175/-.

COAXIAL PLUG 1/3. **PANEL SOCKETS** 1/3. **LINE** 2/-.
OUTLET BOXES. SURFACE OR FLUSH 4/6.
BALANCED TWIN FEEDERS 1/- yard 80 or 300 ohms.
JACK SOCKETS Std. open-circuit 2/6, closed circuit 4/6. Chrome Lead Socket 7/6. Phono Plugs 1/-. Phono Socket 1/-.
JACK PLUGS Std. Chrome 3/-; 3·5mm Chrome 2/6.
DIN SOCKETS Chassis 3-pin 1/6; 5-pin 2/-.
DIN SOCKETS Lead 3-pin 3/6; 5-pin 5/-.
DIN PLUGS 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 4/6 each.
1 p. 12-way, or 4 p. 2-way, or 4 p. 3-way, 4/6 each.
Wavechange "MAKITS" 1p. 12-way, 2 p. 6-way, 3 p. 4-way, 4 p. 3-way, 6 p. 2-way, 1 wafer 12/-, 2 wafer 17/-, 3 wafer 22/-.
Additional wafers 5/- each wafer up to 12 max.
TOGGLE SWITCHES, sp. 2/6; sp. dt. 3/6; dp. 3/6; dp dt. 4/6.

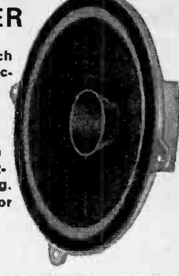
MINI-MODULE LOUDSPEAKER KIT

10 WATT **55/-** Carr. 5/-



Triple speaker system combining on ready cut baffle. ½in. chip-board 15 x 8⅜in. Separate Bass, Middle and Treble loudspeakers and crossover condenser. The heavy duty 5in. Bass Woofer unit has a low bass resonance cone. The Mid-Range unit is specially designed to add drive to the middle register and the tweeter recreates the top end of the musical spectrum. Total response 20-15,000 cps. Full instructions for 3 or 8 ohm Teak Veneered Bookshelf Enclosure £5.10.0 extra.

BAKER 12in. DE-LUXE MKII LOUDSPEAKER



Suitable for any Hi-Fi System. Provides truly rich sound recreating the musical spectrum virtually flat from 25-16,000cps. Latest double cone with special "Ferroba" ceramic magnet. Flux density 14,000 gauss. Bass resonance 32-38cps. 15W British rating. Voice coils available 3 or 8 or 15 ohms. **£9** Post Free
48 page Enclosure Manual 5/9 post paid

BAKER "GROUP SOUND" SPEAKERS—POST FREE

'Group 25'	'Group 35'	'Group 50'
12in. 25 watt **6 gns.**	12in. 35 watt **8½ gns.**	15in. 50 watt **18 gns.**

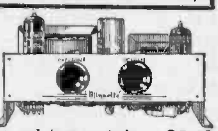
ALL MODELS "BAKER SPEAKERS" IN STOCK

Super Cone Tweeter 2½in. square, 3-17kc/s. 10W 17/6. Quality Horn Tweeters 2-18kc/s, 10W 29/6. Crossover 16/6.
LOUDSPEAKERS P.M. 3 OHMS. 2½in, 3in, 4in, 5in, 7 × 4in. 15/6 each; 6½in 22/6; 10in 37/6; 8 × 5in. 21/-;
12in. Double cone 3 or 15 ohm 39/6; 10 × 6in. 30/-; 8 × 2½in. 21/-.
E.M.I. Double Cone 13¼ × 8in., 3 or 15 ohm models, 45/-, or with twin tweeters, crossover and ceramic magnet, 79/6
SPECIAL OFFER! 8 ohm, 2½in; 6 × 4in; 80 ohm, 2½in, 2½in;
15/6 EACH TYPE 25 ohm, 6 × 4in; 35 ohm, 3in; 15 ohm, 10 × 2½in, 7 × 4in.
8in. **LOUDSPEAKER UNITS** 3 ohm 27/6, Deluxe Ceramic 45/-; 15 ohm 27/6; Deluxe Ceramic 45/-; Twin cone 3 ohm only 35/-.
5in. **WOOFER.** 8 watts max. 30-10,000 cps. 8 or 15 ohm 39/6.
OUTPUT TRANS. EL84 etc. 4/6; **MIKE TRANS.** 50:1, 3/9.
SPEAKER FRET Various Tygan samples. Send S.A.E.

ALL PURPOSE HEADPHONES

H.R. HEADPHONES 2000 ohms Super Sensitive	35/-
LOW RESISTANCE HEADPHONES 3-5 ohms	35/-
DE LUXE PADDED STEREO PHONES 8 ohms	79/6

MINETTE AMPLIFIER



A.C. Mains Transformer. Chassis size 7 × 3½ × 4in. High. Valves ECL82, EZ80. Quality output 3 ohm. With engraved fascia, valves, knobs, volume and tone controls, wired and tested. 12 month guarantee. Post 5/6 **69/6**

ALL EAGLE PRODUCTS

SUPPLIED AT LOWEST PRICES

BARGAIN AM TUNER. Medium Wave. Transistor Superhet. Ferrite aerial, 9 volt. **79/6**
BARGAIN DE LUXE TAPE SPLICER Cuts, trims, joins for editing and repairs. With 3 blades. **17/6**
BARGAIN 4 CHANNEL TRANSISTOR MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt. **59/6**
BARGAIN FM TUNER 88-108 Mc/s Six Transistor. Ready built. Printed Circuit. Calibrated slide dial tuning. Size 6 × 4 × 2½in. 9 volt. **£6.19.6.**
BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control. 9v. **69/6**

45-PAGE EAGLE CATALOGUE 5/- Post Free

★ RADIO BOOKS ★ (Postage 9d.)

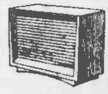
Practical Transistor Receivers	5/-
Practical Stereo Handbook	3/6
Supersensitive Transistor Pocket Radio	3/6
High Fidelity Speaker Enclosures and Plans	5/-
Radio Valve Guide, Books 1, 2, 3, or 4 ea. 5/- No. 5 ea.	6/-
Practical Radio Inside Out	4/6
Shortwave Transistor Receivers	5/-
Transistor Communication Sets	6/-
Modern Transistor Circuits for Beginners	7/6
Sub-Miniature Transistor Receivers	5/-
Wireless World Radio Valve Data	9/6
At a glance valve equivalents	6/-
Valves, Transistors, Diodes equivalents manual	10/6
Receive Foreign T.V. by simple modifications	5/-
Transistor Circuits Radio Controlled Models	7/6

MANUFACTURERS SURPLUS!

Tape Recorder Case. Red/Cream 15 × 12 × 5½in. **25/-** POST FREE

POCKET MOVING COIL MULTIMETER. 0-1,000 AC./DC. ohms 0 to 100k, etc. **49/6**
SUPERIOR MOVING COIL MULTIMETER 0-2-500v. D.C. 20,000 ohms per volt, 0-1,000v. A.C. Ohms 0 to 6 meg. 50 Microamps (Full list Meters S.A.E.) **99/6**

BRAND NEW QUALITY EXTENSION LOUDSPEAKER



Black or Cream plastic cabinet, 20ft. lead and adaptors. For any radio, intercom, tape recorder, etc. 3 to 15 ohms. Size: 7½ × 5½ × 3in. POST 2/6 **30/-**

Minimum Post and Packing 2/6. **RETURN OF POST DESPATCH. CALLERS WELCOME — CUSTOMERS FREE CAR PARK** *C.O.D. orders £1 min. 5/- extra.*

RADIO COMPONENT SPECIALISTS 337 WHITEHORSE ROAD, WEST CROYDON

Full list 1/- **Written guarantee with every purchase.** *(Export—send remittance and extra postage, no C.O.D.)* Buses 133, 68 pass door. S.R. Stn. Selhurst **Tel. 01-684.1665**

JASON KITS

FANTASTICALLY POPULAR

★ TAPE ★

We offer you fully tensilised polyester/mylar and P.V.C. tapes of identical quality hi-fi, wide range recording characteristics as top grade tapes. Quality control manufacture. They are truly worth a few more coppers than acetate, sub-standard, jointed or cheap imports. TRY ONE AND PROVE IT YOURSELF

Standard Play			Long Play		
3in	150ft.	2/3	3in	225ft.	2/9
4in.	300ft.	4/6	4in.	450ft.	5/6
5in.	600ft.	7/6	5in.	900ft.	10/6
5¾in.	900ft.	10/6	5¾in.	1,200ft.	13/-
7in.	1,200ft.	12/6	7in.	1,800ft.	18/6

Double Play			Triple Play		
3in.	300ft.	4/-	4in.	900ft.	13/-
4in.	600ft.	8/-	5in.	1,800ft.	25/-
5in.	1,200ft.	15/-	5¾in.	2,400ft.	34/-
5¾in.	1,800ft.	19/6	7in.	3,600ft.	44/-
7in.	2,400ft.	27/-			
			Quadruple Play		
			3in.	600ft.	8/6

Postage 1/- reel.
Post Free less 5% on three reels.
Quantity and Trade enquiries invited.
NOTE: *Large tape stocks at all branches.*

TUBES

Highest Quality— Compare Our Prices

GUARANTEED

Carr. & Ins. 12/6	6 Months	12 Months
14in.	£2.10.0	£3.10.0
17in. & 19in.	£3. 5.0	£4. 5.0
21in. & 23in.	£3.15.0	£5.15.0

SATISFACTION GUARANTEED

Most Mullard, Mazda, Cossor, Emitron, Emiscope, Brimar, Ferranti types processed in our own factory.
NOTE: ALL tube orders only to Portsmouth branch please.

NEW and SPECIAL Lines at the keenest prices

AM/FM STEREO MULTIPLEX RECEIVERS
18 transistors, 9 diodes, 1 variable diode, 2 Silicon Rectifiers. Push-pull Stereo Amplifiers. FM Stereo Separation 15dB. AM Medium Wave 180-550 Metres. Power output 10W R.M.S.. 220/240V A/C Mains. Beautiful wooden plinth case—approximately 15"(w) × 6"(h) × 9"(d). Controls: Function Switch. Balance. Base/Treble Control. Volume. Tuning. Fine finish. Special purchase enables us to offer these superb machines of famous make at a ridiculously low price. Unrepeatable offer at a fraction of list price . . . only 26 GNS. POST FREE.

SHARP	RD504 Mains Battery Tape Recorder, List 36 gns	28 gns
HITACHI	Marine D/F Receivers SW/MAR/MW/LW	27 gns
GARRARD	1025 Changers with Stereo Cartridge	£8 10s
JASON	12in. Diecast full range twin cone Speakers	£4 10s
AJAX	Mains/Battery. AM/FM larger Radio	12 gns
WELESMERE	AM/FM High Sensitivity Black Leather	7 gns
HITACHI	WH837E All-Wave, full size. Excellent Short Wave	13 gns
HI-FI	By Leak, Wharfedale, Goodmans, WB. Dulci, Arona, Teleton, etc., etc.	

All items previously advertised available. Huge Hi-Fi and Component stocks at all branches. Please call and view without obligation.

TECHNICAL TRADING

RETAIL BRANCHES:

LONOON, 10 Tottenham Court Rd. (MUS 2639)
PORTSMOUTH, 350-352 Fratton Road (Tel. 22034)
SOUTHAMPTON, 72 East Street (Tel. 25851)
BRIGHTON, 6 Queen's Road (Tel. 23975)

MAIL ORDER WAREHOUSE:

Devonian Court, Park Crescent Place, Brighton. (Tel. 680722)

BARGAIN PARCELS

Including variable condensers, i.f. coils, loudspeaker plug/sockets, knobs, pots, condensers, resistors, nuts, bolts, cabinet fittings, switches, transformer choke, rectifier, transistors at a small fraction of list value Due to heavy demand we now pack them in several sizes—be amazed—try one now.

3 lbs. (post 3/-) 9/-
7 lbs. (post 5/-) 17/6
14 lbs. (post 6/-) 29/-

Aerial Wire: Coils of 25 yds. solid core, 2/3 plus 1/- P. & P.

Battery Eliminators for Transistor Supplies, 9v., 7½v., 6v., 29/6 plus 2/6 P. & P.

Condensers: Large range available from 6d. each.

Coax Sockets: Flush, 6d. plus 6d. P. & P.

Cartridges: Acos GP67/2G, 14/9; BSR TC8H, 30/-; TC8M, 28/6; X1M inserts, 22/6, etc.

Ear Pieces: 2·5μ/m or 3·5μ/m Mag., 2/6 plus 1/- P. & P. 2·5μ/m or 3·5μ/m Crystal, 5/6 plus 1/- P. & P.

High Impedance Horns: 1½ to 4½ volt, ideal for alarms, 3/6 plus 1/- P. & P.

Loudspeakers: Large range. 2in. 8 ohm, 7/6; 4in. 8 ohm, 12/6; 5in. 8 ohm, 16/6 plus 2/- P. & P.

Transistors: Full range, i.e. OC44, OC45, OC71, OC82, 2/6; OC35, 9/-; Fet.MPF103, 9/6.

Transformers: 12 volt battery charger, £1.2.6. 250-0-250 volt 60mA. 18/9; 0-250 with 6·3 volt. 19/6 plus 3/6 P. & P.

Relays: 12 volt suitable for car alarm, 21/-; 6 volt AC, 28/6; 240 volt AC, 27/6 plus 3/- P. & P.

Ex. Govt. Panel Meters: 0-SM/A, 17/6; 0-300v AC/DC, 25/6 plus 2/7 P. & P.

Many other items, please send S.A.E. for free price list.

BOTHWELL ELECTRIC SUPPLIES (Glasgow) LTD.
54 EGLINTON STREET,
GLASGOW, C.5. Tel. 041 SOUth 2904

Member of the Lander Group

TRADER SERVICE SHEETS

5/– each plus postage

We can supply Trader Service Sheets and Manufacturers' Manuals for most makes and types of Radios, Tape Recorders and Televisions.

Please complete order form below for your Service Sheet to be sent by return. To:

OAKFIELD ENTERPRISES

LIMITED

30 CRAVEN STREET, STRAND
LONDON WC2

Make	*Model*	*Radio/TV*

1969 List now available at 2/– plus postage

If list is required indicate with X

From ....

Address ....

....

enclose remittance of ....
(and a stamped addressed envelope)
s.a.e. with enquiries please
MAIL ORDER ONLY (April PW)

NEW BOOKS

FEBRUARY

FET Principles, Experiments and Projects
by Edward M. Noll 40/- net

49 Easy Transistor Projects
by Robert M. Brown and Tom Kneitel 16/- net

Photofact Television Course
by the Howard W. Sams Engineering Staff 40/- net

Servicing Digital Devices
by Jim Kyle 26/- net

MARCH

Understanding Electronics Units & Standards
by Earl J. Waters 25/- net

Using Scopes in Transistor Circuits
by Robert G. Middleton 32/- net

Transistor TV Training Course
by Robert G. Middleton 35/- net

Industrial Transistor Circuits
by Allan Lytel 24/- net

APRIL

101 Questions & Answers About Colour TV
by Lee G. Sands 15/- net

Having Fun in Electronics
by Lee G. Sands 25/- net

101 Easy Audio Projects
by Robert M. Brown and Tom Kneitel 28/- net

Practical Design with Transistors
by M. Horowitz 42/- net

FOULSHAM-SAMS TECHNICAL BOOKS

(W. FOULSHAM & CO. LTD.)
YEOVIL ROAD, SLOUGH, BUCKS, ENGLAND.

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times GMT
Frequencies in kc/s

THE BROADCAST BANDS by CHRISTOPHER DANPURE

WELL, the spring transmission season is upon us, autumn south of the equator. This is the month for you DX-ers to send off reports to get that long sought after QSL card, particularly in respect of hearing *R. New Zealand*. The best time to try is between 0800-0845 on the 25mb, frequency is usually 11,780 Mc/s, they are also in the 31mb using either 9,520Mc/s or 9,540Mc/s. Another station which is hard to hear in the British Isles is the *Voice of Free China*, Taipei, this station is heard quite well during March and April during its English transmission from 1800-1900, I have heard them at poor to fair strength in the 19mb.

In the February issue I brought up the question of the swamping of the short wave broadcast bands by *R. Moscow* and Russian jammers, and the large number of frequencies used by the *Voice of America*. But there is also another nuisance on the short wave broadcast bands, that is stations who operate off frequency and cause heterodynes on stations operating on the correct frequency. The chief culprits of this form of interference are *R. Tirana* operating on 15,402-3, 11,863, 11,858 and 9,718 instead of 15,400 or 405, 11,865, 11,860 and 9,715. Another station is *R. Tehran* on 15,137Mc/s and 11,730Mc/s. So perhaps these stations would spend some money on new frequency measuring equipment in 1969 and rid the bands of those horrible heterodynes.

Now here are this months propagation predictions.

West Africa: 0800-1600 25, 21, 17 and 15Mc/s; 1600-1800 25, 21, 17, 15 and 11Mc/s; 1800-2000 21, 17, 15, 11 and 9Mc/s; 2000-2200 17, 15, 11, 9, 7, 6, 5 and 4 Mc/s; 2200-0200 15, 11, 9, 7, 6, 5, 4 and 3Mc/s; 0200-0400 11, 9, 7, 6, 5, 4 and 3Mc/s; 0400-0600 11, 9, 7, 6 and 5Mc/s; 0600-0800 15, 11 and 9Mc/s.

East Africa: 0800-1400 25, 21, 17 and 15Mc/s; 1400-1800 25, 21, 17, 15, 11 and 9Mc/s; 1800-2000 17, 15, 11, 9 and 7Mc/s; 2000-2200 15, 11, 9, 7, 6 and 5Mc/s; 2200-0200 11, 9, 7, 6 and 5Mc/s; 0200-0400 11, 9 and 7Mc/s; 0400-0600 11 and 9Mc/s; 0600-0800 21, 17 and 15Mc/s.

South Africa: 0800-1200 25 and 21Mc/s; 1200-1400 25, 21 and 17Mc/s; 1400-1600 25, 21, 17 and 15Mc/s; 1600-1800 25, 21, 17, 15 and 11Mc/s; 1800-2000 21, 17, 15, 11 and 9Mc/s; 2000-2200 17, 15, 11, 9, 7, 6 and 5 Mc/s; 2200-0200 15, 11, 9, 7, 6 and 5Mc/s; 0200-0400 11, 9, 7, 6 and 5Mc/s; 0400-0600 11 and 9Mc/s; 0600-0800 21, 17 and 15Mc/s.

South Asia: 0800-1200 25, 21, 17 and 15Mc/s; 1200-1400 25, 21, 17, 15 and 11Mc/s; 1400-1600 21, 17, 15, 11, 9 and 7Mc/s; 1600-1800 15, 11, 9, 7, 6, 5 and 4Mc/s; 1800-2000 11, 9, 7, 6, 5 and 4Mc/s; 2000-2200 11, 9, 7, 6, 5, 4 and 3Mc/s; 2200-2400 9, 7, 6, 5, 4 and 3Mc/s; 2400-0200 7, 6 and 5Mc/s; 0200-0400 9 and 7Mc/s; 0400-0600 11 and 9Mc/s; 0600-0800 21, 17 and 15Mc/s.

South East Asia: 0600-0800 21 and 17Mc/s: 0800-1000 25, 21 and 17Mc/s; 1000-1200 25, 21, 17 and 15 Mc/s; 1200-1400 25, 21, 17, 15 and 11Mc/s; 1400-1600 21, 17, 15, 11 and 9Mc/s; 1600-1800 17, 15, 11, 9, 7, 6 and 5Mc/s; 1800-2200 11, 9, 7, 6 and 5Mc/s; 2200-2400 9 and 7Mc/s; 2400-0200 9Mc/s only; 0200-0600 circuit closed.

North East Asia: 0600-0800 15Mc/s only; 0800-1000 21, 17 and 15Mc/s; 1000-1200 17 and 15Mc/s; 1200-1400 15 and 11Mc/s; 1400-1800 11 and 9Mc/s; 1800-2200 9Mc/s only; 2200-0600 circuit closed.

Australia (East) via Asia: 0600-1000 21Mc/s only; 1000-1200 17Mc/s only; 1200-1400 15Mc/s only; 1400-1600 11 and 9Mc/s; 1600-2000 11, 9, 7 and 6Mc/s; 2000-2200 9Mc/s only; 2200-0600 circuit closed.

On 2nd March most shortwave broadcasting stations changed over to spring/autumn transmission schedules. So now here are the latest DX-tips.

AFRICA

South Africa: *R. R.S.A.*, Johannesburg, now has English broadcasts as follows on weekdays only: 0413-0427 on 11,900 and 9,525; 0428-0442 on 21,535 and 17,805; 0458-0512 on 7,270 and 5,980; 0513-0527 on 21,535 and 17,805; 0643-0657 on 17,805 and 15,220. Daily 0956-1050 on 21,535, 17,805 and 15,220; 1056-1150 on 25,790, 21,535, 15,220 and 11,900; 1156-1250 on 21,535, 17,805 and 15,220; 1256-1450 on 25,790, 21,535, 15,220 and 11,900; 1556-1650 on 15,220 and 11,900; 1656-1750 on 25,790 and 21,535; 1756-1850 on 21,535 and 17,805; 1856-1950 on 17,795 and 11,875; 2056-2150 on 21,535 and 17,805; 2326-0320 on 11,875, 9,705 and 6,075.

EUROPE

Denmark: *The Voice of Denmark*, Copenhagen, is now beaming its transmission to South America from 2200-2315 daily in Danish, but on Mon, Wed and Fri the last 30 minutes are in Spanish.

Holland: *Radio Nederland* now has English transmissions on weekdays for 50 minutes at the following times from transmitters at Lopik: 0730-0820 on 11,730 and 9,715; 1430-1520 on 21,480, 17,810 and 6,020; 1900-1950 on 11,730 and 6,020; 2000-2050 on 11,730 and 6,020; 2100-2150 on 15,425 and 11,730

In May the length of all English transmissions will be 80 minutes for weekdays only. On Sundays the Happy Station will go out at the same times.

CARIBBEAN AREA

Bonaire: The planned full operation of this base in March has been postponed until May. There now are new programme times for *R. Nederland* English transmissions with new transmissions. 1900-1950 to Africa on 15,220; 2130-2220 to W. Africa and Spain on 17,810 and 15,220. From 2330-0110 the Spanish/English programme will go out on 6,085 as well as 800kc/s; 0130-0220 on 11,730 and 9,590; 0500-0550 on 11,730 and 9,590.

Deadline this month 14th, so good listening and 73s.

THE AMATEUR BANDS by DAVID GIBSON, G3JDG

SPRING, when a young c.w.l.s. fancy lightly turns to topband—or does it. The sunspots are on the wane but still the DX seems to be coming through so it would seem to be a good idea to make r.f. hay while the sunspot shines.

All bands have been very good although only one report was received on the topband transatlantics. The W stations in some areas are now allowed considerably more power on this band so you stand a very good chance of hearing your first W on 160 if you listen really hard.

Ten metres going well with VK, VU, and ZD9 all coming through plus quite a few more prefixes which eluded my front end. Fifteen has been excellent and stayed open longer. At 0530hrs the stirrings can be heard and it doesn't seem to want to hit the sack until 2200. Twenty—even better than 15 for me. It opens earlier and closes later and only dies from about midnight to 0300. Seven megs is a devil of a din but the noise was well modulated with sigs from JA, DU, VK and the likes. This last month seems to have favoured 40 metres with regards to Oceania.

Eighty and 160 have, at times, been excellent. On 3·5Mc/s Oceania has peaked through albeit mighty weak while the African continent has featured quite prominently on this band.

A reminder, especially for anyone just starting to listen on the amateur bands. The mobile rally season is almost upon us and my diary makes the first one the North Midlands Rally at Drayton Manor Park near Tamworth in Staffs. There's nearly always a talk-in station on topband so if you locate him, then you will be able to hear all the mobiles making contact. Listen for the lads who conduct QSO's on this frequency too. (Fall out the men with red faces!). Be on the look out for cars with weird looking aerials, but be careful. Rushing up to a police car and asking for a QSL just isn't appreciated.

Little birds have whispered that Italian stations are shortly to have a prefix shuffle. The I callsign stays but the number which follows will indicate the province. Another correspondent told tales of a DXpedition to Chatham Island but I didn't hear anything of them at all. Perhaps my front end is more selective than I think; anyone hear sigs from that direction?

SIGS RECEIVED

Desmond Clark (Amersham) is hoping to visit CN8 and 7XØ this summer and says he hopes to hear G3JDG on topband—I hope he hears G3JDG on topband too! Meanwhile his P.W. progressive s'het has been modded and multi-band log reads: 80—CT2AS, EA6BG, K1ANV, OD5BA, VE1IE, VO1AL, W1BL, ZL4KE: 40—HCØBU/HP1, LX1BW, XE3EB; 20—CE6EZ, CE8AA, FP8CS, FR7ZG, HS1MD, JA3IG, OA4AI, UWØJA, VE6TP, VE7ZA, VE8RCS, VK2WD, VK3AK, VKØIA, VP8KD, VP8KO, YBØAAB, ZL2ACP, ZL3KV, ZL4LM, 5V4EG, 6W8DY, 9K2CF, 9X5AA, 9Y4EH. All these on s.s.b.

R. Dinning (Ayrshire) HA350 plus PR30X, 380ft. long wire (my, that is a long wire) got these on 15 s.s.b.—CT2AS, EL2J, FM7WQ, HC2HM, HR1KAS, HR1WTA, KP4AZV, KV4CF, MP4BGY, OD5AT, PJ2CQ, SVØWN, TF2WJR, TI5CPG, VK2FA, VK2SI, VP8KO, VQ8CC, ZL3KV, 9G1GK. Ten metres s.s.b. raised—CR6KD, KP4DED, KV4FA, KZ5EK, MP4BGX, OD5BZ, SVØWN, VP2LX, YO9CN and hosts of W's.

Paul Sams (Romford) RX—60N, 55ft. end fed, had a session on 20 s.s.b. for—EL4BU, HBØLL, JA9KG, KL7EBK, PY2RE, PY7VON, VK2AYE, VK9NT, YN1HF, ZD8NK, ZL1AON, ZL2JB, ZL4BC, 7X2ARA, 9K2PS.

P Cavill (Glos.), who has a CR45, received a mixture of s.s.b. and a.m. from—CT1LM, EA2DZ, TI2CMF, VE1ASN, VE3ETS, VK2PL, WA2EUA/P1, YV1WX, 5A1TX, 6Y5JB, 9H1BG. Aerial was 130ft. long wire and the band 10 metres.

Pat Johnson (Durham) has an unstable RX60 plus PR30 with a 60ft. wire thrown in for good measure. Eighty metres produced s.s.b. from—CT1SQ, EA7ID, HB9XL, K2ADY, K3NPV, LX1JE, OA8VE, OD5BA, OX3WX, TF3BE, TF5TP, VE1AAW, VE1AX, VE2BBY, VO1AK, W1EFM, WB2RDO, WØHP, XE1KB, YV5DU, 9H1BL. Forty metres produced—CR7HM, CT1WA, EA3JO, HK3AIS, HV3SJ, YV1PW. (Psst! How can I make my rx unstable OM?) Pat says that EUs average 5 and 9 plus 10dB, OX and TF 5 and 9, VO/VE/W/K 5 and 7 to 9, S. America 5 and 5. This is for 80. Best listening times—2400 on for Canada and USA, 0630—0730 for S. America, East coast Ws and Oceania.

M. Pipes (Derby), Trio rx, 66ft. end fed is a 20 s.s.b. fan. The log reads—CR7PC, HR2WTA, KV4EY, MP4TCE, OD5FA, PY7APS, SV1CA, TA1KT, TG9EP, VK3RZ, VK7KJ, YV5AG, ZD8Z, ZS3JJ, ZS5DC, ZL6OY, 3A2CQ, 4Z4HG, 5A1TF, 5Z4KL, 6Y5GB, 7XØBF, 9H1I, 9Y4GM.

C. Davis (Stoke-on-Trent) confesses to neglecting his homework to hear—CN8DT, CR6LF, HI8XPM, TF2WLM, UAØBS, VK2AOF, VK3LA, W7LFA, 4X4IH, 9Y4VT. All heard on a Monarch HAM-1 and 50ft. end fed.

A. Hall (Folkestone), 888A plus a.t.u. (ten out of ten), 110ft. end fed, admits he has tendencies towards 80. His best for the band includes CT1LN, GB2IBS, K1RA/P, K2INO, K3UED, K4ASA, K4GSU/P3, VE1IE, WØGEP, W1HO, W2OKI, W3AQX, W4EYM, WAØRZR, WA2APQ, 9H1BL.

J. Hill (Germany), CR70A plus PR30 logged these on 28Mc/s a.m.—OZ1AD, W3BIW, W4CSR, W9DLC, and UA3VKT running 10W.

C. Morgan (Wallsend) CR150/2, 25ft. vertical has been roaming topband. He hooked—GD3VWN, GI6TK, GM3HLQ, HB9CM, HB9YL, OK1ATP, OK1JOE, OM2BM, W1BB/1, W2GGL, W2RAA. He hopes to erect a 132ft. wire soon so that it's ready and tested by next winter.

CONTESTS

Not a very active month for contest fiends. My little black book shows only two. March 8th—9th, BERU contest and also 8th—9th, the YL/OM c.w. contest with the kick-off at 1800 on the Saturday.

Build yourself a quality transistor radio

backed by our after sales service!

roamer seven mk IV

SEVEN WAVEBAND PORTABLE

SEVEN TUNABLE WAVEBANDS—
MW1, MW2, LW, SW1, SW2, SW3 AND TRAWLER BAND.

Extra M.W. band for easier tuning of Luxembourg, etc. Built in ferrite rod aerial for Medium and Long Waves. 5 Section 22in. chrome plated telescopic aerial for Short Waves—can be angled and rotated for peak S.W. listening. Socket for Car Aerial. Powerful push pull output. 7 transistors and 2 diodes including Micro-Alloy R.F. Transistors. Famous make 7 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 carrying handle. Size 9 x 7 x 4in. approx. First grade components. Easy to follow instructions and diagrams make the Roamer 7 a pleasure to build.

Total building costs **£5.19.6** P. & P. 7/6

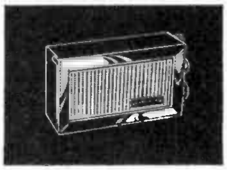
Personal Earpiece with switched socket for private listening 5/- extra.

Parts price list and easy build plans 3/- (Free with parts).

pocket five

MEDIUM WAVE, LONG WAVE AND TRAWLER BAND (to 50 metres approx.) PORTABLE WITH SPEAKER AND EARPIECE

Attractive black and gold case. Size 5½ x 1½ x 3½in. 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 moving coil speaker, also Personal Earpiece with switched socket for private listening. Easy build plans and parts price list 1/6 (FREE with parts).



Total building costs **44/6** P. & P. 3/6

transona five

MEDIUM WAVE, LONG WAVE AND TRAWLER BAND (to 50 metres approx.) PORTABLE WITH SPEAKER AND EARPIECE

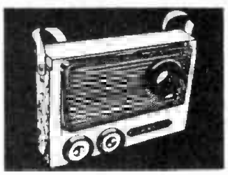
Attractive case with red speaker grille. Size 6¼ x 4½in. x 1½in. 7 stages—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone moving coil speaker also Personal Earpiece with switched socket for private listening. All first grade components. Easy build plans and parts price list 1/6 (FREE with parts.)

Total building costs **47/6** P. & P. 3/9

super seven

THREE WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case size 7¼ x 5¼ x 1½in. with gilt fittings. The ideal radio for home 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 parts). (Personal Earpiece with switched socket for private listening 5/- extra.)

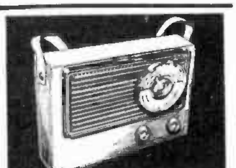


Total building costs **69/6** P. & P. 4/6

roamer six

SIX WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case with gilt fittings. Size 7½ x 5¼ x 1½in. 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 Micro-Alloy R.F. Transistors etc. (Carrying strap 1/6 extra). Easy build plans and parts price list 2/- (FREE with parts). (Personal Earpiece with switched socket for private listening 5/- extra.)

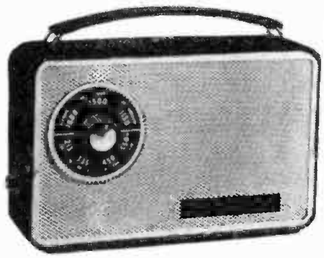


Total building costs **79/6** P. & P. 4/6

* *Callers side entrance Stylo Shoe Shop*
* *Open 10-1, 2.30-4.30 Mon-Fri. 9-12.30 Sat*

NEW LOOK melody six

TWO WAVEBAND PORTABLE



8 stages—6 transistors and 2 diodes. Covers Medium and Long Waves. Top quality 3½in. Loudspeaker for quality output and also with Personal Earpiece with switched socket for private listening. Two R.F. stages for extra boost. High "Q". Ferrite Rod Aerial. Push-pull output. Handsome pocket size case with gilt fittings. Size 6¼ x 4 x 2in. Easy build plans and parts price list 2/- (FREE with parts).

Total building costs **69/6** P. & P. 4/3

RADIO EXCHANGE CO

61 HIGH STREET, BEDFORD. Tel. Bedford 52367

I enclose £.................... please send items marked

ROAMER SEVEN	☐	ROAMER SIX	☐
TRANSONA FIVE	☐	SUPER SEVEN	☐
POCKET FIVE	☐	MELODY SIX	☐

Parts price list and plans for ....

Name ....

Address ....

.... PW4

PART 3 MAGNETIC SOUND RECORDING

W.S.FOWLER

IN THIS FINAL ARTICLE IN THE SERIES, DETAILS ARE GIVEN OF PRACTICAL CIRCUITS USED IN TAPE RECORDERS.

FOR general usefulness, the mains powered tape recorder has several advantages over battery models. A possible exception to this are the recent *cassette loaded* recorders which employ tape of half the normal width; ⅛ instead of ¼in. Two tracks are used and the machine thus approximates to the standard four track machines in performance. The vexed problem of capstan speed stability is tackled by the use of a transistorised "feedback" regulator. Furthermore the disadvantages of d.c. bias and permanent magnet erasure are obviated by the use of a.c. bias, coupled with the use of an a.c. erase head. Again, because of power requirements this last feature is generally restricted to mains powered recorders.

Constructors who wish to build a useful and reliable mains tape recorder are referred to the article in PRACTICAL WIRELESS for March, 1968. Using a B.S.R. TD2 deck, this recorder can be cheaply constructed and it would be difficult to improve on this without considerable expense.

The TD2 deck does however operate at a fixed speed of 3¾ i.p.s. and for those constructors who wish to obtain increased economy on the one hand, and also have the availability of a higher quality performance, it is suggested that the TD2 deck should be replaced by the TD10 B.S.R. deck. Alternative decks providing similar facilities are the Thorn and the Collaro Magnavox, four track versions are also available.

FREQUENCY CORRECTION

It has been assumed so far that the frequency response of the recording tape is linear, i.e., the output of the tape will correspond to the input. In practice this is not so and the losses in the tape head itself, together with the irregular response of the tape, necessitate some form of frequency correction. Normal practice consists in reducing the bass frequencies and accentuating the treble frequencies during the recording process while on playback the bass frequencies are boosted.

Some tape recorders employ a frequency selective choke which is connected in the grid circuit of the second stage of the amplifier and is brought into circuit when the machine is in the record position. A more common method is the use of frequency selective negative feedback.

A simple method giving good results shown in Fig. 11, consists of limiting the value of the cathode by-pass condenser of the second stage of the amplifier. The normal 25mfd by-pass condenser should be disconnected on its positive (cathode) side. A 0·05mfd paper condenser can then be connected across the cathode by-pass resistor. The disconnected positive lead of the electrolytic condenser is connected to a small on/off switch. The other connection of the switch is taken to the cathode. In the record position, the switch is "off" and the 0·05mfd condenser provides any easy path to earth for the higher audio frequencies, while the low frequencies are reduced through negative feedback. In the play position, the switch is "on" and the electrolytic condenser is brought into circuit, restoring normal linear amplification.

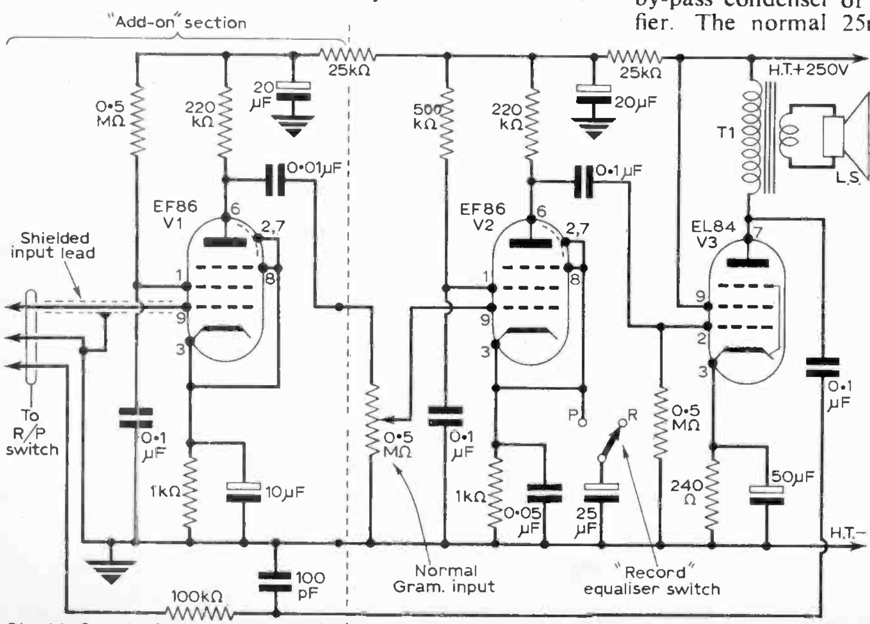


Fig. 11: Circuit of an add-on unit which may be used in conjunction with a record player amplifier.

AN ADD-ON UNIT

The B.S.R. TD2 tape deck unit can be purchased fairly cheaply and if this deck is installed in, or adjacent to, an existing radiogram or player unit, the total cost of providing recording and playback facilities need not exceed £10. The deck itself needs the normal mains connections to power the drive motor; the only other connections are those to the record/play head and to the erase head.

The signal which is to be recorded on to the tape must be derived from the main radiogram amplifier. Referring to Fig. 11 it will be seen that the signal is taken from the anode of V3 (the output valve). In this case the valve is an EL84, but this is unimportant, nor does it make any difference if the final circuit is in push-pull. All that is required is to obtain a signal from the anode side of the output transformer T1. This is fed via the capacitor/resistor chain to the record/play head, through a two-way switch, the other lead of the record/play head is permanently connected to earth.

For replay the output of the record/play head is too low to feed directly into a gramophone amplifier and pre-amplification is provided by the add-on valve V1. This is an EF86 high gain amplifier circuit and the a.f. output is fed via a 0·01mfd to the volume control circuit of the gram amplifier. If desired, a small transistorised preamplifier could be used here.

ERASE AND BIAS

So far, little has been said about the provision of a.c. bias and erase voltages which are necessary when an erase head is used in place of the simple permanent magnet. Basically, a small output valve such as an EL84 is used in an oscillator circuit to

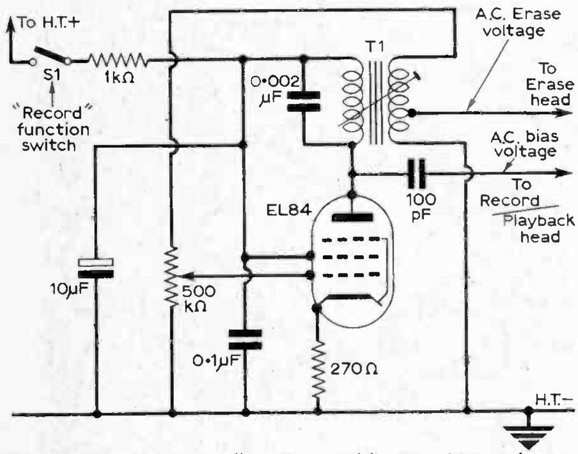


Fig. 12: Circuit of an oscillator for providing a.c. bias and erase currents.

provide a frequency of about 50-70kc/s. Details of the circuit are shown in Fig. 12.

The oscillator coil, T1, shown can be purchased for about seven shillings. The coil usually has a ferrite dust core which gives some control over the actual oscillator frequency. It will be noted that this circuit also provides a.c. bias for the record/play head. Only a small amount of bias is necessary and this is fed directly from the anode through a 100pF capacitor. This capacitor is connected permanently to the record/play head, but as the oscillator is only brought into operation on record, it performs no function when the machine is in the play position.

The oscillator coil has a secondary winding and it is this which is connected directly and permanently to the erase head. Most erase heads function at low impedance in order to avoid the build up of awkward r.f. potentials in the recorder circuit. A simple test to ascertain if the oscillator/erase system is functioning correctly consists in connecting a 6V flashlight bulb

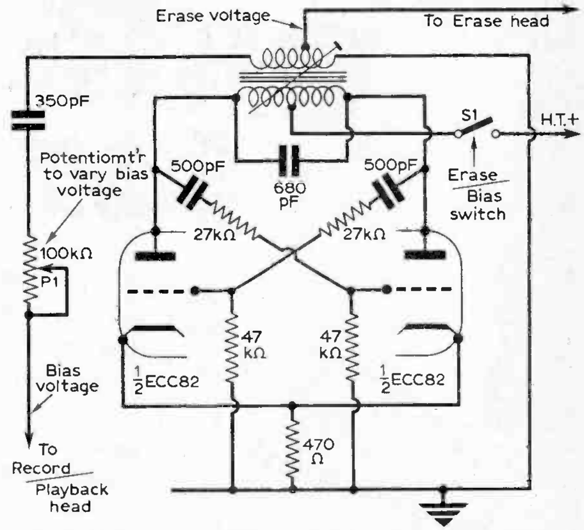


Fig. 13: Arrangement using a double-triode for a push-pull oscillator.

across the erase head, in the record position enough power should be generated to light this bulb.

If an EL84 valve is not readily available, a double triode a.f. amplifier valve such as an ECC82 may be employed instead. The circuit for this type of oscillator is shown in Fig. 13 and the output is provided by the push-pull operation of the two halves of the triode. This gives a purer waveform for the bias and erase. In this circuit, variable control of

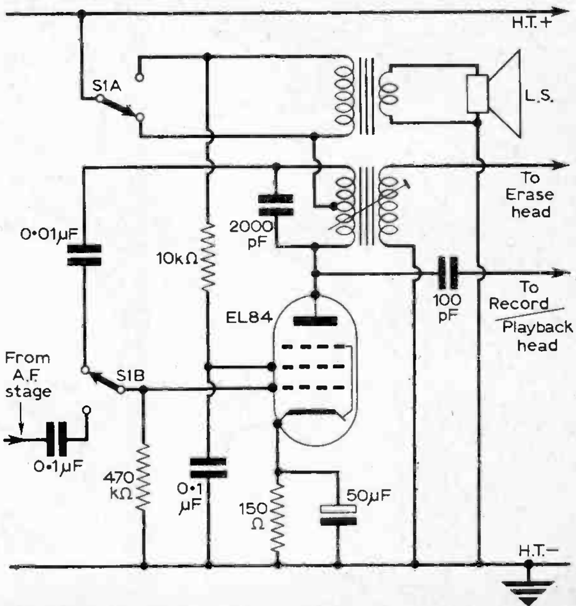
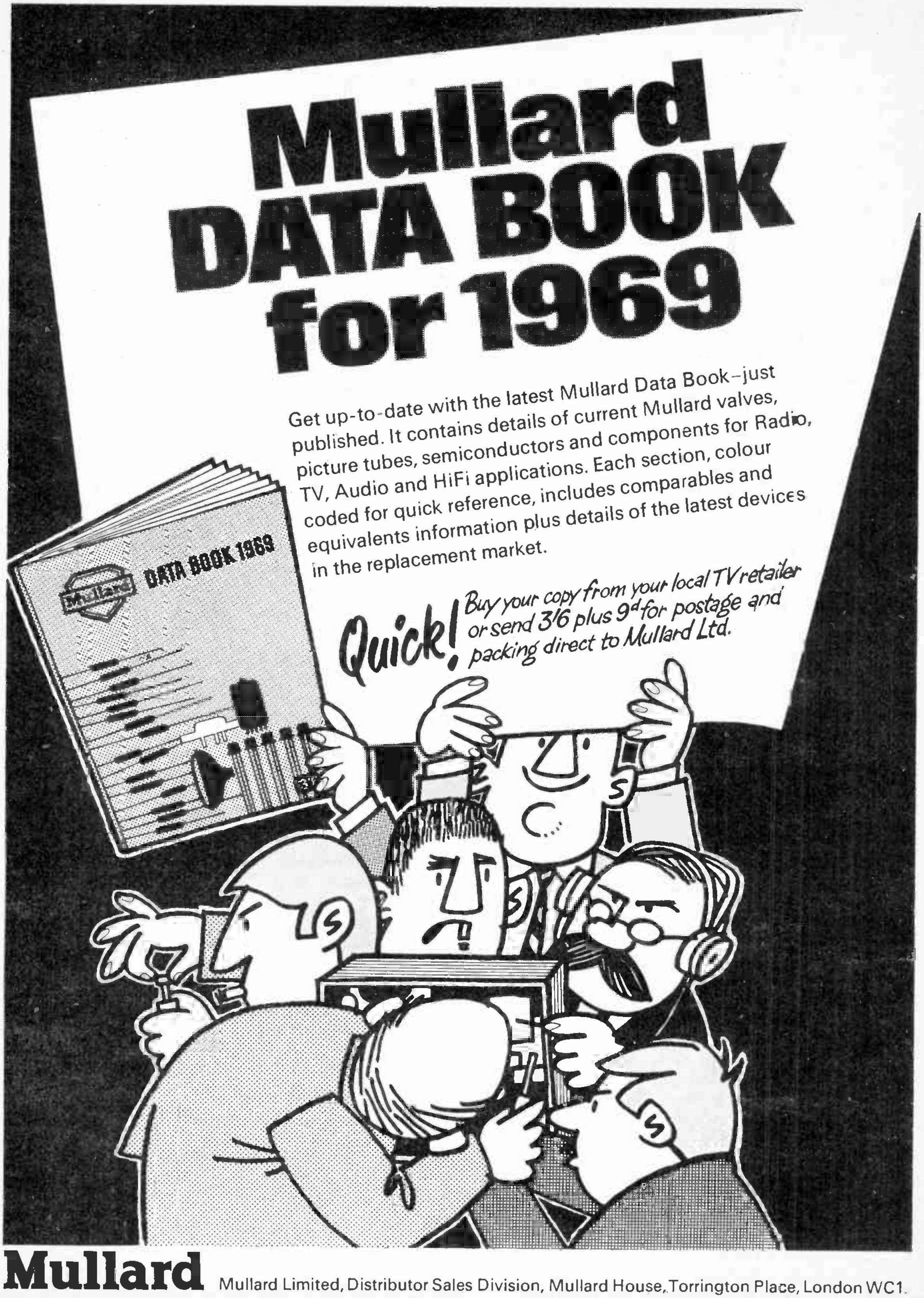


Fig. 14: The output pentode may be used in the circuit shown for providing erase and bias current while recording.



Mullard Mullard Limited, Distributor Sales Division, Mullard House, Torrington Place, London WC1.

CED72

TECHNICAL TRAINING

in radio television and electronics

Whether you are a newcomer to radio and electronics, or are engaged in the industry and wish to prepare for a recognized examination, ICS can further your technical knowledge and provide the specialized training so essential to success. ICS have helped thousands of ambitious men to move up into higher paid jobs—they can help you too! Why not fill in the coupon below and find out how?

Many diploma and examination courses available, including expert coaching for:

- C. & G. Telecommunication Techns'. Certs.
- C. & G. Electronic Servicing
- R.T.E.B. Radio/T.V. Servicing Certificate
- Radio Amateurs' Examination
- P.M.G. Certs. in Radiotelegraphy
- General Certificate of Education, etc.

Examination Students coached until successful

NEW SELF-BUILD RADIO COURSES

Learn as you build. You can learn both the theory and practice of valve and transistor circuits, and servicing work while building your own 5-valve receiver, transistor portable, and high-grade test instruments, incl. professional-type valve volt meter—all under expert tuition. Transistor Portable available as separate course.

POST THIS COUPON TODAY

for full details of ICS courses in Radio, T.V. and Electronics.

INTERNATIONAL CORRESPONDENCE SCHOOLS

Dept. 171, Intertext House, Parkgate Road, London, S.W.11

Please send me the ICS prospectus—free and without obligation.

(state Subject or Exam.) ....

....

NAME ....

ADDRESS ....

.... 4/69

INTERNATIONAL CORRESPONDENCE SCHOOLS

NEWMART

ELECTRONICS Dept. APR 9

30/32, Shudehill, Manchester 4. Tel: 061-832 7710

15, Whitechapel, Liverpool. Tel: 051-236 0738

SEND FOR A FABULOUS COLOUR ILLUSTRATED SOUND AND SCIENCE CATALOGUE, 88 PAGES CRAMMED WITH PICTURES AND INFORMATION ON ALL THE LATEST ELECTRONIC AND SCIENTIFIC GADGETS, ACCESSORIES AND EQUIPMENT, ONLY 1/6 P. & P. 1/-.

FREE GIFT OFFER OF A BRAND NEW WORLD FAMOUS E.M.I. FISK SOLARISCOPE VALUE £2.2.0 WITH EVERY ORDER VALUE £5 AND OVER. THIS UNIQUE INSTRUMENT WHICH IS A BOON TO SHORT WAVE LISTENERS CLEARLY SHOWS THE AREAS OF DAYLIGHT AND DARKNESS ALL OVER THE EARTH AT ANY GIVEN HOUR.

ORTOSLIDE UNIT. Fits any tape recorder, 2 or 4 track. Can be fitted in minutes. List price £8.17.6. Our Price ONLY 59/11 (2/-). Send S.A.E. for Leaflet.

ACOS ROUND Crystal Mike insert, 1⅜in. diameter. 7/6. P. & P. 6d.

CRYSTAL HAND MIKE. Robust and sensitive. Cream plastic case. Just the thing for tape recorders, 10/6. P. & P. 1/6. Similar with built-in stand, 12/6.

INTER-COMS. DE LUXE TRANSISTORISED HOMER. 2-Way. With cable. Uses PP5 battery. OUR PRICE 59/11. P. & P. 2/-. Ideal baby alarm.

4 TRANSISTOR 3W AMPLIFIER. Size 2¼ x 2¾ x 1¼in. 3, 8 or 15 Ω output, 9 volt battery operated. Highly sensitive. Price (less battery) 52/6. P. & P. 1/6.

CAPACITANCE SUBSTITUTION BOX. Range from ·0001mFd to 22mFd. Complete with leads, 25/-. P. & P. 2/-. A 'must' for the bench.

RESISTANCE SUBSTITUTION BOX 15 Ω to 10,000 Ω low range, 15k Ω to 10m Ω high range, 40/-. P. & P. 2/- (both models complete with leads).

NEW MODEL HI-FI 3 WAY VARIABLE CROSSOVER NETWORK, 63/-. P. & P. 2/6. Hi-Fi Tweeter, mod CT10. Spec. 15 Ω 10 Watts. 1,500–16,000 c/s. Sensitivity 104dB. 32/6. P. & P. 2/6.

BATTERY ELIMINATORS, replacement for PP9, 29/6 (2/-). PP3, 25/- (1/6).

GUITAR MICROPHONE. Unobtrusive, lightweight fitting simply requires clipping into the instrument cutout. Size only 1¼ x ¾ x 5/16in. thick. Gold anodised finish. Complete with 7ft. shielded lead. High impedance. 12/6. P. & P. 1/-.

DUVIDAL CRYSTAL MICROPHONE MODEL CM21. With built-in stand. Handsomely styled in two-tone grey plastic case with silver trim and intended for use with most tape recorders and small amplifiers. Fold out stand permits hand or table use. Complete with 4ft. insulated screened lead and moulded standard miniature jack plug. Size 3 x 1⅞ x ⅞in. High Impedance. 12/6. P. & P. 1/6.

DUVIDAL DYNAMIC MICROPHONE MODEL DM391. With built-in stand. High grade dynamic insert in tough, black plastic body with grey and silver trim. Fitted with pull-out stand for desk use. Direct replacement for many recorders; standard 50K ohms impedance permits use with most other equipment. Size 2⅝ x 1⅞ x 1in. deep. Complete with 4ft. cable and standard phono plug. 25/-. P. & P. 1/6.

MYPHONE CRYSTAL MICROPHONE MODEL CM-3. Extremely versatile stick microphone with muting switch that can be used with floor stand, desk stand, or in the hand. Finished in chrome and black enamel, supplied complete with lead and removable stand adaptor. High impedance only. 37/6. P. & P. 2/-. Base 5/- extra.

DUVIDAL SLIMLINE CRYSTAL MICROPHONE MODEL CM80. A new, versatile stick microphone you can use with a desk or floor stand, neck harness or simply hold in the hand. Beautifully finished in satin chrome and measuring only 5in. long x 1⅛in. maximum diameter. With built-in muting switch and supplied complete with lead, neck harness and stand adaptor that permits instant detachment or replacement from the stand. High impedance only £1.9.6. P. & P. 2/-. Base 5/- extra.

MYPHONE DYNAMIC MICROPHONE MODEL MS-11. A desk microphone on pressed steel base with adjustable swan neck stand 6in. long. Very attractive compact design finished dark brown enamel with contrasting silver finish stem and trim. Base fitted with on/off switch. Microphone 3½in. long x ⅞in. diam. Base 4¼ x 3 x ⅝in. Impedance 50K ohms. Supplied with fitted lead. £2.9.0. P. & P. 5/-.

DUVIDAL DYNAMIC MICROPHONE MODEL DM-301. Robust broadcast studio type microphone, adjustable for 600 ohms and 50K ohms impedance. Microphone pivots on fitted stand adaptor which includes built-in on/off switch. Supplied with connector and cable. Maximum dimensions, including adaptor 7 x 2¼ x 1⅞in. With dual impedance adjustment. £4.11.0. P. & P. 4/-.

ARET DYNAMIC MICROPHONE MODEL DM-155. A hand stick microphone, black crackle finish with chrome trim. Insert is housed in unusual "golf-ball" shaped, perforated case. All metal construction. 50K ohms impedance. Fitted on/off switch and connecting cable. Size overall: length 6½in., ball 1⅞in. in diam. £2.13.6. P. & P. 3/-.

PRECISION VERNIER DIALS. Univ. mounting for std. ¼in. drives. Complete range of three progressively sized precision planetary drives. Vernier Dials, each with approximately 8 to 1 ratio. Can be mounted on any panel surface, and requires only drilling for fixing screws and centring hole for metal insert to receive ¼in. drive shaft. Attractive all-metal dials having brushed silver finish with deeply etched enamel filled engraving that provides maximum legibility, even in poor lighting conditions. Each dial is graduated to 0 to 100 over 180° and fitted with large sure-grip knob and housing. Mechanical construction is phosphor-bronze and brass throughout. Range available: Type 1 2in. diam. x 1in. deep, 10/6. Type 2 2⅞in. diam. x 1¼in. deep, 13/-. P. & P. 1/6.

GENUINE DIAMOND STYLUS at 7/11 plus 6d. P.P. as replacements for the following popular types: **BSR TC8LP—BSR TC8 STEREO—BSR TC8 LP/STEREO—COLLARO STUDIO "O" LP/RONETTE—GARRARD GC8 LP—ACOS GP65/67 LP—RONETTE BF40/LP—GARRARD GC2 LP.** Sapphire also available at 3/11 each.

TWEETER. 2½in. Black plastic cone, Square Frame, E.M.I. 3 Ω, 12/6, plus 1/6 P. & P.

EXTRACTOR FANS. Brand new 230/250 volts A.C. mains operated extractor fans. Absolutely complete except for external shrouding which can be readily made up from simple sheet metal wrapping to suit any particular installation. Continuously rated, smooth silent running induction motor, balanced, 2-bladed 6in. fan. Size 7½ x 4in. deep. 35/-. P. & P. 4/-.

TELEPHONE PICK-UP COIL. Actually a special, sealed induction coil with rubber suction cup that simply attaches to telephone handset housing. Lead connects to amplifier or tape recorder, as required. 10/6. P. & P. 1/-

DUVIDAL AUTOMATIC TAPE SPLICER. Essential for editing and making immaculate joins in broken tape. Twin clamps, hold broken ends in perfect alignment; integral cutting tool makes diagonal splice and trims away surplus splicing tape when join is complete. Size only 3 x 2 x 1½in. high. 14/6. P. & P. 1/6.

VERITONE NT200 DEFLUXER. A must for serious tape users! Tape heads become permanently magnetised with constant use; effect is cumulative and leads to background noise that prevents the achievement of perfect recordings. Highly effective, mains operated device is simply applied to recording head and carries magnetic condition through series of hysteresis loops of diminishing amplitude leaving head substantially free of magnetism. Cleans any tape head in seconds. 35/6. P. & P. 1/6.

PICK-UP CARTRIDGE REPLACEMENTS (for all Record Players). **ACOS GP/67-2 Mono 17/6. ACOS GP/91-1 Mono de-luxe 21/-.**

TERMS. Cash with order. No C.O.D. Order total £5 and over sent carriage paid. Guaranteed money refunded if goods returned perfect within 7 days of despatch.

the bias voltage is also provided by the 100kΩ potentiometer.

It is also possible to make an output valve do double duty, so that it performs its normal output function on replay, but is switched to perform as the oscillator during record. This system is often used on domestic recorders and for constructors who wish to experiment with this method the requisite circuit is given in Fig. 14. Here the EL84 output valve has its transformer replaced by the oscillator coil by the operation of S1 when the recorder is switched to the "record" position. It should be noted that if this circuit is employed, the tape "take-off" point cannot be made at the anode of the output valve, since this valve will not be in circuit during the recording process.

RECORDING LEVEL INDICATION

If the signal level applied to the record head is insufficient the recording made will be weak and the background level of noise high. Conversely, if the signal level is too high, severe distortion will be apparent on playback. It is therefore necessary to provide some method of indicating the strength of the applied signal. This is frequently done by means of a "magic eye" valve and for constructors who wish to employ this method, the circuit is given in Fig. 15. The reference signal is taken via a 0·1mfd condenser from the same point as the record signal and several experimental recordings should be made while VR1 is adjusted so that it just closes on the maximum permissible signal obtainable without distortion. Future recordings should then be made with the magic eye just failing to close on peaks.

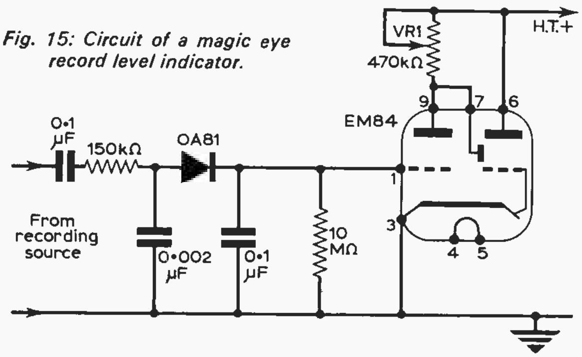


Fig. 15: Circuit of a magic eye record level indicator.

A simple alternative method of assessing recording level, which may well be employed with the "add-on" deck, utilises the loudspeaker output signal. A 1mA meter is connected directly across the loudspeaker connections in series with a miniature diode detector rectifier and a 25Ω potentiometer. This is set so that the meter reads just below full scale deflection (f.s.d.) on the loudest permissible signal (see Fig. 16).

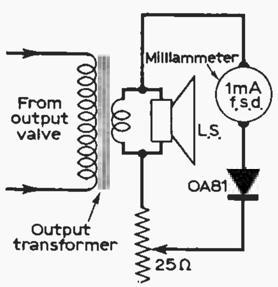


Fig. 16: A simple record level meter.

Heater and h.t. supplies are required for the add-on unit. This can often be done by tapping-off from the unit's own supply, *provided that the gram or player is of the a.c. only type and with 6·3V heater valves.* It must NOT be attempted with a.c./d.c. radiograms or players. In this case a small separate power pack should be constructed. Alternatively, a transistor amplifier module could be employed to amplify the head signals on replay, and a similar module should be used to provide oscillator erase and bias. The only mains connection will then be to the deck itself, for the purpose of driving the deck motors. ■

HOME WORKSHOP PRACTICE

—*continued from page 934*

sharp external corners. The jaws are smoothed off with a medium emery paper.

The jaws are used mainly to raise the edges of a chassis and where it is possible to grip only one end of the jaws in the vice because of the width of chassis being held, it is a good plan to pinch the other ends of the jaws together with one of the "G" clamps from the tool kit. The secret of successful sheet metal working is to hold the work *firmly*.

As and when finance becomes available to add to the tool kit, the following are strongly recommended:

One of the modern **wire-strippers,** which are adjustable for depth of cut. A set of **taps and dies** for thread cutting. It really is amazing how frequently this item is used once it is a part of the tool kit. In fact, the author never buys medium to large bolts nowadays, but simply runs a thread on to a round nail of suitable diameter, at one-quarter the price of a bolt. Most of the power tools in the author's workshop are bolted down with threaded six-inch nails and wing-nuts.

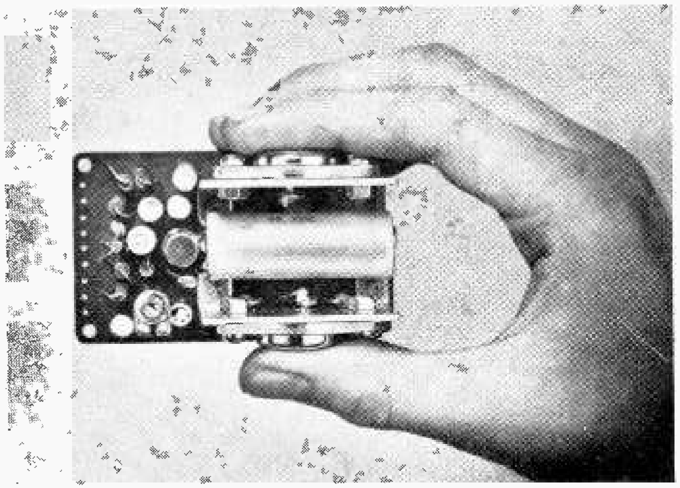
As soon as possible, add a **"Pop-Rivet"** kit to the workshop tools. These are extremely easy to use and the fastenings are permanent, although the rivet is easily drilled out if necessary. Pop rivets are half the price of nuts and bolts.

A good **electric drill** has numerous uses in the workshop. The modern two-speed type allows bits to be run at the correct speed, and the inexpensive kits which are often sold with the drill usually include a small grinding wheel which will be found essential for keeping edge tools in good condition. When the need is felt for an entirely separate power grindstone, a washing machine motor can be obtained, and a thread run on to the spindle in order to bolt the grinding wheel up tight, using large washers each side of the wheel for support. An effective cage of robust construction *must* be built round the grinding wheel in case of fracture at high speed.

A stand can be obtained for the pistol drill which converts it into a drill press, or pedestal drill. This allows accurate vertical drilling, and frees one hand to hold the work. However, the slight inconvenience of continually changing attachments prompted the writer to obtain another motor and fit a chuck to it. This motor is lashed to the drill stand and remains permanently in position as a drill press.

A machine vice for use in conjunction with the drill press is a useful little accessory, although the extension jaws previously mentioned, pinched together with the "G" clamps, is a makeshift substitute. ■

sinclair



Z.12 - for all you want from any amplifier

The Z.12 is a most versatile integrated amplifier and pre-amp in which power, compactness and true high-fidelity standards are combined within a unit of very modest price. The most widely used unit of its kind in the world, the Z.12 has an output of 12 watts R.M.S. continuous sine wave (24 watts peak) or 15 watts music power (30 watts peak). It has Class B ultralinear output which can be fed into any loudspeaker from 3 to 15 ohms. (Two 3 ohm speakers can be used in parallel). Frequency response—15 to 50,000 Hz ±1dB; input sensitivity—2mV into 2 K/ohms. The Z.12 will operate from any power source between 6 and 20 volts d.c. As such, a car battery or the PZ.4 are eminently suitable, giving much wider than usual scope in the applications to which the Z.12 may be put. As well as hi-fi, these include systems for P.A., electronic guitars, organs, intercom systems, laboratory, education or industry. You will find the Z.12 in use in such instances again and again. The Sinclair Z.12 is supplied ready built, tested and guaranteed, complete with manual of circuits and instructions for matching it to your precise requirements. Two may be used in stereo when, with the Stereo 25 and PZ.4 together with two Q.14s, you will have an ideal high fidelity assembly. In addition, you will enjoy an appreciable saving in outlay.

89/6

Q.14 - the unique loudspeaker

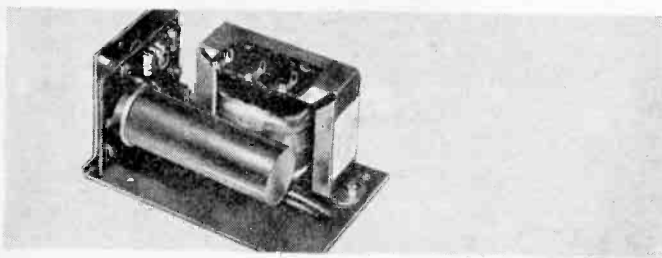
New materials and original design techniques have been used to produce a speaker of fantastic quality at a most attractive price. Experts and reviewers have enthusiastically endorsed its performance. The shape and size of the Q.14 make it far more adaptable to its environment than is the case with conventionally styled speakers, so that it is much easier to position this speaker in the room in which it is to be heard. The Sinclair Q.14 has a substantially flat frequency response from 60 to 16,000 Hz and outstandingly good transient response. It will comfortably handle up to 14 watts loading and is positively brilliant in stereo. Measuring 9¾in square by 4¾in deep, this loudspeaker is finished in matt black with solid aluminium bar trim. Try the Q.14 in your own home without delay. If you are not delighted with it, your money including cost of return postage to Sinclair will be refunded immediately.

£7.19.6

Stereo 25 - de-Luxe pre-amp/ control unit

This is a very elegantly styled unit, which, although designed basically for use with the Z.12, is readily adaptable for use with any high quality power amplifier system. The switched input selector allows for Pick-up, Radio and Auxiliary and there are controls for bass cut and lift, treble cut and lift, volume and stereo balance. P.U. input is equalised to R.I.A.A. curve from 50 to 20,000 Hz $\pm$1dB and the instructions manual provided gives matching details for pick-ups, shows how to connect up etc. The front panel of the Stereo 25 is finished in brushed and polished aluminium embellished in black. The control knobs are in solid aluminium to match. Size 6½in. x 2½in x 2½in plus knobs. Supplied built, tested and guaranteed.

£9.19.6



PZ.4-stabilised power supply unit

Designed specially to meet the power requirements for an assembly of two Z.12s and the Stereo 25, this heavy duty transistorised power supply unit has stabilised output of 18 volts d.c. at up to 1.5A. It is for AC mains operation 200/250V.
Supplied built, tested and guaranteed.

99/6

SINCLAIR MICROMATIC

Whether you buy your Micromatic in kit form or ready built for immediate use, you must not deny yourself the thrill of owning this fantastically small British receiver. Smaller than a matchbox, it has power, range and selectivity that must be experienced to be believed. The high quality magnetic earpiece supplied with the set ensures excellent reproduction indoors and out. The Micromatic tunes over the medium waveband and has A.G.C. to counteract fading from distant stations. Bandpass tuning makes reception of Radio 1 easier; in fact you will find this set performing in some cases where other sets cannot be heard at all. The Micromatic is housed in a neat black case given an elegantly modern appearance by the attractive aluminium front panel and matching tuning control.

Kit in filled pack with magnetic earpiece' instructions and free solder

49/6

Built, tested and guaranteed, inc. magnetic earpiece

59/6

Mallory Mercury Cell type R.M.675 (2 required) 2/9 each

GUARANTEE

Should you not be completely satisfied with your purchase when you receive it from us, your money will be refunded in full at once and without question. **Full service facilities available to all purchasers.**

Goods sent post free in U.K. and Overseas by surface mail. Air-frieght charged at cost.

Please send POST FREE

....

....

....

....

For which I enclose cash/cheque/money order

NAME ....

ADDRESS ....

....

....

PW.469

sinclair

SINCLAIR RADIONICS LTD., 22 NEWMARKET ROAD, CAMBRIDGE OCA-3 52731

RADIONIC

LEARN AS YOU BUILD AT HOME THE EXCITING WAY

Clear, simple, versatile, this rugged system can build almost any electronic circuit. Ideal for the experimenter; the teacher; and the complete beginner. Already used by well over 1,500 schools in the U.K.

Selected by the Council of Industrial Design for all British Design Centres. Featured in Sound and Television broadcasts.

Beautifully engineered; battery operated; no soldering; no prior knowledge needed. Results guaranteed by our technical department. People say:

"I can only describe the results as brilliant, absolutely brilliant."
"You have opened up a new world."
"Nothing could paint the picture clearer than building these sets."
"The kit has been used by my son (aged 10) with complete success."
"Most impressive—a stroke of genius whoever devised it."

UNIQUE! Our "No soldering" printed circuit board for superhet portable. Simply insert components and tighten nuts.

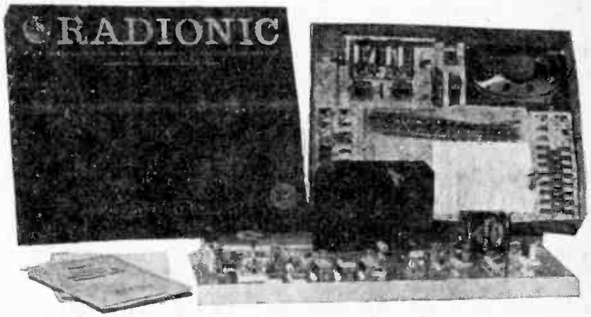
No. 1 Set	**£7.12.9.**	**14 Circuits (Earphone)**
No. 2 Set	**£9.3.3.**	**20 Circuits (Earphone)**
No. 3 Set	**£13.14.11.**	**22 Circuits (7" x 4" Loudspeaker Output)**
No. 4 Set	**£18.15.5.**	**26 Circuits (incl. 6-transistor and reflex superhets)**

ELECTRONICS KIT: 30 plus circuits £19.7.0. (Prices Post Free)

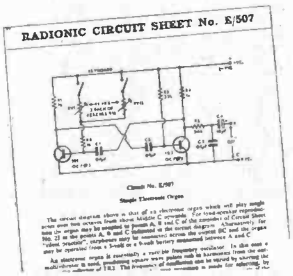
Full details from:

RADIONIC PRODUCTS LIMITED
ST. LAWRENCE HOUSE,
29-31 BROAD STREET, BRISTOL BS1 2HF
Tel. (0272) 25351

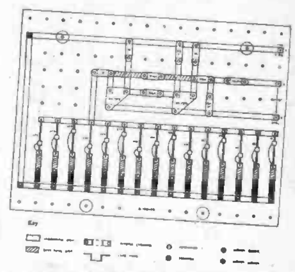
RADIO & ELECTRONIC INSTRUCTIONAL SYSTEM



A No. 4 SET and 6-TRANSISTOR SUPERHET



Theoretical Circuit



Practical Layout

COMET Hi-Fi DISCOUNT WAREHOUSE

- **ALL ITEMS OFFERED ARE FULLY GUARANTEED AND BACKED BY COMET.**
- **OPENING HOURS, OPEN DAILY UNTIL 5.30 p.m. (8 p.m. THURS. AND FRI. EVENINGS) AND 5 p.m. SATURDAY.**
- **COMPLETE FREE PRICE LIST CONTAINING OVER 500 ITEMS ON REQUEST.**

	Recom. Retail Price	Comet Price
AMPLIFIERS		
DULCI 207 Stereo Amplifier	£19 19 0	£15 19 0
DULCI 220 Stereo Amplifier	£44 2 0	£33 1 6
LEAK Stereo 30 Standard	£52 0 0	£44 0 0
LEAK Stereo 30in Teak Case	£58 10 0	£48 14 0
LEAK Stereo 70 chassis ..	£63 0 0	£56 0 0
LEAK Stereo 70 in case ..	£69 10 0	£61 0 0
GOODMANS Maxamp ..	£54 0 0	£45 18 0
QUAD 33 Pre-amplifier ..	£43 0 0	£36 11 9
QUAD 303 Stereo Main Amplifier	£55 0 0	£46 15 0
ROGERS Cadet Mark III ..	£35 15 0	£28 14 0
ROGERS Cadet Mark III in Teak Case	£37 10 0	£31 17 6
ROGERS Ravensbourne 50 W. Stereo	£59 10 0	£50 12 0
ROGERS Ravensbourne in Teak Case	£64 0 0	£54 8 0
TUNERS		
ARENA 211 Stereo with Decoder	£39 18 0	£34 18 0
DULCI FMT 7	£22 1 0	£18 19 6
DULCI FMT 7 Stereo tuner	£29 8 0	£23 19 6
LEAK Stereo Troughline tuner	£50 11 4	£42 19 6
LEAK FM Troughline ..	£35 15 4	£30 10 4
GOODMANS Stereomax AM/FM Stereo tuner ..	£80 19 0	£70 19 0
QUAD Stereo FM Tuner ..	£50 0 0	£44 15 0
ROGERS Cadet tuner ..	£20 12 6	£17 18 0
ROGERS Ravensbourne tuner with decoder ..	£60 15 3	£52 2 0
TRUVOX FM tuner ..	£35 5 0	£30 5 0

	Recom. Retail Price	Comet Price
STEREO TUNER/AMPLIFIERS		
ARENA 2400 with decoder	£90 6 0	£75 0 0
ARENA 2500 with decoder	£97 0 0	£79 0 0
Teleton Equipment		
602X AM/FM Multiplex Stereo Tuner/Amplifier 70 Watts RMS	£92 11 9	£75 0 0
502X AM/FM Multiplex Stereo Tuner/Amplifier 40 watts RMS	£107 8 3	£64 0 0
302X AM/FM Stereo Tuner Amplifier 20 watts RMS	£72 7 0	£59 19 6
MX.990 AM/FM Multiplex Stereo Tuner/Amplifier 2 × 6 watts RMS complete with 2 Speaker Boxes	£64 13 2	£54 16 0
F.2000 AM/FM Multiplex Stereo Tuner/Amplifier 2 × 5 watts RMS with silicon Transistors ..	£43 0 0	£37 0 0
R.8000 AM/FM Multiplex Stereo Tuner/Amplifier 2 × 6 watts RMS complete with 2 Speakers	£60 19 6	£52 15 0
CMS. 400 AM/FM Multiplex Tuner/Amplifier with 2 speakers and turntable ..	£126 0 0	£99 0 0
TURNTABLES		
Garrard 3000	£11 4 1	£9 10 0
Garrard 3500	£11 18 10	£10 1 0
Garrard SL55	£13 10 11	£11 12 6
Garrard SL65	£17 19 4	£14 10 0
Garrard SL75	£34 14 11	£28 19 0
Garrard SL95	£44 6 9	£38 5 0
Garrard SP25 Mk 2 ..	£15 6 4	£11 10 0
Garrard AP75	£23 8 1	£18 19 6
Garrard 401	£31 2 10	£26 10 0

	Recom. Retail Price	Comet Price
GOLDRING Lenco GL.68	£22 7 2	£17 19 11
GOLDRING Lenco GL.75	£35 15 5	£28 15 5
THORENS TD.124/11 ..	£45 18 1	£40 7 0
THORENS 125	£63 4 9	£55 0 0
THORENS TD.150 ..	£28 16 11	£25 7 0
THORENS TD.150B ..	£32 17 6	£28 18 0
THORENS TD.150A ..	£35 1 0	£30 13 6
THORENS TD.150AB ..	£39 1 7	£33 19 6
GOODMANS MT.100 ..	£72 7 2	£63 7 2
SPEAKERS		
WHARFEDALE Denton ..	£16 6 0	£13 18 0
WHARFEDALE Spr. Linton	£20 13 0	£17 10 0
WHARFEDALE Melton ..	£29 10 0	£25 0 0
LEAK Sandwich	£43 10 0	£35 19 6
LEAK Mini-Sandwich ..	£29 15 0	£24 10 0
GOODMANS Maxim ..	£20 0 5	£16 19 6
GOODMANS Mezzo II ..	£30 18 0	£25 18 0
GOODMANS Magnum-K ..	£40 2 0	£32 19 6
AKAI STEREO TAPE RECORDERS		
Model X-360 4 track ..	£339 0 0	£284 0 0
Model X-360D deck 4 tr. ..	£290 0 0	£243 0 0
Model X-300 2 tr.	£263 0 0	£220 0 0
Model X-300 4 tr.	£263 0 0	£220 0 0
Model M-9 4 tr. w/o acc. ..	£195 0 0	£156 0 0
Model X-V 4 tr.	£180 0 0	£151 0 0
Model X-150D deck 4 tr. ..	£130 2 4	£109 0 0
Model 1710W 4 tr. w/o acc.	£109 0 0	£91 0 0
Model 3000D deck 4 tr. ..	£99 10 0	£83 6 0
Model 1800SD 4 tr. ..	£199 0 0	£167 0 0
Model 1800 4 tr.	£158 0 0	£133 0 0
BRANDED-TAPE (incl. postage)		
BASF Long Play 7in. ..	£2 11 0	£1 19 6
BASF Long Play 5¾in. ..	£1 15 10	£1 9 6

All **TANDBERG** Tape Recorders, Amplifiers and Speakers now available at Discount Prices.

Comet Discount Warehouse
Reservoir Road, Clough Road, Hull. Tel. 42363

DELIVERY Comet guarantee that all prices quoted are genuine. All items offered are available at time of offer.
Add 9/- for post and packing on orders outside this area.

YOUR GUIDE TO A BETTER HOME IN 1969

PRACTICAL 1969 HOUSEHOLDER ANNUAL

GET YOURS TODAY 2/6

Fabulous Value

STEREOPHONIC KUBA "ROYAL" RADIOGRAM

This radiogram chassis is offered complete with carefully matched loudspeaker system, two 10in. speakers, two 4in. Cone Tweeters and latest BSR UA70 Mono/Stereo record changer—a complete quality stereophonic radiogram at half normal price.

4 wavebands—AM/FM—8 piano keys control 8 watt push-pull output per channel—frequency response 30-20,000 cycles. EASY TO INSTALL, NO TECHNICAL KNOWLEDGE REQUIRED.

ONLY **£79.19.6.**

H.P. terms available. Deposit £26.13.2 and 24 monthly payments of 55/7 (total H.P. £93.7.2). Send £27.10.8 today or write for free leaflet.

Fantastic Bargain Offer

KUBA "IMPERIAL 666" STEREOPHONIC HI-FI RADIOGRAM CHASSIS—complete with two 10in. x 6in. speakers and the latest BSR Mono/Stereo record changer—a complete radiogram at half normal price. 4 Waveband AM/FM chassis with the very latest printed circuitry—7 push button control, 12 watts total output. Provision for stereo decoder. Only **49½ Gns.** plus P. & P. 17/6. EASILY FITTED, NO TECHNICAL KNOWLEDGE NECESSARY. H.P. available £17.6.6 deposit plus 24 monthly payments 36/2 (total H.P. £60.14.6). Send £18.4.0 today.

CALLERS WELCOME

POST THIS COUPON NOW!

PLEASE SEND ME FREE DETAILS OF YOUR RANGE

Name ....

Address ....

....

LEWIS radio

100 CHASE SIDE, SOUTHGATE, Dept. P169, LONDON, N.14
TELEPHONE 01-886 3733/9666

SILICON N.P.N. TRANSISTORS. Similar to 2N2926. All individually tested. Gold plated leads for easy soldering. Unbeatable value at 1/6 each or £5 per 100.

12 VOLT TRANSISTORISED FLUORESCENT LIGHT. * 8 WATT 12in TUBE. Current drain only 700mA! Complete and tested £2/19/6 only! Or in kit form:

*Case		10/-
Transistor		10/-
Lamp holders—	pair	5/-
Condensers, etc.		3/-
Transformer		13/6
Tube		8/-

*Post and Packing 3/-

TRANSISTORS

OC200, OC203, OC204, all at 2/- each.
ASY22, 2N753, BSY28, BSY65, 2G344A, 2G345A, 2G345B, 2G371A, 2G378A, all at 1/6 each.
Transistors similar to OC44, OC71 and OC72, all 1/- each.
Unmarked, untested transistors, 7/6 for 50.
LIGHT SENSITIVE TRANSISTORS (similar OCP 71), 2/- each.
30 watt transistors (ASZ17), 10/- each.
ORP 12 Cadmium sulphide light-sensitive resistors, 9/-.

RECTIFIERS

BY100, 800 p.i.v., 2/6 each, 24/- per doz., £7/10/- per 100, £50 per 1,000. BYZ13, 6-amp, 400 p.i.v., available on same terms.

MULLARD POLYESTER CAPACITORS FAR BELOW COST PRICE!

0·001µF	400 volts	3d	0·15µF	160 volts	6d
0·0015µF	400 volts	3d	0·22µF	160 volts	6d
0·0018µF	400 volts	3d	0·27µF	160 volts	6d
0·0022µF	400 volts	3d	1µF	125 volts	1/-
0·01µF	400 volts	3d			

VERY SPECIAL VALUE! Small Silver-mica, Ceramic, Polystyrene Condensers. Well assorted. Mixed types and values. 10/- per 100.
PAPER CONDENSERS, MIXED BAGS, 0·0001 to 0·5µF. 12/6 per 100.

RESISTORS! Give-away offer! Mixed types and values, ¼ to ½ watt 6/6 per 100, 55/- per 1,000. Individual resistors 3d each. Also ½ to 3 watt close tolerance. Mixed values. 7/6 100, 55/- 1,000.
WIRE-WOUND RESISTORS. 1 watt to 10 watts. Mixed bags only. 16 for 10/-.

RECORD PLAYER CARTRIDGES

ACOS

GP	67/2	Mono.	15/- complete with needles.
GP	91/3	Stereo Compatible	£1/-/- "
GP	93/1	Stereo Ceramic	£1/5/- "
GP	94/1	Stereo Ceramic	£1/5/-

Small pick-up arms complete with cartridge and needle, 10/- only.

UNREPEATABLE OFFER!

GIANT SELENIUM PHOTO-CELLS PRODUCE UP TO 6ma. FROM DAYLIGHT!

67mm. Diameter (29·2sq.cm.) **10/-** each.
50mm. x 37mm. (16·5sq.cm.) 2 for **10/-** each.

TRANSISTORISED SIGNAL INJECTOR KIT R.F./I.F./A.F. 10/- only
TRANSISTORISED SIGNAL TRACER KIT 10/- only
TRANSISTORISED REV. COUNTER KIT 10/-

VEROBOARD

2½in × 1in 0·15in matrix	1/6	17in × 2½in 0·15in matrix	11/-
3¾in × 2½in 0·15in matrix	3/3	17in × 3¾in 0·15in matrix	14/8
3¾in × 3¾in 0·15in matrix	3/11	3¾in × 2½in 0·1in matrix	4/2
5in × 2½in 0·15in matrix	3/11	3¾in × 3¾in 0·1in matrix	4/9
5in × 3¾in 0·15in matrix	5/6	5in × 2½in 0·1in matrix	4/7
		5in × 3¾in 0·1in matrix	5/6

Spot Face Cutter 7/6. Pin Insert Tool 9/6. Terminal Pins 3/6—36.

MULTIMETERS. 20,000 ohms per volt.
Ranges: a.c. 1,000V, 500V, 100V, 50V, 10V.
d.c. 250mA, 2·5mA, 50µA.
d.c. 2,500V, 500V, 250V, 50V, 25V, 5V.
Resistance: 0/60kΩ and 0/6MΩ.
Special price **£4** only.

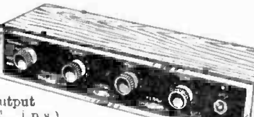
ELECTROLYTIC CONDENSERS

0·25µF	3 volt	4µF	4 volt	10µF	25 volt	64µF	9 volt
1µF	6 volt	4µF	12 volt	20µF	6 volt	100µF	9 volt
1µF	20 volt	4µF	25 volt	25µF	6 volt	320µF	4 volt
1·25µF	16 volt	5µF	6 volt	25µF	12 volt	320µF	10 volt
2µF	3 volt	6µF	6 volt	25µF	25 volt	400µF	6·4 volt
2µF	350 volt	8µF	3 volt	30µF	6 volt	All at 1/- each.	
2·5µF	16 volt	8µF	12 volt	30µF	10 volt	20 assorted	
3µF	25 volt	8µF	50 volt	50µF	6 volt	(our selection)	
3·2µF	64 volt	10µF	6 volt	64µF	2·5 volt	10/-.	

SMALL TRANSISTOR OUTPUT TRANSFORMERS 2/6 each.
SMALL TRANSISTOR DRIVER TRANSFORMERS 2/6 each.

Orders by post to:
G. F. MILWARD, DRAYTON BASSETT, NEAR TAMWORTH, STAFFS.
Please include suitable amount to cover post and packing. Minimum 2/-. Stamped addressed envelope must accompany any enquiries.
For customers in Birmingham area goods may be obtained from Rock Exchanges, 231 Alum Rock Road, Birmingham 8.

THE CLASSIC

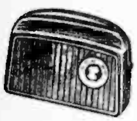


Controls: Selector switch Tape speed equalisation switch (3¾ and 7½ i.p.s.). Volume. Treble. Bass. 2 position scratch filter and 2 position rumble filter.

Specification: Sensitivities for 10 watt output at 1KHz. *Tape head:* 3mV (at 3¾ i.p.s.). *Mag. P.U.:* 2mV. *Cer. P.U.:* 80mV. *Radio:* 100mV. *Aux.:* 100mV. *Tape/Rec. output:* 100mV. Equalisation for each input is correct to within ± 2dB (R.I.A.A.) from 20Hz to 20KHz. *Tone control range:* Bass ± 13dB at 60 Hz. Treble ± 14dB at 15KHz. *Total distortion:* (for 10 watt output) <1·5%. *Signal noise:* < —60dB. A.C. mains 200–250v. Size 12¼in. long, 4¼in. deep. 2¾in. high. Teak finished case. **Price 8½ gns.** + 7/6 p. & p.

Built and Tested

THE DORSET (600mW output)

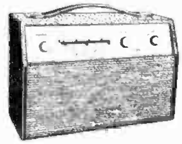


7-transistor fully tunable M.W.–L.W. superhet portable —with baby alarm facility. Set of parts. The latest modulised and pre-alignment techniques makes this simple to build. Sizes: 12 x 8 x 3in.

MAINS POWER PACK KIT: 9/6 extra.

PRICE £5.5.0 plus 7/6 p. & p. Circuit 2/6 FREE WITH PARTS.

THE ELEGANT SEVEN MK. III (350mW output)



7-transistor fully tunable M.W.–L.W. portable. Set of parts. Complete with all components, including ready etched and drilled printed circuit board—back printed for foolproof construction.

MAINS POWER PACK KIT: 9/6 extra.

Price £4.9.6 plus 7/6 p. & p.

Circuit 2/6 FREE WITH PARTS.

X101 10W SOLID-STATE HI-FI AMP WITH INTEGRAL PRE-AMP

Specifications: *Power Output* (into 3 ohms speaker) 10 watts. *Sensitivity* (for rated output): 1mV into 3K ohms (0·33 microamp). *Total Distortion at* 1KHz. at 5 watts 0·35%, at rated output 1·5%. *Frequency Response:* Minus 3dB points 20Hz and 40KHz. *Speaker:* 3–4 ohms (3–15 ohms may be used). *Supply voltage:* 24V d.c. at 800mA (6–24V may be used).

Control assembly: including resistors and capacitors.
1. Volume: PRICE 5/-.
2. Treble: PRICE 5/-.
3. Comprehensive bass and treble: PRICE 10/-.

The above 3 items can be purchased for use with the X101.

Price 49/6 plus 2/6 p. & p.

Power Supplies for the X101:
P101 M (for mono) 35/- plus 4/6 p. & p. P101 S (for stereo) 42/6 plus 4/6 p. & p.

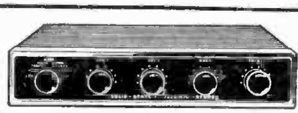
THE RELIANT MK II
10W SOLID-STATE HIGH QUALITY AMPLIFIER

SPECIFICATIONS

Output—10 watts
Inputs—1. -xtal mic 10mV
2. -gram/radio 250mV
Output Impedance—3 to 4 ohms
Tone Controls—Treble control range ± 12dB at 10KH2
Bass control range ± 13dB at 100H2

Frequency Response—(with tone controls central) Minus 3dB points are 20H2 and 40KH2. Signal to Noise Ratio—better than —60dB. Transistors—4 silicon Planar type and 3 Germanium type. Mains input— —220 —250V. A.C. Size of chassis—10" × 3¼" × 2". A.C. Mains, 200-250V. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Separate bass and treble lift control. Two inputs with control for gram. and mike. Built and tested. 8" × 5" speaker to suit price **14/6** plus 1/6 P. & P. Crystal mike to suit **12/6** plus 1/6 P. & P.

Reliant Mark II. 6½ gns., plus 7/6 p. & p.
In teak finished case.



THE VISCOUNT

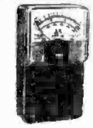
Integrated High Fidelity Transistor Stereo Amplifier

SPECIFICATIONS: Output: 10 watts per channel into 3 to 4 ohms speakers (20 watts monoral). Input: 6 position rotary selector switch (3 pos. mono and 3 pos. stereo), P.U., Tuner, Tape and Tape Rec. Sensitivities: All inputs 100mV into 1·8M ohm. Frequency response: 40Hz–20KHz + 2db. Tone controls: (Baxandall type). separate bass and treble controls. Treble 13db lift and cut at 15KHz. Bass 15db lift and 25db cut at 60Hz. Volume controls: Separate for each channel. AC Mains input: 200-240v. 50-60Hz. Size 12½ × 6 × 2¾in. in teak-finished case. Built and tested.

PRICE 13½ Gns. Postage & Packing 7/6 extra.

Goods not despatched outside U.K. Terms C.W.O. All enquiries Stamped Addressed Envelope

RADIO & TV COMPONENTS (Acton) LTD
21c High Street, Acton, London, W.3.
All orders by post to our Acton address
323 Edgware Road, London, W.2.



POCKET MULTI-METER

Size 3¾ x 2¼ x 1⅜in. Meter size 2¼ x 1⅝in. Sensitivity 1000 O.P.V. on both A.C. and D.C. volts. 0–15. 0–150. 0–1000 D.C. current 0–150mA. Resistance 0–100kΩ. Complete with test prods, battery and full instructions, **42/6**. P. & P. 3/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

CYLDON 4 TRANSISTOR U.H.F. TUNER

Brand new. Complete with circuit diagram.

£2.10.0 plus 1/- p. & p.

THREE-IN-ONE HI-FI 10 WATT SPEAKER

A complete Loud Speaker system on one frame, combining three matched ceramic magnet speakers with a low loss cross over network. Peak handling power 10 watts. Impedance 15 ohms. Flux density 11,000 gauss. Resonance 40–60 c/s. Frequency range 50c/s to 20kc/s. Size 13½ x 8¹/₁₆ x 4¼ inches. By famous manufacturer. List Price £7. Our price **74/6** plus 5/- P. & P.

Similar speaker to the above without tweeters in 3 and 15 ohm **44/6** plus 5/- P. & P.

B.S.R. TD-2 TAPE DECK

This tape deck takes 5¾in. spools complete with two-track heads. Size 13½in. long by 8¾in. wide.
£8.19.6 plus 7/6 p. & p.

2½ watt ALL TRANSISTOR AMPLIFIER

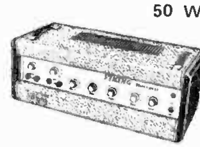
AC mains 240V. Size 7" x 4¼" x 1¾". Frequency response 100 c/s—10 Kc/s Semi conductors, two OC 75's two AC 128's and two stabilizers AA129. Tone and volume controls on flying leads. **£2.10.0** plus P. & P. 3/6. Suitable 8" x 5" 10,000 line high flux speaker, **18/6** plus 2/- P. & P.

FIRST QUALITY P.V.C. TAPE

5¾" Std. 850ft.	11/6	5" L.P. 850ft.	12/-
7" Std. 1200ft.	13/-	3" T.P. 600ft.	12/-
3" L.P. 240ft.	5/6	5" T.P. 1800ft.	27/-
5¾" L.P. 1200ft.	13/-	5¾" T.P. 2400ft.	34/-
7" L.P. 1800ft.	20/-	7" T.P. 3600ft.	44/-
5¾" D.P. 1800ft.	20/-	4" T.P. 900ft.	16/6

P. & P. on each 1/6.

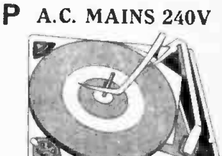
50 WATT AMPLIFIER A.C. MAINS 200–250V



An extremely reliable general purpose valve amplifier—with six electronically mixed inputs. Suitable for use with: mics, guitars, gram, tuner, organs, etc. Separate bass and treble controls. Output Impedance 3, 8, 15 ohms.

Price 27 gns. Plus 20/- p. & p.

RECORD PLAYER SNIP A.C. MAINS 240V



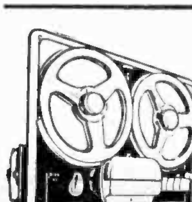
The "Princess" 4-speed automatic record changer and player engineered with the utmost precision for beauty, long life, and trouble free service. Will take up to ten records which may be mixed 7" to 10" or 12". Patent stylus brush cleans stylus after each playing and at shut off, the pick-up locks itself into its recess, a most useful feature with portable equipment—other features include pick-up height adjustment and stylus pressure adjustment. This truly is a fine instrument which you can purchase this month at only **£5.19.6** complete with cartridge and ready to play. Post and insurance 7/6 extra.

CAR TRANSISTOR IGNITION SYSTEM

(by famous manufacturer)

For 6 volt or 12 volt positive earth systems. Comprising: special high voltage working hermetically sealed silicon transistor mounted in finned heat-sink, high output ignition coil, ballast resistor and hardwear (screws, washers etc.).

PRICE £4.19.6. (post and packing 5/- extra).



MOTEK

3 Speed 2 track Tape Deck complete with heads, takes 7in. spool.

Incorporating 3 motors.

A.C. mains, 240 volts, listed at £21.0.0.

Our Price £9.19.6, plus 10/- P. & P.

YOUR CAREER in *RADIO & ELECTRONICS?*

Big opportunities and big money await the qualified man in every field of Electronics today—both in the U.K. and throughout the world. We offer the finest home study training for all subjects in radio, television, etc., especially for the **CITY & GUILDS EXAMS** (Technicians' Certificates); the Grad. Brit. I.E.R. Exam.; the **RADIO AMATEUR'S LICENCE;** P.M.G. Certificates; the R.T.E.B. Servicing Certificates; etc. Also courses in Television; Transistors; Radar; Computers; Servo-mechanisms; Mathematics and Practical Transistor Radio course with equipment. We have **OVER 20 YEARS'** experience in teaching radio subjects and an unbroken record of exam. successes. We are the only privately run British home study College specialising in electronics subjects only. Fullest details will be glady sent without any obligation.

To: British National Radio School, Reading, Berks.

Please send FREE BROCHURE *to:*

NAME .... Block

ADDRESS .... Caps.

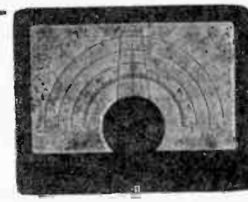
.... Please

4/69

BRITISH NATIONAL RADIO SCHOOL

JACKSON

the big name in PRECISION components



No. 6/36 DRIVE

Price 24/-

Incorporating the Dual Ratio Ball Drive providing 36–1 Slow drive and 6–1 Fast drive under one knob with co-axial control. Scale is calibrated 0–100 and an extra blank scale is provided for individual calibration. Overall size $4\frac{7}{8} \times 3\frac{3}{8}$in.
The unit consists of aluminium back plate, drive unit, scale, spare scale, transparent cover, hair-line pointer, escutcheon and knob. Fits in front of panel which may be any thickness up to $\frac{1}{2}$in. (or more by providing longer screws).

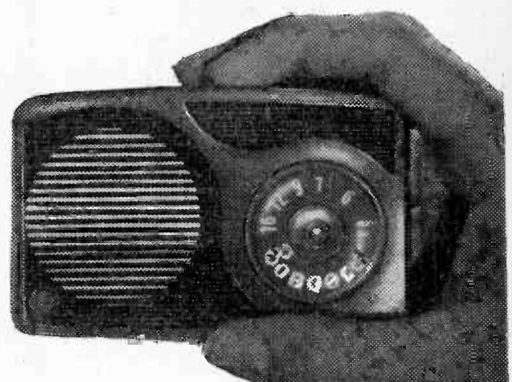
It's reliable if it's made by Jackson!

JACKSON BROS. (LONDON) LIMITED

Dept. PW, KINGSWAY-WADDON, CROYDON, CR9 4DG
Phone Croydon 2754-5 (01-688). *Grams* Walfilco, Croydon
US office:- M. Swedgal,
258, Broadway, NEW YORK, NY-10007

BIGGEST BREAKTHROUGH IN RADIO KITS!

THE REVOLUTIONARY APOLLO "6" CAN BE BUILT FOR 59/6



SPECIALLY made for the thousands of discriminating people who want the finest easy-to-build radio . . . at a reasonable price! *This is a different breed—it will startle you!* **EIGHT MONTHS AGO** our two designers were briefed to produce a radio kit that would fill these technical demands:—**DEMAND—A. IT SHOULD BE POSSIBLE TO BUILD PAINLESSLY IN ONE EVENING . . . ANSWER**—the Apollo "6" has simplified, well illustrated step-by-step plans plus *vocal*

CONTAINS FEATURES THAT CAN'T BE BOUGHT IN READY MADE SETS—AT ANY PRICE

- receives medium wave & trawler broadcasts.
- every component brand new—no surplus, rejects or "seconds".
- uses latest Silicon Planar Epitaxial Epoxy transistors.
- six stage stable reflex—2 R.F., 1 Diode demodulation, 3 A.F.
- simplified illustrated plans plus vocal instructional recording.
- from parts to programmes in an evening ... PLUS MANY MORE!

instructional recording! no soldering iron is necessary and you don't have to have a magnifying glass and a pair of tweezers. **DEMAND—B. IT SHOULD WORK FIRST TIME . . . —ANSWER**—Apollo "6" uses latest rugged Silicon Transistor Circuitry and every single transistor, diode, capacitor, resistor, inductance etc. is brand new and fully tested—no surplus parts, no manufacturers rejects, no manufacturers "seconds", and uses "Ever Ready" battery. **DEMAND—C. IT MUST HAVE THE POWER TO OPERATE OPTIONAL LOUDSPEAKER . . . DEMAND—D. IT MUST GIVE GOOD RECEPTION IN DIFFICULT AREAS . . . DEMAND—E. IT MUST WORK ON ITS OWN INTERNAL FERRITE ROD AERIAL . . . ETC. ETC. ANSWER**—The Apollo "6" does all this—and much more!

REVOLUTIONARY SILICON PLANAR EPOXY CIRCUIT DESIGN

Apollo "6" will probably be bang up-to-date well into the seventies! it bristles with latest technical innovations. Six stage stable reflex N.P.N. and P.N.P. circuit consisting of 2 Radio Frequency stages, 1 Diode demodulation stage and 3 Audio Frequency stages. Uses latest Silicon Planar Epitaxial Epoxy transistors (similar to types used in America's Space Project). *The first two transistors give amplification of* 100 *to* 400 *each,* (at only 100 Microamps collector current approx). *Output transistor gives amplification of* 235 *to* 470. Stable reflexing gives the Apollo "6" staggering selectivity, uncanny sensitivity, true-to-life sound reproduction—in fact its range, power and selectivity must be experienced to be believed.
Enter a new magic world of reception—station after station (home and abroad).

IRON CLAD GUARANTEE

Should you not be completely satisfied with your purchase when you receive it from us, your money will be refunded in full, at once and without quibble or question . . .

THRILLING SOUND OF AN S.O.S. AT SEA

Listen to the thrilling sound of an S.O.S. at sea—tune in to a world you've never heard before . . . **NOTE.** Because members of our own Staff (and their friends) are enthusiastic and have already bought Apollo "6" parts we know demand will be enormous. **DON'T DELAY—SEND FOR YOURS NOW,** send 59/6+3/6 P. & P. for all parts, illustrated plans, instructional recording, personal listening earpiece etc. (all parts can be bought separately) **MONEY BACK GUARANTEE** (see panel).

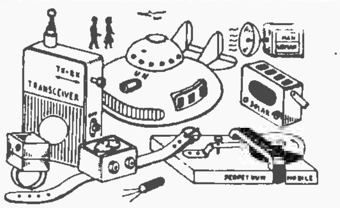
Orders despatched in strict rotation.

PHOENIX ELECTRONICS (Dept. PW1) 18 Little Preston St, Brighton, 1. Sussex.

PRINTED CIRCUIT KIT

BUILD 40 INTERESTING PROJECTS on a PRINTED CIRCUIT CHASSIS with PARTS and TRANSISTORS from your SPARES BOX

CONTENTS: (1) 2 Copper Laminate Boards 4½" × 2½". (2) 1 Board for Matchbox Radio. (3) 1 Board for Wristwatch Radio, etc. (4) Resist. (5) Resist Solvent. (6) Etchant. (7) Cleanser/Degreaser. (8) 16-page Booklet *Printed Circuits for Amateurs*. (9) 2 Miniature Radio Dials SW/MW/LW. Also free with each kit. (10) Essential Design Data, Circuits, Chassis Plans, etc. for 40 TRANSISTORISED PROJECTS. A very comprehensive selection of circuits to suit everyone's requirements and constructional ability. Many recently developed very efficient designs published for the first time, including 10 new circuits.



EXPERIMENTER'S PRINTED CIRCUIT KIT

8/6

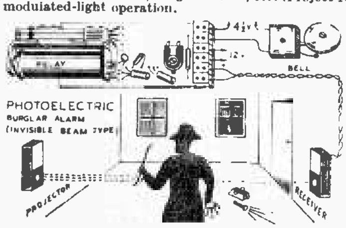
Postage & Pack. 1/6 (UK)

Commonwealth:
SURFACE MAIL 2/-
AIR MAIL 8/-
Australia, New Zealand
South Africa, Canada.

(1) Crystal Set with biased Detector. (2) Crystal Set with voltage-quadrupler detector. (3) Crystal Set with Dynamic Loudspeaker. (4) Crystal Tuner with Audio Amplifier. (5) Carrier Power Conversion Receiver. (6) Split-Load Neutralised Double Reflex. (7) Matchbox or Photocell Radio. (8) "TRI-FLEXON" Triple Reflex with self-adjusting regeneration (Patent Pending). (9) Solar Battery Loudspeaker Radio. The smallest 3 designs yet offered to the Home Constructor anywhere in the World. 3 Subminiature Radio Receivers based on the "Triflexon" circuit. Let us know if you know of a smaller design published anywhere. (10) Postage Stamp Radio. Size only 1·62" × ·95" × ·25". (11) Wristwatch Radio 1·15" × ·80" × ·55". (12) Ring Radio ·70" × ·70" × ·55". (13) Bacteria-powered Radio. Runs on sugar or bread. (14) Radio Control Tone Receiver. (15) Transistor P/P Amplifier. (16) Intercom. (17) 1-valve Amplifier. (18) Reliable Burglar Alarm. (19) Light-Seeking Animal, Guided Missile. (20) Perpetual Motion Machine. (21) Metal Detector. (22) Transistor Tester. (23) Human Body Radiation Detector. (24) Man/Woman Discriminator. (25) Signal Injector. (26) Pocket Transceiver (Licence required). (27) Constant Volume Intercom. (28) Remote Control of Models by Induction. (29) Inductive-Loop Transmitter. (30) Pocket Triple Reflex Radio. (31) Wristwatch Transmitter/Wire-less Microphone. (32) Wire-less Door Bell. (33) Ultrasonic Switch/Alarm. (34) Stereo Preamplifier. (35) Quality Stereo Push-Pull Amplifier. (36) Light-Beam Telephone "Photophone". (37) Light-Beam Transmitter. (38) Silent TV Sound Adaptor. (39) Ultrasonic Transmitter. (40) Thyristor Drill Speed Controller.

PHOTOELECTRIC KIT

CONTENTS: 2 P.C. Chassis Boards, Chemicals, Etching Manual, Infra-Red Phototransistor, Latching Relay, 2 Transistors, Condensers, Resistors, Gain Control, Terminal Block, Elegant Case, Screws, etc. In fact everything you need to build a Steady-Light Photo-Switch/Counter/Burglar Alarm, etc. (Project No. 1) which can be modified for modulated-light operation.



PHOTOELECTRIC KIT

39/6

Postage and Pack. 2/6 (UK)
Commonwealth:
SURFACE MAIL 3/6
AIR MAIL £1.0.0
Australia, New Zealand, S. Africa, Canada and U.S.A.
Also Essential Data Circuits and Plans for Building

12 PHOTOELECTRIC PROJECTS. (1) Steady-Light Photo-Switch/Alarm. (2) Modulated-Light Alarm. (3) Long-Range Stray-Light Alarm. (4) Relay-less Alarm. (5) Warbling-Tone Alarm. (6) Closed-Loop Alarm. (7) Projector Lamp Stabiliser. (8) Electronic Projector Modulator. (9) Mains Power Supply. (10) Car Parking Lamp Switch. (11) Automatic Headlamp Dipper. (12) Super-Sensitive Alarm.

INVISIBLE BEAM OPTICAL KIT

Everything needed (except plywood) for building: 1 Invisible-Beam Projector and 1 Photocell Receiver (as illustrated). Suitable for all Photoelectric Burglar Alarms, Counters, Door Openers, etc.
CONTENTS: 2 lenses, 2 mirrors, 2 45-degree wooden blocks, infra-red filter, projector lamp holder, building plans, performance data, etc. Price 19/6. Postage and Pack. 1/6 (UK). Commonwealth: Surface Mail 2/-; Air Mail 8/-.

JUNIOR PHOTOELECTRIC KIT

Versatile Invisible-beam, Relay-less, Steady-light Photo-Switch, Burglar Alarm, Door Opener, Counter, etc., for the Experimenter.
CONTENTS: Infra-Red Sensitive Phototransistor, 3 Transistors, Chassis, Plastic Case, Resistors, Screws, etc. Full Size Plans, Instructions, Data Sheet "10 Advanced Photoelectric Designs".
Price 19/6. Postage and Pack. 1/6 (UK). Commonwealth 2/-; Air Mail 4/-.

JUNIOR OPTICAL KIT

CONTENTS: 2 Lenses, Infra-red Filter, Lampholder, Bracket, Plans, etc. Everything (except plywood) to build 1 miniature invisible beam projector and photocell receiver for use with Junior Photoelectric Kit.
Price 10/6. Post and Pack. 1/6 (UK). Commonwealth: Surface Mail 2/-; Air Mail 4/-.

PHOTOELECTRIC PARKING LAMP SWITCH

Automatically turns parking lamp on at dusk, off at dawn. Protects your car. Saves the battery. Miniature construction. Simply insert in parking lamp lead. Price: 27/6. Post & Packing 2/6 (U.K.)

THYRISTOR LIGHT DIMMER

Add a touch of luxury to your home. Adjust the light at parties, while watching TV, etc. Ideal for Children's bedroom. (100 watts max.) Replaces on-off switch.
Price: 59/6. Post & Packing 2/6 (U.K.)

YORK ELECTRICS
333 YORK ROAD, LONDON, S.W.11

Send a S.A.E. for full details, a brief description and Photographs of all Kits and all 52 Radio, Electronic and Photoelectric Projects Assembled.

Adamin

MODEL 15

as selected for the DESIGN CENTRE LONDON

MICRO SOLDERING INSTRUMENT

- **EXTREME VERSATILITY**
  Range of 8 interchangeable bits, from 3/64" (·047") to 3/16", including new non-wearing PERMATIPS.

- **ULTRA-SMALL SIZE**
  Length 7⅛". Weight ½ oz.
  Max. handle dia. 7/16".

- **EXTRA-HIGH PERFORMANCE**
  Heating time 90 secs. Max. bit temp. 390°C. Loading 15 watts — equals normal 30/40 watt iron.

- **ALL VOLTAGES**

The ADAMIN range includes five other models (5, 8, 12, 18 and 24 watts), Thermal Strippers (PVC and PTFE) and a De-soldering Tool. Please ask for colour catalogue A/10.

LIGHT SOLDERING DEVELOPMENTS LTD.

28 Sydenham Road, Croydon, CR9 2LL
Telephone 01-688 8589 and 4559

Practical Wireless Classified Advertisements

The pre-paid rate for classified advertisements is 1/8d. per word (minimum order 20/-), box number 1/6d. extra. Semi-displayed setting £5 2s. 0d. per single column inch. All cheques, postal orders, etc., to be made payable to PRACTICAL WIRELESS and crossed "Lloyds Bank Ltd." Treasury notes should always be sent *registered post*. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, PRACTICAL WIRELESS, IPC Magazines Ltd., 15/17 Long Acre, London, WC2, for insertion in the next available issue.

MISCELLANEOUS

RHYTHM MODULES. Build your own rhythm box—simply, cheaply. Realistic sound guaranteed. S.A.E. for details. D.E.W. LTD., 254 Ringwood Road, Ferndown, Dorset.

BUILD IT in a DEWBOX quality cabinet. 2in. x 2½in. x any length. D.E.W. Ltd., Ringwood Road, FERNDOWN, Dorset. S.A.E. for leaflet. Write now—Right now.

ELECTRONIC MUSIC?

Then how about making yourself an electric organ? Constructional data available—full circuits. drawings and notes! It has 5 octaves. 2 manuals and pedals with 24 stops—uses 41 valves. With its variable attack you can play Classics and Swing.

Write NOW for free leaflet and further details to **C. & S., 20 Maude Street, Darlington, Durham.** Send 3d. stamp.

CONVERT ANY TV into an Oscilloscope. Instructions £1. REDMOND, P.O. Box 38397, Los Angeles, California 90038.

UFO DETECTOR CIRCUITS, data. 10s. (refundable). Paraphysical Laboratory (UFO Observatory), Downton, Wilts.

4 WATT GRAM AMPS.

Volume and tone controls, mains operation, 3Ω output, new and boxed **65/-** POST PAID

BIG BARGAIN PARCELS OF COMPONENTS ONLY **10/-** POST PAID

SALOP ELECTRONICS
23 Wyle Cop,
Shrewsbury, Shropshire.
S.A.E. for lists

WANTED

DAMAGED AVO METERS, Models 7 & 8, any quantity. Send for packing instructions. HUGGETT'S LTD., 2/4 Pawsons Road, West Croydon.

NEW VALVES WANTED. Popular TV and Radio types. Best cash price by return. DURHAM SUPPLIES, 367c Kensington Street, Bradford, 8, Yorkshire.

WANTED NEW VALVES, televisions, radiograms, transistors, etc. STAN WILLETTS, 37 High Street, West Bromwich, Staffs. Tel.: WES 0186.

WE BUY New Valves and Transistors. State price. A.D.A. MANUFACTURING CO., 116 Alfreton Road, Nottingham.

WANTED *NEW* VALVES ONLY

Must be new and boxed
Payment by return
WILLIAM CARVIS LTD
103 North Street, Leeds 7

WANTED
(continued)

WANTED: New valves, transistors etc.; state prices. **E.A.V. Factors,** 202 Mansfield Road, Nottingham.

WE BUY New Valves, Transistors and clean new components, large or small quantities, all details, quotation by return. **WALTON'S WIRELESS STORES,** 55 Worcester Street, Wolverhampton.

WANTED: Popular Brand New Valves. R.H.S. Stamford House, 538 Great Horton Road, Bradford 7.

EDUCATIONAL

BECOME "Technically qualified" in your spare time, guaranteed diploma and exam. home-study courses in radio, TV servicing and maintenance. T.T.E.B., City and Guilds, etc.: highly informative 120-page Guide—free. **CHAMBERS COLLEGE** (Dept. 857K), 148 Holborn, London, E.C.1.

RADIO OFFICER training courses. Write: Principal, Newport and Monmouthshire College of Technology, Newport, Mon.

EDUCATIONAL
(continued)

CITY & GUILDS (electrical, etc.) on "Satisfaction or Refund of Fee" terms. Thousands of passes. For details of modern courses in all branches of electrical engineering, electronics, radio, TV., automation, etc., send for 132-page Handbook—FREE. B.I.E.T. (Dept. 168K), Aldermaston Court, Aldermaston, Berks.

TRAIN FOR SUCCESS WITH ICS

Study at home for a progressive post in Radio, TV and Electronics. Expert tuition for City & Guilds (Telecoms and Radio Amateurs') R.T.E.B., etc. Many unique diploma courses incl. Colour TV, Electronics, Telemetry & Computers. Also self-build kit courses—valve and transistor.

Write for FREE prospectus and find out how ICS can help you in your career.

ICS, DEPT. 541, INTERTEXT HOUSE, LONDON, SW11

LEC

RADIO AND TELEVISION SERVICING
RADAR THEORY AND MAINTENANCE
TELECOMMUNICATIONS

This private College provides efficient theoretical and practical training in the above subjects. One-year day courses are available for beginners and shortened courses for men who have had previous training.

Write for details to:
The Secretary, London Electronics College, 20 Penywern Road, Earls Court London, S.W.5. **Tel. 01-373-8721**

SITUATIONS VACANT

RADIO TECHNICIANS with sound knowledge of at least three of the following types of equipment required immediately for Meteorological Office Ocean Weather Ships: Single Side-Band Transmitter, Radar (Navigational), Radar Height Finding, Echo Sounders, Radio Receivers, Automatic DF, VHF and MF Low Voltage Servo Recorders, Digital Telemetering Equipment.

Salary scale £782–£1,304 per annum according to age, plus £120 overtime allowance. Free food and accommodation provided on board ship. Applicants must be natural born British Subjects. Full details from **Shore Captain, Ocean Weather Ship Base, Great Harbour, Greenock. Telephone: Greenock 24291.**

SITUATIONS VACANT
(continued)

RADIO and tape recorder testers and trouble shooters required. Canteen, excellent rates of pay. 8.00 a.m. to 5.00 p.m. 5-day week. Elizabethan Electronics Limited, Crow Lane, Romford, Essex. Phone: Romford 64101.

TV and Radio, A.M.I.E.R.E., City & Guilds, R.T.E.B. Certs., etc. on 'Satisfaction or Refund of Fee' terms. Thousands of passes. For full details of exams and home training Courses (including practical equipment) in all branches of Radio, TV, Electronics, etc. write for 132-page Handbook—FREE. Please state subject. BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY (Dept. 137K), Aldermaston Court, Aldermaston, Berks.

SITUATIONS VACANT
(continued)

ENGINEERS, A TECHNICAL CERTIFICATE or qualification will bring you security and much better pay. Elem. and adv. private postal courses for C. Eng., A.M.I.E.R.E., A.M.S.E. (Mech. & Elec.), City & Guilds, A.M.I.M.I., A.I.O.B., and G.C.E. Exams. Diploma courses in all branches of Engineering —Mech., Elec., Auto., Electronics, Radio, Computers, Draughts., Building, etc. For full details write for FREE 132 page guide: BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, (Dept. 169K), Aldermaston Court, Aldermaston, Berks.

RADIO OPERATORS, PREFERABLY WITH PMG2 CERTIFICATE, REQUIRED IMMEDIATELY FOR DUTY ON METEOROLOGICAL OFFICE OCEAN WEATHER SHIPS

Salary Scale £871–£1,309 per annum (revised rates under negotiation) according to age, plus £157 overtime allowance. Free food and accommodation provided on board ship.

Applicants must be natural born British Subjects.

Full details from **Shore Captain, Ocean Weather Ship Base, Great Harbour, Greenock. Telephone: Greenock 24291.**

BOOKS & PUBLICATIONS

SURPLUS HANDBOOKS

19 set Circuit and Notes	6/6 p/p 6d.
1155 set Circuit and Notes	6/6 p/p 6d.
H.R.O. Technical Instructions ..	5/6 p/p 6d.
38 set Technical Instructions ..	5/6 p/p 6d.
46 set Working Instructions	5/6 p/p 6d.
88 set Technical Instructions ..	7/– p/p 6d.
BC.221 Circuit and Notes	5/6 p/p 6d.
Wavemeter Class D Tech. Instr. ..	5/6 p/p 6d.
18 set Circuit and Notes	5/6 p/p 6d.
BC.1000 (31 set) Circuit and Notes ..	5/6 p/p 6d.
CR.100/B.28 Circuit and Notes ..	10/– p/p 9d.
R.107 Circuit and Notes	7/– p/p 6d.
AR.88D Instruction Manual	18/– p/p 6d.
62 set Circuit and Notes	6/6 p/p 6d.

Circuit Diagram 5/- each post free, R.1116/A, R.1224/A, R.1355, R.F. 24, 25 and 26, A.1134, T.1154, CR.300, BC.312, BC.342, BC.348J, BC.348 (E.M.P.), BC.624, 22 set.

52 set Sender and Receiver circuits 7/6 post free

Resistor colour code indicator 2/6 p/p 6d.

S.A.E. with all enquiries please.

Postage rates apply to U.K. only.

Mail order only to:

INSTRUCTIONAL HANDBOOK SUPPLIES

DEPT. PW, TALBOT HOUSE, 28 TALBOT GARDENS, LEEDS 8

GOVT. SURPLUS WIRELESS EQUIPMENT HANDBOOK

This useful Handbook gives detailed information and circuit diagrams for British and American Government Surplus Receivers, Transmitters and Test Equipment etc; also contained are some suggested modification details and improvements for the equipment. Incorporated in this revised edition is a surplus/commercial cross referenced valve and transistor guide. This book is invaluable to radio enthusiasts, radio clubs, universities and laboratories. The latest edition priced at 35/-. per volume plus 5/-. p & p is obtainable only from us at

GILTEXT (LEEDS) LTD

Dept. P.W., 24 Stansfield Chambers, Gt. George Street, Leeds 1.

s.a.e. with all enquiries, please. Extra postage for foreign orders.

SERVICE SHEETS

SERVICE SHEETS (75,000) 5/- each: please add loose 4d. stamp: callers welcome; always open. THOMAS BOWER, 5 South Street, Oakenshaw, Bradford.

C. & A. SUPPLIERS

SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOGRAMS, RADIOGRAMS)

Only 5/- each, plus S.A.E.

(Uncrossed P.O.'s please, returned if service sheets not available.)

71 BEAUFORT PARK LONDON, N.W.11

We have the largest supplies of Service Sheets (strictly by return of post) Please state make and model number alternative.

Mail order only.

SERVICE SHEETS *(continued)*

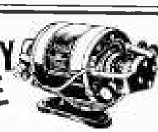
SERVICE SHEETS. RADIO, TV. 5,000 Models. List 1/6. S.A.E. Enquiries. TELRAY, 11 Maudland Bank, Preston, Lancs.

SERVICE SHEETS (1925–1969) for TELEVISIONS, RADIOS, TRANSISTORS, TAPE RECORDERS, RECORD PLAYERS, etc., by return post, with free fault-finding guide. Prices from 1/–. Over 8,000 models available. Please send S.A.E. with all orders/enquiries. HAMILTON RADIO, 54 London Road, Bexhill, Sussex.

RADIO, TELEVISION over 3,000 models. JOHN GILBERT TELEVISION, 1b Shepherds Bush Rd., London W.6. SHE 8441.

ELECTRICAL

240 VOLT ELECTRICITY ANYWHERE



MOST BRILLIANT PERFORMANCE EVER from 12 volt Car Battery

BRILLIANT **HEAVY DUTY** 240 volt AMERICAN DYNAMOTOR with BIG 220 WATT OUTPUT. Marvellous for TELEVISION, ELECTRIC DRILLS, MAINS LIGHTING and ALL UNIVERSAL AC/DC MAINS EQUIPMENT. Marvellous for Fluorescent lighting. Thousands of uses. Tremendous purchase of this model makes fantastically low price possible.

ONLY £4.19.6 each plus 10/6 delivery. C.O.D. with pleasure. MONEY BACK if not DELIGHTED

Please send s.a.e. for full illustrated details.

(Dept. PW) STANFORD ELECTRONICS Rear Derby Road, North Promenade, BLACKPOOL, Lancs.

Open 7 days a week

FOR SALE

£6,000 IN VOUCHERS GIVEN AWAY. See free Catalogue for details. Tools, materials, mechanical, electrical, thousands of interesting items. WHISTON, Dept. VW, New Mills, Stockport SK12 4HL.

COMMUNICATIONS RECEIVER. New. Globe Scientific TRGDX/20.C. Matching speaker in cabinet. Box 86. £14, delivered.

TOP TRADE DISCOUNTS FOR ALL COMPONENTS VALVES TUBES TRANSISTORS

Free Trade Catalogue

Engineers & Service Dealers Only

WILLOW VALE

THE SERVICE DEPT. WHOLESALERS,

4 The Broadway, Hanwell, London, W.7

01-567 5400/2971

FOR SALE
(continued)

THE IDEAL Panel Mounting Meter Movement for any Sensitive Test Meter etc. 200 Micro Amp F.S.D. 4⅛in. x 4⅝in. In clear plastic case. Our special price only 39/6d. P. & P. free. Limited number only. WALTON'S WIRELESS STORES, 55A Worcester Street, Wolverhampton, Staffs.

MINIFLUX HEADS

Special offer SKN4 ½-track stereo record/playback head (list 8 gns.). Special offer 55/-. Miniflux LF6-0 self oscillating half-track mono erase head, list £3.10.0. Offered at 22/6. VLF4 ½-track ferrite erase head, list £4.5.0. Offered at 32/6. S.A.E. for full lists.

LEE ELECTRONICS
400 EDGWARE ROAD. PADdington 5521.

HIGH GLOSS METALLIC
HAMMERED ENAMEL
MAKES FANTASTIC
DIFFERENCE TO PANELS

—say hundreds of enthusiastic users 'Crackle' pattern appears like magic on wood and metal. No undercoat. Air dries 15 min. to hard glossy finish. Heat, liquid and scratch-proof. Bronze, Silver, Green, Black, Lt. and Dk. Blue. **Send NOW** for free list, or 8/- (+ 1/9 post and packing) for trial ½pt. tin, colour samples and instructions.

Hammerite

BRUSH OR SPRAY-ON

FINNIGAN SPECIALITY PAINTS, Dept. P.W. STOCKSFIELD (Tel. 2280), Northumberland.

PRECISION POTENTIOMETERS

Multi-turn, continuous or ganged from 25/-; carbon from 2/-. Also resistors, mains rectifiers, synchros, geared motors, chokes, capacitors, meters, microswitches, semiconductors. 6d. stamp catalogue. **F. HOLFORD & CO.,** 6 Imperial Square, Cheltenham.

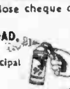
YUKAN SELF-SPRAY SO PROFESSIONAL THE YUKAN AEROSOL WAY—

Get these NOW! air drying **GREY HAMMER OR BLACK WRINKLE (CRACKLE)** finishes

Yukan Aerosol spraykit contains 16 ozs. fine quality durable easy instant spray. No stove baking required. Hammers available in grey, blue, gold, bronze. Modern Eggshell Black Wrinkle (Crackle) all at 15/11 at our counter or 16/11, carriage paid, per push-button self-spray can. Also Durable, heat and water resistant Black Matt finish (12 ozs. self-spray cans only) 13/11 carriage paid.
SPECIAL OFFER: 1 can plus optional transferable snap-on trigger handle (value 5/-) for 16/11, carriage paid. Choice of 13 self-spray plain colours and primer (Motor car quality) also available. Please enclose cheque or crossed P.O. for total amount direct to:

Other Yukan Air Drying Aerosols, 16 ozs. at 16/11 carr. paid. include: Zinc Chromate Clear Lacquer Metallics: Grey, Blue, Bronze and Gold.

Dept: M/3 **YUKAN,** 307a, EDGWARE ROAD, LONDON, W.2.



We supply many Government Departments, Municipal Authorities, Institutes and Leading Industrial Organisations—we can supply you too.
Open all day Saturday. Closed Thursday afternoons.

MORSE MADE EASY !!

FACT NOT FICTION. If you start **RIGHT** you will be reading amateur and commercial Morse within a month. (Normal progress to be expected.)

Using scientifically prepared 3-speed records you automatically learn to recognise the code RHYTHM without translating. You can't help it, it's easy as learning a tune. 18 W.P.M. in 4 weeks guaranteed.

For details and course C.O.D. ring, s.t.d. 01-660 2896 send 8d. stamp for explanatory booklet to:
G3CHS/P, 45 GREEN LANE, PURLEY, SURREY

METAL WORK

METAL WORK: All types cabinets, chassis, racks etc., to your specifications. PHILPOTTS METAL WORKS LTD., Chapman Street, Loughborough.

AERIALS

Enthusiasts
THE T.M.P. EXPERIMENTAL AERIAL KIT

A unique collection of alloy elements, dipoles, booms, clamps, mast reflectors, nuts & bolts, cables even a compass! etc., to make up various experimental aerials to cover all bands.
This includes TV transmissions, SW for the radio amateur, VHF for BBC FM. Amateurs on 2 and 4 MTrs, Aircraft, Police etc., UHF for experiments on BBC 2 and Ultra High Frequencies. These Kits can be used indoor or outdoor. Robust construction with simplified detailed plans for easy assembly.
The Wonder T.M.P. Kit costs only
89/6—no extra for carriage.
Despatched to any address in UK within 7 days.

TUBULAR METAL PRODUCTS
7 LOWESMOOR TERRACE, WORCESTER

RECEIVERS & COMPONENTS

COMPONENTS AT GIVE AWAY PRICES. Digital Counters, Rev Counters, Thyristors, Transistors, Valves, Tool Bags, Track Heads, Recording Tape, Aerials, Intercoms, Microphones, Micro Switches etc. 6d. stamp only to DIAMOND MAIL ORDER PRODUCTS, PROSPECT HOUSE, CANAL HEAD, POCKLINGTON, YORK. NO4 2NW.

BRAND NEW ELECTROLYTICS, 15 Volt, 2, 6, 8, 10, 15, 20, 30, 40, 50, 100 mfds. 7/6d. per dozen, postage 1/-. The C.R. SUPPLY CO., 127 Chesterfield Road, Sheffield 8.

D.I.Y.—All materials and components for construction of high fidelity loudspeaker systems (empty enclosures, BAF wadding, Tygan, Vynair fabric, cross-overs, etc.). Many other audio accessories and speaker kits. S.A.E. for lists: P. F. & A. R. HELME, Dept. PW. Summerbridge, Harrogate, Yorks.

WE ARE BREAKING UP COMPUTERS

EX COMPUTER PRINTED CIRCUIT PANELS 2″ × 4″ packed with semiconductors and top quality resistors, capacitors, diodes etc. Our price: 10 boards 10/-. P. & P. 2/-, with a guaranteed minimum of 35 transistors.
Special Bargain Pack. 25 boards for £1. P. & P. 3/6, with a guaranteed minimum of 85 transistors.
100 boards, 65/-. P. & P. 6/6, with a guaranteed minimum of 350 transistors.
PANELS with 2 power transistors sim. to OC28 on each board + components. 2 boards (4 × OC28) 10/-. P. & P. 2/-.
NPN GERMANIUM TO51 WATT POWER TRANSISTORS on small heat sink, on 2″ x 4″ panel. 5 for 10/-, P. & P. 2/-.
POWER TRANSISTORS sim. to 2N174 ex-eqpt., 4 for 10/-, P. & P. 2/-.
POWER TRANSISTORS sim. to 2N174 **ON** Finned Heat Sink (10D) 4 for £1, P. & P. 3/-.
LONG ARM TOGGLE SWITCHES ex eqpt. SPST 13/6 doz., DPDT 22/6 doz., DPST 17/- doz. P. & P. all types 2/- doz.
ORGAN BUILDERS special 500 TO18 transistors on panels £4. P. & P. 6/-.
OVERLOAD CUT OUTS. Panel mounting in the following values . . . 5/- each. 1, 1½, 2, 3, 4, 5, 7, 8 amp. P. & P. 1/6.
MINIATURE GLASS NEONS, 12/6 doz. P. & P. 1/6.
NEW MIXED DISC CERAMICS. 150 for 10/-. P. & P. 2/-.
LARGE CAPACITY ELECTROLYTICS
4½in., 2in. diam. Screw terminals.
All at 6/- each + 1/6 each P. & P.

4,000mF	72V d.c. wkg.
10,000mF	25V d.c. wkg.
6,600mF	45V d.c. wkg.
1,500mF	150V d.c. wkg.
16,000mF	25V d.c. wkg.
25,000mF	12V d.c. wkg.

Send 1/- stamps for list.

KEYTRONICS, 52 Earls Court Road London, W.8. Mail order only

RECEIVERS & COMPONENTS
(continued)

150 NEW ASSORTED Capacitors, Resistors, Silvered Mica, Ceramic, etc. Carbon, Hystab, Vitreous, ½-20 watt, 12/6 Post Free. WHITSAM ELECTRICAL, 33 Drayton Green Road, West Ealing, W.13.

15 DICTAPHONES (No Parts Removed) with all accessories. Ideal for parts. £20 o.n.o. Buyer collects. Telephone: HARRISON, Bowes Park 6172, After 5.30 p.m.

BAKER & BAINES

Examples of prices:

BBC dipole	30/-	X	38/-	H	42/-
ITA 5 ele	34/-	8 ele	47/6	11 ele	57/6
Combined BBC/ITA 1 + 5	45/-	H + 5	69/-		
BBC2 8 ele	29/-	14 ele	37/-	22 ele	63/-

All types generally available—prices include mounting clamps and postage.
11 Dale Crescent, New Tupton, Chesterfield

SIGNAL INJECTOR. Transistorised square wave generator probe, British Made, only 19/6, P & P 1/6 S A E for details and lists WILSIC ELECTRONICS LTD., 6 Copley Road, Doncaster, Yorks.

BRAND NEW SEMICONDUCTORS

1N914	2/-	ACY07	8/6	BF194	6/6	MPF105	8/-
18O20	3/6	ACY17	5/-	BFX29	12/6	NKT261	4/6
18O21	4/-	ACY18	5/-	BFX84	8/-	NKT264	4/6
2N706	3/-	ACY19	5/-	BFX85	10/-	NKT403	15/-
2N706A	3/-	ACY20	4/-	BFY50	4/6	NKT405	15/-
2N1302	4/6	AD149	8/-	BFY51	4/6	NKT781	6/-
2N1303	4/6	AF114	5/-	BFY52	4/6	OC28	5/6
2N1304	5/6	AF116	5/-	BSX19	5/6	OC35	5/6
2N1305	5/6	AF117	5/-	BSX20	5/6	OC36	5/6
2N2160	14/-	ASY26	4/6	BSY26	4/-	OC44	3/-
2N2220	8/-	ASY28	5/6	BSY27	4/-	OC45	2/6
2N2369A	5/-	BC107	3/6	BSY28	4/-	OC71	2/6
2N2646	11/6	BC108	3/6	BSY38	4/6	OC72	2/6
2N2926	3/6	BC109	3/6	BSY39	4/6	OC81	4/-
2N3053	6/6	BCY70	5/6	BSY40	5/6	OC200	5/6
2N3055	15/-	BCY71	9/-	BSY95A	3/6	OC201	5/6
2N3702	4/-	BCY72	5/-	BY100	4/6	OC202	8/6
2N3707	4/-	BF180	8/6	MPF102	8/6	OCP71	8/6
AC187	12/-	BF181	8/6	MPF103	7/-	OA81	1/6
AC188	12/-	BF184	7/6	MPF104	7/6	OA202	2/-

Send 6d. stamp for complete list. Over 1,000 types Semiconductors in stock. Capacitors, Resistors and Pots also available.

A. MARSHALL & SON (London) LTD.,
28 Cricklewood Broadway, London, N.W.2.
01-452 0161/3

COMPLETE RANGE of Amateur, Aircraft, Communications receivers. Chassis, panels, meters, cabinets, microphones, etc. Stephens-James Ltd., 70 Priory Road, Liverpool 4. Tel. 051-263-7829.

TELEVISION I.F. STRIPS (less valves)
From BBC, 2 converters ideal for spares. contains smoothing capacitor, dropper resistors, 7 valve holders, I.F. transformers, coil formers, capacitors, resistors, diodes, tag strips, chokes, etc., etc., on chassis 11in × 3½in, no information or circuit.
BRAND NEW in makers' boxes, a gold mine of components for ONLY 16/6 each post paid. Reduced to **14/6**.
MAINS TRANSFORMERS
250V input, outputs 10V at 500mA, 24V at 100mA, 32V at 10m/A, size 2½in × 1⅞in × 1¾in (drop through type) ideal for transistor power supply, **10/-** post paid.
250V input, output 22V at 1½A, size 2in × 2in × 2½in, **11/-** post paid.
TRANSISTOR driver and output transformers for 3 ohm speaker, suit OC81s, etc., approx. 1 watt rating, only **6/-** pair or **4/-** each.
As above but 500m/watt rating, **4/-** pair, **3/-** each.
MIXED bag of silver mica and ceramic capacitors, approx. 150, **10/-** per bag.
ERIE Thyristors for drill speed controls 400 p.i.v. at 5A **12/6**. 0·01 mF, 500vw disc ceramics, P.C. type, 7/16in dia., **2/-** doz., 10/- per 100.
HUNTS 0·1mF, 350vw paper capacitors, P.C. type, upright mounting, **2/6** doz., 15/- per 100, post paid per 100,
TUBULAR ceramic capacitors, P.C. type, 3·3pF and 500pF, only **6/-** per 100, 1/3 doz.
MULLARD CAPACITORS 50 + 50 + 50mF, 350vw, **5/-**.
TRANSISTOR ELECTROLYTICS 2mF 6vw, 4mF 64vw, 10mF 12vw, 20mF 6vw, 50mF 6vw, 100mF 6vw, **6d** each. 100mF 9vw, **8d**. 100mF, 25vw, **1/-**. 400mF 15vw, 500mF 9vw, **9d**. 1,000mF 50vw can type, **4/-**.
SPEAKER COVERING 7in × 4in perforated flexible plastic. Simulated chrome on one side **1/6** each **12/-** doz.
HUNTS 2,500mfd 50vw, brand new **6/6**.
SILVER MICA capacitors 80pF size only ½in × ½in 200vw, **4/-** per 100.
MAIL ORDER ONLY SAE FOR LISTS
Postal charges: up to £1 + 1/6; £1-£2 + 2/-; £2-£5 + 3/6; over £5 FREE.

A. J. H. ELECTRONICS
59 Waverley Road, The Kent, Rugby, Warwicks.

ELECTROVALUE

RAPID MAIL-ORDER SERVICE

PROMPT DELIVERY • VERY LARGE STOCKS

EVERYTHING BRAND NEW AND TO SPECIFICATION

★ Unbeatable Value in SEMICONDUCTORS

30W BAILEY AMPLIFIER
MJ481 and MJ491 matched pair output, **59/-**; 40361 and 40362 matched pair driver, **30/3**; 40361 **12/6**; 40362 **16/9**; BC125 **12/-**; BC107 **2/9**; BC109 **2/9**. Main amp. PC board **12/6** each but FREE with each complete transistor set.
Total for one channel £7.8.0 list with 10% discount; only **£6.13.3.** Total for two channels £14.16.0 list, with 15% discount only **£12.11.8.** Complete power supply kit **£4.5.0** list. Circuit reprints **1/-** each.

G.E. 2N2926 PLASTIC RANGE
Price reductions
Red spot = 55 to 110 **2/3**; Orange spot = 90 to 180 **2/3**; Yellow spot = 150 to 300 **2/6**; Green spot = 235 to 470 **2/9**.
All the above brand new stock.

TEXAS SILECT RANGE *PRICES REDUCED*
30V 800mA *npn*:
2N3704 = 90 to 330 3/9
2N3705 = 45 to 165 3/5
25V 200mA *pnp*:
2N3702 = 60 to 300 3/6
2N3703 = 30 to 150 3/3
small signal *npn*:
2N3707 low noise 4/-
2N3711 = 180 to 660 3/11
small signal *pnp*:
2N4058 low noise 4/9
2N4062 = 180 to 660 4/3
BC107 series 300mW 300MHz fT TO18:
BC107 45V = 125 to 500 2/9
BC108 20V = 125 to 900 2/6
BC109 20V = 125 to 900 2/9
BC167 series (180mW 300MHz fT, TO92):
BC167 45V = 125 to 500 2/3
BC168 20V = 125 to 900 2/-
BC169 20V = 240 to 900 2/3
BC109 and BC169 are low noise.
BC167, BC168 and BC169 are plastic.
Beta values for above immediately quoted after type Nos.

FETs—*Prices reduced*
MPF105 25V max., gm = 2 to 6mA/V, low noise **7/6**; 2N3819 25V max., gm = 2 to 6mA/V, low noise **9/-**.

MINI TRANSISTORS—*Prices reduced*
2N4285 *pnp* hFE 35 to 150 at 10mA fT 7MHz min., Veb 35V max. 2N4286 *npn* 30V hFE over 100 at 10µA to 1mA fT 280MHz typ. 2N4289 *pnp* 60V hFE over 100 at 100µA to 1mA fT 170MHz typ. 2N4291 *pnp* 40V hFE over 100 at 100mA, 2N3794 *npn* 40V hFE over 100 at 100mA, complementary driver/output 2N4292 *npn* 30V UHF N.F. 6dB max at 100MHz. fT 570MHz typ. B5041 Power 14·3W at 100°C base temp. 35V, hFE over 100 at 0·5A. Insulated TO66 size mounting surface.
Prices: 2N4285 to 2N4292 and 2N3794 **2/11**; B5041 **13/6**.

1,000V 1·5A **GENERAL PURPOSE RECTIFIER** type 1N5054 **3/6** only.
1,000 0·75A miniature rectifier type TS1 **1/9**; 400V type T84 **2/3**.

ZENER DIODES 3V to 27V 5% 400mW all preferred voltages, **4/6** each.

NEW TRANSISTOR BARGAINS

2N696	5/6	2N1711	7/4	2N4060	4/3	BC148	3/6
2N697	6/-	2N2147	16/9	40250	15/-	BC149	4/3
2N706	3/5	2N2369A	6/9	40406	16/3	BD123	24/3
2N1132	13/-			40408	14/6	BF194	7/-
2N1302	4/-	2N2646	9/6	AC126	6/6	BFX29	12/3
2N1303	4/-	2N2924	5/-	AC128	6/-	BFX84	7/5
2N1304	4/-	2N2925	5/9	AC176	11/-	BFX85	8/3
2N1305	4/-	2N3053	5/6	ACY17	8/-	BFX88	7/9
2N1306	6/9	2N3054	15/6	AD161	7/-	BFY51	4/3
2N1307	6/9	2N3055	16/6	AD162	7/-	BSX20	4/6
2N1308	8/9	2N3391A	5/6	AF114	7/-	NKT403	14/10
2N1309	8/9			AF124	7/6		
2N1613	6/6	2N3706	3/3	BC147	4/3		

All power types supplied with FREE Mica Washers.

★ RESISTORS

METAL OXIDE type TR5 0·5W 2% tolerance. Very low noise, low temperature coefficient, low drift. A Professional resistor. All E24 preferred values 10Ω to 1MΩ. Price: 1 to 11 **10d**; 12 to 25 **9d**; 25 up **8d**.
CARBON FILM high stab low noise.
⅛W 10% 1Ω to 3·3Ω and ⅛W 5% 3·9Ω to 1MΩ 1/10 doz., 14/6 100.
¼W 10% 4·7Ω to 10MΩ, 1/9 doz., 13/6 100.
½W 5% 4·7Ω to 10MΩ 2/2 doz., 17/- 100.
1W 10% 4·7Ω to 10MΩ, 3/3 doz., 25/10 100.
1/6 less per 100 if ordered in complete 100s of one ohmic value.
Please state resistance values required.
Carbon Skeleton pre-sets: 100Ω, 250Ω, 500Ω, 1kΩ, 2kΩ, 2·5kΩ, 5kΩ, 10kΩ, 20kΩ, 25kΩ, 50kΩ, 100kΩ, 200kΩ, 250kΩ, 500kΩ, 1MΩ, 2MΩ, 2·5MΩ, 5MΩ, 10MΩ. Vertical or horizontal mounting.
Small high quality, **1/-** each; Sub-min, type **11d** each.

★ PEAK SOUND PRODUCTS

Peak Sound PA.12-5 Power Amplifier has a maximum distortion level of only 0·1% at 11·5W, into 15Ω. In kit form **£3.19.6**, plus 12/- for ready prepared heat sink and mounting board. Power supply PS.45 Kit **£4.10.0.**
Pre-amp kit **27/-** plus controls mono: **6/3**; stereo **20/-**. Active tone filter kit **19/-** plus controls: mono **5/-**; stereo **16/-**. No discounts allowable on basic kits.

"P.W. DOUBLE 12"

All parts available as described in this issue and advertised by Peak Sound.

★ ELECTROLYTICS

SUB-MIN.
C426 range (µF/V): 0·64/64, 1/40, 1·6/25, 2·5/16, 2·5/64, 4/10, 4/40, 5/64, 6·4/6·4, 6·4/25, 8/4, 10/2·5, 10/16, 10/64, 12·5/25, 16/10, 16/40, 20/16, 20/64, 25/6·4, 25/25, 32/4, 32/10, 32/40, 32/64, 40/2·5, 40/16, 50/6·4, 50/25, 50/40, 64/4, 64/10, 80/2·5, 80/16, 80/25, 100/6·4, 125/4, 125/10, 125/16, 160/2·5, 200/6·4, 200/10, 250/4, 320/2·5, 320/6·4, 400/4, 500/2·5. **Price reduction **1/3** each.

MINIATURE (µF/V):
5/10, 10/10, 25/10, 50/10, **9d** each, 25/25, 50/25, 100/10, 200/10, **1/-** each: 50/50, 100/25, **1/6**; 100/50, 25/25, **2/-**.

LARGE ELECTROLYTICS (µF/V):
1000/50 **7/-**; 2000/50 **9/3**; 5000/50 **17/6**; 5000/25 **10/3**; 2500/64 15/-. Vertical clips for above types **9d** each.

★ CAPACITORS

Ceramic disc 20% 500V: 1,000pF, 2,000pF, 5,000pF. 50V: 0·01µF, 0·02µF, 0·05µF. Mylar film 10%. 100V: 1,000pF, 2,000pF, 5,000pF, 0·01µF, 0·02µF, 0·05µF. Polystyrene 5% 160V: 22pF preferred values to 820pF. ALL at **5d** each. Polyester 250V 20%: 0·01, 0·015, 0·022, 0·033, 0·047, 0·068µF **7d** each. 0·1µF **8d**. 250V 10%: 0·15, 0·22 **9d**; 0·33 **1/2**; 0·47 **1/6**; 1µF **2/3**; 2·2µF **4/-**.

★ POTENTIOMETERS

Prices reduced
Short spindle 100Ω to 10MΩ lin. 5KΩ to 5MΩ log., std. values. Only **2/-** each.
Long spindle 4·7kΩ, 10kΩ, 22kΩ, 47kΩ, 100kΩ, 270KΩ, 470KΩ, 1MΩ, 2·2MΩ, lin. or log. Only **2/6** each.
Long spindle dual stereo: 10kΩ, 22kΩ, 47kΩ, 100kΩ, 220kΩ lin. or log. Only **8/6** each.

ALL GOODS BRAND NEW—NO SURPLUS

1969 CATALOGUE now ready, full of most up to date information essential to every serious user. Send 1/6 for your copy.
COMPONENT DISCOUNTS
10% on total order over £3.0.0. 15% on total order over £10.0.0. *unless stated otherwise.*
POSTAGE AND PACKING on orders up to **£1**, add 1/-; over, post free in U.K.
OVERSEAS ORDERS WELCOMED. Carriage charged at cost.

ELECTROVALUE *Dept. P.W.4*
32A ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY
Telephone: EGHAM 5533 (STD 0784-3)

MOBILE S.W. LISTENERS

The Halson Mobile Antenna for AMATEUR RECEIVING and TRANSMITTING

The most efficient mobile All-Band Whip on the market. COILS FOR ALL BANDS. Complete with one coil **£6.17.6**, plus 3/6. Extra coils **£3.17.6**, plus 3/-.

From leading amateur radio stores or direct from the manufacturers:

HALSON ELECTRICAL SERVICES
Dover Road, off Ansdell Road, Blackpool.

NEW VALVES!

Guaranteed Set Tested
24-HOUR SERVICE

IR5	4/9	DY86	5/6	EZ80	3/9	PL500	12/-
1S5	4/3	DY87	5/6	EZ81	4/6	PL504	12/6
1T4	2/9	EABC80	5/9	KT61	8/3	PY32	10/-
3S4	5/9	EBC41	8/-	KT66	15/9	PY33	10/-
3V4	5/6	EBF80	5/9	N78	14/6	PY81	5/-
6AQ5	4/6	EBF89	5/9	PABC80	6/9	PY82	4/9
6L18	6/-	ECC81	3/9	PC86	9/3	PY83	5/3
30C18	8/9	ECC82	4/3	PC88	9/3	PY88	6/-
30FL1	12/6	ECC83	4/9	PC97	7/9	PY800	6/6
30FL12	14/3	ECC85	4/9	PC900	8/-	PY801	6/6
30FL14	10/3	ECH35	5/6	PCC84	5/9	R19	6/3
30P4	11/6	ECH42	9/9	PCC89	9/9	U25	12/9
30P19	11/6	ECH81	5/3	PCC189	9/6	U26	11/6
30PL1	12/6	ECL80	6/3	PCF80	6/3	U191	12/3
CCH35	9/9	ECL82	6/3	PCF82	5/9	UABC80	5/9
CL33	18/6	ECL83	8/9	PCF801	6/9	UBC41	7/6
DAC32	6/9	ECL86	7/6	PCF805	8/9	UBF89	6/3
DAF91	4/3	EF39	3/6	PCF808	10/3	UCC84	7/9
DAF96	5/11	EF80	4/9	PCL82	6/6	UCC85	6/-
DF33	7/6	EF85	5/-	PCL83	8/9	UCF80	8/-
DF91	2/9	EF86	6/3	PCL84	7/-	UCH42	9/6
DF96	5/11	EF89	4/9	PCL85	8/-	UCH81	6/-
DK32	6/9	EF183	5/9	PCL86	8/-	UCL82	6/9
DK91	4/9	EF184	5/6	PFL200	12/-	UF41	9/6
DK96	6/6	EL33	8/3	PL36	9/3	UF89	5/11
DL35	4/9	EL41	9/3	PL81	7/-	UL41	8/9
DL92	5/9	EL84	4/6	PL82	5/9	UL84	5/9
DL94	5/6	EY51	6/9	PL83	6/-	UY41	6/6
DL96	6/6	EY86	6/-	PL84	6/-	UY85	5/3

Postage on 1 valve 9d. extra. On 2 valves or more, postage 6d. per valve extra. Any parcel insured against damage in transit 6d. extra. Office address, no callers.

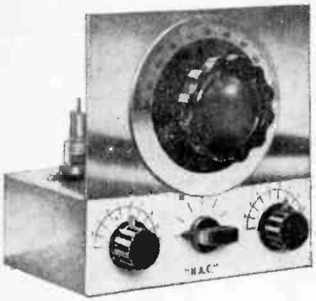
GERALD BERNARD
83 OSBALDESTON ROAD
STOKE NEWINGTON
LONDON, N.16

with a Dewtron "NEW DIMENSIONS" 3-Dimensional effects amplifier. Gives Big Hall Stereo effect to most radios, tapes, etc. PLUS fully adjustable echo, vibrato and tone. 9 volt model, 8 gns. Speaker, 25/- extra. 6/12V car model, 10 gns. incl. speaker. Post and ins. 5/- either model. Write now—right now.

D.E.W. LTD.,
P.W., RINGWOOD ROAD, FERNDOWN, DORSET

H.A.C. SHORT-WAVE KITS

WORLD-WIDE RECEPTION



Famous for over 30 years for Short-Wave Equipment of quality, "H.A.C." were the original suppliers of Short-Wave Receiver Kits for the amateur constructor. Over 10,000 satisfied customers—including Technical Colleges, Hospitals, Public Schools, R.A.F., Army, Hams, etc.

IMPROVED 1969 RANGE

One-valve model "DX", complete kit—price **56/6** (Postage and packing 3/6).

Customer writes:—"Definitely the best one-valve S.W. Kit available at any price. America and Australia received clearly at good volume." This kit contains all genuine short-wave components, drilled chassis, valve accessories and full instructions. Ready to assemble, and of course, as all our products—fully guaranteed. Full range of other S.W. kits still available, including the famous model "K" (recommended by radio clubs). All orders despatched by return. (Mail order only.) Send now for a descriptive catalogue, order form.

"H.A.C." SHORT-WAVE PRODUCTS
29 Old Bond Street, London W.1

NEW RANGE BBC 2 AERIALS

All U.H.F. aerials now fitted with tilting bracket and 4 element grid reflectors. **Loft Mounting Arrays**, 7 element, 37/6. 11 element, 45/-. 14 element, 52/6. 18 element, 60/-. **Wall Mounting with Cranked Arm**, 7 element, 60/-. 11 element, 67/-. 14 element, 75/-. 18 element, 82/6. **Mast Mounting** with 2in. clamp. 7 element, 42/6. 11 element, 55/-. 14 element, 62/-. 18 element, **70/-**. **Chimney Mounting Arrays, Complete.** 7 element, **72/6**. 11 element, **80/-**. 14 element, **87/6**. 18 element, **95/-**. Complete assembly instructions with every unit. **Low Loss Cable, 1/6 yd. U.H.F. Preamps** from 75/-. State clearly channel number required on all orders.

BBC · ITV AERIALS

BBC (Band 1). Telescopic loft, 25/-. External S/D, 30/-. "H" **£2.15.0. ITV (Band 3).** 3 element loft array, 30/-. 5 element, 40/-. 7 element 50/-. Wall mounting, 3 element, **47/6**. 5 element, **52/6**. **Combined BBC/ITV.** Loft 1+3, 40/-; 1+5, 50/-; 1+7, 60/-; Wall mounting 1+3, 57/6; 1+5, 67/6; Chimney 1+3, 67/6; 1+5, 75/-. **VHF** transistor preamps, 75/-.

COMBINED BBC1 — ITV — BBC2 AERIALS 1+3+9, 70/-. 1+5+9, 80/-. 1+5+14, 90/-, 1+7+14, 100/-. Loft mounting only. Special leaflet available.
F.M. (Band 2). Loft S/D, 15/-. "H", **32/6**. 3 element, 55/-. External units available. Co-ax. cable **8d.** yd. Co-ax. plugs, **1/4**. Outlet boxes, 5/-. Diplexer Crossover Boxes, **13/6**. C.W.O. or C.O.D. P. & P. 6/-. Send 6d. stamps for illustrated lists.

Callers welcomed – open all day Saturday

K.V.A. ELECTRONICS (Dept. P.W.)
40-41 MONARCH PARADE
LONDON ROAD, MITCHAM,
SURREY 01-648 4884

Est. 1943 **JOHNSONS** Tel: 24864

VHF and **Short-Wave kits** for the Amateur enthusiast and constructor. For 2 and 4 metres, the unique two transistor model SR2/P, 70–150Mc/s, **75/6**, p.p. 4s. New super 5V all-wave, all-band kit, also "Mini-Amp" self-contained, cabinet, size a mere $4\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{4}$. Write today, enclosing a stamped addressed envelope for interesting free literature, and details, direct to

JOHNSON'S (RADIO)
St. Martin's Gate, Worcester

10W AMPLIFIER

SSAR3 10w push pull output. TW99 output trans. 4 valve. EF94, ECC81, two EL90. Full chassis mounting, new and boxed with circuit drawing. **£2.10.0.** P. & P. 10/-.

19 set power unit, new with handbook. **£3.10.0.** P. & P. **10/-.**

Mixer units type 18. HF., MF., LF. Valve V885. **10/-.** P. & P. 2/6.

Micro Ammeters for instrument mounting. 0–100. **30/-.** P. & P. 2/6.

Micro Ammeters Type Y. Heavy duty with leads. **£3.** P. & P. **5/-.**

Flexible metal tubing. Galvanised ⅜ int. diameter **35/-** 100ft. P. & P. 7/6.

Field Telephones Type F. **32/6.** P. & P. 7/6.

Chassis Unit. 7 valves. ECC82(3) EB91(3) 6F33(1). 45 capacitors, resistors etc., valve bases and cans. **20/-. P. & P. 4/6.**

Cable. Six core (75yds approx) and Drum assembly. **25/-.** P. & P. 4/6.

Resonance Performance Testers, S. Band, 0–25db. 3260–3340 M/cs. **£10.** P. & P. 10/-.

Send us your Transformer requirements, 1000 in stock. S.A.E. full list.

TEST INSTRUMENTS, ETC. S.A.E. FULL LIST.

STATUS SUPPLIES

STATUS HOUSE, WILKINSON AVE., BLACKPOOL

4-STATION INTERCOM

£7/15/0

Solve your communication problems with this **4-Station Transistor Intercom** system (**1 master and 3 Subs**), in de-luxe plastic cabinets for desk or wall mounting. **Call/talk/listen** from **Master** to **Subs** and **Subs** to **Master**. Ideally suitable for **Business, Surgery, Schools, Hospital, Office and Home.** Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 7/6.

WIRE-LESS INTERCOM

No batteries—no wires. Just plug in the mains for instant two-way. loud and clear communication. On/off switch and volume control. Price **12 gns.** P. & P. 9/6 extra.

INTERCOM/BABY ALARM

OUR PRICE ONLY **65/-**

Same as 4-Station Intercom for two-way instant communication. Ideal as Baby Alarm and Door Phone. Complete with 66ft. connecting wire. Battery 2/6. P. & P. 4/6.

Transistor TELEPHONE AMPLIFIER

59/6

Why not boost business efficiency with this incredible De-luxe Telephone Amplifier. Take down long telephone messages or converse without holding the handset. A useful office aid. On/off switch. Volume Control. Battery 2/6 extra. P. & P. 3/6. Full price refunded if not satisfied in 7 days.

WEST LONDON DIRECT SUPPLIES (P/W4)
169 KENSINGTON HIGH STREET, LONDON, W.8.

PLEASE MENTION
"PRACTICAL WIRELESS"
WHEN REPLYING TO
ADVERTISEMENTS

HI-FI SOLID STATE AUDIO AMPLIFIER

10 Watts continuous sine wave output. 15 Watts music power. Output 3–16 ohms impedance. Frequency response 15 Hz to 18 Khz–1dB.

Distortion at full power <0·15%.

This instrument comes to you complete with pre-amplifier, main amplifier and power unit. (A.C. Mains) in modern styled aluminium stelvtite case.

Factory built and tested for the amazingly low price of 16 Gns. P. & P. 5/6.

SUNDERLAND ELECTRICS
48 Princess Street, Manchester 1
TRADE ENQUIRIES INVITED S.A.E. WITH ENQUIRIES PLEASE.

PADGETTS RADIO STORE

OLD TOWN HALL, LIVERSEDGE, YORKSHIRE.

Telephone: Cleckheaton 2866

Indicator Unit type 26
Size 12×9×9in. with outer case. Fitted with 2½in. tube C.R.T. type CV1526. Nine B7G valves. Clean condition, but not tested. **32/6,** p. & p. 10/-.
Lumerator and Secant Gear Unit. Delight for the model maker. **12/6,** p. & p. 8/6.
Silicon Rectifier 500mA, 800 P.I.V. No duds. **2/6,** post paid. **24/-** per dozen, post paid.
Jap Ear Piece. Magnetic 8 ohm. Small and large plug. **1/11,** post paid.
Reclaimed TV tubes with six months guarantee. 17in. type AW43/88, AW43/80, **40/-;** MW43/69, **30/-.** 14in. types, **17/-.** All tubes, 12/- carriage.
Speakers removed from TV sets. All PM and 3 ohms. 8in. round and 8×5in., **6/6,** p. & p. **3/6.**
6in. round, **3/-,** p. & p. 3/-; 6 for **24/-,** post paid.
6×4in., **3/-,** p. & p. 3/-; 6 for **24/-,** post paid. 7×4in., **5/-,** p. & p. **3/-;** 6 for **34/-,** post paid. 5in. round, **3/-,** p. & p. 3/-; 6 for **24/-,** post paid.
Slot Speakers, 8×2½in., **5/-,** p. & p. 3/-; 6 for **30/-,** post paid.
Untested 12-channel 14in. TV sets, **20/-,** carriage **15/-.** Passenger train, double rate. Untested Pye, KB, RDG, Ekco 17in. TV sets. Bush 17in. TV sets, **50/-** each, carriage 15/-. Passenger train double rate.

VALVE LIST

Ex. Equipment. 3 months' guarantee

Single Valves Post 7d., over 3 Valves p. & p. paid. 10FI, EF80, EB91, ECL80, EF50, PY82, PZ30, 20P3. All at 10/- per dozen, post paid.

ARP12	1/6	EF91	9d.	PL81	4/-	U329	5/-	185BT	8/6
EB91	9d.	EY51	2/6	PY33	5/-	U251	5/-	20D1	3/-
EF85	3/-	EY86	5/-	PY81	1/6	6B8	1/8	20P1	5/-
EBF80	3/-	PCC84	2/-	PY82	1/6	6BW7	2/6	20P3	2/6
ECC81	3/-	PCF80	2/-	PZ30	5/-	6K7	1/9	30PL1	5/-
ECC82	3/-	PCL82	4/-	U191	5/-	6U4	5/-	30P12	5/-
ECC83	4/-								
ECL80	1/6	PCL83	5/-	U281	5/-	6V6	1/9	30F5	2/6
EF50	1/-	PL36	5/-	U282	5/-	6P28	5/-	30FL1	5/-
EF80	1/6	PL38	6/-	U301	5/-	10P13	2/6	6/30L2	5/-

GARRARD PLAYING UNITS

LM3000 Record Player with 9T.A. Stereo Cartridge. **£10.10.0. AT.60 Mk. II De-Luxe** Auto-changer, die-cast turntable. Less cartridge. **£13.15.0. SP.25 De-luxe** single record player, die-cast turntable. Less cartridge. **£12.7.6.** Brand new in makers' cartons. Packing and carriage on any one of above 7/6. Plinths available.

CARTRIDGES WHEN PURCHASED WITH ABOVE —STEREO. Sonotone 9TA/HC Ceramic with diamond 55/-. Decca Deram with diamond **99/6; MONO** Acos GP91-1 **22/6;** Goldring MX2M **28/6.**

STEREO VOLUME CONTROLS. 1⅛in. dia., Long Spindles. All values 5000 ohms to 2 Megohms less Sw., ea. **8/6.** All values 100K to 2 Megohms with DP Sw., ea. **10/6.**

STEREO BALANCE CONTROLS. Log/Anti-Log 5K, 10K ½ Meg., 1 Meg., 2 Meg. ea. **9/6.**

TRS STEREO/MONO TUNER. Mono kit **15 gns.** (p/p 3/6). Add-in stereo unit **10** gns. (p/p 2/6). Power Unit **45/-** (p/p 2/6). Cabinet **37/6. Total £29.10.0.** (Carr. 12/6).

9d. BRINGS LATEST TRS LIST of bargains in components, accessories, material and equipment. It's certain to save you money.

TRS RADIO

COMPONENT SPECIALISTS

Established 1946

70 BRIGSTOCK ROAD, THORNTON HEATH, SURREY

Tel.: 01-684 2188. Hours 9 a.m.—6 p.m. 1 p.m. Wednesdays
A few doors from Thornton Heath Stn. (S.R. Victoria section)

DUXFORD ELECTRONICS (PW)

97/97a MILL ROAD, CAMBRIDGE

Tel: 0223-63687

(Visit us at our new Mail Order, Wholesale and Retail Premises)

MINIMUM ORDER VALUE 5/-

C.W.O. Post and Packing 1/-

DISCOUNT 10% over £2
15% over £5

CERAMIC DISC CAPACITORS (Hunts.). 500V±20%; 100, 220, 330pF. −20%, +80%; 470, 680, 1,000pF. 5d each.
ELECTROLYTIC CAPACITORS (Mullard). −10% to +50%.

Subminiature (all values in μF)

4V	8	32	64	125	250	400
6·4V	6·4	25	50	100	200	320
10V	4	16	32	64	125	200
16V	2·5	10	20	40	80	125
25V	1·6	6·4	12·5	25	50	80
40V	1	4	8	16	32	50
64V	0·64	2·5	5	10	20	32
Price	1/6	1/3	1/2	1/-	1/1	1/2

Small (all values in μF)

4V	800	1,250	2,000	3,200
6·4V	640	1,000	1,600	2,500
10V	400	640	1,000	1,600
16V	250	400	640	1,000
25V	160	250	400	640
40V	100	160	250	400
64V	64	100	160	250
Price	1/6	2/-	2/6	3/-

POLYESTER CAPACITORS (Mullard)
Tubular, 10%. 160V: 0·01, 0·015, 0·022μF, **7d.** 0·033, 0·047μF, **8d.** 0·068, 0·1μF, **9d.** 0·15μF, **11d.** 0·22μF, **1/-.** 0·33μF, **1/3.** 0·47μF, **1/6.** 0·68μF, **2/3.** 1μF, **2/8.**
400V: 1,000, 1,500, 2,200, 3,300, 4,700pF, **6d.** 6,800pF, 0·01, 0·015, 0·022μF, **7d.** 0·033μF, **8d.** 0·047μF, **9d.** 0·068, 0·1μF, **11d.** 0·15μF, **1/2.** 0·22μF, **1/6.** 0·33μF, **2/3.** 0·47μF, **2/8.**
Modular, metallised, P.C. mounting, 20%, 250V: 0·01, 0·015, 0·022μF, **7d.** 0·033, 0·047μF, **8d.** 0·068, 0·1μF, **9d.** 0·15μF, **11d.** 0·22μF, **1/-.** 0·33μF, **1/5.** 0·47μF, **1/8.** 0·68μF, **2/3.** 1μF, **2/9.**
POLYSTYRENE CAPACITORS: 5%. 160V (unencapsulated): 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82, 100, 120, 150, 180, 220, 270, 330, 390, 470, 560, 680, 820pF, **5d.** 1,000, 1,500, 2,200pF, **6d.** 3,300, 4,700, 5,600pF, **7d.** 6,800, 8,200, 10,000pF, **8d.** 15,000, 22,000pF, **9d.**
1%, 100V (encapsulated): 100, 120, 150, 180, 220, 270, 330, 390, 470, 500, 560, 680, 820pF, **1/-.** 1,000, 1,200, 1,500, 1,800, 2,200, 2,700, 3,300, 3,900pF, **1/3.** 4,700, 5,000, 5,600, 6,800, 8,200, 10,000, 12,000, 15,000pF. **1/6.** 18,000, 22,000, 27,000, 33,000, 39,000pF, **1/9.** 0·047, 5,000, 0·056μF, **2/-.** 0·068, 0·082, 0·1μF, **2/3.** 0·12μF, **2/9.** 0·15, 0·18μF, **3/-.** 0·22μF, **4/-.** 0·27, 0·33μF, **5/-.** 0·39μF, **5/9.** 0·47, 0·5μF, **6/3.**
JACK PLUGS (Screened): Heavily chromed, ¼in Standard: **2/9** each. Side-entry: **3/3** each.
Standard (Unscreened): **2/3** each.
JACK SOCKETS (¼in Plug): With chrome insert. **2/9** each. Available with: Break/Break, Make/Break, Break/Make. Make/Make contacts.
POTENTIOMETERS (Carbon): Long life, low noise, ¼W at 70°C. ±20% ≦ ½M, ±30% < ½M. Body dia., ⅞in. Spindle, 1in × ¼in. **2/3** each. Linear: 100, 250, 500 ohms, etc., per decade to 10M. Logarithmic: 5k, 10k, 25k, etc., per decade to 5M.
SKELETON PRE-SET POTENTIOMETERS (Carbon): Linear: 100, 250, 500 ohms, etc., per decade to 5M.
Miniature: 0·3W at 70°C. ±20% ≦½M, ±30% > ½M. Horizontal (0·7in × 0·4in P.C.M.) or Vertical (0·4in × 0·2in P.C.M.) mounting, **1/-** each.
Submin. 0·1W at 70°C. ±20% ≦ 1M, ±30% > 1M. Horizontal (0·4in × 0·2in P.C.M.) or Vertical (0·2in × 0·1in P.C.M.) mounting, **10d** each.
RESISTORS (Carbon film), very low noise. Range: 5%, 4·7Ω to 1MΩ (E24 Series): 10%, 10Ω to 10MΩ (E12 Series).
¼W (10%), 1¾d (over 99, 1½d). 100 off per value **12/-.** ¼W (5%), **2d** (over 99, 1¾d), 100 off per value **13/9.** ½W (10%), **2d** (over 99, 1¾d), 100 off per value **13/9.** ½W (5%), **2¼d** (over 99, 2d), 100 off per value **15/6.**
SEMICONDUCTORS: OA5, OA81, 1/9. OC44, OC45, OC71, OC81, OC81D, OC82D, 2/-. OC70, OC72, 2/3. AC107, OC75, OC170, OC171, 2/6. AF115, AF116, AF117, ACY19, ACY21, 3/3. OC140, 4/3. OC200, 5/-. OC139, 5/3. OC25, 7/-. OC35, 8/-. OC23, OC28, 8/3.
SILICON RECTIFIERS: (0·5A). 170 P.I.V., **2/9.** 400 P.I.V., **3/-.** 800 P.I.V., **3/3.** 1250 P.I.V., **3/9.** 1500 P.I.V. **4/-.** (0·75A); 200 P.I.V., **1/6.** 400 P.I.V., **2/-.** 800 P.I.V., **3/3.** (6A); 200 P.I.V., **3/-.** 400 P.I.V., **4/-.** 600 P.I.V., **5/-.** 800 P.I.V., **6/-.**
THYRISTORS (5A): 100 P.I.V., **8/-.** 200 P.I.V., **10/-.** 400 P.I.V., **15/-.**
SWITCHES (Chrome finish, Silver contacts): 3A 250V, 6A 125V. Push Buttons: Push-on or Push-off 5/-. Toggle Switches: SP/ST, 3/6. SP/DT, 3/9. SP/DT (with centre position) 4/-. DP/ST, 4/6. DP/DT, 5/-.
PRINTED CIRCUIT BOARD (Vero).
0·15in Matrix: 3¾in × 2½in. **3/3.** 5½in × 2½in, **3/11.** 3¾in × 3¾in, **3/11.** 5in × 3¾in, **5/6.**
0·1 Matrix: 3¾in × 2½in, **4/-.** 5in × 2½in, **4/6.** 3¾in × 3¾in, **4/6.** 5in × 3¾in **5/3.**
RECORDING TAPE (Finest quality MYLAR—almost unbreakable).
Standard Play: 5in, 600ft, **7/6.** 5¾in, 850ft, **10/6.** 7in, 1,200ft, **12/6.**
Long Play: 3in, 225ft, **4/-.** 5in, 900ft, **10/6.** 5¾in, 1,200ft, **13/-.** 7in, 1,800ft, **18/-.**

SEND S.A.E. for JANUARY, 1969 CATALOGUE

Head Office and Warehouse
44A WESTBOURNE GROVE
LONDON W2
Tel. PARK 5641/2/3

Z & I AERO SERVICES LTD.

Please send all correspondence and Mail-Orders to the Head Office

When sending cash with order, please include 2/6 in £ for postage and handling

MINIMUM CHARGE 2/6. No C.O.D. orders accepted.

Retail Shop
85 TOTTENHAM COURT ROAD
LONDON W1
Tel. LANgham 8403
Open all day Saturday

First Quality Fully Guaranteed

BRAND

ELECTRONIC VALVES

Combined effect of increase in Purchase Tax and S.E.T. and import restrictions forced us to introduce an increase of 1d. per shilling which must be added to the total of each order.

OA2	6/-
OA3	8/6
OB2	6/-
OB3	9/-
OC3	6/6
OD3	6/-
OM10	11/-
1AX2	12/-
1B3GT	7/-
1C5GT	5/-
1G4GT	8/-
1H5GT	7/-
1L4	3/-
1R5	6/-
184	5/-
185	4/6
1T4	4/-
1U4	6/-
1U5	8/6
1V2	9/-
1X2B	7/-
1Z2	25/-
2C26A	8/-
2C40	8/-
2C51	8/-
2CW4	12/-
2D21	6/-
2E26	27/6
2X2	5/-
3A3	11/-
3A4	4/-
3B28	40/-
3Q4	7/6
3S4	6/-
3V4	6/6
4B32	80/-
5R4GY	10/-
5U4G	5/6
5U4GB	7/-
5U8	8/-
5Y3GT	5/6
5Z3	8/-
5Z4G	7/-
6/30L2	14/-
6A8G	5/6
6AB4	6/6
6AB7	4/-
6AC5GT	12/-
6AC7	4/-
6AD4	15/-
6AF4A	9/-
6AG5	3/-
6AG7	6/9

6AH6	10/-
6AJ5	9/-
6AJ8	5/3
6AK5	5/-
6AK6	11/6
6AL5	3/-
6AM4	22/-
6AM5	5/-
6AM6	4/-
6AM8	8/-
6AN8	10/-
6AQ5	6/-
6AQ6	10/-
6AR5	6/-
6AR6	6/-
6AS5	6/6
6AS6	7/-
6AS7G	15/-
6AT6	4/6
6AU4GTA	9/-
6AU6	5/-
6AU8	10/-
6AV5GTA	12/-
6AV6	5/6
6AW8A	11/-
6AX4GTB	8/-
6AX5GT	12/6
6AX7	10/-
6B4G	15/-
6B8G	2/6
6BA6	4/-
6BA7	15/-
6BC5	3/6
6BE6	4/6
6BF5	15/-
6BF6	9/-
6BF7	12/-
6BG6G	11/-
6BH6	8/-
6BJ6	8/-
6BK4	20/-
6BK7A	9/-
6BL7GTA	11/-
6BN6	7/6
6BN8	8/-
6BQ6GTB	12/-
6BQ7A	7/-
6BR7	16/-

6BR8	12/6
6BS7	25/-
6BW6	18/6
6BW7	12/-
6BZ6	6/-
6BZ7	10/-
6C4	5/6
6C5GT	6/6
6C6	4/-
6C8G	7/-
6C9	17/3
6CB6	5/-
6CD6GA	22/-
6CG7	8/-
6CH6	11/-
6CL6	9/-
6CL8	15/-
6CU6	12/-
6CW4	12/-
6CY5	7/-
6D3	7/6
6D4	17/6
6DC6	13/6
6DK6	8/-
6DQ6B	11/-
6DS4	15/-
6DT6	8/-
6EA8	11/-
6EW6	12/-
6F6GB	6/6
6F7	9/-
6F11	6/-
6F13	6/6
6F14	12/-
6F15	11/-
6F17	9/-
6F18	7/6
6F23	15/-
6F24	13/-
6F25	14/-
6F28	13/-
6GH8	11/-
6GK6	12/-
6GW6	11/-
6J4	9/-
6J5GT	5/6
6J6	3/6
6J7	8/-
6K6GT	9/-
6K7G	2/6
6K23	9/-
6K25	15/-
6L1	12/-

6L6GT	8/6
6L7	6/-
6L12	5/-
6L18	6/-
6LD20	5/6
6N7GT	6/6
6P1	11/6
6P25	13/-
6P28	12/-
6Q7	7/-
6SA7	7/-
6SG7	6/-
6SH7	4/6
6SJ7	7/-
6SL7GT	6/-
6SN7GT	5/6
6SQ7	7/-
6SR7	7/-
6SS7	3/-
6T8	6/-
6U4GT	12/-
6U8	6/-
6V6GT	6/-
6X4	4/6
6X5GT	5/-
6X8	11/-
6Y6G	11/6
7C5	13/6
7Y4	9/-
7Z4	7/6
9BW6	7/-
9D2	3/6
9D7	9/-
10C2	10/-
10D2	8/-
10F1	18/-
10F9	10/-
10F18	7/6
10L1	7/6
10LD11	10/-
10P13	12/-
10P14	16/-
12AC6	7/-
12AD6	6/-
12AL5	7/6
12AQ5	7/-
12AT6	4/6
12AT7	6/-
12AU6	5/-
12AU7	5/9
12AV6	5/6
12AX7	5/6
12B4A	9/6
12BA6	6/-

12BA7	6/-
12BE6	6/-
12BH7	6/-
12BT6	4/6
12BY7	10/-
12CU6	12/-
12DQ7	10/-
12E1	20/-
12E14	52/6
12K5	10/-
12K8	8/
12Q7GT	5/6
12SA7GT	8/-
12SC7	4/6
12SG7	6/-
12SK7	6/6
12SQ7	7/6
13D3	5/9
19AQ5	6/-
20CV	62/6
20D1	9/-
20L1	18/-
20P1	10/-
20P3	12/-
20P4	19/-
20P5	19/-
25BQ6GTB	12/-
25C5	9/-
25CU6	12/-
25L6GT	6/6
25Z4G	6/-
25Z5	8/-
25Z6GT	11/-
30A5	7/-
30C15	14/-
30C17	15/-

30C18	14/-
30F5	16/-
30FL1	15/-
30FL12	17/6
30FL13	8/-
30FL14	14/6
30L1	6/-
30L15	16/-
30L17	16/-
30P12	15/-
30P19	14/-
30PL1	15/-
30PL13	17/6
30PL14	17/-
35A5	10/-
35B5	12/-
35C5	6/6
35D5	12/-
35L6GT	8/-
35W4	4/6
35Z3	10/-
35Z4G	4/-
35Z5GT	6/-
50A5	12/-
50B5	12/-
50C5	6/-
50L6GT	7/6
53KU	13/6
75C1	8/-
80	7/-
88A1	12/6
85A2	7/6
85A3	7/6
90AG	46/-
90C1	12/-
90CG	25/-
90CV	25/-

150B2	11/-
150B3	10/-
807	9/-
811A	30/-
812A	60/-
813	75/-
837	15/-
866A	14/-
884	10/-
5670	10/-
5751	11/-
5763	12/-
5886	40/-
6080	27/6
6146	27/6
6197	20/-
6360	25/-
6939	40/-
7360	30/-
7551	30/-
7581	22/6
7591A	20/-
AZ1	8/-
AZ31	9/-
CCH35	9/-
CL33	15/-
CY31	7/-
DAF96	7/-
DF96	7/-
DH81	10/-
DH101	9/-
DK92	8/3
DK96	7/6
DL68	13/-
DL96	7/-
DM70	6/-
DM160	8/-

DY86	6/-
DY87	6/6
DY802	9/-
E55L	52/6
E83F	20/-
E88C	23/-
E88CC	12/6
E130L	100/-
E180F	17/6
EAF801	10/-
EABC80	6/-
EBC33	8/-
EBC41	8/6
EBC81	6/-
EBF80	7/6
EBF83	8/-
EBF89	6/-
EBL1	12/-
EBL31	24/-
EC86	11/6
EC88	11/-
ECC34	8/-
ECC40	10/-
ECC70	17/-
ECC81	6/-
ECC82	5/9
ECC83	5/6
ECC84	5/6
ECC85	5/-
ECC86	8/-
ECC88	7/6
ECC89	11/-
ECC91	3/6
ECC807	14/-
ECF80	6/6
ECF82	6/6
ECF83	14/-

ECF86	9/6
ECF804	32/-
ECH35	11/-
ECH42	10/-
ECH81	5/3
ECH83	8/-
ECH84	9/-
ECL80	7/-
ECL81	7/6
ECL82	6/-
ECL83	10/-
ECL84	10/-
ECL85	10/6
ECL86	8/-
ECLL800	20/-
EF9	8/-
EF37A	8/-
EF39	8/-
EF40	9/-
EF41	9/-
EF42	13/-
EF54	10/-
EF55	12/-
EF80	4/6
EF83	9/6
EF85	6/6
EF86	6/-
EF89	5/-
EF91	4/-
EF92	7/6
EF93	4/-
EF94	5/-
EF95	5/-
EF96	3/6
EF98	10/-
EF183	6/-
EF184	6/6
EF804	20/-
EH90	7/-
EK90	4/6
EL34	9/6
EL36	8/6
EL38	22/6
EL41	9/6
EL42	10/-
EL81	9/-
EL83	7/6
EL84	4/6
EL85	7/6
EL86	8/-
EL90	6/-
EL360	22/-
EL500	17/-

EL821	10/-
EL822	17/-
ELL80	15/-
EM71	12/6
EM80	7/-
EM81	7/6
EM84	7/-
EM87	10/-
EN32	30/-
EN91	6/-
EY51	7/-
EY80	8/6
EY81	7/-
EY83	10/-
EY84	9/6
EY86	6/6
EY87	8/-
EY88	8/-
EZ40	7/6
EZ41	8/6
EZ80	5/-
EZ81	5/-
GZ32	9/6
GZ33	13/6
GZ34	10/-
HL42DD	8/-
KT66	20/-
KT88	29/-
MH4	7/-
MH41	9/-
ML4	8/-
MSPENT	10/-
N78	19/-
ORP61	5/-
ORP90	22/6
PABC80	7/6
PC86	11/-
PC88	11/-
PC95	7/6
PC97	8/-
PC900	8/9
PCC84	6/-
PCC85	7/6
PCC88	11/-
PCC89	9/6
PCC189	10/-
PCC805	16/-
PCC806	16/-
PCE800	15/-
PCF80	6/6
PCF82	6/3
PCF84	8/-

PCF86	8/6
PCF87	15/-
PCF800	14/-
PCF801	9/-
PCF802	9/-
PCF805	14/-
PCF806	12/-
PCF808	14/6
PCL80	15/-
PCL81	9/-
PCL82	7/-
PCL83	9/6
PCL84	8/-
PCL85	8/6
PCL86	8/6
PCL88	17/-
PCL800	17/6
PCL801	15/-
PEN45	6/6
PEN45DD	12/-
PEN383	9/-
PEN384	9/-
PEN453DD	10/-
PF86	10/-
PF818	14/-
PL33	8/-
PL36	10/-
PL81	7/6
PL83	8/-
PL83	7/-
PL84	6/6
PL500	13/6
PL504	15/-
PY31	5/-
PY32	10/-
PY33	12/6
PY80	5/6
PY81	5/6
PY82	5/-
PY83	6/6
PY88	7/6
PY800	9/-
PY801	9/-
QU37	27/-
SP41	5/6
SP61	5/-
TP22	10/-
TT21	35/-
U19	40/-
U20	12/-
U22	8/-

U25	14/6
U26	14/6
U31	8/-
U33	30/-
U76	4/-
U81	10/-
U281	8/-
U282	8/-
U403	8/-
U404	5/-
UABC80	6/-
UAF42	9/6
UBC41	8/6
UBC81	8/6
UBF80	6/6
UBF89	7/-
UBL1	8/6
UC92	6/-
UCC85	7/-
UCF80	9/6
UCH21	9/6
UCH42	9/6
UCH81	6/6
UCL81	10/-
UCL82	7/-
UCL83	9/6
UF9	10/-
UF41	9/9
UF42	10/-
UF43	10/-
UF80	7/-
UF85	7/3
UF89	7/-
UL41	9/6
UL84	8/6
UM4	10/-
UM84	7/-
UU8	7/-
UU9	7/6
UY21	9/6
UY41	7/-
UY82	9/6
UY85	6/-
VU39	9/-
VU111	8/6
VU133	8/-
W76	7/-
W107	7/-
W729	10/-
X65	9/-
Z759	25/-
Z700U	8/-
Z803U	15/-

INTEGRATED CIRCUIT AMPLIFIERS

RCA Type CA3020
Integrated Circuit Audio Amplifier in TO5 encapsulation (size of a small transistor), equivalent to seven n-p-n silicon transistors, 3 diodes and 11 resistors. Power output 550mW. Total harmonic distortion 1%. Will operate on voltage from 3 to 9 volts. 30/- plus 2/- p.p.

GENERAL ELECTRIC Type PA222
Epoxy moulded in-line package equivalent to six n-p-n transistors, one diode and six resistors. It will provide output of up to 1·2 watts into 15 ohms. Battery operation 22 volts. 40/- plus 2/- p.p.

The construction of amplifier using the above integrated circuits had been described in March and August issues of P.W. Please note that we only supply the IC's and no other parts are supplied by us.

GENERAL ELECTRIC TYPE PA234
1-watt Audio Amplifier suitable for supply voltage of 9 to 25V and for output loads of 8, 16 or 22 ohms. Only 3 capacitors and 3 resistors are required for making up a complete amplifier delivering 1 watt for an input voltage of 600mW. Epoxy moulded double four-in-line package. 27/6 each, plus 2/- P. & P.

SILICON WIRE ENDED DIODES
Max. frequency 20mc/s

D223, 50 p.i.v., 50mA 2/-
D233A, 100 p.i.v., 50mA 2/2
D223B, 150 p.i.v., 50mA 2/6

SILICON POWER RECTIFIERS
(Half Wave)

'TOP HAT' type, wire ended:
D226B, 400 p.i.v., 300mA 2/9
D226V, 300 p.i.v., 300mA 2/6

STUD MOUNTED, KD202 series
50 p.i.v., 1A 3/-
50 p.i.v., 3A 5/-
100 p.i.v., 1A 3/3
100 p.i.v., 3A 5/-
200 p.i.v., 1A 3/6
200 p.i.v., 3A 6/-
300 p.i.v., 1A 3/8

SILICON AVALANCHE RECTIFIERS
(Half Wave)

RAS 310 AF, Top Hat type, 1·5A, 1200 p.i.v. 7/6
RAS 508 AF, Stud Mounted, 6A, 960 p.i.v. 10/6

DRY REED INSERTS

Glass dry reed inserts approx. ¼in. dia. x 1in. long with axial leads. One "make" contact of 100mA capacity at 50V. Can be operated by permanent magnet or 30–50 Amp-turns relay coils. PRICE 18/- per doz. post free.

CURRENT PRODUCTION CATHODE RAY TUBES

2AP1—2in. screen. EHT 500 to 1000V. Typical sensitivity at 500V. X—·220mm/V; Y—·260mm/V. USM11 Base. Overall length 7⅜in. 40/-
3BP1—3in. screen. EHT 1500V. Typical sensitivity X—·150mm/V; Y—·200mm/V. B14A Base. Overall length 10¼in. 55/-

MULTIMETERS

TYPE MF16

D.C. voltage range: 0-0·5-10-50-250-500V.
A.C. voltage range: 0-10-50-250-500V.
D.C. current range: 500µ-10-100mA.
Resistance ranges: 100MΩ-1MΩ. The meter is also calibrated, capacity (1000pF to 0·03µF) and output level measurements. Sensitivity 2000ΩV. Accuracy ±2.5% for D.C. and ±4% for A.C. measurements. Dimensions: 4½" x 3¼" x 1½". Price £4.5.0.

Type 108-IT: 24 range precision portable meter. 5000 o.p.v. D.C. Volts: 2·5-10-50-250-500-2500V. A.C. Volts: 10-50-100-250-500-2500V; D.C. current 0·5-5-50-500mA Resistance 2000–20,000 ohms; 2–20 megohms. Power output calibration in A.C. for 600 ohms line. Complete with prods and batteries. £6.5.0. P. & P. 5/-.

OUR NEW 1968/1969 CATALOGUE IS NOW READY

THE TECHNICAL INFORMATION SECTION HAS BEEN FURTHER EXPANDED TO INCLUDE MORE DETAILS OF SEMICONDUCTORS. PLEASE SEND S.A.E. (Quarto Size) FOR FREE CATALOGUE.

HIGH POWER STUD MOUNTED

10% Tol. Zener Diodes
SERIES D815, 8 watts dissipation:
4·7, 5·6, 6·8, 8·2, 10·0, 12·0, 15·0, 18·0V.
SERIES D816, 5 watts dissipation:
22, 27, 33, 39, 47, 56, 68, 82, 100V.
All at 7/6 each.
Orders for ten or more, may be mixed, 6/9 each.

TRIACS TYPE 40432

Gated bi-directional Silicon Thyristors with integral trigger. The triac will control up to 1440 watts at 240V mains frequency. Supplied complete with heat sink, data sheet and application sheets for motor control and dimmer circuits. 37/6 each.

THYRISTORS

Low current:
Blue spot; 200 p.i.v., 5 Amps. Gate voltage 3·25V at 120mA 12/6

High current:
CR 80-021A, 80 Amps. 25 p.i.v. 25/-
CR 100-151A 30/-
CR 100-201A, 100 Amps. 200 p.i.v. 35/-
CR 100-215A, 100 Amps. 250 p.i.v. 40/-
CR 100-301A, 100 Amps. 300 p.i.v. 45/-
CR 100-351A, 100 Amps. 350 p.i.v. 50/-
CR 100-401A, 100 Amps. 400 p.i.v. 60/-
CR 100-501A, 100 Amps, 500 p.i.v. 70/-

For all CR series Minimum gate firing voltage is 3V at 150mA.

UNIJUNCTION TRANSISTORS 2N2646

Power dissipation 300mW R.M.S. Base-to-Base voltage 35V max. Peak emitter current 2·0A. Suitable for triggering of thyristors. 12/6

TRANSISTORS

Apart from the types listed in our Catalogue the following types are added to our stocks:

2N930	6/8	2N2477	12/6	ASY27	6/6
2N1306	6/-	2N3055	20/-	BC118	8/6
2N2217	6/6	2N3704	5/6	BFX88	5/4
2N2218	7/9	AD161	9/-	P346A	5/-
2N2219	8/6	AD162	9/-		

PRACTICAL WIRELESS blueprints

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

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

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

PRACTICAL WIRELESS query service

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

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

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

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

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

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

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

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

QUERY COUPON

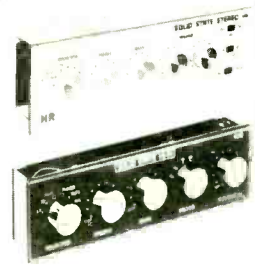
This coupon is available until 7th March, 1969 and must accompany all queries in accordance with the rules of our Query Service.

PRACTICAL WIRELESS, MARCH 1969

Published on or about the 7th of each month by I.P.C. MAGAZINES LIMITED, Tower House, Southampton Street, London, W.C.2. at the recommended maximum price shown on the cover. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia) Ltd. South Africa: CENTRAL NEWS AGENCY LTD. Rhodesia, Malawi and Zambia: KINGSTONS LTD. East Africa: STATIONERY & OFFICE SUPPLIES LTD. Subscription rate including postage for one year: To any part of the World £2.2s.0d.

ENGLANDS LEADING COMPONENT & EQUIPMENT CENTRES

SOLID STATE—HIGH FIDELITY AUDIO EQUIPMENT



Mono or Stereo Audio, Equipment developed from Dinsdale Mk.II—each unit or system will compare favourably with other professional equipment selling at much higher prices.

COMPLETE SYSTEMS FROM £15.5.0

THE FINEST VALUE IN HIGH FIDELITY—CHOOSE A SYSTEM TO SUIT YOUR NEEDS AND SAVE POUNDS

All units available separately.

SEND FOR *FREE BROCHURE* (No. 21) *TODAY!*

DEMONSTRATIONS DAILY AT '303' EDGWARE ROAD

Acclaimed by everyone MAYFAIR ELECTRONIC ORGAN

A completely new development in portable electronic musical instruments and a new field for the home constructor The 'MAYFAIR' produces a multitude of the most pleasing sounds with a wide range of tone colours suitable for classic or popular music **The organ is fully polyphonic, that is full chords can be played over the entire keyboard** Supplied as a kit of parts which includes 165 transistors, printed circuit panels, special fully sprung and depth of touch adjusted keyboard, attractive vynair covered cabinet with carry handle A complete detailed and illustrated construction manual is provided with circuits and full parts list All items may be purchased separately All parts supplied are fully guaranteed Full after sales service.

Once built the 'MAYFAIR' will then provide years of enjoyable entertainment. **ONLY 99 Gns.**

Call in. See it and play it yourself.

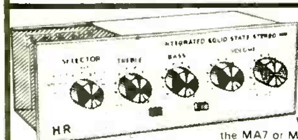
ORGAN COMPONENTS
We carry a comprehensive stock of organ components for TRANSISTOR AND VALVE FREE PHASE designs
Ask for BROCHURE 9

Deferred terms available.
COMPLETE KIT
Deposit £29.19.0.
12 monthly payments of £7.
TOTAL £113.19.0.

BUILT AND TESTED
Deposit £36.8.0 &
12 monthly payments of £9 Total £144 8 0.
RHYTHM UNIT
£59.10.0 pp. 10/-

EXPORT ENQUIRIES INVITED

INTEGRATED SOLID STATE TRANSISTOR POWER AMPLIFIERS



Complete with full Bass Treble Volume and Selector Controls

MA66 12 WATTS STEREO

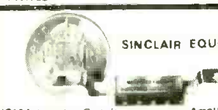
We are pleased to offer two new designs with the choice of either mono or stereo systems These BRITISH DESIGNED UNITS favour the user in so many ways being suitable for use with all types of PICK-UPS TUNERS DECKS and MICROPHONES—with fantastic power and quality with far greater adaptability with freedom for battery or mains operation Output is from 3-16 OHMS Whether you require a home or portable HI-FI installation electronic guitar P.A System Intercomm the MA7 or MA66 will FILL THE BILL

for complete listening satisfaction choose either the — MA7 MONO **£8.10.0** OR THE STEREO MA66 **£16.10.0** POST PACKING 5/- EITHER MODEL

OPTIONAL MAINS UNIT PS20 62 6d p.p.4/- Suitable for either model

Illustrated leaflets 12 and 14 FREE on request Demonstrations Daily at our 309 Edgware Rd. Branch.

SINCLAIR EQUIPMENT



IC10 Integrated Circuit Amplifier	59/6
212 Amplifier	89/6
Micromatic (Kit)	49/6
Micromatic (Built)	59/6
PZ4 Power Unit	99/6
Stereo 25	£9.19.6
Q14 Speaker System	£7.19.6

All POST PAID Delivery from stock

DO IT YOURSELF MW/LW PORTABLE

New printed circuit design with full power output Fully tunable on both mw/lw bands. 7 transistors plus diode, push-pull circuit. Fitted 5 inch speaker, large ferrite aerial and Mullard transistors. Easy to build with terrific results. All local and Continental stations.

TOTAL COST TO BUILD **£6.19.6.** P.P. 4/6

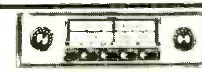
Send for Brochure 1

NEW MODELS NOMBREX TRANSISTORISED Test Equipment

MODEL		PRICE £	s.	d.	Leaflet No.
22	Power Supply	14	0	0	22
30	Audio Generator	19	10	0	24
31	R.F. Generator	12	10	0	25
32	C.R. Bridge	10	10	0	26
33	Inductance Bridge	20	0	0	29

Send for descriptive illustrated Brochure.

QUALITY CAR RADIOS



A precision engineered car radio that's perfect company for long hours on the road Has quick push button operation for immediate station selection and choice of Medium or Long wave frequency Output of 3½ watts ensures crisp, top quality sound even at high motoring speeds Includes full accessories and instructions

POSITIVE/NEGATIVE EARTH PRICE £12 12 0. pp. 4/6

MANUAL as above £8.19.6. but with single MW/LW Push Button.

MULLARD 1 WATT AMPLIFIER

PORTABLE TRANSISTOR UNIT with volume control

Many uses Intercoms Baby Alarms Guitar Practice Telephone or Record Player Amplifier

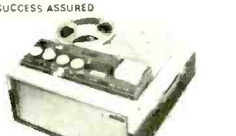
Optional Rexine covered Wood cabinet 12 x 9 x 4. 12 6. 7 x 4 in speaker 17/6 Uses PP9 battery

45/- pp 3/6d.

Ask for Leaflet 2

BUILD A QUALITY TAPE RECORDER

To get the best out of your MAGNAVOX DECK you need a MARTIN RECORDAKIT This comprises a special high quality 6 valve amplifier and pre-amplifier which comes to you assembled on its printed circuit board—in fact everything needed down to the last screw FOR MAKING A SUPERB TAPE RECORDER which when built will compare favourably with instruments costing twice as much, yet you need no experience or technical skill to bring this about THE INSTRUCTIONS MANUAL MAKES BUILDING EASY AND SUCCESS ASSURED



2 Track **36 gns.** 4 Track **39 gns.**

P.P. 22.6 either model

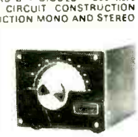
Kit comprises Deck Amplifier, Cabinet and speaker with MICROPHONE 7 in 1,200 ft tape, spare spool.

ALL UNITS AVAILABLE SEPARATELY Today's Value £60.

ASK FOR BROCHURE 6

VHF FM SUPERHET TUNER MKII

'5 MULLARD TRANSISTORS & 4 DIODES ' 300 Kc/s BANDWIDTH ' PRINTED CIRCUIT CONSTRUCTION ' HIGH FIDELITY REPRODUCTION MONO AND STEREO



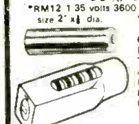
A popular VHF FM Tuner now used throughout the country for quality reception of monophonic and, with the decoder stereophonic broadcasts. There is no doubt about it—VHF FM gives the *real sound* Excellent stability economically priced.

TOTAL COST £6 19.6.

DECODER £5.19.6.

(CABINET 20/- EXTRA) ASK FOR LEAFLET 3.

NEW—MALLORY LONG LIFE MERCURY BATTERIES 50% OFF LIST PRICES



*RM12 1 35 volts 3600 m/aH OUR PRICE 5/- each size 2" x ½ dia.

* RM625 10 35 volts 350 m/aH Pack of 8 Size 2½ x ½ dia. OUR PRICE 10/- each

Easily split into eight 1 35v cells These cells are ideal for any application where SMALL SIZE HIGH CAPACITY and LONG LIFE are required

QUANTITIES AVAILABLE.

GARRARD RECORD DECKS

BRAND NEW All below list price

	£	s.	d.
2025 Mono/Stereo	8	8	0
3000 LM with 9TAHC	9	19	6
SP25 Mk II	11	19	6
AT60 Mk II	13	10	0
3500 Mono/Stereo	12	19	6
401	28	10	0
AP75	19	0	0
SL55	11	19	6
SL65	14	14	0
SL75	29	0	0
SL95	39	10	0
A70 Mk II	12	12	0

Complete range of accessories available

MANUFACTURERS—DISTRIBUTORS

We publish a QUANTITY, SEMI-CONDUCTOR BULLETIN listing over 500 different devices available FROM STOCK in medium to large quantities at KEEN PRICES coupled with PROMPT DELIVERIES

TO OBTAIN YOUR COPY, WRITE TO US (on Company Headed Notepaper please) requesting our SEMI-CONDUCTOR BULLETIN For TELEPHONE QUOTATIONS, PHONE (01) 723 1008/9 Extn 4 (01) 723 0401 Extn 4

We purchase medium to large quantities of Transistors and Devices excess to Manufacturers and Distributors requirements.

TRANSISTORS—SEMICONDUCTORS

COMPLETELY NEW 1969 LIST OF 1000 types. Send for your FREE COPY TODAY. (list 36)

S.C.R.'s from 5/-

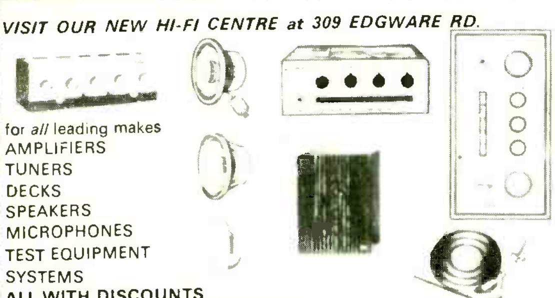
Field Effect Transistors from 9/6

Power Transistors from 5/-

Diodes and Rectifiers from 1/6

HI-FI equipment to suit EVERY POCKET

VISIT OUR NEW HI-FI CENTRE at 309 EDGWARE RD.



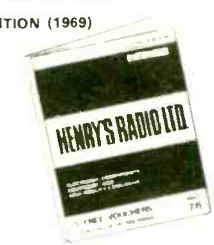
for *all* leading makes
AMPLIFIERS
TUNERS
DECKS
SPEAKERS
MICROPHONES
TEST EQUIPMENT
SYSTEMS
ALL WITH DISCOUNTS

Ask for Hi-Fi- Stock List Leaflet 16.17

IT WILL PAY YOU TO PAY US A VISIT!

Fully Illustrated CATALOGUE

COMPLETELY NEW 9th EDITION (1969)



The most COMPREHENSIVE—CONCISE—CLEAR COMPONENTS CATALOGUE

Complete with 10/- worth discount vouchers

FREE WITH EVERY COPY

- 32 pages of transistors and semi-conductor devices, valves and crystals.
- 210 pages of components and equipment.
- 70 pages of microphones, decks and Hi-Fi equipment.

6,500 ITEMS

320 BIG PAGES

Send today 7'6 Post etc 2/-

HENRY'S RADIO LTD (HR)

OPEN MON.-SAT. 9 a.m.-6 p.m. THURS. 9 a.m.-1 p.m.

303 Edgware Road, London, W.2. Mail Order Dept. all types of Components, Organ Dept. (01) 723-1008/9

309 Edgware Road, London, W.2. High Fidelity Sales, P.A. and Test Equipment, Record Decks (01) 723-6963