PRACTICAL WIRELESS

JANUARY 1971

3'6 (17½ new pence)

PW Stereo Tape Recorder

AUDIO STANDARDS CHART No. 2

ALSO:
7 TRANSISTOR SUPERHET
VERSATILE SIGNAL TRACER

ADCOLA Soldering Instruments add to your efficiency

ADCOLA 64

for Factory Bench Line Assembly

A precision instrument—supplied with standard 3/16″ (4.75 mm) diameter, detachable copper chisel-face bit*.
Standard temp. 360°c at 23 watts.
Special temps. from 250°c—410°c.

***Additional Stock Bits**
(illustrated) available

COPPER

B 38 1/8″ — 3.2 mm CHISEL FACE

B 14 3/32″ — 2.4 mm CHISEL FACE

B 24 3/16″ — 4.75 mm SCREWDRIVER FACE

B 12 3/16″ — 4.75 mm EYELET BIT

B 58 1/4″ — 6.34 mm CHISEL FACE

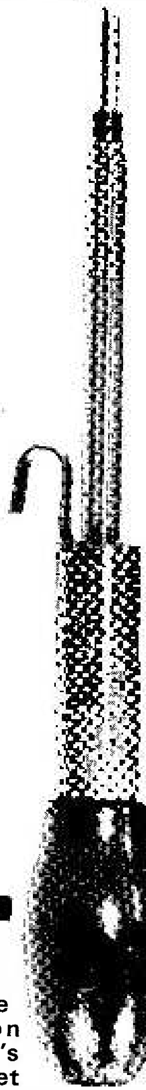
LONG LIFE

B 42 LL 3/16″ — 4.75 mm CHISEL FACE

B 38 LL 1/8″ — 3.2 mm CHISEL FACE

B 14 LL 3/32″ — 2.4 mm CHISEL FACE

B 44 LL 3/16″ — 4.75 mm SCREWDRIVER FACE



Don't take chances. We don't. All our ADCOLA Soldering Instruments are of impeccable quality. You can depend on ADCOLA day after day. That's why they're so popular. You get consistent good service . . . reliability . . . from our famous thermally controlled ADCOLA Element and the tough steel construction of this ideal production tool.

ADCOLA

* *Write for price list and catalogue*

ADCOLA PRODUCTS LTD.,
(Dept. M), ADCOLA HOUSE, GAUDEN RD., LONDON, S.W.4.
Telephone: 01-622 0291/3 • Telegrams: Soljoint London Telex • Telex: Adcola London 21851

EX-RENTAL TELEVISIONS

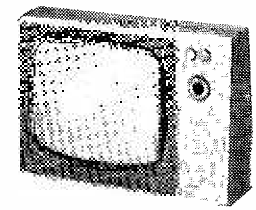
TWO-YEAR GUARANTEE

17″ SLIMLINE
£11 19 0

19″ SLIMLINE 405/625
£29 19 0

Carriage and Insurance 30/-

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



TV TUBES REBUILT GUARANTEED 2 YEARS
14″ — 79/6; 17″ & 19″ — 119/-; 21″ & 23″ — 129/-
(Not Bonded) Insur. & Carr. 10/6

T.V. PRESS-BUTTON VHF TUNERS' 59/6. Complete with valves, PCF806, PCC89. P. & P. 3/6.

Transistors: Mullard matched output kit 7/6, OC81D—2 OC81's. P. & P. FREE.

Transistor Radio Cases: 5/- each. Size 9½″ × 6½″ × 3½″. P. & P. 9/6.

Ferrite Rods 3/6: 6″ and 7″ complete with LW/MW Coils. P. & P. FREE.

PRESS BUTTON SWITCHING UNITS, 4 Banks 3/6, 6 Banks 5/6. P. & P. 1/-.

SPEAKERS 6/6, 2½″ 8Ω.

STEREO RECORD PLAYER CABINET & MATCHING EXTERNAL SPEAKER CABINET
£5.19.6

Cloth covered. Two tone Blue/Black. Size 14½″, 24″, 8¾″. P. & P. 10/6.

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

PHOTOELECTRIC KIT

CONTENTS: 2 P.C. Chassis Boards, Chemicals, Etching Manual, Infra-Red Phototransistor, Latching Relay, 2 Transistors, 3 Diodes, 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 10 Advanced Designs

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, Infa-red filter, projector lamp holder, building plans, etc. Price **19/6**. Postage and Pack. 1/6 (U.K.). Commonwealth: Surface Mail 2/–; Air Mail 8/–.

LONG RANGE INVISIBLE BEAM OPTICAL KIT

CONTENTS: As above. Twice the range of standard kit. Larger Lenses, Filter, etc. Price **29/6**. Postage and Pack. 1/6 (U.K.). Commonwealth: Surface Mail 2/6; Air Mail 10/–.

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 (U.K.). Commonwealth 2/–; Air Mail 4/–.

JUNIOR OPTICAL KIT

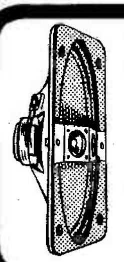
CONTENTS: 2 Lenses, Infra-red Filter, Lampholder, Bracket, Plans, etc. Everything (except plywood) to build 1 miniature invisible beam projector and photocell receiver for use with Junior Photoelectric Kit.
Price **10/6**. Post and Pack. 1/6 (U.K.). Commonwealth: Surface Mail 2/–; Air Mail 4/–.

YORK ELECTRICS Mail Order Dept.
335 BATTERSEA PARK RD., 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.

LiND-AiR AUDiO

E.M.I. LOUDSPEAKERS



MODEL 450 13½″×8″ elliptical with twin tweeters. 8 ohm impedance. 10 watts. Brand New, guaranteed. Lind-Air Price 79/6 P. & P. 4/6.
MODEL 150 13½″×8″ elliptical, 3 and 15 ohm impedance. 10 watts. Lind-Air Price 59/6 P. & P. 4/6.
TEAK FINISH SPEAKER CABINETS Size 16″×10″×9″. Ideal for above units **42/6**

HI-TONE RECORDING TAPE

BRITISH MADE TOP QUALITY

J1001	3″	L.P.	PVC	225ft.	5/6	P & P 1/2
J1002	3″	T.P.	Poly	600ft.	10/6	P & P 1/2
J1003	5″	L.P.	PVC	900ft.	10/-	P & P 1/8
J1004	5″	D.P.	Poly	1200ft.	15/-	P & P 1/8
J1005	5¾″	L.P.	PVC	1200ft.	12/6	P & P 2/-
J1006	5¾″	D.P.	Poly	1800ft.	22/6	P & P 2/-
J1007	7″	S.P.	PVC	1200ft	12/6	P & P 2/6
J1008	7″	L.P.	PVC	1800ft.	17/6	P & P 2/6
J1009	7″	D.P.	Poly	2400ft.	25/-	P & P 2/6
J1010	7″	T.P.	Poly	3600ft.	50/-	P & P 2/6
C60 Cassette (Library cased)					8/6	P & P 1/-
C90 Cassette (Library cased)					13/-	P & P 1/-
C120 Cassette (Library cased)					18/-	P & P 1/-

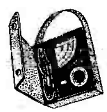
DE-LUXE STEREO HEADPHONES

With soft rubber earpieces. Impedance 8-16 ohms. Frequency response 23-13,000 cps. With lead and stereo plug.
59/6 P. & P. 3/6.

SOLDERING GUN

Comfortable grip with trigger control, "U" shaped 3½″. bit to minimise wear. Light beam is automatically directed on to end of bit when ON/OFF trigger is in use 230-250 volts. 85 watt element **49/6** P. & P. 3/6.

C.1001 MULTI-TESTER



Overload protection. 20,000 opv. AC volts 10, 50, 250, 1,000v. DC volts 5-25, 125, 500, 2500v. D.C. Current 0-50 uA, 0-250 mA. Resistance 0-60K, 0-6 Meg ohm. Decibels—20 to +22dB. Size of meter 4½ x 3¾ x 1in. Complete with leather case. **85/-** P. & P. 3/6.

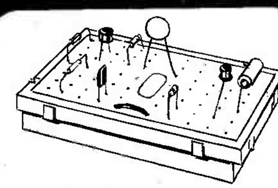
FIRST TIME EVER! SOLID STATE RADIO HEADPHONES

* STEREO EFFECT RADIO
* POWERFUL TRANSISTOR RADIO BUILT INTO HEADPHONE WITH TUNING AND VOLUME CONTROLS
* TWIN TELESCOPIC AERIAL RODS
* TWIN MAGNETIC SPEAKERS—ONE IN EACH EARPIECE

Listen to all your favourite radio programmes anywhere and anytime. Lightweight and comfortable to wear. Covers full medium waveband, supersensitive tuning control and variable volume control. Ideal for outdoors and indoors.
ONLY **£10.19.6.** P. & P. 4/6.

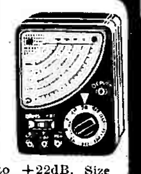
600 WATT LIGHT DIMMER SWITCH
Same size as standard wall switch and will dim incandescent lighting from full on to off. Heavy plastic box with control knob. LIND-AIR PRICE **£4.10.0.** P. & P. 3/6.

S-DEC BREADBOARD



British Made
Solderless breadboard panels, for fast reliable component connections.
Single DeCs. One S-DeC with Control Panel, Jig and Accessories for solderless connections to controls, etc., with booklet "Projects on S-DeC" giving construction details for a variety of circuits. **29/6.** P. & P. 2/6.
4-DeC KIT. Four S-DeCs with two Control Panels, Jigs and Accessories and the booklet "Projects on S-DeC" all contained in a strong attractive plastic case. Ideal for the professional user. **£5.17.6.** P. & P. 3/6.
T-DeC KIT **£2.10.0.** P. & P. 3/6.

62D. MULTI-TESTER



20,000 p.p.v. DC voltage 5 - 25 - 50 - 250 - 500 - 2.5 K (20,000 ohms per volt). AC voltage: 10-50-100-500-1000 volts (10,000 ohms per volt). DC Current: 0-50 uA, 0-2.5 mA, 0-250 mA. Resistance; 0-6K, 0-6 Mg (300 ohm and 30K at centre scale). Capacitance: 10f. to .001 mfd. .001 uf to .1 uf. Decibels: —20 to +22dB. Size 4½ x 3½ x 1in. **71/-** P. & P. 3/6.

UNILEX Audio Modules

A good quality stereo amplifier can be built with no electrical knowledge. All solid state—Baxendall tone control circuit—no soldering—terminal block connections throughout.
Everything you need to know about UNILEX SYSTEMS is in the Mullard book "Do it yourself stereo". Superb designs, detailed plans, simple instructions in non-technical language covering 4 systems in 4 price ranges. Send for your copy now 5/- Post Free.

UNILEX Audio Modules

Amplifier Module EP9000	**£2.18.0 each**
Pre Amplifier Module EP9001	**£3. 2.0 „**
Power Supply Module EP9002	**£4.12.0 „**
Control Panel Assembly and Escutcheon Plate	**£3. 5.0**

BUILD A STEREO AMPLIFIER FOR ONLY
£16.15.0 P. & P. 7/6

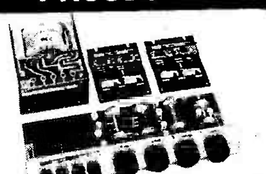
UNILEX PACKAGE DEALS

Unilex Modules	£16.15.0
Garrard 2025	£11.14.1
Celestion Speakers	£ 5.17.0
	£34. 6.1
LIND-AIR PRICE	**28 gns.** P. & P. 20/-

Unilex Modules	£16.15.0
Garrard SP25 Mk II	£15.11.4
B.S.R. C1 Cartridge	£ 3.17.3
Celestion Speakers	£ 5.17.0
	£42. 0.7
LIND-AIR PRICE	**35½ gns.** P. & P. 20/-

NOW OPEN AT
94-96 UPPER PARLIAMENT STREET,
NOTTINGHAM. Tel. 40403 (STD 0602)

sinclair PROJECT 60



An attractive alternative for the enthusiast prepared to assemble these excellent modules to make a stereo assembly.
Z.30 24 watt Power Amplifier **89/6** (2 required).
Stereo Sixty Control/Pre-amplifier **£9.19.6**
PZ.5 Power Supply Unit **£4.19.6.**
SINCLAIR PROJECT 60 Package deal price **19 GNS.** P. & P. 12/6.
Project 60 is supplied complete with instruction manual and templates for plinth mounting.

SINCLAIR IC-10 INTEGRATED CIRCUIT

10 watt Amplifier. Size only 1 x 0.4 x 0.2in. A true hi-fi amplifier complete with manual giving details of a wide range of applications and instructions. Guaranteed 5 years.
ONLY **59/6** P. & P. 1/6.
SPECIAL TRANSFORMER FOR OPERATING SINCLAIR IC-10 from A.C. mains 230/250v. Output 13v. at 0.5 amp. **16/6** P. & P. 2/6.

Garrard HI-FI TURNTABLES

2025 T/C with stereo cartridge ..	£8.19.6
3000 with Sonotone 9TAHCD stereo cartridge......	£10.19.6
SP25 Mk II	£10.19.6
SL65B	£15.19.6
Base and cover for above	£5.19.6
AP75	£18.10.0
SL72B	£24.19.6
SL75B	£28.7.0
SL95B	£39.9.0
401	£28.10.0
Base and cover for above	£8.19.6

P. & P. Decks 12/6. Base & Cover 10/- Deck/Base/Cover 17/6.
SPECIAL OFFERS!
SP25 MkII with base **£14.10.0.** P.&P. 15/-.
SP25 Mk II with Sonotone 9TAHCD cartridge and base **£15.15.0.** P. & P. 15/-
Sonotone 9TAHCD cartridge **£2.15.0** P. & P. 1/6.

18/19, 25 & 53 TOTTENHAM CT. ROAD, LONDON W.1.
Telephone: 01-580 2255/4532/7679
Open 9-6 pm. Monday to Saturday. Thursday until 7 pm.

All Mail Orders and correspondence to Dept. L5/13. Kirkman House, 54a Tottenham Court Road, London, W.1. Tel: 01-580 7041/2.

SCOOP MT-65 SPECIAL OFFER

EXCLUSIVE HI-FI STEREO TUNER AMP. OFFER

THE MT-65 CHASSIS

Solid state AM/FM multiplex tuner with FET front-end/17 + 17 watts stereo amplifier by world famous manufacturer. Frequency response 20–45KHz. Inputs—2·3mV mag. p/u and 140mV tape play. Tape record output. Controls: Left/right volume, bass, treble, loudness, monitor. Tuning meter and stereo beacon. Stereo 'phone jack. Machined stainless steel front panel. Overall size 20×3⅜×16in. List Price £75.

SPECIAL PRICE £66.0.0 CARRIAGE 15/-

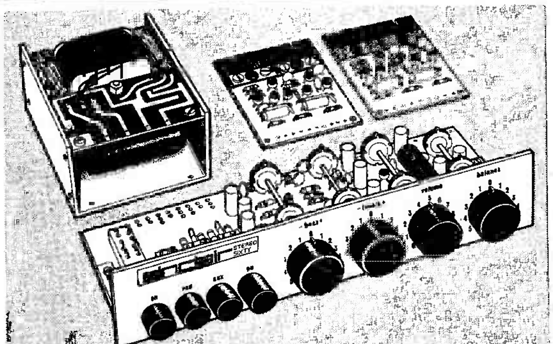
DE-LUXE "COMPACT" PACKAGE OFFER

MT-65 Chassis	£75 0 0
GARRARD AP-75 3-speed Single Player	£23 16 7
AUDIO DEVELOPMENT AD-96K Magnetic Cartridge	£5 18 6
2 WHARFEDALE DENTON Speaker Systems	£36 0 0
"Compact" Teak Cabinet (as shown)	£7 10 0

TOTAL RECOMMENDED LIST PRICE £148.5.1

LASKY'S PACKAGE PRICE **£129.0.0** U.K.: carriage £3.0.0 All units available separately

sinclair Project 60



Project 60 is a range of modules which connect together to form a complete stereo amplifier. The modules are: 1. Z-30 high gain power amp. 2. Stereo-60 pre-amp. control unit. 3. The PZ-5 unstabilised and PZ-6 stabilised power supplies. A complete system comprises two Z-30's, one Stereo-60 and a PZ-5 or PZ-6.

STEREO 60 SPECIFICATION

Input sensitivities: Radio up to 3mV, Magnetic Pick-up 3mV: correct to R.I.A.A. curve ±1dB; 20 to 25,000Hz. Ceramic Pick-up up to 3mV: Auxiliary up to 3mV ● Output: 1 volt ● Signal to noise: better than 70dB ● Front panel: brushed aluminium with black knobs and controls ● Size: 8¼ × 1½ × 4in. **£8.19.6** Post 3/6

Z-30 SPECIFICATION

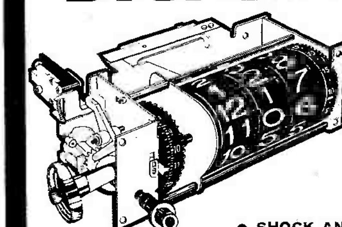
● Power output: 15 w. R.M.S. into 8 ohms using a 35 volt supply ● Frequency response: 30 to 300,000Hz ±1dB ● Distortion: 0.02% ● Signal to noise: better than 70dB ● Input sensitivity: 250mV into 100 K ohms ● Loudspeaker imp: 3 to 15 ohms ● Power requirements: from 8 to 35V DC (The Z30 will operate from batteries if required) – Size: 3½ × 2¼ × ½in. **85/-** Post 3/6

PZ5 30V unstabilised — sufficient to drive two Z-30's and a Stereo 60 for domestic applications. **90/-** Post 2/6

PZ6 35V stabilised — ideal for driving two Z-30's and a Stereo 60 for low efficiency speakers. **£7.10.0** Post 2/6

PACKAGE PRICE For Stereo 60, two Z-30 and one PZ-5 **£19.5.0** Post 10/-

EXCLUSIVE DIGITAL CLOCK SCOOP!



- MADE ESPECIALLY FOR LASKY'S BY FAMOUS MAKER
- MAINS OPERATION
- 12 HOUR ALARM
- AUTO "SLEEP" SWITCH
- HOURS, MINUTES AND SECONDS READ-OFF
- FORWARD AND BACKWARD TIME ADJUSTMENT
- SILENT OPERATION SYNCHRONOUS MOTOR
- SHOCK AND VIBRATION PROOF
- BUILT IN ALARM BUZZER

SPECIAL QUOTATIONS FOR QUANTITIES

This unique DIGITAL CLOCK is now available **EXCLUSIVELY FROM LASKY'S** in chassis form for you to mount in any housing that you choose. All settings are achieved by two dual-concentric controls at the front including: ON-OFF-AUTO and AUTO ALARM, "sleep" switch, 10 minute division "click" set alarm (up to 12 hour delay), time adjustment. Ultra simple mechanism and high quality manufacture guarantee reliable operation and long life.
The sleep switch will automatically turn off any appliance—radio, TV, light, etc., at any pre-set time up to 60 min. and in conjunction with the AUTO setting will switch on the appliance again next morning.
The clock measures 4¾W×1½H×3⅜D (overall from front of drum to back of switch). SPEC: 210/240V AC, 50Hz operation; switch rating 250V, 3A. Complete with instructions. **HUNDREDS OF APPLICATIONS.**

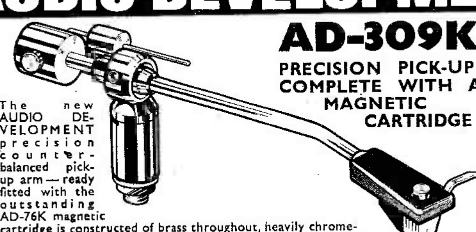
COMPLETE WITH KNOBS.

LASKY'S PRICE **£6.19.6** Post 3/6

AUDIO DEVELOPMENT

AD-309K

PRECISION PICK-UP ARM COMPLETE WITH AD-76K MAGNETIC CARTRIDGE



The new AUDIO DEVELOPMENT precision counter-balanced pick-up arm — ready fitted with the outstanding AD-76K magnetic cartridge is constructed of brass throughout, heavily chrome-plated; uses needle and miniature ballrace bearings; both coarse and fine balance adjustment is provided. The fixed head has standard ½in. mounting centres and is finished in black enamel with chrome lifting spur. Completely wired, with all fixing nuts and washers. Arm rest also supplied. Tech. details: Overall length 285mm; needle to pivot length 223mm; offset angle 24°; overhang 10mm. Requires single 7/16in. dia. mounting hole.

LASKY'S PRICE **£8.19.0** Post 3/6

INTERNATIONAL

MAGNETIC RECORDING TAPE FROM THE U.S.A. AT LASKY'S RECORD LOW PRICES

3in.	Message tape. 150ft.	2 6
3in.	Message tape, 225ft.	3 9
3in.	Message tape, 300ft.	7 6
3¼in.	Triple play. 600ft Mylar	10 0
5in.	Double play, 1200ft.	15 0
5in.	Long play, 900ft. Acetate	10 0
5in.	Standard play 600ft. ,,	8 6
5¾in.	Double play, 1800ft. Mylar	22 6
5¾in.	Long play 1200ft. Acetate	15 0
5¾in.	Standard play 900ft. PVC	12 6
5¾in.	Long play. 1200ft. Mylar	15 0
5¾in.	Triple play. 2400ft.	35 0
7in.	Standard play, 1200ft. Acetate	12 6
7in.	Standard play. 1200ft Mylar	12 6
7in.	Long play, 1800ft. Mylar	19 6
7in.	Double play, 2400ft. Mylar	25 0
7in.	Long play 1800ft. Acetate	15 0
7in.	Triple play 3600ft. Mylar	50 0

P. & P. 1/- extra per reel, 4 reels and over Post Free. Special quotes for quantities.

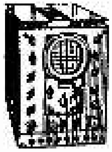
Lasky's Radio Limited

207 EDGWARE ROAD, LONDON, W.2. Tel: 01-723 3271
33 TOTTENHAM CT. RD, LONDON, W1P 9RB. Tel: 01-636 2605
Open all day, 9 a.m.–6 p.m. Monday to Saturday
109 FLEET STREET, LONDON, E.C.4. Tel: 01-353 5812
152/3 FLEET STREET, LONDON, E.C.4. Tel: 01-353 2833
Open all day Thursday, early closing 1 p.m. Saturday

HIGH FIDELITY AUDIO CENTRES
42-45 TOTTENHAM CT. RD, LONDON, W1P 9RD. Tel: 01-580 2573
Open all day, 9 a.m.–6 p.m. Monday to Saturday
118 EDGWARE ROAD, LONDON, W.2. Tel: 01-723 9789
Open all day Saturday early closing 1 p.m. Thursday

ALL MAIL ORDERS AND CORRESPONDENCE TO: 3-15 CAVELL STREET, TOWER HAMLETS, LONDON, E1 2BN Tel: 01-790 4821

TYPE 13A DOUBLE BEAM OSCILLOSCOPES

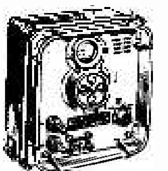


An excellent general purpose D/B oscilloscope. T.B. 2 cps–750 Kc/s. Bandwidth 5.5 Mc/s. Sensitivity 33mV/CM. Operating voltage 0/110/200/250V. A.C. Supplied in excellent working condition. **£22.10.0.** Carriage 30/-.

AVO CT471A MULTIMETER

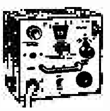
Battery operated, fully transistorised. Sensitivity 100mΩ/v. Measures AC/DC Voltages 12mV to 1,200v. AC/DC Current 12uA to 1.2 Amp. Resistance 12 ohm to 120 mΩ HF, VHF, UHF Voltage with multiplier 4v to 400v up to 50 Mc/s, 40mV to 4v up to 1,000 Mc/s. Offered in perfect condition. **£55 each.** Carr. 10/-

CRYSTAL CALIBRATORS NO. 10



Small portable crystal controlled wavemeter. Size 7 × 7½ × 4in. Frequency range 500 Kc/s–10 Mc/s (up to 30 Mc/s on harmonics). Calibrated dial. Power requirements 300V. D.C. 15mA and 12V D.C. 0.3A. Excellent condition. **89/6.** Carr. 7/6.

CLASS D WAVEMETERS

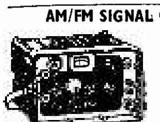


A crystal controlled heterodyne frequency meter covering 1·7–8 Mc/s. Operation on 6 volts D.C. Ideal for amateur use. Available in good used condition. **£5.19.6.** Carr. 7/6. Or brand new. **£7.19.6.** Carr. 7/6.

B.C. 221 FREQUENCY METERS

latest release 125 KHz—20 MHz. Excellent condition. Fully tested and checked and complete with calibrator charts. **£27.10.0 each.** Carr. 10/-

AM/FM SIGNAL GENERATORS

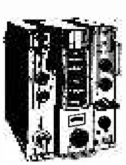


Oscillator Test No. 2. A high quality precision instrument made for the ministry by Airmec. Frequency coverage 20-80 Mc/s. AM CW/FM. Incorporates precision dial, level meter, precision attenuator 1µV-100mV. Operation from 12 volt D.C. or 0/110/200/250 volt A.C. Size 12 × 8½ × 9in. Supplied in brand new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

AVO CT.38 ELECTRONIC MULTIMETERS

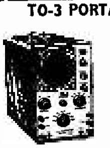
High quality 97 range instrument which measures A.C. and D.C. Voltage. Current, Resistance and Power Output Ranges D.C. volts 250mV–10,000v. (10 meg Ω -11 0meg Ω input). D.C. current 10µA–25 amps. Ohms, 0–1,000 meg Ω A.C. volt 100mV.–250V (with R.F. measuring head up to 250 Mc/s) A.C. current 10µA–25 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/-.

ADMIRALTY 62B RECEIVERS



High quality 10 valve receiver manufactured by Murphy. Coverage in 5 bands 150-300 Kc/s, 560 Kc's–1.5Mc/s; 3.9–30.5 Mc/s I.F. 500/Kc/s. Incorporates 2 R.F. and 3 I.F. stages, bandpass filter, noise limiter, crystal controlled B.F.O. calibrator I.F. output, etc. Built-in speaker, output for phones. Operation 150/230 vol A.C. Size 19½ × 13½ × 16in. Weight 114lb. Offered in good working condition. **£22.10.0.** Carr. 30/-. With circuit diagrams. Also available B41 L.F. version of above, 15 Kc/s–700 Kc/s. **£17.10.0.** Carr. 30/-.

TO-3 PORTABLE OSCILLOSCOPE



3in. tube. Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps–1·5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0·9v. p-p/CM. Bandwidth 1.5 cps–800KHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps–300 KHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½ lb. 220/240V. A.C. Supplied brand new with handbook. **£37.10.0.** Carr. 10/-.

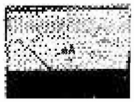
SEW PANEL METERS

USED EXTENSIVELY BY INDUSTRY, GOVERNMENT DEPARTMENTS, EDUCATIONAL AUTHORITIES, ETC.

● LOW COST ● QUICK DELIVERY ● OVER 200 RANGES IN STOCK ● OTHER RANGES TO ORDER

NEW "SEW" DESIGNS!

CLEAR PLASTIC METERS TYPE SW.100 100 x 80 mm.



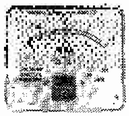
50µA	69/6	20V.D.C.	59/6
50-0-50µA	67/6	50V. D.C.	59/6
100µA	67/6	300V. D.C.	59/6
100-0-100µA	65/-	1 amp. D.C.	59/6
500µA	62/6	5 amp. D.C.	59/6
1mA	59/6	300V. A.C.	59/6
		VU Meter	75/-

BAKELITE PANEL METERS TYPE S-80 80 mm. square fronts

50µA	62/6	50V. D.C.	49/6
50-0-50µA	59/6	300V. D.C.	49/6
100µA	59/6	1 amp. D.C.	49/6
100-0-100µA	57/6	5 amp. D.C.	49/6
500µA	52/6	300V. A.C.	52/6
1mA	49/6	VU Meter	67/6
20V. D.C.	49/6		

"SEW" CLEAR PLASTIC METERS

Type MR.85P. 4¼in. × 4¼in. fronts.



50µA	72/-	50mA	52/-
50-0-50µA	62/-	100mA	52/-
100µA	62/-	500mA	52/-
100-0-100µA	62/-	1 amp.	52/-
200µA	57/6	5 amp.	52/-
500µA	55/-	15 amp.	52/-
500-0-500µA	52/-	30 amp.	52/-
1mA	52/-	20V. D.C.	52/-
1-0-1mA	52/-	50V. D.C.	52/-
5mA	52/-	150V. D.C.	52/-
10mA	52/-	300V. D.C.	52/-
		15V. A.C.	52/-
		300V. A.C.	52/-
		S Meter 1mA	57/6
		VU Meter	72/-
		1 amp. A.C.*	52/-
		5 amp. A.C.*	52/-
		10 amp. A.C.*	52/-
		20 amp. A.C.*	52/-
		30 amp. A.C.*	52/-

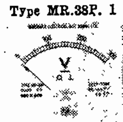
Type MR.52P. 2½in. square fronts.

50µA	62/-	10V. D.C.	40/-
50-0-50µA	52/-	20V. D.C.	40/-
100µA	52/-	50V. D.C.	40/-
100-0-100µA	47/6	300V. D.C.	40/-
500µA	45/-	15V. A.C.	40/-
1mA	40/-	300V. A.C.	40/-
5mA	40/-	S Meter 1mA	42/-
10mA	40/-	VU Meter	62/-
50mA	40/-	1 amp. A.C.*	40/-
100mA	40/-	5 amp. A.C.*	40/-
500mA	40/-	10 amp. A.C.*	40/-
1 amp.	40/-	20 amp. A.C.*	40/-
5 amp.	40/-	30 amp. A.C.*	40/-

Type MR.65P. 3½in. × 3¼in. fronts.

50µA	67/6	10V. D.C.	42/-
50-0-50µA	55/-	20V. D.C.	42/-
100µA	55/-	50V. D.C.	42/-
100-0-100µA	52/-	150V. D-C.	42/-
200µA	52/-	300V. D.C.	42/-
500µA	47/6	15V. A.C.	42/-
500-0-500µA	42/-	50V. A.C.	42/-
1mA	42/-	150V. A.C.	42/-
5mA	42/-	300V. A.C.	42/-
10mA	42/-	500V. A.C.	42/-
50mA	42/-	S Meter 1mA	47/6
100mA	42/-	VU meter	67/6
500mA	42/-	50mA A.C.*	42/-
1 amp.	42/-	100mA A.C.*	42/-
5 amp.	42/-	200mA A.C.*	42/-
10 amp.	42/-	500mA A.C.*	42/-
15 amp.	42/-	1 amp. A.C.*	42/-
20 amp.	42/-	5 amp. A.C.*	42/-
30 amp.	42/-	10 amp. A.C.*	42/-
50 amp.	47/6	20 amp. A.C.*	42/-
5V. D.C.	42/-	30 amp. A.C.*	42/-

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



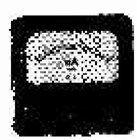
50µA	40/-	200mA	27/6
50-0-50µA	37/6	300mA	27/6
100µA	37/6	500mA	27/6
100-0-100µA	35/-	750mA	27/6
200µA	35/-	1 amp.	27/6
500µA	30/-	2 amp.	27/6
500-0-500µA	27/6	5 amp.	27/6
1mA	27/6	10 amp.	27/6
1-0-1mA	27/6	3V. D.C.	27/6
2mA	27/6	10V. D.C.	27/6
5mA	27/6	15V. D.C.	27/6
10mA	27/6	20V. D.C.	27/6
20mA	27/6	100V. D.C.	27/6
50mA	27/6	150V. D.C.	27/6
100mA	27/6	300V. D.C.	27/6
150mA	27/6	500V. D.C.	27/6
		750V. D.C.	27/6
		15V. A.C.	27/6
		50V. A.C.	27/6
		150V. A.C.	27/6
		300V. A.C.	27/6
		500V. A.C.	27/6
		S Meter 1mA	32/-
		VU meter	42/-

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

50µA	45/-	5 amp.	30/-
50-0-50µA	42/-	10V. D.C.	30/-
100µA	42/-	20V. D.C.	30/-
100-0-100µA	37/6	50V. D.C.	30/-
200µA	37/6	300V. D.C.	30/-
500µA	32/-	15V. A.C.	30/-
500-0-500µA	30/-	300V. A.C.	30/-
1mA	30/-	S Meter 1mA	37/6
5mA	30/-	VU meter	45/-
10mA	30/-	1 amp. A.C.*	30/-
50mA	30/-	5 amp. A.C.*	30/-
100mA	30/-	10 amp. A.C.*	30/-
500mA	30/-	20 amp. A.C.*	30/-
1 amp.	30/-	30 amp. A.C.*	30/-

"SEW" BAKELITE PANEL METERS

Type MR.65. 3½in. square fronts.

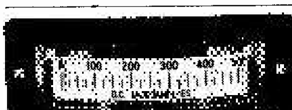


25µA	70/-	500mA	35/-
50µA	47/6	1 amp.	35/-
50-0-50µA	45/-	5 amp.	35/-
100µA	45/-	15 amp.	35/-
100-0-100µA	45/-	30 amp.	35/-
500µA	42/-	50 amp.	35/-
1mA	35/-	5V. D.C.	35/-
1-0-1mA	35/-	10V. D.C.	35/-
5mA	35/-	20V. D.C.	35/-
10mA	35/-	50V. D.C.	35/-
50mA	35/-	150V. D.C.	35/-
100mA	35/-	300V. D.C.	35/-
		30V. A.C.*	35/-
		50V. A.C.*	35/-
		150V. A.C.*	35/-
		300V. A.C.*	35/-
		500mA A.C.*	35/-
		1 amp. A.C.*	35/-
		5 amp. A.C.*	35/-
		10 amp. A.C.*	35/-
		20 amp. A.C.*	35/-
		30 amp. A.C.*	35/-
		50 amp. A.C.*	35/-
		VU meter	62/-

*MOVING IRON—

ALL OTHERS MOVING COIL

Please add postage



EDGWISE METERS

Type PE.70. 3 17/32in. × 1 15/32in. × 2½ in. deep.

50µA	60/-	500µA	52/-
50-0-50µA	57/6	1mA	47/6
100µA	57/6	300V. A.C.	47/6
100-0-100µA	55/-		
200µA	55/-	VU meter	65/-

SEND FOR ILLUSTRATED BROCHURE ON SEW PANEL METERS—DISCOUNTS FOR QUANTITIES

POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range available ex-stock. Single hole fixing, ¼in. dia. shafts. Bulk quantities available.

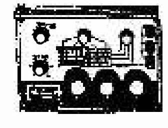
25 WATT. 10/25/50/100/250/500/1000/1500/2500 or 5000 ohms, **14/6**, P. & P. 1/6.
50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms, **21/-** P. & P. 1/6.
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms, **27/6** P. & P. 1/6.

FTC-401 TRANSISTOR TESTER

Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. **£6.19.6** P. & P. 3/-.

MARCONI TF142E DISTORTION FACTOR METERS. Excellent condition. Fully tested. **£20.** Carr. 15/-.

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

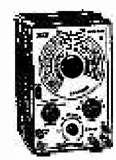


A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω–11·1 meg Ω 6 Ranges ±1% L.1 µ H - 111 HENRYS 6 Ranges – 2% C. 10pF + 1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100µA. Meter indication. Attractive 2 tone metal case. Size 7¾ × 5 × 2in. **£20.** P. & P. 5/-.

COSSOR 1049 DOUBLE BEAM OSCILLOSCOPES

D.C. coupled. Band width 1Kc/s. Perfect order. **£25.** Carr. 30/-.

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.

LELAND MODEL 27 BEAT FREQUENCY OSCILLATORS

Frequency 0-20 Kc/s. on 2 ranges. Output 500 Ω or 5k Ω. Operation 200/250V. A.C. Supplied in perfect order. **£12.10.0** Carr. 10/-.

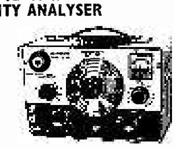
TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20c/s to 200 kc/s on 4 bands. Square: 20c/s to 30 kc/s. Output impedance 5,000 ohms, 200/250V. A.C. Supplied brand new and guaranteed with instruction manual and leads. **£16.10.0.** Carr. 7/6.

MARCONI TF885 VIDEO OSCILLATORS

0–5 mc/s Sine SquareWave **£45.** Carr. 20/-.

LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYSER



2 pF-2000 mFd 2 ohms 200 megohms. Also checks impedance, turns ratio, insulation, 200/250V. A.C. **Brand New £17.10.0** Carr. 7/6.

270° 500 MICROAMP METER

Incorporated in Radio Altitude Indicator 1D-14APN. Ideal for rev. counter etc. **15/6.** P. & P. 3/-.

ADVANCE TEST EQUIPMENT

Brand new boxed in original sealed cartons

J1B. AUDIO SIGNAL GENERATOR. 15 c/s to 50 Kc/s. Sine wave. Output 600 ohms or 5 ohms **£30.0.0.**

VM79. UHF MILLIVOLT METER. 100 Kc/s to 1,000 Mc/s. AC. 10mV to 3v. DC. 10 mV to 3v. Current 0.01 uA to 0.3 mA. Resistance 1 ohm to 10 megohm. **£125.0.0.**

TT1S. TRANSISTOR TESTER. Full range of facilities for testing PNP or NPN transistors in or out of circuit. **£37.10.0.** Carriage 10/- per item.

MARCONI TF195M BEAT FREQUENCY OSCILLATORS

0–40 kc/s. **£20.** Carr. 30/-.

G. W. SMITH & CO (RADIO) LTD.

Also see next two pages

SEMI-CONDUCTORS/VALVES

BRAND NEW & FULLY GUARANTEED

TRANSISTORS

IN914	1/6
IN4001	1/6
IN4002	1/6
IN4003	2/-
IN4004	2/-
IN4005	2/6
IN4006	3/-
IN4007	4/-
IN4148	1/6
IN5054	4/6
2G301	4/-
2G302	4/6
2G303	5/-
2G306	7/6
2G308	6/-
2G309	6/-
2G371	4/6
2G374	5/6
2G381	5/-
2N696	3/6
2N697	3/6
2N698	8/6
2N706	2/-
2N706A	2/6
2N708	3/-
2N914	4/6
2N916	4/6
2N918	7/6
2N929	4/6
2N930	5/6
2N1131	6/-
2N1132	6/-
2N1302	4/-
2N1303	4/6
2N1304	5/-
2N1305	5/-
2N1306	5/-
2N1307	5/-
2N1308	6/-
2N1309	5/-
2N1613	4/8
2N1711	5/-
2N1889	6/6
2N1893	10/-
2N2147	15/-
2N2160	12/6
2N2193	9/6
2N2217	5/6
2N2218	6/-
2N2219	6/6
2N2368	3/6
2N2369	4/-
2N2369A	4/-
2N2484	4/-
2N2613	7/-
2N2646	10/6
2N2904	6/-
2N2923	3/6
2N2924	3/6
2N2925	3/6
2N2926G	2/6
2N2926Y	2/6
2N2926O	2/6
2N3053	5/-
2N3054	10/-
2N3055	15/-
2N3391A	6/-
2N3416	7/6
2N3570	2/6
2N3702	17/6
2N3703	2/6
2N3704	3/6
2N3705	3/-
2N3706	4/6
2N3707	3/-
2N3708	3/6
2N3709	2/6
2N3710	2/6
2N3711	2/6
2N3819	7/-
2N3903	7/-
2N3904	7/-
2N3905	7/6
2N3906	7/6
2N4058	3/6
2N4059	5/-
2N4061	3/-
2N4062	4/6
2N4286	3/-
2N4287	3/6
2N4288	3/-
2N4289	3/6
2N4290	3/-
2N4291	3/-
2N4292	3/-
2N5354	5/6
2N5355	5/6
2S102	5/-
2S103	7/6
2S104	7/6
40250	10/-
40361	11/-
40362	12/-
AC107	7/6
AC126	5/-
AC127	5/-
AC128	5/-
AC154	3/-

AC176	5/-
AC187	6/-
AC188	6/-
ACY17	6/-
ACY18	5/-
ACY19	5/-
ACY20	4/6
ACY21	4/6
ACY22	3/6
ACY28	3/6
ACY40	3/-
AD140	10/-
AD149	10/-
AD161	7/6
AD162	7/6
AF114	6/6
AF115	6/-
AF116	6/6
AF117	5/-
AF118	12/6
AF119	4/-
AF124	5/-
AF126	3/6
AF127	3/6
AF139	6/-
AF178	9/6
AF180	10/6
AF181	8/6
AF186	8/-
AF239	8/6
ASY26	5/-
ASY27	6/6
ASY28	5/-
ASZ17	8/6
AUY10	19/6
BAY31	1/6
BC107	2/6
BC108	2/6
BC109	2/6
BC113	5/-
BC116	8/-
BC125	11/-
BC126	11/-
BC147	3/6
BC148	2/6
BC149	4/-
BC167	3/-
BC172	3/6
BC177	7/6
BC186	7/6
BC182L	4/-
BC184L	4/-
BC212L	4/6
BCY30	5/-
BCY31	6/-
BCY32	10/-
BCY33	4/-
BCY34	5/-
BCY38	6/-
BCY42	3/-
BCY43	4/-
BCY71	6/-
BCY72	3/6
BCZ11	7/6
BD121	13/-
BD123	16/6
BD124	12/-
BF115	5/-
BF117	9/6
BF167	5/-
BF173	6/-
BF180	7/6
BF181	7/6
BF182	6/6
BF184	5/-
BF185	5/-
BF194	3/6
BF195	3/-
BF200	7/6
BF224	6/-
BF225	6/-
BF244	9/6
BFX12	4/6
BFX13	4/6
BFX29	6/-
BFX30	6/6
BFX44	7/6
BFX85	8/-
BFX86	6/6
BFX87	6/6
BFX88	5/-
BFY18	5/-
BFY20	12/6
BFY50	4/6
BFY51	4/-
BFY52	4/6
BFY90	13/6
BSX19	3/6
BSX20	3/6
BSX21	7/6
BSX76	3/-
BSY26	3/6
BSY27	4/-
BSY28	3/6
BSY38	4/-
BSY39	4/6
BSY51	6/6
BSY56	18/-

BSY95A	3/-
BY100	3/6
BY124	3/-
BY126	3/-
BY127	4/-
BYZ10	8/-
BYZ11	7/-
BYZ12	6/-
BYZ13	5/-
MJ480	19/6
MJ481	25/-
MPF102	8/6
MPF103	7/-
MPF104	7/6
MPF105	8/-
NKT213	5/-
NKT214	8/-
NKT216	7/6
NKT217	8/-
NKT224	4/6
NKT241	5/6
NKT261	4/-
NKT271	5/-
NKT272	5/-
NKT274	4/-
NKT275	5/-
NKT278	5/-
NKT281	5/6
NKT403	15/-
NKT404	12/6
NKT405	15/-
NKT773	5/-
NKT10439	7/6
OA5	3/-
OA10	5/-
OA47	2/-
OA70	2/-
OA79	2/-
OA81	2/-
OA85	2/6
OA90	2/-
OA91	1/6
OA95	1/8
OA200	1/6
OA202	2/-
OA210	3/6
OC19	7/6
OC20	19/6
OC22	9/6
OC23	10/-
OC24	10/-
OC25	7/6
OC26	5/-
OC28	12/6
OC29	12/6
OC35	10/-
OC36	12/6
OC41	5/-
OC42	6/-
OC44	3/6
OC45	3/-
OC46	5/6
OC70	2/6
OC71	3/-
OC72	5/-
OC73	6/-
OC74	6/-
OC75	5/-
OC76	5/-
OC77	8/-
OC78	4/-
OC81	5/-
OC81D	4/-
OC83	5/-
OC84	5/-
OC139	5/-
OC140	7/6
OC169	4/-
OC170	5/-
OC171	6/-
OC200	7/6
OC201	9/6
OC202	12/6
OC203	7/6
OC204	8/-
OC205	12/6
OC207	15/-
OCP71	19/6
ORP12	10/-
ORP60	8/-
P346A	5/-
PL4001	2/9
PL4002	3/-
PL4003	3/3
PL4004	3/6
PL4005	3/9
PL4006	4/-
PL4007	4/9
TIS43	8/-
TIS44	2/6
TIS45	3/6
TIS46	3/6

VALVES

OA2	6/6
OB2	6/6
OZ4	6/-
IL4	2/6
IR5	7/-
IS5	5/-
IT4	4/6
IU4	6/-
IU5	9/6
2D21	6/6
3Q4	8/-
3S4	7/-
3V4	8/-
5R4	11/-
5U4	6/-
5V4	8/-
5Y3	6/-
5Z4G	7/6
6/30L2	15/-
6AC7	4/-
6AG7	7/6
6AK5	6/-
6AK6	11/6
6AL5	3/3
6AM6	4/6
6AQ5	6/6
6AS6	6/-
6AT6	5/-
6AU6	5/-
6AV6	6/6
6BA6	4/6
6BE6	5/-
6BH6	8/6
6BJ6	8/6
6BQ7A	7/6
6BR7	17/-
6BR8	13/-
6BW6	16/-
6BW7	13/6
6BZ6	8/6
6C4	6/-
6CD6	23/-
6CL6	10/-
6CW4	12/6
6F1	12/6
6F6G	5/-
6F13	7/-
6F14	12/-
6F15	11/-
6F18	8/-
6F23	15/6
6H6	3/-
6J4	9/6
6J5	4/-
6J5GT	6/-
6J6	3/6
6J7	8/6
6K8G	6/-
6L6GT	9/-
6LD20	8/6
6Q7	7/6
6SA7	7/-
6SG7	6/-
6SJ7	7/-
6SK7	6/-
6SL7	6/-
6SN7	5/6
6SQ7	8/-
6U4	12/6
6V6G	5/-
6V6GT	6/6
6X4	5/-
6X5G	5/6
6X5GT	5/6
10C2	10/-
10F1	18/-
10P13	11/-
10P14	20/-
12AT6	5/-
12AT7	4/-
12AU7	5/-
12AX7	6/-
12AV6	6/-
12BA6	6/6
12BE6	6/6
12BH7	6/6
19AQ5	6/6
20D1	9/-
20F2	15/-
20L1	20/-
20P1	10/-
20P3	12/-
20P4	20/-
20P5	20/-
25L6	7/6

25Z4	6/-
25Z5	8/6
25Z6	11/6
30C15	15/-
30C17	16/-
30C18	15/-
30F5	17/-
30FL1	15/-
30FL12	18/6
30FL14	15/6
30L15	17/-
30L17	17/-
30P12	16/-
30P19	15/-
30PL1	15/6
30PL13	18/-
30PL14	17/-
35L6	9/3
35W4	5/-
35Z4	5/-
35Z5	7/-
50B5	7/-
50C5	7/-
80	9/-
85A2	7/6
807	9/6
1625	6/-
5763	13/-
6146	30/-
AZ31	10/-
CY31	7/-
DAF91	5/6
DAF96	7/9
DF91	4/6
DF96	7/9
DK91	7/-
DK92	9/-
DK96	8/-
DL92	7/-
DL94	8/-
DL96	7/6
DM70	6/6
DY86	6/6
DY87	7/-
E88CC	12/6
E180F	15/-
EABC80	6/6
EAF42	10/-
EB91	3/3
EBC41	10/6
EBC81	6/6
EBF80	8/-
EBF83	8/6
EBF89	6/6
EBL21	12/-
EC86	12/-
EC88	12/-
ECC40	11/-
ECC84	6/-
ECC85	5/6
ECC88	8/-
ECF80	7/-
ECF82	7/-
ECF86	12/6
ECH21	11/6
ECH35	12/-
ECH42	13/-
ECH81	5/6
ECH83	8/6
ECL80	9/-
ECL82	6/6
ECL83	12/6
ECL86	8/6
EF37A	8/-
EF39	8/-
EF40	10/-
EF41	12/8
EF42	14/-
EF80	5/-
EF85	7/-
EF86	6/6
EF89	5/6
EF91	4/6
EF92	7/6
EF183	6/6
EF184	7/-
EH90	8/-
EL34	10/6
EL33	17/6
EL41	11/-
EL42	11/6
EL81	10/-
EL84	5/-
EL85	8/3
EL91	5/-

EL95	7/-
EM80	8/-
EM81	8/6
EM84	7/6
EM85	11/-
EM87	11/-
EY51	8/-
EY86	8/-
EY87	8/6
EZ40	7/6
EZ41	9/-
EZ80	5/6
EZ81	5/6
GZ32	9/6
GZ34	11/-
KT66	27/6
KT88	33/6
MU14	8/-
PABC80	8/-
PC86	11/6
PC88	13/-
PC97	8/6
PC900	9/6
PCC84	7/-
PCC85	8/-
PCC88	12/-
PCC89	10/6
PCC189	11/-
PCF80	6/6
PCF82	6/9
PCF84	9/-
PCF86	11/-
PCF800	15/-
PCF801	10/-
PCF802	10/-
PCF805	15/-
PCF806	13/-
PCF808	15/6
PCL82	7/9
PCL83	13/-
PCL84	8/9
PCL85	9/6
PCL86	9/6
PFL200	11/-
PL36	11/-
PL81	9/6
PL82	9/-
PL83	8/-
PL84	7/-
PL500	15/-
PL504	16/-
PY32	11/-
PY33	12/6
PY80	6/6
PY81	6/-
PY82	6/-
PY83	7/6
PY88	8/-
PY800	10/-
PY801	10/-
U25	15/-
U26	15/-
U50	6/-
U52	6/-
U191	14/-
U281	8/-
U282	8/-
U301	11/6
U801	20/-
UABC80	6/9
UAF42	10/6
UBC41	9/6
UBC81	8/-
UBF80	7/3
UBF89	7/-
UCC84	9/9
UCC85	8/-
UCF80	10/6
UCH21	11/-
UCH42	13/-
UCH81	6/6
UCL82	7/-
UCL83	12/-
UF41	10/-
UF80	7/6
UF85	8/-
UF89	7/-
UL41	12/-
UL84	6/6
UY41	8/-
UY85	6/-
VR105/30	5/6
VR150/30	5/-

SEND SAE FOR FULL LISTS!
DISCOUNTS 10% on 12 + any one type.
15% on 25 + any one type.
Large quantity discounts on application.
Postage: Semi-Conductors 1/6; Valves 3/-.

ZENER DIODES

400mw. (3.3 to 33v) 3/-; 1.5 watt (2.4 to 200v) 4/-; 40 watt (3.9 to 100v) 5/-.

THYRISTORS

PIV	50	100	200	300	350	400
1A	5/-	5/6	7/6	8/-	—	9/6
3A	6/-	7/6	8/-	9/-	—	10/-
5A	—	11/-	13/-	—	—	15/-
7A	—	11/-	13/-	14/-	—	19/6
100A	—	—	—	—	50/-	55/-

INTEGRATED CIRCUITS

L900 9/9; L914 9/9; L923 12/6; IC-10 50/-; SL403 42/6; MC1303 52/6; MC1304 55/-; PA245 52/6; CA3005 25/8; CA3011 16/6; CA3052 36/6; FCH 131 10/-; FCH161 10/-; FJH141 10/-; FJH 10/-; FJH181 10/-; FJH221 10/-; FJH231 10/-; FJH241 10/-; FJH251 10/-; FJJ121 17/6; FJJ131 17/8; FJJ211 25/-; FJY101 10/-.

HI-FI EQUIPMENT

SAVE UP TO 33⅓% OR MORE

SEND S.A.E. FOR DISCOUNT PRICE LISTS AND PACKAGE OFFERS!

GARRARD

FULL CURRENT RANGE OFFERED BRAND NEW AT FANTASTIC SAVINGS

40 Mk II stereo	£8.8.0	SL72B	£24.19.6
2025T/C stereo	£8.17.6	AP75	£16.19.6
3000 stereo	£9.19.6	SL75	£25.19.6
SP25 Mk III	£11.15.0	SL75B	£27.19.6
SL55	£11.12.6	SL95B	£37.10.0
SL65B	£14.19.6	A70/11	£11.19.6
		401	£25.0.0

Carriage 7/6 extra each item.

TEAK PLINTHS & PERSPEX COVERS

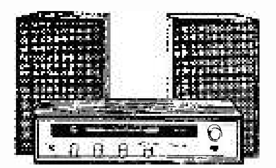
1. For SP25, SL65, SL55, 3000, 2025 T/C 2025, 1000. £4.10.0
2. For AP75, SL75, SL95 £5.19.6.
3. For SP25 etc. to operate with lid in place £5.19.6. Carriage 7/6 extra each type. Full range of Garrard accessories available.

SPECIAL OFFERS!

Garrard SP25 MK III fitted Goldring G800 cartridge and wooden plinth and plastic cover. Total list price £35.
OUR PRICE **£20.19.6** Carr. 10/-

GOLDRING GL69/2 fitted Goldring G800 cartridge complete with deluxe base and cover. Total list price £50.16.0.
OUR PRICE **£39** Carr. 10/-

TELETON SPECIAL OFFER !



CR10T AM/FM STEREO TUNER AMPLIFIER WITH MATCHING PAIR SA1003 SPEAKER SYSTEMS. Output 4 watts per. channel. Excellent reception, AFC, built-in MPX. Cer/XTAL Input. Total List £50/5/-. OUR PRICE £29/19/0, Carr. 12/6.

Also available with Garrard 2025T/C Record Changer, Plinth, cover and stereo cartridge. Ready wired. £45, Carr. 20/-.

TAPE CASSETTES

Top quality in plastic library boxes.
C90 60 min 8/6, 3 for 24/6
C60 90 min 12/6, 3 for 36/-
C120 120 min 15/-, 3 for 43/6
Cassette Head Cleaner 11/3. *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.

TELETON SAQ203E STEREO AMPLIFIER

Solid state, 10W per channel music power. 6W r.m.s. inputs for mag. ceramic, tuner, aux.
SPECIAL PRICE £20. Carr. 7/6

AMERICAN TAPE

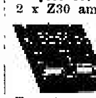
First grade quality American tapes. Brand new. Discount on quantities.

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/-
5¾in. 1,200ft. L.P. acetate	12/6
5¾in. 1,200ft. L.P. mylar	16/-
5¾in. 1,800ft. D.P. mylar	22/6
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.

SINCLAIR EQUIPMENT

Project 60. Package offers.



2 x Z30 amplifier, stereo 60 pre-amp, PZ5 power supply. £19.0.0. Carr. 7/6. Orwith PZ6 power supply £21. Carr. 7/6.2 x Z50 amplifier, stereo 60 pre-amp, PZ8 power supply. £21.10.0. Carr. 7/6.
Transformer for PZ8. 59/6 extra.
Add to any of the above £4.17.6 for active filter unit and £16 for a pair of Q16 speakers.
Project 60 FM Tuner £20.19.6 Carr 7/6.
All other Sinclair products in stock.
2000 Amplifier £23. Carr. 7/6.
3000 Amplifier £36. Carr 7/6.
Neoteric Amplifier £46. Carr. 7/6.

HOSIDEN DH-08S DE-LUXE STEREO HEADPHONES

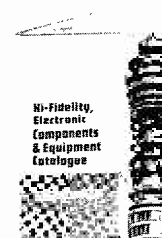
Features unique mechanical 2 way units and fitted adjustable level controls. 8 ohm impedance. 20–20,000cps. Complete with spring lead & stereo jack plug £7.19.6. P. & P. 2/6.

★ 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 9 V battery. Coverage 88–108Mc/s Ready built ready for use. Fantastic value for money. £6.7.6. P. & P. 2/6. Stereo multiplex adaptors 99/6.

Latest Catalogue

Our latest edition giving full details of a comprehensive range of HI-FI EQUIPMENT, COMPONENTS, TEST EQUIPMENT and COMMUNICATIONS EQUIPMENT. FREE DISCOUNT COUPONS VALUE 10/- 248 pages, fully illustrated and detailing thousands of items at bargain prices.

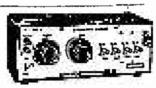


SEND NOW!
•
ONLY 7/6
P & P 1/6

RUSSIAN C1-16 DOUBLE BEAM OSCILLOSCOPES

5 MHz Pass Band. Separate Y1, Y2 amplifiers. Calibrated triggered sweep from ·2 sec to 100 milli sec/cm.
Supplied complete with all accessories and instructions **£87.** Carr. paid.

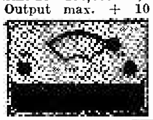
MARCONI T/44/TF956
AF Absorption Wattmeter
1 μ/watts to 6 watts.
£20. Carr. 10/-.



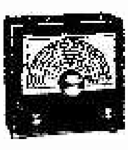
TE111. DECADE RESISTANCE ATTENUATOR
Variable range 0-111dB. Connections, Unbalanced T and Bridge T. Impedance 600 Ω range (0.1dB × 10) + (1dB × 10) + 10 + 20 + 30 + 40dB. Frequency: d.c. to 200kHz (−3dB). Accuracy: 0.05dB. +Indication dB × 0.01. Maximum input less than 4W (50V). Built in 600 Ω load resistance with internal/external switch. Brand new **£27.10.0.** P. & P. 5/-.

BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR

Sine 18—200,000 Hz; Square 18—50,000 Hz Output max. + 10 dB (10 K ohms)

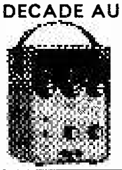


Operation internal batteries Attractive 2-tone case 7½" × 5" × 2". Price **£17.10.0.** Carr. 3/6.



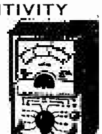
TE-16A Transistorised Signal Generator. 5 ranges 400kHz—30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5¼ × 5¼ × 3½in. Complete with instructions and leads. **£7.19.6.** P. & P. 4/-.

BELCO DA-20 SOLID STATE DECADE AUDIO OSCILLATOR



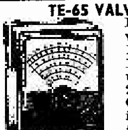
New high quality portable instrument. Sine 1 Hz to 100 KHz. Square 20 Hz to 20 KHz. Output max + 10 dB (10 K ohms). Operation 220/240v. A.C. Size 215mm x 150mm x 120mm.
Price **£27.10.0.** Carr. 5/-

TE-40 HIGH SENSITIVITY A.C. VOLTMETER



10 meg. input 10 ranges: 01/·003/·1/·3/1/3/10/30/100/300V. R.M.S. 4cps.-1·2 Mc/s. Decibels −40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. **£17.10.0** Carr. 5/-.

TE-65 VALVE VOLTMETER



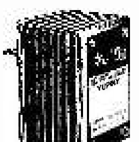
High quality instrument with 28 ranges. D.C. volts 1·5–1,500v. A.C. volts 1·5—1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. **£17.10.0.** P. & P. 6/-. Additional probes available: R.F. **42/6.** H.V. **50/-**

AUTO TRANSFORMERS

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

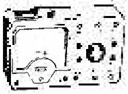
150 W.	£2. 7.6.	P. & P. 3/6.
300 W.	£3. 5.0.	P. & P. 4/6.
500 W.	£4.19.6.	P. & P. 6/6.
1,000 W.	£7. 5.0.	P. & P. 7/6.
1,500 W.	£8.19.6.	P. & P. 8/6.
7,500 W.	£15.10.0.	P. & P. 20/-.

SOLID STATE VARIABLE A.C VOLTAGE REGULATORS

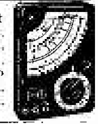


Compact and panel mounting. Ideal for control of lamps, drills, electrical appliances etc. Input 230/240v. A.C. Output continuously variable from 20v—230v. Model MR 2305 5 amp 68 x 46 x 43mm **£8.7.6** Model MR 2310 10 amp 90 x 68 x 60mm **£11.19.6** Postage 2/6

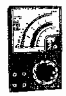
MULTIMETERS for EVERY purpose!



TECH PT-34. 1,000 O.P.V. 0/10/50/250/500/1,000V. A.C. and D.C. 0/1/100/500mA. D.C. 0/100K **39/6.** P. & P. 2/6.



HONOR TE.10A. 20k Ω/Volt 5/25/50/250/500/2,500 v. D.C. 10/50/100/500/1,000 v. A.C. 0/50uA/2.5mA/250mA D.C. 0/6K/6 meg. ohm. −20 to +22 dB. 10–0.100 mfd. 0.100–0.1 mfd. **69/6.** P. & P. 3/-.

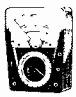


MODEL TE-200 20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000 V.D.C. 0/10/50/250/1,000 V.A.C. 0/50 uA/250 mA. 0/60K/6 megΩ. +20 to +62 db. **75/-.** P. & P. 3/-.

MODEL TE-300. 30,000 O.P.V. Mirror scale, overload protection 0/.6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30uA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm −20 to +63 db. **£5.19.6.** P. & P. 3/-.

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. 1/2·5/10/25/100/250/500/1,000v. 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-80. 20,000 O.P.V. 0/10/50/100/500/1,000v A.C. 0/5/25/50/250/500/1,000 v. D.C. 0—50uA, 5/50/500mA. 0/6K/60K/600K/6meg. **£4.17.6** P. & P. 3/-.



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. 0/30uA/3/30/300mA. 0/16K/160K/1.6M/16 MegΩ. **£5.10.0.** P. & P. 3/-.

MODEL TE-90 50,000 O.P.V. Mirror scale, overload protection. 0/3/12/60/300/600/1,200 v. D.C. 0/6/30/120/300/1,200 v. D.C. .03/6/60/600mA. D.C. 16K/160K/1.6/16 MEGΩ. −20 to +63 db. **£7.10.0.** P. & P. 3/-.

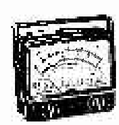
TMK MODEL TW-50K 46 ranges, mirror scale. 50K/Vol. D.C. 5K /Volt A.C. D.C.: Volts .125, .25, 1.25, 2.5, 5, 10, 25, 50, 125, 250, 500, 1000V, A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50uA, 2.5, 5, 25, 50, 250, 500mA, 5, 10 amp, Resistance: 10K, 100K, 1 MEG, 10 MEGΩ. Decibels: −20 to + 81.5 bB. **£8.17.6.** P. & P. 3/6.

TMK MODEL TW-20CB FEATURES RESETTABLE OVERLOAD BUTTON. Sensitivity: 20K Ω/Volt D.C. 5K Ω/Volt A.C. D.C. Volts: 0-0.5, 2.5, 10, 50, 250, 1,000V. A.C. Volts: 0–2.5, 10, 50, 250, 1,000V. D.C. Currents: 0–0.05, 0.5, 5, 50, 500mA. 10 amp. Resistance: 0–5K. 50K, 0–500K. 5 MEGΩ. Decibels: −20 to +52db. **£11.10.0.** P. & P. 3/6.

TE-900 20,000 Ω/VOLT GIANT MULTIMETER. Mirror scale and overload protection. 6in. full view meter. 2 colour scale. 0/2.5/10/250/1,000/5,000 v. A.C. 0/25/12.5/10/50/250/1,000/5,000 v. D.C. 0/50uA/110/100/500mA/10 amp. D.C. 02K/200K/20 MEG. OHM. **£15.0.0.** P. & P. 5/-.

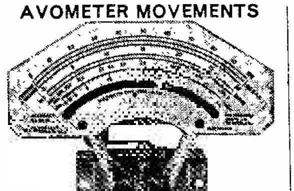
MODEL AS-100D. 100K Ω/Volt. 5in., mirror scale. Built-in meter protection 0/3/12/60/120/300/600/1,200 v. D.C. 0/6/30/120/300/600 v. A.C. 0/10uA/6/60/300MA/12 Amp. 0/2K/200K/2M/200MΩ. −20 to +17 bB. **£12.10.0.** P. & P. 3/6

MODEL 5025. 57 Ranges, Giant 5½in. Meter, Polarity Reverse Switch. Sensitivity: 50K /Volt D.C. 5K /Volt A.C. D.C. Volts: .125, .25, 1.25, 5, 10, 25, 50, 125, 250, 500, 1,000V. A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1,000V. D.C. Current: 25, 50uA, 2.5, 5, 25, 50, 250, 500mA, 5, 10 amp. Resistance: 2 K, 10K, 100K, 1MEG, 10 MEGΩ. Decibels: −20 to +85 db. **£12.10.0.** P. P. 3/6.

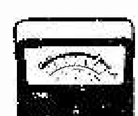


TMK LAB TESTER. 100.000 O.P.V. 6½in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K Ω/Volt A.C. D.C. Volts: .5, 2.5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10. 50, 50, 250, 500, 1,000V. D.C. Current: 10, 100uA, 10, 100, 500mA, 2.5, 10 amp. Resistance: 1K, 10K. 100K, 10MEG, 100 MEGΩ. Decibels: −10 to 49 db. Plastic Case with Carrying Handle. Size 7½in. x 6¾in. x 3¼in. **18.18.0.** P. & P. 5/-.

AVOMETER MOVEMENTS



50uA 20K Ω/V
Spare movements for Model 8 or 9. (Fitted with Model 9 scale) or basis for any multimeter. Brand New & Boxed. **89/6** P.& P.3/6.



SKYWOOD SW-500 50K Ω/Volt. Mirror scale DC Volts 0.6/3/12/30/300/600. DC Current 20uA/6/600mA Resistance 10K/100K/1 Meg/10 Meg. Decibels — 20 to + 57 db **£7.10.0** P. & P. 3/-.

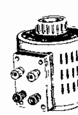
270° WIDE ANGLE 1mA METERS

MW1-6	60mm	square	£3.19.6
MW1-8	80mm	square	£4.19.6

P. & P. extra

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

Excellent quality . Low price . Immediate delivery



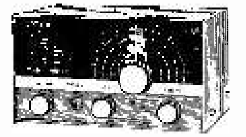
MODEL S-260
General Purpose Bench Mounting

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.

MODEL S-260 B
Panel Mounting

1 Amp	£5.10.0.
2.5 Amp	£6.12.6.

Please add postage
ALL MODELS
INPUT 230 VOLTS, 50/60 CYCLES,
OUTPUT VARIABLE 0-260 VOLTS.
Special discounts for quantity



UNR-30 RECEIVER
4 Bands covering 550kc/s–30mc/s. B.F.O. Built-in Speaker 220/240v. A.C. Brand new with instructions. **£15.15.0.** Carr. 7/6.

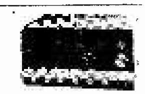
WS62 TRANCEIVERS
Large quantity available for EXPORT ! Excellent condition. Enquiries invited.

UR-1A SOLID STATE COMMUNICATION RECEIVER
4 Bands covering 550kc/s–30mc/s. FET, S Meter, Variable BFO for SSB, Built-in Speaker, Telescopic Aerial, Bandspread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12⅞" x 4½" x 7". Brand new with instructions. **£25.** Carr. 7/6.

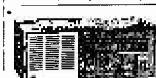
LAFAYETTE HA-600 SOLID STATE RECREIVE

General coverage 150–400kc/s, 550 kc/s–30mc/s. FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter, S. Meter, Bandspread. RF Gain. 15" x 9¾" x 8½". 18 lbs. 220/240v. A.C. or 12v. D.C Brand new with instructions. **£45.** Carr. 10/

LAFAYETTE HA-800 SOLID STATE AMATEUR COMMUNICATION RECEIVER



3.5–4, 7–7.3, 14–14.35, 21–21.45, 28–29.7 50–54 mc/s. Dual conversion, 2 mech. filters, product detector, variable BFO, S Meter, 100kc/s calibrator. 220/240v. A.C. or 12v. D.C. 15" x 9¾" x 8¼". 18 lbs. Brand new with instructions. **£57.10.0.** Carr. Paid. (100kc/s Crystal **39/6** extra.)



LAFAYETTE PF60 VHF FM RECEIVER

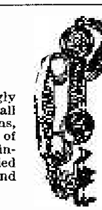
Solid State. 152–174mc/s. Fully tuneable or crystal controlled (not supplied). Built-in Speaker, Squelch and Volume Controls. 220/240v. A.C. or 12v. D.C. Brand new with instructions. **£37.10.0.** Carr. 10/-.

FULL RANGE OF TRIO EQUIPMENT IN STOCK

VOLTAGE STABILISER TRANSFORMERS
180—260v. input. Output 230v. Available 150w or 225w. **£12.10.0.** Carr. 5/-.

EDDYSTONE VHF RECEIVERS Model 770R 19—165 Mc/s. Excellent condition. **£150**

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.

STOP PRESS!
NEW BRANCH AT 27 TOTTENHAM CT. RD, W.1.
OPENING DURING DECEMBER

G.W.SMITH & CO.(RADIO) LTD

27 TOTTENHAM CT. RD. LONDON, W.1 Tel: 01-636 3715
3 LISLE STREET, LONDON, W.C.2 Tel: 01-437 8204
34 LISLE STREET, LONDON, W.C.2 Tel: 01-437 9155
311 EDGWARE ROAD, LONDON, W.2 Tel: 01-262 0387
OPEN 9-6 MONDAY TO SATURDAY (EDGWARE ROAD ½ DAY THURSDAY)

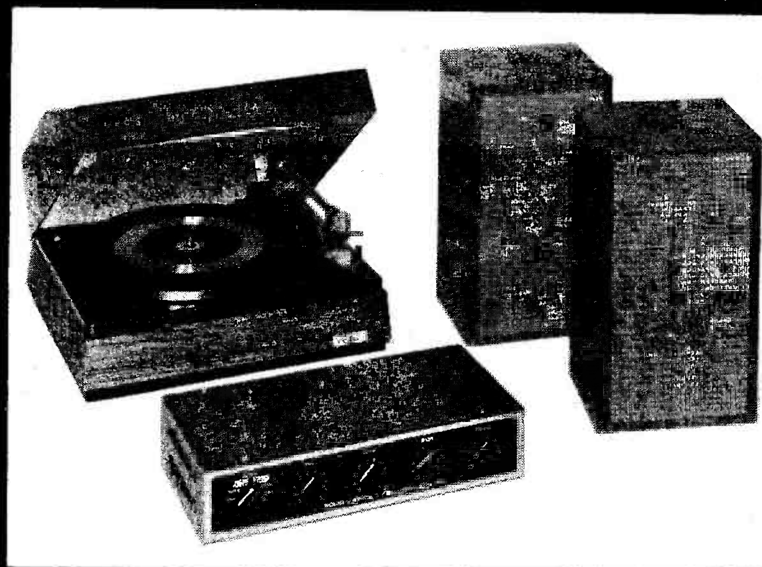
All Mail Orders to— 147, Church Street, London, W.2 Tel: 01-262 6562 (Trade supplied)

R+TV

RADIO & TV COMPONENTS (Acton) Ltd.
21c High Street, Acton, London W.3. 6NG
Also at 323 Edgware Road, London, W.2.
ALL ORDERS BY POST TO OUR ACTON BRANCH
Terms C.W.O. All enquiries S.A.E.

Complete Stereo System £41

WITH VISCOUNT F.E.T. FIELD EFFECT TRANSISTORS AMPLIFIER



This superb stereo system is a real price break through. It comprises the VISCOUNT F.E.T. Mk I amplifier on which full details are given below, the famous Garrard SP 25 (including teak veneer base and transparent cover) with diamond cartridge or 2025 TC and the very successful DUO type 2 speakers. Measuring 17½in x 10¾in x 6¾in, the Duo type 2 speakers are beautifully finished in teak veneer. They incorporate a 10½in x 6¼in drive unit and high frequency speaker, both of which are of 3 ohms impedance. The Duo speaker system is also available separately at £6.6.0 each, plus 15/- p. & p.

Complete stereo system £41 plus £2 10 p. & p. or with Mk II Amplifier and Magnetic Cartridge £45 & £2 10 p. & p.

The Viscount F.E.T. MkI **£14.5** plus 7/6 p. & p.

High fidelity transistor stereo amplifier employing field effect transistors. With this feature and accompanying guaranteed specifications below, the Viscount F.E.T. vastly surpasses amplifiers costing far more.

Specification—Output per channel 10 watts r.m.s. Frequency bandwidth 20 Hz to 20 kHz + 1db at 1 watt. Total distortion at 1 kHz at 9 watts 0.5% Input sensitivities CER. P.U. 100mV into 3 meg ohms. Tuner 100mV into 100K ohms. Tape 100mV into 100K ohms. Overload Factor Better than 26db. Signal to noise ratio—70db on all inputs (with vol. max). Controls—6 position selector switch (3 pos. stereo and 3 pos. mono). Separate volume controls for left and right channels. Bass ± 14db at 60 Hz. Treble (with D.P.S. on off) ± 12 db at 10 KHz. Tape recording output sockets on each channel. Size 12¼in. 6in. 2⅔in. in simulated teak case. BUILT & TESTED.

MkII (MAG P.U.) **£15.15** plus 10/- p. & p.
Specification same as Mk. 1, but with the following inputs. Mag. P.U. CER. P.U. Tuner. Spec. on Mag. P.U. 3mV at 1 kHz input impedance 47K. Fully equalised to within ±1db RIAA. Signal to noise ratio—65db (vol. max).

The £29-10-0 Stereo system

The Duetto is a good quality stereo amplifier, attractively styled and finished. It gives superb reproduction previously associated with amplifiers costing far more.

SPECIFICATION—
R.M.S. power output 3 watts per channel into 10 ohms speakers.

INPUT SENSITIVITY. Suitable for medium or high output crystal cartridges and tuners. Cross-talk better than 30dB at 1Kc/s.

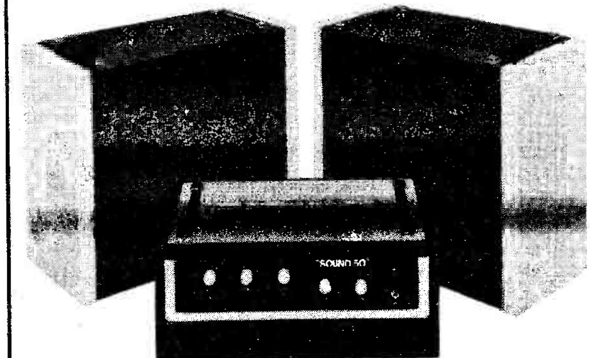
CONTROLS: 4-position selector switch (2 pos. mono and 2 pos stereo) dual ganged volume control.

TONE CONTROL Treble lift and cut Separate on off switch. A preset balance control.

Duetto integrated transistor stereo Amp.	£9.10.0 + 7/6 p&p.
Garrard Changer from	£7.19.6 + 7/6 p&p.
Cover and teak finish plinth	£4.15.0 + 7/6 p&p.
Duo Type I speakers (see opp. page)	ea. £4. 4.0 + 7/6 p&p.
The above items purchased together	£29.10.0 + £1.10 p&p.

SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



The Sound Fifty valve amplifier and speakers are sturdily constructed with smart housings and thoroughly tested electronics. They are designed to last—to withstand the knocks and bumps of life on the road. Built for the small and medium sized gig, they are easy to handle and quick to set up and can be relied upon to come over with all the quality and power you need.

Output Power: 45 watts R.M.S. (Sine wave drive). **Frequency response:** −3dB points 30Hz at 18KHz. **Total distortion:** less than 2% at rated output. **Signal to noise ratio:** better than 60dB. **Speaker Impedance:** 3, 8 or 15 ohms. **Bass Control Range:** ± 13dB at 60Hz. **Treble Control Range:** ± 12dB at 10 KHz. **Inputs:** 4 inputs at 5mV into 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV into 470K.
To protect the output valves, the incorporated fail safe circuit will enable the amplifier to be used at half power.
SPEAKERS! Size 20″ × 20″ × 10″ incorporating Baker's 12″ heavy duty 25 watt high flux, quality loudspeaker with cast frame. Cabinets attractively finished in two tone colour scheme—Black and grey.

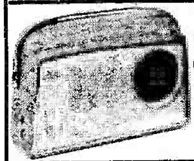
COMPLETE SYSTEM **£45** Plus 60/- P. & P.
Sound 50 amp and 2 speakers

or available separately.
Amplifier **£28.10.0** plus 20/- P. & P.
Speakers **£12.10.0** each plus 30/- P. & P.

The ELEGANT SEVEN Mk. III (350mW Output)

7 transistor fully-tunable M.W.—L.W. superhet 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 **£5.5.0** plus 7/6 P. & P. Circuit 2/6 FREE WITH PARTS



The DORSET (600mW Output)

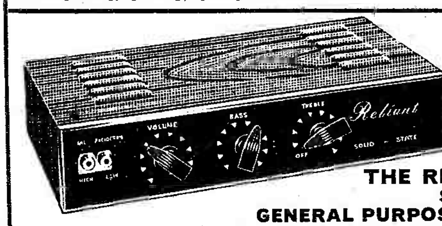
Price **£5.5.0** plus 7/6 P. & P.
Circuit 2/6 FREE WITH PARTS

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.

The Classic

Simulated teak case
£9.10
Plus P. & P. 7/6

SPECIFICATION: Sensitivities for 10 watt output at 1KHz into 3 ohms. Tape Head: 3 mV (at 3¾ i.p.s.) Mag. P.U.: 2 mV. Cer. P.U.: 80mV. Tuner: 100mV. Aux. 100mV. Tape/Rec. Output. Equalisation for each input is correct to within +2dB (R.I.A.A.) from 20Hz to 20KHz. *Tone Control Range: Bass:* 13dB at 60Hz. *Treble:* ± 14dB at 15KHz. *Total Distortion:* (for 10 watt output) < 1.5%. Signal Noise: < −60dB. A.C. Mains 200–250V. Size 12¾in long, 4¼in deep, 2¾in high. **Built and tested**



THE RELIANT MkII SOLID-STATE GENERAL PURPOSE AMPLIFIER

in simulated teak case **£7.5** plus 7/6 P. & P

SPECIFICATIONS
Output ±10 watts. Output impedance—3 to 4 ohms.
Inputs ±1. -xtal mic 10mV Tone Controls—Treble control range ± 12dB at 10KHz.
2. -gram/radio 250mV. Bass control range ± 13dB at 100Hz.
Feqruency Response—(with tone controls central) Minus 3bB points at 20Hz and 40KHz. 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—10¾in. x 4¾in. x 2¼in. 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 from gram. and mike. Built and tested.

THE DUO SPEAKER SYSTEM

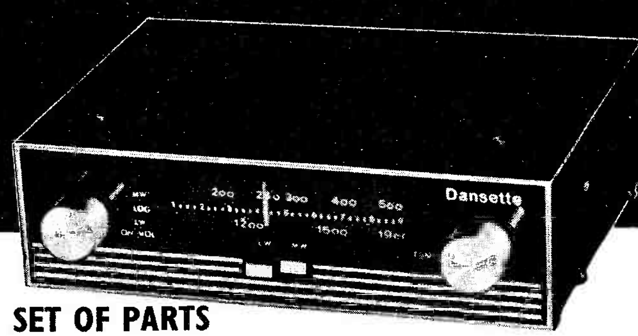
Similar in design to those on the previous page the 2-way speaker system is beautifully finished in polished teak veneer. It is ideal for wall or shelf mounting either upright or horizontally.

Type 1 SPECIFICATION :—
Impedance 8 or 10 ohms (please state requirement). It incorporates high flux 7in. x 3¾in. speaker and 2¼in. speaker. Teak finish 11in. x 6in. x 5¾in. **4 guineas each.** 7/6 P. & P.

LIQUIDATED STOCK

DANSETTE

TOURISTE MK3 CAR RADIO



ALL TRANSISTOR

Beautifully designed to blend with the interiors of all cars. Permeability tuning and long wave loading coils ensure excellent tracking, sensitivity and selectivity on both wave bands. R.F. sensitivity at 1 MHz is better than 8 micro volts. Power output into 3 ohm speaker is 3 watts.
Originally sold completely built for £15.4.6.
Pre-aligned I.F. module and tuner together with comprehensive instructions guarantees success first time. 12 volts negative or positive earth. Size 7in x 2in x 4½in deep.

See top of previous page for address

SET OF PARTS
£6.6.0
plus 7/6 P. & P.
Circuit diagram 2/6. Free with parts
Speaker, baffle and fixing kit **25/-** extra plus 4/- p. & p. Postage free when ordered with parts.

RADIO & TV COMPONENTS
R+TV
(ACTON) LIMITED

F CAVE

5 Bridge Street
Richmond Surrey
01 948 1441 till 8pm

TOP DISCOUNTS HI FI

OPEN ALL DAY SATURDAYS
FIRST CLASS REPAIR SERVICE
UP TO 15% DISCOUNT ON LP RECORDS
SEND FOR LISTS

Our demonstration rooms are equipped to enable you to listen to at least 40 different speakers and a large range of amplifiers, tuners, tuner-amplifiers, together with turntables, for you to compare the kind of sound you can get from both budget low-price systems and higher more sophisticated systems.
Send 1/- Stamp for fully comprehensive Hi-Fi catalogue to Dept. P.W. The above list is only representative of the equipment stocked by us. Equipment can be installed in any part of London, customers rarely being kept waiting. Overseas Customers welcome. Personal Export arranged.
P & C on most units is 12/6. Insurance: 2/- per £10 value.
P & C on Tape Recorders is 17/6.
P & C on cartridge is 3/6.
Prices quoted above are our selling prices at the time of going to press and are subject to alteration E. & O. E.
Special Carriage Charges for 48hr. Delivery Services.

TURNTABLES

	List Price	Cave's Cash Price
MacDonald MP60	£15 0 0	£10 19 0
MacDonald 610	£18 19 0	£13 19 0
MacDonald 510	£16 0 0	£11 19 0
MacDonald 310	£12 19 0	£9 19 0
MacDonald Base & Cover	£7 12 0	£6 7 0
Dual 1219	£60 8 0	£54 6 0
Dual 1209	£42 12 0	£38 6 0
Transcriptor Reference/Arm	£98 2 0	£88 0 0
Transcriptor	£57 12 0	£51 10 0
Garrard 401	£31 14 0	£28 10 0
Garrard SL95B	£45 9 0	£39 19 0
Garrard SL75B	£35 12 0	£31 6 0
Garrard SL65B	£19 6 0	£16 12 0
Garrard AP75	£23 12 0	£18 15 0
Garrard SP25 Mk. II	£15 9 0	£10 19 0
Garrard AP76 Transcription Unit	£26 5 1	£23 0 0
SPC1 & WB1	£7 11 0	£6 15 0
SPC4 & WB4	£10 2 0	£8 18 0
Goldring GL69 P & C	£39 17 1	£33 12 0
Goldring GL75 P & C	£49 2 8	£46 17 0
Goldring GL75 P & C and G800E	£68 9 11	£58 19 0
Goldring GL69 P & C and G800	£52 12 3	£41 2 0
Philips 202	£69 0 0	£60 14 0
Thorens TD150A Mk. II	£43 13 0	£38 19 0
Thorens TD150AB Mk. II P & C	£47 9 0	£41 10 0
Thorens TD125	£75 17 0	£66 19 0
Pioneer PL11AC	£48 17 7	£40 19 0

SPEAKERS

	List Price	Cave's Cash Price
B & W DM3	£63 0 0	£53 11 0
B & W DM1	£32 0 0	£27 4 0
B & W 70 Monitor	£139 10 6	£118 11 0
EMIR Mk. 1	—	£12 10 0
EMIR Mk. 2	—	£15 19 0
EMIR Mk. 3	—	£19 10 0
Celestion Ditton 15	£29 0 0	£25 8 0
Celestion Ditton 25	£59 17 0	£50 17 0
Goodmans Magister	£57 0 0	£47 0 0
Goodmans Magnum K	£40 2 0	£33 0 0
Goodmans Mezzo II Walnut	£30 18 0	£22 10 0
Goodmans Mambo's per pr.	£44 13 0	£39 6 0
KEF Celeste Mk. 2	£29 0 0	£24 13 0
KEF Concord	£43 10 0	£36 19 0
KEF Concerto	£53 10 0	£45 10 0
KEF Choral	£34 16 6	£30 17 0
Leak Mini—Sandwich Walnut	£29 15 0	£20 10 0
Leak Sandwich Teak	£45 10 0	£31 5 0
Wharfedale Denton	£19 0 0	£16 0 0
Wharfedale Super Lintons	£22 10 0	£19 0 0
Wharfedale Dovedale 3	£39 10 0	£32 10 0
Wharfedale Melton	£29 10 0	£24 7 0
Wharfedale Rosedale	£59 10 0	£48 19 0
Philips GL561/70 Enc.	£26 19 0	£22 19 0
Philips RH482 pair	£36 0 0	£32 8 0
Quad Electrostatic	£66 0 0	£59 8 0
Radon SC/1 Amethyst	£13 17 11	£12 5 0
Radon SC/3 Opal	£24 0 0	£21 0 0
Rogers Ravensbrook	£47 10 0	£41 11 0
Tannoy 12" Lancaster	£56 5 0	£49 0 0
Tannoy 15" Lancaster	£63 5 0	£55 7 0
Tannoy 111LZ	£41 0 0	£35 18 0
Tannoy Richmond 12"	—	£46 19 0
Lowther PM6 Acousta	£46 10 0	£39 11 0
Lowther PM7 Acousta	£58 0 0	£49 6 0
Pioneer CS53	£41 13 0	£32 18 0
Sansui SP30	£31 8 7	£27 13 0
Jordan Watts Module	£12 0 0	£10 10 0
Jordan Watts Jumbo	£19 16 0	£17 7 0

CARTRIDGES

	List Price	Cave's Cash Price
Audio Technica AT-66	£6 4 8	£5 10 0
Audio Technica AT-66L/C	£6 4 8	£5 2 0
Audio Technica AT-21	£8 14 4	£7 13 0
Audio Technica AT-21X Elip.	£15 9 11	£12 19 0
Audio Technica AT-35X Elip.	£24 4 0	£14 19 0
Audio Technica VM3	£13 0 9	£11 10 0
Decca Deram Stereo	£5 5 0	£4 5 0
Orbit Magnetic	—	£4 5 0
Sonotone 9TAH/C Diam.	£4 0 6	£2 8 0
Sonotone 9TAH/C Sapp.	—	£2 0 0
Shure M3D-M	£7 8 3	£5 19 0
Shure M44-5	£11 2 4	£9 6 0
Shure M44-7	£10 3 10	£8 10 0
Shure M44 Elip.	£12 11 0	£9 19 0
Shure M55 Elip.	£12 19 5	£10 17 0
Shure M75-6	£16 13 6	£14 0 0
Shure M75-E	£21 6 2	£17 17 0
Shure M75-EJ	£19 19 1	£16 6 0
Shure V-15 Mk. 2	£40 15 3	£32 10 0
Shure V-15-7	£38 18 0	£27 10 0
Shure M75-G	£17 12 0	£14 15 0
Shure M91-E	—	£17 17 0
Goldring G800	£13 0 1	£7 10 0
Goldring G800E	£16 17 0	£12 15 0
Goldring G850	£6 10 0	£4 10 0
Goldring G800 Super E	£26 0 1	£17 19 0

TUNERS

	List Price	Cave's Cash Price
Pioneer TX500	£79 5 3	£66 0 0
Pioneer TX900	£151 19 6	£126 15 0
Quad FM	£51 0 0	£46 0 0
Quad AM3	£48 0 0	£44 12 0
Rotel 120 ST	£49 17 8	£41 19 0
Teleton GT101	£45 10 0	£38 0 0
Wharfedale WFMT 1	£53 6 10	£37 10 0
Armstrong 523	£53 15 3	£47 19 0
Armstrong 524	£41 17 8	£37 14 0
Dual CT15	£81 15 6	£71 17 0
Dual CT16	£106 0 0	£93 3 0
Lux WL515	£108 5 3	£75 15 0
Leak Stereofetic Chassis	£59 18 4	£52 19 0
Radford SMT3	£76 10 0	£64 19 0

TUNER/AMPLIFIERS

	List Price	Cave's Cash Price
Pioneer SX440	£111 1 11	£92 15 0
Pioneer LX440	£116 9 11	£97 5 0
Pioneer LX800	£206 18 10	£181 16 0
Pioneer SX700	£156 0 3	£130 5 0
Pioneer SX990	£193 2 0	£161 5 0
Pioneer SX1500	£225 17 10	£188 13 0
Pioneer KX330	£78 15 11	£66 0 0
Lux 555	£168 0 0	£119 18 0
Rotel No. 130	£79 17 2	£67 12 0
Rotel FAX330	£95 0 5	£79 16 0
Rotel FAX660	£129 0 0	£99 19 0
Sansui 350	£129 2 0	£113 10 0
Sansui 400	£127 4 3	£99 0 0
Sansui 800	£145 19 7	£128 8 0
Sansui 2000	£162 3 0	£142 12 0
Teleton CR10T	£39 15 0	£29 19 0
Teleton TFS50	£74 0 0	£62 16 0
Wharfedale 100.1	£131 5 0	£112 13 0
Akai AA6600	£142 10 7	£125 9 0
Armstrong 525	£91 17 9	£81 19 0
Armstrong 526	£104 14 3	£93 19 0
Dual CR40	£178 1 3	£156 10 0

HEADSETS

	List Price	Cave's Cash Price
Akai ASE9	£6 10 0	£5 14 0
Akai ASE20	£9 0 0	£7 18 0
Akai AEH10	£20 0 0	£17 0 0
Beyer DT48	£33 18 0	£27 19 0
Beyer DT48S	£33 14 0	£28 13 0
Beyer DT100	£13 18 6	£11 17 0
Beyer DT109	£23 18 6	£20 7 0
Beyer DT480	£29 5 0	£24 17 0
Pioneer SE50	£19 3 6	£16 6 0
Pioneer SE30	£12 12 0	£10 14 0
Pioneer SE20	£7 2 11	£6 2 0
Pioneer SE2P	£6 15 5	£5 15 0
Rotel RH600	£5 10 0	£4 14 0
Rotel RH711	£9 0 0	£8 8 0
Sansui SS2	£7 14 6	£6 12 0
Sansui SS20	£16 10 0	£14 0 0
Secom 650	—	£3 12 0
A.K.G. & Eagle	Price upon application	

MICROPHONES

	List Price	Cave's Cash Price
Beyer M64	£10 7 0	£8 16 0
Beyer M64 SH	£14 7 0	£12 4 0
Beyer M67	£29 6 0	£24 18 0
Beyer M260	£25 0 0	£21 5 0
Beyer M260 SM	£29 6 0	£24 18 0
Beyer M81HL	£11 5 0	£9 11 0
Beyer M818HL	£22 18 6	£19 10 0
Beyer M55HL	£8 18 0	£7 11 0
Beyer Soundstar X1 'N'	£19 18 0	£16 18 0
Beyer Soundstar X1 'HLM'	£23 1 6	£19 12 0
Eagle DM 16HL	£6 12 4	£5 15 0
Eagle DM 58HL	£11 0 6	£9 13 0
Akai DM13	£7 10 0	£6 11 0
Akai ADM5	£4 15 0	£4 3 0
Akai ADM10	£5 10 0	£4 16 0
Akai ADM4	£3 17 6	£3 8 0

Grampian, Shure, Reslowsound, Grundig, A.K.G., Tandberg — Prices upon application

TAPE RECORDERS

	List Price	Cave's Cash Price
Ferrograph 702/704	£207 7 0	£180 10 0
Ferrograph 722/724	£242 10 0	£202 19 0
Akai 4000D	£89 19 1	£71 19 0
Akai 1710/1	£89 0 0	£75 19 0
Akai 4000	£124 18 0	£104 19 0
Akai X5000L/W	£177 19 6	£156 13 0
Akai M-10L	£245 1 0	£215 13 0
Philips 4302	£35 17 6	£29 19 0
Philips 4307	£49 10 0	£42 10 0
Philips 4308	£60 10 0	£51 19 0
Philips 4404	£83 0 0	£71 5 0
Philips EL3302	£28 7 0	£21 10 0
Grundig TK124	£44 18 0	£35 7 0
Grundig TK144	£49 19 0	£42 5 0
Grundig TK149	£57 12 8	£46 19 0
Grundig TK121	£54 15 7	£45 19 0
Grundig TK 141	£59 4 8	£49 14 0
Grundig TK146	£68 2 10	£57 3 0
Truvox R44	—	£45 10 0
Teleton T710	£34 15 0	£30 10 0
Teleton SL40	£37 10 0	£33 10 0
Teleton FXB 510D	£62 0 0	£52 15 0

Revox, Ferrograph, Tandberg, Uher, Telefunken, Dual, Sansui, National, Pioneer—Prices upon application.

AMPLIFIERS

	List Price	Cave's Cash Price
Pioneer SA500	£61 19 7	£49 12 6
Pioneer SA700	£97 19 4	£78 7 0
Pioneer SA900	£133 16 7	£107 0 0
Pioneer SR202 Reverb.	£45 8 6	£36 7 0
Rogers Ravensbourne	£59 10 0	£49 19 0
Rogers Ravensbrook	£42 10 0	£37 10 0
Rotel 100AMP	£45 10 0	£35 19 0
Quad 303 & 33	£98 0 0	£87 19 0
Sansui AU222	£62 17 7	£53 10 0
Sansui AU555	£80 9 7	£68 8 0
Teleton SAQ203E	£27 15 0	£19 19 0
Teleton SAQ150/205	£26 5 0	£22 5 0
Teleton GA101	£33 1 5	£23 19 0
Armstrong 521	£56 0 0	£48 10 0
Dual CV80	£89 10 0	£76 0 0
Ferrograph F307 Mk.II	£59 0 0	£48 19 0
J. E. Sugden A21	£59 0 0	£47 19 0
Lux 1220	£124 10 0	£89 13 0
Lux 77T	£66 7 6	£52 10 0
Lux 505	£97 10 0	£69 12 0
Lux 606	£84 0 0	£59 19 0
Leak 30 Chassis	£53 0 0	£42 10 0
Leak 70 Chassis	£63 0 0	£52 0 0
Metrosound ST20	£36 0 0	£28 10 0
Sinclair Z.30	£4 9 6	£3 16 0
Sinclair Z.50	£5 9 6	£4 3 0
Sinclair Stereo 60 Pre-Amp	£9 19 6	£8 10 0
Sinclair S60 Filter Unit	£5 19 6	£5 2 0
Sinclair PZ-5	£4 19 6	£4 5 0
Sinclair PZ-6	£7 19 6	£6 16 0
Sinclair PZ-8	£5 19 6	£5 2 0
Sinclair IC10	£2 19 6	£2 15 0
Sinclair Z12	£4 9 6	£3 16 0
Sinclair PZ4	£4 19 6	£4 5 0
Sinclair Stereo 25	£9 19 6	£8 10 0
Sinclair 2000	£30 9 0	£22 19 0
Sinclair 2000 FM Tuner	£26 14 7	£23 10 0

it makes SOUND SENSE, buy from CAVES

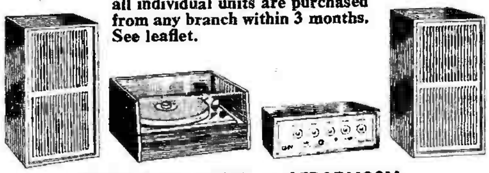
R·S·C HIGH FIDELITY STEREO 'PACKAGE' OFFERS

Four fully wired units ready to 'plug in.'
★ SUPER 30 AMPLIFIER (15 + 15 watt) in veneered housing
★ GARRARD SP25 MK II Turntable on Plinth with cover
★ GOLDRING CS90 Ceramic P.U. Cartridge with diamond stylus
★ PR. OF STANWAY II Speaker Units
Special Total Price **76 Gns.** Carr. 30/-

★ Super 30 Amplifier (15 + 15 watt) in veneered housing
★ Goldring GL69 Transcription Turntable on Plinth as illustrated
★ Shure or Goldring Magnetic P.U. Cartridge.
★ Pair of Stanway II Loudspeaker units
Special Total Price **92 Gns.** Carr. 30/-

Matching as recommended for optimum performance. Send S.A.E for coloured brochure showing other money-saving offers.

Package prices apply providing all individual units are purchased from any branch within 3 months. See leaflet.



ATTRACTIVE TEAK or AFRORMOSIA VENEERED CABINETS and PLINTHS

TERMS AVAILABLE ON ALL PACKAGE OFFERS

★ TA12 AMPLIFIER 6.5 + 6.5 watt in veneered housing
★ GARRARD SP25 MK II Player unit on Plinth
★ GOLDRING CS90 Ceramic P.U. Cartridge with diamond stylus
★ PAIR OF DORCHESTER Loudspeaker Units
Special Total Price **54 Gns.** Carr. 25/-

Or Deposit £6.19.6 and 9 monthly payments £6.4.6 (Total 60 gns.). Trans. Plastic Cover 3 gns. extra.

AS ABOVE BUT WITH GARRARD 3000 AUTOCHANGER AND SONOTONE 9TA CERAMIC CARTRIDGE IN LIEU OF SP25 AND CS90 **49 Gns.** Carr. 25/-
Or Deposit £6 and 9 monthly payments £5.14.0 (Total £57.6.0) Trans. Plastic cover 3 gns. extra.

AUDIOTRINE A55 HIGH QUALITY STEREO SYSTEM

5 + 5 WATT OUTPUT

GARRARD 5200 Changer with low mass pick-up arm and Stereo Cartridge. CONTROLS: TREBLE, BASS, VOLUME, STEREO, BALANCE. Operation on 200-250v. A. C. mains Output rating. I.H.F.M.

Luxurious Teak Veneer Finished Cabinets. Transparent plastic (tinted) cover included for main unit. Silver finished facia plate and matching control knobs.

PAIR OF LOUDSPEAKER UNITS incorporating high flux 8" × 5" speaker. Size approx. 13 × 7½ × 8¾ ins.

Price complete ONLY **40 Gns.**

Terms: Deposit £5.10.0 and 9 monthly payments £4.10.0 (Total £46.0.0)

A REALLY SURPRISING STANDARD OF QUALITY IS OBTAINABLE FROM THIS COMPACT LOW PRICED SYSTEM

LOW DEPOSIT CREDIT TERMS

AVAILABLE ON PURCHASES OVER £8 KITS OF PARTS EXCEPTED

INTEREST CHARGES REFUNDED
On Credit Sales settled in 3 months

RSC G66 6+6 WATT high quality STEREO AMPLIFIER

Individual Ganged controls: Bass, Treble, Volume and Balance. Printed circuit construction employing 10 Transistors plus Diodes. Output rating I.H.F.M. Bass Control −13db to +13db at 40Hz. Treble Control −15db to +15db at 14KHz. Suitable for Crystal Pick-ups etc., and for loudspeaker output impedances of 3 to 15 ohms. For standard 200—250v A.C. mains operation. Attractive silver finished metal facia plate and matching control knobs.

Complete KIT of PARTS INCLUDING FULLY WIRED PRINTED CIRCUIT and comprehensive wiring diagram and instructions **£9.19.9**

No leaflet supplied for this un

Or FACTORY BUILT in Teak veneered cabinet as illustrated **£12.10.0** carr 7/9 Or dep. 37/6 and 9 mthly. pymts. 29/6 (Total £15.8.0).

PACKAGE OFFER SAVE £4 approx Above G66 assembled in cabinet. plus pair DORCHESTER LOUDSPEAKER UNITS **£27.10.0** Carr. £1
Or Deposit £5 and 9 monthly payments 57/6 (Total £30.17.6).

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

★ High-sensitivity. ★ 200-250v. A.C. Mains operation. ★ Sharp A.M. Rejection× ★ Drift-free reception. ★ Output ample for any amplifier (approx. 500 m.v.). ★ 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. Printed circuitry. A quality product at considerably less than the cost of comparable units. FACTORY BUILT 18 *gns*. Or in Teak finished cabinet as illustrated 21 *gns*. Terms: Deposit £6.1.0 & 9 mthly pymts. 2*gns*. Total £24.19.0. STEREO VERSION. 23½ *gns*. Carr. 10/6

HIGH FIDELITY LOUDSPEAKER UNITS

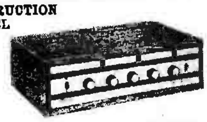
Cabinets latest style Satin Teak or Afrormosia veneer. Acoustically lined or filled acoustic damping. Ported where appropriate. Credit terms available.

DORCHESTER Size 16 × 11 × 9in. appr. Range 45-15,000 c.p.s. Rating 8-10 watts. Fitted High flux 13 × 8in. Dual Cone speaker. Imp. 3 or 15 ohms. **9 Gns.** Carr. 7/6

STANWAY II Size 20 × 10¾ × 9¾in. approx. Rating 10 watts. Inc. 13 × 8in. speaker with highly flexible cone surround, long throw voice coil and 11,000 line magnet. High flux tweeter. Handsome Scandinavian design cabinet. Range 35-20,000 c.p.s. Imp. 15 ohms. Gives smooth realistic sound out put. See top of page for illustration **17 Gns.**

R.S.C. TA12 MKIII 6·5 + 6·5 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 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 20-20,000 c.p.s. −2dB ★ Harmonic Distortion 0.3% at 1,000 c.p.s. Hum and Noise − 70dB ★ Sensitivities (1) 50mV (2) 400mV (3) 100mV. Output rating I.H.F.M. ★ Handsome finish Facia plate and Knobs. Complete kit of parts with full wiring diagrams & instructions. **13½ Gns.** Carr. 7/9
Factory built with 12 months guarantee **17 gns.** or Deposit £3.0.0 and 9 mthly pymts 39/- (Total £20.11.0). Or in Teak veneer housing **20½ gns.** Dep. 3 Gns. & 9 mthly payments 47/- (Total £24.6.0). Send S.A.E. for leaflet

R·S·C SUPER 30 Mk II HIGH FIDELITY STEREO AMPLIFIER

High Grade Components, Specifications · comparable with units costing considerably more.

TRANSISTORS 9 high quality types in each channel.

OUTPUT 10 Watts R.M.S. continuous into 15Ω (per channel). 15 Watts R.M.S. continuous into 3 Ω.

INPUT SENSITIVITIES Mag. P.U. 4 mV. Ceramic P.U. 35 mV. Tape Amp. 400 mV. Aux. 100 mV. Mic. 5 mV. Tape Head 2.5mV.

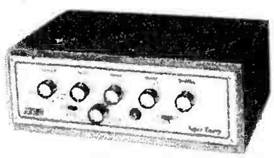
FREQUENCY RESPONSE ± 2 dB. 10–20,000 c.p.s.

TREBLE CONTROL +17 dB to −14 dB at 10 Kc/s.

BASS CONTROL + 17 dB to −15 dB at 50 c/s.

HUM LEVEL −80 dB. **CROSS TALK** 52 dB at 1,000 c.p.s.

HARMONIC DISTORTION 0.1% at 10 watts 1,000 c.p.s. Employing Twin Printed Circuits. 200/250v. A.C. mains operation.



CONTROLS 5 Position Input Selector. Bass, Treble, Vol., Bal., Stereo/Mono Switch, Tape Monitor Switch, Mains Switch.
INPUT SOCKETS (1) P.U. (2) Tape Amp. (3) Radio, (4) Mic. or Tape Head. (Operation of Input Selector assures appropriate equalisation).
CHASSIS Strong Steel construction. Appr. 12 × 3 × 8in.

FACIA PLATE Attractive design in rigid plastic, silver background black lettering. Silver finish matching control knobs as available.
Eminently suitable for use with any make of pick-up or Mic. (Ceramic or Magnetic, Moving Coil, Ribbon or Crystal) currently available. Superb sound output quality can be obtained by use with first rate ancillary equipment.

COMPLETE KIT OF PARTS Point to point wiring diagrams and detailed instructions. **22 Gns.** Carr 15/-

UNIT FACTORY BUILT 29 Gns.
WITH 12 MONTHS GUARANTEE. or Deposit £4 and 9 monthly payments 66/6 (Total £33.18.6) or in Teak or Afrormosia veneer housing **32 Gns.** Carr. 15/- Terms: Deposit £4 and 9 monthly payments of 74/- (Total £37.6.0). Send S.A.E. for leaflet.

PARTRIDGE "JOYSTICK" SHORT WAVE AERIALS AND TUNERS AT ALL BRANCHES (S.A.E. for full list)

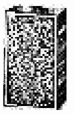
BRADFORD 10 North Parade. (Half-day Wed.) Tel. 25349
BLACKPOOL (Agent) O. & C. Electronics, 227 Church Street
BIRMINGHAM 30/31 Gt. Western Arcade (Half-day Wed.) 021-236-1279
DERBY 26 Osmaston Rd., The Spot (Half-day Wed.) Tel. 41361
DARLINGTON 18 Priestgate (Half-day Wed.) Tel. 68043
EDINBURGH 133 Leith St. (Half-day Wed.) Tel. Waverley 5766
GLASGOW 326 Argyle St. (Half-day Tues.) Tel. CITy 4158
HULL 91 Paragon Street (Half-day Thursday) Tel. 20505

R·S·C HI-FI CENTRES LTD.

MAIL ORDERS TO: Audio House, Henconner Lane, 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. please with enquiries.
Branches open all day Sats.
MAIL ORDERS MUST NOT BE SENT TO SHOPS

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

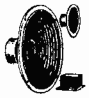
'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM



★ Moderate size only 25 × 14 × 10in. COMPLETE KIT **21 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 × 5in. high flux middle range speaker. (4) High efficiency tweeter. (5) Appropriate quantity acoustic damping material (6) Teak veneered cabinet. (7) Circuit and full instructions. Terms: Dep. 4 Gns. and 9 monthly payments 45/6 (Total 23½ Gns.). DEMONSTRATIONS AT ALL BRANCHES

AUDIOTRINE HI-FI SPEAKER SYSTEMS



Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£5.15.0** Carr. 5/9

OR SENIOR 15 WATT INC. HF126 15,000 LINE SPEAKER CARR 6/6 **£6.15.0**

AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS

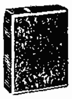
Heavy construction. Latest high efficiency ceramic magnets. Treated Cone surround. "D" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 8–15 ohms. Please state choice. Exceptional performance at low cost.

HF801D	8"	8W	54/3	HF120D	12"	15W	89/9
HF102D	10"	10W	67/11	HF126	12"	15W	£5.5.0
HF120	12"	15W	79/9	HF126D	12"	15W	£5.15.0

FANE 807 HIGH FIDELITY LOUDSPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. Cast chassis roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance at 35 c.p.s. Tweeter cone is fitted to extend high note response. Frequency range 25-15 KHz. Impedance 3 or 8-15 Ω. Remarkable value. **70/-**

HI-FI SPEAKER ENCLOSURES Modern design.



Teak or Afromosia veneer finish. Acoustically lined. All sizes approx. Carr. 5/- per enclosure

JE8 Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi 'speaker. **£4.14.6**

SE8 For optimum performance with any 8in. Hi-Fi 'speaker. Size 22 x 15 x 9in. Ported **£5.15.0**

SE10 For outstanding results with 10in. Hi-Fi 'spkr Size 24x15x10in. P'td. **£5.19.9**

SE12 For exclnt prfmnce with 12in. Hi-Fi speaker and Tweeter. Size 25 x 16 x 10½in. **£6.19.9**

RECORD PLAYING UNITS

Money saving units. Mounted on Plinth. Supplied with transparent plastic cover. Ready to plug into Amplifier or Tape recorder.

RP2C Garrard SP25 Mk II (with heavy turntable) fitted Goldring CS90 high compliance ceramic Stereo/Mono cartridge with diamond stylus. Carr. 10/6 **£24.12.6**

RP5C Garrard 2025 Auto Unit fitted Garrard GCS 23 Stereo Cartridge with diamond tip, Plinth & Cover as RP2C carr. 10/6. **15 Gns.**

Other types available with Magnetic cartridges and with alternative design plinths.

R.S.C. PLINTHS

Superior Solid Natural Wood Construction

for Record Playing units, cut for Garrard 1025, 2025, 3000, AT60, SP25 etc.

3 gns.

AVAILABLE WITH TRANSPARENT PLASTIC COVER **6 gns.**

LEADING MAKES HI-FI EQUIPMENT at CLEARANCE PRICES

Available at branches only

LINEAR L10 HIGH FIDELITY 10W AMPLIFIER 10 Gns.

with separate Pre-amp Magnetic P.U. matching. To clear

SUPER 15 HIGH FIDELITY SOLID STATE AMPLIFIER

Approx. as Super 30 but single channel. Complete kit with full constructional details and point to point wiring diagrams. Carr. 12/6 **12½ gns.**

OR FACTORY BUILT 15½ Gns. Carr. 12/6. Terms: Deposit 4 Gns. and 9 monthly payments 31/- (Total £18.3.0) Available in Teak or Afrormosia veneered housing. 19gns.

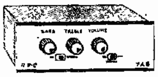
R.S.C. BATTERY/MAINS CONVERSION UNITS

TYPE BM1

An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx.

Completely replaces batteries supplying 1·5v. and 90v. where A.C. mains 200/250v. 50c/s is available. Complete kit with diagram 59/9 or assembled 69/9.

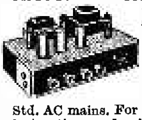
R.S.C. TA6 6 Watt HI-FI SOLID STATE AMPLIFIER



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 spkrs. Max. sensitivity 5mV. Output rating I.H.F.M. Fully enclosed enamelled case, 9½ × 2½ × 5½in. Attractive brushed silver finish facia plate 10½ × 3½in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **7 Gns** Carr. 7/6

OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE £8.19.9

R.S.C. A11 HI-FI 12-14 WATT AMPLIFIER



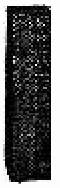
PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP. Two input sockets with mixing facilities High sensitivity, 5 valves. Independent Bass and treble controls. Frequency response ± 3dB 30-20,000 c/s. Hum level —60dB. Sensitivity 40 millivolts. For Crystal or Ceramic PUs. High Impedance "mikes". For Musical Instruments etc.

Std. AC mains. For 3 & 15 ohm spkrs. Complete kit. Full instructions and point-to-point wiring diagrams. Carr. 11/6. **10. Gns**

SAE for leaflet. Twin handled metal cover 35/-.

Factory built 14 *gns.* or Dep. £3 and 9 mthly pymnts of 31/6 (Total £17.3.6.)

R.S.C. COLUMN SPEAKERS



R·S·C HI-FI CENTRES LTD.

IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

ALL TYPES 15 OHMS COVERED IN REXINE/VYNAIR. TYPE C4100 ALSO SUITABLE FOR BASS GUITAR OR ELECTRONIC ORGAN

TYPE C48S 25-30 WATTS
Fitted four 8" high flux 8 watt speakers. Overall size approx 48 x 10 x 5 in. Carr 10/.
Terms: Dep £3 and 9 monthly payments 35/6 (Total £18-19-6) **16 Gns.**

TYPE C412S 50 WATTS
Fitted four 12" 11,000 line 15 watt speakers: Overall size approx 56 x 14 x 9 in. Carr 15/-
Terms: Dep. £4 and 9 monthly payments 58/8 (Total £30-8-0) **26 Gns.**

TYPE C4100 100 WATTS inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx 58 × 16 × 10" Acoustically filled and pressurised. Terms: Dep. £8 and 9 mthly. pyts. £5-10-6 (Total £57-14-6). Carr. £1 **48 Gns.**

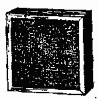
30 WATT HI-FI AMPLIFIER

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 P.V.C. facia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Terms: Deposit £3.14.0 and 9 monthly payments of 42/- (Total £22.12.0) Carr. 12/6 **19 Gns.**

HIGH QUALITY LOUDSPEAKER UNITS

IN TEAK OR AFRORMOSIA VENEERED CABINETS

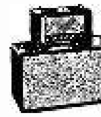


L13 13" × 8" 10 Watt 10,000 lines 3 or 15 ohms. State impedance required. **5 Gns.** Carr. 7/6

L12 12" 20 WATT 10,000 lines 15 ohms. Carr. 8/9 **£8-19-9**

L125 50 WATT Two tone Rexine and vynair finish. Fitted pair of 12" 50 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Carr. 15/- **28 Gns.**

R.S.C. BASS REGENT 50 WATT AMPLIFIER



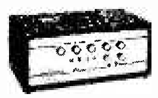
A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape. Peak Output rating. Loudspeaker unit horizontal or vertical mounting. **55Gns.**
★ Two extra heavy duty 12in. Loudspeakers. Carr. 30/-
★ Four Jack inputs and two Volume Controls for simultaneous use of up to four pick-ups or "mikes". Bass and Treble controls. Send S.A.E. for leaflet.
Deposit £14.0.0 and 9 monthly payments of £5.10.0 (Total £63.10.0)

FAL PHASE 50 AMPLIFIER 50 Watt

Solid state 3 Separately controlled inputs Ind. Bass and Treble Controls. Output for Speaker/s 3-30 ohms.

Size 17" × 7" × 7¼" 200-250 A.C. mains. Peak Output rating. For fuller details of Phase 50 send S.A.E. for leaflets. **29 Gns.** Carr. Free

FAL PHASE 100 AMPLIFIER



100 Watt Solid State 4 Separately controlled inputs Plus master volume Control. Ind. Bass and Treble Controls. Output for speaker/s 3-30 ohms. Protective circuit to guard against damage from accidental shorts I.H.F.M. Output rating **59 Gns.**

FANE ULTRA HIGH POWER LOUDSPEAKERS

All power ratings are R.M.S. continuous. 2 years' guarantee. High flux ceramic magnets. Heavy cast chassis. All carr. free.

'POP' 100 18" 100 Watt 14,000 gauss 8/15Ω **21 GNS.** Dep: £6 and 9 monthly pymnts £2 (Total £24).

'POP' 60 15" 60 Watt 14,000 gauss 8/15Ω **£12.18.0.** Dep: 3 gns. and 9 mthly pymnts 26/6 (Total £15.1.6.)

'POP' 50 12" 50 Watt 13,000 gauss 15Ω **10 GNS.** Dep £2 and 9 monthly payments 22/6 (Total £12.2.6) Pair suitable all purposes

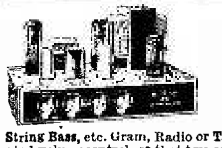
FOR BASS GUITAR OR ELECT. ORGAN, ETC.

FANE LOUDSPEAKERS 'POP' 25/2

12in. 25 WATT Dual Cone 15Ω (For uses other than Bass Guitar or Electronic Organ) **£6-15-0** Carr. free

or Dep. 22/- and 9 mthly payments 14/6 (Total £7.12.6).

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



Highly sensitive. Push-Pull high output, with Pre-amp /Tone Control Stages. Hum level—70dB. Frequency response ±3dB 30-20,000 c/s. All high grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Sensitivity 36 millivolts. Suitable for High Impedance microphones. 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 volumecontrols so that two separate inputs such as Gram and "Mike" can be mixed. 200-250 v., 50 c/s A.C mains For 3 and 15 ohm speakers. Complete Kit of parts with point to point wiring diagram and instructions. Twin-handled perforated cover 35/-. **15 Gns.**
Or factory built with EL34 output valves and 12 months' guarantee for 18 gns. Carr. 12/6
TERMS: Deposit £3.9.0 and 9 monthly payments of £2 (£21.9.0). Send S.A.E. for leaflet.

RSC TRANSFORMERS, L.F. CHOKES & RECTIFIERS

FULLY GUARANTEED. Impregnated and Interleaved where necessary

Primaries 200-250v. 50c/s. Screened

MIDGET CLAMPED TYPE 2½ × 2¾ × 2½in.

250v., 60mA, 6.3v. 2a	17/11
250-0-250v., 60mA 6.3v 2a	18/11

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6.3v. 2a., 0-5-6.3v. 2a.	24/9
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	33/9
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9
300-0-300v. 130mA, 6.3v. 4a., c.t., 6.3v. 1a.	
For Mullard 510 Amplifier	47/11
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	47/9
425-0-425v. 200mA, 6.3v. 4a., c.t., 6.3v. 4a.	89/9
425-0-425v. 200mA, 6.3v. 4a., 6.3v. 3a., 5v. 3a	93/9
450-0-450v. 250mA, 6.3v. 4a., c.t., 5v. 3a.	99/9

TOP SHROUDED DROP-THRO' TYPE

250-0-250v. 70mA, 6.3v. 2a., 0-5-6.3v. 2a.	23/9
250-0-250v. 100mA, 6.3v. 3.5a.	27/9
250-0-250v. 100mA, 6.3v. 2a., 6.3v. 1a.	28/9
350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a.	29/11
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9
300-0-300v. 130mA, 6.3v. 4a., 0-5-6.3v. 1a.	
Suitable for Mullard 510 Amplifier	46/9
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	46/11

FILAMENT or TRANSISTOR POWER PACK Types 6.3v. 1.5a. 8/9; 6.3v. 2a. 9/9; 6.3v. 3a. 13/9; 6.3v. 6a. 22/9; 12v. 1a. 9/11; 12v. 3a. or 24v. 1.5a 23/9; 0.9-18v. 1½a. 19/11; 0-12-25-42v. 2a. 31/9

CHARGER TRANSFORMERS 0-9-15v. 1½a. 18/9; 2½a. 19/11; 3a. 21/11; 5a. 25/11; 6a. 29/9; 8a. 36/9.

AUTO (Step UP/step DOWN) TRANSFORMERS 0-110/120v. 200-230-250v., 50-80 watts 19/9; 150 watts, 33/6 250 watts 49/9; 500 watts 105/-.

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	14/9
Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω	24/9
Push-Pull EL84 to 3 or 15 Ω 10-12 watts	23/9
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	35/9
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.

SELENIUM RECTIFIERS F. W. (Bridged) All 6/12v. D.C. output. Max. A.C. input 18v. 1a. 4/3. 2a. 6/11. 3a. 9/9. 4a. 12/9. 6a. 15/9.

ELECTROVALUE

EVERYTHING BRAND NEW & TO SPEC • LARGE STOCKS • NO SURPLUS

BARGAINS IN NEW SEMICONDUCTORS all power types supplied with free insulating sets

MANY ITEMS AT NEW REDUCED PRICES

1N914	1/3	2N3706	2/6	40512	45/6	BC147	3/-	BFY51	4/-
1N3754	4/-	2N3707	2/6	40602	9/6	BC148	3/-	BSX20	3/9
1N4148	1/9	2N3708	2/6	AC107	14/6	BC149	3/-	BY164	10/-
1N5054	4/-	2N3709	2/6	AC126	4/-	BC153	7/-	BY238	3/6
1S940	1/-	2N3710	2/6	AC127	4/-	BC154	7/6	C106B1	14/6
2N696	3/6	2N3711	2/6	AC128	4/-	BC157	3/9	MC140	5/-
2N697	3/6	2N3731	24/-	AC176	6/-	BC158	3/6	MJ480	21/-
2N706	2/9	2N3794	3/-	ACY22	4/6	BC159	3/9	MJ481	27/-
2N1131	6/3	2N3819	7/-	ACY40	4/-	BC167	2/6	MJ491	30/-
2N1132	6/2	2N3820	12/-	ACY41	5/-	BC168	2/3	MPF102	7/6
2N1302	4/-	2N3904	7/6	AD142	14/3	BC169	2/6	NKT403	15/6
2N1303	4/-	2N3906	7/6	AD149	12/-	BC177	6/3	NKT405	15/-
2N1304	4/6	2N4058	4/-	AD161/AD162		BC178	5/8	OA47	1/9
2N1305	4/6	2N4059	4/-	(matched)	14/- pr	BC179	6/-	OA90	1/3
2N1613	6/-	2N4060	4/-	AF114	7/-	BC182L	2/6	OA91	1/3
2N1711	7/-	2N4061	4/-	AF115	7/-	BC183L	2/3	OA95	1/3
2N2147	19/-	2N4062	4/-	AF116	6/6	BC184L	2/6	OA99	3/-
2N2218	9/3	2N4284	3/-	AF117	6/6	BC186	8/6	OA200	1/11
2N2270	12/9	2N4286	3/-	AF124	7/6	BC212L	5/-	OA202	2/-
2N2483	6/3	2N4289	3/-	AF127	7/-	BC213L	5/-	OC71	5/6
2N2484	7/6	2N4291	3/-	AF139	9/6	BC214L	5/3	TIP31A	16/-
2N2646	10/9	2N4292	3/-	AF180	18/6	BCY70	4/-	TIP32A	20/-
2N2904	11/-	2N4410	4/9	AF239	9/9	BD121	21/-	TIS43	10/6
2N2924	4/-	2N5062	12/3	ASY26	6/6	BD123	21/-	ZTX300	3/6
2N2925	4/6	2N5163	5/-	ASY27	8/3	BD124	20/-	ZTX301	3/6
2N2926	2/3	2N5192	25/-	ASY28	6/6	BF167	8/6	ZTX302	4/6
2N3053	5/6	2N5195	28/3	B5041	15/-	BF178	10/6	ZTX303	4/6
2N3054	14/3	2N5457	9/9	BA102	6/-	BF180	12/-	ZTX304	6/9
2N3055	15/-	2N5458	9/9	BA156	4/-	BF194	7/-	ZTX500	5/-
2N3325	10/9	2N5459	9/9	BA130	4/6	BF195	7/6	ZTX501	5/-
2N3663	11/6	40250	14/3	BA156	4/-	BFX29	6/3	ZTX502	6/-
2N3702	2/6	40361	12/6.	BC107	2/9	BFX84	5/9	ZTX503	5/-
2N3703	2/6	40362	16/-	BC108	2/6	BFX85	7/-	ZTX504	12/-
2N3704	2/6	40406	16/3	BC109	2/9	BFX87	5/9	ZTX530	5/5
2N3705	2/6	40408	14/6	BC125	11/-	BFX88	6/3	ZTX531	6/9
		40430	37/-	BC126	11/-	BFY50	4/6		

RESISTORS

Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99 (see note below)	100 up
C	1/20W	5%	82 Ω–220K Ω	E12	18	16	15
C	1/8W	5%	4·7 Ω–330K Ω	E24	2·5	2	1·75
C	1/4W	10%	4·7 Ω–10M Ω	E12	2·5	2	1·75
C	1/2W	5%	4·7 Ω–10M Ω	E24	3	2·5	2·25
C	1W	10%	4·7 Ω–10M Ω	E12	6	5	4·5
MO	1/2W	2%	10 Ω–1M Ω	E24	9	8	7
WW	1W	10% ±1/20 Ω	0·22 Ω–3·9 Ω	E12		1/6 all quantities	
WW	3W	5%	12 Ω–10K Ω	E12		1/6 all quantities	
WW	7W	5%	12 Ω–10K Ω	E12		1/9 all quantities	

Codes: C = carbon film high stability low noise
MO = metal oxide Electrosil TR5 ultra low noise
WW = wire wound Plessey.

Prices are in pence each for same ohmic value and power rating, NOT mixed values. (Ignore fractions of 1d. on total resistor order)

Values:
E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
E24 denotes series: as E12 plus 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and their decades.

INTEGRATED CIRCUIT AMPLIFIERS

SINCLAIR IC10 complete with instruction book giving amplifier circuit details and range of applications. **59/6** nett.

Components pack for stereo inc. mains transformer, controls etc. **£4.15.0** nett.

PLESSEY SL403A Now only **42/6** nett 3W into 7·5Ω for 18V supply. Application data sent with two more.

WAVECHANGE SWITCHES LONG SPINDLES

1P 12W; 2P 6W; 3P 4W; 4P 3W — **4/9** each

SLIDER SWITCHES D.P.D.T. — **3/-** each

NEON INDICATOR LAMPS

all 200/250V. Square bezel, red only — **3/9**

Round chrome bezel red, amber, clear — **4/9** each

Toggle switches, 250V a.c. 1.5A. chrome dolly and chrome milled nut S.P.S.T. **3/9**; S.P.D.T. **4/6**; D.P.D.T. **5/9**; S.P.D.T. centre off **5/-**.

S-DeC's put an end to "birdsnesting". Components just plug in Saves valuable time. Use components again and again. S-DeC (70 points) only **20/-**. Compact T-DeC, increased capacity, may be temperature-cycled. T-DeC (208 points) only **50/-**. Full range stocked.

MULLARD polyester C280 series

250V 20%: 0·01; 0·022; 0·033, 0·047 **8d** ea. 0·068; 0·1 **9d** ea., 0·15 **11d.**, 0·22 **1/-**, 10%: 0·33 **1/5**, 0·47 **1/8**, 0·68 **2/3**, 1μF **2/9**. 1·5μF **4/2**, 2·2μF **4/9**.

MULLARD SUB-MIN ELECTROLYTIC

C426 range axial lead — **1/3** each

Values (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; 8/40; 10/2·5; 10/16; 10/64; 12·5/25; 16/40; 20/16; 20/64; 25/6·4; 25/25; 32/4; 32/10; 32/40; 32/64; 40/16; 40/2·5; 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.

LARGE CAPACITORS

High ripple current types: 1000/25 **5/6**; 1000/50 **8/2**; 2000/25 **7/4**; 2000/50 **11/4**; 2000/100 **28/9**; 2500/64 **15/5**; 2500/70 **19/6**; 5000/25 **12/6**; 5000/50 **21/11**; 5000/100 **58/3**; 10000/15 **17/-**; 10000/25 **24/6**; 10000/50 **44/-**; 10000/70 **61/-**.

MEDIUM RANGE ELECTROLYTICS

Axial leads: 50/50 **1/9**; 100/25 **1/9**; 100/50 **2/6**; 250/25 **2/6**; 330/25 **2/6**; 250/50 **3/9**; 500/25 **3/9**; 500/50 **4/6**; 1000/25 **4/-**; 1000/50 **6/-**; 2000/25 **6/-**.

SMALL ELECTROLYTICS

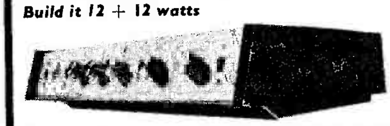
Axial leads: 4·7/10; 4·7/25; 5/50 **1/-** ea. 10/10; 10/25; 10/50, 33/10; 50/10 **1/-** ea. 22/25; 25/50; 47/25; 100/10; 220/10 **1/3** ea.

ENAMELLED COPPER WIRE, even No S.W.G only 2oz reels 16-22 S.W.G. 4/3; 24-30 S.W.G. **5/-**; 32-34 S.W.G **5/6**; 36-38 S.W.G. **6/3**. 4 oz reels 16-22 S.W.G. only **7/6**.

PEAK SOUND PRODUCTS

ENGLEFIELD KITS

Build it 12 + 12 watts



Stereo amplifier in modular kit form 12 watts per channel **£38/9/-**; Cabinet kit only **£6**. These prices nett. As recently reviewed in Hi Fi Sound.

BAXANDALL SPEAKER SYSTEM

Designed by Peter Baxandall. Superb reproduction for its size. Handles 10 watts with ease. Uses ELAC 15 Ω 59RM109 speaker Unit Kit **£13/12/-** nett; built **£19/8/6** nett.

MAINLINE AMPLIFIER KITS

RCA/SGS designed main amplifier kits.
Input sensitivity 500–700mV for full output into 8 Ω.

Power	Kit price including components	Suitable unreg. power supply kit
12W	**168/-** nett	**92/-**
25W	**190/-** nett	N/A
40W	**210/-** nett	**115/1**
70W	**252/-** nett	**138/10**

30 WATT BAILEY AMP. PARTS

Sensitivity 1.2V for full output into 8Ω
Transistors and PCB for one channel **£7/5/6**
Transistors and PCB for two channels **£14/11/-**
Capacitors and resistors (metal oxide) **40/-** per channel
Complete unregulated power supply kit **£4.15.0**

ZENER DIODES

5% full range E24 values: 400mW: 2·7V to 30V **3/9** each 1W: 6·8V to 82V **9/-** each 1·5W: 4·7V to 75V **12/-** each Clip to increase 1·5W rating to 3 watts (type 266F) **9d.**

CARBON TRACK POTENTIOMETERS, long spindles

Double wiper ensures minimum noise level.

Single gang linear	220 Ω, to 2·2M Ω	2/6
Single gang log	4·7K Ω to 2·2M Ω	2/6
Dual gang linear	4·7K Ω to 2·2M Ω	8/6
Dual gang log	4·7K Ω to 2·2M Ω	8/6
Log/antilog	10K, 47K, 1M Ω only	8/6
Any type with ½A D.P. mains switch, extra		2/3

Please note: only decades of 10, 22 and 47 are available within ranges quoted.

CARBON SKELETON PRE-SETS

Small high quality, type PR, linear only 100 Ω, 220 Ω 470 Ω, 1K, 2K2, 4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M2, 5M, 10M Ω Vertical or horizontal mounting **1/-** each.

COMPONENT DISCOUNTS

10% on orders for components for £5 or more. 15% on orders for components for £15 or more (No discount on nett items).

POSTAGE AND PACKING

Free on orders over **£2**. Please add **1/6** if under. Overseas orders welcome: carriage charged at cost.

THE NEW ELECTROVALUE CATALOGUE

48 pages—thousands of items—packed with information generously illustrated with product pictures and technical diagrams. **2/-** post free. Add **4/-** if required to be sent o'seas by air mail.

ELECTROVALUE

(Dept. PW.171) 28 ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM, SURREY

Hours: 9—5.30: Sat. 1 p.m. Tel.: Egham 5533 (STD 0784-3) Telex 264475

HOME RADIO (Components) LTD., Dept. PW, 234-240 London Road, Mitcham, CR4 3HD. *Phone 01-648 8422*

It's the Cat's Whiskers!

You must admit, the lad's keen—he's fallen asleep still tuned in to dad's vintage receiver. His cat's whiskers set lies abandoned by his other "receiver", and now he's dreaming of the super sets and gadgets he's going to build once he's got the Home Radio Components Catalogue that Father Christmas has been ordered to bring. In the morning when the lad sits up in bed and flips through its 300 pages he'll certainly come out with some such phrase as "It's the cat's whiskers!"

If you can't rely on Father Christmas to bring *you* a Home Radio Catalogue, play safe—give yourself one! It will cost you only 8/6 plus 4/- post and packing, and once you've got it you'll wonder how you ever managed without it. It's packed with over 8,000 items, no less than 1,500 of them illustrated; and every copy contains 6 vouchers each worth a bob when used as directed. Fill in the coupon right away and post it with your cheque or P.O. for 12/6.

A Happy Christmas to all our readers.

The price of 12/6 applies only to catalogues purchased by customers residing in the U.K.

Please write your Name and Address in block capitals

Name ______________________

Address ______________________

____

____

Home Radio (Components) Ltd.
Dept. PW, 234-240 London Road, Mitcham, CR4 3HD.

PRACTICAL WIRELESS

VOL 46 NO 9

Issue 767

JANUARY 1971

TOPIC OF THE MONTH

Local what?

READERS of Practical Wireless (at least those who bought the December issue) will know that BBC Radio London is transmitting on 95.3MHz. They are a pretty exclusive club, because hardly anyone else seems to know that the station exists, let alone listens to it. After all the hoo-hah about local radio, it is strange that the actual realisation should be greeted with what might almost be called a deathly 'ush.

The launching of Radio London, for instance, could have been a matter of fanfares. It was, in fact, nothing more than a damp squib. It was not difficult to count the wordage in the southern editions of most newspapers—one gay Editor went mad and gave it five whole lines. In the matter of programme publicity our daily paper today, and we quote in entirety, says:

5.30 a.m. As Radio 2. 6.45 a.m. to 7.15 p.m. Radio London Broadcasts.

Hardly the stuff to set the blood surging and the fingers itching to switch on! However, although the general press treats local radio as a non-event, the BBC itself has taken a curiously aloof attitude towards the publicising of what, after all, is their own brainchild. There is a fair bit of cross-fertilisation between the various BBC radio channels as to what is happening on other channels but we cannot remember having heard much about the local stations. Yet surely the BBC are in the finest possible position to stimulate interest for with a captive audience on four major radio channels and two TV channels the opportunities for a publicity campaign would gladden the heart of any publicity man. Despite this, the launching and sustaining of local radio as a public relations operation has been a disaster.

The programmes themselves have not been good (to be truthful they are mainly pathetic) but the quality hardly matters if nobody is going to listen! In the past the BBC has mounted some magnificent promotions—such as that on colour TV. Local radio appears to have been allowed to happen without any great enthusiasm. Which leads one to ask if the BBC itself has any faith in its own scheme, and further to conclude that if nothing more energetic and imaginative is done in the way of promotion (and programme quality) then local radio, in its present form, is a dead duck.

W. N. STEVENS—*Editor.*

FEBRUARY ISSUE WILL BE PUBLISHED ON JANUARY 8

NEWS AND COMMENT

Leader	717
News . . . News . . . News . . .	718
P.W. at the Audio Fair	743
MW Column *by Charles Molloy*	755
New Books	756
Practically Wireless *by Henry*	758
On the Short Waves *by Malcolm Connah and David Gibson, G3JDG*	761
Letters to the Editor	769
BBC V.H.F. Radio Transmitting Stations	774

CONSTRUCTIONAL

P.W. Stereo Tape Recorder *by Halvor Moorshead*	720
"Grid Stoppers" for Transistors *by G. Young*	726
Ceramic Conundrum *by W. A. Smith*	729
Luxembourg Bandspread Pocket 7 *by R. H. Longden*	734
Harmonic Spotting Signal Generators *by R. F. Graham*	738
Signal Tracer *by John Thornton Lawrence*	744
Amateur Bands Communications Receiver Part 2 *by W. Cameron*	750
I.C. of the Month (G.E.-USA—D13V Utility Voltage Regulator) *by L. A. J. Ireland*	765
Take 20—Two Transistor Radio *by Julian Anderson*	773

OTHER FEATURES

Resonant Circuit Calculations Simplified *by Graham Haslip*	748
Going Back *by Colin Riches and Arthur Dow*	770

NEWS... NEWS... NEWS...

Air Conditioner

To clean, filter, purify and humidify the air in offices and homes or the workshop Felvic Industries have developed a compact, inexpensive air conditioner to sell for £18 18s. under the name of Sanamatic.

The surrounding room air is blown by means of a powerful fan through a spiral filter system which removes dust, dirt, and smoke particles from the air.

By filling the bottom container with up to 8 pints of water, correct humidification is achieved as the passing air evaporates moisture from the water-soaked filter pad inside the container.

To purify, deodorise and/or disinfect the ambient air appropriate liquid additives may be added to the water.

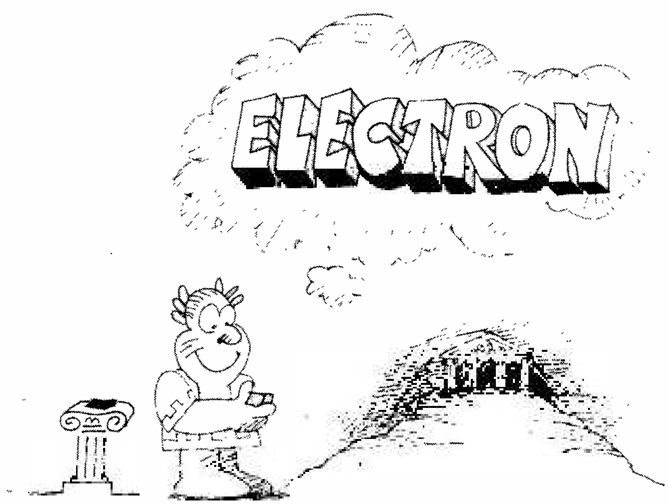
The Sanamatic is quiet running. One unit will serve rooms up to approx. 3,000 cu. ft.

There is no maintenance required except regular changing of the filter every three months or so depending on contamination. For full details and literature contact *Felvic Industries Ltd., 21 Foxley Lane, Purley, Surrey, CR2 3EH. Tel. 01-668 2228.*

World Radio Club

From Thursday, 5th November, the first edition of World Radio Club was broadcast on Thursdays at 1245 GMT with repeats on Fridays at 2345 GMT and Sundays at 0815 GMT.

The Electron's Tale



As part of their Golden Jubilee celebrations, Mullard Ltd. have released a new 15-minute film entitled *The Electron's Tale.*

Using mainly cartoon techniques in colour and black and white, it tells in a light-hearted way how the electron has revolutionised human life. The story—told in the first person by an electron—begins with the ancient Greeks. They discovered the attraction existing between a piece of silk and a piece of amber. A thousand years later in 1752 Franklin confirmed that the movement of electrons in the atmosphere, causing thunder and lightning, was not "the anger of the gods" and invented the lightning conductor.

Then came the battery, the resistor, the magnet and the various laws and units of electrical measurement. Later man found a way to convert his speech into electrons and this led to the thermionic valve, to wireless and, eventually, to the cathode ray tube and television.

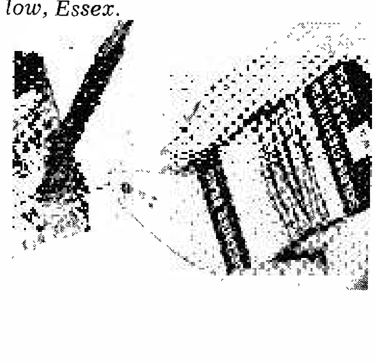
Ideas then began to flow at an ever-increasing rate: electrons gave man radar, computers, transistors, integrated circuits. . . . Today the electron serves man in a host of ways, with the promise of many more to come. Yet, complains the electron in the film, it is man who takes all the credit.

Suitable for lay and technical audience alike, *The Electron's Tale* is available on free loan (16mm) from Mullard Film Library, 269 Merton Road, Merton Park, London, S.W.19. It was produced by Beryl Stevens of The Larkins Studio Ltd. (in association with the Film Producers Guild Ltd.).

Desolder Braid

Solderstat have produced their Desolder Braid. The illustration shows a simple method, by means of which all solder is removed from the joint, using only the Desolder Braid, and a standard 25W soldering iron.

The Desolder Braid is normally supplied on a special Dispenser Card, and is extremely economical in use, the cost of desoldering the joint being less than one penny. The Desolder Braid is also available in larger reels for major industrial users. *Solderstat Ltd., P.O. Box No. 10, Bush Fair, Harlow, Essex.*



NEWS... NEWS... NEWS...

A Day of Memories

Recently, Walters Electrical Manufacturing Co. Ltd., Kensal Town Telegraph Works, 249-251 Kensal Road, London, W.10, donated one of their early receivers to the BBC. The presentation took place in the office of John Redmond, Director of Engineering.

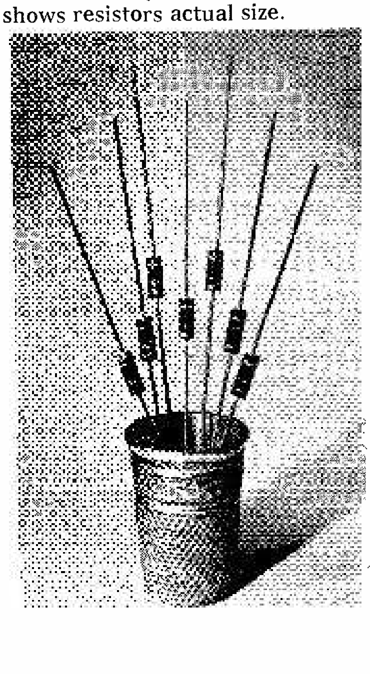
The receiver, which was in pristine form, was one of a few experimental models manufactured by Walters in 1923 and still has the official seal of the GPO bound round it. It will reside in the BBC museum.

The presentation was made by the present Chairman of Walters, Mrs. Guise'Moores, whose father founded the works in the early '20's.

ITT $\frac{1}{8}$W resistors

The ITT range of carbon composition resistors has been augmented by the addition of a $\frac{1}{8}$W device. Resistance values are from 2·2Ω to 470kΩ with choice of tolerances ±5%, ±10% and ±20%.

Available at very competitive prices, these resistors are capable of withstanding high overloads, have excellent h.f. characteristics and are fully insulated. Picture shows resistors actual size.



LST Chart

During the last few years LST Electronic Components Ltd. has sold many hundreds of copies of the RCA Hobbies Circuit Manual, reference HM.90. Many customers have complained that they have been unable to obtain the special transistors specified for the many useful and varied circuits described in this book.

LST have now managed to publish a short list of direct equivalents and wish to contact their many customers who have bought this book and inform them that the equivalents chart is available, free of charge, if they care to write to: *LST Electronic Components Ltd., 7 Coptfold Road, Brentwood, Essex.*

Falkirk & District

The above club is once again active in a rejuvenated form. Meetings are being held on the last Friday of each month in the "Temperance Café," Lint Riggs, Falkirk.

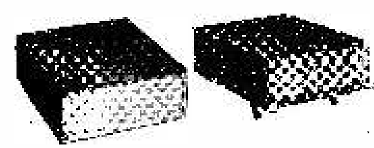
The Chairman of the club is Mr. Alan Cameron GM3OGJ, and the Secretary is Mr. Brian Mulleady. Anyone who would like to know more about the club should contact the Secretary at his QTH—9 Elizabeth Crescent, Camelon, Falkirk (telephone Falkirk 26437).

North Staffs A.R.S.

At the A.G.M. of the above Society Ian Hunter was elected to serve as Secretary for the next twelve months.

He would be obliged if readers would forward all the communications regarding the Society to 34 Ainsworth Street, Stoke-on-Trent, ST4 4JS.

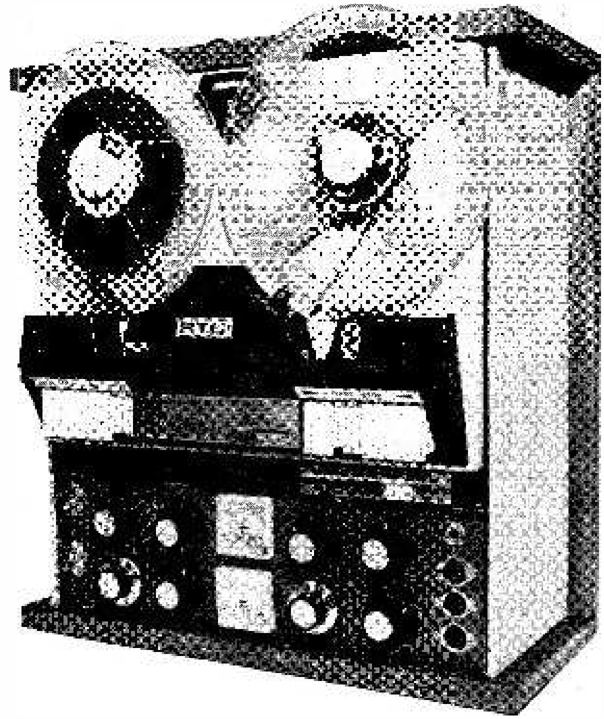
Cases from Vero



A new half-panel width version of their very popular "Series D" Cases has just been introduced by Vero Electronics Ltd., of Chandler's Ford. Hampshire. These cases are designed with the same well-known slim line style of the larger model. On this range, the front aperture is 9·5in wide and internal depth 10·5in. There are four panel sizes ranging from 3·5in to 8·75in in steps of 1·75in. The styling of these cases results in the overall height and width being kept to only 0·75in more than the front panel size. They are available with or without handles, but are supplied with a tilt foot as standard.

PART 1

PW Stereo Tape Recorder



HALVOR MOORSHEAD

THE advent of cassette tape recorders has seen the decline in popularity of the conventional reel-to-reel recorders, yet for good quality the higher speeds and track widths available on the conventional system take a lot of beating. There is also a certain satisfaction in building a machine of your own and there is a considerable saving to be made in cost. Assuming that a tape deck can be acquired for under £15 with heads, the total cost should be only about £30, this is of course a very considerable saving over commercial units.

The P.W. Stereo Tape Recorder has been designed especially for the constructor and although it cannot be recommended as a beginners project, any reader who has built a transistor amplifier should have little difficulty in tackling the project. The unit can, of course, be built for mono by using only one of the channels, but if mono is the main aim, the circuit can be further simplified and the cost reduced and for readers wanting to build a mono version one will be featured in the magazine in the near future.

The tape deck used in the prototype was unfortunately withdrawn from the market a week after the cover photograph was taken but the actual deck used is not at all important since standard wafer switches are used for the record/playback function and the heads used are still available and will be for some time.

It must be emphasised that the specified heads must be used as on record most heads require far higher bias currents and the erase head inductance forms part of the oscillator. For playback most heads will do, including those usually intended for valved recorders, but they will be completely unsuitable for recording.

The heads used are the Marriott X/RPS/36 for the record/playback head and the X/ES/11 for the erase head.

DESIGN CONSIDERATIONS

At first the design of a transistor tape recorder amplifier may seem straightforward, amplifying low level signals and applying the correct equalisation with an oscillator to cater for the a.c. bias and erase voltages.

However, a more careful study will reveal the problems. Transistors are basically low impedance devices but the input to the preamplifier must be reasonably high to accept crystal microphone or ceramic cartridges and on playback to show a reasonably high impedance to the tape head.

Secondly a fair-sized voltage swing (for transistors) is needed for the erase head, so a low voltage supply is not possible, 22V is the practical minimum and the one finally chosen.

The greatest design problems however come from the high gains required. The output from the specified head from a fully modulated tape is in the order of 0·5mV—lower than that from a magnetic pickup, yet in the output stages the currents are high—in the order of 500mA. From this it will be seen that careful thought has been given to layout and actual wiring as far as earth loops are concerned, since the currents in the output stage will cause small, but significant, a.c. voltages to appear across even the shortest wire and if these find their way to the input circuit, instability will result. This point cannot be overstressed; an early prototype, even though some thought had been given to layout, proved quite unsuitable because of instability of this sort.

Another problem is caused by the considerable frequency response of modern silicon transistors. The same transistors used in the audio stage have been successfully used by the author in a short wave receiver so a deliberate effort must be made to prevent and hold back r.f. pickup.

Finally tape recorders require switching from playback to record and the wires leading to the switch can bring about many of the problems mentioned above.

Solutions for all the above problems have been found and have been incorporated in the final design and have resulted in a first-class recorder. The author hesitates to call the final result Hi-Fi for a number of reasons. First, exhaustive tests for distortion, frequency response and noise have been carried out but *not* with laboratory equipment; secondly the monitor amplifiers are fairly simple and would not fall into the Hi-Fi category. But, having said that, the results obtained have been excellent and are indistinguishable from machines retailing for very considerably more.

EQUALISATION

To conform to international standards some treble boost must be applied on record and considerable bass boost applied on playback. Fig. 1 shows the C.C.I.R. equalisation curves for record and playback. It occurred to the author that if the preamplifier was continually applying playback equalisation this would avoid some switching and the correct curve

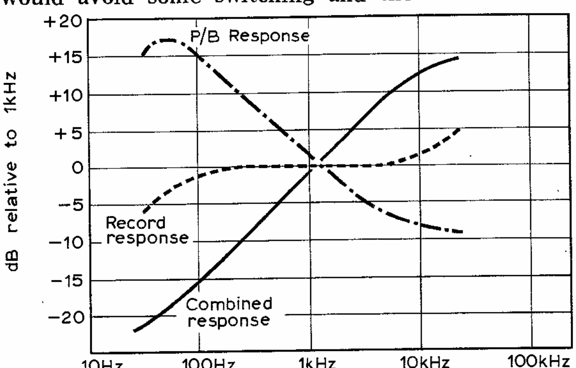


Fig. 1: The equalisation curves which are required to conform with current standards.

could be obtained from frequency sensitive networks which would only be used on record. Therefore, assuming that the preamplifier is arranged to give the curve shown as "Playback Response" in Fig. 1, and after the record amplifier we need a response looking like "Record Response", we can do this by inserting a network between the two amplifiers giving the response marked on the graph "Combined Response". The lines shown in Fig. 1 apply only to $7\frac{1}{2}$ i.p.s. but if similar curves are drawn for $3\frac{3}{4}$ and $1\frac{7}{8}$ i.p.s. the line shown as "Combined Response" will be virtually identical.

This means that by altering only the playback equalisation curve for each speed we will also obtain the correct record response.

There are disadvantages in this system; as we are initially cutting the top and then cutting the bass we are obviously going to need greater gain out of the stages involved and this also means a slightly worse signal-to-noise ratio than we could otherwise achieve but since high-gain, low-noise transistors are used, this effect is not in any way noticeable.

MONITOR AMPLIFIERS

The P.W. Stereo Tape Recorder is designed for use with an existing Hi-Fi system and for this reason a low-level output is taken from the amplifier but, for versatility and portability, two monitor amplifiers are included in the design and built-in loudspeakers are incorporated in the cabinet but the external loudspeaker sockets will have to be used for any real stereo effect.

Since the monitor amplifiers are completely independent of the rest of the recorder, a large number of designs could be used. The one used is based on the Mullard 3 watt record player amplifier design with only slight modifications and using different transistors. This has a high impedance input and so it does not load the preamplifier circuit in any way. The amplifiers are in operation during both playback and record and this of course means that if recordings are made from a microphone the volume will have to be turned right down.

A simple tone control is incorporated and it was considered greater versatility would be achieved by having these independent of each other rather than ganged.

If the monitor amplifiers are left out of the recorder the power supply can be considerably reduced in its size and cost since these amplifiers account for well over half the total current consumption, even on record.

OVERALL CIRCUIT

The block diagram Fig. 2 shows the operation of one channel and the various switching operations. All parts are duplicated for stereo operation except the erase and bias oscillator which is common. In this diagram SWa and SWb convert the amplifier from recording to playback (it is shown here in the record position). SWc applies an earth to the V.U. meter only on record (thus giving an indication of whether the machine is recording) and on playback earths the output from the record amplifier to avoid high-level signals appearing on the switch wafers when they are not needed. This section of the switch is not vital to the operation and can be left out if required. SWd applies 22V to the oscillator only on

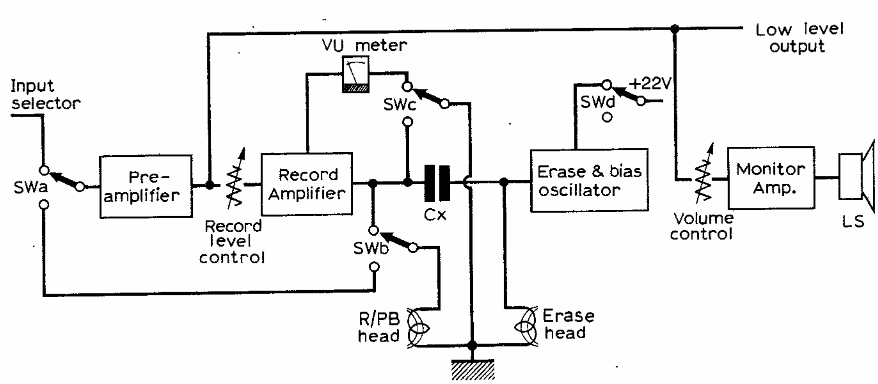


Fig. 2: Block diagram showing the basic operation of the Stereo Tape Recorder; only one channel is shown.

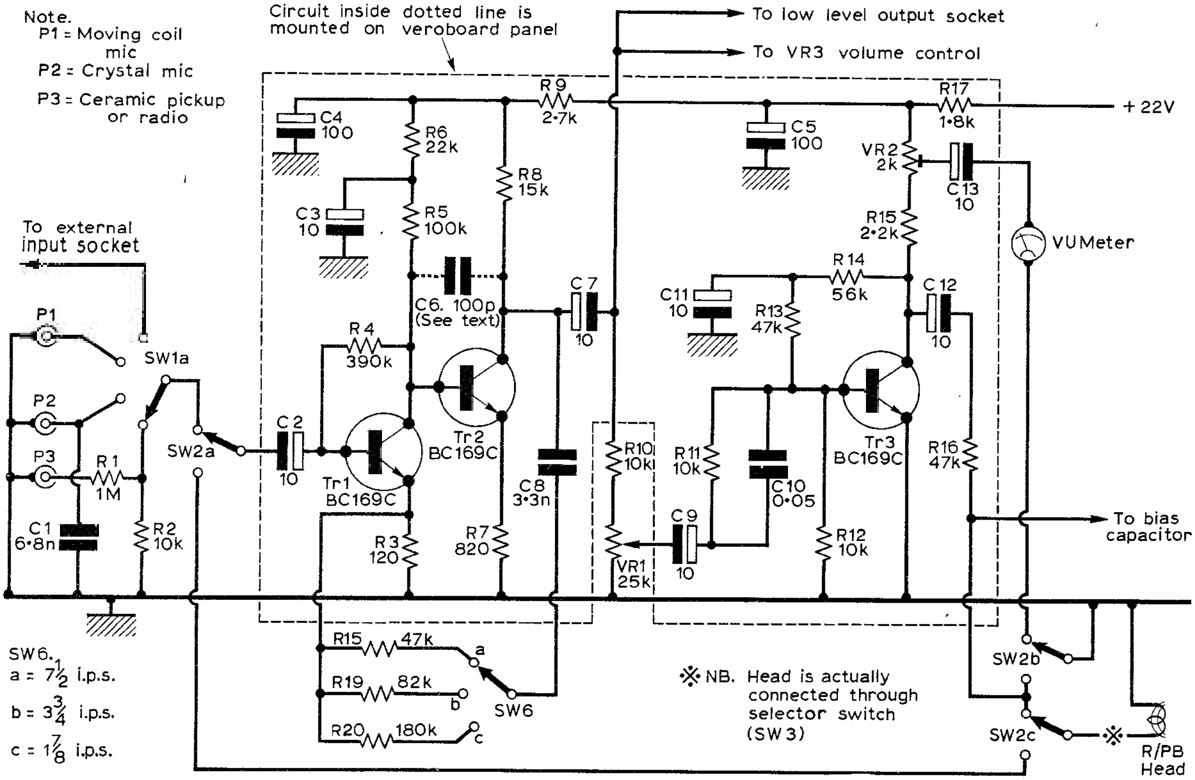


Fig. 3: Circuit diagram of the preamplifier and record amplifier of one channel only, the other is, of course, identical.

record. Cx is a low-value capacitor which applies bias to the record head.

PREAMPLIFIER AND RECORD AMP.

Fig. 3 is the complete circuit of the preamplifier and record amplifiers; the components inside the dotted line are mounted on Veroboard, the layout of which is shown in Fig. 4.

The DIN input sockets are connected as shown to SW1a (SW1b is on the other channel) via various components to attenuate and correct the inputs. The direct input is for a moving coil microphone, the second, which is paralleled by a 6,800pF capacitor, is for a crystal microphone and the third with a 100:1 attenuator is for high-level sources such as a ceramic or crystal pickup or radio; the input impedance of this source is of course high (1MΩ). The output from SW1a is taken via the record/playback switch to the input of the amplifier, C2 acting as a d.c. blocking capacitor. All the coupling capacitors in the amplifier (and some of the decoupling capacitors) are 10μF 25V types. In many cases they could be lower in value or in working voltage but for simplicity and versatility they have all been kept the same.

By using this system the necessary value is never worse and usually better than it need be and it will save the constructor having to purchase a larger variety of types.

Tr1 and Tr2 are d.c. coupled with R4 providing the base bias for Tr1. R3 and R7, the emitter resistors are not by-passed, R3 because it acts as the load for the equalisation circuit and R7 to add a considerable degree of negative feedback to stabilise the circuit. Care has to be taken with the decoupling in the supply to these stages otherwise instability could result. The output from the collector of Tr2

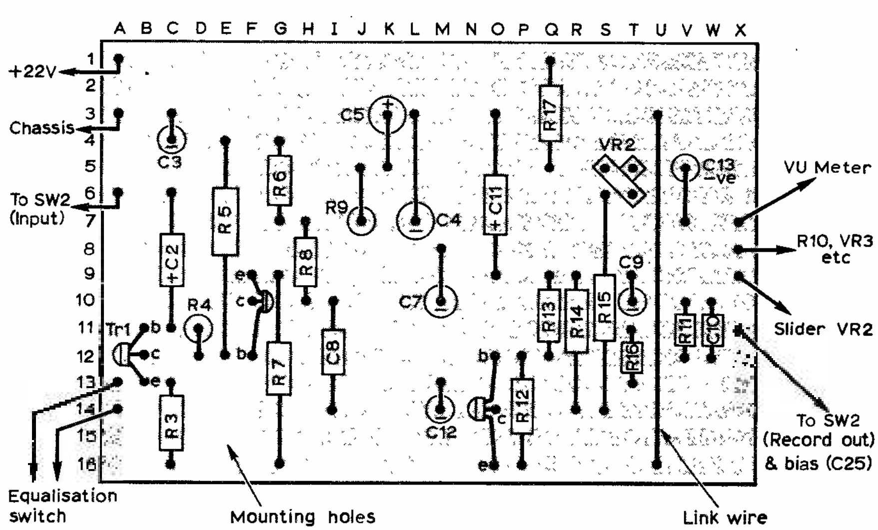


Fig. 4: The components within the dotted line in Fig. 3 are mounted on Veroboard as shown.

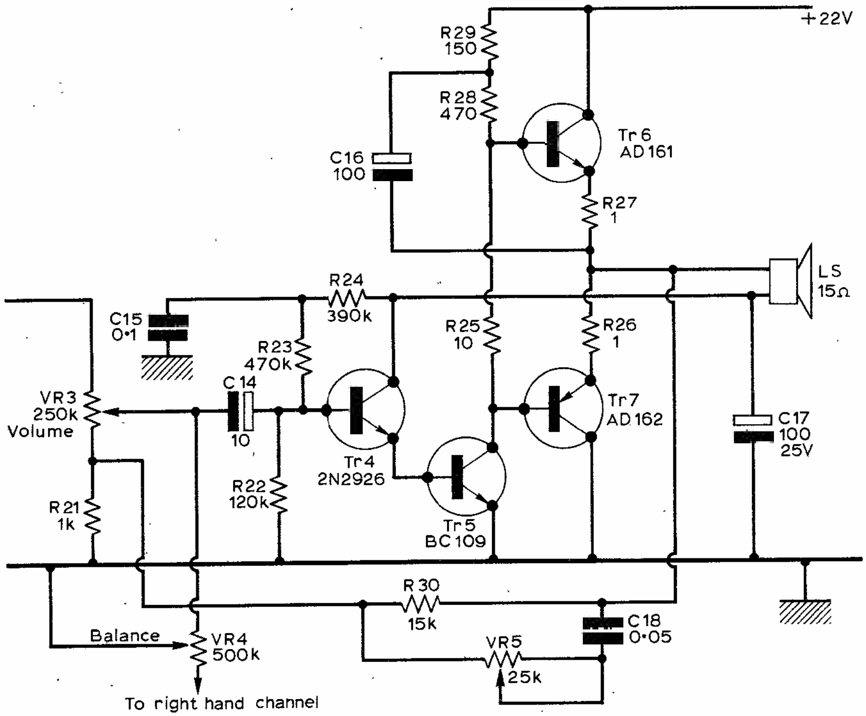


Fig. 5: Circuit of one of the monitor amplifiers; apart from the balance control all components are duplicated for the other channel.

is coupled via C8 and either R18, R19 and R20 back to emitter of Tr1, this giving the response curve shown on Fig. 1 for the playback equalisation.

C6 is a 100pF capacitor connected between the collector and base of Tr2. It will have virtually no effect on the audio response but it will prevent the amplifier going into oscillation under certain conditions and it will hold down any r.f. pickup. Four identical panels as in Fig. 4 were built during development and only one needed this component. For those with limited test equipment it may be as well to incorporate this component automatically between holes A10 and A12.

The output from the preamplifier stage goes three ways; first to the monitor amplifier volume control VR3, secondly to the low-level output socket and thirdly to R10 which is in series with the record level control VR1. The output to the external output socket is about 600mV and this will drive most transistor amplifiers.

R10 is incorporated because at maximum setting of VR1 control (which is far too much anyway) the input to the monitor amplifiers is heavily damped.

R11 and C10 in this circuit give a response which is shown in Fig. 1 as "Combined Response" and this overcomes the bass boost applied in the preamplifier stage and at the base of Tr3 the correct response appears. To prevent too much a.c. feedback in this stage C11 is incorporated in the base bias resistor network to take this to chassis. The collector load comprises VR2 and R15. VR2 is used to obtain the correct setting for the V.U. meter and is a miniature skeleton preset that must be adjusted later.

The output from Tr3 is taken via C12 and R16 to the record head via the various switches.

Note that the wiper of SW2c does not go directly to the head as shown in the circuit but it goes via another switch which enables either track to be used on mono or both to be used on record.

SW6, which alters the equalisation for the various speeds can be incorporated on the actual deck. However excellent results on the two slower speeds can

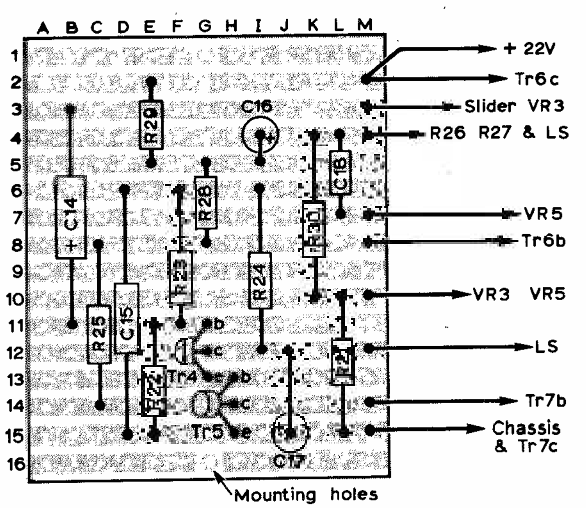
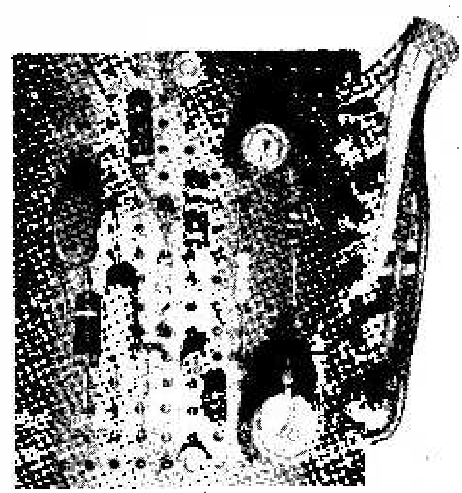


Fig. 6: Layout of the monitor amplifier Veroboards. The power transistors are mounted on the chassis.



Photograph of the monitor amplifier component board.

★ components list

Resistors:

Preamplifier and Record Amp.				Monitor Amp.		Oscillator	
R1	1MΩ	R11	10kΩ	R21	1k	R31	5·6kΩ
R2	10kΩ	R12	10kΩ	R22	120kΩ	R32	68Ω
R3	120Ω	R13	47kΩ	R23	470kΩ	R33	68Ω
R4	390kΩ	R14	56kΩ	R24	390kΩ	R34	5·6kΩ
R5	100kΩ	R15	2·2kΩ	R25	10Ω	R35	6·8Ω*
R6	22kΩ	R16	47kΩ	R26	1Ω 1W	R36	1Ω 1W
R7	820Ω	R17	1·8kΩ	R27	1Ω 1W	R37	1Ω 1W
R8	15kΩ	R18	47kΩ*	R28	470Ω $\frac{1}{4}$W		
R9	2·7kΩ	R19	82kΩ*	R29	150Ω $\frac{1}{4}$W		
R10	10kΩ	R20	180kΩ*	R30	15kΩ		

All resistors $\frac{1}{8}$ watt, 5% except where stated. *See text.

Two off required of each R1 to R30 inclusive.

VR1 (Record level control)	25kΩ log.
VR2 (V.U adjust preset)	2kΩ lin. skeleton preset.
VR3 (Volume control)	250kΩ log. double ganged.
VR4 (Balance control)	500kΩ lin.
VR5 (Tone control)	25kΩ lin.

Two off required VR1, VR2 and VR5.

Capacitors:

Preamplifier and Record Amp.		Monitor Amp.		Oscillator	
C1	6·8nF (68,000pF) polyester	C14	10μF 25V	C19	68nF (68,000pF)
C2	10μF 25V	C15	100nF (0·1μF)	C20	68nF (68,000pF)
C3	10μF 25V	C16	100μF 25V	C21	68nF (68,000pF)
C4	100μF 25V	C17	100μF 25V	C22	68nF (68,000pF)
C5	100μF 25V	C18	50nF (0·05μF)	C23	33nF (33,000pF)
C6	100pF ceramic*			C24	33nF (33,000pF)
C7	10μF 25V			C25	300pF*
C8	3·3nF (3,300pF) ceramic			C26	300pF*
C9	10μF 25V			C27	10μF 25V
C10	50nF (0·05μF) polyester				
C11	10μF 25V	**Power Supply**			
C12	10μF 25V				
C13	10μF 25V	C28	2000μF 25V		

Two off required of C1 to C18 inclusive. * See text

Transistors

Tr1	BC169C	Tr4	2N2926*	Tr7	AD162†
Tr2	BC169C	Tr5	BC109	Tr8	AD161†
Tr3	BC169C	Tr6	AD161†	Tr9	AD162†

Two off required Tr1 to Tr7 inclusive. † Matched pairs. * See text

Switches

SW1 2 pole, 4 way rotary (input selector)
SW2 8 pole, 2 way (depends on tape deck) (record/playback function)
SW3 6 pole, 3 way rotary (mono-stereo-track selector)
SW4 2 pole, on/off toggle (mains on/off)
SW5 2 pole, on/off toggle (deck motor on/off)

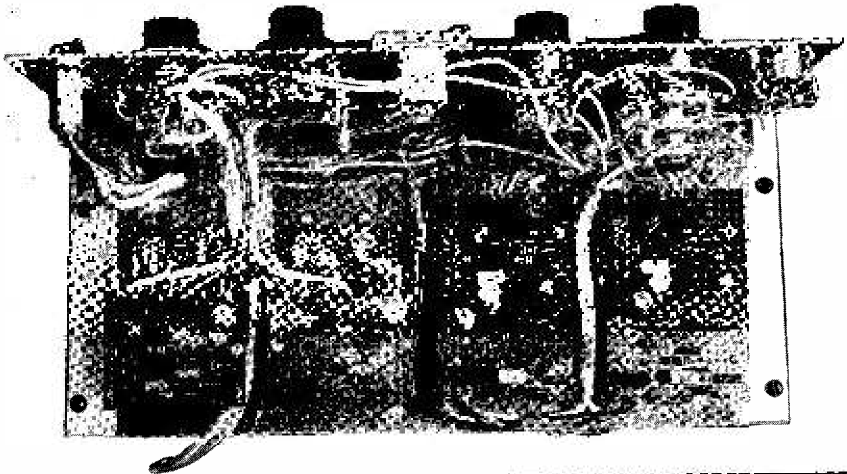
Miscellaneous

Mains transformer, type MT103AT, (misc. secondaries at 1A) (Henry's Radio)
Veroboard, various sizes, see drawings, all 0·15in. matrix, 2½in. wide.
Indicator neons, with built in resistor.
Mains plug and socket, miniature Bulgin type.
Input sockets and low level out socket, 4 off 5-pin DIN types.
Speaker sockets, 2 off DIN speaker type.
Loudspeakers, 2 off 15Ω, 6 x 4in.
V.U. Meters, $1\frac{9}{16}$in. square face, Henry's Radio, type V403.

be obtained if the setting is continually left on the $7\frac{1}{2}$ i.p.s. position and R18 can, if desired be incorporated between holes H13 and H14 on the Veroboard.

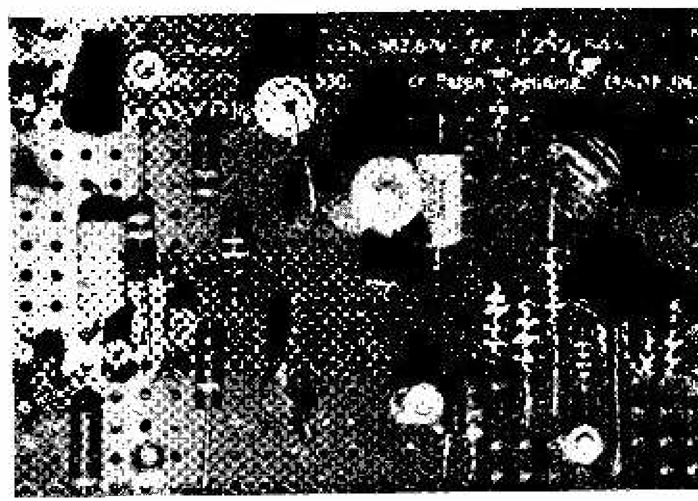
The layout of the components on the Veroboard panel is shown in Fig. 4 and should be quite straight forward. For an uncluttered layout two earth strips are used (3 and 16) and these are connected by a link. All external connections are taken to the ends of the board and it is strongly recommended that Veropins are used as the terminals here. There is an awful amount of wiring to do later this is far easier done with the panels fixed in position.

The breaks in the copper strip are clearly shown,



A view of the completed amplifier viewed inside showing the location of component boards.

Photograph of one of the preamplifier and record amplifier boards.



note that under the preset VR2 one break is needed between two holes.

Mounting holes are located at E2 and E15, and T2 and T15.

The 10μF capacitors as already mentioned are all the same and the cylindrical types with both wires coming out of one end are the best types, these being produced by several manufacturers.

MONITOR AMPLIFIERS

As mentioned previously the monitor amplifiers are very similar to the Mullard record player circuit. VR3 is the volume control which is in series with a 1kΩ resistor which enables a fair amount of negative feedback to be applied at all times. The slider ofthe control is connected to 500kΩ linear potentiometer whose slider is in turn earthed, this acts as the balance control. Tr4 and Tr5 are connected to give very high gain and high input impedance. Tr4 could well be a BC169C like the other transistors used in the preamplifier but Tr5 should be the normal metal covered BC109 as it is handling quite a current and can get hot enough to warrant a heat sink. In any case plastic encapsulated types, though identical in construction, do not really have the current handling capacity. Tr6 and Tr7 are connected in the usual complimentary pair mode. Although power transistors are used here this is done purely on a cost basis. An AC176 and AC128 would do here (though the emitter resistors R26 and R27 should then be raised to 2·2Ω) but generally these cost more than the recommended power types specified. The usual retail price for a matched pair of AD161-AD162 is around 15s but they have been advertised for 10s.

These transistors will handle well over 10 watts in a similar configuration but this would involve a more costly power supply. By under running the output transistors (as is done here) one is not only saving on power but damage due to other factors is far less likely. The amplifier feeds into a 15Ω loundspeaker but 8Ω types will work just as well here.

A simple tone control is incorporated in the feedback circuit and this acts as a top cut; even though simple it is very effective in this circuit and gives a wide control over the tone.

Some readers may have noticed that since playback equalisation is applied at all times to the feed to the monitor amplifier that the input will be far from linear on record. This is quite true and it will be found that signals monitored on record will be rather too high at the bass frequencies but it hardly matters as the amplifiers are only intended for monitoring and anyway recorders are used in the playback mode far more often than for recording. In actual fact with the built in speakers, which are only 6in.×4in. this extra bass tends to overcome the shortcomings of the loudspeakers themselves so the problem is self-cancelling.

Like the preamplifier and record amplifier, the monitor amplifiers are built on Veroboard of a standard width. The layout used brings all take-off points to one end and Vero pins should be used. No breaks are necessary in any of the copper strips. Two mounting holes should be drilled as shown.

In Part 2, next month, the oscillator, construction and wiring of the P.W. Stereo Tape Recorder will be described.

'GRID STOPPERS' FOR TRANSISTORS

G. YOUNG

ONE of the simplest, yet most useful devices used in valve audio amplifiers, yet seldom commented upon, is the 'grid stopper' shown in Fig. 1. Just a simple resistor, yet it is surprising just how many things it can do.

(a) It can prevent any tendency for the valve to self-oscillate due to accidental stray inductances in the wiring or p.c. board. The effect of such oscillation is to make reproduction sound 'strangled', as if it is permanently overloading.

(b) It will prevent r.f. picked up by long leads being rectified into audio. Most of use have experienced pickup of morse or 'Radio One' by a pet amplifier, right in the middle of a favourite record! It can be a hard thing to get rid of, but a 'stopper' will do it without difficulty.

(c) In mains driven apparatus, 'thumps' from thermostats and the like can be troublesome and actually make one fear for the speaker cone! A stopper will often reduce it to inoffensive dimensions.

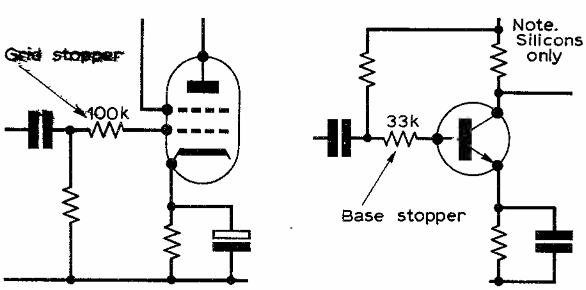


Fig. 1. (Left) Grid stopper in a valve circuit

Fig. 2. (Right) Stopper applied to a transistor

(d) We all know about amplifiers rated to 200 kHz and one wonders what use such response is to anybody but a bat! Unfortunately, such amplifiers tend to exaggerate spiky waveforms such as 'ignition noise' by shock exciting the speaker cone. A stopper will restrict the response to the audible spectrum.

(e) In circuits using large amounts of negative feedback from the speaker circuit, voice coil transients can be fed back causing unexplained 'rattles', known as 'overshoot'. A stopper will often cure it completely. This it does because such overshoot is usually at supersonic frequencies.

(f) Where very compact layouts are used with high gain amplifiers, trouble can arise from accidental capacitative coupling from the output to the input. This can cause instability, which manifests itself by whistles and 'rough' noises. A 'stopper' will reduce the possibility.

Application

Quite a lot of very useful jobs—and all for the price of a threepenny resistor! The strange thing is, that one never seems to see the equivalent in transistor circuits. There was some excuse for this when germanium transistors were the order of the day, for the placing of a series resistor in the base circuit could cause a serious loss of gain, as well as disturbing the bias.

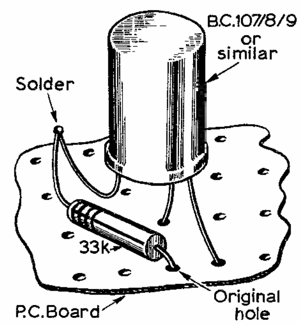


Fig. 3. Method of mounting a stopper on a p.c. board

With silicons, however, the base current is much lower and it is easier to take liberties. Fig. 2 shows a simple application to a silicon transistor of the general class BC107/8/9 and similar low-power types. It is, of course, mainly in the early stages that the 'stoppers' are most effective.

The difference such a simple device can make to an amplifier is astonishing. Pre-amplifiers virtually unusable owing to extraneous noises have been made 'hi-fi' by just one resistor so connected. One warning, however. It is *essential* the resistor is placed as close as is practical to the transistor. On a printed circuit board, a good way is shown in Fig. 3. A $\frac{1}{4}$ watt or even $\frac{1}{10}$ watt resistor is suitable. The value is not critical, but should exceed 22kΩ.

A special case is found with 'Class B' amplifiers. Most of the so-called 'cross-over distortion' when investigated, turns out to be due to feedback transients. (See (e) above.) Do not try to put stoppers on the output transistors, which *must* have a low impedance drive. Try putting a stopper in the earlier stage, somewhere within the feedback chain.

It must also be repeated—*do not put 'stoppers' in circuits using germanium transistors.*

It is hoped that this article will have helped constructors who have been faced with seemingly insoluble problems of electrical noise pickup. The author is convinced that most of the cheap sneers about 'transistor sound' are due just to the absence of this simple device. ■

BRAND NEW

SEMICONDUCTORS & COMPONENTS

SOLE AGENTS FOR SOLID STATES DEVICES INC., (USA). IN U.K.

GUARANTEED

TRANSISTORS

2G301	4/-	2N3402	4/6	3N143	13/6	BC168C	3/-	BFY75	6/-	NKT237	7/-
2G302	4/-	2N3403	4/6	3N152	17/6	BC169	3/6	BFY76	8/-	NKT238	5/-
2G303	4/-	2N3404	6/6			BC169B	2/9	BFY77	11/6	NKT240	5/6
2G306	8/6	2N3405	9/-	R.C.A.:—		BC169C	3/-	BFY85	9/-	NKT241	5/6
2G308	6/-	2N3414	4/6	40050	10/6	BC170	2/6	BFY90	13/6	NKT 281	5/6
2G309	6/-	2N3415	4/6	40251	17/6	BC171	3/-	BPX25	37/-	NKT 713	4/-
2G371	3/-	2N3416	7/6	40309	6/6	BC172	3/-	BPX29	36/-	NKT 781	6/-
2G374	4/-	2N3417	7/6	40310	9/-	BC175	4/6	BPY10	29/-	NKT10419	6/-
2G381	4/6	2N3570	25/-	40311	7/-	BC182	2/6	BRY39	9/6	NKT10439	7/6
2N404	4/6	2N3572	19/6	40312	9/6	BC182L	2/-	BSX19	3/6	NKT10519	
2N696	4/-	2N3605	5/6	40314	7/6	BC183	2/6	BSX20	3/6		6/6
2N697	4/-	2N3606	5/6	40320	7/6	BC184	3/-	BSX21	7/6	NKT20329	
2N698	5/-	2N3607	4/6	40323	6/6	BC212L	2/6	BSX26	9/-		9/6
2N706	2/6	2N3702	2/6	40324	9/6	BCY30	5/6	BSX27	9/6	NKT20339	
2N706A	2/6	2N3703	2/6	40326	7/6	BCY31	5/6	BSX28	6/6		7/6
2N708	3/-	2N3704	3/6	40329	6/-	BCY32	7/6	BSX60	16/6	NKT80111	
2N709	12/6	2N3705	3/-	40344	5/6	BCY33	4/-	BSX61	13/6		15/6
2N2718	5/-	2N3706	2/6	40347	7/6	BCY34	4/6	BSX76	4/6	NKT80112	
2N726	6/-	2N3707	3/-	40348	10/6	BCY38	4/6	BSX77	5/6		19/6
2N727	6/-	2N3708	2/-	40360	8/6	BCY39	10/6	BSX78	5/6	NKT80113	
2N914	3/6	2N3709	2/-	40361	9/6	BCY40	7/6	BSY24	3/-		22/6
2N916	3/6	2N3710	2/6	40362	11/6	BCY42	3/-	BSY25	3/-	NKT80211	
2N918	6/-	2N3711	2/6	40370	6/6	BCY43	3/-	BSY26	3/6		18/6
2N929	4/6	2N3715	44/6	40406	11/6	BCY54	6/6	BSY27	3/6	NKT80212	
2N930	5/6	2N3716	58/-	40407	8/-	BCY58	4/6	BSY28	3/6		18/6
2N987	10/6	2N3773	48/-	40408	10/6	BCY59	4/6	BSY29	3/6	NKT80213	
2N1090	4/6	2N3819	7/-	40410	12/6	BCY60	19/6	BSY32	5/-		18/6
2N1091	4/6	2N3823	19/6	40467A	11/6	BCY70	4/-	BSY36	5/-	NKT80214	
2N1131	5/-	2N3854	5/6	40468A	7/-	BCY71	8/6	BSY37	5/-		18/6
2N1132	5/-	2N3854A	5/6	40600	14/6	BCY72	3/6	BSY38	4/6	NKT80215	
2N1302	3/6	2N3855	5/6	AC107	6/-	BCZ10	5/6	BSY39	4/6		18/6
2N1303	3/6	2N3855A	6/-	AC126	4/-	BCZ11	8/6	BSY40	6/6	NKT80216	
2N1304	4/6	2N3856	6/-	AC127	5/-	BD116	22/6	BSY51	6/6		18/6
2N1305	4/6	2N3856A	7/-	AC128	4/-	BD121	13/-	BSY52	6/6	OC20	15/-
2N1306	5/-	2N3858	5/-	AC154	4/6	BD123	16/6	BSY53	7/6	OC22	10/-
2N1307	5/-	2N3858A	6/-	AC176	5/-	BD124	12/-	BSY54	8/-	OC23	10/-
2N1308	6/-	2N3859	5/6	AC187	12/-	BD131	19/6	BSY56	18/-	OC24	10/-
2N1309	6/-	2N3859A	6/6	AC188	7/6	BD132	19/6	BSY79	9/-	OC25	8/6
2N1507	3/6	2N3860	6/-	ACY17	5/6	BDY10	27/6	BSY82	10/6	OC26	5/6
2N1613	5/-	2N3866	30/-	ACY18	5/-	BDY11	32/6	BSY90	11/6	OC28	12/6
2N1631	7/-	2N3877	8/-	ACY19	5/-	BDY17	30/-	BSY95A	2/6	OC29	12/6
2N1632	6/-	2N3877A	8/-	ACY20	5/-	BDY18	35/-	BSW41	8/6	OC30	8/-
2N1637	6/-	2N388A	12/6	ACY21	5/-	BDY19	39/6	BSW70	5/6	OC35	10/-
2N1638	5/6	2N3900	7/6	ACY22	4/-	BDY20	22/6	C111	15/-	OC36	12/6
2N1639	5/6	2N3900A	8/-	ACY28	4/-	BDY38	19/6	C424	5/6	OC38	10/6
2N1711	5/-	2N3901	19/6	ACY40	4/-	BDY60	25/-	C425	11/-	OC41	4/6
2N1889	6/6	2N3903	7/-	ACY41	5/-	BDY61	25/-	C426	8/-	OC42	5/-
2N1893	7/6	2N3004	7/-	ACY44	8/-	BDY62	20/-	C744	6/-	OC44	4/-
2N2147	16/6	2N3905	7/6	AD140	10/6	BF115	5/-	D16P1	7/6	OC45	2/6
2N2148	11/6	2N3906	7/6	AD149	11/6	BF117	9/6	D16P2	8/-	OC46	3/-
2N2160	11/6	2N4058	3/6	AD150	12/6	BF163	7/6	D16P3	7/6	OC70	3/-
2N2193	8/-	2N4059	2/-	AD161	7/6	BF167	5/-	D16P4	8/-	OC71	2/6
2N2193A	8/6	2N4060	2/6	AD162	7/6	BF173	6/6	GET102	6/-	OC72	2/6
2N2194A	6/-	2N4061	2/6	AF106	8/6	BF177	6/6	GET113	4/-	OC74	6/6
2N2217	5/6	2N4062	2/6	AF114	5/-	BF178	10/6	GET114	4/-	OC75	4/6
2N2218	6/-	2N4244	9/6	AF115	6/-	BF179	14/6	GET118	4/-	OC76	4/6
2N2219	6/-	2N4255	8/6	AF116	5/-	BF180	7/-	EET119	4/-	OC77	6/-
2N2220	5/-	2N4285	3/6	AF117	5/-	BF181	6/6	GET120	6/6	OC81	4/-
2N2221	5/-	2N4286	3/6	AF118	12/6	BF184	5/-	GET873	3/-	OC81D	4/6
2N2222	6/-	2N4287	3/6	AF119	4/-	BF185	8/6	GET880	6/-	OC83	5/-
2N2287	21/6	2N4288	3/6	AF124	4/6	BF194	3/6	GET887	4/-	OC84	5/-
2N2297	6/-	2N4289	3/6	AF125	4/-	BF195	4/-	GET889	4/6	OC139	6/6
2N2303	5/-	2N4290	3/6	AF126	4/-	BF196	8/6	GET890	4/6	OC140	6/6
2N2368	5/-	2N4291	3/6	AF127	3/6	BF197	8/6	GET896	4/6	OC170	6/-
2N2369	3/-	2N4292	2/6	AF139	7/6	BF198	8/6	GET897	4/6	OC171	6/-
2N2369A	3/6	2N4303	9/6	AF178	8/6	BF200	10/6	GET898	4/6	OC200	7/6
2N2410	8/6	2N5027	10/6	AF179	14/6	BF224	4/-	MAT100	6/-	OC201	9/6
2N2483	5/6	2N5028	11/6	AF180	10/6	BF225	4/-	MAT101	6/-	OC202	12/6
2N2484	6/6	2N5029	9/6	AF239	8/6	BF237	4/6	MAT120	6/-	OC203	8/6
2N2539	4/6	2N5030	8/6	AF279	9/6	BF238	4/6	MAT121	6/-	OC204	8/6
2N2540	4/6	2N5172	2/6	AF280	12/6	BF244	6/6	MC140	6/6	OC205	12/6
2N2613	7/-	2N5174	10/6	AFZ11	6/6	BFW58	5/6	MJ400	21/6	OC207	15/-
2N2614	5/-	2N5175	10/6	ASY26	5/-	BFW59	5/-	MJ420	22/6	OCP71	8/6
2N2646	11/6	2N5176	9/-	ASY27	7/6	BFW60	5/-	MJ421	22/6	ORP12	12/6
2N2696	6/6	2N5232	5/6	ASY28	5/6	BFW61	9/6	MJ430	20/6	ORP61	10/-
2N2711	5/-	2N5232A	6/-	ASY29	5/6	BFX12	4/6	MJ440	19/6	P346A	4/6
2N2712	5/-	2N5245	9/-	ASY36	5/-	BFX13	4/6	MJ480	19/6	TIP31A	16/6
2N2713	5/6	2N5246	8/6	ASY50	5/-	BFX29	6/-	MJ481	25/-	TIP32A	19/6
2N2714	6/-	2N5249	13/6	ASY54	5/-	BFX30	6/-	MJ490	20/-	TIS34	12/6
2N2865	12/6	2N5265	65/-	ASY86	6/6	BFX43	7/6	MJ491	27/6	TIS43	8/-
2N2904	6/-	2N5266	55/-	ASZ20	7/6	BFX44	7/6	MJ1800	43/6	TIS44	2/6
2N2904A	6/6	2N5267	52/6	ASZ21	8/6	BFX68	13/6	MJE340	12/6	TIS45	2/6
2N2905	7/6	2N5305	7/6	AUY10	30/-	BFX68A	13/6	MJE520	17/6	TIS46	2/6
2N2905A	8/-	2N5306	8/-	BC107	2/6	BFX84	5/-	MJE521	17/6	TIS47	2/6
2N2906	5/-	2N5307	7/6	BC108	2/6	BFX85	6/6	MPF102	8/6	TIS48	2/6
2N2906A	5/6	2N5308	7/6	BC109	2/6	BFX86	5/-	MPF103	7/6	TIS49	2/6
2N2907	6/-	2N5309	12/6	BC113	5/6	BFX87	5/6	MPF104	7/6	TIS50	3/6
2N2923	3/-	2N5310	8/6	BC115	8/-	BFX88	5/-	MPF105	7/6	TIS51	2/6
2N2924	3/-	2N5354	5/6	BC116A	7/6	BFX89	12/6	MPS3638	6/6	TIS52	2/6
2N2925	3/-	2N5355	5/6	BC118	6/6	BFX92A	12/6	NKT0013	9/6	TIS53	4/6
2N2926		2N5356	6/6	BC121	4/-	BFX93A	14/-	NKT124	8/6	TIS60	4/6
,, Green	2/9	2N5365	9/6	BC122	4/-	BFY10	6/6	NKT125	5/6	TIS61	5/-
,, Yellow	2/6	2N5366	6/6	BC125	11/-	BFY11	8/6	NKT126	5/6	TIS62	5/6
,, Orange	2/6	2N5367	11/6	BC126	11/-	BFY12	4/6	NKT128	5/6	ZTX107	3/6
2N3011	6/-	2N5457	7/6	BC134	6/6	BFY13	4/6	NKT135	5/6	ZTX108	3/6
2N3014	6/6	2N718A	6/-	BC135	8/6	BFY17	4/6	NKT137	6/6	ZTX109	3/6
2N3053	5/-	2S005	15/-	BC136	7/6	BFY18	6/6	NKT210	6/-	ZTX300	3/6
2N3054	10/-	2S020	40/-	BC140	7/6	BFY19	6/6	NKT211	6/-	ZTX301	3/6
2N3055	15/-	2S102	10/-	BC147	3/6	BFY21	8/6	NKT212	6/-	ZTX302	4/6
2N3133	6/-	2S103	5/-	BC148	2/6	BFY24	9/-	NKT213	6/-	ZTX303	4/6
2N3134	6/-	2S104	5/-	BC149	3/6	BFY29	10/-	NKT214	4/6	ZTX304	6/6
2N3135	5/-	2S501	6/6	BC152	3/6	BFY30	10/-	NKT215	4/6	ZTX500	4/6
2N3136	5/-	2S502	7/-	BC154	8/6	BFY41	10/-	NKT216	7/6	ZTX501	5/-
2N3390	5/-	2S503	5/6	BC157	4/-	BFY43	12/6	NKT217	8/6	ZTX502	5/-
2N3391	4/-	3N83	8/-	BC158	3/6	BFY50	4/6	NKT219	6/-	ZTX503	5/-
2N3391A	6/-	3N128	14/-	BC159	4/-	BFY51	4/-	NKT223	5/6	ZTX504	12/6
2N3392	3/6	3N140	15/6	BC160	12/6	BFY52	4/6	NKT224	5/-		
2N3393	3/-	3N141	14/6	BC167	3/-	BFY53	3/6	NKT225	4/6		
2N3394	3/-	3N142	11/-	BC168B	2/9	BFY56A	11/6	NKT229	6/-		

Post & Packing 2/- per order. Europe 5/-. Commonwealth (Air) 13/- (MIN.)

Send 6d. stamp for price list.

PANEL METERS

38 Series—FACE SIZE 42 × 42mm. All prices for 1-9 pieces. 50μA, 37/6; 100μA, 35/-; 200μA, 32/6; 500μA, 27/6; 50-0-50μA, 35/-; 100-0-100μA, 32/6; 500-0-500μA, 25/-; 1MA, 25/-; 5MA, 25/-; 10MA, 25/-; 50MA, 25/-; 100MA, 25/-; 500MA, 25/-; IA, 25/-; 5A, 25/-; 10V 25/-; 20V, 25/-; 50V, 25/; 300V, 25/; 500V, 25/-.

SILICON RECTIFIERS

PIV	50	100	200	400	600	800	1000	1200
IA	2/-	2/6	3/-	3/3	3/6	3/9	4/-	—
3A	3/-	—	—	4/6	—	6/-	—	—
6A	—	—	5/-	6/-	6/6	7/-	10/-*	—
10A	10/6	11/6	13/-	15/6	17/6	19/6	25/-	32/-
17A	11/6	12/6	15/6	18/-	19/6	24/-	31/6	37/6

*5A only IA Types are plastic

DIODES & RECTIFIERS

IN461	4/6	IS132	3/-	BA156	4/6	BY164	11/6	OA73	1/9
IN914	1/6	IS940	1/6	BAX13	1/6	BYX10	4/6	OA79	1/6
IN916	1/6	AA119	2/6	BAX16	1/9	BYZ10	7/-	OA81	1/6
IN4007	4/6	AA213	4/6	BAY18	3/3	BYZ11	6/6	OA85	1/6
IS010	3/-	AAZ13	4/-	BAY31	1/6	BYZ12	6/-	OA90	1/6
IS021	4/-	AAZ15	2/6	BAY38	3/9	BYZ13	5/-	OA91	1/6
IS44	2/-	AAZ17	2/-	BY100	3/6	FST3/8	4/-	OA95	1/6
IS113	3/-	BA100	3/-	BY103	4/6	OA5	3/6	OA200	2/-
IS120	3/-	BA102	4/6	BY122	7/6	OA9	2/-	OA202	2/-
IS121	3/6	BA110	7/-	BY124	3/-	OA10	2/6		
IS130	2/6	BA115	1/6	BY126	3/-	OA47	1/6		
IS131	2/6	BA144	2/6	BY127	3/6	OA70	1/6		

INTEGRATED CIRCUITS

RCA

CA3000	36/-	CA3020A	32/-	CA3036	15/-	CA3050	37/-
CA3005	24/-	CA3021	32/-	CA3039	17/-	CA3051	27/-
CA3007	53/-	CA3022	26/-	CA3041	22/-	CA3052	33/-
CA3011	15/-	CA2023	26/-	CA3042	22/-	CA3053	10/-
CA3012	18/-	CA3026	20/-	CA2043	28/-	CA3054	22/-
CA3013	21/-	CA3028A	15/-	CA3044	24/-	CA3055	48/-
CA3014	25/-	CA3028B	21/-	CA3045	25/-	CA3059	33/-
CA3018	17/-	CA3029	18/-	CA3046	15/-	CA3064	24/-
CA3018A	22/-	CA2029A	33/-	CA3047	28/-		
CA3019	17/-	CA3030	28/-	CA3048	41/-		
CA3020	26/-	CA3035	25/-	CA3049	32/-		

Data and application sheets 2/- per type

Motorola

MC724P	13/3	MC799P	13/3
MC780P	49/5	MC838P	109/9
MC788P	16/6	MC1303P	54/-
MC789P	13/3	MC1304P	72/-
MC790P	24/9	MC1552G	92/2
MC792P	13/-		

MOTOROLA DATA SHEETS 2/- per Type

We can now offer the whole range of Motorola I.C's and most of the RCA, Mullard, Siemens and G.E. I.C's at Industrial Consumer prices

Fairchild

	1-5	6-11	12+
L900 Buffer	8/6	8/-	7/6
L914 Dual Gate	8/6	8/-	7/6
L923 JK Flip Flop	12/6	11/9	11/-
L709 Operational Amplifier	21/-	19/6	18/-

Quantity Prices on Application

General Electric

PA222	37/6	PA246	62/6
PA230	22/6	PA263	46/-
PA234	21/6	PA242	55/-
PA237	37/6		

Our stocks and range of I.C.s. are continually expanding and we invite queries for types not show from Enthusiasts and Industrial users.

Mullard

TAA241	32/6	FJH101	17/6
TAA243	30/-	FJH121	17/6
TAA263	15/6	FJH141	17/6
TAA300	35/-	FJH161	17/6
TAA310	25/-	FJH171	18/3
TAA320	14/6	FJH221	17/6
TAA350	35/-	FJJ101	27/6
TAB101	19/6	FJJ121	37/6
TAD110	39/6	FJJ141	62/6
TAD100	39/6		

Plessey

SL402A	42/6	SL403A	42/6

TRIACS

SC41D, 6A 400V 25/-

SC41B, 6A 200V 22/-

40512 6A 400V 33/-

SC50D 60/-

Data and App. Sheets 2/6

THYRISTORS

PIV	50	100	200	300	400
IA	5/-	5/6	7/6	8/-	9/6
3A	6/-	7/6	8/-	9/-	10/6
5A	—	11/-	13/-	—	15/-
7A	—	11/-	13/-	—	19/6

Also 12A, 100 PIV, 15/-; 600 PIV, 35/6; 25A, 400 PIV 37/6

VEROBOARD

	0·15 *Matrix*	0·1 *Matrix*
2½ × 3¾in	3/6	4/-
2½ × 5in	4/3	4/9
3¾ × 3¾in	4/3	4/9
3¾ × 5in	5/6	5/6
3¾ × 17in	16/-	21/6
3¾ × 17in (plain)	—	11/6
5 × 17in (plain)	15/6	—
Vero Pins (bags of 50)	5/-	5/-

Vero Cutter, 9/-

HEAT SINKS

4·8 × 4 × 1in Finned for Two TO-3 Trans., 9/6. 4·8 × 2 × 1in Finned, for One TO-3 Trans., 6/6. For SO-1, 6d. For TO-5, 1/- Finned. For TO-18, 1/- Finned. For TO-18, 1/- Finned.

RESISTORS

Carbon Film

⅓ watt 5%, 3d.
¼ watt 5%, 4d.
½ watt 5%, 5d.
1 watt 10%, 6d.
2 watt 10%, 1/3

CAPACITORS

A large and comprehensive range available: Electrolytic, Polyester, Ceramic, Polystyrene, Silver Mica, Tantalum, Trimmers, Tuners.

Examples:
2,000mF 25V, 8/6
2,500mF 50V, 13/6
3,000mF 25V, 10/6
5,000mF 50V, 19/6

WIRE-WOUND RESISTORS

2·5 watt 5% (up to 270 ohms only). 1/6
5 watts 5% (up to 8·2kΩ only), 2/-
10 watt 5% (up to 25kΩ only), 2/6

POTENTIOMETERS

Carbon:
Log. and Lin., less switch, 3/-.
Log. and Lin., with switch, 4/6.
Wire-wound Pots (3W), 5/6.
Twin Ganged Stereo Pots, Log. and Lin., 7/6.

PRESETS (CARBON)

0.1 Watt	1/-
0.2 Watt	1/3
0.3 Watt	1/6

THERMISTORS

R53 (STC)	25/6	VA3705	17/6
K151 (1k)	2/6	VA3700	17/6

Mullard Thermistors also in stock. Please enquire.

Tel. 01-452 0161/2/3
Telex 21492

A. MARSHALL & SON
28 CRICKLEWOOD BROADWAY, LONDON, N.W.2

Send 1/- for new Comprehensive Semiconductor and I.C. list (24 pages).

CALLERS WELCOME
HRS, 9-5.30 Mon-Sat

CERAMIC CONUNDRUM

DERAM + DEVICE = DELIGHT

W. A. SMITH

THE phrase "high fidelity" or the foreshortened version, "hi-fi," is currently applied to a variety of products including ladies' hosiery and facial make-up. However, most of us recognise it as referring to the faithful reproduction of sound via the mediums of f.m. radio or modern gramophone plus amplifiers and loudspeakers. Sound, however produced or reproduced is, in the final analysis, what we hear. It may be melodious or hideous and we may be discerning or indifferent. Studio acoustics are very desirable but we cannot all have them and in the average household the simple act of drawing the curtains is often a means of improving baffle. A great many people are quite content with a self-contained record player whilst, for others, this is not nearly good enough. A lot depends on individual taste but I think that it is true to say that in the hi-fi enthusiast bracket, excellence is very closely related to the price we pay for equipment. In catering for the absolute connoisseur, one accepts that his expenditure will be commensurate with his convictions, usually to the tune of many hundreds of pounds. Conversely, but still within the hi-fi category, a high standard of sound reproduction is possible for a much more modest outlay plus, perhaps, a little ingenuity.

This article was prompted by a genuine problem confronting a friend, concerning a certain ceramic cartridge. Whilst no one will deny the superiority of *magnetic* cartridges, they obviously cannot be used to advantage if one's preamplifier inputs are not designed for them. In addition, the better types are quite expensive. The better of the *ceramic* cartridges are less expensive but are capable of high performance *provided that they are given the input conditions recommended by their manufacturers* (i.e. most of the better ones are mechanically corrected for the R.I.A.A. characteristic so that they will produce a desirably flat response when looking into a load impedance of 2MΩ and upwards). The lower priced ceramic cartridges (and my friend had one) are difficult to categorise. I think it is fair to say that, in general, they give reasonable performance but one must accept some discrepancies as inevitable (i.e. they are not fussy as to impedance loading but are not so good in terms of playing weight, compliance and full frequency response).

The device shown in Fig. 1 enables an R.I.A.A. corrected, high impedance loading, 50mV output, high compliance ceramic cartridge to be used sucessfully with an R.I.A.A equalised, stereo preamplifier having a 100-300mV gramophone input. (Normally only suitable for crystal or the lower priced of the ceramic cartridges.) The test results were so outstanding that I considered it well worthwhile passing on. Perhaps I should say at once that I have not tested the device other than as shown in Fig. 1 (i.e. R8, 820Ω, gain factor = 2·6). However, I see no valid reason why R8 should not be selected to produce other gain factors within reasonable limits. D.C. supplies of 15V and upwards can be used. A chassis negative version is easy to arrange (see technical notes).

Two such devices are necessary for stereo application but, in view of the great transformation made to an originally disappointing set up, I do not consider it to be a costly undertaking. Most of the components are available in advertised lists and some may already be in the spares box. Constructors may prefer to style their own pin-boards and housings. Fig. 2 is a facsimile of one of the two pin-boards actually in use and the housings were 2 ounce tobacco tins. No doubt it could be more neatly designed but, since the device worked so well and was out of sight, when connected up, I saw no reason to disturb it. Time, in any case, was not really on my side and I did not have all the tools or the workshop facilities that I would have liked at the time (see constructional notes).

PROOF OF THE PUDDING, VIDEO AND AUDIO

I joined my friend Reg (for an all too brief holiday at his Plymouth home), shortly after he had purchased the following items by mail order: a 24V power supply, two main amplifiers and a stereo preamplifier model SP4A (Henry's Radio Ltd.), Garrard SP25 Mk II turntable, a pair of "Solent" 'speakers and a £3 10s ceramic cartridge to suit the SP4A 100-300MV input.

To be perfectly fair to the latter item it may have been a bad one that got through or have become invisibly damaged in transit, but the following defects were obvious. **1. Output** was low, necessitating the preamplifier gain controls to be turned up to a level not conducive to optimum signal-to-noise ratio. **2. Frequency response.** The amplitude of bass tones compared to the pilot tone on a Decca stereo check-out disc was progressively poor. The two lowest tones could not be heard at all, even with the bass control at maximum. **3. Compliance.** A characteristic poor compliance "fuzz" was evident in both channels when playing high note string passages of music.

Reg is a very discerning character but he did not bemoan his lot. Instead, he simply "wrote off" the offending cartridge and plumped for a Decca Deram ceramic cartridge in the full knowledge that an intermediate input stage would be necessary. i.e. a stage presenting at least 2MΩ input loading followed by an initial gain of at least 2 (to match the 100mV minimum requirement of the SP4A preamplifier). An f.e.t. input was one of the most obvious answers. After some thought and about half a ream of paper later, the circuit of Fig. 1 transpired. Two units were built as shown. (At this stage I must again thank those other very enthusiastic Plymouthian friends who not only came up with most of the components, including the transistors, but also mustered a rather fine video oscillator and double-beam oscilloscope for test purposes. Shades of Sir Francis Drake and the Golden hi-fi, methinks!)

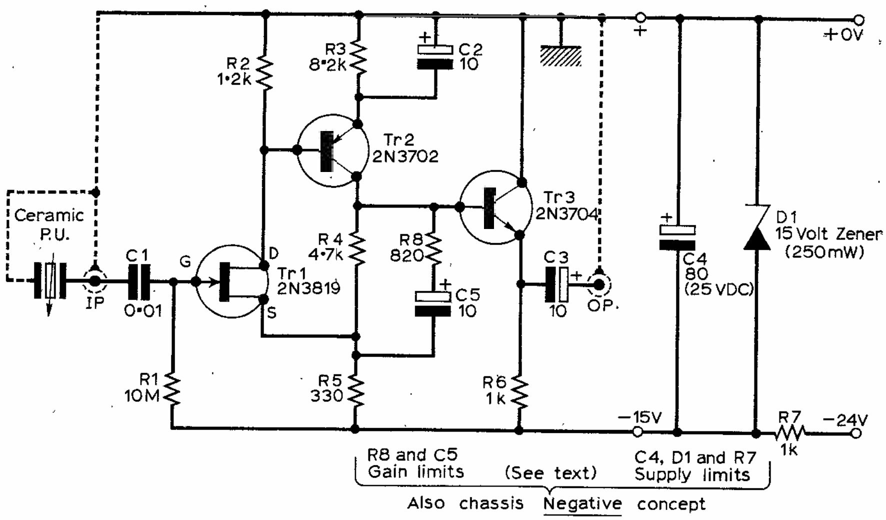


Fig 1 : Circuit of one channel. Note that D1 and C4 are not needed for the second channel if the negative supply is taken from R7.

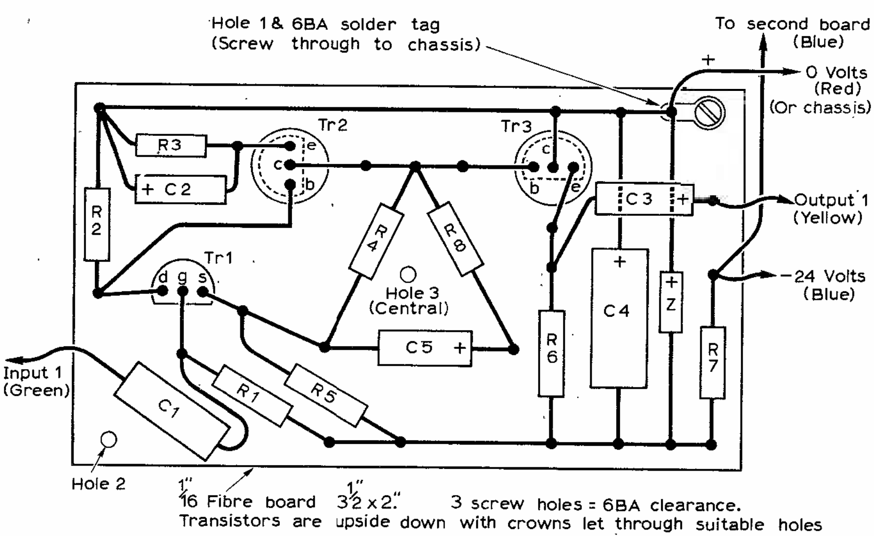


Fig. 2: A suggested layout for the circuit shown above.

Although hopeful, we did not expect the results listed below. The oscillator and 'scope were first arranged so that one beam was monitoring the oscillator output (as applied to the device input), and the other beam seeing the device output. In the channel separation test, the oscillator output was fed to both channel inputs simultaneously with the device outputs fed, one to each beam of the 'scope. In all tests the oscillator sweep was 50Hz to 30Hz. For gain and frequency response the oscillator output was 50mV. For channel separation it was raised to 200mV.

1. Current consumption at 24V d.c. supplied. A steady 20mA throughout sweep (i.e. 10mA per channel).

2. Gain in each channel throughout sweep. Rock steady 2·6 (R8, 820Ω, 5% $\frac{1}{4}$W).

3. Frequency response in each channel throughout sweep. This was carried out with meticulous care and attention. The response was beautifully flat all the way. We could detect no distortion or deviation whatsoever and did the whole gamut about five times just to make sure we weren't dreaming. At the risk of self-praise I can only describe this result as very excellent.

4. Channel separation throughout sweep (at 200mV signals). There was no sign of pick-up hum, interference or phase shift.

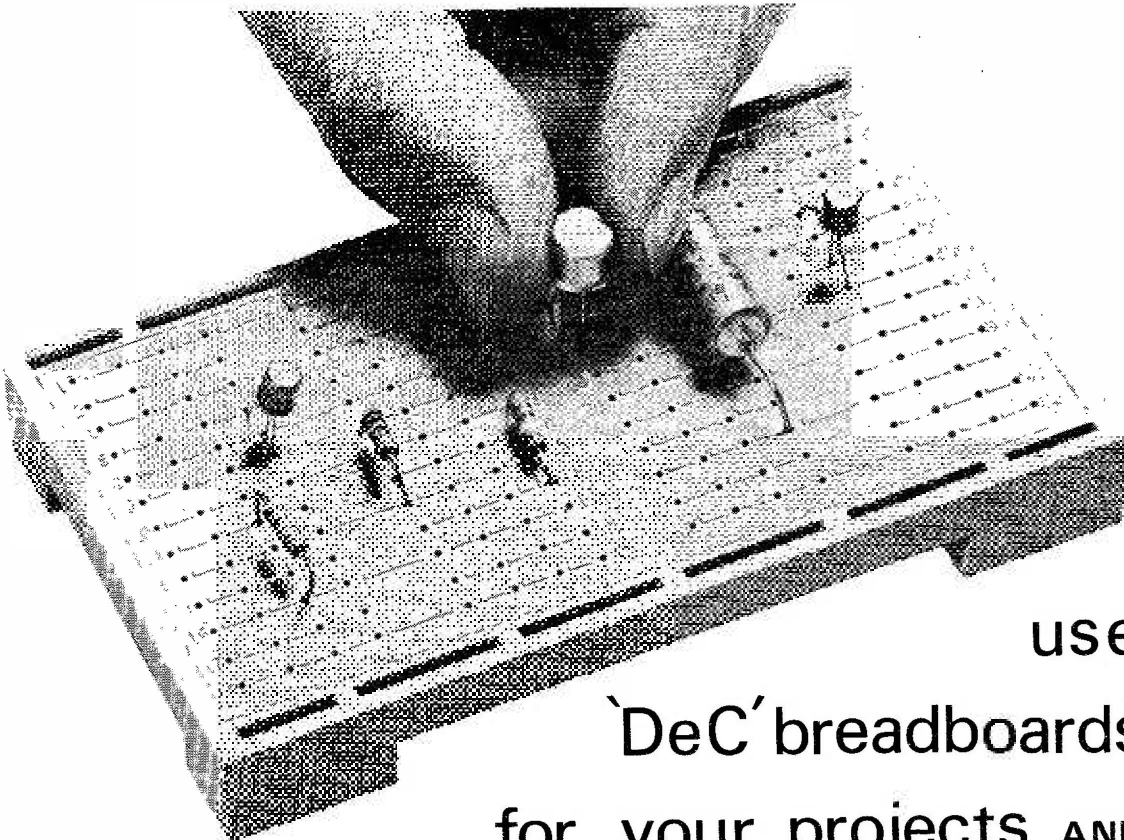
We were now rather jubilant and applied the device between the gram (with the Deram cartridge) and the SP4A input.

ACID TESTS (SOUNDS)

At first there was a very annoying hum. (To sober us somewhat.) However, it was deduced that the now initial gain would invite hum pick-up at the gram. The open tag-terminals below the deck had to be boxed in with thin sheet metal which was joined to the cable screening. The complete silence which followed was indeed golden. From then on we could only express genuine delight. The sounds that came forth when the stylus was applied to disc were quite magnificent and compared very favourably with much more expensive equipment.

1. With the stylus off the disc, no speaker noise could be detected until the preamplifier gain controls were taken up to $\frac{3}{4}$ maximum. A slight hiss did then begin to appear but *playing* at such a level would have blown the house down.

2. Using the Decca stereo check-out disc. Gain controls $\frac{1}{4}$ maximum. Bass and treble controls midway. All tests on the disc were passed with flying colours. Very particularly, the lowest bass tone was now, not



use
'DeC' breadboards
for your projects AND

SAVE MONEY NOW

S-DeC

PRICES SLASHED!

Unit Pack (includes control panel, S-DeC, accessories, Project booklet) **now at 20/-** DeCSTOR Pack (2 S-DeCs, 1 control panel, tray for components, Project booklet, accessories, in black storage container) **now only 50/-**.

4-DeC Pack (4 S-DeCs, 2 control panels, Project booklet, accessories in black storage container) **now only 78/-**.

T-DeC

REDUCED PRICE—7/6 OFF!

T-DeC Unit Pack now available to the amateur, 208 connection points, 38 junction regions. Accommodates ICs using standard carriers. What a bargain at special price of 42/6 with coupon below.

SPECIAL T-DeC OFFER COUPON
Take this coupon to your stockist who will supply one T-DeC for 42/6.

OFFER CLOSES 31st, DECEMBER, 1970

In case of difficulty post coupon direct to:

S.D.C. ELECTRONICS (SALES) LTD.

34 Arkwright, Astmoor Industrial Estate, Runcorn, Cheshire. Tel: Runcorn 65041

Please supply ...... S-DeC Unit Pack, ... DeCSTOR Pack, ... 4-DeC Pack and ...... T-DeC Unit Pack. I enclose £........... in payment.

only present but at *the same amplitude as the pilot tone.*

3. Using a phase four "spectacular" disc. I can only describe the result as *just that.* All the nuances were present and the strings sailed up into sweet crescendo without a trace of poor compliance "fuzz." (Thank you, Deram.)

4. Really "belting" it (sorry neighbours, for this one). The gain controls were turned up until the crockery began to dance. The hum level between tracks was barely discernable.

I returned to my home with one of those rare feelings of real satisfaction and Reg has since written to say that he now considers it really worthwhile to start buying complete operas on disc. Perhaps that is the best recommendation for the cartridge and the device.

TECHNICAL NOTES

Voltage Supplies. Where a 15V *stabilised* supply is available, R7, C4 and the zener diode can be omitted. For supplies of 18V and upward they should be included. R7 is a current limiter (to protect the zener) and it's value should be in proportion to the supply used. I suggest that R7 should be 500Ω for an 18V supply. For higher supplies the value should be increased in the ratio of 500Ω per 6V. i.e. 24V—1kΩ, 30V—1·5kΩ and so on.

For stereo, I duplicated R7, C4 and D1 but a single combination can be used to supply both channels *provided that R7 and D1 are $\frac{1}{2}$W types.*

A *chassis negative* version of the device can be arranged by transferring R7 to the *upper (Fig. 1) rail* and transferring the screening (shown dotted) and the chassis-connecting solder tag (Fig. 2) to the *lower rail* i.e. the polarity and potential difference remain the same but the lower rail and chassis become zero volts and the upper rail becomes a positive number (e.g. +24V).

Device Current. Most mains power supplies should be capable of continuously delivering the small extra current without distress. However, small capacity batteries, if used, would become drained fairly rapidly, (10mA per channel).

Gain. The potential divider formed by R4 and R5 determines the optimum d.c. conditions at Tr1 source. Without C5 and R8, the gain of the device would be 15. i.e. R4 divided by R5.

I cannot envisage any modern ceramic cartridge output/amplifier input sensitivity differing so greatly as to require such a figure and I do not, in any case, advise such usage. However, the facility is there to allow a choice of gain factor as follows—C5 forms an a.c. bypass (without upsetting the d.c. conditions at Tr1 source). The choice of R8 value thus determines the gain factor which now becomes *the parallel sum of R4+R8* divided by R5. The gain for Fig. 1 was calculated to be 2·5 but actually resulted as 2·6 (R8, 820Ω). To save mathematics, R8 could temporarily be a non-inductive, 5kΩ, variable resistor. Optimum gain position for a particular cartridge could be found, the resistance measured and the variable then replaced by a fixed resistor of the nearest preferred value.

The device was not intended as an attenuator and would be rather wasted at less than unity gain (R8, 360Ω). I do not recommend an upper gain factor in excess of 7·5 (R8,4·7kΩ) as already stated, the device has only been tested at a gain of 2·6 and this figure necessitated additional screening of the gram output tags to stop hum pick-up.

High Input Impedance. Among its many assets, the field effect transistor is particularly useful in this respect. It is, as nearly as possible, a solid state triode valve (without the inconvenience of heaters). The gate can be considered to have the same effect as the signal grid of a triode. Perhaps "transistor" is a misnomer? In the device, Tr1 and R1 present an impedance greatly in excess of 2MΩ and the Deram cartridge at any rate, thrives on it.

CONSTRUCTIONAL NOTES

All my resistors were $\frac{1}{4}$W, 5% but R7, if *singular* for stereo, should be $\frac{1}{2}$W.

For C1, I used 200V paper tubular types as they were available at the time but much lower voltage types such as mica sandwich or plastic film will be physically smaller and do the job equally well. C2, C3 and C5 were 16V d.c. rated. For C4 I used a rating greater than the supply voltage (to cope with initial surge).

If duplicated for stereo, the zener diodes can be 250mV types but if D1 is *singular* for two channels it should be rated at 500mW. The transistors should be as Fig. 1. I cannot vouch for equivalents.

The pin-boards were as Fig. 2, the dots being the pin positions and the rails and four short interconnections were of 24 s.w.g. tinned copper wire. The only coloured wire actually attached was the longer blue to extend the −24V supply (through matching holes in the twin housings) to the second board. The other "wires" are included for identification purposes only.

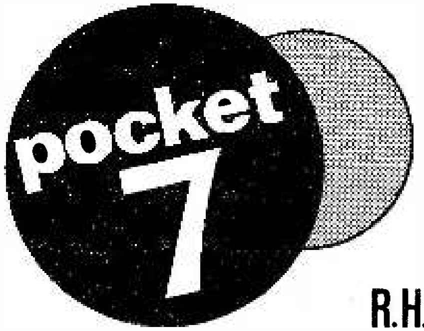
My housings were rather hurriedly made from two, 2 ounce tobacco tins, each $4\frac{1}{4}$in.×$3\frac{1}{8}$in.×$\frac{5}{16}$in. deep. Holes to match 1, 2 and 3 of each board were made in the bottoms of the tins and furnished with 6BA×$\frac{3}{4}$in. screws. These were fixed, first by one nut each followed by two more to form stand-off separators between tin bases and boards.

The tins were fixed together (on their long sides) by 6BA screws and nuts but with the thickness of four washers separating them to allow both lids to go on. Small, matching holes, were made at half depth and as near as possible toward the intended *output* end, in the joined sides (−24V extension wire holes). Five, $\frac{1}{4}$in. dia. holes were made at half depth in the ends of the tins i.e. one in each compartment input end, one in each compartment output end and a single fifth one in one only of the output ends (power cable hole). The projecting pins on the undersides of the boards were snipped off short and the boards placed in position over the stand-off uprights, then fixed down with final nuts.

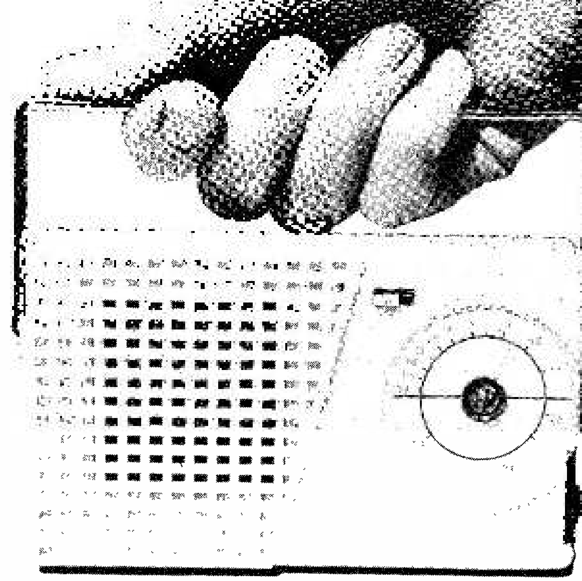
As shown in Fig. 2, the solder tags thus commoned both positive rails to chassis. A length of blue, insulated, flexible wire was used (through the small holes in the joined sides of the tins) to common the two negative rails.

All five connecting cables were made from screened coaxial cable. These were passed through the $\frac{1}{4}$in. holes and the insulated inners were soldered to the appropriate input, output and power pins. The screening of all five cables was made off into short tails which were soldered to the inside of the tins. This served the double purpose of making all screening commonly positive and making cable "anchors." The lids were applied to the tins, the free ends of the cables attached appropriately to gram, preamplifier and power pack and we were in business. ■

LUXEMBOURG BANDSPREAD



R.H.LONGDEN



THIS compact receiver, constructed in a readily available case, measures approximately $5\frac{1}{2}$in. x $3\frac{1}{4}$in. x $1\frac{5}{8}$in. external dimensions. The use of seven transistors—all popular types—results in adequate volume from quite a large number of transmissions.

Usual medium wave coverage is provided, and in addition a band which covers about 1650-1400kHz or the high-frequency end of the medium waves. This is useful for easy tuning of those stations which come at the extreme h.f. end of the usual m.w. band and where tuning is difficult.

CIRCUIT DETAILS

Figure 1 is the circuit; L1 is the internal ferrite rod aerial. Transistor Tr1 is the mixer with oscillator coil L2. S1 and S2 are sections of the band-switch. When S1 is at "M.W.", VC1 tunes L1, for usual m.w. coverage, and S2 is at "M.W.", so that VC2 tunes the oscillator coil L2. TC1 is the aerial trimmer, TC2 the oscillator trimmer, and C3 the oscillator padder.

When S1 is in the "LUX" (Luxembourg bandspread) position, TC3 is in series with VC1, while S2 places C4 in series with VC2. The full swing of VC1/2 now covers a narrow band. TC3 is adjusted so that the tuning of L1 tracks with that of the oscillator coil.

Tr2 and Tr3 are AF117 intermediate frequency amplifiers and three single-tuned miniature i.f.t's. are employed. This section has good gain, and the small i.f.t's are easily accommodated.

D1 is the usual diode detector and applies automatic gain control bias through R6 to Tr2. VR1 is the audio gain control.

Tr4 is the first a.f. amplifier, followed by the driver Tr5. Both these stages are OC71's, and they give considerable amplification with little noise. Tr6 and Tr7 are OC72s, operated as single-ended push-pull output, feeding the speaker through C15. These transistors give plenty of volume for a pocket receiver, while the current drawn is small, so that the internal battery has a long life.

FORM OF CONSTRUCTION

The speaker is mounted inside the case, and two flexible leads from the receiver are soldered to it. The receiver itself is constructed completely on a 5×3in. paxolin panel. The larger components are on the back of this panel, with most of the wiring and some smaller items on the front.

When the panel is inserted in the case the volume control and tuning capacitor spindle project through the apertures provided, and the panel is fixed with three 6BA bolts, which pass into threaded mounting pillars already incorporated in the case. The back is a snap fit, and the chrome handle included may be used for carrying, or turned to support the receiver upright.

Quite a number of components have to be accommodated, so it is essential to use the small resistors and capacitors which are made for transistor equipment.

NOTES ON WIRING

Because of the small free space between some items, neat soldered joints are required. In many places the wire ends of resistors and capacitors can be used for connecting purposes. Elsewhere, leads are best made with thin tinned copper wire (such as 26 s.w.g.).

All leads and wires are insulated with sleeving, small 1mm sleeving is probably most suitable. For easy identification of leads when building, and afterwards, blue sleeving was put on each transistor emitter wire, green sleeving on each base wire, and orange sleeving on collector leads.

For identification of circuits within the receiver, it is very helpful to use black sleeving for the negative line, with red (or orange) for the positive line. A different colour is used with other connections. Sleeving which does not melt when soldering is strongly recommended.

SPEAKER MOUNTING

A piece of $\frac{1}{16}$in. thick paxolin is cut to the dimensions shown in Fig. 2. The speaker fixing holes are countersunk for the heads of short 6BA bolts. These are put in place and the paxolin with bolts is cemented inside the case. When the cement is dry, the speaker can be placed on the bolts, and held with washers and nuts.

PREPARING THE PANEL

Dimensions for this are shown in Fig. 3. A hole to

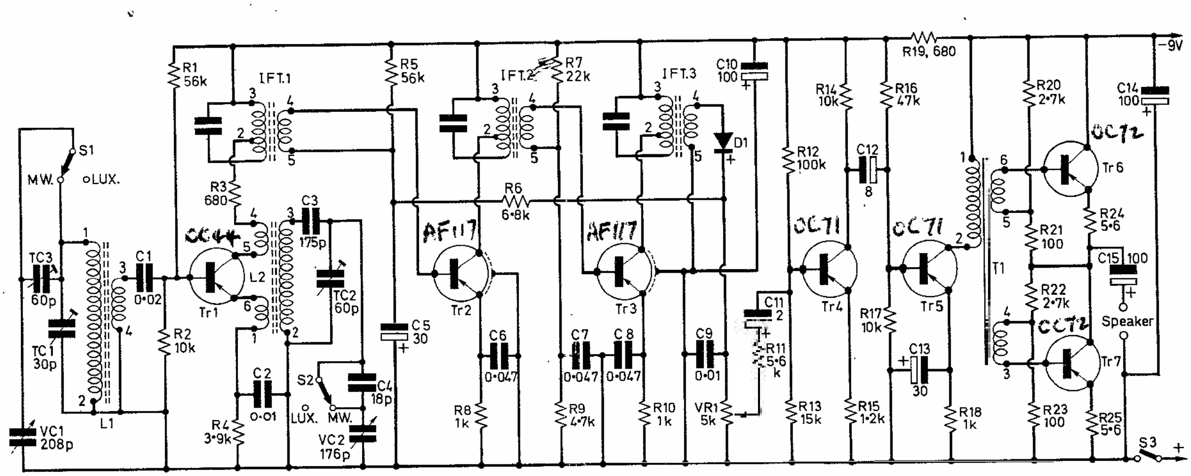


Fig. 1: Circuit of the Luxembourg Bandspread Pocket 7.

★ components list

Resistors

R1	56kΩ	R14	10kΩ
R2	10kΩ	R15	1·2kΩ
R3	680Ω	R16	47kΩ
R4	3·9kΩ	R17	10kΩ
R5	56kΩ	R18	1kΩ
R6	6·8kΩ	R19	680Ω
R7	22kΩ	R20	2·7kΩ 5%
R8	1kΩ	R21	100Ω 5%
R9	4·7kΩ	R22	2·7kΩ 5%
R10	1kΩ	R23	100Ω 5%
R11	5·6kΩ	R24	5·6Ω
R12	100kΩ	R25	5·6Ω
R13	15kΩ		

All resistors ¼ watt, 10% except where indicated.
VR1 5kΩ miniature log. pot. with switch.

Capacitors

C1	0·02μF	C9	0·01μF
C2	0·01μF	C10	100μF 12V
C3	175pF 2% silver mica	C11	2μF 6V
C4	18pF silver mica	C12	8μF 6V
C5	30μF 6V	C13	30μF 6V
C6	0·047μF	C14	100μF 12V
C7	0·047μF	C15	100μF 12V
C8	0·047μF		

VC1/VC2 208/176pF Jackson ganged.
TC1 30pF trimmer
TC2 60pF trimmer
TC3 60pF trimmer

Semiconductors

Tr1	OC44	Tr5	OC71
Tr2	AF117	Tr6	OC72 } matched pair
Tr3	AF117	Tr7	OC72 }
Tr4	OC71	D1	OA81

Coils and Transformers

L1	MW5FR	(Denco)
L1	TOC.1	"
IFT1	IFT13	"
IFT2	IFT13	"
IFT3	IFT14	"
T1	Driver transformer Home Radio Cat. No. TR61	

Miscellaneous

Loudspeaker, WB 2½in 75Ω; S1/S2, miniature 2-pole slide switch; 5 x 3in case with dial Electronics (Croydon) Ltd, 266 London Road, Croydon, Surrey; 5 x 3 x $\frac{1}{16}$in paxolin; 1mm sleeving; etc.

clear the speaker is cut with a washer-cutter or fret-saw. The three holes marked **X** are for short bolts which secure the panel inside the case. If these or other holes are drilled in slightly incorrect positions, a correct fit can be achieved by using a very small round file to enlarge or elongate the holes. Alternatively cut a postcard as a template, put this in the case, and mark it into the fixing bushes with a pointed tool. The card can then be placed on the paxolin, and drilling positions marked through in the correct positions.

The hole **Y** is for the volume control, which is held with a single small bolt and projects through a side slot.

The two holes **Z-Z** are for the miniature slide switch. It was found necessary to file this to reduce the thickness of its operating knob to suit the slot already formed in the case front.

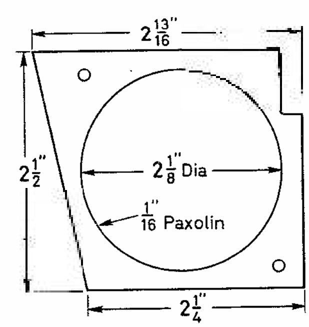


Fig. 2: The speaker mounting paxolin panel.

The ganged capacitor is held with three 4BA bolts. It must be placed slightly high so that a PP4 type battery will rest easily between it and the case. If VC1/2 is fixed with its spindle centrally in the cabinet hole, only the smaller type of 9V battery can be accommodated.

A tag for earthing is placed under one bolt head when the capacitor is finally secured. The bolts must be extremely short or must have washers under their heads, so that they do not project and foul the inner plates of the capacitor. The capacitor should have a short, flat-sided and threaded spindle.

Figure 3 also shows drilling positions for the oscillator coil and i.f.t's. Paper can be pressed against the pins, then held on the paxolin board. Pin positions can then be marked through with a sharp tool so that drilling is accurate.

Slots for the trimmer tags and TC1 feet are made by drilling small holes side by side.

It is best to drill as many holes as possible before fixing any components in place. Small holes for wires can be made afterwards, during construction, with a

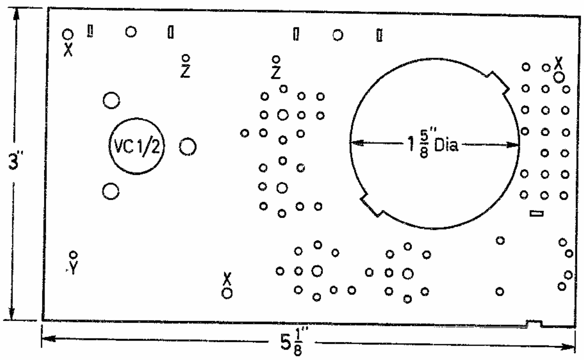


Fig. 3: The main panel drilling details.

$\frac{1}{16}$in. drill. The panel should be fitted in a small vice while doing this, or supported so that other items, already fitted, are not damaged. It was found very helpful to place long 6BA bolts or screwed rods through the holes **X**, locked with a nut each side of the panel. The panel may then be rested upright, or will stand with either surface uppermost for wiring.

When wiring, be sure to leave clearance round the speaker, and for the bolts holding this item. There is a free space of about $\frac{5}{16}$in. between the panel and front of the case inside, and about 1in. from the panel to the case back. With reasonable care, all wiring and components can be kept within these limits.

Some care is necessary, because there is little free space. The following notes on this part of the construction should be useful.

L2 and i.f.t's. L2 has six pins, with slightly closer spacing between 1 and 2, 5 and 6, which are placed as in Fig. 5. The i.f.t's have five pins, arranged as in Fig. 5. All these items have two can tags, which pass through small holes. These tags are wired together and to the "earth" (positive) line.

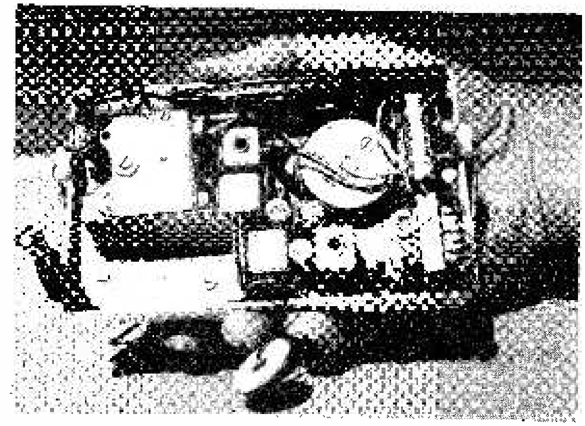
VR1 and S3. The five tags lie flat on the board, as in Fig. 5. The control is secured with an 8BA or 10BA countersunk headed bolt which is cut or filed off so that it does not project into the space required for the battery.

S1/S2. This is secured with two 8BA or 10BA countersunk headed bolts, with nuts **Z-Z**, Fig. 4. Spacers (or lock nuts) are put between the switch flange and paxolin.

Driver Transformer. The projections on T1 pass through small slots and are bent over. Tags come as in Fig. 5, and are numbered 1 to 6.

Trimmer TC1. The "earth" tag of this is soldered directly to the frame of VC1/2, Fig. 4. This really requires a large iron (say 60 watt). If only a small iron is to hand, solder TC1 to a tag which can be bolted near VC1/2, and connect this to the frame (MC in Fig. 5).

Other Trimmers. In addition to slots for the



Internal view of the completed receiver.

tags, a central hole is necessary under each to clear the screw.

Resistors. Shape and cut the wire ends to suit, before fitting these. Put sleeving on all leads.

Electrolytic Capacitors. Each must be fitted with the polarity shown. Miniature electrolytic capacitors generally have some form of external insulation. This is essential as otherwise contact between the metal cans (negative) and other leads could prevent the receiver working.

Other Capacitors. These can be fitted either way round, and the $0 \cdot 047\mu$F miniature low voltage discs could be $0 \cdot 04\mu$F tubular types.

Transistors. The leads from these are all left at such a length that the tops of the transistors come about level with the tops of the i.f.t's.

WIRING

Figure 4 shows connections etc. at the back of the panel, and the front side is shown in Fig. 5.

It will be very helpful to take a coloured pencil, and run over each lead and component on this drawing as it is fitted and soldered. If this is done systematically, it will always be clear what has been done, and what items and leads remain to do. It will also avoid any connection being omitted.

Wiring is easier if very small sleeving is used, so that it can pass through the holes in the paxolin. This avoids having to fit separate lengths of sleeving on each side of the board.

No heat sinks are needed when soldering D1 and the transistors, provided these wires are not too short. The iron should be at full temperature, and is removed immediately the joint is made. Lengthy heating of resistors, capacitors or other items may also cause damage to them. Usually, the iron should only need to be in contact with the joint for a second or two.

The junction of C1, R1, R2 and Tr1 base are anchored by the wire end of one resistor going through a small hole, but no connections go to this point on the other side of the board.

The emitter lead of Tr6 is soldered to R24, Fig. 4, but no connection is made to this point the other side of the board. R18 is soldered to the negative lead of C13, and so only a single wire comes through to the panel front, Fig. 5. Use thin flex for the battery leads, with the correct clips. Glue cardboard to keep the battery a little away from VC1/2 and

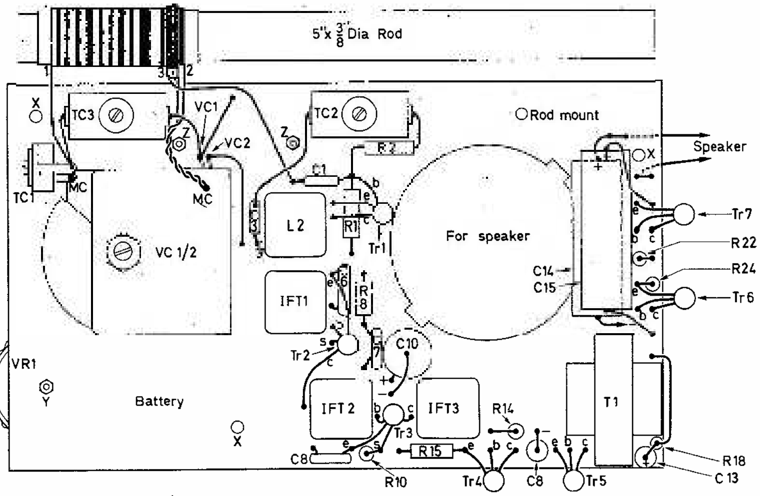


Fig. 4: The wiring at the back of the paxolin panel shown in Fig. 3.

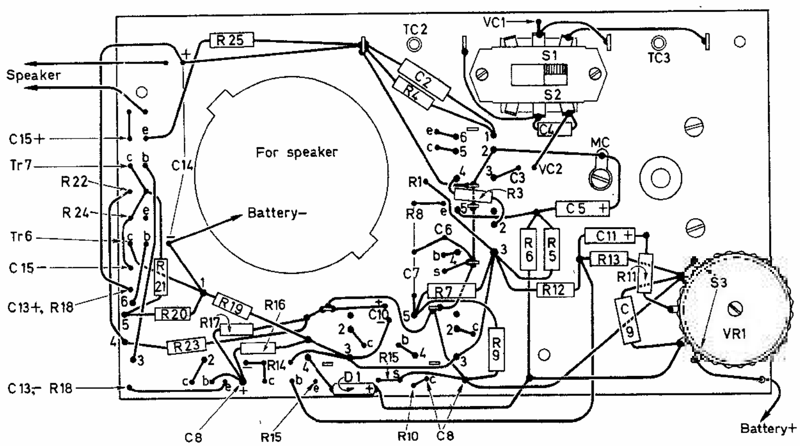


Fig. 5: The wiring at the front of the circuit board.

i.f.t.2. If metal parts of a battery clip touch i.f.t.2, this will put the receiver on or short-circuit the battery.

FERRITE ROD AERIAL

Connections for this are shown in Figs. 1 and 4. The rod lies above TC2 and TC3, with a little clearance. A mount with a V-shaped notch to take the rod is made from wood or other insulating material, and screwed at the hole shown in Fig. 4, near the speaker. Tape holds the rod to the mount.

The tuned section of the aerial is that between 1 and 2, and the coupling winding is 3 and 4. Ends 2 and 4 are twisted together, insulated with sleeving, and soldered to the frame of VC1/2, or to a tag bolted to the frame.

End 1 goes to TC1 and TC3 as in Fig. 4, from where a lead passes to S1, as in Fig. 5. End 3 is soldered C1, Fig. 4.

The tuned winding consists of Litz wire, which has many individually insulated strands of fine wire, so it is advisable to solder to the ready prepared ends. If this wire is cut, all strands have to be cleaned and soldered together, which may prove difficult.

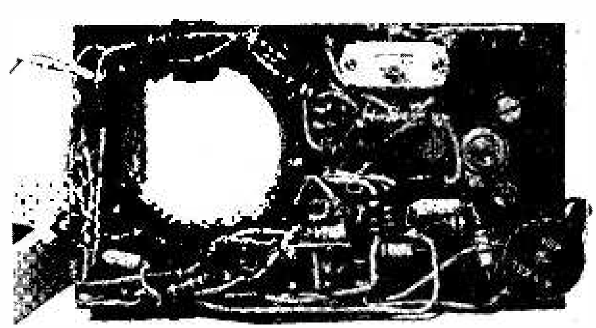
The winding should not be pressed on to the adjusting screw of TC3. If there is danger of this, place insulating tape at this point. Trimmers TC2 and TC3 can be reached with a small bladed tool or the rod can be swivelled a little clear, for initial adjustments to these.

The end of the rod near TC3 was further supported by a stout wire loop. This should not be a complete turn electrically, but goes about three-quarters round the rod, and is soldered to a tag, which is held by the fixing screw which passes through the adjacent hole **X**.

ALIGNMENT

The cores of the three i.f.t's have first to be aligned at about 465kHz. If a signal generator is available, tune it to provide a modulated output of this frequency, and couple it to the base of the Tr1. Output from the receiver can be checked by ear or preferably by using an audio output meter or observing the battery current with a d.c. meter. Make adjustments for maximum current, but keep this down to 20mA or so by reducing the generator input.

If no signal generator is to hand, adjust the cores



The wiring on the finished receiver.

for best reception of a steady signal tuned in, and repeat this later with a weak transmission.

The receiver was adjusted to provide coverage of 575-1450kHz on "MW" (about 520-210 metres) and 1400-1625kHz (about 215-185 metres) on "LUX". To do this, close VC1/VC2, set the generator to 575kHz, and rotate the core of L2 until the signal is tuned

—*continued on page 747*

HARMONIC SPOTTING SIGNAL GENERATORS

R. F. GRAHAM

A SIGNAL generator which provides harmonic "pips" at regular frequency intervals is much easier to build than a tuned signal generator, and also much more accurate. It does not have to be calibrated throughout its working range as required with the conventional, fully tunable signal generator, because all its outputs are multiples of one or more known frequencies.

A comparison between the popular type of signal generator, and the harmonic marker, will help to differentiate between their modes of operation.

Tuned Signal Generator

This will have several switched frequency ranges, each tuned with a variable capacitor and with a scale upon which frequencies are marked. For average long, medium and short wave use, the ranges may cover from about 2000 metres to 10 metres, or 150kHz to 30MHz.

One advantage of this type of generator is that it can be tuned to give an output at any wanted frequency within its range. Outputs such as 1·62MHz, 470kHz or any other frequency can be had, for intermediate frequency circuit alignment. The generator can also be used to check band coverage, and for the trimming and alignment of a receiver. Though harmonics are sometimes used for higher frequencies, the output is usually at the fundamental frequency.

A disadvantage of this type of generator is that each fundamental band requires a separate inductor, and each band has to be individually calibrated which can be a problem to a user with little other equipment. Accuracy, with a large dial, would not be better than 1 or 2% except with laboratory-type generators.

Harmonic Marker

This has no variable tuning (except for initial adjustment). A crystal, or capacitor-inductor combination, operates at some fixed frequency and its harmonics are then used for calibration and other purposes. For example, a 100kHz marker will give outputs at multiples of 100kHz, such as 600, 700, 1400 and 1500kHz, to allow calibration of a medium wave receiver band from 600kHz (500 metres) to 1500kHz (200 metres).

Primary advantages are a simple circuit and extremely high accuracy, while there are no individual tuning ranges on the marker requiring calibration. Accuracy can easily be within a few parts per million, quite unattainable with a tuned type of generator and its accuracy is well within the limits required for the calibration of amateur transmitting equipment.

The main disadvantage arises from the fact that all outputs are "round" figures or multiples, intermediate figures such as 455kHz not being available. However, the output allows alignment of an r.f. stage for example, if done at round figures such as 1400kHz and 600kHz.

Another disadvantage is that harmonics have to be identified, but this is generally easy although their strength falls as the frequency rises, but they can be usable up to 30MHz. They give very few calibration points at

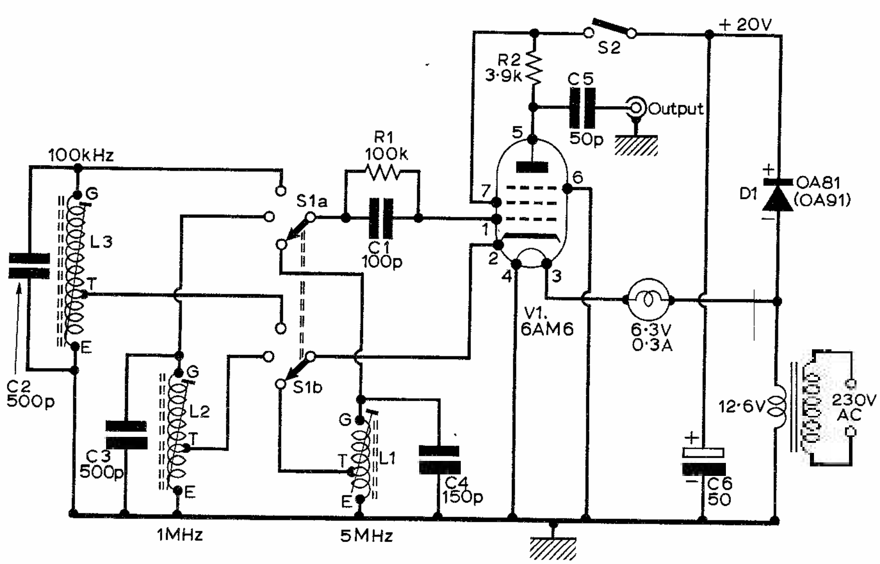


Fig. 1: Circuit of the single valve harmonic marker using tuned circuits.

low frequencies, such as 150-300 kHz, so are most useful over the medium and short wave bands.

It is clear that a harmonic marker can be a very useful instrument. Two circuits are described here, one very simple but extremely handy, the other more comprehensive.

Frequency Determining Circuits

For high accuracy without too much checking, a harmonic marker has one or more crystals. These maintain their frequency with only extremely small errors, and are used in the comprehensive marker.

When experimenting with such circuits, it was apparent that stable L/C tuned circuits could be used. These save the expense of crystals, and can easily give enough accuracy for general purposes, so they are employed in the simpler marker.

The simple marker can be identified if necessary by switching it on and off.

The larger marker has a neon which modulates the amplifier and thus gives a tone on the carrier.

Single-Valve Marker

The circuit for this is shown in Fig. 1 and it has very few parts. A 3-way switch selects L1 for 5MHz, L2 for 1MHz, and L3 for 100kHz. These inductors are core-tuned. A range can be omitted if its harmonics are not wanted. Output is via the isolating capacitor C5. An isolating transformer supplies power for the valve heater and the positive supply.

With a home-built receiver 100kHz harmonics were heard to 5MHz, 1HMz harmonics to 10MHz, and 5MHz harmonics to 30MHz.

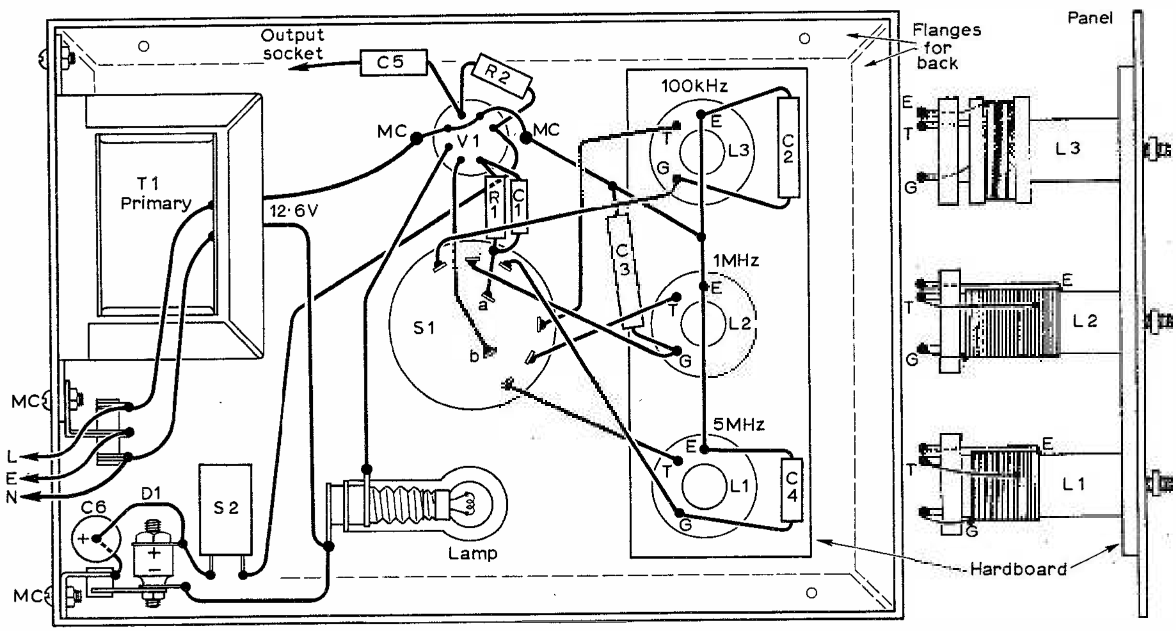


Fig. 2: Under chassis wiring of the single valve marker.

A harmonic marker need have *one* frequency determining circuit only, often 100kHz. Then harmonic pips arise at multiples of 100kHz.

For higher frequencies, the pips fall very close together on the tuning scales of a general coverage receiver. So a second higher fundamental frequency and its harmonics can be useful. The simple marker (Fig. 1) has three fundamental frequencies that for 100kHz giving harmonics as already described. The 1MHz circuit gives signals at 1, 2, 3, 4, 5MHz, etc., with the third circuit providing pips at 5MHz intervals.

The larger marker (Fig. 3) has a 100kHz crystal, and an h.f. crystal to identify 100kHz frequency points within the amateur bands up to 30MHz.

Identification

A means of identification of the pips from a harmonic marker is useful, because the receiver will probably pick up other signals even with the aerial disconnected.

Construction

The chassis is four-sided with flanges, and is closed by fixing a plate with self-tapping screws, the core-adjusting screws projecting above.

Wiring is straightforward, and is shown in Fig. 2. No mains on/off switch was included, as the marker can be plugged in when required. A mains toggle switch could be placed in the transformer primary.

The coil formers are ½ in. in diameter, with pins and adjustable core. Windings are shown in Fig. 2.

<u>L1:5MHz.</u> 20 turns of 24 s.w.g. enamelled wire, <u>layer wound</u>, and the tapping T is 5 turns from E.

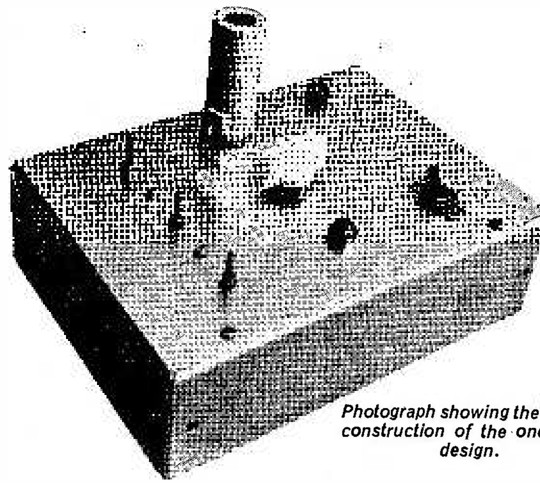
<u>L2:1MHz.</u> 58 turns of 34 s.w.g. enamelled wire, <u>layer wound</u>, with the tapping 8 turns from E.

Smear the formers lightly with adhesive before winding. Windings commence as near the tagged end of the former as possible.

L3: 100kHz. 500 turns of 36 s.w.g. enamelled wire, the tapping T being 50 turns from E. Cut two discs of paxolin or other insulating material, with ½in. holes to fit the former. Cement one disc near the tagged end, and the other to leave ¼ in. winding space. Take end G through a small hole near the centre of one disc. Wind on 450 turns, pass a loop through a small hole for the tapping T, and wind on the further 50 turns, ending at E.

Three ½ in. holes are made in a piece of insulating material about 4×1½ in. The inductors are cemented in these, with the threaded rods passing through the metal box. Put a spring washer and 6BA nut on each rod. The ends of the windings are bared and soldered to the end pins of the formers.

Other details of wiring and construction should be clear from Fig. 2.



Photograph showing the simple construction of the one valve design.

Frequency Adjustment

As the purpose of a harmonic marker is to permit calibration, etc., of receivers, a receiver is brought into use to adjust the circuits L1, L2 and L3.

For L3, on 100kHz, tune a receiver to the 1500m (200kHz) BBC transmission. If an external aerial is used, and signal strength is too great, keep this down by using a temporary short wire as aerial. Place an insulated lead from the marker output socket near to the receiver, or its aerial or lead-in, or ferrite rod.

Adjust the core of L3 until a heterodyne whistle is heard in the receiver. Set the core to the zero-beat position. Rotating the core either way, from this position, should cause a tone which rises in pitch. Lightly lock the core in the zero-beat position, which means L3 is tuned to 100kHz, and its second harmonic falls on 200kHz.

Tune the receiver across the medium wave band when the marker signal should come in at multiples of 100kHz, as described. If necessary, reduce extraneous signals by removing the aerial connection.

The tuning scale of an uncalibrated receiver can be marked at 100kHz points. Identify one such point by reference to a known BBC transmission, then count up and down from it, putting in the actual frequencies.

Tune the receiver to the 1000kHz or 1MHz point found, and switch the marker to 1MHz. Rotate the core of L2 until the marker signal is correctly tuned on the receiver.

L2 can now be adjusted precisely by tuning the receiver to the 5th harmonic on 5HMz. Switch the marker off, and search with the receiver a little either side to find a 5MHz standard frequency transmission. Switch the marker on, and adjust L2

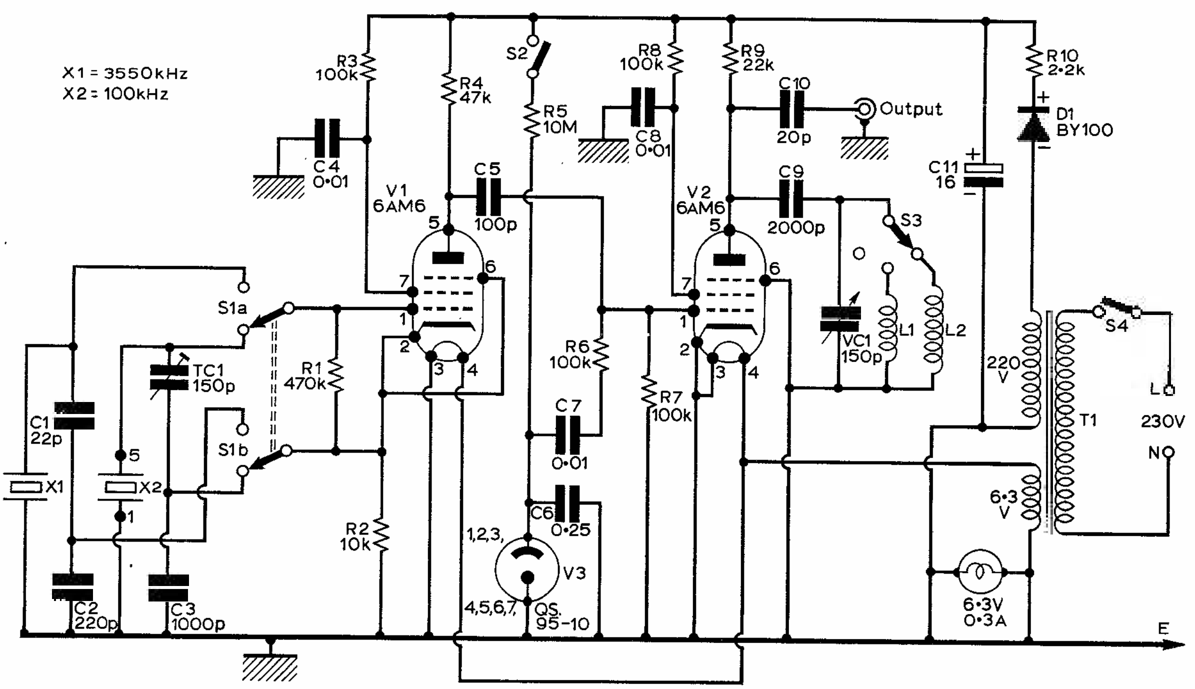


Fig. 3: In this circuit two valves are used with crystals to determine the marker frequencies.

to zero-beat. Then switch to L1, and adjust it for zero-beat, or 5MHz.

Check the core adjustments, and lock the cores. Before permanently calibrating a receiver from the marker, make a quick check of frequencies at one known frequency for each circuit, such as the BBC on 200kHz or MSF on 2·5MHz (for L3), and 5MHz (for L2 and L1).

Two Valve Crystal Marker

Fig. 3 is the circuit of this instrument and V1, a 6AM6, is the crystal controlled oscillator, with two crystals. The h.f. crystal, X1, is 3550kHz, giving outputs on 33·55, 7·10, 14·20, 21·30 and 28·40MHz. Crystal X2 is for immediate identification of 100kHz points in the 80, 40, 20, 15 and 10 metre amateur bands.

V2, another 6AM6, is a harmonic amplifier, increasing the signal strength of the higher order harmonics and is normally used untuned. The switch may, however, bring in inductors which can be peaked with the variable capacitor, to boost and identify high order harmonics. This makes 100kHz points available up to 30MHz, without too much difficulty. Resonance, or best signal strength, obtained with the variable capacitor, also identifies immediately the harmonic of the h.f. crystal. This proves useful occasionally with uncalibrated equipment.

Switching allows the neon V3 to modulate the harmonic amplifier grid, to identify the marker among other external signals. The ordinary type of neon mains voltage indicator lamp is not suitable.

X1 is the h.f. crystal, 3550kHz but numerous crystals in the 1·8MHz to 8MHz range were all found satisfactory in this circuit. X2 is the l.f. crystal, adjustment of TC1 allowing a change of a few cycles, for synchronisation with the BBC or MSF.

Construction

Components are on a $6\frac{1}{2} \times 4$in. chassis, as in Fig. 4. The rotary switches and lampholder secure panel and chassis together. The h.f. crystals mentioned fit a $\frac{3}{4}$in. 2-pin holder, and the 100kHz crystal requires an International octal holder.

The mains cord is anchored at a 3-tag strip, E goes to chassis, N to transformer primary, and L to switch.

When wiring V1, keep grid, switch and crystal leads short, and near the chassis, to avoid any chance of spurious oscillation. Pin 6 of the octal holder is merely used an an anchor point for C3.

Both sets of plates of the trimmer TC1 must be insulated from the chassis. No extra insulation is needed when fitting the trimmer listed. Its 6BA adjusting screw was replaced by a longer one, so that lock nuts could be put on, allowing adjustment from the rear.

With reasonably direct grid and anode leads, V2 was perfectly stable, both untuned or when resonated by VC1. Since VC1 is left in circuit, it is placed at minimum capacitance when using V2 untuned. Wiring an extra switch pole to disconnect VC1 did not seem worth while.

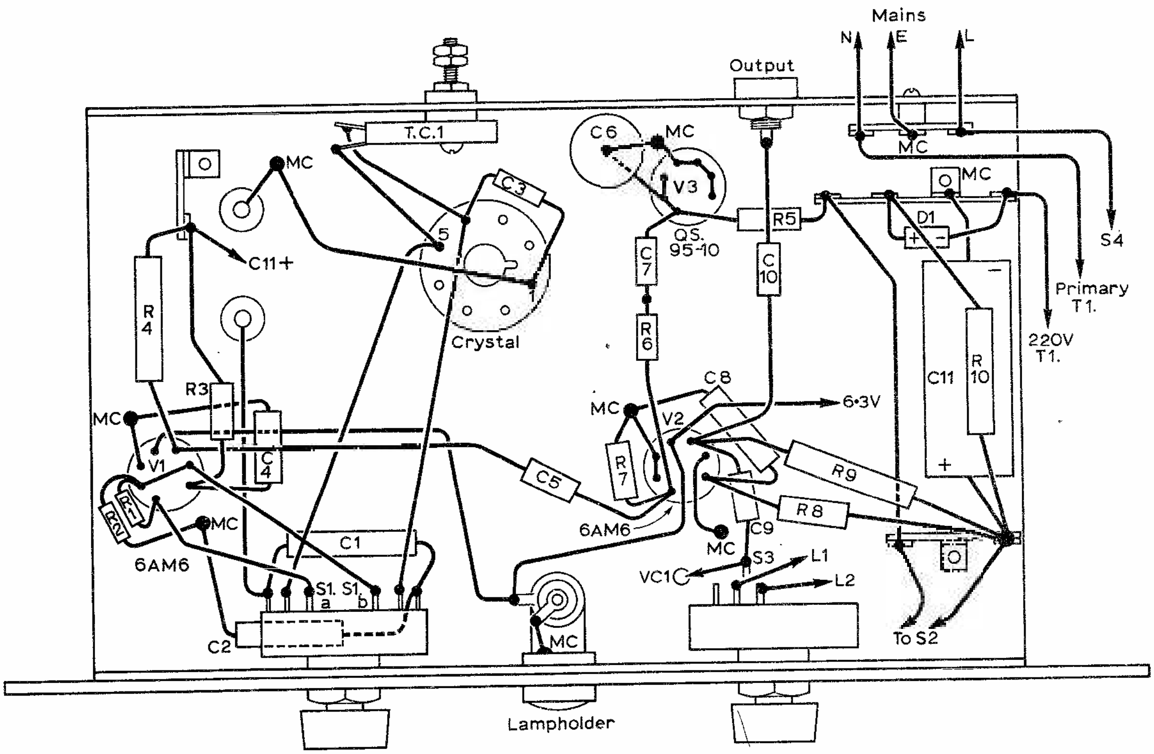


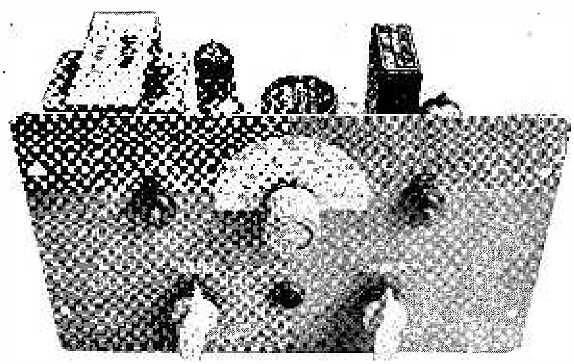
Fig. 4: Wiring details of the two valve crystal marker.

Inductors

Two ranges are provided, covering 5·5-15MHz, and 15MHz to 32MHz. The larger inductor has 32 turns of 26s.w.g. enamelled wire, layer wound, on a paxolin tube 1¼in. long and $^{7}/_{16}$in. in diameter.

The smaller inductor is self-supporting, and wound with 16s.w.g. tinned copper wire. It has 10½ turns, spaced to occupy ⅞in. winding length, and it is ⅝in. outside diameter. The ends of the 16s.w.g. wire are shaped to solder to the switch tag, and a chassis tag. The larger inductor is fitted with stouter leads, which support it.

A small scale is fixed so that a pointer knob on VC1 can be read against it. Known harmonics are tuned in on a receiver, and the signal peaked with VC1, so that the scale can be roughly calibrated.



The neat panel arrangement and compact layout are shown in this photograph.

Adjustment

Normally, adjustment of X1 is not necessary, and no means of altering this frequency is provided.

Adjusting TC1 allows the 100kHz frequency to be adjusted very slightly. Switch V3 off. Tune in the BBC 200kHz transmission and place the marker output lead near the receiver aerial lead, so as not to swamp the signal. A difference between the 100kHz crystal 2nd harmonic and BBC frequency

★ components list

Single Valve Marker

Resistors:

R1 100kΩ ½W 10%
R2 3·9kΩ ½W 10%

Capacitors:

C1 100pF S.M.	C4 150pF S.M. 2%
C2 500pF S.M. 2%	C5 50pF mica
C3 500pF S.M. 2%	C6 50μF 50V elec.

Miscellaneous:

Valve, 6AM6 with B7G holder and screen. Diode OA81 or OA91. Transformer 230V/12·6V 0·75A or similar. Dial lamp 6·3V 0·3A and holder. 3 Coil formers, ¼in. dia. with cores (Home Radio type CR22). Universal box 7 x 5 x 2in. with plate 7 x 5in. (Home Radio). On/off switch. Rotary wafer switch, 2-pole 3-way. Insulated socket.

Two Valve Crystal Marker

Resistors:

R1 470kΩ ½W	R6 100kΩ ¼W
R2 10kΩ ½W	R7 100kΩ ¼W
R3 100kΩ 1W	R8 100kΩ 1W
R4 47kΩ 1W	R9 22kΩ 1W
R5 10MΩ ½W	R10 2·2kΩ 1W

Capacitors:

C1 22pF S.M.	C7 0·01μF ceramic
C2 220pF S.M.	C8 0·01μF 350V
C3 1000pF S.M.	C9 2000pF ceramic
C4 0·01μF 350V	C10 20pF mica
C5 100pF mica	C11 16μF 450V elec.
C6 0·25μF 350V	TC1 150pF pre-set

Valves:

V1 6AM6 V2 6AM6 V3 QS95-10

Miscellaneous:

VC1, 150pF, miniature, air spaced tuning capacitor.
3 B7G valveholders and 2 screens.
Switch, 2-pole 2-way. Switch, Single pole, 3-way (Home Radio WS17 for both switches)
Switches, 2, on/off. Dial lamp 6·3V 0·3A and holder.
100kHz crystal and holder (QCC). 3·550MHz crystal and holder
Transformer (Home Radio TM26A) Dinkicase 8 x 5 x 5in. (Electroniques). Chassis 6½ x 4 x 2in.
Diode BY100 or similar. Knobs. Socket, etc.

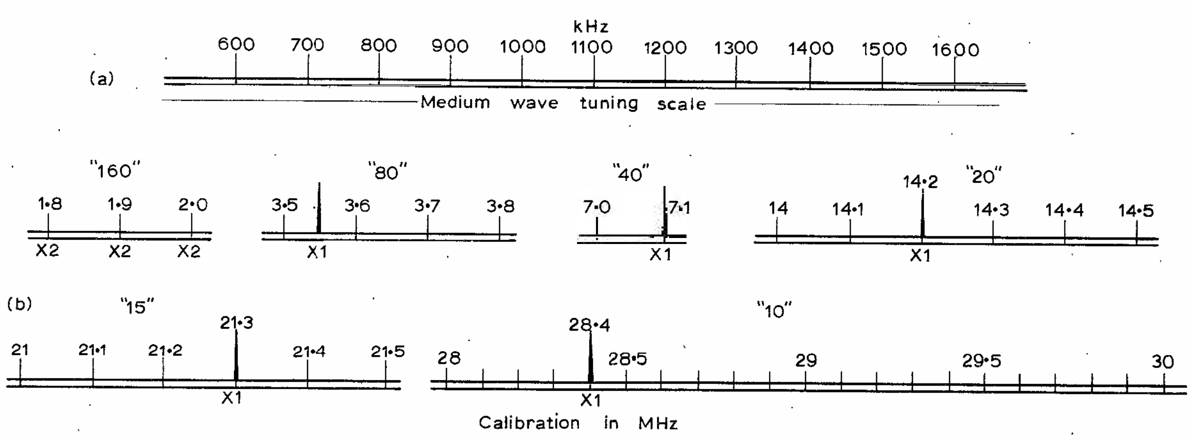


Fig. 5: Typical calibration points obtainable on the medium waveband and the amateur bands.

will be apparent as a fluttering, or rise and fall in signal strength.

Rotate TC1 to bring the beat (or difference) to the lowest frequency. An accuracy of one or two cycles per second is easily obtained, but there is no point whatever in achieving better than this, which is of far greater accuracy than ever required for ordinary purposes. The standard frequency transmissions on 2·5MHz or 5 MHz may be used instead of the BBC.

Receiver Calibration

For medium waves or relatively low frequencies, tune in the 100kHz crystal harmonics one by one. Fig. 5(a) is a m.w. scale marked in this way.

For higher frequencies, mark the h.f. crystal harmonics as a guide, then fill in as wanted with the 100kHz harmonics. Fig. 5(b) shows this method employed with an amateur band receiver, and also shows positions of the 3·55MHz harmonics. It will be realised that the crystal need not be 3550kHz. The frequencies which will be obtained with other crystals can be found by multiplying its actual or fundamental frequency by 2, then by 3, and 4, and so on, up to any wanted figure.

IF Alignment

IFT's may be peaked, without knowing the actual frequency, by using the crystal marker as a source of stable signals. Feed the marker harmonic into the receiver aerial circuit, tune it correctly with the receiver, then peak the i.f.t's.

RF Circuits

Select a harmonic near the low frequency end of a band, and adjust r.f. coil cores for maximum signal. Tune in a harmonic near the high frequency end of the band, and adjust trimmers. ■

MAXWELL

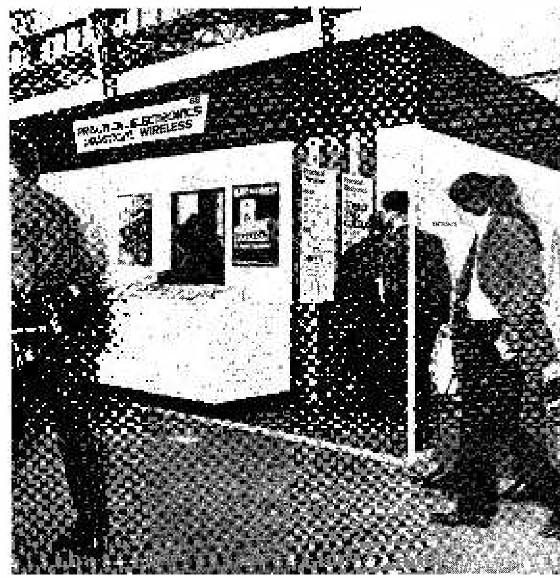
by G8DSH

"He can't be WX3MAS—that's our callsign!"

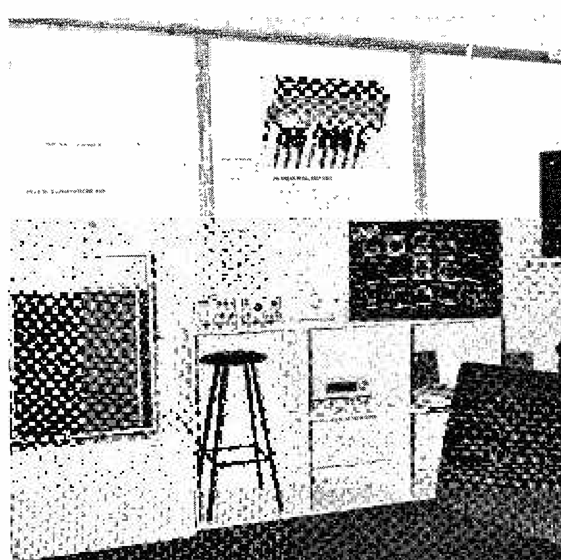
P.W. AT THE AUDIO FAIR

Practical Wireless was represented once again at the 1970 International Audio Music Fair, Olympia. We shared an exhibition stand with our Sister Magazine P.E. The Practical Wireless part of the display featured a selection of constructional projects of particular interest to audio enthusiasts. The 25/25 Stereo Amplifier was demonstrated together with the 25-50 Guitar Amplifier (our grateful thanks here to a pop group whose lead guitarist gave a musical rendering on a borrowed instrument). The P.W. Organ Pedal Base Unit was exhibited and a great amount of interest was shown in the Sound Effects Synthesiser (to be published in 1971).

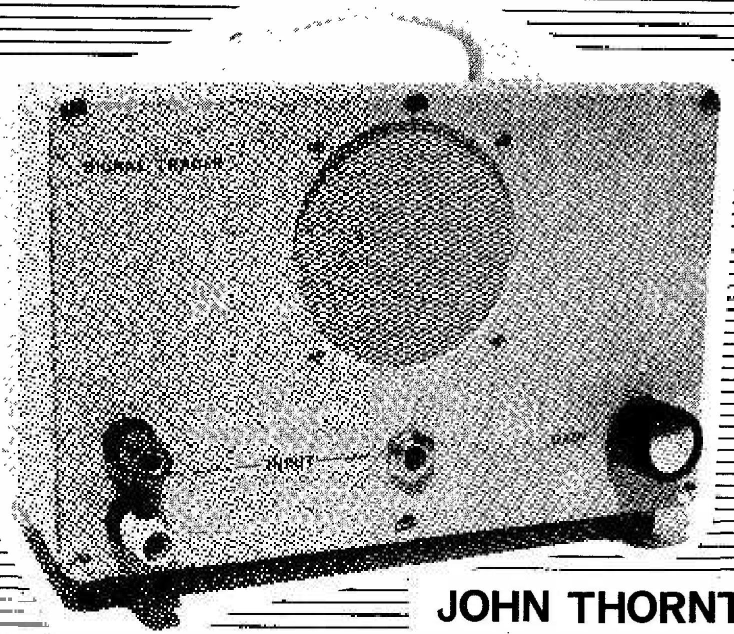
A special display was devoted to the Decca 3000 Series Audio System—the prize offered in the competition mentioned in our November issue.

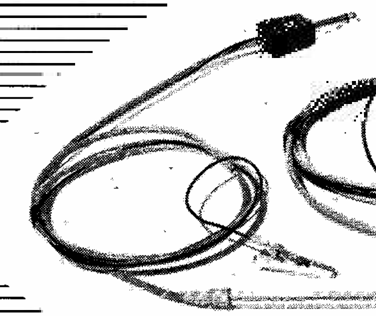


An outside and an inside view of the Practical Wireless stand.



SIGNA





JOHN THORNTON LAWRENCE

A signal tracer in its basic form consists of a test probe, an audio amplifier and a loudspeaker. Even in this form it has many uses, such as, tracing audio signals, hum, distortion, noise, etc., checking microphones, pick-up cartridges and as a null detector for an a.c. bridge.

The Signal Tracer to be described is one of a range of simple test instruments, the first two of which have been described recently in Practical Wireless, namely, a Transistor Tester (October 1970) and a CR Bridge (November 1970). The Signal Tracer is built into the large size Eddystone die-cast box and matches the previous instruments in style and appearance.

The versatility of a Signal Tracer depends on the accessories that are available for use with it. Three probes are included in the design and these are for use in a.f., r.f. and e.h.t. circuits.

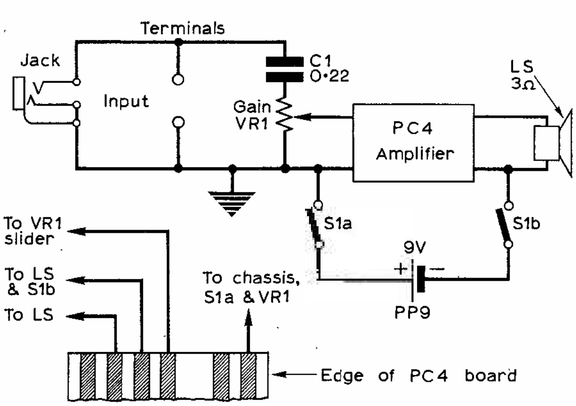


Fig. 1: Circuit of the Signal Tracer with connections of PC4 amplifier module

CIRCUIT DESCRIPTION

The circuit of the Signal Tracer is shown in Fig. 1. The input signal may be connected via the two input terminals or the jacket socket. The terminals are primarily intended for connection to the "Detector" terminals of the companion CR Bridge and the jack socket for the connection of the various probes, which are all fitted with jack plugs.

The input signal is a.c. coupled by C1 to the gain control VR1. This control has a double-pole switch attached, S1a and S1b, which enables the battery supply to be switched on and off. The signal from the slider of the gain control is passed to the input of the Amplifier Module, which is a Newmarket Type PC4. This amplifier was chosen because of its high input impedance of 220kΩ and its high sensitivity of 150mV input for an output of 400mW.

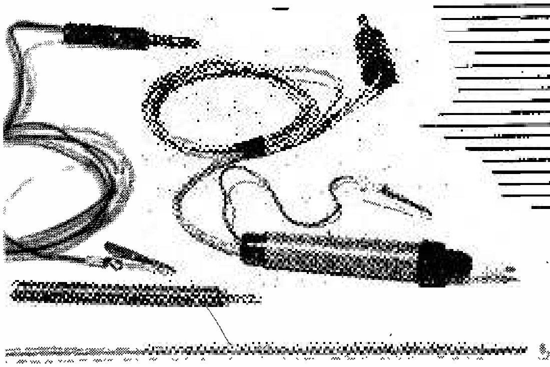
The loudspeaker used in the Signal Tracer is a Radiospares $2\frac{1}{2}$-inch type, but any alternative type may be used provided that it will fit physically into the space available, and that it has an impedance of between about 8 ohms and 35 ohms. The amplifier module requires a supply of 9 volts and this is provided by a single PP9 battery.

The a.c. probe, which is shown in Fig. 2, is a simple direct probe in which the probe tip is directly connected to the centre of the screened lead and through this to the live input, tip, of the jack plug. The earthy connection is made by a croc-clip lead connected to the earth tag, sleeve, of the jack plug along with the braid of the screened cable.

This probe is useful for tracing audio signals and the coupling capacitor, C1, in the Signal Tracer, provides blocking of any d.c. voltage which may be present at the point of test.

The r.f. probe, shown in Fig. 3, has a built-in detector/demodulator circuit for tracing signals at

AL TRACER



radio and intermediate frequencies.

Input signals are coupled by C2 to the demodulator diode, D1. The diode load resistor for D1 is R2 and r.f. filtering is provided by R1 and the capacitance of the screened cable, which carries the a.f. signals to the input jack.

The r.f. probe is suitable for use up to about 30MHz and the maximum voltage input should not exceed about 35 volts r.m.s. (50 volts peak).

The e.h.t. probe, shown in Fig. 4, is intended for tracing high voltage breakdown, tracking or corona discharge. The probe consists of an insulated perspex tube, sealed at one end, in which a length of screened cable is fitted. The screening at the end of the cable is cut back for about one inch to provide a small capacitance pick-up probe having high insulation.

Input signals are capacitively coupled from the external circuit through the perspex tube to the unscreened wire end and then via the cable to the input jack. The use of this probe is described later.

If difficulty is experienced in obtaining a suitable piece of perspex tube, $\frac{1}{4}$ inch diameter and $\frac{5}{32}$ inch bore, heavy gauge polythene tube may be used instead. The importance of adequate insulation of the tube cannot be stressed too strongly.

CONSTRUCTION

The Signal Tracer is built in the large Eddystone die-cast box, type 6357P. The lid is used as the front panel of the instrument and the box itself forms the case and as such is fitted with a small plastic carrying handle and plastic feet.

The drilling information for the front panel is given in Fig. 5. It should be noted that the terminal fixing holes should be drilled to suit the actual terminals being used and that the drillings for the loudspeaker are only suitable for the $2\frac{1}{2}$-inch Radiospares type listed.

The PC4 amplifier is mounted on an aluminium bracket which is held in place on the back of the front panel by clamping it under the gain control. The details of the bracket are given in Fig. 6 and the method of mounting can be seen from the photographs.

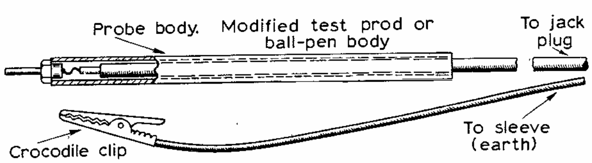
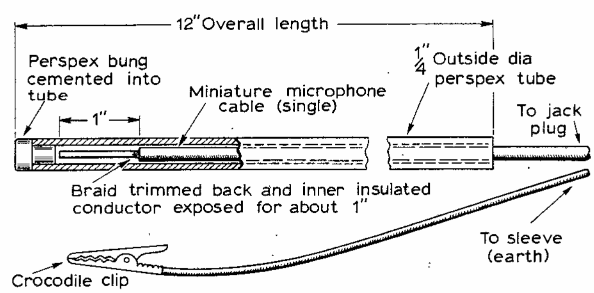
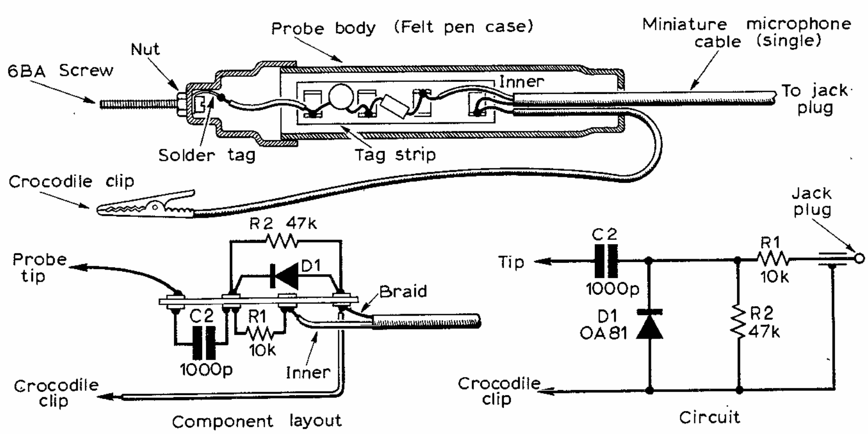


Fig. 2: Details of the simple a.c. probe



▲ *Fig 4: The e.h.t. probe. It is very important that the tubing used in its construction should provide adequate insulation*



◀ *Fig. 3: Construction of the r.f. probe and built-in detector demodulator*

The PC4 amplifier is fixed to the bracket with the copper circuit side facing the bracket. Two 6BA nylon screws and nuts are used to fix and insulate the amplifier from the bracket and extra nylon nuts are used to provide the required spacing of the amplifier from the bracket.

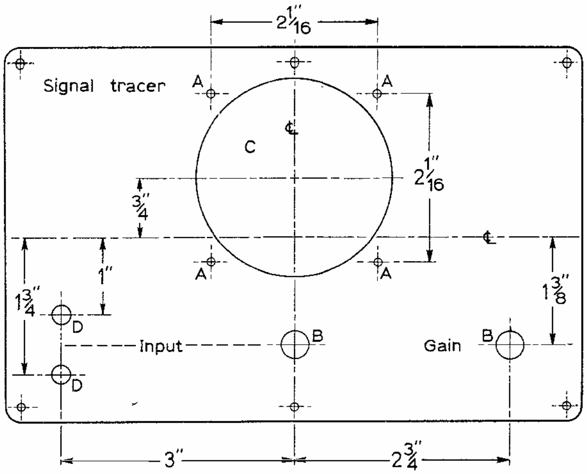


Fig. 5: Drilling details for panel :— Holes A–⅛in, B–⅜in, C–2½in. Holes D to suit terminals

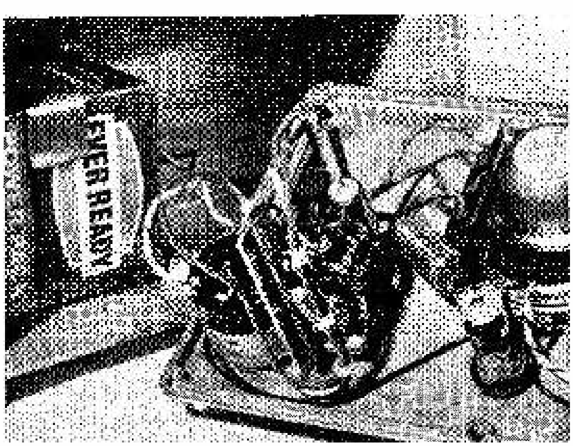
The PP9 battery is held inside the case by means of a metal clip, bent to the shape of the battery and fixed to the case with a screw and nut as shown in the photographs.

The layout of the wiring is not critical but it is desirable to keep the amplifier input and output wiring separated to avoid any possibility of feedback and instability.

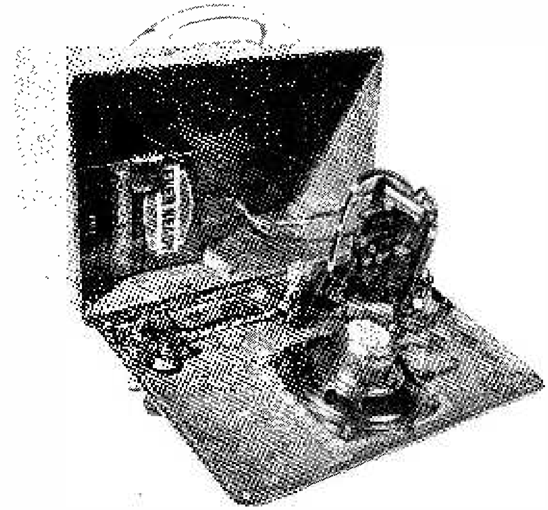
OPERATION

Using the simple a.c. probe, it is possible to trace the presence of an audio signal through the various stages of an audio amplifier. The absence of a signal from an expected point will narrow down the area in which the faulty component may be located.

Cathode and emitter decoupling capacitors may be



Close-up of the PC4 amplifier module mounted on bracket (Fig. 6) and fixed to front panel by the gain control.



checked *in situ* by testing the level of a.f. signal appearing across them whilst the amplifier is carrying a signal. A relatively large signal across a decoupling capacitor may indicate a partial or complete open circuit of the component.

The cause of noise or hum may be located by tracing through a circuit for the area where this signal originates and then by checking across the various components, the faulty component, earth connection or switch contact, etc., may be found.

The r.f. probe can be used in a similar way to the a.f. probe, but this time in the r.f. and i.f. stages of a receiver. It is necessary to provide an input signal to the receiver being tested and this may be done by connecting an r.f. signal generator and setting this to the required frequency or by tuning to a local station.

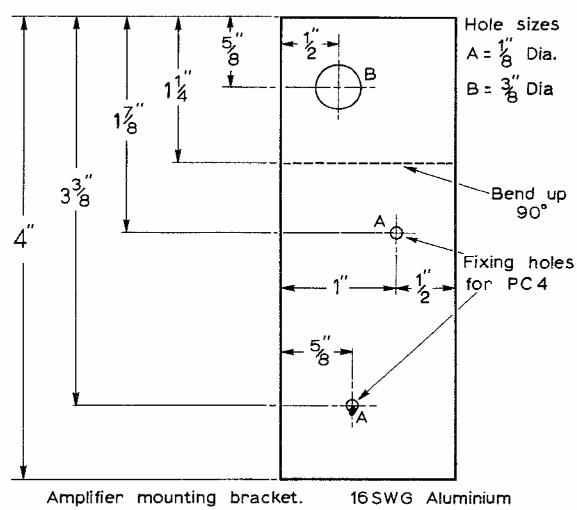


Fig. 6: Details of mounting bracket for amplifier Module

The main purpose of the e.h.t. probe is to trace corona discharge and partial breakdown in the components of the e.h.t. supplies of a television receiver or an oscilloscope.

Corona discharge is usually caused by a sharp point in the e.h.t. wiring causing a discharge into the surrounding air. The location of the discharge can sometimes be located by carefully listening for the source of the fizzing-singing noise or by looking in total darkness for the characteristic blue glow.

The e.h.t. probe picks up the electric field of the discharge and, as the probe is moved about, the point of maximum noise and thus the source of the discharge will easily be located. This can be done in normal lighting and ambient noise.

★ components list

Resistors:
R1 10kΩ R2 47kΩ
both ½W 10% carbon
VR1 500kΩ log. with DP switch

Miscellaneous:
C1 0·22μF 400V polyester
D1 OA81 (Mullard)
PC4 Amplifier module (Newmarket—Electroniques Ltd.)
Die-cast box (Eddystone 6357P—Home Radio)

Jack socket, Jack plugs (3), Handle, plastic feet, Knob, PP9 battery with connectors. Loudspeaker 2½in. (Radiospares). Terminals, materials for probes.

The e.h.t. probe will make it possible to detect and locate leakage paths and tracking across components and insulators. The probe tip is moved carefully around the suspected location and the path of the leakage will be indicated by the areas of maximum noise.

WARNING

It is most important to exercise the greatest care when working on the e.h.t. circuits of electronic equipment. If the e.h.t. voltage is generated by rectifiers, from the secondary winding of a 50Hz mains transformer, the current available could almost certainly be lethal, and work on this type of equipment should not be carried out by the beginner.

The e.h.t. supply of television receivers is usually derived from the line output stage and is current limited to some extent. However, quite severe shocks can be obtained from this type of supply and it should be treated with the greatest respect.

When working on equipment containing high voltages, the following safety suggestions should be observed:—

1. Make sure the equipment is properly earthed. If it is a television receiver which is connected to the mains, ensure the chassis is at neutral. Better still, use an isolating transformer.
2. Connect the earth connection of the probe to the chassis under test.
3. Stand on a rubber or plastic mat.
4. Use only one hand, keeping the other hand in the pocket.
5. Don't stick the head inside the equipment.
6. After switching off, ensure that all e.h.t. capacitors are discharged by shorting them with an earthing lead. ■

LUXEMBOURG 7

—continued from page 737

in. Slide the ferrite rod in L1 to peak the signal for best results.

Open VC1/2 fully and set the generator to 1450kHz. Adjust T2 to tune to this frequency, and rotate TC1 for best results. As this and earlier adjustments to L2 and L1 interact, repeat to check band coverage.

When band coverage is suitable, move L1 on the rod at about 600kHz for best results, and adjust TC1 at about 1350kHz, also for best results.

The switch should then be placed in the "LUX" position, and a signal is tuned in with VC1/2 about half closed. TC3 is then rotated for best reception.

When further adjustment of trimmers or cores gives no improvement, alignment is completed.

If no generator is available, choose signals near the open and closed position or VC1/2, and use these for adjustment purposes. The setting of TC2 considerably influences frequencies at the high frequency end of the band (VC1/2 nearly open) while the core of L2 has most effect at the low frequency end (VC1/2 nearly closed). Alignment is not particularly difficult, and it is not essential that the exact band coverages are as mentioned above. Because oscillator coverage at the "LUX" position depends on C4, which is fixed, adjustment of this band is easy, once "MW" alignment is in order. TC3 is not in circuit on "MW", but is merely peaked for best reception with the switch in the "LUX" position.

The best value for R3 depends somewhat on the actual transistors, though 680Ω should generally be suitable. It may be reduced in value, provided continuous oscillation does not arise at some frequencies.

Should a first test of the receiver produce only weak and very distorted signals, it is most likely that one of the secondaries of T1 is in the wrong phase. This could arise with alternative transformers. Reversing connections to one secondary will cure this. For example, take 4 to Tr7 base, and 3 to the junction of R22 and R23.

If audio signals from D1, Tr4 and Tr5 are of normal quality, but results sound somewhat unpleasant from the speaker, this is probably crossover distortion, and can be cured by slightly increasing the values of R21 and R23 (120Ω resistors can be tried). Alternatively R20 and R22 can be reduced to be about 2·2kΩ. Exact results depend on Tr6 and Tr7, but the values shown are normally suitable. ■

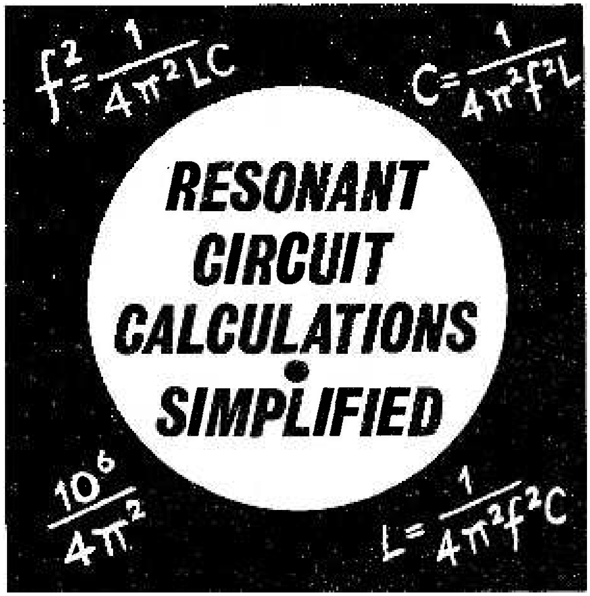
PW Vibrasonic 25-50 Guitar Amplifier Part 2.

PW, October 1970.—It is regretted that the following errors occurred in the diagrams of the circuit boards:—

Fig. 6. The connections to Tr1 should read 'c', 'b', 'e', not 'c', 'e', 'b'.

Fig. 7. The connections to Tr5 should read 'c', 'e', 'b', not 'c', 'b', 'e'.
Insert R40, 4·7kΩ, from the emitter of Tr8 to common negative line.

Fig. 8. The connections to Tr3 should read 'c', 'b', 'e', not 'c', 'e', 'b'.



GRAHAM HASLIP

MANY readers, like the author, have most probably found great difficulty when working resonant frequency calculations using the standard formulae:

$$f = \frac{1}{2\pi\sqrt{LC}} \text{ or } L = \frac{1}{4\pi^2 f^2 C} \text{ or } C = \frac{1}{4\pi^2 f^2 L}$$

where the frequency is in hertz, capacity in farads and the inductance in henrys.

Therefore, purely out of interest. it was decided to see if an easier way could be found of calculating values in resonant circuits.

After burning a couple of pints of the old midnight oil three far easier formulae were evolved in which the frequency is in megahertz, the capacity in picofarads and the inductance in microhenrys.

The three formulae for calculating the unknown quantity, given the other two quantities are:

$$f^2 = \frac{25000}{L \times C} \quad L = \frac{25000}{f^2} \div C \quad C = \frac{25000}{f^2} \div L$$

The simplicity in the working of the formulae may best be shown in the following examples.

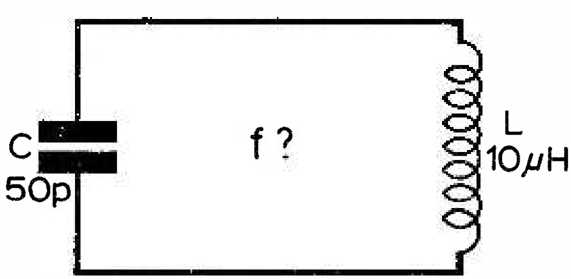


Fig. 1: A tuned circuit of which the resonant frequency is unknown.

Example 1. A tuned circuit (Fig. 1) consists of an inductor of 10μH and a capacitor of 50pF. What is the resonant frequency of the circuit?

$$f^2 = \frac{25000}{L \times C}$$

Substituting values:

$$f^2 = \frac{25000}{10 \times 50} = \frac{25000}{500} = 50$$

Therefore 50 is the frequency squared so the frequency is equal to the square root of 50 which is 7·07 or approximately 7MHz.

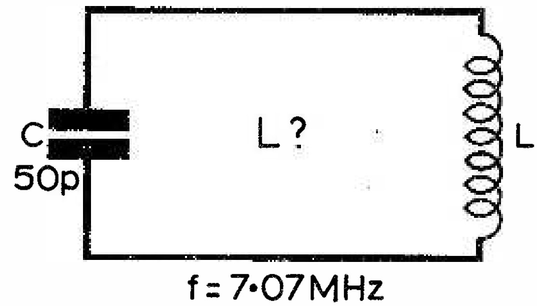


Fig. 2: In this case the frequency and the capacity only are known.

Example 2. A tuned circuit (Fig. 2) consists of an inductor of unknown value, a capacitor of 50 pF and resonates at 7·07 MHz. What is the value of the inductor?

$$L = \frac{25000}{f^2} \div C$$

Substituting values:

$$L = \frac{25000}{7{\cdot}07 \times 7{\cdot}07} \div 50 = \frac{25000}{50} \div 50 = 10$$

Therefore L is 10μH approximately.

Example 3. A tuned circuit (Fig. 3) consists of an inductor of 10μH and a capacitor of unknown value, the circuit resonating at 7·07 MHz. What is the value of the capacitor?

$$C = \frac{25000}{f^2} \div L$$

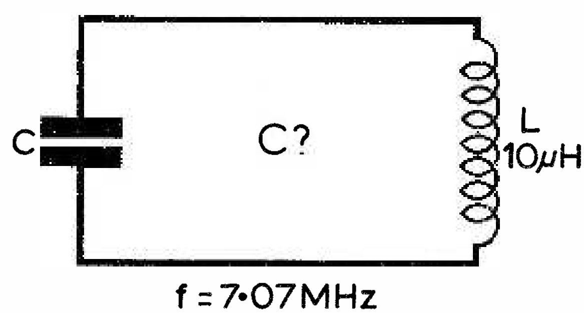


Fig. 3: In this circuit the value of the capacitor is required.

Substituting values:

$$C = \frac{25000}{7{\cdot}07 \times 7{\cdot}07} \div 10 = \frac{25000}{50} \div 10 = 50$$

Therefore C is 50pF approximately.

The great advantage is that the formulae can be worked out very quickly and easily on paper and on occasions entirely in one's head. For general working a table of square roots is advisable but not always necessary. In the examples just given the square root of 50 could be taken as 7 and the same may be done with other numbers.

Explanation

Now to explain how the three formulae were derived which may be of some interest to readers.

Starting by making out a table of all the values of L and C in relationship to their respective values of resonant frequency, Table 1, it was noticed that the LC product for 10MHz was 250 and that for 1 MHz, 25000. This is the square of the ratio of the frequencies which is 10. So the formulae, already quoted, was easily arrived at, i.e.

$$f^2 = \frac{25000}{L \times C}$$

Table 1

Frequency MHz	L × C	Frequency MHz	L × C
1	25000	11	207
2	6250	12	175
3	2777	13	147
4	1560	14	125
5	1000	15	111
6	695	16	94
7	510	17	86
8	390	18	77
9	310	19	69
10	250	20	62

It is now possible to rearrange this first formulae to find either L or C thus:

$$f^2 = \frac{25000}{L \times C}$$

Multiplying both sides of the equation by LC

$$LC\,(f^2) = 25000$$

Dividing both sides of the equation by f^2

$$LC = \frac{25000}{f^2}$$

Dividing both sides of the equation by L

$$C = \frac{25000}{f^2} \div L$$

Dividing both sides of the equation by C

$$L = \frac{25000}{f^2} \div C$$

Keeping the two steps of division separate enables most calculations to be done in the head or to make at least a close approximation.

It must be noted that the formulae only hold good when the units are in megahertz, picofarads and microhenrys but this is not a great disadvantage as the majority of tuned circuits used by amateurs employ these units.

The formulae are not precise as the figure of 25000 is only an approximation of the constant used in the basic formula, i.e.,

$$\frac{10_6}{4\pi^2} \text{ i.e. } \frac{1000000}{4 \times 3{\cdot}14 \times 3{\cdot}14} = 25330$$

Table 2

Frequency MHz	L × C
1·8	7700
2·0	6250
3·5	2040
7·0	510
14·0	125
21·0	56
28·0	32

Those interested only in the h.f. amateur bands will find the values of LC given in Table 2 of great value. If, for instance, it is required to use a 100pF capacitor set at half scale to tune to 14 MHz then, from Table 2, it is only necessary to divide 125 by 50 to find the value of the inductor required, i.e. 2·5μH. ■

Merry Christmas and a Happy New Year

from

Norman Stevens (Editor) Colin Riches
Lionel Howes, G3AYA Eric Dowdeswell, G4AR
Halvor Moorshead John Reddihough

Peter Metalli (Art Editor)

Ruth Cyster Miriam Casey

(Secretarial)

AMATEUR BANDS COMMUNICATIONS RECEIVER

PART 2

W. CAMERON

IN this part the b.f.o., product detector, audio amplifier, S meter and power supply circuits will be discussed and details given of their construction. This will enable the second converter and i.f. stages described last month to be used as a complete receiver for Top Band.

BFO and Product Detector

The essential features of a b.f.o. are that it must be frequency stable, and produce (for lowest distortion in the product detector) a perfect sine wave. These requirements are easily met in the oscillator used, which is similar in most respects to that used in the v.f.o.

In the case of s.s.b. and c.w. the two transistors of the product detector are used in the same manner as a normal mixer, where the difference in frequency between the b.f.o. and i.f. appear in the collector circuit as a.f. The filter R11, C6, C7 removes the 470kHz component present on the audio.

On a.m., the b.f.o. is switched off, and Tr3, biased approximately to cut off, serves on its own as a.m. detector, R7, C5, being switched across the emitter resistor to ensure that the gain on a.m. is comparable to that on s.s.b.

On s.s.b. and c.w. the drive required by the product detector is low if distortion is to be kept to a minimum, but should be sufficiently high to secure a reasonable conversion gain. The optimum drive voltages are 200mV r.m.s. from the b.f.o. and a maximum of 100mV from the i.f. which means small value coupling capacitors, 10pF (C4) from the b.f.o. and 15pF (C19) from the i.f. The complete circuit is shown in Fig. 5.

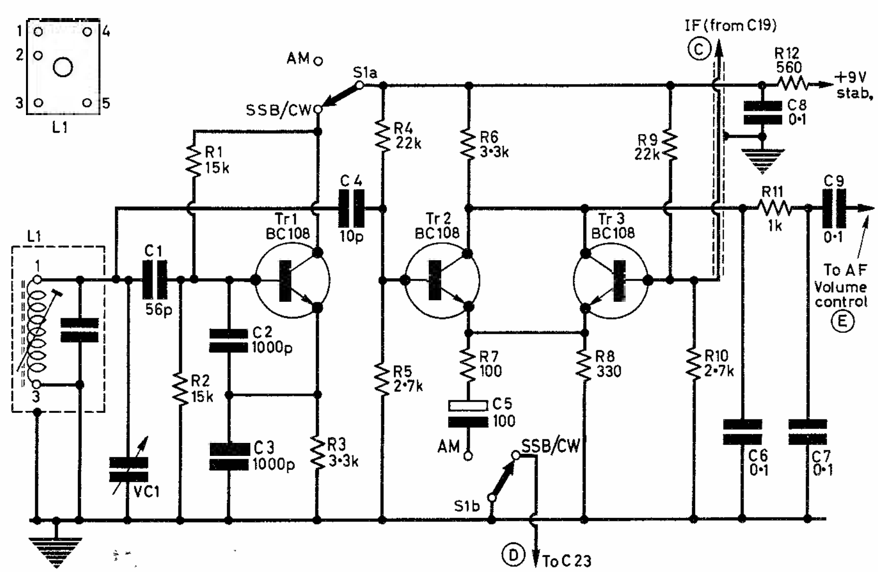


Fig. 5. Circuit diagram of the b.f.o. and product detector sub-assembly.

Construction of BFO/Product Detector

The b.f.o. and product detector is constructed on an 18-way group panel board measuring $4\frac{1}{2} \times 1\frac{1}{2}$in.

The oscillator coil used is a standard 470kHz miniature i.f.t. Only the primary (tuned) winding is used, the capacitor across this winding being part of the assembly enclosed within the screening can.

Apart from voltage checks (Table 2) it will not be possible to set up the unit until the audio unit is installed. The only adjustment then required is to set VC1 at half capacity, and adjust the core of L1 to zero beat with the i.f.

This is done by again feeding an i.f. signal (470kHz) into Tr2 in the second converter/i.f. amplifier unit,

TABLE 2

	Collector	Base	Emitter
Tr1	7·6	3·7	3·3
Tr2	3·5	1·0	0·4
Tr3	3·5	1·0	0·4

Voltage readings with B.F.O. "on".

and adjusting the b.f.o. coil L1 for zero beat.

The circuit of this unit is shown in Fig. 5 and assembly details in Fig. 6.

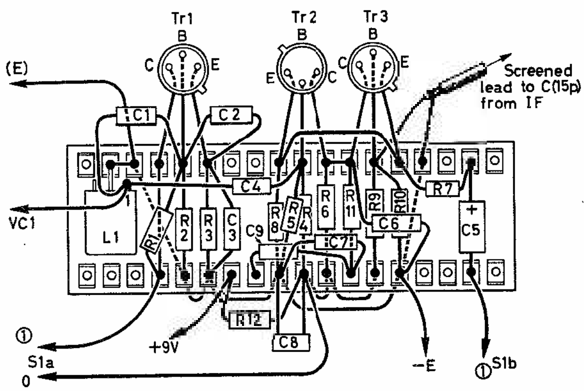


Fig. 6. Panel board for the b.f.o./product detector. Pin 3 of L1 is soldered directly to a tag which acts as a support for L1.

Construction of Audio Amplifier

The audio amplifier is also assembled on an 18-way group panel board, $4\frac{1}{2} \times 1\frac{1}{2}$in. The circuit is given in Fig. 7 and assembly details in Fig. 8.

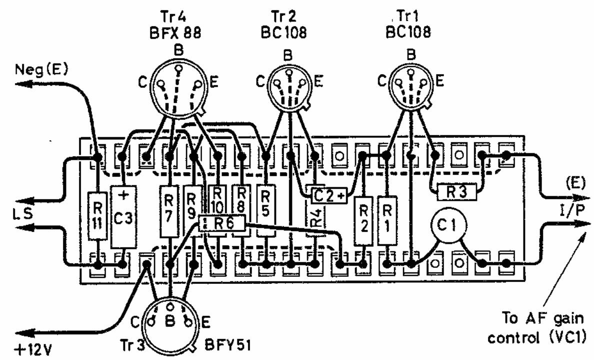
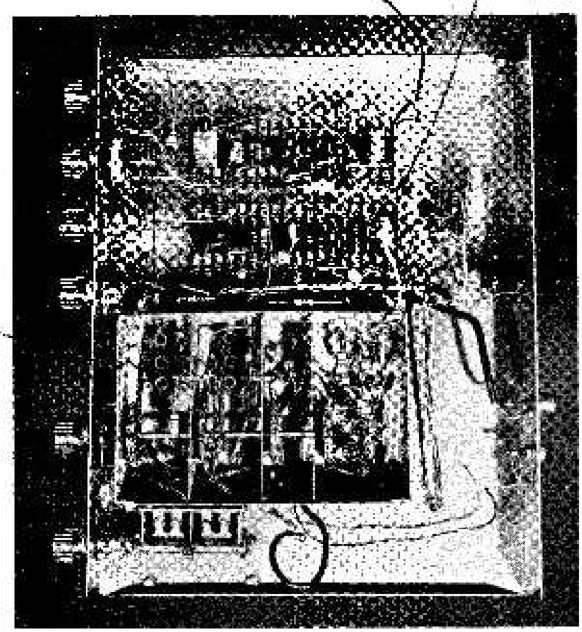


Fig. 8. Layout of the audio amplifier panel board. The a.f. gain control referred to is VR1 (Fig. 7) not VC1.



A below-chassis view of the receiver. The b.f.o./p.d. board is at the top and the audio amplifier assembly immediately below.

Audio Amplifier

Nothing elaborate is required for this, the requirements being that it should have an output of about 1 watt with low distortion, and a sensitivity of not less than 30mV to produce this output. The input impedance should be not less than 20kΩ.

For best results the loudspeaker impedance should be 15 or 25 ohms, although a 3 ohm speaker can be used if distortion at high volume is acceptable.

RF Amp + 1st converter

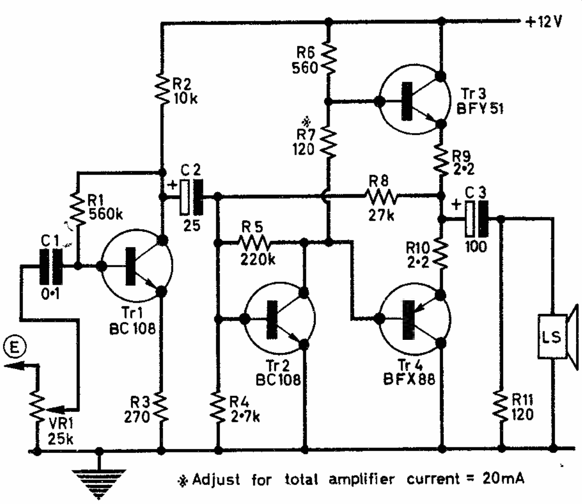


Fig. 7. Circuit diagram of the audio amplifier.

TABLE 3

	Collector	Base	Emitter
Tr1	4·0	0·9	0·4
Tr2	5·2	0·65	0
Tr3	11·7	6·6	6·0
Tr4	5·8	5·2	0

Resistor R7 is approximate and may require adjustment if either crossover distortion or overheating of the output transistors is apparent. Its value should be chosen so that the total quiescent current of the amplifier is within the limits 15 to 20mA. A lower resistor will reduce the current and vice versa.

The voltage at the centre point of the output transistors (junction of R9 and R10) should be approximately half the supply voltage (±1V) and this can be corrected if necessary by adjustment of R4. Reducing this will increase the voltage at the centre point and vice versa.

It is as well not to wire in these two resistors permanently until these two points have been established.

The amplifier will work well with a supply voltage

★ components list

BFO/PRODUCT DETECTOR

Resistors:

R1	15kΩ	R5	2·7kΩ	R9	22kΩ
R2	15kΩ	R6	3·3kΩ	R10	2·7kΩ
R3	3·3kΩ	R7	100Ω	R11	1kΩ
R4	22kΩ	R8	330Ω	R12	560Ω

All ½W 10%

Capacitors

C1	56pF poly	C4	10pF poly	C7	0·1μF cer
C2	1000pF poly	C5	100μF 12V	C8	0·1μF cer
C3	1000pF poly	C6	0·1μF cer	C9	0·1μF cer

VC1 15pF variable (Jackson Type C804)

Semi-conductors:
Tr1 BC108 Tr2 BC108 Tr3 BC108

Miscellaneous:
L1, IFT 470 kHz, miniature.
Group panel board 18-way, 4½ x 1½in.
S1a-b 2 pole 2 way rotary switch.

AUDIO AMPLIFIER

Resistors:

R1	560kΩ	R5	220kΩ	R9	2·2Ω
R2	10kΩ	R6	560Ω	R10	2·2Ω
R3	270Ω	R7	120-180Ω*	R11	120Ω
R4	2·7-3·3kΩ*	R8	27kΩ		

All ½W 10% *see text.

VR1 25kΩ potentiometer, log

Capacitors:
C1 0·1μF cer C2 25μF 12V C3 100μF 12V

Semi conductors:
Tr1-2 BC108 Tr3 BFY51 Tr4 BFX88

Miscellaneous:
Group panel board, 4½ x 1½in.

POWER SUPPLY

Resistors:
R1 10Ω R2 15Ω R3 56Ω R4 15Ω
All wirewound

Capacitors:
C1, C2, C3, C4. 1000μF 12V

Semi-conductors:
D1, D2, D3, D4. Silicon rectifiers 50 p.i.v. or more.
D5 Zener diode, 9·1V, 1W.

Miscellaneous:
Mains transformer, 230/250V primary,
9-0-9V secondary at 500mA.
Fuse holder and fuse 1·5A.
DPDT changeover switch.

S-METER

Resistors:
R1 270kΩ R2 2·2kΩ R3 1kΩ
All ½W 10%

Vr1 10kΩ pre-set Vr2 1kΩ pre-set

Miscellaneous:
Tr1 BC108. Moving-coil meter 1mA f.s.d.

of up to 16 volts. In this case R7 would be about 100 ohms. Table 3 gives typical voltage readings at the transistors.

Power Supply

The total current consumption of the receiver at maximum volume is about 150mA, so the mains transformer can be quite small. That used in the model provides 9—0—9V at 500mA giving 12V d.c. after rectification and smoothing.

Separate rectifier and smoothing circuits are used for the supplies to the audio amplifier, and to the rest of the receiver. This is to isolate the receiver supply line from any audio fluctuations present on the audio supply line, which would otherwise cause distortion.

The rectifiers are any silicon types rated at 50 p.i.v. or more, such as BY100's, and all the power supply components are mounted directly on the chassis. (See photographs in Part 1.)

The circuit, for mains or battery operation, is

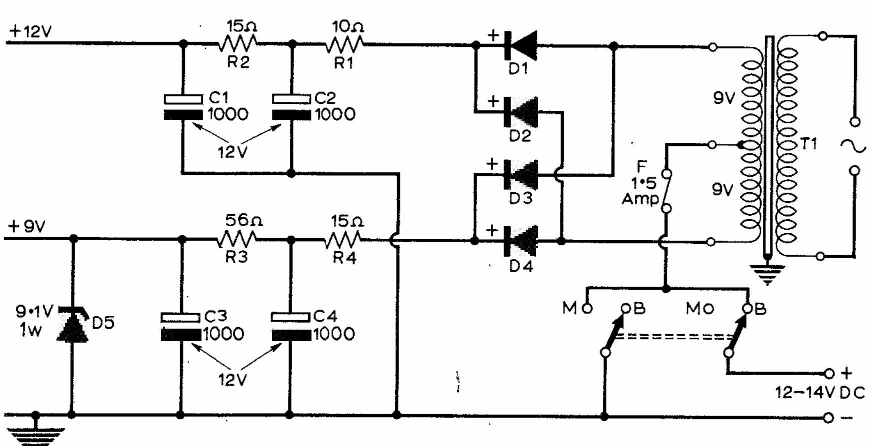


Fig. 9. Circuit of the mains/battery power supply. Components are mounted on a tag strip on top of the chassis. See photographs in Part 1.

shown in Fig. 9. This has the advantage that the rectifiers also serve as protective diodes against accidental reversal of battery polarity.

If battery operation only is required, then the input resistors R1 and R4 and electrolytics C2 and C4 can be dispensed with and the two supply lines via R2 and R3 connected together. The remarks concerning audio fluctuations do not apply as a battery, particularly if an accumulator, has a low internal resistance.

If mains-only operation is required the switching may be deleted and the centre-tap of the transformer returned to earth.

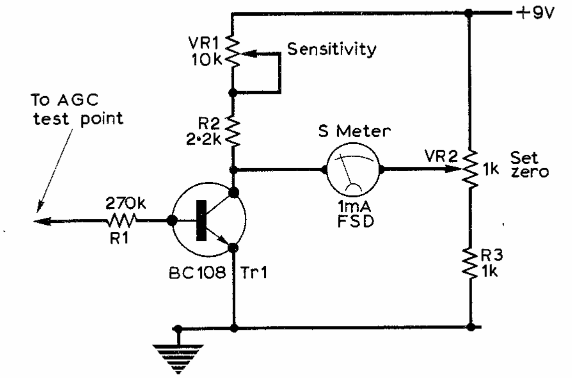


Fig. 10. Circuitry of the simple S-meter. The few components are located below the panel-mounted meter.

S–Meter

The S-meter circuit is shown in Fig. 10. Its components can be wired on a tag strip and mounted in any convenient position on the chassis. Each adjustment of the sensitivity control makes necessary the readjustment of the set-zero control. Sensitivity can be further increased if required by reducing the value of R1.

NOTE:— An error occurred in Fig. 2, Part 1 of this article. The diagram of the connections for transistor Tr5 (BC108) was incorrect. Reading clockwise they should read e,b,c and not c,b,e.

NEXT MONTH FULL DETAILS WILL BE GIVEN OF THE R.F. AND FIRST CONVERTER STAGES WHICH WILL ENABLE THE RECEIVER TO BE COMPLETED AND ALIGNED FOR USE ON ALL THE H.F. AMATEUR BANDS.

LATE FLASH . . . The Editor wishes to thank the many contributors who sent in entries for this competition. All entries have been acknowledged and preliminary judging is now taking place. An announcement naming the winner of the PW "Designer's Trophy" and the runners-up will appear in our next issue.

THE MW COLUMN

ENUGU NIGERIA 1320kHz is now a consistent signal during the late evening before it signs-off at 2305hrs GMT. Programmes are European in style and there is a nightly news bulletin in English at 2300hrs. CKEC in New Glasgow, Nova Scotia is on the same channel but a medium wave loop aerial will easily separate the two. CQA 760kHz on the Portuguese island of Sao Tome in the Gulf of Guinea is occasionally heard during the evenings. This station is currently being raised in power to 10kW so it should soon be a much stronger signal. Further south, CR6RZ in Luanda, Angola has been heard on 1088kHz after BBC4 has closed down for the night (nominally at 2300hrs GMT). Although Sottons, Switzerland transmits the letters ST in morse on 764kHz after it's programmes finish at 2230hrs (2300hrs on Saturdays) Dakar in Senegal on the same frequency is usually a strong signal when it closes down with announcements in French at 2300hrs.

The strongest West African on the band is Conakry 1403kHz in the Republic of Guinea which is prominent and free of QRM from 2300hrs until it goes off at midnight GMT. Conakry's programmes are quite distinctive, with African music, drums, singing and announcements in French. Others from this area to look for, include EAJ203 El Aioun, Spanish Sahara on 656kHz until midnight, Tenerife 620kHz in the Canary Islands in Spanish until 0100hrs and CSB91 Funchal Madeira 1529kHz. Vatican Radio is on 1529 until 2200hrs while CSB91 signs-off in Portuguese at 0000hrs. Monrovia, Liberia on 629kHz closes down at 0045hrs GMT; the programmes are in English and it is usually during the last half hour of transmission, when it is carrying the Late Night Show, that it is logged.

From Freemantle in Australia comes a report of reception of the medium wave Radio Luxemburg 1439kHz at 2030hrs GMT on the 24th August, 1970. The logging was made by David Worthy who is a member of the World DX Club and he gave it a SINPO rating of 22442 in a report to Contact, the club magazine. Reception of European medium wave stations is not unknown in Australia, in fact the late Radio Caroline North had reports from both Australia and New Zealand. Propagation should be the same in either direction but Australians are not logged in UK as the European DXer is at a disadvantage compared with his opposite number down under. The most favourable time for reception on this path is at sunset in Spring and Autumn but it is at this time of day that European QRM is heavy while many Australian stations have not yet signed-on. In spite of the difficulties, it can only be a matter of time until someone in this country adds Australia to his list of medium wave countries verified.

On the long waves, Chris Stacey in Tunbridge Wells has heard Yakutsk 263kHz at 2300hrs GMT through strong QRM from Radio Volga, while the writer has logged Omsk 394kHz at 2240hrs when it was carrying the same programme as Minsk 400kHz. Yakutsk is situated 4000 miles away at the far side of Asiatic USSR.

CHARLES MOLLOY

New Books

Books reviewed on this page are normally obtainable through any retail bookshop. In this instance, the information printed in **heavy** type should be quoted.

BEGINNERS GUIDE TO RADIO
By Gordon J. King
Published by Newnes-Butterworths
194 pages, $7\frac{1}{2} \times 5$in. 20s.

THIS book is a rewritten version of the original *Beginner's Guide to Radio* by F. J. Camm, first published in 1955. The rapid advances in electronics during the last decade have made the publishing of any "beginner's" book a difficult and risky business, for one intended even as a simple introduction is quickly dated. Only three years ago how many of us foresaw the dominance of silicon transistors, the availability of integrated circuits for the amateur hobbyist or the wide use of FETs?

The function of a beginner's book is to introduce the reader to the subject and raise his knowledge to the level where he can understand and appreciate more advanced books or magazines such as Practical Wireless. Unfortunately *Beginner's Guide to Radio* does not achieve this and still retains the flavour of the 1950s and the first edition. It pays only lip service to the massive changes of the last fifteen years.

Although the basic principles are well explained and there are sections covering most aspects of the subject, the book leaves a large gap from where it leaves off to the "state-of-the-art" today. Transistors take second place to valves and although we are told about the existence of FETs and ICs, there is no information given on their operation or uses.

There is only one transistor circuit given (and this contains at least one error) and the caption describing "two typical transistors" is underneath an illustration of two types, both of which are now obsolete!—*HWM.*

101 QUESTIONS AND ANSWERS ABOUT HI-FI AND STEREO
By Sands and Shunaman
Published by Foulsham Ltd.
128 pages, $8\frac{1}{2} \times 5\frac{1}{2}$in. Price 24s.

THIS book, the text written and printed in the U.S.A., has the usual rather inane introductory chapter directed towards us natives in Great Britain. Therefore before starting to read the book proper it will be necessary for the newcomer to the subject to go through the three and a half pages of the introductory chapter and to mark the pages of the text where differences in jargon or standards occur. The expert will not bother about this of course as he will spot the differences right away but then he will hardly be reading the book in the first place!

The book is dividend into six sections: High Fidelity, Amplifiers, Tuners, Record and Tape Players, Speakers and Troubleshooting and Maintenance. The old problem of trying adequately to define a standard for amplifier output power ratings is highlighted when the reader is told that the "50 watts output for 5 millivolts magnetic-circuit input" is the practical one to use. However, the questions are well chosen and no matter how experienced one may be in electronics it is usually possible to pick up the odd hint or tip from this type of book.

To the hi-fi enthusiast who has merely assembled a collection of boxes into a working unit this book will be able to answer most of the questions he will start to ask when his curiousity begins to be aroused as to just what goes on inside those expensive boxes.—*AED.*

HOW TO USE INTEGRATED CIRCUIT LOGIC ELEMENTS
By Jack W. Streater
Published by Foulsham-Sams
136 pages, $8\frac{3}{4} \times 5\frac{3}{4}$in. Price 28s.

DURING the last few years many readers must have noticed some funny-looking words appear in the technical press—words like Flip-Flop, Nand, Gate, etc. and references to Boolean Algebra. Most of us know that these have something to do with computers but that is as far as it goes.

Most constructors are all too aware of the "transistor revolution" that has been going on for the last fifteen or so years; this book is heralding the new revolution and teaching us the new language that is necessary. The Integrated Circuit Logic Element revolution has of course been going on for some time, but as yet it has affected us little.

This book, in clear and simple language, gently guides the average constructor into this new field and for those not wishing to be left behind by the new revolution it is a very good buy.—*HWM.*

WORKSHOP IN SOLID STATE
By Harold E. Ennes
Published by Foulsham-Sams
382 pages, $8\frac{3}{4} \times 5\frac{3}{4}$ins. Price 65s.

IT is unusual to come across a book today which sets out to convert the reader from thinking in terms of valves to transistors, but that is the aim of this book and it succeeds admirably.

A basic knowledge of electronics is assumed, but not to any great level, and it takes the reader through the theories governing transistor operation to a pretty advanced level. Each section is terminated with a short questionnaire with the answers at the back.

Although originally written for broadcast engineers, this book should be ideal for the electronics enthusiast who, although thoroughly conversant with valves and general theory, never quite got round to finding out much about transistors and found himself behind.—*MW.*

practically wireless commentary by HENRY

No. 75

Just Jottings

THE task of providing a monthly hunk of comment and controversy, with only the redoubtable Pax to make other inroads into a PW page, may seem enviably simple.

"Say what you think" suggests the Editor, when the problem of an impending deadline is broached. Well, do *you* want to read a blank page, Joe? Or worse, a rag-bag of radio trivia?

Henry has been told more than once that his regular offerings should read like "letters home". He would be pleased to think that his effusions gave the impression of being dashed off between Sunday lunch and the Al Read Show—even more flattered if they could be compared with the Al Read Show . . .

Their genesis is more laborious. Henry keeps masses of jottings in one of his bulging files. To this, he adds newspaper cuttings, magazine snippets, or references on twists of paper that say: "PW May 69 P18."*

In the H for Henry file we may find scraps of hilarious verse, notes of odd happenings in the radio world, dates and times of special programmes, peculiar advertisements—everything, it seems, but the fatstock prices. When it is deadline-plus-one day the impression is sometimes gained that it would be of more interest if I really *did* quote the fatstock prices. When nothing seems to have been occurring in the world of wireless, when the Editor is markedly reserved and Pax becomes unrestrainedly explosive—heaven knows why, for he's an expert at the dashed-off cartoon—Henry delves into his jotting file, seeking electronic inspiration.

The chronic disease of "sorter's cramp".

Trouble is, like Eric Shorter digging in his cellar through trunks of old theatre programmes, like Colin Reid hoarding old laundry bills or Bernard Levin papering the walls of his retreat with Hansard or Wagnerian *leits motif*, your scribe falls prey to the chronic disease of "sorter's cramp".

The symptoms are a tendency to squat among the papers until one's haunches ache, for the eye to become glazed and the mouth to drop open and the fingers to make febrile fluttering movements. There also occurs a selective deafness in advanced stages of the ailment, when the sufferer becomes impervious to such cries as: "How long are you going to be up there in that dusty attic? Your dinner's going cold."

The PW reader who has had to thumb back to find whether F. G. Rayer described the Beginner's One-plus-three (or was it Three-plus-one?) in June 1956 or October '61, will know exactly what I mean. As the soup grows cold in inverse proportion to the way the little lady grows more heated we find ourselves absorbed by the proof of the old adage "there's nothing new under the sun."

For example, the thoughts of those ubiquitous portable radios on the summer beaches (and promenading the evening streets of town) lead us to the kind of music they generally broadcast. Henry is always tempted—but has thus far lacked the temerity—to recline among the sun-worshippers with a large-speakered Bush or something equally powerful, tuned to the Third programme in the middle of a chamber concert. Well, what's sauce for a skinhead. . . .

Third programme among the sun worshippers.

But there is nothing new—guess who said this, and when: "The introduction of a new kind of music should be shunned as imperilling the whole state, since styles of music are never disturbed without affecting the most important political institutions."

Chairman Mao? Mrs. Woodhouse? Vice-President Agnew? Lord Reith? You would be wrong on all counts, for those sentiments were expressed by Plato, a couple of thousand years ago. And he did not even have to endure the benefits of modern solid-state technology.

Another odd item—the give-away gimmick, little known in the pure world of wireless, but introduced by Pyttronic Industries Corp. (USA) with the offer of a record album "Greatest Conductors" to anyone ordering more than fifty dollars' worth of Motorola transistors. Fine except that the offer only stands if their delivery takes more than 24 hours.

PW advertisers please note!

*And if you care to look that up you will find a column of letters that Henry evoked with a piece "To Kit or Not"—Ed.

COMET

Hi-Fi DISCOUNT WAREHOUSES

- All items offered are brand new, latest models in manufacturers' sealed cartons. Fully guaranteed with after-sales service.
- Over 1000 items in stock. Complete Free price list on request.

Customers Welcome
Open Daily to the public from 9 a.m. Closed Tuesday 1 p.m.
Mon. & Sat. 5-30 p.m. Open until 8 p.m. Wednesday, Thursday & Friday.

STEREO AMPLIFIERS

	Rec. Retail Price	Comet Price
ARMSTRONG 521	£56 0 0	£46 0 0
DULCI 207	£25 0 0	£17 0 0
DULCI 207M	£30 0 0	£20 19 0
FERROGRAPH F307 ..	£59 0 0	£47 19 6
GOODMANS Maxamp ..	£54 0 0	£37 19 6
HL.505..	£23 2 0	£16 19 6
LEAK Stereo 30 Plus ..	£53 0 0	£41 19 6
LEAK Stereo30Plus(cased)	£59 10 0	£46 19 6
LEAK Stereo 70 ..	£65 0 0	£52 0 0
LEAK Stereo 70 in teak case	£71 10 0	£56 19 6
LINEAR LT.66	£21 0 0	£16 19 6
LL. Stereo Amp.	£23 10 0	£16 19 6
METROSOUND ST 20 ..	£36 0 0	£28 19 6
PHILIPS RH 591	£73 0 0	£55 19 6
PHILIPS RH 590	£49 0 0	£37 12 6
PHILIPS RH 580	£26 0 0	£19 19 6
PIONEER SA500	£62 1 11	£42 19 6
PIONEER SA700	£98 0 0	£69 19 6
PIONEER SA900 ..	£134 2 0	£96 19 6
PIONEER Reverberation..	£45 9 11	£32 19 6
QUAD 33 Pre-amplifier ..	£43 0 0	£38 19 6
QUAD 303 Main Amplifier	£55 0 0	£48 19 6
ROGERS Ravensbourne ..	£59 10 0	£46 19 6
Ravensbourne (cased) ..	£64 0 0	£49 19 6
Ravensbrook	£44 0 0	£34 19 6
Ravensbrook (cased) ..	£49 0 0	£38 19 6
SINCLAIR 2000	£30 9 0	£22 19 0
SINCLAIR PROJECT 60/2 x 230/PZ5 ..	£23 18 0	£16 19 0
SINCLAIR PROJECT 60/2 x 250/PZ8/trans	£32 17 6	£23 8 6
SINCLAIR NEOTERIC ..	£61 19 0	£45 19 6
TELETON 150	£29 0 0	£19 19 6
TELETON 203E	£28 15 0	£19 19 6
TELETON GA 101 30 w. RMS	£33 15 0	£22 19 6
VOLTEX 100 watt stereo discotheque 8 electronically mixed inputs	£185 0 0	£139 0 0

TUNERS

	Rec. Retail Price	Comet Price
*ARMSTRONG 523 AM/FM	£53 15 3	£44 19 6
*ARMSTRONG 524 FM ..	£41 17 8	£34 19 6
ARMSTRONG M8 decoder	£9 10 0	£7 19 6
*DULCI FMT.7FM	£22 1 0	£17 19 6
DULCI FMT.7S Stereo ..	£31 0 0	£25 5 0
GOODMANS Stereomax	£82 10 5	£63 19 6
LEAK Stereofetic Chassis	£59 18 0	£51 19 6
LEAK Stereofetic in teak case	£67 3 6	£58 19 6
PHILIPS RH 690	£39 0 0	£31 19 6
PHILIPS RH691	£83 0 0	£70 10 6
PIONEER TX500 AM/FM ..	£77 18 9	£63 19 6
PIONEER TX900 AM/FM ..	£153 13 10	£125 0 0
QUAD Stereo FM	£51 0 0	£39 19 6
ROGERS Ravensbourne ..	£61 17 9	£49 19 6
ROGERS Ravensbrook ..	£45 0 2	£39 19 6
ROGERS Ravensbrook (cased)	£51 5 3	£42 19 6
*SINCLAIR 2000	£26 14 6	£19 4 6
SINCLAIR Project 60 ..	£25 0 0	£20 19 6
TELETON 201X FM ..	£36 0 0	£29 19 6
TELETON GT101	£47 10 0	£33 19 6
TRUVOX FM 200/1C ..	£60 11 10	£39 19 6

All above tuners are complete with MPX stereo decoder except where starred.

TUNER/AMPLIFIERS

	Rec. Retail Price	Comet Price
AKAI 6600	£142 10 7	£112 0 0
ARENA R500	£82 0 0	£66 19 6
ARENA 2400..	£90 6 0	£71 19 6
ARENA 2600 Stereo AM/FM	£111 6 0	£94 0 0
ARENA 2700 Stereo ..	£105 0 0	£85 0 0
ARENA T1500F	£72 9 0	£59 19 6
ARENA T9000	£303 9 0	£258 0 0
*ARMSTRONG 525 ..	£91 17 9	£76 19 6
*ARMSTRONG 526 ..	£104 14 3	£86 19 6
ARMSTRONG M8 decoder	£9 10 0	£7 19 6
GOODMANS 3000 ..	£77 14 7	£52 19 6
PHILIPS RH781	£74 19 6	£54 19 6
PHILIPS RH790	£125 0 0	£101 19 6
PIONEER KX330 AM/FM/SW	£78 12 4	£62 19 6
PIONEER SX770 AM/FM ..	£160 8 6	£125 19 6
PIONEER SX990 AM/FM ..	£194 14 8	£149 19 6
TELETON CR55	£120 0 0	£95 0 0
TELETON F.2000	£51 10 0	£31 19 6
TELETON R4200	£51 15 0	£35 19 6
TELETON TFS50	£75 10 0	£55 19 6
TELETON 7AT 20	£105 0 0	£79 19 6
TELETON 10AT 1 150w. RMS	£160 0 0	£109 0 0
TELETON MX990 with speakers	£67 5 0	£48 19 6
TELETON R8000 with speakers	£63 5 0	£49 19 6
WHARFEDALE 1001 ..	£131 5 0	£105 0 0

All above Tuner Amplifiers are complete with MPX stereo decoder except where starred.

COMET for after-sales service
THROUGHOUT THE U.K.

SERVICE DEPOTS at **LEEDS, GOOLE WAKEFIELD DONCASTER HULL and BRIDLINGTON**

TURNTABLES

	Rec. Retail Price	Comet Price
ARENA SP25 with base, cover	£22 1 0	£17 19 6
DUAL 1219 transcription	£60 8 0	£49 19 6
DUAL 1209 transcription	£42 12 4	£34 19 6
GARRARD SP25, fully wired with Goldring G800 magnetic cartridge, complete with base, plinth and cover	Special price	£20 19 6
GARRARD SP.25 Mk II ..	£15 11 4	£10 10 0
GARRARD AP.75 ..	£23 16 0	£17 10 0
GARRARD SL.55	£13 17 9	£11 12 6
GARRARD SL.65B ..	£19 6 5	£14 19 6
GARRARD SL.75B ..	£35 12 4	£27 10 0
GARRARD SL.95B ..	£45 9 1	£36 10 0
GARRARD 401	£31 14 2	£25 19 6
GARRARD SL.72B ..	£30 2 0	£24 19 6
GARRARD 3500 with GKS Cartridge	£15 15 0	£11 19 6
base and cover to fit GARRARD SP25, SL55, SL65B and 3500	Special price	£3 19 6
GOLDRING GL69 Mk. II ..	£26 12 6	£21 10 0
GOLDRING GL69P Mk. II	£35 2 10	£27 19 6
GOLDRING GL.75 ..	£36 8 2	£29 19 6
GOLDRING GL75P ..	£46 18 8	£39 19 6
GOLDRING Covers for 69P and 75P	£4 4 3	£3 8 0
GOLDRING GL75 comp with plinth, cover and G800E Cartridge	£67 19 0	£53 19 6
GOODMANS 3025	£37 14 9	£25 19 6
McDONALD MP60.. ..	£15 0 0	£10 19 6
McDONALD 610	£18 19 6	£13 19 6
Base to fit McDONALD turntable	£3 13 0	£3 2 6
Cover to fit McDONALD turntable	£2 12 0	£2 2 6
PHILIPS 228	£19 19 6	£16 19 6
PHILIPS GA146	£29 19 6	£24 19 6
PHILIPS 217	£32 0 9	£27 4 0
PHILIPS 202 Electronic ..	£64 0 0	£54 0 0
PIONEER PL11	£50 17 11	£39 0 0
THORENS TD.125 ..	£75 17 8	£61 19 0
THORENS 125AB	£120 3 11	£99 19 6
THORENS 150A Mk II ..	£43 12 7	£32 19 6
THORENS 150AB Mk II ..	£47 8 7	£40 19 6
THORENS TX11 Cover ..	£4 2 3	£3 13 6

Bases, plinths, and covers stocked.

CARTRIDGES ALL MAKES STOCKED AT DISCOUNT PRICES

DELIVERY BY SECURICOR
WITHIN 72 HOURS

ALL IN-STOCK Items delivered by SECURICOR within 72 hrs. (Add 20/- only for Securicor delivery). All goods fully insured against loss or damage whilst in transit.

SPEAKERS

	Rec. Retail Price	Comet Price
ARENA HT 27	£18 18 0	£13 19 6
ARENA HT 28	£17 17 0	£12 19 6
ARENA HT 21	£10 10 0	£9 5 0
ARENA HT 7	£19 19 0	£17 0 0
ARENA HT 10	£22 1 0	£18 19 6
ARENA HT 20	£32 11 0	£26 19 6
ARENA HT 26	£78 15 0	£65 19 6
B & W DM3	£63 0 0	£52 19 6
B & W P2H	£94 10 0	£79 0 0
B & W DM1	£32 0 0	£25 10 0
CELESTION Ditton 10 ..	£21 3 2	£16 19 6
CELESTION Ditton 15 ..	£29 0 0	£22 19 6
CELESTION Ditton 25 ..	£59 17 0	£46 19 6
DULCI AS 3	£8 8 0	£6 19 6
GOODMANS MINISTER..	£22 9 0	£18 19 6
GOODMANS Majesta ..	£57 0 0	£44 19 6
GOODMANS Maxim ..	£20 7 9	£16 15 0
GOODMANS Mezzo II ..	£30 18 0	£22 19 6
GOODMANS Magnum-K	£40 2 0	£28 19 6
GOODMANS Marimba ..	£24 0 1	£18 19 6
GOODMANS Mambo ..	£22 5 6	£17 19 6
GOODMANS 3005 (pair)	£25 0 0	£18 19 6
KEF Celeste	£29 0 0	£21 10 0
KEF Concord	£43 10 0	£32 19 6
KEF Concerto	£53 10 0	£41 19 6
KEF Cresta	£22 3 4	£17 19 6
LEAK Sandwich	£45 10 0	£32 10 0
LEAK Mini-Sandwich ..	£29 15 0	£21 19 6
LEAK 300	£29 10 0	£20 19 6
LEAK 200	£23 0 0	£17 19 6
LEAK 600	£45 0 0	£32 19 6
LOWTHER Acousta (with PM6)	£45 10 0	£38 7 6
Ideal Baffle	£35 10 0	£29 17 6
Acousta (with PM7) ..	£53 0 0	£45 19 6
QUAD Electrostatic ..	£66 0 0	£52 19 6
SINCLAIR Q16	£8 19 6	£7 19 6
PHILIPS RH 481	£11 0 0	£9 2 6
PHILIPS RH 482	£18 0 0	£14 19 6
WHARFEDALE Speakers		
Airedale	£69 10 0	£55 19 6
Denton	£19 0 0	£14 19 6
Super Linton	£22 10 0	£18 10 0
Melton	£29 10 0	£22 19 6
Dovedale 3	£39 10 0	£29 19 6
Rosedale	£59 10 0	£46 19 6
TRITON (PAIR)	£55 0 0	£42 19 6
UNIT 3 Speaker Kit ..	£11 19 6	£9 10 0
UNIT 4 Speaker Kit ..	£16 0 0	£12 10 0
UNIT 5 Speaker Kit ..	£23 10 0	£17 19 6

LOW COST AUDIO SYSTEMS

	Rec. Retail Price	Comet Price
TELETON 2S60F	£75 0 0	£55 19 6

CHASSIS SPEAKERS

LARGE RANGE TO CHOOSE FROM—
Send for full list.

HI-FI STEREO TAPE DECKS AND TAPE RECORDERS

	Rec. Retail Price	Comet Price
AKAI X200D	£190 0 0	£159 19 6
AKAI X-360	£380 1 6	£284 0 0
AKAI X-360D deck.. ..	£318 18 4	£243 0 0
AKAI 1710L	£89 17 0	£69 19 6
AKAI 1800SD	£199 8 4	£167 0 0
AKAI 4000	£124 18 0	£99 19 6
AKAI 4000 D deck ..	£89 19 1	£69 19 6
AKAI M10L	£245 1 0	£189 0 0
AKAI X5000 W/L	£177 19 7	£139 19 6
AKAI X330	£342 11 4	£269 0 0
AKAI X330D	£312 11 3	£245 0 0
ALBA R22 Battery/Mains..	£50 5 0	£29 19 6
BUSH TP 60 Cassette ..	£29 8 0	£24 19 6
BUSH TP 70 Cassette, Battery/Mains	£29 19 0	£23 19 6
FERGUSON 3246	£43 0 0	£33 19 6
FERGUSON 3247 4-track ..	£48 9 0	£38 19 6
FERGUSON 3248 4-track ..	£54 6 0	£41 19 6
FERGUSON 3249 4-track ..	£64 6 0	£49 19 6
FERGUSON 3244 Stereo 4-track	£97 18 0	£79 19 6
FERROGRAPH 722 ..	£242 10 9	£202 0 0
FERROGRAPH 724 ..	£242 10 9	£202 0 0
GRUNDIG TK 146. 4tk auto.	£68 2 10	£58 19 6
GRUNDIG TK 141 4tk. ..	£59 4 8	£49 19 6
GRUNDIG TK 121	£54 15 7	£43 19 6
GRUNDIG C200 Cassette	£37 19 10	£29 19 6
GRUNDIG TK 124 ..	£44 18 0	£34 19 6
GRUNDIG TK 149	£57 12 8	£47 19 6
PHILIPS 3302 Cassette ..	£28 7 0	£19 10 0
PHILIPS 4408 4 tk. Stereo	£139 0 0	£109 0 0
PHILIPS 4302 Twin Track Auto.	£39 0 0	£31 19 6
PHILIPS 4307 4-track ..	£49 10 0	£38 19 6
PHILIPS N4404 (4 track stereo)	£87 0 0	£69 19 6
PHILIPS N4407 Stereo ..	£105 0 0	£85 19 6
PHILIPS N4308	£60 10 0	£49 19 6
PHILIPS 4500	£126 0 0	£98 19 6
PYE Cassette/Radio ..	£44 8 0	£36 19 6
TELETON 5L40. 2 tk. Bat/ Mains	£38 10 0	£24 19 6
TELETON FXB 510D Stereo	£62 10 0	£47 19 6
TOSHIBA GT601V ..	£45 3 0	£29 19 0
TOSHIBA GT 840 S ..	£110 0 0	£79 19 6
TOSHIBA 850 SA. ..	£94 0 0	£59 19 6

PICKUP ARMS

	Rec. Retail Price	Comet Price
GOLDRING Lenco L75 ..	£12 6 6	£10 10 0
GOLDRING Lenco L69 ..	£9 5 9	£7 0 0
SME 3009 with S2 shell ..	£31 6 3	£25 19 6
SME 3012 with S2 shell ..	£33 7 3	£28 19 6

COMET Hi-Fi DISCOUNT WAREHOUSES

(Dept. P.W.) Reservoir Rd., Clough Rd., Hull HU6 7QD. Tel 407906 & 407877
also at (Dept P.W.) 68a Armley Rd (Artist St) Leeds LS12 2EF Tel 32055 (5 lines)

Customers are welcome to call personally.
Ample Car Parking facilities

Comet guarantee that all prices quoted are genuine. All items offered available at these prices at the time this issue closed for press. Comprehensive Hi-Fi Catalogue available 5/-
Add 9/- for post and packing on all orders (cartridges 4/-). Make cheques Money Orders payable to "COMET"
If Securicor Delivery Required add 20/- only.

ON THE SHORT WAVES MONTHLY NEWS FOR DX LISTENERS

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz • Times in GMT

THE first reporter this month is **John W. Smith** of Anstruther in Fife who has started to report again after several months. His equipment consists of an Eddystone 840C with a Joystick and A.T.U., his very interesting log included:

4777 *R. TV Gabonaise,* sign-off at 2300
4800 *Radio Lara,* Ven. at 0130
4850 *R. Dif. Nat. de Mauritanie* at 1925
4890 *R. Dif. Venezuela* at 0330
4900 *Radio Juventud,* Ven. at 0430
4915 Tentative: *R. Guatapuri,* Col. at 0455
4945 *Radio Colosal,* Col. at 0700
4965 *R. Sante Fe,* Col. at 0625
4970 *R. Rumbos,* Ven. at 0445
4980 *Ecos del Torbes,* Ven. at 0010
4990 *R. Barquisimeto,* Ven. at 0130
4995 *R. Brasil Central* at 2315

James Parker also lives in Anstruther in Fife and his equipment is a Codar CR70A, a PR30 preselector and a 60foot long-wire. With this equipment he heard the following stations:

4810 *R. Popular,* Ven. in Spanish at 0215
4915 Nairobi, Kenya, Swahili at 1730
4915 Ghana B.C., English at 2245
4955 *R. Nacional,* Col., Spanish at 2300
4967 *R. Kuwait,* English at 1900
5050 *R. Tanzania,* Swahili at 1700
6250 Santa Isabel, Guinea, Spanish at 2230
11865 *R. Trans Europe* in English, 1345-1415
11920 Ivory Coast in French at 2320
15265 *R. Afghanistan* in German at 1730
15270 *ETLF,* Addis Ababa, Ethiopia at 0430

Craig Tyson has sent in his second report from Perth in Australia. The stations in his log may seem easy to European DXers but they are quite difficult for Australians.

9570 *BBC,* Far East Relay, Tebrau at 0000
9630 *R. Canada* in English from 0830 to 0930
9650 *V.O.A.* in English from 0000 to 0200
9705 *R. South Africa* in English at 2330
9745 *HCJB,* Quito, Ecuador, 0930 to 1000
15105 *Radio Sweden* at 1230 in English
15165 *Radio Denmark* in Danish, 1000
15175 *Radio Norway,* Oslo at 0700
17885 *Radio Portugal* in English at 0830

Paul Sexton of Preston in Lancashire has used his Ultra transistor radio and 20foot long-wire to hear the following stations:

6130 *Radio Norway* in English from 1200 to 1230
7310 *R. Vilnius,* Lithuania from 2230 to 2300
9625 *Kol Israel* in English, 2100 to 2145
9730 *Radio Australia* in English at 0815
11735 *Radio Rabat,* Morocco at 1715
11795 *WINB,* Red Lion, U.S.A., English at 2140
15300 *NHK,* Japan in English at 2200

Roy Patrick of Derby has sent in some more news items of interest including:

AFGHANISTAN *Radio Kabul* has been logged at 1800 in English on 15265 but now seems to have stopped using this frequency.

JORDAN *Radio Amman* has been audible on 7160 until about 2030 or later at 2100.

NORWAY *Radio Norway* has been heard with a new transmission at 0500 to 0630 on the frequencies of 9645 and 21730.

UNITED ARAB REPUBLIC *Radio Cairo* has been testing various frequencies in the 31 metre band and has been heard on 9605 and 9640 on different days.

DXing Tips

One of the major problems experienced by newcomers to DXing is that of obtaining the accurate frequency of a station. Crystal calibrators or frequency meters are expensive pieces of equipment which are usually beyond the reach of the beginner.

A receiver which has a bandspread control can be calibrated easily to very good accuracy using the method described below. Bandspread control can easily be added to a receiver as detailed in the article: *Tuning Facilitated* in the November 1970 issue of Practical Wireless.

The only requirements for this method are several sheets of graph paper (preferably 1/10th of an inch grid) and a little patience. The bandspread dial is usually marked from 0 to 100 and these numbers should be plotted on the vertical axis of the graph.

Suppose, for instance, that we wish to calibrate the 31 metre band. The main tuning is set so that the bandspread covers the whole of the band; this position of the main tuning is marked so that it can be returned to at any time. The horizontal axis of the graph is marked with frequencies from 9500 to 10000kHz.

Whilst tuning through the band there are bound to be several strong stations of which the frequency is known or announced during the transmission. These stations can be plotted on the graph until several points have been obtained. (Standard frequency stations such as *WWV* on 10000kHz are very useful in this method.)

When enough points have been obtained they can be joined by a smooth curve. Similar graphs can be made for all the bands of interest. When an unknown station is heard the bandspread dial reading can be converted to frequency using the graph. The frequency obtained by this method will be reasonably accurate providing that the graph is made carefully and the main tuning is set correctly.

ON THE SHORT WAVES

THE AMATEUR BANDS

David Gibson, G3JDG

Frequencies in kHz • Times in GMT

WHAT should one do about BC pirates? This question has cropped up again and again in letters, a number being received this month. First, note the time, and frequency. This must be as accurate as possible and care should be taken to ensure that the signals really are within the Amateur band and are not, for example, second channel QRM. This particularly applies if you are using a single conversion superhet. Next, all the relevant information should be sent to the R.S.G.B. who run a special intruder watch.

The QSL address of the Irish Radio Transmitters Society is now P.O. Box 462, Stella Avenue, Dublin 9, Ireland. Cards sent to the old address in Wicklow Street are being forwarded.

Logs

Conditions on 144MHz have been nothing short of fantastic, claims **N. Richardson** from his Aylesbury den. One G station was heard working an HB9/M who was running 10W to a halo antenna. Nick is to work in Air Traffic Control at Heathrow soon. No mods to the radar to come out on Topband OM! Using an 8-element Yagi at 30ft. to a Garex converter, PR30 and CR70A tuning 28-30MHz, Nick heard 2 metre sigs from: DC6BE, DC8BP, DCØKT, DJ9UXA, DK1VE, DK2DPX, DK4EO, DLØAK, DL8LR, F1AOY, F3NG, F6AKQ/P, F8MM, F9YR, HB9LN, ON5NY, OZ5KG, to mention just a few.

Another two-metre sleuth is **T. Rumble** (Wilts), 4-element Yagi at 20ft., transistor converter to an HA700 tuning 3-5MHz. Some signals tried to get away, but the following were rumbled: DC6BB, DC6EQ, DC8KU, DC9KY, DJ9DL, DK2AM, DK4DQ, DL1XG, DL8LR, F1CF, F1AAY/P, ON5KE, OZ5NM, PAØFWS. Trevor is thinking of building a 70cm converter and threatens logs for that band. (Promises, promises.)

If you saw a suspicious character loitering around the l.f. bands with an R209, 150ft. end-fed plus a.t.u., it was probably **P. Bonfield** (Dorset). Patrick hopes to take the R.A.E. this month (good luck OM) and says his favourite band is 160 metres. Heard on Topband: EI6AN, GC3HFE, G13WSS, numerous GMs, and GWs. These were on phone, while a spell on c.w. raised: DL9KRA, EI9BG, EI9J, GW3YGH, OK1AEH, OL4AMU, OL5ALY. Eighty metres brought sigs from: HBØWQ/P, OX3WQ, VE1IE, VO1FG, VP9GR, VS6OO, WA6EGL/TF, ZB2AH, 4U1ITU, 9H1BH all on phone. Even the dreaded forty parted with: AX3ABR, CM3LN, CO2DC, HI3PG and TF5TP.

Clive (of Kent, not India) **Manuel,** 6-valve homebrew plus 100ft of wire in the loft, finds the best times for an eavesdrop on eighty is between 2030 and 0600. His log for the band seems to prove him right: AP2AD, AP2KS, ELØK/MM, KL7DTH/KG6, MP4MBB, OX6CH, OY2X, VEØNEF/P/OZ, VE1LJ, VE2DNS, VP6GR, VS6DO, WA6EGL, YA1HG, YT2NFJ, ZB2A, ZS1EC, 4X4VF, 7P8PR, 9L1RP.

The best frequency on eighty, according to **T. Morrison** (Lancs) is around 3798. Trevor has bagged the R.A.E. and hopes to be licensed in 1971. Meanwhile, he sends in a 3·5MHz log of some of the stations heard. These include: CN8AW, CR7IJ, ELØK/MM (off coast of S.W. Africa), JW1EE, K1GZO, K2ZKA, PYØAD, PY3BAD, VE1EK/P, VE2XR, VO1FG, W1CBH, W4NYL, W4XHR/P, WA6EGO/P/TF, YT2NFJ, YT2RBN, ZB2A, 4X4RN, 9H1BZ, 9X5PB.

On 7MHz, Trevor logged: AX2KM, AX6SM, CN8HD, CN8BH, CT1GD, JAØSX, JA2JHH, JA3MZB, W2HCW, YO6ALD, 4X4AB.

M. Marsden (Essex), Hallicrafters S120, 66ft. end-fed plus the treat of making a 144MHz converter, went s.s.b.-ing on 14MHz. Fruits of labours include: AP2KT, AX2WZ, AX3AXC, AX6FD, CR4BS, CM8CD, CN8AX, EL6EQ, ET3XL, HT1FCH, HS1ACW, HSØISB, KP4OKX, KH6HIH, KH6FF, KL7YK, LX1BJ, MP4TT, M1ZKB, OX2BFR, PY2DUT, SV1EQ, SVØWY, TR8ML, TJ1AX, VU3FD, VK2ABC, VK6FD, VE1EL, W5ZXS, XF5AM, ZS1KJ, ZL2BGV, ZL1AH, ZM4BXD, ZK2AF, ZS6BKW, 4X4NJ, 6W8AW, 7X2MD, 9H1R, 9K2AM.

S. Wainwright (Lancs) confesses to listening on 14MHz with a Trio 9R-59DS and a 100ft. long wire. He pleads guilty to hearing: AX3AHR, AX3MO, AX4TT, CE6GB, CT2AE, DA1RS (new prefix for U.S. Forces in Germany), KV4FZ, LU4VW, OD5FA, PY2BCQ, PY7YS, PZ5RK, VK2FU, VK2XG, VO1CU, VU1AFY, WB5VVS/YV6, YV1WX, 4S7PB, 4U1ITU, 4X4GT, 5J3CC, 9K2AM, 9V1PQ.

Andy Crooks (Leics) is off to Tees-side for a spell (there's nothing like a nice cup of Tee). Last log from Leicester for 21MHz reads: AX4TT, CT3AS, EA6AR, HI8FED, HKØBKW (San Andre), JA1WUN, JA2WAA, JA3MNM, JA4ITN, JA7GST, JA8FZT, K6BW, KP4QM, KR6JU, PY1CZH, PY2HY, W7GVA, WØOYP, YA1HD, YV1TP, ZE4JW, 3V8AL, 9H1R, 9J2MA.

On ten metres s.s.b. Andy bagged: AX6CT, AX6NM, CE8AO, CR6MT, CR7JP, CX9CO, FH8CG, LU2DEK, LU3DLZ, LU5FEH, PY2RE, PZ1AH, TY7ATF, VE8YL, VK6CF, VP8KL, VP9FE, YV5AK, ZE1BP, ZE5JU, ZS6HR, 9J2HE, 9J2RO.

Sad news for the contest fanatics. There's only one in December and that's a two-meter fixed station contest. It only remains to wish all readers a Very Happy Christmas and New Year. Don't forget the local nets on Christmas morning. Favourite bands are 160 metres and 2 metres.

Logs for the Amateur Bands must arrive before the 15th of each month. The address is:
14 Manland Avenue, Harpenden, Herts.

FIND BURIED TREASURE! TREASURE LOCATOR FULLY TRANSISTORIZED

NOW IT'S HERE AT LAST, after experimenting for four and a half months with a multitude of different circuits and carrying out actual field tests with prototypes, our design team have come up with this real winner. This fully portable transistorized metal locator detects and tracks down buried metal objects—it signals exact location with loud audible sound (no phones used). **FINDS GOLD, SILVER, LOST COINS, JEWELLERY, KEYS, WAR SOUVENIRS, ARCHAEOLOGICAL PIECES, METALLIC ORE, NUGGETS ETC. ETC.** Outdoors or indoors. *Extremely sensitive, will signal presence of certain objects buried several feet below ground!* No knowledge of radio or electronics required. *Can be built with ease in one short evening by anybody from nine years of age upwards,* with the wonderfully clear, easy to follow, step-by-step, fully illustrated instructions—it really is easy as A.B.C. Fully transistorized—no valves. Uses standard PP3 battery. No soldering necessary. Size of detector head 13¾" x 10" x 2½" **Great demand expected at this remarkably low price—ORDER WHILE PRESENT STOCKS LAST.** All parts including detector head case, nuts, screws, wire, simple instructions etc. etc **ONLY 47/6d + 6/6d** P. & P. (Telescopic handle as illustrated 25/- extra). Parts available separately. Made up looks worth £15! Money back guarantee.

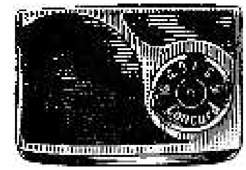
ONLY **47/6**

UNIQUE RADIO FOR BEDROOM OR OFFICE

No batteries, no electricity, never wears out

Tune in your favourite programmes or the news, or sports in the Office or in your bedroom. Uses sensitive, germanium diode originally evolved from Wartime radar. Never buy a battery. Never use electricity. Never replace. Covers all medium waves. Clear beautiful tone. Size 4½" x 2¾" x 1½" in beautiful case. **ONLY 7 CONNECTIONS AND IT'S WORKING.** No soldering necessary. **CAN BE BUILT ALMOST BLINDFOLD IN UNDER 15 MINUTES!** Ideal for absolute beginner from 8 years of age upwards. **SPECIAL PRICE TO CLEAR STOCKS OF COMPONENTS, ONLY 19/6d** + 2/6d. P. & P. for all parts including beautiful case, Germanium semi-conductor, tuning condenser, personal phone, wire, nuts, screws. **SIMPLE AS A.B.C. INSTRUCTIONS.** *Will make an exceptional Christmas present.* (Parts available separately). Money Back Guarantee.

ONLY **19/6**



REAL WORKING ELECTRONIC ORGAN

Don't confuse with ordinary electric organs that simply blow air over mouth-organ type reeds etc. Eight months were spent in creating and testing this superb, revolutionary electronic organ. Fully transistorized—no valves. **Proper self-contained loudspeaker.** *Fifteen separate keys span two full octaves*—play the *"Yellow Rose of Texas"*, play *"Silent Night"*, play *"Auld Lang Syne"*, play *lots and lots of similar tunes* on this real working electronic organ. Although it's no theatre organ it's certainly no tiny thing, it measures 13¾ x 10 x 2½". You have the thrill and excitement of building it together with the pleasure of playing a real, live, throbbing electronic organ. *Take it anywhere—play it anywhere.* **NO PREVIOUS KNOWLEDGE OF ELECTRONICS NEEDED—NONE WHATEVER.** No soldering necessary, it really is as simple as a.b.c. to make.

ONLY **55/-**

Anyone from nine years upwards can build it easily in one short evening following the fully illustrated, step-by-step, simply worded instructions. **BIG DEMAND ANTICIPATED FOR THIS UNIQUE INSTRUMENT** at our low, low building price. **ONLY 55/-** + 4/6d. P. & P. for all parts, including case, loudspeaker, transistors, condensers, resistors, knobs, transformer, volume control, wire, nuts, screws, simple (but full) instructions, etc. etc. Uses standard PP3 battery (parts available separately). Have all the pleasure of making it yourself, finish with an exciting gift for someone. Money back guarantee.

AMAZING TRANSISTORIZED CIGARETTE RADIO

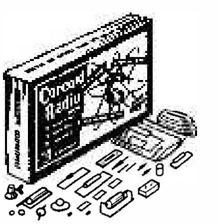
Yes, a perfectly ordinary packet of cigarettes! But watch your friends astonishment on hearing its range of stations loud and clear. Holds 10 cigarettes yet conceals sensitive, fully transistorised circuit **(including tiny battery).** A young boy can assemble it in under 2 hours. **No soldering. Only 16 connections to make.** ALL PARTS including semi-conductors. Simple as ABC Illustrated Plans, etc. **ONLY 29/6 plus 2/6 post, etc.** Parts available separately. Money back guarantee.

TOTAL BUILDING PRICE **29/6**

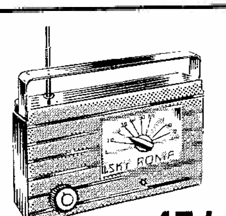
MAKE 5 DIFFERENT TRANSISTOR RADIOS

Last 250

TOTAL BUILDING PRICE **39/6**



Amazing Radio Construction set! Become a radio expert for **39/6.** A complete Home Radio Course. No experience needed. Parts including simple instructions for each design. Illustrated Step-by-step plans, all Transistors, loud-speaker, personal phone, knobs, screws, etc., all you need. Box size 14" x 10" x 2" (parts avail. separately). Send only **39/6** + 4/6 P. & P. Money back guarantee.



ONLY **45/-**

SHORTWAVE TRANSISTOR RADIO

Can be built in one evening

At last! After trying countless circuits searching for easy build, work-first-time short waver. Giving advanced world-wide performance, we chose this 'Sky Roma'. Anyone from 9 years up can follow the step-by-step, easy-as-ABC, fully illustrated instructions. (We built ten propotypes and every one worked first time) no soldering necessary. 76 stations logged on rod aerial in 30 mins.—**Russia, Africa, USA, Switzerland, etc.** Experience thrills of world wide news, sport, music, etc. **Eavesdrop on unusual broadcasts.** Uses PP3 battery. Transistorised (no valves!). Size only 3" x 4¾" x 1⅝". **As tremendous demand anticipated price held to only 45/- + 3/6** p. & p. for all parts incl. Cabinet, screws, instr. etc. (Parts available separately). Money back guarantee.

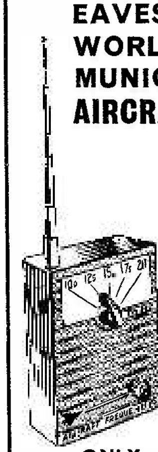
"READ PEOPLE'S MINDS"—TEST THEIR NERVES—BEAT THEM AT CARDS—TEST THEIR MENTAL ABILITY, ETC. WITH THIS ASTONISHING ELECTRONIC BRAIN-BOX

Make this an exciting Christmas

ONLY **57/6**

If you've seen a giant computor on show at an electronics exhibition, you will have seen people of all ages queueing to pit their abilities against the giant electronic brain. There is a tremendous fascination that attracts ordinary people and professional engineers alike to electronic games of skill, chance and mystery. With this "Brain-box" you will be able to *perform mind-boggling feats.* **THE MIND READING DEVICE** will make *people swear you have "telepathic" powers.* **THE AMAZING CARD TRICK UNIT** completely mystifies and baffles from one to six people. *You correctly "guess" the two cards each person has selected at random from a pack they themselves shuffled.* **THE ELECTRONICS NERVES TESTER** puts your friends to a very lively test. It gives out fail and finish signals (the winner is the person with lowest number of fail signals.) *Can be adjusted from the weakest to strongest person.* **THE ELECTRONIC MAZE** *tests the mental ability of the player* because it uses psychology with an electronic twist to it. You can change the maze pathways in seconds to prevent the maze becoming too stale after lots of use. Completely safe and foolproof, uses standard battery. Size 18" x 12" x 6" (Max.) You can play all these games and more beside after building the "Brainbox". **WE GUARANTEE THAT ANYONE FROM NINE TO NINETY CAN EASILY ASSEMBLE ALL THESE PROJECTS IN UNDER ONE HOUR!** You can't go wrong, no soldering, you get pictorial, easy as a.b.c. step-by-step simple instructions. **ONLY 57/6d** + 6/6d P. & P. for all parts including chassis, switches, stylus, signalling lights, wire, nuts, screws etc. etc. Uses standard U2 bettery. (PARTS AVAILABLE SEPARATELY) **FULL OPERATING DIRECTIONS WITH EACH OF THE PROJECTS.** MONEY BACK GUARANTEE.

EAVESDROP ON THE EXCITING WORLD OF AIRCRAFT COMMUNICATIONS-JUST OUT V.H.F. AIRCRAFT BAND CONVERTER



ONLY **47/6**

Many thousands of v.h.f. Aircraft Band Converters now selling in U.S.A. *Listen in to* **AIRLINES, PRIVATE PLANES, JETPLANES.** *Eavesdrop on exciting crosstalk between pilots, ground approach, ground control, airport tower. Hear for yourself the disciplined voices hiding tenseness on talk downs.* Be with them when they have to take nerve ripping decisions in emergencies—Tune into the international distress frequency. Covers the aircraft frequency band including **HEATHROW, GATWICK, LUTON, RINGWAY, PRESTWICK ETC., ETC. CLEAR AS A BELL.** This fantastic fully transistorised instrument *can be built by anyone nine to ninety in under two hours.* (Our design team built four—everyone worked first time). *No knowledge of radio or electronics required.* No soldering necessary. Fully illustrated simply worked instructions take you step-by-step. Uses standard PP3 battery. Size only 4¾" x 3" x 1½". All you do is extend rod aerial, place close to any ordinary medium-wave radio-(even tiny portables) **NO CONNECTIONS WHATEVER NEEDED.** Use indoors or outdoors. **THERE WILL BE ENORMOUS DEMAND FOR THIS NEW DESIGN. SEND NOW. ONLY 47/6** for all parts, including case, nuts, screws, wire, etc. etc. (parts available separately). Money back guarantee.

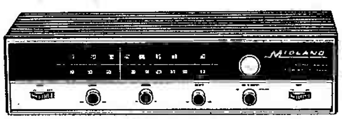
CONCORD ELECTRONICS LTD (Dept. PW15) 8 Westbourne Grove, London W.2. (Nr Bayswater & Queensway Tubes. 1 minute ABC Cinema) Callers Welcome 9 a.m.-6 p.m. inc. Saturday

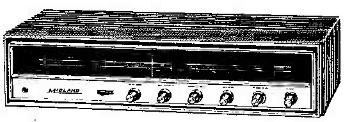
PREMIER STEREO SYSTEM "ONE" Consists of an all transistor stereo amplifier. Garrard 2025 T/C auto manual record player unit fitted stereo mono cartridge and mounted in teak finish plinth with perspex cover and two matching teak finish loudspeaker systems. Absolutely complete and supplied ready to plug in and play. The 10 transistor amplifier has an output of 5 watts per channel with inputs for pick-up, tape and tuner also tape output socket. Controls: Bass, Treble, Volume, Balance, Selector. Power on off, stereo mono switch. Brushed aluminium front panel Black metal case with teakwood ends: Size 12 × 5½ × 3½in. high (Amplifier available separately if required £14.19.6. Carr. 7/6.) ***NOW AVAILABLE – MATCHING FM TUNER 21 GNS.***

PREMIER STEREO SYSTEM "TWO"
As system 'ONE' above but with Garrard SP25.
PREMIER PRICE 45 Gns. Carr. 35/-

MIDLAND AM/FM STEREO TUNER AMPLIFIERS

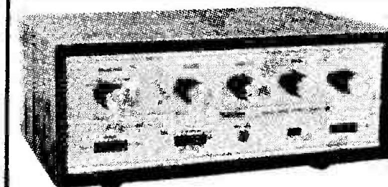
Two new all solid state receivers from Midland at economical prices. Beautifully styled in slimline cabinets.


MODEL 19-520


MODEL 19-542

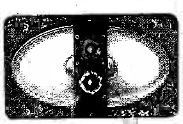
Specifications	Model 19-520	Model 19-542
Semi conductors	19 transistors, 12 diodes, 2 varistors	22 transistors, 12 diodes
Tuning range	FM 88–108 MHz FM Stereo Multiplex AM 535–1635 kHz	FM 88–108 mHz FM Stereo Multiplex AM 535–1605 kHz
Aerial	Internal AM and external FM	Internal AM and external FM
Frequency response	50–17,000 Hz	35–20,000 Hz
Power output	2½ watts rms per channel (8 watts music power)	4 watts rms per channel (18 watts music power)
Inputs	Ceramic phono	Magnetic/Ceramic phono and aux.
Speaker impedance	4–8 ohm	8 ohm
Controls	Power on/off, Volume, tone, balance, tuning, AFC. Stereo indicator	On/off, Volume, bass, treble, balance, tuning, AFC. Stereo indicator
Function selector	AM, FM, FM Stereo, Phono (Stereo indicator light)	AM, FM, FM Stereo, Ceramic, Magnetic. Aux.
Size	15″ x 8$\frac{3}{16}$″ x 3½″	16½″ x 9⅛″ x 3⅛″
PRICE	**37 Gns.** Carr. & Ins. 10/-	**42 Gns.** Carr. & Ins. 10/-

TELETON SAQ203E STEREO AMPLIFIER



A small but powerful amplifier designed for stereo hi-fi reproduction. 10 watts per channel music power. Inputs for Gram (Magnetic and Crystal), Tuner and Auxiliary. Tape Record output. Controls: Volume, Balance, Bass, Treble, Stereo/Mono slide switch. Stereo headphone socket. Attractive oiled walnut cabinet with brushed aluminium front panel. List Price £28.7.0

PREMIER PRICE 22 Gns. P. & P. 10/-



E.M.I. 13×8in. HI-FI SPEAKERS
Fitted two 2½in tweeters and crossover network. Impedance 8 or 15 ohm. Handling capacity 10W. Brand new.
79/6 P. & P. 7/6

PREMIER EXCLUSIVE
MIDLAND CASSETTE TAPE RECORDER 12-115

Solid state incorporating piano key controls for trouble-free 2-track recording. Inputs for mike and aux. Earphone socket. Complete with batteries and earpiece. Size 10¾″ × 5¼″ × 2¾″. **£16.10.0** P. & P. 7/6.

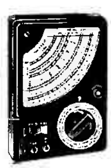
PREMIER STEREO SYSTEM "FOUR"

Teleton SAQ203E Amplifier (as above)	£23.2.0
Garrard SP25	£11.19.6
Shure M3D	£6.19.6
Teak base and cover	£5.10.0
Pair of Hi-Fi Enclosures fitted E.M.I. Speakers	£26.5.0
Total cost if purchased separately	£73.16.0

PREMIER PRICE 65 Gns. Carr. 35/-

HI-FI STEREO HEADPHONES
Designed to the highest possible standard. Fitted 2½in speaker units with soft padded car muffs. Adjustable headband. 8 ohms impedance. Complete with 6ft lead and stereo jack plug.
49/6 P. & P. 5/-.

MONO HEADPHONES 2000 ohm 14/6 P. & P. 2/6.
STEREO STETHOSCOPE SET Low imp. 25/- P. & P. 2/-.
MONO STETHOSCOPE SET Low imp. 10/6 P. & P. 2/-.



POCKET SIZE MULTI-TESTER With wide angle, jewelled meter movement, ceramic long-life, low-loss switching, tough impact resisting case. Sensitivity 20,000 ohms/volt D.C. 10,000 ohms/volt A.C. **19 Ranges:** 0-5-25-50-250-500-2500 volts DC. 0-10-50-100-500-1000 volts AC. 0-50μA-2·5 mA-250 mA DC. 0-6000 ohms-6 megohms, 10μ μf-0·001 mfd-1 mfd. −20 to +22dB. Complete battery, test lead and instructions. **£4. 19. 6** P. & P. 3/6.

SPECIAL OFFER!

GARRARD SP25 MK II SINGLE RECORD PLAYER FITTED GOLDRING 850 MAGNETIC STEREO CARTRIDGE COMPLETE IN TEAK PLINTH WITH RIGID PERSPEX COVER.

Total list price over £24.
PREMIER PRICE
18 Gns.
P. & P. 10/-.

"VERITONE" RECORDING TAPE

SPECIALLY MANUFACTURED IN U.S.A. FROM EXTRA STRONG PRE-STRETCHED MATERIAL. THE QUALITY IS UNEQUALLED. TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped–attractively boxed.

LP3	3″	250′	P.V.C.	5/6
TT3	3″	450′	POLYESTER	7/6
DT3	3½″	600′	POLYESTER	11/6
SP5	5″	600′	P.V.C.	8/6
LP5	5″	900′	P.V.C.	10/–
DT5	5″	1200′	POLYESTER	15/–
LP6	5¾″	1200′	P.V.C.	12/6
DT6	5¾″	1800′	POLYESTER	22/6
TT6	5¾″	2400′	POLYESTER	37/6
SP7	7″	1200′	P.V.C.	12/6
LP7	7″	1800′	P.V.C.	15/-
DT7	7″	2400′	POLYESTER	25/–
TT7	7″	3600′	POLYESTER	50/–

TAPE SPOOLS 3″ 1/-, 5″, 5¾″, 7″ 1/9,
Post and Packing 3″ 1/-, 5″, 5¾″, 1/6, 7″ 2/-. (3 reels and over Post Free).

TAPE CASSETTES

C60 (60 min.)	7/6	3 for 21/-
C90 (90 min.)	12/6	3 for 36/-
C120 (120 min.)	17/6	3 for 51/-

P. & P. 1/-.

All cassettes can be supplied with library cases at 6d. extra each

PREMIER RADIO
23, TOTTENHAM COURT ROAD, LONDON, W.1 Tel: 01-636 3451

I.C. OF THE MONTH

L.A.J. IRELAND

Number 15 — **G.E. (U.S.A.) D13V Utility Voltage Regulator**

THESE monthly notes have illustrated two divergent trends in linear integrated circuits. On one hand there is the continuing evolution of more complex special function i.c.'s, contrasting with the wider adoption of silicon planar technology at the other end of the scale for the production of a range of basic utility circuits for the mass market. Typical of these units is the TAA320 bifet, the topic of this column last November, which combines features of the bipolar transistor and the field effect device in a single three terminal assembly.

D13V Characteristics

Power dissipation	400mW
Regulated voltage (V_{21})	40V
Shunt current (I_2)	40mA
Bias current (I_3)	5mA
Temp. range	—15 to +125°C

Absolute max. ratings. (At 25°C. Reduce dissipation for higher temperatures)

Description

This month it is the General Electric (U.S.A.) type D13V, again a three terminal device, but this time associating the zener effect with bipolar transistors, to provide a voltage regulating unit. The device acts alone as a shunt (parallel) regulator, or with an auxiliary external transistor in series regulation. It can also form a voltage reference unit, for example in power d.c. amplifiers or control systems.

In appearance identical to a small signal transistor in an epoxy package (TO-98), the device falls into the same price range, currently being available in the U.K. at around 8s. 6d. for single units. This economy should be reflected in a great popularity, since active regulation now becomes attractive for many purposes where previously decoupling with r.c. circuits would have been considered quite satisfactory. R.F., i.f. and b.f.o. stages of transistor communications sets are points at which cheap regulator circuits can pay off in increased stability and performance.

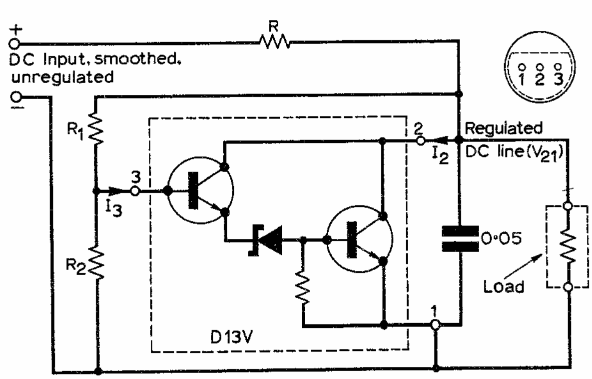


Fig. 1. Basic shunt regulator circuit. R is a dropper resistor chosen to ensure that, at minimum d.c. supply volts and maximum load current, at least 1mA flows in D13V.

Shunt Regulator

Fig. 1 shows the regulator in a typical shunt circuit. As is evident, a drop in the current drawn by the load would tend to increase the voltage applied to the load, due to the drop in the "lost" voltage in the current source internal resistance. However, the resistive voltage divider across the output of the D13V will then feed a higher bias back to the transistors, with a resultant increase in regulator current. Hence the i.c. compensates for fluctuations in the load by sharing current to ensure constant demand on the power supply.

Series Regulator

It is also evident that this procedure is incompatible with battery economy in portable devices, where series regulation is called for. Here the integrated voltage regulator is used as a reference voltage, with the base of a transistor in series with the load connected to the output of the D13V. If a positive supply is to be series regulated, an n.p.n. power series transistor is used, with a p.n.p. for a negative supply. The collector is connected to the smoothed power supply or battery, the emitter to the load. The current in the transistor is practically independent of the collector-base voltage, so that the emitter remains close to the value of the voltage reference., Hence the voltage applied to the load remains practically constant despite variations in the current drain.

Advantages

The advantage over a simple zener controlled regulator lies in the fact that the voltage at which the unit is effective can be set simply by a variable resistor, whereas with a zener a fixed reference voltage is attained. The unit can therefore form the basis of a controlled regulated voltage source.

The chief disadvantage is that the minimum voltage at which the device is applicable is 10 volts, so that 9 volt supplies in utility transistor apparatus lies below its range. It is however ideal for auto applications, as every device designed for use in and around the car is commonly designed for the 12 volt car battery. Indeed, a "trickle" battery charger is an obvious outlet for the potential of this unit. At the high end of the scale, up to 40 volts can be applied across the unit, though care must be taken to ensure that device dissipation is not exceeded.

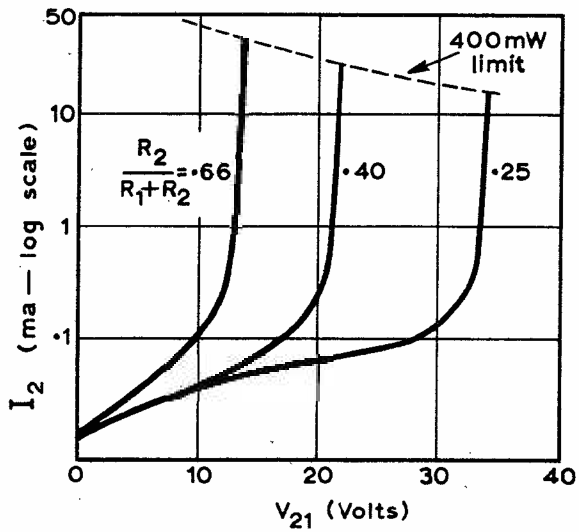


Fig. 2. Regulation characteristic curves.

Fig. 2 gives an indication of the effectiveness of the unit with differing feedback resistances, and consequently differing voltage regulating levels. In choosing the resistors, it should be the objective to keep the value of $R_1R_2/(R_1+R_2)$ in the range 10kΩ to 50kΩ. The output voltage will be given approximately by:

$$V_{21} = 8 \cdot 5(R_1+R_2)/R_2.$$

Sensitivity and Stability

The sensitivity of the device to variation in power supply output voltage is less than 2mV per 1 volt supply variation, while stability over an extended period is within 100mV. Naturally this compares rather unfavourably with the LM300 or other complex regulators, as reported in these notes some time ago, but their excellence must be paid for; at its price the D13V is undoubtedly a bargain. It is available from: Jermyn Industries, Vestry Estate, Sevenoaks, Kent or Celdis Limited, 37-39 Loverock Road, Reading, Berks. ■

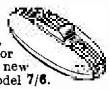
ELECTRIC CLOCK WITH 25 AMP SWITCH

Made by Smith's, these units are as fitted to many top quality cookers to control the oven. The clock is mains driven and frequency controlled so it is extremely accurate. The two small dials enable switch on and off times to be accurately set. Ideal for switching on tape recorders. Offered at only a fraction of the regular price—new and unused only **39/6**, less than the value of the clock alone—post and insurance 2/9.

FLUORESCENT CONTROL KITS

Each kit comprises seven items—Choke, 2 tube ends, starter, starter holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A —15-20 w. **19/6**. Kit B—30-40 w. **19/6**. Kit C—80 w. **23/6**. Kit E—65 w. **23/6**. Kit F for 8ft. 125 w. tube **35/-**. Kit MF1 is for 6in., 9in. and 12in. miniature tubes, **19/6**. Kit MF2 for 21in. 13 w. miniature tube **20/-**. Postage on Kits A and B 4/6 for one or two kits then 4/6 for each two kits ordered. Kits C, D and E 4/6 on first kit than 3/6 for each kit ordered. Kit F 6/6 than 4/6 for each kit ordered. Kit MF1 3/6 on first kit then 3/6 on each two kits ordered.

BLANKET SWITCH

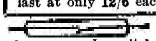


Double pole with neon let into side so luminous in dark, ideal for dark room light or for use with waterproof element, new plastic case. **5/6** each. 3 heat model **7/6**.

BLANKET SIMMERSTAT

Although looking like, and fitted as an ordinary blanket switch, this is in fact a device for switching on for varying time periods, thus giving a complete control from off to full heat. Although suitable for controlling the temperature of any other appliances using up to 1 amp. Listed at **27/6** each we offer these while our stocks last at only **12/6** each.

REED SWITCHES



Glass encased, switches operated by external magnet—gold welded contacts. We can now offer 3 types;

Miniature. 1in. long × approximately ⅛in. diameter. Will make and break up to ½A up to 300 volts. Price **2/6** each. **24/-** dozen.

Standard. 2in long × 3/16in. diameter. This will break currents of up to 1A, voltages up to 250 volts. Price **2/-** each. **18/-** per dozen.

Flat. Flat type, 2in. long, just over 1/16in. thick, approximately ⅛in. wide. The Standard Type flattened out, so that it can be fitted into a smaller space or a larger quantity may be packed into a square solenoid. Rating 1 amp 200 volts. Price **6/-** each. **£3** per dozen.

Small ceramic magnets to operate these reed switches **1/9** each. **18/-** dozen.

HIGH CAPACITY ELECTROLYTICS

Brand new, not ex-equipment.

100 mfd. 25v., **1/3** each **12/-** doz.
200 mfd. 25v., **1/6** each **15/-** doz.
250 mfd. 50v., **3/3** each **33/-** doz.
400 mfd. 40v., **4/4** each **46/-** doz.
500 mfd. 12v., **2/-** each **£1.1.0** doz.
500 mfr. 25v., **3/6** each **36/-** doz.
500 mfd. 50v., **4/6** each **48/-** doz.
500 mfd. 350v., **8/6** each **£4.10.0** doz.
1000 mfd. 12v., **3/-** each **£1.10.0** doz.
1000 mfd. 18v., **3/4** each **34/-** doz.
1000 mfd. 64v., **7/4** each **80/-** doz.
2000 mfd. 25v., **6/8** each **79/-** doz.
5000 mfd. 12v., **4/9** each **£2.8.0** doz.
10,000 mfd. 6v., **5/9** each **£3.0.0** doz.
10,000 mfd. 15v., **8/6** each **£4.10.0** doz.
15,000 mfd. 10v., **10/6** each **£5.0.0** doz.
60,000 mfd. 8v., **22/-** each **£10.0.0** doz.
70,000 mfd. 18v., **40/-** each **£20.0.0** doz.

3 amp 12v Battery Charger Kit—comprising 230/40 mains transformer with 3 amp secondary and 3 amp rectifier **22/6** plus 4/6 post.

12 volt 1½v amp Power Pack. This comprises double-wound 230/240V mains transformer with full wave rectifier and 2000 m/f/d/smoothing. Price **27/6**.

Sonotone Stereo Cartidge. Turnover type, ref. No. 19 T1. This fits most British pick-ups and is a really excellent reproducer. Limited quantity, 19/6

5 amp 3 pin Sockets. These are always good stock, you never know when you will need some. Famous make, brown bakelite, standard size, 12 for **13/-** plus 4/6 post.

Ditto but with switch. 12 for **£1** plus 4/6 post.

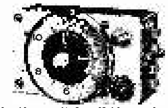
13 amp sockets, flush mounting. Bakelite, cream, less switch. 6 for **£1.**

Bakelite Panels, many thicknesses. We have just taken delivery of approximately 10 tons of bakelite in varying thicknesses from 2in. to a few thou. If you have a need for any of this then we would be glad to supply. The thickest is very heavy and could be used, for instance, as a bed for a motorised unit. Medium thickness is useful for front panels of instrument, etc., etc. Cut to your size price is **6/-** per lb. plus 6/- cutting charge plus carriage.

2 amp 3 pin Switched sockets for surface mounting, brown bakelite. Made by famous maker, **2/6** each or **24/-** dozen.

100 Assorted Silicon Rectifiers G.P. and switching diodes. Small and very small sizes. A real snip for experimenters, **12/6** per 100.

20 AMP ELECTRICAL, PROGRAMMER



Learn in your sleep: Have Radio playing and kettle boiling as you awake—switch-on lights to ward off intruders—have warm house to come home to. All these and many other things you can do if you invest in an Electrical Programmer. Made by the famous Smiths Instrument Company. This is essentially a 230/240 volt mains operated Clock and a 20 amp Switch, the switch-off time of which can be delayed up to 12 hours (continuously variable not stepped). Similarly the switch-on time can be delayed. This is a beautiful unit, size 5¾ × 3¾ × 2½in. deep. Metal encased, glass fronted with chrome surround. Offered at **47/6** pus 4/6 postage and insurance.

40 WATT 12in. HI-FI SPEAKER

Is undoubtedly one of the finest loudspeakers that we have ever offered, produced by one of the country's most famous makers. It has a die-cast metal frame and is strongly recommended for Hi-Fi and public address. Handling 40 watts R.M.S.—Cone moulded fibre—Freq. response 30—10,000 c.p.s.—specify 3 or 15 ohms. Chassis diam. 12in.—12⅜in. over mounting lugs. Overall 5½in. height A £10 speaker offered this month for **£5.19.6** plus 7/6 post and ins.

INTEGRATED CIRCUIT BARGAIN

A parcel of integrated circuits made by the famous Plessey Company. A once-in-a-lifetime offer of Micro-electronic devices well below cost of manufacture. The parcel contains 5 ICs all new and perfect, first-grade device, definitely not sub-standard or seconds. 4 of the ICs are single silicon chip GP amplifiers. The 5th is a monolithic NPN matched pair. Regular price of parcel well over **£5**. Full circuit details of the ICs are included and in addition you will receive a list of many different ICs available at bargain prices 5/- upwards with circuits and technical data of each. Complete parcel only **£1** post paid. *DON'T MISS THIS TERRIFIC BARGAIN.*

THIS MONTH'S SNIP

4 AMP VARIAC CONTROLLERS

With this you can vary the voltage applied to your circuit from zero to full mains without generating undue heat. One obvious application therefore is to dim lighting. Ex equipment but little used—as good as new offered at approx. half price. **£5** plus 12/6 post and ins.

DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 × 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Suppled complete with 7 feet of heavy cable. Wired up ready to work, **39/6** less plug **45/-** with fitted 13 amp plug; **47/6** with fitted 15 amp plug, plus 4/6 P. & I.

BARGAIN OF THE YEAR

MICROSONIC KEYCHAIN RADIO

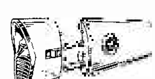
7 transistor Keychain Radio in very pretty case, size 2¾ x 2⅛ x 1½in.—complete with soft leather zipped bag. Specification:—Circuit: 7 transistor superheterodyne. Frequency range: 530 to 1600 Kc/s. Sensitivity: 5 mv/m. Intermediate frequency; 465 Kc/s or 455 Kc/s. Power output: 40mW. Antenna: ferrite rod. Loudspeaker; Permanent magnet type.

In transit from the East these sets suffered slight corrosion as the batteries were left in them but when this corrosion is cleared away they should work perfectly—offered without guarantee except that they are new. Price only **24/6** less batteries plus 2/6 post 6 for **£7** post free. Pair of rechargeable batteries and charger **17/-**.

TANGENTIAL HEATER UNITS

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in hoover and blower heaters costing **£15** and more. We have a few only. Comprises motor, impeller, and two elements allowing 3 heat switching and with thermal safety cut out. Can be fitted into any metalline case or cabinet. Only need control switch. 2¼ k.w. model **59/6**; 2 k.w. model **39/6**. Postage and insurance 6/6. Control switch 5/6.

RE-CHARGEABLE TORCH

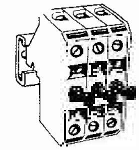


Neat flat torch, fits unobtrusively in your pocket, contains 2 Nicad cells and built-in charger. Plugs into shaver adaptor and charges from our standard 200/240 volt mains. American made, sold originally at over 4 dollars. Our price only **19/6** each.

MOTORISED SWITCH
For Animated Signs, etc.

This is a motorised programmer switch, mains operated, with six 15 amp changeover contacts operated by triggers on a rotating drum. Six triggers will put switches up and another six triggers will put switches down. This simple on/off operation or changeovers are possible. The triggers can be exactly set to any position around the drum which is rotated by a one rev. per hour motor. A beautifully made precision switch which probably cost in excess of £20. Limited quantity only **£7.15** each plus 4/6 post and ins. Similar programmer by Honeywell with 15 × 10 amp switches operated by 5 r.p.m. motor **£5.15** plus 4/6 post. & ins.

Mains Connector



A quick way to connect equipment to the mains safely and firmly—L, N. and E. coded to new colour scheme; disconnection by plugs prevents accidental switching on; has sockets which allow insertion of meter without disconnection: cable inlets firmly hold one hair wire on up to four 7.029 cables. **12/6** each.

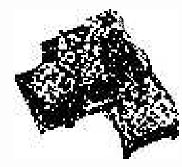
DRILL CONTROLLER

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. **19/6** plus 2/6 post and insurance. Made up model also available, **37/6**, plus 2/6 post & p.

BALANCED ARMATURE UNIT

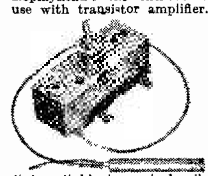
500 ohm. operates speaker or microphone, so useful in intercom or similar circuits. **6/6** ea, **£3.10.0** doz.

BATTERY OPERATED TAPE DECK



With Capstan control. This unit is extremely well made and measures approx. 6×5×2 in. deep. Has three piano key type controls for Record, Playback and Rewind. Motor is a special heavy duty type intended for operation off 4/5 volts. Supplied complete with 2 spools ready to install. Record. Replayhead is the sensitive M4 type intended for use with transistor amplifier. Price **79/6**. Post and insurance 4/6.

THERMOSTAT WITH PROBE

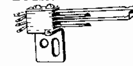


This has a sensor attached to a 15A switch by a 14in. length of flexible capillary tubing —control range is 20°F to 150°F so it is suitable to control soil heating and liquid heating especially when in buckets or portable vessels as the sensor can be raised out and lowered into the vessel. This thermostat could also be used to sound a bell or other alarm when critical temp. is reached in stack or heap subject to spontaneous combustion or if liquid is being heated by gas or other means not controllable by the switch. Made by the famous Teddington Co., we offer these at **12/6** each. Postage and insurance 2/9.

MAINS MOTOR

Precision made — as used in record decks and tape recorders—ideal also for extractor fan, blower, heaters, etc. New and perfect. Snip at **9/6**. Postage 3/- for first one then 1/- for each one ordered, 12 and over post free.

NEED A SPECIAL SWITCH?



Double Leaf Contact. Very slight pressure closes both contacts, **1/3** each, **12/-** doz. Plastic push-rod suitable for operating, **1/-** each, **9/-** doz.

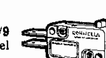
MINIATURE WAFER SWITCHES

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

WATERPROOF HEATING ELEMENT

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

MICRO SWITCH

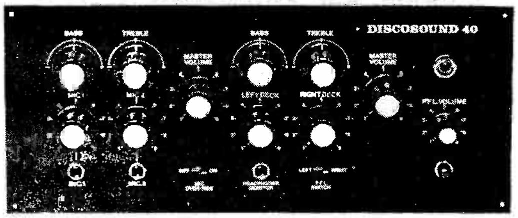


5 amp. changeover contacts, **1/9** each, **18/-** doz. 15 amp Model **2/-** each or **21/-** doz.

Where postage is not stated then orders over £5 are post free. Below £5 add 2/9. Semi-conductors add 1/- post. Over £1 post free. S.A.E. with enquiries please.

ELECTRONICS (CROYDON) LTD
Dept. PW, 266 London Rd., Croydon CRO 2T H
Also 102/3 Tamworth Road, Croydon

DISCOSOUND

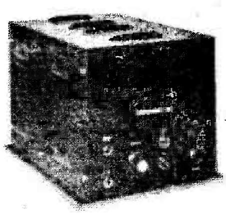


DISCOSOUND 40 PRE-AMP

The Discosound 40 offers the same specification as the D.J. Disco Amp without the power output stage. Size 16in × 7in × 7in. Self powered and ideal for use with the Discosound 100 Power Amplifier below and one of the outstanding features is that it is capable of running ten of these Power Amplifiers (Total 1,000W).

PRICE £40.10.0 inc. P. & P.

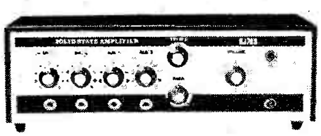
DISCOSOUND 100 POWER AMPLIFIER



A 100W RMS (8 Ohms) High Fidelity power Amplifier which utilises all silicon transistors of modular construction and features full automatic overload protection against short or open circuits. Frequency response 20–20,000Hz ± 2dB. The High output is ideally suited for discotheques, groups, clubs, etc., or anywhere where reliability and quality are required. This unit is the companion model for use with our control pre-amp Discosound 40, or can be used with any other high quality pre-amp control unit. Completely built and tested on steel Chassis.

PRICE £49.10.0 inc. P. & P.

DJ70S INTEGRATED MIXER-AMPLIFIER



One of the finest units available on the market today, regardless of price. The front end of the unit consists of a four channel mixer with separate inputs and volume controls, plus a separate bass, treble and master volume control. One of the main features of this remarkable amplifier is its elaborate protection against short and open circuit and we can guarantee that it is virtually indestructible. Allied to this is its very high power output (70W R.M.S.), a frequency response (30-20,000Hz ± 3dB) that is superb, and distortionthat is well below 1% even at full output. The unit is suitable for use with discotheques, groups, P.A., clubs, etc., or anywhere that high quality high output is required. Size: 15½in × 5in × 6in.

PRICE £63.0.0 inc. P. & P.

Also available DJ105S 30W PA Amplifier. Similar specification to above.

PRICE £41.0.0 inc. P. & P.

For full details of these and all Discosound Products write direct to:-

DISCOSOUND,

122 BALLS POND ROAD, LONDON, N.1.

Telephone: 01-254 5779

Full money back guarantee if returned within 10 days. All Discosound Products are guaranteed for 12 months. Demonstrations given at any time.

BRAND NEW FULLY GUARANTEED TRANSISTORS

SEND FOR NEW LIST NEW PRICES

1N4001	1/6	AAZ12	4/-	BPY10	19/6
1N4002	1/6	AAZ13	2/6	BSX20	3/6
1N4003	2/-	AAZ17	2/-	BSX21	7/6
1N4004	2/-	AC126	5/-	BSX76	3/-
1N4005	2/6	AC127	5/-	BSY27	4/-
1N4006	3/-	AC127Z	10/-	BSY28	5/-
1N4007	4/-	AC128	5/-	BSY29	5/-
1N4009	1/6	AC153	4/-	BSY50	5/-
1N4148	1/9	AC154	3/-	BSY53	5/-
2G210	12/6	AC169	3/-	BSY66	5/-
2G240	49/6	AC176	5/-	BSY67	5/-
2G301	4/-	AC187	6/-	BSY95A	3/-
2G302	4/6	AC188	6/-	BSY95	3/-
2G303	5/-	ACY17	6/-	BY100	3/6
2G306	6/-	ACY18	4/-	BY103	4/6
2G308	6/-	ACY19	5/-	BY126	3/-
2G309	6/-	ACY20	4/-	BY127	4/-
2G371	4/6	ACY21	4/6	BYZ10	8/-
2G374	5/6	ACY22	3/6	BYZ11	7/-
2G381	5/-	ACY28	3/6	BYZ12	6/-
2G382	6/-	ACY34	4/-	BYZ13	5/-
2G383	5/-	ACY36	5/-	BYZ15	20/-
2N404	4/6	ACY39	11/-	BYZ16	12/6
2N696	3/6	ACY40	3/-	GET102	6/-
2N697	3/6	AD140	10/-	GET103	4/6
2N698	8/6	AD149	10/-	MPF102	8/6
2N706	2/-	AD161	7/6	MPF103	7/-
2N706A	2/6	AD162	7/6	MPF104	7/6
2N707	9/6	AF102	12/6	MPF105	8/-
2N708	3/-	AF114	6/6	OA5	3/-
2N914	4/6	AF115	6/-	OA7	4/-
2N916	4/6	AF116	6/6	OA9	2/-
2N918	7/6	AF117	5/-	OA10	5/-
2N919	4/-	AF118	12/6	OA47	2/-
2N920	5/-	AF124	6/-	OA70	2/-
2N922	8/6	AF125	5/-	OA71	2/-
2N930	5/6	AF126	4/-	OA73	2/-
2N1131	6/-	AF127	4/-	OA74	2/-
2N1132	6/6	AF139	6/-	OA79	2/-
2N1303	4/6	AF178	9/6	OA81	2/-
2N1304	5/-	AF181	8/6	OA85	2/6
2N1305	5/-	AF186	8/-	OA86	4/-
2N1306	5/-	AF239	8/-	OA90	2/-
2N1307	5/-	AFY19	22/6	OA91	1/6
2N1308	6/-	AFZ11	12/6	OA95	1/6
2N1309	5/-	AFZ12	15/-	OA200	1/6
2N1613	4/6	ASY26	5/-	OA202	2/-
2N2147	15/-	ASY27	6/6	OA210	5/-
2N2160	12/6	ASY28	5/-	OA211	7/6
2N2287	25/-	ASY29	6/-	OAZ225	7/6
2N2646	10/6	ASY67	9/6	OAZ228	7/6
2N2904	6/-	ASZ21	8/6	OAZ229	9/6
2N2905	7/6	AUY10	19/6	OAZ231	9/6
2N2925	4/-	B3M	19/6	OAZ234	7/6
2N2926	2/6	BA110	5/-	OAZ238	9/6
2N3011	5/-	BAY31	2/-	OC16	8/6
2N3053	5/-	BC107	2/6	OC19	7/6
2N3054	10/-	BC108	2/6	OC20	19/6
2N3055	15/-	BC109	2/6	OC22	9/6
2N3702	2/6	BC113	5/-	OC23	10/-
2N3703	2/6	BC116	8/-	OC24	10/-
2N3704	3/6	BC118	7/6	OC25	7/6
2N3705	3/6	BC134	7/6	OC26	5/-
2N3707	3/-	BC135	6/-	OC28	12/6
2N3709	2/6	BC136	7/-	OC29	12/6
2N3710	2/6	BC137	8/-	OC35	10/-
2N3711	2/6	BC138	8/-	OC36	12/6
2N3730	10/-	BCY30	5/6	OC41	5/-
2N3731	12/6	BCY31	6/-	OC42	6/-
2N3794	2/6	BCY32	10/-	OC43	8/-
2N3819	7/-	BCY33	4/-	OC44	4/-
2N3820	17/6	BCY34	5/-	OC45	3/6
2N3823	17/6	BCY38	6/-	OC46	5/6
2N4058	3/6	BCY39	9/6	OC70	2/6
2N4061	3/-	BCY40	8/6	OC71	3/-
2N4286	3/-	BCY42	5/-	OC72	5/-
2N4288	3/-	BCY43	5/-	OC73	6/-
2N4289	3/6	BCY70	4/-	OC74	6/-
2N4290	3/-	BCZ11	7/6	OC75	5/-
2N4291	3/-	BC147	3/9	OC76	5/-
2N4292	3/-	BC148	2/9	OC77	8/-
40361	11/-	BC149	4/-	OC78	5/-
40362	12/-	BF152	6/-	OC81	5/-
2S001	10/-	BF194	3/6	OC81D	4/-
2S002	10/6	BF195	3/-	OC82	5/-
2S003	9/6	BD124	12/6	OC83	5/-
2S004	9/6	BEN3000	5/-	OC84	5/-
2S005	14/-	BF115	5/-	OC122	10/-
2S012	25/-	BF154	8/-	OC123	10/-
2S013	20/-	BF158	6/-	OC139	5/-
2S017	15/-	BF159	12/-	OC140	7/6
2S034	12/6	BF163	8/-	OC141	15/-
2S036	25/-	BF167	5/-	OC169	4/-
2S320	9/-	BF173	6/-	OC170	5/-
2S321	6/-	BF180	7/6	OC171	6/-
2S322	7/6	BF181	7/6	OC200	7/6
2S323	10/-	BFX30	6/-	OC201	9/6
2S324	12/6	BFX88	5/-	OC202	12/6
2S512	9/6	BFY20	12/6	OC203	7/6
2S701	8/6	BFY50	4/6	OC204	8/-
2S702	11/-	BFY51	4/-	OC205	12/6
2S731	8/6	BFY52	4/6	OC206	15/-
2S732	8/6	BFY53	3/6	OC207	15/-
2S733	9/6	BFY64	8/6	OCP71	19/6
AA178	8/6	BLY10	20/-	ORP12	10/-
AAY12	5/-	BLY11	22/6	ORP60	8/-

INTEGRATED CIRCUITS

Type	1	12+	25+	100+	500+
UL914	8/6	7/9	7/3	6/9	6/6
UL923	12/6	11/9	11/-	10/-	9/3
SL403A	42/6	41/-	40/-	37/6	35/-
MC1303	52/6	48/-	45/-	40/-	35/-
MC1304	55/-	50/-	47/6	42/6	37/6
PA246	52/6	48/-	45/-	40/-	35/-

2N3055 15/-
Mullard 115watt Silicon Power
25 + 13/-
100 + 11/-

2N3819 7/-
Texas F.E.T.
25 + 6/-
100 + 5/3
500 + 4/9

1N4003 and 4 2/-
1 AMP 300–400v
25 + 1/9
100 + 1/6
500 + 1/3

2N2646 10/6
Motorola Unijunction
25 + 8/9
100 + 7/6
500 + 6/9

AF139 6/-
Siemens V.H.F.
25 + 5/3
100 + 4/6
500 + 3/9

AF186 8/-
Mullard V.H.F.
25 + 7/-
100 + 6/-
500 + 5/-

OC170 5/-
25 + 4/3
100 + 3/6

OC171 6/-
25 + 5/3
100 + 4/6

BY126 3/-
Mullard 800v 1 amp Plastic
25 + 2/6
100 + 2/3

BY127 4/-
Mullard 1000v 1 amp Plastic
25 + 3/3
100 + 3/-

BYZ13 5/-
Mullard 6a 200v
25 + 4/-
100 + 3/6
500 + 3/-

AF239 8/-
Siemens VHF
25 + 7/-
100 + 6/-
500 + 5/-
1000 + 4/-

BC107/8/9 2/6 ea.
I.T.T. or Mullard
25 + 2/3
100 + 2/-
500 + 1/9

OA200/OA202 2/-
SILICON Diodes
25 + 1/6
100 + 1/3
500 + 1/1

OCP71 19/6
Mullard Photo
25 + 17/3
100 + 14/9
500 + 13/6

OC42 6/-
Mullard
25 + 5/3
100 + 4/9
500 + 4/3

OC28 12/6
Mullard Power
25 + 11/-
100 + 10/-
500 + 8/6

OC45 3/6
Mullard
25 + 3/-
100 + 2/6
500 + 2/-

OC71 3/-
Mullard
25 + 2/3
100 + 2/-
500 + 1/9

OC75 5/-
Mullard
25 + 4/3
100 + 3/6
500 + 3/-

BCY34 5/-
Mullard
25 + 4/3
100 + 3/9
500 + 3/6

BCY38 6/-
Mullard
25 + 5/3
100 + 4/6
500 + 4/-

1N4001 and 2 1/6
1 amp 100-200v
25 + 1/4
100 + 1/2
500 + 1/-

1N4005 2/6
600v 1 amp
25 + 2/-
100 + 1/9
500 + 1/6

ZENER DIODES
400 MW 5%
BZY88 Range
All Voltages
3.3v—33v 3/6
25 + 2/9
100 + 2/-
500 + 1/9
1000 + 1/7
any one type

1N4006 1N4007
800v 3/- 1000v 4/-
25 + 2/10 ...... 3/3
100 + 2/6 .... 2/9
500 + 2/3 .... 2/6

OC139 5/-
Mullard
25 + 4/-
100 + 3/3
500 + 3/-

OC140 7/6
Mullard
25 + 6/-
100 + 5/-
500 + 4/-

PLEASE NOTE MINIMUM ORDER SHOULD BE 10/-

Quantity Prices 100+ Phone (01) 723 0401 Ex. 4. All listed devices are from stock at time of going to press Please add 1/6 post packing to your order

New Autumn List. New devices, New prices. Ask for List 36. Send for free copy today! Discounts 10% on 12+ any one type 15% on 25+ any one type

HENRY'S RADIO

Mail Order Dept. Components. Organ Dept
303 EDGWARE ROAD, LONDON W.2.
Telephone: 01-723 1008 9
OPEN MON-SAT 9am-6pm THURS 9am-1pm

LETTERS...

The Editor does not necessarily endorse the views expressed by correspondents

The Mystery Solved?

The letters by J. B. Jobe (Feb. 1970) and the one by D. A. Evered recently, concerning speaker-less reception, are intriguing. (They should have solved the mystery, though). I had a valve superhet which did the same thing, perking out music with one speaker lead disconnected! Refusing to go "round the bend," I removed the loudspeaker from the metal chassis, whereupon the music stopped. I replaced three shorted capacitors (connected to chassis) and put in a new valve, which had emission damaged, and the mystery was solved, the radio was back to normal. Why did it receive? Because of those capacitors conducting a portion of the signals to a leaky speaker transformer, hence the music. The transformer was cleaned with petrol, varnished, and is still working fine. — **R. Wibberley** (*Nottingham*).

* * *

Recently I have noticed one or two correspondents in your magazine describing sound coming from transistors themselves.

The other day, on removing the loudspeaker leads from a radio, I noticed the same phenomenon, faint but definitely audible. It was Radio Luxembourg, to which the radio had been tuned before removing the loudspeaker.

P. Everett (July 1970) suggests the Piezoelectric effect for the cause. This seems the most plausible.

The radio was a reasonably modern type, though imported (Empire made), and the transistors were metal-encased, being 2×2SB56 in push-pull output.

It was not possible to ascertain whether one or both output transistors were "sounding off," though it seemed to be only one, as on moving the radio about, it seemed to be localised to only one.

In this case, the volume control did affect the volume coming from the transistors, which would seem to support the Piezoelectric theory, as the greater the current the greater the vibration.—**G. Hughes** (*Flintshire*).

* * *

I recently read a letter published in the August edition of your magazine. In it Mr. David A. Evered described phenomena which he experienced when servicing a receiver some years ago.

I, too, experienced the same phenomena a few days ago whilst installing a car radio. I switched on and tuned in a station. I could hear music but it was not very loud. I then noticed that the loudspeaker was not connected—so where was the music coming from?

I know very little about radios and would not attempt to explain this but it may be of interest to some of your readers. The make of the set is Halcyon A.M. Minor.—**P. Duggan** (*N. Ireland*).

* * *

Having read Mr. Evered's addition to Mr. Jobes phenomenal event of disconnected radio, I would like to go one better and claim the prize.

I serviced a transistor radio only a few months ago, and found it to be one of those awkward types where one has to disconnect a wire here and there to make the job more "getatable."

Having soldered a short link across a cracked circuit line on p.c. board, I proceeded to fit it back in its case, and in doing so broke a lead away from the speaker. Unfortunately this was not noticed until I had connected the battery for a try-out, and there it was; a stray lead with one end anchored to nowt! the novice's nightmare.

It was then that I saw only one lead going to the speaker from the p.c. board, and in order to verify this situation I decided to switch on and place the loose lead on to its respective terminal. No need to bother, the programme came through the speaker loud and clear, the loose wire still detached.

I, too, thought it a bit comical at first until I realised the speaker was being fed by a well-worn ear plug socket. — **J. Thompson** (*Lancashire*).

* * *

Having read Mr. Evered's letter (August '70) I feel bound to give an account of my experience.

I was testing my newly completed miniature audio amplifier (T. Bölstad, Dec. '69). A six-volt battery operated the device with an American "Rola" microphone and a loudspeaker (picked up at a Jumble Sale!) connected to it.

On shorting out the two microphone terminals, Radio 4 was quite clearly heard, with Franklin Englemann and the programme "Down Your Way!". Examination of the wiring gave no reasonable explanation, so the only answer I can give is that the long length of wire to the mike must act as an aerial for the "amplifier-cum-radio" and the large frequency response of the unit must serve as an r.f. and a.f. amplifier, thus sending the signal through the speaker.

I would be grateful to anyone who has had similar experiences to contact me, as I am a relative newcomer to this subject and would like more information.—**Christopher Pearce**, age 14 (*85 Percy Road, Hampton, Middx*).

Thanks

Thank you for publishing my CQ in your columns. The Sunday after publication of the issue it was printed in I received a call from two gentlemen who kindly lent some information, and a few days later received a large sheaf of immensely useable information from an anonymous donor who signed himself "e.h.t." with the postmark Ipswich. I received many other letters and would like to thank all, especially "e.h.t.," and to assure the same that his request about passing on the information will be honoured.—**A. Howard**, A7033 (*Norfolk*).

Switched F.M. Tuner

Would anyone who has built the above project and who lives in the Hamilton-Glasgow area please contact me with a view to giving me some assistance.—**B. Bach** (6 *Birch Brae, Hamilton, Lanarkshire*).

GOING BACK...

1970 60 50 40 30 20

COLIN RICHES
ARTHUR DOW

AS one of the pioneers of radio communication the Mullard organisation has a very fine record of development in this field and to celebrate its Golden Jubilee held an exhibition in London from October 5th to 24th.

Entitled "Electronic Jubilee—An Exhibition of Electronic Ideas and Development" the show had many vintage items of radio equipment on display including part of the original 2LO station (see "Going Back" PW August 1970) various microphones with historical associations and a 1932 BBC receiver that was used for many years to pick up the transmissions from the launch that followed the annual Varsity Boat Race.

Although not strictly "vintage" the tape recorder used by the infamous WW2 character Lord Haw-Haw together with some of his original tapes were on display. As if to show that a recorder can be put to better use the disc recorder belonging to Stanley Maxwell, the BBC wartime correspondent of Arnhem fame, was also on view.

One of the exhibits, "Mullard Through the Decades" illustrated the way in which Mullard have always kept abreast of developments and produced the latest electronic equipment for the public and industry alike.

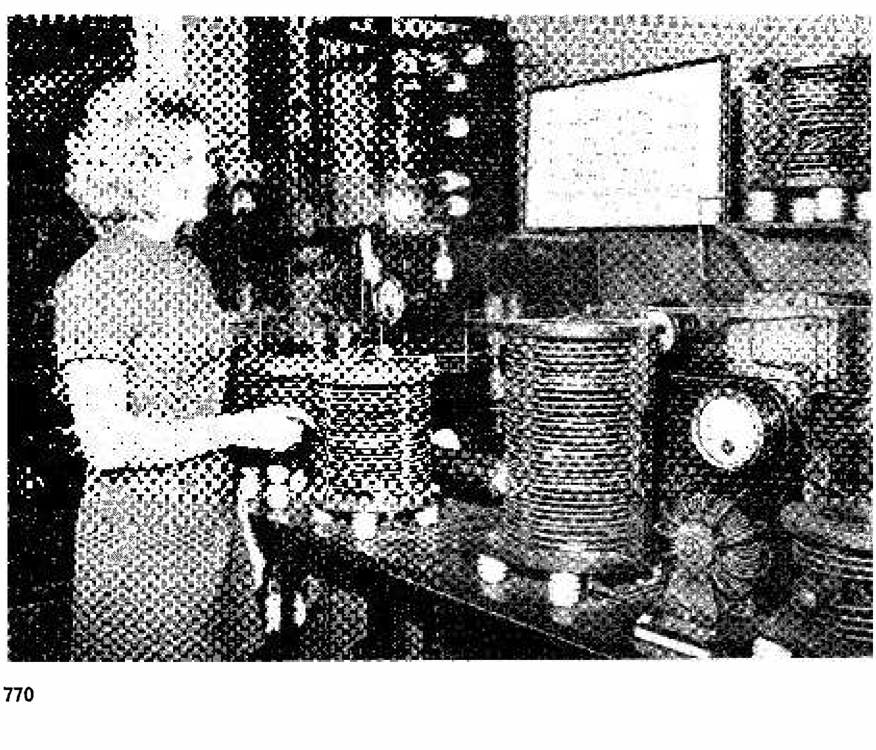
An interesting mixture of ancient and modern was to be seen in the amateur station set up at the exhibition. With the callsign GB3MUL and manned by radio amateurs employed within the Mullard organisation the station made many contacts all over the world. Part of the gear using early Mullard valves worked happily alongside some of the latest s.s.b. communication equipment.

It was obvious that many of the radio receivers of the early days had been constructed with much loving care and it was good to see that the cabinets which held them were also fine examples of another art.

It is hoped that some readers of this column were able to take the opportunity to inspect some of these old receivers, powered with accumulators and high-tension batteries, together with their cumbersome frame aerials and horn loudspeakers.

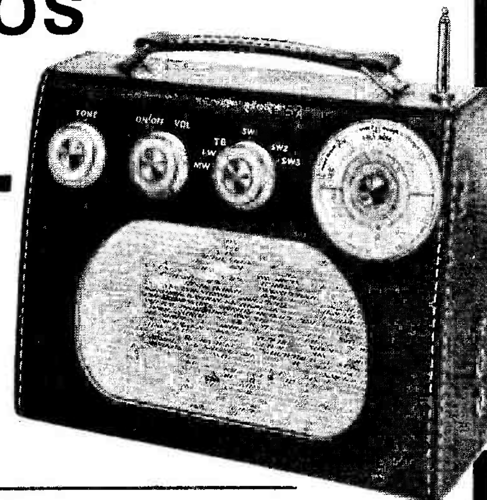
Modern Mullard equipment on show included a hi-fi amplifier, a car radio and a closed-circuit colour television unit and, of course, the inevitable computing equipment.

Those who thought the vintage side of the exhibition a trifle "heavy" were able to pit their wits against various electronic games in the "Electronics Go Pop" section of the show.



◀*Jane Belcher, Mullard's Rose Queen inspects part of the original 2LO transmitting equipment.*

TRANSISTOR RADIOS
TO BUILD YOURSELF
Backed by after sales service



NEW! roamer eight mk 1
WITH VARIABLE TONE CONTROL

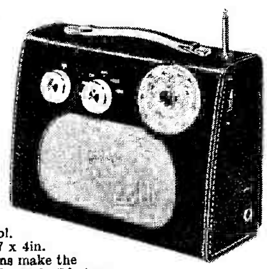
7 Tunable Wavebands: Medium Wave 1, Medium Wave 2, Long Wave, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for Medium and Long Waves. 4 section 24" retractable chrome plated Telescopic aerial for Short Waves for maximum performance. Push pull output using 600 mW transistors. Socket for car aerial. Tape record socket. Selectivity switch. Switched earpiece socket complete with earpiece for private listening. Eight transistors plus 3 diodes. Famous make 7in. x 4in. Speaker. Air spaced ganged tuning condenser. On/Off switch volume control. Wave change switch and tuning control. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams make the Roamer Eight a pleasure to build.

Total Building Costs **£6.19.6**

P. & P. 7/6

Parts Price List and Easy Build Plans 5/- (FREE with parts).

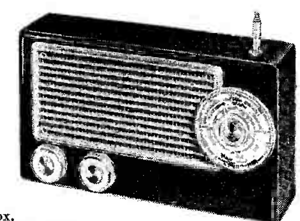
roamer seven mk IV



SEVEN FULLY TUNABLE WAVEBANDS—MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for Medium and Long Waves. Retractable 4 section 24in. chrome plated telescopic aerial for peak Short Wave listening. Socket for Car Aerial. Powerful push-pull output. Seven transistors and two diodes including Micro-Alloy R.F. Transistors. Famous make 7 x 4in. P.M. speaker. Air spaced ganged tuning condenser. Volume/on/off control, wave change switches and tuning control. Attractive case with carrying handle. Size 9 x 7 x 4in. approx. Easy to follow instructions and diagrams make the Roamer 7 a pleasure to build. Parts price list and easy build plans 3/- (FREE with parts). Personal Earpiece with switched socket for private listening, 5/- extra.

Total building costs **£5.19.6** P. & P. 7/6

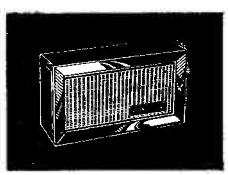
NEW! trans eight
SIX WAVEBAND PORTABLE WITH 3in. SPEAKER



Attractive case in black with red grille and cream knobs and dial with polished brass inserts. Size 9 x 5½ x 2½in. approx. Tunable on Medium and Long Waves, three Short Waves and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. Eight improved type transistors plus 3 diodes. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 5/- (FREE with parts). Earpiece with switched socket for private listening 5/- extra.

Total building costs **89/6** P. & P. 5/6

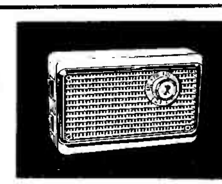
pocket five
MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE WITH SPEAKER



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. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Easy build plans and parts price list 1/6 (FREE with parts).

Total building costs **44/6** P. & P 3/6

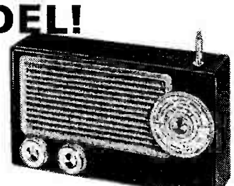
transona five
MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE WITH SPEAKER



Attractive case with red speaker grille. Size 6½ x 4½ x 1½in. 7 stage—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone moving coil speaker. Easy build plans and parts price list 1/6 (FREE with parts).

Total building costs **47/6** P. & P. 3/9

IMPROVED MODEL!
roamer six
SIX WAVEBAND PORTABLE WITH 3in. SPEAKER



Attractive black case with red grille and cream knobs and dial polished brass inserts. Size 9 × 5½ × 2½in. approx. 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 latest telescopic aerial for Short Waves. Improved circuit. 8 stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors, etc. (Carrying strap 2/6 extra). Easy build plans and parts price list 2/- (FREE with parts).

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 Sat.*

RADIO EXCHANGE CO

61 HIGH STREET, BEDFORD. Tel. 0234 52367

I enclose £.................... please send items marked

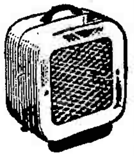
ROAMER EIGHT	☐	ROAMER SEVEN	☐
TRANSONA FIVE	☐	TRANS EIGHT	☐
POCKET FIVE	☐	ROAMER SIX	☐

Parts price list and plans for ....

Name ....

Address ....

.... PW.25



2½kW FAN HEATER

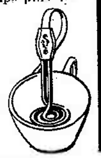
Three position switching to suit changes in the weather. Switch up for full heater (2½ kW), switch down for half heat (1¼kW), switch central blows cold for summer cooling —adjustable thermostat acts as auto control and safety cut-out. Complete kit **£3.15.0** Post and ins. 7/6.

MAINS SUPPRESSION ADAPTOR

for preventing mains interference caused by vacuum cleaners, razors, sewing machines, etc. rated at 4 amps, simply plug this into your 5 amp 3 pin socket, **6/-** each.

12 VOLT BATTERY CHARGER

Made in Japan, this is very small and neat Regular use will keep your car battery in good trip throughout the winter. Silly price, **25/-** complete with leads and crocodile clips plus 4/6 postage and insurance.



QUICK CUPPA

Mini Immersion Heater, 350w. 200/240v. Boils full cup in about two minutes. Use any socket or lamp holder. Have at bedside for tea, baby's food, etc. **24/6** post and insurance 2/9. **12v. car model also available 19/6** plus 2/9 postage.

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only **16/6**, plus 3/6 postage.

PLINTH AND COVER

Suitable for most auto changers, teak base with tinted perspex cover **65/-** plus 6/6 postage. Plinth and Cover for Balfour record changer **79/6** plus 6/6 post.

0.005mFd TUNING CONDENSER

Proved design, ideal for straight or reflex circuits **2/6** each, **24/-** doz.

RESETTABLE FUSE

How long does it take you to renew a fuse? Time yourself when next one blows. Then reckoning your time at £1 per hour see how quickly our resettable fuse (auto circuit breaker) will pay for itself. Price only **£1** each or **£11** per dozen, specify 10 or 15 amp —simply fit in place of switch.

COMPUTER TAPE

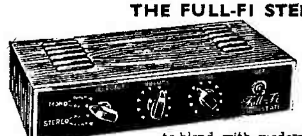
2,400ft of the best magnetic tape money can buy. Made by E.M.I., 1" wide almost unbreakable and on a 10½" metal computer spool. Users have claimed successful results with video as well as sound recordings. **19/6** plus 6/6 post. Cassette to hold spool 10/- extra.

STANDARD WAFER SWITCHES

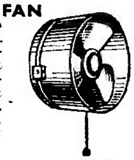
Standard Size 1½ wafer—silver-plated 5 amp contact, standard ¼" spindle 2". long—with locking washer and nut.

No of Poles	2 way	3 way	4 way	5 way	6 way	8 way	9 way	10 way	12 way
1 pole	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6	6/6
2 poles	6/6	6/6	6/6	6/6	6/6	6/6	6/6	10/6	10/6
3 poles	6/6	6/6	6/6	6/6	10/6	10/6	10/6	14/6	14/6
4 poles	6/6	6/6	6/6	10/6	10/6	10/6	10/6	18/6	18/6
5 poles	6/6	6/6	10/6	10/6	14/6	14/6	14/6	22/6	22/6
6 poles	6/6	10/6	10/6	10/6	14/6	14/6	14/6	26/6	26/6
7 poles	10/6	10/6	10/6	14/6	18/6	18/6	18/6	30/6	30/6
8 poles	10/6	10/6	10/6	14/6	18/6	18/6	18/6	34/6	34/6
9 poles	10/6	10/6	14/6	14/6	22/6	22/6	22/6	38/6	38/6
10 poles	10/6	10/6	14/6	18/6	22/6	22/6	22/6	42/6	42/6
11 poles	10/6	14/6	14/6	18/6	26/6	26/6	26/6	46/6	46/6
12 poles	10/6	14/6	14/6	18/6	26/6	26/6	26/6	50/6	50/6

THE FULL-FI STEREO SIX

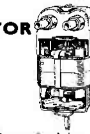


The amplifier sensation of the year You will be amazed at the fullness of reproduction and at the added qualities your records or tuner will reproduce. Built into metal cabinet elegantly styled in simulated teak finished to blend with modern furnishings, this amplifier uses an integrated solid state circuit with an output power of 6 watts R.M.S. split over the two channels. The amplifier is ideal for use with normal pick-ups and tuners, it has a double wound mains transformer and ganged volume and tone controls— also switching for Mono to Stereo, tuner or pick-up. Other controls include "treble lift and cut", "balance" and separate mains on/off switch. UNREPEATABLE PRICE is **£8.19.6** plus 7/6 post and insurance.



EXTRACTOR FAN

At the pull of a cord out go cooking smells and stale air. Suitable for kitchens, bathrooms, toilets, etc., it's so quiet it can hardly be heard. Compact 5½" casing with fan. Kit comprises motor, fan blades, sheet steel casing, pull switch, mains connector and fixing brackets. **39/6 + 6/6** post and ins.



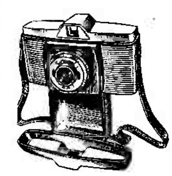
MULTI-SPEED MOTOR

Replacement in many well known food mixers. Six speeds are available. 500, 850 and 1100 r.p.m. from either or both of the nylon sockets (Where the beaters of the food mixers normally go) and 8,000, 12,000 and 15,000 r.p.m. (ideal polishing speeds) from the main drive shaft. Very powerful and useful motor size appox. 2in. diameter, 5in. long. Price **17/6** plus 4/6 p. & ins. 12 or more post free.

MAINS OPERATED CONTACTOR

220/240v. 50 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10 amps. Extremely well made by a German Electrical Company. Overall size 2½ × 2 × 2in. **19/6** each.

'CORONET' CAMERA



at a fraction of maker's price. Plus this FREE ever-ready drop-front case and shoulder strap. British made with precision auto-focus lens. Perfect pictures in colour and B & W. 12 pictures on Kodak 127 film. Extremely strong and robust. **14 days' free trial. We guarantee to return your money in full if you can't take perfect pictures. 19/6**+2/6 p & p.

Where postage is not stated then orders over £3 are post free. Below £3 add 2/9. Semi-conductors add 1/- post. Over £1 post free. S.A.E. with enquiries please.

ELECTRONICS (CROYDON) LTD

Dept PW 266 London Road, Croydon CRO-2TH

Also 102/3 Tamworth Road, Croydon

G. F. MILWARD | **MAIL ORDERS: Drayton Bassett, Tamworth, Staffs.**

ELECTROLYTIC CAPACITORS

WHOLESALE/RETAIL: **369, Alum Rock Road, Birmingham, B8 3Dr.** **Tel: 021-327-2339**

WIRE-ENDED TYPES

NOTE: IT IS ESSENTIAL THAT REFERENCE NUMBER IS QUOTED WHEN ORDERING THESE CAPACITORS

REF. No.			REF. NO.			REF. No.			REF. NO.			REF. NO.		
G1/11	20/450V	2/-	H1/11	8/6V	6d	G4/13	400/50V	2/-	H7/1	10/12V	9d	H7/9	60/12V	1/6
G1/13	40/50V	1/-	H2/2	64/2·5V	1/-	G4/14	500/4V	9d	H7/2	20/15V	1/-	H7/10	60/15V	1/6
G2/5	10/6V	9d	H2/6A	24/275V	1/-	H5/3A	500/25V	2/-	H7/2A	20/6.4V	9d	H7/11	64/25V	1/6
G3/7	100/25V	2/-	H2/8	32/150V	1/-	H5/6A	40/3V	6d	H7/3	25/12V	9d	H7/13	75/15V	1/6
G3/14	100/180V	2/-	H2/9A	2/150V	1/-	H5/7	30/6V	6d	H7/4	25/25V	1/6	H7/14	100/4V	1/-
G5/9	8/8/450V	3/-	H2/10A	16/32/350V	2/-	H5/11	400/6.4V	4d	H7/4A	25/20V	1/6	H8/2	2/50V	1/-
G6/13A	40/450V	2/-	H2/11A	32/275V	1/6	H5/12	320/10V	1/-	H7/5	40/15V	1/6	H8/3	3/50V	1/-
H1/1	1/6V	6d	H3/7A	500/12V	1/6	H5/14	5/6V	6d	H7/6	50/3V	6d	H8/7	12/25V	1/6
H1/3	4/4V	6d	H3/8	750/12V	1/6	H6/1	100/50V	1/6	H7/6A	26/50V	1/6	H8/7A	15/15V	1/6
H1/4	6/6V	6d	H3/10A	30/10V	6d	H6/6	200/3V	6d	H7/7	50/12V	1/6	H8/10	2/275V	1/-
H1/7	20/6V	6d	H3/12	16/50 (REV)	2/-	H6/7	200/16V	1/6	H7/7A	50/10V	1/-	H8/11A	250/12V	1/6
H1/9	60/6V	6d	H4/1	20/4/275V	1/6	H6/13	500/3V	9d	H7/8	50/15V	1/6	H8/13	100/25V	2/-

CAN TYPES

REF. NO.			REF. NO.			REF. NO.			REF. NO.			REF. NO.		
G1/8A	16/35V	1/-	G3/13A	2,000/30V	5/-	G5/12	100/20/10/350/20/50V		H1/10A	10/10/350V	1/6	H4/3A	500/50V	1/6
G1/10	32/275V	1/-	G4/1	300/700/320V	7/6			2/6	H1/12	200/275V	2/-	H4/4	400/6 (REV)	2/-
G1/14	16/275V	1/-	G4/3	250/150V	2/-	G5/13	40/100/350V	2/6	H1/15	100/200/60/275V	5/-	H4/5	32/32/350V	2/-
G2/1	6,000/30V	7/6	G4/4	50/50/200V	2/-	G5/13A	40/40/40/40/350V	2/6	H2/4	50/80/300V	2/-	H4/6	64/275V	2/-
G2/5	125/200V (REV)	5/-	G4/5A	60/350V	1/-	G6/1	12,000/15V	15/-	H2/5	100/100/100/275V	2/6	H4/8	8/8/8/275V	2/6
G2/11	100/350V	2/-	G4/6	60/200/275V	2/6	G6/2A	2,500/50V	7/6	H2/6	50/275V	1/6	H4/9	500/6V	1/-
G2/12	100/150V	2/-	G4/7	40/40/275V	1/6	G6/3A	2,000/15V	3/-	H2/9	16/16/450V	2/-	H4/10	10/10/425V	2/6
G2/14	20/10/10/450V	2/-	G4/7A	40/40/450V	2/6	G6/4A	1,000/25V	2/6	H2/10	1,000/100V	7/6	H4/11	75/400/16/275V	7/6
G3/1	60/100/350V	3/-	G4/11	2,000/25V	3/-	G6/5	1,000/1,500/25V	7/6	H2/11	32/32/250V	1/6	H5/2	64/32/8/275V	2/-
G3/2	200/200/350V	6/-	G4/12	150/30V	1/-	G6/5A	1,600/70V	7/6	H2/12	50/50/150V	1/6	H5/3	500/25V (REV)	2/6
G3/2A	200/200/100/350V	7/6	G4/13	100/200/16/275V	6/-	G6/6	1,000/60V	6/-	H3/4	1,000/50V	6/-	H5/9	100/100/150V	2/-
G3/4	650/300V	7/6	G5/3	35,000/15V	15/-	G6/8	200/250V	3/-	H3/4A	3,000/25V	3/-	H5/9	50/50/50/350V	3/-
G3/6A	50/50/350V	2/-	G5/5	400/275V	3/-	G6/9	60/200/300V	5/-	H3/6	2,500/9V	2/6	H5/13	32/32/8/300V	2/-
G3/9	100/200/250V	6/-	G5/6	60/100/275V	2/6	G6/11	40/350V	1/-	H3/6A	5,000/18V	4/-	H6/4	150/150V	1/6
G3/10	40/20/10/10/350V	3/-	G5/7	100/400/300V	7/6	G6/12	250/25V	2/-	H3/9	100/275B	2/-	H6/14	1,000/20V	2/-
G3/10A	200/350V	2/-	G5/7A	45,000/12V	15/-	H5/4	325/25V	1/6	H3/11	150/200V	2/-	H8/12	3,000/6V	3/-
G3/12	100/200/16/16/300V	5/-	G5/10	100/100/50/350V	3/-	H1/5	2,000/18V	3/-	H3/13	16/16/375V	2/-	H8/13	6,000/6V	4/-
G3/13	64/275V	2/-	G5/11	100/200/25V	2/-	H1/6	125/200V	2/-	H4/3	500/12V	1/6	H8/13A	100/25/200/25V	1/6

TAG ENDS

REF. NO.			REF. NO.			REF. NO.			REF. NO.			REF. NO.		
G1/4	4/150V	1/-	G2/4	40/300V	1/6	G4/9	8/8/350V	2/-	H1/9A	50/150V	1/-	H4/12	500/50V	2/-
G1/5	8/275V	1/-	G2/13	100/50V	1/-	G4/10	350/25V	2/-	H3/5	250/150V	2/-	H5/6	250/50V	2/-
G1/5A	32/350V	1/-	G4/3A	200/25V	1/6	G6/1A	3,000/15 '	3/-	H4/2	250/25V	1/6			
G1/7	16/16/275V	2/-	G4/5	16/300V	1/-	G6/12	1,000/12V	2/-	H4/7A	32/32/275V	2/6			

G. F. MILLWARD, Drayton Bassett, Tamworth, Staffs. Postage (minimum) per order 2/-

TAKE 20

JULIAN ANDERSON

A series of simple transistor projects, each using less than twenty components and costing less than twenty shillings to build.

No. 21 TWO TRANSISTOR RADIO

WE have described a two transistor radio before in this series (Take 20 No. 13, May 1970) and the only reason why we are doing another one is because of the popularity of these simple radio circuits. We get quite a large mailbag dealing with this page and from it we can get a pretty good idea of what people like; if you are one of those who thinks we have too many simple radio circuits I am afraid you will have to bow to the majority opinion.

Despite the fact that the previous circuit used two transistors, the similarity between the circuits stops there, for the one we are describing this month is not only simpler but, in my opinion at least, it is rather better.

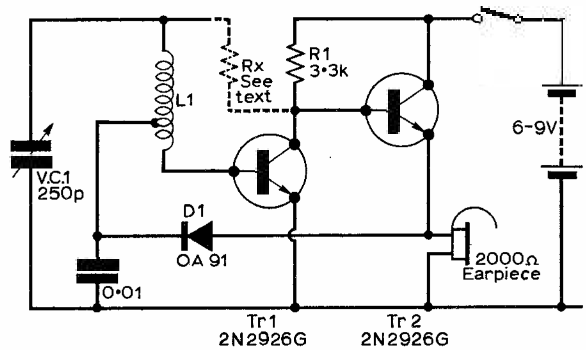


Fig. 1: The complete circuit.

★ components list

R1	3·3kΩ 10%, ¼ watt—see text
C1	0·01μF
VC1	250pF variable
L1	See text
D1	OA91 diode
Tr1	2N2926G (green)
Tr2	2N2926G (green)
Earpiece, 2000Ω magnetic type	
9V battery	
On/off switch	

THE CIRCUIT

The function of any radio, whether it be a communications receiver or a simple little design of the type shown here, is to pick up the radio waves, amplify them, detect them and present them as usable information, which in the case of normal sets is in the form of sound waves. To pick up radio waves an aerial is required and to differentiate between the various frequencies (for an aerial will of course pick up *all* frequencies) a tuned circuit is needed.

In the design shown here the coil part of the tuned circuit also acts as the aerial, the rest of the tuned circuit comprising VC1 and the 0·01μF capacitor. The radio frequencies appearing across the tuned circuit are coupled to the base of Tr1 and amplified by it. The amplified signal appears at the collector, R1 acting as the load and this is directly connected to the base of Tr2 which acts as an emitter follower. Now the emitter "resistor" of Tr2 is a 2,000Ω magnetic earpiece which has considerable inductance and r.f. signals will not pass through it, but the detector diode D1 *will* pass them and these are smoothed by the 0·01μF capacitor which also forms part of the tuned circuit so that audio frequency signals are presented to the base of Tr1. The same amplification action takes place as for the r.f. signals but this time the inductance of the earpiece is far less effective at blocking the r.f. signals and so it is heard in the earpiece itself. Some of the a.f. does get through for a third trip but so little that it doesn't really matter. D.C. base bias for Tr1 is taken from the emitter of Tr2 through D1. Depending on the characteristics of Tr1 and D1 an additional resistor R_x may improve the performance and indeed with some components may be essential. It's value will probably lie between 100kΩ and 3·3MΩ. In addition to helping with the base bias it will also introduce a certain amount of regeneration which will improve the performance. R3 is nominally 3·3kΩ but values between 2·2kΩ and 22kΩ can be tried for best results.

Generally speaking I dislike reflex circuits (which of course this one is) and this is only the second that has been shown in this column; they tend to be unstable, highly dependent on component values and poor value for money (the extra components usually cost more than an extra transistor) but in this circuit it works very well and none of the values are critical.

It must be emphasised that low impedance and crystal earpieces are *not* suitable for this type of circuit and only high impedance magnetic types will work at all.

The coil L1 consist of about 80 turns of enamelled copper wire wound on to a ⅞ in. diameter ferrite rod tapped at 8 turns. The actual gauge of wire used is not critical but I usually use 36 s.w.g. size. ■

At the time of going to press, it seems that the December issue of Television will not be published due to an industrial dispute at the printers. Future issues of Practical Wireless will not be affected.

BBC
VHF RADIO TRANSMITTING STATIONS

Radio 2, Radio 3, Radio 4 (BBC sheet)

	Frequencies (MHz) Radio 2	Radio 3	Radio 4		Maximum ERP (Each Prog)
Ashkirk	89·1	91·3	93·5	(Scottish)	18 kW*
Ballachulish	88·1	90·3	92·5	(Scottish)	15 W*
Ballycastle	89·0	91·2	93·4	(N. Ireland)	40 W*
Barnstaple	88·5	90·7	92·9	(South and West)	150 W*
Bath	88·8	91·0	93·2	(South and West)	35 W*
Belmont	88·8	90·9	93·1	(North)	8 kW*
Betws-y-Coed	88·2	90·4	92·6	(Welsh)	10 W*
Blaenplwyf	88·7	90·9	93·1	(Welsh)	60 kW
Brecon	88·9	91·1	93·3	(Welsh)	10 W*
Bressay	88·3	90·5	92·7	(Scottish)	10 kW*
Brighton	90·1	92·3[S]	94·5	(South and West)	150 W*
Brougher Mountain	88·9	91·1	93·3	(N. Ireland)	2·5 kW
Cambridge	88·9	91·1	93·3	(Midland)	20 W*
Campbeltown	88·2	90·4	92·6	(Scottish)	35 W*
Carmarthen	88·5	90·7	92·9	(Welsh)	10 W*
Churchdown Hill	89·0	91·2	93·4	(Midland)	25 W*
Divis	90·1	92·3	94·5	(N. Ireland)	60 kW
Dolgellau	90·1	92·3	94·5	(Welsh)	15 W*
Douglas	88·4	90·6	92·8	(North)	6 kW*
Ffestiniog	88·1	90·3	92·5	(Welsh)	50 W*
Forfar	88·3	90·5	92·7	(Scottish)	10 kW*
Fort William	89·3	91·5	93·7	(Scottish)	1·5 kW
Grantown	89·8	92·0	94·2	(Scottish)	350 W*
Haverfordwest	89·3	91·5	93·7	(Welsh)	10 kW*
Hereford	89·7	91·9	94·1	(Midland)	25 W*
Holme Moss	89·3	91·5[S]	93·7	(North)	120 kW
Isles of Scilly	88·8	91·0	93·2	(South and West)	20 W*
Kendal	88·7	90·9[S]	93·1	(North)	25 W*
Kilkeel	88·8	91·0	93·2	(N. Ireland)	25 W*
Kingussie	89·1	91·3	93·5	(Scottish)	35 W*
Kinlochleven	89·7	91·9	94·1	(Scottish)	2 W
Kirk o'Shotts	89·9	92·1	94·3	(Scottish)	120 kW
Larne	89·1	91·3	93·5	(N. Ireland)	15 W*
Les Platons	91·1	94·75	97·1	(South and West)	1·5 kW*
Llanddona	89·6	91·8	94·0	(Welsh)	12 kW*
Llandrindod Wells	89·1	91·3	93·5	(Welsh)	1·5 kW
Llangollen	88·85	91·05	93·25	(Welsh)	10 kW*
Llanidloes	88·1	90·3	92·5	(Welsh)	5 W
Lochgilphead	88·3	90·5	92·7	(Scottish)	10 W*
Londonderry	88·3	90·55	92·7	(N. Ireland)	13 kW*
Machynlleth	89·4	91·6	93·8	(Welsh)	60 W*
Maddybenny More	88·7	90·9	93·1	(N. Ireland)	30 W*
Meldrum	88·7	90·9	93·1	(Scottish)	60 kW
Melvaig	89·1	91·3	93·5	(Scottish)	22 kW*
Morecambe Bay	90·0	92·2[S]	94·4	(North)	4 kW*
Newry	88·6	90·8	93·0	(N. Ireland)	30 W*
Northampton	88·9	91·1[S]	93·3	(Midland)	60 W*
North Hessary Tor	88·1	90·3	92·5	(South and West)	60 kW
Oban	88·9	91·1	93·3	(Scottish)	1·5 kW
Okehampton	88·7	90·9	93·1	(South and West)	15 W*
Orkney	89·3	91·5	93·7	(Scottish)	20 kW*
Oxford	89·5	91·7[S]	93·9	(South and West)	22 kW*
Penifiler	89·5	91·7	93·9	(Scottish)	6 W*
Perth	89·3	91·5	93·7	(Scottish)	15 W*
Peterborough	90·1	92·3	94·5	(Midland)	20 kW*
Pitlochry	89·2	91·4	93·6	(Scottish)	200 W*
Pontop Pike	88·5	90·7	92·9	(North)	60 kW
Redruth	89·7	91·9	94·1	(South and West)	9 kW*
Rosemarkie	89·6	91·8	94·0	(Scottish)	12 kW*
Rowridge	88·5	90·7	92·9	(South and West)	60 kW
Sandale	88·1	90·3	92·5	(Scottish)	120 kW
			94·7	(North)	120 kW
Scarborough	89·9	92·1[S]	94·3	(North)	25 W*
Sheffield	89·9	92·1[S]	94·3	(North)	60 W
Skriaig	88·5	90·7	92·9	(Scottish)	10 kW*
Sutton Coldfield	88·3	90·5[S]	92·7	(Midland)	120 kW
†Swaledale	89·6	91·8	94·0	(North)	35 W*
Swingate	90·0	92·4[S]	94·4	(London)	7 kW*
Tacolneston	89·7	91·9	94·1	(Midland)	120 kW
Thrumster	90·1	92·3	94·5	(Scottish)	10 kW*
Toward	88·5	90·7	92·9	(Scottish)	250 W*
Ventnor	89·4	91·6	93·8	(South and West)	20 W*
Weardale	89·7	91·9	94·1	(North)	100 W*
Wensleydale	88·3	90·5	92·7	(North)	25 W*
Wenvoe	89·95	96·8	94·3	(Welsh)	120 kW
			92·125	(South and West)	120 kW
Whitby	89·6	91·8	94·0	(North)	40 W*
†Windermere	88·6	90·8	93·0	(North)	20 W*
Wrotham	89·1	91·3[S]	93·5	(London)	120 kW

BBC Local Radio Stations

	Frequency (MHz)		Maximum ERP	
†Birmingham (opening November 1970)	95·6		5·5 kW*	
†Blackburn	96·4‡		1·5 kW*	
Brighton	88·1	(95·8)	75 W*	(500W*)
Bristol	95·4		5 kW*	
†Derby	96·5‡		5·5 kW*	
Durham	96·8	(94·5)	2·6 kW*	
†Humberside	95·3		4·5 kW*	
Leeds	94·6		140 W	
Leicester	95·2		140 W	(155 W)
†London (opening October 1970)	95·3		16·5 kW*	
Manchester	95·1‡		4 kW*	
†Medway (opening December 1970)	97·0		5·5 kW*	
Merseyside	95·85	(95·8)	2·5 kW*	(5 kW*)
†Newcastle (opening November/December 1970)	95·4		3·5 kW	
Nottingham	94·8		140 W	
†Oxford (opening October 1970)	95·0		4·5 kW	
Sheffield	88·6		30 W	
(Rotherham)	95·05		9 W*	
†Solent (opening December 1970)	96·1		5 kW	
Stoke-on-Trent	94·6		2·5 kW*	
†Teesside (opening November/December 1970)	96·6		5 kW*	

Changes of frequency and power are planned at some stations, as indicated by the figures in brackets.

S Includes stereophonic programmes
* Directional aerial
† Station not in service at date of issue of this sheet
‡ Slant polarization. All other vhf radio transmissions are horizontally polarized

QUERY COUPON

This coupon is available until 8th January 1971 and must accompany all queries in accordance with the rules of our Query Service.

PRACTICAL WIRELESS, JANUARY 1971

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 textbooks. 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.

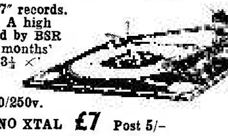
(*c*) It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.

(*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.**

BSR 4-SPEED SUPERSLIM AUTO RECORD CHANGER



Plays 12", 10" or 7" records. Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. Size 13¼ × 11¼in. Above motor board 3¾in. below 2¼in. AC 200/250v.
with STEREO/MONO XTAL **£7** Post 5/-
BSR UA70 Stereo/Mono Transcription Auto Changer. Calibrated Stylus Pressure. **£14**
BSR Minichanger UA50 Stereo/Mono. Plays 12", 10" or 7" records. Size 12 × 8¾in. AC 200/250v. Post 5/-. **£8**

GARRARD PLAYERS with Sonotone 9TA Cartridges. Stereo Diamond/Mono Sapphire. SP25 Mk II £15 AT60 Mk II £15 Model 3000 £13 Post 5/-.

RECORD PLAYER PORTABLE CABINET Space for amplifier and autochanger. Post 5/-. **75/-**

RCS DE-LUXE 3 WATT AMPLIFIER. Ready made with 2-stage triode pentode valve. 3 watts output. Tone and volume controls. Isolated mains transformer, knobs, loudspeaker valves ECL82, EZ80. Response 50-12,000 cps. Sensitivity 200mV. Post 5/-. **£4**

RSC 2 WATT AMPLIFIER with loudspeaker and valves UCL82 and UY85 Post 5/- **£3**

R.C.S. TEAKWOOD BASE. Ready cut out for mounting (State player make and model) **77/6**

R.C.S. PLASTIC COVERS FOR ABOVE BASE. Durable tinted plastic, attractive appearance. **77/6**

EMI PICK-UP ARM. Complete with mono cartridge 30/-.

EMI JUNIOR 4 SPEED RECORD PLAYER Mains operated motor, turntable and pick up **£3** Post 5/-.

HI-FI PICK UP CARTRIDGES
GP94 55/-; GP93 45/-; GP91 30/-; GP67 19/6, ACOS L.P. only 10/6. All standard fixing complete with stylus.

CRYSTAL MIKE INSERTS
1¼" dia. 6/6. ACOS 1¼" dial 12/6. BM3, 1" dia. 9/6.

PORTABLE AMPLIFIER

Portable mini p.a. system. Many uses — ideal for Parties, or as a Baby Alarm, Intercom, Telephone or Record Player Amplifier, etc. Attractive rexine covered cabinet, size 12 × 9 × 4in., with powerful 7 × 4in. speaker and four transistor one watt power amplifier. Uses PP9 battery Brand new with famous maker's guarantee. Only **75/-** Post 5/-

WEYRAD P50—TRANSISTOR COILS

RA2W Ferrite Aerial	13/-	Spare Cores	6d.
Osc. P50/1AC	6/-	Driver Trans. LFDT4	10/-
I.F. P50/2CC 470 kc/s.	6/7	Printed Circuit, PCA1	10/-
3rd I.F. P50/3CC	6/7	J.B. Tuning Gang	11/-
P51/1 or P51/2	6/7	Weyrad Booklet	2/-
P50/3V	6/7	OPTI	11/-

Mullard Ferrite Rod 8 × ⅜in. 4/-, 6 × ¼in. 5/-.

VOLUME CONTROLS
Long spindles. Midget Size 5 K. ohms to 2 Meg. LOG or LIN. L/S 3/-. D.P. 5/- STEREO L/S 11/-. D.P. 15/- Edge 5K. S.P. Transistor, 5/-

80ohm Coax 9d. yd.
BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. 28/-; 60 yd. 40/-. FRINGE LOW LOSS Ideal 625 lines. **2/-** yd.

WIRE-WOUND 3-WATT POTS. Small type with small knob. Values 10 Ω to 30 K., Carbon 30 K to 2 meg. **5/-**

WIRE-WOUND 3-WATT STANDARD SIZE POTS. LONG SPINDLE 10 OHMS to 100 K. **8/-**

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 1 in.; 5in. side 1/- per 1in. (up to 17in.).
S.R.B.P. undrilled 1/16in. Board 10 × 8in. 3/-.

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

1-inch DIAMETER WAVE-CHANGE SWITCHES.
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. 1 inch DIAMETER Wavechange "MAKITS" 1 p. 12-way, 2 p. 6-way, 3 p. 4-way, 4 p. 3-way, 6 p. 2-way, 1 wafer 12/-, 2 wafer 18/-, 3 wafer 24/-. 4 wafer 30/-, 5 wafer 36/-, 6 wafer 42/-.
TOGGLE SWITCHES, sp. 2/6; sp. dt. 3/6; dp. 3/6; dp. dt. 4/6.

ALL PURPOSE HEADPHONES
H.R. HEADPHONES 2000 ohms Super Sensitive	35/-
LOW RESISTANCE HEADPHONES 3-5 ohms	39/6
DE LUXE STEREO HEADPHONES 8 ohms	65/-

"THE INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER

200/250 v. A.C. Leaflet S.A.E. **47/6** Post 2/6

★ GENERAL PURPOSE TRANSISTOR PRE AMPLIFIER BRITISH MADE ★
for Mike, Tape, P.U., Guitar

Battery 9–12v or H.T. line 200–300v D.C. operation. Size 1¾" x 1¼" x ¾". Response 25 c.p.s. to 25 Ks/s. 26db gain. For use with valve or transistor equipment. Full instructions supplied. Brand new. Guaranteed. Details S.A.E. **17/6** Post 2/6

NEW TUBULAR ELECTROLYTICS				CAN TYPES	
2/350V	2/6	100/25V	2/-	16+16/500V	11/-
4/350V	2/6	250/25V	2/6	50+50/350V	7/-
8/450V	2/6	500/25V	4/-	60+100/350V	11/6
16/450V	3/-	8+8/450V	3/6	32+32/250V	3/6
32/450V	4/-	8+16/450V	4/-	32+32/450V	6/6
25/25V	2/-	16+16/450V	5/-	32+32+32/350V	6/9
50/50V	2/-	32+32/350V	5/-	100+50+50/350V	9/6

SUB-MIN. ELECTROLYTICS. 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF 15V 2/-; 500, 1000mF 12V 3/6; 2000mF 25V 7/-.
CERAMIC 1pF to 0.01 mF, 9d. Silver Mica 2 to 5000pF, 9d.
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; 0.47 5/-. 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% 2.2–500pF 1/6; 560-2,200 pF 2/-; 2,700–5,600pF 4/-; 6,800pF-0.01, mfd 6/-; each.
TWIN GANG. "0-0" 208pF+176pF, 11/-; Slow motion drive 365+365 with 25+25pF, 11/-; 500pF slow motion, standard 9/-; small 3-gang 500pF 22/-. SHORT WAVE. Single 25pF 11/-
CHROME TELESCOPIC AERIAL, swivel base, 23in. 5/-.
TUNING. Solid dielectric. 100pF, 300pF, 500pF, 7/- each.
TRIMMERS. Compression 30, 50, 70pF, 1/-; 100pF, 150pF, 1/6; 250pF, 1/6; 600pF, 750pF, 2/-; 1000 pF, 2/6.
RECTIFIERS CONTACT COOLED ½ wave 60mA 7/6; 85mA 9/6. SILICON BYZ13 6/-; BY100 10/-.
Full wave Bridge Rectifiers 75mA 10/-; 150mA 19/6.
EX-GOVERNMENT RECTIFIERS 250v. 200mA. 6/-.
NEON PANEL INDICATORS 250V AC/DC Red or Amber 4/-.
RESISTORS. Preferred values, 10 ohms to 10 meg. ¼ w., ½ w., 1 w., 20% 3d.; 1½ w. 8d.; 2 w. 1/-; ½ w. 10% 6d.
HIGH STABILITY. ½ w. 2% 10 ohms to 10 meg., 2/-. Ditto 5% Preferred values 10 ohms to 22 meg., 9d.
WIRE-WOUND RESISTORS 5 watt, 10 watt, 15 watt, 10 ohms to 100K. 2/- each; 2½ watt. 1 ohm to 8.2 ohms 2/-.

Q MAX CHASSIS CUTTER
Complete: a die, a punch, an Allen screw and key

½in.	16/6	⅞in.	17/6	1⅛in.	19/6	1½in.	24/-	2 3/32	44/3
⅝in.	16/6	1in.	19/6	1¼in.	20/6	1¾in.	29/-	2½in.	57/3
¾in.	16/9	1 1/16in.	19/6	1⅜in.	21/6	2in.	39/9	1in. sq.	36/6

TRANSISTOR MAINS POWER PACKS. FULL WAVE 9 volt 500mA. Size 4½ × 2½ × 2in. Metal case. Crackle finish. Output terminals. On/off switch. **78/-**
Half Wave 9 volt 50mA. Size 2½ × 1¼in. Snap terminals 36/-

MAINS TRANSFORMERS
Post 5/- each

250-0-250 50 mA. 6.3 v. 2 amps, centre tapped	22/-
250-0-250 80 mA. 6.3 v. 4 amp.	28/-
250-0-250 80 mA. 6.3 v. 3.5 a. 6.3 v. 1 a, or 5 v. 2 a.	38/-
350-0-350 80 mA. 6.3 v. 3.5 a. 6.3 v. 1 a, or 5 v. 2 a.	38/-
300-0-300 v. 120 mA. 6.3 v. 4 a. C.T.; 6.3 v. 2 a.	50/-
MINIATURE 200 v. 20 mA., 6.3 v. 1 a. 2¼ × 2 × 1⅝in.	15/-
MIDGET 220 v. 45 mA., 6.3 v. 2 a. 2¾ × 2¼ × 2in.	18/-
HEATER TRANS. 6.3v. 1½ a.	10/6
Ditto tapped sec. 1.4 v., 2, 3, 4, 5, 6.3 v. 1½ amp.	15/6

GENERAL PURPOSE LOW VOLTAGE. Outputs 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. at 2 amp. 38/- 1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60, 38/-
AUTO TRANSFORMERS 0-115-230 v. Input/Output, 60 w. 18/6; 150w. 38/-; 500w. £5; 1000w. £12.
CHARGER TRANSFORMERS. Input 200/250v. for 6 or 12v.. 1½ amp., 24/-; 4 amp., 38/-
FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12 v. outputs, 1½ amp. 8/-; 2 amp. 11/-; 4 amp. 17/-.

COAXIAL PLUG 1/3, PANEL SOCKETS 1/3. LINE 3/6. OUTLET BOXES. SURFACE OR FLUSH 5/-. BALANCED TWIN FEEDERS 1/- yd. 80 ohms or 300 ohms. JACK SOCKET 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/-. VALVE HOLDERS, 1/-; CERAMIC 1/6; CANS 1/-.

E.M I. 13½ × 8in. LOUDSPEAKERS
With flared tweeter cone and ceramic magnet. 10 watts. Bass res. 45-60 cps. Flux 10,000 gauss. State 3 or 8 or 15 ohm Post 2/6 each **45/-**

Also with twin tweeters. With crossover, 10 watt. State 3 or 8 or 15 ohm. Post 2/6 each **£4**

Recommended Teak Cabinet Size 16 × 10 × 9in. Post 2/6 **£5**

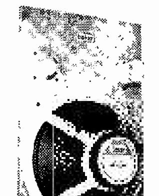
MINI-MODULE LOUDSPEAKER KIT
10 WATT **65/-** CARRIAGE 5/-

Triple speaker system combining on ready cut baffle. ½ in. chipboard 15 in. × 8½ in. Separate Bass, Middle and Treble loudspeakers and crossover condenser. The heavy duty 5 in. Bass Woofer unit has a low 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. 16 × 10 × 9 in. Modern Scandinavian fluted front design for Mini-Module. **£5** Post 2/6

ALL MODELS "BAKER SPEAKERS" IN STOCK

BAKER 12in. MAJOR £9



30-14,500 c.p.s., 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c.p.s. Rated 20 watts. Voice coils 3 or 8 or 15 ohms. Post Free

Module kit, 30-17,000 c.p.s. with tweeter, crossover, baffle and instructions, **£11.10.0**

BAKER "GROUP SOUND" SPEAKERS— 8 or 15 ohm

'Group 25'	'Group 35'	'Group 50'
12 inch 25 watt **£7**	12 inch 25 watt **£9**	15 inch 50 watt **£19**

TEAK HI-FI SPEAKER CABINETS. Fluted wood front.

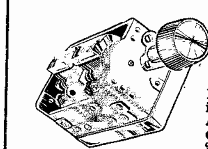
For 10 or 12in. round Loudspeaker	£9.0.0.
For 13 × 8in. or 8in. round Loudspeaker	£5.0.0.
For 10 × 6in. or 6½in. round Loudspeaker	£4.0.0.

LOUDSPEAKER CABINET WADDING 18in. wide, 3/- ft

TWO-WAY XOVER NETWORK 3000 c/s.
With variable tweeter attenuator giving accurate high/low frequency balance. Mounted on panel 5½in. × 4in. with control knob, tweeter and woofer leads and input terminals. Suitable for 3 to 8 ohm impedance **38/-** Post 2/-

Horn Tweeters 2-16kc/s, 10W 8 ohm or 15 ohm 29/6
De Luxe Horn Tweeters 2-18 Kc/s, 15W, 8 ohm 59/6
ELAC MOVING COIL Deluxe cone tweeter 3 or 15 ohm 35/-
TWO-WAY 3000cps CROSSOVERS 3 or 8 or 15 ohm 19/-
SPECIAL OFFER! 80 ohm, 2¼in., 2¾in. dia.; 35 ohm. 3in. 25 ohm, 3in. dia.; 6 × 4in.; 8 × 5in. 15 ohm 3⅜in. dia; 7 × 4in.; 8 × 5in. 8 ohm, 6 × 4in., 3 ohm, 2¾in, 3in, 5in. 5 × 3in. 7 × 4in. **17/6** EACH TYPE
LOUDSPEAKERS P.M. 3 OHMS. 6½in. 22/6; 8 × 5in, 25/-; 8 × 2½in. 18/-; 8in. 35/-; 10 × 6in. 38/-.
5in. WOOFER 8 watts max. 20-10,000 cps. 8 or 15 ohm. 36/-.
ELAC 8 in. De Luxe Ceramic 3 ohm or 15 ohm 50/-, RICHARD ALLAN LOUDSPEAKERS, twin cone 8in or 10in or 12in, 3 or 15 ohm 39/6.
OUTPUT TRANS. EL84 etc. 5/-; MIKE TRANS. 50:1 5/-.
SPEAKER COVERING MATERIALS. Samples Large S.A.E.
GOODMAN'S OUTPUT TRANSFORMER 4 watt push-pull for 3, 8 and 15 ohms 17/6.

VHF–FM TUNER FRONT END
88–108 Mc/s



Transistor FM tuner oscillator and frequency changer printed circuit. Slow motion tuning gang condenser. Ready wired and tested including two transistors AF124 and AF125. A total of 29 components. Size 2¼ × 2 × 2in. Requires I.F. and Detector stages 10.7 Mc/s. 9 Volt. Connection details supplied but we have no further information available. **45/-** POST FREE

ALL EAGLE PRODUCTS
SUPPLIED AT LOWEST PRICES
ILLUSTRATED EAGLE CATALOGUE 5/-. Post Free.

BARGAIN AM TUNER. Medium Wave. Transistor Superhet. Ferrite aerial. 9 volt. **£4**

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. **£3**

BARGAIN FM TUNER 88-108 Mc/s Six Transistor. 9 volt Printed Circuit. Calibrated slide dial tuning. Walnut Cabinet. Size 7 × 5 × 4in. **£10**

BARGAIN FM TUNER as above less cabinet **£7.10.0**

FM STEREO MULTIPLEX ADAPTOR. For above or general use. Ready made with 4 transistors, 6 diodes. **99/6**

BARGAIN 3 WATT AMPLIFEIR. 4 Transistor Push-Pull Ready built, with volume control. 9v. **69/6**

★RADIO BOOKS ★ (Postage 9d.)

Practical Radio Inside Out	4/6
Practical Stereo Handbook	3/6
Supersensitive Transistor Pocket Radio	3/6
Radio Valve Guide, Books 1,2,3 or 4 ea. 5/- No. 5 ea.	6/-
T.V. Fault Finding 405/625 lines	10/-
Transistor Communication Sets	6/-
Wireless World Radio Valve Data	10/-
Transistor Circuits for Radio Controlled Models	7/6
Coil design & construction	5/-
22 Circuits for Micro Alloy transistors	5/-

E.M.I. TAPE MOTORS
120v. or 240v. AC. 1,200 r.p.m. 4 pole 135mA. Spindle 0·187 × 0·75in. Size 3¼ × 2¼ × 2¼in. (illustrated). Post 2/6 **25/-**

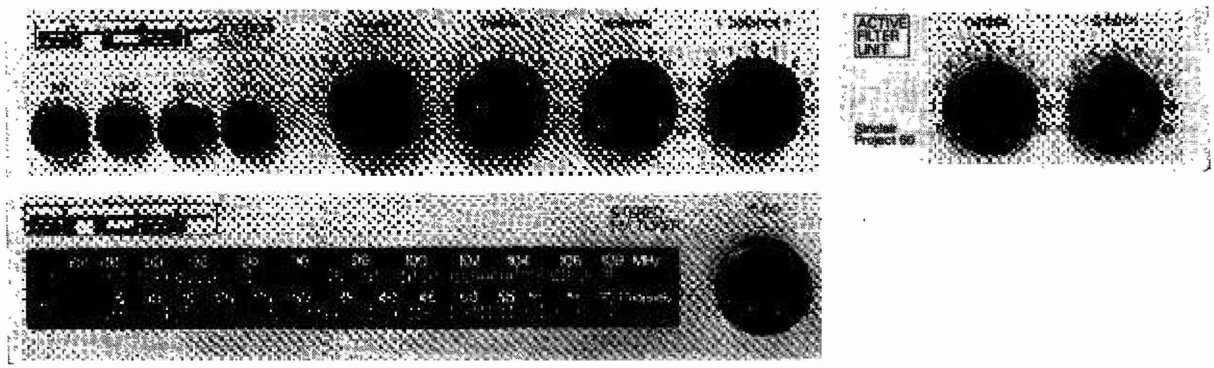
BALFOUR GRAM MOTORS
120v. or 240v A.C. 1,200 r.p.m. 4 pole 50mA. Spindle ⅛ × 3/20. Size 2¼ × 2¼ × 1¼in. Post 2/6 **17/6**

Minimum Post and Packing 2/6 RETURN OF POST DESPATCH. HI-FI STOCKISTS. CUSTOMERS FREE CAR PARK. CALLERS WELCOME.

RADIO COMPONENT SPECIALISTS
337 WHITEHORSE ROAD, CROYDON
Open 9–6 p.m. (Wednesdays 9–1 p.m., Saturdays 9–5 p.m.)

List 1/-. **Written guarantee with every purchase.** *(Export: Remit cash and extra postage.) Buses 133, 68 pass door. S.R. Stn. Selhurst.* **Tel. 01-684-1665**

Project 60



the world's most advanced high fidelity modules

With the introduction of an entirely new and original high fidelity stereo F.M. tuner, the Project 60 range can be said at this stage to be complete. It offers the constructor a most attractive choice of modular arrangements whereby a high fidelity system can be selected to suit the user's personal requirements. Equally, it is possible to use any Project 60 modules separately or partially grouped and so benefit greatly from the flexibility in use these modules afford. The chart below shows some of the most popular applications for constructors to assemble. The Project 60 manual (free with the modules) suggests others as well and its 48 pages are packed with valuable information. The new tuner, for example can be used with any good high fidelity system as well as Project 60.

Project 60 now falls into four interdependent groups : – 1. The Z.30 and Z.50 amplifiers which have only 0.02% distortion at all output levels and are useful in a wide variety of other applications. 2. The control units comprising the Stereo 60 preamp and control unit and the Active Filter Unit (A.F.U.) with which both high pass and low pass filtering can be introduced between control unit and power amplifiers. 3. The Stereo F.M. tuner as described opposite ; and 4. The power supply units PZ.5, PZ.6 and PZ.8. For most requirements when using Z.30 power amplifiers, the PZ.5 will be perfectly adequate ; if low efficiency (high quality) loud speakers are used, the PZ.6 stabilised power supply unit will be used. The PZ.8 will be needed with Z.50s which can be used for any Project 60 system.

Project 60 modules incorporate some of the most advanced circuitry in the world to achieve unsurpassed standards of high fidelity and modern manufacturing techniques enable these modules to be sold at exceptionally attractive prices. Assembling the modules requires no skill or previous experience since the manual supplied with the modules explains clearly how everything can be done with nothing more than the simplest of domestic tools.

Project 60 manuals
How to assemble and use Project 60 modules to best advantage in the above and other applications will be found in the fully descriptive Project 60 manual included with Project 60 systems. This 48 page manual is available separately, price 2/6d including postage.

	System	The Units to use	In conjuction with	Cost of Units	+ Project 60 tuner
A	Car Radio	**Z.30**	Existing car radio, Sinclair Micromatic	**89/6**	
B	Simple battery powered record player	**Z.30**	Crystal pick-up, 12V or more battery supply and volume control	**89/6**	
C	Mains powered record player	**Z.30 and PZ.5**	Crystal or ceramic P.U. Volume control etc.	**£9.9.0**	**£34.9.0**
D	20+20 watts R.M.S. stereo amplifier for most needs	**Two Z.30s, Stereo 60 and PZ.5**	Crystal, ceramic or magnetic P.U., most dynamic speakers, F.M. tuner etc.	**£23.18.0**	**£48.18.0**
E	20+20 watts R.M.S. stereo amplifier for use with low efficiency (high performance) speakers	**Two Z.30s, Stereo 60 and PZ.6**	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc All dynamic speakers	**£26.18.0**	**£51.18.9**
F	40+40 watts R.M.S. de-luxe stereo amplifier	**Two Z.50s, Stereo 60 PZ.8 and mains transformer**	As for E	**£32.17.6**	**£57.17.6**
G	Outdoor public address system	**Z.50**	Microphone, up to 4 P.A. speakers, 12V car battery with converter, or 45V d.c., controls	**£5.9.6**	
H	Indoor P.A.	**One Z.50, PZ.8 and mains transformer**	Microphone, guitar, heavy duty speakers etc., controls	**£17.8.6.**	
J	High pass and low pass filters	**A.F.U.**	D, E or F as above	**£5.19.6**	

sinclair

Sinclair Radionics Limited, 22 Newmarket Road, Cambridge
Telephone (0223) 52731

Z.30 & Z.50 power amplifiers


Z.50

Z.30

The Z.30 together with the Z.50 are both of advanced design using silicon epitaxial planar transistors to achieve unsurpassed standards of performance. Total harmonic distortion is an incredibly low 0.02% at full output and all lower outputs. Whether you use the Z.30 or Z.50 power amplifiers in your Project 60 system will depend on personal preference, but they are the same physical size and may be used with other units in the Project 60 range equally well. For operating from mains, for the Z.30 use PZ.5 for most domestic requirements, or PZ.6 if you have very low efficiency loudspeakers. For Z.50, use the PZ.8 described below.

SPECIFICATIONS ***(Z.50 units are interchangeable with Z.30s in all applications).***
Power Outputs
Z.30 15 watts R.M.S. into 8 ohms, using 35V: 20 watts R.M.S. into 3 ohms using 30 volts.
Z.50 40 watts R.M.S. into 3 ohms from 40 volts: 30 watts R.M.S. into 8 ohms, using 50 volts.
Frequency response 30 to 300,000 Hz ± 1dB
Distortion 0.02% into 8 ohms
Signal to noise ratio better than 70 dB unweighted
Input sensitivity 250mV into 100 Kohms.
For speakers from 3 to 15 ohms impedance.
Size $3\frac{1}{2} \times 2\frac{1}{4} \times \frac{1}{2}$ ins.

Z.30
Built, tested and guaranteed with circuits and instructions manual **89/6**

Z.50
Built, tested and guaranteed with circuits and instructions manual **109/6**

Stereo 60 pre amp/control unit

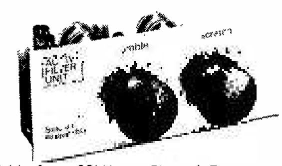
Designed for the Project 60 range but suitable for use with any high quality power amplifier. Again silicon epitaxial planar transistors are used throughout, achieving a really high signal-to-noise ratio and excellent tracking between channels. Input selection is by means of push buttons and accurate equalisation is provided for all the usual inputs.

SPECIFICATIONS
- Input sensitivities – Radio – up to 3mV. Mag. p.u. – 3mV: correct to R.I.A.A. curve ± 1dB: 20 to 25,000Hz. Ceramic p.u. – up to 3mV: Aux. – up to 3mV.
- Output – 250mV.
- Signal-to-noise ratio – better than 70dB.
- Channel matching – within 1dB.
- Tone controls – TREBLE +15 to –15dB at 10kHz: BASS +15 to –15dB at 100Hz.

- Front panel – brushed aluminium with black knobs and controls.
- Size $8\frac{1}{4} \times 1\frac{1}{2} \times 4$ ins.

Built, tested and guaranteed **£9.19.6**

Active Filter Unit

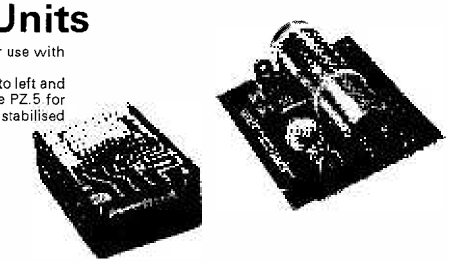


For use between Stereo 60 unit and two Z.30s or Z.50s, the Active Filter Unit matches the Stereo 60 in styling and is as easily mounted. It is unique in that the cut-off frequencies are continuously variable, and as attenuation in the rejected band is rapid (12dB/octave), there is less loss of the wanted signal than has previously been possible. Amplitude and phase distortion are negligible. The Sinclair A.F.U. is suitable also for use with any other amplifier system.
Two stages of filtering are incorporated – rumble (high pass) and scratch (low pass). Supply voltage – 15 to 35V. Current – 3mA. H.F cut-off (–3dB) variable from 28kHz to 5kHz. L.F cut-off (–3dB) variable from 25Hz to 100Hz. Filter slope, both sections 12dB per octave. Distortion at 1kHz (35V supply) 0.02% at rated output.

Built, tested and guaranteed **£5.19.6**

Power Supply Units

The units below are designed specially for use with the Project 60 system of your choice.
Illustration shows PZ.5 power supply unit to left and PZ.8 (for use with Z.50s) to the right. Use PZ.5 for normal Z.30 assemblies and PZ.6 where a stabilised supply is essential.



PZ-5 *30 volts unstabilised* **£4.19.6**
PZ-6 *35 volts stabilised* **£7.19.6**
PZ-8 *45 volts stabilised (less mains transformers)* **£5.19.6**
PZ-8 *mains transformer* **£5.19.6**

GUARANTEE *If within 3 months of purchasing Project 60 modules directly from us, you are dissatisfied with them, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail. Air-mail charged at cost.*

sinclair

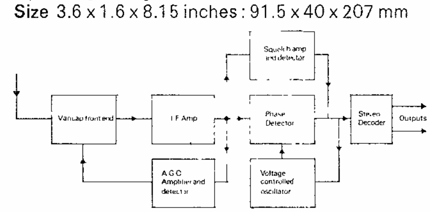
Stereo FM tuner

first in the world to use the phase lock loop principle

Before production of this tuner, the phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio over other systems. Now, for the first time the principle has been applied to an FM tuner with fantastically good results. By the inclusion of other original features such as varicap diode tuning, printed circuit coils and an I.C. in the specially designed stereo decoder, the tuner has an unsurpassed specification, which also incorporates a squelch circuit for silent tuning between stations, A.F.C. and A.G.C. Sensitivity is such that good reception becomes possible in difficult areas, foreign stations can be tuned in suitable conditions and often a few inches of wire are enough for an aerial. In terms of high fidelity, this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically as the tuning control is rotated, a panel indicator lighting up as the stereo signal is tuned in. Although the tuner is intended primarily for use with a Project 60 system, it can be used to advantage with any other high fidelity system. It is easily mounted into any cabinet as shown in the manual supplied with it.

Specifications

Number of transistors 16 plus 20 in I.C.
Tuning range 87.5 to 108 MHz
Capture ratio 1.5dB
Sensitivity 2μV for 30dB quieting
7μV for full limiting
Squelch level 20μV
A.F.C. range ± 200 KHz
Signal to noise ratio > 65dB
Audio frequency response 10Hz—15kHz (±1dB)
Total harmonic distortion 0.15% for 30% modulation
Stereo decoder operating level 2μV
Pilot tone suppression 30dB
Cross talk 40dB
I.F. frequency 10.7 MHz
Output voltage 2 x 150mV R.M.S.
Aerial Impedance 75 Ohms
Indicators Mains on; Stereo on; tuning indicator
Operating voltage 25-30 VDC
Size 3.6 x 1.6 x 8.15 inches: 91.5 x 40 x 207 mm



Price: **£25** built and tested. Post free.

To: Sinclair Radionics Ltd., 22 Newmarket Road, Cambridge

Please send ....

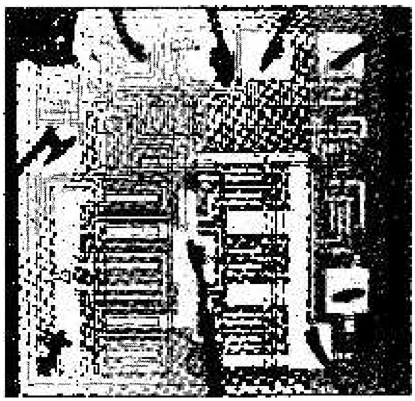
for which I enclose cash/cheque money order

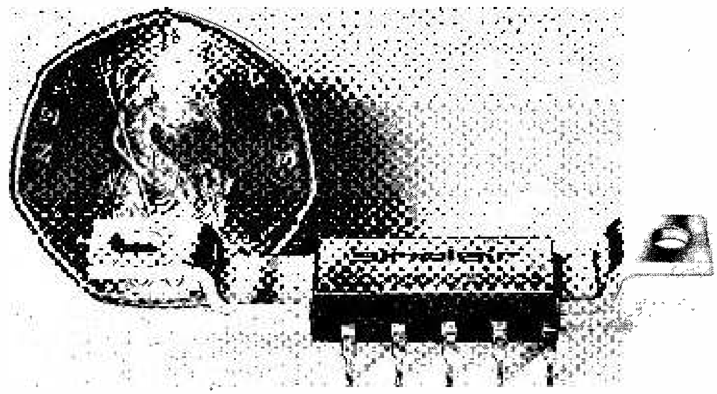
NAME ....

ADDRESS ....

PW. 171A

Sinclair IC-10





the world's most advanced high fidelity amplifier

Specifications

Output: 10 Watts peak, 5 Watts R.M.S. continuous
Frequency response: 5 Hz to 100 KHz±1dB
Total harmonic distortion: Less than 1% at full output.
Load impedance: 3 to 15 ohms.
Power gain: 110dB (100,000,000,000 times) total.
Supply voltage: 8 to 18 volts.
Size: 1 x 0.4 x 0 2 inches.
Sensitivity: 5mV.
Input impedance: Adjustable externally up to 2 5 M ohms.

Circuit Description

The first three transistors are used in the pre-amp and the remaining 10 in the power amplifier. Class AB output is used with closely controlled quiescent current which is independent of temperature. Generous negative feedback is used round both sections and the amplifier is completely free from crossover distortion at all supply voltages, making battery operation eminently satisfactory.

Applications

Each IC-10 is sold with a very comprehensive manual giving circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include stabilised power supplies, oscillators, etc. The pre-amp section can be used as an R.F. or I.F. amplifier without any additional transistors.

The Sinclair IC-10 is the world's first monolithic integrated circuit high fidelity power amplifier and pre-amplifier. The circuit itself, a chip of silicon only a twentieth of an inch square by one hundredth of an inch thick, has 5 watts R.M.S. output (10w. peak). It contains 13 transistors (including two power types), 2 diodes, 1 zener diode and 18 resistors, formed simultaneously in the silicon by a series of diffusions. The chip is encapsulated in a solid plastic package which holds the metal heat sink and connecting pins. This exciting device is not only more rugged and reliable than any previous amplifier, it also has considerable performance advantages. The most important are complete freedom from thermal runaway due to the close thermal coupling between the output transistors and the bias diodes and very low level of distortion.

The IC-10 is primarily intended as a full performance high fidelity power and pre-amplifier, for which application it only requires the addition of such components as tone and volume controls and a battery or mains power supply. However, it is so designed that it may be used simply in many other applications including car radios, electronic organs, servo amplifiers (it is d.c. coupled throughout), etc. Once proven, the circuits can be produced with complete uniformity which enables us to give a full guarantee on every IC-10, knowing that every unit will work as perfectly as the original and do so for a lifetime.

SINCLAIR
IC-10 *with IC-10 manual Post free.* **59/6**

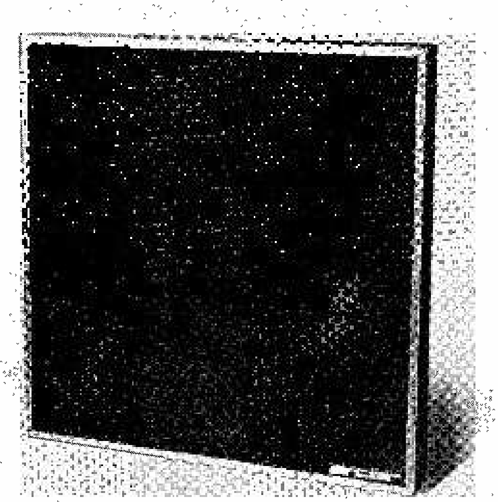
To: Sinclair Radionics Ltd., 22 Newmarket Road, Cambridge

Please send	*NAME* ....
....	*ADDRESS* ....
....	....
....	....
for which I enclose cash/cheque money order	.... PW. 13A

sinclair

Q.16 High fidelity loudspeaker

Developed out of the revolutionary and much praised design of the original Sinclair Q.14 comes this more advanced version to meet the requirements of even greater numbers of high fidelity enthusiasts. The Q.16 employs the same well proven acoustic principles in which a special driver assembly is meticulously matched to the physical characteristics of the uniquely designed housing. In reviewing this exclusive Sinclair design, technical journals have been loud in their praise for it and it comfortably stands comparison with very much more expensive loudspeakers. The shape of the Q.16 enables it to be positioned and matched to its environment to much better effect than is the case with conventionally styled enclosures, and with its improved styling, the Q.16 presents an entirely new and attractive appearance. A solid teak surround is used with a special all-over cellular black foam front chosen as much for its appearance as for its ability to pass all audio frequencies unimpaired.
The Q.16 is compact and slim and is the ideal shelf-mounted speaker, and brings genuine high fidelity within reach of every music lover.



Specifications

Construction:	A sealed seamless sound or pressure chamber is used with internal baffle, all of materials carefully chosen to ensure freedom from spurious tone coloration.
Loading:	Up to 14 watts R.M.S.
Input impedance:	8 ohms.
Frequency response:	From 60 to 16,000Hz, as confirmed. by independently plotted B & K curve.
Driver unit:	Specially designed high compliance unit having massive ceramic magnet of 11,000 gauss, aluminium speech coil and special cone suspension. Excellent transient response is achieved.
Size and styling:	$9\frac{3}{4}$" square on face x $4\frac{3}{4}$" deep with neat pedestal base. Black all-over cellular foam front with natural solid teak surround.
Price:	£8 19 6.

Micromatic Britain's smallest radio

Considerably smaller than an ordinary box of matches, this is a multi-stage A.M. receiver meticulously designed to provide remarkable standards of selectivity, power and quality. Powerful A.G.C. is incorporated to counteract fading from distant stations; bandspread at higher frequencies makes reception of Radio 1 easy at all times. Vernier type tuning plus the directional properties of the self-contained special ferrite rod aerial makes station separation very much easier than with many larger sets. The plug-in high fidelity type magnetic earpiece which matches exactly with the output of the Micromatic provides wonderful standards of reproduction both for speech and for music. Everything including the batteries is contained within the attractively designed case. Whether you build your Micromatic or buy it ready built and tested, you will find it as easy to take with you as your wristwatch, and dependable under the severest listening conditions.

Specifications

Size:	$1\frac{13}{16}$" x $1\frac{7}{16}$" x $\frac{1}{2}$" (46 x 33 x 13mm).
Weight including batteries:	1 oz. (28.35gm) approx.
Tuning:	Medium wave band with bandspread at higher frequency end.
Earpiece:	High-fidelity magnetic type.
Battery requirements:	Two Mallory Mercury Cells, type R.M. 675, for long working life.
Case:	Black plastic with anodised aluminium front panel, spun aluminium dial.
Controls:	Tuning dial, and on/off switching by means of earpiece plug.
Price:	Available in kit form complete with earpiece, case, instructions and supply of solder in fitted pack. 49/6. Ready built, tested and guaranteed. 59/6.

Sinclair Radionics Ltd, 22 Newmarket Road, Cambridge Telephone 0223 52731

SMITHS FOR SERVICE & TOP DISCOUNT

AMPLIFIERS

	Rec. Retail Price	Discount Price
ARENA F210... ...	£36 15 0	£29 10 0
ARMSTRONG 521 ...	£56 0 0	£47 0 0
CAMBRIDGE P40 ...	£75 0 0	£62 10 0
CORAL 550	£59 0 0	£48 0 0
DULCI 207	£25 0 0	£17 0 0
DULCI 207M... ...	£30 0 0	£21 10 0
GOODMANS Maxamp	£54 0 0	£42 10 0
LEAK Stereo 20 plus chassis	£53 0 0	£43 10 0
LEAK Stereo 30 plus teak	£59 10 0	£48 12 6
LEAK Stereo 70 chassis	£65 0 0	£53 10 0
LEAK Stereo 70 teak	£71 10 0	£57 10 0
LUX SQ 77T... ...	£67 7 6	£59 5 0
LUX SQ 505... ...	£97 10 0	£79 10 0
LUX SQ 1220 ...	£124 10 0	£104 10 0
LINEAR LT 66 ...	£18 18 0	£15 10 0
L.L. NOVA AMP ...	£30 9 0	£22 10 0
METROSOUND ST20	£36 0 0	£29 0 0
NIKKO TRM 30 ...	£36 0 0	£29 19 6
NIKKO TRM 40 I.C.	£46 10 0	£39 10 0
NIKKO TRM 50 ...	£95 10 0	£50 19 4
NIKKO TRM 1200 ...	£95 0 0	£74 10 0
PHILIPS RH 580 ...	£26 0 0	£19 19 6
PIONEER SA 500 ...	£61 15 0	£51 10 0
PIONEER 5A 700 ...	£98 0 0	£79 10 0
QUAD 33 and 303 ...	£98 0 0	£85 0 0
ROGERS Ravensbrook	£45 0 2	£37 10 0
ROGERS Ravensbrook Teak	£49 0 0	£39 10 0
ROGERS Ravensbourne	£59 10 0	£48 10 0
Teak	£64 0 0	£52 10 0
ROTEL 100	£44 0 0	£37 10 0
J. E. SUGDEN A21 Mk. 2	£59 10 0	£49 10 0
SANSUI AU 222 ...	£62 17 7	£49 10 0
SANSUI AU 555 ...	£80 9 7	£65 0 0
SINCLAIR 2000 ...	£30 9 0	£23 15 0
SINCLAIR project 60 with PZ5	£00 0 0	£20 10 0
TELETON SAQ 203E	£28 7 0	£20 0 0
TELETON GA 101 ...	£38 5 0	£29 0 0

FM TUNERS

	Rec. Retail Price	Discount Price
ARENA F211... ...	£44 2 0	£36 15 0
ARMSTRONG 523 ...	£52 9 0	£44 17 6
ARMSTRONG 524 ...	£40 4 6	£34 17 6
ARMSTRONG M8 Dec.	£9 10 0	£7 15 0
DULCI FMT7... ...	£22 1 0	£17 19 6
DULCI FMT7S ...	£31 0 0	£25 5 0
GOODMANS Stereo-max	£82 10 0	£70 10 0
GRUNDIG R.T. 40M	£126 9 3	£104 10 0
LEAK Stereofetic ...	£56 13 10	£50 19 6
LEAK Teak	£67 3 6	£56 19 6
L.L. NOVA Tuner ...	£40 9 0	£32 10 0
NIKKO Fam 12F ...	£68 8 3	£59 10 0
PHILIPS RH690 ...	£39 0 0	£33 0 0
ROGERS Ravensbrook FET Teak	£51 10 0	£44 10 0
ROGERS Ravensbourne FET Teak	£61 17 9	£52 12 6
SANSUI TU555 ...	£77 9 2	£69 10 0
SANSUI TU777 ...	£94 5 11	£82 10 0
TELETON GT101 ...	£48 12 6	£37 10 0

TUNER AMPLIFIERS

	Rec. Retail Price	Discount Price
ARENA T 1500F ...	£72 9 0	£62 15 0
ARENA T 2600 ...	£104 9 0	£89 10 0
ARENA T 2700 ...	£97 13 0	£82 10 0
ARENA T 9000 ...	£303 9 0	£255 0 0
ARMSTRONG 525 ...	£91 17 6	£77 10 0
ARMSTRONG 526 ...	£104 14 3	£87 10 0
GOODMANS 3000 ...	£77 14 9	£67 10 0
GRUNDIG RTV 600...	£212 0 0	£177 10 0
LUX SQ 555... ...	£187 10 0	£149 10 0
NIKKO 5TA 301 ...	£99 10 0	£84 10 0
NIKKO ST 501 ...	£121 17 11	£102 10 0
NIKKO ST 701 ...	£136 3 11	£112 10 0
PIONEER KX 330 ...	£78 12 4	£63 10 0
PIONEER SX 770 ...	£160 8 6	£129 10 0
SANSUI 200	£89 10 0	£69 10 0
SANSUI 350	£129 1 10	£105 0 0
SANSUI 800	£148 0 0	£120 0 0
SANYO DC60E ...	£99 0 0	£84 10 0
TOSHIBA SA2600M ...	£74 10 0	£49 10 0
ROTEL 130	£79 10 0	£68 0 0
PHILIPS RH781 ...	£74 19 6	£63 10 0
PHILIPS RH691 ...	£83 0 0	£71 10 0
TELETON CR10T ...	£39 10 0	£32 0 0
TELETON F2000 ...	£51 19 0	£39 10 0
TELETON MX990 ...	£64 12 0	£49 10 0
TELETON R8000 ...	£69 10 0	£52 10 0
TELETON TFS50 ...	£79 10 0	£59 10 0

SPEAKERS

	Rec. Retail Price	Discount Price
ARENA HT7 ...	£19 19 0	£16 15 0
ARENA HT10 ...	£22 1 0	£18 17 6
ARENA HT20 ...	£32 11 0	£27 15 0
ARENA HT21 ...	£10 10 9	£9 0 0
ARENA HT26 ...	£78 15 0	£65 10 0
ARENA HT27 ...	£18 18 0	£14 15 0
ARENA HT28 ...	£17 17 0	£13 17 6
B & W DM1 ...	£32 0 0	£26 10 0
B & W DM3 ...	£63 0 0	£49 10 0
B & W DM70 ...	£139 0 0	£117 10 0
CELESTION Ditton 10	£21 3 2	£17 5 0
CELESTION Ditton 15	£29 0 0	£23 0 0
CELESTION Ditton 25	£59 17 0	£45 0 0
DULCI A53	£9 9 0	£8 0 0
GOODMANS Maxim	£20 15 6	£16 15 0
GOODMANS Magnum K2 ...	£40 2 0	£29 19 6
GOODMANS Magister	£57 0 0	£40 0 0
GOODMANS MEZZO III	£30 18 0	£23 10 0
GOODMANS Minster per pair	£44 18 0	£38 10 0
GRUNDIG System 412	£86 7 10	£72 10 0
GRUNDIG System 740	£176 9 10	£145 0 0
KEF Cresta	£22 3 7	£18 0 0
KEF Celeste Mk. 2 ...	£29 0 0	£22 10 0
KEF Concerto ...	£53 10 0	£42 10 0
KEF Chorale	£34 16 6	£29 10 0
KEF Cadenza... ...	£38 0 0	£32 0 0
LEAK 200	£23 10 0	£17 10 0
LEAK 300	£27 10 0	£21 0 0
LEAK 600	£45 0 0	£32 10 0
LOWTHER Acousta PM6	£45 10 0	£37 10 0
MORDAUNT SHORT MS 100	£36 15 0	£29 10 0
MORDAUNT SHORT MS 600	£57 15 0	£45 0 0
PHILIPS RH481 per pair	£22 0 0	£17 10 0
SANYO SX-X per pair	£37 16 0	£32 10 0
WHARFEDALE Denton	£37 16 0	£30 10 0
WHARFEDALE Super Linton	£45 0 0	£37 10 0
WHARFEDALE Melton	£29 10 0	£23 0 0
WHARFEDALE Dove-dale III	£39 10 0	£31 0 0
WHARFEDALE Aire-dale	£69 10 0	£56 10 0
WHARFEDALE Rose-dale	£57 0 0	£47 10 0
WHARFEDALE Unit 3	£11 19 0	£9 15 0
WHARFEDALE Unit 4	£16 0 0	£13 10 0
WHARFEDALE Unit 5	£23 10 0	£19 0 0

PLAYING DECKS

	Rec. Retail Price	Discount Price
GARRARD 401 ...	£31 14 2	£27 0 0
GARRARD SL95B ...	£45 9 1	£34 10 0
GARRARD SL75B ...	£35 12 2	£25 10 0
GARRARD SL65B ...	£19 6 5	£15 10 0
GARRARD SP25 ...	£15 15 11	£11 7 6
GARRARD 2025 T/C	£11 3 11	£9 10 0
GOLDRING GL69P	£33 11 9	£27 10 0
GARRARD GL75 ...	£36 8 2	£28 10 0
GOLDRING GL7SP ...	£46 18 8	£37 10 0
GOODMANS 3025 ...	£37 14 9	£31 10 0
THORENS TD150A Mk. II ...	£43 12 7	£33 10 0
THORENS TD150 AB II ...	£47 8 7	£39 10 0
THORENS TD125 ...	£75 17 8	£59 10 0
THORENS TD125 AB	£120 3 11	£95 0 0
JP T500 ...	£36 15 4	£29 10 0
Pioneer PL12AC ...	£50 17 11	£41 10 0

STEREO CARTRIDGES

	Rec. Retail Price	Discount Price
AUDIO TECHNICA AT66	£6 4 8	£5 10 0
AUDIO TECHNICA AT21S	£8 14 4	£7 10 0
AUDIO TECHNICA AT21X	£15 9 11	£13 0 0
ADC 660	£16 6 6	£13 10 0
ADC 10E Mk. II ...	£46 4 2	£36 10 0
GOLDRING G850 ...	£6 10 0	£5 10 0
GOLDRING G800 ...	£13 0 0	£9 10 0
GOLDRING G800E...	£18 17 1	£15 10 0
GOLDRING G800 S/E	£26 0 0	£19 10 0
GOLDRING CS90 ...	£5 4 0	£4 7 6
GOLDRING CS91E ...	£7 16 1	£6 10 0
NEAT V70	£5 4 8	£4 7 6
NEAT V70E	£7 15 3	£6 12 6
PICKERING V15/AME2	£19 5 10	£16 10 0
PICKERING V15 AM2	£13 17 6	£11 10 0
PICKERING V15 AC2	£10 14 8	£8 7 6
PICKERING V115 AC2	£8 8 0	£6 17 6
SHURE M3D M ...	£7 8 3	£6 0 0
SHURE N3D ...	£5 11 2	£4 5 0
SHURE M31E ...	£12 19 5	£10 5 0
SHURE N31E ...	£9 5 3	£7 5 0
SHURE M32E ...	£12 0 11	£9 10 0
SHURE N32E ...	£8 6 9	£6 10 0
SHURE M44 7 ...	£10 3 10	£8 5 0
SHURE N44 7 ...	£6 9 8	£5 2 6
SHURE M44E ...	£12 0 11	£9 0 0
SHURE N44E ...	£10 3 10	£8 2 6
SHURE M55E ...	£12 19 5	£10 10 0
SHURE N55E ...	£11 12 4	£8 5 0
SHURE M75/6 ...	£16 13 6	£13 0 0
SHURE N75/6 ...	£8 6 9	£6 10 0
SHURE M75E Type 2	£21 6 2	£17 0 0
SHURE M75 EJ ...	£19 9 1	£16 5 0
SHURE N75 EJ ...	£11 2 4	£8 12 6
SHURE V15 II ...	£40 15 0	£29 17 6
SHURE VN15E ...	£16 13 6	£14 10 0

STEREO TAPE DECKS AND RECORDERS

	Rec. Retail Price	Discount Price
AKAI 4000D	£89 10 0	£72 10 0
AKAI 1710W... ...	£109 0 0	£89 10 0
AKAI 1710L	£109 0 0	£89 10 0
AKAI 150D	£130 2 4	£109 10 0
AKAI 1800 SD ...	£199 0 0	£165 0 0
REVOX 1104... ...	£204 15 0	£184 10 0
PHILIPS 4404... ...	£80 0 0	£67 10 0
PHILIPS 4407... ...	£103 15 4	£87 0 0
PHILIPS 4408... ...	£136 5 0	£110 0 0
SANYO MR 801 ...	£76 0 0	£67 10 0
SANYO MR 929 ...	£100 16 0	£86 0 0
SANYO MR 939 ...	£110 0 0	£91 10 0
SANYO MR 800 ...	£86 0 0	£75 0 0
TELETON FXB 570D	£52 10 0	£43 10 0
SHARP RD 712 ...	£75 0 0	£60 0 0
UHER 4200L ...	£162 14 10	£130 0 0
UHER 4400L ...	£162 14 10	£130 0 0
GRUNDIG TK 147 ...	£87 10 0	£72 10 0
GRUNDIG TK 246 ...	£128 17 8	£109 0 0
GRUNDIG TK 248 ...	£157 14 0	£120 0 0
TELEFUNKEN 207 ...	£110 0 0	£95 0 0
TELEFUNKEN 204TS ...	£124 0 0	£105 0 0

TRANSCRIPTION ARMS

	Rec. Retail Price	Discount Price
SME 3009 with S2 shell	£34 0 0	£27 0 0
SME 3012 with S2 shell	£36 0 0	£29 0 0
AUDIO TECHNICA AT1005 Mk. II ...	£19 19 0	£16 5 0
GOLDRING L75 ...	£12 10 0	£9 19 6
GOLDRING L69 ...	£9 5 9	£8 5 0

STEREO HEADPHONES

	Rec. Retail Price	Discount Price
AKAI ASE9SE ...	£6 16 0	£5 10 0
SANSUI SS2	£7 14 6	£6 10 0
SANSUI SS20 ...	£16 10 0	£13 0 0
TELETON SH301D ...	£4 10 0	£3 10 0
SHARP HP100 ...	£5 17 6	£4 10 0
PIONEER SE 50 ...	£19 3 8	£15 0 0
PIONEER SE 30 ...	£12 19 6	£10 0 0
PIONEER SE 20A ...	£9 19 6	£7 0 0

THORENS TD150 AB with TX II Cover fitted with Shure M55E wired to phone plugs ... £64 8 0 £52 10 0

GOLDRING GL75 with Goldring plinth and hinged perspex cover ready fitted with Goldring 800E cartridge ready wired to 5 pin din or phono plug. Rec. Retail price £67.19.10. Discount price £54.0.0.

GOLDRING GL69 Mk II with Goldring plinth and hinged perspex cover ready fitted with Goldring 800 cartridge ready wired to 5 pin din or phono plug. Rec. Retail price £50.11.9. Discount price £41.10.0.

All goods are in manufacturer's sealed cartons and are insured against loss or damage in transit. **Guaranteed "by return" service. Carriage 10/- for speakers & stereo tape recorders. 7/6 for amplifiers, tuners, playing decks, tape decks. 5/- for cartridges, headphones and transcription arms.** *Send cash/cheque with order. Personal callers very welcome. 9.30 am—6 pm. Monday to Saturday. Thursday ½ day closing.*

Smith's Radio Service (Wolverhampton) Ltd. **Mail Order Department, 26 Victoria Street, Wolverhampton, Staffs. Tel: Wolv. 29246**

HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT

NEW IMPROVED MODEL WITH HIGHER OUTPUT AND INCORPORATING HIGH QUALITY READY DRILLED PRINTED CIRCUIT BOARD FOR EASY CONSTRUCTION

A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 5 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled printed circuit 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; Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response ±3dB 15–30,000 Hz Sensitivity: better than 80mV into 1MΩ. Full power bandwidth: ±3dB 20–14,000 Hz. Bass boost approx. to ±12dB. Treble cut approx. to −16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp. Overall Size 12″w. x 8″d. x 2¾″h.
Fully detailed 7 page construction manual and parts list free with kit or send 3/6 plus large S.A.E.

PRICES

AMPLIFIER KIT	£10.10.0	P. & P. 3/-
POWER PACK KIT	£3. 0.0	P. & P. 5/-
CABINET	£3. 0.0	P. & P. 5/-

(Post Free if all units purchased at same time)
Full after sales service
Also available ready built and tested **£20.10.0.** Post Free.

Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi Fi Discotheque use, etc.

FANTASTIC 'POLY PLANAR' WAFER-TYPE, WIDE RANGE ELECTRO-DYNAMIC SPEAKER

Size only 11¾″ x 14$\frac{5}{16}$″ x 1$\frac{3}{16}$″ deep. Weight only 19 ozs. Can replace cone speakers in any application and is particularly useful for those with limited space. Extremely rugged and shockproof. Operating temperature—20°F to 175°F. Power handling 10 watts rms (20 watts peak). Impedance 8 ohm only. Response 40 Hz-20 KHz. Can be mounted on ceilings, walls, doors, under tables etc. and used with or without baffle.
Send S.A.E. for full details. **ONLY £5.15.0.** each P. & P. 5/-

MAGNAVOX DESK TYPE MOVING COIL MICROPHONE. Medium imp. Brand New. Special Price **42/-** p. & p. 2/-.
SINGLE HEADPHONE With aluminium headband. Approx 200 ohm 5/- P. & P. 1/6
CRYSTAL MIKES. High imp. for desk or hand use. High sensitivity. **18/6**, P. & P. 1/6.
HIGH IMPEDANCE CRYSTAL STICK MIKES. OUR PRICE **21/-**, P. & P. 1/6.
HIGH IMPEDANCE DYNAMIC STICK MIKES. High sensitivity, **39/6**, P. & P. 2/6.

HONEYWELL MICROSWITCHES. S/P. C/O. Push button action. Rating 250v. AC at 15 amps. Size approx. 1¼ × ⅝ × ⅜in. **5/-** each. P. & P. 1/- (6 or more post free).

SPECIAL OFFER! PLESSEY TYPE 29 TWIN TUNING GANG. 400pF + 146pF. Fitted with trimmers and 5:1 integral slow motion. Suitable for nominal 470 k/sc I.F. Size appox. 2×1×1½. Only **8/6.** P. & P. 2/6.

TELESCOPIC AERIALS WITH SWIVEL JOINT. Can be angled and rotated in any direction. 6 section Lacquered Brass. Extends from 6in. to 22½in. approx. Maximum diameter ½in. **5/-** each. P. & P. 1/-.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0–210–240v. Secondary combinations 0–5–10–15–20–25–30–35–40–60v. half wave at 1 amp. or 10–0–10, 20–0–20, 30–0–30v. at 2 amps full wave. Size 3in. long × 3½in. wide × 3in. deep. Price **35/-**, P. & P. 6/-.
MAINS TRANSFORMER. For transistor power supplies. Pri 200/240v. Sec. 9–0–9 at 500mA. **14/-**. P. & P. 2/6. Pri. 200/240v. Sec. 12–0–12 at 1 amp. **17/6**. P. & P. 2/6. Pri. 200/240v. Sec. 10–0–10 at 2 amp. **27/6**. P. & P. 3/6. Tapped Primary 200–220–240v. Sec. 21.5v. at 500mA. **12/6**. P. & P. 2/6.
BATTERY CHARGER TRANSFORMERS. 200/240v. input. Nominal output for 6 or 12v. batteries 3 amps. Size approx. 3″ x 2½″ x 2½″. Brand New. Price **21/-**. P. & P. 5/-.

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

SPECIAL OFFER !

HI-FI LOUDSPEAKER SYSTEMS

Beautifully made teak finish enclosure with most attractive Tygan-Uynair front. Size 16½″ high x 10½″ wide x 6″ deep. Fitted with E.M.I. Ceramic Magnet 13″ x 8″ bass unit, two H.F. tweeter units and crossover. Power handling 10 watts. Available 3 or 8 or 15 ohms impedance.

OUR PRICE £8.8.0. Carr. 10/-

Also available in 8 ohms with EMI 13″ x 8″ bass speaker with parasitic tweeter **£6.10.0.** Carr. 10/-

LOUDSPEAKER BARGAINS
3″ 4 ohm **10/-** P. & P. 1/6. 5in. 3 ohm **16/-**. P. & P. 3/-. 7 × 4in. 3 ohm **21/-**, P. & P. 4/-, 10 × 6in. 3 or 15 ohm **35/-**, P. & P. 6/-, E.M.I. 8 × 5in. 3 ohm with high flux magnet **26/-**. P. & P. 4/- E.M.I. 13¼ × 8in. 3 ohm with high flux ceramic magnet **42/-** (15 ohm **45/-**), P. & P. 6/-. E.M.I. 13 × 8in. 3 or 15 ohm with two inbuilt tweeters and crossover network **4 gns.** P. & P. 6/-.
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. 7/6 Guitar models: 25w. **£6.10.0**, 35w. **£8.10.0.**
E.M.I. 3½in. HEAVY DUTY TWEETERS. Powerful ceramic magnet. Available in 3 or 8 or 15 ohms **18/6** each. P. & P. 2/6.
12in. "RA" TWIN CONE LOUDSPEAKER. 10 watts peak handling, 3 or 15 ohm **37/6**, P. & P. 6/-.
35 OHM SPEAKERS 3in. **14/-**, P. & P. 2/6;

HI-FI STEREO HEADPHONES

Adjustable headband with comfortable flexifoam earmuffs. Wired and fitted with standard stereo ¼in jack plug. Frequency response 30–15,000Hz. Matching impedance 8–16 ohms. PRICE **59/-**. P. & P. 3/-.

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER
For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz—25KHz. Gain 26dB. Solid encapsulation size 1¾″ x 1¼″ x ⅜″. Brand new complete with instructions. Price **17/6** P. & P. 2/6.

BRAND NEW E.M.I. LIGHTWEIGHT PICK-UP ARM WITH ARM REST, (as above.) Fitted mono t/o stylus and cartridge for LP/78. ONLY **20/-**, P. & P. 1/6.

QUALITY RECORD PLAYER AMPLIFIER MK II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide × 3in. deep × 6in. high. 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 MK II. Uncut motor board size 14½ × 12in. clearance 2in. below, 5½in. above. Will take above amplifier and any B.S.R. or GARRARD changer or Single Player (except AT60 and SP25). Size 18 × 15 × 8in. PRICE **79/6**, P. & P. 9/6.

10/14 WATT HI-FI AMPLIFIER KIT

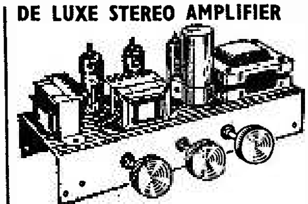
A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3–15 Ω speaker and 2 independent volume controls, and separate base and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet **2/6** (Free with parts). **All parts sold separately.** ONLY **£7.19.6.** P. & P. 8/6. Also available ready built and tested complete with std. input sockets, **£9.19.6.** P. & P. 8/6.

BRAND NEW TRANSISTOR BARGAINS. GET 15 (Matched pair) **15/-**; V15/10p **10/-**; OC71 **5/-**; OC76 **6/-**; AF117 **3/6**; 2G339 (NPN) **3/-**.
Set of Mullard 6 transistors OC44, 2—OC45, AC128D matched pair AC128 **25/-**: ORP12 Cadmium Sulphide Cells **10/6.** All post free.

VERY POWERFUL COMPACT MOTOR

For 12v. D.C. operation. Off load consumption approx. 100mA. Totally enclosed. Quiet in operation with high starting torque. Overall size approx. 1⅞″L × 1¼″ dia. Free shaft $\frac{1}{16}$″ dia. × ⅜″L. Ideal for Model Makers, etc. ONLY **7/6** each P. & P. 1/-
3 or more post free (A few 6v. versions also available)

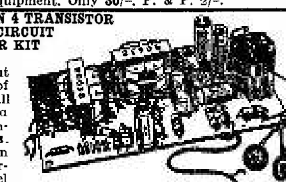
DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:—2 × ECL86 Triode Pentodes. 1 × EZ80 as full wave rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11″w × 4″d. Overall height including valves 5″. Ready built and tested to a high standard. **PRICE £8.18.6** P. & P. 8/-.

4-SPEED RECORD PLAYER BARGAINS
Mains models. All brand new in maker's packing.
LATEST B.S.R. C109/A21 4-SPEED AUTOCHANGER. With latest mono compatible cartridge **£6.19.6.** Carr. 6/6. With stereo cartridge **£7.19.6.** Carr. 6/6.
SUITABLE PLINTH UNIT FOR ABOVE with rigid plastic cover. **£5.15.0.** complete P. & P. 8/6.
LATEST GARRARD MODELS. All types available 1025, 2025, SP25, 3000, AT60 etc. S.A.E. for latest Prices!
PLINTH UNITS cut out for Garrard Models, 1025, 2025, 2000, 3000, 3500 etc. With rigid transparent plastic cover. Special design enables above models to be used with cover in position. Also suitable for housing AT60 and SP25. OUR PRICE **£5.15.0** complete. P. & P. 8/6.
LATEST ACOS GP91/1SC mono compatible cartridge with t/o stylus for LP/EP/78. Universal mounting bracket. **30/-**. P. & P. 1/6.
ACOS HI-G Single sided mono cartridge for LP & EP. **ONLY 10/-** Post Free.
SONOTONE 9TAHC COMPATIBLE STEREO CARTRIDGE T/O stylus Diamond Stereo LP and Sapphire 78. **ONLY £2.10.0.** P. & P. 2/-.
Also available fitted with twin Diamond T/O stylus for Stereo LP. **ONLY £3.** P. & P. 2/-.
LATEST RONETTE T/O STEREO/COMPATIBLE CARTRIDGE for EP/LP/Stereo/78. **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/-.

HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT
Type TA1



Peak output in excess of 1½ watts. All standard British components. Built on printed circuit panel size 6 x 3in. 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 49/6.** P. & P. 3/-.
Also ready built and tested, **55/-**. P. & P. 3/-.

3-VALVE AUDIO AMPLIFIER HA34 MK II.

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 volume control and now with improved wide range tone controls giving bass and treble lift and cut. 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 **£4.15.0.** 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/-.

HARVERSON'S SUPER MONO AMPLIFIER
A super quality gram amplifier using a double wound fully isolated mains transformer, 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 7in. wide × 3in. deep × 6in. high overall. AC mains 200/240v. Supplied absolutely Brand New completely wired and tested with good quality output transformer.
FEW ONLY.
BARGAIN PRICE **55/-** P. & P. 6/-

Open 9–5.30 Monday to Saturday
Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station.

HARVERSON SURPLUS CO. LTD.

170 HIGH ST., MERTON, LONDON, 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.

Selections from FELSTEAD ELECTRONIC'S

Winter List (Sent free for stamped addressed envelope to address below:—
Transistors & c. AC126 **2/6**. AF115 **3/-**. AF116 **3/-**. AF117 **4/-**. OA5 **1/6**. OA10 **1/6**. OA81 **1/6**. OA85 **1/6**. OC23 **6/6**. OC25 **6/-**. OC26 **7/6**. OC28 **8/6**. OC35 **8/6**. OC44 **2/9**. OC45 **2/6**. OC71 **2/6**. OC72 **2/6**. OC75 **2/6**. OC81 **2/6**. OC81D **2/6**. OC82D **2/6**. OC170 **4/-**. OC171 **2/6**. Many more in list. **S.D.R.** BY100 800piv **2/10**. **6 Amp series:** BYZ13 300 piv **4/-**. BYZ12 600piv **5/-**. BYZ11 900piv **6/-** BYZ10 1200piv **7/-**. (Charges 1/- upto 11, paid for 12 and over.) **Sub-Min Transformers:** OUTPUT (3Ω for OC72, & c) **2/9** DRIVER **3/-**. (Upto 6 either 1/-). **MULTIMETER.** Our famous 20000 Ωper V **£4.12.6** (2/6). Details and other in list.

SOLDERING IRON. Slim, modern, British high-speed 8¼", all parts replaceable, highest quality, full guarantee: **21/-** (1/6). **DIAMOND STYLII** Replacements for BSR TC8/LP, TC8/S, TC8LP/STEREO; COLLARO 'O': RONETTE BF40LP: GARRARD GC2/LP and GC8/LP: ACOS GP65/67. all at **7/6**. (1/-) ACOS GP73, GP91: BSR ST4 (ST3, ST5), ST8 (ST9): SONOTONE 8TA, 9TA, 9TAHC: PHILIPS AG3306, 3060 (3063, 3066, 3301, 3302, 3304) all at **15/-** (1/-). All are of the very highest quality. **Double Diamond:** ST4 (ST3, ST5); ST10 (ST9, ST8): 9TA, 9TAHC, 3306, GP91 (For GP92, GP93, GP94 cartridges): GP91SC for all GP91-SC cartridges; All at **30/-** each (1/-). **PICK-UP CARTRIDGES** All standard fittings and stylii. MONO GP67/2 **15/-** STEREO-COMPATIBLE (MONO) GP91/SC (21/)- STEREO GP93 **25/6**. STEREO CERAMIC GP94 **38/6**. SONOTONE STEREO 9TAHC (DIA.) **47/6**. GOLDRING G850 **97/6**. G800 **£8.10.0.** G800E **£13.10.0** G800 SUPER E **£19.10.0** (1/- all types), Reg. Post 4/-) STYLII FOR ALL ABOVE TYPES, including GOLDRING available. **RECORDING TAPE.** Still the finest quality British Mylar available: Standard 5" 600 ft. **7/3** 5¾" 900 ft. **10/-** 7" 1200ft. **11/3. LONG PLAY** 5" 900 ft. **10/-** 5¾" 1200ft **11/3** 7" 1800ft. **18/-** (1/3 on 5" and 5¾" 1/6 on 7"). **MICROPHONES Crystal** Mic 91, hand/desk **16/3.** MIC45 Curved metal handgrip **20/-**. CM21 Grey hand/desk **10/6**. Stick '60' **20/3** CM70 "Planet" machined metal tapered stick type with neck cord, adaptor to fit floor stands **29/6** (All 1/6) LAPEL (or hand) with clip **6/6** (1/-). All are fitted with leads. **Dynamic.** Cream hand/table MINY **15/6** (1/6) MS10, 50K Ω for desk, tapered, with base and slide-out adaptor **39/6** MS11, Similar, but fixed on swivel swan neck to switch-fitted base **42/6**. (Either 2/6). Type 209 Cardioid ball, 50K/600 Ω, omni-dir., built-in vol. control, on/off switch, special lead, handle (as good as money can buy) **£6.6.0**. DM160, Non-Dir. Ball, 50KΩ, switch, cable, adaptor **77/6** (5/- either). **MICROPHONE INSERTS.** Dia., 1.75" OR 0.9" either size **5/6** (1/-). **EARPIECES** with lead & min. jack plug (2.5 or 3.5mm, state which) Magnetic **1/9** Crystal (3.5 only) **4/9**. (Upto 3 for 1/- on any). **HEADPHONES** De luxe STEREO 8-16 ohms, **47/6**d. Same, fitted vol. control each earpiece, **67/6**. Both have lead and stereo jack plug. (3/-). High Res. 2000 ohm. Adjustable **18/6** (2/-) **SPEAKERS.** 12" ROUND, fitted tweeter, 3 or 15 Ω (state which) **37/6** (5/6) or for Stereo **80/-** pair, carr. paid. 2½" 3 OR 8 Ω (state which) **7/6** (1/-) 2½" powerful transistor replacement, high ohms **6/-** (1/-). **EMI 13" x 8"**, 3, 8 or 15 Ω (State which) **42/6** (4/6): with single flared para. tweeter cone 8 or 15 Ω (state which) **45/6** (4/6): with two tweeters and cross-over network **75/-** (5/-). **VIBRATORS.** Genuine Plessey 12v.4 pin non-synch. 121HD4, 2¾" ex. pins **5/6**. Am. 12v. 4-pin. non-synch. 7/16ths. longer, **4/6** 12v. 7-pin Synch. (12SR7) **12/6**. 6v. 7-pin. Synch. (6SR7) **12/6**. (All types 1/- per vibrator). **CONNECTING WIRE.** Packs of 5 coils asstd. cols. ea. coil 5yds. Solid core **2/9** (1/-). Flexible **3/3** (1/3.) Super thin for transistor wiring **3/3** (1/-). **PICK-UP WIRE.** Super thin twin flex. screened and sheathed **1/3** yd. (1/- upto 6yds.—over, free.) **RETRACTABLE Flex. Leads.** (Curlies) 6ft. phono plug ea. end **4/6**. 12ft. **7/9**. 6ft. phono plug/phono socket other end **5/-** 12ft **8/6** (1/- per lead, all types). **SEND SAE** for full free lists—Teleton and small 3w and 7½w trans. amplifiers, Electrolytics, Vol. Controls, all types of radio switches, car and portable expanding aerials, Meters, Test prods, all types of Brit. & cont.. standard and min. plugs and sockets, SDR's, Thyristors, croc. clips (various), terminals, etc. etc. and many 'Special Offer' lines at lowest possible prices.

FELSTEAD ELECTRONICS, (PW38)
LONGLEY LANE, GATLEY, CHEADLE, CHES. SK8 4EE

Cash with order only. No COD or Caller Service. Charges (Min. 1/-) in brackets after all items. Regret Orders under 5/- unacceptable. SAE please for enquiries Overseas orders welcomed—lists free.

M. & B. RADIO

38 BRIDGE END, LEEDS 1

Telephone: 0532-35649

GEIGER COUNTERS. Well known contamination meter comprised of main unit fitted with meter, probe and lead. Supplied complete with carrying haversack in good clean condition less batteries. 65/- plus 10/- pp. A self contained hand held model less batteries. 62/6 plus 5/- pp.

RF24 UNITS. Well known unit used for 10-15-20 metre converters. Good clean condition 15/-. Rough appearance but serviceable 10/-. Both plus 4/6 pp.

RECEIVER TYPE 78. 2.4 to 13Mc/s receiver unit requiring output stage and p.s.u. in rough condition but ideal for breakdown. Each one contains a 100Kc/s crystal. 30/- plus 6/- pp.

TRANSISTOR INVERTERS.
MODEL 1. 12vdc input. 270vdc at 150mA approx. output. £3-5-0 plus 4/- pp.
MODEL 2. 12vdc input. 330vdc at 330mA approx output. £5-15-0 plus 5/- p.p Both models new.

455 Kc/s TRANSISTOR FM I.F PANELS. Brand new 6 transistor panels but faulty, usually low in gain. 12/6 each plus 1/6 pp.

10.7Mc/s TO 455Kc/s CONVERTER PANELS. Transistorised converter panel supplied in used tested condition complete with 11.155Mc/s crystal. 10/- plus 1/- pp.

BNC PLUGS. New 2/6d each plus 9d pp any quantity.
HC6U CRYSTAL SOCKETS. 3 for 2/6d plus 9d pp any quantity.
60 UNMARKED UNTESTED TRANSISTORS. 5/- plus 1/- pp.
60 UNMARKED UNTESTED DIODES. 2/6d plus 1/- pp.

TRANSISTOR MODULATOR FRONT END. Brand new 4 transistor modulator pre-amp panel 4⅝" x 2⅞". Fitted with preset mic gain control and mod filter. Originally used to drive an NKT404 which drove a pair of NKT404s. Supplied with circuit of complete modulator. 22/6d plus 1/6d pp.

RECEIVER TYPE R1933A. 18 miniature valve vhf receiver. Requires power unit and external oscillator to complete. Ideal 2 or 4 metres 45/- each plus 6/- pp.

TRANSISTOR AUDIO DRIVER AND MUTING PANELS. Set of 3 transistor panels. Audio driver panel with audio gate. Mute drive panel. Mute panel with schmitt trigger circuit to switch the gate on the audio panel. Plus b/p filter. 30/- plus 3/- p.p. Less b/p filter 22/6 plus.

ELECTRO MAGNETIC COUNTERS. 4 Digit counter GPO style. Used but tested. 5/- each plus 1/6d pp. 3 for 12/6d plus 2/6d pp.

If you're a telecommunications man and match up to the qualifications below **cut yourself into a slice of Britain's future**

Become a

Radio Technician

in the fast-growing world of Air Traffic Control

Please send me an application form and details of how I can join the fascinating world of Air Traffic Control Telecommunications

Name ....

Address ....

.... PWT/E2

To: A J Edwards, C Eng, MIEE,
The Adelphi, Room 705, John Adam Street,
London WC2N 6BQ.
marking your envelope 'Recruitment'

Sending this coupon could be your first step to a job that's growing in importance every year.

The National Air Traffic Control Service needs Radio Technicians to install and maintain the vital electronic aids that help control Britain's ever-increasing air traffic.

This is the kind of work that requires not only highly specialised technical skills but also a well developed sense of responsibility, and candidates must be prepared to undergo a rigorous selection process. Those who succeed are assured a steadily developing career of unusual interest and challenge. Starting salary varies from £1044 (at 19) to £1373 (at 25 or over): scale maximum £1590 (higher rates at Heathrow). There is a good annual leave allowance and a non-contributory pension for established staff.

You must be 19 or over, with at least one year's practical experience in telecommunications, ('ONC' or 'C and G' qualifications preferred).

NATCS

National Air Traffic Control Service

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 £6 0s. 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., Fleetway House, Farringdon Street, London, E.C.4 for insertion in the next available issue.

MISCELLANEOUS

NEW LOW PRICE

Brand New and Individually Tested Transistors supplied unmarked, but packed separately for indentification and guaranteed to be within their correct specification or money refunded. All at **1/9d.** each or

Any 16 transistors for only £1.

ACY22	BSY27	OC201	2N3702
BC108	OC45	OC202	2N3703
BC109	OC71	ZTX300	2N3705
BFY51	OC72	2NX300	2N3706
BFY52	OC200	2N2926	2N3708

ANTEX SOLDER IRON

A lightweight iron with a 15 watt nickel plated bit. Designed to enable you to weld reliable joints accurately. Model CN240 volts. Special low price. Act Now, Only **29/11**

MONEY BACK GUARANTEE. P. & P. 1/-

J. M. KING (1)

17 Buckridge, Portpool Lane, London, E.C.1

ENAMELLED COPPER WIRE

S.W.G.	Per ½lb reel	Per 1lb reel
18-22.	11/3d	16/6d
23-30.	11/9d	17/6d
31-35.	12/3d	18/6d
36-40.	15/-	24/-
41-44.	17/9d	29/6d

Orders despatched by return of post. Please add 1/- per item P. & P.

Supplied by: Banner Transformers, Brooks St., Higher Hillgate, Stockport, Cheshire.

TRADE ENQUIRIES INVITED

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.

THE NEW

ELECTRONIC MUSIC FOR YOU

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 4d. stamp.

BIG BARGAIN PARCEL 13/-

POST PAID

Containing multi-contact relay, transistors, resistors (some high stab), rectifiers, diodes, capacitors, pots, knobs, etc.

4 WATT GRAM AMPS.

Volume and tone controls, mains operation, 3Ω output, new and boxed **72/6** POST PAID

SALOP ELECTRONICS Callers welcome

23 Wyle Cop, Shrewsbury, Shropshire *S.A.E. for lists*

VICTORIA STREET'S unique magazine and paperback centre, Hills Westminster. "Practical Wireless" always in stock. HILLS WESTMINSTER LTD., 5 Artillery Row, Victoria Street, S.W.1 (01-222 6165).

MISCELLANEOUS *(continued)*

We stock all those components and materials required by the home Hi-Fi constructor, including speaker grille fabrics, BAF wadding, Peerless speaker kits, Helme Cabinet Kits, cross-over networks, inductors, etc. Special offers also available. Send 5 x 5d stamps NOW for your copy of our new fully illustrated catalogue (catalogue cost refunded against purchases over 10s). No callers please, mail-order ONLY.

AUDIOSCAN Dept. PW1

4, PRINCES SQUARE, HARROGATE, YORKS.

PARAPHYSICAL LABORATORY, Downton, Wilts. Fascinating international magazines. S.A.E. for list. Parcel 20s.

SERVICE MANUALS for Pre 1958 H.M.V. and E.M.I. MODELS. Radio and Record Player Manuals 5/- each. Television Manuals 7/6 each. Send C.W.O. stating model required. Also limited range of components and spares. Send details of your requirements. R.D.I. Ltd., Chilton Works, Garden Road, Richmond, Surrey.

SPEAKER ENCLOSURES from £3. Enclosures also made to specification. Send S.A.E. for prices and details. Newman and Spice, 223 Mount Pleasant Road, Hastings, Sussex.

ENGINEERING SERVICE for constructors. Lathe work, milling, sheet metal, castings, etc. S.A.E. for details. Chelmsford Machine Tool Company, P.O. Box 55, Chelmsford, Essex.

---

1 WATT AMPLIFIER BARGAIN

5 Transistor, 9 volt supply, for 3 ohm speaker. Measures only 2in x 3in.

Built and tested, only 24/- post paid.

A. MANLEY.

13 Randisbourne Gardens, Bromley Rd., London, S.E.6.

SPEAK AND LISTEN TO THE WORLD, through the medium of your Recorder. Particulars: Worldwide Tapetalk, 35 The Gardens, Harrow, HA1 4HE.

---

6 or 12 volt FLUORESCENT LIGHTS 12 ins. 8 watt tube, ample light for camping, caravan or boats, etc. fully transistorised, low battery drain.

Only **65/-** post paid.
or in kit form **57/6** post paid

4 watt GRAM AMPS

Quality gram amplifier, volume/on, off and tone controls, A.C. mains operation, 3Ω output, dimensions 4½x4½x5½ ins. app. new and boxed.

Unbeatable at **67/6** post paid
or in kit form **59/6** post paid

ELECTRONIC INDUSTRIES (SHROPSHIRE)

4 Longden Green, Shrewsbury, Shropshire

MISCELLANEOUS *(continued)*

MUSICAL MIRACLES

WAA-WAA Pedal. Complete kit of all parts, robust cabinet, mechanism & instructions. Huge sales, well proven design. **Only** 49/- complete. Or built & tested **£4.15s. post free.**

Rhythm Box. Build your own from our pre-built electronic circuit modules, e.g. box giving waltz, foxtrot etc., cost under £17.

Organ Percussion units **£14.** Bass pedal and other fascinating effects, fuzz, tremolo etc.

Send s.a.e. for list. **D.E.W. Ltd., 254 Ringwood Rd., Ferndown, Dorset.**

TV NOTES for UFO Detection. and 2 Optical Circuits, 9/6. Optical/radiation Detector Circuit (electronic "memory") 9/6. UFO Daily Flight Patterns (American. British) 7/6. Radar & Electronic Publications, "Highlands". Needham Market, Suffolk.

WANTED

CASH PAID for New Valves. Payment by return. WILLOW VALE, ELECTRONICS, 4 The Broadway, Hanwell, London, W.7. 01-567/5400-2971.

WE BUY New Valves and Transistors. State price: A.D.A. MANUFACTURING CO., 116 Alfreton Road, Nottingham.

WANTED NEW VALVES, televisions, radiograms, transistors, etc. STAN WILLETTS, 37 High Street, West Bromwich, Staffs. Tel.: WES 0186.

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.

HIGHEST CASH PRICES for good quality Tape Recorders. 9.30-5.00. Immediate quotations. 01-472 2185.

TOP PRICES PAID for NEW VALVES

popular T.V. and Radio types.

KENSINGTON SUPPLIES (C),

367 Kensington Street, Bradford 8, Yorkshire.

WANTED. Service Sheet for Avantic FM/AM Tuner. Please write: Spencer, 1 Brogden Ave., Culcheth, Lancashire.

WANTED. Newnes Radio and T.V. Servicing, 1961-62, 1963-64. Ormston, 45 Crescent Court, Blackpool.

HELP. URGENTLY WANTED. Slow Motion Drive for R1155. J. Essex, 198 London Road, Aston Clinton, Bucks.

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 Low Voltage Servo Recorders, Digital Telemetering Equipment.

Salary scale £938–£1,590 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.

Radio Operators

There will be a number of vacancies in the Composite Signals Organisation for experienced Radio Operators in 1971 and subsequent years.

Specialist training courses lasting approximately 8 months are held at intervals. Applications are now invited for the course starting in September 1971.

Salary Scales

During training with free accommodation provided at the Training School:—

Age 21	£848	per annum
22	£906	,, ,,
23	£943	,, ,,
24	£981	,, ,,
25 and over	£1,023	,, ,,

On successfu lcompletion of course:—

Age 21	£1,023	per annum
22	£1,087	,, ,,
23	£1,150	,, ,,
24	£1,214	,, ,,
25 (highest age point)	£1,288	,, ,,

then by 6 annual increments to a maixmum of £1,749 per annum.

Excellent conditions and good prospects of promotion Opportunities for service abroad.

Applicants must be United Kingdom residents, normally under 35 years of age at start of training course, and must have at least 2 years operating experience or PMG qualifications. Preference given to those who also have GCE 'O' level or similar qualification

Interviews will be arranged throughout 1971

Application forms and further particulars from:—

RECRUITMENT OFFICER (TRO 37)
Government Communications Headquarters,
Oakley, Priors Road,
CHELTENHAM, Glos. GL52 5AJ
Tel: No. Cheltenham 21491 Ext 2270

LADDERS

VARNISHED TIMBER LADDERS from manufacturer, LOWEST PRICES anywhere. 15½ft. ext. £5.10. 17ft. ext. £5.15. 20ft. ext. £6.5. 21½ft. ext. £7. 24½ft. ext. £8.2. 29ft. ext. £9.5. 31½ft. Triple ext. £11.2.6. 36ft. triple ext. £14.10. Carr. 13/6. Free Lists. Also Aluminium Ext. and Loft Ladders. CALLERS WELCOME. **Dept. W.L.S. HOME SALES, BALDWIN ROAD, STOURPORT, WORCS. Phone Stourport 2574.**

METAL WORK

METAL WORK: All types cabinets, chassis, racks etc., to your specifications. PHILPOTTS METAL WORKS LTD., Chapman Street, Loughborough.

EDUCATIONAL

R.T.E.B. Certs., City & Guilds, Colour TV, Radio, Computers, Radio Amateurs' Cert., Practical Electronics (with kit). Thousands of successes. Send for full details of Home Study Courses and illustrated book—**FREE. BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, Dept. 137K, Aldermaston Court, Reading RG7 4PF.**

COLOUR TV SERVICING

Be ready for the coming Colour TV boom. Learn the techniques of servicing colour TV sets through new home-study courses specially prepared for the practical TV engineer technician, and approved by leading manufacturer. Full details from:

ICS (D.562), Intertext House, London SW8, or 'phone 01-720 1983.

A.M.S.E. (Elec.), City & Guilds, R.T.E.B. Cert., Radio Amateurs' Cert., etc., on 'Satisfaction or Refund' terms. Wide range of courses in Elec. Engineering, Design, Installation, Repairs, Refrigeration, Electronics, Radio & TV., etc. Send for full details and illustrated book—**FREE. BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY, Dept. 124K, Aldermaston Court, Reading RG7 4PF.**

RADIO OFFICER training courses. Write: Principal, Newport and Monmouthshire College of Technology, Newport, Mon.

ELECTRICAL

240 VOLT ELECTRICITY ANYWHERE

BEST EVER 200/240 VOLS "MAINS" SUPPLY FROM 12 VOLT CAR BATTERY

Exclusive World Scoop Purchase. The fabulous **Mk. 12D American Heavy Duty Dynamotor Unit** with a Massive 220 watt output and giving the most brilliant 200/240 volt performance of all time. Marvellous for **Television, Drills, Power Tools, Mains Lighting, AC Fluorescent Lighting** and all 200/240 volt Universal AC/DC mains equipment. Made at tremendous cost for U.S.A. Govt. by Delco-Remy. This magnificent machine is unobtainable elsewhere. **Brand New and Fully Tested,** only **£4.19.6,** plus 10/6 postage. C.O.D. with pleasure. Money back if not delighted. Please send s.a.e. for interesting illus. details.

Dept. PW, STANFORD ELECTRONICS
Rear Derby Road, North Promenade, Blackpool, Lancashire.

FOR SALE

SEEN MY CAT? 5,000 items. Mechanical & Electrical Gear, and materials. S.A.E. K. R. WHISTON, Dept. PW. NEW MILLS, Stockport.

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 (BOX 11), 45 GREEN LANE, PURLEY, SURREY

"MULLARD", "BRIMAR" E180F valves (gold plated pins), guaranteed, 5/6d post paid. Jack Porter Limited, "Electronics," College Street, Worcester.

ANTEX ESS de-soldering irons only £2. Paterson, 94 Victoria Road, Birmingham B33 8AN.

PYE A39J/H, 8 valves, 9 watts, L, M, MB, 8 bandspread SW, excellent condition. £15 o.n.o. Burnett, 23 Jackman Drive, Horsforth, Leeds.

AERIALS

BAKER AND BAINES

UHF Aerials BBC and ITV 625 Colour 10 ele 42/-, 14 ele 47/-, 18 ele 65/-, 22 ele 75/-, Double 22 ele 160/-.
BBC Aerials: Dipole 35/-, X 43/-, H 48/-.
ITA Aerials: 5 ele 39/-, 8 ele 54/-, 11 ele 66/-, double 5 array 98/-.
Combination Aerials: Dipole plus 5 54/-, H plus 5 82/-, X plus 5 90/-. Special Loft Dipole plus 5 42/-.
Diplexers — Triplexers — Matched Diplexers UHF — VHF.
Poles, Lashings, Clamps, Couplers, etc. Co-Ax 1/3 and 2/3.
Postage paid inland on Aerials only. Please state channels when ordering. SAE for full lists.

11 Dale Crescent, Tupton, Chesterfield

EXPERIMENTERS

NEW VHF AERIAL KIT

Unique push-pull colour coded adjustable element system gives coverage of 2 metre Amateur band, Aircraft, BBC VHF FM and the new "local" stations, plus Stereo! For use in or outdoors, easy to instal with universal mounting bracket and mast, together with rotary ball clamp, VHF boom and four elements. S.A.E. for leaflet.

Complete kit, direct from makers, or from your local dealers, 52/- post and packing paid.

TUBULAR METAL PRODUCTS
7 Lowesmoor Terrace, Worcester

SERVICE SHEETS

SERVICE SHEETS. Radio, TV etc. 8,000 models. List 2/-. S.A.E. enquiries. TELRAY, 11 Maudland Bank, Preston.

RADIO, TELEVISION over 3,000 models. JOHN GILBERT TELEVISION, 1b Shepherds Bush Rd., London W.6. SHE 8441.

SERVICE SHEETS (1925-1970) 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. Catalogue 2/6. Please send S.A.E. wth all orders/enquiries. Hamilton Radio, 54 London Road, Bexhill, Sussex.

SERVICE SHEETS
(continued)

TRADER SERVICE SHEETS

5/– each plus postage

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

Cheques and open P.O.s returned if sheets not available.

OAKFIELD ENTERPRISES
LIMITED

30 CRAVEN STREET, STRAND

LONDON WC2

Make	Model	Radio/TV

1970 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 (February PW)

RADIO & TV SERVICE SHEETS 4/- S.A.E. Service manuals 12/6d each, P.&P. 1/6d. State make and model No. to:—Bell's Television Service, Albert Place, Starbeck, Harrogate, Yorks.

RECEIVERS & COMPONENTS

Rx/Ind APN–9
This is a swt tuned Rx with CRT Ind unit, the Rx covers 1.8 to 2 Mc/s in 4 channels. The Ind section uses CRT type 3BP1 3" green screen and 34 octal type valves 6SN7, 6SL7, 6SK7, 6SJ7, 6H6, 6Y6, 5Z3, 2X2, VR105, 6N7, 6SA7, there is also a high grade 100Kc xtal, the CRT is fitted Mu Metal shield, all contained in case size 20 x 12 x 8" black crackle finish. These units are for 115v 400c/s supply, the tube is well suited to scope use or modification to 1.6Mc/s Pan Adap. Supplied with circ. Available new with magnifier and visor at £8 or in good condition less magnifier and visor at £6 both plus 15/- carr.

R.F.26 Tuning Units.
Tune 50 to 65 Mc/s with 7 Mc/s I.F. O/P fitted slow motion drive, use 3 valves R.F. Mix and L.O. will mod up to 100 Mc/s, supplied with circ good condition.
42/- plus 7/6 post.

Test Set 210
Test Osc range 20 to 85 Mc/s in 4 bands as 2 Mc/s xtal check, noise generator with meter, fitted slow motion drive, Ae etc, these require 250v H.T. at 40 Ma & 6.3v AC. supplied in good condition.
£3-5s plus 12/6 carr.

S.A.E. for list or enquiry.

A. H. SUPPLIES
57 Main Road
SHEFFIELD, S9.5HL

RECEIVERS & COMPONENTS
(continued)

£5 TELEVISIONS £5
Delivered anywhere in Great Britain

17" 12 channel. Complete & tested. Excellent condition
Carriage and ins. £1

17" Untested T.V.s 12 channel. 30/- Carriage £1. All makes

TUBES! TUBES!
Guaranteed 6 months

17" & 19" All makes 30/-
23" 50/-
19" Bonded 70/-
23" Bonded 90/-

Plus 10/-. carriage

SPEAKERS P.M. 3 Ohm
PERFECT CONDITION EX T.V. 5" Round 2/-, 6" x 4" 2/-, 7" x 4" 4/-. 1/6 postage and packing on all speakers.

VALVES EX EQUIPMENT
Guaranteed 6 months

APR12	1/-	PCC84	1/6	PL36	4/6	688	1/-
EB91	3d	PCF80	1/6	PL81	3/6	68W7	2/-
EBF89	2/6	PCC89	2/6	PY81	1/-	6U4	3/6
ECC82	2/6	PCL85	4/6	PY800	3/-	20D1	2/6
ECL80	1/-	PCL84	3/6	PY82	1/-	20P1	4/6
EF183	2/6	PCL82	3/6	PY33	4/6	20P3	2/-
EF184	2/6	PCF86	3/6	U191	3/6	30PLI	4/6
EY86	3/6	PCL83	2/6	6F23	3/6	30PI2	4/-
						30F5	2/3

On 2 valves or more 6d. postage & packaging

UHF TUNERS TO SUIT MOST MODELS

i.e. FERGUSON 850 900 Chassis
K.B. G.E.C. etc. 50/-. P. & P. 10/-

VHF TUNERS MOST MAKES

20/- delivered. (Discount for quantity)

Dept. T.S.

THORNBURY TRADE DISPOSALS

Thornbury Roundabout, Leeds Rd., Bradford. Tel. 665670

EX COMPUTER PRINTED CIRCUIT PANELS 2in x 4in packed with semi-conductors and top quality resistors, capacitors, diodes, etc. Our price, 10 boards **10/-**. P. & P. 1/6. With a guaranteed minimum of 35 transistors. Data on transistors included.

SPECIAL BARGAIN PACK. 25 boards for **£1**. P. & P. 3/6. With a guaranteed minimum of 85 transistors. Data on transistors included.

PANELS with 2 power transistors similar to OC28 on each board + components. 2 boards (4 x OC28) **10/–**. P. & P. 1/6.

9 OA5, 3 OA10, 3 Pot Cores, 26 Resistors, 14 Capacitors, 3 GET 872, 3 GET 872B, 1 GET 875. All long leaded on panels 13in x 4in, **4** for **20/–**. P. & P. 5/–

LARGE CAPACITY ELECTROLYTICS
10000MFD 30V } **7/6** ea. P. & P. 1/6
16000MFD 12V }
or **£3.10.0** per doz. Carr. 10/–

250 MIXED RESISTORS 12/6
¼ & ½ watt.

150 MIXED HI STABS 12/6
¼, ½ & 1 watt 5% and better.

EXTRACTOR/BLOWER FANS (PAPST)
100 CFM 2800 RPM 4½in x 4½in x 2in. Ideal for kitchen extraction, instrument cooling, etc., etc. **50/–** each. P. & P. 5/–. 240V AC 50Hz.

DIODES ex EQPT; SILICON
1 Amp 1000 PIV. 4 for **10/–**
20 Amp 150 PIV. 4 for **£1**. P. & P. 1/–.

BARGAIN RELAY OFFER
Single pole change over silver contacts. 25V to 50V. 2.5kΩ coil. 8 for **10/–**. P. & P. 1/–

KEYTRONICS mail order only
52 EARLS COURT ROAD,
LONDON W8 01-478 8499

Stella Nine Range Cases

Manufactured in Black, Grey, or Blue Stelvetite and finished in Plastic-coated Steel, Morocco Finish with Aluminium end plates. Rubber feet are attached and there is a removable back plate. There is also a removable front panel in 18 s.w.g Alloy.

Now all Aluminium surfaces are coated with a strippable plastic for protection during manufacture and transit. All edges are polished.

LIST OF PRICES AND SIZES

Width	*Depth*	*4" Height* £	s.	d.	*6" Height* £	s.	d.	*7½" Height* £	s.	d.
6¼"	3⅞"		15	0		18	0	1	1	6
6¼"	4⅞"		16	3	1	1	6	1	5	0
8¼"	3⅞"		18	0	1	5	0	1	5	0
8¼"	6⅞"	1	5	0	1	11	9	1	17	0
10¼"	7⅞"	1	14	6	2	2	6	2	6	0
12¼"	3⅞"	1	5	0	1	11	9	1	17	6
12¼"	5⅞"	1	14	0	2	2	0	2	5	6
12¼"	8⅞"	2	3	0	2	11	6	2	15	6
14¼"	3⅞"	1	10	0	1	17	6	2	2	0
14¼"	9⅞"	2	11	6	3	7	0	3	10	0
16⅞"	6⅞"	2	6	0	2	15	6	3	1	9
16¼"	10⅞"	3	0	0	3	18	0	4	6	0

Cases—Post 4s. 6d. per order.
Discounts available on quantities.

CHASSIS in Aluminium, Standard Sizes, with Gusset Plates
Sizes to fit Cases. All 2½" Walls

	s.	d.		s.	d.		s.	d.
6"×3"	6	6	10"×7"	10	3	14"×3"	8	9
6"×4"	6	9	12"×3"	8	0	14"×9"	17	3
8"×3"	7	9	12"×5"	9	0	16"×6"	12	9
8"×6"	9	3	12"×8"	12	9	16"×10"	19	0

Chassis—Post 3s. 0d. per order.
Discounts available on quantities.

E. R. NICHOLLS
Manufacturer of Electronic Instrument Cases
46 LOWFIELD ROAD
STOCKPORT - CHESHIRE
Tel: 061-480 2179

COMPUTER PANELS 5-BC108, Diodes 4-10/-. **American,** total transistors. Minimum 30. Details types. First grade components. 3-10/6. Post 1/6. **Assorted Components,** 7lb 20/- C.P. J.W.B. Radio, 75 Hayfield Road, Salford 6, Lancs.

BC108B 2/3: BC109C 2/6; 2N3705, 50V, 800mA, 100MHz, 2/9. Postage 1/-, SAE list. GREENWELD, 24 Goodhart Way, W. Wickham, Kent.

SUB-MINIATURE RESISTORS SMALLER THAN A MATCH HEAD!
Microhm 1/16th Watt 5% values from 51 to 100K at 10d. each
Microhm Metal Glaze Resistors for the ultimate in D.I.Y. miniaturisation.
Integrated Circuits complete with Data:
SN72741N Type 741 Op. Amp. 23/-
N5709A Type 709 Op. Amp. 10/-
PA230 Audio Preamplifier 18/6
PA234 1W Audio Amplifier 17/6
PA237 2W Audio Amplifier 31/6
SL402A 2W Audio Amplifier 35/-
D40C1 4W Darlington Amplifier 13/6
MEL 11 Photo Darlington Amp. 9/6
Connectors for D.I.L. i.c's 6/-
Transistors:
2N5172......1/9 BFX 86...... 6/-
ME0412 ....3/9 BD 124.......12/-
2N4059......3/6 2N3055 ......14/-
Silicon Diode 1N914 .... 1/-
RCA 40583 Trigger Diode 5/3
Silicon Rectifiers: 1A 1N4000 Series
50V..1/5 200V..1/9 600V..2/4
100V..1/6 400V..2/- 800V..2/10
1000V..3/4
1.5A PL4000 Series
200V..2/3 400V..2/6
Bridge Rectifiers:
1A 50V..7/6 1A 200V..8/- 2A 400V..12/6

JEF ELECTRONICS (P.W.1)
York House, 12 York Drive, Grappenhall, Warrington Lancs. MAIL ORDER ONLY
C.W.O. P. & P. 1/- per order.
Overseas 7/6
Money back if not satisfied.

"AUDIO 1" 3 WATT AMPLIFIER

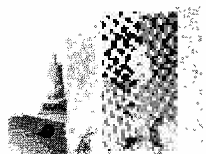
Ready built, tested and guaranteed. Very attractive Cabinet in black leatheretté with light grey front, size 10" x 4½" x 4". Fitted large speaker, Jack Socket and Volume Control. Many uses e.g. Radio Kit Amplifier, Intercom, Record Player, Public Address or even Crystal Set Amplifier. OUR PRICE ONLY **97/-** P. & P. 4/6d.

EXTENSION SPEAKER CABINET
The same Cabinet that houses our Amplifier. ONLY **26/-** P. & P. 3/-. Or with fitted Speaker **34/-** P. & P. 3/6d.

NEW MODEL V.H.F. KIT MK2

Our latest Kit, improved design and performance plus extra Amplifier Stage, receives Aircraft, Amateurs, Mobile, Radio 2, 3, 4, etc.
This novel little set will give you endless hours of pleasure and can be built in one evening. Powered by 9 Volt Battery, complete with easy to follow instructions and built in Jack Socket for use with Earphones or Amplifier.
Only 68/-. P. & P. Free U.K. only

" MAY FLOWER "
5 Wave Band Short Wave Kit



As illustrated above our all wave band one valve easy to build kit. Complete with one short wave and one medium wave plug in coil. Extra coils available at 7/- each. Price **75/-** P. & P. included. This kit contains the very best in components. Drilled chassis, bandspread tuning, step by step instructions and of course first class reception and value for money.
Illustrated Catalogue of Selected Kits and Components **2/6**. P. & P. Free.

Cheques, Postal Orders to:
Dept. P.W.,
Galleon Trading Co., 25 Avelon Road, Romford, Essex

EX-GOVT. COMMUNICATIONS RECEIVERS, calibrators, signal generators, components, etc., with money back guarantee. SAE list. Callers welcome, please phone first.—P. R. Golledge, G3EDW, Glen Tor, Torrington, Devon. (STD 08-052) 2411.

BRAND NEW ELECTROLYTICS, 15/16V. 0·5, 1, 2, 5, 10, 20, 30, 40, 50, 100 mfds. 9d. E12 series 5% resistors. Carbon Film ¼W 1Ω to 1MΩ, 1·5d. Wirewound 5W 15Ω to 15KΩ, 10d., postage 1/-. The C. R. Supply Co., 127 Chesterfield Rd., Sheffield 8.

COMPLETE RANGE of receivers by Trio, Lafayette, Hallicrafters, etc. Chassis, panels, cabinets. S.a.e. for lists. Stephens-James Ltd., 70 Priory Road, Liverpool 4. Tel. 051-263-7829.

A CORNUCOPIA OF COMPONENTS! Scarce valve, selected T.V. components, Speakers, Cabinets. Computer panels—long leads NOT printed circuits. Transistors, resistors—new and recovered. State requirements. S.A.E. (F.S.) for details. MAIL-MART, 6 Eastbourne Road, Pevensey Bay, Sussex.

ANDOR ELECTRONICS LTD
for
MULLARD COMPONENTS
for
AUDIO CIRCUITS
178 HIGHER HILLGATE
STOCKPORT
061-480-9791

PADGETTS RADIO STORE

OLD TOWN HALL, LIVERSEDGE, YORKS

TEL. HECKMONDWIKE 4285

AIR POSITION INDICATORS. Contains gears, Ball Races, Dimmer units, Lamps, four numbered Counters, 24 Volt motor, etc. Great interest to the model makers, in good condition, **15/-**, Carriage 10/-.

GROUND POSITION INDICATOR. Contains 24 Volt Lamp. Prisms, mirror, gears. Could interest schools and model makers, **15/-**, Carriage 15/-.

NEW BOXED UNIT TYPE 8197. Contains two Toggle D.P.S.T. switches, also one press Toggle D.P.S.T. Sixteen miniature 500 Ohm. Pre-set Pots. RX, TX, Switches, etc. **5/-**, P/P 4/6. **£8** per dozen. Carriage paid.

TOGGLE SWITCHES. D.P.S.T. **1/-**, P/P 9d. on any Switch. 1 doz. Post Free. Ex Units. D.P.D.T. SWITCHES **1/9**. PRESS BUTTON D.P.S.T. **1/9**.

G.P.O. RELAYS, EX-UNITS 400 Ohms. Doz. 10/- P/P 5/-. Sample, 1/3, P/P 1/6.

SPECIAL OFFER. Bush 17" T.V. Sets Series 75. 12 Channels. Complete and Tested with good Tube **£6.10.0.** Cabinet Fair. Carriage and Insurance Passenger Train G.B. only 35/-. Untested 17" T.V. Complete 12 Channel 50/- Carriage £1.

Speakers Removed from T.V. Sets. All P.M. 3 Ohms. 5" round **3/-** each 6 x 4, **3/-**each, 7 x 4, **5/-** each. Slot Speakers 8 × 2½ **5/-** each. Post on any Speaker 4/-.

8" P.M. Speakers in Cabinet with Volume Control 3 Ohm. Cabinet Condition Poor, Speaker First Class. **10/-** Post and Packing 10/-. Reclaimed T.V. Tubes with 6 month Guarantee 17" AW 43/80, AW 43/88 **40/-**, MW 43/69 **30/-** each. All Tubes 15/- Carriage.

VALVE LIST—Ex Equipment, 3 months' guarantee. Single Valves Post 7d., over 3 Valves p. & p. paid.

ARP12	1/6	PCL85	4/-	6B8	1/8
EB91	9d.	EF183	4/-	6BW7	2/6
EF85	3/-	EF184	4/-	6K7	1/9
EBF80	3/-	PCL82	4/-	6U4	5/-
ECC81	3/-	PCL83	5/-	6P28	5/-
ECC82	3/-	PL36	5/-	10P13	2/6
ECC83	4/-	PL81	4/-	185BT	8/6
ECL80	1/6	PY33	5/-	20D1	3/-
EF50	1/-	PY81	1/6	20P1	5/-
EF80	1/6	PY82	1/6	20P3	2/6
EF91	9d.	PZ30	5/-	30PL1	5/-
EY86	5/-	U191	5/-	30P12	5/-
PCC84	2/-	U281	5/-	30F5	2/6
PCF80	2/-	U282	5/-	40FL1	5/-
PCL84	4/-	U251	5/-	6/30L2	5/-

FREE

2-in 1 Windscreen DE-ICER DE-MISTER

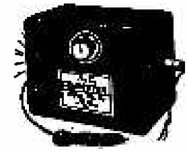
Turn one way – a really efficient rigid edge for scraping snow and ice . . . turn the other – a thick 3" rubber blade for de-misting. It's strong, it's durable, it's essential! **CONTENTS INCLUDE:** Customise your mini. Cut maintenance costs. Bargain offer - Welpac map-reading light for only 24/-.

PRACTICAL MOTORIST

Get the DECEMBER issue now 3/- (15p)

MAINS UNITS for all types of TRANSISTOR EQUIPMENT

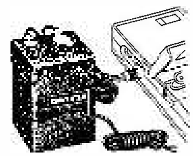
PLUS-3 MAINS UNIT



Provides three separate switched output voltages 6v., 7½v. and 9v. DC. attractive case with indicator light, mains lead output socket, plug and lead. Size 4¼ x 3½ x 2¼ in.
57/6 P. & P. 2/6

(Extra lead with DIN plug for Cassette Recorders 7/6)

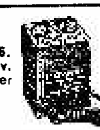
MAINS UNIT



for transis for equipment using 7½v. Complete with DIN plug for power socket. Can also be supplied for a 6-volt output complete with suitable plug. (State make, model and voltage required.) **45/-** P. & P. 2/6

UNIT FOR USE WITH 12v CAR BATTERY
Suitable for running transistor radios etc. (State output reqd. - 6v, 7½v or 9v) Price 35/- including fused lead P. & P. 2/6

MAINS UNITS



For single outputs, 6v, 9v, 12v, 18v, **39/6**. For two separate outputs, 4½v + 4½v, 6v + 6v., 9v + 9v. **50/-**. P. & P. 2/6 per unit. *(Please state outputs reqd.).*

MAINS UNIT FOR ALL TRANSISTOR RADIOS ETC., USING PP3 TYPE BATTERY. (ALSO AVAILABLE FOR 6V.) **20/-** P. & P. 2/-

All units are completely isolated from mains by double wound transformer ensuring 100% safety.

R.C.S. PRODUCTS (RADIO) LTD.

(Dept. P.W.), 31 Oliver Road, London, E.17

Est. 1943 **JOHNSONS** Tel: 24864

New! CV2—a unique triple-purpose VHF kit for the Amateur enthusiast. Integrated converter, receiver, and tuner-feeder. Fantastic single transistor performance! Comprehensive kit of high grade parts with three coils covering 80-178MHz, 9v battery, etc., together with simplified diagrams and instructions. Price complete, **£4**, post, packing and insurance paid, direct from makers. S.A.E. for literature.

JOHNSONS (RADIO)
St. Martin's Gate, Worcester
WR1 2DT

KEYNECTOR

The safe quick way to connect electrical equipment to the mains

46/6 +5/-p&p

Send for full details
EB INSTRUMENTS
49-53 PANCRAS ROAD, LONDON N.W.1
Tel: 01-837 7781

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

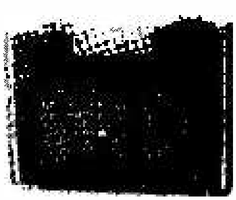
Components for several receivers are available, including the following for the "Clubman".

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

MW/LW TRANSISTOR RADIO



Complete set of parts for this MW/LW Transistor Radio. Originally sold by world-famous company as a set for more than £17. Coverage 192-555m + 1070-1870m. 4½" loudspeaker. Transistors 3 x AF117, OC81D + 2 OC81. Also works off car-aerial. Full instruction book 2/6, free with parts. State preference red, blue or tan and give alternative. Requires PP7 battery, price 4/6 extra. All parts **£6.17.6** + 4/6 post or **£10.10.0** fully built + 4/6 post.
A few left of Super Six Kit (see previous issues) at **£4.5.0** (+ 4/6 post).
9 volt 6 transistor superhet using 3HF AA17 in RF and IF stages powered by a two stage AF amplifier using OC81D. 2 x OC81. Output approx. 500MW.

STEREO AMPLIFIER type HV— 2 x 3 Watts

Fully built. On off sep. vol. and tone each channel 12 x 4¾ x 6in. high. EZ80. 2 x ECL86; for 3 ohm speakers, double wound main trans: fixing flanges and base plate, suitable for crystal cart, tuner etc. **£6.10.0** (8/- p. & p., 200-250V. A.C.
Superior version — separate base. treble & vol. each channel with mono/stereo switch 15/- extra.

MULLARD STEREO "DO IT YOURSELF"

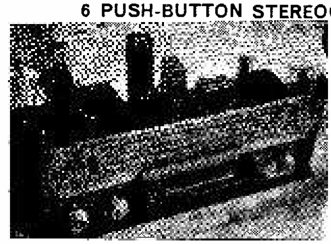
Pre-amplifier EP9001 **£3.2.0.** 2 amps. EP9000 **£2.18.0** each. Power Supply EP9002 **£4.12.0.** Control panel **£2.10.0** or the lot for **£15.10.0** post paid. Booklet **5/-** (6d post)

MONO GRAM CHASSIS 3 WATT

3 Wave band long-med-short. Gram., 200-250V A.C Ferrite aerial. Chassis 13 x 7 x 5in. Dial 13 x 4in. Double wound mains transformer 5 valves ECH81, EF89,EBC81, EL84, EZ80. Price **£10.12.6.**
(7/6 p. & p.) Output trans. for 3-ohm speaker

NEW TAPE AMPLIFIER for 4 track B.S.R. Deck TD2. Mains and output Trans· 10" x 6" x 4" overall. Rect; ECC83, EL84. Mike and Gram Inputs. **£7.5.0.** (10/- p. & p.) For 3-ohm speaker. (For 200-250V. A.C.)

6 PUSH-BUTTON STEREOGRAM CHASSIS



M.W.; S.W.1; S.W.2; V.H.F.; Gram: Stereo Gram Two separate channels for Stereogram with balance control. Also operates with two speakers on Radio. Chassis size: 15 x 7 x 6½in. 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.

1½W MAINS GRAMOPHONE AMPLIFIER

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 **67/6** including 5in. Speaker (**55/-** less speaker). (Post paid.) (Two less 10%).

SINCLAIR AMPS & PRE-AMPS IN STOCK. RETURN OF POST SERVICE.

MAINS TRANSFORMERS (200-250V AC INPUT)

6·3V at 2½A **7/6** (2/-)
Postage. Postage in brackets.
Out 250V at 50mA and 6·3V at 1½A. **10/-** (2/6).
22V at 1A + 6.3V at 2A and 250V at 50mA **15/-** (3/6).
250V at 40mA, 24V at 1A and 6·3V at 1½A **12/6** (2/6).
250V at 50mA, 22V at 1A and 6·3V at 1½A **17/6** (3/6).
90V at 20mA and 1.4V at 250 mA **10/-** (2/6).

USEFUL BOX 3¼" × 3½" × 1¾" with fixing bracket **2/6** (Postage 2/-). **25/-** per dozen post free. Metal with grey-green finish.

NEW F.M. TUNER

Range 87 to 107 MHz Attractively finished metal container with cast front escutcheon. Case size 13in. x 7in. x 3¾in. high. Mains transformer. Metal Rectifier and Valves ECC85, EF89, EF80, ECC82 as cathode follower. EM84 tuning indicator, 2 x AF117 and 2 diodes. A really fantastic performer. Price **£16**, tax paid and carr. paid or with Stereo Decoder, **£24**.

GLADSTONE RADIO

66 ELMS ROAD, ALDERSHOT, Hants.
(2 mins. from Station and Buses). FULL GUARANTEE. Aldershot 22240
CLOSED WEDNESDAY. S.A.E. for enquiries please.

Head Office and Warehouse
44A WESTBOURNE GROVE
LONDON W2
Tel. PARK 5641/2/3

Z & I AERO SERVICES LTD.

Retail Shop
85 TOTTENHAM COURT ROAD
LONDON W1
Tel. LANgham 8403
Open all day Saturday

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**
PLEASE NOTE THAT THE VALVES OFFERED BELOW ARE NOT NECESSARILY OF U.K. ORIGIN

PLEASE NOTE THAT ALL PRICES ARE IN DECIMAL PARTS OF £, I.E. IN NEW PENCE

OA2	0.38	6AR5	0.35	6EJ7	0.35	6Y6G	0.65
OA3	0.45	6AR6	0.40	6EW6	0.65	7Y4	0.60
OB2	0.35	6AS5	0.35	6F1	0.70	9BW6	0.50
OB3	0.60	6AS7G	0.80	6F5	0.65	10C2	0.50
OC3	0.38	6AT6	0.30	6F6G	0.30	10D1	0.50
OD3	0.35	6AU6	0.25	6F11	0.38	10D2	0.40
IB3GT	0.38	6AV6	0.30	6F13	0.38	10F1	0.90
IL4	0.20	6AW8A	0.55	6F14	0.65	10F9	0.50
IR4	0.35	6BA6	0.25	6F15	0.65	10F18	0.45
IR5	0.35	6BE6	0.30	6F18	0.45	10L1	0.45
IS4	0.27	6BF5	0.80	6F23	0.80	10LD11	0.60
IS5	0.25	6BF6	0.50	6F24	0.75	10P13	0.55
IT4	0.25	6BH6	0.45	6F25	0.75	10P14	1.10
IU4	0.27	6BJ6	0.45	6F26	0.35	12AB5	0.60
IU5	0.50	6BK7A	0.55	6F28	0.60	12AC6	0.40
IV2	0.45	6BL7GTA	0.65	6J4	0.50	12AD6	0.40
IX2B	0.40	6BN5	0.43	6J5GT	0.30	12AL5	0.45
2D21	0.35	6BN6	0.40	6J7	0.45	12AQ5	0.43
3A4	0.35	6BQ5	0.25	6K6GT	0.55	12AT6	0.30
3B28	2.15	6BR8	0.65	6K7	0.35	12AT7	0.33
3BP1	2.75	6BS7	1.30	6K8G	0.35	12AU6	0.30
3Q4	0.40	6BW6	0.85	6K23	0.55	12AU7	0.30
3S4	0.35	6BW7	0.70	6K25	0.75	12AV6	0.33
3V4	0.45	6BX6	0.25	6L6GT	0.45	12AV7	0.50
5R4GY	0.60	6BZ6	0.35	6L7	0.40	12AX7	0.30
5U4G	0.33	6C4	0.33	6L18	0.45	12AY7	0.70
5U4GB	0.42	6C5GT	0.40	6LD20	0.40	12B44	A0.55
5V4G	0.42	6CA4	0.28	6N7GT	0.40	12BA6	0.35
5Y3GT	0.32	6CA7	0.50	6P1	0.60	12BA7	0.35
5Z3	0.50	6CB6	0.30	6P28	0.65	12BE6	0.35
5Z4G	0.40	6CD6GA	1.15	6Q7	0.40	12BH7	0.40
6/30L2	0.75	6CG7	0.50	6SA7	0.40	12BY7	0.55
6AB4	0.35	6CH6	0.55	6SG7	0.35	12K5	0.55
6AF4A	0.50	6CL6	0.50	6SK7	0.35	12K7GT	0.35
6AG7	0.40	6CW4	0.63	6SL7GT	0.35	12Q7G	0.30
6AH6	0.50	6CY7	0.65	6SN7GT	0.35	12SR7	0.35
6AJ8	0.30	6D3	0.45	6SQ7	0.40	14S7	0.80
6AK5	0.30	6DC6	0.75	6SR7	0.40	20D1	0.45
6AK6	0.57	6DK6	0.48	6T8	0.35	20L1	1.10
6AL3	0.43	6DQ6B	0.63	6U4GT	0.60	20P1	0.50
6AL5	0.20	6DS4	0.75	6U8A	0.40	20P4	1.10
6AM5	0.32	6EA8	0.58	6V6GT	0.38	20P5	1.20
6AM6	0.33	6EH7	0.30	6X4	0.30	25C5	0.50
6AQ5	0.35			6X5GT	0.35	25L6GT	0.45
6AQ6	0.55			6X8	0.55	25Z4G	0.30

First Quality Fully Guaranteed

ZAERIX BRAND

ELECTRONIC VALVES

25Z6GT	0.65	50B5	0.45	DAF96	0.42	ECC81	0.33
30A5	0.45	50C5	0.40	DF96	0.42	ECC82	0.30
30AE3	0.40	50CD6G	1.65	DK40	0.55	ECC83	0.30
30C1	0.30	50L6GT	0.50	DK92	0.50	ECC84	0.30
30C15	0.80	85A2	0.40	DK96	0.42	ECC85	0.60
30C17	0.85	90AV	2.50	DL96	0.42	ECC88	0.40
30C18	0.75	90C1	0.60	DM160	0.65	ECC89	0.50
30F5	0.85	90CV	1.25	DY86	0.33	ECC91	0.20
30FL1	0.70	807	0.50	DY87	0.35	ECC189	0.60
30FL12	0.93	812A	3.50	DY802	0.50	ECF80	0.35
30FL14	0.75	813	3.75	E55L	2.75	ECF82	0.35
30L1	0.40	866A	0.75	E88CC	0.65	ECF83	0.75
30L15	0.85	5642	0.65	E130L	5.00	ECF86	0.65
30L17	0.80	6080	1.50	E180F	0.95	ECF804	1.50
30P12	0.80	6146	1.50	EABC80	0.35	ECH42	0.70
30P19	0.80	6146B	2.50	EAF42	0.55	ECH81	0.30
30PL1	0.70	6360	1.25	EBC33	0.50	ECH83	0.40
30PL13	0.93	6939	2.15	EBC41	0.55	ECH84	0.45
30PL14	0.90	7199	0.75	EBC81	0.30	ECL80	0.40
35A3	0.55	7360	1.80	EBF80	0.40	ECL81	0.45
35A5	0.75	7586	1.25	EBF83	0.40	ECL82	0.35
35B5	0.65	7895	1.25	EBF89	0.30	ECL83	0.65
35C5	0.40	9002	0.35	EC53	0.50	ECL84	0.55
35D5	0.70	9003	0.50	EC86	0.60	ECL85	0.55
35L6GT	0.50	AZ1	0.48	EC88	0.60	ECL86	0.40
35W4	0.30	AZ31	0.55	EC90	0.33	ECLL800	1.50
35Z3	0.60	CBL1	0.80	EC92	0.35	EF37A	0.60
35Z4G	0.30	CBL31	0.90	EC93	0.50	EF39	0.40
35Z5GT	0.40	CY31	0.35	EC8010	2.25	EF40	0.50
50A5	0.70			ECC40	0.60		

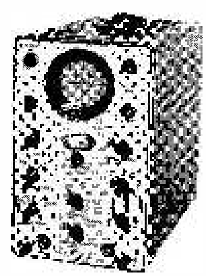
EF41	0.65	EZ40	0.45	PCL88	0.90	U191	0.75
EF42	0.70	EZ41	0.45	PCL800	0.93	U201	0.35
EF80	0.25	EZ80	0.25	PCL801	0.70	U281	0.40
EF83	0.55	EZ81	0.28	PD500	1.50	U282	0.40
EF85	0.35	GY501	0.80	PF86	0.60	U301	0.40
EF86	0.30	GZ30	0.40	PF818	0.85	U403	0.50
EF89	0.28	GZ31	0.33	PFL200	0.70	U404	0.40
EF91	0.33	GZ32	0.48	PL33	0.35	U801	1.00
EF92	0.40	GZ33	0.70	PL36	0.55	UABC80	0.35
EF95	0.30	HABC80	0.45	PL81	0.50	UAF41	0.50
EF97	0.65	HK90	0.35	PL82	0.45	UAF42	0.55
EF183	0.30	KT66	1.70	PL83	0.45	UBC41	0.50
EF184	0.35	KT88	1.75	PL84	0.40	UBC81	0.40
EF800	1.00	N78	1.15	PL302	0.80	UBF80	0.40
EK90	0.30	PABC80	0.40	PL504	0.80	UBF89	0.35
EL34	0.50	PC86	0.60	PL508	0.90	UBL1	0.50
EL36	0.50	PC88	0.60	PL801	0.80	UBL21	0.60
EL41	0.55	PC97	0.50	PM84	0.50	UC92	0.35
EL42	0.58	PC900	0.48	PY31	0.30	UCC85	0.40
EL81	0.55	PCC84	0.40	PY33	0.63	UCF80	0.55
EL83	0.42	PCC85	0.40	PY80	0.35	UCH21	0.60
EL84	0.25	PCC88	0.55	PY81	0.30	UCH42	0.70
EL85	0.43	PCC89	0.50	PY82	0.30	UCH43	0.75
EL86	0.40	PCC189	0.55	PY83	0.38	UCH81	0.35
EL90	0.35	PCC805	0.85	PY88	0.40	UCL81	0.60
EL95	0.35	PCC806	0.80	PY500	1.00	UCL82	0.35
EL360	1.15	PCF80	0.30	PY800	0.50	UCL83	0.60
EL803	1.00	PCF82	0.35	PY801	0.50	UF41	0.60
EL821	0.55	PCF84	0.50	PZ30	0.35	UF42	0.60
EL822	0.90	PCF86	0.60	QQV2-6	2.15	UF43	0.60
ELL80	0.75	PCF87	0.85	QQVO3-10	1.25	UF80	0.35
EM34	0.90	PCF801	0.50	QQV03-20A	5.25	UF85	0.40
EM71	0.75	PCF802	0.50	TT21	2.65	UF89	0.35
EM80	0.40	PCF805	0.75	TT22	2.80	UL41	0.65
EM81	0.60	PCF806	0.70	U18/20	0.75	UL84	0.30
EM84	0.35	PCF808	0.75	U25	0.75	UM84	0.20
EM87	0.55	PCH200	0.70	U26	0.75	UY1N	0.50
EN91	0.35	PCL81	0.50	U31	0.45	UY11	0.65
EY51	0.40	PCL82	0.35	U37	1.50	UY41	0.45
EY80	0.45	PCL83	0.65	U52	0.33	UY82	0.50
EY81	0.40	PCL84	0.45	U76	0.30	UY85	0.30
EY83	0.55	PCL85	0.40	U78	0.30	W729	0.60
EY86	0.40	PCL86	0.45			Z803U	0.90
EY87	0.43						
EY88	0.43						

TRANSISTORS

Quantity prices quoted on request

2N404	0.17	2S004	1.00	BCY34	0.30
2N444A	0.25	2S034	1.00	BCY72	0.20
2N696	0.20	2S102	0.40	BCZ11	0.40
2N697	0.23	2S104	0.50	BD121	0.80
2N698	0.40	2S701	0.50	BD123	0.95
2N705	0.70	2S702	0.50	BF115	0.20
2N706	0.15	2S746	0.30	BF167	0.25
2N708	0.20	AC113	0.15	BF173	0.30
2N753	0.25	AC125	0.30	BF181	0.25
2N929	0.30	AC126	0.25	BF184	0.25
2N930	0.35	AC127	0.20	BF185	0.20
2N987	0.35	AC128	0.20	BF194	0.20
2N1131	0.40	AC153	0.25	BF195	0.15
2N1132	0.45	AC154	0.15	BF196	0.20
2N1184	1.25	AC157	0.20	BF197	0.20
2N1301	0.40	AC169	0.10	BFX88	0.25
2N1302	0.25	AC176	0.25	BFY17	0.40
2N1304	0.25	AC187	0.30	BFY19	0.60
2N1305	0.25	AC188	0.30	BFY50	0.25
2N1306	0.25	ACY17	0.30	BFY51	0.20
2N1307	0.30	ACY18	0.20	BFY52	0.25
2N1308	0.40	ACY19	0.25	BSY26	0.25
2N1309	0.35	ACY20	0.20	BSY27	0.30
2N1613	0.25	ACY21	0.20	BSY28	0.30
2N1711	0.30	ACY22	0.15	BSY65	0.20
2N1756	0.75	AD140	0.80	BSY95A	0.20
2N2147	0.75	AD149	0.50	OC16	0.75
2N2160	1.25	AD161	0.35	OC22	0.65
2N2217	0.30	AD162	0.35	OC23	0.60
2N2218	0.40	AF114	0.25	OC24	0.60
2N2219	0.45	AF115	0.30	OC25	0.40
2N2369A	0.25	AF116	0.25	OC26	0.30
2N2477	0.65	AF117	0.20	OC28	0.60
2N2646	0.60	AF118	0.45	OC29	0.65
2N2905	0.50	AF125	0.25	OC30	0.75
2N2923	0.15	AF126	0.25	OC35	0.50
2N2924	0.15	AF127	0.25	OC36	0.60
2N2926	0.15	AF178	0.40	OC42	0.30
2N3053	0.30	AF186	0.50	OC44	0.20
2N3055	0.75	AF239	0.40	OC45	0.20
2N3133	0.35	AFZ11	0.45	OC70	0.20
2N3134	0.50	ASY26	0.25	OC71	0.15
2N3391	0.20	ASY27	0.30	OC72	0.25
2N3392	0.15	ASY28	0.30	OC73	0.40
2N3393	0.15	ASY29	0.30	OC75	0.25
2N3394	0.15	ASY54	0.25	OC76	0.25
2N3395	0.20	ASY74	0.50	OC78	0.25
2N3402	0.15	ASY77	0.35	OC78D	0.20
2N3403	0.15	ASY82	0.20	OC81	0.25
2N3404	0.35	ASY86	0.20	OC81D	0.15
2N3414	0.20	BC107	0.15	OC83	0.20
2N3415	0.15	BC108	0.15	OC139	0.35
2N3416	0.25	BC109	0.20	OC140	0.40
2N3417	0.25	BC113	0.40	OC141	0.60
2N3702	0.15	BC118	0.30	OC170	0.25
2N3703	0.15	BC134	0.30	OC171	0.25
2N3704	0.20	BC147	0.20	OC200	0.30
2N3707	0.20	BC148	0.15	OC201	0.60
2N3709	0.15	BC149	0.15	OC202	0.65
2N3710	0.15	BC152	0.15	OC203	0.40
2N3819	0.35	BC175	0.25	OC204	0.40
2N3906	0.30	BCY30	0.35	OC205	0.70
2S002	1.00	BCY33	0.25	OC206	0.70

SYNCHROSCOPE TYPE C1-5



3-in tube fitted with telescopic viewing hood, giving bright display in full daylight.
Bandwidth 10 c/s—10 mc/s. Triggered sweep pre-set at 1-2-5-10-30-100-300-1000-3000 μsec per stroke. Free-running time base 20 c/s to 2000kc/s with built-in crystal calibrator providing timing marks at .05-.2-1-5-20-100 μ sec + 5%.
Amptiihide calibrator directly calibrated in volts.
Input attenuator 1-10-100.
Power supplies 127/230v AC.

PRICE **£39.00.** Packing and carriage 1.50

MINIATURE 1-IN CATHODE RAY TUBE TYPE DH3-91—1CP1—1CP31

63v heater. Anode voltage 500v. Sensitivity Y plates 45v/cm; X plates 52v/cm (typical) Y plates suitable for assymmetrical deflection. Green face, medium persistence.

PRICE **£6.0.0** p.p. 0.25

CARTRIDGE TYPE HS32 EHT RECTIFIER

10,000p.i.v. Rectified current 350mA mat. Surge current 30 Amps. PRICE **£7.00**

OUR NEW 1970/1971 CATALOGUE IS NOW READY AND AVAILABLE FREE OF CHARGE. PLEASE SEND QUARTO STAMPED AND ADDRESSED ENVELOPE FOR THIS VALUABLE SOURCE OF REFERENCE LISTING MANY THOUSAND TYPES OF VALVES, SEMICONDUCTORS, TUBES ETC.

TWO NEW MULTIMETERS FROM RUSSIA

Type U4312 U4313

Type U4312—Low sensitivity instrument (667 o.p.v.) 1% accuracy on DC and 1·5% on AC. 9 current ranges on DC (300μA to 6A) and 8 current ranges on AC (1·5mA to 6A). 9 voltage ranges 0·3 to 900V AC/DC. Resistance 0·2 to 30k Ω. Mirror scale.

PRICE, complete with leads and case **£9.15.0**

Type U4313—20,000 o.p.v. DC and 2,000 o.p.v. on AC. 8 DC current ranges 60μA to 1·5A. 6 AC current ranges 0·6 to 1·5A. 9 DC and AC voltage ranges 1·5–500V. Resistance ranges 0·5–500k Ω. Accuracy 1·5% DC and 2·5% AC. Mirror scale. **£10.10.0.**

INTEGRATED CIRCUIT AMPLIFIERS

CA3005 RF amplifier, 100mc/s bandwidth	£1.35
CA3012 Wide Band Amplifier for IF applications ..	1.10
CA3020 550mW Audio Amplifier	1.50
CA3036 Two super-alpha pairs for stereo pick-up systems	0.95
CA3052 Latest addition to RCA range. Four-in-one amplifier	2.10
PA222 1.2 watt Audio Amplifier	3.25
PA234 1 watt Audio Amplifier	1.30
PA237 2 watts Audio Amplifier	2.00
MC1709G—G.P. operational Amplifier	1.15
TAA263 3-stage direct coupled Amplifier	0.75
TAA293 3-stage direct coupled Amplifier	1.00
TAA320 MOST input + bi-polar stage	0.65
TAD100 All active components required to construct an AM receiver	2.25
SL403A 3 watts Audio Amplifier	2.40

Published approximately on the 7th of each month by IPC Magazines Limited, Fleetway House, Farringdon Street, London, E.C.4. Tel: 01-634 4444. Printed in England by Index Printers, Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon and Gotch (A/sia) Ltd.; South Africa—Central News Agency Ltd.; Rhodesia and Zambia—Kingston Ltd.; East Africa—Stationery and Office Supplies Ltd. Subscription rate (including postage); For one year to any part of the world £2 5s 0d. (£2·25)

HENRY'S RADIO LTD • MAIL ORDER AND INDUSTRIAL SALES DEPT. 303, EDGWARE ROAD LONDON W.2. 01 723 1008 9

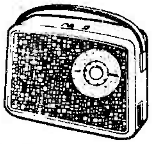
• ELECTRONIC COMPONENTS AND EQUIPMENT AUDIO AND TEST GEAR 356 EDGWARE ROAD LONDON W.2 TEL. 01-402 4736

• ELECTRONIC ORGANS PUBLIC ADDRESS DISCOTHEQUE EQUIPMENT 309 EDGWARE ROAD LONDON W.2 TEL. 01-723 6963

• HIGH FIDELITY SALES AND DEMONSTRATIONS 354 EDGWARE ROAD LONDON W.2 TEL. 01-402 5854

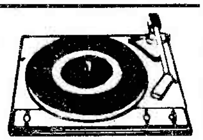
OPEN MONDAY TO SATURDAY 9AM TO 6PM. THURS 9AM TO 1PM. OPEN ALL DAY SATURDAY

BUILD YOURSELF A QUALITY RADIO



Excellent printed circuit design with full power output. Fully tuneable on both MW/LW bands. 7 Mullard transistors. Fitted 5in. speaker. Room filling power. Easy to build with terrific results. Two colour leather-cloth cabinet with silvered front. All local and continental stations. Complete detailed instructions.
Total cost **£6.19.6.** p.p. 6/6.
All parts sold separately.
Ask for leaflet No. 1.

YOU CAN SAVE 25% on Garrard, Goldring and McDonald Decks



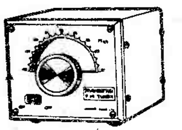
*SP25 Mk. II	£10.19.6	*SP25 Mk. III	£11.10.0
*SL65B	£14. 9.6	†AP75	£16.19.6
†SL72B	£25. 0.0	MP60	£10.19.6
MP610	£13.19.6	GL69 II	£23. 0.0
GL75	£32. 0.0	(P. & P. 7/6 any type)	

PLINTHS & COVERS
*Standard 89/6. P. & P. 4/6. †Deluxe **£8.15.0.** P. & P. 6/6
SPECIAL OFFER! The above decks supplied with 9TAH/C Diamond Add £2; 940 magnetic Add £3; G850 or AT66 Add £5; G800 Add £7.10.0; GP91 SC Add £1 (Also applies to MP60/PC.
SPECIAL! SP25 fitted G800 with Plinth/Cover wired and mounted **£20.19.6.** P. & P. 10/–.
2025 TC with 9TAH/C diamond, plinth and cover wired and mounted **£13.19.6.** P. & P. 10/–.
GL69 II fitted G800 plinth and cover wired and mounted **£35.0.0.** P. & P. 12/6.
ALSO IN STOCK
2025 TC/9TAHC diam. **£8.17.6**; 3000 LM/9TAHC diam. **£9.15.0.** 3500/KS40A **£12.10.0**; MP60 fitted plinth and cover (see above for cartridges) **£17.12.6.** P. & P. 10/–.
★FREE—Complete lists No. 16/17 on request.

SINCLAIR EQUIPMENT — SAVE £££'s

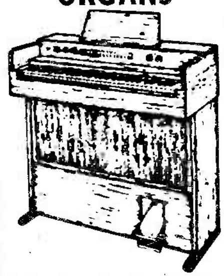
PROJECT 60 PACKAGE DEALS
2xZ30 amplifier, stereo 60 pre-amp, PZ5 power supply. **£19.0.0.** Carr. 7/6. Or with PZ6 power supply **£21.0.0.** Carr. 7/6. 2xZ50 amplifier, stereo 60 pre-amp, PZ8 power supply, **£21.10.0.** Carr. 7/6. Transformer for PZ8 59/6 extra. Any of the above with Active Filter unit add 97/6 or with pair Q16 speakers add £16. All Sinclair models in stock. 2000 amplifier, **£23.0.0.** Carr. 7/6. Neoteric amplifier, **£46.0.0.** Carr. 7/6.

BUILD THIS VHF FM TUNER



5 MULLARD TRANSISTORS 300 kc/s BANDWIDTH. PRINTED CIRCUIT. HIGH FIDELITY REPRODUCTION. MONO AND STEREO.
A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately.
PARTS TOTAL COST **£6.19.6.** p.p. 3/6. MULTIPLEX DECODER **£5.19.6** (FOR STEREO) p.p. 3/–. ASK FOR BROCHURE No. 3.

ELECTRONIC ORGANS



You can build our Mayfair Portable for
£99 p.p. 30/-
All parts available separately—Several models to choose from—visit our New Showrooms at 309 Edgware Road.

DISCOTHEQUE—PA CENTRE

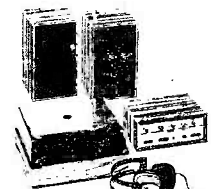
All the latest equipment in stock. Call and see for yourself or send for latest lists.

HENRY'S LATEST CATALOGUE

Latest edition. No. 350 pages.
★ COMPONENTS, TEST GEAR
★ EQUIPMENT, MODULES
★ SPECIAL OFFERS, etc. etc.
Everything for the constructor. Complete with 10/– value discount voucher for use with purchase. Price 7/6. p.p. 2/–.
WHY NOT SEND AWAY TODAY? FREE 8 page SEMI-CONDUCTOR LISTS No. 36. New ranges and a few circuits

HI-FI TO SUIT EVERY POCKET

FREE—Stock list No. 16/17 on request—BEST VALUE IN U.K.
100 STEREO SYSTEMS
and a complete range of individual units in stock—Demonstrations all day—visit our new Hi Fi Store.
LOW CASH OR CREDIT/HP TERMS (Credit terms from £30 purchase—callers only).



SPECIAL STEREO SYSTEMS

★**FREE**—pair of stereo headphones for private listening★ C5/8 Teleton 203E 6+6 watts amplifier, SP25 or MP60 with deluxe plinth/cover pair of 3-way 10 watt bookshelf speakers, all cables, leads, magnetic cartridge (List **£79.10.0**) PRICE **£59.** P. & P. 30/–.

C1/8 Nova 505 Amplifier, 2025 TC with 9TAH/C diamond, plinth and cover, pair of 3-way 10 watt bookshelf speakers, cables/leads, etc. (List £65). PRICE **£49.** P. & P. 30/–.

C9A/8 Sinclair 2000 amplifier, SP25 or MP60 with G800, plinth and cover pair of 3-way 10 watt bookshelf speakers, cables/leads, etc. (List £88). PRICE **£69.** P. & P. 30/–.

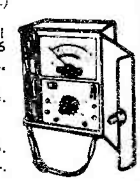
B11/8 Teleton F2000 (or F2300) MW/FM/STEREO Tuner amplifier, SP25 or MP60 with 9TAHC diamond, pair of 3-way 10 watt speakers, cables/leads, etc. (List £100). PRICE **£79.** P. & P. 30/–.

(All systems add £10 for larger speakers, £14 for Dentons).

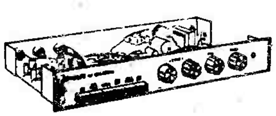
SEND FOR FREE LISTS OF 100 STEREO SYSTEMS

TEST EQUIPMENT FOR HOME, SCHOOL & PROFESSIONAL USE

AF105 50k/volt multimeter (illus.). Price **£8.10.0.** p.p. 3/6. Leather case 28/6.
200H 20k/volt. Price **£3.17.6.** p.p. 3/6. Case 12/6.
500 30k/volt multi-meter. Price **£8.17.6.** p.p. 3/6. Leather case 30/–.
THL 33 2k/volt. Price **£4.2.6.** p.p. 3/–. Leather case 22/6.
TE65 Valve voltmeter (illus.) Price **£17.10.0.** p.p. 7/6.
SE250B Pocket pencil signal injector. Price **35/–.** p.p. 1/6
SE500 Pocket pencil signal tracer. Price **29/6.** p.p. 1/6.
TE20D RF generator. Price **£15.0.0.** p.p. 7/6.
TE22D Matching audio generator. Price **£17.0.0.** p.p. 7/6.
TE15 Grid dip meter. Price **£12.10.0.** p.p. 3/6.
TO3 Scope 3" tube. Price **£37.10.0.** p.p. 10/–.

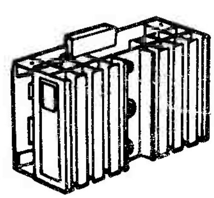


NEW SELF-POWERED PRE-AMPLIFIERS



SLIM MODERN DESIGNS USING THE LATEST SILICON TRANSISTORS FET's and IC's. DIN SOCKETS, Etc. fitted.
PUSH-BUTTON SELECTION, ±20dB BASS AND TREBLE BOOST & CUT
All inputs provided plus TAPE RECORD and REPLAY. Specifically designed for use with PA25 and PA50 Amplifiers GOLD AND SILVER FINISH, Mains operated. Supplied with all plugs, etc. ADJUSTABLE OUTPUT UP TO 1 VOLT.

★ FET9/4. Mono with built-in mic. mixer. Accepts any ceramic or crystal cartridge. Plus tuner, tape, etc. Price **£12.10.0.** p.p. 4/–.
★ FET154 STEREO (illus.). Magnetic cart. input, tuner, tape, etc. Beautiful stereo sound. Price **£16.10.0.** p.p. 4/6.
★ I.C. STEREO All facilities plus headphone socket without amplifiers. Uses IC's, FET's etc. Price **£24.0.0.** p.p. 5/6.



25 WATT AND 50 WATT SILICON AMPLIFIERS

LOOK AT THE SPECIFICATIONS
★ **At full power 0.3% distortion.**
★ **At full power—1dB 11c/s to 40 kc/s.**
★ **Response—1dB 11 c/s to 100 kc/s.**
★ **Rise time 2μ sec.**
★ **Short circuit proof plus limiting cct.**

PA 25 10 transistor all silicon differential input 400mV sensitivity. 25 watts Rms into 8 ohms. Supplied with edge connector harness size 5" x 3" x 2".
PA 50 12 transistor version 50 watts Rms into 3 to 4 ohms. Size 5" x 3" x 4".
MU 442. Power supply or one or two PA 25 or one PA 50. PA 25 **£7.10.0** PA 50 **£9.10.0.** MU 442 **£6.0.0.**

SIMPLICITY TO MOUNT—EASY TO USE—DESIGNED FOR QUALITY, PERFORMANCE AND PRICE
All units no soldering—just edge connectors and plugs

HENRY'S RADIO LTD FOUR ELECTRONICS CENTRES ALL WITHIN 100 YARDS
303·309·354·356 EDGWARE ROAD LONDON W.2