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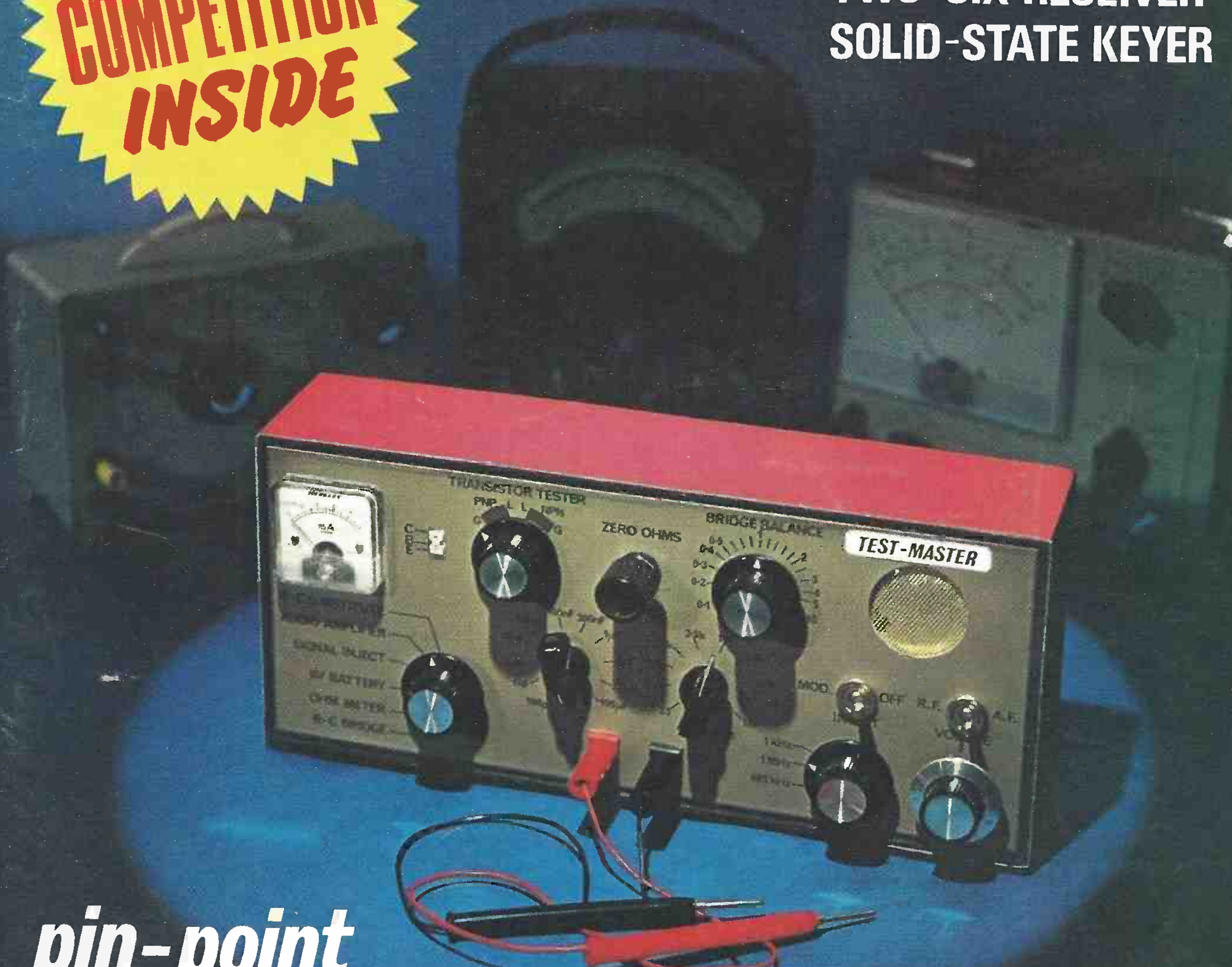

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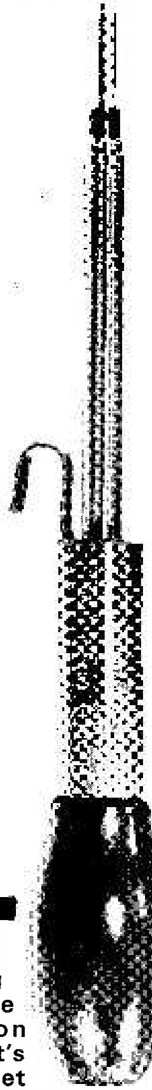

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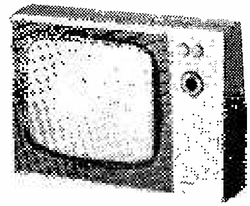

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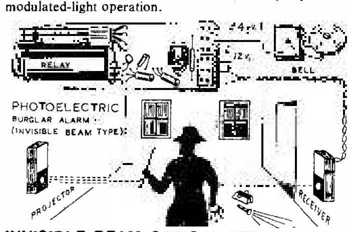

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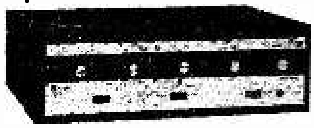
KG-865 50 Watt Stereo Amplifier Kit

DELUXE FEATURES



All Silicon Transistors for Stability, Cleaner Sound ● Extremely Wide Power Bandwidth and Frequency Response ● 50W IHF Power Output ● Specially Selected Low-Noise Preamp Transistors ● Two Printed Circuit Boards for Fast Easy Assembly ● Convenient Front-Panel Stereo Headphone Jack ● Teak-finished Extruded Aluminium Front Panel ● Two AC Convenience Outlets

● **Output:** *50W IFH, 25W per channel; 34W continuous sine wave* ● **Response:** *±1dB, 18 to 30,000Hz* ● **Output Impedances:** *4 through 16ohms, plus stereo headphones* ● **IM Distortion:** *under 1% at 60Hz and 7,000Hz mixed 4:1 at rated power* ● **Input Sensitivity:** *Magnetic Phono, 5mV; Tuner and Auxiliary, 500mV* ● **Power Requirement:** *230-250V, 50Hz a.c.*

Recommended List Price £34.19.6: **24 GNS.** Assembled **29 GNS. Teak Case £5 extra**

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The NEW KG-980 Stereo FM Receiver Kit

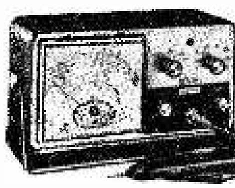
Designed to Satisfy the Most Critical Listener

R.F. and I.F. Panels Assembled and Aligned ● Front Panel Stereo Headphone Jack and Speaker Muting Switch ● Full Controls including Tape Monitor ● 50W I.H.F. Output ● Usable I.H.F. Sensitivity: *3μV* ● **Frequency Response:** *±1dB, 30 to 15,000Hz.* ● **Harmonic Distortion:** less than *1.0%* ● **A.M. Suppression:** *more than 30dB* ● **Channel Separation:** *30dB* ● **Complimentary Transformerless ● Power Output:** *50W I.H.F. (25W per channel); 34W continuous sine wave* ● **Frequency Response:** *±1dB, 18 to 30,000Hz* ● **Power Bandwidth:** *20–20,000Hz at 1% harmonic distortion* ● **Two R.F. Stages ● Stereo indicator light.** Recommended List Price £62.19.6: **39 GNS.** Assembled **49 GNS.** Teak Case **5 GNS. Extra.**

KG-375A Deluxe Solid-State Auto Analyzer Kit

Tune-up and trouble-shoot any car, perform actual road tests

Its several testers in one . . . do all this



Set Engine Idle and Automatic Transmission Shift Points ● Detect Condition of Point Surfaces ● Detect Distributor Wear ● Check Voltage and Current Regulators ● Check Generators for both Current and Voltage Output ● Find Poor or Open Earth Circuits ● Detect Variation in Dwell Angle.
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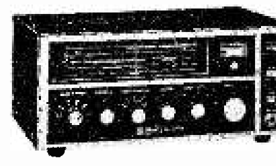
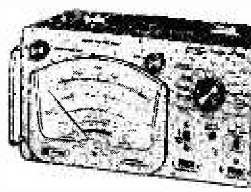
Assembled Price: **21 GNS.**

STAR ROAMER 5-Band Shortwave Receiver Kit



Bandspread: *electrical, calibrated 0–100* ● **Sensitivity:** *10μV for 10dB signal-to-noise ratio* ● **I.F. Bandwidth:** *8kHz at 6dB down* ● **Beat Frequency:** *variable, 0–5kHz* ● **Speaker:** *4in permanent-magnet type* ● **Power Supply:** *fused, transformer operated* ● **Headphone Output:** *low impedance* ● **Valve Complements:** *1–6BE6, 1–6HR6, 1–12AX7, 1–6AK6 or 1–6AR5* ● **Power Requirements:** *230–250V, 50Hz a.c.; 16W* ● **Covers 200 to 400kHz and 550kHz to 30MHz in 5 Band-switched Ranges ● Superheterodyne Circuit includes controlled regenerative I.F. stage ● A.V.C. reduces fading and blasting; A.N.L. cuts noise to a minimum ● Aerial Trimmer effectively peaks incoming signals for best reception ● Illuminated "S" Meter; Large, Easy-to-Read 7½in Slide Rule Dial.**
Recommended List Price £21.19.0: **14 GNS.** Assembled Price **19 GNS.**

KG-625 Deluxe 6in Vacuum Tube Volt Meter Kit



Huge 6in Meter Scale ● Ranges: *d.c. 0–0·5–1·5–5–15–50–150–500–1,500V full scale.* ● **Accuracy:** *±3% of full scale reading* ● **Input Resistance:** *11MΩ to 1,500V* ● **Ranges:** *a.c. 0–1·5–5–15–50–150–500–1,500V full scale. 0–4·2–14–42–140–420–1,400–4,200V full scale* ● **Accuracy** *±5%* ● **Frequency Response** *±1dB, 30Hz to 3MHz; ±3dB, 30Hz to 5MHz* ● **Ohmmeter Ranges:** *1–1,000–10,000 ohms; 0–1–10–100–1,000MΩ* ● **Battery** *1½V U2.*
Recommended List Price £24.19.6. **12 GNS.**
KG 620 as KG 625 (same Ranges) but 4½in Scale: Recommended List Price £18.5.6 **9½ GNS.**

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Includes: ● Dual Headset ● Photocell ● Speaker ● Meter ● Aerial ● Transistors.
Recommended List Price £16.8.0: **9½ GNS.**

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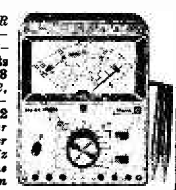
Recommended List Price £12.10.0: **9 GNS.** Available Assembled Only.

KG-640 20,000 ohms/Volt VOM Kit

BIG PROFESSIONAL SIZE 62 RANGE MULTIMETER



● **A.C. Volts (12 Ranges):** *0–2–4–8–16–40–80–200–400–800–1,600–2,000–4,000V* ● **D.C. Volts (12 Ranges):** *0–0·8–1·6–8–16–40–80–200–400–800–1,600–2,000–4,000V* ● **Output Volts (8 Ranges):** *0–2–4–8–16–40–80–200–400V* ● **Resistance (8 Ranges):** *0–1,000–100,000 ohms–10 megs. Centre scales at 12, 1,200 and 120KΩ* ● **D.C. Current (10 Ranges):** *0–80–160–400–800μA, 8–16–200–400mA, 8–16A* ● **Decibels (12 Ranges):** *−12 to +74* ● **D.C. Sensitivity:** *20,000 ohms per volt or 10,000 ohms per volt (function of scale multiplier switch).* ● **Frequency Response:** *20Hz to beyond 200kHz* ● **Accuracy:** *D.C. 3%, A.C. 5%* ● **Test Leads:** *one red, one black, each 48in long* ● **Multiplier Resistors:** *All 1% carbon film.*
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We offer you fully tensilised polyester/mylar and P.V.C. tapes of identical quality hi-fi, wide range recording characteristics as top grade tapes. Quality control manufacture. They are truly worth a few more coppers than acetate, sub-standard, jointed or cheap imports. TRY ONE AND PROVE IT YOURSELF.

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5in.	600ft.	7/6	5in.	900ft.	10/6	5in.	1,200ft.	15/-	5¾in.	2,400ft.	34/-
5¾in.	900ft.	10/6	5¾in.	1,200ft.	13/-	5¾in.	1,800ft.	19/-	7in.	3,600ft.	44/-
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- ***RECHARGEABLE BATTERY***
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THE BATTERY WE SUPPLY WITH THE ORION IS A RECHARGEABLE TYPE. BATTERY CHARGERS ARE AVAILABLE TO RECHARGE THE BATTERY AGAIN AND AGAIN. OPERATES ON HOME MAINS 200/240 VOLTS A.C.

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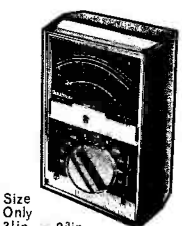
The AS57 is the compact Sonics space saver. This fine miniature high-fidelity speaker system will provide good quality sound anywhere in your home at remarkably low cost. Designed for use where space is at a premium, the AS57 system is ideal for the small apartment or isolated listening area. The specially designed, high efficiency 5in. x 7in. full range speaker has a frequency range of 70-18,000Hz with a peak handling capacity of 10 watts. Impedance: 8 ohms. Finished in walnut. Size 5¾in. x 15¾in. x 8¼in.

Lasky's price £15 per PAIR Post 33p

EXCLUSIVE TM1 & TM5

MODEL TM-1 MINI TESTER



The first of Lasky's new-look top value meters, the TM-1 is a really tiny pocket multimeter providing "big" meter accuracy and performance. Precision movement calibrated to ±3% of full scale. Click stop range selection switch. Beautifully designed and made impact resistant black case—with white and metallic red/green figuring. Ohms zero.

- DC/V: 0–10–50–250–1,000 at 1K/OPV.
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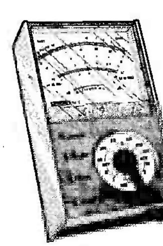
- DC CURRENT: 0–1mA, 100mA.
- Resistance: 0–150kΩ.
- Decibels: −10dB to 22dB.
- Complete with test leads, battery and instructions.

Size Only 3½in. × 2⅜in. × 1¼in.

***LASKY'S PRICE £1.95* POST 13p**

MODEL TM-5 5K OHMS/V POCKET MULTIMETER



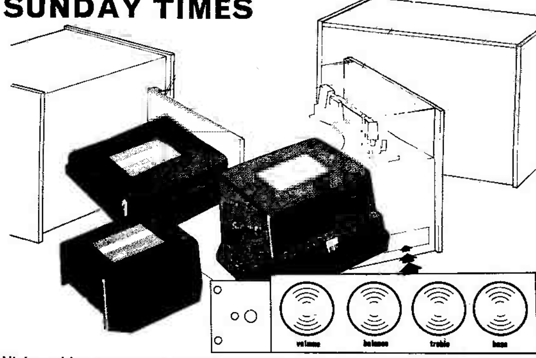
Another new look pocket multi-meter from Lasky's providing top quality and value. The "slimline" impact resistant case—size 4¾in x 2⅞in x 1¼in, fitted with extra large 2⅞in square meter. Readability is superior on all low ranges; making this an excellent instrument for servicing transistorised equipment. Recessed click stop selection switch. Ohms zero adjustment. Buff finish with crystal clear meter cover.

- DC/V: 3–15–150–300–1,200 at 5K OPV.
- AC/V: 6–30–300–600 at 2·5K OPV.
- DC Current 0–300μA, 0–300mA.
- Resistance: 0–10kΩ, 0–1MΩ.
- Decibels: −10dB to 16dB.
- Complete with test leads, battery and instructions.

***LASKY'S PRICE £2.95* POST 13p**

MULLARD UNILEX *AUDIO MODULES*

Do-it-yourself stereo as featured in the SUNDAY TIMES



With nothing more than simple tools and the parts described below, you can build your own stereo system with excellent results guaranteed. The heart of the system comprises our Mullard Unilex modules and a control unit. All the modules and the control unit are supplied to you fully built and only require connecting together. Screw terminals are and each module is housed in a tough plastic case, giving you complete freedom to use any of the recommended cabinets or your own design to suit your home.

Control Unit. Fitted with Bass, Treble, Volume and balance controls. A metal fascia panel is supplied and all wires are ready fitted for connecting to the pre-amp. Size 9in x 10in. x 1in. Plus 2in. long control shafts. **£3.25**

Pre-amplifier Module Type EP-9001. Input impedance: P/U 2.2M Tuner 1M. Input Sens.: P/U 320mV, Tuner 140mV. Treble control range—14dB to 14dB at 16KHz, Bass control range —14dB to 14dB at 60Hz. Size: 4in. x 5in. x 1in. **£3.10**

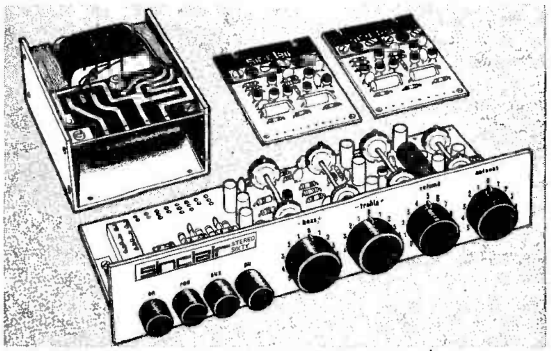
Amplifier Module Type EP-9000. Output 4 watts per channel to 12 ohms to 15 ohms or 8 ohms with series resistor. Frequency resp. (to 3dB at 50mW): 50Hz to 16KHz. Harmonic distortion less than 2% at typical listening level. Size: 30in. x 4in. x 10in. **£5.80** per. pair

Power Sypply Module Type EP-9002. For use with control unit, EP-9001 and 2 x EP-9000. For 220/250 volt AC mains. Size 50in. x 30in x 3in. **£4.60**

PACKAGE DEAL

Two EP-9000 Modules £5.80 ● EP9002 Mod £4.60 ● EP-9001 Module £3.10 ● Control Unit £3.25 ● Instruction Book 25p.
TOTAL LIST PRICE £17.00 **PACKAGE PRICE £14.95** post 20p.

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 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: $8\frac{1}{4}$ x $1\frac{1}{2}$ x 4in. **£8.95** Post 18p

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: $3\frac{1}{2}$ x $2\frac{1}{4}$ x $1\frac{1}{8}$in. **£4.25** Post 18p

PZ5 30V unstabilised—sufficient to drive two Z-30's and a Stereo 60 for domestic applications. **£4.50** Post 13p

PZ6 35V stabilised—ideal for driving two Z-30's and a Stereo 60 for low efficiency speakers. **£7.50** Post 13p

PACKAGE PRICE For Stereo 60, two Z-30 and one PZ-5 **£19.25** Post 50p

FANTAVOX 500 4+4 WATTS

This outstanding amplifier incorporates all features of an expensive unit but at a really budget price. Separate tone and volume controls are provided with on/off, and phono/tuner switches. A pilot light on the front panel indicates the unit is on. Attractive walnut grained metal cabinet with champagne satin aluminium front panel. This amplifier would be a proud addition to any budget stereo system. Brief Spec: ● Freq. Response: 40-20,000Hz ● Output Impedance: 4-16 ohms ● Sensitivity Phono/Tuner 250mV.

LASKY'S PRICE **£11.50** Post 25p

FANTAVOX 500 PACKAGE

Fantavox 500 Stereo Amplifier	£11.50
Garrard SL55 Autochanger with plinth and cover	£18.64
TTC J2006S Stereo Cartridge	£1.25
Two Harrow Bookshelf Speakers	£11.95
TOTAL LIST PRICE	£43.34

£37 Post £1.25

MIDLAND 10-406 AM/AIRCRAFT RADIO

The first pocket size receiver of its type allowing you to tune-in to the entire air communications band covered by 108-137 MHz in addition to full AM medium wave. Intermediate frequencies: AM 455 KHz; VHF 10.7 mc/s. Output power; 200mV $2\frac{1}{4}$in. P.D. 8 ohm speaker. A built in ferrite rod aerial is provided or AM reception. The 10-406 is finished in blue with chrome trim, chrome telescopic antenna. Size: $6\frac{5}{8}$ x $3\frac{3}{8}$ x $1\frac{3}{8}$in. Complete with batteries, magnetic earphone, instructions and circuit date.

LASKY'S PRICE **£8.35** Post 13p

McDONALD

McDONALD PROFESSIONAL SERIES FOUR-SPEED SINGLE PLAY UNIT MP60

High-precision low-mass fully counterbalanced pick-up arm, heavy balanced turntable, simple to operate controls, viscous cueing device, slide-in cartridge carrier, four pole motor.

LASKY'S PRICE **£11.50** post 35p

complete with plinth and cover **£15.00** Post 40p

610 AUTOMATIC TURNTABLE

Same specifications as the MP60 but with synchronous four pole motor and full automatic change facilities.

LASKY'S PRICE **£13.95** Post 35p

WITH PLINTH AND COVER £17.75 POST 40p

510 AUTOMATIC TURNTABLE

Counterbalanced pick-up arm, pressed steel turntable, bias compensator, viscous curing and synchronous four pole motor.

LASKY'S PRICE **£11.75** POST 35p

WITH PLINTH AND COVER £15.50 POST 40p

310 AUTOMATIC TURNTABLE

Low-mass square sectron pick-up arm, cue and pause lever, visual stylus pressure indicator, slide-in cartridge carrier, four pole motor.

LASKY'S PRICE **£9.95** POST 35p

WITH PLINTH AND COVER £13.75 POST 40p

BSR McDONALD PACKAGE 1

McDonald MP60 4 speed Single Player	£15.00
AD76K Magnetic Cartridg with diamond stylus	£4.50
BSR Afromosia Plinth with black mounting board	£4.44
BSR Smoked Perspex Dust Cover	£3.17
Total list price	£27.11

LASKY'S PRICE £23.95 POST 40p

ADD £5.00 if Micro M2100/E Magnetic Cartridge is preferred
ADD £6.00 if Shure M44/5 Magnetic Cartridge is preferred

BSR McDONALD PACKAGE 2

BSR McDONALD 510 4 Speed Autochange	£16.03
AUDIO DEVELOPMENT AD76K Magnetic Cartridge	£4.50
BSR Afromosia Plinth with black mounting board	£4.44
BSR Smoked Perspex Dust Cover	£3.17
Recommended retail price	£28.14

LASKY'S PRICE £23.25 POST 40p

ADD £5.50 if Micro M-2100/E is preferred
ADD £6.50 if Shure M44/5 is preferred

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See page 876 for further details

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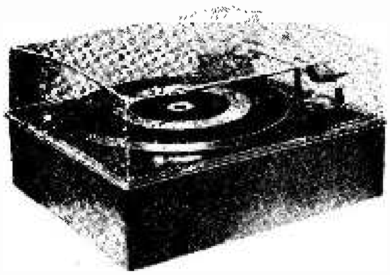

TURNTABLES (P. p., 10/-, Great Britain)

GARRARD 2025TC with Sonotone 9TAHC dia. Cart.	£9/15/0
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TUNERS (P.P., 10/-, Great Britain)

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TELETON STQ201X	£28/0/0
TELETON STQ204X	£39/10/0
PHILIPS RH691	£66/0/0
PHILIPS RH690	£31/19/6

TUNER-AMPLIFIERS (P.p., 12/6)

TELETON MX990	£49/10/0
TELETON R8000 WITH SPEAKERS	£48/0/0
TELETON TFS50	£55/0/0
TELETON CR/10T WITH SPEAKERS	£29/0/0
TELETON R4200	£34/19/6
TELETON F2000	£31/10/0
TELETON 7ATI	£84/0/0
TELETON R4300	£42/0/0
TELETON F2300	£42/0/0
PHILIPS RH781	£54/17/6
WHARFEDALE 100.1	£105/0/0
TELETON CR55	£93/0/0
TELETON 10ATI	£108/0/0
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SMC-101
MOVING MAGNET STEREO CARTRIDGE

●FEATURES

Excellent Vibration System
The canti-lever made from a Ultra-hard light alloy most carefully selected performs quite well with a high compliance and no distortion, tightening the system of vibration.

Precise Construction
The high precise assembly of 4 coils and 4 pole-pieces results in an excellent channel balance and channel separation. S/N ratio is also best with the super malloy shield.

Easy Needle Interchangeability
With an interchangeable system of plug-in knob, it is quite easy to interchange the whole vibration system as well as the stylus.

●SPECIFICATIONS

Frequency response: 20—20,000Hz
Output voltage: 5mV at 1,000Hz 5cm/s
Channel balance: ±1dB at 1,000Hz
Channel separation: better than 25dB at 1,000Hz
Impedance: 2,500 ohms at 1,000Hz
D.C. resistance: 600 ohms
Load resistance: 50—100K ohms
Compliance: 8 x 10⁻⁶cm/dyne
Tracking pressure: 3—5 grams
Stylus: 0.7 mil diamond
Cartridge weight: 9 grams
Mounting: ½" or 12.7 mm

PRICE ONLY 65/- P.p., 2/6.

MCI-5
HIGH FIDELITY STEREO MOVING MAGNET CARTRIDGE

●FEATURES

●Ultra-hard light alloy canti-lever...... Widest range of Hi-Fi
●High precise assembly .... High balance and no distortion
●Interchangeable needle of vertical tracking angle 15° plug-in knob system

●SPECIFICATIONS

Frequency response: 15—20,000Hz
Output voltage: 5mV at 1,000Hz 5cm/s
Channel balance: ±1dB at 1,000Hz
Channel separation: better than 25dB/1,000Hz
Impedance: 2,200 ohms at 1,000Hz
D.C. resistance: 580 ohms
Load resistance: 50—100K ohms
Compliance: 8 x 10⁻⁶ cm/dyne
Tracking pressure: 3—5 grams
Tracking angle: 15°
Stylus: 0.7 mil diamond
Cartridge weight: 6.5 grams
Mounting: ½" or 12.7mm

PRICE ONLY £6/0/0 P.p., 2/6.

FULL RANGE OF MICROPHONES AND PICKUP ARMS IN STOCK.

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APOLLO 3-WAY SPEAKER SYSTEMS

The Systems are housed in handsome Slim-Line Cabinets of Modern Design, finished in Polished Teak with Padded Front Panel covered in I.C.I. Vynair Grille.

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OUR PRICE £11 19 6 (p.p. 12/6)

APOLLO-7 3-WAY SPEAKER SYSTEM

As above but 7 Watts R.M.S. (14 Watts peak). Size, 20 x 12 x 8 in. **£8/17/6** (P.p., 10/-)

APOLLO-5 3-WAY SPEAKER SYSTEM
As above but 5 Watts R.M.S. (10 Watts peak). Size, 14½ x 8 x 6 in. PRICE **£5/19/6** (P.p., 7/6)

NEW MkII LEAK SANDWICH SPEAKERS

Size, 26 x 15 x 12 in. Walnut Cabinet. 8 ohms. 35 Watt handling.
LIST PRICE £45/10/0 OUR PRICE **£32/0/0** (P.p., £1)

Now available the superb RIGONDA SYMPHONY DELUXE 7 waveband stereogram which includes VHF and 4 Short bands. Incorporates a single playing deck and auto cueing device. Sizes: Radiogram 43½ x 13½ x 23in. Speakers 14½ x 8½ x 39in. Guaranteed Unbeatable value at only **£84/0/0.**

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Also see the opposite page for our fantastic value for money Apollo Unit Audio Hi-Fi System. Only **36 gns.** complete.

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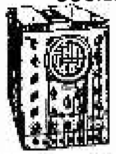
TYPE 13A DOUBLE BEAM OSCILLOSCOPES

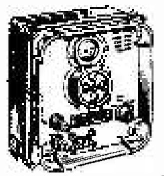


An excellent general purpose D/B oscilloscope. T.B. 2 cps–750 Kc/s. Bandwidth 5.5 Mc/s. Sensitivity 33mV/CM. Operating voltage 0/110/200/250V. A.C. Supplied in excellent working condition. **£22.10.0.** Carriage 30/-.

AVO CT471A MULTIMETER

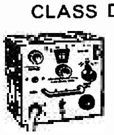
Battery operated, fully transistorised. Sensitivity 100mΩ/v.
Measures AC/DC Voltages 12mV to 1,200v.
AC/DC Current 12uA to 1.2 Amp.
Resistance 12 ohm to 120 mΩ
HF, VHF, UHF Voltage with multiplier 4v to 400v up to 50 Mc/s, 40mV to 4v up to 1,000 Mc/s.
Offered in perfect condition.
£55 each. Carr. 10/-

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

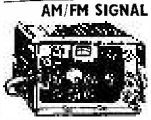


A crystal controlled heterodyne frequency meter covering 1·7–8 Mc/s. Operation on 6 volts D.C. Ideal for amateur use. Available in good used condition. **£5.19.6.** Carr. 7/6. Or brand new. **£7.19.6.** Carr. 7/6.

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

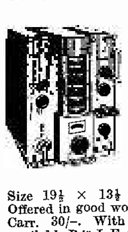


Oscillator Test No. 2. A high quality precision instrument made for the ministry by Airmec. Frequency coverage 20-80 Mc/s. AM CW/FM. Incorporates precision dial, level meter, precision attenuator 1μV–100mV. Operation from 12 volt D.C. or 0/110/200/250 volt A.C. Size 12 × 8½ × 9in. Supplied in brand new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

AVO CT.38 ELECTRONIC MULTIMETERS

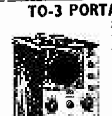
High quality 97 range instrument which measures A.C. and D.C. Voltage. Current, Resistance and Power Output Ranges D.C. volts 250mV–10,000v. (10 meg Ω –11 0meg Ω input). D.C. current 10μA–25 amps. Ohms, 0–1,000 meg Ω A.C. volt 100mV.–250V (with R.F. measuring head up to 250 Mc/s) A.C. current 10μA–25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

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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!

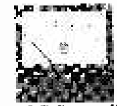
CLEAR PLASTIC METERS

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

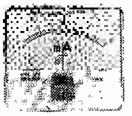
TYPE S-80
80 mm.
square fronts



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. × 4¾in. 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/-

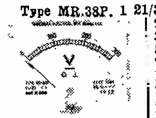
Type MR.52P. 2⅜in. square fronts.

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. 3⅜in. × 3⅛in. 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.¼..	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.



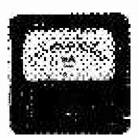
50μA	40/-	200mA	27/6
50-0-50μA ..	37/6	300mA	27/6
100μA	37/6	500mA	27/6
100-0-100μA	35/-	750mA	27/6
200μA	35/-	1 amp.	27/6
500μA	30/-	2 amp.	27/6
500-0-500μA	27/6	5 amp.	27/6
1mA	27/6	10 amp.	27/6
1-0-1mA	27/6	3V. D.C.	27/6
2mA	27/6	10V. D.C.....	27/6
5mA	27/6	15V. D.C.....	27/6
10mA	27/6	20V. D.C.....	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

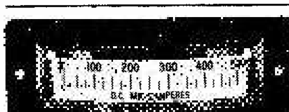
Type MR.65. 3⅛in. square fronts.



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. × 2¾ 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/-	VU meter ..	65/-
200μA	55/-		

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

POWER RHEOSTATS

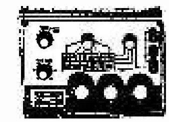
High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range available ex-stock. Single hole fixing, ¼in. dia. shafts. Bulk quantities available.
25 WATT. 10/25/50/100/250/500/1000/1500/2500 or 5000 ohms, **14/6**, P. & P. 1/6.
50 WATT. 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

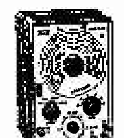


A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1 Ω–11·1 meg Ω 6 Ranges ±1% L.1 μ H - 111 HENRYS 6 Ranges—2% C. 10pF ±1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7⅜ × 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

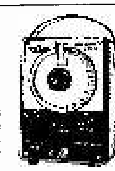


Accurate wide range signal generator covering 120 Kc/s–500 Mc/s on 6 bands. Directly calibrated Variable R.F attenuator, audio output. Xtal socket for calibration. 220/240V. A.C. Brand new with instructions. **£15.** Carr. 7/6. Size 140 × 215 × 170 mm.

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/-.

TY75 AUDIO SIGNAL GENERATOR

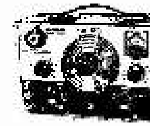


Sine Wave 20c/s to 200 kc/s. Square Wave 20c/s to 30kc/s. High and low impedance output. Output variable up to 6 volts 220/240 volts A.C. Size 210 × 150 × 120 mm. Brand new with instructions. **£16.** Carr. 7/6.

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

← See previous page • G.W. SMITH & Co. (RADIO) LTD. • See opposite page →

DISCOTHEQUE EQUIP. PACKAGE OFFERS

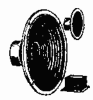
F.A.L. PHASE 50D AMPLIFIER £34.50
PR. R.S.C. L12/25 25W L/S in cabinets £19 00
£53.50
PACKAGE PRICE **£48** carr. £1
Terms Dep £9 and 9 Mthly Pymts £5 (Total £54)

F.A.L. PHASE 50D AMPLIFIER £34.50
PR. FANE POP 50 L/SPEAKERS £21
£55.50
PACKAGE PRICE **£50** carr. £1
Terms Dep £11 and 9 Mthly Pymts £5 (Total £56)

F.A.L. PHASE 100D AMPLIFIER £62.95
PR. L125 50W L/S in cabinets £59.80
£122.75
PACKAGE PRICE **£110** carr. £1.50
Terms Dep £22 and 9 Mthly Pymts £11 (Total £121)

F.A.L. PHASE 100D AMPLIFIER £62.95
4 FANE POP 50 L/SPEAKERS £42
£104.95
PACKAGE PRICE **£95** carr. £1.50
Terms Dep £15 and 9 Mthly Pymts £10 (Total £105)

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. **£5.75**
OR SENIOR 15 WATT INC. HF126 15,000 LINE SPEAKER carr. 35p **£6.75** Carr. 30p

AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS

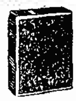
Heavy construction. Latest high efficiency ceramic magnets. Treated Cone surround. "D" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 8–15 ohms. **Please state choice.** Exceptional performance at low cost.

HF801D	8"	8W	£2.71	HF120D	12"	15W	£4.49
HF102D	10"	10W	£3.40	HF126	12"	15W	£5.25
HF120	12"	15W	£3.99	HF126D	12"	15W	£5.75

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 30 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. **£3.50**

HI-FI SPEAKER ENCLOSURES



Modern design. Teak veneer finish. Acoustically lined. All sizes approx. Carr. 25p. per enclosure
JE8 Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi 'speaker. **£4.75**
SE8 For optimum performance with any 8in. Hi-Fi 'speaker. Size 22 x 15 x 9in. Ported **£5.75**
SE10 For outstanding results with 10in. Hi-Fi 'spkr Size 24x15x10in. P'td. **£5.99**
SE12 For exclnt prfmnce with 12in. Hi-Fi speaker and Tweeter. Size 25 x 16 x 10½in. **£6.99**

RECORD PLAYING UNITS

Money saving units. Mounted on Plinth. Supplied with transparent plastic cover. Ready to plug into Amp. or Tape recorder.
RP2C Garrard SP25 Mk II (with heavy turntable) fitted Goldring CS90 high compliance ceramic Stereo/Mono cartridge with diamond stylus. Carr. 50p **£24.65**
RP6C Garrard 5200 Auto Unit fitted Stereo Cartridge
Plinth & Cover as RP2C carr. 50p. **£15**
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. **£3.15**

WITH TRANSP. PLASTIC COVER **£6.30**

LEADING MAKES HI-FI EQUIPMENT AT CLEARANCE PRICES
Available at branches only

SUPER 15 HIGH FIDELITY SOLID STATE AMPLIFIER

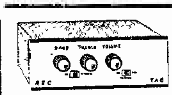
Approx. as Super 30 but single channel. Complete kit with full constructional details and point to point wiring diagrams. Carr. 60p **£13.15**
OR FACTORY BUILT £16.50 Carr. 60p. Terms: Deposit £4.20 and 9 monthly payments £1.55 (Total £18.15) Available in Teak or Afrormosia veneered housing. £20

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 £3 or assembled ready for use £3.50

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



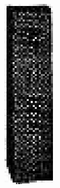
200-250v. AC mains operated. Frequency Response 30-20,000 c.p.s. —2dB. Harmonic Distortion 0.3% at 1,000 c.p.s. Separate Bass and Treble 'lift' and 'cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3-15 ohm spkrs. Max. sensitivity 5mV. Output rating I.H.F.M. Fully enclosed enamelled case, 9¼ × 2¾ × 5½in. Attractive brushed silver finish facia plate 10¼ × 3¼in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£7.35** Carr. 40p
OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE £8.99

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

PUSH-PULL OUTPUT. Two input sockets with sep. vol. controls for mixing. High sensitivity, 5 valves. Bass and treble controls. 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. 60p **£10.50**
SAE for leaflet. Twin handled metal cover £1.75
Factory built £14.75 or Dep. £3 and 9 mthly pymnts of £1.60 (Total £17.40.)

R.S.C. COLUMN SPEAKERS

R.S.C HI-FI CENTRES LTD.



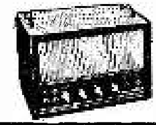
IDEAL FOR VOCALISTS AND PUBLIC ADDRESS
ALL TYPES 15 OHMS COVERED IN REXINE/VYNAIR.
TYPE C4100 ALSO SUITABLE FOR BASS GUITAR OR ELECTRONIC ORGAN

TYPE C48S 25-30 WATTS
Fitted four 8" high flux 8 watt speakers. Overall size approx 48 x 10 x 5 in. Carr 50p
Terms: Dep £3 and 9 monthly payments £1.80 (Total £19.20) **£16.80**

TYPE C412S 50 WATTS
Fitted four 12" 11,000 line 15 watt speakers: Overall size approx 56 x 14 x 9 in. Carr 75p
Terms: Dep. £4 and 9 monthly payments £2.95 (Total £30.55) **£27.50**

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. £5.50 (Total £57.50). Carr. £1 **£50.50**

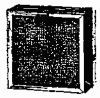
30 WATT HI-FI AMPLIFIER



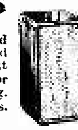
FOR GUITAR, VOCAL OR INSTRUMENTAL GROUP.
A 2 or 4 input. 2 vol. control Hi-Fi unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/gold P.V.C. facia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet.
Terms: Deposit £3.70 and 9 monthly payments of £2.10 (Total £22.60) Carr. 65p **£19.95**

HIGH QUALITY LOUDSPEAKER UNITS

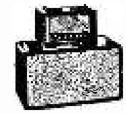
IN TEAK VENEERED CABINETS



L18 13" × 8" 10 Watt 10,000 lines 3 or 15 ohms. State impedance required. **£5.25** Carr. 40p
L12 12" 25 WATT 10,000 lines 15 ohms. **£8.99** Carr. 45p
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. 75p **£29.40**

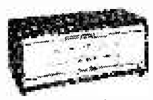


R.S.C. BASS REGENT 50 WATT AMPLIFIER



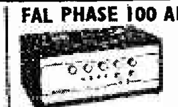
A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape, Peak Output rating.
Loudspeaker unit horizontal or vertical mounting. **£60**
★ **Two extra heavy duty 12in. Loudspeakers.**
★ **Four Jack inputs and two Volume Controls for simultaneous use of up to four pick-ups or "mikes". Bass and Treble controls.** Send S.A.E. for leaflet. Carr. £1.50
Deposit £16 and 9 monthly payments of £5.75 (Total £67.75)

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" 200-250v. A.C. mains.
Peak Output rating.
For fuller details of Phase 50 send S.A.E. for leaflets. **£30.45** Carr. Free

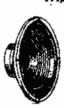
FAL PHASE 100 AMPLIFIER 100W



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 **£61.95**

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
£22.05
Dep: £6 and 9 monthly pymnts £2 (Total £24).

'POP' 60
15" 60 Watt
14,000 gauss
8/15Ω
£12.90
Dep: £3.30 and 9 mthly pymnts £1.30 (Total £15.)

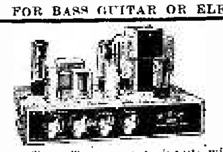
'POP' 50
12" 50 Watt
13,000 gauss
15Ω **£10.50**
Dep £2 and 9 monthly payments £1.15 (Total £12.35)
Pair suitable all purposes

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)
£6.75 Carr. free
or Dep. £1 and 9 mthly payments 75p (Total £7.75).

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



Highly sensitive. Push-Pull high output, Hum level—70dB. 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. For High Impedance microphones. For **Clubs, Schools, Theatres. Dance Halls Outdoor Functions,** etc. For **Electronic Organ, Guitar, String Bass,** etc. Gram. Radio or Tape. Two separate inputs with vol. controls permit such as "mike" and Pick-up etc. to be used for mixing purposes. 200-250 v. 50 c/s A.C mains. For 3 and 15 ohm speakers. Complete Kit of parts with wiring diagram and instructions. Twin-handled perforated cover £1.75 Or factory built with EL34 output valves and 12 months' guarantee for £18.90 **£15.75** Carr. 65p
TERMS: Deposit £3.45 and 9 monthly payments of £2 (Total £21.45). 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 × 2¼ in.
250v., 60mA, 6.3v. 2a 90p
250-0-250v., 60mA 6.3v 2a 95p
FULLY SHROUDED UPRIGHT MOUNTING
250-0-250v. 60mA, 6.3v. 2a., 0-5-6.3v. 2a. £1.25
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. £1.99
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. £1.99
300-0-300v. 130mA, 6.3v. 4a., c.t., 6.3v. 1a.
For Mullard 510 Amplifier £2.40
350-0-350v. 100mA, 6.3v. 4a., 0.5-6.3v. 3a. £1.99
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a. £2.40
425-0-425v. 200mA, 6.3v. 4a., c.t., 5v. 3a. £4.49
425-0-425v. 200mA, 6.3v. 4a., 6.3v. 3a., 5v. 3a £4.69
450-0-450v. 250mA, 6.3v. 4a., c.t., 5v. 3a. £4.99
TOP SHROUDED DROP-THRO' TYPE
250-0-250v. 70mA, 6,3v. 2a., 0-5-6.3v. 2a. £1.20
250-0-250v. 100mA. 6.3v. 3.5a. £1.40
250-0-250v. 100mA, 6.3v. 2a., 6.3v. 1a. .. £1.45
350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a. £1.50
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. £1.99
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. £1.99
300-0-300v. 130mA, 6.3v. 4a., 0-5-6.3v. 1a.
Suitable for Mullard 510 Amplifier £2.35
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a. £1.99
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a. £2.35

FILAMENT or TRANSISTOR POWER PACK
Types 6.3v. 1.5a. 45p; 6.3v. 2a. 49p; 6.3v. 3a. 69p; 6.3v. 6a. £1.15; 12v. 1a. 50p; 12v. 3a. or 24v. 1.5a £1.20; 0.9-18v. 1½a. 99p; 0-12-25-42v. 2a. £1.60
CHARGER TRANSFORMERS 0-9-15v. 1½a. 95p; 2½a. 99p; 3a. £1.10; 5a. £1.30; 6a. £1.49; 8a. £1.35
AUTO (Step UP/step DOWN) TRANSFORMERS 0-110/120v. 200-230-250v., 50-80 watts 99p; 150 watts, £1.70 250 watts £2.49; 500 watts £5.25.
OUTPUT TRANSFORMERS
Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω 45p
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω .. 75p
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Push-Pull EL84 to 3 or 15 Ω 10-12 watts .. £1.20
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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

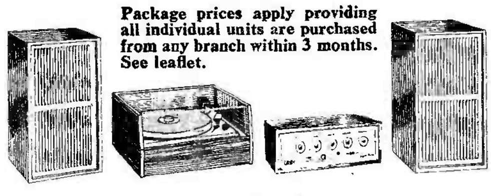
Special Total Price **£79.80** Carr. £1.50

- ★ 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 **£96.60** Carr. £1.50

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 **£56.70** Carr. £1.25

Or Deposit £6.75 and 9 monthly payments £6.25 (Total £63). Trans. Plastic Cover £3.15 extra.

AS ABOVE BUT WITH GARRARD 3000 AUTOCHANGER AND SONOTONE 9TA CERAMIC CARTRIDGE IN LIEU OF SP25 AND CS90 **£51.45** Carr. £1.25

Or Deposit £6. and 9 monthly payments £5.70 (Total £57.30) Trans. Plastic cover £3.15 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 **£42** Carr. £1.25

Terms: Deposit £5.50 and 9 monthly payments £4.50 (Total £46.)

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

LOW DEPOSIT CREDIT TERMS

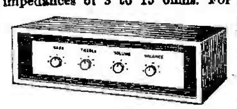
AVAILABLE ON PURCHASES OVER £8 KITS OF PARTS EXCEPTED

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. 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 **£9.99**

Or FACTORY BUILT in Teak veneered cabinet as illustrated **£12.50** carr 40p Or dep. £2 and 9 mthly. pymts. £1.45 (Total £15.05). No leaflet supplied for this unit

PACKAGE OFFER SAVE £4 approx Above G66 assembled in cabinet. plus pair DORCHESTER LOUDSPEAKER UNITS **£27.50** Carr. £1

Or Deposit £5.25 and 9 monthly payments £2.85 (Total £30.90).

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. **£9.45** Carr. 40p.

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 output. See top of page for illustration **£17.85**

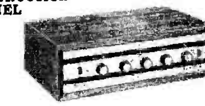
'YORK' HIGH-FIDELITY 3 SPEAKER SYSTEM

- ★ Moderate size only 25 × 14 × 10in. COMPLETE KIT **£22** Carr. 63p
- ★ Response 30-20,000 c.p.s. Impedance 15 ohms
- ★ Performance comparable with units costing considerably more.

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) Handsome Teak veneered cabinet. (7) Circuit and full instructions. Terms: Dep. £4·50 and 9 monthly payments £2·25 (Total £24·75 DEMONSTRATIONS AT ALL BRANCHES

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. **£14.25** Carr. 40p.

Factory built with 12 months guarantee **£17.85** or Deposit £3 and 9 mthly pymts £1.95 (Total £20.55). Or in Teak veneer housing **£21.50** Dep. £3.15 & 9 mthly payments £2.35 (Total £24.80). Send S.A.E. for leaflet

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

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.

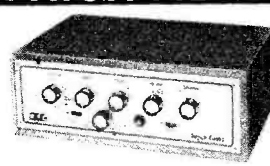
FREQUENCY RESPONSE ± 2 dB. 10–20,000 c.p.s.

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. **£23.25** Carr. 75p.

UNIT FACTORY BUILT £30.50

WITH 12 MONTHS GUARANTEE. or Deposit £4 and 9 monthly payments £3.35 (Total £34.15) or in Teak or Afrormosia veneer housing **£33.75** Carr. 75p Terms: Deposit £4 and 9 monthly payments of £3.75 (Total £37.75). Send S.A.E. for leaflet.

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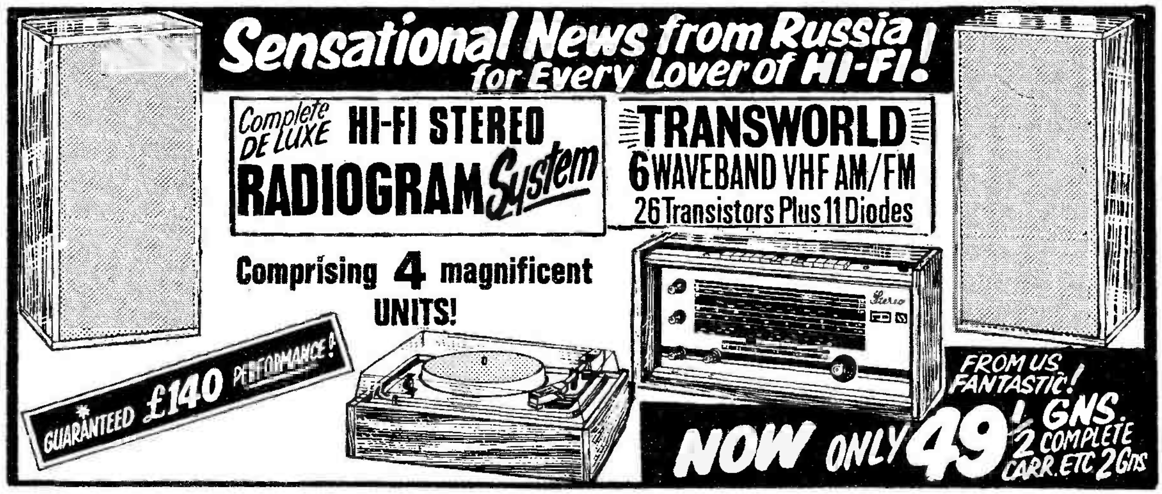

PLEASE DON'T CONFUSE WITH 'HOTCH POTCH' SYSTEMS MADE INTO A SET FROM PARTS OBTAINED FROM A VARIETY OF DIFFERENT SOURCES. THIS magnificent system from a famous Russian manufacturer is a miraculous achievement of Russian technology and only Shopertunitics **bring you this fantastic system (comparable with specifications costing around £140) brand spanking new with written 12 months' guarantee for the unbelievable price of only 49½ gns., carriage, etc., 2 gns. You'll never appreciate the wonderful reproduction possible from your old stereo or mono records until you listen to them on this superb Hi-Fi Audio Unit. It's a breathtaking experience;** but wait, with the 6 Waveband Radio you can get thousands of transmissions from all over the world including ham radio, ships at sea, Continental and international stations. Amazing clarity of tone and incredible station selection. Just read the magnificent specification of this compact fully transistorised high quality sound reproduction equipment in matching unit form:—**Four-speed single Record Player deck,** light-weight arm with "turnover" sapphire stylus and transparent deck cover, etc. (15½" × 12" × 6¾" approx). **Two Speaker Cabinets** (each 18¾" × 9½" × 8" approx), each containing 8" high efficiency units and 3" cone tweeter. **Fully** transistorised **Tuner/Amplifier** (26 transistors, 11 diodes) (18¾" × 9½" × 8" approx) incorporating **VHF AM/FM plus automatic frequency control, LONG, MEDIUM AND 3 SHORT WAVEBANDS Yes, Six WAVEBANDS in all! All instantaneous Press Button Top Panel Controls!** Push-Pull output stage. Frontally controlled rotatable ferrite rod aerial, internal FM aerial, meter type tuning indicator, stereo balance control, separate variable bass and treble controls give superb balance and tone, plus all usual extension sockets. **110, 127, 220, 240v A.C.** All cabinets very strongly constructed—with beautiful gleaming walnut polyester finish—doesn't stain—retains high gloss indefinitely! **Long negotiations and a final purchase for cash made this incredible offer possible! Please don't ask questions —just hurry! Only 500 will be lucky! Spares & U.K. Service constantly available. Send only 49½ gns. plus carriage, crating handling, etc. 2 gns., and test on 7-day appro. No more to pay! OR CALL *U.K. Trade distributors claim that British** models comparing with this specification could cost you £140! We guarantee to refund your money if YOU don't agree!

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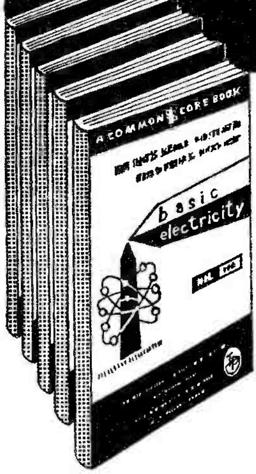

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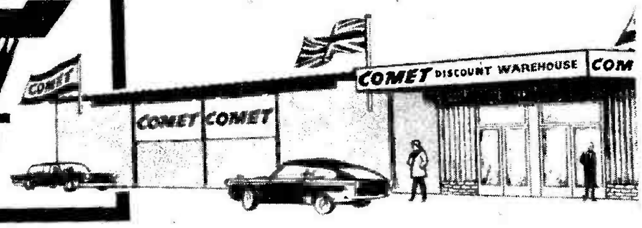

STEREO AMPLIFIERS

	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
*HL505	23 2 0	16 19 6
LEAK Stereo 30 Plus	53 0 0	41 19 6
LEAK Stereo 30 Plus, in teak case	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
METROSOUND ST20	36 0 0	28 19 6
PHILIPS RH 591	76 15 0	55 19 6
PHILIPS RH 590	51 15 0	37 12 6
PHILIPS RH 580	28 0 0	19 19 6
PIONEER SA 500	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
ROGERS Ravensbourne (cased)	64 0 0	49 19 6
ROGERS Ravensbrook	44 0 0	34 19 6
ROGERS 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 203E	28 15 0	19 19 6
TELETON GA 101 30w. RMS	33 15 0	22 19 6
VOLTEX 100w. Stereo Discotheque, eight electronically mixed inputs	185 0 0	139 0 0

Starred items above take ceramic cartridges only. All others take both ceramic and magnetic cartridges.

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.7 FM	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 Sterofetic in teak case	67 3 6	58 19 6
PHILIPS RH 690	44 10 0	31 19 6
PHILIPS RH 691	89 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 GT 101	47 10 0	33 19 6
TELETON 201X FM	36 0 0	29 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 M8 Decoder	9 10 0	7 19 6
ARMSTRONG 525	91 17 9	76 19 6
ARMSTRONG 526	104 14 3	86 19 6
GOODMANS 3000	77 14 7	49 19 6
*PHILIPS RH 781	74 19 6	54 19 6
PHILIPS RH 790	135 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 F2000	51 10 0	31 19 6
TELETON 7AT 20	105 0 0	79 19 6
TELETON 10AT1 150w RMS	160 0 0	109 0 0
*TELETON R4200	51 15 0	35 19 6
TELETON TFS50	75 10 0	55 19 6
*TELETON R.8000 with Speakers	63 5 0	49 19 6
WHARFEDALE 100.1	131 5 0	105 0 0
TELETON CR55	120 0 0	95 0 0

Starred items above take ceramic cartridges only. All others take both ceramic and magnetic cartridges Except for Armstrong (where decoder is extra) all the above Tuner Amplifiers are *complete* with MPX Stereo Decoder.

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CARTRIDGES

	Rec. Retail Price	Comet Price
GOLDRING 800 Cartridge	13 0 0	7 10 0
GOLDRING 800H	10 13 9	7 19 6
GOLDRING 800E	18 17 1	12 5 0
GOLDRING 800 Super E	26 0 1	19 19 6
*GOLDRING CS90 Stereo	5 4 0	4 3 0
*GOLDRING CS91/E	7 16 1	6 4 6
GOLDRING G850	6 10 0	5 2 6
ORBIT Magnetic	Special Price	3 9 6
PICKERING V15 AC2	8 8 0	6 19 6
ORTOFON SL15E	29 12 11	23 12 11
ORTOFON 2X15K Transformer	7 0 0	5 5 4
SURE M3DM	7 8 3	5 5 0
SHURE M31E	12 0 11	9 9 0
SHURE M32E	11 2 4	8 15 0
SHURE M32-3	10 3 10	7 19 6
SHURE M44-5	11 2 4	8 10 0
SHURE M44-7	10 3 10	7 19 6
SHURE M44C	10 3 10	7 19 6
SHURE M44E	12 0 11	9 10 0
SHURE M55E	12 19 5	10 5 0
SHURE M75G	17 12 1	14 0 0
SHURE M75-6	16 13 6	12 19 6
SHURE M75EJ	19 9 1	15 19 6
SHURE M75E-95G	23 3 3	17 19 6
SHURE V15-11	40 15 3	29 19 6
SHURE V15-11-7	38 18 3	31 0 0
SHURE M75E	21 6 2	15 19 6
SHURE M75E/D19	23 3 3	18 18 6

Starred cartridges above are ceramic. All others are magnetic.

TURNTABLES

GARRARD SP25, fully wired with Goldring G800 Magnetic Cartridge. Complete with base, plinth and cover. Special price £20 19 6

	Rec. Retail Price	Comet Price
ARENA SP25, with base and 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 40B	12 11 3	9 19 6
GARRARD SP25 Mk. II	15 11 4	10 10 0
GARRARD AP75	23 16 0	17 10 0
GARRARD SL65 B	19 6 5	14 19 6
GARRARD SL75 B	35 12 4	27 10 0
GARRARD SL95 B	45 9 1	36 10 0
GARRARD 401	31 14 2	25 19 6
GARRARD SL72 B	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 705 P	36 0 0	21 19 6
GOLDRING 705/P	26 0 0	21 19 6
GOLDRING GL69 Mk. II	26 12 6	21 10 0
GOLDRING GL69 P Mk. II	35 5 9	27 19 6
GOLDRING GL75	39 0 0	32 19 6
GOLDRING GL75 P	47 13 4	39 19 6
GOLDRING Covers for 69P and 75P	4 6 7	3 10 6
GOLDRING GL 75 complete with plinth, cover and G800 E Cartridge	67 19 0	53 19 6
GOODMANS 3025	37 14 9	25 19 6
McDONALD MP 60	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	31 10 0	24 19 6
PHILIPS 217	33 0 0	27 4 0
PHILIPS 202 Electronic	69 0 0	54 0 0
PIONEER PL11	50 17 11	39 0 0
THORENS TX 25 cover	8 4 5	6 10 6
THORENS, TD125	75 17 8	61 19 0
THORENS TD 150A Mk. II	43 12 7	35 10 0
THORENS TD 125AB	120 2 11	99 19 6
THORENS TD 150AB Mk. II	47 8 7	39 5 0
THORENS TD TX11 Cover	4 2 3	3 13

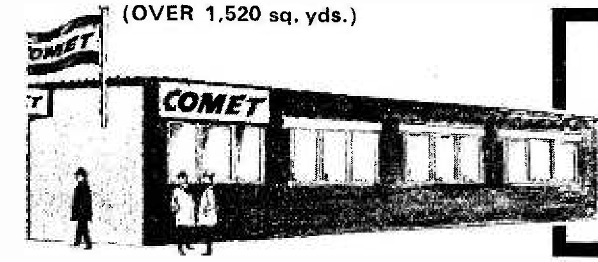
PICKUP ARMS

	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	34 9 5	27 19 6
SME 3012 with S2 shell	36 14 3	29 19 6

SPEAKERS

	Rec. Retail Price	Comet Price
ARENA HT 16	13 0 0	10 19 0
B. & W. Model 70	139 10 0	115 0 0
B & W DM3	63 0 0	52 19 6
B & W DMI	32 0 0	25 10 0
CELESTION Ditton 120	24 0 0	18 0 0
CELESTION Ditton 15	32 0 0	24 0 0
CELESTION Ditton 25	65 0 0	49 0 0
GOODMANS Minster	22 9 0	18 19 6
GOODMANS Majesta	57 0 0	44 19 6
GOODMANS Maxim	20 7 9	16 15 0
GOODMANS Mezzo 3	30 18 0	22 19 6
GOODMANS Magnum K2	40 2 0	28 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
KELETRON KN654/3 3 speaker system (pair)	19 0 0	14 19 6
KELETRON KN824/3 3 speaker system (pair)	23 0 0	18 19 6
KELETRON KN104/3 3 speaker system	16 15 0	12 19 6
KELETRON KN123/3 3 speaker system	18 15 0	15 19 6
KELETRON KN120/4 4 speaker system	24 10 0	18 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
LOWTHER Acousta (with PM7)	53 0 0	45 19 6
LOWTHER Ideal Baffle	35 10 0	29 17 6
PHILIPS RH481	11 0 0	9 2 6
PHILIPS RH482	18 0 0	14 19 6
SINCLAIR Q16	8 19 6	7 19 6
STE-MA 275 3 speaker system	23 2 0	15 0 0
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

(OVER 1,520 sq. yds.)



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	Rec. Retail Price	Comet Price
CHASSIS SPEAKERS		
GOODMANS Axiette 8	7 9 6	5 19 6
GOODMANS Twinaxlette 8	8 8 8	6 19 6
GOODMANS Axiom 10	8 16 8	6 19 6
GOODMANS Axiom 80	26 1 4	21 12 6
GOODMANS Axiom 201	13 9 0	9 19 6
GOODMANS Axiom 301	19 5 0	14 10 0
GOODMANS Audiom 51	12 3 0	9 10 0
GOODMANS Audiom 61	17 12 0	12 19 6
GOODMANS 15P	20 0 0	16 19 6
GOODMANS Audiom 18P	34 0 0	26 19 6
GOODMANS Twin Axiom 10	9 8 5	7 15 0
GOODMANS ARU 172	3 17 8	2 18 6
GOODMANS Trebax 100	7 9 0	5 11 6
GOODMANS Trebax 5K/20KL	8 8 0	6 6 0
GOODMANS Midax	11 4 0	8 8 0
GOODMANS Attenuator	3 1 4	2 6 0
GOODMANS Crossover Networks XO/950/5000	8 8 7	6 6 0
GOODMANS Crossover Networks XO/950	6 7 9	4 15 9
GOODMANS Crossover Networks XO/5000	2 6 0	1 14 6
WHARFEDALE 8in. Bronze/RS/DD	4 8 0	3 13 6
WHARFEDALE Super 8/RS/DD	7 12 0	6 6 0
WHARFEDALE Super 10/RS/DD	12 14 0	10 10 0
WHARFEDALE WMT 1 Matching Transformer	16 9	13 6
LOW COST AUDIO		
ALBA UA552	45 10 0	37 19 6
ALBA UA662	59 15 0	49 19 6
ALBA 1552	45 10 0	37 19 6
BUSH Sound 749/746/764	102 13 0	82 13 0
BUSH Sound A749/A758/A763	165 18 0	135 18 0
DECCA Sound 603	72 10 0	59 19 6
DECCA Sound 604	72 10 0	60 19 6
DECCA Sound 1203	97 10 0	79 19 6
DECCALIAN 5 complete with stand	65 10 0	52 19 6
EKCO S.R.G. 609	88 10 0	69 19 6
EKCO ZU 5	165 0 0	135 0 0
FERGUSON 2065	117 0 0	79 19 6
FERGUSON 3422	84 14 0	68 19 6
GOODMANS 3000 Suite	140 9 0	92 19 6
HMV 2416	129 14 0	104 19 6
HMV 204/5/6	202 17 0	169 19 6
KB KA1250	69 0 0	55 19 6
LEAK 30/GOLDRING/WHARFEDALE	182 12 11	142 19 6
LEAK 70/THORENS/WHARFEDALE	218 14 4	169 19 6
MARCONI Unit 4	77 9 0	66 19 6
MARCONI Unit 3	86 0 0	69 19 6
METROSOUND Stereo 1010	77 6 4	65 19 0
PHILIPS GF 417	94 10 0	78 19 6
TELETON 8-track Stereo	52 5 0	45 19 6
TELETON CMS 400	102 10 0	69 19 6
TELETON 2S60F	75 0 0	55 19 6
TOSHIBA SP8507	248 0 0	199 19 6
QUAD/THORENS/GOODMANS	372 15 3	312 15 3
ULTRA 6405	79 15 0	66 19 6
TAPE RECORDERS & TAPE DECKS		
ALBA R22 Twin Track Battery Mains	50 5 0	29 19 6
AKAI M10L	245 1 0	189 0 0
AKAI X200D	190 0 0	159 19 6
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
AKAI X-360	380 1 6	284 0 0
AKAI X-360 D-deck	318 18 4	243 0 0
AKAI 1800SD	199 8 4	167 0 0
AKAI 4000 4-track Stereo	124 18 0	99 19 6
AKAI 4000 D 4-track Stereo deck	89 19 1	69 19 6
AKAI 1710L 4-track Stereo	89 17 0	69 19 6
BUSH TP 60 Cassette Tape Recorder	29 8 0	24 19 6
BUSH TP 70 Cassette, Battery Mains Tape Recorder	29 19 0	23 19 6
FERGUSON 3244 Stereo 4-track	97 18 0	79 19 6
FERGUSON 3245 Twin Track	37 1 0	29 19 6
FERGUSON 3246 4-track	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
FERROGRAPH 722	242 10 9	202 0 0
FERROGRAPH 724	242 10 9	202 0 0
FERROGRAPH 702/W 2-Track Tape Deck	207 7 0	168 0 0
FERROGRAPH 704/W 4-Track Tape Deck	207 7 0	168 0 0
GRUNDIG C200 Cassette	37 19 10	29 19 6
GRUNDIG TK 141 (4-track)	59 4 8	49 19 6
GRUNDIG TK 121 (Twin-track)	54 15 7	43 19 6
GRUNDIG TK 146 (4-track Auto)	68 2 10	58 19 6
GRUNDIG TK 124 Twin-track	44 18 0	34 19 6
GRUNDIG TK 149 4-track	57 12 8	47 19 6
PHILIPS 3302 Cassette Tape Recorder	28 7 0	19 10 0
PHILIPS 4302 Twin Track Auto.	39 0 0	28 19 6
PHILIPS 4307 4-Track	49 10 0	38 19 0
PHILIPS 4500 4-Track Stereo Tape Deck	126 0 0	98 19 6
PHILIPS 4408 4-Track Stereo	139 0 0	109 0 0
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
PYE Cassette Recorder/Radio (Batt./Mains)	44 8 0	36 19 6
TELETON FXB 510 D 4-track Stereo	62 10 0	47 19 6
TELETON 5L40 Twin Track Battery/Mains	38 10 0	24 19 6
TOSHIBA GT 840 S	110 0 0	79 19 6
TOSHIBA GT 601v Twin Track	45 3 0	29 19 0
TOSHIBA 850 SA	94 0 0	59 19 6
BASES AND COVERS		
GARRARD WB1 Base	3 17 1	3 2 6
GARRARD WB4 Base	5 13 9	4 15 0
GARRARD SPC 1 Cover	3 14 8	3 0 0
GARRARD SPC 4 Cover	4 8 8	3 14 0
SPECIAL OFFER OF BASE AND COVER TO FIT GARRARD SP 25, SL 55, SL 65B and 3500	Special Price	3 19 6
GOLDRING Plinth 75	8 10 4	7 0 0
GOLDRING Plinth 69	8 10 4	7 0 0
GOLDRING Covers for 69P and 75P	4 4 3	3 8 0
THORENS TX11 Cover	4 2 3	3 13 6
THORENS TD 124 Cover	5 1 2	4 10 0
THORENS TD125 Cover	5 1 2	4 10 0
THORENS TD 124 Plinth	7 5 0	6 1 6
SME Plinth System 2000	39 4 0	31 6 0
MOTORBOARDS only	4 18 11	2 19 6
HEADPHONES		
AKAI	6 10 0	5 2 6
TELETON	5 0 0	3 5 0
AGK K60	13 10 0	10 12 6
SHRIRO	Special Price	3 19 6

	Rec. Retail Price	Comet Price
COMPLETE HI-FI SYSTEMS Completely wired, mounted and ready for use		
TELETRON Stereo 8 track tape Audio system complete	52 5 0	45 19 6
GARRARD SP 25 mounted in base plinth and cover with GOLDRING G800 Cartridge. Teleton 203 Stereo Amplifier 12 watts RMS, and 2 KELETRON 654/3 Speakers, each speaker is a 2-speaker system	84 6 6	55 19 6
FERGUSON complete Unit Audio System with 206 STA Tuner/Amplifier and stereo decoder, RP 202 player with Garrard SP 25 and two 3407 Speakers	117 0 0	79 19 6
GOLDRING GL 69P Mk. II mounted in base with hinged lid. Goldring G800 Cartridge, Rogers Ravensbrook Amplifier in Teak case. Two Wharfdale Super Linton Speakers	144 16 0	115 19 6
GOLDRING GL 75P mounted in teak base with hinged perspex cover, complete with Goldring G 800E Cartridge. Leak Stereo 30 Plus Amplifier in Teak case. 2 Mezzo 3 Speakers	182 12 11	142 19 6
THORENS TD 150AB Mark II with TX11 dust cover. Shure M55E Cartridge. Leak Stereo 70 Amplifier in Teak case. 2 Wharfdale Dovedale 3 Speakers	218 14 4	169 19 6
THORENS TD 125AB Electronic Turntable complete with cover. Shure V15-11 Cartridge. Goodmans Maxamp, Goodmans Stereomax AM/FM Tuner. 2 Goodmans Majesta Speakers.	411 9 4	311 9 4

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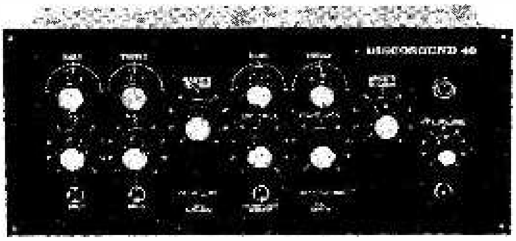

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The Discosound 40 offers the same specification as the D.J. Disco Amp without the power output stage. Size 16in × 7in × 7in. Self powered and ideal for use with the Discosound 100 Power Amplifier below and one of the outstanding features is that it is capable of running ten of these Power Amplifiers (Total 1,000W).

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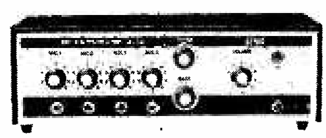
A 100W RMS (8 Ohms) High Fidelity power Amplifier which utilises all silicon transistors of modular construction and features full automatic overload protection against short or open circuits. Frequency response 20–20,000Hz±2dB. The High output is ideally suited for discotheques, groups, clubs, etc., 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.

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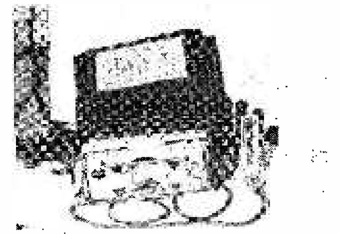

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TRANSISTOR INVERTERS. Both models are brand new.
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Model 2. 12 vdc input 330 vdc at 330mA approx output. £5 15s. plus 5/–d. p.p.
VHF RECEIVER UNIT TYPE R1933A. 18 miniature valve vhf receiver ideal for 2 metres, 4 metres or aircraft band. Requires p.s.u. and oscillator. 45/–d. plus 6/–d. p.p.
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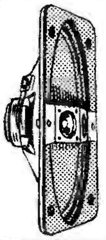

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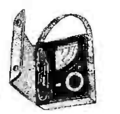
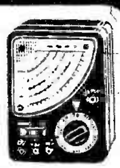
C.1001 MULTI-TESTER



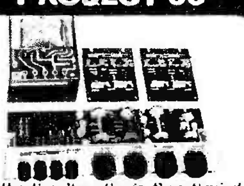
Overload protection. 20,000 opv. AC volts 10, 50, 250, 1,000v. DC volts 5-25, 125, 500, 2500v. D.C. Current 0-50 uA, 0-250 mA. Resistance 0-60K, 0-6 Meg ohm. Decibels—20 to +22dB. Size of meter 4½ x 3¾ x 1in. Complete with case. 85/- P. & P. 3/6.

62 D. 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 4¾ x 3½ x 1in. 71/- P. & P. 3/6.

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).
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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.
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Recommended Retail Price	£53.9.6

LIND-AIR PRICE 39½ gns.
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1710L Stereo Tape Recorder. List £89
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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

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With soft rubber earpieces. Impedance 8-16 ohms. Frequency response 23-13,000 cps. With lead and stereo plug.
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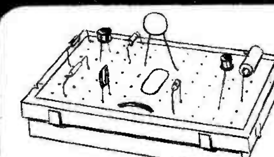

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PRACTICAL WIRELESS

VOL 46 NO 10
Issue 768

FEBRUARY 1971

TOPIC OF THE MONTH

Designer's Trophy 1970

THE PROJECT AUTUMN competition has closed, the entries have been read, the equipment examined—and the judges have retired feeling slightly type-happy. As a result of all this, it is with pleasure that we can now announce that the Practical Wireless Designer's Trophy for 1970 has been awarded to **Caleb R. Bradley** for his winning article, **"A High Impedance Voltmeter"**. The formal presentation of the silver cup will be made at the Practical Wireless/Mullard Film Show at Caxton Hall on Friday, March 5th.

Other entries which were selected by the judges as deserving special mention include the following (not given in order of merit): "Transistorised Oscilloscope" by **J. R. Ransome**, "Stereo Decoder" by **A. Barber**, "Language Laboratory" by **N. Howie**, "Enlarger Timer" by **D. Smith**, "Punchcard Operated Safe" by **A. Birds**, "Oscilloscope Trigger Unit" by **P. Rouse** and "A Novel Door Alarm" by **D. Cross.** The winning entry will be published in the April issue and others will appear in future issues.

So much for the successful competitors, but what of the losers? Entries were judged on a combination of factors, including originality, construction, presentation, technical accuracy and so forth. Thus it is not, perhaps, surprising that many articles were returned due to non-originality, poorly written text (in the literal sense), badly designed circuits, unnecessary complexity. A few entries featured circuitry which could never work properly (some of these, however, were nicely built!) but the main reason for failure seemed to be inability to grasp the *type* of article and the *style* required. Authors are free to develop a theme in their own way, but certain conventions should be followed (which can be determined by studying samples from recent issues). To help those wishing to try again, we will be publishing shortly some hints on how to set about writing for P.W.

Getting back to Project Autumn, readers will note that the professional regulars stood aside from the competition, thus leaving it wide open to anyone interested enough to put in the effort. Congratulations to the winner and to the runners-up in the 1970 contest and our thanks to *everyone* who entered into the spirit of the event and sent something along. And remember—now is the time to start thinking about your entry for the 1971 Trophy, details of which will be given in the near future.

W. N. STEVENS—*Editor.*

MARCH ISSUE WILL BE PUBLISHED ON FEBRUARY 5

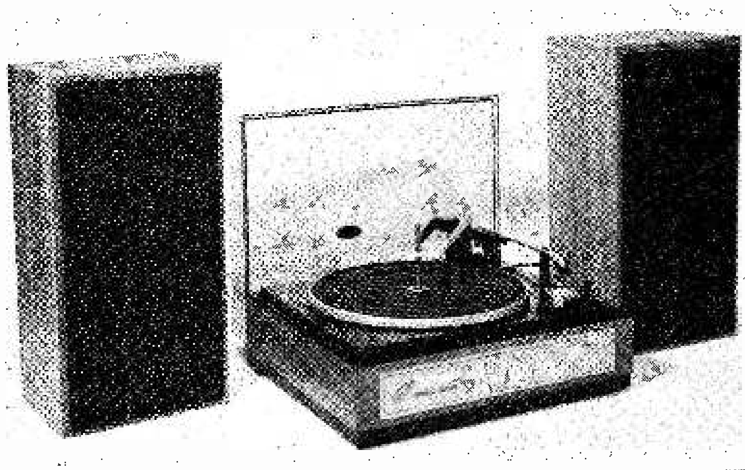
NEWS AND COMMENT

CONSTRUCTIONAL

OTHER FEATURES

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

Compact Unit Audio



The Apollo Unit Audio Hi-Fi system employs a Garrard 2025 TC deck and Garrard G.C. 536 cartridge. Amplifier output is 5W per channel, frequency response 40-20,000Hz and controls are volume, bass, treble and balance. Speakers are in polished teak and comprise a 6in. twin cone bass unit and a $2\frac{1}{2}$in. parasitic tweeter with LC crossover. The suppliers stress that this unit is 100% made in England and supply a 12 months guarantee. The plinth, cover and amplifier unit measures $14\frac{1}{2} \times 12\frac{3}{4} \times 7\frac{1}{2}$in. and the speakers measure $14\frac{1}{2} \times 8 \times 6\frac{1}{2}$in. The price is 36gns. and postage, packing and insurance come to 50s. *Audio Supplies (PW) 50 Stamford Hill, London, N.16.*

Bristol reader wins Hi-Fi Competition

Remember the Hi-Fi Competition which appeared in our November issue? Entrants were invited to put in order of importance eight features applying to the Decca 3000 Series audio unit system.

All entries were examined and it was decided that the best entry was that submitted by Mr. A. R. Dyke, of Bristol, whose order was: 1-J; 2-K; 3-L; 4-E; 5-A; 6-D; 7-B; 8-C.

Congratulations to Mr. Dyke who becomes the winner of a Deccasound 3000 Series Hi-Fi system, worth over £200.

Our thanks, too, to all readers who joined in the competition and helped to make it such a great success.

Mini Power Supplies

Bentron Electronics have developed a new series of miniature power supplies.

The maximum input voltage is, depending upon the model, 40 volts to 70 volts and the output voltage 4 volts to 60 volts. All parts are absolutely protected against overload and each unit is completely short circuit proof. Encapsulation by epoxy resin ensures full protection against humidity and mechanical influence which results in unusually high reliability. Further information: *Rastra Electronics Ltd., 275 King Street, London, W.6.*

The Transensor

The Transensor offers complete slide/commentary synchronisation from one standard-type cassette recorder. Synchronised commentaries are made both sides of an ordinary compact cassette tape. No special tapes are required and no extras or "small black box" are needed as a separate unit from the recorder.

The makers claim that this is the only recorder/sychroniser in its price range that allows one to erase the sync pulses independently of the commentary on both sides of the cassette tape.

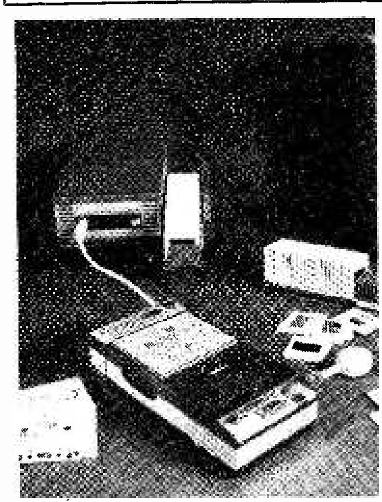
The miniature amplifier in the Transensor is powered by a PP3 9V battery and when the battery current is below a working strength, a warning tone can be heard on the recording position. This prevents the synchroniser from being used until a new battery is put in. The switch of the Transensor is situated in the 4-pin DIN plug connecting lead, so that the synchroniser will be in the "on" position automatically when used in conjunction with the projector and in the "off" position when the plug is removed. Price is £43 which includes recorder/Transensor, microphone, C60 cassette, carrying case, lead for connecting Transensor to projector, 2 separate manuals and 1 year guarantee. *Audio Visual Picture Enterprises, 17 Abercorn Place, London, N.W.8. Phone 01-328 1461.*

£20 Prize Winner

The winner of the £20 prize in the competition run in conjunction with Public Opinion Surveys questionnaire is: Mr. H. C. Anthony, 25 Edwalton Avenue, Peterborough.

Trouble getting P.W.?

Some readers report having difficulty in obtaining their copies of *Practical Wireless*. We strongly recommend that if this is the case, a regular order should be placed with a local newsagent. If difficulty is still encountered, please write to me direct, giving all the relevant information.—*Editor*.



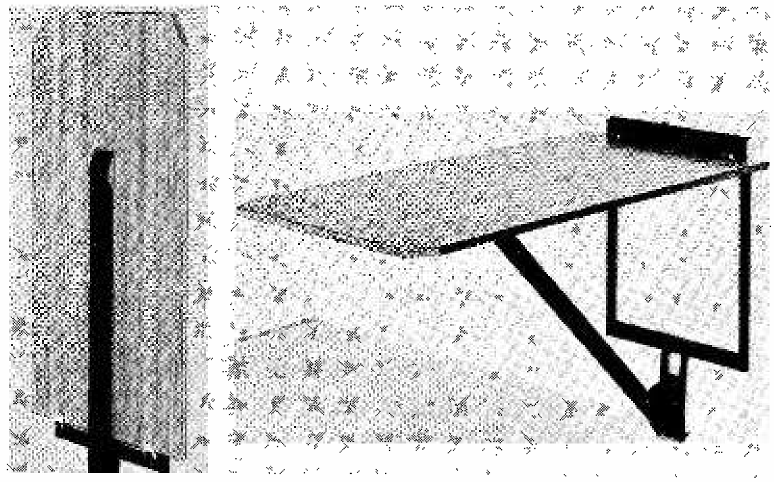
NEWS... NEWS... NEWS...

More Room

A useful working surface for those with small shacks or just a corner of the kitchen, is provided by the Foldette—a folding table. Fixed to the wall by a simple: do-it-yourself system, it can be pulled down with one easy movement, to provide 8 square feet of peace-restoring extra space.

The Foldette takes up no valuable floor space whatsoever. It has no legs to impede the endless to-ing and fro-ing that goes on, and when finished with, it can be pushed up again, with just one hand, to lie flat, protruding only 2¾in. from the wall. It has a specially designed balance mechanism engineered to return the table to the wall automatically if it is pulled down less than 30 degrees. If it is pulled down more than that it stays put—and doesn't descend on to your head just as you bend to pick up a dropped screw. Gentle downward pressure brings it into the positive, ready for use position where it can accept a weight of up to 500 lb.

A choice of three colours for the wipe-clean plastic laminate top fits the table into most decorative schemes. White, Blue, and Yellow, are available, with two patterns—Grey Tweed and Teak Wood Grain. The strong, steel frame is finished in black stelvetite—a coating which gives a pleasant grained effect to the metal. The table costs approximately £25, with the mechanism guaranteed for 12 months. The Foldette is supplied complete with everything needed for fixing, including clear, easy-to-follow instructions. *Polydesigns Limited, Coronation Road, High Wycombe, Bucks.*



The Foldette table shown in folded and open positions.

Baker Speakers

A new model—the "Regent" has been introduced by Baker Reproducers Ltd. and sells at £7. The D.W.1. Laboratory Loudspeakers 12in. model now has a double central metallic ellipse.

Copies of the leaflet giving details of Baker speakers may be obtained from *Baker Reproducers Limited, Bensham Manor Road Passage, Thornton Heath, Surrey.*

Readers are cordially invited to the

Practical Wireless and Television Film show

(in collaboration with Mullard Ltd.)

at

Caxton Hall, Caxton Street, London, S.W.1

(Great Hall Site)

on

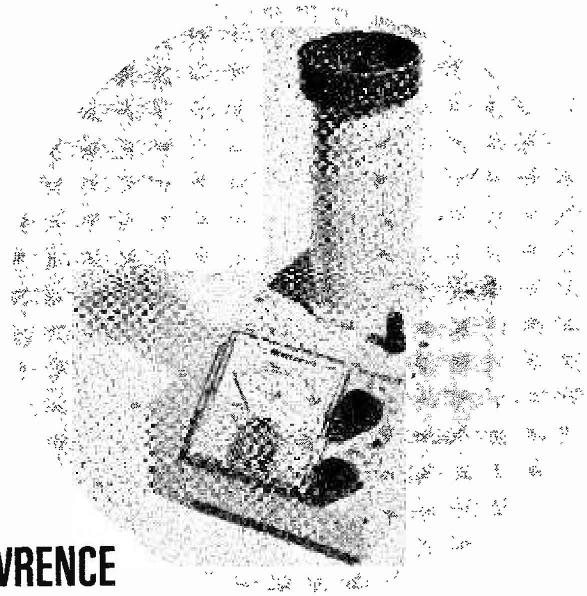
Friday 5th March, 1971

7-15 p.m. for 7-30 p.m.

W. N. Stevens, Editor of "Practical Wireless" and "Television" will be in the chair

The films this year include "The Electron's Tale" and the lecture will be entitled "The I.C. Story-Continued" and the principal speaker will be Ian Nicholson of Mullard Ltd. Free refreshments will be served during the interval. For tickets send a stamped addressed envelope marked FILMSHOW to: Practical Wireless Editorial, I.P.C. Magazines Ltd., Fleetway House, Farringdon Street, London, E.C.4.

THE E.H.T. Voltmeter, to be described, may be built in two versions, either as a simple single range 0-25 kilovolt meter, consisting of high resistance series resistor and a 0-50 microamp meter, or as a sophisticated multi-range instrument which will have many uses in the electronics field, as well as in television servicing. The multi-range version has ranges of 2·5kV, 5kV, 10kV and 25kV, with a constant input resistance of 500MΩ on all ranges.



MULTI-RANGE E.H.T. VOLTMETER

J. THORNTON LAWRENCE

Single-range Version

The basic circuit of the single range E.H.T. Voltmeter is shown in Fig. 1. The internal resistance of the meter is negligible compared with the series resistor R1 and so can be neglected. The deflection of the meter is determined by the input voltage and the series resistor, giving a full scale reading of 25kV.

$$\text{Im (50 microamps)} = \frac{\text{Vin (25kV)}}{\text{R1 (500M}\Omega\text{)}}$$

The series resistor is identical to that used in the multi-range version and the construction of it is described later.

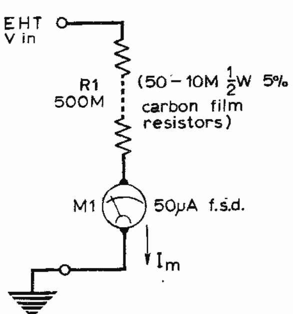


Fig. 1. Basic circuit of single-range EHT voltmeter.

Multi-range Version

The multi-range version of the E.H.T. Voltmeter employs an integrated circuit operational amplifier of the '709' type, operating as a d.c. amplifier and driving an indicating meter, as shown in Fig. 2.

In the circuit, the operational amplifier has negative voltage feedback connected in shunt with the input signal. The '709' type of amplifier has an 'open loop' gain in excess of 20,000, and as the demanded gain for the circuit, on the most sensitive range, is only 10, the overall voltage gain of the amplifier circuit, for all practical purposes, is determined entirely by the ratio of the feedback resistor Rf to the series resistor R1. The output voltage can be expressed as:

$$\text{Vout} = \text{Vin} \times \frac{\text{Rf}}{\text{R1}}$$

The meter deflection depends on the output voltage of the amplifier and the meter series resistor Rm (which includes the resistance of the meter), and may be expressed as:

$$\text{Im} = \frac{\text{Vout}}{\text{Rm}}$$

The meter deflection for any input voltage can therefore be expressed as:

$$\text{Im} = \frac{\text{Vin} \times \text{Rf}}{\text{R1} \times \text{Rm}}$$

To change the voltage range, it is necessary to change the value of one of the resistors in the circuit, and the most convenient one to change is Rf.

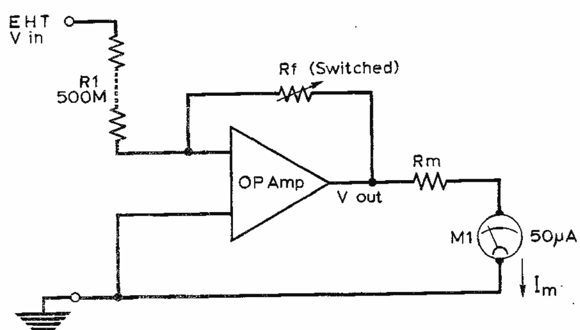


Fig. 2. Basic circuit of multi-range EHT voltmeter using an i.c. operational amplifier.

Working out the values of Rf required to give the desired voltage ranges, with R1 = 500MΩ, Rm = 100kΩ and Im = 50 microamps, we get the following results:

Vin	*Rf for full scale reading*
25kV	100kΩ
10kV	250kΩ
5kV	500kΩ
2·5kV	1MΩ

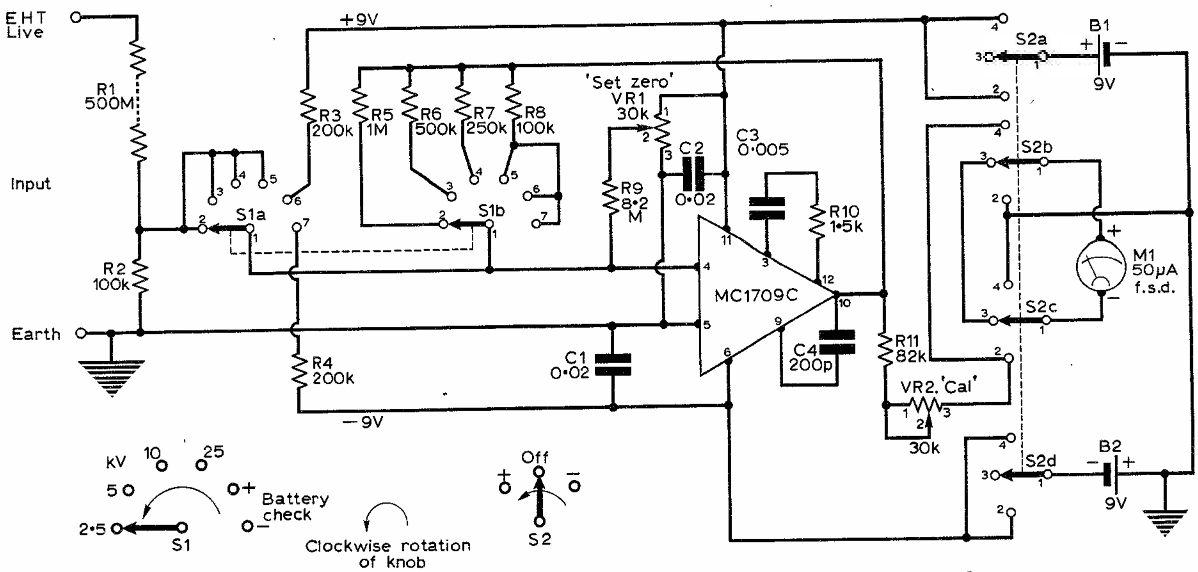


Fig. 3. Complete circuit of the multi-range voltmeter. Switch contacts and knob rotation shown from rear.

In the practical circuit, the meter series resistor, Rm, actually consists of a fixed resistor of 82kΩ, a pre-set variable resistor of 30kΩ and the internal resistance of the meter. The variable resistor is adjusted to give the required total value of 100kΩ. Should R1 not be exactly 500MΩ, due to resistor tolerances, the value of Rm can be adjusted slightly by this variable resistor to compensate for these inaccuracies and thus give the correct full scale reading.

Circuit

The full circuit of the Multi-range E.H.T. Voltmeter is shown in Fig. 3. The e.h.t. voltage to be measured is connected to the input terminal and the current through R1 is passed through S1a to the inverting input of the operational amplifier, pin 4. The output of the amplifier, pin 10, is fed back to the input through the selected feed-back resistor, R5 to R8, and S1b.

The output of the amplifier is also fed through R11, VR2, S2b, S2c and the meter, M1. Switch S2 performs several functions, section S2b and S2c reverse the connections to the meter for positive and negative e.h.t. inputs, and short circuits the meter when the instrument is switched off. Sections S2a and S2d connect the positive and negative supply rails to the positive and negative batteries when the instrument is in use.

An internal battery check position is provided on S1a by switching to R3 to check the positive supply battery and to R4 to check the negative supply battery. The range of the meter in these positions is 10 volts full scale.

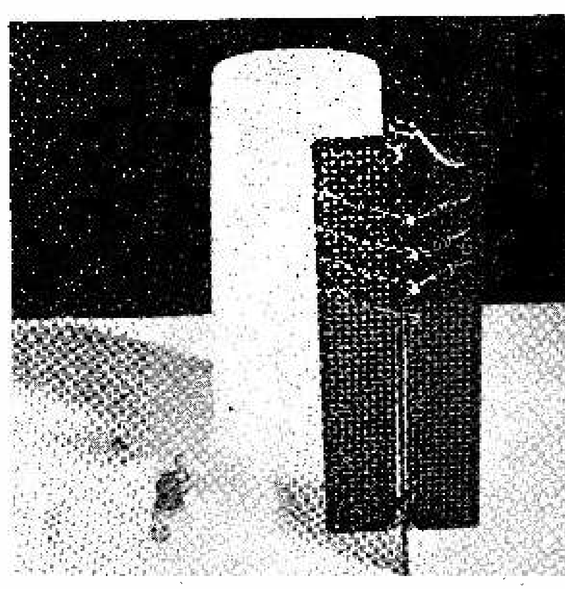
The operational amplifier has a small input current which would cause an off-set voltage at the output. A compensating current is provided by VR1 and R9 to bring the output of the amplifier to zero. This control is the "Zero" control and is adjusted on the most sensitive, 2·5kV, range for zero indication on the meter.

Capacitors C1 and C2 provide decoupling for the amplifier and C3, R10 and C4 are compensation components to ensure stability of the amplifier when operated with considerable negative feedback.

Resistor R2 is included at the bottom of R1 to prevent voltage building up across S1a if the switch was in the battery check position, with e.h.t. connected to R1. R2 does not affect the accuracy of measurement as it shunts the input of the amplifier, which is very low resistance due to the large amount of negative feedback being used.

E.H.T. Resistor

The heart of the E.H.T. Voltmeter is the chain of voltage dropping resistors which have to be capable of being connected to 25kV. Because of the high voltage involved, it is necessary to employ a special method of construction that will keep the voltage across each individual resistor to a satisfactory value and to allow adequate insulation between adjoining resistors in the chain and to surrounding objects.



Photograph of the partially assembled e.h.t. resistor chain.

This is done by mounting fifty 10MΩ ½ watt resistors on a framework by two perforated S.R.B.P. (Synthetic Resin Bonded Paper) boards which are housed in a plastic beaker, Fig. 4.

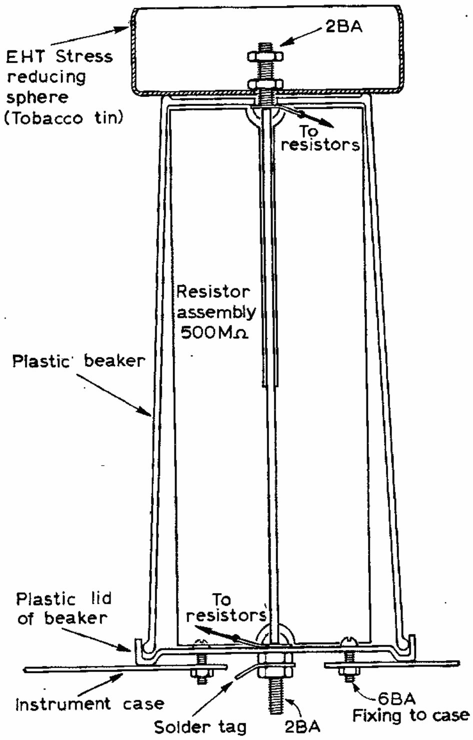


Fig. 4. Assembly details of the e.h.t. resistor in its protective container.

The 10MΩ resistors are fitted in a spiral fashion by starting at one end and moving one line of holes (0·1 inch) further as each resistor is fitted, so that between each resistor and the one directly below it, there are three blank holes, as shown in the drawing. It is important to make clean soldered joints, with no spikes of solder or wire sticking out as at very high voltages any sharp points will cause corona breakdown.

To reduce any tendency for corona discharge to take place, from the top input terminal of the resistor assembly, it is fitted with a stress reducing partial-sphere consisting of a round edged tobacco tin.

Instrument case

The metal for the top cover is cut, marked out, drilled and folded as shown. The position of the bends have been arrived at empirically and it is advisable to check the position of the markings by physically comparing these with the lower part of the case before actually making the bend.

When the cover is fitting snugly on the lower part of the case, the fixing screw holes can be marked through and then drilled for self-tapping screws or drilled and tapped 6BA. The case may be sprayed with car touch-up enamel or covered with 'Fablon' or 'Contact' material and lettered with 'Letraset.'

Meter and Amplifier

The amplifier circuit is built on a 0·1in. x 0·1in. matrix Veroboard panel, size 3 in x 2·6in., which is mounted directly onto the meter terminals. The layout of the plain side of the Veroboard panel and the wiring connections are shown in Fig. 5. A break in the copper strip, on the reverse side, is shown as an 'X' on the drawing.

It is necessary to use the 0·1in. matrix Veroboard because the Integrated Circuit holder used has a 0·1in. pin spacing. As there is only 0·05in. between the copper strips, it is important to use a small soldering iron bit and to avoid using excess solder when fixing the components as this may result in a short circuit between adjacent strips.

★ components list

Resistors :

R1 500MΩ*	R5 1MΩ 1%	R9 8·2MΩ 10%
R2 100kΩ 10%	R6 500kΩ 1%	R10 1·5kΩ 10%
R3 200kΩ 1%	R7 250kΩ 1%	R11 82kΩ 5%
R4 200kΩ 1%	R8 100kΩ 1%	

* Constructed from fifty (50) 10MΩ ½W 5% resistors.
All resistors ½W carbon film (Home Radio).
VR1 30kΩ pre-set VR2 30kΩ pre-set

Capacitors :
C1 0·02μF 160V poly C3 0·005μF 250V disc
C2 0·02μF 160V poly C4 200pF 250V SM

Integrated Circuit :
Motorola MC1709C (Bi-Pak BP709)
I.C. socket (Bi-Pak TSO14)

Switches :
S1 2-pole 6-way midget wafer
S2 4-pole 3-way midget wafer

Miscellaneous :
Meter M1, 50μA f.s.d. (Henrys MRA-65B).
Veroboard (1) 0·1 x 0·1in. matrix, 3 x 2·6in.
Matrix boards (2) (Radiospares Type 187).
Knobs (1 Type WK, 1 Type PK with trims, Radiospares).
Batteries (2) PP9, and connectors.
Polythene beaker (Tudor Rose, Woolworths).
Earth terminal, plastic feet, high-tension cable.

Set Zero and Calibration Controls

The ZERO and CAL controls are of the pre-set type and the knobs protrude through the back of the instrument. To avoid any possibility of accidental misadjustment, the CAL control is set in from the panel by using spacers and long screws so that the knob is only just showing, whereas the ZERO control knob protrudes the normal amount.

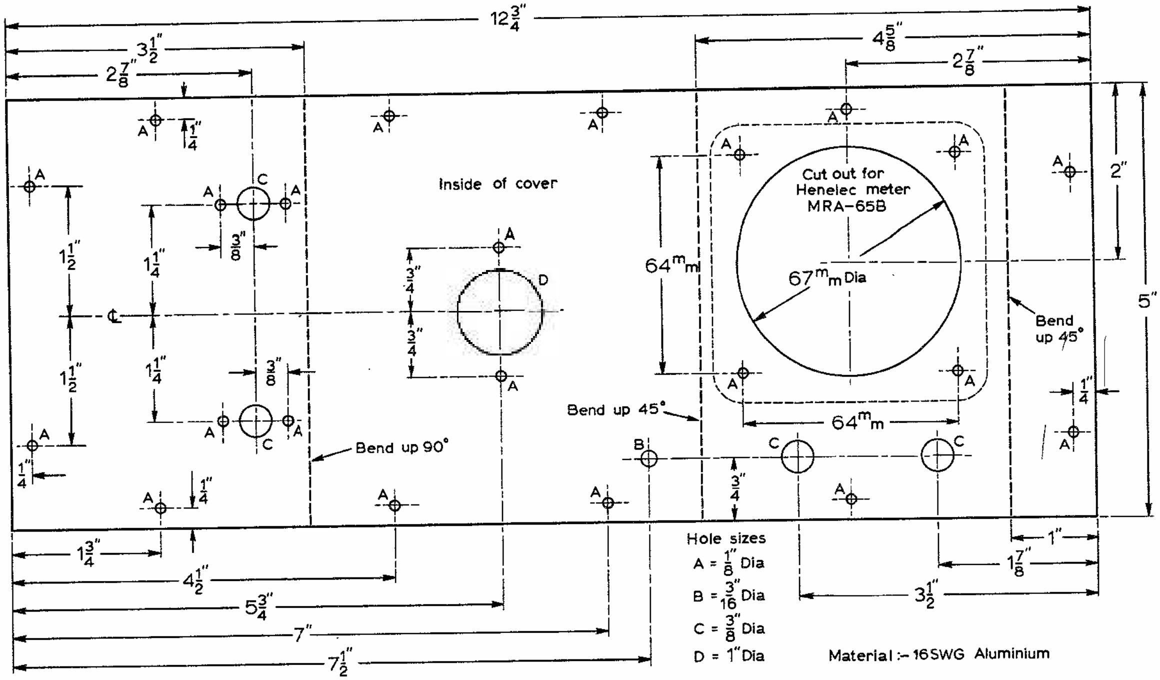
Range and Polarity Switches

The range switch is a 2-pole 6-way midget wafer switch and is mounted in the upper hole on the front panel. The switch positions, reading from left to right, are −, +, 25, 10, 5 and 2·5. The first two positions enable the negative and positive batteries to be checked and the other positions indicate the full scale reading in kilovolts.

The polarity switch is a 4-pole 3-way midget wafer switch and is mounted below the range switch. The positions are −, OFF and +.

Connecting Leads

The earth lead from the Voltmeter should be of a reasonable size, say 23/·0076, and should terminate



Marking out and drilling details for the top of the instrument case.

in a reliable crocodile clip, so there is no danger of the lead fracturing or becoming un-clipped. The e.h.t. connecting lead should be of special high tension cable, such as Radiospares 'E.H.T.' cable, which is suitable for operation up to 18kV.

For voltages higher than this it is possible to remove the braiding from co-ax cables, to obtain a conductor with the required insulation. The inner conductor and insulation on Uniradio 43 is good to 21kV and Uniradio 67 to 38kV.

Some kind of probe tip arrangement is useful when working on voltages up to about 5kV, but a simple hook at the end of the probe is probably the best arrangement for general use as it can be hooked on and left without being held. The probe used with the prototype was made from a giant ball-pen case.

The E.H.T. Voltmeter should be carefully connected to the circuit under test by first connecting the earth terminal of the voltmeter to the chassis of the equipment. In the case of t.v. receivers, all the usual precautions regarding mains connected chassis should be observed.

It is most important to exercise the greatest care when working on the e.h.t. circuits of electronic equipment where these are derived directly from a 50Hz mains transformer. Always stand on a rubber or plastic mat, work using one hand only and keep the other in your pocket and never stick your head near the e.h.t. voltage or inside the equipment. After switching off, ensure that all the e.h.t. capacitors are discharged by shorting them out with an earthing lead.

Calibration

As with any transistor equipment, the wiring should be double checked, particularly the polarity of the battery supplies, before switching on.

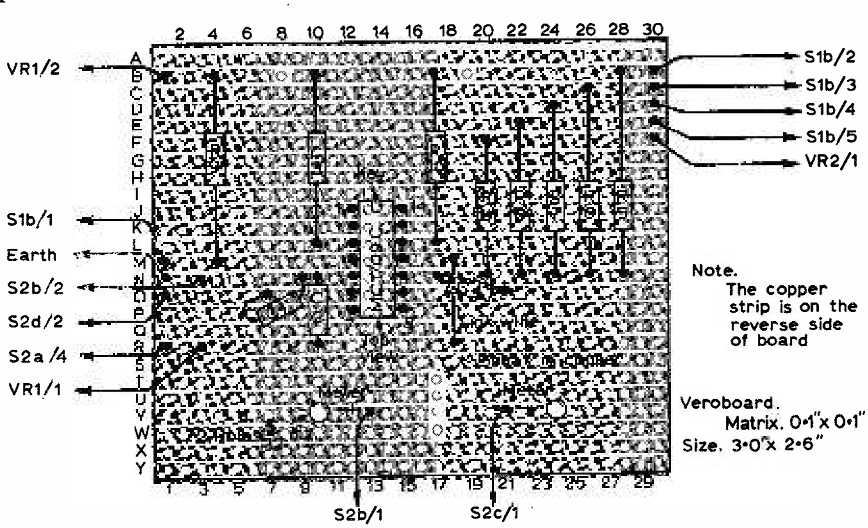
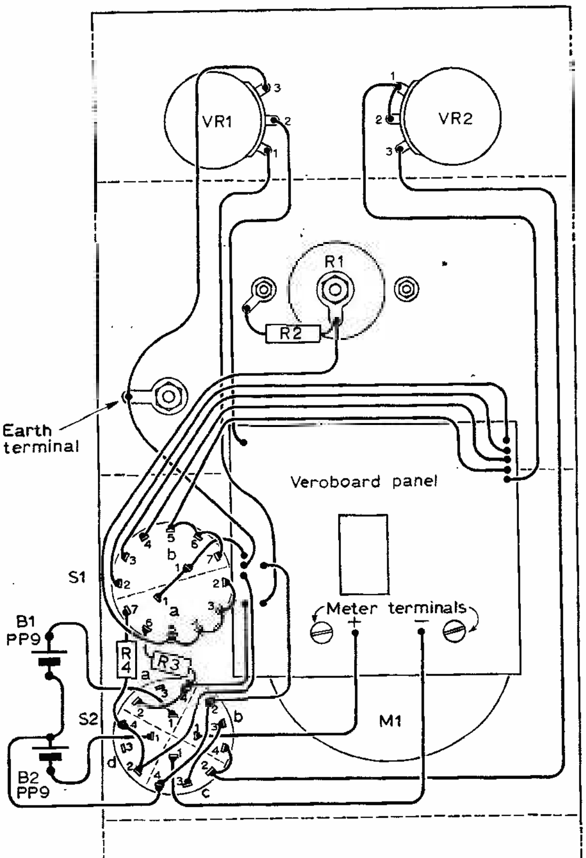


Fig. 5. Circuit board component layout.

1. With the Polarity switch at OFF, check the mechanical zero of the meter.
2. Set the Range switch to 2·5kV.
3. Set the Polarity switch to +.
4. Adjust the amplifier ZERO control for zero indication.
5. Switch the Polarity switch to − and check that the meter is still at zero.
6. Connect the meter to an accurate supply of 2·5kV and set the CAL control to give full scale reading. The accuracy on the other ranges should be within about 3%.



Practical wiring layout of the EHT multi-range voltmeter.

If no accurate e.h.t. supply is available the meter may be calibrated as follows:

Fit two new PP9 batteries.
Complete operation 1 to 5.

7. Switch the Range switch to +.
8. Switch the Polarity switch to +.
9. Adjust the CAL control for an indication of 9·6 volts, (48 on the 0-50 scale).
10. Switch the Range and Polarity switches to − and check that the voltage reading is the same.
11. If there is any difference, adjust ZERO control so that 9·6 volts, (48 on the scale), is midway between the + and − indications.

The calibration of the e.h.t. ranges should now be accurate to within about 7% of the full scale reading of the range in use. ■

THE MW COLUMN

ASIATICS have been prominent on the medium waves this winter. On some parts of the band they appear in the spaces between European channels and are audible in the evenings before local stations close down for the night. Hopei 940kHz which lies between AFN 935kHz and Toulouse 944kHz, has been picked out several times by the writer at 2200hrs GMT. The programmes are unmistakably Chinese. Calcutta 1130kHz can be found on the l.f. side of the burble on 1133kHz, it signs off at 1700hrs but has been logged again at 2210hrs after sign on. Three Japanese stations reported recently to Medium Wave News are JOIB Sapporo on 750kHz at 2115hrs GMT; JOBB Osaka 830kHz at 2030hrs; JOLB Fukyoka 870kHz at 2105hrs while Chinese have been reported between 2100hrs and 2230hrs GMT on 660, 740, 770, 860, 920, 1020, 1280, 1290kHz. KSBU 1360kHz in the Ryuku Islands (Okinawa) now signs on at 2000hrs and has been logged at 2130hrs. Taiwan (Formosa) has been heard at 2000hrs from BED96 900kHz and at 2100hrs from BED97 1100kHz. The VOA operates a 1000kW Voice of Free Asia in Thailand on 1580kHz which was heard recently in Holland at 2200hrs and by the writer at 2240hrs. Bagdad Iraq is a consistent signal during the evening on 760kHz while from the Persian Gulf there is Kuwait 1345kHz and the BBC relay on Masirah Island on 1410kHz, both being logged at 2100hrs. Omdurman Sudan on 960kHz is on the air until 2200hrs with Arabic programming but should not be confused with the stronger signal from Tunis on 962kHz.

There is an Asiatic station on 200kHz on the long waves which has been heard after the close down of BBC-2 at 0110hrs GMT, with music that is neither oriental nor arab in style. The language is unknown to the writer but is probably Turkmenian, since Ashkhabad, which is located north of Iran and east of the Caspian Sea, is listed on this frequency. This station has been heard several times and on one occasion was strong enough to produce a beat on the S meter before Droitwich signed off. Prague on 272kHz closes down at 0100hrs GMT with multilingual announcements, to clear the channel for Novosibirsk in Siberia, which has been heard with news in Russian.

The two oldest broadcasters in the United States—KDKA and WBZ—which were featured recently in the *Going Back* series, are still on the air and are often logged by DXers in this country. KDKA Pittsburg is on 1020kHz and WBZ Boston is on 1030kHz. Listen after midnight when the path is open, and both will be heard. The third oldest is WBT Charlotte North Carolina now on 1110kHz, which is usually logged together with CBD Saint John, New Brunswick on the same channel. Other U.S. stations in the centre of the band are WINS 1010kHz in New York City; WHN 1050 also in NYC; WBAL 1090 in Baltimore. From Canada there are CKBW 1000kHz in Bridgewater Nova Scotia; CJRP 1060 in Quebec City (in French) and CBA 1070 Moncton N.B.

Charles Molloy

AMATEUR BANDS COMMUNICATIONS RECEIVER

PART 3

W. CAMERON

RF Amplifier/First Converter

In order to reduce the complexity of the switching, the tuned circuits are arranged round a 4-wafer, single pole, 8-way switch, S1a-d. Any compromise is more than made up in efficiency, particularly as there is only one switch contact per circuit instead of the usual two or three, plus a bonus of considerably simplified wiring. The circuit is shown in Fig. 11.

Tr1 is used in the common collector mode, which provides a sufficiently high input impedance (about 100kΩ) directly across the tuned circuit.

The 7MHz coil L2 is permanently in circuit, a capacitor C2 being switched across it in the 3·5MHz position to resonate the coil in this band, while on the h.f. bands another coil is switched in parallel to resonate in the required band.

The series resistor R10 in the base of Tr2 deliberately holds down the gain which would otherwise be excessive, and also reduces the loading of Tr1, at the same time helping to keep the gain constant on all bands, as the load is now almost purely resistive.

The same method of switching is used in the collector circuit of Tr2. A low impedance link carries the signal to the mixer Tr3 via C8. In the interests of low noise, the oscillator injection is at a rather low level (about 100mV). The output from the mixer is via the screened lead to L1 in the second converter stage.

Probably the nearest that one can get to stability approaching that of a crystal (in an oscillator circuit) is the series tuned Colpits circuit. This has a number of good points, not least being the fact that small changes in inductance have little effect on oscillator frequency, which is as well, as the band switch has to be part of the inductance. In fact, due to being in the low impedance end of the coils, the switch has no effect on oscillator frequency. It is possible to zero beat a signal on one band and then switch around, returning to this band, when the signal will still be in zero beat.

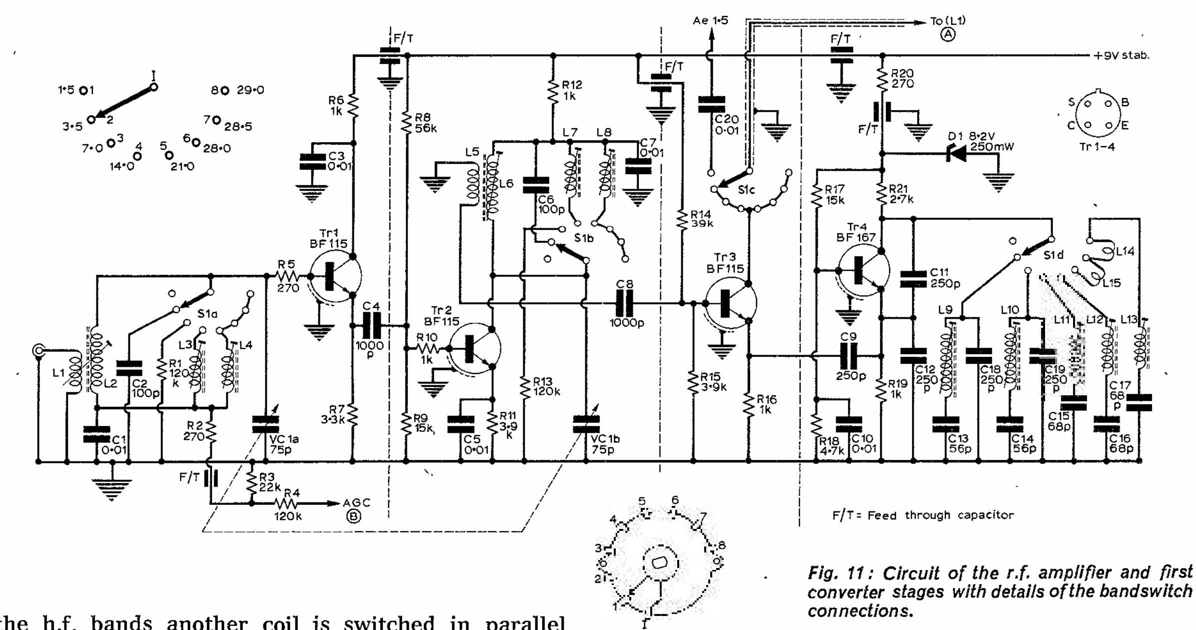


Fig. 11: Circuit of the r.f. amplifier and first converter stages with details of the bandswitch connections.

As a point of interest, it should be possible to use this converter with any receiver covering 1·5-2·0MHz (or even 1·0-1·5MHz) by taking Tr3 collector to the 9V line via an r.f. choke or a 2·2kΩ resistor, and coupling via a 0·01μF capacitor and screened lead to the receiver aerial and earth sockets. Test voltages are given in Table 4.

Construction

The unit is built up in a box chassis, fabricated from tinned plate with aluminium end panels, each stage being screened from its neighbour by a partition screen, also of tinned plate.

The chassis measures 6 × 4 × $1\frac{3}{4}$in and the assembly details are shown in Fig. 12. Partitions and end plates should be cut very slightly undersize. Drilling is completed before the pieces are assembled but note that the two screws holding the front of the gang also secure that side of the front plate. Take care that all the holes for the switch wafers are aligned correctly, any undue stress on the switch sections will cause excessive wear and erratic operation later on.

TABLE 4

	Collector	Base	Emitter
Tr1	8·9	1·0	0·4
Tr2	8·8	1·4	0·9
Tr3	9·0	0·9	0·3
Tr4	4·5	2·0	1·4
Measured with 20kΩ/V meter			

When all the parts of the box are ready, the front plate and gang are fitted first, then the switch shaft, indexing mechanism, and first switch wafer. The mounting position of the wafer is as Fig. 11. Mark the positions of the three partitions as these are fitted only after the wiring-in of the components in each previous section has been completed.

Next wire up the first stage as in Fig. 12. The coil formers are secured with impact adhesive and earth returns are soldered direct to the chassis.

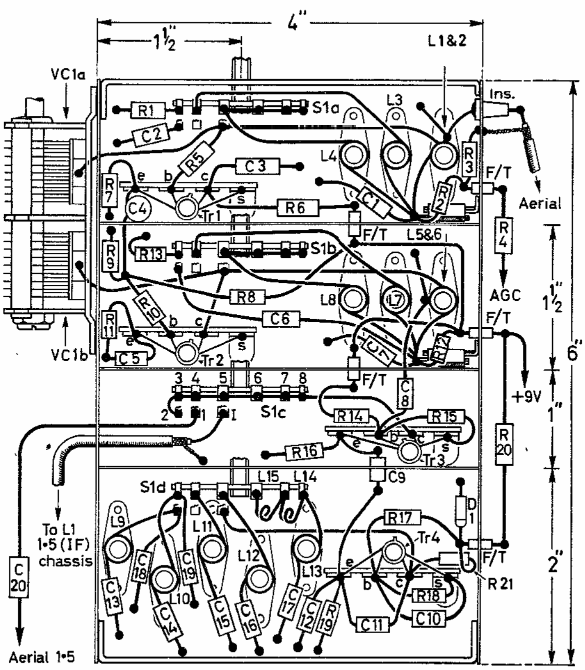


Fig. 12: Wiring details of the r.f. amplifier and first converter stages. Winding information for the inductors is given in the adjacent table.

The first partition, with the second wafer secured, is now soldered into position, and wiring of the second stage completed. The procedure is repeated for the third and fourth stages.

Alignment

This will be made easier, if the r.f. coils are first roughly pre-tuned. To do this, solder a diode (OA70 or similar) to the live side of VC1a and connect a meter from this to chassis. Set the gang to mid-position and inject a 3·8MHz signal into L1, switching to the 80m band. Adjust the core of L2 for maximum reading on the meter. The reading will depend on the output available from the signal generator, but can be expected to be half a volt or so. If more, the output from the generator should be reduced; if less, use the 50 or 100 microamp range of the meter. An indication of maximum reading is all that is required. Repeat the procedure on the 14 and 21MHz bands.

The coil L2 is common for both 7 and 3·5MHz bands and L4 for 21 and 28MHz bands, the swing of VC1a being sufficient to accommodate the two adjacent bands in each case.

The coils in the second stage can be adjusted in the same way by connecting the diode to VC1b and injecting the signal into L5.

Note that the unit is *not* connected to a power supply for these adjustments.

Assembly and Final Alignment

With the aid of the cover photograph of the receiver (December 1970 issue of PW) and the below-chassis view in Part 2 (January 1971) the various units can now be assembled on to the common chassis which is 12 x 9 x 2in and made of 18 s.w.g. aluminium. The panel 12 x $4\frac{1}{8}$in (12 x $4\frac{5}{8}$in with flange) is bolted to the front to carry the tuning

INDUCTORS

		Function
L1	3 turns p.v.c. insulated wire over earthy end of L2	
L2	50 turns 36 s.w.g. enam. close wound	AE 80/40
L5/6	As L1/2	RF 80/40
L3, L7	28 turns 32 s.w.g. enam. close wound	AE/RF 20
L4, L8	15 turns 24 s.w.g. enam. close wound	AE/RF 15/10
L9	65 turns 36 sw.g. enam. close wound	Osc. 80
L10	40 turns 32 s.w.g. enam. close wound	Osc. 40
L11	20 turns 24 s.w.g. enam. close wound	Osc. 20
L12	15 turns 24 s.w.g. enam. close wound	Osc. 15
L13	9 turns 24 s.w.g. enam. close wound	Osc. 10
Above inductors wound on Radiospares formers $\frac{1}{4}$in. dia. with dust cores.		
L14, 15	Each 2 turns 24 s.w.g. tinned copper wire $\frac{1}{8}$in. i.d. self-supporting	Osc. 10

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17A	—	9/6	10/6	12/6	14/6	17/6	21/-	28/-

*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	4/6		
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 2/6 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	87/6	PA246	62/6
PA230	22/6	PA263	46/-
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Our stocks and range of I.C.s. are continually expanding and we invite queries for types not show from Enthusiasts and Industrial users.

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TAA241	32/6	FJH101	17/6
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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

Data and App. Sheets 2/6 SL403A 42/6

TRIACS

SC41D, 6A 400V 25/-

SC41B, 6A 200V 22/-

40512, 6A 400V 33/-

SC50D 60/-

THYRISTORS

PIV	50	100	200	300	400
IA	5/-	5/6	7/6	8/-	9/6
4A	9/6	11/-	11/6	—	16/6
5A	—	11/-	13/-	—	15/-
7A	—	11/-	13/-	—	19/6

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

VEROBOARD

	0·15 *Matrix*	0·1 *Matrix*
2½ × 3¾in	3/6	4/-
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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)	17/-	—
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

⅛ 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/-
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POTENTIOMETERS

Carbon:
Log. and Lin., less switch, 3/-.
Log. and Lin., with switch, 4/6.
Wire-wounu Pots (3W), 6/6.
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.

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CALLERS WELCOME HRS, 9-5.30 Mon-Sat

scale, drive and S meter. This panel is mounted with the flange forward so that the scale is recessed behind the front panel proper which can also be of aluminium with cut-outs to show the scale and S meter.

The interconnections of the units can now be made and the alignment of the r.f. stage and first converter completed.

Connect the voltmeter to the a.g.c. test-point, set the main tuning control to 2·0MHz (near minimum capacity) and "R.F. Tune" to near maximum capacity. Switch to the 80 metre band and inject a signal of 3·5MHz and adjust the core of L9 for maximum, reducing the input signal to obtain accurate tuning. Now adjust L6 and then L2 for maximum, always reducing the generator output so that the meter reading (a.g.c. voltage) does not exceed about 3 volts.

Leave the main tuning at 2MHz and reset "R.F. Tune" to mid-position and repeat the above procedure on the remaining bands. Note that the r.f. cores will not require adjustment on the 40 metre or 10 metre bands; it is only necessary to tune "R.F. Tune" to maximum on these bands.

In each case, the oscillator is tuned to a signal injected at the low frequency end of the respective band, i.e., 7, 14, 21, 28, 28·5 and 29MHz. In the case of the 10 metre band, L13 is adjusted first to 29MHz, after which L14 and 15 are adjusted if necessary to 28·5 and 28MHz respectively, by squeezing or opening the turns as required.

It will be noted that the second converter gang is at minimum capacity when tuning the l.f. end of the bands (except Top Band) and vice versa. This is because the i.f. produced (signal out) is the difference frequency between the fixed oscillator and signal-in frequencies. Table 5 should make this clear.

TABLE 5

Signal In	Oscillator	Signal Out
3.5 4·0	5.5	2·0 1·5
7·0 7·5	9·0	2·0 1·5
14·0 14·5	16·0	2·0 1·5
21·0 21·5	23·0	2·0 1·5
28·0 28·5	30·0	2·0 1·5
28·5 29·0	30·5	2·0 1·5
29·0 29·5	31·0	2·0 1·5

Frequencies in MHz

On the h.f. bands it is possible to tune the r.f. circuits to the other side of the oscillator; for example, to 18MHz instead of 14MHz to produce the same i.f. so the approximately correct position for this control for each band should be marked on the front panel.

★ components list

Resistors:

R1 120kΩ	R8 56kΩ	R15 3·9kΩ
R2 270Ω	R9 15kΩ	R16 1kΩ
R3 22kΩ	R10 1kΩ	R17 15kΩ
R4 120kΩ	R11 3·9kΩ	R18 4·7kΩ
R5 270Ω	R12 1kΩ	R19 1kΩ
R6 1kΩ	R13 120kΩ	R20 270Ω
R7 3·3kΩ	R14 39kΩ	R21 2·7kΩ

All resistors ¼W 10%

Capacitors:

C1 0·01μF ceramic	C11 250pF poly 5%
C2 100pF poly 5%	C12 250pF poly 5%
C3 0·01μF ceramic	C13 56pF poly 5%
C4 1000pF poly	C14 56pF poly 5%
C5 0·01μF ceramic	C15 68pF poly 5%
C6 100pF poly 5%	C16 68pF poly 5%
C7 0·01μF ceramic	C17 68pF poly 5%
C8 1000pF poly	C18 250pF poly 5%
C9 250pF poly	C19 250pF poly 5%
C10 0·01μF ceramic	C20 0·01μF ceramic

VC1a-b 75 + 75pF ganged (Jackson type U102)
F/T 1000pF Feedthrough capacitors (5)

Semi-conductors:

Tr1 BF115	Tr3 BF115
Tr2 BF115	Tr4 BF167

D1 Zener diode 8·2V 250mW

Miscellaneous:

S1a-d 4-wafer switch, each single pole, 8 way (NFS type FPA/DM)
Tag strips (4) 3 way plus earth. Chassis 6 x 4 x 1¾in, see text.

Aerials

A separate socket is provided for Top Band, for which an ordinary end fed aerial is suitable, although a coaxial socket could be used, to feed from an aerial tuner unit.

On all other bands, the input impedance approximates to 80 ohms, and for best results the aerial must be matched to this impedance. A dipole aerial would provide the correct impedance, but it will be difficult to have a dipole for each band! The alternative is to use an end fed aerial coupled to the receiver via an a.t.u. or a multiband dipole.

Muting

When working in conjunction with a transmitter, the receiver can be muted by inserting a switch (or break-in relay) in the 9V supply line after the zener diode.

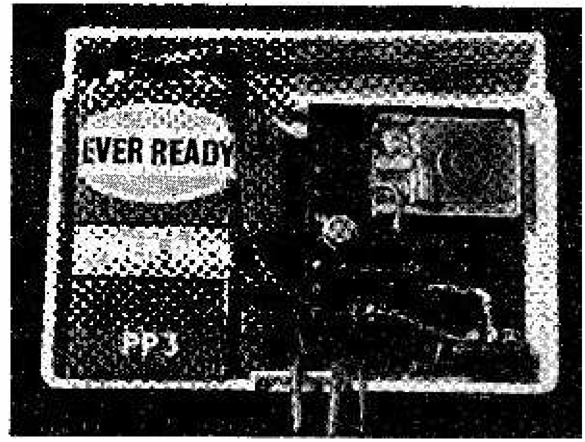
It will be a wise precaution to fit a pair of low capacity diodes (such as AA119) back-to-back across the first transistor input circuit. These can simply be connected across VC1a (R.F. Tune) with a physically small d.c. blocking capacitor of 1,000-5,000pF in series with them. The purpose of the diodes being to protect the first transistor against damage from r.f. from the transmitter. If a resistor is inserted between one of these diodes and earth, a voltage will be developed across it during "transmit". This can probably be used via a d.c. amplifier, to operate a transistor switch in the 9V supply line (before the zener in this case). ■

TAKE 20

JULIAN ANDERSON

No. 22 METAL LOCATOR

A series of simple transistor projects, each using less than twenty components and costing less than twenty shillings to build.



The components can be mounted on a small piece of Veroboard which in turn is mounted inside a small plastic box. The three wires at the bottom go to the search coil.

WE get all the American electronic magazines in the office and after reading through a few of them you realise that they are nutty on "Treasure Finders". Circuit after circuit crops up and the advertising pages are full of them. I would have thought that the amount of buried treasure on the other side of the Atlantic was minute compared to that in Britain but we don't seem to have caught the bug for these.

Metal locators work on a variety of principles—some are extremely complicated—but the simplest type is very simple indeed and, when used with a transistor radio, consists only of the circuit in Fig. 1.

All the circuit does is to oscillate at a frequency in the medium wave band. The coil part of the circuit is the business end of the device. When standing in free air, away from metal objects the oscillator will work at a particular frequency which can be varied by VC1. However, as soon as a metal object is moved near this coil its inductance will increase and the frequency of the oscillator will fall. The amount of this decrease will depend on the proximity and size of the metal object. By itself this is of course no good; since the frequencies are at r.f. we can't hear them. We can, however, make this signal beat with an existing signal whose frequency does not vary and we shall then be able to hear the note as a whistle.

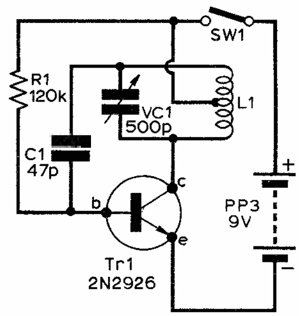
The existing signal we are using is the carrier of a local broadcast station; if we set our oscillator very close to that of a local station we will hear a beat note which can be tuned by VC1 and we hear this over the set's loudspeaker as a whistle. With this principle you will still hear the station but the sound will be low compared to the whistle. You don't have to make any connection to the radio set, it need only be near the oscillator (within a few inches).

The Circuit

The simple r.f. oscillator used is shown in Fig. 1. VC1 can be any 500pF variable but the cheapest type and the easiest to mount is one of the Radiospares compression trimmers; this will have a wide enough range for our purposes. C1 is the feedback capacitor and R1 the base bias resistor. L1 is the search coil and this consists of 30 turns of wire, any normal type, wound onto a former between 3" and 4" in diameter. A tap at 15 turns is necessary. A number of things can be used for the former, in the prototype it was the cardboard inner ring from a large roll of "Sellotape". A 4ft. length of planed timber $\frac{3}{4}$" x $\frac{3}{4}$" is used as the handle and this is joined to a shorter piece of similar section wood jammed inside the cardboard former. The wires run up the handle to the rest of the circuit. Make sure that these wires are securely taped to the handle as they must not be allowed to flop about since this will cause a slight change in frequency.

Apart from L1 the rest of the circuit is built into a small plastic box with the battery and the on-off switch. This box can be screwed to the handle and the transistor radio held near it with elastic bands.

Layout and construction are not critical at all but the photograph shows the prototype built on Veroboard.



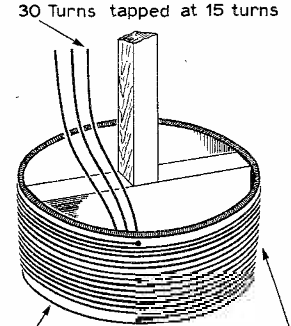


Fig. 1 (left) The circuit of the metal locator.
Fig. 2: (right) The construction of the search coil.

When built the radio should be switched on and a station tuned in. The oscillator should then be switched on and VC1 varied until a beat note is heard. When the coil at the other end of the handle is moved near a metal object, the frequency of the beat note will change. Getting good results is a matter of practice but it will be found that gas pipes and electrical conduit can be traced under the floor boards and pennies inside books can be detected. As far as finding treasure is concerned that is up to you but for ambitious readers remember that the Crown Jewels of King John were lost in the Wash and still haven't been found—Good Luck! ■

ROC ELECTRONICS

20 PROJECT SOLAR ELECTRONIC KIT
Model R.128

This ultra modern Project Kit is shaped for the space age. Carried inside a transparent domed 4½in capsule the R.128 comes complete with a self-contained solar cell to power any one of 20 projects ranging from a one transistor radio to a morse set complete with key and morse training code. Supplied complete with easy to follow instructions and even the cement to assemble this unique electronic space capsule.

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Using a robust Solid State Integrated circuit the R.127 kits will build any one of these projects: (1) Germanium Radio. (2) Test Oscillator. (3) Morse Telegraph Training Set. (4) I.C.I. Transistor Radio. (5) Germanium 1 Transistor Radio. (6) Record Player Amp. (7) Continuity Tester. (8) AF Signal Tracer. (9) Radio Transmitter. (10) Water Purity Tester.

PRICE £3.10.0

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Like all Roc Electronic Kits the R.126 uses reliable no-solder connections to produce a complete 2 transistor radio in under 2 hours. As well as battery operation the kit is supplied complete with a solar cell to provide power from the Sun or any strong light source.

EXCLUSIVE

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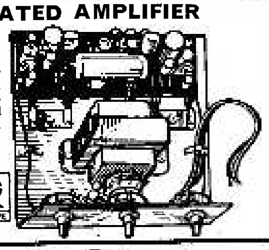
CRYSTAL RADIO KIT Model R.125

This easy to build Radio is based on the same circuit developed by Marconi for the very first radio transmission but uses a modern ferrite aerial for maximum efficiency. A perfect introduction to Radio Theory.

EXCLUSIVE

PRICE £1.10.0

5 WATT STEREO INTEGRATED AMPLIFIER CHASSIS Model R.123



Mounted on a heavy gauge chassis the fully transistorised R.123 stereo amplifier is completely self-contained even down to ganged volume and separate tone controls. For a simple stereo amplifier of excellent quality all you have to provide is the cabinet and control knobs.

SPECIFICATION:
Output: 5W total, 2·5W per channel.
Input sensitivity: 600mV at 2·2Mohms.
A.C. 240v. operation

EXCLUSIVE

PRICE £4.19.0

5 WATT 8 TRACK CARTRIDGE STEREO AMPLIFIER Model R.133

Just slot in one of the many 8 track cartridge tapes available for a continuous programme of your favourite music. A manual programme override switch enables you to switch from one track to the next at the push of a button at the same time a numbered indicator lights up to show which track is playing. Beautifully finished in an oiled walnut cabinet the R.133 is mechanically engineered to provide long and reliable service. SPECIFICATION—Tape speed: 9·5 cm/sec (3¾ i.p.s.). Wow & flutter: better than 0·3%. Frequency range: 40-12,000Hz. Cross talk: better than 45dB at 1,000Hz. Output: 5W total. 2·5W per channel. Amplifier outputs: 200mV.

EXCLUSIVE

PRICE £36.0.0

40 WATTS STEREO AMPLIFIER Model R.131

Looking as good as it sounds the R.131 stereo amplifier offers excellent quality and value for money. Housed in a handsome wooden cabinet this new Roc Amplifier uses the latest solid state circuit techniques to give a specification second to none at the price.

SPECIFICATION—Output: 40W total 20W per channel. Frequency Range: 20-35000Hz. Inputs: Phone: Mag, 3.6mV R.I.A.A.; Xtal, 100mV; tape, 200mV; tuner, 200mV. Control: Bass, treble, volume left, volume right, selector main/remote speakers, power on/off, loudness and stereo/mono.

EXCLUSIVE

PRICE £25.0.0.

AM/FM/MPX STEREO TUNER Model R.132

Matching the R.131 amplifier in both styling and performance the R.132 tuner covers AM and FM including stereo multiplex channels. A separate meter indicates signal strength and tuning on both AM and FM Bands. A usable FM sensitivity of 3μV means that the R.132 can be used anywhere, even in different stereo reception areas.

SPECIFICATION:
FM: frequency range: 87–108MHz. Usable sensitivity: 3μV for 20dB quieting. Stereo separation: 30dB at 1KHz. Image rejection: 60dB. AM: Frequency range: 525–1605 KHz. Usable sensitivity: 250μV.

EXCLUSIVE

PRICE £36.0.0.

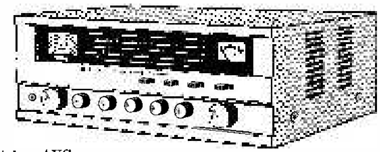
4 BAND SHORT WAVE RECEIVER KIT Mod. R.140

This excellent transistorised battery operated kit will not only provide hours of entertainment when made up but also in its construction.
It receives the normal broadcast band 550 KhZ—1.6MhZ and on shortwave 1.5 MhZ—30 MhZ in three bands.
The 32 page manual not only shows step by step instructions on how to assemble the kit but also includes a guide on broadcasting stations throughout the world.

PRICE: £9.8.0

EXCLUSIVE

PROFESSIONAL SOLID STATE FOUR BAND COMMUNICATION RECEIVER Model R.135

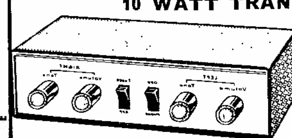


This is the communication receiver that you have long been waiting for. Fully transistorised and continuous coverage from 555 KhZ–30 MhZ in four bands including illuminated electronic bandspread for 160—10 metres. Also incorporated is an internal speaker, automatic noise limiter, SSB/AM/CW Switch, AVC Switch, S Meter, Receive and Standby Switch, external socket for headphone or speaker, bandspread control, BFO control, on/off/AF gain, band selector, antenna trimmer and RF gain. The R.135 will run off of 240v AC, dry batteries or any 12v DC negative ground source.

EXCLUSIVE

PRICE: £45.0.0

10 WATT TRANSISTOR STEREO AMPLIFIER MODEL R.137

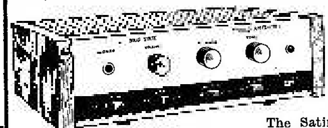


With separate tone and volume controls on each channel and inputs for both phono and tuner, this 10 Transistor Amplifier is the ideal start to an excellent budget system. Frequency response 70–20 KHz. Output impedance 8-16 ohm. Attractively styled with brushed aluminium front panel.

PRICE: £9.10.0

EXCLUSIVE

10 WATT BUDGET STEREO ALL TRANSISTOR AMPLIFIER Model R.136



Ideal as a second stereo system or for the newcomer to Hi-Fi who wishes to upgrade existing equipment the R.136 sounds every bit as good as it looks. As well as inputs for crystal or ceramic cartridge the R.136 has a Stereo Tuner input which accepts the matching R.134 Stereo AM/FM Tuner.

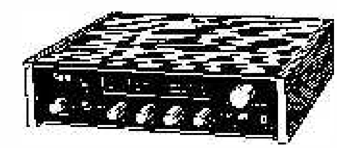
The Satin Finish front panel carries a stereo headphone socket as well as volume, balance, tone, (all ganged) speaker, mode and selector controls. Supplied complete with oiled walnut enclosure.

SPECIFICATION: Output: 10 Watts Total. 5 Watts per Channel. Frequency Range: 35-18,000Hz. Inputs. Phono and Tuner

PRICE: £13.0.0

EXCLUSIVE

STEREO FM/AM/MPX TUNER AMPILFIER
Model R.124



Another Roc Exclusive offering top value for money performance the R.124 is a Stereo Tuner/Amp with facilities only usually found in much more expensive units. Features like separate bass and treble controls, automatic frequency control switch and stereo headphone socket give the R.124 a price to specification ratio second to none. Housed in a handsome walnit cabinet the classical low line styling of the R.124 will grace any home.

SPECIFICATION: FM : Frequency Range: 88-108 MHz; Usable sensitivity: 20μV; Stereo Separation: 26db at 1 KHz, 20dB Minimum.; Image Rejection: 55 dB; AM: Frequency Range: 535-1605 KHz; Usable Sensitivity: 300μV; Audio Section: Total Output Power: 4 Watts; Phono Input: 200mV at 1 megohm. Tape Input: 100mV at 100 Kohm.

PRICE £29.19.0

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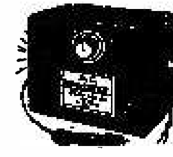

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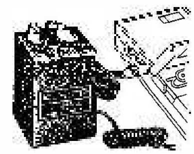

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Circuit

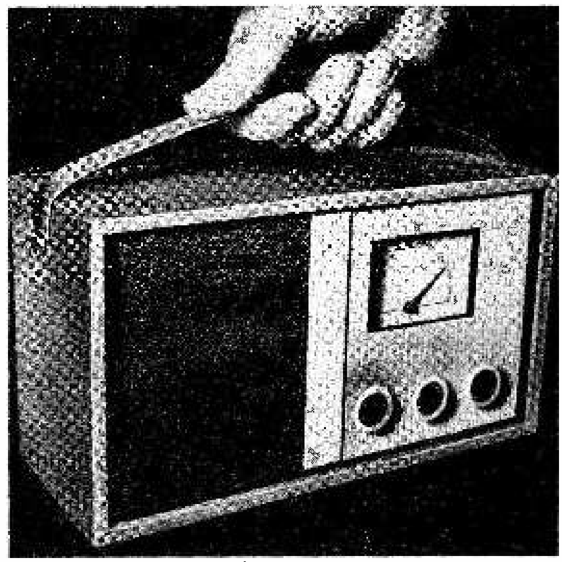
This is shown in Fig. 1, and will be described briefly because the receiver is an ideal project for the beginner.

Signals are picked up by the ferrite rod aerial, of which L1 is the medium wave winding, and L2 the long wave winding. Tuning is by one section, VC1, of the ganged capacitor. When the wavechange switch S1 is at M, L2 is shorted out, for m.w. reception. Coloured flexible leads are attached to the aerial windings for identification. L3 is the base coupling winding, supplying the mixer transistor Tr1.

L4 is the oscillator coil, with emitter and collector coupling windings. It is tuned by VC2, the second section of the ganged capacitor. For m.w. reception C5 is in circuit, and is of such a value as to allow correct tracking. That is, L4 is tuned higher in frequency than L1, throughout the band, and the difference in frequency is that of the intermediate frequency amplifier.

When S1 is in the L position for long waves, C3 and the trimmer TC2 are shunted across C5 and VC2, and change the frequency coverage of L4 for long wave reception.

The first intermediate frequency transformer is



i.f.t.1. and signals pass from its secondary to the first i.f. amplifier, Tr2 then to i.f.t.2, a similar transformer, and Tr3 is the 2nd i.f. amplifier. These transistors have emitter bias resistors R6 and R12, each with a by-pass capacitor.

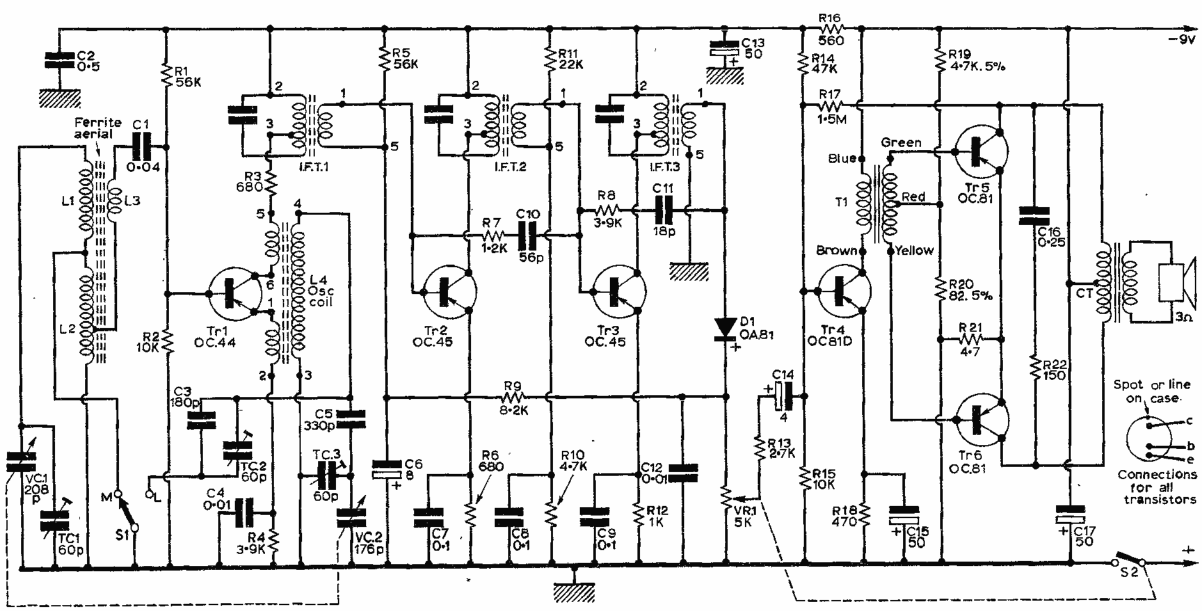


Fig. 1: Circuit diagram of receiver. Consult maker's data sheet for connections to ferrite aerial.

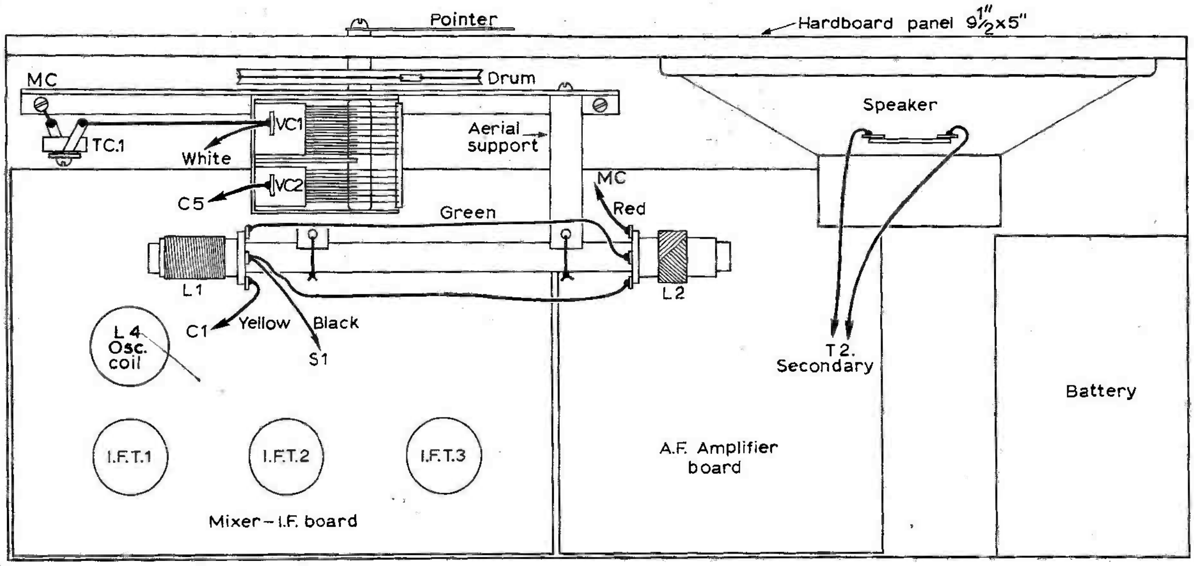
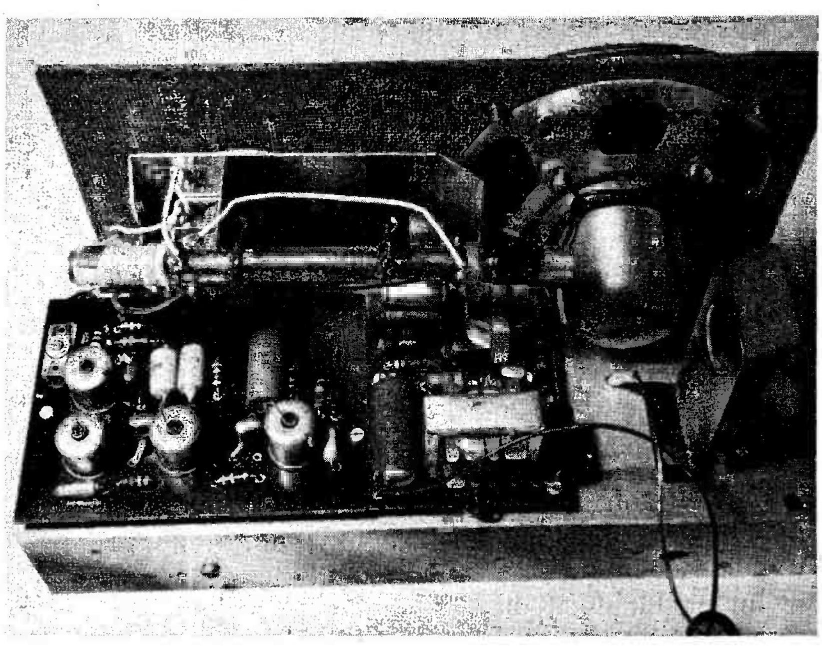


Fig. 2: Top of chassis layout. Colour identification of ferrite aerial leads was that used by author.

Amplifier signals pass from i.f.t.3 to the demodulation and a.g.c. diode D1. This diode supplies audio signals to the volume control VR1. Rectification of the carrier by the diode D1 also develops a steady d.c. potential across VR1. This is the a.g.c. bias, which reaches the base of Tr2 via R9 and the secondary of i.f.t.1. If signals are strong, additional positive bias reaches Tr2, reducing its gain. With weak signals, there is little or no a.g.c. bias, and gain is raised. In this way output from the receiver is maintained at a fairly steady level, despite changes in the strength of signals received.

Audio signals from VR1 reach Tr4 through R13 and C14, and are amplified. R18 is the emitter bias resistor, with capacitor C15, while R14 and R15 provide correct base operating conditions. The amplified signals go to the primary of the driver transformer T1.

Tr5 and Tr6 are the output transistors, and are so biased that little collector current flows when no signals are present. The transformer T1 has a centre-tapped secondary. Audio signals thus drive Tr5 and Tr6 into conduction when the base of either swings negative, the collector currents being combined in the speaker matching transformer T2, the secondary of which is connected to the loudspeaker. R17 provides negative feedback, to obtain improved audio response.



Photograph of completed receiver. Compare with Fig. 2.

Ferrite aerial

The ferrite aerial employed has a m.w. base coupling winding L3 and tapping on L2, Fig. 1. This operates with the simplest possible switching, only S1 being required for aerial and oscillator.

The ferrite rod is supported by two pieces of insulating material as in Fig. 2, or strips of paxolin held with small brackets. Thin coloured flexible leads are soldered on, to identify connections when the aerial and windings are in position. Leads can then be taken to VC1, S1, chassis and C1.

Other ferrite rod and slab aerials intended for use with a 208pF tuning capacitor should be satisfactory. With this design and layout, there is no difficulty in fitting a multi-pole switch for S1. This would allow the use of ferrite aerials having separate base couplings windings, or requiring different switching for L1/L2. The ferrite aerial must be of the type

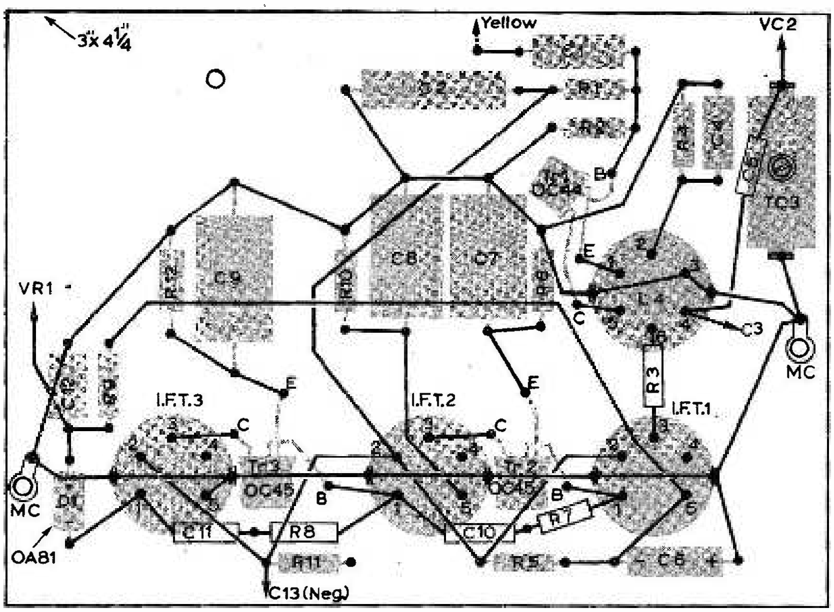


Fig. 3. Wiring guide for mixer—i.f. board.

intended for an OC44 mixer. The actual connections for it should be made as shown by the maker's leaflet.

In the same way, in a standard circuit of this kind, it is possible to use other oscillator coils and i.f.t.'s. The oscillator coil should be for 176pF tuning with an OC44, while the i.f.t.'s are 465-470kHz types for use with OC45's. When fitting other types, check pin connections against the maker's data.

Mixer-IF board

Components are placed as in Fig. 3, the positions of the clearance holes for the oscillator coil and i.f.t.'s being most easily found by pressing the pins on paper, then holding the paper on the paxolin board, and marking through it with a sharply pointed tool. Drill holes for the tags of TC3, and for the wire ends of resistors, etc.

Insert the coils, resistors and capacitors, noting the positive end of C6 is as shown. Spread the wires to keep the components in position and turn the board over.

Items are now connected as in Fig. 3. Some 26 s.w.g. tinned copper wire, with 1mm coloured sleeving will be most convenient. First join all the coil-can tags as shown, taking this circuit to the soldering tags MC. For easy checking, red sleeving can be put on all the chassis return, or positive, circuit wires.

Continue wiring, snipping off the unwanted ends of resistors, etc. Black sleeving can be put on the negative circuit connections, and yellow or some other colour on other wires. If each connection is marked with coloured pencil on the wiring diagram, as it is actually made; it extremely unlikely that any lead will be overlooked or wrongly wired.

The transistor leads can be identified by putting ½ in. of black sleeving on the emitter wire, a similar length of yellow sleeving on the base, and red sleeving on the collector wire.

Put the transistor leads in the correct holes, and draw them through until only the lengths of sleeving remain between the circuit board and transistor. Bend the leads over to the correct tags in Fig. 3, solder them, and cut off unwanted ends. A heat shunt is not essential if the iron is removed immediately the joint is made (a matter of perhaps two or three seconds). Fit the diode in the same way, with the polarity as shown.

The lead from the aerial will be soldered to C1. Solder the wire to the junction of TC3 and C5, and identify it with coloured sleeving. Also solder a lead to pin 4 of the oscillator coil.

Take a black lead from R11, for the negative side of C13. A connection is also soldered to diode D1 positive, and goes to VR1.

When the board is fitted to the chassis, the wires from pin 4 of the coil and diode D1 positive pass down through holes.

AF amplifier

Components are fitted to an insulated board $3 \times 2\frac{1}{8}$ in. as in Fig. 4. Note the polarity of C13, C14 and C15, and proceed as described for the i.f. board. The tag fixed with a bolt and lock nuts, providing the chassis return MC.

Provide colour coded leads from C13 (negative supply to i.f. board) and C14 (audio circuit from R13 and volume control slider). Solder on a black flexible lead with a negative battery clip, and two leads from the secondary of T2, for the speaker.

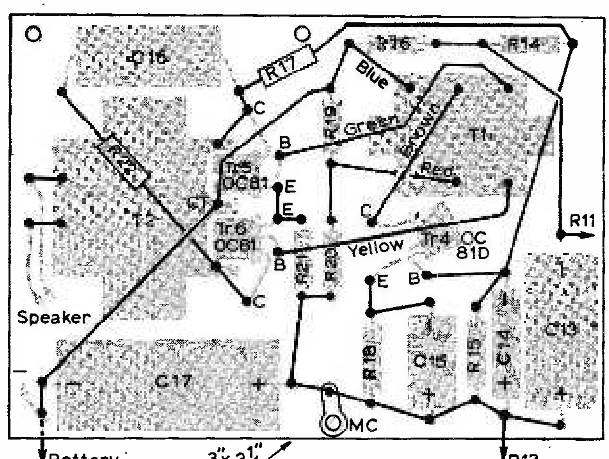


Fig. 4. Wiring guide for a.f. amplifier board.

★ components list

Resistors:

R1	56k Ω	R12	1k Ω
R2	10k Ω	R13	2·7k Ω
R3	680 Ω	R14	47k Ω
R4	3·9k Ω	R15	10k Ω
R5	56k Ω	R16	560 Ω
R6	680 Ω	R17	1·5M Ω
R7	1·2k Ω 5%	R18	470 Ω
R8	3·9k Ω 5%	R19	4·7k Ω 5%
R9	8·2k Ω	R20	82 Ω 5%
R10	4·7k Ω	R21	4·7 Ω
R11	22k Ω	R22	150 Ω

All ¼W 10% except as noted
VR1, 5k Ω potentiometer, log, with switch, S2

Capacitors:

C1	0·04μF	C10	56pF 5%
C2	0·5μF	C11	18pF 5%
C3	180pF S.M.	C12	0·01μF
C4	0·01μF	C13	50μF 12VW
C5	330pF S.M.	C14	4μF 6VW
C6	8μF 6VW	C15	50μF 6VW
C7	0·1μF	C16	0·25μF
C8	0·1μF	C17	50μF 12VW
C9	0·1μF		

VC1/VC2 208-176pF (Jackson 00 Gang, threaded spindle)
TC1/2/3 60pF trimmer

Semi-conductors:

Tr1	OC44	Tr4	OC81D
Tr2	OC45	Tr5/6	OC81 (matched pair)
Tr3	OC45	D1	OA81

Inductors:
Ferrite aerial MW/LW (Denco Ltd.)
L4 Oscillator coil (Weyrad P50/1AC)
IFT1 465-470kHz (Weyrad P50/2CC)
IFT2 465-470kHz (Weyrad P50/2CC)
IFT3 465-470kHz (Weyrad P50/3CC)

Miscellaneous:
S1, Single pole, two way switch
T1, Driver transformer OC81 (Weyrad LFDT4)
T2, Output transformer 2 x OC81 (Weyrad OPT1)
Chassis: 9½ x 4 x 1½in. Speaker, 3½in, 3 Ω
Capacitor drive assembly (2⅜in. dia. drum, spindle, cord and spring) (Home Radio)
Flanged plate 5 x 3in. (Home Radio—CU145)
Paxolin sheet for circuit boards. Knobs etc.

Chassis and drive

Fig. 2 shows the top of the chassis, which includes the speaker and battery space, and which can be removed from the cabinet as a complete working unit. A hardboard panel, carrying the speaker and tuning scale, is secured to the chassis by S1, VR1, the cord drive spindle, and one or two bolts. An aperture is cut to match the speaker.

VC1/2 is bolted to a flanged plate 3in. high but short screws must be used. The drum is placed on the spindle with its flush side towards the capacitor and two ⅜in. holes are punched so that the cord can run as shown in Fig. 5.

The variable capacitor has a threaded spindle, so that the pointer can be held with a 6BA bolt, small washers or spacers being put on to obtain a little clearance. The best method of assembly is probably by first preparing the chassis for S1, drive spindle, and VR1 and then fitting the ganged capacitor on its flanged plate to the chassis. Bolt on the supports for the ferrite rod.

Take the cord round the drum, through the chassis, give it one complete turn round the drive spindle, pass it back up through the chassis, and round the drum. Draw it to tension the spring, and tie, as in Fig. 5. Tighten the drum set-screw and check that the full 180-degrees rotation is possible.

Temporarily remove the drive spindle nut and put on the prepared panel, holding it with this nut, S1, etc. Screw on the pointer, leaving a little clearance and then fix the loudspeaker.

Fig. 5 also shows connections to S1 and VR1 under the chassis. Solder a red flexible lead with a positive battery clip to the switch S2 of VR1.

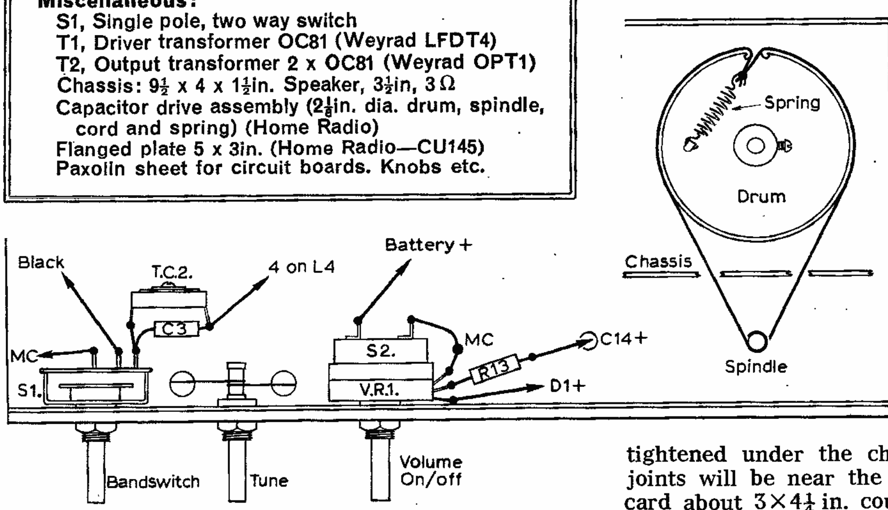


Fig. 5: Wiring of panel controls. At right, arrangement of tuning drive assembly.

Several makes of driver and output transformer are available for the transistors used. In the case of the output transformer T2, connections to the centre-tapped primary, and secondary (for speaker) should generally be clear. With driver transformer T1, tag or lead positions, or colour coding, will depend on the manufacturer, so it should be checked against the maker's leaflet if necessary.

Assembly

It is best not to fit the i.f. and a.f. circuit boards until work on the chassis is completed. To fit the i.f. board, put ½ in. bolts through the holes shown, and lock the nuts tightly against the soldering tags. Put further nuts on the bolts, which pass through matching holes in the chassis. These extra nuts are placed to give about ¼ in. clearance between the board and the chassis. A third nut is put on each bolt, and tightened under the chassis. If wiring is neat, no joints will be near the metal. However, a piece of card about 3×4½ in. could be put under the board, before fixing it, to make sure no short circuit can arise.

When first testing the circuit, leave the collector end of R17, on the a.f. circuit board, disconnected. The board can be temporarily raised, with a lead clipped from chassis to MC tag. Temporarily connect R17 (Fig. 4), but if oscillation begins, or volume or distortion increases, switch off at once and connect R17 to the collector of the other output transistor. The correct connection is that which improves quality, and causes some drop in volume.

Alignment

If a signal generator is available, proceed in the usual way for aligning a superhet.

To align without a generator, tune in any steady signal and then rotate the three i.f.t. cores, with a proper tool, for best volume. Repeat with a weak signal. Each core should have a definite tuning point giving best results.

Switch to m.w. and find a station with VC1/2 nearly fully open, and adjust TC1 for best results. If TC1 cannot be "tuned" to a peak giving best volume, modify the setting of TC3 until this can be done.

A signal is now tuned in with VC1/2 nearly fully closed, and L1 is moved along the rod, for best results.

Switch to l.w. and adjust trimmer TC2 and the position of L2 on the rod, for best results.

Repeat all adjustments (except those to the i.f.t.'s) until no further improvement is possible.

Actual frequency coverage can be modified by adjusting TC3, and the core of L4. After any such change, repeat alignment as described.

A scale is glued behind the pointer, and marked with station names, or frequencies or wavelengths determined by the signal generator.

Current drawn should be about 10-12mA with no signal, rising to 20-45mA with strong signals. A PP9 type battery is most suitable.

Cabinet construction

Top, bottom and sides are made of $5\times\frac{1}{4}$in. sanded board which may be obtained from a handicraft supplier. The front is hardboard or 3-ply, cut so that it is a push fit. Drill clearance holes for the spindles, cut an aperture to match the speaker, and a window about $2\frac{3}{4}\times 2$in. for the tuning dial.

The parts are assembled with a quick-setting adhesive, and *fine* gauge panel pins, with the panel inset about $\frac{1}{4}$in. The exterior is painted with clear cellulose.

A piece of fabric is cut and glued over the speaker aperture. A piece of Fablon-type material is glued over the remaining half of the panel and the dial window and spindle holes are cut through this with a sharp, pointed blade. A piece of glass or other transparent material is cemented inside over the tuning dial window.

A strip of coloured plastic or similar material about $\frac{3}{4}$in. wide is cemented vertically to cover the joint between the panel finishing materials. Lengths of narrow beading are cemented round the panel edges. A plastic carrying handle is attached with screws or bolts.

The receiver is inserted from behind, and the spindles are sawn off to a suitable length for the control knobs. Brackets hold the chassis to the cabinet bottom. ■

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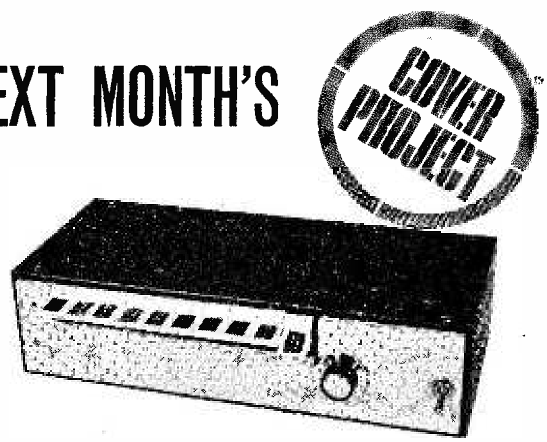

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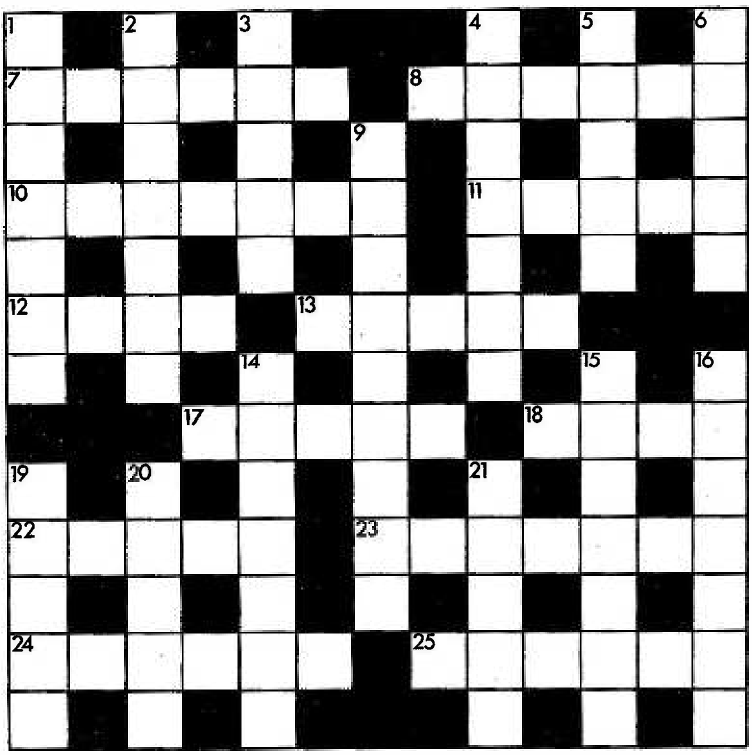
Rules

Entry is open to all readers in Great Britain, Northern Ireland and the Channel Isles, except employees (and their families) of IPC Magazines Ltd. and the printers of Practical Wireless. There is no entry fee, but each solution must be completed in ink or ballpoint pen on the proper printed coupon cut from Practical Wireless and bear the entrant's own full name and address. The Editor's decision in all matters is final and binding. No correspondence can be entered into. The winners will be notified and the result announced in the earliest possible issue of Practical Wireless.



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Cut out along this line

Clues Across

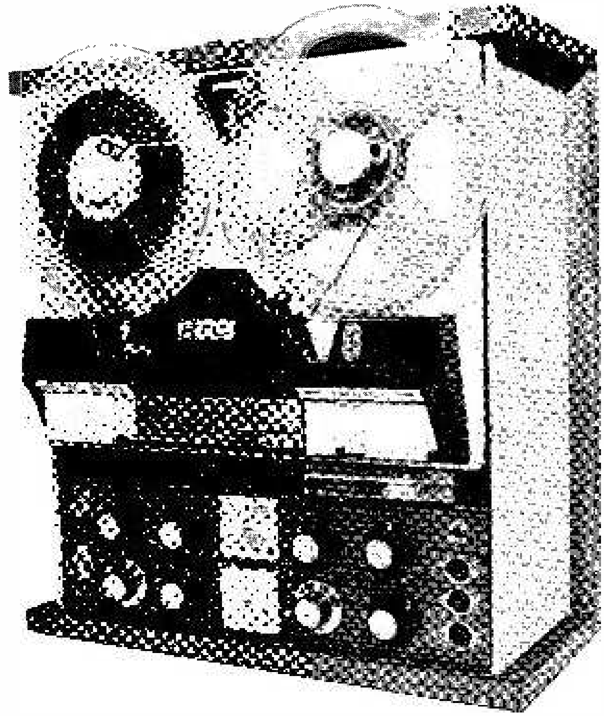
7. New wireless sets for old. (6)
8. Agent dealing with power? (6)
10. The basic one is rather kinky! (7)
11. Strength for the basic power. (5)
12. Part of the apple that's used in transformers. (4)
13. Short way of getting positive feedback. (5)
17. One way circuit, not as popular as in the past. (5)
18. Michael is so short that he's become a transducer. (4)
22. Sounds like disposing of something for money but is really a battery. (5)
23. Some get prison sentences for this but radio listeners do it all the time. (7)
24. What you end up with when you reverse some of the way you put out things. (6)
25. Mr. Miller's belonging. (6)

Clues Down

1. A long running radio programme (now finished) about TV journalists? (7)
2. Their decision is usually final on this magazine as far as slicing is concerned. (7)
3. Somehow associated with the driving force in a dynamo toroid. (5)
4. Confused way of improving loudspeaker performance? (7)
5. Part of the last or most unwanted atmospherics for DX listening. (5)
6. The envious circuits in colour TV sets. (5)
9. These people can mislead. (9)
14. To overcome rumblings this does *not* mean drunk on a make of beer. (4-3)
15. Name for a weight reducer that also gets rid of noise? (7)
16. Notices a change from r.f. to a.f. (7)
19. This kind of shovel was also a great news story. (5)
20. Do the Americans really use this sort of dish in their valves? (5)
21. Mock the people who eat fast. (5)

PART 2

PW Stereo Tape Recorder



HALVOR MOORSHEAD

Last month the basic operation was described and the circuits of the preamplifiers, record and monitor amplifiers given. The second part gives circuits of the oscillator and power supply and details the construction

THE BIAS AND ERASE OSCILLATOR

Like the monitor amplifiers, the oscillator is based on a Mullard design. This has the advantage that no special inductors have to be used as the erase head inductance forms part of the network. A fair amount of power is needed for erasure and AD161-AD162 transistors are again used. As with the record heads the switching for either track or stereo has been left out to simplify the circuit but it basically involves either or both the heads. Astute readers will see that the bias frequency will thus be different on stereo or mono but it was found in practise that this difference was small. C21 and C22, C19 and C20 could of course be replaced by $0{\cdot}132\mu F$ capacitors but as these are not available and even those near this value were hard to get, the two capacitors have been shown in parallel.

The value of R35 was found to be surprisingly critical; if it is too high the circuit will not operate and if it is too low the waveform takes on a very distorted form and this will cause all sorts of undesirable effects during recording. Three oscillators were built and the value shown worked well in all of them but if troubles are found with the oscillator this is the component to check and during the building of the Veroboard panel it may be as well to leave good long leads on this component.

As with the monitor amplifier panels two mounting holes are cut at the edges of the panel; no breaks are necessary in the copper strips. C27 is included to enable the erase to die away slowly once the supply voltage has been switched off, there is a danger otherwise of magnetising the tape heads.

C25 and C26 are the capacitors which couple a little of the a.c. signal to the record heads for the bias needed. 300pF was found to be the best value in the prototype but this can bear experimenting with to obtain the best results.

POWER SUPPLY

The power supply is conventional enough and is built on a separate chassis, the circuit is shown in Fig. 9.

It is well worthwhile fitting a fuse both in the mains supply and in the 22V line, especially the latter. While checking the monitor amplifiers and oscillators individually, a 250mA fuse can be used in the hope that this will protect the transistors in case of error. Once the amplifier is working correctly a 1A fuse can be substituted.

The bridge rectifier which is an LT120 type, available from Henry's Radio can, of course, be substituted by any with a working voltage of 30V and a current handling capacity of 1A. Any transformer with a secondary in the order of 17V or 18V will do, although the one specified is widely available, easy to mount and gives a variety of other voltages apart from the one used.

CONSTRUCTION

Almost as much thought was given to the constructional side as to the circuit design of the Tape Recorder. Several layouts and chassis designs were

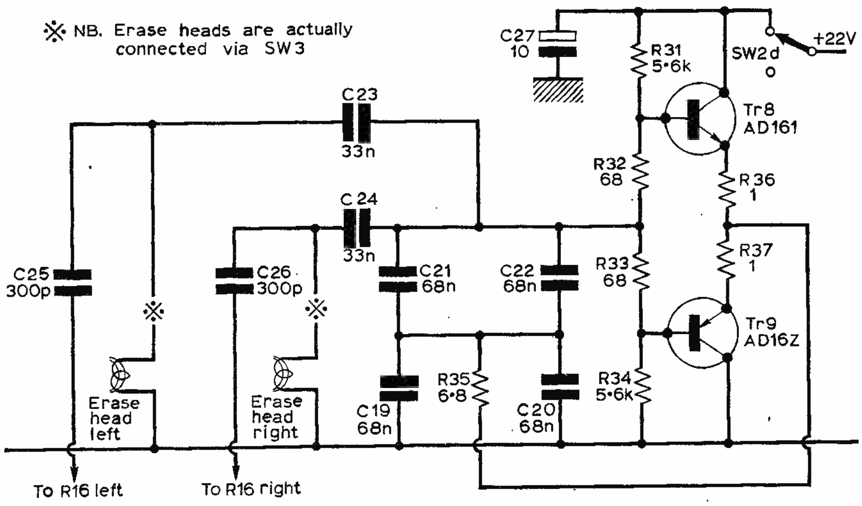
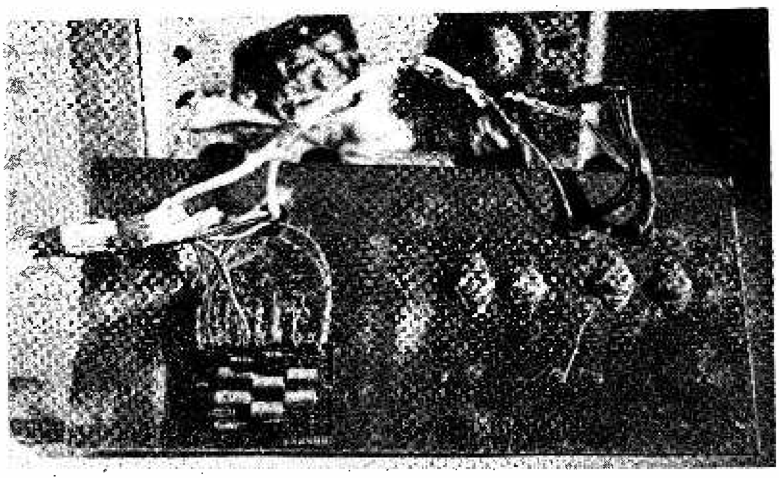


Fig. 7: The circuit of the oscillator section.



The reverse of the main chassis. The oscillator section can be seen on the left with the monitor amplifier power transistors on the right.

considered and even tried but the one described here was finally chosen. Two chassis are used, one for the power supply and the other for the remaining circuit; both chassis are extremely simple but they allow for an uncrowded layout, can be wired easily, the component boards are accessible while the recorder is in operation, yet the appearance is attractive as can be seen from the photographs.

As mentioned two chassis are used; it is good practice to keep the power supply separate and as far away from the tape heads as possible as the magnetic fields surrounding the mains transformer can be picked up on the heads. To this end a small chassis holds the power supply at the back (or the top in case of vertical operation) of the cabinet. The extension loudspeaker sockets and the low level input/output sockets are also mounted on this.

The two chassis can be homemade and the overall dimensions are given, but arrangements have been made with H. L. Smith and Co. Ltd., 287 Edgware Road, London W.2 to supply both units made from 16 s.w.g. aluminium for 12s post paid. Heavy gauge metal is strongly recommended as the control panel is unsupported except along one long side.

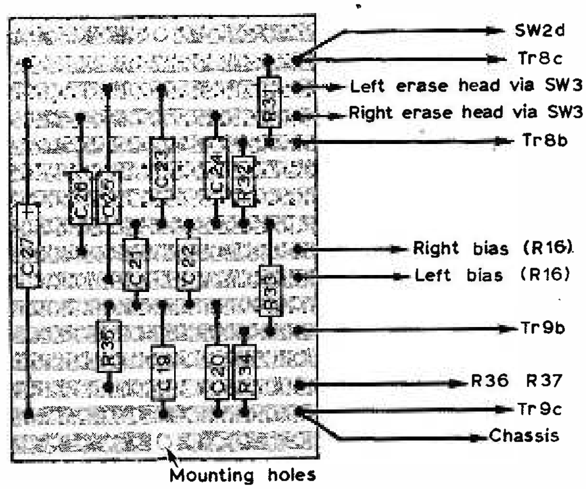


Fig. 8: The layout of the oscillator Veroboard panel. No breaks are required in the copper strips.

POWER SUPPLY CONSTRUCTION

The power supply should be built first as this will be needed for all later testing. Figure 10 shows the dimensions, drilling and basic wiring of this. The primary of the mains transformer should be wired for the local mains voltage and it is worthwhile

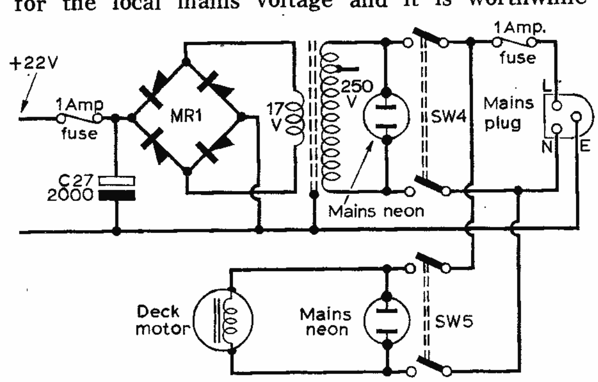
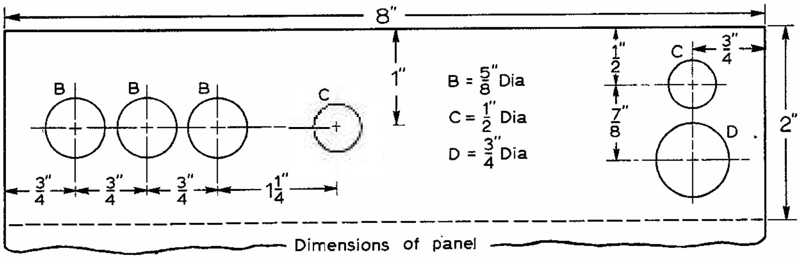


Fig. 9: The power supply circuit.



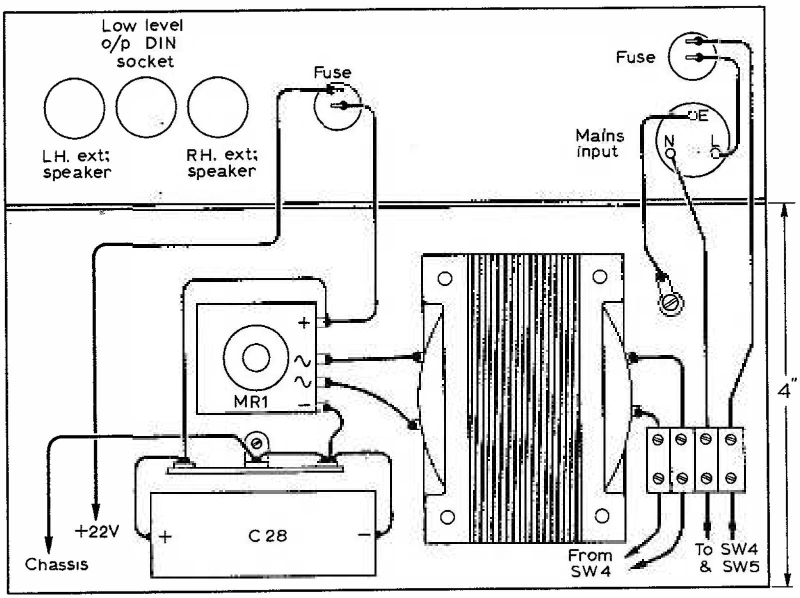


Fig. 10: The construction of the power supply—the dimensions of the back panel are shown above.

connecting the wires from the mains socket and the switched supply through a four way connecting block to provide a firm anchoring point for these wires.

A variety of secondaries are provided for on the specified transformer, 0-19-25-33-40-50V. Since we shall need 17V a.c. this should be taken from the 33-50V contacts. Before wiring these to the rectifier, however, it is worthwhile checking with a meter that you are getting 17V since it seems that taps are not always accurate; if it is found that the voltage is far from this (outside the 16-18V range) select two that give you the nearest to this (e.g. the 25-40V may give 17V rather than 15V).

These secondaries are wired directly to the a.c. tags on the bridge rectifier and the + and − connections are taken to the large smoothing capacitor C29. This component is mounted onto a short tag strip which also provides the chassis connection. The positive conection should be connected to the fuse.

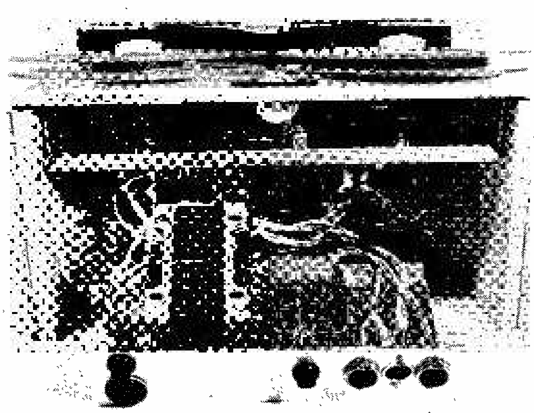
MAIN CHASSIS

The drilling of the main chassis is shown in Fig. 11 and the siting of the various components boards can be seen from the photographs.

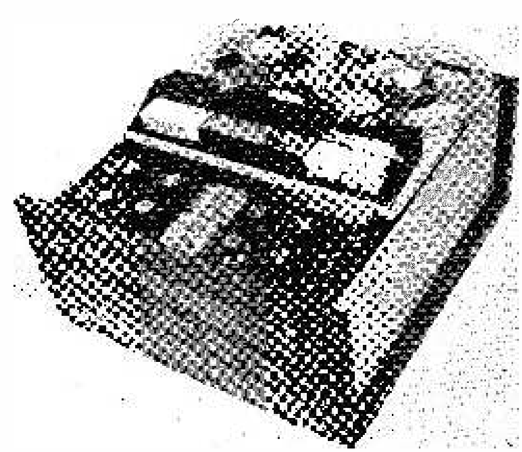
The monitor amplifier, pre-amplifier and record amplifier and oscillator component boards are mounted about half an inch off the chassis by means of 6BA screws and spacing nuts.

If the boards have been built up first the holes previously drilled for mounting can be used as a template for siting these screws exactly.

Once these positions have been marked the mica insulating washers for the power transistors can be used as a template, again for accurately siting the holes.



A rear view of the tape recorder. The plywood side panels and the speakers can be clearly seen with the power supply chassis propped up.



The P.W. Stereo Tape Recorder can be operated either vertically or horizontally as shown, but many decks are not suitable for vertical operation.

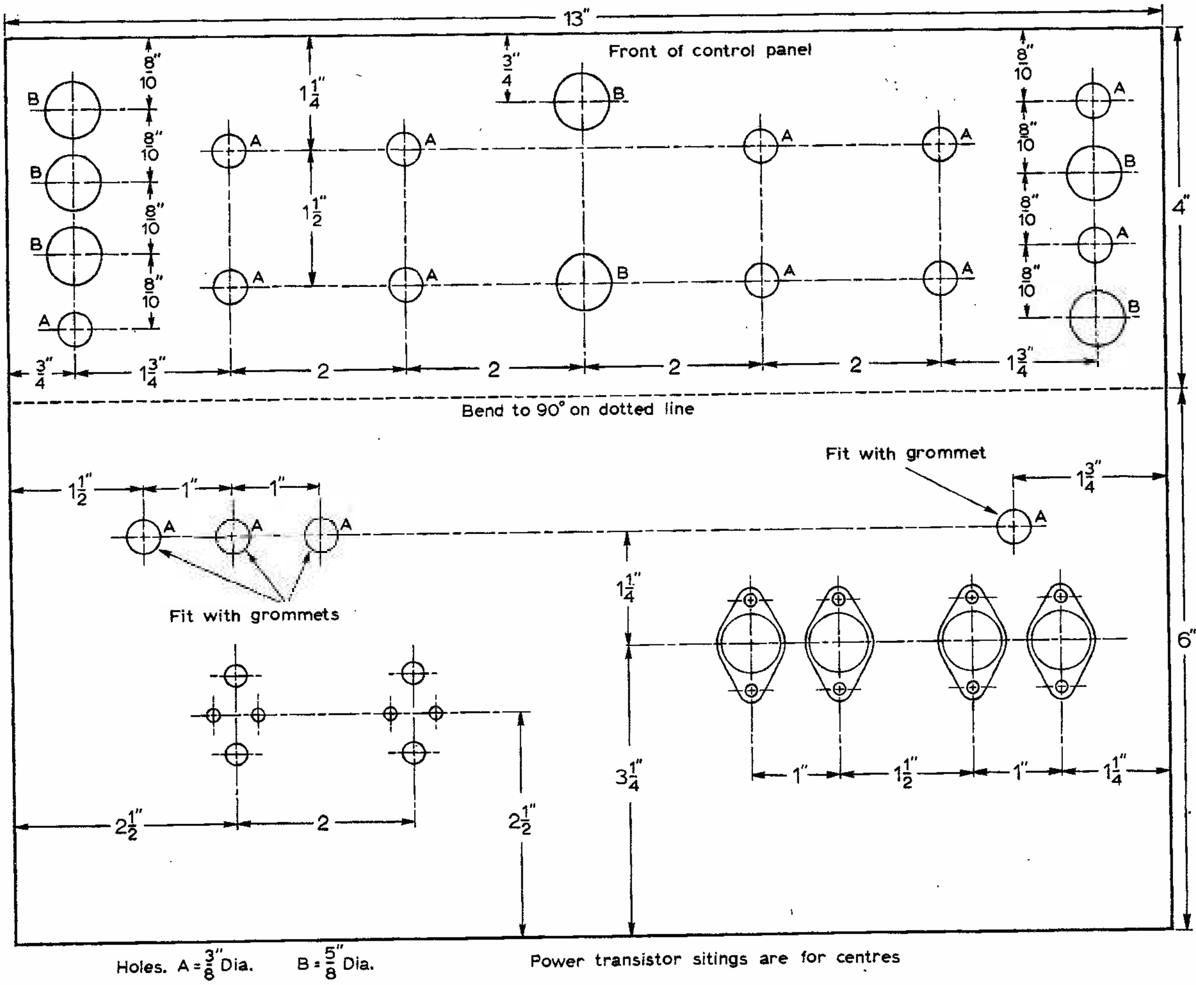


Fig. 11: The basic drilling of the main chassis. See text for the siting of the mounting holes and the power transistors.

Once the drilling has been done the power transistors can be mounted, making sure that the bodies are insulated from the chassis. The collectors of three of the transistors are at chassis potential but do not be tempted to leave off the mica washers as this is exactly the sort of thing that causes instability.

The oscillator panel and the tags of the associated power transistor tags are mounted on the rear of the chassis; not only does this lead to a less crowded layout but it also tends to screen the oscillator from the rest of the circuit.

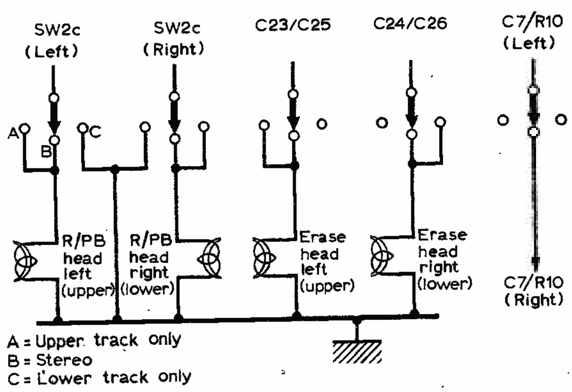


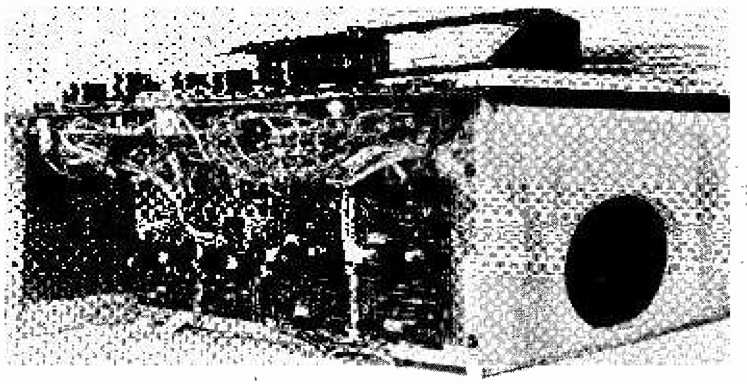
Fig. 12: The wiring of SW3, the LEFT-STEREO-RIGHT switch.

The various controls can be mounted after the power transistors. The specified V.U. Meters are held in position by a small amount of glue on the rear face. To save a lot of work later on cut the excess spindles from the controls as later on there is a lot of wiring that could be damaged by a slipping hacksaw.

Once the mounting screws have been fitted the main wiring can take place. It is very important to adopt a logical approach to this and the author used the rule LEFT-TOP-FRONT: this means that for wiring on all controls that the left hand channel wiring is always at the top and at the front where there is a choice. So the top track of the head is for the left hand channel, and for that same channel the record level control is at the front. It is amazingly easy to "cross" channels and this can lead to puzzling results (the author came across these several times).

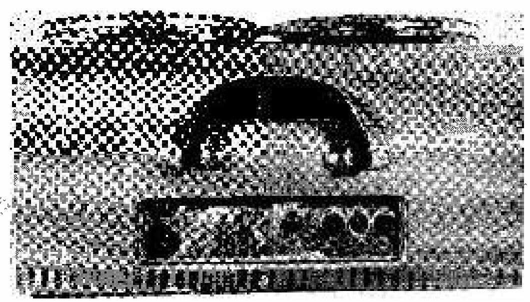
There is one major earthing point and a common 22V point. For these a tag strip should be fixed to the chassis just below the V.U. Meters. All earthing points and supply voltages should be wired to these.

Assuming the power supply has been constructed first of all, it is best to build the monitor amplifiers



A view of the completed recorder, out of the cabinet with one of the speaker covers removed.

next. These can be tested separately by injecting signals in at the volume controls. The input level and impedances are correct for a crystal or ceramic pickup and if one is used as the signal source the quality, level etc. can be properly tested. If an oscilloscope is available the signal across the loudspeaker can be monitored to see that there is no ultra-sonic oscillation. There is one great advantage in building stereo projects; each part is duplicated and if one section is not working properly one has something to compare it with.



Rear view of the completed recorder showing the access to the external connection sockets.

The emitter resistors for the output pair are wired directly from the circuit board to the appropriate tags on the transistors. Once the monitor amplifiers are working satisfactorily they can be used almost as signal tracers for the remaining circuit.

The preamplifier and record amplifier panels can next be mounted. For testing, the input side can be left unconnected, this being taken directly to the tape head, the output being fed directly to the input of the monitor amplifiers—once all this is working the majority of the circuit has been tested. One final test that will establish the working is to connect temporarily the output from the record amplifier to the input of the monitor amplifiers. This signal should sound very "toppy" and be at a much higher level than the proper output.

The oscillator can be checked by ensuring that there is some indication of a.c. volts across a tape head when the supply and heads are wired in. Most meters will be very inefficient at 50kHz but most will give at least some indication that the thing is working.

Once the various sections have been tested, the switch wiring can be tackled. No details are given in drawings as these will vary with the actual switch used.

The circuit of the switch for the Left-Stereo-Right switch is shown in Fig. 12 and again the wiring diagram of this has been omitted as the switch used will vary.

The DIN input sockets are wired directly to the input selector with the correcting components wired onto the sockets themselves.

A table of test voltages from the prototype is given for checking in case of difficulty.

CHECK VOLTAGES

	Collector	Base	Emitter
Tr1	1·1	0·3	—
Tr2	2·6	1·1	0·5
Tr3	8·5	0·6	—
Tr4	9·0	1·1	0·6
Tr5	9·0	0·6	—
Tr6	22·0	9·0	9·0
Tr7	—	9·0	9·0
Tr8	22·0	11·0	11·0
Tr9	—	11·0	11·0

Voltages measured with a meter of 20k Ω/V under no signal conditions on record.

It is vital that all wires carrying signals to the switches are screened and that all the earth points are taken to the common point. This is not really practical as far as the earthing of the DIN inputs are concerned nor is some of the screening of the wires to the Left-Stereo-Right switch, these exceptions are not important.

CABINET CONSTRUCTION

The general construction of the cabinet can be seen from the photographs and the size and final finish are of course a matter of personal taste. The deck is mounted on two ½in plywood pieces with a hole cut for the loudspeakers, the chassis is also screwed to this. This arrangement has considerable advantages from the constructional point of view but of course other designs can be used.

Once the Tape Recorder is completed make sure that the heads are aligned correctly before doing any serious recording and make sure that the erase heads and record/playback heads are in line.

The P.W. Stereo Tape Recorder has proved very satisfactory in operation and stood up well to continuous usage at the P.W. stand at the Audio Fair, despite the number of unwelcome dabbling fingers. When working the recorder will have a good quality specification and should be well worthwhile the trouble and expense. ■

TEST-MASTER

*CAPACITANCE SUBSTITUTION *9V SUPPLY *DIODE TESTER *RESISTANCE SUBSTITUTION *465kHz i.f. INJECTOR *MODULATED SIGNALS *AUDIO AMPLIFIER *1MHz SIGNAL INJECTOR *R.F. SIGNAL TRACER *CAPACITANCE BRIDGE *1kHz a.f. SIGNAL INJECTOR *OHMMETER *TRANSISTOR TESTER *RESISTANCE BRIDGE

IN recent years the author has done a considerable amount of dabbling in electronics and radio servicing and to this end has acquired a reasonable amount of test equipment. There is no doubt that a multimeter and an oscilloscope are by far the most useful pieces of test gear, but in addition there was a signal injector and tracer, a transistor tester, a small battery operated audio amplifier and a couple of cheap multimeters, one which was rarely used for anything else except to measure continuity on the ohms range and the other usually lashed into the supply circuit to monitor current consumption. In addition there was a box of components used for component substitution.

Most of the author's recent work has been with transistors and considerable use is made of S-Decs and T-Decs. These excellent products make possible reliable breadboarding and rapid development and unlike more traditional methods component leads are not messed up. A special tray was used for a long time, a sheet of plywood two foot square with an S-Dec glued to the centre, the outer rim of the tray being fitted with small cardboard boxes to hold various components. Unfortunately the more complicated projects meant that all sorts of test equipment were being used in conjunction and the old time "rats nest" was being replaced by another.

To overcome this the author decided to build a small "laboratory" into a conveniently sized case which would replace the majority of the bits and pieces used. It was also decided that facilities should be included to aid servicing and in practice the final result has made this very much easier.

CHOICE OF FACILITIES

There are some facilities that are essential to a unit of this type; both the small audio amplifier and the signal injector were constantly in use and it was decided that these were obvious candidates for inclusion. Resistance and capacitance substitution were also thought to be very useful as having these on switches would allow immediate selection of a wide variety of components.

An ohmmeter was also thought very useful—especially for rapid checking of continuity and since a meter was necessary for this a few extra components were incorporated to allow the internal battery to be available for use with a 100mA meter in series to monitor the current consumption. The meter is also used for testing transistors, both p-n-p and n-p-n for leakage and gain.

As standard value capacitors, an audio generator and an audio amplifier were already to be included, it was thought worthwhile to include a capacitance bridge. The unit will also work as a resistance bridge but this facility is less useful.

The signal inject facility eventually decided upon was to have an audio note available of about 1kHz and to have an r.f. signal of about 1MHz as well as an i.f. signal of 465kHz, the last two being capable of being modulated by the 1kHz audio note.

The audio amplifier would have to be fairly sensitive and in fact will produce a useful output from a 0·5mV signal. A simple switch was included at the input to include a detector for monitoring r.f. or i.f. signals.

It is of course a fairly simple matter to build the various items mentioned above, but the virtue of the unit described is that by the turning of one master switch, all the facilities mentioned above are available between two probes. The alternative would be to have a series of terminals on the front which would have to be changed with each function and this would have destroyed one of the major advantages.

The block diagram, which gives the basic circuitry, is shown in Fig. 1 and the various operations are as follows:

SUBSTITUTION RANGE

The negative terminal of the probes is connected at all times, directly to the aluminium chassis which

M. WALLIS

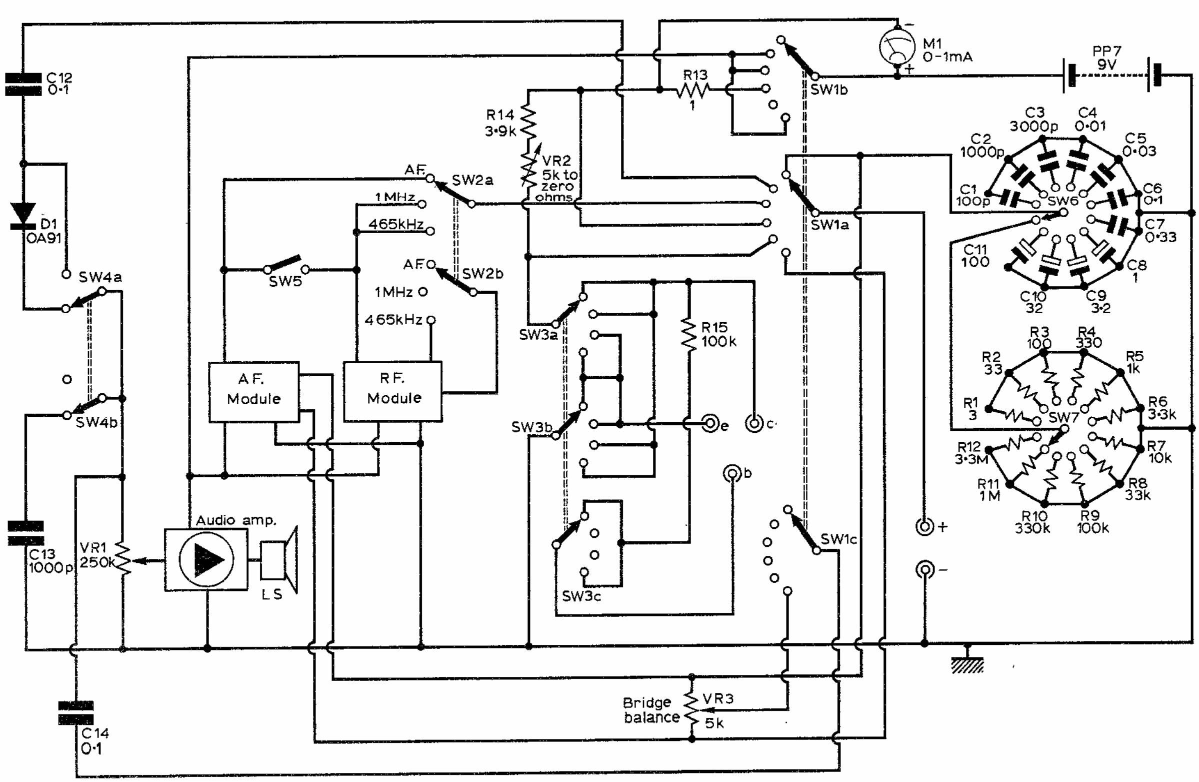


Fig. 1: The basic circuit of the Test-Master showing all the switching. The circuits of the three modules are shown overleaf.

acts as the common line, the positive terminal being connected to one section of SW1. When this switch, which is the main selector, is set to "substitution," the positive probe goes directly to the wiper of a one-pole, twelve-way switch. Eleven of these positions are wired to a variety of capacitors whose other ends go to the chassis. The actual choice of capacitors is a matter of personal preference but in the prototype the lowest value is 100pF followed by 1,000pF and there on up values increasing by a factor of three in each stage to 100μF. Values below 1,000pF are generally used for r.f. work and become quite critical, in addition there is a danger of radiating signals because one end is connected to the chassis. Also stray capacity would vary the lower values. Values of 1μF and above are electrolytic types and their working voltage is again a matter of personal preference. Ideally they would all be high but this would mean the use of very large components. The prototype uses 25V or higher components which enable them to be used with most transistor equipment.

The twelfth position on the capacitance switch connects to the resistance substitution switch, which, like the previous one, is a one-pole twelve-way type. Values here run from 3Ω to 3·3MΩ and were chosen so that differences between one value and the next increase by a factor of 3. Again the wattages chosen depend on the likely usage; the prototype used $\frac{1}{8}$ watt values for all except 3Ω which was included for loudspeaker loads and the 3·3MΩ which is not available in $\frac{1}{8}$ watt, a $\frac{1}{4}$ watt type was used instead. Like the capacitors the other connection of the resistors are joined together and go to the chassis.

AUDIO AMPLIFIER

In position 2 of SW1 the positive probe is connected to SW4 which is the normal/detect switch for the audio amplifier. SW1b applies 9V to the amplifier.

SW4 in the "Detect" position applies the signal to the top of VR1 via an OA91 diode, the other part of the switch connecting a 1,000pF to earth to smooth the signal. In the "Normal" position the diode is bypassed and C2 disconnected. C12 only serves to d.c. block the input. A highish value potentiometer is chosen for VR1 as this allows high impedance signals to be amplified with the slider near the middle.

The circuit of the amplifier is shown in Fig. 2 and it will be seen that it is very simple. High quality is not all that important but nevertheless some care was taken in the design to ensure high gain and stability. To improve stability a small capacitor decouples the very high frequencies from the base of the output transistor. A high impedance speaker (35Ω-80Ω) is used as this avoids the necessity for an output transformer. The circuit used is fairly conventional and has the virtue that the application of bias to the first stage from the emitter of the second stage d.c. stabilises the circuit and makes allowances for the wide divergence of parameters associated with cheap transistors. 2N2926G transistors were used but many similar silicon types will do just as well with no alteration of component values.

SIGNAL INJECTOR

Although one section on the main selector switch is marked "Inject" this only leads to a subsidiary switch, SW2 which selects the output from one of two oscillators, either the r.f. or the a.f. A second section of this switch alters the frequency of the r.f. oscillator from about 1MHz to 465kHz. A further subsidiary switch, SW5 provides modulation for the r.f. and i.f. signals.

The audio oscillator is a simple Hartley type, the inductor being a small tapped output transformer, normally used in push-pull output stages. The circuit is shown in Fig. 3. The centre tap goes to the positive supply line. The value of the capacitor across the total primary determines the frequency and can be varied to suit. In the prototype the transformer used with the specified capacitor gave a frequency of about 1kHz and this is about right. R21 provides the base bias and C25 the feedback.

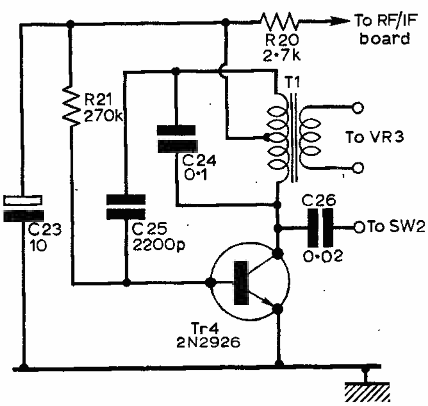


Fig. 3: The audio oscillator. This produces a 1kHz note for signal injecting and for the R-C bridge.

In the normal inject mode the output is taken via C26 from the collector. The secondary of the transformer is used for the bridge circuit only, this providing a balanced output. The shape of the audio note hardly

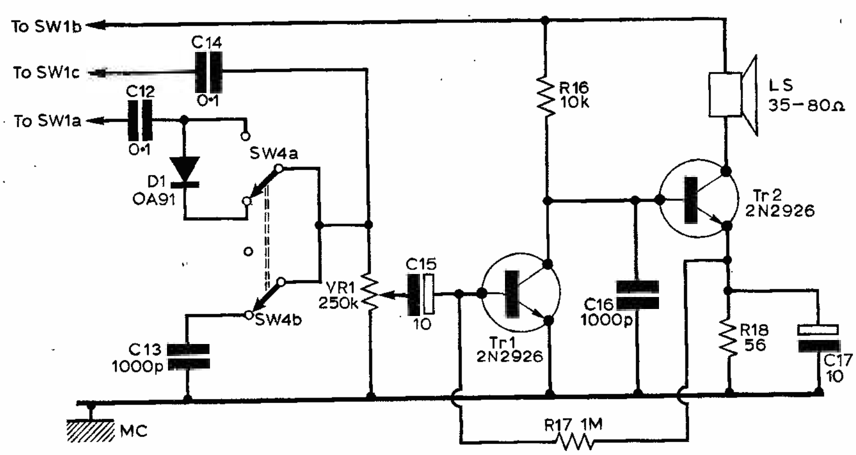


Fig. 2: The audio amplifier circuit module.

matters in the inject mode and a simple multivibrator or relaxation oscillator could have been used but a decent sine wave is far better for use with a bridge circuit.

The r.f./i.f. section is almost identical, a Hartley type circuit being used again but instead of an output transformer an i.f. transformer is used. The circuit is shown in Fig. 4. A 465kHz transformer could have been used here and this would make the i.f. injector very simple but to obtain a fundamental frequency in the r.f. spectrum it would necessitate removing the small tuning capacitor inside the i.f. can and arranging for this to be switched.

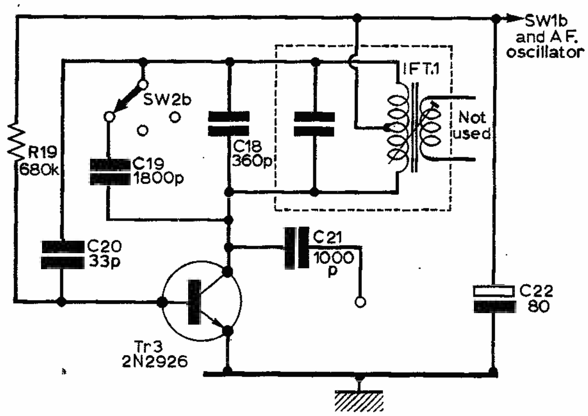


Fig. 4: The r.f./i.f. oscillator module.

This was originally tried but it was a messy business and it was instead decided to use a 1·6MHz i.f. and to put capacitors in parallel with this to lower the frequency to 1MHz and 465kHz. However clumsy this solution sounds it does in fact make construction far easier. To be able to make this work the specified i.f. transformer must of course be used.

With the internal capacitor and the two external capacitors necessary to produce the 465kHz oscillation it will of course be necessary to trim the core of the coil to obtain the exact i.f. frequency required. Obviously this means that the 1MHz signal will not be exact but this doesn't really matter as it is only intended for general r.f. use. It is, of course, possible and sometimes desirable to set the i.f. frequency to 455kHz, the standard Japanese/U.S./Hong Kong transistor radio i.f., but this is a matter of choice.

TRANSISTOR TESTER

Unlike the other functions of the unit, the transistor tester section is operative at all times—this is quite acceptable as no current is drawn from the batteries if no transistor is fitted. The basic circuit is shown in Fig. 5 but the complete circuit can be easily traced from Fig. 1.

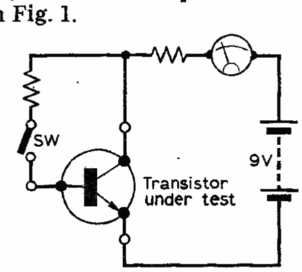
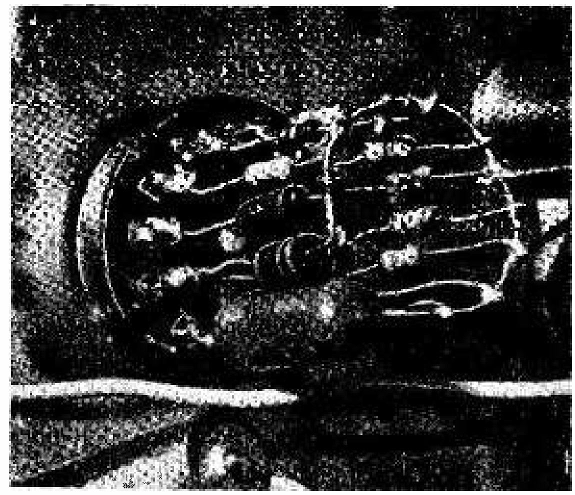


Fig. 5: The basic transistor tester circuit.


The photograph shows the wiring used for the substitution range switches.

Referring to Fig. 5 it will be seen that with the switch open the battery is applied in the correct polarity across the transistor. With this set-up the meter will register the leakage passed by the transistor. As the ohmmeter resistors R14 and VR2 are connected in series the readings will be logarithmic and they will also protect the meter when a short-circuit transistor is inserted.

As a general guide one can say that the first 'third' of the scale registers acceptable leakage, the second 'third' inferior, but usable, devices and the final 'third' duds. However certain transistors, especially power output germanium types will show high leakage while still being perfectly O.K. and so the readings are subjective and one will have to have tested quite a few good types before the readings tell you anything. This test is quite crude but it is rare that it will not tell you if a transistor is usable.

When the switch is made a 100kΩ resistor is connected between the collector and the base thus providing bias and the transistor will begin to conduct. The reading shown on leakage will rise appreciably on a good device and the rise will give an indication of the gain. Once again readings and their interpretation are a matter of judgement.

Low leakage (especially silicon types) transistors will show little or no reading on leakage and this will not mean that the device is open-circuit.

SW3 is a 3-way, 4-pole switch wired as in Fig. 6 and this serves to change the battery supply to the transistor test socket and also to apply base bias in two of the positions.

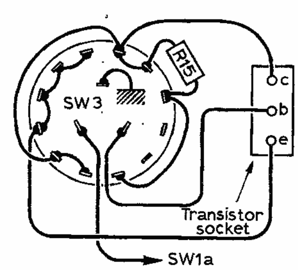


Fig. 6: The wiring of the transistor test switch.

Diodes can be tested quite easily using the same basic circuit. When connected one way around between the emitter and collector junctions the leakage shown should be very low—no indication at all is quite common. When the device is reversed a pretty high current will be registered on the meter—this of course applies to a good device only.

BATTERY SUPPLY

In the battery supply position of SW1, the positive connection is coupled through the meter with a section on SW1b shunting the meter so that it reads 100mA f.s.d. The value of R13 should be one-hundredth of the internal resistance of the meter; in the case of the one specified this is 109Ω. The author

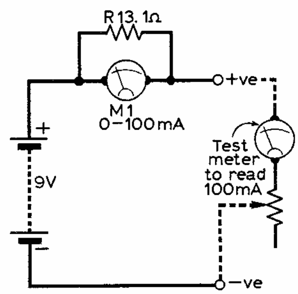


Fig. 7: The method of obtaining the correct shunt resistor to make the meter read 100mA f.s.d.

was lucky enough in finding a resistor that was exactly right but it is possible to derive the value as follows.

Initially choose a resistor that is slightly *over* 1Ω and shunt this across the meter and then couple this in series with a 100Ω potentiometer. The additional components are shown dotted in Fig. 7. Set the pot. so that 100mA is shown passing in the circuit, this being read off the testmeter which should be on a suitable range. The meter that we are trying to shunt should, in this position, have its needle pressing hard against the back stop. When this arrangement is achieved start putting low value resistors (10Ω to 100Ω) in parallel with R13 until one is found that shows f.s.d.

It doesn't matter greatly about the accuracy of the supply current reading and many readers will be content with using a 1Ω 5% resistor—this will give an accuracy ±7% which, although not good enough for normal measuring standards, should generally be good enough to tell us if something is wrong with a piece of equipment.

It is good practice to have a meter in the battery supply to transistor equipment when working on it as it will show up shorts and transistors running away in time to stop any damage and is a very much more useful facility than at first appears.

OHMMETER

The circuit of the ohmmeter is shown in Fig. 8. This

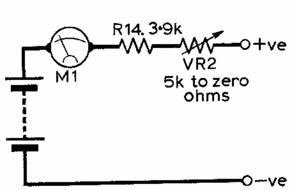
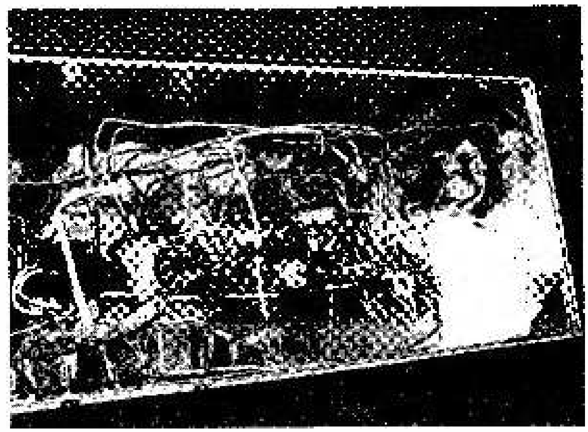


Fig. 8: The ohmmeter circuitry.

is a standard circuit with VR2 acting as the "Zero Ohms" control. As a 9V battery is used this is a fairly sensitive ohmmeter and the centre scale deflection, which is the only proper way of giving it's sensitivity, is 18kΩ. This is somewhat overcome by the small scale of the meter itself but it should nevertheless be very useful. It will have to be calibrated using known value, close tolerance resistors but if it is only to be used as a continuity tester there will be no need.



An internal rear view of the Test-Master. The battery fits into the space on the right below the meter.

BRIDGE CIRCUIT

Although bridge circuits usually require an article to themselves we have already got nearly everything necessary to incorporate one. The a.f. oscillator provides a balanced output from the secondary of the transformer used, the amplifier can be used as the detector and the capacitors used for substitution can be used as the standards against which to balance the unknown value. All that is necessary to add is a 5kΩ potentiometer.

At a particular setting of the potentiometer the bridge will balance and there will be only a low output from the loudspeaker and the setting of that pot. will give a multiplication or dividing factor with which to calculate the value. The actual arrangement used here is especially useful as the value of the capacitors go up by a factor of about three each time and so the calculating factor will never be more than this.

By changing the capacitance switch to the resistance substitution range it becomes a resistance bridge and this can be useful for measuring low value resistors and possibly high value ones as well (though the simple design means that breakthrough can be troublesome here).

The switching to achieve this arrangement can be

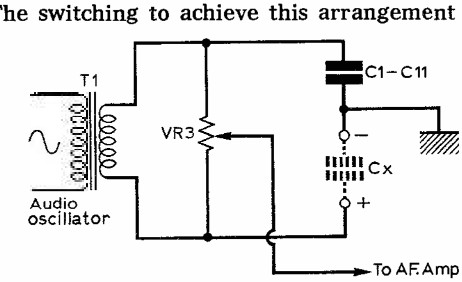


Fig. 9: The bridge circuit for measuring the values of unknown capacitors.

traced from Fig. 1, the basic circuit is shown in Fig. 9 and this will be recognised as a conventional bridge circuit.

CONSTRUCTION NOTES

The actual construction of the Test-Master should present no real problems, the only ones are likely to be getting the switches wired correctly.

A large aluminium chassis, 12 x 5 x 2½" is used on its side so that what is normally the top becomes the control face—quite a lot of controls are involved as can be seen from the photographs but little depth is needed. A smaller cabinet could be used—there is little crowding of components—but this will make wiring difficult.

There are three "active" parts to the Test-Master; the audio amplifier, the a.f. signal source and the r.f./i.f. signal generator. These are all built on small Veroboard panels and mounted on the bottom and side of the chassis.

The component layout on the panels is shown in Figs. 10, 11 and 12 together with the connections to the adjacent switches etc.

The positioning of the meter, the controls, switches and loudspeaker are shown in Fig. 13; the sides are shown in the same plane as the front. Exact positioning will depend on the type and size of the components and so dimensions are not given but some thought was given to the arrangement of the various sections and the layout shown does give relatively short wires to the various sections.

The battery, a PP7, is mounted beneath the meter. The panels themselves can be laid on a sheet of card

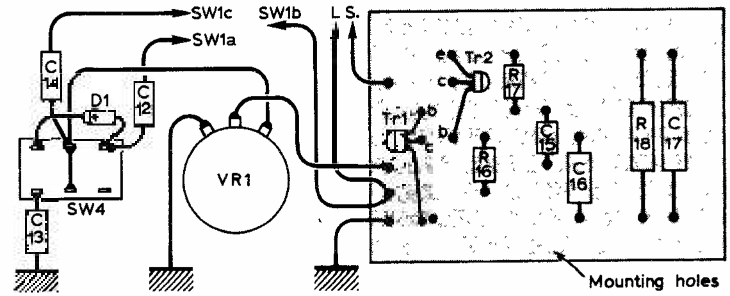


Fig. 11: The component layout of the audio amplifier.

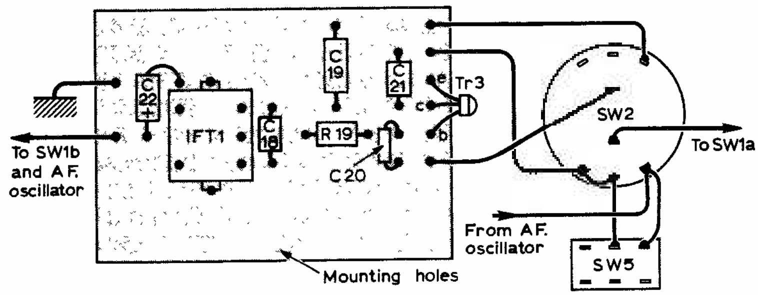


Fig. 12: The r.f./i.f. injector module.

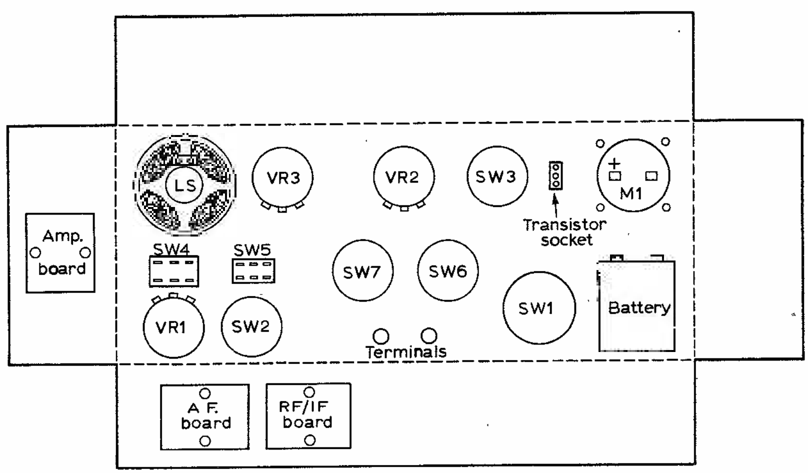


Fig. 13: Approximate siting of the controls and modules inside the chassis.

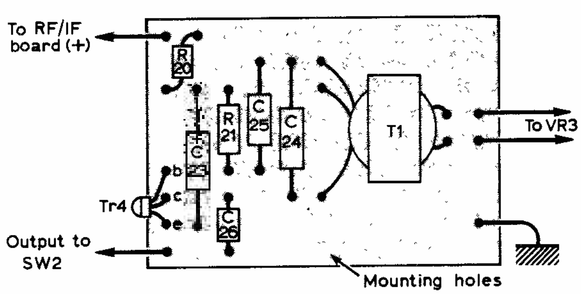
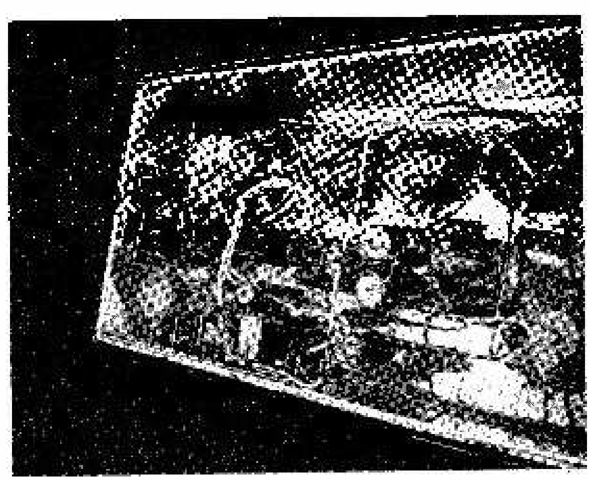


Fig. 10: The layout of the audio oscillator module.



An internal view of the completed Test-Master.

(to stop the bottom connections shorting to chassis) with the screws through the mounting holes clamping them to the chassis.

The socket associated with the transistor tester is a normal transistor mounting socket; a slightly undersized hole will enable it to be pressed firmly home.

★ components list

Resistors :

R1	3·3Ω 2W	R12	3·3MΩ
R2	33Ω	R13	1Ω—see text
R3	100Ω	R14	3·9kΩ
R4	330Ω	R15	100kΩ
R5	1kΩ	R16	10kΩ
R6	3·3kΩ	R17	1MΩ
R7	10kΩ	R18	56Ω
R8	33kΩ	R19	680kΩ
R9	100kΩ	R20	2·7kΩ
R10	330kΩ	R21	270Ω
R11	1MΩ		

All resistors 5%, $\frac{1}{8}$ watt except R1.

VR1	250kΩ log.	VR3	5kΩ
VR2	5kΩ lin.		

Capacitors :

C1	100pF	C14	0·1μF
C2	1000pF	C15	10μF 12V
C3	3300pF	C16	1000pF
C4	0·01μF	C17	10μF 12V
C5	0·03μF	C18	360pF
C6	0·1μF	C19	1800pF
C7	0·33μF	C20	33pF
C8	1μF 25V	C21	1000pF
C9	3·2μF 25V	C22	80μF 12V
C10	32μF 25V	C23	10μF 12V
C11	100μF 25V	C24	0·1μF
C12	0·1μF	C25	2200pF
C13	1000pF		

Switches :

SW1 3-pole, 6-way rotary
SW2 2-pole, 3-way rotary
SW3 3-pole, 4-way rotary
SW4 2-pole, 2-way toggle
SW5 On-off toggle or same as SW4
SW6 1-pole, 12-way rotary
SW7 1-pole, 12-way rotary

Semi-conductors :

Tr1	2N2926G	Tr4	2N2926G
Tr2	2N2926G	D1	OA91 or similar
Tr3	2N2926G		

Miscellaneous :

Meter—1mA d.c., Henelec '38 Series'.
Loudspeaker—miniature (2–2½in. diameter), 35Ω–80Ω impedance.
T1—tapped transistor audio output transformer (Henry's Radio type JOT).
I.F.T.1—1·6MHz i.f. transformer, Denco type IFT. 16/1·6.
Veroboard—3 off panels 11 x 9 holes, 0·15in. hole matrix.
Aluminium chassis—12 x 5 x 2½in.—see text.
Transistor mounting socket.
Output/Input sockets.

For the substitution ranges the components can be mounted as shown and soldered in place; with the resistors which are all the same size this is easy but the bulkier capacitors will have to be arranged as well as possible.

Two-way, two-pole toggle switches were preferred over miniature slide switches as they are far easier to mount. The loudspeaker for the amplifier is best glued into position behind a small expanded metal grill.

For readers who have difficulty making things work first time (and aren't most of us in that category) it is fairly simple to fix and test one facility at a time; for instance wire up the main switch first with flying leads and then only try the capacitance substitution range followed by resistance substitution and so on ending up with the bridge circuit.

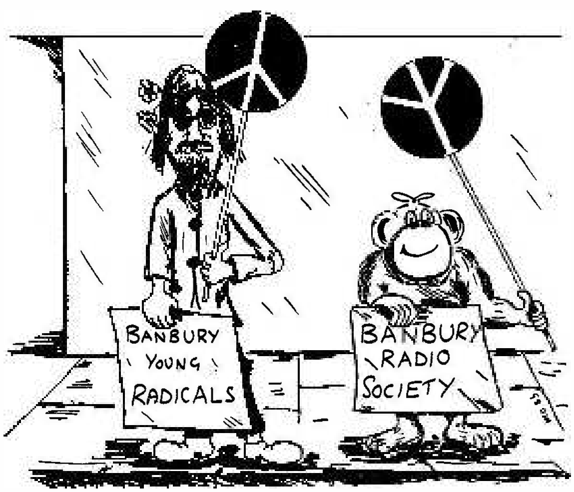
As far as wiring is concerned, screened wire may be better for the outputs of the signal injectors and the input to the audio amplifier but the author was prepared to accept a certain amount of breakthrough and so normal wires were used throughout.

No facility is incorporated for attenuating the level of the injected signals and a further control could be inserted for this purpose but it was found easier to have an extra probe with a 1MΩ resistor incorporated as this can also be used for tracing high level signals.

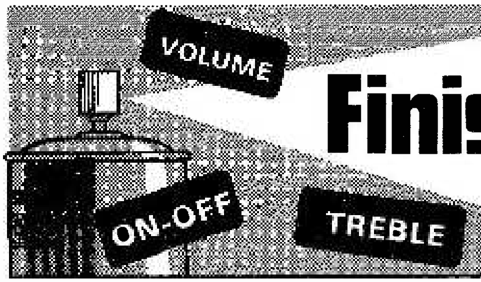
Once completed the Test-Master should prove to be a really useful addition to any test bench and will enable a lot of odd pieces of test gear to be relegated to the shelves for use on rare occasions only. ■

MAXWELL

by G8DSH



ARTHUR DOW



Finish off that EQUIPMENT

JUDGING by the appearance of the average radio enthusiasts den, shack, workshop or what-have-you the percentage of home-made equipment that is properly finished off is quite minimal.

The author is the first to admit that he was the world's worst offender in this respect, having over the years built just about everything from an absorption wavemeter to an all-band SSB transceiver. The gear always worked, eventually, but having spent so much time on the building of it the author was usually only too happy just to sit back and play with the knobs for a while!

The thought of taking off that panel with its myriad knobs, dials, switches, etc., was anathema and anyway there was always that new project that had to be started!

It is a good idea to relax once a project has been completed but it is also necessary to be quite determined, in the near future, to put that finishing touch to it so that the uninitiated may remark on the excellence of one's handiwork whether it actually works or not!

Some enthusiasts have even reported receiving actual words of encouragement from their dear ones on emerging from the shack with a new bit of gear that was actually in a cabinet and which had a panel that was not dented or scratched or a mass of unused holes, but such reports should be treated with some reserve!

But seriously, a great deal of satisfaction is to be had by spending a little time and effort on putting the finishing touches to a job and it need not be an expensive or lengthy procedure.

The legendary rift between the enthusiast and his family does, one can be sure, spring from the good old days when to get a good crackle finish on a panel it was necessary to bake the panel in the kitchen oven for a couple of hours! The fact that the roast joint tasted of paint for the next fortnight was quite immaterial!

Fortunately today paints are available that dry hard in an hour or so and which can be sprayed from a can. A variety of colours gives a wide choice to satisfy individual tastes.

FINISHES

Among the many possibilities should be mentioned the natural metallic finish, painting by brush or spray, the covering of the panel with a plastic film and the use of a dummy panel attached to the front of the main panel.

Finishing should also take into account the lettering and numbering of all the controls, switches, etc. on the panel as one would expect to find on commercial equipment. This again is not difficult to achieve and one does not have to be an artist to stick a few transfers on to a panel.

PREPARATION

Whatever finish it is decided to adopt there are certain preliminary steps that are essential to ensure good results. If the design of the equipment is being copied from a magazine the chances are that the panel layout will be given and that the author has made some effort to ensure that the layout of the controls is a reasonably symmetrical one.

If the constructor has to make his own layout he should spend some time on working out a neat arrangement for the controls consistent with the electrical requirements of the circuitry. In marking out the final positions of holes, cutouts, etc., use a rule and pencil and do not "guesstimate" as the eye can often be quite unreliable as far as measurements are concerned.

After the holes have been made ensure that all burrs and rough edges are removed from both sides of the panel.

Next, lay the panel on a sheet of thin cardboard or stout paper and with a sharp pencil make an outline drawing of the panel and all holes and cutouts. Be careful about using a biro pen for this purpose as the tip is usually quite blunt and the resulting drawing will not be at all accurate in size.

This drawing will be found very useful for future reference especially if it is decided to fit a dummy panel to the equipment as will be described later.

NATURAL FINISHES

An aluminium panel may be given quite an attractive finish by laying it on a sheet of newspaper and rubbing the panel down on one side with a piece of wood around which a piece of fine sandpaper has been wrapped. A fine oil can be used as a lubricant during the rubbing down but great care must be taken to ensure that the oil is removed completely when the panel is finished. A circular rubbing motion will produce the best effect.

To complete this particular finish the panel should be given a coat of transparent varnish with a soft brush or from an aerosol spray.

It is important to read the instructions on these spray cans in order to get a smooth clean result. Often the spray is held too near the object or is not moved about fast enough and blobs and runs appear in the finish.

PAINTING

The number and types of paint available today are legion but attention should be paid to those paints that are available in aerosol spray cans. A large range of colours can be found in most motor accessory shops as well as in the usual paint and decorators and DIY shops. The sprays are cheap, clean, fast and just about infallible if the instructions are followed.

Again, the panel should be laid on a sheet of newspaper and carefully cleaned of all dirt or grease with a white spirit or similar solvent. Spray the panel according to the instructions and remember that two thin coats are better than one thick coat. So do not try to put on too much paint in one go but apply a thin coat and allow to dry properly before applying the finishing coat.

It is a good idea to do the whole job outdoors if the weather permits as otherwise the fumes from the paint can be very objectionable and even dangerous indoors.

Give the paint ample time to dry before starting to reassemble the panel and above all don't be tempted to prod the panel with a fingertip 'just to see if it is dry' . . . it won't be! The drying process can be speeded up by directing the heat from an electric fire on to the panel for a short time.

Air-drying crackle finish paint such as Yucan is now obtainable in aerosol spray cans in various colours and this provides an excellent finish that will hide blemishes on a panel that might not be so easily covered by a flat paint.

PLASTIC FILM FINISH

This method of finishing a panel is one of the simplest, cheapest and cleanest ways and the time spent in removing and replacing the panel on the equipment is well justified.

The plastic film is available from Letraset dealers and art shops under the name of "Letrafilm" in no less than 119 colours in matt finish and 20 colours in a gloss finish. Sheets 10" x 7½" are 4s 3d each and 20" x 15" at 8s 6d each.

Remove the panel from the equipment checking that there are no burrs or rough edges. These are easily caused by the action of lock washers especially on soft aluminium panels.

Lay the panel over one corner of the sheet of Letrafilm, moving the panel around to get the most economical position. Offcuts of the material can come in very handy. Mark round the outside of the panel with a pencil leaving a border of about ¼in. and then cut out the piece required with scissors.

Remove the backing paper from the film and drop the centre of the film on to the centre of the panel. Drop one end and smooth it down then dropping the other end and smoothing that down also. With this technique there will be a minimum of air bubbles underneath the film. Finally put a sheet of clean paper over the whole panel and with the ball of the hand smooth the film down leaving a perfectly flat and bubble-free surface.

The film may be pushed through small holes using a biro pen. On larger holes cut the film in the hole radially and fold back behind the panel. The excess material at the panel edges may now be folded over the edges, if necessary snipping the film at the corners.

The whole operation takes far longer to describe than to perform!

DUMMY PANELS

The advantage of a dummy panel is that it is not necessary to take off the main panel but only to remove the locking nuts and fixing screws from the components mounted on the panel. We shall now need the tracing of the front panel that it was recommended should be made once the main panel is completed.

The dummy panel may be plastic sheet of the appropriate colour and about 1/32in. thick. Place the plastic sheet underneath the tracing and mark through the outline of the panel and all the holes and cutouts, then cutting them out with scissors or a sharp knife such as is used by modelmakers.

Panel screws should be countersunk where possible so that they will be out of sight when the dummy panel is fitted.

If the main controls are reasonably spread out over the area of the panel the holes nearer the centre can be clearing holes around locknuts, etc., thus simplifying the work even further.

PANEL LETTERING

The final touch that cannot be omitted on any score, least of all of expense! Sets of panel transfers can be obtained from Data Publications, 57 Maida Vale, London, W9 at 5s. per set. These cover receiving, transmitting and audio equipment requirements.

The transfers are easily applied by following the instructions supplied. But one tip, if there are to be several transfers in a line rule a faint pencil line on the panel in order to assist the placing of the transfers on to the panel.

It is better if the transfers are put on before the panel is replaced on the equipment and, of course, after the panel has been painted or otherwise finished off, but don't forget to take into consideration the diameter of scales, knobs, etc. before finally placing the transfers.

Another point worthy of some thought is that of placing the transfers above or below the controls. If the equipment is to be low down the transfers should be over the controls so that they can be read from above. If the equipment is, say, up on a shelf then the transfers ought to be below the controls.

GENERAL NOTES

Whether a panel is to be properly finished off or not there is a right and wrong way of mounting components on a panel. Subject to space permitting, potentiometers and switches etc., should have two lock nuts fitted. This allows the minimum of the threaded bushing to project at the front of the panel enabling knobs and dials to lay as close to the panel as possible. It also removes strain from the body of the component itself, and finally, it is good engineering practice.

Do not be shy about cutting off any excessive length of spindle. This is best done by holding the end of the spindle in a vice or pair of pliers and cutting off the excess spindle with a fine-toothed small hacksaw afterwards removing any burrs with a file. Do not make the mistake of holding the component itself in the vice and possibly damaging it irreparably.

When refitting potentiometers and rotary switches to the panel make sure that the arc of rotation is symmetrical so that the indicating line or spot on the knob is vertical when in the centre of its travel. A small point perhaps but it does add to the final finish of the equipment.

—continued on page 854

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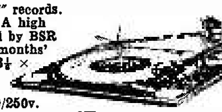

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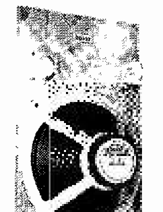

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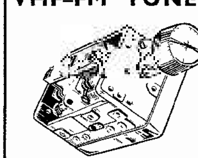

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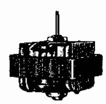

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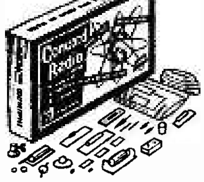
TOTAL BUILDING PRICE 39/6



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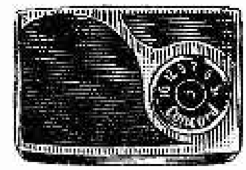

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Don't confuse with ordinary electric organs that simply blow air over mouth-organ type reeds etc. Eight months were spent in creating and testing this superb, revolutionary electronic organ. Fully transistorized—no valves. **Proper self-contained loudspeaker.** *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 2¼". 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. **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, loud-speaker, 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.

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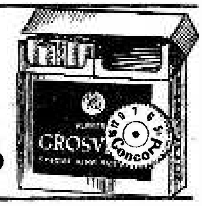

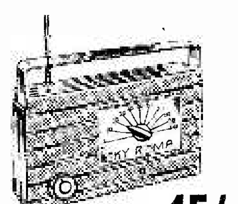

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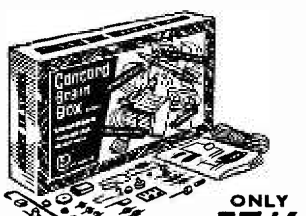

If you've seen a giant computor on show at an electronics exhibition, you will have seen people of all ages queueing to pit their abilities against the giant electronic brain. There is a tremendous fascination that attracts ordinary people and professional engineers alike to electronic games of skill, 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. Size 18" × 12" × 6" (Max.). You can play all these games and more beside after building the "Brain box". 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 battery. Presentation box 5/6 extra. (PARTS AVAILABLE SEPARATELY) **FULL OPERATING DIRECTIONS WITH EACH OF THE PROJECTS.** Examine at home for 7 days. Your money back if not delighted.

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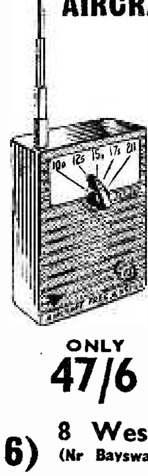

Many thousands of v.h.f. Aircraft Band Converters now selling in U.S.A. *Listen in to* **AIRLINES, PRIVATE PLANES, JETPLANES.** *Eavesdrop on exciting crosstalk between pilots, ground approach, ground control, airport tower. Hear for yourself the disciplined voices hiding tenseness on talk downs.* Be 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 1¾". 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).

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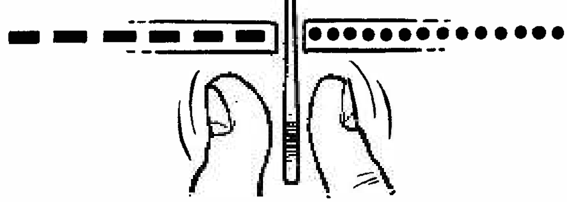
A SIMPLE SOLID-STATE KEYER



A S CARPENTER G3TYJ

ELECTRONIC keyers various in type have featured from time to time and some designs are quite sophisticated. Of the various configurations the familiar multi-vibrator "dot" generator tied to an ancillary flip-flop "dash" circuit is hard to beat and most commercially produced keyers feature this mode of operation. These designs do, however, require use of many semiconductors particularly if a monitor is incorporated so naturally one does tend initially to look for something simpler.

Fortunately, it is possible to construct a useful keyer around a single transistor plus a handful of small components and if care is taken excellent results can be obtained; in all fairness, however, it must be pointed out that it is the more refined type of keyer that does the better job for the serious operator.

Circuit

The circuit of a keyer which has been in regular use for over a year and which is complete with its own audio monitor is shown in Fig. 1. The basic switching circuit is by no means unique and to it is added the essential variable speed facility plus provision for adjusting the dot-dash length; a degree of dot-dot space control is also incorporated.

Transistors Tr1 and Tr2 plus the associated items are the elements of the audio monitor, whilst the section around Tr3 takes care of the keying.

Adequate switching is also provided and when ganged switches S1a and S1b are at the position shown in Fig. 1 the keyer is off. With switch S1 in position "2" the battery negative is applied to the paddle control blade via one section of the relay but transistor Tr3 remains inoperative since its base is open circuit.

When the paddle control is held against the "dot" stop, however, the transistor base goes heavily negative. Tr3 conducts hard and capacitors C3 and C4 are charged. The relay operates and its contacts open which immediately cuts off the base supply potential. Capacitors C3/C4 immediately start to "discharge via R6 and VR1 but the relay is "held on" for a period of time dependent upon the setting of VR1. When C3/C4 have discharged sufficiently the relay drops out and its contacts change over once more. If the paddle is still in contact with the dot stop the operation is repeated and continues until the control is returned to the central resting position. Gate diode D1 does not conduct during the dot formation.

When the control paddle is held against the dash stop, gate diode D1 conducts as its cathode end goes negative with respect to its anode. With the necessary negative potential applied to the transistor base the relay again operates. The base circuit discharge period is longer now, however, for additional capacitance due to C2 (via D1) is introduced and this ensures that the relay cannot drop out as quickly as it did during the dot forming operation; a dash is thus produced.

Capacitor C3 and control VR2 are included to make the dot-dash ratio adjustable over a small range. The repetition frequency is decided mainly by the setting of VR1, however, and this is a panel-controlled item marked "Speed". A degree of controllable mark/space ratio is afforded by VR4, being so set that the keyer *just* operates.

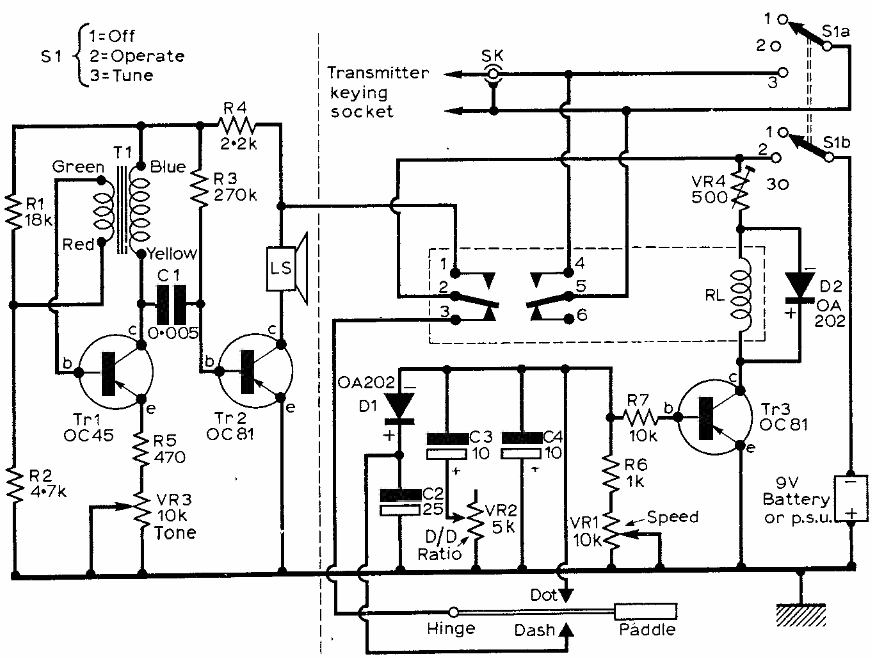


Fig. 1. Complete circuit of the solid-state keyer.

Monitoring

Whenever the control paddle is at its central rest position current flow is negligible even when S1 is at position "2" and the collector current of Tr3 can be measured in micro-amps. The audio oscillator around Tr1 and Tr2 is also inoperative provided the relay is connected with its contacts as shown when in the rest position.

Immediately the keyer is operated, however, a negative potential appears at the junction of R4/LS and this energises the audio oscillator. The audio oscillator proper is that section around Tr1, transformer T1 providing the required degree of feedback essential for oscillation from collector to base. A crude tone control VR3 in the emitter circuit allows the note obtained to be adjusted within limits to suit the user's taste.

Transistor Tr2 merely acts as a simple amplifier feeding the loudspeaker LS which may be any medium impedance insert type. A balanced armature type works well but sub-miniature speaker units or discarded headphone elements may be tried. Transformer T1 is a sub-miniature type which measures but $\frac{1}{2} \times \frac{3}{8} \times \frac{1}{2}$in and has a ratio of 5:1 with a primary inductance of 12H.

Since the audio generator energising potential is tied to the relay operation the monitor note is heard in sympathy with the keying. It may also be noted with interest that the monitor note can be obtained by keying irrespective of whether the transmitter is connected or not and this means that the unit can be employed for Morse code practice if required!

Note that a further position is used on switch S1 which when switched to "3" leaves the keyer dead but short-circuits the output and gives "Key down" for netting or tune-up.

Construction

A standard Radiospares 18-way tag board is a convenient base on which to construct the keyer. For controls VR2 and VR4 miniature pre-set items are suitable, but for the speed control VR1 a long spindled item must be used to enable the control knob to be brought clear of the final housing. The keyer outlet socket can conveniently be made a co-axial type; such a socket is useful in that it allows various transmitters to be connected not all of which have standard jack sockets—the Codar AT5 for example.

A "U" bracket for the paddle contacts is easily fabricated on the lines shown in Fig. 2, the saw cut being made last. Adjustable dot and dash stop terminal screws can be inserted and tightened in the holes in the uprights.

The tag board may be held securely to a metal base using a few 1in spacers cut from ball-point pens.

The paddle control blade is made from thin brass strip and the ideal material is to be found in the composing departments of printers where a piece of 25 "ems" ($4\frac{1}{8}$in) $\times$ $1\frac{1}{2}$-point "brass rule" will if cut centrally lengthwise provide two blades; hacksaw blade may also be used. Finger-plates of thin perspex are easily fixed at the operating end of the paddle.

The relay used is obviously of considerable importance, but STC sealed types with 520 ohm coils work well and coil resistances up to 820 ohms should also be satisfactory provided the relay is light and reasonably fast in operation. Types STC4190GD and 4189GD available from Henry's Radio should be suitable, but if any doubt exists or where the constructor wishes to try using a specimen already to hand a small pre-construction "mock-up"' may prove enlightening. Capacitor values may have to be modified slightly

★ components list

Resistors:

R1 18kΩ	R4 2·2kΩ	R7 10kΩ
R2 4·7kΩ	R5 470Ω	R8 1kΩ½W
R3 270kΩ	R6 1kΩ	R9 390Ω

VR1 10kΩ pot — VR4 500Ω pre-set
VR2 5kΩ pre-set — VR5 1kΩ pot wirewound
VR3 10kΩ pot
Fixed resistors ¼W 10% except R8

Capacitors:

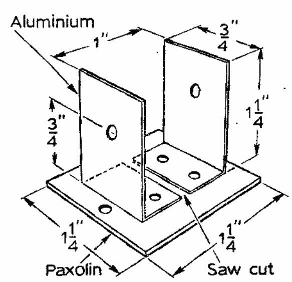
C1 5000pF ceramic	C4 10μF 25V
C2 25μF 25V	C5 100μF 50V
C3 10μF 25V	C6 100μF 50V

Semi-conductors:

Tr1 OC45	D1 OA202	D4 GJ7-M (AEI)
Tr2 OC81	D2 OA202	D5 GJ7-M (AEI)
Tr3 OC81	D3 GJ7-M (AEI)	D6 GJ7-M (AEI)

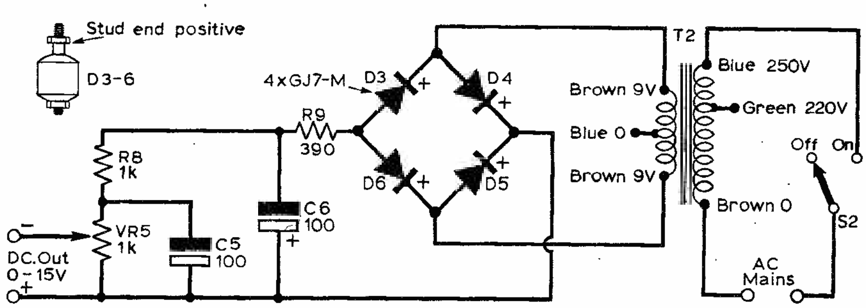
Miscellaneous:

S1 2-pole 3-way rotary. S2 on-off toggle.
T1 Transformer Type T1079 (Ardente-Henrys Radio)
T2 Transformer Type MT-9 (Osmor-Henrys Radio)
Speaker (see text) Material for paddle. Relay (see text).



▲*Fig. 2. Details of the construction of the paddle bracket.*

▼*Fig. 3. Circuit of the suggested power supply unit.*



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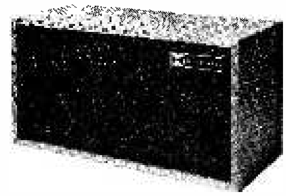
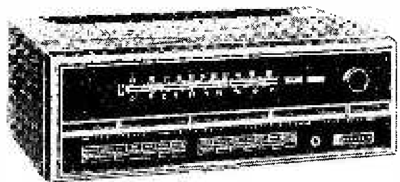
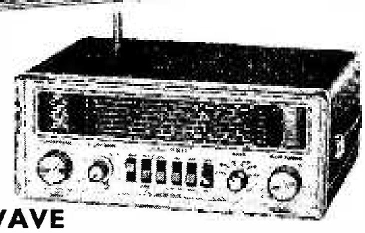


SPEAKERS

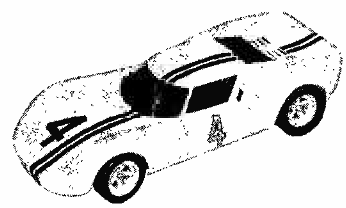
HI-FI AND AUDIO



CONSUMER



SHORTWAVE



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depending upon other components used, but wide variations from values specified are considered unlikely.

Power Supply

The supply potential should not be less than 9 volts d.c. and the current drain demanded will approximate to 20mA during operation. A battery is the obvious source of power but use of an adjustable-output mains driven unit may be considered; a suitable circuit is given in Fig. 3. Here the mains-isolating transformer selected measures but $1\frac{1}{8} \times 1\frac{1}{2} \times 1\frac{1}{4}$in which means that the entire p.s.u. can be built into a space no greater than that needed for a type PP9 battery; this unit will also be found useful in other workshop connections.

By using the whole of the transformer secondary winding in conjunction with four rectifiers bridge-connected as shown up to 12 volts d.c. at 35mA can be taken or 15 volts at 10mA; the transformer is rated to 80mA.

Conclusion

Housing the completed keyer in a box made from aluminium sheet is desirable and if the battery is to be used for powering this can be accommodated within the box. If the mains-derived power supply is adopted it may be found more convenient to keep the p.s.u. as an item separate to the keyer.

Due to the integral audio monitor there is no need initially to switch on the transmitter to get the feel of the keyer—in fact, your friends will thank you for not doing so! The keyer does take a little while to get used to after operating with a conventional key and it therefore is wise to spend some time practising. When the various controls and the paddle have been adjusted to suit individual fingering subsequent "on the air" operation should prove both pleasurable and relaxing, but if you do feel the urge to speed your sending do not forget the chap at the other end! ■

CORRIGENDA

October 1970. Mini-Organ.

Fig. 2. Connection between VR12 and VR11 should be extended to dotted arrow 11. Similarly the connection between V13 and V12 should be extended to dotted arrow 12.

Fig. 3. The capacitor between rails M and S should be marked C6 and not C4. Transistor Tr4 connection to rail M is the collector, to rail O the emitter and to rail T the base.

October 1970. Transistor and Diode Tester.

In the components list on page 431 the specifications for switches S1 and S2 should be transposed.

September 1970. Guitar Amplifier, Part 1.

To the components list add R47, 150kΩ and amend Henelec mains power unit reference number to Type MU442, (not 422).

Finish off that Equipment—*continued from page p.848*

Any screwheads that must appear on the panel should be plated ones. In general tighten up nuts from the back of the panel rather than using a screwdriver on the screw. The slot may be damaged or, far worse, the screwdriver may slip and ruin the panel.

These precautions are doubly necessary when using Letraset as a panel finish as it is easily pulled up when tightening screws or nuts from the front. Always use a flat washer under a lock nut.

As far as possible knobs and dials should match in size and colour and again a little extra expense in this direction is well worth while. If the equipment is mains operated don't forget to fit an indicator lamp to the front panel because apart from the pleasant effect it prevents the equipment being left switched on inadvertently.

It is also a good idea to fit an on-off switch to each separate piece of equipment rather than to have a loose plug that has to be picked up and plugged into the mains every time the equipment is wanted.

If one is likely to be a prolific producer of gear it is advisable to settle on a particular make or design of cabinet and colour scheme so that eventually the units will blend together instead of finishing up with a motley collection of cabinets of varying sizes and colours. ■

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I.C. OF THE MONTH

L.A.J. IRELAND

Number 16 — Operational Amplifiers in Audio Circuits

OPERATIONAL amplifiers have not figured significantly in these notes to date, despite the fact that, in terms of numbers produced, these are by far the most popular linear i.c.'s. They have not figured, though, for the very good reason that their applications lie mainly in the field of industry and instrumentation; indeed the phrase comes from the origin of this type of device, in the simulation of mathematical operations in analogue computing.

The primary feature required in an operational amplifier is the ability to cope with input signals varying in voltage only slowly (i.e. pseudo direct currents) representing for example the temperature or pressure at which a chemical reaction takes place. Interstage coupling with capacitors is therefore impossible since these have a frequency-dependent impedance, so the designer must resort to direct coupling throughout to achieve a fixed gain with signals ranging from virtually d.c. to (typically) 1MHz.

Further requirements are a low drift (good long-term stability in gain and voltage levels) with a high input impedance and a low output impedance, and high voltage gain. These features ensure that the circuit imposes only a small load on the instrument or transducer driving it, while output is only slightly affected by the drain of the following stage.

The mathematical operations of addition and subtraction, integration or differentiation are achieved by resistive or capacitative feedback, which also limits the gain of the amplifier from the very high "open loop" figure to that required for the specific application.

Two input terminals are available, the negative (to which the feedback connection is made) which produces an output signal of opposite polarity to the input (corresponding to multiplication by -1 or phase shift of 180° depending on the particular simulation) and the positive which secures an output similar to the input in sign and phase.

Fig. 1 shows an operational amplifier in a simple simulation. An extended discussion of the theory of the operational amplifier, centred on the type 709 which is the standard model monolithic circuit, was given in the August 1970 edition of our companion journal, "Practical Television".

Several of the units previously treated in these pages were adapted from industrial applications, and the same potential exists for the operational amplifier. The characteristics of the circuit make

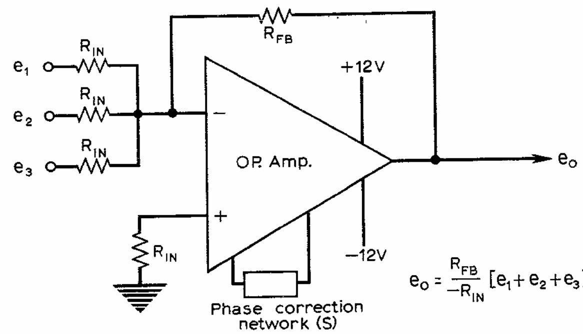


Fig. 1: Operational amplifier as used in mathematical simulation of expression shown. Input impedance = R_{IN} since feedback produces a "virtual earth" at the input terminal.

it ideal for audio and video amplification, with its wide bandwidth and stability. With additional power transistors, a first rate hi-fi unit can be assembled at low cost and with minimal possibilities for error. Indeed the power transistors can be brought within the feedback loop of the operational amplifier, so that crossover problems, and other sources of distortion and noise are automatically compensated.

Complementary transistors allow the principle of

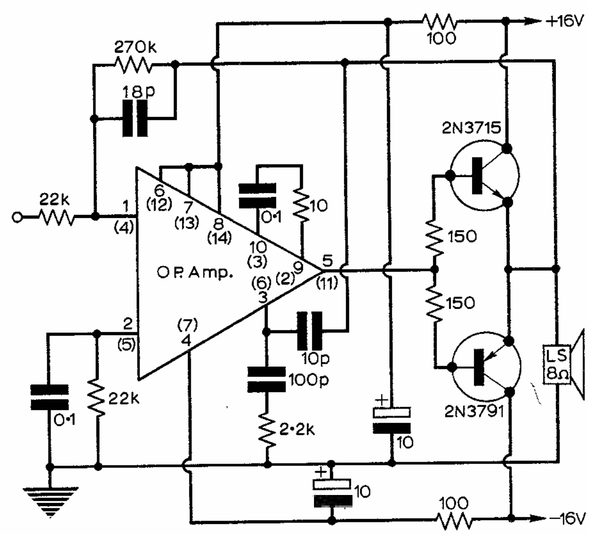
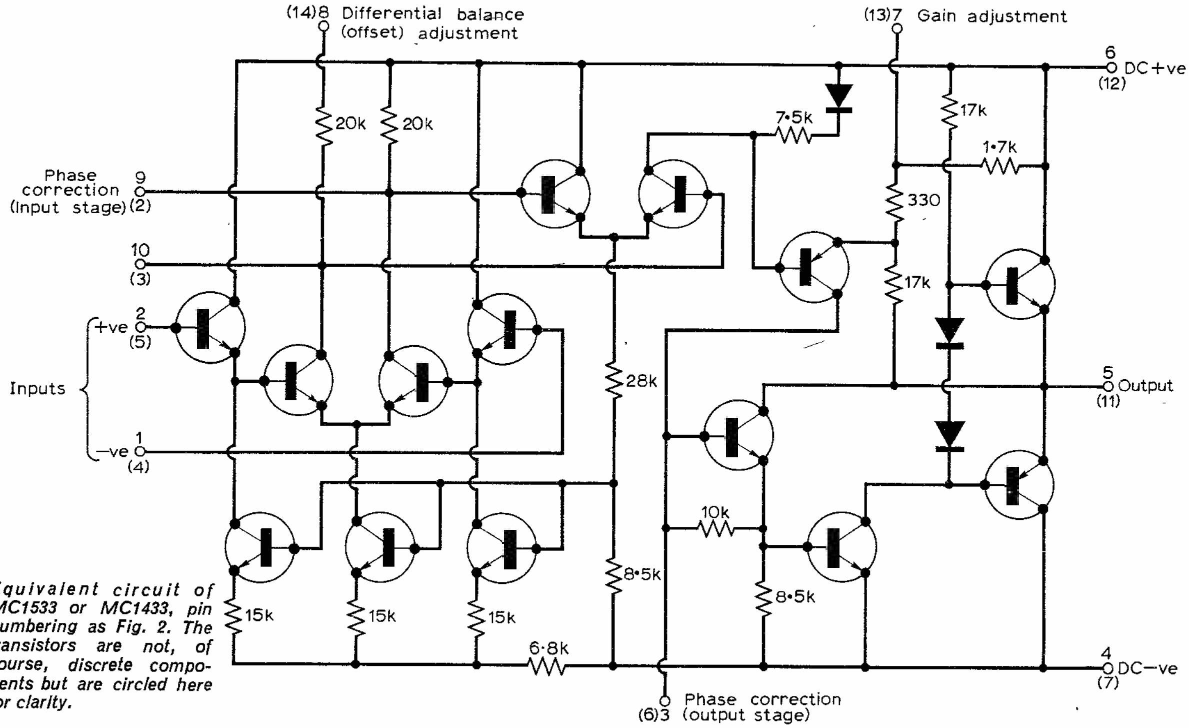


Fig. 2: 4 watt mono amplifier, using the MC1533 (TO-5). Numbers in brackets refer to economy style MC1433P, electrically identical, in 14 pin package.

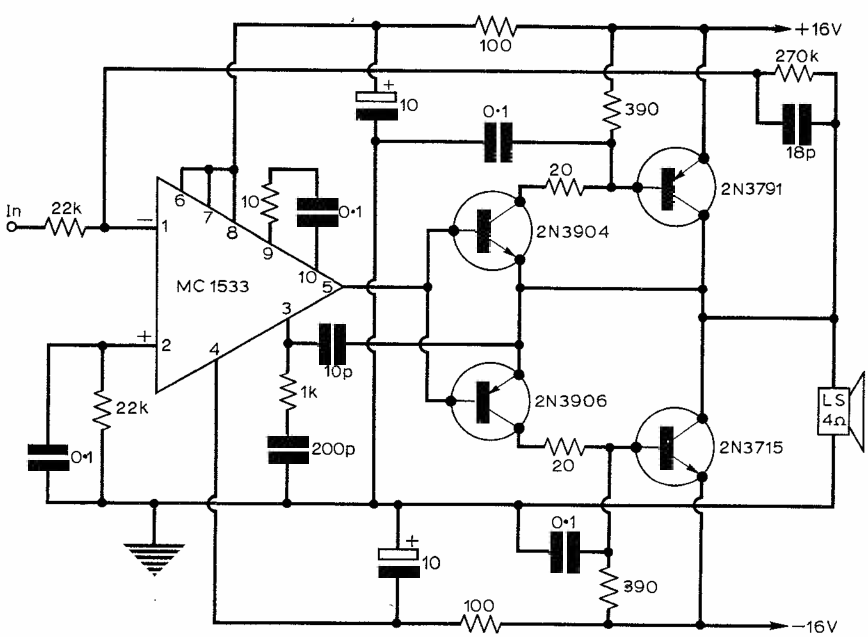


Equivalent circuit of MC1533 or MC1433, pin numbering as Fig. 2. The transistors are not, of course, discrete components but are circled here for clarity.

direct coupling to extend to the output stage, with the result that the amplifier has a fixed gain from d.c. to above 20kHz (there is no low frequency cut off). At the same time the theory of the operational amplifier can be applied to the complete circuit to determine its gain, while mixing facilities are available at the input as in addition simulation.

Two applications of these ideas are illustrated—one a domestic sound system, Fig. 2, the other for p.a. work, Fig. 3. It will be noted that a "split" power supply is used, corresponding to industrial practice. This has the advantage that all signals are referred to earth, and the load is directly connected from the amplifier output to earth without the necessity of a large blocking capacitor, a not unusual source of trouble in more conventional schemes.

For stereo operation, there is an alternative to straightforward duplication of one of the amplifiers illustrated. Readers may recall that in the August 1970 issue a Motorola unit MC1303 was introduced as a stereo preamplifier, and it was mentioned that it was a development of the industrial unit MC1535. In fact this is a dual operational amplifier, and the remarks given above apply to each of the sections independently. Given the pin connections (Fig. 4) it should be a challenge to the reader to design a stereo system along the lines indicated for the mono amplifiers of Fig. 2 or Fig. 3. ■



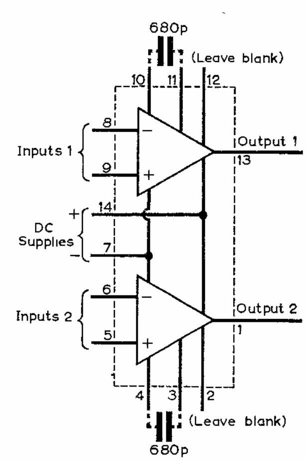


Fig. 3: (left) A 20W mono hi-fi amplifier suitable for p.a. work. Fig. 4: (above) The connections for the MC1303 a dual operational amplifier suitable for stereo work.

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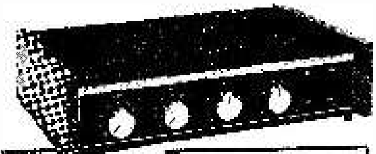

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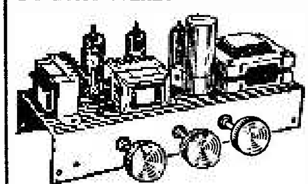

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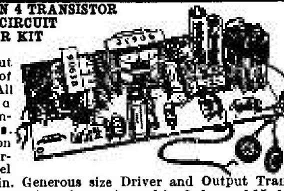
PLINTH UNITS cut out for Garrard Models, 1025, 2025, 2000, 3000, 3500 etc. With rigid transparent plastic cover. Special design enables above models to be used with cover in position. Also suitable for housing AT60 and SP25. **OUR PRICE £5.15.0** complete. P. & P. 8/6.

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/-.

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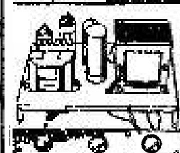

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½" w. × 4" d. × 4½" h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker. Separate volume control and 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/-.
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ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz • Times in GMT

THE onset of winter has seen the usual increase in activity and a consequent increase in the number of reports to this column. The first comes from:

C. R. S. Stacey of Tunbridge Wells who tuned his Lafayette HA-700 receiver and Joystick antenna to hear:

4875 *S. Africa, Domestic Sce.*, Afrikaans at 1924
4890 *Radiodiff. du Senegal* in French at 1900
4915 *Voice of Kenya*, Home Sce., Swahili at 1820
6040 *Voice of the Coast* (Sharjah), Arabic at 1400
6045 *R.R. Indonesia* in Indonesian at 1521-1537
6045 *Greek Armed Forces Information Service* at 1530
6065 *Radio Voice of the Gospel*, Amharic at 1630
9770 *Vladivostock*, Ext. Sce. of R. Moscow at 1500
15280 *Voice of Malaysia*, Indonesian at 1543-1553

Jeffrey Malina of London, N.4, is a new reporter who used his Skyrover Mark II receiver and 104-foot long-wire antenna to hear:

5920 *Kiev, Ukrainian S.S.R.*, noted at 1930
7065 *Tirana, Albania*, from 2130 to 2145
9009 *Israel B.S.* from 2045 to 2100 and 2115 to 2130
9625 *Israel B.S.* from 2045 to 2130
9520 *Trans World Radio* noted at 1700
9912 *All India Radio* from 2045 to 2115
17715 *Radio Havana*, Cuba, at 2105 to 2140
17725 *Radio Cairo, U.A.R.*, from 1415 to 1430
17870 *Radio Ghana* noted from 1400 to 1410

Regular reporter **John Trewick** of London Colney has heard the following stations:

9635 *Baghdad, Iraq*, news in English at 1935
11790 *ABC, Australia*, in Vietnamese at 2130
11845 *Trans World Radio*, Bonaire, testing at 2140
11855 *Saudi Arabia* with news in English at 1950
15080 *All India Radio* with English to Africa at 1900
15320 *ABC, Australia*, with "Mailbag" at 2115.

Robert Cork of Basingstoke has sent in another report which included:

7065 *Radio Tirana*, Albania, at 1845
9625 *Israel B.S.* at 1130 with religious programme
9665 *Radio Malaysia* from 1100 to 1200
11805 *Radio Globo* from 2215 to 2225

Nigel Milner of Sutton Coldfield used his Invicta 5-valve domestic equipment to hear some interesting stations including:

6095 *Radio Baghdad*, Iraq, in English at 2020
9009 *Radio Israel* in English at 2015
11915 *HCJB, Quito, Ecuador*, in English at 0430
15250 *RSA, S. Africa*, with news in English at 1900
15405 *Radio Kuwait*, Top Twenty Show at 1700

Patrick Hendrick of Wellington in South Africa has built various pieces of equipment as described in P.W., including the Modular 3-band s.w. receiver. This equipment and three 50-foot long-wires enabled Patrick to hear the following:

3925 *Australian B.C.*, VLK3 at 0740
4896 *Australian B.C.*, VLT4 at 0740
6250 *Lourenço Marques*, Mozambique, at 1830
7205 *Voice of America* relay at 1745
11760 *B.B.C.* noted in English at 2145
15125 *Voice of Free China*, BED60, noted at 1705
15140 *B.B.C.* noted at 2145
17845 *Radio New York World-Wide* at 1710

Nicholas Hall of Cheadle has an AR88D receiver, a BC221 frequency meter and a 150-foot long-wire antenna, which enable him to hear:

4825 *Radio Ashkabad*, USSR, at 1710
4865 *Ponta Delgada*, Azores, at 1845 in Portuguese
4940 *Radio Kiev*, Ukrainian S.S.R., at 1540
5040 *Radio Tbilisi*, USSR, at 1615
15020 *Radio Hanoi*, Vietnam, at 1300
17705 *Radio Havana*, Cuba, at 2015
21545 *RSA, S. Africa*, to N. Zealand at 0800 to 0850

Derek Hart of Lancaster has an Astrad Auriga receiver and an excerpt from his log reads as follows:

6065 *Seoul, Korea*, with news in English at 2115
9390 *Radio Tirana*, Albania, in English at 1835
9550 *Radio Finland*, in English at 1000
15365 *RSA, S. Africa*, in English at 1000
15405 *Radio Kuwait*, documentary at 1730
17945 *Karachi, Pakistan*, news in English at 1515
21460 *HCJB, Quito, Ecuador*, in English at 1945

News

Regular reporter **Roy Patrick** of Derby has sent in some more items of news. Many thanks, Roy, for another excellent contribution.

ECUADOR, HCJB, Quito is now using the frequency of 15300 instead of 15425 for the European Service. The best frequency for reception in this country is 21460.

LIBERIA, ELWA, Liberia has been logged on the new frequency of 15170 at 2000. The programme heard was in French.

GHANA, Radio Accra, Ghana has been heard at 1445 on 21545 with a programme in English.

UNITED ARAB REPUBLIC, The Voice of Africa from Cairo has been heard on 17725 in English from 2030 to 2155.

UNITED STATES OF AMERICA, WNYW, Radio New York World-Wide has been reported to be up for sale by several DX publications. According to a station announcement the station is very definitely not for sale.

All reports, which should be in frequency order, must arrive by the 17th of the month. They should be addressed to me at *5 Ranelagh Gardens, Cranbrook, Ilford, Essex.*

ON THE SHORT WAVES

EACH year begins with a new crop of resolutions all made, at the time, in good faith. How about making some of them a reality this year? That crystal frequency marker which would enable the receiver dial to be made far more meaningful is an example of planning something concrete and sticking to it.

Others might like to make their resolutions, or plans, for later on in the year. One can usefully employ the cold winter months planning some antennas which might be tried. How about a ground plane, or even a vertical dipole. Neither antenna is difficult to make and plans as to construction and location could be made so that the antenna can materialise with the minimum of effort once the warmer weather arrives.

For those who want to get a bit more out of their hobby, a world map plus a good atlas can work wonders. The world map goes on the shack wall and small coloured pins may be pushed in when stations are either worked or logged. When a station gives his precise QTH, it is interesting to check in the atlas to see just where some of these funny-sounding places really are. This scheme does a number of things besides giving added interest. It will build up quite a good knowledge of geography without really trying and will assist in associating the callsigns of countries with their exact location.

Don't forget that receivers, like motor cars, need servicing. A check up and re-alignment can work wonders and simple accessories can be a great help. A simple oscilloscope hooked on to the first i.f. transformer can give a very good indication of what the modulation of the incoming signal is like and will show any whiskers on a c.w. signal.

None of the above suggestions are obscure or ingenious. However, readers might care to sit down and think how they will be getting the most out of their hobby this year. Perhaps you can think of an idea better suited to your own particular needs.

The l.f. bands have given a clear indication this past month that things are happening for those who can be bothered to listen. Anyone can log DX on 14 and 21MHz but it takes a definite skill on the lower frequencies and not just a good receiver.

Steve Champion (Herts.), reports the 7MHz at 0730 is a good time to harken to VK types and the like with little QRM to make things difficult. Both VK3OZ and VK3ZL were logged at 5 and 7 on s.s.b.

Down at Weymouth, **Les Barnes** has been stoking up his CR70A on 3·5MHz. Rewards from—CR4BC, K5PFL, LX1DAC, W2TF, ZL4IE, 9H1BW, 9V1PP.

Tim Thornton (Berks.), CR70A, 132ft. end fed also reckons that conditions are excellent on eighty metres. Extract from his s.s.b. log reads—EA4JL, FB8XX, HB0XFB, VE1IE, VE1AAW (5 and 9 plus at 0640), VO1FG, WA8ROJ (c.w.), YT2NFJ, ZB2A, ZM4PG, OH1PS/4X, 5Z4KL, 6W8DY, 9X5PB.

Still on eighty, **Charles Lewis** (Flint.), is also an l.f. addict. Armed with W.S.19 set Mk.III he hooked KCVR and VS6DO on a.m. and VK6DF on s.s.b.

THE AMATEUR BANDS

David Gibson, G3JDG

Frequencies in kHz • Times in GMT

P. Baldwin (Northants), homebrew receiver, 67ft. end fed, 80 s.s.b.—CT1NK, HC4BS, K3UZE, TF5TP, VE1AA, VE1IE, VE8RX, VO1BV, W2HCW, XE1KB, ZL4IE, ZL4NJ, ZS5XA, 9F3USA.

At Maldon in Essex, **Paul Fereyer** has a Marconi No. 9 set and a 100ft. wire. Goodies on eighty include —CN8HD, EP2DX, JA5CQ, JX8XF, K8HCL, PJ0DX, VE3TX, VO1FX, VP1WMU, VP2VP, VP7BW, VP9DX, VS6DO, VS9MB, XE1KB, ZL4IE, ZL4JW, ZL4KE, ZM1AIX, 4X4UF, 6W8DY, 9J2BG.

Not up but down. **Stephen Davies** (S. Wales), B40, 250ft. long, long wire, reports signals on Topband from—EI9ONE, OK1AA, OK1AKN, OK1ATP, PO0SE, ZC4RB.

If you thought we'd finished with eighty, you're wrong. **John Moxham** (Somerset), SR200, 67ft. end fed plus a.t.u. says it's been a great month for 3·5MHz. His log reads—FB8XX, JX8YN, K4MMY, OY7JD, OY9LV, PJ7JC, TJ1AW, TZ2AB, VE1AA, VE8YL, (Resolution Is.), VS6DO, VS9MB, VU2BEO, WA5AHB, XE1KB, ZB2A, 4S7AB, 4U1ITU, 4X4KT, 4Z4HF, 6W8DY, 9F3USA.

On the h.f. bands things have been pretty lively adding up to a very nice six-band month as regards activity. Twenty metres gave **John Morrie** (Lancs.) AX2ZQ, OA7KP, VP8OJ and VR6GA. Up on 21MHz, **Mark Wallace** (Lincs.) grabbed himself his first Australian call from VK2FU.

Philip Beeson (Staffs.) HA500 and 67ft. end fed pricked up his ears to signals from JY1 on 14,300 s.s.b., while a listen on 28MHz raised calls like CR7FO, W5KDI and YS2ACB. **S. Wainwright** (Lancs.) heard CR7IZ, EP2FB, FR7ZN, JY1, KP4ADY, LU5DL, MP4BHL, TJ1AZ and 8P6TCA on ten metres but makes no mention of what receiver or aerial. (Perhaps he's psychic?).

An ancient Ferguson domestic receiver is ye sad lot of **P. Harris** bought second hand in 1946 (the set —not P. Harris). Trouble is, when he connects his homebrew preselector and an antenna he hears things on twenty metres, like—CE3TP, CR6FR, FB8XX, FR7ZN, JA1NAW, KR6TQ, ZM4BO, 8P6AZ and 9K2AM.

Listening in the the school holidays is the sin of **Paul Austin** (unpronounceable place in Monmouthshire). The CR100/2 plus dipole on twenty aided and abetted with—AP5HQ, AX7GC, CR6IK, FO8BY, JA6JBR, KH6FF, LU1ZE, PZ1BK, SU1MA, ZL3VV, ZM3US, 9Q5AS.

An 8-over-8 at 30ft., m.o.s.f.e.t. converter and Trio 9R59DE together with **John Haig** all live in Hitchin, Herts. Combined effort for two metres includes—G8EGS, G8BZR/P (Rutland), G3TUW, G8ATK, G8BXX, G3DAH, G8BCL, G3BGH, G8BTX, G8CEX,

Listen in January (30-31) for the world-wide 160 metre contest. February (6-7) is the time for ARRL DX phone contest.

Logs, in alphabetical order please, to arrive by the 15th of the month.
14, Manland Avenue, Harpenden, Herts.

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FOR ONLY 39 GNS

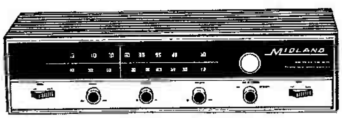
CARRIAGE 35/-

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.*

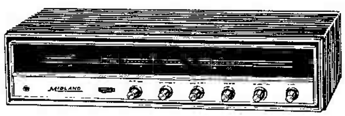
PREMIER STEREO SYSTEM "TWO"
As system 'ONE' above but with Garrard SP25.
PREMIER PRICE 45 Gns. Carr. 35/-

MIDLAND AM/FM STEREO TUNER AMPLIFIERS

Two new all solid state receivers from Midland at economical prices. Beautifully styled in slimline cabinets.



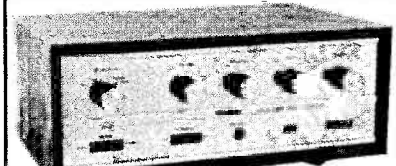
MODEL 19-520



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$\frac{1}{16}$" x 3½"	16½" x 9⅛" x 3⅛"
PRICE	**29 Gns.** Carr. & Ins. 10/-	**42 Gns.** Carr. & Ins. 10/-

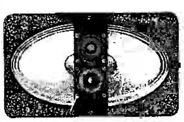
TELETON SAQ203E STEREO AMPLIFIER



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



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69/6 P. & P. 7/6

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Battery operated 4-channel audio mixer providing four separate inputs. Size 6 × 3 × 2in. suitable for crystal microphone low impedance microphone, with transformer, radio, tape, etc. Max. input 1·5v. Max. output 2·5v. Gain 6 dB. Standard jack plug socket inputs. phonoplugs output. Attractive teak wood grain finish case.

MONO MODEL **59/6** STEREO MODEL **69/6** P. & P. 2/6.

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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

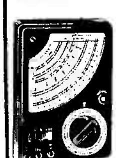
PREMIER PRICE 65 Gns. Carr. 35/-

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/-.

STEREO STETHOSCOPE SET Low imp. **25/-** P. & P. 2/-.
MONO STETHOSCOPE SET Low imp. **10/6** P. & P. 2/-.



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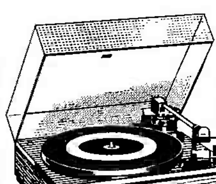

GARRARD SP25 MK II SINGLE RECORD PLAYER FITTED AUDIO TECHNICA AT66 MAGNETIC STEREO CARTRIDGE COMPLETE IN TEAK PLINTH WITH RIGID PERSPEX COVER.

Total list price over £24.
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DT3	3½"	600'	POLYESTER	11/6	TT6	5¾"	2400'	POLYESTER	37/6
SP5	5"	600'	P.V.C.	8/6	SP7	7"	1200'	P.V.C.	12/6
LP5	5"	900'	P.V.C.	10/-	LP7	7"	1800'	P.V.C.	15/-
DT5	5"	1200'	POLYESTER	15/-	DT7	7"	2400'	POLYESTER	25/-
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TAPE SPOOLS 3" 1/-, 5", 5¾", 7" 1/9,
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U2	60 Mixed Germanium Transistors AF/RF	10/-
U3	75 Germanium Gold Bonded Diodes sim. OA5, OA47	10/-
U4	40 Germanium Transistors like OC81, AC128	10/-
U5	60 200mA Sub-min. Sil. Diodes	10/-
U6	30 Silicon Planar Transistors NPN sim. BSY95A, 2N706	10/-
U7	16 Silicon Rectifiers Top-Hat 750mA up to 1,000V	10/-
U8	50 Sil. Planar Diodes 250mA OA/200/202	10/-
U9	20 Mixed Volts 1 watt Zener Diodes	10/-
U11	30 PNP Silicon Planar Transistors TO-5 sim. 2N1132	10/-
U13	30 PNP-NPN Sil. Transistors OC200 & 2S104	10/-
U14	150 Mixed Silicon and Germanium Diodes	10/-
U15	25 NPN Silicon Planar Transistors TO-5 sim. 2N697	10/-
U16	10 3-amp Silicon Rectifiers Stud Type up to 1,000 PIV	10/-
U17	30 Germanium PNP AF Transistors TO-5 like ACY17-22	10/-
U18	8 6-Amp Silicon Rectifiers BYZ13 Type up to 600 PIV	10/-
U19	25 Silicon NPN Transistors like BC108	10/-
U20	12 1·5 amp Silicon Rectifiers Top-Hat up to 1,000 PIV	10/-
U21	30 AF Germanium alloy Transistors 2G300 Ser. & OC71	10/-
U23	30 Madt's like MAT Series PNP Transistors	10/-
U24	20 Germanium 1-amp Rectifiers GJM up to 300 PIV	10/-
U25	25 300Mc/s NPN Silicon Transistors 2N708, BSY27	10/-
U26	30 Fast Switching Silicon Diodes like IN914 Micro-min.	10/-
U28	Experimenters' Assortment of Integrated Circuits, untested. Gates, Flip-Flops, Registers, etc., 8 Assorted Pieces	20/-
U29	10 1-amp SCR's TO-5 can up to 600 PIV CRS1/25-600	20/-
U31	20 Sil. Planar NPN trans. low noise Amp 2N3707	10/-
U32	25 Zener diodes 400mW D07 case mixed Volts, 3-18	10/-
U33	15 Plastic case 1 amp Silicon Rectifiers 1N4000 series	10/-
U34	30 Sil. PNP alloy trans. TO-5 BCY26, 2S302/4	10/-
U35	25 Sil. Planar trans. PNP TO-18 2N2906	10/-
U36	25 Sil. Planar NPN trans. TO-5 BFY 50/51/52	10/-
U37	30 Sil. alloy trans. SO-2 PNP, OC200 2S322	10/-
U38	20 Fast Switching Sil. trans. NPN. 400 Mc/s 2N3011	10/-
U39	30 RF Germ. PNP trans. 2N1303/5 TO-5	10/-
U40	10 Dual trans. 6 lead TO-5 2N2060	10/-
U41	25 RF Germ. trans. TO-1 OC45 NKT72	10/-
U42	10 VHF Germ. PNP trans. TO-1 NKT667 AF117	10/-

Code Nos. mentioned above are given as a guide to the type of device in the Pak. The devices themselves are normally unmarked.

UNIJUNCTION
UT46. Eqvt. 2N2646
Eqvt. TIS43. BEN3000
5/6 EACH
25-99 5/- 100 UP 4/-

NPN Silicon PLANAR
BC107/8/9, 2/- each 50-99, 1/10 100 up, 1/8 each, 1,000 off, 1/6 each. Fully tested and coded TO-18 case.

120VCB NIXIE DRIVER TRANSISTOR. Sim. BSX21 & C407, 2N1893 FULLY TESTED AND CODED ND120, 1-24, 3/6 each. TO-5 NPN 25 up 3/- each.

AD161 NPN
AD162 PNP
OUR LOWEST PRICE OF **12/6** PER PAIR.

2N3055 115 WATT SIL. POWER. NPN.
OUR PRICE **12/6** EACH

FET'S
2N 3819 .... 8/-
2N 3820 .... 20/-
MPF105 .... 8/6

PRINTED CIRCUITS EX-COMPUTER
Packed with semiconductors and components. 10 boards give a guaranteed 30 trans. and 30 diodes. Our price 10 boards **10/-** plus 2/- p.&p.

FULL RANGE OF ZENER DIODES VOLTAGE RANGE 2-33V. 400mV (DO-7 Case) **2/6 ea.** 1·5W (Top-Hat) **3/6 ea.** 10 W. (SO-10 Stud) **5/- ea.** All fully tested 5% tol. and marked. State voltage required.

SIL. RECTS. TESTED

PIV	750mA	3A	10A	30A
50	1/-	2/9	4/3	9/6
100	1/3	3/3	4/6	15/-
200	1/9	4/-	4/9	20/-
300	2/3	4/6	6/6	22/-
400	2/6	5/6	7/6	25/-
500	3/-	6/-	8/6	30/-
600	3/3	6/9	9/-	37/-
800	3/6	7/6	11/-	40/-
1000	5/-	9/3	12/6	50/-
1200	6/6	11/6	15/-	

BI-PAK = LOW COST I.C's

BI-PAK Semiconductors now offer you the largest and most popular range of I.C's available at these **EXCLUSIVE LOW PRICES.** TTL Digital 74N Series fully coded, brand new. Dual in-line plastic 14 and 16 pin packages.

BI-PAK Order No.	SIM-TYPE.	Description	Price and qty. prices 1-24	25-99	100 up
BP00	7400N	Quad 2-Input NAND GATE	6/6	5/6	4/6
BP01	7401N	Quad 2-Input NAND Gate—OPEN COLLECTOR	6/6	5/6	4/6
BP04	7404N	HEX INVERTER	6/6	5/6	4/6
BP10	7410N	Triple 3-Input NAND GATE	6/6	5/6	4/6
BP20	7420N	Dual 4-Input NAND GATE	6/6	5/6	4/6
BP30	7430N	Single 8-Input NAND GATE	6/6	5/6	4/6
BP40	7440N	Dual 4-Input BUFFER GATE	6/6	5/6	4/6
BP41	7441AN	BCD to decimal decoder and NIT Driver	22/6	20/-	17/6
BP42	7442N	BCD to decimal decode (TTL 0/1)	22/6	20/-	17/6
BP50	7450N	Dual 2-Input AND/OR/NOT GATE—expandable	6/6	5/6	4/6
BP53	7453N	Expandable 4-wide 2 input and-or-nor gate.	6/6	5/6	4/6
BP60	7460N	Dual 4-Input—expandable	6/6	5/6	4/6
BP70	7470N	Single JK Flip-flop—edge triggered	9/-	8/-	7/-
BP72	7472N	Single Master Slave JK Flip-flop	9/-	8/-	7/-
BP73	7473N	Dual Master Slave JK Flip-flop	10/-	9/-	8/6
BP74	7474N	Dual D Flip-flop	10/-	9/-	8/6
BP75	7475N	Quad Bistable Latch	11/-	10/-	9/6
BP76	7476N	Dual Master Slave Flip-flop with preset and clear	11/-	10/-	9/6
BP83	7483N	Four Bit Binary Adder	26/-	22/6	20/-
BP90	7490N	BCD Decade Counter	22/6	20/-	17/6
BP92	7492N	Divide by 12 4 Bit binary counter	22/6	20/-	17/6
BP93	7493N	Divide by 16 4 Bit binary counter	22/6	20/-	17/6
BP94	7494N	Dual Entry 4 Bit Shift Register	22/6	20/-	17/6
BP95	7495N	4 Bit Up-Down Shift Register	22/6	20/-	17/6
BP96	7496N	5 Bit shift register	24/-	21/-	18/6

Data is available for the above Series of Integrated circuits in booklet form, price 2/6

FREE One 10/- Pack of your own choice free with orders valued £4 or over. **FREE**

NEW LOW PRICED TESTED S.C.R's.

PIV	1 A (TO-5 case) each	3 A (TO-66 case) each	7 A (TO-48 case) each	16 A (TO-48 case) each	PIV	30 A each
50	4/6	5/-	9/6	10/6	25	20/-
100	5/-	6/6	10/6	12/6	50	23/-
200	7/-	7/6	11/6	15/-	100	28/-
400	8/6	9/6	13/6	18/6	200	32/-
600	10/6	11/6	15/6	25/-	400	35/-
800	12/6	14/-	18/-	30/-	800	80/-

DUAL-IN-LINE LOW PROFILE SOCKETS. 14 AND 16 Lead Sockets for use with Dual-in-Line Integrated Circuits.

Order No.	Price each 1–24	25–99	100 up
TS014 14 pin type	7/6	6/-	5/3
TS016 16 pin type	10/-	8/6	7/9

TRIACS

VBOM	2A (TO-1)	6A (TO-66)	10A (TO-88)
100	14/-	15/-	22/6
200	17/6	20/-	28/-
400	20/-	25/-	35/-

VBOM = Blocking voltage in either directi on.

BRAND NEW. FULL TO MANUFACTURERS' SPECIFICATION

	Price each 1–24	25–99	100 up
BP709 Operational Amplifier, dual-in-line 14 pin package = SN72709 and similar to MIC709 and ZLD709C	10/6	9/-	8/-

This is a high performance operational amplifier with high impedance differential inputs and low impedance output.

TTL. INTEGRATED CIRCUITS

Manufacturers' "Fall outs"—out of spec. devices including functional units and part functional but classed as out of spec. from the manufacturers very ridged specifications. Ideal for learning about I.C's and experimental work, on testing some will be found perfect.

PAK No.	PAK No.	PAK No.
UIC00 = 5 × 7400N ..10/-	UIC42 = 5 × 7442N ..10/-	UIC80 = 5 × 7480N ..10/-
UIC01 = 5 × 7401N ..10/-	UIC50 = 5 × 7450N ..10/-	UIC82 = 5 × 7482N ..10/-
UIC02 = 5 × 7402N ..10/-	UIC51 = 5 × 7451N ..10/-	UIC83 = 5 × 7483N ..10/-
UIC03 = 5 × 7403N ..10/-	UIC60 = 5 × 7460N ..10/-	UIC86 = 5 × 7486N ..10/-
UIC04 = 5 × 7404N ..10/-	UIC70 = 5 × 7470N ..10/-	UIC90 = 5 × 7490N ..10/-
UIC05 = 5 × 7405N ..10/-	UIC72 = 5 × 7472N ..10/-	UIC92 = 5 = 7492N ..10/-
UIC10 = 5 × 7410N ..10/-	UIC73 = 5 × 7473N ..10/-	UIC93 = 5 × 7493N ..10/-
UIC20 = 5 × 7420N ..10/-	UIC74 = 5 × 7474N ..10/-	UIC94 = 5 × 7494N ..10/-
UIC40 = 5 × 7440N ..10/-	UIC75 = 5 × 7475N ..10/-	UIC95 = 5 × 7495N ..10/-
UIC41 = 5 × 7441AN ..10/-	UIC76 = 5 × 7476N ..10/-	UIC96 = 5 × 7496N ..10/-
		UICX1 = 20 × asst'd 74's ..30/-

Packs cannot be split but 20 assorted pieces (our mix) is available as PAK UICX1. Every PAK carries our BI-PAK Satisfaction or money back GUARANTEE.

RTL. FAIRCHILD (U.S.A.) I.C's

RTL Micrologic Circuits
Epoxy case To-5 temp range 15°C to 55°C.

	Qty. prices each 1-11	12-24	25-99	100 +
μL 900 Buffer	8/-	7/-	6/6	5/6
μL 914 Dual two-input GATE	8/-	7/-	6/6	5/6
μL 923 J-K Flip-flop	10/6	10/-	9/6	9/-

Full data and circuits for ICS in Booklet form price 1/6 each.

μA703E Linear RF-IF AMPLIFIER PLASTIC CASE To-5 6 lead up to 100 m/cs.	11/-	10/-	9/-	8/3

Please send all orders direct to our warehouse and despatch department.

BI-PAK SEMICONDUCTORS
P.O. BOX 6, WARE, HERTS.

Postage and packing add 1/-. Overseas add extra for Airmail. Minimum order 10/-. Cash with order please.

practically wireless commentary by HENRY

No. 76

Demotic for What?

A determined attempt sends the set skidding.

ELECTRONICS is notorious for spawning strange words and oddly evocative phrases. Just look at the computer languages—JOSS, ALGOL, FORTRAN, COBOL, even POP-2.

They all mean something: each new word comprises the initials of a descriptive sentence. We are used to the technique: every village committee practises it, twisting the meaning of the Old Folks Fellowship Annual Love-in to a more innocuous abbreviation. You don't think the draughtsmen hit upon DATA by accident, do you? They could so easily have called themselves the Draughtsmens' Association of Fitting Technicians.

The lads from *Which* normally cut little ice with Henry. But those long-haired boffins from Loughborough College have now collaborated with the Consumer Association and have come up with ICE—a fashion-making force to be reckoned with.

The aim of the Institute of Consumer Ergonomics, I am told, is to ensure the handles of our pots and the knobs of our appliances are in the right place when we buy newly designed equipment.

They could well expend some effort in the radio and audio field. (I hesitate to mention Television, now that our sister-mag has gone all hoity-toity.)

In radio and audio design, ergonomics, though given lip service, is not a strong point. Itsy-bitsy edge controls come to mind. Partially recessed in shrunk plastic, they invite an unwary thumb to "Press—not turn." And tuning dials ride askew, rocking as they rotate. Where corded, they often have such backlash as to threaten a wrist fracture when we do a rapid "CQ".

To ensure pot handles are in the right places.

Tiny knobs look glitteringly attractive. But when we grasp them, the fingers slip fruitlessly, like wet hands clutching for soap. A determined attempt simply sends the set skidding away like Charlie Chaplin's bowler. These knobs are a result of designing for *style*—nothing to do with ergonomics.

ICE have a long way to go if they want to make audio gear look as good as it sometimes sounds. Take the current trend; all black with silver trim and brushed aluminium "satin" finish. These opulent panels attract. But after a short spell of service the satin dulls, the gleam diminishes, the trim black lettering becomes a smear beneath one's fingers.

In the audio world we meet some of those abbreviations that keep copywriters bouncing with glee. Only the other day we came across an amplifier that boasted a SEPPOTL circuit. Feverishly, we searched the Mullard Bulletins, scanned the Sasco News, perused ITT Standard, **even** Practical Electronics (no knowing what Fred may get up to) but failed to find any mention of this new device. We were not deterred: remember the Nuvisor? We plied our friends in the trade, and received only the usual knowing grins that denote an interested ignorance. The cost of the stamps prevented a direct enquiry from Japan.

Henry remembers a colleague bustling a flimsy loudspeaker to the spare room for a new tweeter. "Fifteen watts," he muttered. "That's WFT rating."

We knew about RMS—but, of course—of IHF, Peak IHF and all the twists of Music Power, but WFT was a new one. Why should Messrs Blank use that particular rating, we enquired. He snorted: "Don't they always? I've never known a bigger bunch of Wishful Thinkers."

Abbreviations are O.K., just so long as we all talk the same language. According to the British Association, there are 88 ways in our dialect of saying "left-handed." In the radio trade, we get used to LH. We use it as we use the red plug for the right channel, and the copper wire for earth.

Except that the plugs supplied will be blue and yellow, or both grey, and the twin cable will be twin *copper,* good for guessers. There was some hope that decimalisation would improve all this, but by the time we have sorted out our dodecacahedral from our equilateral curved heptagon coins, we haven't the energy to spare.

As for the chap who, with no foreknowledge, has to work out those audio symbols—Heaven help him. A gramophone pickup sign is simple: it even begins to look like an old-fashioned playing head (which is more than some modern ones do). That dinky aerial symbol is pretty meaningful. But when we get inverted top hats, buckets on their sides and pairs of wavy lines, even, bless us, a lightning flash, we hardly know which button to press.

If in difficulty, call HELP. That is, Henry's Enquiry Liaison Panel.

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.

TUNERS AND AMPLIFIERS
By John Earl
Published by Fountain Press Ltd., 46-47 Chancery Lane, London W.C.2.
187 pages, $8\frac{1}{2} \times 5\frac{1}{2}$ inches. Hard covers
Price 42s.

HAIL and welcome to the first of a new series of books on radio, television, audio and allied subjects. This venture by Fountain Press deserves success, if only for the meticulous way the series has been planned and the care with which preparation and layout have been made.

The project sounds simple enough—commission a top author in each branch of the subject and let him loose within a set format; edit his work and embellish it with tasteful illustration, then sit back and wait for the sales. We all know that it is never so simple, and if Mr. Earl's book reads effortlessly we may be sure it is the result of great diligence and not a little expertise.

It is certainly comprehensive. The field of amplifiers and tuners has grown apace in recent times; new devices have come along; new techniques flourish; we are even blessed with new basic materials. Mr. Earl has performed a much-needed service for the technician and the enthusiast in collating, summarising, discussing and in many cases explaining in admirable detail the modern tuner and amplifier.

He states his aims at the outset, to have *'maximum appeal not only to the user of high quality audio equipment but also to the person who is about to start out on the hi-fi adventure.'* The subtle technicalities do not bog us down, there are, as Mr. Earl says, a number of books that fill this role. In eight chapters, he roves the difficult country of semiconductors in modern equipment, the ups and downs of tuner circuitry, the controversial ground of amplifiers, with many practical examples, touches upon aerials, systems, the addition of a cartridge, power supplies, headphone and speaker matching and has even found space to add an excellent chapter on specifications.

The writing is concise, the illustrations well chosen and clear and the information throughout as up-to-date as a new-minted coin. Reading through this book, we come up against the very personal approach quite unexpectedly and if it teaches us to rethink, so much the better. Take for example Mr. Earl's remarks on 'Dynamic Range' in Chapter Four: exploding the wattage myth he comments, *'To reproduce 70 acoustic watts in full-force from a pair of speakers of 5% efficiency would require 350 electric watts in each channel . . . without distortion.'* There are watts and watts, and it is not said often enough!

This is not specifically a 'hi-fi' book. It caters for the chap who can only afford mid-fi equipment as well as the true audiophile. It is, in fact, one of the few books I have read which could help to turn the one into the other. It earns a welcome place on my bookshelf, from where I know it is going to be withdrawn many times for some reference or other to be checked. I shall probably be thankful for the index, which covers well over four pages. I shall certanly be grateful for Mr. Earl's easy style and look forward to seeing later contributions by him in what promises to be a useful and entertaining series of technical books.—*AWH.*

TAPE RECORDER SERVICING GUIDE
By Robert G. Middleton
Published by Foulsham-Sams
96 pages, $11 \times 8\frac{5}{8}$in. Price 35s.

I HAVE only one serious quibble about this book: its size. Large of page and thin of stature, it is more suitable for the coffee table than the bookshelf, and books laid on tables in my workshop tend to be used as wedges and props.

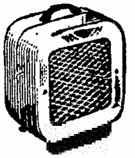
Mr. Middleton's latest work—the latest of many, for RGM is the American equivalent of our own Gordon J. King—is worthy of more than a casual dismissal. He has managed to compress a wide field of specialised service work into seven chapters, of which all but the first are strictly practical and to the point.

This first chapter lays the ground quite efficiently, describing the general principles of tape recording, with much emphasis on basic magnetism, the theory of bias and mechanical drive systems. For the reader unacquainted with tape recording, this chapter is necessary, for the more experienced audiophile it nevertheless offers an interesting and quite personal review of the subject.

After this we have the tape recorder described in detail by first dealing with maintenance and testing, then adjustments and minor repairs, and finally, in chapters 4 and 5, the troubles that can beset the machine's transport and recording circuitry. After this, chapters on relay troubles and those that can present problems with associated equipment underline the points and fill in a few of the gaps. But it is the heart of this book that is the vital part for the student of recording.

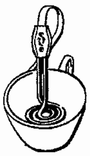
I would have liked more definite examples of recording equipment: nowhere is apparatus named; and yet valuable space is wasted on parts lists, complete with computer programme parts numbers. Some of the circuitry could have been brought nearer the present day, also, for this is a copyright 1970 work, and not a rewrite polished up for the benefit of we poor Limeys.

For those who have trouble wrestling with decibels allow me to commend the section on microphones, where one of the neatest explanations of relative levels, standard values and the importance of similar load values that I have ever seen is most admirably expressed. As, for that matter, is the whole book, making interesting and informative reading that is thoroughly recommended.—*HWH.*



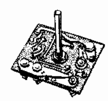
2½kW FAN HEATER
Three position switching to suit changes in the weather. Switch up for full heater (2½ kW), switch down for half heat (1¼kW), switch central blows cold for summer cooling—adjustable thermostat acts as auto control and safety cut-out. Complete kit **£3.15.0** Post and ins. 7/6.

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/-** plus 4/6 postage and insurance.

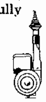


QUICK CUPPA
Mini Immersion Heater, 350w. 200/240v. Boils full cup in about two minutes. Use any socket or lamp holder. Have at bedside for tea, baby's food, etc. **24/6** post and insurance 2/9. **12v. car model also available 19/6**

PLINTH AND COVER
Suitable for most auto changers, teak base with tinted perspex cover **65/-** plus 6/6 postage. Special set for Balfour auto changer **85/-** plus 6/6.



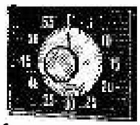
THYRISTOR LIGHT DIMMERS
Will dim incandescent lighting up to 600 watts from full brilliance to out. Assembled and wired ready to install. **59/6.**



AUTO ELECTRIC CAR AERIAL
With dash board control switch—fully extendable to 40" or fully retracted Suitable for 12V positive or Neg. earth supplied complete with fitting instructions and ready wired dash board switch **£5.18.6** plus 5/- p. & p.

COMPUTER TAPE
2,400 ft. of the best magnetic tape money can buy. Made by E.M.I., 1in. wide almost unbreakable and on a 10½in 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.

HORSTMANN "TIME AND SET" SWITCH
(A 15 amp Switch). Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fires, etc., up to 14 hours from setting time or you can use the switch to give a boost period of up to 3 hours. Equally suitable to control processing. Regular price probably around £5. Special snip price **29/6**, p. & ins. 4/6.



1 HOUR MINUTE TIMER
Made by famous Smiths company, these have a large clear dial, size 4⅜ x 3⅜, which can be set in minutes up to 1 hour. After preset period the bell rings. Ideal for processing, a memory jogger or, by adding simple lever, would operate micro-switch **22/6.**

THE FULL-FI STEREO SIX

The amplifier sensation of the year

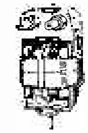
You will be amazed at the fullness of reproduction and at the added qualities your records or tuner will reproduce. Built into metal cabinet elegantly styled in simulated teak finished to blend with modern furnishings, this amplifier uses an integrated solid state circuit with an output power of 6 watts 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.

STANDARD WAFER SWITCHES

Standard Size 1½ wafer—silver-plated 5 amp contact, standard ¼" spindle 2". long—with locking washer and nut.

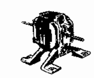
No of Poles	2 way	3 way	4 way	5 way	6 way	8 way	9 way	10 way	12 way
1 pole	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**
2 poles	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**	**10/6**	**10/6**
3 poles	**6/6**	**6/6**	**6/6**	**6/6**	**10/6**	**10/6**	**10/6**	**14/6**	**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**

SPARTAN Portable RADIO
Long and medium wave, 7 transistor, size 6in. x 4in. x 1¾in. with larger than usual speaker giving very good tone. Built-in ferrite aerial and telescopic aerial for distant stations. A real bargain complete with leather case, carry sling, earplug and case. **£3.15.0.** plus 5/- post and ins.

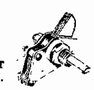


MULTI-SPEED MOTOR
Replacement in many well known food mixers. Six speeds are available. 500, 850 and 1100 r.p.m. from either or both of the nylon sockets (Where the beaters of the food mixers normally go) and 8,000, 12,000 and 15,000 r.p.m. (ideal polishing speeds) from the main drive shaft. Very powerful and useful motor size appox. 2in. diameter, 5in. long. Price **17/6** plus 4/6 p. & ins.

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 x 2 x 2in. **19/6** each.



DOUBLE ENDED MAINS MOTOR
On feet with holes for screw-down fixing. To drive models, oven, blower heater, etc. **10/-** each, plus 3/6 post and insurance, 6 or more post free.

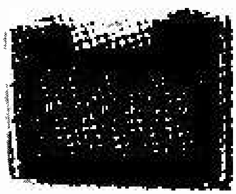


0.005mFd TUNING CONDENSER
Proved design, ideal for straight or reflex circuits **2/6** each, **24/-** doz.

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

MW/LW TRANSISTOR RADIO

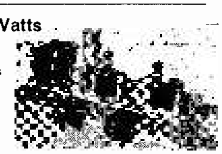


Complete set of parts for this MW/LW Transistor Radio. Originally sold by world-famous company as a set for more than £17. Coverage 192-555m + 1070-1870m. 4½" loudspeaker. Transistors 3 x AF117, OC81D + 2 OC81. Also works off car-aerial. Full instruction book 2/6, free with parts. State preference red, 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



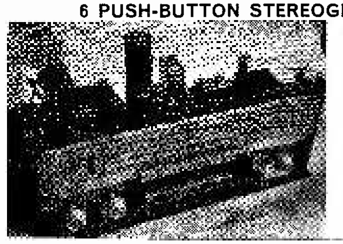
Fully built. On off sep. vol. and tone each channel 12 x 4½ x 6in. high. EZ80. 2 x ECL86; for 3 ohm speakers, double wound main trans: fixing flanges and base plate, suitable for crystal cart, tuner etc. **£6.10.0** (8/- p. & p., 200-250V. A.C. Superior version — separate base. treble & vol each channel 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. 2¾ 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).

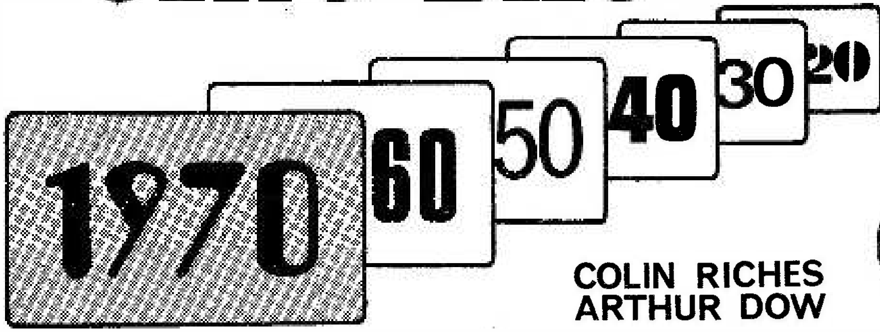
USEFUL BOX 3½" x 3½" x 1¾" with fixing bracket **2/6** (Postage 2/-). **25/-** per dozen post free. Metal with grey-green finish.

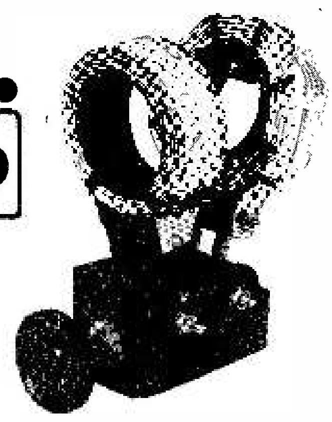
NEW F.M. TUNER

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.

GOING BACK...





COLIN RICHES
ARTHUR DOW

A book which was recently submitted to us for review was entitled *"A History of The Marconi Company"* and published by Methuen & Co. Ltd. The reason we felt we should mention it in the Going Back article and not in our normal New Books section is that not only is this book a history of a Company—it is an excellent reference to the history of radio.

The first chapter entitled 'The Stage is Set' describes the conception of the use of electromagnetic waves for communication purposes and covers the work of pioneers like James Clerk Maxwell (1855), our old friend Hertz and Professor (later to be Sir) Oliver Lodge, who in 1894 demonstrated his improved 'Branly' tube of iron filings in a new and important role—that of a detector of Hertzian waves. Lodge incidentally christened this device a 'coherer' because the filings 'cohered' whenever a Hertzian wave was applied to it by the associated circuitry.

Marconi and his Coherer Receiver—1896.

Marconi and Kemp with 1901 apparatus. (Copyright Marconi Company.)

Chapter two, 'The Young Signor Marconi' tells how Guglielmo Marconi, born on 25th April, 1874 at No. 7 Via delle Asse in Bologna, came to take interest in Professor Righi's papers on electromagnetic radiation. It describes how the critical point in Marconi's life came when he was on holiday in the Italian Alps and he chanced to read yet another paper on the Hertz experiments. Out of this, the idea to use the waves as a means of communication was born and this fired his enthusiasm to the point where he cut short his holiday and returned to his laboratory—a spare room at the Villa Griffone.

Marconi's first effort at commercial exploitation of his equipment was flatly turned down by the Italian Government and the book tells how, after a family conference, it was decided to send the twenty-one-year-old Marconi to England. This, they thought, would be a logical choice of country, for there were influential relatives living in London—the notable amongst these being Jameson Davis, who had promised all possible aid. Furthermore it was well-known that Great Britain was the hub of a great Empire and the workshop of the world possessing the world's biggest mercantile fleet and the mightiest Navy—and it was in shipping that Marconi saw his best chance.

This was with good reason for, as the text states, it is difficult today to visualise the utter isolation which enshrouded a ship of the 1890's once it had lost sight of land. Disaster could strike—and not infrequently did—with no-one on shore or in nearby vessels being any the wiser.

The entry of Marconi into England was marred by the fact that an over-zealous Customs officer investigated his apparatus with such thoroughness that it arrived in London broken and useless. Repairs were soon made however and the equipment was demonstrated to Jameson Davis who set about establishing influential contacts.

On June 2, 1896 Marconi applied for the world's first patent for wireless telegraphy (Brit. Pat. No.

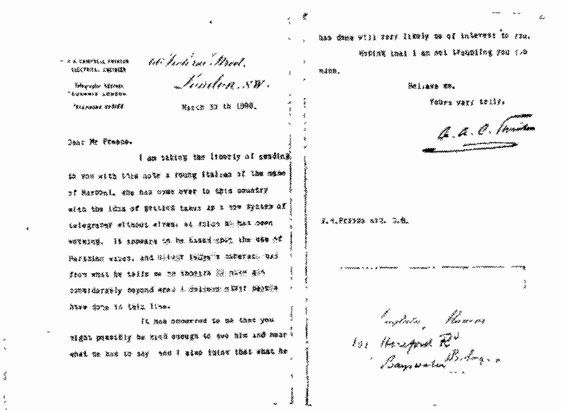
12,039). By this time, contact had been made with A. A. Campbell Swinton, an eminent electrical engineer of the day, who in turn provided Marconi with a letter of introduction to William H. Preece (later Sir William) the then Chief Engineer of the British Post Office.

Further chapters go on to describe how work progressed on Marconi's transmitters and receivers and the great trouble he had trying to cut red tape and make governments see the possibilities of wireless communication. The help that ships gained from Marconi's experiments was phenomenal and lighthouses became far less cut-off from the rest of the world when equipped with Marconi apparatus, but it seemed that governments remained sceptical.

The foundation of the Marconi Company is described. The first suggestion put forward for the name of the company was "Marconi's Patent Telegraphs Ltd.", this was rejected by Marconi who agreed it should be called "The Wireless Telegraph and Signal Company Ltd."

The remainder of the history of the Marconi Company is chronicled and the uses to which wireless apparatus were put are described in detail with magnificent pictures and diagrams throughout. There is even a photograph of the W.A.A.F. servicing a World War 2 bomber with the Marconi T1154/R1155 transmitter/receiver clearly shown. Just a point of interest—over 80,000 of these units were manufactured!

And so we read on through the book and come



London, S.W.
March 30 th 1896.

Dear Mr Preece,

I am taking the liberty of sending to you with this note a young Italian of the name of Marconi, who has come over to this country with the idea of getting taken up a new system of telegraphy without wires, at which he has been working. It appears to be based upon the use of Hertzian waves, and Oliver Lodge's coherer, but from what he tells me he appears to have got considerably beyond what I believe other people have done in this line.

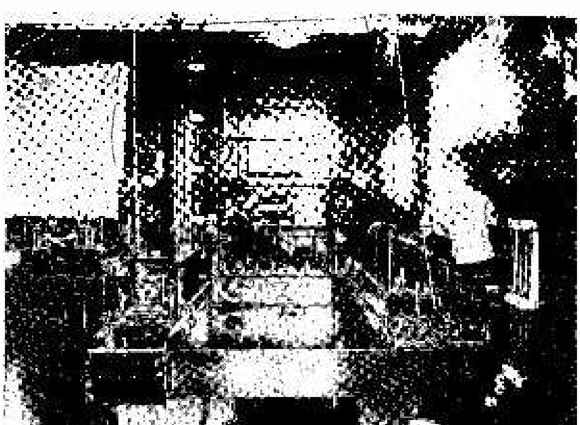
It has occurred to me that you might possibly be kind enough to see him and hear what he has to say and I also think that what he has done will very likely be of interest to you.

Hoping that I am not troubling you too much,

Believe me,
Yours very truly,
A. A. C. Swinton

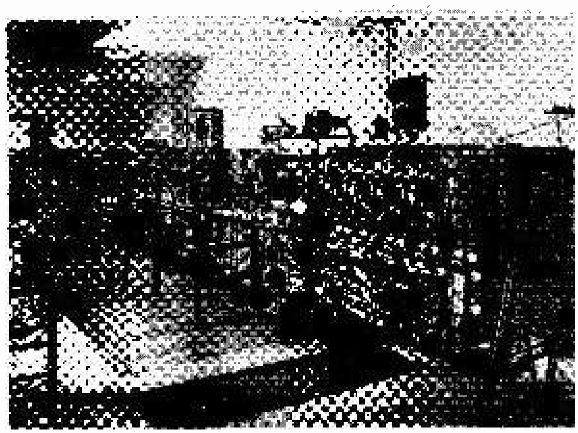
W. H. Preece Esq. C.B.

The letter of introduction to William H. Preece.



The wireless cabin of the Lusitania (copyright Marconi Company).

The Poldhu aerial system erected for the transatlantic experiment of 1901.



The first 2LO at Marconi House, used for transmissions from 1922. On the left is the rectifier. Next is the master oscillator with "cage-mounted" valve. Third panel contains main oscillator with h.f. circuit and speech choke. Main and sub-modulator with five valves are to the right.

across such chapters as 'The Passing of Guglielmo Marconi', 'Developments in Radar', 'Developments in TV', 'Developments in Aviation and Marine Communication'. Therefore, all in all, we feel that this book will not only be of interest—and great interest at that—to the vintage radio enthusiast, but almost a Bible to all those who take any interest in wireless communication, however minute.

For those readers who are interested, the book, *"A History of the Marconi Company"* by W. J. Baker is published by Methuen and costs £5.

CQ! CQ! CQ! CQ! CQ!

BOOKS WANTED

. . . a copy of "Outline of Wireless" by Ralph Stranger. I have often wondered who Ralph Stranger really was or—is. He is one of the best writers I have ever come across.—G. M. Watson, 2 Winn Court, Winn Road, Southampton, SO2 1UZ.

INFORMATION REQUIRED

. . . any information on the Dorian Super Screened Four. Valve line-up is: HL2, LP2, 210HL, PM12M. I would also welcome advice and possible source of supply of a jelly acid non-spillable accumulator—for, as I wish to keep the set as an original example, I do not propose making modifications. —D. Claridge, 3 Bakery Drive, Horsefair, Shrewsbury, Shropshire.

Z.30 & Z.50 power amplifiers

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.

Z.50

Z.30

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**

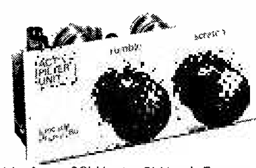
Stereo 60 pre amp/control unit

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**

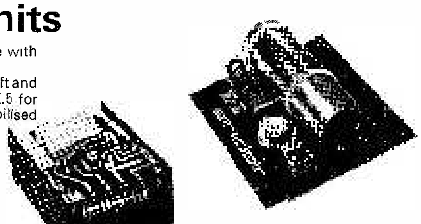
Active Filter Unit



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

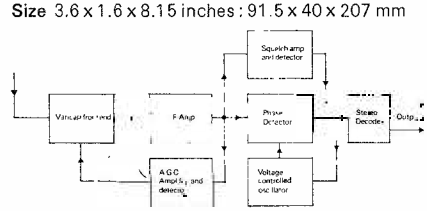
Stereo FM tuner

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.

Sinclair Radionics Ltd., London Road, St. Ives, Huntingdonshire

Please send ....
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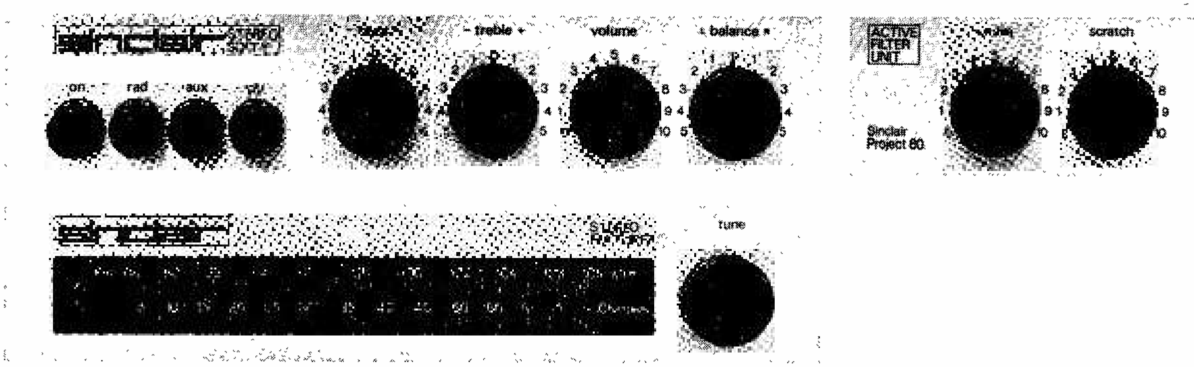
....
....
for which I enclose cash/cheque/money order.

NAME ....
ADDRESS ....
....
....
.... PW.271A

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 interdepencent 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, London Road, St. Ives, Huntingdonshire
Telephone: (04806) 4311

Sinclair IC10/Q16/Micromatic

IC10

The world's most advanced high fidelity amplifier

The circuit comprises a minute chip of silicon giving 5 watts RMS output (10 watts peak) which contains 13 transistors (including two power types), 2 diodes, 1 zener diode and 18 resistors. This exciting device is not only rugged and reliable, it also has performance advantages including freedom from thermal runaway and very low level of distortion. The IC10 is primarily intended as a full performance high fidelity power and pre-amplifier, for which it only requires the addition of such components as tone and volume controls and a battery or mains power supply. It may also be used simply in many other applications including car radios, electronic organs, servo amplifiers (it is dc coupled throughout), etc.

Circuit Description

Three transistors form the pre-amp and the remaining 10 the power amplifier. Generous neg. feedback is used round both sections and the amplifier is free from crossover distortion at all supply voltages, making battery operation eminently satisfactory.

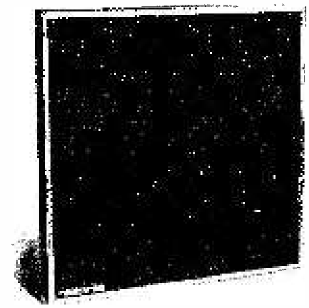
Applications

Each IC10 is sold with a comprehensive manual giving circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include oscillators. RF or IF amplifier without any additional transistors.

Specifications

Output: 10 watts peak, 5 watts RMS continuous.
Frequency response: 5 Hz to 100 kHz ± 1 dB.
Total harmonic distortion: Less than 1% at full output.
Load impedance: 3 to 15 ohms.
Power gain: 110 dB (100,000,000,000 times) total.
Supply voltage: 8 to 18 volts.
Size: 1 x 0.4 x 0.2 in. plus heat sink and tags.
Sensitivity: 5 mV.
Input impedance: Adjustable externally up to 2.5 Mohms.
Price, with manual, **59/6** post free.

Q16



High fidelity loudspeaker

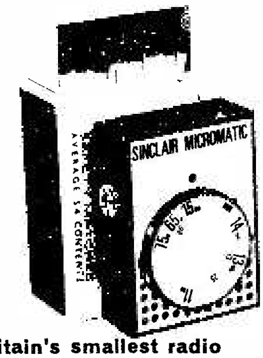
The Q16 employs well proven acoustic principles in which a special driver assembly is meticulously matched to the physical characteristics of the uniquely designed housing. Technical journals have been loud in their praise for this speaker which comfortably stands comparison with very much more expensive models. Its shape 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 Q16 presents an entirely new and attractive appearance. A solid teak surround is used with a special all-over cellular foam front chosen as much for its appearance as for its ability to pass all audio frequencies.
The Q16 makes the ideal shelf-mounted speaker, and brings genuine high fidelity within reach of every music lover.

Driver unit: Specially designed high compliance unit with aluminium speech coil and special cone suspension.
Size and styling: 9¾ in. square on face x 4¾ in. deep with neat pedestal base; all-over cellular foam front with natural solid teak surround.
Frequency response: From 60 to 16,000 Hz, as confirmed by independently plotted B and K curve.

Specifications

Loading: Up to 14 watts RMS.
Input impedance: 8 ohms.
Price: **£8.19.6.**

Micromatic



Britain's smallest radio

Considerably smaller than an ordinary box of matches, this is a fantastically efficient multi-stage AM receiver meticulously designed to provide remarkable standards of selectivity, power and quality. Powerful AGC is incorporated to counteract fading from distant stations, whilst bandspread at higher frequencies makes reception of Radio 1 easy at all times. The high quality plug-in magnetic earpiece provided matches the Micromatic's output to provide wonderful standards of reproduction. Everything including the special ferrite rod aerial and batteries is contained within the very small and attractively designed case. Whether you build a Micromatic kit or buy this amazing receiver ready built, tested and ready for immediate use you will find it as easy to take with you as your wrist-watch, and dependable under the severest operating conditions.

Specifications

Size: 46 x 33 x 13 mm. ($1\frac{4}{5}$ x $1\frac{3}{10}$ x $\frac{1}{2}$ in.).
Weight: including batteries, 28.4 gm (one ounce).
Case: Black plastic with aluminium front panel and dial.
Tuning: Medium wave band.
Earpiece: Magnetic type.
Kit in pack with earpiece, case, instructions and solder **49/6.**
Ready built, tested and guaranteed, with earpiece **59/6.**
Two Mallory Mercury batteries type RM675 required. Available from radio shops, chemists, etc.

Sinclair Radionics Ltd., London Rd., St. Ives, Huntingdonshire

Please send

....
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....
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for which I enclose cash/cheque/money order.

NAME ....
ADDRESS ....
....
....
.... PW.271B

Sinclair Radionics Ltd, London Rd, St Ives, Huntingdonshire. Tel: St Ives (048 06) 4311

sinclair

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.

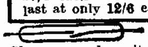
BLANKET SWITCH

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 ¼in. 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.

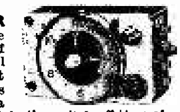
13 amp sockets, flush mounting. Bakelite, cream, less switch. 6 for £1.

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 5¼ × 3¾ × 2¼in. 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 £6.19.6 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
HONEYWELL PROGRAMMER

This is a drum type timing device, the drum being calibrated in equal divisions for switch setting purposes witn trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control, Boiler firing, Dispensing and Vending machines, Display lighting animated and signs, Signalling, etc. Price from Makers probably over £10 each. Special snip price £5.15.0 plus 5/- post and insurance. Don't miss this terrific bargain.

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. Supplied 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

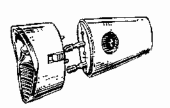
7 transistor Keychain Radio in very pretty case, size 2⅞ x 2⅛ x 1⅛in.—complete with soft leather zipped bag. Specification:—Circuit: 7 transistor superheterodyne. Frequency range: 530 to 1600 Kc/s. Sensitivity: 5 mv/m. Intermediate frequency: 465 Kc/s or 455 Kc/s. Power output: 40mW. Antenna: ferrite 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

These heater units are the very latest type, most efficient, and quiet running. As fitted in Hoover and blower heaters costing £15 and more. Comprises motor, impeller, and two elements allowing variable heat switching and with thermal safety cut out. Can be fitted into any metalline case or cabinet. Only need control switch. 1¼ K.W. model 39/6, 2 2½ K.W. 69/6 and 3 K.W. model 79/6. Postage and insurance 6/6. Control switch 8/6.

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.

19 PIECE SOCKET SETS

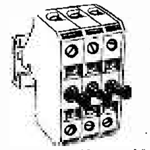
Complete with wall or bench rack. An ideal gift for the motorist. 15/6 plus 4/6 post and insurance.

PLINTH and COVER

Suitable for most auto-changers, teak base with tinted perspex cover. Specially made for Balfour. 85/- plus 6/6 postage.

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.

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. 29/6 plus 2/6 post and insurance. Made up model also available, 37/6, plus 2/6 post & p.

BALANCED ARMATURE UNIT

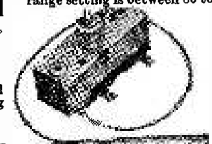
500 ohm. operates speaker or microphone, so useful in intercom or similar circuits. 6/6 ea. £3.10.0 doz.

PROTECT VALUABLE DEVICES

FROM THERMAL RUNAWAY OR OVERHEATING:

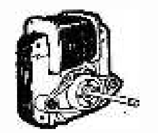
Thyristors, rectifiers, transistors, etc., which use heat-sinks can easily be protected. Simply make the contact thermostat part of the heat-sink. Motors and equipment generally, can also be adequately protected by having thermostats in strategic spots on the casing. Our contact thermostat has a calibrated dial for setting between 90deg. to 190deg.F. or with the dial removed range setting is between 80 to 300 deg. F. Price 10/-

THERMOSTAT WITH PROBE



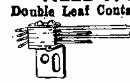
This has a sensor attached to a 15A switch by a 14in. length of flexible capillary tubing—control range is 20°F to 150°F so it is suitable to control soil heating and liquid heating especially when in buckets or portable vessels as the sensor can be raised out and lowered into the vessel. This thermostat 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.

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.

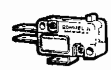
MINIATURE WAFER SWITCHES

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.

ELECTRONICS (CROYDON) LTD

Dept. PW, 266 London Rd., Croydon CRO 2TH

Also 102/3 Tamworth Road, Croydon

NEW VALVES

		6BA6	5/-	6J7M	8/6	7D5	8/-	20D1	10/-	50C5	6/3	DAF96	7/6	EBL31	27/6	EL34	10/6	N78	19/-	PL504	16/-	U404	7/6
		6BE6	5/-	6J7G	6/-	7H7	6/6	20F2	14/-	50CD6G	31/-	DCC90	20/-	EC90	5/-	EL38	25/-	N108	28/-	PL508	29/-	U801	23/6
		6BH6	9/-	6J7GT	7/6	7R7	13/-	20L1	20/-	50L6GT	8/-	DF33	8/-	ECC81	6/-	EL41	11/-	OA2	6/-	PL509	29/-	UABC80	6/6
		6BJ6	9/-	6K6GT	8/-	7S7	45/-	20P4	20/-	75	9/6	DF70	9/-	ECC82	5/9	EL42	11/6	OC3	5/-	PL802	16/6	UAF42	10/6
		6BQ7A	7/-	6K7M	6/6	7Y4	8/6	20P5	20/-	78	5/-	DF91	4/-	ECC83	6/3	EL84	4/9	OZ4	4/6	PX4	24/-	UBC 41	9/3
1A7	7/9	6BR7	17/-	6K7G	2/-	9BW6	7/-	25A6	5/9	80	7/6	DF92	3/6	ECC84	5/6	EL95	7/-	PC86	11/6	PX25	27/6	UBC81	9/3
1CP31	122/6	6BR8	12/6	6K7GT	4/6	10C2	12/6	25L6GT	7/-	85A2	7/3	DF96	7/6	ECC85	5/-	ELL80	20/-	PC88	11/6	PY33	10/9	UBF80	7/-
1D5	7/6	6BS7	25/-	6K8M	11/6	10F1	14/9	25Y5	6/-	150B2	11/6	DH3-91		ECC88	7/6	EM34	16/-	PC97	8/9	PY81	5/9	UBF89	7/6
1H5	7/-	6BW6	14/6	6K8G	3/-	10F3	18/-	25Z4	6/3	150C4	9/6		122/6	ECF80	6/6	EM80	7/6	PCC84	6/6	PY82	5/3	UCC84	8/6
IN5GT	8/-	6BW7	13/-	6K8GT	7/-	10F9	10/6	25Z5	8/-	801	9/6	DH77	4/9	ECF82	6/6	EM81	12/6	PCC89	10/6	PY83	7/-	UCC85	7/6
IR5	6/-	6C4	5/-	6K25	15/-	10F18	8/-	25Z6	8/6	807	9/-	DK32	7/9	ECH21	12/6	EM84	7/6	PCC189	10/6	PY500	18/6	UCF80	8/6
IS4	5/6	6C5G	5/-	6L6G	7/9	10LD11	10/6	30C1	6/9	813USA		DK91	6/-	ECH35	11/6	EY51	7/8	PCF80	6/9	PY800	9/6	UCH42	10/6
IS5	4/6	6C6	3/9	6L18	6/-	10P13	13/6	30C15	15/-		120/-	DK92	9/-	ECH42	13/-	EY86	7/-	PCF82	6/6	PY801	9/6	UCH81	7/-
IT4	4/-	6CD6G	24/-	6Q7G	6/-	11E3	70/-	30C17	16/-	866A	15/-	DK96	7/9	ECH81	5/9	EZ35	6/-	PCF84	8/-	R2	7/6	UCL82	7/6
3A4	4/-	6CH6	7/6	6Q7GT	8/6	12AT6	4/9	30C18	15/-	954	5/3	DL66	25/-	ECH83	8/6	EZ40	9/-	PCF86	9/-	R19	7/9	UCL83	11/6
3Q4	7/9	6CW4	13/6	6SA7M	7/-	12AT7	6/-	30F5	17/-	1625	6/6	DL92	6/3	ECL80	7/-	EZ41	9/6	PCF801	9/9	S130	40/-	UF41	10/6
3Q5	7/-	6D6	3/9	6SC7	7/-	12AU6	5/9	30FLI	15/-	4022AR	67/-	DL93	4/-	ECL82	7/-	EZ80	5/6	PCF802	9/9	SP4	8/-	UF89	7/6
3S4	6/3	6E5	7/6	6SG7	6/-	12AU7	5/9	30FL12	19/-	5763	12/-	DL94	6/9	ECL83	10/3	EZ81	5/6	PCF805	15/-	SP41	6/6	UL41	12/-
3V4	6/9	6F1	12/6	6SH7	3/3	12AX7	6/3	30FL14	15/6	7193	2/-	DL95	7/9	ECL86	9/-	GY501	15/-	PCF806	13/-	SP61	6/6	UL84	7/-
5R4GY	10/6	6F5G	8/-	6SJ7	6/-	12BA6	6/-	30L15	17/-	7475	14/-	DL96	7/6	ECLL800	35/-	GZ30	10/-	PCF808	15/6	STV280/80		UM80	5/6
5U4G	5/6	6F6G	5/-	6SK7GT	4/9	12BE6	6/3	30L17	17/-	A61	9/6	DM70	6/-	EF9	20/-	GZ32	10/-	PCL82	7/9		95/-	UU6	21/-
5V4G	8/-	6F8G	5/6	6SL7GT	6/-	12C8GT	5/-	30P4	22/6	ATP4	2/3	DY86	6/-	EF37A	7/-	GZ34	11/-	PCL83	10/3	SU25	19/6	UU7	21/-
5Y3GT	6/6	6F11	6/6	6SN7GT	5/6	12E1	20/-	30P12	16/-	ATP5	12/-	DY87	6/6	EF39	8/-	KT36	18/-	PCL84	8/6	SU2150	12/6	UU8	21/-
5Z4G	7/-	6F13	6/6	6SQ7	7/6	12J5GT	2/6	30P19	15/-	ATP7	8/6	E88CC	12/-	EF41	12/6	KT61	22/6	PCL85	9/3	T41	17/6	UU9	8/3
6/30L2	15/-	6F14	12/6	6U4GT	12/-	12J7GT	6/6	30PL1	16/-	AU2	80/-	EA50	3/6	EF50	5/-	KT66	30/-	PCL86	9/3	TDD4	8/6	UY21	9/6
6A7	15/-	6F23	16/-	6U5G	7/9	12K7GT	7/-	30PL13	18/6	AU5	8/9	EABC80	6/6	EF80	4/6	KT81	35/-	PD500	29/-	TH41	35/-	UY41	8/6
6A8G	12/6	6F24	14/-	6V6M	12/-	12K8GT	8/-	30PL14	15/-	AZ1	8/-	EAF42	10/-	EF85	7/-	KT81 (7C5)		PENA4	20/-	U10	7/6	UY85	6/6
6AK5	5/-	6F25	15/-	6V6G	4/6	12Q7GT	6/-	35A5	12/6	AZ31	10/-	EB91	3/-	EF86	6/6		22/6	PENB4	20/-	U14	7/6	VMP4G	17/-
6AM5	4/6	6F28	14/-	6V6GT	6/6	12SA7	8/-	35L6	9/-	CBL31	16/-	EBC33	8/6	EF89	5/6	KT88	34/-	PEN45	7/-	U19	35/-	VP4B	25/-
6AM6	3/6	6F32	2/9	6X4	4/6	12SG7	6/-	35W4	4/6	CCH35	15/-	EBC41	12/6	EF91	3/6	KTW61	12/6	PEN46	4/-	U25	15/6	VR105/30	6/6
6AQ5	6/3	6G6	3/6	6X5G	4/6	12SH7	3/-	35Z3	10/-	CL33	20/-	EBC90	4/9	EF92	2/6	KTZ41	6/-	PL36	10/9	U26	15/6	VR150/30	6/-
6AS7G	15/-	6H6	3/-	6X5GT	6/-	12SJ7	3/9	35Z4GT	8/6	CV450	25/-	EBF80	7/6	EF98	15/-	ML4	17/6	PL81	9/6	U78	4/6	VU111	8/9
6AT6	5/6	6J5M	9/-	7B6	11/6	12SK7	4/9	35Z5	6/-	CY30	12/6	EBF83	9/-	EF183	6/6	ML6	7/6	PL82	8/6	U191	13/9	VU120	12/6
6AU6	5/-	6J5G	4/-	7B7	7/6	12SR7	5/-	37	6/6	CY31	8/6	EBF89	6/6	EF184	7/-	MSP4	10/-	PL83	7/6	U251	16/3	VU508	35/-
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6B8G	2/-	6J6	3/6	7C6	15/-	19AQ5	5/-	50B5	6/8	DAF91	4/6	EBL21	12/-	EL33	12/6	MX40	12/6	PL500	14/6	U403	6/6	Y63	7/6

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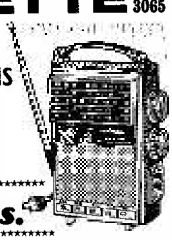

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Miniature Portable Oscilloscope. C.T. 52. £22.10.0

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1035	5Hz–5MHz	,,	£19.10.0	Overhauled
1035 Mk II	20Hz–7MHz	,,	£25. 0.0	,,
1049	DC—100KHz	,,	£35. 0.0	,,
MARCONI T.F. 1159	15Hz–20KHz	Single	£55. 0.0	17" screen (suitable
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,, CD523	DC–10Mhz	,,	£52.10.0	,,
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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. (£6.30 75p)

Complete stereo system £41 plus £2 10 p. & p. (£41 £2.50) or with Mk II Amplifier and Magnetic Cartridge £45 & £2 10 p. & p. (£45 £2.50)

The Viscount F.E.T. Mk I £14.5 plus 7/6 p. & p. (£14·25 37p)

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. 2¾in. in simulated teak case. BUILT & TESTED.

MkII (MAG P.U.) £15.15 plus 10/- p. & p. (£15.75 50p)

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 (£29.50) Stereo system

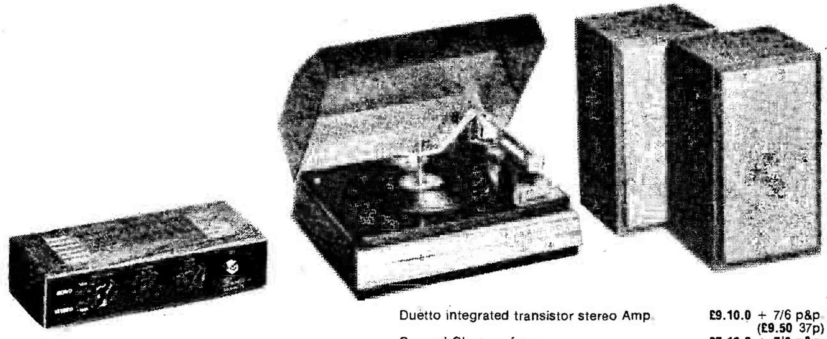
The Duetto is a good quality stereo amplifier, attractively styled and finished. It gives superb reproduction previously associated with amplifiers costing far more.

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 (£9.50 37p)
Garrard Changer from	£7.19.6 + 7/6 p&p. (£7.97 37p)
Cover and teak finish plinth	£4.15.0 + 7/6 p&p. (£4.75 37p)
Duo Type I speakers (see opp. page)	ea. £4.4.0 + 7/6 p&p. (£4.20 37p)
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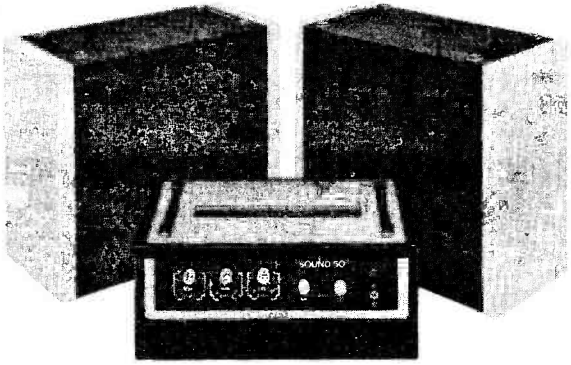
SOUND 50

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 £4 P. & P.
Sound 50 amp and 2 speakers

or available separately.

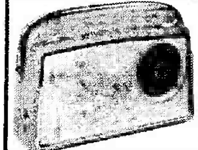
Amplifier **£28.10.0 (£28.50)** plus 20/- (£1) P. & P.

Speakers **£12.10.0 (£12.50)** each plus 30/- (£1.50) 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 (47p)** extra.

Price **£5.5.0** plus 7/6 P. & P. (£5·25 plus 37p P.&P.)
Circuit 2/6 (13p) FREE WITH PARTS



The DORSET (600mW Output)

Price **£5.5.0 (£5.25)** plus 7/6 (37p) P. & P.
Circuit 2/6 (13p) 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.
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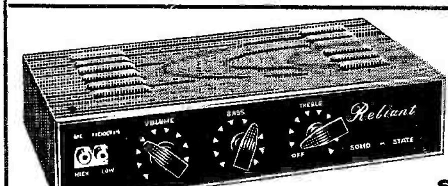
The Classic

Simulated teak case

£9.10.0 (£9.50)

Plus P. & P. 7/6 (37p)

SPECIFICATION: Sensitivities for 10 watt output at 1KHz into 3 ohms. Tape Head: 3 mV (at 3¾.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 12¼in long, 4¼in deep, 2¾in high. **Built and tested**



THE RELIANT MkII SOLID-STATE GENERAL PURPOSE AMPLIFIER

in simulated teak case **£7.5.0 (£7.25)** plus 7/6 (37p) P. & P.

SPECIFICATIONS
Output ±10 watts. Output impedance—3 to 4 ohms.
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2. -gram/radio 250mV. Bass control range ± 13dB at 100Hz.
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14¼"	3⅞"	1	10	0	1	17	6	2	2	0
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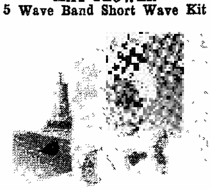

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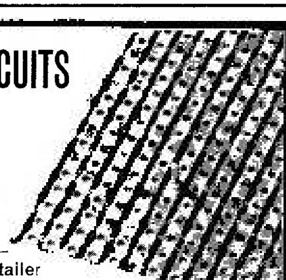

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Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99 (see note below)	100 up
C	1/20W	5%	82 Ω–220K Ω	E12	18	16	15
C	1/8W	5%	4·7 Ω–330K Ω	E24	2·5	2	1·75
C	1/4W	10%	4·7 Ω–10M Ω	E12	2·5	2	1·75
C	1/2W	5%	4·7 Ω–10M Ω	E24	3	2·5	2·25
C	1W	10%	4·7 Ω–10M 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	
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Codes: C = carbon film high stability low noise
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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.

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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.

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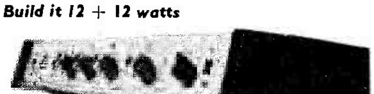

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OC3	0.38	6AT6	0.30	6F6G	0.30	10D2	0.40
OD3	0.35	6AU6	0.25	6F11	0.38	10F1	0.90
IB3GT	0.38	6AV6	0.30	6F13	0.38	10F9	0.50
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IR4	0.35	6BA6	0.25	6F15	0.65	10L1	0.45
IR5	0.35	6BE6	0.30	6F18	0.45	10LD11	0.60
IS4	0.27	6BF5	0.80	6F23	0.80	10P13	0.55
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3Q4	0.40	6BS7	1.30	6K23	0.55	12AV7	0.50
3S4	0.35	6BW6	0.85	6K25	0.75	12AX7	0.30
3V4	0.45	6BW7	0.70	6L6GT	0.45	12AY7	0.70
5R4GY	0.60	6BX6	0.25	6L7	0.40	12B44A	0.55
5U4G	0.33	6BZ6	0.35	6L18	0.45	12BA6	0.35
5U4GB	0.42	6C4	0.33	6LD20	0.40	12BA7	0.35
5V4G	0.42	6C5GT	0.40	6N7GT	0.40	12BE6	0.35
5Y3GT	0.32	6CA4	0.28	6P1	0.60	12BH7	0.40
5Z3	0.50	6CA7	0.50	6P28	0.65	12BY7	0.55
5Z4G	0.40	6CB6	0.30	6Q7	0.40	12K5	0.55
6/30L2	0.75	6CD6GA		6SA7	0.40	12K7GT	0.35
6AB4	0.35		1.15	6SG7	0.35	12Q7G	0.30
6AF4A	0.50	6CG7	0.50	6SK7	0.35	12SR7	0.35
6AG7	0.40	6CH6	0.55	6SL7GT	0.35	14S7	0.80
6AH6	0.50	6CL6	0.50	6SN7GT	0.35	20D1	0.45
6AJ8	0.30	6CW4	0.63	6SQ7	0.40	20L1	1.10
6AK5	0.30	6CY7	0.65	6SR7	0.40	20P1	0.50
6AK6	0.57	6D3	0.45	6T8	0.35	20P4	1.10
6AL3	0.43	6DC6	0.75	6U4GT	0.60	20P5	1.20
6AL5	0.20	6DK6	0.48	6U8A	0.40	25C5	0.50
6AM5	0.32	6DQ6B	0.63	6X4	0.30	25L6GT	0.45
6AM6	0.33	6DS4	0.75	6X5GT	0.35	25Z4G	0.30
6AQ5	0.35	6EA8	0.58	6X8	0.55	25Z6GT	0.65
6AQ6	0.55	6EH7	0.30	6Y6G	0.65	30A5	0.45

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30AE3	0.40	50CD6G	1.65	DK92	0.50	ECC84	0.30
30C1	0.30	50L6GT	0.50	DK96	0.42	ECC85	0.60
30C15	0.80	85A2	0.40	DL96	0.42	ECC88	0.40
30C17	0.85	90AV	2.50	DM160	0.65	ECC89	0.50
30C18	0.75	90C1	0.60	DY86	0.33	ECC91	0.20
30F5	0.85	90CV	1.25	DY87	0.35	ECC189	0.60
30FL1	0.70	807	0.50	DY802	0.50	ECF80	0.35
30FL12	0.93	812A	3.50	E55L	2.75	ECF82	0.35
30FL14	0.75	813	3.75	E88CC	0.65	ECF86	0.65
30L1	0.40	866A	0.75	E130L	5.00	ECF804	1.50
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30P12	0.80	6146	1.50	EAF42	0.55	ECH83	0.40
30P19	0.80	6146B	2.50	EBC33	0.50	ECH84	0.45
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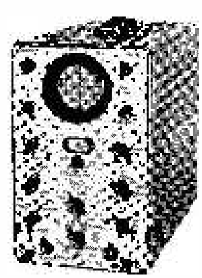
30PL14	0.90	7199	0.75	EBF80	0.40	ECL82	0.35
35A3	0.55	7360	1.80	EBF83	0.40	ECL83	0.65
35A5	0.75	7586	1.25	EBF89	0.30	ECL84	0.55
35B5	0.65	7895	1.25	EC53	0.50	ECL85	0.55
35C5	0.40	9002	0.35	EC86	0.60	ECL86	0.40
35D5	0.70	9003	0.50	EC88	0.60	ECLL800	
35L6GT	0.50	AZ1	0.48	EC90	0.33		1.50
35W4	0.30	AZ31	0.55	EC92	0.35	EF37A	0.60
35Z3	0.60	CBL1	0.80	EC93	0.50	EF39	0.40
35Z4G	0.30	CBL31	0.90	EC8010	2.25	EF40	0.50
35Z5GT	0.40	CY31	0.35	ECC40	0.60	EF41	0.65
50A5	0.70	DAF96	0.42	ECC81	0.33	EF42	0.70
50B5	0.45	DF96	0.42	ECC82	0.30	EF80	0.25
50C5	0.40	DK40	0.55	ECC83	0.30	EF83	0.55

EF85	0.35	EZ40	0.45	PCL88	0.90	U78	0.30
EF86	0.30	EZ41	0.45	PCL800	0.93	U191	0.75
EF89	0.28	EZ80	0.25	PCL801	0.70	U201	0.35
EF91	0.33	EZ81	0.28	PD500	1.50	U281	0.40
EF92	0.40	GY501	0.80	PF86	0.60	U282	0.40
EF95	0.30	GZ30	0.40	PF818	0.85	U301	0.40
EF97	0.65	GZ31	0.33	PFL200	0.70	U403	0.50
EF98	0.65	GZ32	0.48	PL33	0.35	U404	0.40
EF183	0.30	GZ33	0.70	PL36	0.55	U801	1.00
EF184	0.35	GZ34	0.60	PL81	0.50	UABC80	
EF800	1.00	HABC80		PL82	0.45		0.35
EF804	1.25		0.45	PL83	0.45	UAF41	0.50
EK90	0.30	HK90	0.35	PL84	0.40	UAF42	0.55
EL33	1.25	KT66	1.70	PL302	0.80	UBC41	0.50
EL34	0.50	KT88	1.75	PL504	0.80	UBC81	0.40
EL36	0.50	N78	1.15	PL508	0.90	UBF80	0.40
EL41	0.55	PABC80	0.40	PL509	1.30	UBF89	0.35
EL42	0.58	PC86	0.60	PL509	1·30	UBL1	0.50
EL81	0.55	PC88	0.60	PL801	0.80	UBL21	0.60
EL83	0.42	PC97	0.50	PM84	0.50	UC92	0.35
EL84	0.25	PC900	0.48	PY31	0.30	UCC85	0.40
EL85	0.43	PCC84	0.40	PY33	0.63	UCF80	0.55
EL86	0.40	PCC85	0.40	PY80	0.35	UCH21	0.60
EL90	0.35	PCC88	0.55	PY81	0.30	UCH42	0.70
EL95	0.35	PCC89	0.50	PY82	0.30	UCH43	0.75
EL360	1.15	PCC189	0.55	PY83	0.38	UCH81	0.35
EL803	1.00	PCC805	0.85	PY88	0.40	UCL81	0.60
EL821	0.55	PCC806	0.80	PY500	1.00	UCL82	0.35
EL822	0.90	PCF80	0.30	PY800	0.50	UCL83	0.60
ELL80	0.75	PCF82	0.35	PY801	0.50	UF41	0.60
EM34	0.90	PCF84	0.50	PZ30	0.35	UF42	0.60
EM71	0.75	PCF86	0.60	QQV2-6	2.15	UF43	0.60
EM80	0.40	PCF87	0.85	QQVO3-10		UF80	0.35
EM81	0.60	PCF801	0.50		1.25	UF85	0.40
EM84	0.35	PCF802	0.50	QQV03-20A		UF89	0.35
EM85	1.00	PCF805	0.75		5.25	UL41	0.65
EM87	0.55	PCF806	0.70	TT21	2.65	UL84	0.30
EN91	0.35	PCF808	0.75	TT22	2.80	UM84	0.20
EY51	0.40	PCH200	0.70	U18/20	0.75	UY1N	0.50
EY80	0.45	PCL81	0.50	U25	0.75	UY11	0.65
EY81	0.40	PCL82	0.35	U26	0.75	UY41	0.45
EY83	0.55	PCL83	0.65	U31	0.45	UY82	0.50
EY86	0.40	PCL84	0.45	U37	1.50	UY85	0.30
EY87	0.43	PCL85	0.40	U52	0.33	W729	0.60
EY88	0.43	PCL86	0.45	U76	0.30	Z803U	0.90

TRANSISTORS

2N404	0.17	2S034	1.00	BCY34	0.30
2N444A	0.25	2S102	0.40	BCY72	0.20
2N696	0.20	2S104	0.50	BCZ11	0.40
2N697	0.23	2S701	0.50	BD121	0.80
2N698	0.40	2S702	0.50	BD123	0.95
2N705	0.70	2S746	0.30	BF115	0.20
2N706	0.15	AC113	0.15	BF167	0.25
2N708	0.20	AC125	0.30	BF173	0.30
2N753	0.25	AC126	0.25	BF181	0.25
2N929	0.30	AC127	0.20	BF184	0.25
2N930	0.35	AC128	0.20	BF185	0.20
2N987	0.35	AC153	0.25	BF194	0.20
2N1131	0.40	AC154	0.15	BF195	0.15
2N1132	0.45	AC157	0.20	BF196	0.20
2N1184	1.25	AC169	0.10	BF197	0.20
2N1301	0.40	AC176	0.25	BFX88	0.25
2N1302	0.25	AC187	0.30	BFY17	0.40
2N1304	0.25	AC188	0.30	BFY19	0.60
2N1305	0.25	ACY17	0.30	BFY50	0.25
2N1306	0.25	ACY18	0.20	BFY51	0.20
2N1307	0.30	ACY19	0.25	BFY52	0.25
2N1308	0.40	ACY20	0.20	BSY26	0.25
2N1309	0.35	ACY21	0.20	BSY27	0.30
2N1613	0.25	ACY22	0.15	BSY28	0.30
2N1711	0.30	AD140	0.80	BSY65	0.20
2N1756	0.75	AD149	0.50	BSY95A	0.20
2N2147	0.75	AD161	0.35	OC16	0.75
2N2160	1.25	AD162	0.35	OC22	0.65
2N2217	0.30	AF114	0.25	OC23	0.60
2N2218	0.40	AF115	0.30	OC24	0.60
2N2219	0.45	AF116	0.25	OC25	0.40
2N2369A	0.25	AF117	0.20	OC26	0.30
2N2477	0.65	AF118	0.45	OC28	0.60
2N2646	0.60	AF125	0.25	OC29	0.65
2N2905	0.50	AF126	0.25	OC30	0.75
2N2923	0.15	AF127	0.25	OC35	0.50
2N2924	0.15	AF178	0.40	OC36	0.60
2N2926	0.15	AF180	0.35	OC42	0.30
2N3053	0.30	AF181	0.35	OC44	0.20
2N3055	0.75	AF186	0.50	OC45	0.20
2N3133	0.35	AF239	0.40	OC70	0.20
2N3134	0.50	AFZ11	0.45	OC71	0.15
2N3391	0.20	ASY26	0.25	OC72	0.25
2N3392	0.15	ASY27	0.30	OC73	0.40
2N3393	0.15	ASY28	0.30	OC75	0.25
2N3394	0.15	ASY29	0.30	OC76	0.25
2N3395	0.20	ASY54	0.25	OC78	0.25
2N3402	0.15	ASY74	0.50	OC78D	0.20
2N3403	0.15	ASY77	0.35	OC81	0.25
2N3404	0.35	ASY82	0.20	OC81D	0.15
2N3414	0.20	ASY86	0.20	OC83	0.20
2N3415	0.15	BC107	0.15	OC139	0.35
2N3416	0.25	BC108	0.15	OC140	0.40
2N3417	0.25	BC109	0.20	OC141	0.60
2N3702	0.15	BC113	0.40	OC170	0.25
2N3703	0.15	BC118	0.30	OC171	0.25
2N3704	0.20	BC134	0.30	OC200	0.30
2N3707	0.20	BC147	0.20	OC201	0.60
2N3709	0.15	BC148	0.15	OC202	0.65
2N3710	0.15	BC149	0.15	OC203	0.40
2N3819	0.35	BC152	0.15	OC204	0.40
2N3906	0.30	BC175	0.25	OC205	0.70
2S002	1.00	BCY30	0.35	OC206	0.70
2S004	1.00	BCY33	0.25		

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%.
Amptitude calibrator directly calibrated in volts.
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Power suppiies 127/230v AC.

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BY125	200 p.i.v.	425 mA	**13np**
BY127	600 p.i.v.	1 Amp	**15np**
BY130	450 p.i.v.	800 mA	**10np**

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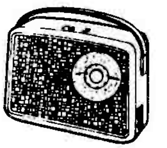

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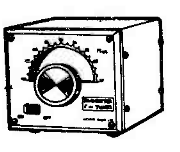

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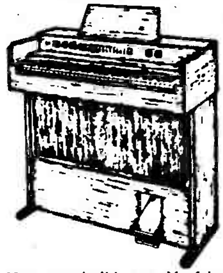

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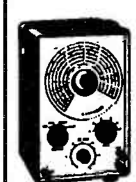

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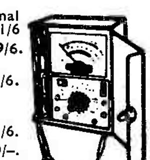

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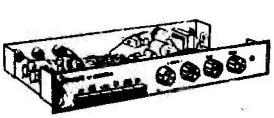

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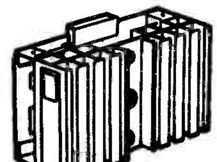

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