

**PRACTICAL**

# **ELECTRONICS**

DECEMBER 1969

THREE SHILLINGS

**DOUBLE-SIX**

electronic domino player



*A New Outlook in Audio Design*

**HI FI STEREO AMPLIFIER**

# ADCOLA

PRODUCTS LIMITED  
(Regd Trade Mark)

## THE RELIABLE SOLDERING INSTRUMENT!



SEND COUPON FOR LATEST LEAFLET

**ADCOLA PRODUCTS LTD**  
**ADCOLA HOUSE**  
**GAUDEN ROAD**  
**LONDON SW4**

01-622 0291/3

NAME .....

ADDRESS .....

.....

.....

.....

PE170

# ELECTROVALUE

**RAPID  
MAIL ORDER  
SERVICE**

**EVERYTHING BRAND NEW AND TO EXACT  
SPECIFICATION • NO SURPLUS GOODS**

## AMPLIFIER KITS

P.W. DOUBLE 12

Complete stereo kit including cabinet, but less panel and other metalwork. £23 net. Available in separate packages as follows: Main amplifier kit £3.19.6 per channel, net. Accessories 19/- mono, 36/- stereo.

Pre-amplifier kit £1.7.0 per channel, net. Accessories 13/6 mono, 27/3 stereo.

Tone control kit 19/- per channel, net. Accessories 8/9 mono, 22/6 stereo.

Power supply kit £4.10.0 mono or stereo, net.

Cabinet kit £2.12.6 net. Metalwork available separately from other sources, details on request.

30 WATT (designed by Dr. A. R. Bailey). Published May 1968 W.W., modified November 1968 W.W.

Full kit for main amplifier £9.9.6 (less power supply). Transistors only for main amplifier £7.9.6. PC board supplied free with above kit. Heat sinks for output transistors 8/6 extra.

Power supply kit, unregulated, November 1969 circuit £4.14.0. Regulated version, 60V 1.6A or 0.8A, current limiting, re-entrant characteristic: does not need re-set button £8.10.0. Transformer only: 0-25-45-50V 2A 58/-.

8 x 8 watt Stereo only. Peak Sound SA 8 x 8 kit. Sensitivity 50mV into 1M $\Omega$ , output into 5 $\Omega$ . Complete with cabinet and power supply. Kit complete £16.10.0 net. Built and tested £21 net.

## BARGAINS IN BRAND NEW ELECTRONIC COMPONENTS

Ultra low-noise resistors (under 0.1 $\mu$ V/V) ElectroSil TR5: Metal oxide, 2% tolerance, range 10 $\Omega$  to 1M $\Omega$ . All values in E24 series available.  $\frac{1}{2}$ W rating. 1-24 10d. each; 25-99 9d. each; 100 up 8d. each. (Ohmic values may be mixed to obtain quantity price.) Potentiometers, carbon track, long plastic spindles: Single gang linear 220 $\Omega$  to 2.2M $\Omega$  2/6 each; log 4.7K $\Omega$  to 2.2M $\Omega$  2/6 each. Dual gang stereo-matched lin or log 10K to 1M $\Omega$  8/6 each. Stereo balance log/anti-log 10K, 47K, 1M $\Omega$  only, 8/6 each. All types available with  $\frac{1}{2}$ A D.P. switch 2/3 extra.

### TRANSISTORS, etc.

|              |      |               |      |        |      |           |      |
|--------------|------|---------------|------|--------|------|-----------|------|
| 2N696        | 5/6  | 2N3704        | 3/9  | BC107  | 3/6  | BFY51     | 4/3  |
| 2N697        | 6/-  | 2N3705        | 3/5  | BC108  | 3/-  | MC140     | 6/3  |
| 2N706        | 3/5  | 2N3707        | 4/-  | BC109  | 3/6  | MJ480     | 21/- |
| 2N1302       | 4/-  | 2N3794        | 2/11 | BC125  | 12/- | MJ481     | 27/- |
| 2N1303       | 4/-  | 2N4286        | 2/11 | BC126  | 12/- | MJ491     | 31/- |
| 2N1304       | 4/-  | 2N4289        | 2/11 | BC148  | 3/3  | MPF103    | 11/6 |
| 2N1305       | 4/-  | 2N4291        | 2/11 | BC149  | 4/3  | MPF105    | 7/6  |
| 2N2147       | 18/9 |               |      | BC169  | 2/3  | OA47      | 1/9  |
| 2N2926yellow | 1/9  | cheapest FET: |      | BC183L | 2/-  | OA90      | 1/3  |
| 2N2926green  | 2/3  | 2N5163        | 5/-  | BC184L | 2/3  | OA91      | 1/3  |
| 2N3053       | 5/3  | 40361         | 12/6 | BD124  | 16/- | OA202     | 2/-  |
| 2N3054       | 15/6 | 40362         | 16/9 | BFX85  | 8/3  | P346A     | 5/9  |
| 2N3055       | 16/6 | AD149         | 17/6 | BFX88  | 7/9  | TPMD      |      |
| 2N3702       | 3/6  | AD161         | 14/- | BFY50  | 4/9  | (= ORP12) | 6/-  |
| 2N3703       | 3/3  | AD162         | pr.  |        |      |           |      |

Large capacitors, high ripple current types. 2000 $\mu$ F 25V 7/-; 2000 $\mu$ F 50V 9/3; 5000 $\mu$ F 25V 10/3; 5000 $\mu$ F 50V 17/6. S-DeC 30/6; 2-DeC DeCstore 69/6; 4-DeC 119/6.

● **DISCOUNTS** (on all but net items): 10% for total order value of £3 or over. 15% for total order value of £10 or over.

● **POSTAGE** and packing: on orders up to £1 add 1/- . Over £1 post free in U.K. Overseas orders welcomed: carriage charged at cost.

● **CATALOGUE** gives further details of above products and much information on semiconductor characteristics etc. 1/6 post free.

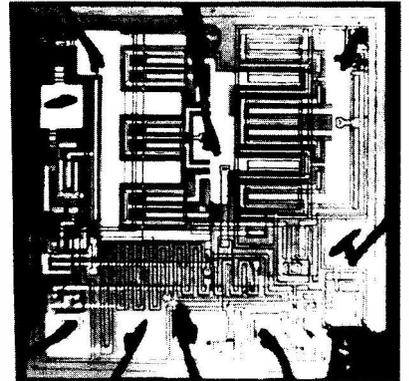
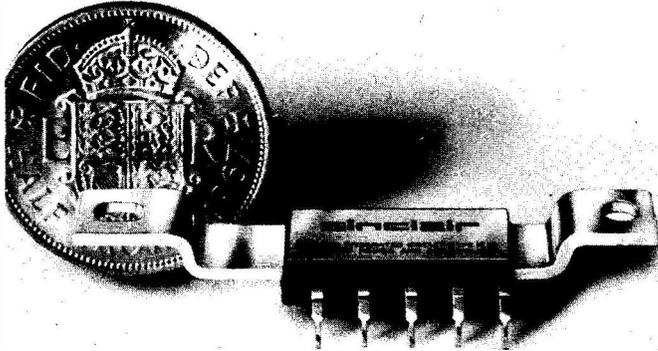
# ELECTROVALUE

(Dept. P.E.12)

28 ST. JUDES ROAD, ENGLEFIELD GREEN, EGHAM,  
SURREY.

Tel: Egham 5533

# 10 WATT MONOLITHIC INTEGRATED CIRCUIT AMPLIFIER AND PRE-AMP



## the world's most advanced high fidelity amplifier

The Sinclair IC-10 is the world's first monolithic integrated circuit high fidelity power amplifier and pre-amplifier. The circuit itself, a chip of silicon only a twentieth of an inch square by a hundredth of an inch thick, has an output 5 watts R.M.S. (10 watts peak). It contains 13 transistors (including two power types), 2 diodes, 1 zenor diode and 18 resistors, formed simultaneously in the silicon by a series of diffusions. The chip is encapsulated in a solid plastic package which holds the metal heat sink and connecting pins. This exciting device is not only more rugged and reliable than any previous amplifier, it also has considerable performance advantages. The most important are complete freedom from thermal runaway due to the close thermal coupling between the output transistors and the bias diodes and very low level of distortion.

The IC-10 is primarily intended as a full performance high fidelity power and pre-amplifier, for which application it only requires the addition of the usual tone and volume controls and a battery or mains power supply. However, it is so designed that it may be used simply in many other applications including car radios, electronic organs servo amplifiers (it is d.c. coupled throughout) etc. The photographic masks required for producing monolithic I.C.s are expensive but once made, the circuits can be produced with complete uniformity and at very low cost. It also enables us to give a 5 year guarantee on each IC-10 knowing that every unit will work as perfectly as the original and do so for a lifetime.

### ■ SPECIFICATIONS

|                           |   |
|---------------------------|---|
| Output                    | 10 Watts peak, 5 Watts R.M.S. continuous. |
| Frequency response        | 5 Hz to 100 KHz $\pm 1$ dB.               |
| Total harmonic distortion | Less than 1% at full output.              |
| Load impedance            | 3 to 15 ohms.                             |
| Power gain                | 110dB (100,000,000,000 times) total.      |
| Supply voltage            | 8 to 18 volts.                            |
| Size                      | 1 x 0.4 x 0.2 inches.                     |
| Sensitivity               | 5mV.                                      |
| Input impedance           | Adjustable externally up to 2.5 M ohms.   |

### ■ CIRCUIT DESCRIPTION

The first three transistors are used in the pre-amp and the remaining 10 in the power amplifier. Class AB output is used with closely controlled quiescent current which is independent of temperature. Generous negative feedback is used round both sections and the amplifier is completely free from crossover distortion at all supply voltages, making battery operation eminently satisfactory.

### ■ APPLICATIONS

Each IC-10 is sold with a very comprehensive manual giving circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include stabilised power supplies, oscillators, etc. The pre-amp section can be used as an R.F. or I.F. amplifier without any additional transistors.

SINCLAIR

**IC.10** with IC.10 manual and 5 year guarantee **59/6**

POST FREE

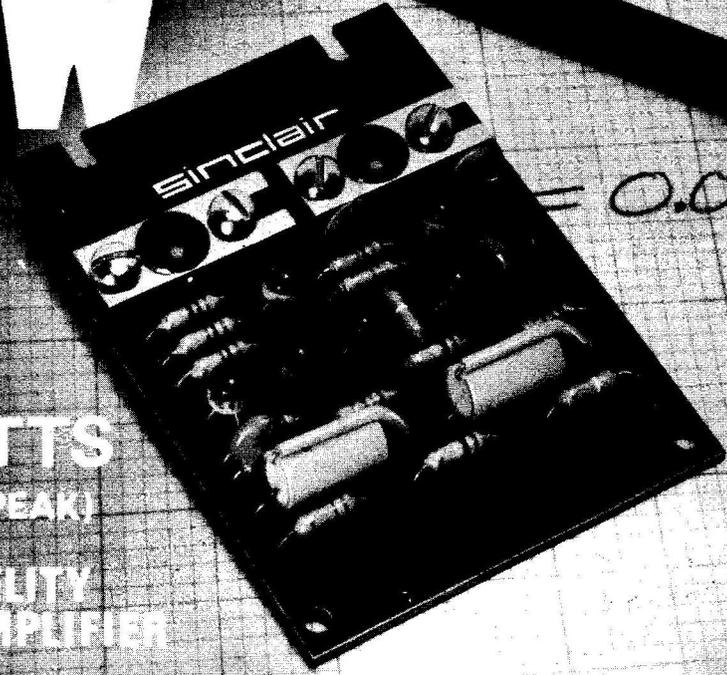
**sinclair**

**SINCLAIR RADIONICS LIMITED**  
22 NEWMARKET ROAD · CAMBRIDGE  
Tel. 0233-52731

# NEW

## 25 WATTS (50 WATTS PEAK)

### HIGH-FIDELITY POWER AMPLIFIER



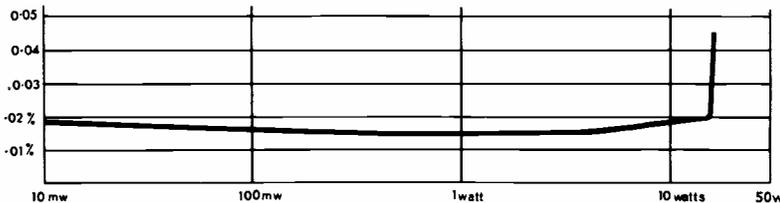
# Z.30

## THE WORLD'S LOWEST DISTORTION HIGH FIDELITY AMPLIFIER.

For four years, the Sinclair Z.12 dominated the constructor world, being the best selling unit of its kind this side of the Atlantic. Excellent as it was, the new Sinclair Z.30 is still better. Half the size of the Z.12, it has more than twice the power, very much greater gain and a level of distortion 50 times lower. This incredible figure results from using over 60dB of negative feed back with a constant current load to the driver stage obtained by incorporating a two transistor circuit in place of the more usual bootstrapping. 9 silicon epitaxial planar transistors are used to provide enormous power; up to 20 watts RMS sine wave (40 watts peak). The circuitry of this marvellous amplifier allows it to be operated from any voltage from 8 to 35 to perfection. At all output levels, distortion is only 0.02%. This puts true laboratory standards into the hands of every user of a Z.30. Two Z.30s and a new Stereo Sixty will make a stereo assembly of such perfection that it could not be bettered in its class no matter how much you spent. But the Z.30 has an enormous variety of applications, particularly where quality, precision and reliability are essential. It can also be used entirely on its own as an amplifier for an efficient economy record player.

#### APPLICATIONS

Hi-fi amplifier; car radio amplifier; record player amplifier fed directly from pick-up; intercom; electronic music and instruments; P.A.; laboratory work, etc. Full details for these and many other applications are given in the manual supplied with the Z.30.



#### SPECIFICATIONS

**Power output**—15 watts R.M.S. into 8 ohms using a 35V supply: 20 watts R.M.S. into 3 ohms using a 30V supply.

**Output**—Class AB.

**Frequency response**—30 to 300,000 Hz  $\pm$  1dB.

**Distortion**—0.02% total harmonic distortion at full output into 8 ohms and at all lower output levels.

**Signal-to-noise ratio**—better than 70dB unweighted.

**Input sensitivity**—250mV into 100k $\Omega$ .

**Damping factor**—>500.

**Loudspeaker impedances**—3 to 15 ohms.

**Power requirements**—From 8 to 35V d.c. (The Z.30 will operate ideally from batteries if required.)

**Size**—3½ × 2¼ × ½ inches.

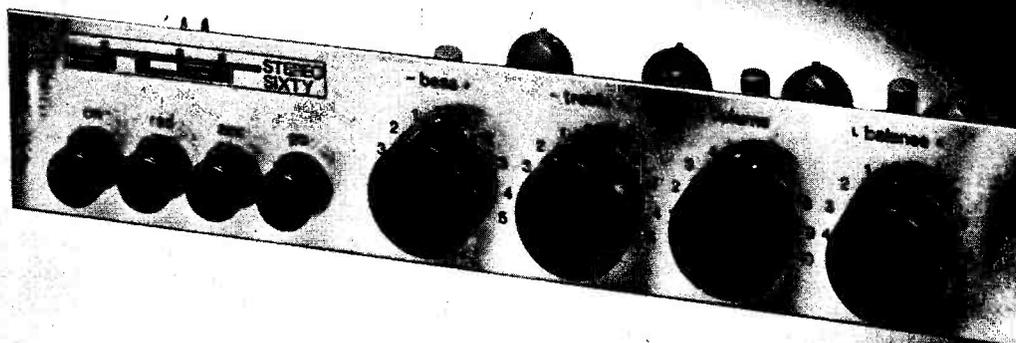
*Built, tested and guaranteed, with circuits and instructions manual*

# 89/6

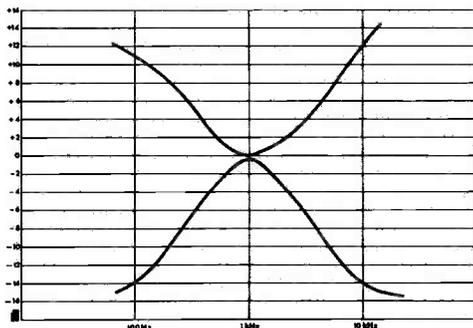
# sinclair

**SINCLAIR RADIONICS LIMITED**  
22 NEWMARKET RD., CAMBRIDGE Tel: 0223 52731

# NEW



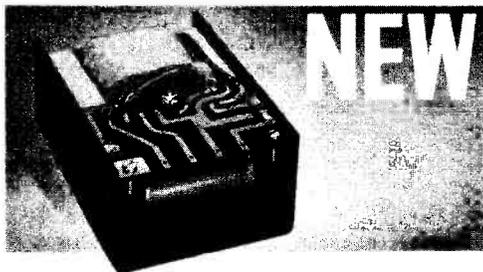
## STEREO SIXTY PRE-AMP & TONE CONTROL UNIT



Curves to show bass and treble cut and boost

Ready built, tested and guaranteed with instructions

**£9.19.6**



This attractive and completely new unit is intended for use with two new Z.30 amplifiers to provide the finest possible standards of stereo reproduction. Four press buttons and four rotary controls are used to provide on-off, three input selectors and Volume, Bass cut/boost, Treble cut/boost and Stereo balance. The on-off button also switches the power amplifiers. The front panel in brushed aluminium is flush mounted to the cabinet front, it being necessary only to drill holes to accommodate the controls. Rear adjustable brackets hold the chassis tight to the cabinet. The very latest ganged rotary controls are used to afford compactness and extra long working life free from noise.

*The Stereo-60 may also be used with 2 IC-10's or any other high performance amplifiers.*

### SPECIFICATIONS

- Input sensitivities—Radio—up to 3mV Magnetic Pickup—3mV: correct to R.I.A.A. curve  $\pm 1$ dB; 20 to 25,000 Hz. Ceramic Pickup—up to 3mV: Auxiliary—up to 3mV.
- Output—1 volt.
- Signal-to-noise ratio—better than 70dB.

- Channel matching—within 1dB.
- Tone Controls—TREBLE +15 to -15dB at 10 KHz; BASS +15 to -15dB at 100 Hz.
- Power consumption 5mA.
- Front panel—brushed aluminium with black knobs and controls.
- Size  $8\frac{1}{2} \times 1\frac{1}{2} \times 4$  inches.

### PZ.5 POWER SUPPLY UNIT

A new heavy duty mains power supply unit designed specially to drive two Z.30s and a Stereo Sixty. New compact design.

For AC Mains, 200-240V/50Hz. **£4.19.6**

USE THIS COUPON FOR Z.30, STEREO 60 AND P.Z.5.

Q.16 LOUDSPEAKER AND MICROMATIC ON NEXT PAGE

To: SINCLAIR RADIONICS LTD., 22 NEWMARKET RD., CAMBRIDGE  
Please send

NAME .....

ADDRESS .....

For which I enclose cash/cheque money order

PE.1269

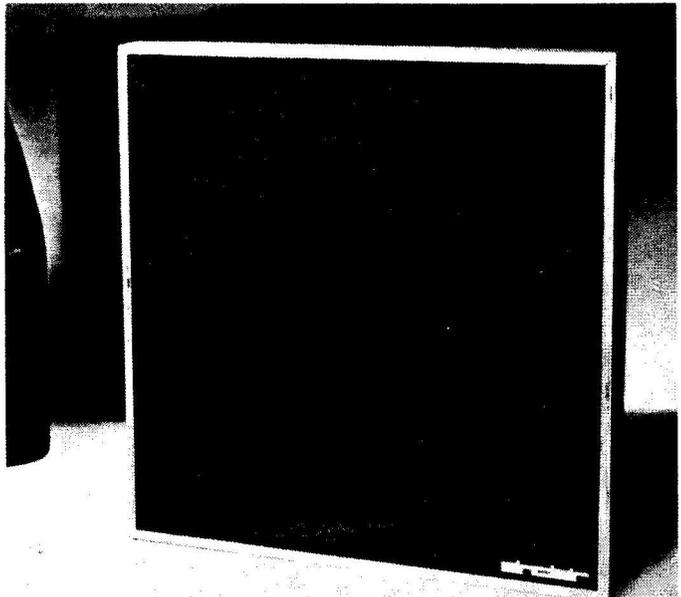
# sinclair

SINCLAIR

# Q.16

new elegance in an outstanding loudspeaker

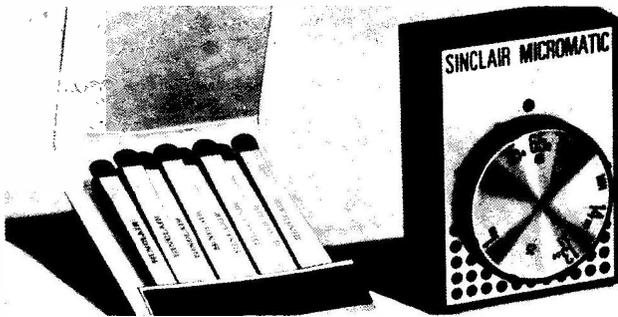
All the superb features which went to make the Sinclair Q.14 have been incorporated in the new Q.16 which gives an exciting new opportunity for you to match your Sinclair equipment with modern decor. Employing the same well proven acoustic system in which materials, processing and styling are used in such a radical and successful departure from conventional design, the new Q.16 presents an entirely new appearance with its attractive teak surround and all-over special cellular foam front chosen as much for its appearance as for its ability to pass all audio frequencies without loss. The Q.16 is compact and slim. Its new styling makes it eminently suitable for shelf mounting, but it is no less versatile than its famous predecessor. Listen to a pair of Q.16s in stereo and marvel at the standards of quality and clarity they give.



The Q.16 will handle loading up to 14 watts R.M.S. and presents an 8 ohm impedance to the amplifier output. Frequency response extends from 60 to 16,000 Hz. with exceptional smoothness. A specially designed driver system is used in a sealed and contoured pressure chamber to ensure good transient response at all frequencies. Size:  $9\frac{1}{2}$ " square  $\times$   $4\frac{3}{4}$ " deep from front to back.

**£8.19.6**  
POST FREE

## SINCLAIR MICROMATIC The world's most successful miniature radio



**Specifications**

**Size:**  $1\frac{1}{8}$ "  $\times$   $1\frac{1}{4}$ "  $\times$   $\frac{1}{2}$ " (46  $\times$  33  $\times$  13mm).  
**Weight incl. batteries:** 1 oz. (28.35gm) approx.  
**Tuning:** Medium wave band with bandspread at higher frequency end.  
**Earpiece.** Magnetic type.  
**Case:** Black plastic with anodized aluminium front panel, spun aluminium dial.

Complete kit incl. earpiece, case, solder and instructions in fitted pack.

**49/6**

Plus 11d. P.T. surcharge

Ready built, tested and guaranteed, with earpiece.

**59/6**

Plus 11d. P.T. surcharge

Mallory Mercury Cell RM675 (2 required) each 2/9d.

Considerably smaller than an ordinary box of matches, this is a multi-stage A.M. receiver meticulously designed to provide remarkable standards of selectivity, power and quality. Powerful A.G.C. is incorporated to counteract fading from distant stations; bandspread at higher frequencies makes reception of Radio 1 easy at all times. Vernier type tuning plus the directional properties of the self-contained special ferrite rod aerial makes station separation much easier than with many larger sets. The plug-in magnetic earpiece which matches exactly with the output provides wonderful standards of reproduction. Everything including the batteries is contained within the attractively designed case. Whether you build your Micromatic or buy it ready built and tested, you will find it as easy to take with you as your wristwatch, and dependable under the severest listening conditions.

**SINCLAIR GENERAL GUARANTEE**

Should you not be completely satisfied with your purchase when you receive it from us, return the goods without delay and your money will be refunded in full, including cost of return postage, at once and without question. Full service facilities are available to all Sinclair customers.

**USE THIS COUPON FOR MICROMATIC AND Q.16 ORDERS**

To: **SINCLAIR RADIONICS LIMITED, 22 NEWMARKET ROAD, CAMBRIDGE**

Please send

NAME .....

ADDRESS .....

For which I enclose cash/cheque/money order.

PE 1269

**sinclair**  
SINCLAIR RADIONICS LIMITED

22 NEWMARKET ROAD  
CAMBRIDGE Tel. 0223 52731

# A LONG COOL LIFE

for your valuable components with the  
S.D.C. DeC range of SOLDERLESS breadboards

**S-DeC** Available as single packs with accessories and control panel @ 29/6d or the DeCSTOR double pack containing 2 S-DeCs, accessories, control panel, all in a plastic storage container. Only 67/6d. A 4 DeC pack is available, only 117/6d.

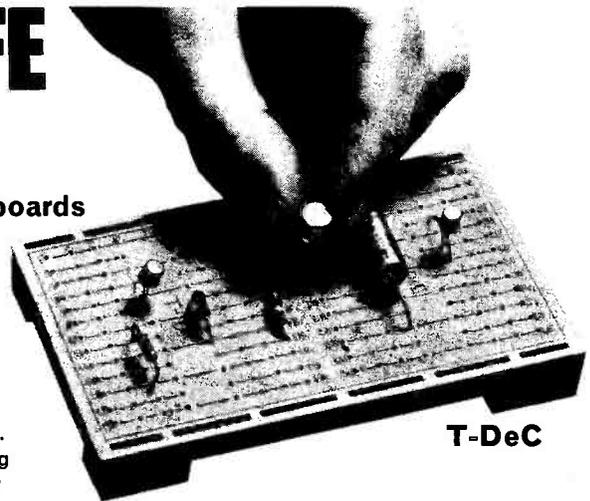
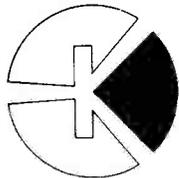
**T-DeC** Now available to the amateur. 208 connection points. 38 independent junctions. Accommodates I.C.s using standard carriers. Three times the capability for only twice the price! Unit pack with control panel 50/-d.

**μ-DeC** Primarily for use with integrated circuits; further details on request.

*T-DeCs, S-DeCs and Accessories are all obtainable from leading suppliers throughout the U.K. In case of difficulty complete the coupon and mail without delay.*

Post to:

**S.D.C. Electronics (Sales) Ltd.,**  
34, Arkwright, Astmoor Industrial Estate,  
Runcorn, Cheshire. Tel: Runcorn 5041



**T-DeC**

Please send me:

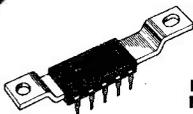
..... T-DeC Pack ..... S-DeC Single Pack  
..... DeCSTOR Pack ..... 4-DeC Pack

Tick here if you require further details of the μ-DeC  
I enclose PO/Cheque/Money Order value £ | | d.  
Money refunded if not satisfied.

Name.....

Address.....

## Kinver for Integrated Circuits



**LINEAR  
INTEGRATED  
CIRCUITS  
FOR ALL YOUR  
REQUIREMENTS**



|   |      |
|---|------|
| Plessey Type SL403A 3 Watt Audio Amplifier .....          | 49/6 |
| G.E. Type PA230 Low Level Amplifier .....                 | 21/- |
| G.E. Type PA234 1 Watt Audio Amplifier .....              | 23/- |
| G.E. Type PA237 2 Watt Audio Amplifier .....              | 34/- |
| G.E. Type PA246 5 Watt Audio Amplifier .....              | 57/- |
| RCA Type CA3000 D.C. Amplifier .....                      | 54/9 |
| RCA Type CA3011 Wide Band Amplifier .....                 | 20/- |
| RCA Type CA3020 1/2 Watt Wide Band Amplifier .....        | 32/- |
| RCA Type CA3028A Differential/Cascode Amp (120 MHz) ..... | 32/- |
| RCA Type CA3029 Operational Amplifier .....               | 55/3 |
| RCA Type CA3035 Ultra High Gain Amplifier .....           | 30/- |
| Mullard Type TAA263 A.F. Amplifier .....                  | 15/9 |
| Mullard Type TAA293 General Purpose Amplifier .....       | 21/8 |
| Mullard Type TAA310 Record/Playback Pre-Amplifier .....   | 32/- |
| Mullard Type TAA320 MOS L.F. Amplifier .....              | 13/5 |
| G.E. Type 2N5306 Darlington Pair .....                    | 11/6 |
| G.E. Type D13T1 Programmable Unijunction Transistor ..... | 10/8 |

Add 1/- each to the above i.c.s. for data sheets if required. Data sheets may be purchased separately at 1/6 each post free.

**KINVER  
GIFT  
TOKENS**

Value £1 or multiples of £1. The ideal gift for the amateur radio and electronics enthusiasts.

FREE catalogue, value 2/- with every gift token purchased.

**PROFESSIONAL COMPONENTS AT REALISTIC PRICES!**

Send NOW for our COMPONENTS CATALOGUE, at only 2/- post free. This catalogue is packed with information on a host of up-to-the-minute components by leading manufacturers. Included are International Rectifier Products, Resistors, Capacitors, Veroboard, Plugs and Sockets, Switches, etc.

Please note that all goods supplied by us are brand new and guaranteed to fully conform to the manufacturers' published specifications. DISCOUNTS: Order value of £5—10%: Order value over £10—15%. Cash with order please. Post and packing 1/6 per order.

**ELECTRONICS LTD**  
**Kinver**

STONE LANE KINVER  
STOURBRIDGE WORCS  
Telephone: KINVER 2014

## Connoisseur

Precision in Sound

**B.D.2 COMBINED TURNTABLE AND  
PICK-UP ASSEMBLY. QUALITY  
PERFORMANCE AT A REALISTIC PRICE**

Featuring:

- ★ Belt drive turntable with S.A.U. 2 arm operated by hydraulic lift and with lowering device.
- ★ 33½ and 45 r.p.m.
- ★ Virtually silent.
- ★ Anti-vibration springs.
- ★ Available as chassis only or on teak plinth.



Prices and full details from:

**A. R. SUGDEN & Co. (Engineers) Ltd.**  
Market Street, Brighouse, HD6 1DX, Yorkshire. Tel. 2142

# Lasky's

## LASKY'S EXCLUSIVE TMK METER KITS

These two meter kits by TMK offer the unique opportunity of building a really first-class precision multimeter at a worthwhile saving in cost. The cabinets are supplied with the meter scale and movement mounted in position; the Model 200 also has the range selector in position. The highest quality in components and 1% tolerance resistors are used throughout. Both offer professional standards of accuracy. Supplied complete with full constructional, circuit and operating instructions.

### MODEL 200

20,000 O.P.V. Multimeter. Features 24 measurement ranges with mirror scale.

Large 3" x 2 1/2" meter. Full scale accuracy: DCV and current: ±2%, ACV: ±3%, resistance ±3%. Special 0-6V DC range for transistor circuit measurements.

#### SPECIFICATION

● DCV: 0-0.6-6-30-120-600-1,200V at 20K/OPV. ● ACV: 0-6-30-120-600-1,200V at 10K/OPV. ● DC Current: 0-0.6-6-60-600mA. ● Resistance: 0-10K-100K-1M-10M/ohms (58-580-5.8K-58K at mid-scale). ● Capacitance: 0.002-0.2uf (AC 6V range). ● Decibels -20 to +63dB. ● Output: 0.05uf blocking capacitor. Uses two 1.5V (1.7 type) batteries. Black bakelite cabinet—Size 3 1/2" x 3 1/2" 1 1/2". Complete with test leads.



**LASKY'S PRICE 85/-** Post 3/6

### MODEL 5025

50,000 O.P.V. FEATURING  
57 MEASUREMENT RANGES

Uses an entirely new range selection mechanism which permits the use of a really large meter in a more compact cabinet. The range selected is clearly indicated on the actual meter face. High speed rotary range selection knob; also features polarity reversal measurement ranges.

**SPECIFICATION** DCV: 0-0.25-2.5-10-50-250-1,000V at 25K/OPV. 0-0.125-1.25-6.3-30-125-500V at 10K/OPV. ACV: 0-0.3-3-10-50-250-1,000V at 2.5K/OPV. DCuA: 0-1.5-5-25-125-500V at 5K/OPV. DCmA: 0-25uA at 125mA; 0-50uA at 250mA. DCmA: 0-2.5-25-250mA at 125mV; 0-5-50-500mA at 250mV. DC Amps: 0-5A at 125mV; 0-10A at 250mV. Resistance: 0-10M/ohms. Output: Capacitor (0.1uF, 400V) in series with ACV ranges. Decibels: -20 to +81.5dB. Operates on two 1.5V batts. Black bakelite cabinet, size 5 1/2" x 6 1/2" x 2 1/2". Complete with test leads.



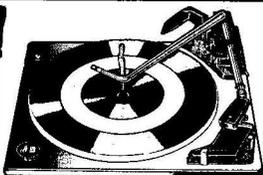
**LASKY'S PRICE  
£10.10.0** Post 5/-

ALSO AVAILABLE READY BUILT  
AND TESTED £12.10.0. Post 5/-

## Garrard

### SL.55

4-speed autochanger  
with stereo cartridge



**LASKY'S  
PRICE £11.19.6** Post 5/-

#### AUTOCHANGERS

|   |          |
|---|----------|
| 1025 less cartridge ..                            | £6 9 6   |
| 1025 with GCM21 mono cartridge (Stereo Compat) .. | £6 19 6  |
| 2025TC with 9TA stereo diamond cartridge ..       | £8 17 6  |
| SL65B less cartridge ..                           | £16 5 0  |
| AT60 Mk. II less cartridge ..                     | £13 5 0  |
| SL75 less cartridge ..                            | £28 10 0 |
| SL95 less cartridge ..                            | £35 0 0  |
| A70 Mk. II less cartridge ..                      | £18 19 6 |
| B.S.R.UA-47 less cartridge ..                     | £5 9 6   |

Postage on all above 5/- extra

#### SINGLE PLAYERS

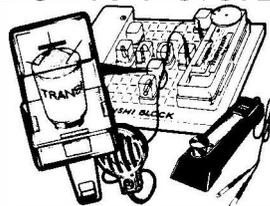
|                                       |          |
|---------------------------------------|----------|
| AP75 with AD76K magnetic cartridge .. | £21 0 0  |
| AP75 less cartridge ..                | £19 10 0 |
| SP25 Mk.II less cartridge ..          | £11 19 6 |
| SRP25 Mains model less cartridge ..   | £6 12 10 |
| SRP25 Battery model less cartridge .. | £7 15 3  |
| TRANSCRIPTION DECK 401 ..             | £28 10 0 |
| <b>GARRARD BASES:</b>                 |          |
| WB1 £3. 6. 11; WB4 Mk. II £5. 8. 11;  |          |
| WB5 £5. 8. 11.                        |          |
| <b>CLEARVIEW PERSPEX COVERS:</b>      |          |
| SPC1 £3. 5. 0 SPC4 Mk. II £4. 6. 6.   |          |

### GET YOUR LASKY'S AUDIO-TRONICS PICTORIAL

16 colour pages in large 16x11in. format packed with 1,000's of items from our vast stocks. Hi-Fi, Radio, Electronics, Test equipment, Components, etc., etc. Send 1/- for post only and inclusion on our regular mailing list. (5/- overseas)

## DENSHI BOARD KITS EXPERIMENTAL AND EDUCATIONAL CIRCUIT SYSTEM

The DENSHI BOARD system enables the young experimenter and electronics hobbyist to produce a wide range of transistor circuits of increasing sophistication without soldering or the use of any tools at all! Basically the system comprises a slotted circuit board into which plug-in components and bridge pieces are set to produce up to 30 different circuits. The components are encapsulated in transparent plastic blocks bearing the appropriate circuit symbol and value thus enabling even the complete novice to visually grasp the fundamentals of circuitry after only a few moments' study. DENSHI BOARD KITS comes complete with an 80 page manual of circuits and data. Manuals are available separate at \*4/6 post 6d. \*Refundable if you purchase kit.



THESE ARE JUST A FEW OF THE CIRCUITS YOU CAN BUILD IN MINUTES: VARIOUS RADIO RECEIVERS, AMPLIFIERS, MORSE CODE PRACTICE DEVICE, CONTINUITY TESTER, SIGNAL INJECTOR, SIGNAL TRACER, WIRELESS MICROPHONE, ETC., ETC.

#### DENSHI BOARD KIT SR-1A comprises:

Base board; tuner block; 4 resistors; choke coil; transformer; 28A transistor for RF; 2 diodes; 3 capacitors; battery block; mouse key; antenna lead; crystal earphone; various bridge and connecting pieces. This kit permits the building of 16 basic circuits.

**LASKY'S PRICE £4.19.6** Post 3/6

#### DENSHI KIT SR-2A as SR-1A with these additional parts:

28B transistor for AF; 2 resistors; 1 capacitor; crystal microphone; test probes; electrode; additional connecting pieces; 9V battery. This kit permits the building of 30 circuits

**LASKY'S PRICE £7.2.6** Post 3/6

## SPECIAL HI-FI OFFER AD-86K STEREO MAGNETIC CARTRIDGE

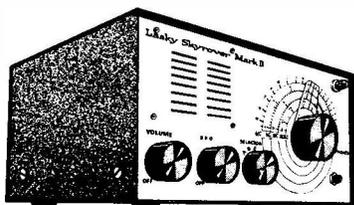
The famous AUDIO DEVELOPMENT AD-86K high compliance stereo magnetic cartridge now at our "all time low" special price offers you the opportunity of obtaining magnetic pickup quality for your hi-fi at a price you can afford. Brief Spec: Diamond L.P. stylus Compliance 10 x 10<sup>-6</sup> cm/dyne. Frequency response 20-20KHz. Channel separation 25dB. Output 5mV. Tracking pressure 3gm ± 0.5gm. Standard 1/2" mounting. (Replacement stylus available.) Don't miss this great chance. List Price £8.2.6.



**SPECIAL PRICE 69/6** Post 2/6

Replacement diamond stylus EN30S 39/6.

## SKYROVER MK II



### COMMUNICATION RECEIVER

A short wave receiver, exclusive to Lasky's, at a real economy price. Five valve line up using one each 6BE6, 6B4S, 6AV6 and 6AR5 valves, gives highly sensitive reception and powerful gain. Switch selected 8W frequency range cover: 1.5 to 30Mc/s in three separate bandspread ranges and full AM medium waveband cover in one range 550-1,600Kc/s. Reduction drive tuning with hair line cursor.

Controls include volume on/off BFO, Band selector. Power on indicator lamp. External antenna connections and mains fuse at rear. Internal speaker plus standard 500uA Jack socket for phones on front. For 220/240V a.c. mains operation. Strong metal cabinet finished in grey crackle with modified silver front panel. Size 9 1/2" x 5 1/2" x 5 1/2". Complete with mains lead and full instructions.

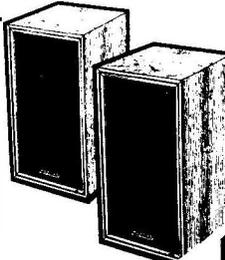
**LASKY'S  
PRICE £13.13.0** Post 5/-

# Lasky's

## NEW FOSTER "Criterion" Mk II

### 2 SPEAKER TWO WAY BOOK-SHELF SPEAKER SYSTEM

Another high quality sub-miniature book-shelf system from Foster. The "Criterion" Mk II is a sealed infinite baffle type enclosure using 8in base/mid-range woofer with rolled cloth edge and a 2in HF cone type tweeter. The compact cabinet is constructed in laminate with handsome oiled walnut veneer finish and black woven acoustic gauze front panel with satin chrome edge insert. SPEC: Frequency range 90-20,000Hz. Power handling 10 watts. Impedance 8 ohms. HF crossover. Screw tag connections at rear. Size 12 1/2 x 7 1/2 x 6 1/2 in. The performance of the "Criterion" is superior to many larger and more expensive units and Lasky's exclusive price offers absolutely unbeatable value.

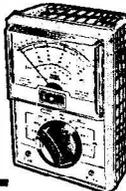


Post 1-7/6  
2-12/6

LASKY'S PRICE £9.10/- or £17.10/-  
2 for

### TTC MODEL C-1000

A really tiny 1,000 O.P.V. pocket multi-tester with "big" meter performance. Precision 2 jewel meter movement. Hand calibrated to ±3% accuracy on full scale of DC ranges, 4% on AC ranges. 2 1/2 in square meter. SPECIFICATIONS AC/V ranges: 0-10, 50, 250 100V at 1K/O.P.V. DC currents: 0-1-100mA. Resistance: 0-150K/ohms (3,000 ohms centre scale). Decibels: -10 to +22dB. Operated on one penlight cell. Two colour buff/green case—size only 3 1/2 x 2 1/2 x 1 1/2 in. Click stop range selection switch. Ohms zero adjustment. Complete with test leads, battery and instructions with circuit data.

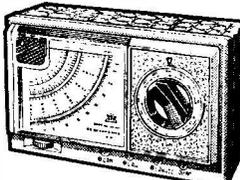


LASKY'S PRICE 39/6

Post 2/6

### TTC MODEL C-1051

20,000 O.P.V. pocket multimeter with mirror scale and built in thermal protection circuit. Exceptionally large easy to read meter with D'Arsonval movement. Colour coded scales. Single positive click-in, recessed selection switch for all ranges. Ohms zero adjustment. Range spec. A.C. volts: 0-6-30-300-1200V at 10/K/ohms/V. D.C. volts: 0-3-15-150-300-1-2KV at 20K/ohms/V. Resistance: 0-60K-6megs. D.C. current: 0-50µA-300mA. Decibels: -20dB to +17dB. Hand calibration gives extremely high standard of accuracy on all ranges. Uses one 1 1/2 V penlight battery. Strong impact resistant plastic cabinet—size only 4 1/2 x 3 1/2 x 1 1/2 in. Two colour buff/green finish. Complete with test leads and battery. Original list price 59s.

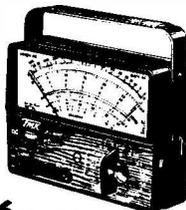


LASKY'S PRICE 75/-

Post 2/6

### TMK PL-436

20,000 O.P.V. Multitester for the amateur or professional. Features mirror scale and wood grain finish front panel. Spec.: D.C./V ranges: 0-6, 3, 12, 30, 120, 600V at 20K/O.P.V. A.C./V ranges: 3, 30, 120, 600V at 8K/O.P.V. D.C. current: 50µA, 0-6, 60, 600mA. Resistance: 10K, 100K, 1M and 10M ohms end scale (65, 650, 6.5K and 65K ohms centre scale). Decibels: -20 to +57dB in four ranges. Operates on 2 x 1.5V C7 type batteries. Size: 5 1/2 x 4 1/2 x 2 1/2 in. Complete with test leads, batteries and instructions.



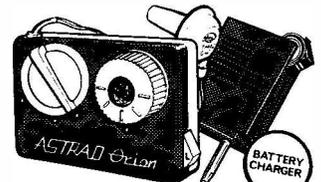
LASKY'S PRICE £6.19.6

Post 5/-

## SCOOPI! THE WORLD'S SMALLEST

### 6 TRANSISTOR TWO WAVEBAND RADIO RECEIVER FROM RUSSIA

## THE Astrad ORION



Made to the highest Russian space-age standard—this remarkable micro-size set measures only 1 1/2 x 1 3/16 x 3/16 in. yet it contains 6 transistors and other components combined in a photo etched circuit, only 1 x 1 in. tuning capacitor, ferrite rod aerial, battery, wave band selection switch etc. Output to a high impedance crystal earpiece, giving ample volume (automatically adjusted) and clear tone. Brief tech. spec.: Waveband coverage: Medium wave 325 to 160 ke/s. Long wave 150 ke/s to 408 ke/s. Sensitivity: 35MV max. Selectivity—10dB (at 30 ke/s de-tuning). Power source: 1 1.4V Mercury battery.

The Orion is supplied fully built and tested complete with battery, left and right fitting earphone supports and attractive black and ivory plastic presentation/carrying case (matching the Orion). Never miss your favourite music, sport, news—the Orion is an ideal gift for all, providing a constant source of enjoyment without disturbing others.

LASKY'S PRICE ONLY 39/6

Post 2/6  
Extra rechargeable battery 3/6

\*NOTE: The battery we supply with the Orion is a rechargeable type. Charger units are available enabling you to re-charge the battery from AC Mains 220/240V supply.

PRICE 19/6 extra. Post free with radio—otherwise 2/-

### MIDLAND Model 10-502 VHF AIRCRAFT BAND CONVERTER

An entirely new item for the radio enthusiast bringing instant reception of the ground-to-air, air-to-ground waveband. For use with any standard AM or FM radio covering 635 to 1605Kc/s, 88 to 108Mc/s respectively—with no electrical conversion or connection required. The Model 10-502 self powered by one 9V (FP3 type) battery is merely placed close to the receiving set and then tuned over 110 to 135Mc/s which covers the whole aircraft communications band. Volume and reception effectiveness is adjusted by moving both sets to the most favourable position and balancing the vol. controls of each accordingly. The Model 10-502 has a smartly designed black plastic cabinet with brushed metal front panel and 8 in. chrome telescopic antenna, size only 4 x 2 1/2 x 2 1/2 in. (inc. knobs). Complete with battery and full instructions.



LASKY'S PRICE 79/6

Post Free

### NEW INTERNATIONAL TAPE

#### FAMOUS AMERICAN MADE BRAND TAPE at RECORD LOW PRICES

|                                    |      |                                    |      |
|------------------------------------|------|------------------------------------|------|
| 3in Message tape, 150ft            | 2 6  | 5in Standard play, 850ft PVC       | 11 0 |
| 3in Message tape, 225ft            | 3 9  | 5in Long play, 1,200ft Mylar       | 11 0 |
| 3in Message tape, 300ft            | 4 6  | 5in Triple play, 2,400ft Mylar     | 45 0 |
| 3 1/2in Triple play, 600ft Mylar   | 10 0 | 7in Standard play, 1,200ft Acetate | 12 6 |
| 4in Triple play, 900ft Mylar       | 17 6 | 7in Standard play, 3,200ft Mylar   | 12 6 |
| 5in Double play, 1,200ft Mylar     | 15 0 | 7in Long play, 1,800ft Mylar       | 19 6 |
| 5in Long play, 900ft Acetate       | 10 0 | 7in Double play, 2,400ft Mylar     | 25 0 |
| 5in Standard play, 600ft PVC       | 8 6  | 7in Long play, 1,800ft Acetate     | 15 0 |
| 5in Triple play, 1,800ft Mylar     | 35 0 | 7in Triple play, 3,600ft Mylar     | 50 0 |
| 5 1/2in Double play, 1,800ft Mylar | 22 8 |                                    |      |
| 5 1/2in Long play, 1,200ft Acetate | 12 6 |                                    |      |

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

### NEW BUDGET PRICED CASSETTES

from the U.S.A.

C.60-7/6 (6-42/6) C.90-12/6 (6-70/-) C.120-17/6

Post 1/- each. 4 and over Post Free. Special quotes for quantities.

## Lasky's Radio Limited

Branches

207 EDGWARE ROAD, LONDON, W.2 Tel. 01-723 3271

33 TOTTENHAM CT. RD., LONDON, W.1 Tel. 01-636 2605

Open all day, 9 a.m. - 6 p.m. Monday to Saturday

152/3 FLEET STREET, LONDON, E.C.4 Tel. 01-353 2833

Open all day Thursday, early closing 1 p.m. Saturday

High Fidelity Audio Centres

42-45 TOTTENHAM CT. RD., LONDON, W.1 Tel. 01-580 2573

Open all day, 9 a.m. - 6 p.m. Monday to Saturday

118 EDGWARE ROAD, LONDON, W.2 Tel. 01-723 9789

Open all day Saturday, early closing 1 p.m. Thursday

ALL MAIL ORDERS AND CORRESPONDENCE TO: 3-15 CAVELL STREET, TOWER HAMLETS, LONDON, E.1 Tel.: 01-790 4821



# Lasky's

**HOME EXPERIMENTERS - HOBBYISTS - SERVICEMEN** **LOOK!**  
**ONCE ONLY ½ PRICE SALE**

## MARTIN AUDIO KITS INTERNATIONAL RECTIFIER

A varied selection of these high quality audio/Hi-Fi modules are available—enabling you to build a really top class HI-FI system at a fantastically low cost—remember ALL UNITS ARE HALF PRICE !

### UNITS AVAILABLE:

#### AUDIOKITS:

1: 1A; 1S; 2; 2A; 2S; 3; 3A; 3S; 4A; 4S; 5; 6; 7; 8; 9A; 9S; 10S; 12; 12S; 14; 14S; 15; 16; 17.

#### PANELS:

32; 32S; 34; 34S

#### ADAPTORS—VARIOUS TYPES

#### RECORD AMPLIFIERS:

8311-V; 8311-4V; 8312-CP; 8312-4CP.

*Hurry there are only a very few of some of these items*

**EVERYTHING HALF PRICE · LIMITED QUANTITIES ONLY · HURRY DON'T MISS THIS GREAT CHANCE · SALE CONTINUES ONLY WHILE STOCKS LAST**

**PERSONAL CALLERS ONLY: 207 Edgware Road, London, W2**

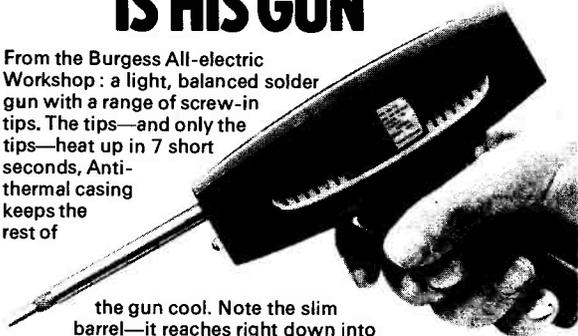
REGRET NO MAIL ORDERS ACCEPTED

### ITEMS AVAILABLE

SCR02-C; TR-12-C; TR05-C; TR7-C; TR09-C; TR10-C; TR13-C; TR16-C; E150(L)-C; Q4B-C; 20HB5-C; SCR04-C; DD121-C; 10DB4A-C; JJ1010-C; DD190; ZN2160-C; Z1114-C; EP50; S4M; 3F40D-C; IN87A-C; K546; B2M; B3M; TR08; TR01; TR22-C; E075; E150L-C; 2N2160-C; EP50; Q4B-C; 3F20D-C; 20HB5-C; 10DB2A-C; 10DB4A-C; Z0HB40-C; 3F10-C; IN34-A; IN60-C; IN87-A; IN64-C; IN82-A; E500L-C; ST14-C; Z1100-C; Z1102-C; Z1118-C; Z1120-C; Z1104-C; Z1108-C; Z1112-C; TR01-C; TR02-C; TR03-C; TR05-C; TR06-C; TR07-C; TR08-C; TR11-C; TR10-C; TR12-C; TR13-C; TR14-C; TR15-C; TR16-C; TR20-C; TR21-C; TR17-C; C1B-C; B1B-C; SCR-03-C; SCR-02-C; B3M; SCR-04-C; SCR01-C; SCR04-C; JJ1020-C; Z1114-C; Z1116-C; Z1106-C; SD600-C; 5A60D-C; SD500-C; TR18-C; TR19-C; TR22-C; TR24-C; TR23-C; 5MA4D-C; DD148; DD121; DD144; DD175; DD104; DD177; DD170; DD180; DD176; DD119-C; DD05; DD04; DD184; DD144; JJ1020-C; JJ1010-C; 3F40D-C; 5A4DC; DD125; DD124; K421.

## A SOLDER'S BEST FRIEND IS HIS GUN

From the Burgess All-electric Workshop: a light, balanced solder gun with a range of screw-in tips. The tips—and only the tips—heat up in 7 short seconds. Anti-thermal casing keeps the rest of



the gun cool. Note the slim barrel—it reaches right down into confined spaces. There are spike-like extension barrels for real 'in-deep' work. A prefocused lamp pinpoints work detail. Fail-safe soldering even for delicate work! The price of this tough, modern instrument? Just £4 12 6 complete with two tips, a 6" extension barrel, a double-ended probe and solder. **FREE 24-PAGE CATALOGUE!** For details of the Burgess instant heat solder gun, plus other equipment in the Burgess All-Electric Workshop, write for a free copy of our information-packed catalogue.

**BURGESS** take the work out of your workshop.

Burgess Products Company Limited, Electric Tools Division, Sapcote, Leicester LE9 6JW.

## AMAZING MINI-DRILL



**FOR PRECISION MODEL WORK**

ABRASIVE  
 SPEAR DRILL  
 BURR  
 REAMER  
 BRUSH

+ 6 TOOLS

ONLY 39/6  
 R & P 2/

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

**MERLIN SUPPLY CO.**

Dept. PE12D, Nailsea, Bristol BS19 2LP

## BUILD YOUR CIRCUITS on VEROBOARD

—the Universal Wiring Board—obtainable from your local Retailer

Trade enquiries to:

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

Technical enquiries to:

**VERO ELECTRONICS LTD.**  
 Industrial Estate, Chandler's Ford, Hants

# There's Something for Everyone in the NEW HEATHKIT CATALOGUE!



- GUITAR PRACTICE AMPLIFIER
- ELECTRONIC METRONOME
- AMBASSADOR SPEAKERS
- AUTO-TUNE-UP METER
- AIRCRAFT MONITOR RECEIVER
- CAR RADIO
- TECHNICIANS LOW-COST 'VVM'
- SEVERN AM/FM RADIO
- FABULOUS STEREO HI-FI COMPACTS
- STEREO RECORD PLAYER
- D.I.Y. SPEAKER SETS
- GENERATORS
- POWER SUPPLIES
- D.I.Y. RADIOGRAM PACK
- MANY OTHER MODELS TOO NUMEROUS TO MENTION

Send for this  
**FREE Catalogue**  
and see for yourself, Today!



**DAYSTROM LIMITED**  
**HEATHKIT DIVISION**  
**GLOUCESTER GL2 6EE**

Tel.: Gloucester 29451 Telex 43216

To: DAYSTROM LTD., GLOUCESTER

Please send me my free copy of the  
1970 HEATHKIT CATALOGUE

NAME

ADDRESS

P.E. 12

# Complete stereo system – 28 gns.

The new Duo general-purpose 2-way speaker system is beautifully finished in polished teak veneer, with matching vynair grille. It is ideal for wall or shelf mounting either upright or horizontally.

## Type 1 SPECIFICATION:

Impedance 10 ohms. It incorporates Goodmans high flux 6" x 4" speaker and 2 1/2" tweeter. Teak finish 12" x 6 1/2" x 5 1/2". 4 guineas each. 7/6d. p. & p.

Type 2 as type 1. Size 17 1/2" x 10 1/2" x 6 1/2". Incorporating 10 1/2" x 6 1/2" bass unit and 2 1/2" tweeter. 3 ohms impedance 5 1/2 guineas plus 7/6d. p. & p.

Garrard Changers from £7.19.6d. p. & p. 7/6d.

Cover and Teak finish Plinth £4.15.0d. 7/6d. p. & p.

*Duetto*

Integrated Transistor Stereo Amplifier **9 GNS.**  
plus 7/6d. p. & p.

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

## SPECIFICATION:

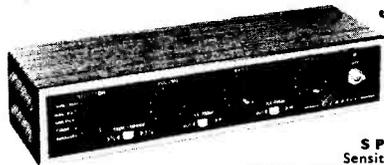
R.M.S. power output: 3 watts per channel into 10 ohms speakers  
INPUT SENSITIVITY: Suitable for medium or high output crystal cartridges and tuners. Cross-talk better than 30dB at 1 Kc/s

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.



These 5 items can be purchased together for 28 gns. + £1.10P.&P.



*The Classic*

Teak finished case

**8 1/2 GNS.**

Plus P. & P. 7/6

## SPECIFICATION:

Sensitivities for 10 watt output

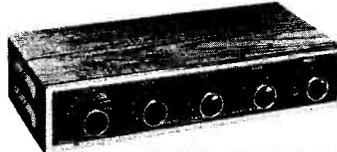
at 1KHz into 3 ohms. Tape Head: 3mV (at 3 1/2

i.p.s.) Mag. P.U.: 2mV. 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 12 1/2in long, 4 1/2in deep, 2 1/2in high. Built and tested.



*The Viscount*

INTEGRATED HIGH FIDELITY TRANSISTOR STEREO AMPLIFIER  
**13 1/2 GNS.**

Plus P. & P. 7/6

## SPECIFICATION:

Output: 10 watts per channel into 3 to 4 ohms speakers (20 watts monaural). Input: 6-position rotary selector switch (3 pos. mono and 3 pos. stereo). P.U., Tuner, Tape and Tape Rec. out. Sensitivities: All inputs 100mV into 1.8M ohm. Frequency Response: 40Hz-20KHz ±2dB. Tone Controls: Separate bass and treble controls. Treble 13dB lift and cut [at 15KHz]. Bass: 15dB lift and 25dB cut [at 60Hz]. Volume Controls: Separate for each channel. A.C. Mains Input: 200-240V, 50-60Hz. Size: 12 1/2 x 6in x 2 1/2in teak-finished case. Built and tested. P. & P. 7/6.

Viscount Mark II for use with magnetic pick ups specification as above. Fully equalised for magnetic pick ups. Suitable for cartridges with minimum outputs of 4mV/cm/sec. at 1kc. Input Impedance 47k. 15 gns. plus 7/6 P. & P.



**THE RELIANT Mk. II**  
SOLID STATE  
GENERAL PURPOSE AMPLIFIER

**6 1/2 GNS.** Plus P. & P. 7/6

In teak finished case

## SPECIFICATION:

Output: 10

watts into a 3 ohms speaker.

Inputs: (1) for mike (10mV). Input (2) for

gram. radio (250mV) individual bass and treble control.

Transistors: 4 silicon and three germanium. Mains input: 220/250

volts. Size: 10 1/2 x 4 1/2 x 2 1/2in. Mike to suit (crystal): 12/6 plus 1/6 P. & P. 8 x 5in speaker 14/6 plus 3/- P. & P. Mk. I 5 1/2 gns. plus 7/6 P. & P. Less teak finished case.

**SPECIAL OFFER**  
Complete stereo systems comprising BALFOUR 4 speed auto player with stereo head, 2 DUO speaker systems size 12 x 6 1/2 x 5 1/2in. Plinth (less cover) and the DUETTO stereo amplifier. All above items  
**19 GNS.** Plus P. & P. 20/-

## B.S.R. TD2 TAPE DECK

This tape deck takes 5 1/2in spools complete with two-track heads. Size 13 1/2 in long by 8 1/2in wide.

**Price £8.19.6** Plus P. & P. 7/6



**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 fool-proof construction. MAINS POWER PACK KIT: 9/6 extra.

**Price £49.6** Plus P. & P. 7/6.

Circuit 2/6. Free with parts.

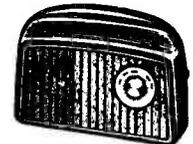
**THE DORSET**  
(600mW Output)

7 transistor fully tunable M.W.-L.W. superhet portaset—with baby alarm facility. Set of parts. The latest modulated and pre-alignment techniques makes this simple to build. Size: 12 x 9 x 3in.

MAINS POWER PACK KIT: 9/6 extra.

**Price £5.5.0** Plus P. & P. 7/6.

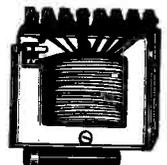
Circuit 2/6. Free with parts.



## QUALITY MAINS TRANSFORMER

Input 250V OUTPUT (All RMS values) 4 windings of 11.5V connected in series total 46V at 4.5 amps (conservatively rated). The following combinations may be used. 1. 23—23V; 2. 46V. Both of these above voltages are commonly used in medium to high powered transistor amplifiers, power supplies, etc.

**Price 35/-** Plus P. & P. 7/6



Also see opposite page

RADIO & TV COMPONENTS  
**R-TV**  
(FACTORY) LIMITED



### EXTRACTOR FAN

AC mains 230/250V, complete with pull switch. Size 6 x 6 x 4 in.

Price 27/6 Plus 7/6 P. & P.

### X101 10W SOLID-STATE HI-FI AMP WITH INTEGRAL PRE-AMP

Specifications: Power Output (into 3 ohms speaker) 10 watts. Sensitivity (for rated output): 1mV into 3K ohms (0.33 microamp). Total Distortion at 1KHz. at 5 watts 0.35%, at rated output 1.5%. Frequency Response: Minus 3dB points 20Hz and 40KHz. Speaker: 3-4 ohms (3-15 ohms may be used). Supply voltage: 24V d.c. at 880mA (6-24V may be used).

Price 69/6 Plus 2/6 P. & P.

Control assembly: including resistors and capacitors.

1. Volume: PRICE 5/-.

2. Treble: PRICE 5/-.

3. Comprehensive bass and treble: PRICE 10/-.

The above 3 items can be purchased for use with the X101.



Power Supplies for the X101:  
P101 M (for mono) 35/- plus 4/6 P. & P.  
P101 S (for stereo) 42/6 plus 4/6 P. & P.

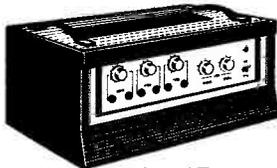
### CAR TRANSISTOR IGNITION SYSTEM

(by famous manufacturer)

For 6V or 12V positive earth systems. Comprising: special high voltage working hermetically sealed silicon transistor mounted in finned heat-sink, high output ignition coil, ballast resistor and hardware (screws, washers etc.).

Price £4.19.6 (Post and Packing 5/- extra)

### 50 WATT AMPLIFIER A.C. Mains 200-250V



Price 27 gns.

Plus 20/- P. & P.

An extremely reliable general purpose valve amplifier. Its rugged construction yet spare age styling and design makes it by far the best value for money.

**TECHNICAL SPECIFICATIONS**  
3 electronically mixed channels, with 2 inputs per channel, enables the use of 6 separate instruments at the same time. The volume controls for each channel are located directly above the corresponding input sockets. **SENSITIVITIES AND INPUT IMPEDANCES.** Channels 1 & 2 4mV at 470K. These 2 channels (4 inputs) are suitable for microphone or guitars. Channels 3 & 4 300 mV at 1m. Suitable for most high output instruments (gram, tuner, organ etc.). Input sensitivity relative to 10w output. **TONE CONTROLS ARE COMMON TO ALL INPUTS.** Bass Boost +12dB at 60 Hz/s. Bass Cut -13dB at 60 Hz/s. Treble Boost +11dB at 15 KHz/s. Treble Cut -12dB at 15KHz/s. With bass and treble controls central -3dB points are 30Hz/s and 20 KHz/s. **POWER OUTPUT.** For speech and music 50 watts rms. 100 watts peak. For sustained music 45 watts rms. 90 watts peak. For sine wave 38.5 watts rms. Nearly 80 watts peak. Total distortion at rated output 3.2% at 1KHz/s. Total distortion at 20 watts 0.15% at 1KHz/s. Output to match into 8 or 15 ohms speaker system. **NEGATIVE FEED BACK** 20dB at 1KHz/s. **SIGNAL TO NOISE RATIO** 60dB. **MAINS VOLTAGES.** Adjustable from 200-250V, A.C. 50-60Hz/s. A protective fuse is located at the rear of unit. Output impedance 3, 8 and 15 ohms.

high output instruments (gram, tuner, organ etc.). Input sensitivity relative to 10w output. **TONE CONTROLS ARE COMMON TO ALL INPUTS.** Bass Boost +12dB at 60 Hz/s. Bass Cut -13dB at 60 Hz/s. Treble Boost +11dB at 15 KHz/s. Treble Cut -12dB at 15KHz/s. With bass and treble controls central -3dB points are 30Hz/s and 20 KHz/s. **POWER OUTPUT.** For speech and music 50 watts rms. 100 watts peak. For sustained music 45 watts rms. 90 watts peak. For sine wave 38.5 watts rms. Nearly 80 watts peak. Total distortion at rated output 3.2% at 1KHz/s. Total distortion at 20 watts 0.15% at 1KHz/s. Output to match into 8 or 15 ohms speaker system. **NEGATIVE FEED BACK** 20dB at 1KHz/s. **SIGNAL TO NOISE RATIO** 60dB. **MAINS VOLTAGES.** Adjustable from 200-250V, A.C. 50-60Hz/s. A protective fuse is located at the rear of unit. Output impedance 3, 8 and 15 ohms.

### THREE-IN-ONE HI-FI 10 WATT SPEAKER

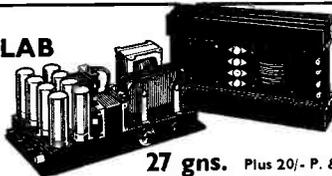
A complete Loud Speaker system on one frame, combining three matched ceramic magnet speakers with a low loss cross over network. Peak handling power 10 watts. Impedance 15 ohms. Flux density 11,000 gauss. Resonance 40-60 cps. Frequency range 50cps to 20Kcps. Size 1 3/4 x 8 1/4 x 4 1/2 inches. By famous manufacturer.

List Price £7. Our Price 74/6 Plus 5/- P. & P.

Similar speaker to the above without tweeters in 3 and 15 ohms 44/6 plus 5/- P. & P.

### LIVINGSTONE LAB

50 watt RMS Base Transistor Amplifier. This amplifier is designed and manufactured by L.L. using the best quality components, thus making it extremely reliable and almost indestructible. Size (Power supply) 16 x 9 1/2 x 6 1/2 in. (Amplifier) 14 1/2 x 9 x 4 in; sensitivity for rated output 1V.



27 gns. Plus 20/- P. & P.

TERMS C.W.O.  
All enquiries  
S.A.E.

### RECORD PLAYER SNIP A.C. MAINS 240V

The "Princess" 4-speed automatic record changer and player engineered with the utmost precision for beauty, long life, and trouble free service. Will take up to ten records which may be mixed 7in to 10in or 12in. Patent stylus brush cleans stylus after each playing and at shut off, the pick-up locks itself into its recess, a most useful feature with portable equipment—other features include pick-up height adjustment and stylus pressure adjustment. This truly is a fine instrument which you can purchase this month at only £5.19.6 complete with cartridge and ready to play.



Only £5.19.6 Post and insurance 7/6 extra

### STEREO PRE-AMPLIFIER

Inputs—6 position rotary switch (3 position mono, 3 position stereo). Tuner 150 mV into 680k. Magnetic pick-up fully equalised and suitable for magnetic cartridges with minimising output of 4mV/cm/sec. Load 47k. Ceramic pick-up 150 mV into 680k. Sensitivities taken for 200mV output. Controls—separate volume controls for each channel. Twin ganged bass. 12dB lift and 15dB cut at 60cps. Twin ganged treble. 10dB lift and 15dB cut at 10Kcps. Voltage required 23-30V D.C. at 5mA. Size 12 1/2 x 3 1/4 x 2 1/2 in. In teak finished case, complete with front panel and knobs. Built and tested.

Price £7.7.0 Plus 5/- P. & P.

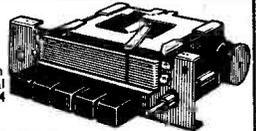
### CYLDON 2 TRANSISTOR U.H.F. TUNER

Brand new. Complete with circuit diagram.

Price £2.10.0 Plus 1/- P. & P.

### PYE CAR-RADIO PUSH BUTTON TUNING HEART

This PRESTOLOCK 5 station Push-Button Tuner Heart with Manual Over-ride is an ideal basis for a quality AM car radio. Size 6 1/2 x 4 x 2 in. 25/- Plus 3/- P. & P.



### POCKET MULTI-METER

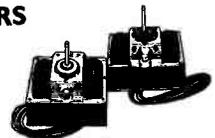
Size 3 1/2 x 2 1/4 x 1 1/2 in. Meter size 2 1/4 x 1 1/2 in. Sensitivity 1000 O.P.V. on both A.C. and D.C. volts. 0-15, 0-150, 0-1000 D.C. current 0-150mA. Resistance 0-100kΩ. Complete with test prods. battery and full instructions.

Price 42/6 Plus 3/6 P. & P.

FREE GIFT for limited period only. 30 watt Electric Soldering Iron value 15/- to every purchaser of the Pocket Multi-Meter.

### GARRARD TAPE MOTORS

Fast forward and fast re-wind motors, as used by famous manufacturer. Size 3 x 2 1/4 x 2 1/2 in. Spindle 3/8 in. A.C. Mains 250V.



39/6 per pair Plus 7/6 P. & P.



### ADVANCE CONSTANT VOLTAGE TRANSFORMER

Output 7.5V at 1 amp and 30V at 100MA. Mains input 125V (2 can be used in series for 250V).

Price 22/6 Plus 7/6 P. & P.

### 40W FLUORESCENT LIGHT KIT



Incorporating GEC Choke size 8 1/2 x 1 1/2 x 1 1/2 in. 2 bi-pin holders, starter and starter-holder. P. & P. 5/6. 11/6

Similar to above: 80V. Fluorescent Light Kit incorporating GEC choke size 11 1/2 x 1 1/2 x 1 1/2 in. 2 bi-pin holders, start and starter holder. P. & P. 6/6. 17/6

RADIO & TV COMPONENTS  
**RTV**  
(ACTON) LIMITED

### RADIO & TV COMPONENTS (ACTON) LTD.

21d High Street, Acton, London, W.3

Also at 323 Edgware Road, London, W.2

ALL ORDERS BY POST TO OUR ACTON ADDRESS

# INTEGRATED CIRCUIT F.M. TUNER KIT

Dart Electronics has been appointed by General Avionics Limited as their U.K. distributor for their FM Tuner kit, the first to use integrated circuits with pulse counting techniques developed by Marconi-Elliott Microelectronics.

The circuit has built-in automatic frequency control, and with the inherent stability of the integrated circuits, a reliable and easily set up circuit is offered to the home constructor in kit form. A resistively tuned version is in widespread use as an industrial radio system and is noted for its extreme reliability under continuous, unattended operation. The circuit employed effectively contains 44 transistors and, although the quantity of discrete components is fairly high, the entire unit is built on a double-sided board measuring 133 × 98.5mm (3.875 × 5.25in). The Tuner can be run off a 12V d.c. power supply or a combination of 6 and 12V batteries.

All components are available BY POST ONLY from Dart Electronics at a special kit price of **£9 19s 6d** plus 5/- post and packaging (U.K. & N. Ireland) which includes selector switch and double-sided p.c. board ready drilled and tinned. The kit is complete with all necessary circuits and instructions.

Full assembly details, circuit diagram and parts list are also available separately from Dart Electronics at 2/6 per copy and an article appeared in the June issue of the WIRELESS WORLD magazine.

## DART ELECTRONICS

P.O. BOX No. 47, WITHAM, ESSEX

### AUDIO EFFECTS

5 SHAW LANE HALIFAX YOKES.

Buy with confidence and obtain the right results. Refunds without question if any of our products fail to give 100% satisfaction.

**REVERBERATION AMPLIFIER.** Self-contained transistorised battery operated. An entirely different approach to sound reproduction. Normally sound reproduction from a single source has a flat, one-dimensional effect. With this unit proper sound delay through reverberation, tones are created with a truly third dimension for concert hall originality. Two controls adjust volume and reverberation. Simply plug microphone, guitar, etc. in and the output into your amplifier. Supplied in a beautiful walnut cabinet. 7 1/2 × 3 × 4 1/2 in. **£10.4.0.** P.P. & Ins. 6/-.



with box, power socket, cables, etc. In kit form with easy to follow instructions **£8.9.6.** Ready built **£9.4.6** plus 5/6 P.P. & Ins.

**VOX SWITCH.** This sound operated switch is ideal for mobile TX work, tape recorder switching, etc. You speak, it switches. High and medium imp. inputs. AF take off point. Drives your 12 volt relay. In kit form with full instructions, **42/8.** Ready built, tested and guaranteed, **62/6** plus 2/6 P.P.

**METRONOME UNIT.** Variable beat. Listen while you play and keep in time. Easily built, pocket size with personal mini earphone. In kit form **£7/8** post paid. Ready built in an attractive black and white polythene case **£7/8** post paid.

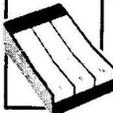
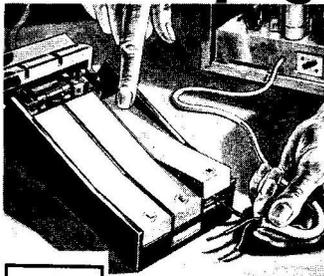
**MORSE OSCILLATOR.** PC board, transistors, high stab. components, battery carrier, ear piece. Adjustable tone. Just attach your key. Drives phones or speakers. In kit form **17/8** post paid. Ready built in similar case as above, **25/-** post paid.

**JUST ARRIVED IN STOCK.** Texas transistors. Complementary symmetry. Driver, NPN, FXP output. The set of three **ONLY 6/8** post paid. Free lists with every order. For lists only send 1/6 (deductible from first order).

### Keynector

A REVOLUTIONARY NEW PRODUCT

## cuts out plugs



### SAFEST & QUICKEST WAY TO CONNECT ELECTRICAL EQUIPMENT TO THE MAINS

No plugs—no sockets—no risk of bare wires. To connect anything electrical, from an oscilloscope to an electric drill, simply open the fuse housing, depress the keys, insert the wires and close the housing. A neon light on the front of the Keynector glows to indicate proper connection. Multi-parallel connections can be made up to 13 amps. Keys are colour coded and lettered LEN for quick identification. The Keynector casing is in two-tone plastic and measures 5 x 3 x 1 1/4 in. Please send for further information.

**E.B. INSTRUMENTS**  
DIVISION OF ELECTRONIC BROKERS LTD.  
49-53 PANCRAS ROAD, LONDON, N.W.1  
Telephone 01-837 7781

### DIMMASWITCH



This is an attractive dimmer unit which fits in place of the normal wall light switch. The mounting plate is ivory to match modern fittings and the control knob is in bright chrome. An ON/OFF switch is incorporated to control up to 500 watts at mains voltages from 200-250 volts, 50 Hz.

These are normally sold at £4 19s. 6d.—our price is £3 5s. We also offer at £2 15s. a complete kit of parts with simple instructions enabling you to build this dimmer yourself.

The circuit uses the latest miniature RCA triac and new diac triggering device to give complete reliability. Radio interference suppression is included.

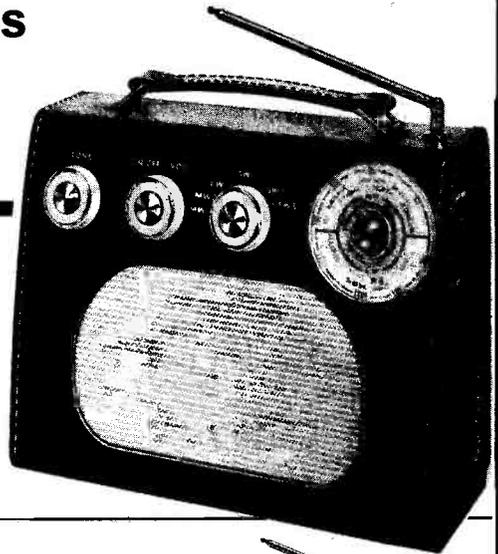
**DEXTER & COMPANY**  
ULVER HOUSE, 19 KING STREET  
CHESTER CHI 2AH  
Chester 25883

# Quality Transistor Radios to build yourself backed by our after sales service

## **NEW!** roamer eight mk 1 WITH VARIABLE TONE CONTROL

7 Tunable Wavebands: Medium Wave 1, Medium Wave 2, Long Wave, S.W.1, S.W.2, S.W.3, and Trawler Band. Built in ferrite rod aerial for Medium and Long Waves. 5 section 22in chrome plated telescopic aerial for Short Waves can be angled and rotated for maximum performance. Push-pull output using 600mw type transistors. Socket for car aerial. Tape record socket. Selectivity switch. Switched earpiece socket complete with earpiece for private listening. 8 transistors plus 3 diodes. Famous make 7 x 4in speaker. Air spaced ganged tuning condenser. On/off switch volume control. Wave change switch and tuning control. Attractive case in rich chestnut shade with gold blocking. Size 9 x 7 x 4in approx. First grade components. Easy to follow instructions and diagrams make the Roamer Eight a pleasure to build. Parts price list and easy build plans 5/- (FREE with parts).

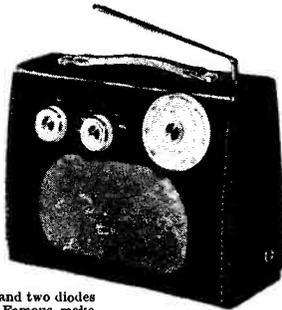
Total building costs **£6.19.6** P. & P. 7/6



## roamer seven mk IV

7 FULLY TUNABLE WAVE BANDS—M.W.1, M.W.2, L.W., S.W.1, S.W.2, S.W.3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for Medium and Long Waves. 5 Section 22in chrome plated telescopic aerial for Short Waves—can be angled and rotated for peak S.W. listening. Socket for Car Aerial. Powerful push-pull output. 7 transistors and two diodes including Micro-Alloy R.F. Transistors. Famous make 7 x 4in P.M. speaker. Air spaced ganged tuning condenser. Volume/on/off control, wave change switches and tuning control. Attractive case with carrying handle. Size 9 x 7 x 4in approx. First grade components. Easy to follow instructions and diagrams make the Roamer 7 a pleasure to build. Parts price list and easy build plans 3/- (FREE with parts).

Total building costs **£5.19.6** P. & P. 7/6 Personal Earpiece with switched socket for private listening, 5/- extra.



## **NEW!** transeight

### SIX WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case in black with red grille and cream knobs and dial with polished brass inserts. Size 9 x 5 1/2 x 2 1/2 in. approx. Tunable on Medium and Long Waves, 3 Short Waves and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 8 improved type transistors plus 3 diodes. All top grade components. Push-pull output. Ample power to drive a larger speaker. Parts price list and easy build plans 5/- (FREE with parts).

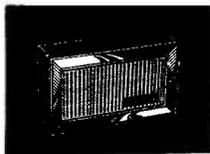
Total building costs **89/6** P. & P. 5/6 Earpiece with switched socket for private listening 5/- extra.



## pocket five

### MEDIUM WAVE, LONG WAVE AND TRAWLER BAND (to 50 metres approx.) PORTABLE WITH SPEAKER AND EARPIECE

Attractive black and gold case. Size 5 1/2 x 1 1/2 x 5 1/2 in. Tunable over both Medium and Long Waves with extended M.W. band for easier tuning of Luxembourg, etc. All first grade components—7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker, also Personal Earpiece with switched socket for private listening. Easy build plans and parts price list 1/6 (FREE with parts).



Total building costs **44/6** P. & P. 3/6

## transona five

### MEDIUM WAVE, LONG WAVE AND TRAWLER BAND (to 50 metres approx.) PORTABLE WITH SPEAKER AND EARPIECE

Attractive case with red speaker grille. Size 6 1/2 x 4 1/2 x 1 1/2 in. 7 stages—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone moving coil speaker also Personal Earpiece with switched socket for private listening. All first grade components. Easy build plans and parts price list 1/6 (FREE with parts).



Total building costs **47/6** P. & P. 3/9

## roamer six

### SIX WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case with gilt fittings. Size 7 1/2 x 5 1/2 x 1 1/2 in. Tunable on Medium and Long Waves, two Short Waves, Trawler Band plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. All top grade components. 8 stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors, etc. (Carrying strap 1/6 extra). Easy build plans and parts price list 2/- (FREE with parts).



Total building costs **79/6** P. & P. 4/6

## RADIO EXCHANGE LTD

61a, HIGH STREET, BEDFORD. Tel. 0234 52367

I enclose £..... please send items marked

ROAMER EIGHT  ROAMER SEVEN   
TRANSEIGHT  POCKET FIVE   
TRANSONA FIVE  ROAMER SIX

Parts price list and plans for.....

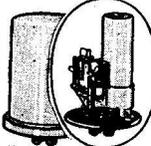
Name.....

Address.....

PE 12

\* Callers side entrance Stylo Shoe Shop  
\* Open 10-1, 2.30-4.30 Mon.-Fri. 9-12 Sat.

### CAR LIGHT FLASHERS



Heavy duty light flasher employs a condenser discharge principle operating on electro-mechanical relay. (As inset.) Housed in strong plastic case. Flashing rate between 60-120 per minute. 12 volt DC operation. Maximum load 6 amps. Size 2 1/8" dia. 4". Supplied brand new at a fraction of original cost. 6/6 each. P. & P. 2/6. (3 for 17/6. P. & P. 4/6.)

### RZ09 MK II COMMUNICATION RECEIVER

11 valve high grade communication receiver suitable for tropical use. 1-30 Mc/s on 4 bands. AM/CW/FM operation. Incorporates precision vernier driver, BFO. Aerial trimmer, internal speaker and 12 V d.c. internal power supply. Supplied in excellent condition, fully tested and checked.



£15

Carr. 20/-.

### TYPE 13A DOUBLE BEAM OSCILLOSCOPES

An excellent general purpose D/B oscilloscope. T.B. 2 c/s-750 kc/s. Bandwidth 5.5 Mc/s. Sensitivity 33 mV/CM. Operating voltage 0/110/200/250 V. a.c. Supplied in excellent working condition. £22.10.0 or complete with all accessories, probe, leads, lid, etc. £25. Carriage 30/-.



### MARCONI CT44/TF956 AF ABSORPTION WATTMETER

1 μ/watt to 6 watts. £20. Carr. 20/-.

### SOLARTRON CD. 1016 OSCILLOSCOPE

Double beam, d.c. To 5 Mc/s. Excellent condition. £55 each. Carr. 20/-.

### CLASS D WAVEMETERS

A crystal controlled heterodyne frequency meter covering 1.7-8 Mc/s. Operation on 6V d.c. Ideal for amateur use. Available in good used condition. £5.18.6. Carr. 7/6, or brand new with accessories. £7.19.6. Carr. 7/6.

### CLASS D WAVEMETERS No. 2

Crystal controlled, 1-2-19 Mc/s. Mains or 12V d.c. operation. Complete with calibration charts. Excellent condition. £12.10.0. Carr. 30/-.

### TO-3 PORTABLE OSCILLOSCOPE

3in. tube. V amp. Sensitivity 0.1v p-p/CM. Bandwidth 1.5 cps-1.5 MHz. Input imp. 2 meg Ω 25 PF. X amp. sensitivity 0.9v p-p/CM. Bandwidth 1.5 cps-800 KHZ. Input imp. 2 meg Ω 20 PF. Time base. 5 ranges. cps-300 KHZ. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 MM Weight 15 1/2 lb. 220/240 V. A.C. Supplied brand new with handbook. £35.0.0. Carr. 10/-.

### SOLARTRON CD: 711S.2 OSCILLOSCOPES

Double beam, D.C. to 9 Mc/s. Perfect order. £65. Carr. 50/-.

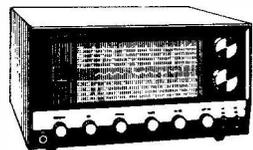
### TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE

A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 10-11.1 meg Ω 6 Ranges ±1%. 6 L. μH - 1.1 HENRY'S 6 Ranges -2%. C. 10pF ±1110 mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000-1:1100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts, 100μA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 × 5 1/2 in. £20. P. & P. 5/-.

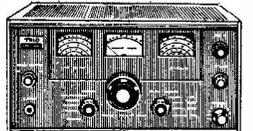
### UNR-30 4-BAND COMMUNICATION RECEIVER

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

### TRIO JR-310 NEW AMATEUR BAND 10-80 METRE RECEIVER. In stock. £77.10.0.



**LAFAYETTE SOLID STATE HAGOD RECEIVER**  
5 BAND AM/CW/SSB AMATEUR AND SHORT WAVE 150 kc/s-400 kc/s and 650 kc/s-30 Mc/s. FET front end • 2 mechanical filters • Huge dial • Product detector • Variable BFO • Noise limiter • 8 meter • 24in Bandspread • 230V a.c./12V d.c. neg. earth operation • RF gain control. Size 15in × 9in × 8in. Weight 18lb. EXCEPTIONAL VALUE. £45. Carr. 10/-, S.A.E. for full details.



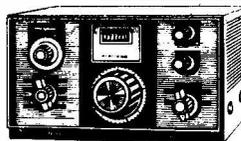
### TRIO COMMUNICATION RECEIVER MODEL 9R-59DE

4 band receiver covering 550Kc/s to 30Mc/s. continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW • ANL • Variable BFO • 8 meter • Sep. bandspread dial • IF 445Kc/s • Audio output 1.5W. • Variable RF and AF gain controls. 115/250V A.C. Mains. Beautifully designed. Size: 7 1/2 × 15 × 10in. With instruction manual and service data. £42 Carriage paid. **TRIO COMMUNICATION TYPE HEADPHONES** Normally £5.19.6. OUR PRICE £3.15.0 if purchased with above receiver.

### TRIO JR-500SE 10-80 Metre AMATEUR RECEIVER

Covers all the amateur bands in 7 separate ranges between 3-5 and 29.7Mc/s. 7 valves, 2 transistors and 5 diodes plus 8 crystals: output 8 and 500 ohm and 5,000 ohm phone jack, crystal controlled oscillator. Variable BFO, VFO. AVC, ANL, 8 meter, SSB-CW, Stand-by switch. Special double gear dial drive with direct reading down to 1KHz. Remote control socket for connection to a transmitter. Audio output 1W 115/250V a.c. mains. Superb modern styling. Size 7 × 13 × 10in. with instruction manual and service data. £69.10.0. Carr. paid.

### TRIO TS 610 AMATEUR TRANSCEIVER with speaker and mains P.S.U. £212. IN STOCK!

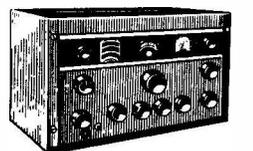


### GEARED MAINS MOTORS

Paralux type SD19 230/250V a.c. Reversible 30 RPM. 40lb in. Complete with capacitor. Excellent condition. 99/6. Carr. 10/-.

### CRYSTAL CALIBRATORS No. 10

Small portable crystal controlled wavemeter. Size 7" × 7 1/4" × 4". Frequency range 500 Kc/s, 10 Mc/s (up to 30 Mc/s on harmonics). Calibrated dial. Power requirements 300 V.D.C. 15mA and 12 V.D.C. 0.3A. Excellent condition. 89/6. Carr. 7/6.

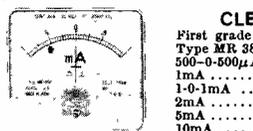
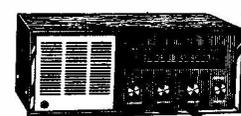


### RCA COMMUNICATION RECEIVER AR88D

Latest release by ministry BRAND NEW in original cases. 110-250V a.c. operation. Frequency in 6 Bands. 535Kc/s-32Mc/s continuous. Output impedance 2-6-800 ohms. Incorporating crystal filter, noise limiter, variable BFO, variable selectivity, etc. Price £37.10.0. Carr. £2.

### LAFAYETTE PF-60 SOLID STATE VHF FM RECEIVER

A completely new transistorised receiver covering 152-174 Mc/s. Fully tuneable or crystal controlled (not supplied) for fixed frequency operation. Incorporates 4 INTEGRATED CIRCUITS. Built in speaker and illuminated dial. Squelch and volume controls. Tape recorder output. 75 Ω serial input. Headphone jack. Operation 230V. A.C./12V. D.C. Neg. earth. £37.10.0. Carr. 10/-.



### CLEAR PLASTIC PANEL METERS

First grade quality Moving Coil panel meters. Type MR 38P. 1 1/2" square fronts.

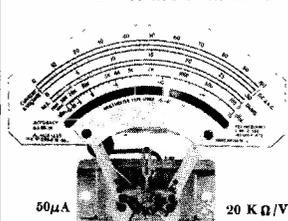
|             |      |          |      |            |      |
|-------------|------|----------|------|------------|------|
| 500-0-500μA | 27/6 | 50mA     | 27/6 | 150V. D.C. | 27/6 |
| 1mA         | 27/6 | 100mA    | 27/6 | 300V. D.C. | 27/6 |
| 1-0-1mA     | 27/6 | 150mA    | 27/6 | 500V. D.C. | 27/6 |
| 2mA         | 27/6 | 200mA    | 27/6 | 750V. D.C. | 27/6 |
| 5mA         | 27/6 | 300mA    | 27/6 | 15V. A.C.  | 27/6 |
| 10mA        | 27/6 | 500mA    | 27/6 | 50V. A.C.  | 27/6 |
| 750mA       | 27/6 | 3V. D.C. | 27/6 | 150V. A.C. | 27/6 |
| 50-0-50μA   | 27/6 | 1 amp    | 27/6 | 300V. A.C. | 27/6 |
| 100μA       | 27/6 | 2 amp    | 27/6 | 500V. A.C. | 27/6 |
| 100-0-100μA | 27/6 | 5 amp    | 27/6 | 20V. D.C.  | 27/6 |
| 200μA       | 27/6 | 20mA     | 27/6 | 100V. D.C. | 27/6 |
| 500μA       | 27/6 |          |      |            |      |

Full range of other sizes in stock. Send s.a.e. for leaflet.

### POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range ex-stock. Single hole fixing. 1in. dia. shafts. Bulk quantities available. 25 WATT. 10/25/50/100/250/500/1,000/1,500/2,500 or 5,000 ohms. 14/6. P. & P. 1/6. 50 WATT. 10/25/50/100/250/500/1,000/1,500/2,500 or 5,000 ohms. 21/- P. & P. 1/6. 100 WATT. 1/5/10/25/50/100/250/500/1,000 or 5,000 ohms. 27/6. P. & P. 1/6.

### AVOMETER MOVEMENTS



Spare movements for Model 8 or 9. (Fitted with Model 9 scale) or basis for any multi-meter. Brand New and Boxed 69/6 P. & P. 3/6.

### T.E.40 HIGH SENSITIVITY A.C. VOLTMETER

10 meg. input 10 ranges: 0.1 / 0.03 / 1 / 3 / 10 / 30 / 100 / 300V. R.M.S. 4c/s-1.2Mc/s. Decibels -40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V a.c. £17.10.0. Carr. 5/-.



### 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/-.

### TE-65 VALVE VOLTMETER

High quality instrument with 28 ranges. D.c. volts 1.5-1,500V. A.c. volts 1.5-1,500V. Resistance up to 1,900 megohms. 220/240V a.c. operation. Complete with probe and instructions. £17.10.0. P. & P. 6/- Additional Probes available: R.F. 35/- H.V. 42/6.

### COSSOR 1049 DOUBLE BEAM OSCILLOSCOPES

D.c. coupled. Band width 1kc/s. Perfect order. £25. Carr. 30/-.

### AM/FM SIGNAL GENERATORS

Oscillator Test No. 2. A high quality precision instrument made for the ministry by Alrmec. Frequency coverage 20-30Mc/s. AM C.W./FM. Incorporates precision dial, level meter, precision attenuator 1μV-100mV. Operation from 12V d.c. or 0/110/200/250V a.c. Size 12 × 8 1/2 × 9in. Supplied in brand new condition complete with all connectors fully tested. £45. Carr. 20/-.

### HANMARLUND SP600J COMMUNICATION RECEIVER

540kc/s-54 Mc/s in 6 bands. FEW ONLY! £100.

### EDDYSTONE VEF RECEIVERS MODEL 770E

19-165 Mc/s. Excellent condition. £160.



### TE-16A Transistorised Signal Generator

5 ranges 400 kHz-30 MHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide, easy to read scale. 800 kHz modulation. 5 1/2 × 5 1/2 × 3 1/2 in. Complete with instructions and leads. £7.19.6. P. & P. 4/-.

### FIELD TELEPHONES TYPE L

Generator ringing, metal cases. Operates from two 1.5v. batteries (not supplied). Excellent condition. £4.10.0 per pair. Carr. 10/-.

### AUTO TRANSFORMERS

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

|          |           |              |
|----------|-----------|--------------|
| 150 W.   | £2.2.6.   | P. & P. 3/6  |
| 300 W.   | £2.19.6.  | P. & P. 4/6  |
| 500 W.   | £4.10.0.  | P. & P. 6/6  |
| 1,600 W. | £2.10.0.  | P. & P. 7/6  |
| 1,800 W. | £7.19.6.  | P. & P. 8/6  |
| 7,500 W. | £15.10.0. | P. & P. 20/- |

G. W. SMITH & CO (RADIO) LTD.  
Also see oppo. page

**ARF-100 COMBINED AF-RF SIGNAL GENERATOR**



**A.F. SINE WAVE**  
20-200,000 c/s.  
Square wave 20-30,000 c/s. O.P. HIGH IMP. 200V. P.P. 500Ω 3-8 V. P.P. TF 100 kc/s-300 Mc/s. Variable R.F. attenuation int./ext. modulation. Incorporates dual purpose meter to monitor AF output and % mod. on R.F. 220/240 V a.c. £30.0. Carr. 7/6.

**TE-20D RF SIGNAL GENERATOR**



Accurate wide range signal generator covering 120kc/s to 500Mc/s on 6 bands. Directly calibrated. Variable RF attenuator, audio output. Xtal socket for calibration. 220/240V a.c. Size 140 x 215 x 170mm. Brand new with instructions. £15. Carr. 7/6.

**TY75 AUDIO SIGNAL GENERATOR**



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

**MARCONI TRIASE DISTORTION FACTOR METERS**

Excellent condition. Fully tested. £20. Carr. 15/-

**LAFAYETTE TE46 RESISTANCE CAPACITY ANALYSER**

2pF-2,000 mfd 20 ohms-200 megohms. Also checks impedance, turns ratio, insulation. 200/250V a.c. Brand New £17.10.0 Carr. 7/6.



**ADVANCE TEST EQUIPMENT**

Brand new and boxed in original sealed cartons. **VM.75 VALVE VOLTMETER** R.F. measurements in excess of 100Mc/s and d.c. measurements up to 100V with accuracy of ±2% d.c. range 300 MV to 1kV a.c. range 600MV to 300V R.M.S. Resistance 0.02-500M Ω. Price £72.

**VM.79 UHF MILLIVOLT METER.** Transistorised. A.c. range 10MV-3V. D.c. current range 0-0.1μA-0.8mA. Resistance 1 ohm-10 megohms. Price £125.

**H1B AUDIO SIGNAL GENERATOR.** 15c/s-50kc/s. sine or square wave. Price £30.

**J1B AUDIO SIGNAL GENERATOR.** 15c/s-50kc/s. Price £30.

**TT1B TRANSISTOR TESTER.** £37.10.0. Carriage 10/- per item.

**MODEL ZQM TRANSISTOR CHECKER**

It has the fullest capacity for checking on A, B and Ico. Equally adaptable for checking diodes, etc. Spec.: A: 0.7-0.9967. B: 5-200. Ico: 0-50 microamps. Resistance for diode: 200 Ω-1 MΩ. Supplied complete with instructions, battery and lead. £21.0.6. P. & P. 2/6.



**TE11. DECADE RESISTANCE ATTENUATOR**

Variable range 0-111dB. Connections. Unbalanced T and Bridge T. Impedance 600Ω range (0-1dB x 10) + (1dB x 10) + 10 + 30 + 40dB. Frequency: d.c. to 200kHz (-3dB). Accuracy: 0-0.5dB. Indication ±0.1. Maximum input less than 4W (50V). Built in 600Ω load resistance with internal/external switch. Brand new £27.10.0. P. & P. 5/-.



**SOLARTRON MONITOR OSCILLOSCOPE TYPE 101**

An extremely high quality oscilloscope with time base of 10μsec to 20m/sec. Internal Y amplifier. Separate mains power supply £20/250. Supplied in excellent condition with cables, probe, etc. as received from Ministry. £31.9.6. Carr. 30/-.

The latest edition giving full details of a comprehensive range of Hi-Fi EQUIPMENT, COMPONENTS, TEST EQUIPMENT and COMMUNICATIONS EQUIPMENT. Nearly 200 pages, fully illustrated and detailing thousands of items - many at bargain prices. FREE DISCOUNT COUPONS. VALUE 10/-

**SEND NOW - ONLY 7/6 P & P!!**

**GARRARD**

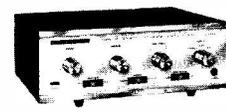
FULL CURRENT RANGE OFFERED. BRAND NEW AND GUARANTEED AT FANTASTIC SAVINGS

- SRP22 Stereo £5.19.6
- \*1025 Mono £7.10.0
- \*1026 Stereo £7.19.6
- \*2025 Stereo £7.19.6
- \*2025T/C Mono/Stereo £3.17.6
- \*3000 Stereo £3.19.6
- SP25 MKII £11.19.6
- \*8L55 £11.19.6
- A70 MKII £12.10.0
- \*8L55 £14.14.0
- AP75 £17.17.9
- 401 £25.7.6
- SL75 £28.10.0



Carriage/insurance 7/6 extra any model. WB4 Bases £3.9.6. Persech covers £3.10.0. \*Special offer base and cover available for these models at £4.16.0. Carr. 5/- Full range of Garrard accessories available.

**LAFAYETTE LA-224T TRANSISTOR STEREO AMPLIFIER**



19 transistors, 8 diodes, 1HF music power, 30W at 8Ω. Response 30-20,000 ± 2dB at 1W. Distortion 1% or less. Inputs 3mV and 250mV. Output 3-16Ω. Separate L and R volume controls. Treble and bass control. Stereo phone jack. Brushed aluminum, gold anodised extruded front panel with complementary metal case. Size 10 1/2 x 3 9/16 x 7 13/16in. Operation 115/230V. A.C. £28. Carriage 7/6.

**MULTIMETERS for EVERY purpose!**

**TE-51. NEW 20,000 Ω / VOLT MULTIMETER** with overload protection and mirror scale. 0/5/10/20/120/300/600/1,200V a.c. 0/3/30/60/300/600/3,000V d.c. 0.60μA/12/300mA d.c. 0/60K/6 meg. ohm. 92/6. P. & P. 2/6.

**MODEL AS-100D. 100K Ω / VOLT.** 5in. mirror scale. Built-in meter protection. 0/3/12/60/120/300/600/1,200V d.c. 0/6/30/120/300/600V a.c. 0/10μA/6/60/300mA/12 Amp. 0/2K/200K/2M/200MΩ. -20 to +174dB. £12.10.0. P. & P. 3/6.

**MODEL TE-90 50,000 O.P.V. MIRROR SCALE OVERLOAD PROTECTION** 0/3/12/60/300/600/1,200V d.c. 0/6/30/120/300/1,200V d.c. 0/0.6/6/60/600mA d.c. 16K Ω / 160K Ω / 1.6/16M Ω. -20 to +63dB. £7.10.0. P. & P. 3/6.

**MODEL TE-70. 30,000 O.P.V.** 0/3/15/60/300/600/1,200V d.c. 0/6/30/120/600/1,200V a.c. 0/90μA/3/30/300mA. 0/16K/160K/1.6M/16megohm £5.10.0. P. & P. 3/-.

**MODEL FT-34. 1,000 O.P.V.** 0/10/50/250/500/1,000V a.c. and d.c. 0/1/100/500mA d.c. 0/100K Ω 30/6. P. & P. 1/6.

**TE-900 20,000 Ω VOLT GIANT MULTIMETER** 6in. full view meter. 2 colour scale, overload protection. 0/2.5/10/250/1,000/5,000V a.c. 0/25/12.5/10/50/250/1,000/5,000V d.c. 0/50μA/110/100/500mA/10A d.c. 20K/200K/20 MΩ. £15. P. & P. 5/-.

**MODEL TE-10A.** 20K Ω / Volt. 5/25/50/250/500/2,500 V, d.c. 10/50/100/500/1,000V. a.c. 0/50μA/2.5mA/250mA. d.c. 0/5K/6 megohm. -20 to +22dB. 10-0.100 mfd. t.c. 0-100-0-1 mfd. 60/6. P. & P. 2/6.

**MODEL TE 60. 20,000 O.P.V.** 0/10/50/100/500/1,000V. a.c. 0/5/25/50/250/500/1,000V d.c. 0.5μA. 5/50/500mA/0/6K/60K/600K/6 Meg. £4.17.6. P. & P. 3/-.

**MODEL TE12. 20,000 O.P.V.** 0/0.6/30/120/600/1,200/3,000/6,000V d.c. 0/6/30/120/600/1,200V a.c. 0/60μA/6/60/600mA. 0/6K/60K/600K/6meg. 60PF. 2 MFD £5.19.6. P. & P. 3/6.

**LAFAYETTE 57 Range Super 50,000 O.P.V.** Multimeter. D.c. Volts 125V-1,000V. A.c. Volts 1.5V-1,000V D.c. Current 25μA Amp. Ohms. 0-15 Meg Ω -20 to +83dB. Overload Protection. £12.10.0. Carr. 3/6.

**★ TRANSISTORISED FM TUNER ★**



**6 TRANSISTOR HIGH QUALITY TUNER.** SIZE ONLY 6 1/4 x 3 1/2 in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88-108 Mc/s. Ready built ready for use. Fantastic value for money. £6.7.6. P. & P. 2/6. Stereo multiplex adaptors 99/6.

**TRANSISTORISED TWO-WAY TELEPHONE INTERCOM**

Operative over amazingly long distances. Separate call and press to talk buttons. 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. £6.9.6. P. & P. 3/6.



**SINCLAIR EQUIPMENT**

Z12 12 watt amplifier, 89/6  
P24 Power Supply Unit, 89/6  
Stereo 25 Preamp., £5.19.6  
Q14 Speakers, £7.19.6  
Micromatic Radio Kit, 49/6. Built 59/6

**NOW IN STOCK IC/10 59/6 ALL POST PAID SPECIAL OFFER**

Two Z12 Amps., P24 Power Supply, Stereo 25 Preamplifier, £25, or with two Q14 speakers, £37.

**NEW SINCLAIR 2000 SYSTEM**

35 watt Integrated Amplifier £39. Carr. 5/-.  
Self powered F.M. Tuner. £25. Carr. 5/-.

**PEAK SOUND PRODUCTS**

Full range of Amplifiers, Kits, Speakers in stock.

**ECHO HS-606 STEREO HEADPHONES**

Wonderfully comfortable. Lightweight adjustable vinyl headband. 6ft. cable and stereo jack plug. 25-17,000 cps. 8 ohm imp. £7/6 P. & P. 2/6.

**HOSIDEN DH04S 2-WAY STEREO HEADSETS**

Each headphone contains a 2 1/2in woofer and a 3/4in tweeter. Built in individual level controls. 8Ω imp. 25-18,000cps. with cable and stereo plug. £5.19.6. P. & P. 2/6.

**RECORDING HEADS**

COSMOCORD i-track heads. High imp. record/playback 65/- Low imp. erase 20/- MARRIOTT i-track heads. High imp. record/playback 65/- Low imp. erase 20/- Post extra.

**RACAL MA.168 TRANSISTORISED DIVERSITY SWITCH.** Brand New Condition £15. Carr. 10/-

**AMERICAN TAPE**

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

|                                 |      |
|---------------------------------|------|
| 3in. 225ft. L.P. acetate.....   | 3/6  |
| 3in. 600ft. T.P. mylar.....     | 10/- |
| 3in. 600ft. std. acetate.....   | 10/6 |
| 5in. 900ft. L.P. acetate.....   | 10/- |
| 5in. 1,200ft. D.P. mylar.....   | 15/- |
| 5in. 1,200ft. L.P. acetate..... | 12/6 |
| 5in. 1,200ft. L.P. mylar.....   | 16/- |
| 5in. 1,800ft. D.P. mylar.....   | 22/6 |
| 5in. 2,400ft. L.P. mylar.....   | 32/6 |
| 7in. 1,200ft. std. acetate..... | 15/6 |
| 7in. 1,800ft. L.P. acetate..... | 15/- |
| 7in. 1,800ft. L.P. mylar.....   | 20/- |
| 7in. 2,400ft. T.P. mylar.....   | 25/- |
| 7in. 3,600ft. T.P. mylar.....   | 45/- |

Postage 2/- Over £3 post paid.

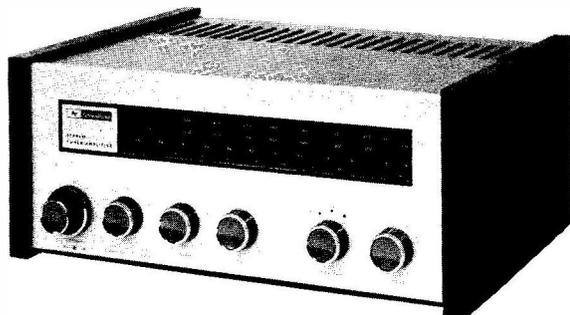
**MAXELL TAPE CASSETTES**

C60. 10/8; C90. 14/3; C120. 19/6. Post extra.

**G.W. SMITH & CO (RADIO) LIMITED**  
3 and 34, LISLE STREET, LEICESTER SQ., LONDON, W.C. 2  
01-437 8204  
311, EDGWARE RD., LONDON W.2  
01-262 0387  
9 a.m. to 6 p.m. Mon. to Sat. (Edgware Road & day Thurs.) Trade supplied.

**Armstrong**  
the high fidelity sound

**A STEREO  
TUNER-AMPLIFIER  
for the  
BUDGET SYSTEM**



If you want high fidelity in the highest class don't buy the 127 Tuner-Amplifier; it isn't meant for you. But if you want a good quality system that is a great deal better than the average radiogram, and your power requirements, as well as your budget, are of modest proportions, then this is meant for you.

The 10 watts power output, 5 from each channel, won't fill a hall, but it is more than adequate for most domestic purposes. The AM-FM Tuner incorporated is doubly attractive because, as well as covering the medium wave-band, it has a performance on FM which is good enough to give excellent results on stereo radio once you add the optional M5 stereo radio decoder.

There are of course the usual facilities; pickup and tape inputs, tape recording outputs, bass and treble tone controls.

As we said at the outset, if you are after top-class hi-fi you don't want the 127, what you want is the Armstrong series 500 models.

For details and technical specifications of all models, plus list of stockists, post coupon or write, mentioning 12 PE69.

127 STEREO TUNER-AMPLIFIER **£43.13.9**  
OPTIONAL CASE. As illustrated **£3.17.0**

**ARMSTRONG AUDIO LTD., WARLTERS ROAD N.7**  
Telephone 01-607 3213

name.....

address.....

12 PE69

**More than a Christmas Present!**

... a stepping stone to a career for electronically minded teenagers.



**New... Unique... RADIONIC X30**  
Radio and Electronic Construction Kit.

*An educational hobby-set comprising:*

Over 30 fascinating experiments, including a printed-circuit transistor radio - which works! Burglar-alarm, Morse Code, etc. Completely safe, battery operated. Easy to build with detailed, fully illustrated instruction manual. Radionic is used in over 2000 schools. Special cash price direct from manufacturer £7.19.6 inc. P.T. Post Free. Dispatch before Dec. 15th guaranteed for orders received before Dec. 10th. *Send cheque or P.O. to:*

**RADIONIC PRODUCTS LTD. Dept. P**  
**St. Lawrence House, Broad St, Bristol 1**

**WEL'S FARGO**  
**now ship E line**  
**transistors**  
**from**  
**Ferranti**



E line epoxy transistors include low cost, general purpose amplifiers and switches, high speed switches, neon drivers and low noise VHF amplifiers.

NPN and PNP complimentary types are available for most functions.

Further data and ex stock delivery from:

**WEL** Components Ltd

5 Loverock Road Reading Berks · Tel: Reading 580616-9 · Telex 84529

Ministry of Technology approved distributor.

# L.S.T. ELECTRONIC COMPONENTS LTD.

|            |            |            |              |            |            |             |
|------------|------------|------------|--------------|------------|------------|-------------|
| AA119 2/-  | BC142 15/- | BY125 31/9 | NKT217 13/-  | OC24 18/-  | 2G302 3/9  | 2N2369 5/6  |
| AA121 2/1  | BC143 15/- | BY152 3/9  | NKT218 13/3  | OC25 6/9   | 2G359A 5/- | 2N2369A 6/- |
| AA122 1/6  | BC144 15/- | BY210 3/9  | NKT219 13/3  | OC26 5/6   | 2G374 5/6  | 2N2432 8/6  |
| AC107 14/6 | BC145 15/- | BY213 3/9  | NKT220 13/3  | OC27 12/-  | 2G381 4/-  | 2N2477 18/- |
| AC126 6/6  | BC149 7/6  | BY215 3/9  | NKT221 13/3  | OC28 12/-  | 2G371 4/-  | 2N2484 14/- |
| AC127 6/6  | BC154 7/6  | BY216 3/9  | NKT222A 13/3 | OC29 13/-  | 2G372 4/-  | 2N2613 8/3  |
| AC127Z 6/6 | BC150 7/6  | BY217 3/9  | NKT223 13/3  | OC30 13/-  | 2N174 24/- | 2N2614 7/6  |
| AC128 4/6  | BC152 7/6  | BY218 3/9  | NKT224 13/3  | OC31 3/6   | 2N175 24/- | 2N2646 14/- |
| AC130 6/6  | BC153 7/6  | BY219 3/9  | NKT225 13/3  | OC42 12/-  | 2N176 24/- | 2N2647 14/- |
| AC176 7/6  | BC154 7/6  | BY220 3/9  | NKT226 13/3  | OC43 12/-  | 2N177 24/- | 2N2648 14/- |
| AC187 12/- | BC155 7/6  | BY221 3/9  | NKT227 13/3  | OC44 12/-  | 2N178 24/- | 2N2649 14/- |
| AC190 12/- | BC156 7/6  | BY222 3/9  | NKT228 13/3  | OC45 12/-  | 2N179 24/- | 2N2650 14/- |
| AC197 9/6  | BC157 7/6  | BY223 3/9  | NKT229 13/3  | OC46 12/-  | 2N180 24/- | 2N2651 14/- |
| AC198 9/6  | BC158 7/6  | BY224 3/9  | NKT230 13/3  | OC47 12/-  | 2N181 24/- | 2N2652 14/- |
| AC199 4/6  | BC159 7/6  | BY225 3/9  | NKT231 13/3  | OC48 12/-  | 2N182 24/- | 2N2653 14/- |
| AC200 3/7  | BC160 7/6  | BY226 3/9  | NKT232 13/3  | OC49 12/-  | 2N183 24/- | 2N2654 14/- |
| AC221 4/6  | BC161 7/6  | BY227 3/9  | NKT233 13/3  | OC50 12/-  | 2N184 24/- | 2N2655 14/- |
| AC222 2/11 | BC162 7/6  | BY228 3/9  | NKT234 13/3  | OC51 12/-  | 2N185 24/- | 2N2656 14/- |
| AC230 9/6  | BC163 7/6  | BY229 3/9  | NKT235 13/3  | OC52 12/-  | 2N186 24/- | 2N2657 14/- |
| AD149 11/6 | BC164 7/6  | BY230 3/9  | NKT236 13/3  | OC53 12/-  | 2N187 24/- | 2N2658 14/- |
| AD181 6/6  | BC165 7/6  | BY231 3/9  | NKT237 13/3  | OC54 12/-  | 2N188 24/- | 2N2659 14/- |
| AD182 6/6  | BC166 7/6  | BY232 3/9  | NKT238 13/3  | OC55 12/-  | 2N189 24/- | 2N2660 14/- |
| AD183 6/6  | BC167 7/6  | BY233 3/9  | NKT239 13/3  | OC56 12/-  | 2N190 24/- | 2N2661 14/- |
| AD184 6/6  | BC168 7/6  | BY234 3/9  | NKT240 13/3  | OC57 12/-  | 2N191 24/- | 2N2662 14/- |
| AD185 6/6  | BC169 7/6  | BY235 3/9  | NKT241 13/3  | OC58 12/-  | 2N192 24/- | 2N2663 14/- |
| AD186 6/6  | BC170 7/6  | BY236 3/9  | NKT242 13/3  | OC59 12/-  | 2N193 24/- | 2N2664 14/- |
| AD187 6/6  | BC171 7/6  | BY237 3/9  | NKT243 13/3  | OC60 12/-  | 2N194 24/- | 2N2665 14/- |
| AD188 6/6  | BC172 7/6  | BY238 3/9  | NKT244 13/3  | OC61 12/-  | 2N195 24/- | 2N2666 14/- |
| AD189 6/6  | BC173 7/6  | BY239 3/9  | NKT245 13/3  | OC62 12/-  | 2N196 24/- | 2N2667 14/- |
| AD190 6/6  | BC174 7/6  | BY240 3/9  | NKT246 13/3  | OC63 12/-  | 2N197 24/- | 2N2668 14/- |
| AD191 6/6  | BC175 7/6  | BY241 3/9  | NKT247 13/3  | OC64 12/-  | 2N198 24/- | 2N2669 14/- |
| AD192 6/6  | BC176 7/6  | BY242 3/9  | NKT248 13/3  | OC65 12/-  | 2N199 24/- | 2N2670 14/- |
| AD193 6/6  | BC177 7/6  | BY243 3/9  | NKT249 13/3  | OC66 12/-  | 2N200 24/- | 2N2671 14/- |
| AD194 6/6  | BC178 7/6  | BY244 3/9  | NKT250 13/3  | OC67 12/-  | 2N201 24/- | 2N2672 14/- |
| AD195 6/6  | BC179 7/6  | BY245 3/9  | NKT251 13/3  | OC68 12/-  | 2N202 24/- | 2N2673 14/- |
| AD196 6/6  | BC180 7/6  | BY246 3/9  | NKT252 13/3  | OC69 12/-  | 2N203 24/- | 2N2674 14/- |
| AD197 6/6  | BC181 7/6  | BY247 3/9  | NKT253 13/3  | OC70 12/-  | 2N204 24/- | 2N2675 14/- |
| AD198 6/6  | BC182 7/6  | BY248 3/9  | NKT254 13/3  | OC71 12/-  | 2N205 24/- | 2N2676 14/- |
| AD199 6/6  | BC183 7/6  | BY249 3/9  | NKT255 13/3  | OC72 12/-  | 2N206 24/- | 2N2677 14/- |
| AD200 6/6  | BC184 7/6  | BY250 3/9  | NKT256 13/3  | OC73 12/-  | 2N207 24/- | 2N2678 14/- |
| AD201 6/6  | BC185 7/6  | BY251 3/9  | NKT257 13/3  | OC74 12/-  | 2N208 24/- | 2N2679 14/- |
| AD202 6/6  | BC186 7/6  | BY252 3/9  | NKT258 13/3  | OC75 12/-  | 2N209 24/- | 2N2680 14/- |
| AD203 6/6  | BC187 7/6  | BY253 3/9  | NKT259 13/3  | OC76 12/-  | 2N210 24/- | 2N2681 14/- |
| AD204 6/6  | BC188 7/6  | BY254 3/9  | NKT260 13/3  | OC77 12/-  | 2N211 24/- | 2N2682 14/- |
| AD205 6/6  | BC189 7/6  | BY255 3/9  | NKT261 13/3  | OC78 12/-  | 2N212 24/- | 2N2683 14/- |
| AD206 6/6  | BC190 7/6  | BY256 3/9  | NKT262 13/3  | OC79 12/-  | 2N213 24/- | 2N2684 14/- |
| AD207 6/6  | BC191 7/6  | BY257 3/9  | NKT263 13/3  | OC80 12/-  | 2N214 24/- | 2N2685 14/- |
| AD208 6/6  | BC192 7/6  | BY258 3/9  | NKT264 13/3  | OC81 12/-  | 2N215 24/- | 2N2686 14/- |
| AD209 6/6  | BC193 7/6  | BY259 3/9  | NKT265 13/3  | OC82 12/-  | 2N216 24/- | 2N2687 14/- |
| AD210 6/6  | BC194 7/6  | BY260 3/9  | NKT266 13/3  | OC83 12/-  | 2N217 24/- | 2N2688 14/- |
| AD211 6/6  | BC195 7/6  | BY261 3/9  | NKT267 13/3  | OC84 12/-  | 2N218 24/- | 2N2689 14/- |
| AD212 6/6  | BC196 7/6  | BY262 3/9  | NKT268 13/3  | OC85 12/-  | 2N219 24/- | 2N2690 14/- |
| AD213 6/6  | BC197 7/6  | BY263 3/9  | NKT269 13/3  | OC86 12/-  | 2N220 24/- | 2N2691 14/- |
| AD214 6/6  | BC198 7/6  | BY264 3/9  | NKT270 13/3  | OC87 12/-  | 2N221 24/- | 2N2692 14/- |
| AD215 6/6  | BC199 7/6  | BY265 3/9  | NKT271 13/3  | OC88 12/-  | 2N222 24/- | 2N2693 14/- |
| AD216 6/6  | BC200 7/6  | BY266 3/9  | NKT272 13/3  | OC89 12/-  | 2N223 24/- | 2N2694 14/- |
| AD217 6/6  | BC201 7/6  | BY267 3/9  | NKT273 13/3  | OC90 12/-  | 2N224 24/- | 2N2695 14/- |
| AD218 6/6  | BC202 7/6  | BY268 3/9  | NKT274 13/3  | OC91 12/-  | 2N225 24/- | 2N2696 14/- |
| AD219 6/6  | BC203 7/6  | BY269 3/9  | NKT275 13/3  | OC92 12/-  | 2N226 24/- | 2N2697 14/- |
| AD220 6/6  | BC204 7/6  | BY270 3/9  | NKT276 13/3  | OC93 12/-  | 2N227 24/- | 2N2698 14/- |
| AD221 6/6  | BC205 7/6  | BY271 3/9  | NKT277 13/3  | OC94 12/-  | 2N228 24/- | 2N2699 14/- |
| AD222 6/6  | BC206 7/6  | BY272 3/9  | NKT278 13/3  | OC95 12/-  | 2N229 24/- | 2N2700 14/- |
| AD223 6/6  | BC207 7/6  | BY273 3/9  | NKT279 13/3  | OC96 12/-  | 2N230 24/- | 2N2701 14/- |
| AD224 6/6  | BC208 7/6  | BY274 3/9  | NKT280 13/3  | OC97 12/-  | 2N231 24/- | 2N2702 14/- |
| AD225 6/6  | BC209 7/6  | BY275 3/9  | NKT281 13/3  | OC98 12/-  | 2N232 24/- | 2N2703 14/- |
| AD226 6/6  | BC210 7/6  | BY276 3/9  | NKT282 13/3  | OC99 12/-  | 2N233 24/- | 2N2704 14/- |
| AD227 6/6  | BC211 7/6  | BY277 3/9  | NKT283 13/3  | OC100 12/- | 2N234 24/- | 2N2705 14/- |
| AD228 6/6  | BC212 7/6  | BY278 3/9  | NKT284 13/3  | OC101 12/- | 2N235 24/- | 2N2706 14/- |
| AD229 6/6  | BC213 7/6  | BY279 3/9  | NKT285 13/3  | OC102 12/- | 2N236 24/- | 2N2707 14/- |
| AD230 6/6  | BC214 7/6  | BY280 3/9  | NKT286 13/3  | OC103 12/- | 2N237 24/- | 2N2708 14/- |
| AD231 6/6  | BC215 7/6  | BY281 3/9  | NKT287 13/3  | OC104 12/- | 2N238 24/- | 2N2709 14/- |
| AD232 6/6  | BC216 7/6  | BY282 3/9  | NKT288 13/3  | OC105 12/- | 2N239 24/- | 2N2710 14/- |
| AD233 6/6  | BC217 7/6  | BY283 3/9  | NKT289 13/3  | OC106 12/- | 2N240 24/- | 2N2711 14/- |
| AD234 6/6  | BC218 7/6  | BY284 3/9  | NKT290 13/3  | OC107 12/- | 2N241 24/- | 2N2712 14/- |
| AD235 6/6  | BC219 7/6  | BY285 3/9  | NKT291 13/3  | OC108 12/- | 2N242 24/- | 2N2713 14/- |
| AD236 6/6  | BC220 7/6  | BY286 3/9  | NKT292 13/3  | OC109 12/- | 2N243 24/- | 2N2714 14/- |
| AD237 6/6  | BC221 7/6  | BY287 3/9  | NKT293 13/3  | OC110 12/- | 2N244 24/- | 2N2715 14/- |
| AD238 6/6  | BC222 7/6  | BY288 3/9  | NKT294 13/3  | OC111 12/- | 2N245 24/- | 2N2716 14/- |
| AD239 6/6  | BC223 7/6  | BY289 3/9  | NKT295 13/3  | OC112 12/- | 2N246 24/- | 2N2717 14/- |
| AD240 6/6  | BC224 7/6  | BY290 3/9  | NKT296 13/3  | OC113 12/- | 2N247 24/- | 2N2718 14/- |
| AD241 6/6  | BC225 7/6  | BY291 3/9  | NKT297 13/3  | OC114 12/- | 2N248 24/- | 2N2719 14/- |
| AD242 6/6  | BC226 7/6  | BY292 3/9  | NKT298 13/3  | OC115 12/- | 2N249 24/- | 2N2720 14/- |
| AD243 6/6  | BC227 7/6  | BY293 3/9  | NKT299 13/3  | OC116 12/- | 2N250 24/- | 2N2721 14/- |
| AD244 6/6  | BC228 7/6  | BY294 3/9  | NKT300 13/3  | OC117 12/- | 2N251 24/- | 2N2722 14/- |
| AD245 6/6  | BC229 7/6  | BY295 3/9  | NKT301 13/3  | OC118 12/- | 2N252 24/- | 2N2723 14/- |
| AD246 6/6  | BC230 7/6  | BY296 3/9  | NKT302 13/3  | OC119 12/- | 2N253 24/- | 2N2724 14/- |
| AD247 6/6  | BC231 7/6  | BY297 3/9  | NKT303 13/3  | OC120 12/- | 2N254 24/- | 2N2725 14/- |
| AD248 6/6  | BC232 7/6  | BY298 3/9  | NKT304 13/3  | OC121 12/- | 2N255 24/- | 2N2726 14/- |
| AD249 6/6  | BC233 7/6  | BY299 3/9  | NKT305 13/3  | OC122 12/- | 2N256 24/- | 2N2727 14/- |
| AD250 6/6  | BC234 7/6  | BY300 3/9  | NKT306 13/3  | OC123 12/- | 2N257 24/- | 2N2728 14/- |
| AD251 6/6  | BC235 7/6  | BY301 3/9  | NKT307 13/3  | OC124 12/- | 2N258 24/- | 2N2729 14/- |
| AD252 6/6  | BC236 7/6  | BY302 3/9  | NKT308 13/3  | OC125 12/- | 2N259 24/- | 2N2730 14/- |
| AD253 6/6  | BC237 7/6  | BY303 3/9  | NKT309 13/3  | OC126 12/- | 2N260 24/- | 2N2731 14/- |
| AD254 6/6  | BC238 7/6  | BY304 3/9  | NKT310 13/3  | OC127 12/- | 2N261 24/- | 2N2732 14/- |
| AD255 6/6  | BC239 7/6  | BY305 3/9  | NKT311 13/3  | OC128 12/- | 2N262 24/- | 2N2733 14/- |
| AD256 6/6  | BC240 7/6  | BY306 3/9  | NKT312 13/3  | OC129 12/- | 2N263 24/- | 2N2734 14/- |
| AD257 6/6  | BC241 7/6  | BY307 3/9  | NKT313 13/3  | OC130 12/- | 2N264 24/- | 2N2735 14/- |
| AD258 6/6  | BC242 7/6  | BY308 3/9  | NKT314 13/3  | OC131 12/- | 2N265 24/- | 2N2736 14/- |
| AD259 6/6  | BC243 7/6  | BY309 3/9  | NKT315 13/3  | OC132 12/- | 2N266 24/- | 2N2737 14/- |
| AD260 6/6  | BC244 7/6  | BY310 3/9  | NKT316 13/3  | OC133 12/- | 2N267 24/- | 2N2738 14/- |
| AD261 6/6  | BC245 7/6  | BY311 3/9  | NKT317 13/3  | OC134 12/- | 2N268 24/- | 2N2739 14/- |
| AD262 6/6  | BC246 7/6  | BY312 3/9  | NKT318 13/3  | OC135 12/- | 2N269 24/- | 2N2740 14/- |
| AD263 6/6  | BC247 7/6  | BY313 3/9  | NKT319 13/3  | OC136 12/- | 2N270 24/- | 2N2741 14/- |
| AD264 6/6  | BC248 7/6  | BY314 3/9  | NKT320 13/3  | OC137 12/- | 2N271 24/- | 2N2742 14/- |
| AD265 6/6  | BC249 7/6  | BY315 3/9  | NKT321 13/3  | OC138 12/- | 2N272 24/- | 2N2743 14/- |
| AD266 6/6  | BC250 7/6  | BY316 3/9  | NKT322 13/3  | OC139 12/- | 2N273 24/- | 2N2744 14/- |
| AD267 6/6  | BC251 7/6  | BY317 3/9  | NKT323 13/3  | OC140 12/- | 2N274 24/- | 2N2745 14/- |
| AD268 6/6  | BC252 7/6  | BY318 3/9  | NKT324 13/3  | OC141 12/- | 2N275 24/- | 2N2746 14/- |
| AD269 6/6  | BC253 7/6  | BY319 3/9  | NKT325 13/3  | OC142 12/- | 2N276 24/- | 2N2747 14/- |
| AD270 6/6  | BC254 7/6  | BY320 3/9  | NKT326 13/3  | OC143 12/- | 2N277 24/- | 2N2748 14/- |
| AD271 6/6  | BC255 7/6  | BY321 3/9  | NKT327 13/3  | OC144 12/- | 2N278 24/- | 2N2749 14/- |
| AD272 6/6  | BC256 7/6  | BY322 3/9  | NKT328 13/3  | OC145 12/- | 2N279 24/- | 2N2750 14/- |
| AD273 6/6  | BC257 7/6  | BY323 3/9  | NKT329 13/3  | OC146 12/- | 2N280 24/- | 2N2751 14/- |
| AD274 6/6  | BC258 7/6  | BY324 3/9  | N            |            |            |             |

# the BIG one...



# 350

pages

# 8,000

components

# 1,500

illustrations

The HOME RADIO CATALOGUE — the complete and easy answer to the problem of tracking down components. This Catalogue really is a **must** if you are interested in Radio and Electronics. It is one of the largest ever compiled. Also, **FREE** with each catalogue a Book Mark giving Electronic Abbreviations, an Order Form and an Addressed Envelope. All for only 8/6 plus 3/6 post, packing and insurance. In addition every catalogue contains 6 vouchers each worth 1/- when used as indicated.

just a  
phone call  
away



And for users of our catalogue . . .  
**a CREDIT ACCOUNT SERVICE to  
simplify and speed up your orders**

You can now order components just by picking up a telephone any time of day or night, including Sundays. No need to bother with postal orders, cheques, registering envelopes every time you make an order. Special prepaid envelopes and order forms are provided and only one postal order or cheque is required to settle the account each month . . . and no minimum invoice charge. So simple. 8,000 items just as near to you as your telephone. It's well worth the small deposit which enables you to use this Home Radio Deposit Credit Account Scheme. Why not write for more details?

Please write your Name and Address in block capitals

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



**HOME RADIO (COMPONENTS) LTD., Dept. PE**  
234-240 London Road, Mitcham, Surrey, CR4 3HD

## THE NON-REGISTERED ENGINEER

THE news that a national register of qualified engineers and technicians is planned will certainly provoke argument amongst the professional engineering community. The idea will no doubt appeal to those eligible for inclusion in the register, that is those who have attained membership of one of the engineering institutions. On the other hand, practising engineers and technicians who do not possess the appropriate qualifications may fear their professional prospects could be harmed by the existence of such a register. Indeed, they may suspect this to be the first step towards the total exclusion of non-registered persons from the more rewarding and responsible posts in industry, government departments, and other establishments.

It is understandable that members of the engineering institutions should endeavour to enhance their status and terms of employment, just as members of other professional bodies do. But concern must be expressed about the possible harm this could also cause. With regard to electronics specifically, if this scheme is carried out to the detriment of non-member engineers and technicians, the loss will not be the latter's alone, but the electronic industry as a whole would suffer.

Much normal commercial development and application work does not necessarily demand the higher academic qualifications. Given a sound basic knowledge of electronic principles and circuit practice, the most important and desirable asset, in many instances, would seem to be an imaginative mind. Some engineers and technicians have an innate ability to invent and develop ways and means for exploiting electronic devices and circuits. Surely these are the kind of people industry should be looking for, without too much concern about qualification status.

The expansion of electronics is not entirely a self-generating process, as may be innocently believed by some. New ideas must, constantly, be found to widen further the infiltration of this branch of technology into everyday activities. Microcircuits provide a topical illustration. These devices are a key factor in future expansion of the industry; however, their economic viability depends upon large scale production and this can only be maintained if a large user demand exists.

The national register sounds fine in its way, but it is impossible to detect a potential inventor or innovator by examination alone. Somehow we must guard against any academic barrier denying us the fruits of ingenious minds, just because they have not been formally examined and attested.

F. E. Bennett—*Editor*

## THIS MONTH

### CONSTRUCTIONAL PROJECTS

|                                   |     |
|-----------------------------------|-----|
| HI FI STEREO AMPLIFIER            | 900 |
| DOUBLE SIX                        | 924 |
| P.E. ORGAN—8                      | 932 |
| CAR FLASHER                       | 941 |
| P.E. COMMUNICATIONS<br>RECEIVER—3 | 949 |

### SPECIAL SERIES

|                                       |     |
|---------------------------------------|-----|
| MODEL RAILWAY<br>LOGIC SYSTEMS—4      | 913 |
| DEMONSTRATION SWITCHING<br>CIRCUITS—1 | 918 |

### GENERAL FEATURES

|                     |     |
|---------------------|-----|
| INGENUITY UNLIMITED | 954 |
|---------------------|-----|

### NEWS AND COMMENT

|                            |          |
|----------------------------|----------|
| EDITORIAL                  | 899      |
| MARKET PLACE               | 909      |
| SPACEWATCH                 | 917      |
| R.S.G.B. EXHIBITION        | 923      |
| ELECTRONORAMA              | 930      |
| NEWS BRIEFS                | 938, 945 |
| DUTCH FIRATO-69 EXHIBITION | 946      |

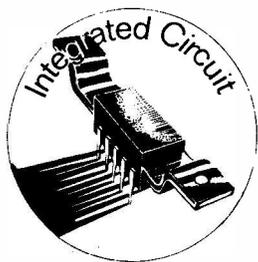
*Our January issue will be published on  
Monday, December 15*

© IPC Magazines Limited 1969. Copyright in all drawings, photographs and articles published in PRACTICAL ELECTRONICS is fully protected, and reproduction or imitations in whole or in part are expressly forbidden.

All reasonable precautions are taken by PRACTICAL ELECTRONICS to ensure that the advice and data given to readers are reliable. We cannot, however, guarantee it, and we cannot accept legal responsibility for it. Prices quoted are those current as we go to press.

Subscription Rates including postage for one year, to any part of the world, 42s.

All correspondence intended for the Editor should be addressed to Tower House, Southampton St., London, W.C.2. Phone: 01-836 4363. Address correspondence regarding advertisements to Advertisement Manager, Fleetway House, Farringdon St., London, E.C.4. Phone 01-236 8080.



# hifi

# stereo

By **M. J. Gay** Chief Circuit Engineer (Linear), Plessey Microelectronics

**T**HIS, the last article in the series describing the use of the Plessey SL402 and SL403 integrated circuit audio amplifiers, will describe a high fidelity stereo system using SL403's and a pre-amplifier suitable for feeding the system from magnetic, crystal, tape or radio inputs.

### BASIC SYSTEM

The essential feature of the system is that a three speaker set-up (bass, middle, treble) with one SL403 feeding each speaker is used (Fig. 1). The part of the frequency spectrum fed to each speaker is selected by an active filter formed around the pre-amplifier section of the corresponding SL403. Potentiometers between the pre-amplifiers and main amplifiers allow differences in the sensitivities of the speakers to be corrected for.

This system has a number of advantages over the conventional arrangement in which the speakers are fed from a single amplifier via passive cross-over filters and attenuators. These are:

- (a) All speakers are always voltage fed.
- (b) The frequency spectrum is split before passing through the power amplifiers, so intermodulation distortion is reduced.

- (c) The cross-over frequencies and filter characteristics may be freely and independently chosen; the system is free from spurious electrical resonances.
- (d) No inductors are required.

### ACTIVE FILTER DESIGN

The part of the frequency spectrum to be handled by each amplifier is selected by its pre-amplifier section connected as an active filter. Thus we have one pre-amplifier acting as a low-pass filter for the bass range amplifier, one acting as a band-pass filter for the mid-range amplifier and one acting as a high-pass filter for the treble range amplifier. The active filter design is of the basic two integrator type, the particular arrangement being commonly attributed to Rauch. It generates a second order filter characteristic giving a cut-off rate of 12dB per octave.

The low-pass design is shown in Fig. 2a and Fig. 2b shows the high-pass design. The responses are characterised by the equations given. By suitable choice of the passive components we may produce responses corresponding to any of the standard forms, e.g. Butterworth, Bessel, Chebyshev, Gaussian. Of these Cheby-

## SPECIFICATION...

**Output power:** 3 watts r.m.s. per channel into 15 ohm loads.

**Frequency response:** 13Hz to 100kHz  $\pm$  3dB.

**Total harmonic distortion—at full output:** 0.3% at 1kHz.

**Integrated noise level:** 90dB below full output.

**Tone control characteristics**

Treble:  $\pm$  15dB at 15kHz.

Bass:  $\pm$  18dB at 20Hz.

### Sensitivity

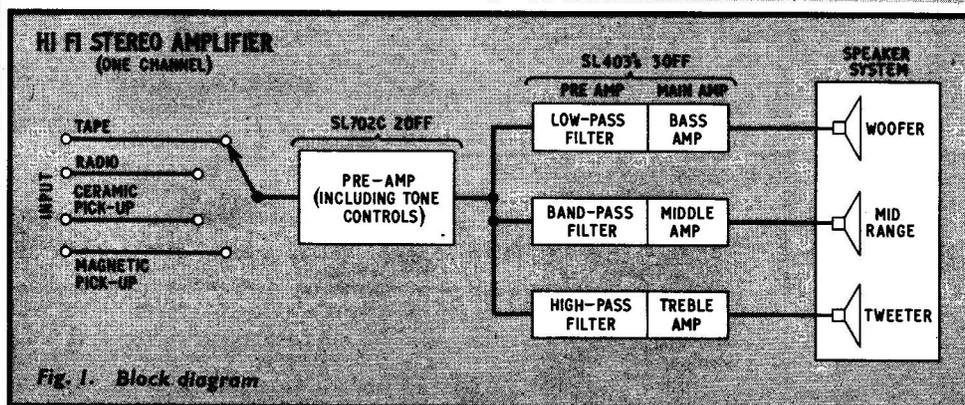
Radio: 35mV r.m.s.

Ceramic p.u.: 400mV r.m.s.

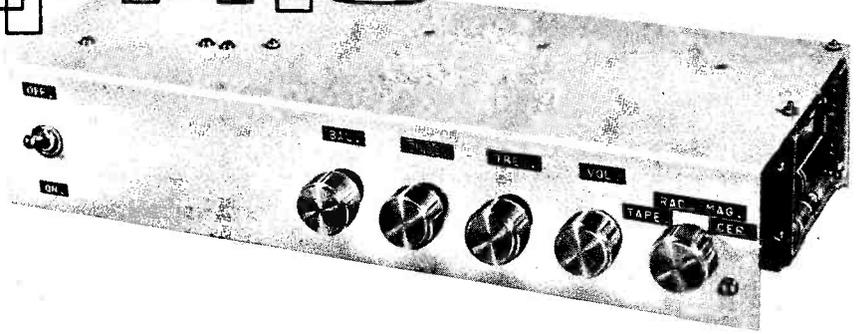
Magnetic p.u. and tape: 2.5mV r.m.s. at 1kHz.

**Crosstalk:** -40dB at 1kHz

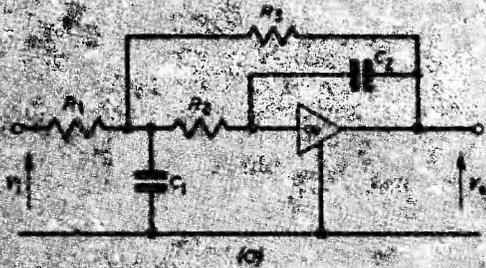
**Speaker system:** two three-channel speakers having individual 15 ohm impedance low, middle and high frequency units.



# amplifier



## ACTIVE FILTER CIRCUITS



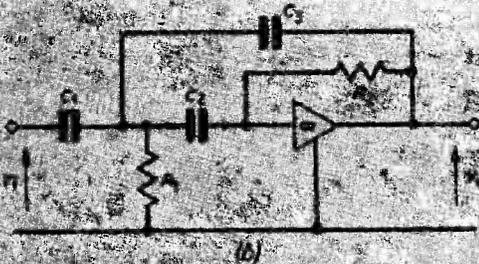
$$\frac{V_2}{V_1} = \frac{-R_2}{R_1} \left[ 1 + j\omega \left( \frac{R_1 R_2 + R_2 R_3 + R_1 R_3}{R_1} \right) C_2 - \omega^2 R_2 R_3 C_1 C_2 \right]$$

Bessel Response

$$R_1 = R_2 = R_3$$

$$C_1 = 3C_2$$

$$\text{Cut off frequency} = \frac{1.4}{2\pi C_1 R_1}$$



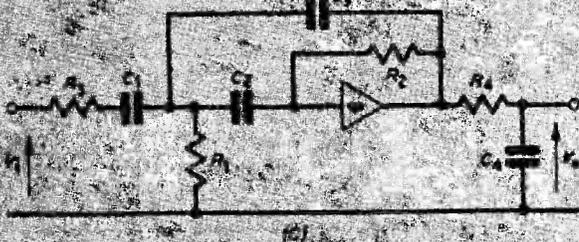
$$\frac{V_2}{V_1} = \frac{-C_1}{C_2} \left[ 1 + j\omega \left( \frac{C_1 + C_2 + C_3}{C_1 C_2 R_1} \right) - \frac{1}{\omega^2} \left( \frac{1}{C_1 C_2 R_1 R_2} \right) \right]$$

Bessel Response

$$C_1 = C_2 = C_3$$

$$R_2 = 3R_1$$

$$\text{Cut off frequency} = \frac{0.7}{2\pi C_1 R_1}$$



Bessel High-pass

Gaussian Low-pass

$$C_1 = C_2 = C_3$$

$$C_2 R_2 = C_1 R_1$$

$$R_2 = 3R_1$$

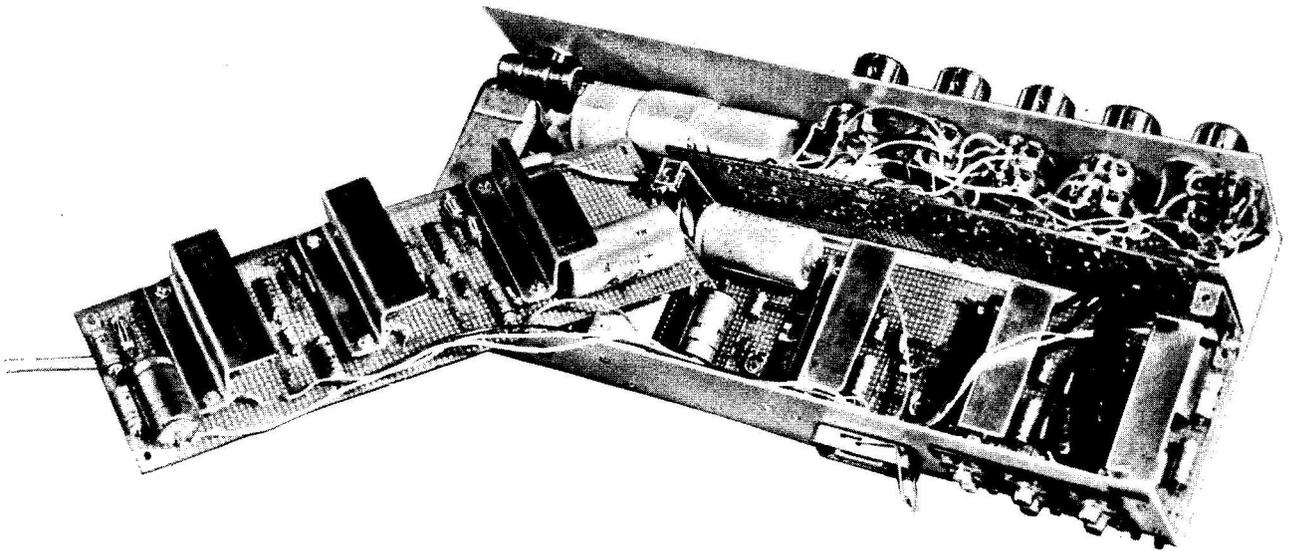
Cut off frequency

Cut off frequency

$$\frac{0.7}{2\pi C_1 R_1}$$

$$\frac{0.64}{2\pi C_1 R_1}$$

Fig. 2. Active filter circuits: (a) low-pass filter; (b) high-pass filter; (c) band-pass filter



General view of the hi fi stereo amplifier with one board removed to show layout and construction

shev gives the sharpest cut-off but will ring badly on transients; Gaussian will not ring or overshoot on transients but gives a rather slow initial roll-off; Butterworth and Bessel are in between.

Bessel response was in fact selected as about the best compromise giving reasonably sharp cut-off with negligible overshoot on transients. The second order Bessel polynomials are of the form

$$1 / \left( 1 + \sqrt{3}j\omega t - \omega t^2 \right), \text{ low pass with cut-off at } \omega t = 0.8$$

$$1 / \left( 1 + \frac{\sqrt{3}}{j\omega t} - \frac{1}{\omega^2 t^2} \right), \text{ high pass with cut-off at } \omega t = 1.25$$

and these forms are produced with the component ratios tabulated in Fig. 2. The component values are not too critical; it suffices to use low tolerance resistors (preferably  $\pm 2$  per cent, but  $\pm 5$  per cent will suffice) and  $\pm 10$  per cent capacitors.

The mid-range filter being band-pass has a rather more difficult task to perform. It is shown in Fig. 2c and consists of a second order Bessel high-pass section as in Fig. 2b, followed by a simple RC low-pass section giving 6dB per octave roll-off at the top end of the pass band and preceded by a series resistor R3, which generates a further 6dB per octave roll-off at the top end by virtue of the input impedance of the basic high-pass section being reduced to C1 at high frequencies. The addition of R3 necessitates slight modifications to the other resistor values to maintain the desired high-pass characteristic.

A set of response curves of the three filter sections and the resultant overall response are shown in Fig. 3. It will be seen that the high frequency cut-off rate of the mid-range filter is initially less sharp than the other cut-off rates. This is because it is generated differently as outlined above; in fact this particular characteristic is second order Gaussian. The slower cut-off rate is acceptable here as it is not too important to remove the treble from the mid-range speaker.

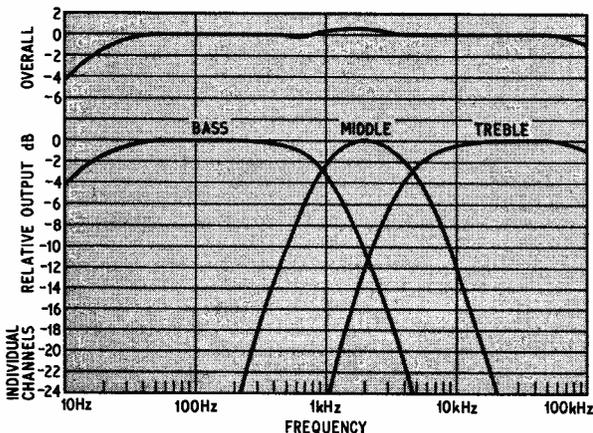


Fig. 3. Frequency responses of the hi fi stereo amplifier—individual and overall

Table I. ACTIVE FILTER COMPONENT VALUES FOR VARIOUS CROSS-OVER FREQUENCIES

| Lower cross-over | Bass channel |      | Middle channel |      |
|------------------|--------------|------|----------------|------|
|                  | R1           | C1   | R1             | C1   |
| 250Hz            | 82k $\Omega$ | 10nF | 39k $\Omega$   | 10nF |
| 400Hz            | 56k $\Omega$ | 10nF | 27k $\Omega$   | 10nF |
| 600Hz            | 33k $\Omega$ | 10nF | 18k $\Omega$ * | 10nF |
| 950Hz            | 22k $\Omega$ | 10nF | 10k $\Omega$ * | 10nF |

| Upper cross-over | Middle channel |              | Treble channel |              |       |
|------------------|----------------|--------------|----------------|--------------|-------|
|                  | R3             | R4           | C4             | R1           | C1    |
| 3kHz             | 3.3k $\Omega$  | 82k $\Omega$ | 330pF          | 27k $\Omega$ | 1.5nF |
| 5kHz             | 2.2k $\Omega$  | 47k $\Omega$ | 330pF          | 15k $\Omega$ | 1.5nF |

NOTE: where resistor and capacitor ratios of 3 : 1 are required take nearest standard values.

\* Reduced to correct for presence of R3.

## CROSS-OVER FREQUENCIES

The cross-over frequencies shown in Fig. 3, 950Hz and 5kHz, are those recommended for a Goodman's three speaker system consisting of Audiom 61, Midax and Trebax. The frequencies can readily be set virtually anywhere in the audio range by scaling the resistor and/or capacitor values in the filters. The cut-off frequencies ( $-3\text{dB}$ ) are given in Fig. 2 and Table 1 gives a list of component values for some typical choices. Note that for smooth cross-over the cut-off frequency of the bass filter must coincide with the lower cut-off frequency of the mid-range filter and the upper cut-off frequency of the mid-range filter must coincide with the cut-off frequency of the treble filter.

## COMPLETE DESIGN—POWER AMPLIFIER

The complete circuit for the three amplifiers of a single channel is shown in Fig. 4; this has the cross-over characteristics shown in Fig. 3. As always the pre-

amplifier must provide the main amplifier bias. The filter arrangement provides 100 per cent d.c. shunt feedback around the pre-amplifier in all cases, so that its output and input quiescent voltages are equal and provide the correct temperature compensated bias voltage as detailed in the first article (October issue).

The bias voltage is applied to the main amplifier via the pre-set potentiometers VR6, VR8 and VR10 (Fig. 4) which allow the gain of each amplifier to be adjusted to balance out differences in the sensitivities of the loudspeakers. Bias adjustment is by means of pre-set potentiometers VR5, VR7 and VR9 which are set so that the quiescent output voltages of the main amplifier are at half supply potential.

The main amplifier sections are connected in the usual manner except that the values of speaker coupling capacitors, bootstrap capacitors and compensation components have been altered where appropriate, in accordance with the frequency range to be handled

## POWER AMPLIFIER (one channel only)

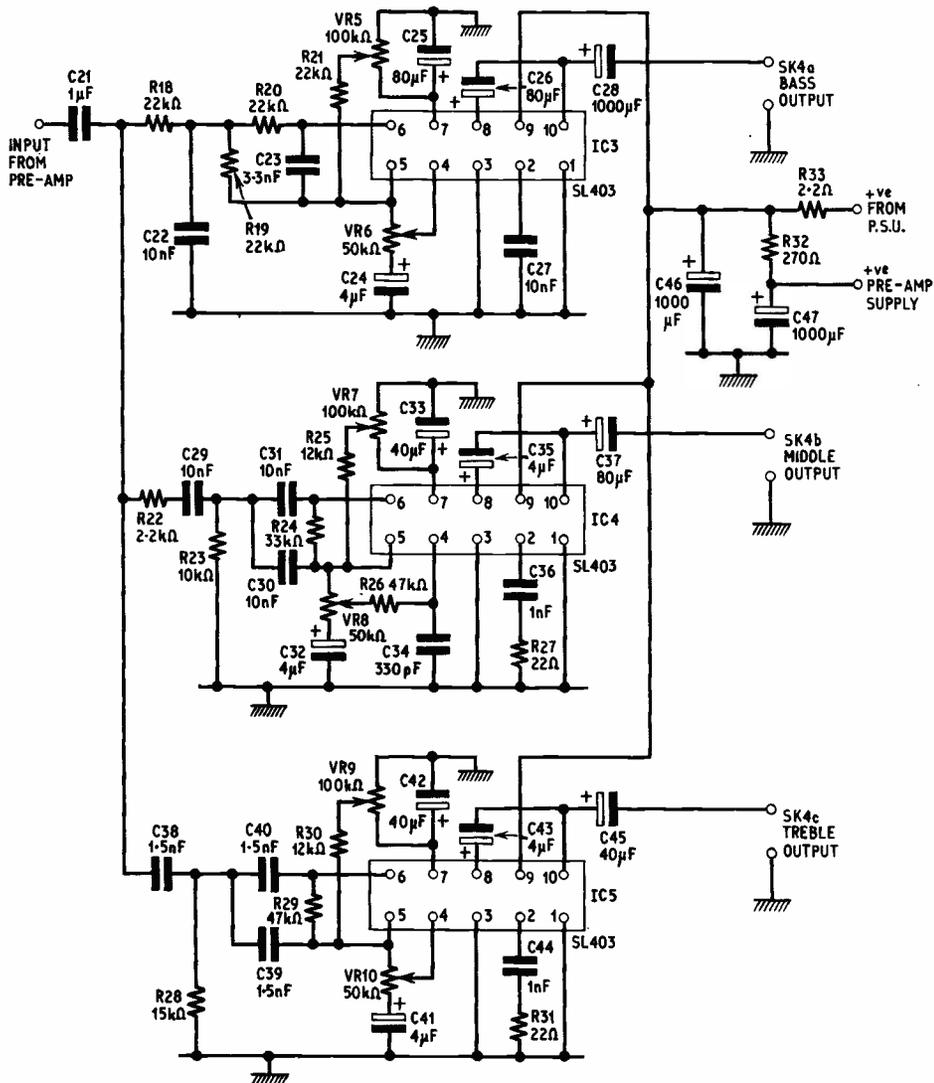


Fig. 4. Circuit diagram of one channel of the hi fi stereo power amplifier; not including the pre-amplifier

(one should not use a 1,000 $\mu$ F coupling capacitor to the treble speaker for example).

Note that although all amplifiers have been provided with level and bias adjustment potentiometers, some of these are not really necessary in practice. Commonly, middle and treble speakers are more efficient than bass units so that the bass amplifier level adjustment potentiometer VR6 and the blocking capacitor C24 could be dispensed with. The treble range output is much smaller than the bass and middle range outputs, so the treble range amplifier need not be provided with bias adjustment to obtain maximum possible output. Thus VR9 and R30 could be dispensed with.

### CONSTRUCTION OF POWER AMPLIFIER

A Veroboard layout for a single channel power amplifier is shown in Fig. 5. In this design 0-1in matrix Veroboard was used to allow a more compact layout. A number of copper strips were tinned and connected in parallel to provide a low impedance earth line.

When using 0-1in matrix Veroboard, great care must be taken to avoid short circuiting adjacent conductors. Finished boards should be very carefully inspected; it is a good idea to run a small screwdriver blade along the spaces between conductors to ensure that no bridges are present.

### POWER AMPLIFIER WIRING (one channel only)

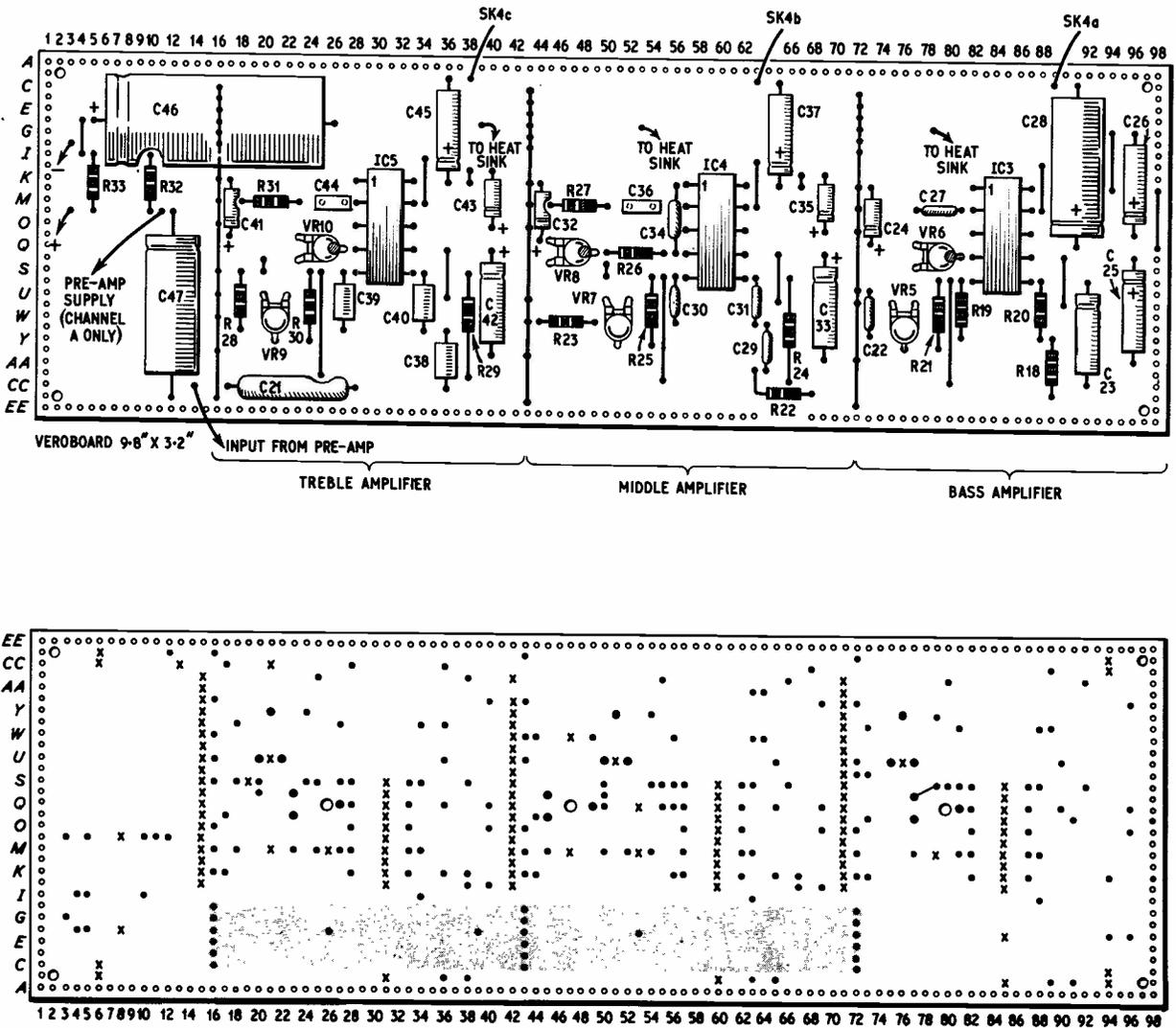
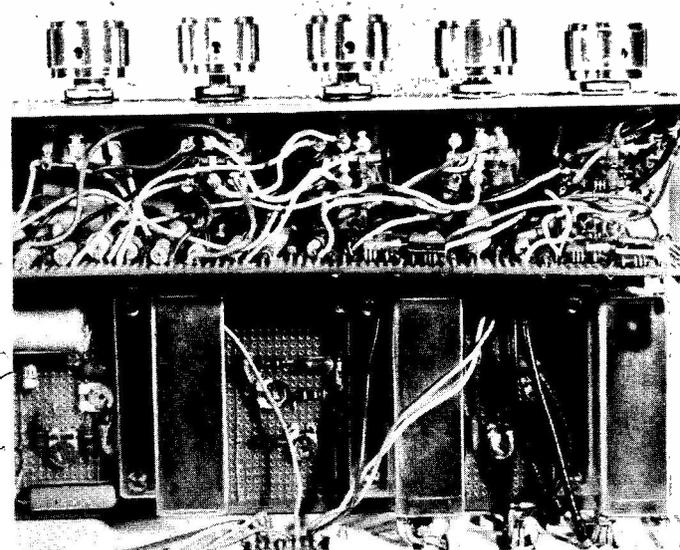


Fig. 5. Component layout and wiring diagram of one channel of the power amplifier. Conductors within the tinted area to be tinned for earth line



Part of one complete main amplifier board, with heat sinks attached, mounted in the chassis

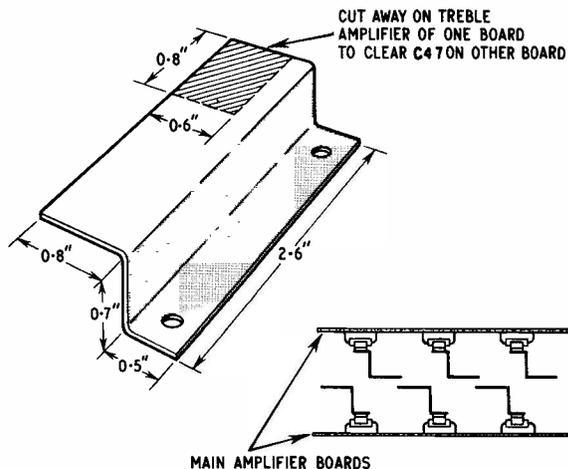


Fig. 6. Showing constructional details of the heat sinks for the six SL403's used in the main amplifiers and the arrangement of the amplifier boards

## COMPONENTS...

### MAIN AMPLIFIER

All components except R32 and C47 must be duplicated for channel B

#### Resistors

|     |               |               |
|-----|---------------|---------------|
| R18 | 22k $\Omega$  | $\pm$ 5% h.s. |
| R19 | 22k $\Omega$  | $\pm$ 5% h.s. |
| R20 | 22k $\Omega$  | $\pm$ 5% h.s. |
| R21 | 22k $\Omega$  | $\pm$ 10%     |
| R22 | 2.2k $\Omega$ | $\pm$ 5% h.s. |
| R23 | 10k $\Omega$  | $\pm$ 5% h.s. |
| R24 | 33k $\Omega$  | $\pm$ 5% h.s. |
| R25 | 12k $\Omega$  | $\pm$ 10%     |
| R26 | 47k $\Omega$  | $\pm$ 5% h.s. |
| R27 | 22 $\Omega$   | $\pm$ 10%     |
| R28 | 15k $\Omega$  | $\pm$ 5% h.s. |
| R29 | 47k $\Omega$  | $\pm$ 5% h.s. |
| R30 | 12k $\Omega$  | $\pm$ 10%     |
| R31 | 22 $\Omega$   | $\pm$ 10%     |
| R32 | 270 $\Omega$  | $\pm$ 10%     |
| R33 | 2.2 $\Omega$  | $\pm$ 10%     |

#### Capacitors

|     |                          |
|-----|--------------------------|
| C21 | 1 $\mu$ F polyester      |
| C22 | 10nF polyester           |
| C23 | 3.3nF polystyrene        |
| C24 | 4 $\mu$ F elect. 16V     |
| C25 | 80 $\mu$ F elect. 16V    |
| C26 | 80 $\mu$ F elect. 16V    |
| C27 | 10nF polyester           |
| C28 | 1,000 $\mu$ F elect. 16V |
| C29 | 10nF polyester           |
| C30 | 10nF polyester           |
| C31 | 10nF polyester           |
| C32 | 4 $\mu$ F elect. 16V     |
| C33 | 40 $\mu$ F elect. 16V    |

|     |                          |
|-----|--------------------------|
| C34 | 330pF polystyrene        |
| C35 | 4 $\mu$ F elect. 16V     |
| C36 | 1nF ceramic              |
| C37 | 80 $\mu$ F elect. 16V    |
| C38 | 1.5nF polystyrene        |
| C39 | 1.5nF polystyrene        |
| C40 | 1.5nF polystyrene        |
| C41 | 4 $\mu$ F elect. 16V     |
| C42 | 40 $\mu$ F elect. 16V    |
| C43 | 4 $\mu$ F elect. 16V     |
| C44 | 1nF ceramic              |
| C45 | 40 $\mu$ F elect. 16V    |
| C46 | 1,000 $\mu$ F elect. 25V |
| C47 | 1,000 $\mu$ F elect. 16V |

#### Potentiometers

|      |                               |
|------|-------------------------------|
| VR5  | 100k $\Omega$ skeleton preset |
| VR6  | 50k $\Omega$ skeleton preset  |
| VR7  | 100k $\Omega$ skeleton preset |
| VR8  | 50k $\Omega$ skeleton preset  |
| VR9  | 100k $\Omega$ skeleton preset |
| VR10 | 50k $\Omega$ skeleton preset  |

#### Integrated circuits

IC3, 4 and 5 SL403 Plessey (3 off)

#### Miscellaneous

SK4 12 pole sub miniature plug and socket (Radio-spares)  
Veroboard 0.1in matrix 9.8in  $\times$  3.2in  
16 s.w.g. aluminium 2.6in  $\times$  2in (3 off for heat sinks)  
6B.A. fixings

slight rise in distortion (to around 0.5 per cent).

The frequency response of the three amplifiers and the overall frequency response is shown in Fig. 3, while Fig. 7 shows distortion at the onset of clipping over the audio frequency range. The rise at l.f. is due to thermal feedback in the integrated circuit. Distortion is once again predominantly second harmonic and falls as power is reduced in a similar manner to the curves given in previous articles; since the amplifier is biased in class AB, cross-over distortion does not occur. Fig. 8 shows the output noise voltage ( $\mu\text{V}/\sqrt{\text{Hz}}$ ) as a function of frequency over the audio band. This is measured

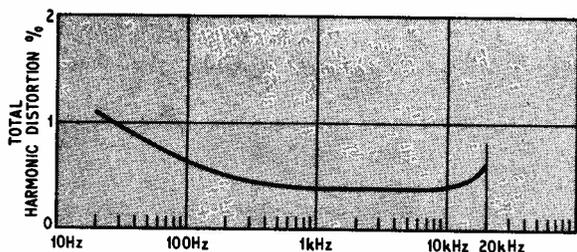


Fig. 7. Distortion curve for the stereo amplifier at full output

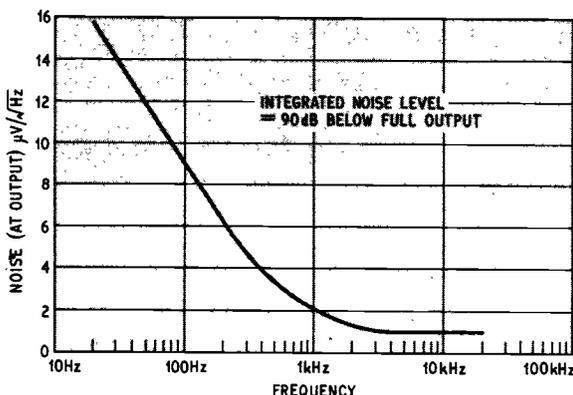


Fig. 8. Noise output curve for the stereo amplifier

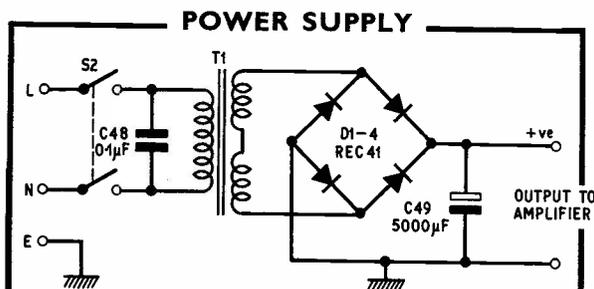


Fig. 9. Power supply circuit

#### COMPONENTS . . .

- T1 LVT/1 mains transformer, secondary  $2 \times 6.3\text{V}$  (Electroniques)
- S2 D.P.S.T. toggle
- C48  $0.1\mu\text{F}$  paper 300V
- C49  $5,000\mu\text{F}$  elect. 25V
- DI-4 REC 41 bridge rectifier (Radiospares)

with short circuit input and at the output of the appropriate amplifier for each frequency. The integrated noise level over the band is 90dB below full output; the perceived noise level will be about 5dB lower since the l.f. components which are significant in the integrated figure are much less audible.

#### OUTPUT POWER

The output power available is 2 watts r.m.s. (continuous sine wave) from each amplifier into a 15 ohm load on an 18 volt supply or 3W into a 7.5 ohm load. The effective r.m.s. output power on music depends on how the music frequency spectrum, during fortissimo passages, splits between the ranges covered by each amplifier. Some simple tests indicate that with the cross-over frequencies at 950Hz and 5kHz the effective power rating for music is around 1.5 times the individual amplifier rating. Thus the effective music power rating is 3W r.m.s. into 15 ohm speakers and 4.5W r.m.s. into 7.5 ohm speakers. With a 400Hz cross-over frequency the effective power rating would be about twice the individual amplifier rating.

These powers may seem rather low by the standards of hi fi amplifiers but it must be remembered that 30W sounds only twice as loud as 3W. Using the types of speakers envisaged for this system, 3W r.m.s. music power per (frequency) channel is more than adequate.

#### POWER SUPPLY ARRANGEMENTS

The main amplifiers are fed from a transformer and bridge rectifier with a  $5,000\mu\text{F}$  reservoir capacitor, see Fig. 9. This produces a hum level of  $-70\text{dB}$  which is normally considered adequate. With a simple power supply such as this, however, the supply ripple is a sawtooth wave-form containing significant components at 300Hz, 500Hz, etc. which are much more audible than the fundamental 100Hz ripple. For this reason additional smoothing is incorporated by including the  $1,000\mu\text{F}$  capacitors and 2.2 ohm supply line resistors on each power amplifier. This gives 12dB attenuation of the 300Hz component, 17dB attenuation of 500Hz, etc.

#### PRE-AMPLIFIER SUPPLY

The pre-amplifier supply is taken via an additional decoupling network (R32 and C47 in Fig. 4) from one of the power amplifiers. If power supply for external equipment is required, it can be taken from the other power amplifier via a similar decoupling network.

The amplifier described offers a novel approach to high fidelity reproduction. The emphasis of the design is on establishing ideal feed conditions for all speakers and on ensuring that they are fed with a properly selected section of the frequency spectrum. Incidental advantages of the system are reduction in intermodulation distortion and improved transient performance, due to the fact that low and high frequency components are not handled by the same power amplifier. Particular attention has been paid to obtaining low hum and noise levels.

#### Next month: Pre-amplifier and final construction details

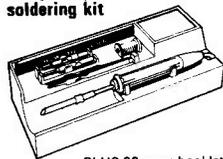
*Note.* In Fig. 3 page 813 (last month) VR1 should have been  $2\text{M}\Omega$  and C11,  $2,200\text{pF}$ . The distortion curves on pages 812 and 816 must be transposed.

# Merry Christmas from Antex



**A choice of Practical Christmas gifts for amateur or professional**

### Complete precision soldering kit



PLUS 36-page booklet on "How-to-Solder"—a mine of information for amateur and professional.

This kit—in a rigid plastic "tool-box" — contains

- Model CN 15 watts miniature iron, fitted 3/32" bit. Interchangeable spare bits 3/32", 1/8", 3/16".
- Reel of resin-cored solder
- Felt cleaning pad
- Stand for soldering iron

From Electrical and Radio Shops or send cash to Antex. **49/6**

**Attractively gift wrapped.**

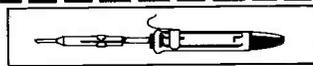


**Model CN 240/2**  
15 watts - 240 volts

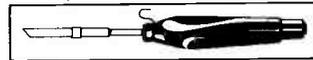
Fitted with nickel plated bit (3/32") and in handy transparent pack. From Electrical and Radio Shops or send cash to Antex.

**31/-**

**Attractively gift wrapped.**



G 18 watts. Fitted 3/32" bit for miniature work on production lines. Interchangeable spare bits, 1/8", 3/16" and 1/4" available. For 240, 220 or 110 volts. 32/6.



E 20 watts. Fitted with 1/4" bit. Interchangeable spare bits 3/32", 1/8", 3/16" available. For 240, 220, 110 volts. From 35/-



ES 25 watts. Fitted with 1/8" bit. Interchangeable bits 3/32", 3/16" and 1/4" available. Ideal for high speed production lines. For 240, 220, 110, 24 or 12 volts. From 35/-



F 40 watts. Fitted 5/16" bit. Interchangeable bits 1/4", 3/16", 1/8", 3/32" available. Very high temperature iron. For 240, 220, 110, 24 or 20 volts. From 42/6 Spare bits and elements for all models and voltages immediately available from stock.



### PRECISION MINIATURE SOLDERING IRONS

Antex, Mayflower House, Plymouth, Devon.  
Telephone: Plymouth 67377/8.  
Telex: 45296. Giro No. 2581000.

- Please send me the Antex colour catalogue
- Please send me the following irons

Quantity Model Bit Size Volts Price

.....  
.....  
.....

I enclose cheque/P.O./cash value

NAME .....

ADDRESS .....

.....



# MARKET PLACE

Items mentioned in this feature are usually available from electronic equipment and component retailers advertising in this magazine. However, where a full address is given, enquiries and orders should then be made direct to the firm concerned.

## EQUIPMENT CASE

Finding a means of obtaining an attractively finished case for a piece of equipment can become a problem to the amateur constructor, since there are several proprietary cases now on the market.

The Contil Mod-2 case from West Hyde Developments is available in varying sizes each with a p.v.c. coating. It comes in kit form and is easily assembled with a special cross-head screwdriver, included with each case kit.

The finish makes the case look equally attractive in the living room or laboratory. It is quite easy to add your own lettering to the front panel.

The cases would seem to be suitable for housing any of the P.E. i.c. amplifiers described last month and in this issue.

The prices of the Contil Mod-2 cases vary from 29s 6d to 129s 6d, postage extra.

Sizes and prices of the cases are contained in a short form catalogue available from West Hyde Developments Ltd., 30 High Street, Northwood, Middlesex.

## TEST EQUIPMENT

A regulated d.c. power supply, designed for operating or testing transistor receivers, amplifiers and other low voltage equipment is the latest product from Nombrex (1969) Ltd., Exmouth, Devon.

Known as the Model-22 Mk11 it provides a variable voltage from zero to 15V at currents of up to 500mA. Any short circuit or overload condition (approximately >600mA) is indicated instantly by a red warning light on the front panel.

The required output voltage is selected by a control on the front panel and both voltage and current can be monitored on separate scales of the output meter. The maximum loading for the power supply unit is 12 watts. Regulation accuracy from zero to full load is claimed at better than 2 per cent, and ripple is less than 5mV at maximum current.

The Model-22 d.c. power supply is mains operated and is priced at £14 18s 6d.

Another item of importance for the test bench is the oscilloscope and although this is a rather expensive item it should be considered a must for any amateur experimenter.

A fairly inexpensive oscilloscope is the EA 0699-1 from Mitre Electronic Products, 22 Powis Terrace, London, W.11. Intended for use in schools, as a monitor, or for use in the service repair laboratory, it costs £24 10s.

It features a 2½in diameter tube and has a Y bandwidth from d.c. to 100kHz. The Y sensitivity at maximum gain with full Y shift is claimed to be less than 100mV/cm. The timebase covers a range of approximately 10µs/cm to 100ms/cm.

## SOLDERING IRON

A new miniature 12V 12W soldering iron, type L20, has just been

**L20**  
**Miniature 12V**  
**12 watt soldering**  
**iron from Adcola Products**

introduced by Adcola Products Ltd., price 28s 6d. The iron is ideal for printed circuit work and being 12V operated is a useful addition to the car tool box for carrying out small or temporary electrical repairs on printed circuits.

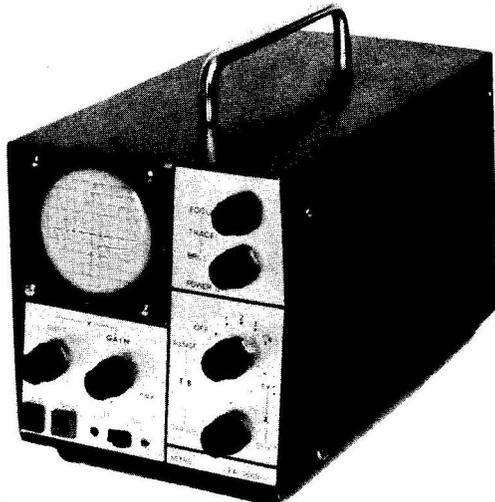
The iron can also be powered from the mains using a transformer which will become available as an extra.

## SMALLEST RADIO

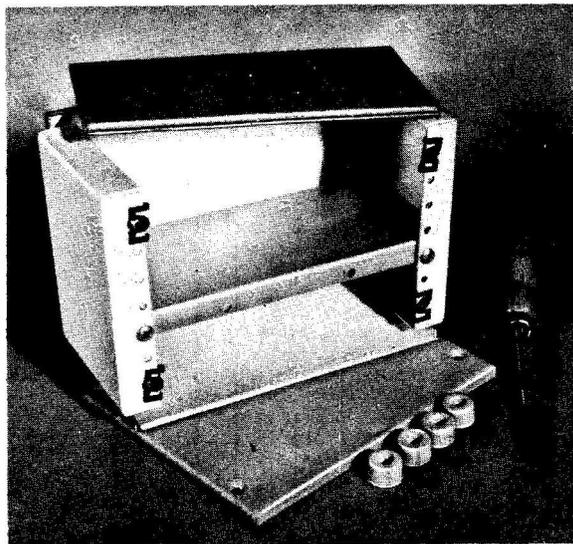
The introduction of the world's smallest radio in production is now claimed by Lasky's Radio Ltd. Called the Astrad Orion it is made in Russia and is a six transistor two-waveband receiver measuring only 1½in × 1½in × 1½in.

The set has a built-in ferrite rod aerial and is fully tunable over the medium and long waves. The signal output is heard through a miniature earphone and the set is powered by either a rechargeable nickel cadmium cell or a hearing aid mercury cell.

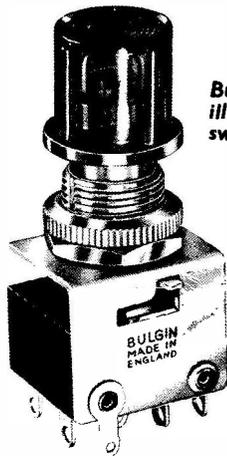
Complete with earpiece and battery the Astrad Orion costs 39s 6d.



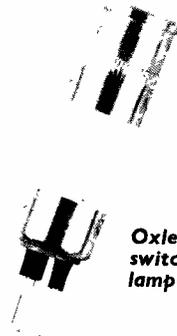
EA 0699-1 Oscilloscope manufactured by Mitre Electronic Products



West Hyde Developments Contil Mod-2 case kit



**Bulgin  
illuminating  
switch**



**Oxley transistor  
switched indicator  
lamp**

## SWITCHES AND LAMPS

The practice of illuminating controls seems to be on the increase each month, whether this is due to an increase in general short-sightedness, or the ever increasing sophistication and greater demand expected of the electronics industry, is a matter of conjecture.

But following this trend is the latest range of illuminated switches from A. F. Bulgin & Co. Ltd., Bye-Pass Road, Barking, Essex. The switch unit has a normally biased push action which can be locked in the depressed position by twisting the lens cap.

Two versions are available with either single-pole changeover or twin single-pole changeover switches. The maximum switch contact ratings are 8A 250V a.c.

The lampholder accepts 1.e.s. lamps up to 28V and the lens caps are available in five different colours. The lamp contacts are isolated from the switch.

A new product from Oxley is a range of transistor switched indicator lamps. The lamp contains its own driver stage enabling the bulb to be controlled from a low-current signal and is available in two versions, normally on and normally off.

The lamp holders have been specifically designed to indicate the state of logic or counting circuitry, but no doubt many ingenious readers will find other applications when they finally appear on the retail market.

## CINE/TAPE SYNC

Many of our photographically minded readers may be interested in the new Carol Model CS/2 pulse system of tape/film synchronisation. This new version is very similar to the original one and incorporates all of the more proven facilities of the previous model, as well as some new features.

The tape/film synchroniser is housed in a two-tone metal case with controls and a frames per second meter all mounted on the front panel.

The recommended selling price, including tax, is £46 13s 6d and is designed so that most projectors can stand on top of the case, making a neat compact set-up.

The main feature of the CS/2 model is the inclusion of a motor speed control circuit, which eliminates the need for heavy ballast resistors and gives more precise sync control.

The Carol Cinesound Model CS/2 is obtainable at most photographic shops or direct from Contronics Ltd., Deepcut, Camberley, Surrey.

## LITERATURE

Some 5,800 semiconductor devices, including integrated circuits, f.e.t.'s and thyristors are given in the new semiconductor price list now being issued by W.E.L. Components Ltd., 5 Loverock Road, Reading, Berks.

Items listed cover devices manu-

factured by Texas, A.E.I. Semiconductors, Ferranti and Sprague; a large number of CV types are also listed. The semiconductor price list is available free of charge, but all applications for copies must be made on company letterhead paper.

Also recommended is the added service of Mainline Electronics who now provide a catalogue of semiconductor devices which they can supply from S.G.S., R.C.A., International Rectifier, Emihus, Semitron, and Plessey. Additions to their components of all kinds are the i.c. amplifiers 12A, 25A, and 70A at £7, £8 5s, and £10 10s respectively. These are R.C.A. designs that are available in kit form. Details are given in 4s catalogue by post from Mainline Electronics Ltd., Thames Avenue, Windsor, Berkshire.

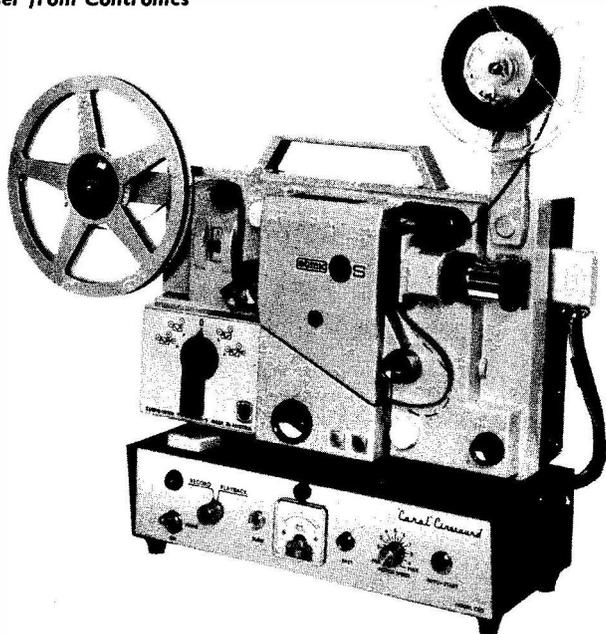
Two new editions of component catalogues are now available from LST Electronic Components Ltd., 7 Coptfold Road, Brentwood, Essex, and Adcola Products Ltd., Adcola House, Garden Road, London, S.W.4.

The LST catalogue lists many new semiconductor devices, including a special *pnpn* unijunction, type D13T, which is claimed to be programmable. Also listed in the catalogue are complete power supply and audio amplifier kits.

The Adcola catalogue contains details of their complete range of soldering instruments from replacement bits to de-soldering irons. The new de-soldering instrument styled on the lines of their soldering irons is also shown.

Both of the above mentioned catalogues are available free of charge.

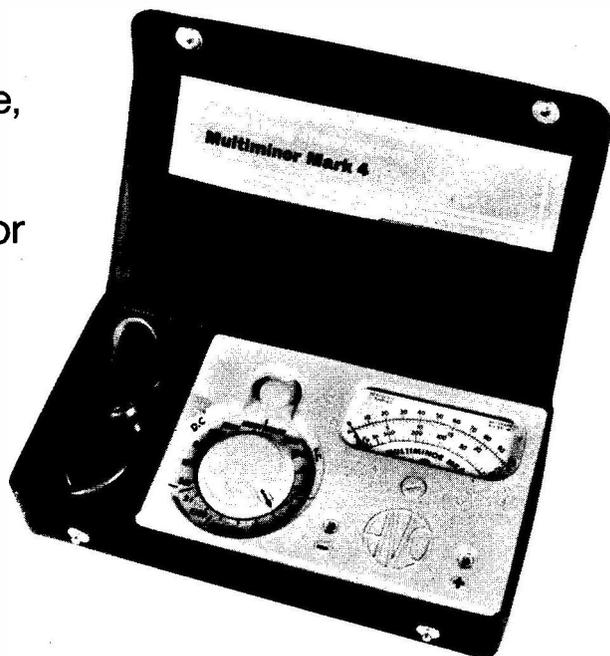
## Carol Model CS/2 tape/film synchroniser from Contronics



# why the MULTIMINOR is still the best mini-meter

- It's still an Avometer yet fits in the pocket/held easily in one hand
- Has a d.c. sensitivity of  $10,000\Omega/V$
- Measures up to 25kV and 25A with optional accessories
- Accuracy conforms to B.S.S. 89/54.

Get your own Multimeter today (complete with plastic case, leads, instruction booklet and a full year's guarantee) from your local supplier, or ask for details direct from Avo.

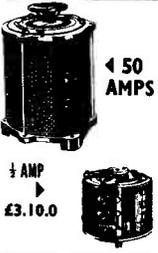


**THORN**  
A Member of  
the Thorn Group



Avo Limited  
Avocet House, Dover, Kent  
Telephone: Dover 2626  
Telex: 96283

# VARIABLE VOLTAGE TRANSFORMERS



**INPUT 230/240v. A.C. 50/60—  
OUTPUT VARIABLE 0-260v.**  
**BRAND NEW**  
Keenest prices in the country.  
All Types (and Spares) from  
1/2 to 50 amp. from stock.

**SHROUDED TYPE**  
1 amp, £5. 10. 0. 2.5 amps,  
£6. 15. 0. 4 amps, £9. 0. 0.  
5 amps, £9. 15. 0. 8 amps,  
£14. 10. 0. 10 amps, £18. 10. 0.  
12 amps, £21. 0. 0. 15 amps,  
£25. 0. 0. 20 amps, £37. 0. 0.  
37.5 amps, £72. 0. 0. 50 amps,  
£92. 0. 0.

**OPEN TYPE (Panel Mounting)**  
1/2 amp, £3.10.0. 1 amp, £5.10.0. 2 1/2 amps, £6.12.6.

## STROBE! STROBE! STROBE!

Build a Strobe Unit, using the latest type Xenon white light flash tube. Solid state timing and triggering circuit. 230/250v. A.C. operation.

**EXPERIMENTERS' ECONOMY KIT**  
1 to 36 Flash per sec. All electronic components including Veroboard S.C.R. Unijunction Xenon Tube and instructions £5.5.0 plus 5/- P. & P.

**NEW INDUSTRIAL KIT**  
Ideally suitable for schools, laboratories, etc. Roller tin printed circuit. New trigger coil, plastic thyristor 1-80 p.p.s. Price 9 gns. 7/6 P. & P.

**HY-LIGHT STROBE**  
This strobe has been designed and produced in response to wide public demand, for use in large rooms, halls and the photographic field. It has four times the light output at 30 f.p.s. and utilizes a silica plug-in tube for longer life expectancy, printed circuit for easy assembly, also a special trigger coil and output capacitor. Light output approx. 4 joules. Price £10.17.6. P. & P. 7/6.

**7-inch POLISHED REFLECTOR**  
Ideally suited for above Strobe kits. Price 10/6. P. & P. 2/6 or Post Paid with kits.  
Several types of Flash Tubes available from stock.

## 100 WATT POWER RHEOSTATS (NEW)

AVAILABLE IN THE FOLLOWING VALUES:  
1 ohm, 10 a.; 5 ohm, 4.7 a.; 10 ohm, 3 a.;  
25 ohm, 2 a.; 50 ohm, 1.4 a.; 100 ohm, 1 a.;  
250 ohm, .7 a.; 500 ohm, .45 a.; 1,000 ohm,  
280 mA.; 1,500 ohm, 230 mA.; 2,500 ohm, .2 a. Diameter  
3 1/2 in. Shaft length 3/4 in., dia. 1/4 in. All at 27/6 each.  
P. & P. 1/6.

**50 WATT.** 1/5/10/25/50/100/250/500/1,000/1,500/2,500  
ohm. All at 21/- each. P. & P. 1/6.

**25 WATT.** 10/25/50/100/250/500/1,000/1,500/2,500  
ohm. All at 14/6 each. P. & P. 1/6.



## VEEDER ROOT, 230V a.c. 50 cycle, 5-figure counter (non-resettable).

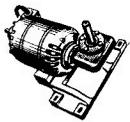
18/6, P. & P. 1/6.

**Large Digit 12-18 V D.C. MAGNETIC COUNTER.** 4in drum calibrated 0-9. Figures 1 1/2 in high, 3/4 in wide. Set of 1m, 1b; 1c/o contacts operated by drum cam. The units which can be used in multiples are ideally suited for batch or lap recording or for the many purposes where large easily read numerals are required. Price 18/6, P. & P. 2/6.



## PARVALUX TYPE SD19 230/250 VOLTS A.C. REVERSIBLE GEARED MOTOR.

30 r.p.m. 40lb. ins. Position of drive spindle adjustable to 3 different angles. Mounted on substantial cast aluminium base. Ex-equipment. Tested and in first class running order. A really powerful motor offered at a fraction of makers' price. 6 GNS. P. & P. 10/-.



**NICKEL CADMIUM BATTERY.** 1.2 volt 35 AH. Size 8 1/2 in. high x 3 x 1 1/4 in. 30/- each plus 4/- P. & P. Sintered Cadmium Type 1-2 v. 7AH. Size: height 3 1/2 in., width 2 1/2 x 1 1/4 in. Weight: approx. 13 oz. Ex-R.A.F. Tested. 12/6. P. & P. 2/6.

## UNISELECTOR SWITCHES NEW

**4 BANK 25 WAY FULL WIPER**  
25 ohm coil, 24v. D.C. operation.  
£5.17.6, plus 2/6 P. & P.

**6 BANK 25 WAY FULL WIPER**  
25 ohm coil, 24 v. D.C. operation. £6.10.0, plus 2/6 P. & P.

**8 BANK 25 WAY FULL WIPER**  
24 v. D.C. operation, £7.12.6, plus 4/- P. & P.



## LIGHT SENSITIVE SWITCH

Kit of parts, including ORP12 Cadmium Sulphide Photocell, Relay, Transistor and Circuit, etc., 6-12 volt D.C. op. price 25/- plus 2/6 P. & P. ORP 12 including circuit, 10/6 each, plus 1/- P. & P.

**A.C. MAINS MODEL.** Incorporates Mains Transformer, Rectifier and special relay with 2 5 amp mains c/o contacts. Price inc. circuit 47/6 plus 2/6 P. & P.



## LIGHT SOURCE AND PHOTO CELL MOUNTING

Precision engineered light source with focussible lens assembly and ventilated lamp housing, to take MBC bulb. Separate photo cell mounting assembly for ORP. 12 or similar cell. Both units are single hole fixing. Price per pair £2.15.0. P. & P. 3/6.



## RELAYS

New SIEMENS, PLESSEY, etc. miniature relays at highly COMPETITIVE PRICES

| Coil Ω | Working d.c. Volts | Contacts           | Price    |
|--------|--------------------|--------------------|----------|
| 170    | 9-12               | 4 c/o H.D.         | 14/6     |
| 170    | 9-12               | 3 c/o + 1 H.D. c/o | 12/6     |
| 280    | 6-12               | 2 c/o              | 1.8 12/6 |
| 700    | 12-24              | 2 c/o              | 1.8 12/6 |
| 700    | 16-24              | 4 c/o              | 1.8 15/6 |
| 700    | 16-24              | 4M 2B              | 1.8 12/6 |
| 1250   | 20-40              | 2 c/o H.D.         | 1.8 12/6 |
| 2500   | 30-50              | 2 c/o H.D.         | 1.8 12/6 |
| 9000   | 40-70              | 2 c/o              | 1.8 10/- |

H.D. Heavy Duty. POST PAID  
I.B. = Including Base

## MINIATURE RELAYS

9-12 volt d.c. 2 c/o 500 M.A. contacts. Size 1 x 1/2 x 3/4 in. Price 11/6 post paid.  
30-36 v d.c. 2 c/o 500 M.A. contacts. 3,200 ohm coil. Size 1 x 1/2 x 3/4 in. 8/6. Post paid.

## 230 VOLT AC RELAYS

230 volt AC Coil. Three c/o 5 amp. contacts. 17/6 post paid. (Illustrated).  
LONDEX 4 c/o 3 amp contacts. 18/6 inc. base, post paid.



## RING TRANSFORMER

Functional Versatile Educational  
This multi-purpose Auto Transformer, with large centre aperture, can be used as a Double wound current Transformer, Auto Transformer, H.T. or L.T. Transformer, by simply hand winding the required number of turns through the centre opening. E.g. Using the RT. 100 V.A. Model the output could be wound to give 8V. @ 12 1/2 a., 4V. @ 25 a., 2V. @ 50 a., etc.  
Price: RT.100VA 3.18 turns per volt, £2.5.0 + 3/6 p. and p. RT.300VA 2.27 turns per volt, £4.4.0 + 5/6 p. and p. RT.1KVA 1.82 turns per volt, £6.10.0 + 6/6 p. and p.



## SANWA MULTI RANGE METERS

New Model U50D Multi tester. 20,000 OPV, mirror scaled with overload protection. Ranges—d.c. volts: 100mV, 0.5V, 5V, 250V, 1,000V; a.c. volts: 2.5V, 10V, 50V, 250V, 1,000V; d.c. current: 5µA, 0.5MA, 5MA, 50MA, 250MA. Complete with battery and test probe. £7.5.0 post paid.

## 230V A.C. SOLENOID.

Heavy duty type. Approx. 21b pull. 17/6, P. & P. 2/6.  
**12V D.C. SOLENOID.** Approx. 11b pull. 10/6, P. & P. 1/6.  
**50V D.C. SOLENOID.** Approx. 11b pull. 10/6, P. & P. 1/6.  
**50V D.C. SOLENOID.** Approx. 21b pull. 12/6, P. & P. 1/6.



# NEW BOOKS

OCTOBER 1969

TRANSISTOR SUBSTITUTION HANDBOOK — 9th Edition

18/- net

47 EASY ENTERTAINMENT AND SCIENCE PROJECTS VOL. 1

by Robert M. Brown and Tom Kneitel 24/- net

NOVEMBER 1969

TRANSISTOR COLOUR TV SERVICING GUIDE

by Robert G. Middleton 35/- net

CLOSED CIRCUIT TV FOR ENGINEERS AND TECHNICIANS

by Leonard E. Showler 50/- net

JANUARY 1970

UNDERSTANDING AND USING UNIUNCTION TRANSISTORS

by S. Hoberman 24/- net

ELECTRONIC CIRCUIT DESIGN

by Farl J. Waters 30/- net

FEBRUARY 1970

LEARN ELECTRONICS THROUGH TROUBLESHOOTING

by Wayne Lemons 75/- net

FM FROM ANTENNA TO AUDIO

by Leonard Feldman 30/- net

The above are obtainable from most good bookshops or direct from the Publishers (see below) on remittance of the price plus 2/6 p. & p.

# FOULSHAM-SAMS TECHNICAL BOOKS

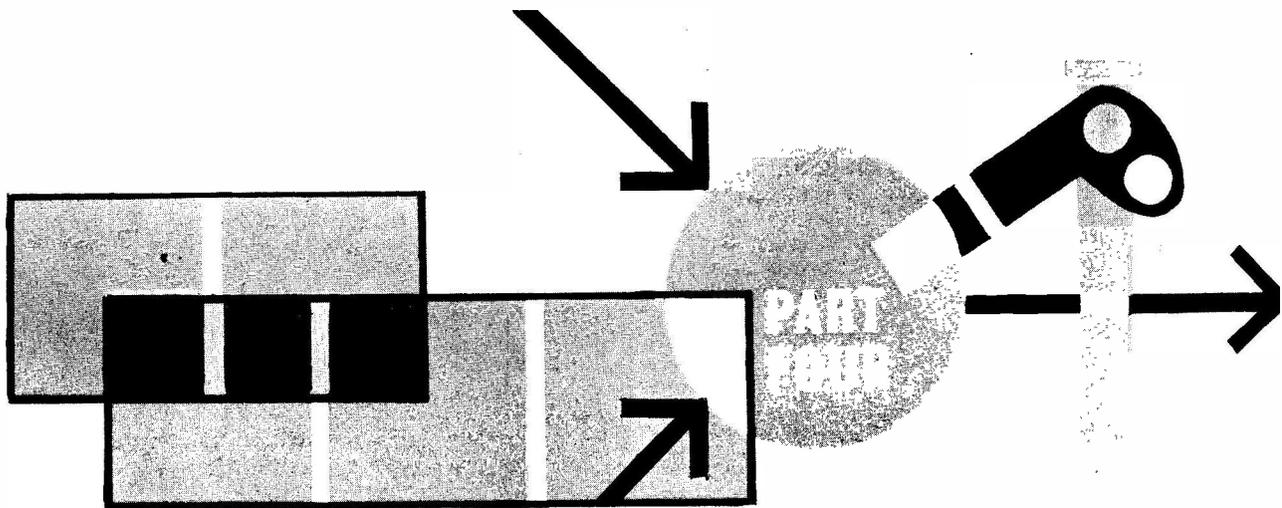
(W. FOULSHAM & CO. LTD.)

YEOVIL RD. SLOUGH, BUCKS, ENGLAND

# SERVICE TRADING CO

All Mail Orders—Also Callers—Ample Parking Space  
57 BRIDGMAN ROAD, LONDON, W.4 Phone 995 1560  
SHOWROOM NOW OPEN CLOSED SATURDAY

Personal callers only  
9 LITTLE NEWPORT ST.  
LONDON, W.C.2. Tel. GER 0576



# MODEL RAILWAY LOGIC SYSTEMS

By P. GOODES

## AUTOMATIC MARSHALLING YARD AND TURNTABLE

LAST month's article gave some suggestions, based on the author's layout, for automatic control of a marshalling yard. The gates used on the master control panel (G3, G4, G5, G6, G7) and those on the store (G2, G4, G6, G8, G10) require buffer amplifiers on the output. The gate and buffer are shown in Fig. 4.1.

For added security, gates G1 to G5 on the track switch decoder should each have an input from bistable BS2B on the master control.

A greater degree of flexibility can be provided if a loco unit can be made to turn round or change track. This is where an automatic turntable can come in useful. The remainder of this last part of the series will describe the author's home-made unit.

### TURNTABLE

The turntable to be described was built entirely from scratch, since those obtainable commercially were unable to give the required facilities. The requirements were as follows:

To allow a train on to the turntable at any one outlet and to enable it to be removed either forwards or backwards from any preselected one of five outlets.

### BISTABLE CONTROL

Obviously a bistable is required to do this, giving a sharp control so that it is either stationary or rotating. Rotation is started by a push button on the control panel. This sets the bistable BS1 in Fig. 4.2 with a 1 at its B output and a 0 at its A output. Since the control amplifier is an inverting device, the A output 0 is fed to it, starting the turntable rotating.

To stop the turntable at the required outlet, a negative voltage "1" is taken from the output of monostable MS1 and is applied to a control wiping contact mounted on the underside of the turntable. On the fixed base, five contacts are mounted and as the turn-

table rotates a 1 pulse is fed through each of these five contacts in turn. A rotary switch S3, mounted on the control panel, is used to select the particular outlet and when the 1 pulse reaches the corresponding fixed contact, it is fed through to switch off the bistable.

Monostable MS1 is used to overcome such conditions as follows: if, for example, the turntable starts at position 2, it is impossible to bring the engine out in reverse at, say, outlet 5 without the turntable stopping at outlet 5 and then needing to be restarted to take it through another 180 degrees.

When switch S1 is closed the 1 pulse from BS1B output triggers the monostable which has a time constant of approximately the time taken for the turntable to complete a quarter of a revolution. Thus the output becomes 0 for this period of time and the bistable cannot be triggered off until the monostable reverts to its quiescent state.

The speed of the turntable was made adjustable, but optimum speed was found to be about 1½ rev/minute.

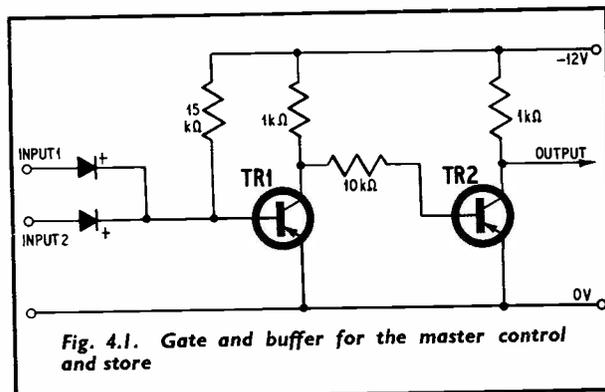


Fig. 4.1. Gate and buffer for the master control and store

## TRIP SWITCH

As an alternative to the start button a trip switch may be mounted on the turntable so that the engine starts the turntable rotating. In this case a relay buffer and relay should be used instead of the control amplifier and should be operated from the B output of BS1. One pair of contacts is used to switch the turntable motor on and another two pairs to cut off the supply to the engine.

The circuitry is mounted on a printed circuit board, the layout for which is shown in Fig. 4.3. The board shown caters only for the bistable and monostable and it is left to the reader to build up a relay buffer or control amplifier according to which ever he requires.

## WIPER SWITCH MECHANISM

The moving part of the turntable consists of a circle of hardboard 12in in diameter. On to the underside of this is fixed a circle of ordinary railway track (Fig. 4.3). The central wiping contacts are also fitted to the underside of this piece of hardboard and may be made

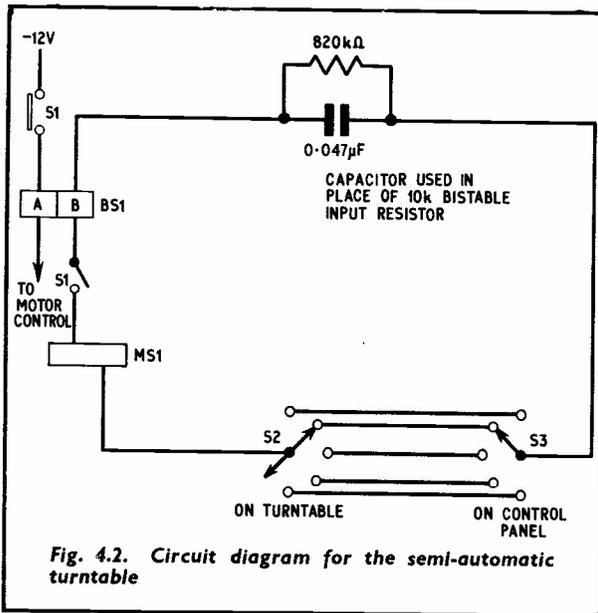


Fig. 4.2. Circuit diagram for the semi-automatic turntable

from old relay contacts or similar springy material and bent to shape. This contact is connected electrically to a Meccano wheel which is screwed on to the board and acts as a bush.

The base carries four cradles set at 90 degree intervals. Slots are cut in the tops of these cradles to carry truck axles and wheels and the whole so set that the rails of the rotating part run on these wheels. At the centre of the base another Meccano wheel is fitted and a short piece of rod is secured through this wheel. Using this as the axis of rotation, the rotating table should now run smoothly on the base. At this stage the piece of straight railway track, which carried the engine to be turned, may be fitted and this should be a little over 12in in length.

The five fixed contacts should now be fitted to the base so that contact is made between the wiper and each fixed contact as the track on the table is opposite the associated incoming track.

The motor may be fitted now (Fig. 4.4). The motor used was a "Mighty Midget" motor with gears.

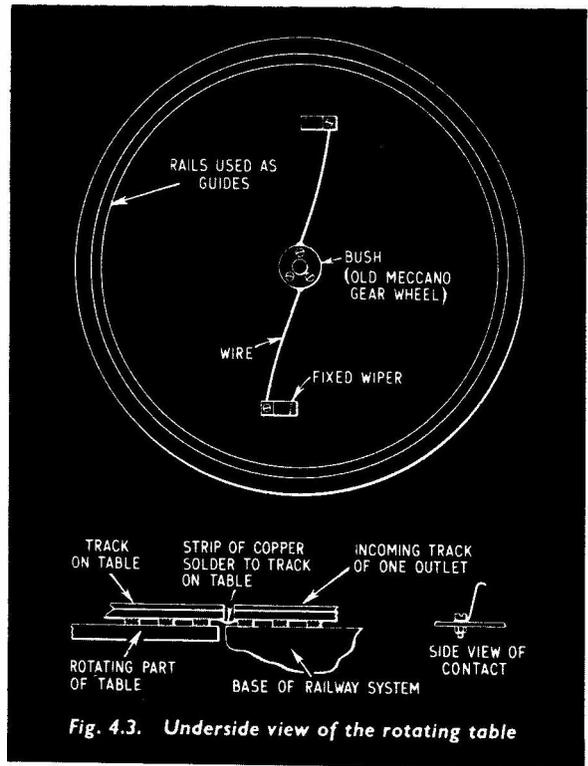


Fig. 4.3. Underside view of the rotating table

This is screwed to an aluminium base which in turn is hinged to the base. A rubber band connected between the motor and the base ensures that the drive shaft is tensioned against the edge of the rotating table. The electronics may now be incorporated and a dummy run attempted. When the turntable stops at each point the incoming tracks should be aligned to the track on the rotating table and secured.

Finally, a piece of spring strip should be soldered to each rail of the turntable track so that connection is made to the track at the outlets selected, thereby ensuring that the train supply gets through to the turntable track. ★

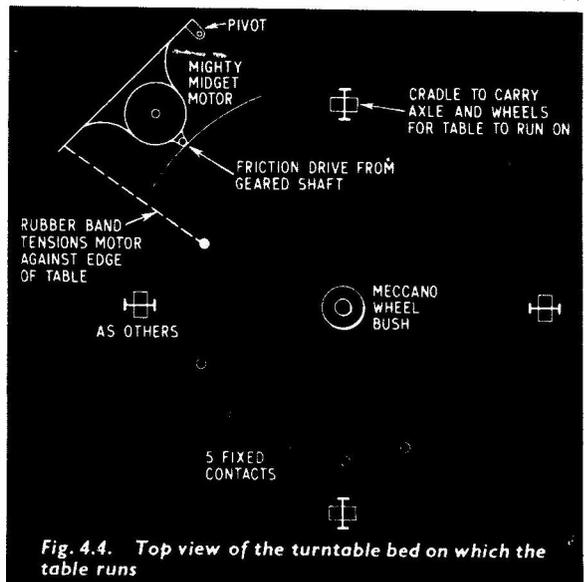


Fig. 4.4. Top view of the turntable bed on which the table runs

# 4! brings you a mountain of components at manufacturers' prices

The serious amateur should never be without this comprehensive price list and guide to semiconductor and electronic components from RCA, IR, SGS, Emihus, Semitron, Keyswitch, Plessey, Morganite, Litesold and others (together with manufacturers' application data) which you can buy direct from us at *manufacturers' prices* e.g. IN914 1/3d. □ IN916 1/11d. □ 2N697 4/5d. □ 2N706 2/3d. □ 2N706A 2/9d. □ 2N929 5/8d. □ 2N1613 4/8d. □ 2N3011 9/1d. □ 2N3053 6/2d. □ 2N3055 15/9d. □ 3N140 15/3d. □ BFY50 4/8d. □ BFY51 3/9d. □ BSY27 18/- □ BSY95A 3/3d. □ C407 4/6d. □ CA3012 18/3d. □ CA3014 25/6d. □ CA3020 25/9d. □ OA200 1/9d. □ OA202 1/11d.



## Build the NEW Mainline Audio Amplifier kits - UP TO 70 WATTS

The result of the combined resources of SGS and RCA, these quasi circuits set new standards in quality and performance. Each kit is complete with circuit diagram, all semiconductors, resistors, capacitors and printed circuit board.

|     |            |
|-----|------------|
| 12A | £7. 0. 0.  |
| 25A | £8. 5. 0.  |
| 40A | £9. 0. 0.  |
| 70A | £10.10. 0. |

Any two will make an outstanding stereo equipment.



To: Mainline Electronics Limited, Thames Avenue, Windsor, Berkshire

I enclose 4/-. Please send me your price list and guide

I am interested in ..... Amp Mainline Audio Amplifier Kits. Please send me full data

I am interested in receiving data on preamplifier & power supply kits

NAME \_\_\_\_\_ ADDRESS \_\_\_\_\_

(A member of the ECS Group of Companies)

PE 1269

### MINIATURE WAFFER SWITCHES

2 pole, 2 way—4 pole, 2 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.

### 15 Amp FOOT SWITCH

Suitable for sewing machine motor, drilling machine or in fact to switch any job where both hands are to be left free. Rated at 13A, 250V. Price 22/6.



### 3 DIGIT COUNTER

For tape recorder or other application, re-settable by depressing button. Price 2/6.



### TRANSDUCER

Made by ACOS, reference No. I.D.1001. For measuring vibration, etc., to be used in conjunction with "G" Meter. Regular price 55. Our price 49/6. Brand new and unused.



### ISOLATION SWITCH

20A D.P. 250V. Ideal to control water heater or any other appliance. Neon indicator shows when current is on. 4/6. 48/- per dozen.



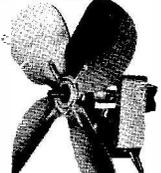
### 12 VOLT SOLENOID

For energizing Reed Switches, etc., size approx. 1 1/2 in. long by 1 1/2 in. diameter. Hole through solenoid approx. 1/8 in. 3/6 each.



### AC FAN

Small but very powerful mains motor with 6 1/2" blades. Ideal for cooling equipment or as extractor. Silent but very efficient. 17/6. Post 4/6. Mounts from back or front with 4BA screws.



### M.W. SIGNAL GENERATOR

Complete kit as described in last month's issue 12/6 each.

### 80 OHM BALANCED ARMATURE EAR PIECE

Usable as microphone or loudspeaker 4/6 each.

### 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 motor 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/- less than the value of the clock alone—post and insurance 2/9.



### BECKASTAT

This is an instant thermostat, simply plug your appliance into it and its lead into wall plug. Adjustable setting for normal air temperatures. 13A loading. Will save its cost in a season 19/6, post and insurance 2/9.



### SOLDER GUN

A must for every busy man. Gives almost instant heat; also illuminates job. 100 watt 220/240V, 39/6 (saves you over 30/- post and ins. 4/6. BIG JOB 250 watt model, 99/6 (saves you over 23.10), post and ins. 6/6.



### FLEX BARGAINS

**Screened 3 Core Flex.** Each core 14/0076 copper P.V.C. insulated and coloured, the 3 cores laid together and metal braided overall. Price 23.15 per 100yd coil.  
**15 amp 3 Core Non-Kink Flex.** 70/0076 insulated coloured cores, protected by tough rubber sheath, then black cotton braided with white tracer. A normal domestic flex as fitted to 3kW fires. Regular price 3/6 per yd. 50yd coil, 24.10 or cut to your length 8/6 per yd.  
**10 amp 3 Core Non-Kink Flex.** As above but cores are 28/0076 copper. Normal price 2/6 per yd. 100yd coil 27.10 or cut to your length 1/9 per yd.  
**6 amp 2 Core Flex.** As above but 2 cores each 23/0076 as used for vacuum cleaners, electric blankets, etc., 39/6 100yd coil.  
**23/0076 Triple Core P.V.C. covered, circular, normally sold at 1/6 yd.** Our price 100 yd coil 23.15.6. Post and Insurance 6/6.

### ELECTRIC TIME SWITCH

Made by Smith's, these are A.C. mains operated, NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. 2 completely adjustable time periods per 24 hours, 5 amp changing-over contacts will switch circuits on or off during these periods. 59/6, post and ins. 4/6. Additional time contacts 10/- pair.



### STEREO CABINET

Size 25in. x 14in. x 9 1/2in. deep—speaker compartment each end. Centre portion with hinged lid and removable bottom has platform for autochanger and room for amplifier. Two tone (red and grey) retrace covered but loud speaker ends need metal grilles. With handle and clips, 22/6. Carriage and packing 15/-.



### 'GLADIATOR' 2 WAVE BAND TRANSISTOR RADIO

7 transistor, 2 wave band (medium and long) pocket radio with carrying handle and ear-plug. These radios use a ferrite slab aerial and a conventional superhet circuit with built in moving coil speaker. Completely built up, ready to play. Offered at less than import price due to bankrupt purchase. A remarkable bargain. 39/6 plus 3/6 post and insurance.



### DRILL CONTROLLER

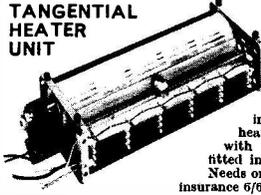
Electrically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-clip control. KIT includes all parts, case, everything and full instructions, 19/6 plus 2/6 post and insurance. Made up model available at 27/6 plus 2/6 p. & p.



### THIS MONTH'S SNIP

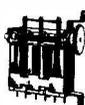
#### TANGENTIAL HEATER UNIT

Winter is coming but act today and you won't dismay. This heater unit is the very latest type, most efficient and quiet running. Is as fitted in Hoover and blower heaters costing 215 and more. We have a few only. Units complete, wired ready to fit into cases, i.e. motor impeller, 3kW, heater switching 1, 2 and 3kW, and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Needs only on/off switch, 79/6; postage and insurance 6/6. Don't miss this.



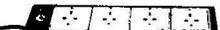
### 3 STAGE PERMEABILITY TUNER

This Tuner is a precision instrument made by the famous 'Clydon' Company for the equally famous Radomobile Car Radio. It is a medium wave tuner (but set of longwave coils available as an extra if required) with a frequency coverage 1220 kc/s—220 kc/s intended to operate with an I.F. value of 470 kc/s. Extremely compact (size only 2 1/2 x 2 1/2 in thick) with reduction gear for fine tuning. Snip price this month 12/6, with circuit of front end suitable for car radio or as a general purpose tuner for use with Amplifier. Post Free.



### DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets in metal box to take standard 13 amp fused plugs. Supplied complete with 5 feet of heavy cable and 13 amp plug. Similar advertised at 25. Our price 39/6, post and ins. 4/6.



### VARYLITE

Will dim incandescent lighting up to 600 watts from full brilliance to out. Fitted on M.K. flush plate, same size and fixing as standard wall switch so may be fitted in place of this, or mount on surface. Price complete in heavy plastic box with control knob 23.19.6.



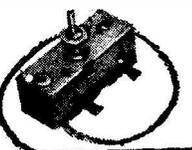
### BUY TIME SLOT METERS

If you hire out equipment such as T.V. sets by the hour then these slot meters are what you require. We have 3 types, 8d an hour, 1/- an hour and 1/6 an hour. Brand new. Made by the famous Weston Company. Price 23.19.6, postage and insurance 6/6.



### THERMOSTAT WITH PROBE

This has a sensor attached to a 15A switch by a 1 1/2 in length of flexible capillary tubing—control range is 20°F to 160°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 stock 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 Teidington Co., we offer these at 12/6 each. Postage and insurance 2/9.



### HI-FI BARGAIN

**FULL FI 12-INCH LOUDSPEAKER.** This is undoubtedly one of the finest loudspeakers that we have ever offered, produced by one of the country's most famous Hi-Fi designers. Die-cast metal frame and is strongly recommended for Hi-Fi loud and Rhythm Guitar and public address. Flux Density 11,000 gauss. Total Flux 44,000 Maxwells—Power Handling 15 watts R.M.S. Cone Moulded fibre. Frequency response 30-10,000 c.p.s.—specify 3 or 16 ohms—Mains resonance 60 c.p.s.—Chassis diam. 12in.—12in over mounting lugs—Baffle hole 11in diam.—Mounting holes 4, holes—1/2 in diam, on pitch circle 11in diam.—Overall height 5 1/2 in. A 46 speaker offered for only 23.9.6 plus 7/6 p. & p. Don't miss this offer, 15in 30 watt 27.19.6, 16 in 100 watt 224.10.



Where postage is not stated then orders over 43 are post free. Below 43 add 2/9. Semiconductors add 1/- post. Over 21 post free. S.A.E. with enquiries please.

### REED SWITCHES

Glass encased switches operated by external magnet—gold welded contacts. We can now offer 3 types:—  
**Miniature.** 1in long—approximately 1/2 in diameter. Will make and break up to 1 amp up to 300 volts. Price 2/6 each, 24/- dozen.  
**Standard.** 2in long by 1/2 in diameter. This will break currents of up to 1 amp, voltages up to 250 volts. Price 2/- each, 18/- per dozen.  
**Flat.** 2in long, just over 1/4 in thick, approximately 1/2 in 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, 250 volts. Price 6/- each, 53/- per dozen.  
 Small ceramic magnets to operate these reed switches 1/3 each, 12/- per dozen.

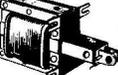


### MOTOR WITH GEARBOX

Very powerful 7 r.p.m., operates from standard A.C. mains. 29/6 plus 3/6 P. & P.

### EXTRACTOR FAN

Cleans the air at the rate of 10,000 cubic feet per hour. At the pull of a cord it extracts grease, grime and cooking smells before they become dirty decorations. Suitable for kitchens, bathrooms, factories, changing rooms, etc., it's so quiet it can hardly be heard. Compact, 6in casing with 5 1/2 in fan blades. Suitable wherever it is necessary to move air fast. Kit comprises motor, fan blades, sheet steel casing, pull and ins. switch, mains connector and fixing brackets. 39/6 + 4/6 post.



**230 VOLT SOLENOID**  
 1/2 in stroke. Size 2 1/2 in x 2 1/2 in x 1 1/2 in. 14/6, postage 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. 19/6. Kit D—95 w. 19/6. Kit MF1 is for 6in, 9in and 12in miniature tubes 19/6. Postage on Kits A and B 4/6 for one or two kits then 4/6 for each two kits ordered. Kits C, D and E 4/6 for first kit then 3/6 for each kit ordered. Kit MF1 3/6 for first kit then 3/6 on each two kits ordered.

### DEAC RECHARGEABLE BATTERY

1.2V-2000mA/hr type (2000DKZ). Size 2in dia. x 1 1/2 in thick approx. Tremendously powerful, will deliver 4 amp for 1 hour. Regular price over 22 each. Snip price 19/6 each. NEW AND UNUSED.

### MAINS TRANSFORMER SNIP

Making a power pack for amplifier or other equipment? These transformers have normal mains primaries (230/240v.) and isolated secondaries two types (1) 12v. 500mA at 3/6; (2) 15v. 500mA at 8/6.

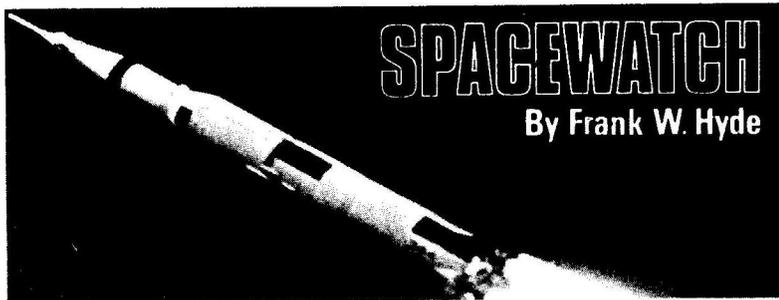


### THERMOSTATS

**Type "A"** 15 amp, for controlling room heaters, greenhouses, airing cupboard. Has spindle for pointer knob. Quickly adjustable from 30-80°F. 9/6 plus 1/- post. Suitable box for wall mounting. 5/-, P. & P. 1/-.  
**Type "B"** 15 amp. This is a 17in long rod type made by the famous Sunvic Co. Spindle adjusts this from 50-550°F. Internal screw alters the setting so this could be used as a thermostat adjustable over 30° to 1000°F. Suitable for controlling furnace, oven, kill immersion heater or to make flame-stat or fire alarm. 8/6 plus 2/6 post and insurance.  
**Type "D"** We call this the Ice-stat as it cuts in and out at around freezing point, 2/3 amp. Has many uses one of which would be to keep the loft pipes from freezing. If a length of our blanket wire (12 yds. 10/-) is wound round the pipes. 7/6. P. & P. 1/-.  
**Type "E"** This is standard refrigerator thermostat. Spindle adjustment cover normal refrigerator temperature. 7/6, plus 1/- post.  
**Type "F"** Glass encased for controlling the temp. of liquid, particularly those in glass tanks, vats or sinks, thermostat is held (half submerged) by rubber sucker or wire clip—ideal for fish tanks—Developers and chemical baths of all types. Adjustable over range 50° to 150°F. Price 18/-, plus 2/- post and insurance.

## ELECTRONICS (CROYDON) LTD

Dept. PE, 266 London Road, Croydon CRO 2TH  
 Also 102/3 Tamworth Road, Croydon



# SPACEWATCH

By Frank W. Hyde

## JUPITER PROBE

The fly-by probes scheduled for launching to study the Jupiter environment in 1973 and 1974, are making demands on the time of astronomers for planning the trajectories. Accurate observations are required of the positions of the Galilean satellites *Io*, *Europa*, *Ganymede* and *Callisto*.

There are a number of difficulties here, the principal one being the uncertainty of predicting the orbits of these bodies. The errors at present are high and amount to some thousands of kilometres. Amateur observers have been able to establish this with their much less sophisticated apparatus than that of the professional observatories.

The general studies to be made of the Jovian environment includes the study of particles, magnetic and electric fields, gravitational fields, effect of the solar wind and the atmospheric constituents of the planet!

One of the instruments used will be an imaging photo-electric polarimeter which will observe the Galilean satellites and Jupiter itself. Unfortunately, the error noted above is certainly larger than the field of view of the imaging instrument.

Locking on to the satellites could be impossible unless the astrometric data is improved and NASA is therefore urgently seeking positional data of the four Galilean satellites, and if possible also the position of *Amalthea* (satellite V).

If the position is not improved, particularly for the next two apparitions, NASA made be forced to set up conventional observatories to deal with this problem.

## HONEYSUCKLE DISH

The rapid growth of Australia's contribution to the U.S.A. space programmes may have a spectacular reward. As a result of the successful *Apollo 11* mission NASA have indicated that Honeysuckle Creek tracking centre near Canberra will be up-graded by the addition of a 200ft dish aerial.

The existing 85ft aerial was able to receive the telemetry quite satisfactorily but its ability to deal with the television signals was marginal.

It was as a result of this situation that the Commonwealth Scientific and Industrial Research Organisation made the Parkes 210ft dish available during the critical moon transmissions.

The geographical position of Australia in relation to Cape Kennedy has been the reason for the close co-operation between the personnel and their contact with advanced space techniques. These facilities in the southern hemisphere are essential to the future projects of space exploration and the moon based stations of the future.

## WATCHING THE BIRTH OF STARS

The dark clouds in the Orion Nebula look like "protostars" condensing and the Green Bank radio astronomers have found some very compact clouds in regions of star formation.

These clouds of ionised hydrogen emit radio waves at 2cm. The emission at 18cm of the hydroxyl radical (OH) is believed to come from protostars and there is also the possibility that the OH radical also emits at 2cm. Some nebulae also show that they contain concentrations of ionised hydrogen.

In 1947 Bok, working with the Mount Palomar telescope, noticed the dark patches against bright emission nebulae and suggested that they were clouds of matter. Since then Dr M. Penston has studied several of the Bok globules which are seen against the bright Orion nebula, three of these are like spheres of gas, and they appear to have cooled down well below the usual temperature in interstellar space. Their mass is of the order of one solar mass and this supports the idea that they are stars in formation.

## SATELLITE AERIAL WITHOUT A DOME

On October 1 this year *Raistang 2*, a new large radio aerial for satellite communications, went into operation. *Raistang 1* went into service in 1964 and was 25 metres in diameter, housed in a radome of plastic kept inflated by internal excess pressure.

The theory was that by housing it in a protective cover the construction could be both lighter to erect and easier to maintain. Also working conditions for staff would be more amiable.

In practice however, a number of grave disadvantages appeared. When wet the radome causes a higher level in the noise component of the system and this leads to considerable damping of the signal in passing through the wet shell. Also the wet shell reflects earth radiation back to the aerial. With a rainfall of 1mm/h there is a rise of noise temperature of 3.5db and when the rainfall rises to 10mm/h the increase is as much as 7 Bels.

The second aerial, which was built without the radome, has a far more robust structure and provision is also made for differing weather conditions according to location.

Some five thousand 150 watt radiators (infra red) are arranged in groups behind the reflector to take care of snow and ice. The rear of the dish aerial is totally enclosed so that the supporting struts of the aerial are shaded from the heat of the sun in order to reduce distortion.

An axially mounted horn feed enables both transmitter and receiver electronics to remain in position wherever the aerial is moved. The diameter of this dish is 28 metres.

There are plans for two more aerials in this complex which is the measure of what is expected from the increase in communications traffic when *Intelstat III* programme gets under way.

The next major event to be handled by the present aerials will be the 1972 Munich Olympics.

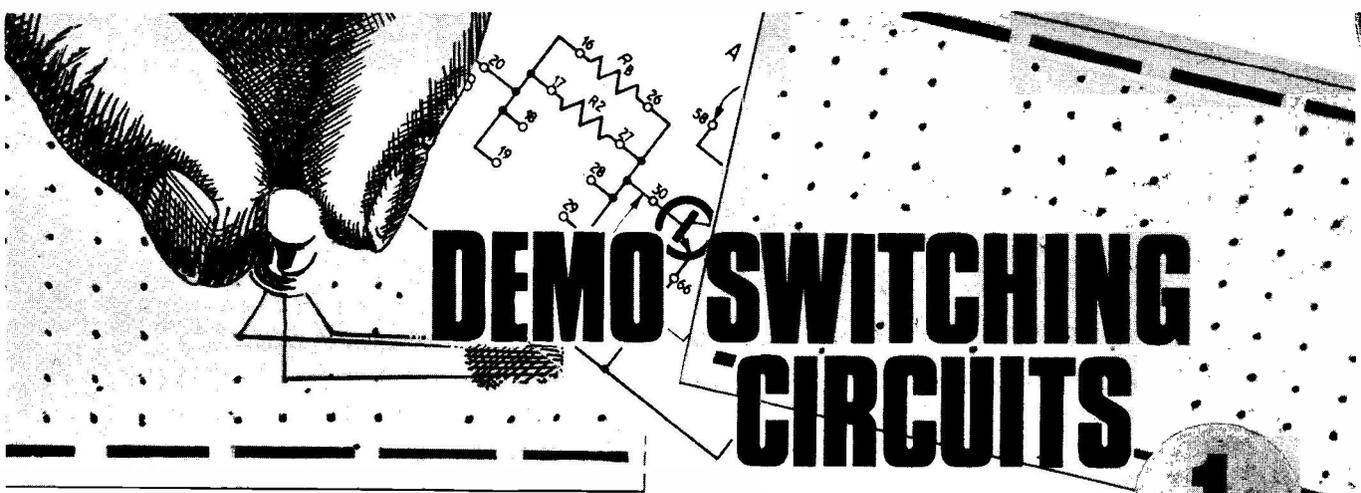
## METEORS ON TAPE

A machine which will increase man's knowledge of the origin of meteors has been developed by Sheffield University and the Projects Division of Dunford Hadfields. The University team under Prof. Kaiser have installed an automatic digital recording system to process and analyse meteor echoes at the radio astronomy observatory at High Bradfield.

For some 12 years meteors have been observed at Bradfield using the technique of reflected pulses from ionised meteor trails. The new technique being developed by Prof. Kaiser's team will help to remove the laborious analysis work involved in the old method.

## THE MOON AIDS THE MOTORIST

A new synthetic rubber which man used to make his first footprints on the moon may help the motorist. The material, a fluoro-elastomer can be used for seals, disc brake systems and other places where very high temperatures occur. Full return after deformation is possible up to 200 degrees centigrade.



**T**HIS series of articles is intended as a basic "self-teaching" course for the home-constructor who wishes to design his own transistor switching circuits. Component values may be calculated from the simple theory given and it will be shown how the circuits may be assembled and tested.

Expensive test gear will not be required; neither will elaborate power supplies. Battery operation will be utilised throughout so that circuits may be tested without the need for setting up elaborate equipment.

By B. Pounder

**A**NYONE with a knowledge of little more than Ohm's law can easily acquire the facility of arriving at first-approximation circuit designs from which improvements can be made as experience develops. The designs given start with basic transistor operation and lead on to practical circuits.

#### BREADBOARD ASSEMBLY

One of the easiest methods of construction is the "breadboard" assembly technique based upon the use of component push-in boards such as S-Dec,  $\mu$ -Dec and T-Dec. These are available from component suppliers and from M.L.I. for members of the teaching profession.

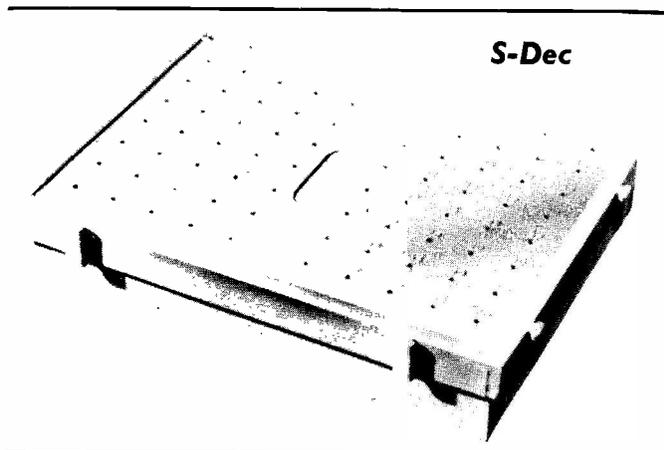
The use of these Decs enables a limited kit of components to be used many times over, and makes the task of changing components in an already assembled circuit simplicity itself. Because of this easy form of component assembly, a number of circuits can be built and tested very quickly. If a mistake is made in the connections, correction is straightforward without using a soldering iron.

There are three basic types of "Dec", S,  $\mu$ , and T. Each contains rows of phosphor bronze contact strips mounted in a small box beneath a plastics panel. The panel contains rows of numbered holes above the contact strips through which component leads may be inserted into the contact strips. Contacts are electrically and mechanically sound. Once a lead has been set in a particular position and attitude, so it will remain unless pushed or bent into another.

The arrangement of sockets on the three types of Dec is shown in the photographs. Circuit layouts are similar to those used with Veroboard, except that no solder is required.

Of the three types of Dec, the S-Dec is the least expensive and the easiest to get components into and out of on account of the relatively wide pitch between socket rows. It is designed for long-lead transistors in TO1 or TO5 encapsulations and will only accept short-lead TO18 or plastics devices if these are used in conjunction with transistor sockets to which leads about 1.5in long have been pre-soldered.

The other two types are more expensive but much more versatile. They will accept both long- and short-lead transistors directly as well as the standard integrated circuit packages provided that they are purchased with the appropriate i.c. carriers. The small socket spacings on the  $\mu$ - and T-Decs enables circuits of considerable complexity to be assembled as will be shown as this series develops.



If required, two or more of these "breadboards" can be fitted together by their dovetail slots and panel mounted components can be fitted to the associated metal brackets.

### COMPONENTS

Before getting down to the actual circuits, a word or two about the components to be used is appropriate here.

Apart from the breadboard and some single stranded connecting wire, a stock of transistors, resistors and capacitors will be required for all the circuits to be discussed. In addition, one or two extras will be required for some circuits, for example, diodes, bulbs, a relay, and so on. Some of these may need wires attached to facilitate insertion in the breadboard holes.

The transistor stock need only consist of a few general purpose types, *npn* or *pnP*, silicon or germanium; few circuits will require both *npn* and *pnP* devices. If the transistors will stand currents of up to one ampere, they will be capable of working in all the circuits, but smaller types can be substituted in low current applications up to about 100mA.

The circuit layouts to be given will be based on the assumption that the transistors used have an e-b-c lead sequence. It should be noted that some readily available plastics devices have an e-c-b sequence. It will be a simple matter to modify the suggested layouts to accommodate devices of this type. Some specimen lead arrangements are shown in Fig. 1.1.

For resistors, it is advisable to have a few of all the 10 per cent values. This may not be as expensive as it seems and has the advantage that a component of approximately the same value as that calculated will always be available for use in a circuit.

Capacitor requirements will be modest. If a few components of about 100pF, 0.1μF, 10μF are available, most needs should be met.

### TRANSISTOR CHARACTERISTICS

Fig. 1.2 shows the basic diagram of a one transistor operational test circuit with S-Dec hole numbers given at the appropriate junctions. This is converted to a practical layout in Fig. 1.3. This circuit is used to illustrate the function of a transistor under linear d.c. conditions.

Before using transistors as switches, it will be useful to have a look at those characteristics which illustrate the behaviour of a typical device under d.c. conditions and see how a set of these characteristics may be plotted

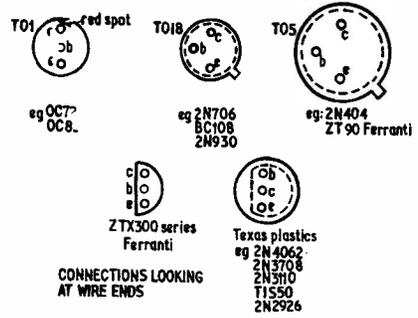


Fig. 1.1. Lead arrangements for some commonly used types of transistors

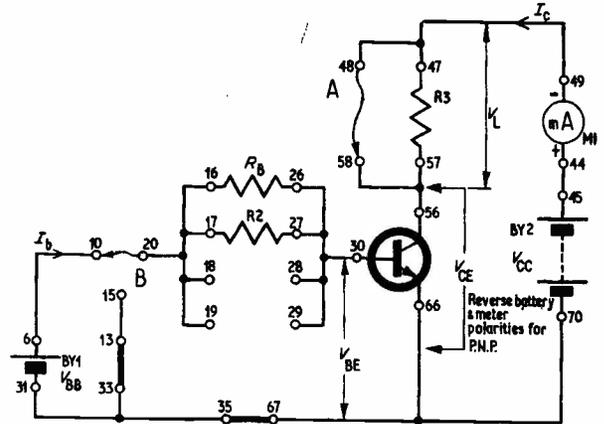


Fig. 1.2. A test circuit used to demonstrate the function of a transistor. S-Dec hole numbers are given at the component junctions

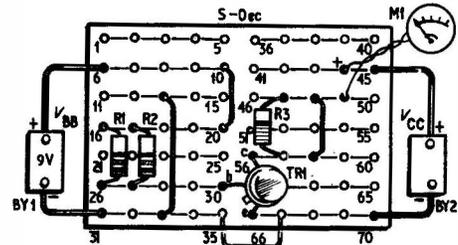
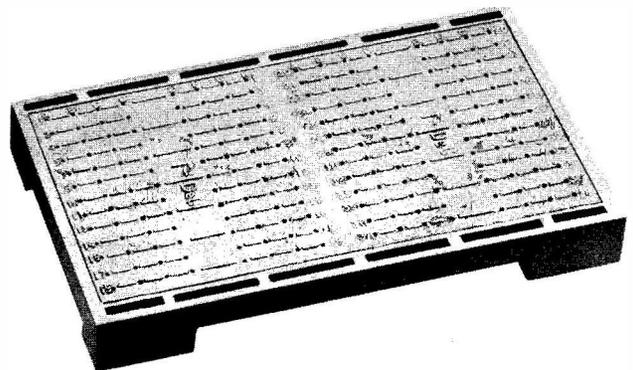
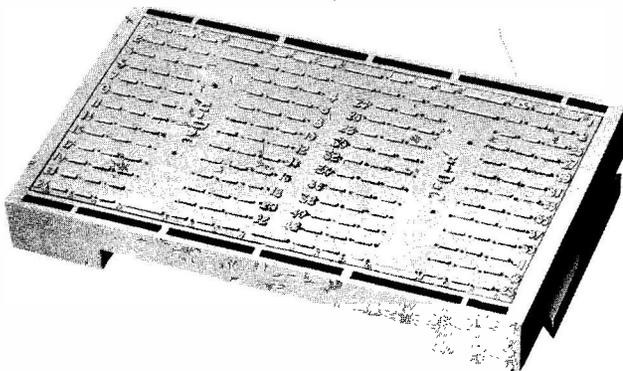


Fig. 1.3. Practical arrangement of circuit given in Fig. 1.2

μ-Dec

T-Dec



quickly to a degree of accuracy sufficient for many practical purposes.

Fig. 1.4 shows a set of output characteristics, that is, curves of collector current  $I_C$  against collector-emitter voltage  $V_{CE}$ , each plotted for a constant base current  $I_B$ .

A point P is shown on one of the curves, and for the particular transistor to which these curves refer, the

collector current and collector-emitter voltage are 1.5mA and 6V respectively. Also, the base current is  $30\mu\text{A}$ . The ratio of the collector current to the base current at this point is the d.c. current gain for a grounded emitter configuration, usually given one of the symbols  $\beta$  or  $h_{FE}$ .

$$\text{Thus } \beta = h_{FE} = \frac{I_C}{I_B} = \frac{1,500}{30} = 50$$

Roughly the same value would be obtained at other points on the other curves, except at values of  $I_C$  very much greater or very much less than that chosen.

Note that all the curves merge into a line OA. If the transistor is operated at a point such as  $P_S$  on this line, the transistor is said to be saturated;  $I_C$  and  $V_{CE}$  for this point could correspond to any one of the base current values of all the curves which pass through this point, i.e. to all base currents greater than  $30\mu\text{A}$  in the example shown. Conversely, if the transistor is operated at a point such as  $P_C$  on the zero base current curve, it is said to be cut-off.

Two input characteristics are shown in Fig. 1.5. These are curves of base current  $I_B$  against forward bias base-emitter voltage  $V_{BE}$ , drawn for a particular value of  $V_{CE}$ . Curves drawn for other values of  $V_{CE}$  differ only slightly from one another.

The curves shown are typical for germanium and silicon transistors, and show an important difference between the two types, namely that the base current is approximately zero for forward bias voltages of less than about 0.1V for germanium and 0.4V for silicon. Further, the curves rise rapidly with increase in  $V_{BE}$  beyond about 0.2V for germanium and 0.6V for silicon.

When saturated,  $V_{BE}$  values are approximately 0.3V and 0.8V for germanium and silicon transistors respectively. These figures are worth remembering.

### PLOTTING THE CHARACTERISTICS

A quick method of plotting a set of output characteristics is as follows.

Connect up the circuit shown in Fig. 1.2 with  $R_3$  shorted by means of the link A. Use a 9V battery for  $V_{CC}$ . Insert a 2 megohm resistor for  $R_B$  and connect the link B to contact 15. The collector current should be small, much less than 0.1mA for a germanium transistor and negligibly small for a silicon device.

Now connect link B to contact 10 and note  $I_C$ . This will probably be less than 1mA. Whatever the value of  $I_C$ , replace  $R_B$  by a resistor of value such that  $I_C = 1\text{mA}$  (as near as possible). The base current corresponding to this collector current is calculated as follows.

From Fig. 1.2, it can be seen that the battery voltage  $V_{BB}$  is divided by the potential difference across  $R_B$  and that between the base and emitter terminals of the transistor. Thus the potential difference across  $R_B = V_{BB} - V_{BE}$ . But since  $V_{BE}$  is much less than  $V_{BB}$ , even if a silicon transistor is used, it can be neglected by comparison; the whole of the base circuit supply voltage  $V_{BB}$  can be considered to exist across  $R_B$ .

Ohm's Law now tells us that the base current  $I_B \approx V_{BB}/R_B$ . Having calculated this current, and knowing  $I_C$  and  $V_{CE}$ , mark in a point such as  $A_1$  shown in Fig. 1.6.

Next shunt  $R_B$  with a resistor of the same value in order to double  $I_B$ . Read the new value of  $I_C$  and mark in point  $B_1$  on Fig. 1.6: Next shunt  $R_B$  with two further resistors of the same value so that  $I_B$  is three times and then four times its initial value. Note the corresponding values of  $I_C$  and mark in points  $C_1$  and  $D_1$ .

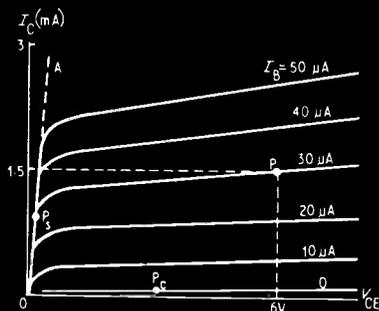


Fig. 1.4. A set of transistor output characteristics

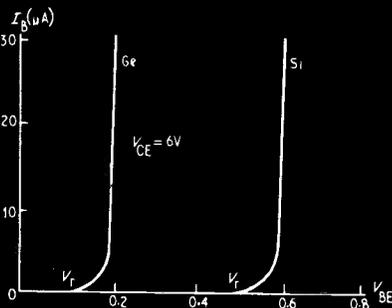


Fig. 1.5. Transistor input characteristics

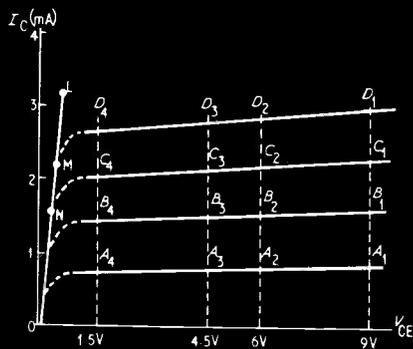
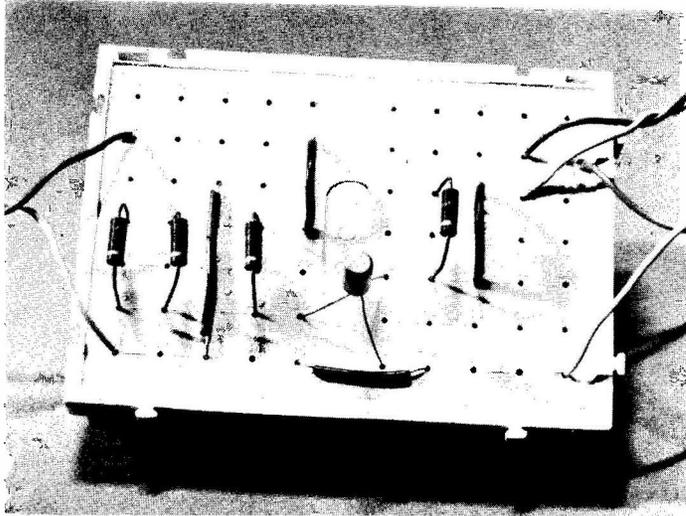


Fig. 1.6. Plotting the output characteristics



Photograph of the arrangement shown in Fig. 1.3

The whole procedure is then repeated using batteries, for  $V_{CC}$  of 6V, 4.5V and 1.5V, and points  $A_2, B_2, C_2, D_2$  etc. marked in on Fig. 1.6. The small-slope sections of the characteristics can be drawn in as shown. The saturation part of the characteristic can now be found.

Replace the supply battery  $V_{CC}$  by one of 9V and remove the link A in order to place the collector load resistance  $R_3$  in circuit. A suitable value is 3.3 kilohms. Insert resistance  $R_B$  of gradually decreasing value until the collector current no longer rises. This occurs when the transistor saturates.

Calculate the voltage dropped along  $R_C$  at saturation using Ohm's Law, i.e.  $V_L = I_C R_3$ , where  $I_C$  is the saturation collector current  $I_{C(sat)}$ . The collector-emitter voltage at saturation is therefore  $V_{CE(sat)} = V_{CC} - V_L$ . Mark in the point L corresponding to these values of  $I_{C(sat)}$  and  $V_{CE(sat)}$  on Fig. 1.6.

Repeat the whole procedure with  $R_3 = 4.7$  and 5.6 kilohms, and obtain points such as M and N. Join points L, M and N by a smooth curve to complete the characteristics.

The whole procedure described above need take no longer than it does to read the instructions, once a little practice is obtained.

For the home experimenter who is interested in a quick check of a particular transistor, rather than a more complete knowledge of the characteristics as a set, all that is usually required is to check that  $I_C$  is approximately zero at  $I_B = 0$ , and then find a value of  $R_B$  for which  $I_C$  is about 1mA. The current gain is then obtained by dividing the indicated  $I_C$  by the calculated value of  $I_B$ .

### TRANSISTOR OPERATED AS A SWITCH

The circuit shown in Fig. 1.7 depicts a transistor amplifier with collector load resistance  $R_L$ . Part of the supply voltage  $V_{CC}$  is dropped across  $R_L$ , the remainder between the collector and emitter terminals. Thus

$$\begin{aligned} V_{CC} &= V_L + V_{CE} \\ \text{But } V_L &= I_C R_L \\ \text{so } V_{CC} &= I_C R_L + V_{CE} \\ \text{or } V_{CE} &= V_{CC} - I_C R_L. \end{aligned}$$

This last equation is the load-line equation for the load  $R_L$ . It shows that

- (a) if  $I_C = 0, V_{CE} = V_{CC} - 0 = V_{CC}$ ,
- (b) if  $V_{CE} = 0, I_C R_L = V_{CC}$ , so  $I_C = V_{CC}/R_L$ ,
- (c) if  $V_{CE} = V_{CC}/2, I_C = V_{CC}/2R_L$ .

These points are plotted at the extremities and centre of a load line in Fig. 1.8 (p, q, r).

A transistor can be used to switch the current through  $R_L$  on and off if it is operated between cut-off (i.e. point  $P_C$  almost at the lower end of the load line) and a point higher up the load line corresponding to the required current. The higher point is frequently the saturation point  $P_S$  for the following reason. At  $P_S, V_{CE} = V_{CE(sat)}$  and is very small, so although  $I_C$  may be large, the power dissipated in the transistor,  $V_{CE} I_C$ , is small. The power is also small at cut-off, since  $I_C$  is very small even though  $V_{CE}$  may be large.

At a point about half way up the load line however, the power dissipated in the transistor is a maximum, and equal to  $(V_{CC}/2) \times (I_{C(sat)}/2)$ . For example, suppose we have the following numerical values,

$$\begin{aligned} I_C &\approx 0.1\text{mA}, V_{CE} = 6\text{V at cut-off,} \\ I_C &\approx 100\text{mA}, V_{CE} = 0.1\text{V at saturation,} \end{aligned}$$

then  $I_C = 50\text{mA}, V_{CE} = 3\text{V}$  at the mid-point of the load line. The power dissipations are therefore:

$$\begin{aligned} \text{At cut-off, } &0.1\text{mA} \times 6\text{V} = 0.6\text{mW,} \\ \text{At saturation, } &100\text{mA} \times 0.1\text{V} = 10\text{mW,} \\ \text{At mid-point, } &50\text{mA} \times 3\text{V} = 150\text{mW.} \end{aligned}$$

It can be seen from these results that a transistor with a maximum rated dissipation of only 100mW could be used for switching between saturation and cut-off,

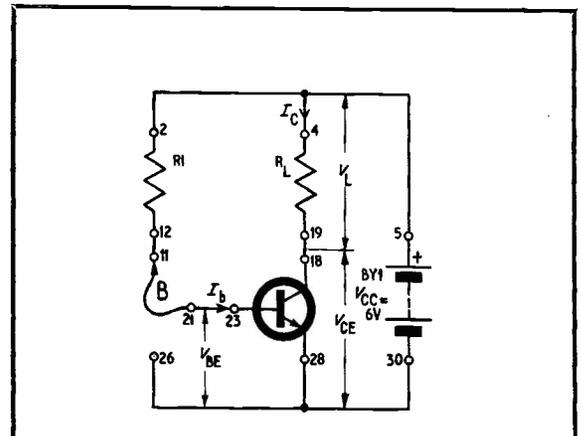


Fig. 1.7. A transistor amplifier circuit

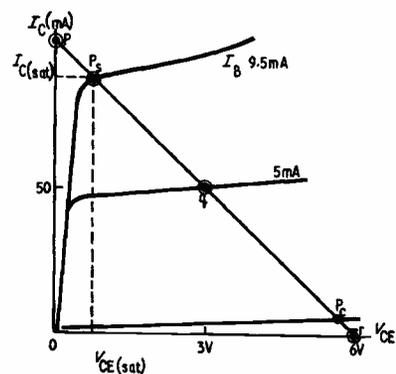


Fig. 1.8. Plotting the load line for the circuit given in Fig. 1.7

provided first that it can carry a steady current of 100mA, and second that it is made to spend most of its time at cut-off or in saturation. The transitions between cut-off and saturation would have to be fast.

It is for this reason that in first-approximation designs using small low power transistors as switches, it is important to be certain that sufficient base current can be supplied in order to ensure saturation.

### LAMP DRIVER

When TR1 in Fig. 1.7 is cut-off,  $I_C = 0$  so  $V_L = 0$ . When it is saturated,  $V_{CE} = V_{CE(sat)} \approx 0$ , so  $V_L = 6V$ . Also, if  $R_L = 60$  ohms,  $I_{C(sat)}$  will be  $6/60 = 100mA$ . Hence if  $R_L$  is a 6V, 100mA lamp, it will be off when the transistor is cut-off, and on when the transistor is saturated.

Connect up the circuit and check that the bulb is switched on and off when the link B is changed from socket 11 to socket 26. If the transistor used happens to have an  $h_{FE}$  value greater than 20, the base current being supplied will be more than sufficient to ensure saturation. Check this by changing  $R_B$  in small steps, keeping a careful watch on the bulb.

As soon as the bulb glows with less than its maximum brightness, the transistor is not being operated under saturation conditions. The power which is not now being dissipated by the bulb is being dissipated as heat from the transistor.

Some high-gain TO18 or plastics transistors may be harmed in this circuit, e.g. 2N930 or BC108. TO5 size devices, or TO1 metal-canned devices such as the OC72 will operate satisfactorily.

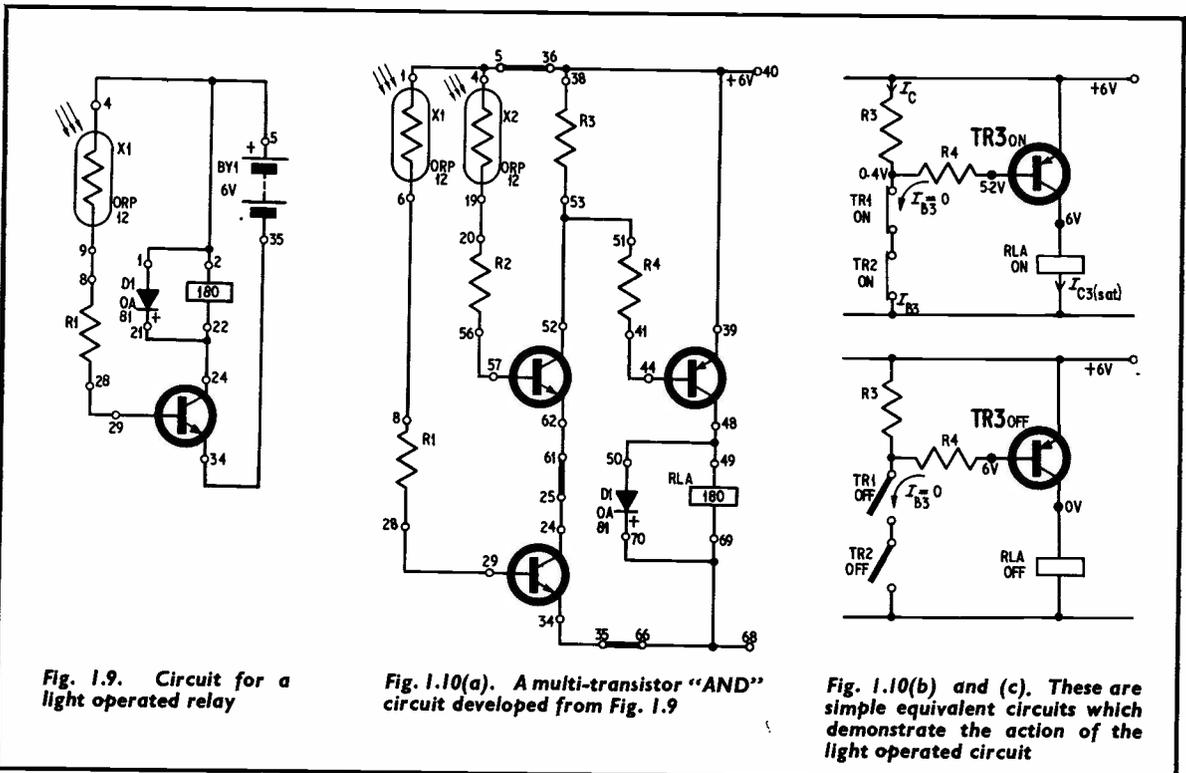


Fig. 1.9. Circuit for a light operated relay

Fig. 1.10(a). A multi-transistor "AND" circuit developed from Fig. 1.9

Fig. 1.10(b) and (c). These are simple equivalent circuits which demonstrate the action of the light operated circuit

In order to avoid excess power dissipation in the transistor, the base current supply must be sufficient to ensure saturation. At 100mA collector current, the average general purpose or switching transistor might have a d.c. current gain of only 20. Thus the base current must be  $100/20 = 5mA$  to meet this "worst case" possibility.

If a surplus transistor is used, it might be desirable to double this current to allow for a minimum possible  $h_{FE}$  of 10. The base current flows through  $R_B$  which drops a voltage  $V_{CC} - V_{BE(sat)}$  under saturation conditions. Hence using the value of 20 for the minimum  $h_{FE}$ ,

$R_B = (6 - 0.8)V/5 \approx 1,000$  ohms for a silicon device, or  $R_B = (6 - 0.3)V/5 \approx 1,200$  ohms for a germanium device.

### LIGHT OPERATED RELAY

The ORP12 photo-conductive cell shown in Fig. 1.9 has a low resistance when brightly illuminated and a high resistance when in darkness (megohms). The cell is used to pass base current under conditions of bright illumination and in sufficient quantity to saturate the transistor. When the transistor saturates, the collector current, which also flows through the relay coil, actuates the relay. The relay used is a 6V, 180 ohm type. Calculation of component values is as follows.

$$I_{C(sat)} = 6/180 = 30mA$$

$$\text{If } h_{FE(min)} = 20$$

$$I_{B(sat)} = 30/20 = 1.5mA.$$

Let the combined resistance of the ORP12 and  $R_1$  be equal to  $R_B$

Then  $R_B = (6 - 0.8)/1.5$  kilohms for silicon,  
 or  $R_B = (6 - 0.3)/1.5$  kilohms for germanium.  
 Thus try  $R_B = 3.3k\Omega$  (Si)  
 or  $3.9k\Omega$  (Ge)

The extra base resistor  $R_1$  is included to protect the transistor from too high a base current under conditions of extremely bright illumination when the resistance of the ORP12 may be very small. Any transistor should be able to withstand a base current of 5mA without harm.

Thus we arrange for  $R_1$  to limit the base current to this value even under the lower possible resistance of the ORP12, namely zero. Hence  $R_1 = 6V/5 = 1,200$  ohms (we have ignored  $V_{BE}$  here).

The diode shown shunting the relay coil can be almost any type to absorb the stored energy (back e.m.f.) from the relay coil when the magnetic field collapses during the switch-off period. If the diode is not included, the back e.m.f. set up by the relay coil might be sufficiently large to exceed the collector-emitter breakdown voltage and possibly damage the transistor. Such diodes are always included across inductive loads in switching circuits.

### LIGHT OPERATED AND CIRCUIT

The circuit shown in Fig. 1.10 is included to show how to calculate the component values in a multi-transistor circuit. TR1 and TR2 are *nnp* transistors while TR3 is *ppn*. There is no reason why TR1 and TR2 should not be *ppn* and TR3 *nnp*, provided that the battery and diode polarities in the current are reversed.

Collector current cannot flow through TR1 if TR2 is cut off and vice-versa, because the two transistors are connected in series. Therefore, these transistors can only saturate when both photo-conductive cells are illuminated simultaneously.

If both TR1 and TR2 are cut off, the base current flow path for TR3 is blocked as shown, so TR3 is also cut off. If both TR1 and TR2 are saturated, they act as low resistances and allow a path along which current can flow from the base of TR3. TR3 can therefore saturate if  $R_4$  has a low enough value.

Typical voltage values are shown in Fig. 10 for a circuit employing silicon transistors. Component values are calculated starting from the output end of the circuit as follows.

If the relay is a 6V, 180 $\Omega$  type,

$$I_{C3(sat)} = 6/180 = 33\text{mA}$$

Assuming  $h_{FE3(min)} = 20$ ,  $I_{B3(sat)} = 33/20 = 1.6\text{mA}$ .

Hence  $R_{4(min)} = (5.2 - 0.4)/1.6 \approx 3,300$  ohms.

Let  $I_{C1(sat)} = I_{C2(sat)} = 5\text{mA}$  (a current at which the average small switching transistor will have plenty of current gain) and assume a minimum current gain of 20.

Then  $R_C = (6 - 0.4)/5 = 1,100$  ohms.

and  $I_{B1} = I_{B2} = 5/20 = 0.25\text{mA}$ .

The resistance in each base lead of the series transistors must therefore be  $(6 - 0.9)/0.25 \approx 2,200$  ohms. (The 0.9V is the average base voltage on TR1 and TR2). The limiting resistors  $R_1$  and  $R_2$  can be about 4.7 kilohms each in order to limit the base currents to about 1mA.

If these calculations are repeated with base-emitter voltages assumed to be zero, it will be seen that few errors of importance will be made. If germanium transistors are to be used, the above component values will therefore suffice. If need be, the values can easily be recalculated using the base-emitter voltage of 0.3V under saturation conditions, instead of the 0.6V used above.

*To be continued*



## EXHIBITION

"CRITICS of annual exhibitions are often heard to complain that they become in time the mixture as before. To some extent this is true of our International Radio Engineering and Communications Exhibition, but I venture to suggest that this sameness is one of its salient features . . . Yet from another point of view we must try never to be accused of sameness." Thus wrote, Mr John Swinnerton, President of the R.S.G.B., in his "Foreword" for the show catalogue.

As one of the participants of this exhibition, held at the New Horticultural Hall, London, from October 1 to 4, *Practical Electronics* is well aware of this "sameness."

If ever an exhibition, albeit for amateur interests, needs progressive thought in its design, this one does to update the image of modern communications to its rightful position in modern society.

### HOME CONSTRUCTION

*Practical Electronics* had a communication receiver on show of revolutionary design (now being published). *Practical Wireless* exhibited a panoramic receiver of simple construction and suitable for visual display of signals on the 80 and 160 metre bands.

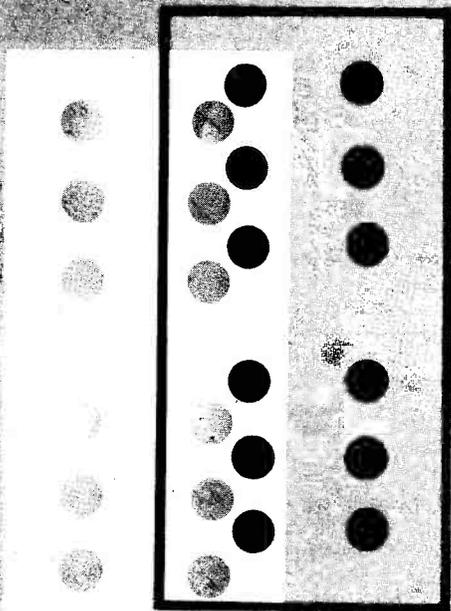
Although not strictly communications, P.E. were fully justified in showing advanced techniques in the "50 plus 50" fully stabilised power transistor amplifier, which can deliver up to 120 watts r.m.s. power from each channel of a stereo outfit. This design will no doubt find many homes in ham shacks for transmitter modulation when published in the near future.

Probably the most interesting feature of an otherwise clerical R.S.G.B. stand is the section devoted to the display of home constructed equipment, including transmitters, receivers and even a discotheque control panel. The standard achieved by the worthy award winners is often on a par with professional work, and one tends to think that many of these undertake similar work as a full time occupation.

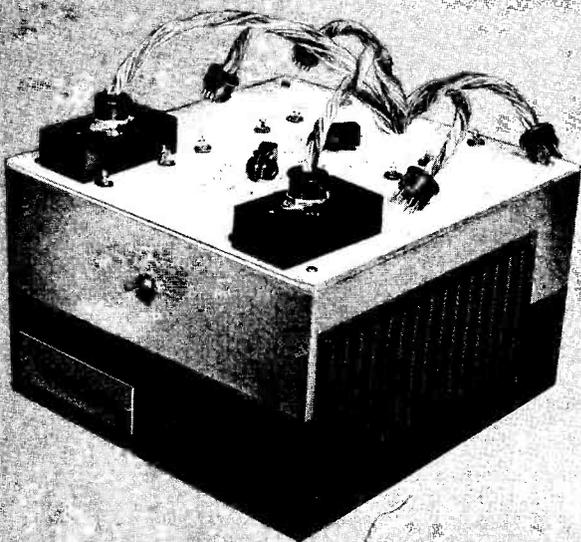
### WORKING DEMONSTRATIONS

It was apparent that working demonstrations attracted some of the best crowds. These included those put on by the British Amateur Television Club, Cable and Wireless with their teleprinters and facsimile transmitters and receivers, British Amateur Teleprinter Group, and the Royal Navy Amateur Radio Society who conducted morse code proficiency tests. The Post Office celebrated their change to the Ministry of Posts and Telecommunications by demonstrating their latest type of television detector vehicle for the u.h.f. as well as v.h.f. bands.

Several visitors come to the exhibition every year, and it was obvious that this is a good way of meeting those faceless radio contacts over a sandwich downstairs. But behind the very conspicuous R.A.F. *Skynet* satellite world communications demonstration, there was an equally large and conspicuous empty space. If only some seats could have filled this space many a QSO could have taken place face to face in comfort.



# DOUBLE SIX



By S. J. KEARLEY

**D**DOUBLE SIX is a machine which plays dominoes. In operation Double Six is given six dominoes, face down, and plugged into them. When it is Double Six's turn to play, the machine causes a light to appear opposite the most favourable domino, at the same time emitting a "cackling" noise. If unable to play, Double Six makes a dismal moaning noise. Full playing instructions and the rules by which Double Six plays will be given later in this article.

## STRATEGY

Double Six's strategy has been kept fairly simple so as to keep down the complexity and price of the machine. If allowed to play first against good opposition, Double Six should win just over half the time.

The strategy is as follows:

1. To play a domino matching one of those on the end of the chain.
2. When there is a choice between two dominoes, to play the domino with the most spots on. This gives the machine a useful chance of winning if nobody is able to play, and the total number of spots are counted. This rule is broken for "doubles" which are played in preference to any other dominoes—even those with more spots on. This is for three reasons:
  - (a) One has two chances of disposing of most dominoes, as they have two different numbers on. However, "doubles" have the same number on both ends, and so there is a correspondingly smaller chance of disposing of them, especially towards the end of the game. So it is advisable to play "doubles" while one has the chance.
  - (b) If the opponent plays onto the opposite end from the "double", Double Six will certainly be able to play on its next turn.
  - (c) If the opponent cannot play and the machine plays a "double", the opponent will still be unable to play, and so he will miss yet another turn.
3. When unable to play, the machine must acknowledge this fact. In the prototype this was achieved by making the machine "moan", and this has proved one of Double Six's most popular features. The machine may easily be modified to make a "knocking" sound if a more conventional response is desired.

## DOUBLE SIX CIRCUIT

The main circuit diagram is shown in Fig. 1. TR1 and TR2 form a multivibrator, the output of which is fed to TR6 via the emitter follower TR3. The emitter follower prevents TR6 from loading the multivibrator and so stopping it oscillating. When TR6 is being driven the primary of T1—the winding that was originally the 6.3 volt secondary—has an a.c. voltage of approximately 9V across it and an output of approximately 350V is obtained at D2 causing a high voltage to build up across C3.

If any indicating neons (V2 to V13) strike current flows through R6 and R7 making the base of TR5 negative and hence turning on TR4 and TR5. This virtually shorts the base of TR6 to the positive line and prevents it being driven by TR3; it also turns off TR10, reverse biasing D4. Transistor TR9 will now oscillate in bursts, unaffected by TR8 which is turned off via D3. The bursts of oscillation form the "cackle",

heard when Double Six can play, and this can be adjusted by VR2; the pitch can also be varied by altering C5.

Once the oscillation at TR6 collector has stopped, the voltage across C3 will fall until the neon which has fired extinguishes, returning the circuit to its original condition. The voltage across C3 then begins to build up again. This process causes the neon to flash and prevents the voltage across C3 from rising above the striking voltage of the neon in the lowest resistance path.

If the machine cannot play a domino, V1 eventually strikes, this turns on TR7, reverse biasing D3 and allowing TR8 to oscillate, producing the "moan". By increasing R12 in value the oscillator can be made to block and so produce a "knocking" sound.

While Double Six is on, a rising voltage is applied to the pins of plugs PL1 to PL6 (Fig. 3), for this reason a biased off switch has been used for S1.

### CONSTRUCTIONAL DETAILS

Most of the circuitry was constructed on a piece of plain Veroboard using pins for transistor and fly lead connection and the component wires for wiring up where possible, see Fig. 2. The transistors should be added when the rest of the circuit has been completed and the whole unit can then be housed in a suitable wooden case similar to that shown in the photographs. The case must be large enough to house the circuit board, batteries, transformer and loudspeaker, and there should be plenty of room under the top panel to allow for wiring to switches S2 and S3; the suggested case size is 10in × 9in × 6in deep.

### FRONT PANEL CONSTRUCTION

The front panel is made of paxolin,  $\frac{1}{4}$ in diameter holes are drilled for the neons (see Fig. 6), rubber grommets are inserted, and the neons pushed into the grommets. (If the glass envelopes of the neons are moistened slightly, this job is made much easier.) Switches S2 and S3 are single pole, 10- or 12-way wafer switches; only seven positions are used.

Wiring to the switches and neons on the top panel is shown in Fig. 5. Two small tag strips were used for the wires from pins 1 and 9 on the B9A plugs but these are not essential if longer wires are fitted. The wiring connections to the B9A plugs are shown in Figs. 3 and 4; each wire is thin p.v.c. covered, preferably colour coded to make wiring easier. The wires to each plug are twisted together. As seven wires are to be connected to each tag of S2, each individual wire should be carefully inserted into its tag, and bent over to keep it in place. Solder is not applied until all the wires are in place.

It is wise to check the wiring to each plug with a continuity tester or an ohmmeter before soldering, in case wiring errors have been made. Such errors would be extremely difficult to track down at a later stage. The length of the wires to each B9A plug should be adjusted so that each plug matches its own position on the top panel.

### DOMINO DETAILS

The dominoes are made from solid blocks of wood, a  $\frac{3}{4}$ in diameter hole being drilled in each to accept a B9A valveholder, see Fig. 7. It is advisable to obtain the valveholders either off old TV chassis, or from a "surplus" supplier, as otherwise the cost of these components may be rather high. The inside of each hole should be varnished to prevent leakage through the wood. The dominoes are painted matt black, and

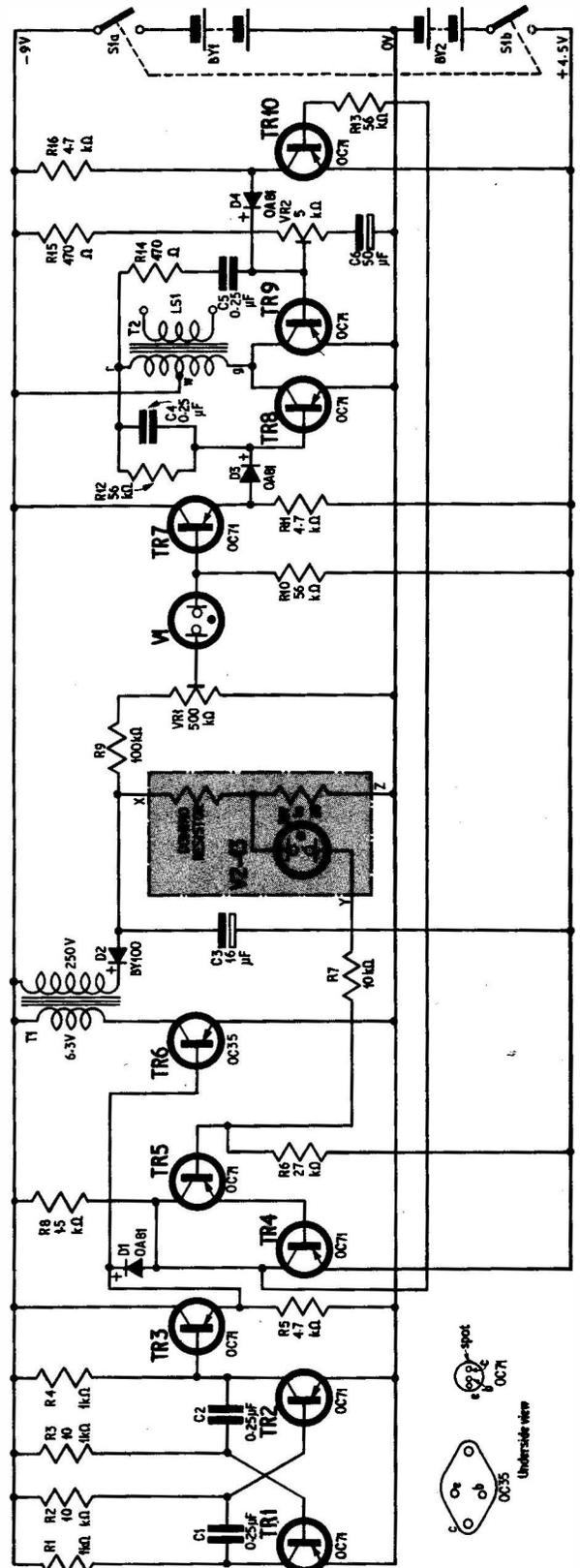


Fig. 1. The main circuit diagram of Double Six

Table I. DOMINO WIRING DATA

| Domino | Resistor      | Pins | Resistor     | Pins | Domino | Resistor      | Pins | Resistor      | Pins |
|--------|---------------|------|--------------|------|--------|---------------|------|---------------|------|
| 6-6    | 0             | 1-8  | 0            | 9-8  | 4-3    | 150k $\Omega$ | 1-6  | 100k $\Omega$ | 9-5  |
| 6-5    | 56k $\Omega$  | 1-8  | 22k $\Omega$ | 9-7  | 4-2    | 220k $\Omega$ | 1-6  | 100k $\Omega$ | 9-4  |
| 6-4    | 100k $\Omega$ | 1-8  | 22k $\Omega$ | 9-6  | 4-1    | 330k $\Omega$ | 1-6  | 100k $\Omega$ | 9-3  |
| 6-3    | 150k $\Omega$ | 1-8  | 22k $\Omega$ | 9-5  | 4-0    | 470k $\Omega$ | 1-6  | 100k $\Omega$ | 9-2  |
| 6-2    | 220k $\Omega$ | 1-8  | 22k $\Omega$ | 9-4  | 3-3    | 0             | 1-5  | 0             | 9-5  |
| 6-1    | 330k $\Omega$ | 1-8  | 22k $\Omega$ | 9-3  | 3-2    | 220k $\Omega$ | 1-5  | 150k $\Omega$ | 9-4  |
| 6-0    | 470k $\Omega$ | 1-8  | 22k $\Omega$ | 9-2  | 3-1    | 330k $\Omega$ | 1-5  | 150k $\Omega$ | 9-3  |
| 5-5    | 0             | 1-7  | 0            | 9-7  | 3-0    | 470k $\Omega$ | 1-5  | 150k $\Omega$ | 9-2  |
| 5-4    | 100k $\Omega$ | 1-7  | 56k $\Omega$ | 9-6  | 2-2    | 0             | 1-4  | 0             | 9-4  |
| 5-3    | 150k $\Omega$ | 1-7  | 56k $\Omega$ | 9-5  | 2-1    | 330k $\Omega$ | 1-4  | 220k $\Omega$ | 9-3  |
| 5-2    | 220k $\Omega$ | 1-7  | 56k $\Omega$ | 9-4  | 2-0    | 470k $\Omega$ | 1-4  | 220k $\Omega$ | 9-2  |
| 5-1    | 330k $\Omega$ | 1-7  | 56k $\Omega$ | 9-3  | 1-1    | 0             | 1-3  | 0             | 9-3  |
| 5-0    | 470k $\Omega$ | 1-7  | 56k $\Omega$ | 9-2  | 1-0    | 470k $\Omega$ | 1-3  | 330k $\Omega$ | 9-2  |
| 4-4    | 0             | 1-6  | 0            | 9-6  | 0-0    | 0             | 1-2  | 0             | 9-2  |

Note: Resistors shown as 0 must be wire links between the pins indicated

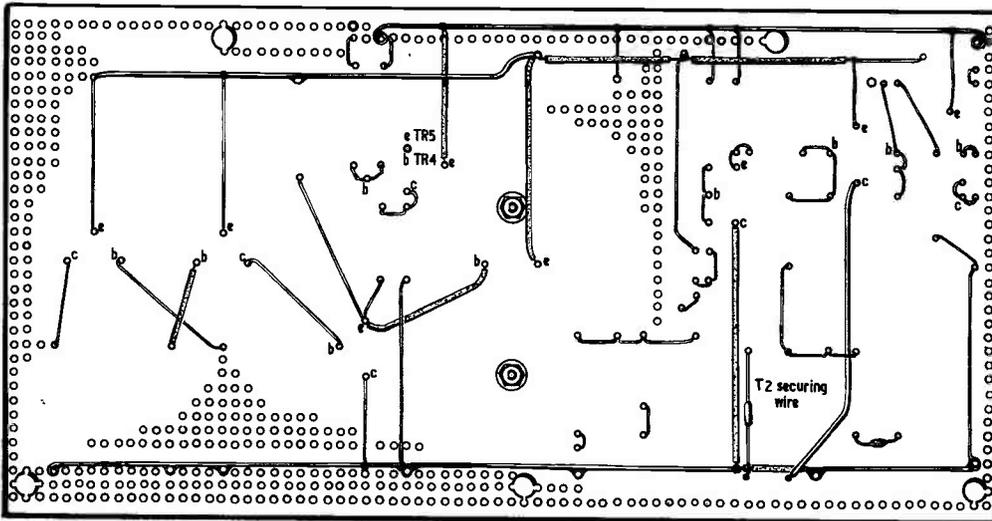
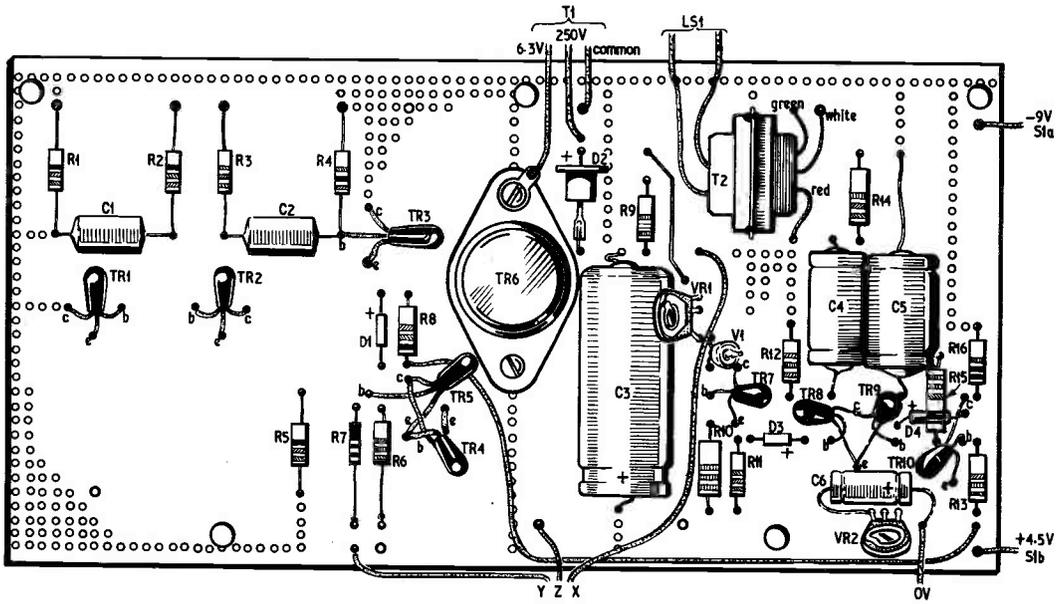


Fig. 2. Component layout and wiring of the circuit board

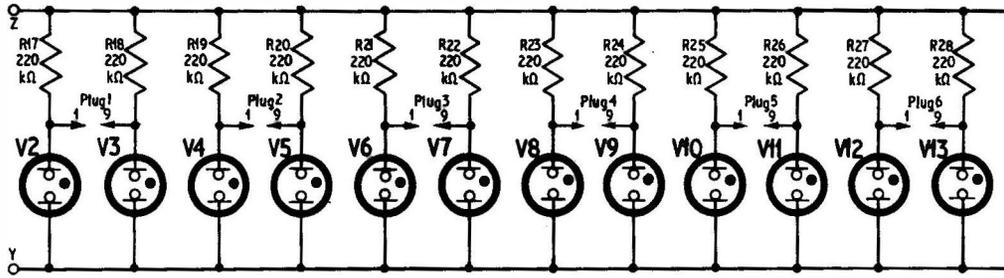


Fig. 3. Circuit diagram of the components mounted on the front panel

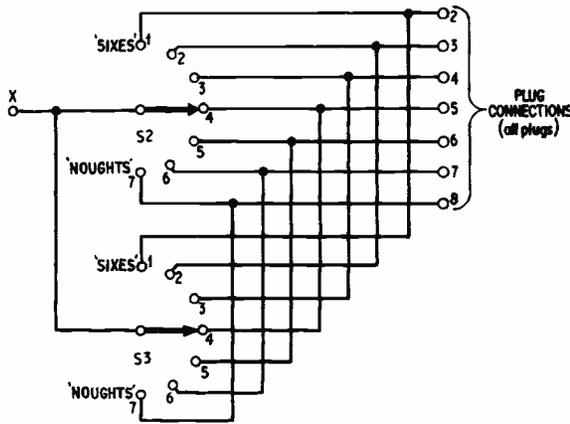


Fig. 4. Circuit details of the selector switches

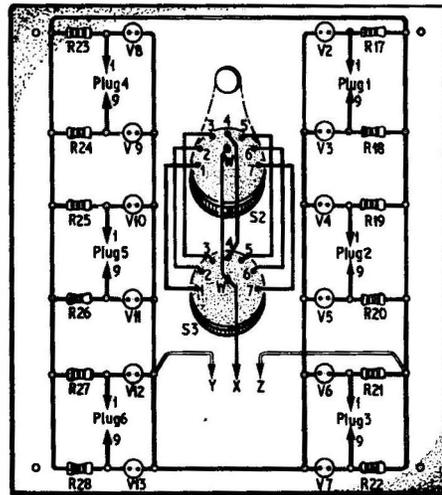


Fig. 5. Top panel wiring details

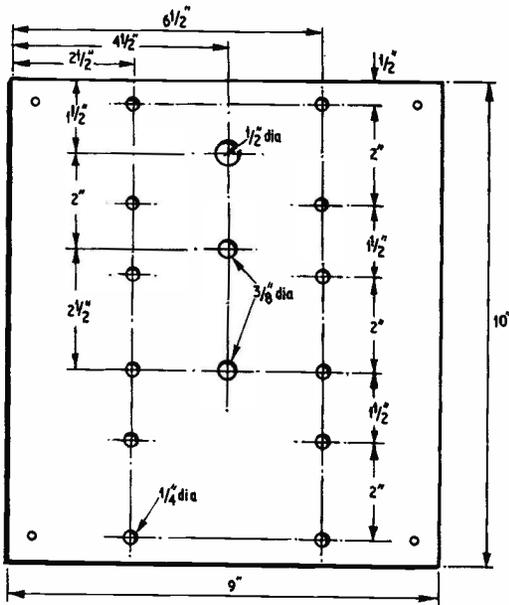


Fig. 6. Top panel drilling measurements

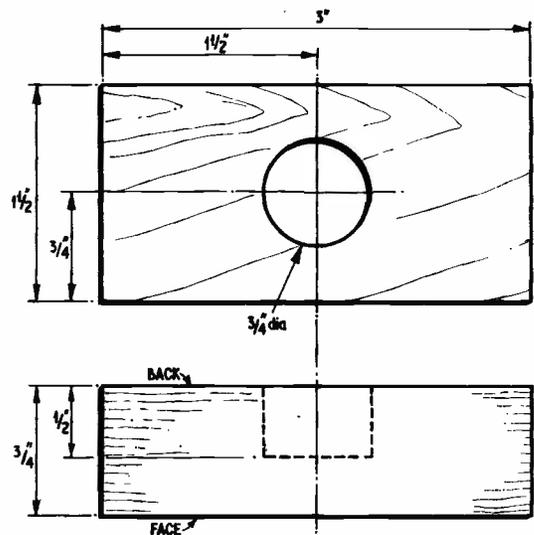


Fig. 7. Details of a domino. The 28 dominoes can be made from one 7ft 6in length of  $1\frac{1}{2} \times \frac{3}{4}$ in wood

## COMPONENTS...

### Resistors

|         |                       |
|---------|-----------------------|
| R1      | 1k $\Omega$           |
| R2      | 10k $\Omega$          |
| R3      | 10k $\Omega$          |
| R4      | 1k $\Omega$           |
| R5      | 4.7k $\Omega$         |
| R6      | 27k $\Omega$          |
| R7      | 10k $\Omega$          |
| R8      | 1.5k $\Omega$         |
| R9      | 100k $\Omega$         |
| R10     | 56k $\Omega$          |
| R11     | 4.7k $\Omega$         |
| R12     | 56k $\Omega$          |
| R13     | 56k $\Omega$          |
| R14     | 470 $\Omega$          |
| R15     | 56k $\Omega$          |
| R16     | 4.7k $\Omega$         |
| R17-R28 | 220k $\Omega \pm 5\%$ |

All  $\pm 10\%$ ,  $\frac{1}{4}$  watt carbon except where stated

### Resistors for dominoes (6 of each)

|               |            |
|---------------|------------|
| 22k $\Omega$  | $\pm 10\%$ |
| 56k $\Omega$  | $\pm 10\%$ |
| 100k $\Omega$ | $\pm 10\%$ |
| 150k $\Omega$ | $\pm 5\%$  |
| 220k $\Omega$ | $\pm 5\%$  |
| 330k $\Omega$ | $\pm 5\%$  |
| 470k $\Omega$ | $\pm 5\%$  |

All  $\frac{1}{4}$  watt carbon

### Capacitors

|    |                        |
|----|------------------------|
| C1 | 0.25 $\mu$ F           |
| C2 | 0.25 $\mu$ F           |
| C3 | 16 $\mu$ F elect. 450V |
| C4 | 0.25 $\mu$ F           |
| C5 | 0.25 $\mu$ F           |
| C6 | 50 $\mu$ F elect. 12V  |

### Potentiometers

|     |                               |
|-----|-------------------------------|
| VR1 | 500k $\Omega$ skeleton preset |
| VR2 | 5k $\Omega$ skeleton preset   |

### Semiconductors

|          |              |
|----------|--------------|
| TR1-TR5  | OC71 (5 off) |
| TR6      | OC35         |
| TR7-TR10 | OC71 (4 off) |
| D1       | OA81         |
| D2       | BY100        |
| D3       | OA81         |
| D4       | OA81         |

### Switches

|    |  |
|----|--|
| S1 | D.P.D.T. biased off                                |
| S2 | Single pole 10- or 12-way wafer (only 7 ways used) |
| S3 | Single pole 10- or 12-way wafer (only 7 ways used) |

### Miscellaneous

|                                       |  |
|---------------------------------------|--|
| V1-V13                                | miniature (wire ended) neons                             |
| T1                                    | Mains transformer. Secondary 0-6.3V (used in oscillator) |
| T2                                    | LT700 transistor push/pull output type, 19.4 : 1         |
| LS1                                   | Small 3 $\Omega$ loudspeaker                             |
| BY1                                   | 3V type 800 (3 off)                                      |
| BY2                                   | 4.5V type 1289   |
| PL1-PL6                               | B9A plugs (6 off)  |
| B9A                                   | valveholders (28 off)                                    |
| Veroboard                             |  |
| Grommets small (12 off)               |  |
| Wood for case and dominoes (see text) |  |

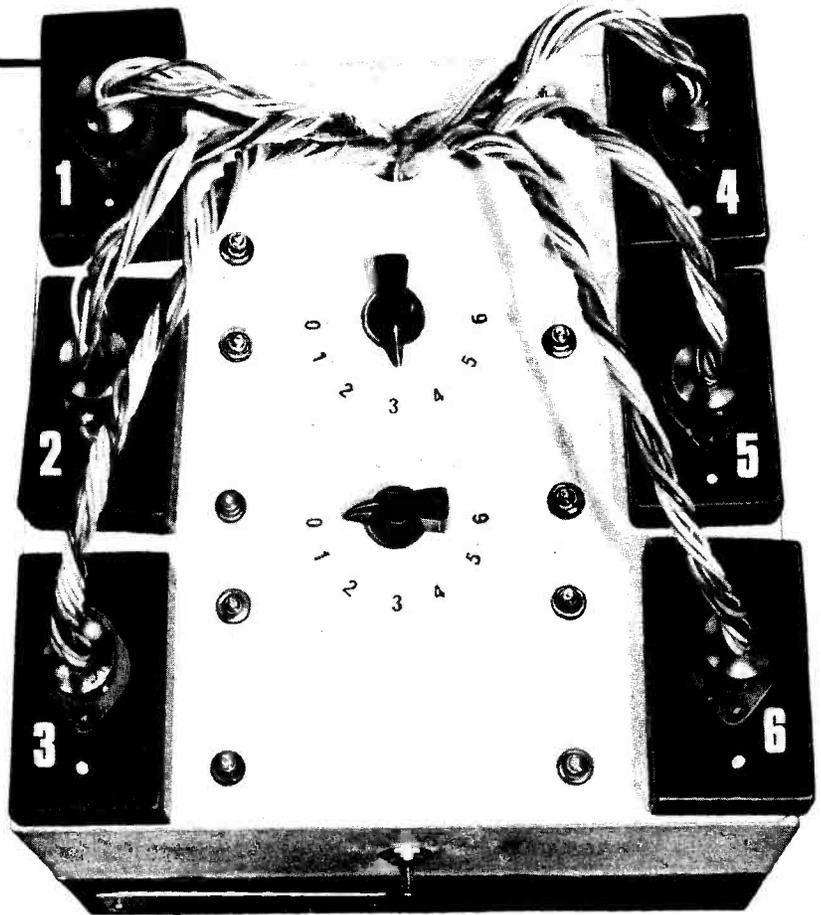


Fig. 8. View of the top panel of Double Six showing the dominoes in their positions and the indicating marks on the dominoes

drawing pins with white plastic covered heads inserted as the spots on the dominoes.

It is necessary to place a small dab of glue under the head of each drawing pin, or the plastic covering the heads may fall off. The connections of the resistors inside each domino are given in Table 1.

### BASIS OF OPERATION

The pins of the socket in the dominoes to which resistors are connected define the number of spots on either face of the domino; the value of the resistor defines how many spots are on the other face. To give an example of Double Six in action, let us assume that the 6-0 domino is in position 1 (Fig. 8) and that the 6-4 is in position 2.

When S2 or S3 is switched to "sixes", a steadily rising voltage is applied to pin 2 on each B9A plug. So the neon indicating position 1 is connected to h.t. via a 470 kilohm resistor, whilst the neon indicating position 2 is connected via a 100 kilohm resistor. Therefore there is a greater fraction of the h.t. voltage across the neon indicating position 2 than across the neon indicating position 1, therefore it will strike first. This is arranged to cause the h.t. voltage to fall and therefore the neon will switch off allowing the voltage to rise again.

This results in the neon indicating position 2 to flash and the "cackling" to be heard, while the neon indicating position 1 will not attain its striking voltage. The machine thus indicates that the 6-4 domino is to be played, in accordance with its strategy.

### DOMINO MARKING

It is desirable to make the machine light the neon opposite the end of the domino which matches, e.g. when set to play "sixes" (tag 1 on S2 and S3 connected) and playing a 6-4 domino, to light the neon opposite the "six" end rather than the "four" end.

For this reason the dominoes are marked with a locating spot as in Fig. 8. This is done by the following method:

- (a) Fit the valvholder such that pins 1 and 9 are on the same side as the locating mark.
- (b) For each domino, ensure that the higher number of spots is on the same side as the locating mark.
- (c) When plugging dominoes onto the machine, orient them so that the locating mark always faces the front, i.e., S1 end of Double Six.

### SETTING UP

When the wiring has been completed, the following setting up operations are required. Disconnect the wire from h.t. to S2, and turn VR1 clockwise (no voltage across V1). Check that the voltage across C3 exceeds 310 volts. It will possibly be well in excess of this and if it is over 350V a resistor should be placed in series

with TR6 collector and T1. The value of this resistor can be determined by trial and error to obtain an output of around 350 volts.

The current drawn by TR6 when oscillating is approximately 350mA, so large capacity batteries must be used. Turn VR1 anticlockwise until V1 strikes; this should be accompanied by the "moan" from the speaker. If all is well, connect point X to S1 wiper, and plug in a domino, setting up its value on S2 and S3. Soon after switching on S1 the "cackling" sound should be heard and a neon should flash alongside the domino. If not, check the connections to first the domino, then the plug. If the neon comes on but does not flash, check the circuitry around TR4 and TR5.

When Double Six is functioning satisfactorily, it is ready for its "test" game. Put six dominoes face down in positions 1 to 6, with the locating marks facing the front of the machine and plug them in. Choose six dominoes for yourself, and play one of them. Set S2 and S3 to inform the machine as to what you have played and switch on S1. A cackle will probably be heard, accompanied by a neon flashing alongside a domino. Switch off S1, remove the domino, and play it next to your own. The correct end to play is that alongside which the neon was flashing (for this reason it is necessary to put the dominoes in the right way round). Continue in this way until the game is finished.

This design has no provision for starting the game—the procedure adopted is to set S2 and S3 to "sixes or fives" and if Double Six has none of these (very unlikely) to try fours. If preferred, a seven pole two-way switch could be wired between h.t. and S2, in order to connect tags 1 to 7 to h.t. when S1 is in the "on" position. The machine would then play a "double" or a six or five if it had no "double".

### RULES OF THE GAME

Since there are many variations of the game of dominoes, it would be as well to state the rules of the game which Double Six plays. (By modifying the circuit slightly, it should be possible to programme the machine to play other variations.) Each player is given six dominoes face-down, which he does not show to his opponents. The first player may put down any domino he chooses to start with. If a player has no domino matching the ones on the table, he admits this, usually by knocking on the table, and misses his turn.

The first player to dispose of all his dominoes is the winner. If no player has a domino which matches, the player with the lowest total number of spots on his remaining dominoes is the winner. It should be noted that, as no player knows which dominoes his opponents have, and the selection of dominoes which each player gets depends on chance alone, the outcome of the game is not strictly determined, and no strategy can guarantee a win. This is in contrast to games like Noughts and Crosses, or Nim, where correct play always arrives at a predetermined result. ★

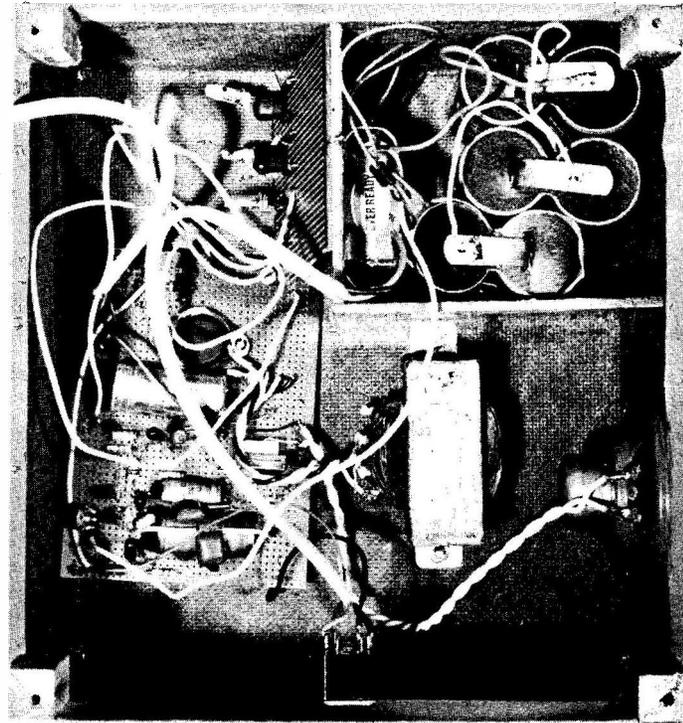
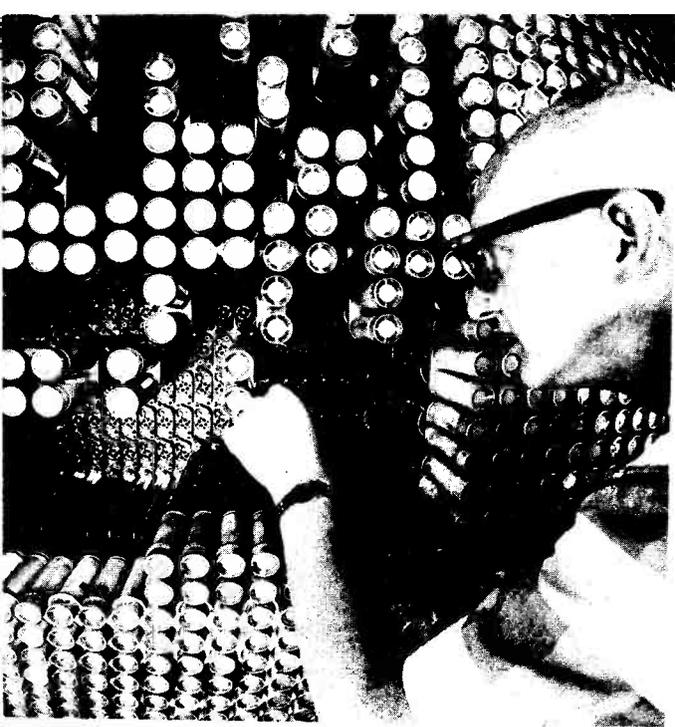


Fig. 9. Prototype wiring; the main circuitry has now been included on a single board. This shows the positioning of the major components in the case



### Advanced Radar System

**S**YSTEM tests on a new advanced radar prototype— forerunner of what could be the world's most powerful radar for defence against missile attack in the 1970's and beyond—have begun at Hughes Aircraft Company in California.

The tests include radar range exercises and actual detection and tracking of air traffic. The prototype, a scale version of a proposed long-range system called ADAR (Advanced Design Array Radar), will be the most powerful radar yet built by Hughes.

An engineer is shown making adjustments to energy feeds on a scale prototype of the new phased-array radar. The energy feeds are devices that channel radio-frequency energy between points in the system.

# ELECTRONORAMA

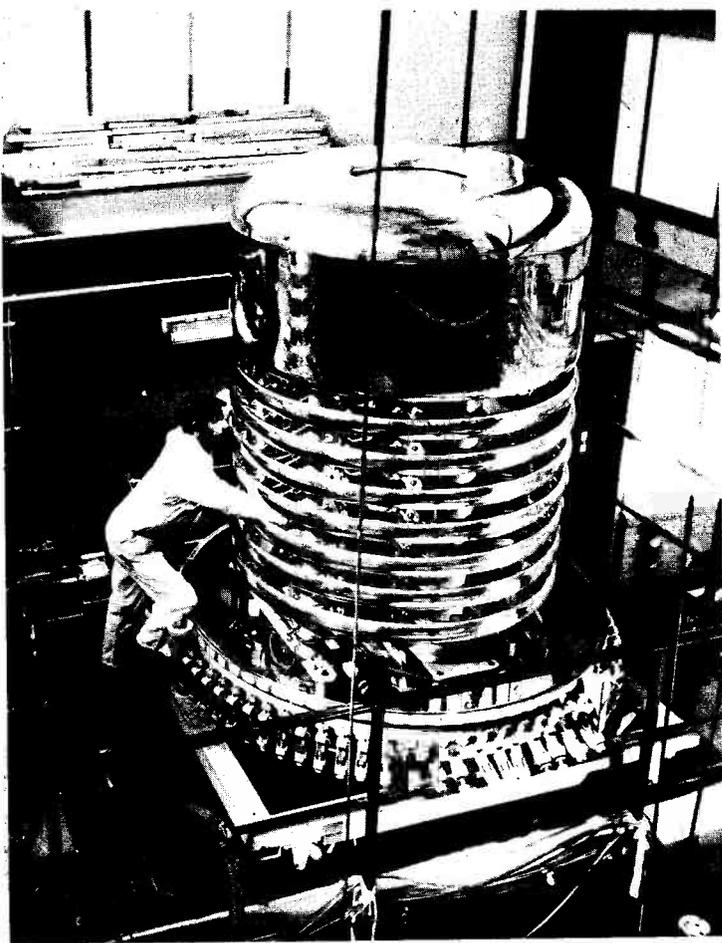


### Laser Television Tape Player

**A** LABORATORY model of a revolutionary, low-cost colour television tape player built around lasers and holography and destined for home use in the early 1970's was unveiled recently by RCA. In commercial form the tape player, named "Selectavision", is expected to be the first consumer product to employ lasers, and will be designed to attach to any standard colour or black and white television set. It will play full-colour programmes recorded on tapes made of the same clear, inexpensive plastic material used in supermarkets to wrap and display meats. The material for the tapes will cost only about one-tenth as much as conventional type films.

The clear plastic Selectavision programme tapes will be scratch-proof, dust-proof, and virtually indestructible under conditions of normal use. They will have countless replay capabilities, be able to run in slow motion, or be able to be stopped and started at will so that a single frame can be studied at length, if desired. The player itself will be compact, and as easy to operate as a modern cartridge player.

*The television tape player is shown in use on the left —tape cartridges can be changed easily as can be seen from the photograph*



## Giant Microscope

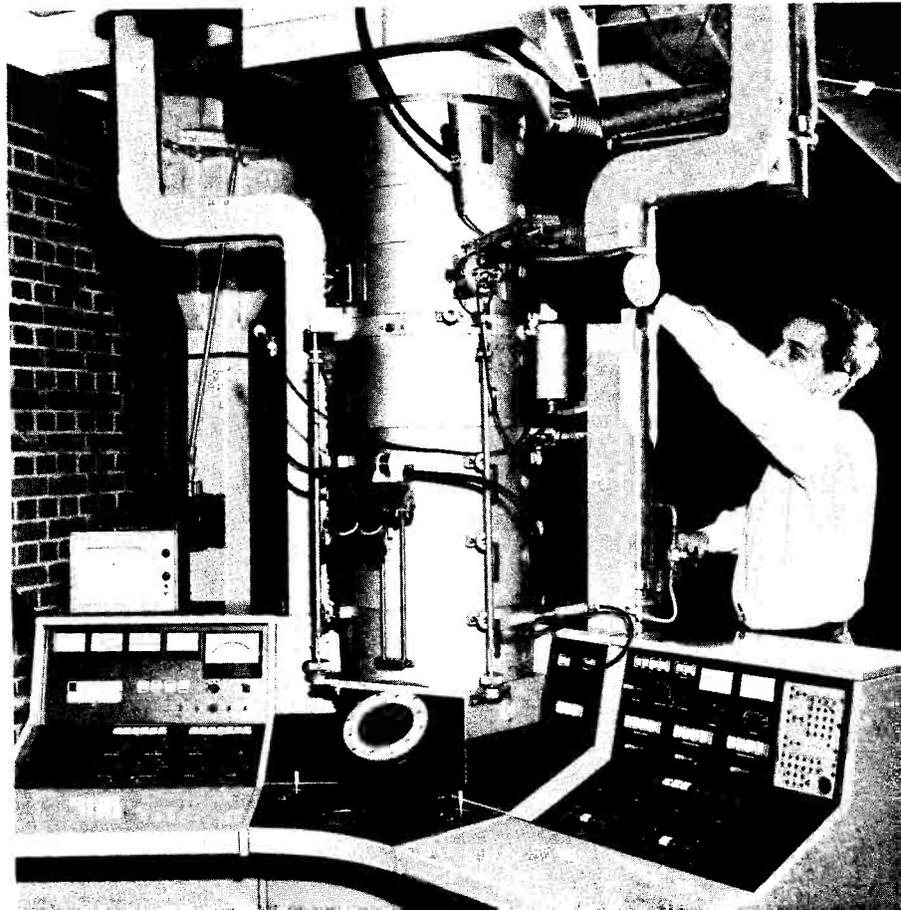
**T**HE first of five giant electron microscopes is nearing completion at the AEI Scientific Apparatus Limited; it has already been operating successfully at one million volts during tests.

In November the UKAEA, Harwell, will take delivery of this advanced instrument, the first commercial million-volt electron microscope to be built in Europe. It will be used to investigate thicker sections of metals and materials than hitherto possible using an electron beam accelerated by ten times the voltage used in a conventional high resolution electron microscope. The beam will probe the samples in an effort to discover new information about the structure and behaviour of metals both in common use and those with special properties needed for new technological developments.

Biologists will also use these electron microscopes to study the structure of cells. There is also the exciting possibility that the great penetrating power of these new instruments may permit observation of living material in special protective surroundings in the microscope.

*The accelerator and voltage generator (above) of the AEI million-volt electron microscope during manufacture. Five of these instruments are on order from AEI*

*The massive microscope column (right), over 8ft high and 18in diameter, and the control desks*



# FOR AN PART 2

## By Alan Douglas, Sen. Mem. I.E.E.E.

In the last two parts we have presented all of the tone forming circuitry as Veroboard modules.

Since the solo accompaniment and pedal sub-assemblies are contained in a metal box, details of the shelf needed for mounting this are presented first. In addition to the screening box this shelf also serves as a platform for the 23 stop tab units used variously for voice selection.

### VOICE BOX SHELF

The shelf supporting the voice box and stop tab assemblies measures 4ft 3½in by 8in by ½in and is of plywood. Reference to the console rear view given in Part Two shows that the shelf just clears the upper manual assembly.

To fix this position, measure off 6in from the lower keyframe and make pencil marks on the console sides "A" shown in Fig. 1.4. Angle brackets or lengths of 1in batten can be affixed at these marks and the shelf attached.

### STOP PANEL ASSEMBLY

In Fig. 8.1 is given details of the stop panel (A) and keyboard flanking panels (B).

Whilst the latter need not be made up at this stage, it is rather important that the stop panel is, as the four rectangular apertures will fix the final placement of the stop tab units. With the panel completed this can be temporarily screwed to the top panel B of Fig. 1.4. If the keyboard flanking panels have been made up it should be possible to press fit this without a screw.

### STOP TAB UNITS

The stop tab units used are made by Kimber-Allen Ltd. These are manually operated switches which are used to activate or de-activate the individual voice nets of the tone forming circuitry.

Each switch has a smooth positive toggle action and there is screw adjustment with felt stops for correct positioning of the tab.

In the tone networks of Fig. 6.5 the stop switches, S1-S10, are shown open; here the voices are active as square waves from the pre-amplifier are not short circuited to ground.

For this condition to prevail, the switch tabs would normally be depressed hence the stop tab unit required is of the depress-to-break variety.

However, for the 8ft Dolce in the accompaniment and the 16ft Sub-Bass of the pedals a depress-to-make type of switch is required as additional filtration is being included to soften the voice it complements.

Of the 23 stop units called for, two are spares—for additional functions as required—and one used for switching the tremulant motor.

Details of a stop unit is given in Fig. 8.2. The accompanying photograph shows the order of the stop voices as viewed at the stop panel.

### TAB ENGRAVING

The tabs used are standard K-A types, again available from Kimber-Allen Ltd. These are tapered and radiused at the nose. Made from cellulose sheet, they can be obtained in a choice of three colours: grained ivorine, red, and black. On the prototype organ the choice was ivorine for the solo tabs, red for the accompaniment, and black for the pedals.

When ordering the stop units and tabs, engraving details should be included as follows:

Table 8.1.

| Solo            | Accompaniment | Pedals        |
|-----------------|---------------|---------------|
| Contra Viola 16 | Dolce 8       | Major Bass 16 |
| Contra Tibia 16 | Flute 8       | Sub Bass 16   |
| Viola 8         | Viola Acute 8 | Base Flute 8  |
| Tibia 8         | Flute 4       |               |
| Tibia 4         | Violins 4     | Tremulant     |
| Violina 4       | Clarinet 8    | Leslie Trem   |
| Piccoto 2       | Trumpet 8     |               |
| Double Horn 16  |               |               |
| Echo Horn 8     |               |               |
| Oboe 2          |               |               |

### SCREENING BOX ASSEMBLIES

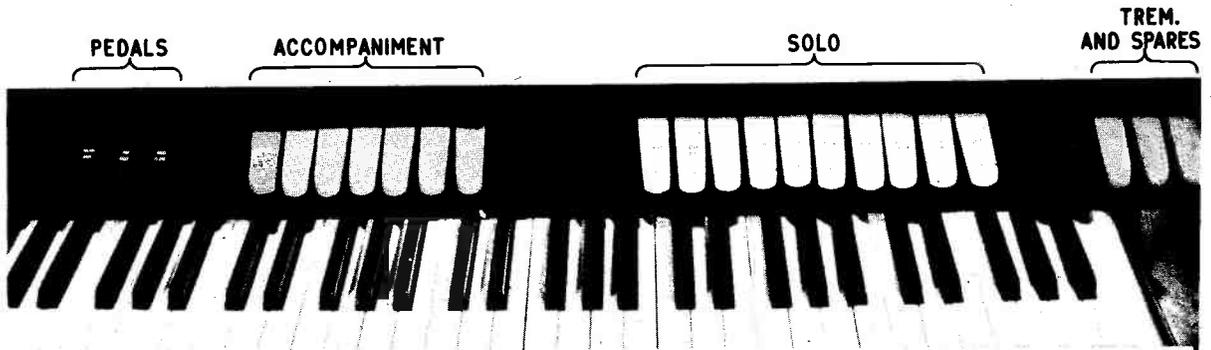
When the stop tab units have been shelf mounted, we can proceed with the mounting of the voicing sub-assemblies in a metal screening box.

The screening box, which measures 24in by 5½in by 2in is shown in the photograph with the sub-assemblies mounted inside. The chokes, boards and relevant cables are shown annotated. The box drilling requirements are for busbar, filter and stop unit leads; the placement of these is not critical. This 16 s.w.g. aluminium box must have a lid to be effective. It can be obtained undrilled from H. L. Smith and Co., Ltd., 287/289 Edgware Road, London, W.2.

To insulate the Veroboard modules, two lengths of 5in by 8in s.r.b.p. board are used, one for each pair of sub-assemblies. Reference to the photograph shows the coils centrally placed between these assemblies. These coils are in fact the first items to be mounted, this being achieved by Aralditing.

With this completed, the two tag strips can be mounted. These serve merely as junctions between the fragile choke wires and Veroboard assemblies.

# FINAL CONSOLE DETAILS



Stop units in position with tabs shown projecting at stop panel apertures. Table 8.1. gives the order of the stop engravings reading from left to right

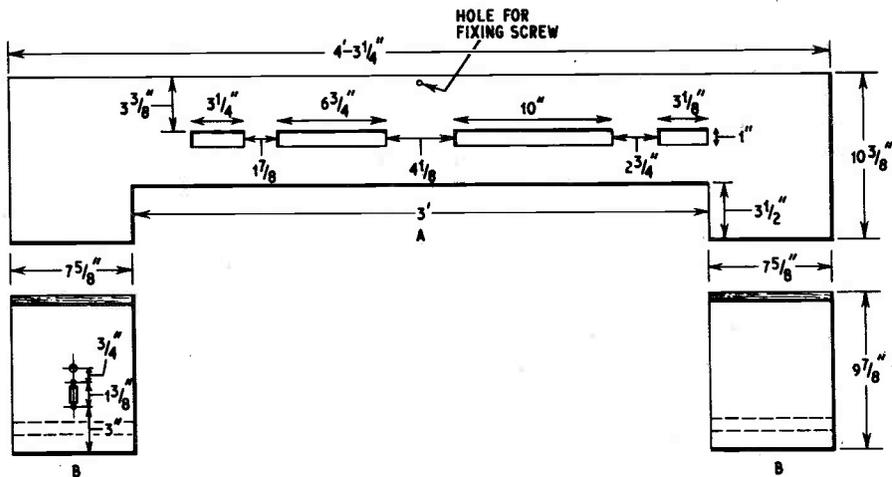


Fig. 8.1. Details of stop panel (A) and keyboard side panels. With the stop apertures cut these should be lined with green felt

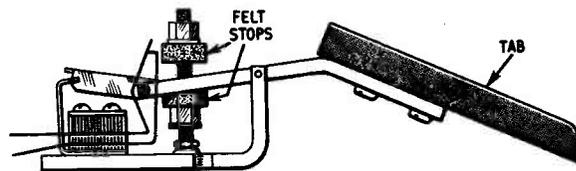


Fig. 8.2. Details of a stop tab unit

The wires should be carefully cleaned with a fine gauge sandpaper before soldering. The first unit to be wired up and mounted is the solo pre-amplifier board. Details of this are given in Fig. 6.3 where it can be seen that there are four busbar connections and two positive and negative supply connections.

We have previously connected coaxial cables at the busbars so it only means routing these as shown in the photograph and connecting at the points shown in Fig. 6.3.

As these cables travel the length of the box, cable clip fixing is necessary. Small polythene press-fixing straps were used here.

The supply lines can be conveniently picked off from the oscillators and taken through a hole drilled in the shelf. This supply, of course, will feed all of the pre-amplifiers in the box, it only being necessary to parallel the connections.

## WIRING THE SOLO FILTERS

The next board to wire is that of the solo filters. Wiring between this and the adjacent pre-amplifier board is fully detailed in Fig. 6.6 so this can be undertaken.

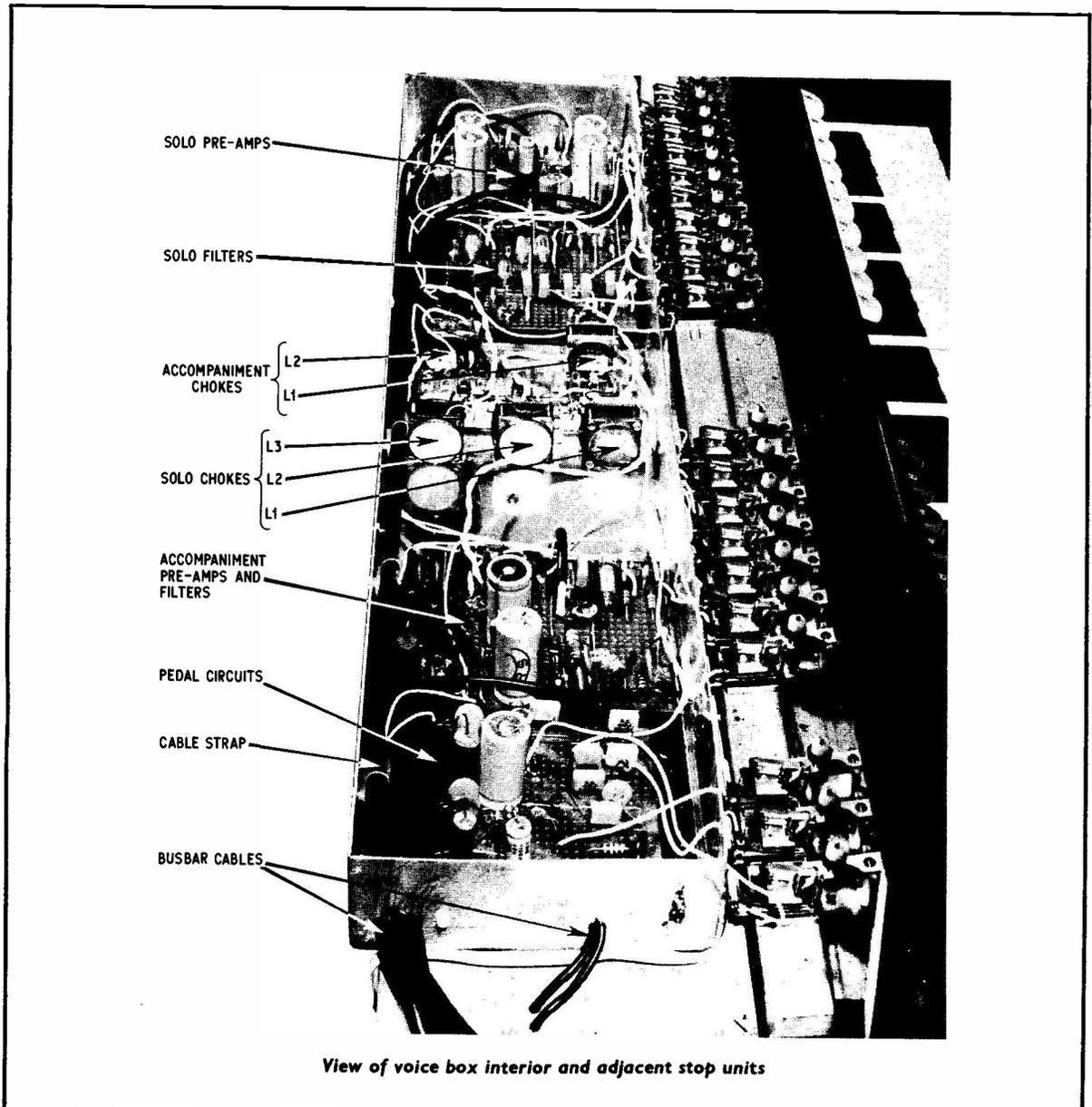
Lengths of sleeved wires are connected at the stop units shown as S1-S10 in Fig. 6.5 and then run through the holes drilled as shown in Fig. 8.3.

Connections to the chokes at the tag strips are by twisted wire pairs.

## ACCOMPANIMENT AND PEDAL BOARDS

The wiring of the accompaniment and pedal boards follow the same general procedure as has gone before.

The 8ft and 4ft pitch coaxial cables are routed from the accompaniment busbars through the box and connected as in Fig. 7.2; then the stop switches are con-



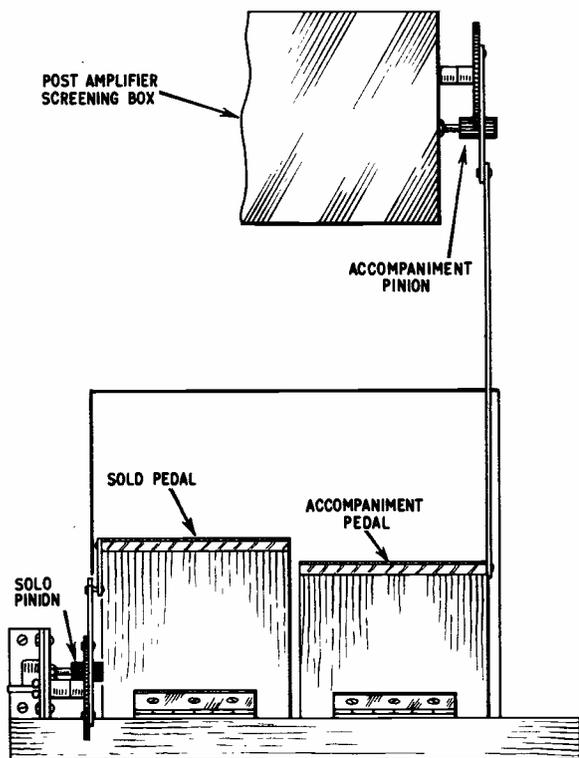
View of voice box interior and adjacent stop units

nected. At this stage connection from the solo and accompaniment filter outputs can be made with 2ft lengths of miniature coaxial cable.

As was described in Part Four, the pedal inputs are taken from pins 31 and 32 of one of the pedal sockets, so lengths of coaxial cable can be taken from the pedal socket chosen. The accompanying photograph to Fig. 4.1 shows these cables clearly.

With these terminated at the pedal pre-amplifiers it remains to earth their screens. This is done at the pedal sockets by baring the coaxial braid and soldering a common wire connection to a simple aluminium surround seen in the photograph of the pedal resistor boards in Part Four. This screens the pedal plugs and resistor boards from extraneous field influences.

With the stop switches wired, it only remains to loop in the supply lines from the pre-amplifier board. Now, since the negative supply line is finally grounded, this should be connected to the aluminium of the voice box; suitable connection will be found at the screwed terminals of the choke tag strips.

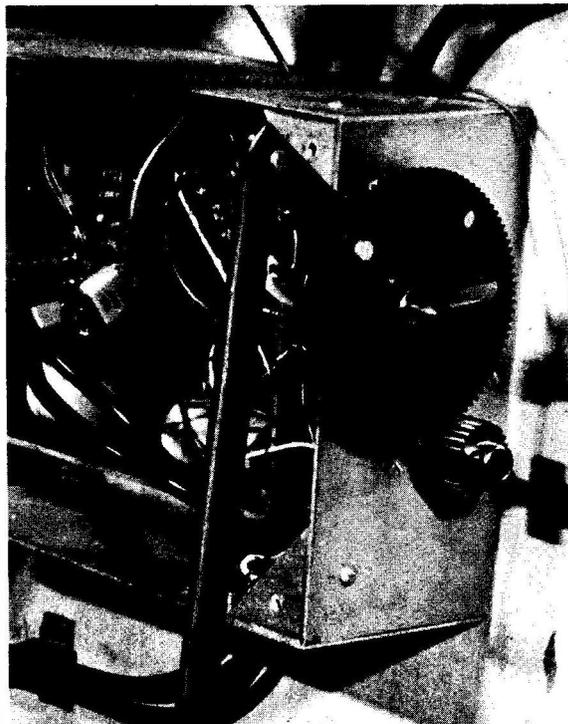


**Fig. 8.3. Solo and accompaniment swell pedals shown hinge mounted**

To complete the earth line of the voicing circuits, a length of 22 s.w.g. tinned copper wire is strung along the unattached connectors of the stop tab units and soldered. The free wire end is soldered to a tag at the screening box.

### POST AMPLIFIER SCREENING

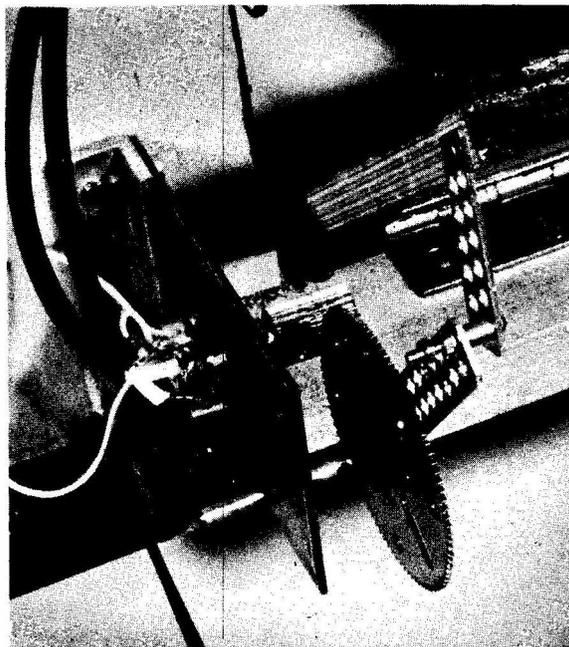
The outputs from the manual filters terminate at the post amplifiers "A" and "B" as described in Part Seven. The two cables used are again miniature coaxial. Before any flying connections are made to these Veroboard assemblies a 7in by 5in by 2½in screening box should be fixed to the kneeboard with two binder screws, positioning being indicated in the



**Details of accompaniment swell linkage at post amplifier screening box**

rear console view given in Part Two. This box is lidded an can also be obtained from H. L. Smith Ltd. In this is mounted the post amplifiers "A" and "B" using s.r.b.p. insulating boards. Sufficient space should be left for mounting the swell potentiometer and gear wheel as seen in Fig. 8.3 and the photograph.

**Details of solo swell linkage. The bush for mounting the large wheel spindle is soldered to the brass plate**



Now we can go on to wiring these amplifiers. First, 15V supply leads are taken again from the oscillator shelf and connected as shown in Fig. 7.10. Then the filter coaxial cables are connected, making sure that the copper braid is grounded at the box.

### EXPRESSION PEDALS

The next thing to tackle is the expression pedals. Two have to be made from 9½in by 5in by ¾in plywood and faced one side with ribbed rubber or linoleum. In the usual type of construction, these pedals are carried on substantial metal rods and pivots, but we are not making them do much work so plain 3in steel hinges will suffice as shown in Fig. 8.3 and Fig. 8.4.

First of all a piece of 2in by 1in hardwood is screwed across the swell aperture of the kneeboard at the bottom. This is reinforced at the end with metal strips which are screwed to the lower frame member. This can be seen in the photograph.

Two lengths of pierced s.r.b.p. or metal strip are used to transmit the pedal movement. To fix the strip at the pedal end a 1in round head wood screw with washer is used. The shorter strip is bolted to the large gearwheel to give about 25 degrees of movement to the pedal for a full rotation of the potentiometer.

The small pinions will need to be drilled out slightly to fit the ¼in spindle of the potentiometer. Standard Meccano spindles support the 60 tooth wheels.

The potentiometer for the accompaniment swell is situated near to the bottom of the post amplifier screening box as seen in the photograph. The fitting of this component is not critical, the main object being to ensure a straight pull being exerted on the connecting strip by the pedal. Full details of the gear assembly are given in Fig. 8.3.

If 4B.A. screws with nylon locknuts are used to assemble the moving parts, a good degree of stiffness can be imparted to the movement.

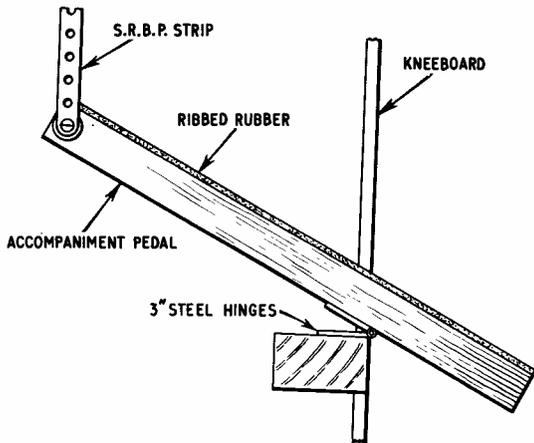


Fig. 8.4. Side view of accompaniment pedal

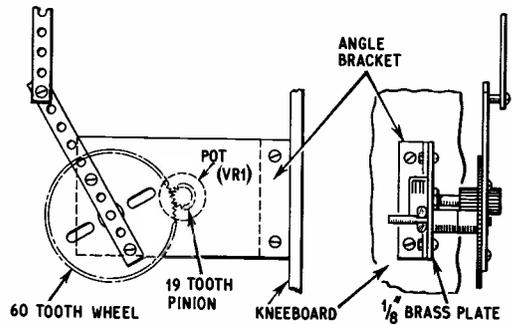


Fig. 8.5. Detail of solo swell linkage which is identical to the accompaniment assembly on the post amplifier screening box. To stiffen the pedal action nylon, lock nuts should be used at the junction of the s.r.b.p. strips

The hinges are then attached to the wood block and pedals; plain wood side of course.

### SWELL MECHANICS

We could control the volume by several means, including photocells, but to keep the circuits as simple as possible we use logarithmic 4.7 kilohm potentiometers as the emitter resistors of the post amplifier emitter follower outputs as shown in Fig. 7.8.

The potentiometer for the solo post amplifier "A" is mounted below the divider boards. The potentiometer for the accompaniment post amplifier "B" is on the post amplifier screening box. For the gear assembly we need two No. 26A 19 tooth pinions and two No. 27D 60 tooth gear wheels. These items should be obtainable from any Meccano parts stockist.

Fig. 8.5 gives details of the solo swell linkage. Here the potentiometer and gear train are mounted on ½in brass plate which is fixed to the kneeboard by way of an angle bracket.

With the potentiometers connected, these can be wired to the post amplifier outlets, making sure that all earth return lines terminate at the post amplifier screening box.

### MAINS WIRING

The mains wiring layout is given in Fig. 8.6. A three-pin 5A socket is fitted to a wooden bracket as shown in the photograph of the console rear given in Part Two. Two terminal strips serve to route the supply to the master switch S1 and neon indicator to the left keyboard flanking panel shown in Fig. 8.1.

The switch is an on/off rocker switch type RS200 available from Henry's Radio Ltd. S2 is the tremulant stop unit, the capacitor across it being used for spark suppression as without it unpleasant thumps feed through to the speakers when the tremulant motor is switched in.

# SUPER BARGAIN STOCKTAKING SALE!!!

Use the form below for your order. **CONDENSERS MUST BE ORDERED BY STOCK NUMBER ONLY.** If any sale item is "sold-out" when order received we shall substitute items of equal value.

## ELECTROLYTIC CAPACITORS

| Stock No. | Capacity       | Voltage | Price | No. Req'd | £ s. d. | Stock No. | Capacity    | Voltage | Price | No. Req'd | £ s. d. |
|-----------|----------------|---------|-------|-----------|---------|-----------|-------------|---------|-------|-----------|---------|
| 1         | 1µF            | 6       | 4d    |           |         | 39        | 100µF       | 275     | 2/6   |           |         |
| 2         | 4µF            | 25      | 4d    |           |         | 40        | 30µF        | 10      | 3d    |           |         |
| 3         | 4µF            | 4       | 4d    |           |         | 41        | 2,000/2,000 | 25      | 7/6   |           |         |
| 4         | 6µF            | 4       | 4d    |           |         | 42        | 16µF        | 50REV   | 2/-   |           |         |
| 5         | 3µF            | 25      | 4d    |           |         | 43        | 16/16       | 275     | 2/-   |           |         |
| 6         | 64µF           | 6       | 4d    |           |         | 44        | 16          | 275     | 1/-   |           |         |
| 7         | 20µF           | 6       | 4d    |           |         | 45        | 350         | 12      | 9d    |           |         |
| 8         | 20µF           | 50      | 6d    |           |         | 46        | 20/4        | 275     | 1/-   |           |         |
| 9         | 30µF           | 15      | 6d    |           |         | 47        | 250         | 50      | 2/-   |           |         |
| 10        | 8µF            | 12      | 4d    |           |         | 48        | 500         | 25      | 1/6   |           |         |
| 11        | 8µF            | 6       | 4d    |           |         | 49        | 400         | 15      | 1/-   |           |         |
| 12        | 1µF            | 350     | 6d    |           |         | 50        | 400         | 2.5     | 3d    |           |         |
| 13        | 8/8/8          | 350     | 1/-   |           |         | 51        | 64          | 275     | 1/9   |           |         |
| 14        | 50µF           | 6       | 4d    |           |         | 52        | 32/32       | 350     | 2/6   |           |         |
| 15        | 100/200        | 275     | 6/-   |           |         | 53        | 8/8/8       | 275     | 1/9   |           |         |
| 16        | 32             | 150     | 9d    |           |         | 54        | 500         | 6       | 6d    |           |         |
| 17        | 64             | 2.5     | 3d    |           |         | 55        | 64          | 275     | 1/3   |           |         |
| 18        | 100/200/200/50 | 275     | 7/6   |           |         | 56        | 25          | 6       | 3d    |           |         |
| 19        | 50/80          | 300     | 7/-   |           |         | 57        | 100         | 9       | 6d    |           |         |
| 20        | 150/200        | 275     | 6/-   |           |         | 58        | 400         | 50      | 2/-   |           |         |
| 21        | 24             | 275     | 1/-   |           |         | 59        | 400         | 30      | 1/6   |           |         |
| 22        | 10             | 25      | 3d    |           |         | 60        | 500         | 4       | 3d    |           |         |
| 23        | 125            | 2.5     | 3d    |           |         | 61        | 150         | 30      | 1/6   |           |         |
| 24        | 2              | 150     | 3d    |           |         | 62        | 64/32/8     | 275     | 2/6   |           |         |
| 25        | 16/32          | 350     | 2/6   |           |         | 63        | 200         | 275     | 2/6   |           |         |
| 26        | 32             | 275     | 1/6   |           |         | 64        | 40          | 6.4     | 3d    |           |         |
| 27        | 350            | 12      | 6d    |           |         | 65        | 50          | 25      | 6d    |           |         |
| 28        | 75/75/75/75    | 150     | 2/6   |           |         | 66        | 250         | 50      | 1/9   |           |         |
| 29        | 1              | 20      | 3d    |           |         | 67        | 30          | 6       | 3d    |           |         |
| 30        | 12.5           | 40      | 9d    |           |         | 68        | 100/100/50  | 275     | 5/-   |           |         |
| 31        | 640            | 2.5     | 3d    |           |         | 69        | 50/50/50    | 250     | 4/-   |           |         |
| 32        | 3,000          | 35      | 7/6   |           |         | 70        | 40/40/20    | 275     | 2/-   |           |         |
| 33        | 3,000          | 15      | 3/-   |           |         | 71        | 400         | 6.4     | 3d    |           |         |
| 34        | 3,000          | 30      | 7/-   |           |         | 72        | 320         | 10      | 3d    |           |         |
| 35        | 250            | 70      | 2/-   |           |         | 73        | 32/32       | 275     | 2/6   |           |         |
| 36        | 2,500          | 9       | 2/-   |           |         |           | 25          | 25      | 25    |           |         |
| 37        | 32             | 50      | 9d    |           |         |           |             |         |       |           |         |
| 38        | 750            | 12      | 1/9   |           |         |           |             |         |       |           |         |

Total:—

## RESISTORS. 5% EXCELLENT QUALITY. 7/6 per 100 or 2/- per doz.

Tick the values required.

|         |          |        |        |        |       |       |       |        |        |        |        |
|---------|----------|--------|--------|--------|-------|-------|-------|--------|--------|--------|--------|
| 13 ohms | 220 ohms | 1.5k Ω | 3.6k Ω | 7.5k Ω | 22k Ω | 39k Ω | 62k Ω | 130k Ω | 560k Ω | 1.8M Ω | 7.5M Ω |
| 22 ohms | 470 ohms | 1.8k Ω | 4.7k Ω | 10k Ω  | 24k Ω | 43k Ω | 75k Ω | 360k Ω | 620k Ω | 3.6M Ω | 8.2M Ω |
| 36 ohms | 560 ohms | 2.2k Ω | 4.7k Ω | 16k Ω  | 27k Ω | 47k Ω | 82k Ω | 430k Ω | 1.2M Ω | 5.1M Ω | 9.1M Ω |
| 47 ohms | 750 ohms | 2.4k Ω | 5.6k Ω | 18k Ω  | 30k Ω | 51k Ω | 91k Ω | 470k Ω | 1.5M Ω | 6.2M Ω | 10M Ω  |
| 91 ohms | 1k Ω     | 3.3k Ω | 6.8k Ω |        |       |       |       |        |        |        |        |

or our selection (mixed) 6/6 per 100

## SILVER MICA/CERAMIC/POLYSTYRENE CONDENSERS 10/- per 100, 3/- per doz.

Available in following values. Tick those required.

|       |      |      |      |      |       |       |       |       |       |         |         |
|-------|------|------|------|------|-------|-------|-------|-------|-------|---------|---------|
| 2pF   | 5pF  | 12pF | 25pF | 50pF | 80pF  | 135pF | 180pF | 250pF | 680pF | 1,000pF | 2,500pF |
| 3.9pF | 6pF  | 15pF | 27pF | 58pF | 82pF  | 140pF | 190pF | 330pF | 800pF | 1,100pF | 2,700pF |
| 4pF   | 8pF  | 18pF | 30pF | 62pF | 100pF | 158pF | 200pF | 420pF | 820pF | 1,500pF | 3,000pF |
| 4.7pF | 10pF | 22pF | 39pF | 72pF | 125pF | 170pF | 240pF | 600pF | 900pF | 2,200pF | 6,200pF |

Total:

# COMPARE THESE PRICES

## MULLARD POLYESTER CONDENSERS

| No.                  | Price |
|----------------------|-------|
| 1,000 pF 3d ea. 400V |       |
| 1,500 pF 3d ea.      |       |
| 1,800 pF 3d ea.      |       |
| 2,200 pF 3d ea.      |       |
| 0.15 µF 6d ea. 160V  |       |
| 0.22 µF 6d ea. 160V  |       |
| 0.27 µF 6d ea. 160V  |       |
| 1 µF 1/- ea. 125V    |       |

Total: \_\_\_\_\_

25% discount lots of 100 per type.  
50% discount lots of 1,000 per type.

## GANGED STEREO POTS. 250K Ω, 2/6 ea.

## SKELETON PRESETS. Mixed. 6/- doz.

## VOLUME CONTROLS. ½ M Ω, 1 M Ω, with D.P. switch, 2/- ea.

## TELEVISION REMOTE CONTROLS. Philips, contain 11 7-way cable, 1 double pot., 5 resistors, two condensers, 10/- ea. (cost £3/3/-).

## THIN CONNECTING WIRE 10yd 1/- 100yd 7/6. 1,000yd 50/-

## CO-AXIAL CABLE. Black. 6d yd, £1 50 yd.

## CRYSTAL MIKES. 10/- ea.

## THYRISTORS 400V BTY79, 7/6 ea. SCR51 (10A), £1 ea.

**RECTIFIERS** Latest type. All marked. 800V peak, 1A mean current type IN4006  
2/6 ea., 24/- doz, £7/10/- 100.  
S.T.C. 3/4 (400V), 2/6 ea., 24/- doz, £7/10/- 100.  
BYZ 13 or 19 (6A), 2/6 ea., 24/- doz, £7/10/- 100.

**TRANSISTOR BARGAIN! THEY CAN'T GET ANY CHEAPER!!!**  
P.N.P. Audio, Untested, unmarked. MAINLY O.K., 10/- per 100.  
N.P.N. Silicon. R.F. types, unmarked. ALL USABLE, 10/- per 50.  
POWER OUTPUT (Similar OC35) ALL TESTED, 4/- ea; £2 doz.  
**SILICON PLANAR TRANSISTORS. ALL TESTED. NO LEAKS OR SHORTS**  
Gain of 20/50, 6d ea.; 50/100, 9d ea.; 100/200, 1/- ea.  
Transistors similar to OCP71 (Light sensitive) 2/- ea.

**RECORDING TAPE GIVE-AWAY!!!**  
ALL BRITISH MADE, BEST QUALITY. 5in, 600ft, 7/3; 5½in, 900ft, 9/-; 7in, 1,200ft, 12/-.  
3in "odd-ends"—may be standard, long or double play—but minimum 150ft, 2/3.

**MAINS DROPPER TYPE RESISTORS.** Hundreds of types from 0.7 ohm upwards. 1W to 50W. A large percentage of these are Multi-tapped droppers for radio/television. Owing to the huge variety these can only be offered "assorted", 10/- per doz.

**GIANT SELENIUM SOLAR CELLS.** Last few to clear at half price!  
Circular, 67mm diameter, 3/- ea.; 50 x 37mm, 3 for 10/-.

## RECORD PLAYER CARTRIDGES

- ACOS GP67/2, 15/- (Mono)
- GP91/3, 20/- (Compatible)
- GP93/1, 25/- (Stereo)
- GP94/1, 30/- (Stereo, ceramic)
- GP93/1 with diamond needle, 32/6
- GP94/1 with diamond needle, 37/6

## TRANSISTORISED FLUORESCENT LIGHTS. 12V.

- 8W 12in tube, Reflector type, 59/6
  - 15W 18 in tube, Batten type, 79/6
- Complete with tube. Postage 3/-

## TRANSISTORISED SIGNAL INJECTOR KIT 10/-

## TRANSISTORISED SIGNAL TRACER KIT 10/- TRANSISTORISED REV. COUNTER (CAR) 10/- VERO-BOARD

- 2½ x 1 x 0.15in, 1/3
  - 3½ x 2½ x 15 in, 3/3
  - 3½ x 3½ x 0.15in, 3/11
  - 5 x 2½ x 0.15in, 3/11
  - 5 x 3½ x 0.15in, 5/6
  - 17 x 2½ x 0.15in, 11/-
  - 17 x 3½ x 0.15in, 14/8
  - 3½ x 2½ x 0.1in, 4/2
  - 3½ x 3½ x 0.1in, 4/9
  - 5 x 2½ x 0.1in, 4/7
  - 5 x 3½ x 0.1in, 5/6
- Spot Face Cutter 7/- Pin Insert Tool, 9/6.  
Terminal Pins, 3/6 for 36.  
Spot Face Cutter and 5 2½ x 1in boards, 9/9.

These prices cannot be repeated. Order now. Don't forget to add your name and address! Please include suitable amount to cover post and packing. Minimum 2/-

**G. F. MILWARD - DRAYTON BASSETT - Nr. TAMWORTH, STAFFS - Phone TAMWORTH 2321**

# NEWS BRIEFS

## Airborne Equipment

**A** CONTRACT worth £73,000 to supply the European Space Technology Centre with airborne telemetry equipment has been awarded to Dynatel Ltd. This is the first time a contract of this kind has been awarded to a British company.

The telemetry equipment will be installed in sounding rockets and used in a number of research projects to transmit data picked up by the sensors in the vehicle to a receiving station.

## Memory Drum

**S**PERRY HAVE introduced a new magnetic storage drum (the J101) which has been designed as an economical memory storage unit for a wide range of digital data applications, including use as a back-up store for computers and invoicing machines.

Read/write heads which float on a minute air cushion, are used to record the information as binary digits (bits) on the ferric oxide covered drum surface. The average access time to retrieve stored information is 10 milliseconds.

## Telephone Messenger

**P**UBLICLY demonstrated for the first time at the Business Efficiency Exhibition at Olympia was a new business communication machine (shown below) that can send and receive documents and drawings over any distance by telephone.

Sendox, as the new system is named, will provide the much-needed breakthrough in inter-office and inter-city document communication by overcoming current problems of availability of messengers, transport and skilled operators.

Sendox has been developed by Muirhead Ltd. of Beckenham—suppliers of facsimile systems to newspaper publishers, police forces and meteorological services. It can operate over private or public telephone lines or radio circuits, to an office in the same building or a customer or supplier miles away.



## FUNCTIONAL CHECKS

With the mains wiring completed we can start making functional checks on the manuals.

First switch off P.S.U.2, the pedal power unit.

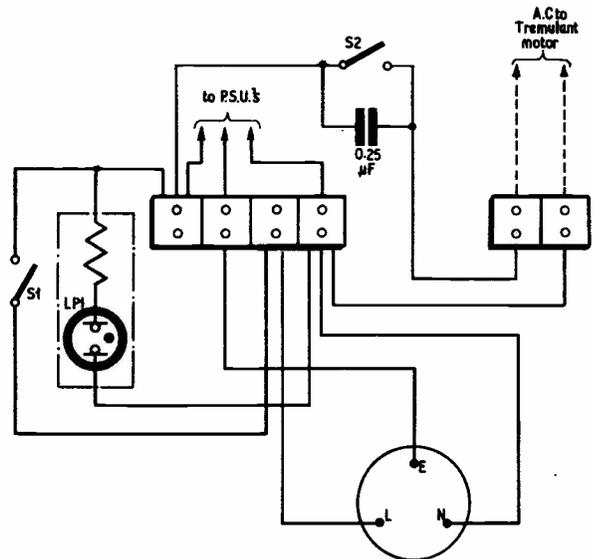
Now adjust all of the potentiometer wipers in the voice box to mid-travel.

With a WB HF.1214 loudspeaker connected at the terminal block of P.A.2 the mains supply can be switched on.

Checking the solo and accompaniment stops merely means depressing each tab individually, noting the voice and balancing the output level with the filter attenuators.

As we have not, as yet, tuned the oscillators it is necessary for these checks to add capacitors to one oscillator, at least.

Roughly tune one oscillator to B flat by adding one 500pF and one 10pF capacitor connected in parallel



**Fig. 8.6.** Mains wiring layout for organ console. For plug mounting details refer to rear view photograph of organ given in Part Two

across the coil. These components should be close tolerance silver mica types.

The related divider will be indicated as shown in Fig. 3.5 if the method of annotating the retaining bars has been followed.

If the supply is now switched on and the middle keyboard B flat depressed and held, it should be possible to check the stops and output levels. This method should be followed for both keyboards and at the same time the action of the swell pedals can be examined.

If all is well, the solo and accompaniment tone box assemblies can be fixed with binder screws. It is important that no screw should come in contact with active circuitry and in this connection reference should be made to the relative underboard wiring diagram given in Parts Six and Seven.

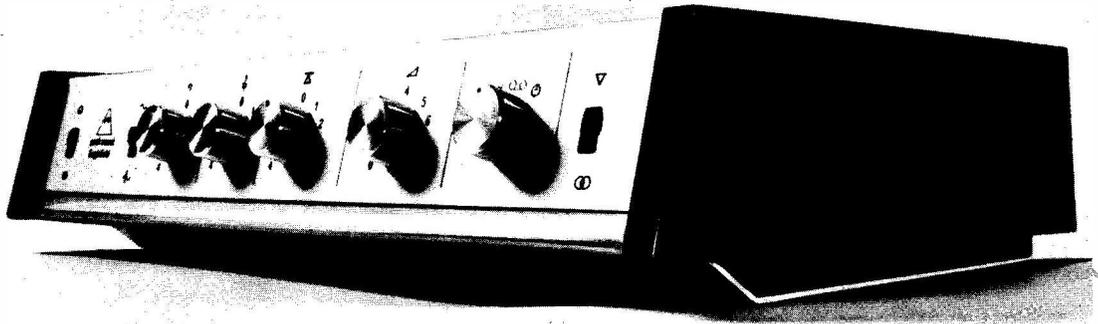
Next month we will start on the pedalboard assembly.

*To be continued*

# peak sound



# englefield



## think of hi-fi this way

Think of a stereo amplifier delivering 12 watts R.M.S. into 15 ohms per channel and having a total harmonic distortion of 0.1% at full output at 1 kHz. Think what an overload factor of 29dB means on all inputs. Think what it means, too, to have a top-flight amplifier housed in a cabinet of elegantly original design that is both beautiful and completely practical back and front. Think what such an amplifier with its many desirable features might cost—then remember that by assembling the Peak Sound "Englefield" yourself from the pre-built lab. tested modules we design and make, you can own one of the best designed amplifiers you have ever heard for about £38. The ease with which you can do this will delight you. So will the performance and appearance of the complete equipment. The Englefield system enables you to use the exclusive design cabinet for either a 12 + 12 watt assembly complete with built-in power supply, or 25 + 25 watt assembly, the pre-amp and tone control unit is common to either.

### SPECIFICATION

Using two Peak Sound PA 12-15's. SCU400 and PS45K.  
Power output per channel  
13 watts into 15Ω. 18w. into 8Ω, 24w. into 3Ω all R.M.S.

Frequency bandwidth—10Hz to 45kHz for 1dB at 1 watt. Total Harmonic Distortion at 1kHz at 11.5w. into 15Ω—0.1%.

Input sensitivities—  
Mag. P.U. RIAA—3.5mV.  
RIAA equalized ceramic P.U. 35mV low imp.  
Tape—100mV linear.  
Radio 100mV linear.  
29dB on all input channels.

Overload factor—  
—65dB on mag. P.U.  
Signal/noise ratio—  
Controls—  
Volume; Treble (+ to -12dB at 10kHz); Bass (+12dB at 100Hz); Filter 9kHz at 12dB per Octave. Mono/Stereo: On/off.

Using two PA 25-15 amplifiers and PS/685 power supply output is then 28 watts into 15Ω per channel at 1kHz or 35w. into 8Ω.

### THE MODULES

|   |          |
|---|----------|
| Englefield Amplifier Cabinet with front panel, knobs, sockets, cut wire, fuses, edge connectors, etc. . . . . | £6 0 0   |
| Two PA.12-15 power amp. built modules (£5/19/6 each) . . . . .  | £11 19 0 |
| SCU/400 Pre-amp./Control module, built . . . . .  | £15 15 0 |
| PS/45 Power Supply kit . . . . .  | £4 10 0  |
|   | <hr/>    |
|   | £38 4 0  |

Using two PA25-15 power amplifier modules at £11/15/0 each and PS/685 Stabilized Power Supply Unit at £13/10/0, total price for complete system comes to . . . . . £58 15 0

**Go to your Stockist.** The products of Peak Sound are available from dealers in all parts. If, however, your own local stockist is not yet ready with the Peak Sound items you require, please send direct together with your supplier's name and address and your requirements will be dealt with without delay. **TRADE ENQUIRIES INVITED.**



**PEAK SOUND (HARROW) LTD.**  
32 ST. JUDE'S ROAD  
ENGLEFIELD GREEN, EGHAM  
SURREY Telephone : Egham 5316

**To PEAK SOUND, 32 ST. JUDE'S ROAD, ENGLEFIELD GREEN, EGHAM, SURREY.** Please send details of

Englefield and ..... to

NAME .....

ADDRESS .....

PE12

# DIOTRAN SALES

P.O. BOX 5  
WARE, HERTS  
TEL.: WARE 3442

| SIL. G.P. DIODES          |     |      |
|---------------------------|-----|------|
| 300mW                     | 30  | 10/- |
| 40PIV (Min.)              | 100 | 30/- |
| Sub-Min.                  | 500 | £5   |
| Fully Tested 1,000        |     | £9   |
| Ideal for Organ Builders. |     |      |

Post and Packing costs are continually rising. Please add 1/- towards same. **CASH WITH ORDER PLEASE. GIRO No. 30-102**

**OVERSEAS QUOTATIONS BY RETURN SHIPMENTS TO ANYWHERE IN THE WORLD**

## OVER 3 MILLION SILICON ALLOY & GERM. TRANSISTORS AVAILABLE FOR IMMEDIATE DELIVERY

| TRANSISTORS  | Qty. | Price | Qty.  | Price | Qty.  | Price | Qty.   | Price |
|--|------|-------|-------|-------|-------|-------|--------|-------|
| Type and Construction  | 100  | £3.10 | 500   | £15   | 1,000 | £25   | 10,000 | £200  |
| A 1 Germ. A.F. PNP T0-1                                      |      |       |       |       |       |       |        |       |
| = AC127, NKT773, AC157, ASY86                                |      |       |       |       |       |       |        |       |
| A 2 Germ. A.F. PNP T0-5                                      |      |       |       |       |       |       |        |       |
| = ACY17-21, NKT237-245                                       |      |       |       |       |       |       |        |       |
| A 3 Germ. A.F. PNP T0-1                                      |      |       |       |       |       |       |        |       |
| = AC128, NKT271, 2G381                                       |      |       |       |       |       |       |        |       |
| A 4 Germ. R.F. PNP T0-1                                      |      |       |       |       |       |       |        |       |
| = OC44-45, NKT72/125, ASY54                                  |      |       |       |       |       |       |        |       |
| A 5 Germ. R.F. PNP T0-5                                      |      |       |       |       |       |       |        |       |
| = 2N1303, NKT164-7, 2G301-3                                  |      |       |       |       |       |       |        |       |
| A 6 Germ. V.H.F. PNP T0-1                                    |      |       |       |       |       |       |        |       |
| = AF116-7, KNT667, 2G417                                     |      |       |       |       |       |       |        |       |
| A 7 Assorted Germ. A.F.-R.F. PNP mixed cans, general purpose | 15s. |       | £2.10 |       |       |       |        |       |
| A 8 Germ. A.F. 50-2 PNP                                      |      |       |       |       |       |       |        |       |
| = 2G371-89, ACY27-31, OC71-75                                |      |       |       |       |       |       |        |       |
| A 9 Sil. Alloy PNP T0-5                                      |      |       |       |       |       |       |        |       |
| = 2S301-5, BCY17-29, BCY30-34                                |      |       |       |       |       |       |        |       |
| A 10 Sil. Alloy PNP 50-2                                     |      |       |       |       |       |       |        |       |
| = 2S321-325, OC200-205                                       |      |       |       |       |       |       |        |       |

A1 to A7 Guaranteed 80% Good usable Transistors ideal for low cost production work and experimental use. A8 to A10 are all perfect devices, factory tested, no open or short circuit Transistors in these lots.

**BRAND NEW FULLY TESTED EPOXY CASE UNIJUNCTION TRANSISTORS.** Type T1543 and BEN 3000 and replacement for 2N2646. Full data available. **LOWEST PRICE AVAILABLE ANYWHERE.** 100 off 4/- each = £20; 500 off 3/6 each = £87.10; 1,000 off 3/- each = £150. Sample devices 7/- each on request.

**HIGH QUALITY SILICON PLANAR DIODES.** SUB-MINIATURE DO-7 Glass Type, suitable replacements for OA200, OA202, BAY38, IS130, IS940. 200,000 to clear at £4 per 1,000 pieces. **GUARANTEED 80% GOOD.**

**SILICON PLANAR PLASTIC TRANSISTORS.** 2N3708A VcB30 Hie 20-60. All marked fully tested and guaranteed. 1 off 1/6 each; 100 off 10d. each; 500 off 9d. each; 1,000 off 7½d. each.

**TO-5 METAL CAN SILICON PLANAR TRANSISTORS.** VERY HIGH QUALITY 99% good type. 2N697, BFY51, 2N1893, £8 per 500 pieces. £13/0/0 for 1,000 pieces.

**FULLY TESTED DEVICES AND QUALITY GUARANTEED—SURPLUS TO REQUIREMENTS** OA202 Silicon Diode. Fully Coded. 150 PIV 250mA Qty. Price £30 per 1,000 pieces.

02A00 Silicon Diode. Fully Coded. 50PIV 250mA. Qty. Price £25 per 1,000.

BY100 SIL. RECT'S 800 PIV 550mA. 1-49 2/6 each; 50-99 2/3 each; 100-999 2/- each; 1,000 up 1/10 each. Fully Coded. 1st Qty.

**PLASTIC PNP SILICON TRANSISTORS.** Manufacturers' seconds from 2N3702-3 family. Ideal cheap trans. for manufacturing, etc. £8.0.0.—500, £13.10.0—1,000 pieces.

**PLASTIC NPN SILICON TRANSISTORS.** Manufacturers' seconds from 2N3707-3711 family. Ideal cheap trans. for manufacturing, etc. £7.10.0—500, £12.0.0—1,000 pieces.

**TO-18 METAL CAN SILICON PLANAR TRANS.** Very high quality, 99% good. Type 2N706, BSY27, £8 per 500 pieces. £13 per 1,000 pieces.

**TOP HAT RECTIFIERS.** All good. No short or open circuit devices. Voltage range 25-400PIV, 750mA. £3 per 100, £12.10.0 per 500.

**S.C.R.'s 16AMP (unplated)**  
1-24 25-99 100 up  
100PIV, 9/6 7/6 6/-  
400PIV, 14/- 12/- 10/-  
All tested perfect functional devices guaranteed.

## TESTED TRANSISTORS

| each  | ONE PRICE ONLY PNP, NPN, SILICON PLANAR 1/6 EACH |        |        |  | each    |
|-------|--|--------|--------|--|---------|
| BC108 | 2N696  | 2N1132 | 2N2220 |  | 25733   |
| BC109 | 2N697  | 2N1613 | 2N3707 |  | 2N13391 |
| BFY50 | 2N706  | 2N1711 | 2N3711 |  | T1544   |
| BFY51 | 2N708  | 2N2904 | 2S102  |  | 2N2906  |
| BFX84 | 2N929  | 2N2905 | 2S103  |  | 2N2907  |
| BFX86 | 2N930  | 2N2924 | 2S104  |  | 2N2696  |
| BFX88 | 2N1131   | 2N2926 | 2S732  |  | 2N3702  |
|       |  |        |        |  | 2N3703  |

From Manufacturers' Over-runs—Unmarked Plastic and Metal cases. Devices similar to above Nos.

**GERM. PNP AND NPN TRANSISTORS FULLY TESTED, UNMARKED SIMILAR TO 1/6 EACH**  
AC125 ACY22 ACY36 NKT677 OC81 2G381  
AC126 ACY27 NKT141 NKT713 OC82 2G382  
AC127 ACY28 NKT142 NKT773 2G301 2G399A  
AC128 ACY29 NKT121 OC64 2G202  
AC130 ACY30 NKT213 OC45 2G303  
ACY19 ACY31 NKT214 OC71 2G308  
ACY20 ACY34 NKT215 OC72 2G371  
ACY21 ACY35 NKT271 OC75 2G374

**POWER TRANSISTORS**  
OC25 OC35 NKT403 ASZ17  
OC26 AD130 NKT404 T13027 5/-  
OC28 AD140 NKT405 T13028  
OC29 AD149 NKT452 T13029  
Manufacturers' Surplus Germ. A.F. All similar to above.

## TRANSISTOR EQVT. BOOK

2,500 cross references of transistors—British, European, American and Japanese. A must for every transistor user. Distributed by DIOTRAN SALES. 15/- EACH.

**TEXAS 2G371 A/B Eqvt. OC71 Germ. Gen. Purpose Trans.**  
1-99 .. 1/6  
100-499 .. 1/3  
500-999 .. 1/-  
1000 up .. 9d.  
All Brand New and Coded.

Vast mixed lot of subminiature silicon diodes. Comprising of Silicon, Germ., Point Contact and Gold Banded types plus some Zeners. 500,000 available at Lowest of Low Price. 1,000 pieces £3.0.0, 5,000 pieces £13.10.0, 10,000 pieces £23.

## TRANSISTOR AUDIO AND RADIO CIRCUITS

for Radio Receivers, Radiograms, Record Players, Tape Recorders and Hi-Fi Equipment.  
**A Mullard Publication**  
30/- Postage 1/-

**TELEVISION ENGINEERS' POCKET BOOK**, by J.P. Hawker & J.A. Reddihough. 21/-. Postage 1/-.

**RADIO SERVICING PROBLEMS**, by W. A. L. Smith. 9/-. Postage 6d.

**SERVICING WITH THE OSCILLOSCOPE**, by Gordon J. King. 28/-. Postage 1/-.

**THE HI-FI AND TAPE RECORDER HANDBOOK**, by Gordon J. King. 40/-. Postage 2/-.

**PRACTICAL INTEGRATED CIRCUITS**, by A. J. McEvoy & L. McNamara. 18/-. Postage 1/-.

**TRANSISTOR MANUAL**, by General Electric Company. 21/-. Postage 1/6.

**TRANSISTOR ELECTRONIC ORGANS FOR THE AMATEUR**, by Alan Douglas & S. Astley. 20/-. Postage 1/-.

**110 SEMICONDUCTOR PROJECTS FOR THE HOME CONSTRUCTOR**, by R. M. Marston. 18/-. Postage 1/-.

**THE MODERN BOOK CO.**  
BRITAIN'S LARGEST STOCKIST of British and American Technical Books  
**19-21 PRAED STREET LONDON, W.2**  
Phone: PADdington 4185  
Closed Saturday 1 p.m.

## CRESCENT RADIO LTD.

(electronic component specialists)  
For all regular components try  
**40 Mayes Road, Wood Green, N.22**  
For surplus components and equipment try  
**11 Mayes Road, Wood Green, N.22**

**BARGAIN COMPUTER BOARDS**  
Assorted Components mounted on boards all with long tags. Ideal for breaking down and experimenting with. Take advantage of bulk purchase  
1 Board .. 2/- each  
20 Boards .. 20/-

**PRINTED CIRCUIT BOARD**  
8 x 6 inch One Sided Board .. 2/- each

**TRANSISTOR RADIO PANEL**  
Incomplete Min. Radio Panel; I.F.T.s; Transistors; Resistors; Capacitors; All for 2/- per panel.

**COMPONENT BARGAINS**  
S.P. Flick Toggle Switch, 2in. Dolly .. 3/6 each  
250V 2 amp. Toggle Switch .. 1/6 each  
4 Pin Transistor Holders .. 6d. each  
1in. Spun Aluminium Knobs, 4in Spindle .. 2/6 each  
OC19 Power Transistor .. 3/- each  
Low Impedance Transistor Earpiece .. 1/6 each  
2 1/2in Bohm Loudspeaker .. 5/6 each  
Continental Razor Adaptor Kit .. 7/6 each  
100mF 6V d.c. Transistor Capacitor .. 9d. each  
500mF 6V d.c. Transistor Capacitor .. 1/- each  
6,800pF Mullard Capacitor 400V d.c. .. 6d. each

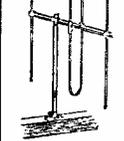
We have large stock of  
Veroboard; Valves; Transistors; Loudspeakers; Auto-Changers; Recording Tape; Cable; Hi Fi  
Send 1/6d for Our Catalogue  
Postage with order please

## NEW RANGE BBC 2 AERIALS

All U.H.F. aerials now fitted with tilting bracket and 4 element grid reflectors.

**Loft Mounting Arrays**, 7 element, 37/6. 11 element, 45/-. 14 element, 52/6. 18 element, 60/-.  
**Wall Mounting with Cranked Arm**, 7 element, 60/-. 11 element, 67/-. 14 element, 75/-. 18 element, 82/6.  
**Mast Mounting with 2in. clamp**, 7 element, 42/6; 11 element, 55/-. 14 element, 62/-. 18 element, 70/-.  
**Chimney Mounting Arrays, Complete**, 7 element, 72/6; 11 element, 80/-. 14 element, 87/6; 18 element, 95/-.  
Complete assembly instructions with every unit. Low Loss Cable, 1/6 yd. U.H.F. Pre-amps from 75/-. State clearly channel number required on all orders.

**BBC · ITV AERIALS**  
BBC (Band 1). Telescopic loft, 25/-. External S/D, 36/-. "H", £2.15.0.  
ITV (Band 3). 3 element loft array, 30/-. 5 element, 40/-. 7 element, 50/-. Wall mounting, 3 element, 47/6. 5 element, 52/6.



**Combined BBC/ITV**. Loft 1+3, 40/-. 1+5, 50/-. 1+7, 60/-. Wall mounting 1+3, 57/6; 1+5, 67/6; Chimney 1+3, 67/6; 1+5, 75/-.  
VHF transistor pre-amps, 75/-.

**COMBINED BBC1-ITV-BBC2 AERIALS**  
1+3+9, 70/-. 1+5+9, 80/-. 1+5+14, 90/-. 1+7+14, 100/-. Loft mounting only. Special leaflet available.

F.M. (Band 2). Loft S/D, 15/-. "H", 32/6. 3 element, 55/-. External units available. Co-ax. cable, 6d. yd. Co-ax. plugs, 1/4. Outlet boxes, 5/-; Diplexer Crossover Boxes, 13/6. C.W.O. or C.O.D. P. & P. 6/- Send 6d. stamps for illustrated lists.  
CALLERS WELCOME  
OPEN ALL DAY SATURDAY  
**K.V.A. ELECTRONICS (Dept. P.E.)**  
40-41 Monarch Parade  
London Road, Mitcham, Surrey  
01-648 4884

A solid state flashing indicator for a car can be constructed for relatively low cost and has several advantages over the standard electro-mechanical type. As transistor switching is employed there are no moving parts that can wear out; the flash or pulse repetition frequency (p.r.f.) can be set to within the legal limits of  $90 \pm 30$  flashes/minute and does not vary with time or load; the on/off time ratio can be pre-set and does not alter if a lamp fails or additional lamps are flashed, for example, when towing a caravan.

Further improvements incorporated in this circuit are an internal warning of flasher lamp failure, without affecting the operation of the remaining lamps, and the inclusion of an audio bleeper as an alternative, or additional warning system if preferred. The design is illustrated for positive 12V car battery systems, but can be modified for negative earth systems (see later).

### TRANSISTOR TIME SWITCH

A simple two wire flasher circuit for flashing any low power indicator lamp from 6 to 24V is shown in Fig. 1.

When the circuit is switched on, practically the full battery voltage appears across TR1 bias chain but the transistor is held off until the capacitor C1 charges up through R4 and the lamp causing TR1 to conduct. The resulting collector current of TR1 is then amplified by complementary transistor TR2, increasing the lamp voltage and decreasing the control circuit voltage.

As the emitter voltage of TR1 is held by the voltage across C1, the bias of TR1 is increased causing a further increase of collector current. This action is cumulative, producing a rapid switching action which saturates TR1 and TR2, holding the lamp on until C1 discharges through TR1, R3, and the base emitter junction of TR2. When the capacitor discharge current drops below the saturation current of TR1 and TR2, the switching action is reversed and the cycle is repeated.

The "off" time of the lamp depends on the charging time constant  $C_1R_4$ ; the "on" time depends on the discharging time constant  $C_1R_3$ . Hence the p.r.f. is proportional to  $1/(C_1R_3 + C_1R_4)$ .

Resistor R4 limits TR2 overload current by pre-warming the lamp; switching on from cold can produce a peak of about five times the normal lamp current. A 10 ohm resistance in series with LP1 is preferable for switched lamp circuits as this extends the life of the

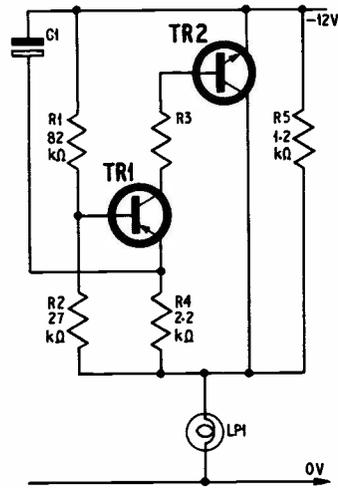


Fig. 1. Circuit diagram of a simple lamp flasher

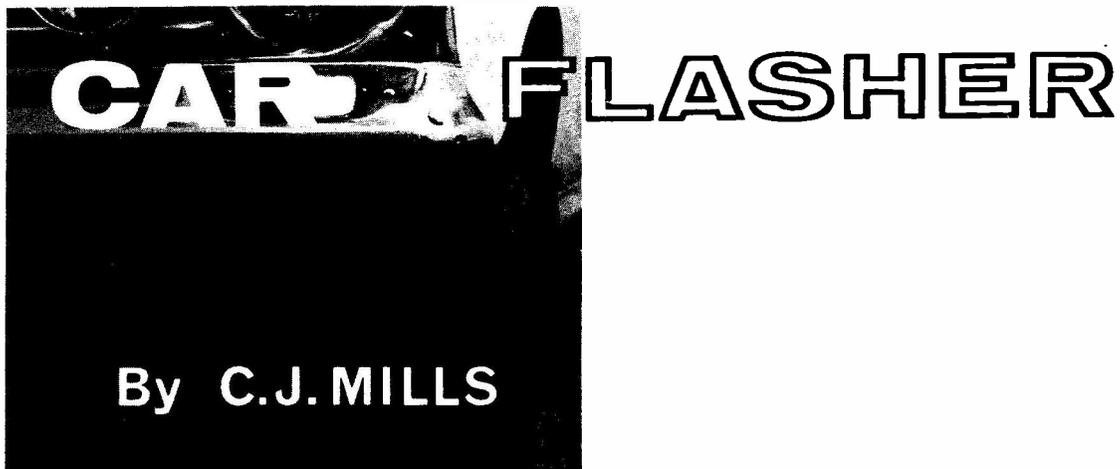
lamp as well as the transistor but it requires a supply voltage higher than the normal lamp voltage.

### COMPLETE BLEEPING FLASHER

The final circuit (Fig. 2) is developed from the above by adding a power transistor TR3 and an indicator switching transistor TR4. The 0.25W resistor in series with TR3 provides enough bias to switch the indicator lamp on via TR4 when two 20 watt flasher lamps are used. If only one or both flasher lamps fail, the indicator lamp will not light.

For the motorist who prefers an audio indicator, the circuit in Fig. 1 can be used as a "bleeper" by changing the value of C1 to  $0.25\mu\text{F}$  (selected to suit preferred tone). This is an aid for forgetful drivers and produces some interesting comments from passengers who hear it for the first time. A limiting resistor R10 to control the amplitude from the loudspeaker completes the circuit.

The final circuit (Fig. 2) includes the bleeper and its components are re-numbered around TR5 and TR6.



# CAR FLASHER

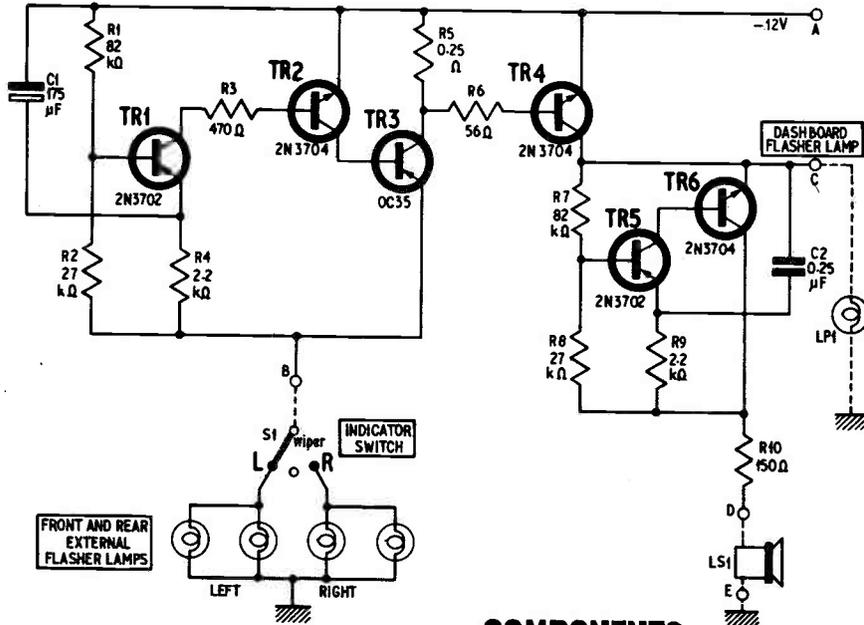


Fig. 2. Complete circuit diagram of car flasher unit. The circuit includes the audio bleeper section and is wired for positive earth systems. See Fig. 4 for negative earth circuit

## COMPONENTS...

### Resistors

|    |                  |     |       |
|----|------------------|-----|-------|
| R1 | 82kΩ             | R6  | 56Ω   |
| R2 | 27kΩ             | R7  | 82kΩ  |
| R3 | 470Ω             | R8  | 27kΩ  |
| R4 | 2.2kΩ            | R9  | 2.2kΩ |
| R5 | 0.25Ω (see text) | R10 | 150Ω  |

All  $\pm 10\%$ ,  $\frac{1}{4}$  watt carbon except R5.

### Capacitors

|    |   |
|----|---|
| C1 | 175μF elect. 16V (120μF + 50μF in parallel) |
| C2 | 0.25μF polyester                            |

### Transistors

|     |  |
|-----|--|
| TR1 | 2N3702 or OC202  |
| TR2 | 2N3704 or BFY50  |
| TR3 | OC28, OC29, or OC35  |
| TR4 | 2N3704 or BFY50 for positive earth<br>OC205 for negative earth systems |
| TR5 | 2N3702 or OC202  |
| TR6 | 2N3704 or BFY50  |

### Miscellaneous

Die cast box  $4\frac{3}{8}$ in  $\times$   $2\frac{3}{8}$ in  $\times$   $1\frac{1}{4}$ in  
Perforated s.r.b.p.  $4$ in  $\times$   $2$ in  
Wire, car connectors

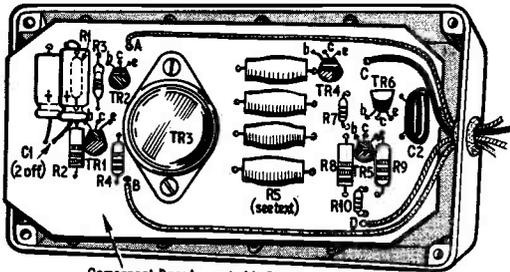
## INSTALLATION

The following plan indicates connections to the car for both positive and negative earth systems.

### Circuit Pin

|   |                        |
|---|------------------------|
| A | Ignition switch        |
| B | Indicator switch wiper |
| C | Dashboard flasher lamp |
| D | Loudspeaker            |
| E | Loudspeaker to chassis |

Details are not given for 6V systems since this would need a complete redesign of the whole circuit.



Component Board mounted in Box on 4-6BA  $\times$   $\frac{1}{4}$  long Spacers

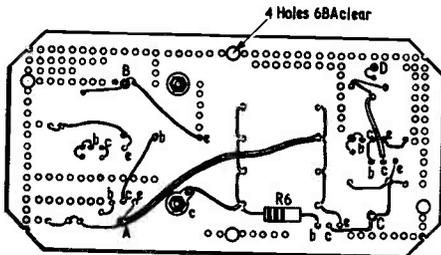


Fig. 3. Component layout and wiring of the flasher unit for positive earth systems



# ELECTRONIC BROKERS

## NEW—TEST EQUIPMENT



### 20,000 ohm/volt AC/DC MULTIRANGE METER

Eleven current ranges. Fourteen voltage ranges. Three resistance. Price **£12.19.6**. P. & P. 15/-.

### PORTABLE WHEATSTONE BRIDGE

With five switched range from 0-05  $\Omega$  to 50,000  $\Omega$ . 2% accuracy. Price **£9.19.6**. P. & P. 10/-.

### MUTUAL INDUCTANCE BOX

Ranges from 0 to 11.1mH in 0-002 divisions. Price **£22.10.0**. P. & P. £1.0.0.

### HIGH VALUE DECADE RESISTANCE BOX

Ranges from 0.01M  $\Omega$  to 111M  $\Omega$ . Accuracy 0.05%. Maximum Power Rating 0.1W per step. Price **£22.10.0**. P. & P. £1.0.0.

### MUTUAL INDUCTANCE COIL

0-001 Hz. Accuracy 3%. Maximum current 3amps. Price **£2.10.0**. P. & P. 7/6. Full specification available on request.

## NEW—5 in. CHART PEN RECORDER JY100A-2

High quality single pen recorder with 0-10mV deflection. Chart speed 1 in per min. and 16 in per hour. Adjustable zero location. Power supplies 230V 50Hz. Full specification available on request. **£69.10.0**. P. & P. 30/-.



## SET OF MEASURING INSTRUMENTS



Specification Type: Moving Coil D.C. Ranges: 0-75mV, 0-3V, 3-15-150V, 3-150-450V, 0.3-0.75A, 1.5-7.5A, 16-30A. Scale Length: 82mm. Accuracy: 1.0%. Shunts: 1.0-3-0.75 amps. 2. 1.5-7.5 amps. 3. 15-30 amps. Case: Moulded plastic. Carrying Case: Stove enamelled metal. List price £20. Our price **£23.19.6**. P. & P. 30/-.

## DECODER WITH 4 and 5 DIGIT READ-OUT

Can be used to construct frequency counter or Digital Voltmeter. Consists of NOR gates with amplifiers to drive digital display. 4 digit, **£19.10.0**; 5 digit, **£25.0.0**. P. & P. £2.0.0.

## MULLARD MATRIX CORE STORE STACKS

A.W. 510 5 planes 8 x 16 cores/per plane **£12. 10.0**  
A.W. 511 5 planes 18 x 32 cores/per plane **£25. 0.0**  
A.W. 534 20 planes 64 x 64 cores/per plane **£89. 10.0**  
A.W. 597 8 planes 32 x 32 cores/per plane **£55. 0.0**  
Single plane 40 x 25 x 4 **£8. 10.0**

## LOW COST ELECTRONIC & SCIENTIFIC EQUIPMENT AND COMPONENTS

### MOTORS HYSTERESIS REVERSIBLE MOTOR

Incorporating two coils. Each coil when energised will produce opposite rotation of output shaft. 240V 50Hz. 1 r.p.m., 1 r.p.m., 1 r.p.m., 6 r.p.m. 30/- each. P. & P. 3/-.

### LOW TORQUE HYSTERESIS MOTOR MA23

Ideal for instrument chart drives. Extremely quiet, useful in areas where ambient noise levels are low. High starting torque enables relative high inertia loads to be driven up to 602/in. Available in the following speeds and ranges: 240V 50Hz, 15 r.p.m., 2 r.p.m., 2 r.p.m., 1 r.p.m., 1 r.p.m., 1 r.p.m., 1/3 r.p.m., 1/3 r.p.m., 1/6 r.p.m., 1/10 r.p.m., 1/12 r.p.m., 1/40 r.p.m., 1/60 r.p.m., 1/75 r.p.m., 1/120 r.p.m., 1/180 r.p.m., 1/360 r.p.m., 1/720 r.p.m., 1/1440 r.p.m., 1/2880 r.p.m.; 120V 50Hz, 1/6 r.p.m., 1/6 r.p.m., 1/15 r.p.m., 1/15 r.p.m., 1/30 r.p.m., 1/30 r.p.m., 1/60 r.p.m., 1/120 r.p.m., 1/240 r.p.m., 1/300 r.p.m. 25/- each.



### HYSTERESIS CLUTCH MOTOR

With integral clutch allowing the motor to drop out of engagement with the gear train, thereby facilitating easy resetting when used in timers or in conjunction with a light spring. 6 oz torque at 1 r.p.m. 240V, 50Hz. L = left, R = right. 15 r.p.m., L, 8 r.p.m. R and L, 8 r.p.m. L, 4 r.p.m., L, 1/2 r.p.m. L, 1/5 r.p.m., 1/6 r.p.m., R and L, 1/10 r.p.m., 1/12, 1/15 r.p.m. R. Also 120V 50Hz 2, 1/6, 1/12, 5/12, 4/11, 1/10 r.p.m. 25/- P. & P. 3/-.



### MINIATURE DIGITAL DISPLAY

Operates on a rear projection 6-3 pilot lamp. The lamp projects the corresponding digit on the condensing lens through a projector lens, on to the viewing screen at the front of the unit.



1in width. 3 1/2in high. Weight 3/4oz. Character size 1in high. 0-9 with 8 right hand decimal point and figure. List price 6 gns. Our price **£9/6**. P. & P. 5/-.

### EAC DIGIVISOR MK. II DIGITAL READ-OUT DISPLAY

Ideally suitable for use in conjunction with transistorised decade counting devices. The DIGI-VISOR incorporates a moving coil movement which moves a translucent scale through an optical system and the resultant single plane image is projected on a screen. The translucent scale is made to represent digits 0-9. Specifications: 6-3V 250 microamp. Image height 1in. Size 4 9/16 x 2 39/64 x 1 1/2in. Our price **£3 gns**. List price **£4 gns**.



### MINIATURE MOVING COIL RELAY S115

By Sangamo Weston, suitable for D.C. circuit. A high sensitivity relay more sensitive than the electromagnet type. Single Coil Resistance 310 micro amps. 315  $\Omega$ . List price **£4.10**. Our price **20/-**.



### ELECTRO MAGNETIC COUNTER

Slow impulse counter of 10 impulses per second. 6/6. P. & P. 3/-.



### 6 DIGIT ELECTRICAL IMPULSE COUNTER

with electrical and mechanical reset counter driven by 110V D.C. 4400 ohms coil. Reset 110 V D.C. 800 ohms coil. Housed in plastic-alloy case. The units can be interlocked with each other to give vertical or horizontal displays. Price 79/6. P. & P. 5/-.

### REPEAT CYCLE TIMERS

These timers repeat a set cycle of switching operations with a cam and micro switch, for as long as the motor is energised. Single Cam RB 21in 2 min, 3 min, 4 min, 5 min, 6 min, cycles at 45/-.



### AVO SIGNAL GENERATOR

Frequency Range 50kc/s-80Mc/s. Output 0-5V. Price **£15**. Carriage £1.10.

Low ohm safety meter 12mA 5 ohms. Suitable for testing circuits where current must be limited. W/N and P/E. **£12.10.0**. P. and P. 17/6.

### ADVANCE TRANSISTORISED DC POWER UNITS

Input Volts Output Volts Amps Price  
DC 4 200-245  $\pm$  15% 12 4 **£17.10**

### LEDEX ROTARY SWITCHES (New)

N.S.F. wafer switches driven by 24V or 48V d.c. motor. Ideal where switching is to be controlled by a signal pulse. Following sizes available: 2E-3 wafers 1 pole, 12 position per wafer. 3E-1 wafer, 1 pole, 12 pole per wafer. 35/- each. P. & P. 3/6. 3E-Tandem Drive 12 wafers-70/- P. & P. 5/-.

### DC TACHO GENERATOR

1 1/4 inch. Size 11. 400 cycles, 115v. input, 0.5V/1000 r.p.m. **£15**. P. & P. 5/-.

### SERVO MOTORS

11M. 10E2. Size 11. 400 cycles. Ref/Control: 115/40V. Torque 20 oz per inch. Speed 5,600 112.10.0. P. & P. 5/-.

### SYNCHRO TORQUE TX.

11 TX. 4B. Synchro Torque Transmitter. 400 cycles. Ref/Control: 115/90V. **£9.10.0**. P. & P. 5/-.

### SYNCHRO CONTROL TX/TRANSFORMER

15 CX/CT 4 SL. 400 cycles. Ref/Control: 115/15V. 1.4v. per degree. **£15**. P. & P. 5/-.

## ★ HIGH PRECISION ★ FULLY STABILISED TRANSISTORISED LOW VOLTAGE POWER SUPPLIES

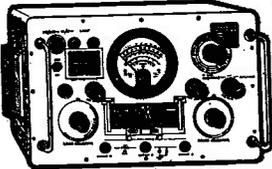
incorporating  
\* S.C.R. Panel for overload protection.  
\* OVERLOAD & CIRCUIT BREAKER WITH MANUALS RESET button.  
\* RIPPLE better, better than 3000:1.  
\* CHOKE OF CAPACITOR transistorised 120/130V A.C. INPUT.  
Available in the following types:  
6V 12 amp **£17.10.0**  
6V 16 amp **£22.10.0**  
12V 8 amp **£22.10.0**  
12V 16 amp **£25. 0.0**  
12V 22 amp **£25. 0.0**  
20V 16 amp **£25. 0.0**  
24V 4 amp **£18.10.0**  
30V 8 amp **£18.10.0**  
56V 7 amp **£25. 0.0**  
Ex-equipment but fully tested in our laboratory. Carr. 30/-

### POCKET CALCULATOR

Save time and solve all your multiplication, division, percentage, cube and square-root problems. Easy to use pocket calculator with no errors. Invaluable daily aid, should last a lifetime, offered complete in black wallet with full instructions. 2 1/2 in diam. 12/6 each. P. & P. 1/6.



## NEW—AVO ELECTRONIC METER



A quality instrument capable of measuring A.C. and D.C. voltage and current, resistance plus power output. Ranges: D.C. voltage 250mV-10,000V. D.C. current 100uA-25A. A.C. voltage 100mV-250V. A.C. current 10uA-25A. Resistance 0-100M  $\Omega$ . Power output 50W-5W. Supply voltage 110/200/250 50Hz. Complete with lead and probe for RF measurement up to 250M Hz **£25**. P. & P. £1

### METERS

Milliammeter. A.C./D.C. 100MA and 200MA FSD Cambridge 47323/4 Electrodynamic **£25**  
Precision Voltmeter. A.C./D.C. 0-75V: 0-150V: 0-300V Sangamo Weston **£32.1.6** **£25**  
Precision Multimeter. V.I.R.W. E.I.L. Model 44 **£15. 0.0**  
Watt Absorption Meter. Marconi CT44 200 UW-6W **£25. 0.0**  
A.F. Micro Voltmeter. Dymar 703, as new **£45. 0.0**  
V.H.F. "Q" Meter-Marconi TF886B **£45. 0.0**  
Wide Band Millivoltmeter-Marconi TR1371 **£35.10.0**

### POTENTIOMETERS

Precision-Tinsley 5205C **£55. 0.0**  
Precision Vernier Pot.-Cambridge **£25. 0.0**  
Wheatstone Bridge-Tinsley **£25. 0.0**

### OSCILLOSCOPES

Cosor 1035 **£25. 0.0**  
Cosor 1035 Mk. III **£35. 0.0**  
Cosor 1049 Mk. III **£40. 0.0**  
Solartron CD513.2, CD523S.2-LF and Servos, Long Persistent tube **£49.10.0**  
Solartron AD567-Pulses and Radar Field **£55. 0.0**  
Solartron CD711S.2-Double Beam DC 7 Meg. **£85. 0.0**  
Mullard L101/3 Double Beam **£99.10.0**  
Furzehill 0-100 **£25. 0.0**  
Airmec 723 **£19.10.0**  
Airmec 240 **£25. 0.0**

### PEN RECORDERS

Ammeter D.C. 0-2mA Single Pen-Elliott **£37.10.0**  
Portable Single Pen-Record Electrical New **£49. 0.0**

### OSCILLATORS

Automatic L.F. Sweep Oscillator Dawe 444C New **£59.10.0**  
Wide Band Oscillator Dawe 400C **£35.10.0**



### CONTINUOUS TAPE CASSETTE

Suitable for sleeping, learning, teaching programmes. Programming machine tools, telephone answering, separate erase head. 1in. tape, twin track tape. Price **£3.9.6**. P. & P. 7/6.

### SINGLE SPEED TAPE DECK

Driven by 240V 50 Hz power supply. Speed 3 1/2in. per sec. Remote control operation, 3 motors, record/replay heads with separate erase head. Fast erase facilities and counter. Price **£2.19.6**. P. & P. 10/-.

### MEMORY CORE STORES

42 x 52 2K bit ferrite core store complete with 84 OA 10 load diodes. Ideal for building computer store or holding information in binary form. Price **£4.10.0**. P. & P. 6/-.

### MINIATURE SQUARE COUNTER 6 DIGIT

by Veeder Root. Rotary ratchet type, adds 1 count for each 36° movement of shaft 9/6 + 2/6 P. & P.

# PREMIER RADIO

23, TOTTENHAM COURT ROAD, LONDON, W.1 Tel: 01-636 3451



## SPECIAL STEREO CARTRIDGES

| SHURE |  |
|-------|--|
| M3D   | List £8.10.6. Premier Price <b>£6.19.6</b>   |
| M44-5 | List £14.9.1. Premier Price <b>£10.10.0</b>  |
| M44C  | List £12.19.5. Premier Price <b>£9.9.0</b>   |
| M44E  | List £17.5.4. Premier Price <b>£13.19.6</b>  |
| M55E  | List £20.15.1. Premier Price <b>£15.15.0</b> |
| M75-6 | List £17.8.4. Premier Price <b>£13.19.6</b>  |
| M75E  | List £25.18.10. Premier Price <b>£21.0.0</b> |

## AUDIO-TECHNICA

|                 |                                       |
|-----------------|---------------------------------------|
| AT7S Stereo     | List £22.0.0 Our Price <b>£15.0.0</b> |
| AT7X Elliptical | List £25.0.0 Our Price <b>£18.0.0</b> |

Post and Packing 1/6 each

## "NOVA" TRANSISTOR STEREO AMPLIFIER

A superb stereo amplifier offering every facility for the hi-fi enthusiast. Output 10 watts per channel. Frequency response 40-20,000Hz ± 3dB. Inputs for Radio, P.U., Ceramic, P.U., Magnetic Tape. Separate bass and treble controls, Volume and Balance Controls. Mono/Stereo Switch. Also features headphone socket and tape output. Teak case with attractive illuminated front panel. Size 14 1/2" x 3 1/2" x 3 1/2", a.c. 200/250V.



WONDERFUL VALUE AT ONLY 25 gns. Carr. 10/-

## PICK-UP CARTRIDGES

AT MONEY SAVING PRICES!

|                                 |         |
|---------------------------------|---------|
| GOLDRING G800 (Stereo)          | £2.19.6 |
| SONOTONE 9TAC/D (Stereo)        | £2.15.0 |
| ACOS GP91/18C (Mono compatible) | £1.13.5 |
| ACOS GP93-1 (Stereo)            | £2.8.7  |
| ACOS GP94 (Stereo)              | £2.14.8 |
| B S R X3M (Mono compatible)     | £1.16.5 |
| B S R X3H (Mono compatible)     | £1.15.0 |
| RONETTE 105 (Stereo)            | £1.15.0 |
| RONETTE 106 (Stereo)            | £1.15.0 |

All complete with mounting brackets and instructions. Post and Packing 1/6 each.

# COMPLETE STEREO SYSTEM

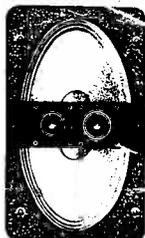
FOR ONLY **39 gns**  
CARRIAGE 35/-



The Premier Stereo System consists of an all transistor stereo amplifier, Garrard Model 2025 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" x 5 1/2" x 3 1/2" high (Amplifier available separately if required £14.19.6. Carr. 7/6).

## WIDE RANGE OF HI-FI STEREO EQUIPMENT ON DEMONSTRATION

All leading makes available including Rogers, Armstrong, Dulci, Wharfedale, Goodmans, Goldring, Shure, etc. etc.



## E.M.I. 13 x 8in HI-FI SPEAKERS

Fitted two 2 1/2in tweeters and crossover network. Impedance 3 & 15 ohms. Handling capacity 10W. Brand new. 99/6. P. & P. 7/6. Also available without tweeters. 49/6. P. & P. 7/6.

TEAK FINISHED CABINET Size 17 1/2" x 10" x 7 1/4". Ideal for above speakers. £5.10.0. P. & P. 7/6.



## HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2 1/2in speaker units with soft padded ear muffs. Adjustable headband. 8 ohm impedance. Complete with 6ft lead and stereo jack plug. 59/6 P. & P. 5/-.

MONO HEADPHONES 2,000 ohm 14/6 P. & P. 2/6.  
STEREO STETHOSCOPE SET Low imp. 25/- P. & P. 2/-.  
MONO STETHOSCOPE SET Low imp. 10/6 P. & P. 2/-.

## SAVE NEARLY £5!

Premier Stereo System with "NOVA" 10 watt Stereo Amplifier as above. 45 Gns. Carr. 35/-.

## VERITAS V-149 MIXER

Battery operated 4-channel audio mixer providing four separate inputs. Size 6 x 3 x 2in. suitable for crystal microphone, low impedance microphone with transformer, radio, tape, etc. Max. input 1.5V, max. output 2.5V, gain 6dB. Standard jack plug socket inputs, phonoplug output. Attractive teak wood grain finish case.



Model 59/6 Stereo Model 69/6 P. & P. 2/6.

## 'VERITAS' V-313 TAPE HEAD DEFLUXER

A must for all tape users! Tape heads become permanently magnetized with constant use; this leads to background noise that prevents perfect recordings. Simply applied to recording head the V313 leaves head free of magnetism. Cleans any tape head in seconds. 34/6 P. & P. 1/6

## SPECIAL BARGAIN OFFER!

B.S.R. UA75 RECORD PLAYER UNIT COMPLETE WITH TEAK PLINTH, 4 speeds. Automatic or Manual operation. Low mass arm with cue and pause lever, bias compensator, stylus pressure adjuster, etc. Complete with Stereo/Mono Cartridge. Original Price £25.18.8 OUR PRICE 14 gns. Carr. 10/6



"WELLER EXPERT" SOLDER GUN. Saves time and simplifies soldering in the home and service dept. Two position trigger gives instant dual heat 100/140 watt. 240 volt A.C. 67/6 P. & P. 2/-.

## POCKET SIZE MULTI TESTER

With wide-angle, jewelled meter movement, ceramic long-life, low-loss switching, tough impact resisting case. Sensitivity 20,000 ohms/volt d.c. 10,000 ohms/volt a.c. 19 Ranges: 0.5-25-50-250-500-2,500 volts d.c. 0-10-50-100-500-1,000 volts a.c. 0-50μA-2.5mA-250mA d.c. 0-0.000 ohms-6 megohms, 10μA-0-001 mA-1 mA -20 to +22dB. Complete battery, test lead and instructions. £4.19.6 P. & P. 3/6.



## TWO STATION TRANSISTOR INTERCOMS.

Complete with battery and 50ft connecting wire. Compact size, two way call system. Ideal for home, office, factory, etc. 65/- P. & P. 4/-.



FOUR STATION INTERCOM. Master unit and 3 slaves. Ideal for office and home. Complete with battery and connecting wire £7.19.6. P. & P. 5/6.

## "PREMIER" TAPE CASSETTES

|                 |      |            |
|-----------------|------|------------|
| C60 (60 min.)   | 7/6  | 3 for £1-  |
| C90 (90 min.)   | 12/6 | 3 for 38/- |
| C120 (120 min.) | 17/6 | 3 for 51/- |

P. & P. 1/-.



## CASSETTE HEAD CLEANER

Removes unwanted deposits from delicate tape heads. Fits all cassette recorders. 11/6 P. & P. 1/-.

## "VERITONE" RECORDING TAPE

SPECIALLY MANUFACTURED IN U.S.A. FROM EXTRA STRONG PRE-STRETCHED MATERIAL. THE QUALITY IS UNEQUALLED.

TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped—attractively boxed.

|                           |      |                            |      |
|---------------------------|------|----------------------------|------|
| LP3 3" 250' P.V.C.        | 5/6  | LP6 5 1/2" 1800' P.V.C.    | 12/6 |
| TT3 3" 450' POLYESTER     | 7/6  | DT6 5 1/2" 1800' POLYESTER | 25/6 |
| DT3 3 1/2" 600' POLYESTER | 11/6 | TT6 5 1/2" 2400' POLYESTER | 37/6 |
| SP5 5" 600' P.V.C.        | 8/6  | BT7 7" 1800' P.V.C.        | 12/6 |
| LP5 5" 900' P.V.C.        | 10/- | DT7 7" 2400' POLYESTER     | 25/- |
| DT5 5" 1200' POLYESTER    | 15/- | TT7 7" 3600' POLYESTER     | 50/- |

TAPE SPOOLS 3" 1/-, 5", 5 1/2", 7" 1/6. TAPE CASES 5", 7" 2/6.

Post and Packing 3" 1/-, 5", 5 1/2" 1/6, 7" 2/-. (3 reels and over Post Free.)

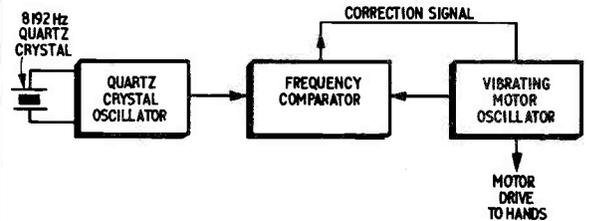


# NEWS BRIEFS

## Quartz Oscillator Wristwatch

IN SPITE of improved timekeeping in modern wrist watches, the Longines company of Switzerland have developed an electronic watch, called the "Ultra Quartz", which is claimed to maintain an accuracy of one tenth of a second per day or less than one minute per year.

It uses a quartz crystal oscillator to control the speed of a vibrating motor by comparison with actual motor speed. The quartz resonator operates at a frequency of 8,192Hz while the vibrant motor oscillator runs at a much lower frequency, 170Hz. The difference signal detected by the comparator is used to stabilise the motor speed.



The electronics comprises 14 transistors, 19 resistors and 7 capacitors which, with the motor drive and 1.35V screw-in battery, is built into a case. Battery life is in excess of 18 months. The watch is not expected to become generally available until late 1970, when it will retail for about £150.

## A Register of Engineers

THE organisation of a composite register covering the principal sections of the engineering community is proposed by The Council of Engineering Institutions. Those to be eligible for inclusion in this register are Chartered Engineers, Technician Engineers, and Engineering Technicians.

A Working Party has been set up to implement the intention and its first duty will be to prepare a submission to the Privy Council to get agreement to such modifications to the CEI Charter and By-laws as may be necessary, and then to determine which other interested parties should be invited to collaborate.

The Council of Engineering Institutions embraces all branches of engineering. Its constituent members include the I.E.E. and the I.E.R.E.

## Instant Banking

NINE BANKS have commissioned NDPS (GPO National Data Processing Service) to set up and operate a computing system for handling nearly 20 million transactions a year.

Customers' records will be maintained on a large magnetic disc file and will be amended in real time by transactions received from bank branches. The terminals will automatically align the passbook and will print transaction details and new balances in the book while the customer waits, the entire process taking a claimed maximum of five seconds.

The system will cover other aspects of TSB work, including the automatic processing of standing orders and savings scheme transactions and the maintenance of customer records.

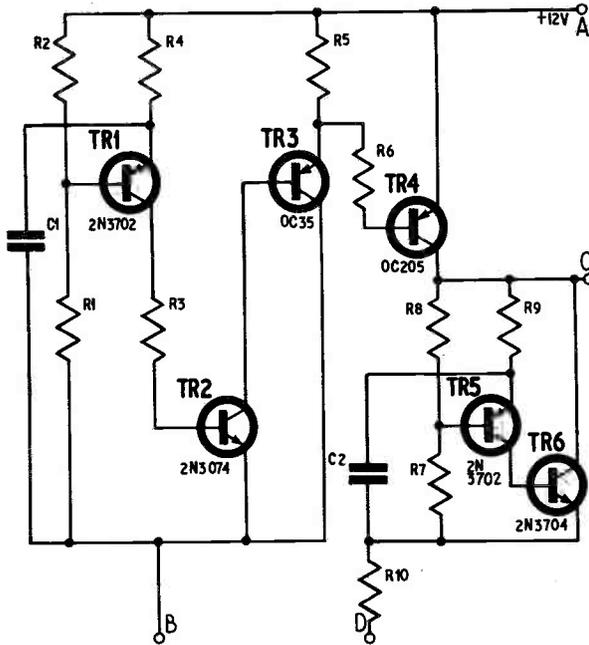


Fig. 4. Alternative arrangement for negative earth systems. Connections from A, B, C, and D to car components are the same as for the positive earth system. TR4 here is an OC205; all other components are as given in the components list

## CONSTRUCTIONAL DETAILS

A piece of perforated s.r.b.p. board is trimmed to fit inside a 4in x 2in (internal size) diecast box and is drilled for mounting on four 6B.A. screws. The components are then mounted on the board and connected up as shown in Fig. 3 for positive earth systems, using the termination wires whenever possible. If the circuit in Fig. 4 is used this layout must be modified to suit it.

The 0.25 ohm resistor consists of four 1 ohm wire-wound resistors connected in parallel or alternatively a 9in length of 22 s.w.g. eureka wire can be used. It should be insulated with heat resistant sleeving and wound on a small bobbin or former.

Due to the on/off time ratio of about 1 : 3, the mean current through R5 and the power transistor is less than 1 amp and the power dissipated is less than ¼W and 1W respectively. Hence the heat generated is comparatively low and a heat sink should not be required.

The bleeper circuit is mounted at the opposite end of the board to the main flasher components and miniature components may be required to fit it into the space available. Three leads from pins A, B and C are brought out through grommets to flat male "car connectors". A mounting bracket is screwed to the case to complete the unit—a direct replacement for an electro-mechanical flasher. When the bleeper circuit is used in positive earth systems, the third lead should be connected from pin D to the loudspeaker as shown in Fig. 2; another lead connects the loudspeaker to the positive earth terminal of the car battery.

An alternative method of construction with the bleeper circuit is to use a slightly larger case with a small speaker mounted inside it. The unit is then completely self-contained. ★

ELECTRONICS AT THE DUTCH

# FIRATO-69

INTERNATIONAL EXHIBITION

**T**HE 16th biennial Firato International Electronics Exhibition held at the R.A.I. Gebouw in Amsterdam attracts a very large audience. This year colour television was competing heavily with hi fi, electronic musical instruments and home video recording.

One of the highlights of the exhibition was a display of "50 years in sound recording and broadcasting" in which the original transmitter of the first Dutch broadcasting station PCGG was featured.

The Dutch Amateur Radio organisation V.E.R.O.N. were operational with s.s.b. transmitters on 80, 40, and 20 metres and the N.V.G. tape recording and colour slide society were showing the new Philips domestic video tape recorder in action.

An organisation called "Elektron", which is an information centre for students and others interested in electronics, were also displaying a vast range of equipment, books and literature. Elektron is sponsored by the joint efforts of various Government departments, professional institutions, major electronics companies and industrial and scientific organisations.

## SMALLEST TELEVISION

The Firato is a very large exhibition covering even domestic electrical products and although most of the hi fi equipment, electronic musical instruments and other equipment on show were of either British, Dutch, German or Japanese manufacture, there were items being shown for the first time that have not yet appeared in the U.K.

Some of these may have arrived here by the time this report appears in print. For example, what is claimed to be the world's smallest complete television receiver was being shown by the National Company of Japan. This tiny receiver, called the National Panasonic, is operated entirely from an internal battery and has a screen only 25mm x 25mm.

## VIDEO AND TAPE

The Japanese Akai company were showing for the first time a domestic video tape recorder that uses

standard  $\frac{1}{4}$ in wide tape and converts to a conventional quarter-track stereo recorder. This can be supplied complete with a standard television receiver and video camera and it employs twin rotating heads for video recording and playback.

No details were available regarding video frequency response but recordings from the tape taken off camera were producing pictures as well defined as those from average television broadcast reception.

Philips also introduced their new domestic video tape recorder which employs  $\frac{1}{2}$ in wide tape and a scanning head record/replay system. This too is available complete with camera and a standard television receiver on which video recordings can be reproduced.

Another unusual tape recorder was the Japanese made "Dokorder" which makes copies, hence the four spools as can be seen in the photograph. It has separate tape head sets for recording, replay and copying but employs a common tape drive for both normal recording and the copying facility. The tape drive is a centre capstan system and will run the tape in either direction.

Most of the hi fi equipment on show was the same as that available in the U.K., in fact quite a number of British manufacturers were exhibiting. One novel item however, was a stereo headphone set with a built-in f.m. receiver and aerials. This was produced by the Japanese National Company and the receiver covers the normal 87 to 108MHz band. The outfit is battery operated, has a stereo balance control and can also be connected to a hi fi amplifier system.

## ELECTRONIC ORGANS

Electronic organs were also attracting a good deal of attention. The Hammond Netherlands NV were demonstrating a completely new series of transistorised Hammond organs with the "tone wheel" sound, but which despite the vast range of voices and facilities, sells in Holland at only £500.

Another novel feature now being incorporated in electronic organs is a tape cassette recorder, which records directly from the organ pre-amplifier or replays via the main amplifier. The new Gawina organ (Dutch made) has this facility and they also supply pre-recorded cassette tapes for instructional and practice purposes.

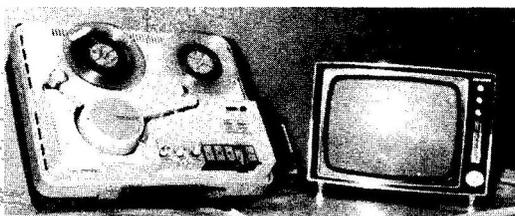
A large annual exhibition on the lines of the Firato might be a worthwhile proposition in this country instead of the many small and separate "trade only" and/or "open to the public" exhibitions now being run at odd intervals during the year.

F.C.J.

*The new Akai video/audio tape recorder (left) records TV with a scanning head system on  $\frac{1}{4}$ in tape*

*This four spool "Dokorder" (right) is a new idea from Japan, that makes copies of tapes but employs a single tape drive system*

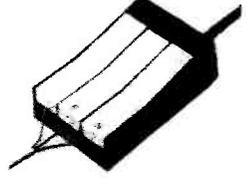
*The latest from Philips in Holland. A domestic video tape recorder (below) which uses  $\frac{1}{2}$ in wide tape and a scanning head system for video recording and playback*



# LIND-AIR OPTRONICS LTD

See our vast range of Electronic Components and Accessories at our enlarged Component Centre  
25 Tottenham Court Road

## MAINS KEYNECTOR SAVES TIME—SAFELY!



One mains "Keynector" instantly and safely connects electrical appliances to mains supply without the use of a plug. A number of appliances may be used simultaneously up to the full 13 amp rating of this device. A red light glows when "live". The "Keynector" is fused and has its own robust switch which is interlocked to prevent connections when "live".  
*Inalienable to handyman, servicemen, demonstrators, etc.*

39/6 P. & P. 3/-

## VHF AIRCRAFT BAND CONVERTOR

When placed within 1in. of a MW band radio full coverage of VHF Aircraft Band 108-135Mc/s. can be obtained. AH transistor, 9V battery operation. Fully tunable 18in. x 7-section telescopic aerial. Size 4 1/2 x 1 1/2in. 79/6 P. & P. 3/6



## MODEL MAKER'S MOTOR

No. 153N Voltage 11-5V. Current 400mA. Torque 12g.cm. Body size 1 1/2" long x 1/2" dia. Shaft 3/8" long x 1/8" dia. Ideal for small models and toys. 5/6 each. P. & P. 1/3. 3 for 15/- P. & P. 2/6.



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

## NEW STEREO/MONO HEADPHONES

SDH-7. Soft rubber earpieces with slide switch for mono/stereo listening and ind. vol. controls. Impedance 8-16 ohm. Freq. response 25-15,000cps. With lead and stereo plug. 23.6/0. P. & P. 3/6.



## SINCLAIR IC-10 INTEGRATED CIRCUIT



10 watt Amplifier. Size only 1 x 0.4 x 0.2in. A true hi-fi amplifier complete with manual giving details of a wide range of applications and instructions. Guaranteed 5 years. ONLY 59/6. P. & P. 1/6.

**SPECIAL TRANSFORMER FOR OPERATING SINCLAIR IC-10** from A.C. mains 230/250V. Output 13V. at 0.5 amps. 12/6. P. & P. 2/6.

## LIND-AIR COMPACT HI-FI STEREO SYSTEM



**ONLY 39 1/2 GNS.**  
Carr. & Ins. 25/-.  
**NEVER BEFORE SUCH VALUE!**

Big sound at low cost! 6 watt Mono/Stereo switch. Tape record outlet. Inputs for Tape replay/Tuner. Headphone facility. Beautiful teak case with matched loudspeakers. Garrard Auto-changer unit fitted Stereo Cartridge.

LIMITED PERIOD ONLY! EXCLUSIVE TO LIND-AIR!

## HI-TONE RECORDING TAPE

| BRITISH MADE TOP QUALITY |        |                   |                         |
|--------------------------|--------|-------------------|-------------------------|
| J1001                    | 3"     | Long Play PVC     | 225ft 5/6 P. & P. 1/2   |
| J1002                    | 3"     | Triple Play Poly  | 600ft 10/6 P. & P. 1/2  |
| J1003                    | 5"     | Long Play PVC     | 900ft 10/- P. & P. 1/8  |
| J1004                    | 5"     | Double Play Poly  | 1200ft 15/- P. & P. 1/8 |
| J1005                    | 5 1/2" | Long Play PVC     | 1200ft 12/6 P. & P. 2/- |
| J1006                    | 5 1/2" | Double Play Poly  | 1800ft 22/6 P. & P. 2/- |
| J1007                    | 7"     | Standard Play PVC | 1200ft 12/6 P. & P. 2/6 |
| J1008                    | 7"     | Long Play PVC     | 1800ft 17/6 P. & P. 2/6 |
| J1009                    | 7"     | Double Play Poly  | 2400ft 25/- P. & P. 2/6 |
| J1010                    | 7"     | Triple Play Poly  | 3600ft 50/- P. & P. 2/6 |



Visit our Brand New enlarged Hi-Fi Demonstration Room, Tape, Record Bar and Scientific Show of Microscopes, Binoculars, Telescopes and Watches at 18/19 Tottenham Court Road

**TTC. C1001 MULTITESTER** in leather case. Overload protection. 20,000 opv. AC volts 10, 50, 250, 1,000V. DC, volts 0-25, 125, 500, 2,500V. DC Current 0-50mA, 0-250mA Resistance 0-60K, 0-6 Megohm. Decibels -20 to +22dB. Size of meter 4 1/2 x 3 1/2 in. 85/- P. & P. 3/6.

**SHIBA 62D MULTITESTER 20,000 o.p.v.** DC voltage: 5-25-50-250-500-2.5K (20,000 ohms per volt). AC Voltage: 10-50-100-500 1000 volts (10,000 ohms per volt). DC Current: 0-50mA, 0-2.5mA, 0-250mA. Resistance: 0-6K, 0-6Mg (500 ohm and 30K at centre scale). Capacitance: 10pf. to -901 mfd. -001uf to -1uf. Decibels: -20 to +22dB. Size 4 1/2 x 3 1/2 in. Complete with case 77/- P. & P. 3/6.

## S-8-DEC BREAD BOARD



British made  
Solderless breadboard panels, for fast reliable component connections. Single DeCs. One S-8-DEC with Control Panel, Jig and Accessories for solderless connections to controls, etc., with booklet "Projects on S-8-DEC" giving construction details for a variety of circuits. 29/6. P. & P. 2/6.  
4-DeC KIT. Four S-8-DeCs with two Control Panels, Jigs and Accessories and the booklet "Projects on S-8-DEC" all contained in a strong attractive plastic case. Ideal for the professional user. 25.17.6. P. & P. 3/6.

## SPECIAL LIND-AIR OFFER!



**TELETON SAQ203 TRANSISTOR STEREO AMPLIFIER**

One of the most popular models from the fabulous Teleton range. Incorporates 16 transistors and diodes producing superb quality hi-fi. 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 228.7.0

**OUR PRICE 22 GNS**

## TRANSFORMERS

### AUTO WOUND TRANSFORMERS

All winding voltage ratings and tappings 0-115-200-220-240V, except MT113 0-115-210-240V

| Model | Power | Size                     | Weight   | Price               |
|-------|-------|--------------------------|----------|---------------------|
| MT113 | 20W   | 2 1/8 x 1 1/2 x 1 1/2 in | 11oz     | 12/6 (P. & P. 2/6)  |
| MT64  | 75W   | 2 1/2 x 2 1/2 x 2 1/2 in | 11b 14oz | 21/6 (P. & P. 4/6)  |
| MT4   | 150W  | 3 1/2 x 2 1/2 x 3 in     | 3lb      | 38/- (P. & P. 6/-)  |
| MT65  | 200W  | 3 1/2 x 4 1/2 x 4 in     | 4lb      | 39/6 (P. & P. 6/-)  |
| MT66  | 300W  | 4 x 4 x 3 1/2 in         | 6lb 7oz  | 59/4 (P. & P. 9/-)  |
| MT110 | 400W  | 4 1/2 x 4 1/2 x 4 in     | 11lb     | 85/- (P. & P. 10/-) |
| MT67  | 500W  | 5 1/2 x 4 1/2 x 4 in     | 12lb 8oz | 89/- (P. & P. 10/6) |
| MT63  | 750W  | 4 1/2 x 5 1/2 x 5 in     | 13lb 4oz | 95/7 (P. & P. 10/6) |
| MT84  | 1000W | 4 1/2 x 6 1/2 x 5 in     | 16lb     | 142.2 (Carr. extra) |
| MT93  | 1500W | 5 1/2 x 5 1/2 x 6 1/2 in | 28lb 8oz | 170/6 (Carr. extra) |
| MT94  | 1750W | 5 1/2 x 6 1/2 x 6 1/2 in | 31lb     | 195/- (Carr. extra) |
| MT95  | 2000W | 7 x 6 1/2 x 8 1/2 in     | 40lb     | 211.2 (Carr. extra) |
| MT73  | 3000W | 8 1/2 x 7 x 8 1/2 in     | 45lb 8oz | 300/- (Carr. extra) |

### LOW VOLTAGE 12V RANGE

Primary 200-250V; secondary 12V

| Model | Current | Size                     | Weight    | Price                |
|-------|---------|--------------------------|-----------|----------------------|
| MT111 | 0.5A    | 3 x 2 1/2 x 1 1/2 in     | 12oz      | 15/3 (P. & P. 2/6)   |
| MT71  | 2A      | 2 1/2 x 2 1/2 x 2 1/2 in | 11b       | 19/- (P. & P. 3/6)   |
| MT69  | 4A      | 3 1/2 x 2 1/2 x 3 in     | 2lb 4oz   | 28/- (P. & P. 6/-)   |
| MT70  | 6A      | 4 x 3 x 3 1/2 in         | 3lb 12oz  | 39/- (P. & P. 6/-)   |
| MT72  | 10A     | 3 1/2 x 4 1/2 x 4 in     | 6lb 3oz   | 51/- (P. & P. 9/-)   |
| MT115 | 20A     | 4 1/2 x 4 1/2 x 4 in     | 11lb 13oz | 95/- (P. & P. 9/-)   |
| MT187 | 30A     | 5 1/2 x 4 1/2 x 4 1/2 in | 16lb 12oz | 180/- (P. & P. 13/6) |

Other ranges available—Send for complete list.

## GARRARD DECKS



|  |          |
|--|----------|
| NRP22 less cartridge                     | 25.9.6   |
| 1025 Stereo/Mono with cart.              | 26.19.6  |
| 2925 Stereo/Mono with cart.              | 27.19.6  |
| 3006S Stereo/Mono with cart.             | 29.19.6  |
| 3000D Stereo/Mono with cart.             | 210.19.6 |
| NP25 less cartridge                      | 111.9.6  |
| SP25 with Decca Deram cart.              | 217.4.6  |
| SL55 less cartridge                      | 111.9.6  |
| SL55 with Decca Deram cart.              | 217.4.6  |
| SL65 less cartridge                      | 214.9.6  |
| Covers for above                         | 22.19.6  |
| Bases for above                          | 22.10.0  |
| AP75 less cartridge                      | 218.19.6 |
| SL75 less cartridge                      | 228.7.6  |
| SL95 less cartridge                      | 238.19.6 |
| Bases for above                          | 24.19.6  |
| <b>SPECIAL OFFER!</b>                    |          |
| SP25 less cart., with base               | 213.10.0 |
| P. & P. Decks 12/6, Cover 4/6, Base 4/6. |          |
| P. & P. Deck/Cover/Base 17/-             |          |

**MINIATURE SOLDERING IRON**  
British made and designed for use with transistor circuitry but ideal for many other uses. A.C. 240V, 18W. Length 7 1/2 in. 1in slide on bit. Price 32/6. P. & P. 2/-.



## LIND-AIR OPTRONICS LTD

18, 25 & 53 TOTTENHAM COURT ROAD, LONDON W.1.  
Telephone: 01-580 2255/4532/7679

Shops open 9-6 pm. Monday to Saturday. Thursday until 7 pm.

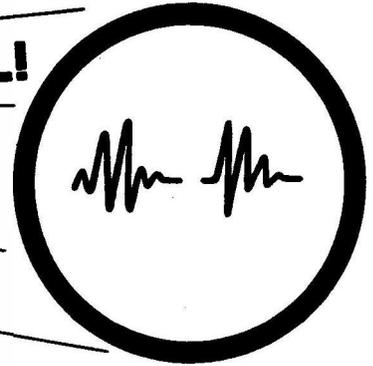
**ALL MAIL ORDERS**  
To Dept. PE1269  
54a Tottenham Court Road,  
London, W.1

# LOOK!

**PRACTICAL!**

**VISUAL!**

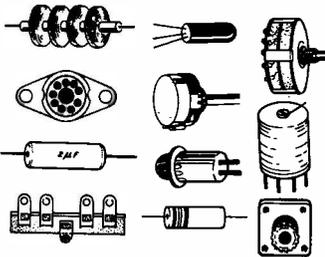
**EXCITING!**



a new 4-way method of mastering  
**ELECTRONICS**  
 by doing — and — seeing . . .

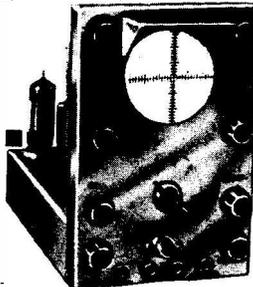
**1** ▶ **OWN and HANDLE a**

complete range of present-day **ELECTRONIC PARTS and COMPONENTS**

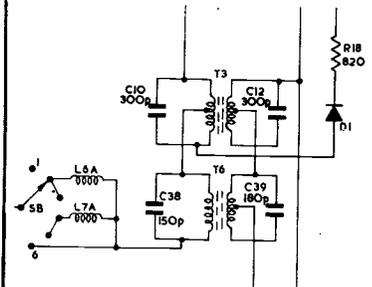


**2** ▶ **BUILD and USE**

a modern and professional **CATHODE RAY OSCILLOSCOPE**



**3** ▶ **READ and DRAW and UNDERSTAND CIRCUIT DIAGRAMS**



**4** ▶ **CARRY OUT OVER 40 EXPERIMENTS ON BASIC ELECTRONIC CIRCUITS AND SEE HOW THEY WORK . . . INCLUDING . . .**

- VALVE EXPERIMENTS
- TRANSISTOR EXPERIMENTS
- AMPLIFIERS
- OSCILLATORS
- SIGNAL TRACER
- PHOTO ELECTRIC CIRCUIT
- COMPUTER CIRCUIT
- BASIC RADIO RECEIVER
- ELECTRONIC SWITCH
- SIMPLE TRANSMITTER
- A.C. EXPERIMENTS
- D.C. EXPERIMENTS
- SIMPLE COUNTER
- TIME DELAY CIRCUIT
- SERVICING PROCEDURES

This new style course will enable anyone to really understand electronics by a modern, practical and visual method—no maths, and a minimum of theory—no previous knowledge required. It will also enable anyone to understand how to test, service and maintain all types of Electronic equipment, Radio and TV receivers, etc.

**FREE** POST NOW  
 for  
**BROCHURE**

or write if you prefer not to cut page

To: **BRITISH NATIONAL RADIO SCHOOL, READING, BERKS.** Please send your free Brochure, without obligation, to: we do not employ representatives

NAME..... **BLOCK CAPS**

ADDRESS..... **PLEASE P.E.12**

# P.E. WIDEBAND H.F. COMMUNICATIONS RECEIVER

By R. HIRST S.T.C. LTD.

## PART THREE FIRST I.F. MODULE

THE circuit diagram of the first i.f. is given in Fig. 3.1. This unit was described in reasonable functional detail in the first article of this series. The following paragraphs should be studied in conjunction with the previously presented material and with the block diagram Fig. 1.4.

### CONSTRUCTION

The complete circuit of the i.f. unit (Module 2) is shown in Fig. 3.1. As before the inductors L6, L7 and L8 should be wound first, to the information given in Fig. 3.2. The winding of L7 and L8 is carried out in the following manner: a 12in length of 20 strand 50 s.w.g. wire is doubled and wound onto the bobbin as if it were a single wire. The 11 turns of wire should make up slightly more than one complete layer. Once the wire is in place the bobbin is covered with varnish and allowed to set. The cores are then glued around the bobbin and fixed to the circuit board.

Once the inductors have been completed the circuit board should be constructed in a manner similar to that indicated last month for the r.f. unit. Layout and wiring details for the i.f. module are shown in Fig. 3.3. The construction of the module case was detailed last month.

### SETTING UP INSTRUCTIONS

This particular section applies to the constructor who has sufficient equipment to make the necessary measurements listed below. The instruments required are as follows:

- Power supply:** 12 volts, 50mA and 2.5V, 5mA.
- 34MHz signal generator** capable of delivering 1mV into 50 ohms.
- 36MHz signal generator** capable of delivering 1V into 50 ohms.
- Valve voltmeter** capable of measuring 100 $\mu$ V to 1V at 2MHz to 36MHz.

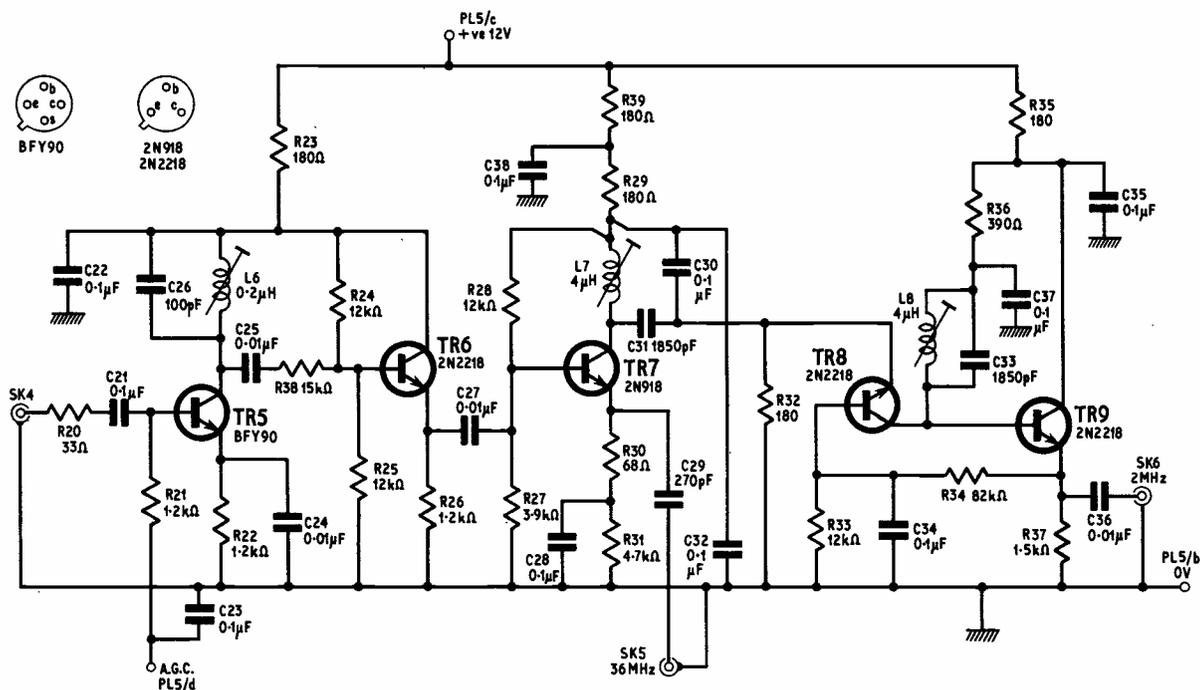


Fig. 3.1. The complete circuit diagram of the i.f. unit

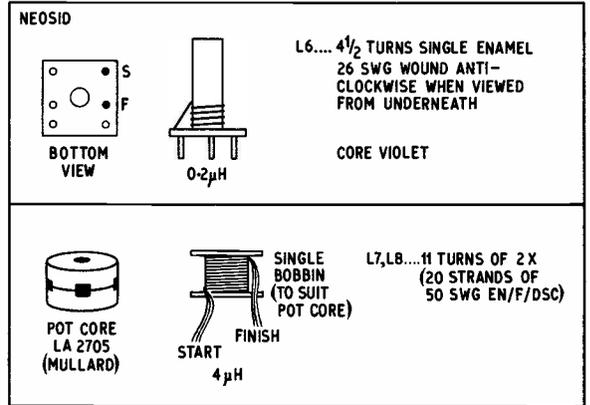
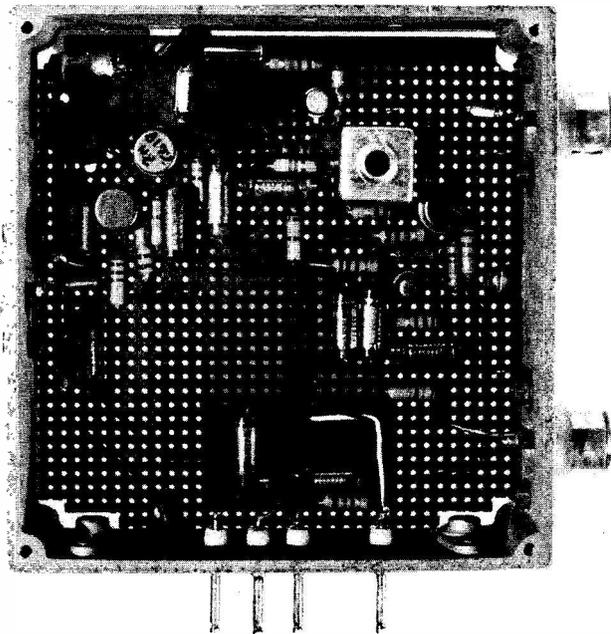


Fig. 3.2. Coil winding details for the i.f. unit

### PROCEDURE

Apply the required h.t. potential, ensuring correct polarity, and set the a.g.c. voltage at the incoming terminal (PL5/d) to 2.5 volts. Check all potentials at the base, collector and emitter of each stage to ensure that they correspond with the levels indicated in Table 3.1. Resistor R34 may be adjusted in value if the voltage at the emitter of TR9 is less than eight volts or more than ten volts. Once R34 has been adjusted recheck all the potentials. If the circuit appears to be functioning correctly from a d.c. point of view the a.c. testing can be undertaken as follows.

Apply a 34MHz signal to SK4 and set the level of this signal to 1 millivolt. Connect the valve voltmeter across R27 and adjust L6 for maximum signal. Now apply a 36MHz signal at a level of 400 millivolts to SK5 (this level to be measured when connected to SK5) and transfer the millivoltmeter to SK6. Inductors L7 and L8 should now be adjusted so that a maximum reading is obtained on the meter. Having adjusted the two coils in this latter measurement it is advisable to reduce the input signal of 34MHz by 10dB and readjust coils L6, L7 and L8 for maximum output. If the 34MHz input signal is set so that the output at SK6 is 500 microvolts and the a.g.c. voltage adjusted for maximum output at SK6 by measuring the input signal

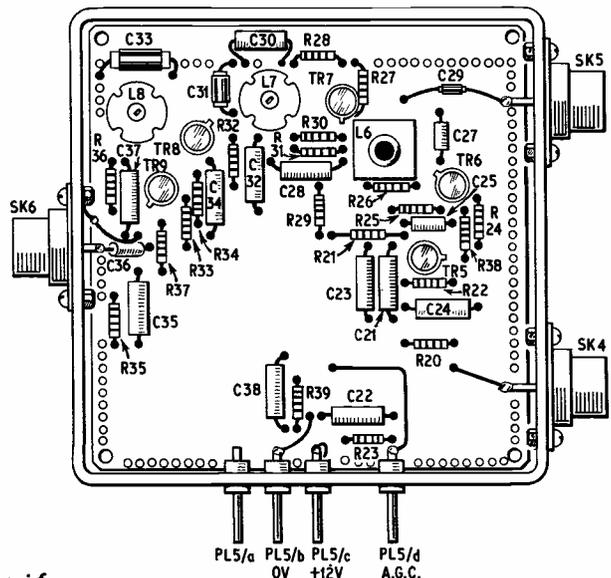
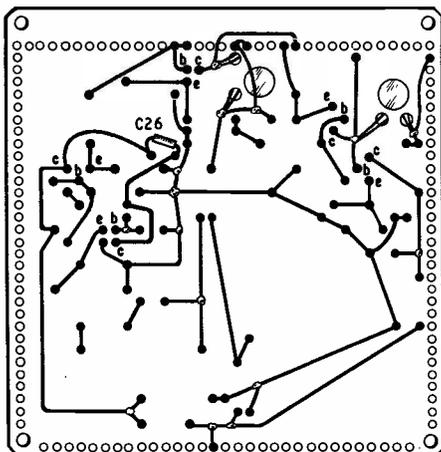


Fig. 3.3. Veroboard layout and wiring details of the i.f. module

# QUALITY COMPONENTS AND EQUIPMENT

## NEW RANGES FOR THE AMATEUR AND PROFESSIONAL USER



### \* QUALITY PANEL METERS

38 Series: Face size 42 x 42mm (1 1/2 x 1 1/2 in). 50µA, 37/6; 100µA, 35/6; 200µA, 33/6; 500µA, 27/6; 1mA, 5mA, 10mA, 50mA, 100mA, 500mA, 25/- each. 10V, 20V, 50V, 100V, 200V and 500V, 25/- each. 1A and 5A, 25/- each. "5" meter, 1mA, 29/6. VU meter, 37/6.

63 Series: Face size 86 x 78mm (3 1/2 x 3 in). 50µA, 62/6; 100µA, 52/6; 200µA, 47/6; 500µA, 45/6; 1mA, 5mA, 10mA, 500mA, 37/6 each. "5" meter, 1mA, 42/6.

Other ranges and sizes available. List on request with full details.

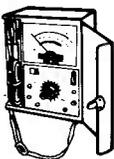


### \* 50,000 OHMS PER VOLT MULTIMETER

Recommended quality instrument with mirror scale and overload protection. 0 to 1000Ω, 100/1200/300/600/1200V d.c. (50kΩ/V); 0/6/30/120/300/600/1200V a.c. (10kΩ/V); 0/30µA/6/60/300mA, 0/12A; resistance 0/10k/10/100MΩ.

100MΩ. Meter movement 20µA. Polarity reversing switch. Complete with batteries, leads and instructions.

AF105 Price £8.10.0 p.p. 2/6  
Leather case 28/6



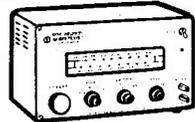
### \* SINE/SQUARE WAVE AUDIO GENERATOR



Provides audio output on 4 bands. Sine wave 20c/s to 200kc/s, output up to 7V; square wave 60c/s to 30kc/s, 7V p-p. Distortion under 2%. Output impedance 1kΩ. Variable output amplitude control. Supplied with leads and instruction book. Mains operated.

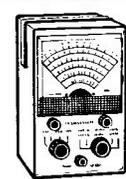
TE22 Price £16.10.0.

### \* DELUXE SINE-SQUARE WAVE RC AUDIO GENERATOR



Weinbridge RC Audio oscillator featuring four overlapping scales covering 18c/s to 200 Kc/s. Output waveforms are sine, square and complex. Mirrored scale with smooth gear tuning control. Output 5 volts RMS or 10 volts P-P. Sine wave response 1/2dB, Distortion under 1% at 10c/s. Stability 1%. Accuracy ± 2% O/P impedance under 30kΩms. Variable Attenuator. Mains operated. With Handbook.

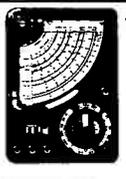
ORC 27A Price £28.10.0 pp.10/-



### \* VACUUM TUBE VOLTMETER

Features low price for such an instrument. Large bin full view scaled meter. 28 ranges. D.C. volts: 0/1/15/15/50/150/500/1500. A.C. volts: 0/1/15/15/50/150/500/1500 r.m.s.; 0/1/4/4/14/40/140/400/1400/4000 p-p. Resistance: R x 10<sup>10</sup> - 100 - 1k - 10k - 100k - 1M - 10M. Range 0.2 ohm to 1000MΩ.

MODEL TE65  
£17.10.0 p.p. 7/6  
H.V. Probe 50/-  
R.F. Probe 42/6



### \* 20,000 OHMS PER VOLT MULTIMETER

Popular model but with extra scale range. 20,000 ohms per volt. 0/5/25/50/250/500/2500V d.c.; 0/10/50/100/500/1000V a.c.; 0/50µA, 0/2/1/250mA. Resistance 0-4kΩ and 6MΩ. Also dB scales or capacitance.

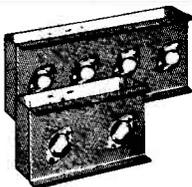
Model 200H ... 77/6 pp.2/-  
(Leather case, Price 15/- pp.2/-)



### \* PORTABLE OSCILLOSCOPE

Features 3in clear view tube, easy to use controls and good stability. Y amp. Sensitivity: 1V p-p/C.M. Bandwidth 1.5 cps-1.5 MHz. Input imp. 2 meg Ω, 25 PF. X amp sensitivity: 5V p-p/C.M. Bandwidth 1.5 cps-800 KHz. Input imp. 2 meg Ω, 20 PF. Time base: 5 ranges 10 cps-300 KHz. Synchronization. Internal/external. Illuminated scale. 140 x 215 x 310 MM. Weight 15 lbs. 20/240V. A.C. Supplied brand new with handbook.

TO3 Price £35 p.p. 10/-



### \* TRANSISTOR POWER AMPLIFIERS

12 watt 3 ohm 100mV input 24 volt supply. Model MPA 12/2 £4.10 p.p. 3/-

12 watt 12-16 ohm 100mV input 40 volts supply. Model MPA 12/15 £3.5 p.p. 13/-

25 watt 8-16 ohm 180mV input 50/60 volt supply. Model MPA 25 £7.10 p.p. 4/6

Power Supplies 24-40 volt 90/ p.p. 3/6 50-60 volt 97/6 p.p. 4/6

Model PA7. 7 watt Amplifier 3 ohms O.P. 7mV input, operates 12-18 volts D.C. Price 72/6 p.p. 2/6

### \* GRID DIP METER

All transistor grid dip meter, absorption wavemeter and osc. detector. Frequency range 40kc/s to 280kc/s in 6 coils. Uses 3 transistors plus diode with 500µA meter. Internal battery. TE15

Price .. £11.10.0 pp.3/6



### \* DC STABILISED POWER SUPPLY

Switched DC Stabilised Outputs UP TO 1AMP. 3-6 & 12 VOLTS. Indicator lamp for each output. Fully fused mains operated. Negligible ripple. Regulation 1%.

SE101A Price £8 15 0



### \* FIELD STRENGTH METER

5-Ranges 1 - 250 mc/s. Fitted 200µA meter. Earphone output. Calibrated tuning scales. FL30HA Price 72/6 pp.2/-

Also non-calibrated type peaking F/S meter. FSI Price 45/- pp.2/6



### \* TRANSISTORISED INTERCOMMS

2-station, £3.10.0; 3-station, £5.15.0; 4-station, £6.12.6 (3-station uses no wires) mains operated, £11.19.6. Telephone amplifier, 39/6. P & P 3/6



### \* SIGNAL INJECTOR

New model for checking all audio and RF up to VHF. Simple to use. Battery operated. Output approx. 1kc/s, 1-4V pp. Harmonics up to VHF. SE250B Price 35/- p.p. 1/6

\*MATCHING SIGNAL TRACER SE 500 Price 27/6 p.p. 1/6

Suppliers of quality components and equipment for over 25 years

AUDIO - HIGH FIDELITY Complete range in stock to suit all Hi-Fi and Public Address requirements.

COMPONENTS UK's largest supplier of components. EVERYTHING YOU NEED



\* TRANSISTOR CHECKER Complete capacity for checking all transistors npn and pnp for alpha, beta and German. Also diodes complete with leads and instructions. ZGM-2, Price £5.19.6, p.p. 3/6.

### EXPERIMENTER'S MODULE



Terrific offer of brand new STC time delay electronic units. Adjustable 3-15 recs. 9-12V operated. Supplied complete with suggested uses circuits. STC Module Price 35/-

9 VOLT 100 mA STABILISED SUPPLY Size 3" x 2" x 1 1/2" Fused ready to use. U.K. made Transistorised. PRICE 45/- p.p. 2/6.

Transistors Huge quantities in stock for industrial users. Write for Industrial Price List. Includes all types of Semiconductor Device.

### PORTABLE GEIGER COUNTERS

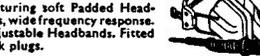


### DOSIMETER POCKET-TYPE 0-50/12/6



| MODEL                | £ s d. | No.     |
|----------------------|--------|---------|
| 295 RF. Gen.         | 21     | 0 35    |
| 295a Xial RF Gen.    | 28     | 10 0 35 |
| 30 Audio Generator   | 19     | 10 0 24 |
| 31 R.F. Generator    | 12     | 10 0 25 |
| 32 C.R. Bridge       | 10     | 10 0 28 |
| 33 Inductance Bridge | 20     | 0 0 29  |

### STEREO HEADPHONES



DHO 2/5 Recommended 20C/S-15K/C/S. £2.00.4  
SE28 Built in Tweeters and Volume Controls £2.19.6  
KOSS, KOD77 £16.10.0. PRO-4A .. £22.0.0  
SP.3KC CALL FOR DEMONSTRATION £11.15.0  
Mono Switched 8/16 ohms and 4K ohms. Price £4.4.0  
Stereo Headphone Amplifiers  
Inputs for PU/Tuner, Battery Model Mains Operated High Quality

Eagle HA10 .. .. . £8.19.6  
Shure SA2/E .. .. . £16.16.0

### GRAVINER FIRE DETECTOR UNIT



### \* SWR ALIGNMENT METER

Ideal for all transmitter alignment. Built-in field strength meter 100µA. Complete. Ready to use. SWR 1:1 to 1:3. SWR 3 .. Price 69/6 p.p. 2/6

### WELLER SOLDERING IRONS

8200 Gun & Iron .. 59/6  
8200D PK Gun Kit .. 79/6  
ANTEX CN Iron .. 26/6  
ANTEX Iron Kit .. 42/6

### \* MULTIMETER

Return of a popular model. 2000 ohms/V. 0/10/50/100/1000V a.c./d.c. 0/50µA, 0/10/250µA, 0/10/100kΩ/1MΩ resistance, dB and capacitance scales. Size 5in. x 3 1/2in. x 1 1/2in. Robust and easy to use. Complete with leads, batteries and instructions. THL 33A 82/6 p.p. 2/6  
Leather case Price 22/6

CATALOGUES - TWO NEW EDITIONS NOW AVAILABLE SEE BACK COVER FOR DETAILS Did you know we stock 1,000 Transistors and Devices? Ask for Latest FREE List (No. 36)

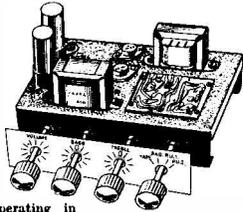
**HENRY'S RADIO LTD.**  
303 & 309 Edgware Rd, London W2

'303' Components/Equipment/Organ Parts also MAIL ORDER DEPT. 01-723-1008/9  
'309' Test Gear/High Fidelity etc. 01-723 6983

ALL MAIL ORDERS TO '303'  
SHOP HOURS 9 a.m.-6 p.m. THURSDAY 1 p.m.  
OPEN ALL DAY SATURDAY.

## NEW! HSL.700 MONO TRANSISTOR AMPLIFIER

A really high fidelity monaural amplifier with performance characteristics to suit the most discriminating listener. 6 transistor circuit with integrated preamplifier assembled on a special printed sub panel.



AD161-AD162 operating in symmetrical complementary pair. Output transformer coupled to 3 ohm and 15 ohm speaker sockets. Standard phono input sockets. Full wave bridge rectifier power supply for a.c. mains 200-240v. Controls: bass, treble, volume/on/off. Function selector for PU1, PU2, tape, radio. The HSL.700 is strongly constructed on rigid steel chassis bronze hammer enamel finish, size 9 1/2 x 4 1/2 in. high.

**Performance figures:**  
Sensitivity—PU1—50mV, 50K input impedance. PU2—110mV, 1 meg input impedance. Tape—110mV, 1 meg input impedance. Radio—110mV, 1 meg input impedance.  
Output power measured at 1Kc—6.2 watts RMS into 3 ohm, 0.8 watt RMS into 15 ohm. Overall frequency response 30c/s-18Kc/s. Continuously variable tone controls; Bass, +8db to -12db at 100c/s. Treble, +10db to -10db at 10Kc/s.

The HSL.700 has been designed for true high fidelity reproduction from radio tuner, gramophone deck and tape recorder preamps. Supplied ready built and tested, complete with knobs, attractive anodised aluminium front escutcheon panel, long spindles (can be cut to suit your housing requirements) full circuit diagram and operating instructions.

**OUR SPECIAL PRICE £7.19.6.** P. & P. 7/6.

### LOUDSPEAKER BARGAINS

5in 3 ohm 16/-, P. & P. 4/-, 4in 8 ohm 21/-, P. & P. 4/-, 10 x 8 watt RMS into 15 ohm. E.M.I. 8 x 5in 3 ohm with high flux magnet 21/-, P. & P. 4/-, E.M.I. 13 x 8in 3 ohm with high flux ceramic magnet 42/-, (15 ohm 45/-), P. & P. 6/-, E.M.I. 13 x 8in, 3 or 15 ohm with two inbuilt tweeters and crossover network 4 gns. P. & P. 6/-.

**BRAND NEW.** 12in 15w H/D Speakers, 3 or 15 ohm. Current production by well-known British maker. Now with Hiflux ceramic ferrobar magnet assembly 45.10.0, P. & P. 7/6. Guitar models: 25w 24.0.0, 30w 26.0.0, E.M.I. 3 1/2in HEAVY DUTY TWEETERS. Powerful ceramic magnet. Available in 3 or 8 ohm 15/- each; 15 ohm 18/- each. P. & P. 3/6.

18in "EA" TWIN COIL SPEAKERS. 10 watts peak handling. 3 or 15 ohm, 37/6, P. & P. 6/-.

### 35 OHM SPEAKERS

3 1/2in 14/-, P. & P. 2/6; 7 x 4in 21/-, P. & P. 4/-.

**80 OHM MOVING COIL SPEAKERS.** High Flux Magnet 2 1/2" dia. 12/- each. P. & P. 1/6.

### SPECIAL OFFER

**HI-FI Celestion Speaker Unit.** Size 6 x 4in. Powerful 11,000 line magnet with specially treated cone surround. 10-12 ohm impedance. Few only at 20/-, P. & P. 3/6.

**QUALITY PORTABLE TAPE RECORDER CASE.** Brand new. Beautifully made. Only 40/6. P. & P. 3/6.

**DUAL PURPOSE BUILT IN EARPHONE AND TAPE HEAD DEMAGNETISER 42/6.** P. & P. 3/-.

**CRYSTAL MIKES.** High imp. for desk or hand use. High sensitivity, 18/6, P. & P. 1/6.

**HIGH IMPEDANCE CRYSTAL STICK MIKES.** OUR PRICE 21/-, P. & P. 1/6.

**PYE MICROSWITCHES 5/P. C/O.** Lever roller action. Rating 250v. AC at 5 amps. Size approx. 1" x 1" x 1/2". 4/- each. P. & P. 1/- (6 or more post free).

**HONEYWELL MICROSWITCHES 5/P. C/O.** Push-button action. Rating 250v. AC at 15 amps. Size approx. 1 1/2" x 1" x 1/2". 5/- each. P. & P. 1/- (6 or more post free).

**TELESCOPIC AERIALS WITH SWIVEL JOINT.** Can be angled and rotated in any direction. 12 section Heavy Chrome. Extends from 7" to approx. 56". Maximum diameter 1 1/2" each. P. & P. 1/6. 6 section Lacquered Brass. Extends from 6" to approx. 22 1/2". Maximum diameter 1 1/2" each. P. & P. 1/6.

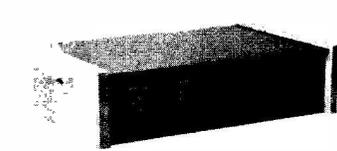
**BRAND NEW MULTI-RATIO MAINS TRANSFORMERS.** Giving 13 alternatives. Primary: 0-210-240V. Secondary combinations: 0-5-10-15-20-25-30-35-40-60V half wave at 1 amp or 10-10-20, 20-20, 30-0-30V. at 2 amps full wave. Size 3inL x 3 1/2inW x 3inD. Price 22/6, P. & P. 6/-.

**MAINS TRANSFORMER.** For transistor power supplies. Pri. 200/240V. Sec. 9-0-9 at 500mA. 11/-, P. & P. 2/6. Pri. 200/240V. Sec. 12-0-12 at 1 amp. 14/6, P. & P. 3/6. Pri. 200/240V. Sec. 10-0-10 at 2 amp. 27/6, P. & P. 3/6.

**BRAND NEW MAINS TRANSFORMERS for Bridge Rectifier.** Pri. 240v. AC Sec. 240v. at 50mA and 6-3v. at 1.5 amp. Stack size 2 1/2 x 1 1/2 x 2 1/2 in. 10/6, P. & P. 3/6. (Special quotations on quantities).

**BRAND NEW! FERRITE MAINS TRANSFORMERS.** Primary 110v-250v. Secondary 330-0-330v. 100mA and 6-3v. at 2 amps and 6-3v. at 1 amp. Conservatively rated. Fully impregnated Electrostatic screen suitable for vertical or drop through mounting. Overall size 4 1/2 x 3 1/2 x 3 1/2 in. Weight 8 lb. Limited number only at 27/6, P. & P. 2/-.

## TRANSISTOR STEREO 8 + 8 MK II



Now using Silicon Transistors in first five stages on each channel resulting in even lower noise level with improved sensitivity. A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors giving 8 watts push pull output per channel (16W mono). Integrated pre-amp, with Bass, Treble and Volume controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 3 to 15 ohms. Compact design, all parts supplied including drilled metal work. Cir-Kit board, attractive front panel, knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification: Freq. response ±3dB. 20-20,000c/s. Bass boost approx. to +12dB. Treble cut approx. to -16dB. Negative feedback 18dB over main amp. Power requirements 25V at 0.6 amp.

**PRICES: AMPLIFIER KIT 410.10.0; POWER PACK KIT 25.0.0; CABINET 23.0.0.** All Post Free. Also available STEREO 10+10. As above but 10 watts per channel. **PRICES: AMPLIFIER KIT 412. POWER PACK KIT 23.10.0.** Circuit diagram, construction details and parts list (free with kit) 1/6. (S.A.E.).

### Official stockists of all PEAK SOUND HI-FI EQUIPMENT including the

**P.W. DOUBLE 12 STEREO AMPLIFIER** as featured in Practical Wireless April and June issues. Component pack as specified. Total cost 233.5.6 plus P. & P. 11/-. (Excluding metalwork, knobs, plugs and sockets and fuses.)



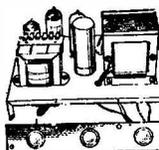
### SPECIAL PURCHASE!

**E.M.I. 4-SPEED PLAYER.** Heavy 8 1/2in. metal turntable. Low flutter performance 200/250 V shaded motor (90 V tap). Complete with latest type lightweight pick-up arm and mono cartridge with t/o stylus for LP/78. ONLY 65/-, P. & P. 6/6.

### QUALITY RECORD PLAYER AMPLIFIER MK II

A top-quality record player amplifier employing heavy duty double wound mains transformer. ECC83, EL84, EZ80 valves. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. w. x 8 1/2 in. h. clearance 2 1/2 in. (top). Complete with latest type lightweight pick-up arm and mono cartridge with t/o stylus for LP/78. ONLY 75/-, P. & P. 6/-. ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE 97/6, P. & P. 7/6.

**DE LUXE QUALITY PORTABLE B/P CABINET MK II** Uncut motor board size 14 1/2 in. clearance 2 in. below, 5 1/2 in. above. Will take above amplifier and any B.S.E. or GARRARD changer or Single Player (except AT60 and SP25). Size 18 x 15 x 8in. PRICE 79/6, P. & P. 6/6.



### 3-VALVE AUDIO AMPLIFIER HA34 MK II

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy duty metal chassis, size 7 1/2 in. w. x 4 in. d. x 4 1/2 in. 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 4 1/2 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only 24.15.0, P. & P. 6/-.

speaker. Separate volume control and now with improved wide range tone controls giving bass and treble lift and cut. Negative feedback line. Output 4 1/2 watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only 24.15.0, P. & P. 6/-.

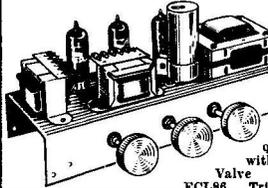
**HEL "FOUR" AMPLIFIER KIT.** Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. 79/6, P. & P. 6/-.

**BRAND NEW TRANSISTOR BARGAINS. GET 15 (Matched Pair) 15/-; V15/10p, 10/-; OC71 5/-; OC76 6/-; AF117 3/6; 2G339 (NPN) 3/-. Set of Mullard 6 transistors OC44, 2-OC45, AC128D, matched pair AC128 25/-; ORP12 Cadmium Sulphide Cell 10/6. All post free.**

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

**POWERFUL COMPACT MOTOR** for 0-9v. Battery operation approx. 25mA. Made originally for "Stax" and "Greencoat" record player decks. Built in constant speed device. Ideal for models, etc. Overall size approx. 1 1/2" x 1 1/2", 7/6 each. P. & P. 1/6. (3 or more Post Free).

## DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 volts. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:—2 x ECL86 Triode Pentodes.

1 x EZ80 as full wave rectifier. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate "balance" control fitted at the rear of the chassis. Input sensitivity is approximately 300mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11in. w. x 4in. x. Overall height including valves 5in. Ready built and tested to a high standard. Price 8 gns. P. & P. 8/-.

### 4-SPEED RECORD PLAYER BARGAINS

**Mains models.** All brand new in maker's packing. **B.S.E. UAE** with latest mono compatible cart. ... 24.19.6. All plus Carriage and Packing 9/6. **LATEST GARRARD MODELS.** All types available 1085, 1695, SP25, 3000, AT60 etc. **Brand S.A.E. for Latest Prices!** **PLINTEH UNITS** cut out for Garrard Models 1025, 9025, 2000, 3000, AT60, SP25. With transparent plastic cover. OUR PRICE 5 gns. complete. P. & P. 8/6.

**SONOFONE STANC** compatible Stereo Cartridge with diamond stylus 50/-, P. & P. 2/-.

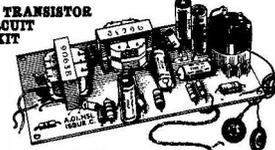
**LATEST RONETTE T/O Stereo Compatible Cartridge** for EP/LP/Stereo/78. 33/6, P. & P. 2/-.

**LATEST RONETTE T/O Mono Compatible Cartridge** for EP/LP/78 mono or stereo records on mono equipment. 30/-, P. & P. 2/-.

**FEW ONLY! ACOS HIGH-G Mono Cartridge** for EP and LP. Only 10/-, P. & P. 2/-.

### HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT

**Type Kit**  
● Peak-out in excess of 13 watts.  
● Output transformer for 3 ohm and 15 ohm speakers. ● Transistors (GET114 or 81 Mullard AC 128D and matched pair of AC128 o/p). ● 9 volt operation.  
● Everything supplied, wire, battery clips, solder, etc.  
● Comprehensive easy to follow instructions and circuit diagram 2/6 (Free with Kit). All parts sold separately. **SPECIAL PRICE 45/-, P. & P. 3/-.** Also ready built and tested, 52/6, P. & P. 3/-.



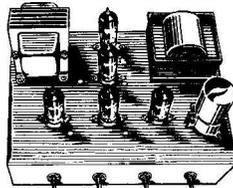
### HARVERSON'S SUPER MONO AMPLIFIER

A super quality gram amplifier using a double wound mains transformer, EZ80 rectifier and ECC83 triode pentode valve as audio amplifier and power output stage. Impedance 3 ohms. Output approx. 3.5 watts. Volume and tone controls. Chassis size only 7in. wide x 3in. deep x 6in. high overall. A.C. mains 200/240V. Supplied absolutely Brand New completely wired and tested with valves and good quality output transformer. FEW ONLY.

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

### 10/14 WATT HI-FI AMPLIFIER KIT

A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shielded section wound output transformer to match 3-15Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 2/6 (Free with parts). All parts sold separately. ONLY 27.9.6, P. & P. 8/6. Also available ready built and tested complete with kit. input sockets, 29.5.0, P. & P. 8/6.



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

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

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

## COMPONENTS...

|  |         | I.F. UNIT         |        |
|--|---------|-------------------|--------|
| <b>Resistors</b>   |         |                   |        |
| R20  | 33Ω     | R27               | 3.9kΩ  |
| R21  | 1.2kΩ   | R28               | 12kΩ   |
| R22  | 1.2kΩ   | R29               | 180Ω   |
| R23  | 180Ω    | R30               | 68Ω    |
| R24  | 12kΩ    | R31               | 4.7kΩ  |
| R25  | 12kΩ    | R32               | 180Ω   |
| R26  | 1.2kΩ   | R33               | 12kΩ   |
| R34  | 82kΩ    | R35               | 180Ω   |
| R36  | 390Ω    | R37               | 1.5kΩ  |
| R38  | 15kΩ    | R39               | 180Ω   |
| All 5%, 1/4W to 1/2W high stability carbon film  |         |                   |        |
| <b>Capacitors</b>  |         |                   |        |
| C21  | 0.1μF   | Polyester or foil |        |
| C22  | 0.1μF   | Polyester or foil |        |
| C23  | 0.1μF   | Polyester or foil |        |
| C24  | 0.01μF  | Ceramic           |        |
| C25  | 0.01μF  | Ceramic           |        |
| C26*   | 100pF   | Polystyrene       |        |
| C27  | 0.01μF  | Ceramic           |        |
| C28  | 0.1μF   | Polyester or foil |        |
| C29  | 270pF   | Polystyrene       |        |
| C30  | 0.1μF   | Polyester or foil |        |
| C31*   | 1,850pF | Polystyrene       |        |
| C32  | 0.1μF   | Polyester or foil |        |
| C33*   | 1,850pF | Polystyrene       |        |
| C34  | 0.1μF   | Polyester or foil |        |
| C35  | 0.1μF   | Polyester or foil |        |
| C36  | 0.01μF  | Ceramic           |        |
| C37  | 0.1μF   | Polyester or foil |        |
| C38  | 0.1μF   | Polyester or foil |        |
| * The exact value of these capacitors will depend on the coils; it may be necessary to adjust the capacity to suit |         |                   |        |
| <b>Transistors</b>   |         |                   |        |
| TR5  | BFY90   | TR7               | 2N918  |
| TR6  | 2N2218  | TR8               | 2N2218 |
| TR9  | 2N2218  |                   |        |
| <b>Inductors</b>   |         |                   |        |
| L6   | 0.2μH   |                   |        |
| L7   | 4μH     | See Fig. 3.2      |        |
| L8   | 4μH     |                   |        |
| <b>Miscellaneous</b>   |         |                   |        |
| Veroboard 3 1/2 x 3 1/2 in, 0.1 in grid  |         |                   |        |
| PL5/a, b, c, d insulated lead through connectors (4 off)   |         |                   |        |
| SK4, 5, 6 coaxial chassis mounted sockets (3 off)  |         |                   |        |

of 34MHz, the overall gain of the unit may be determined. This input level should be in the order of 25 microvolts. The i.f. unit is now complete.

Table 3.1. I.F. UNIT D.C. VOLTAGES

| Stage | Voltage                |
|-------|------------------------|
| TR5   | V <sub>c</sub> = 11V   |
|       | V <sub>b</sub> = 2.3V  |
|       | V <sub>e</sub> = 1.8V  |
| TR6   | V <sub>c</sub> = 11V   |
|       | V <sub>b</sub> = 5.6V  |
|       | V <sub>e</sub> = 5V    |
| TR7   | V <sub>c</sub> = 11V   |
|       | V <sub>b</sub> = 2.8V  |
|       | V <sub>e</sub> = 2.1V  |
| TR8   | V <sub>c</sub> = 9.6V  |
|       | V <sub>b</sub> = 1V    |
|       | V <sub>e</sub> = 0.4V  |
| TR9   | V <sub>c</sub> = 10.5V |
|       | V <sub>b</sub> = 9.6V  |
|       | V <sub>e</sub> = 9V    |

The measurements for TR5 were taken with the incoming a.g.c. voltage set for 2.5 volts at the input terminal. A 20 kilohm per volt voltmeter was used in all the measurements.

Next month: details of further modules

# HIGHLIGHTS OF THE JANUARY ISSUE

## THYRISTORS

and the experimenter...

Featuring one of the most versatile and important solid state devices now available. The thyristor, or silicon controlled rectifier (s.c.r.), extends the functions of electronic circuits into the field of power control and switching. This article explains the properties of the thyristor and its circuit operation and gives design information and suggested applications.

## EMMA HAS GROWN !

During the months following her birth in our March issue, EMMA (Electronic Mime Mobile Animal) has developed a self-preservation awareness—she has learnt to "work" for her keep. EMMA's circuitry has also improved in various other details recently and her new powers will be described in this supplementary article.

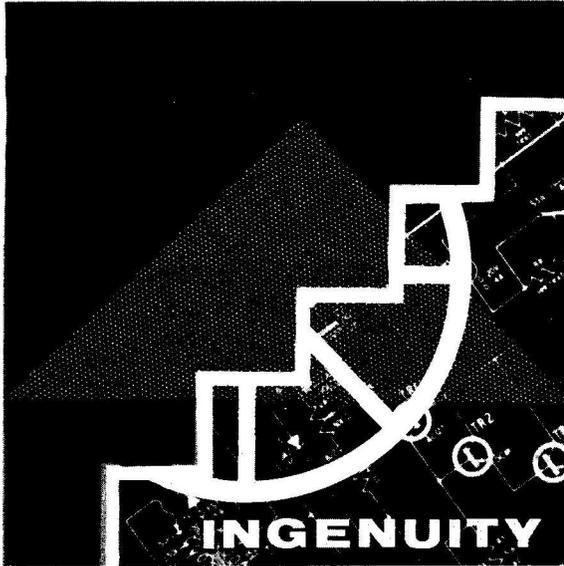
## TREASURE HUNT ?

You can locate hidden metal objects under floors or behind walls with this sensitive inductive detector, or trace the route of buried cables and pipes. As for treasure—well, coins can be found up to six inches away, while larger objects of about half a square foot in size can be detected at distances of up to 18 inches.

# PRACTICAL ELECTRONICS

January issue on sale Monday December 15

ORDER YOUR COPY NOW! 3/-



# UNLIMITED!

A selection of readers' suggested circuits. It should be emphasised that these designs have not been proven by us. They will at any rate stimulate further thought. This is YOUR page and any idea published will be awarded payment according to its merit.

## LOGICAL STATE INDICATOR

THE circuit diagram in Fig. 1 was designed to enable the logical state of i.c. flip-flops, such as the Motorola MC790P or the Fairchild  $\mu$ L923 to be determined.

The high input impedance avoids any possibility of the flip-flop outputs being loaded down, which would inhibit their operation.

When the input is at 0V (logical 0 in positive logic system) the lamp is off. When the input is at 3V or so (logical 1) the lamp is on.

L. F. Heller,  
London, W.4.

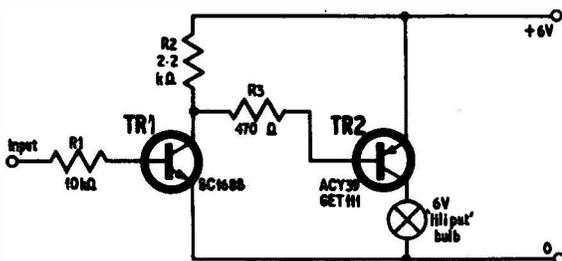


Fig. 1. Logical state indicator circuit diagram

## TAPE STOP-FOIL DEVICE

SOME years ago, I decided to build a stop-foil device for my tape recorder, and not wanting the machine to draw any current, even the small amount needed to hold the relay down, I devised a latching relay using a small permanent magnet. The applied voltage is derived from the tape recorder 6.3V heater supply, and is rectified and smoothed by D1 and C1 before it is connected to the relay, Fig. 1.

The relay used is a Keyswitch subminiature, type 1051, having a 6V 120 ohm coil, and single-pole changeover contacts rated at 250V 5A continuous load. The diagram in Fig. 2 shows the positioning of the permanent magnet glued to the top of the armature. The foil contacts are arranged as shown in Fig. 3, and only about an inch of foil is actually required.

The permanent magnet has to be mounted so that the polarity of the electromagnet on the relay is opposite to the bottom end of the magnet glued to the armature. Once the relay has been triggered the relay is then held on by the attraction of the permanent magnet, even though the supply voltage has been removed.

Any small type of magnet will suffice, and the beauty of the device is that it effectively turns the whole machine off. The relay is reset manually by pushing a lever connected to the armature as shown in Fig. 2, although an electrical reset is also possible.

T. Price,  
Pencoed.

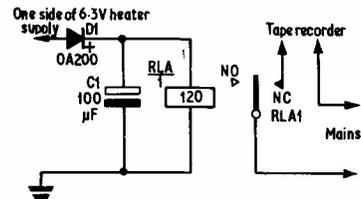


Fig. 1. Tape stop-foil circuit

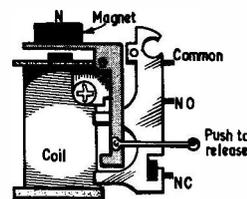


Fig. 2. Positioning of permanent magnet on relay

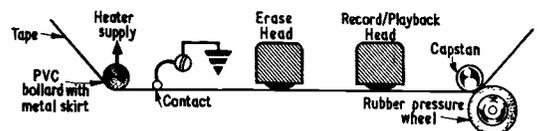


Fig. 3. Contact arrangement of tape stop-foil device

# VALUE ALL THE WAY

## INTEGRATED CIRCUITS

- BI-PAK MONOLITHIC DIGITAL CIRCUITS (10 lead TO-5)**
- BP305A, 4-Input AND gate, 9/6 each.
  - BP314A, 7 Input NOR gate, 9/6 each.
  - BP315A, Dual 3-Input NOR gate, 9/6 each.
  - BP316A, Dual 2-Input NOR gate (expandable), 9/6 each.
  - BP320A, J-K-Binary element, 11/6 each.
  - BP322A, Dual 3-Input OR gate, 9/6 each.

- BI-PAK MONOLITHIC AMPLIFIERS (TO-5 8 lead)**
- BP709C, Operational amplifier, 15/4 each.
  - BP701C, Operational amplifier (with Zener output), 12/6 each.
  - BP702C, Operational amplifier (with direct output), 12/6 each.
  - BP301, Wide band amplifier, 18/- each.
  - BP321, Logarithmic wide band amp., 14/- each.
  - BP20C, General purpose amplifier (TO-5 8 lead), (voltage or current amp.), 12/6 each.
  - LC, Operational Amplifier with Zener output.
- Type 701C. Ideal for P.E. Projects. 8 Lead TO-5 case. Full data.**
- Our price 12/6 each**  
5 off 11/- each. Large Qty. Prices quoted for.

- OTHER MONOLITHIC DEVICES**
- BP424, Zero voltage switch, 8/6 each.
  - This device is a monolithic I.C. that acts as combined threshold detector and trigger circuit for controlling a triac. It is designed to pulse the gate of a thyristor at the point of zero supply voltage, and therefore eliminate radio frequency interference when used with resistive loads.
  - D13D1 Silicon Unilateral switch 10/- each.
  - A Silicon Planar, monolithic integrated circuit having thyristor electrical characteristics, but with an anode gate and a built-in "Zener" diode between gate and cathode. Full data and application circuits available on request.
- FAIRCHILD (U.S.A.) RTIL MICROCIRCUIT INTEGRATED CIRCUITS**
- Epoxy case 17-5 lead temp. range 15°C. to 55°C.
- UL900, Buffer, 10/6 each.
  - UL914, Dual two-input gate, 10/6 each.
  - UL923 J-K-flip-flop, 14/- each.
- Complete data and circuits at the Fairchild I.C.'s available in booklet form priced 1/4.

- MULLARD I.C. AMPLIFIERS**
- TAA243, Operational amplifier, 70/- each.
  - TAA263, Linear AF amplifier, 18/6 each.
  - TAA293, General purpose amplifier, 21/- each.
- CA3020 RCA (U.S.A.) LINEAR INTEGRATED CIRCUIT**
- Audio Power Amplifier, 30/- each.
- Owing to the mass of I.C. printed matter often required by customers in connection with the I.C.'s themselves we ask you to help us in the cost of reproducing this literature by adding 2s. towards same. This is only necessary when a number of different sheets are required.

Sil. trans. suitable for P.E. Organ. Metal TO-18 Eqv. ZTX300 1/- each. Any Qty.

## ADI61 NPN ADI62 PNP

**MATCHED COMPLETELY PAIRS OF GERM. POWER TRANSISTORS.**

For mains driven output stages of Amplifiers and Radio receivers.

**OUR LOWEST PRICE OF 12/6 PER PAIR**

- HIGH POWER SILICON PLANAR TRANSISTORS. TO-3.**
- TEXAS 28034 NPN VCB100 1c 4A IT. 15M/cs
  - VCE100 Ptot. 40W
  - VEBS hFE(min.) 18/- each 60
  - 2N3055 12/6 each

## FREE

One 10/- Pack of your own choice free with orders valued 24 or over.

- NPN DIFFUSED SILICON PHOTO-DIODE TYPE IS701 (2N2175) for Tape Readout, high switching and measurement indicators. 50V, 250mW. OUR PRICE 10/- EACH, 50 OR OVER 8/6 EACH, FULL DETAILS.**

## LOW COST F.E.T.s

- Fully Tested, Guaranteed Parameters equit.
- 2N3819, MPF102, 2N-5459, 1-24 7/6 each;
  - 25-99 8/3 each; 100 up 5/6 each. Coded FE19. Full data sent. TO-72 case.

## TRIACS

- 2A, 400 PIV, TO-5 case, 20/- each; 6A, 400 PIV, TO-6 case, 25/- each; 10A, 400 PIV, TO-48 case, 35/- each. New and fully tested.

## LUCAS 35A SIL. RECTS.

- Branded, 400 PIV. Special Price, stud type, flying lead, 22/6 each.

## SPECIAL OFFER S.C.R.s

- 3A, 400 PIV similar to CR53/40AF-BYT97400R, 2N1777, 10/- each; 25-99, 9/- each; 100 up 8/6 each.

## NPN SILICON PLANAR

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

## PNP SIL. PLASTIC TRANS.

- Similar to 2N3702, uncoded but fully tested, 1/6 each; 25-99, 1/3 each; 100 up, 1/- each.

## "TRANSISTOREN"

- Transistor equit. book. New Dutch edition printed in English. Equit. to European, American and Japanese Trans. 190 pages, 15/- each.
- SPECIAL CLEARANCE OF GET120**
- PNP Med. Power Trans. complete with heatink, mica washers, etc. similar to NKT303, I.C. 2A, 5W, 2/6 each; 12 up, 2/- each.

## KING OF THE PAKS Unequalled Value and Quality SUPER PAKS NEW BI-PAK UNTESTED SEMICONDUCTORS

Satisfaction GUARANTEED in Every Pak, or money back.

- Pak No.
- U1 20 Glass Sub-min. General Purpose Germanium Diodes ..... 10/-
  - 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 40 Silicon Planar Transistors NPN sim. BSY95A, 2N706 ..... 10/-
  - U7 16 Silicon Rectifiers Top-Hat 760mA up to 1,000V ..... 10/-
  - U8 50 Sil. Planar Diodes 280mA 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/-
  - U16 30 NPN Silicon Planar Transistors TO-5 sim. 2N697 ..... 10/-
  - U16 10 3-Amp Silicon Rectifiers Stud Type up to 1000 PIV ..... 10/-
  - U17 30 Germanium PNP AF Transistors TO-5 like ACY 17-22 ..... 10/-
  - U18 8 6-Amp Silicon Rectifiers BYZ13 Type up to 600 PIV ..... 10/-
  - U19 30 Silicon NPN Transistors like BC108 ..... 10/-
  - U20 12 1.5-amp Silicon Rectifiers Top-Hat up to 1,000 PIV ..... 10/-
  - U21 30 A.F. Germanium alloy Transistors ZG300 Series & 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/-
  - U30 15 Plastic Silicon Planar trans. NPN 2N2924-2N2926 ..... 10/-
  - 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 IN4000 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 BFY50/51/52 ..... 10/-
  - U37 30 sil. alloy trans. SO-2 PNP, OC200 2S322 ..... 10/-
  - U38 20 Fast Switching Sil. trans. NPN, 400Mc/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 30 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

- FULL RANGE OF ZENER DIODES VOLTAGE RANGE 1-16V.**
- 400mW (DO-7 Case) ..... 2/6 each
  - 1-5W (Top-Hat) ..... 3/6 each
  - 10W (SO-10 Stud) ..... 5/- each
- All fully tested 5% tol. and marked state voltage eq. reqd.

## SILICON HIGH VOLTAGE RECTIFIERS

10 Amp 3 kV (3000 PIV). Stud type with flying leads 16/- each

## 2N2060 NPN SIL. DUAL TRANS.

CODE D1699 TEXAS. OUR PRICE 5/- each.

## 150 VCB NIXIE DRIVER TRANSISTOR

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

**PLEASE NOTE.** To avoid any further increased Postal Charges to our Customers and enable us to keep our "By Return Postal service" which is second to none, we have re-organized and streamlined our Despatch Order Department and we now request you to send all your orders together with your remittance, direct to our Warehouse and Despatch Department, postal address: **BI-PAK SEMICONDUCTORS, Despatch Dept., P.O. BOX 6, WARE, HERTS.** Postage and packing still 1/- per order. Minimum order 10/-.

## QUALITY-TESTED PAKS

- 26 Matched Trans. OC44/45/81/81D ..... 10/-
- 20 Red Spot AF Trans. PNP ..... 10/-
- 16 White Spot RF Trans. PNP ..... 10/-
- 5 Silicon Rects. 3 A 100-400 PIV ..... 10/-
- 10 A Silicon Rects. 100 PIV ..... 10/-
- 2 OC1 140 Trans. NPN Switching ..... 10/-
- 1 12 A SCR 100 PIV ..... 10/-
- 3 Sil. Trans. 28303 PNP ..... 10/-
- 4 Zener Diodes 240mW 3-12V ..... 10/-
- 3 200 Mc/s Sil. Trans. NPN BSY26/27 ..... 10/-
- 3 Zener Diodes 1W 33% 5% Tol. ..... 10/-
- 4 High Current Trans. OC42 Evt. ..... 10/-
- 2 Power Transistors 1 OC26 1 OC35 ..... 10/-
- 5 Silicon Rects. 400 PIV 250mA ..... 10/-
- 4 OC75 Transistors ..... 10/-
- 1 Power Trans. OC20 160V ..... 10/-
- 10 OA202 Sil. Diodes Sub-min. ..... 10/-
- 2 Low Noise Trans. NPN 2N929/30 ..... 10/-
- 1 Sil. Trans. NPN VCB 100 ZT86 ..... 10/-
- 8 OA81 Diodes ..... 10/-
- 4 OC72 Transistors ..... 10/-
- 4 OC77 Transistors ..... 10/-
- 4 Sil. Rects. 400 PIV 500mA ..... 10/-
- 5 GET884 Trans. Evt. OC44 ..... 10/-
- 1 GET885 Trans. Evt. OC42 ..... 10/-
- 2 N2708 Sil. Trans. 300Mc/s NPN ..... 10/-
- 3 GT31 LF Low Noise Germ. Trans. ..... 10/-
- 6 IN914 Sil. Diodes 75 PIV 76mA ..... 10/-
- 8 OA95 Germ. Diodes Sub-min. IN69 ..... 10/-
- 3 NPN Germ. Trans. NKT773 Evt. ..... 10/-
- 2 OC28 Power Trans. Germ. ..... 10/-
- 2 OC26 Power Trans. Germ. ..... 10/-
- 4 AC128 Trans. PNP High Gain ..... 10/-
- 4 AC127/128 Comp. pair PNP/NPN ..... 10/-
- 3 2N1307 PNP Switching Trans. ..... 10/-
- 3 G62H Germ. Diodes Evt. OA71 ..... 10/-
- 3 AF116 Type Trans. ..... 10/-
- 12 Assorted Germ. Diodes Marked ..... 10/-
- 4 AC126 Germ. PNP Trans. ..... 10/-
- 4 Silicon Rects. 100 PIV 760mA ..... 10/-
- 3 AF117 Trans. ..... 10/-
- 7 OC81 Type Trans. ..... 10/-
- 3 OC171 Trans. ..... 10/-
- 2 2N2926 Sil. Epoxy Trans. ..... 10/-
- 7 OC71 Type Trans. ..... 10/-
- 2 2S701 Sil. Trans. Texas ..... 10/-
- 3 12 Volt Zener 400mW ..... 10/-
- 2 10 A 600 PIV Sil. Rects. 1845R ..... 10/-
- 3 BC108 Sil. NPN High Gain Trans. ..... 10/-
- 1 2N910 NPN Sil. Trans. VCB 100 ..... 10/-
- 2 1000 PIV Sil. Rect. 1.5 A R5310 AF ..... 10/-
- 3 BSY95A Sil. Trans. NPN 200Mc/s ..... 10/-
- 3 OC200 Sil. Trans. ..... 10/-
- 2 GET880 Low Noise Germ. Trans. ..... 10/-
- 1 AF139 PNP High Freq. Trans. ..... 10/-
- 3 NPN Trans. 1 ST141 & 2ST140 ..... 10/-
- 4 Madt's 2 MAT100 & 2 MAT120 ..... 10/-
- 3 Madt's 2 MAT101 & 1 MAT121 ..... 10/-
- 4 OC44 Germ. Trans. AF ..... 10/-
- 3 AC127 NPN Germ. Trans. ..... 10/-
- 1 2N3906 Sil. PNP Trans. Motorola ..... 10/-
- 2 Sil. Power Rects. BYZ13 ..... 10/-
- 1 Sil. Power Trans. NPN 100Mc/s. TK201A ..... 15/-
- 6 Zener Diodes 3-15V Sub-min. ..... 15/-
- 2 2N1132 PNP Epitaxial Planar Sil. ..... 15/-
- 3 2N697 Epitaxial Planar Trans. Sil. ..... 15/-
- 4 Germ. Power Trans. Evt. OC16 ..... 15/-
- 1 Unijunction Trans. 2N2646 ..... 15/-
- 3 Sil. Trans. 200 Mc/s 2S322/84 ..... 15/-
- 1 Tunnel Diode A EY11 1050 Mc/s ..... 15/-
- 2 2N2712 Sil. Epoxy Planar HFE225 ..... 15/-
- 8 BY100 Type Sil. Rects. ..... 20/-
- 25 SH. and Germ. Trans. Mixed, all marked, New ..... 30/-

- FET'S**
- 2N 3819 ..... 10/-
  - 2N 3820 ..... 25/-
  - MPF105 ..... 8/-
- OCPT1 Type ... 8/6

## UNIUNCTION

- UT46, Evt. 2N2646, Evt. T1843, BEN3000, 7/6 ea. 25-99 5/- 100 up 4/-

## CADMIUM CELLS

- ORP60, ORP61 8/- each

## TESTED SCR'S

- PIV 1A 7A 16A 30A
- 25 - 7/6 - 80/-
- 50 7/6 8/6 10/6 35/-
- 100 8/6 10/- 15/- 45/-
- 200 12/6 15/- 20/- 55/-
- 300 15/- 20/- 25/-
- 400 17/6 25/- 35/- 80/-
- 500 30/- 40/- 45/- 85/-
- 600 - 40/- 50/-

## SIL. RECTS. TESTED

- PIV 750mA 3A 10A 30A
- 50 1/- 3/3 4/3 9/6
- 100 1/6 2/6 4/6 18/-
- 200 1/6 4/6 4/9 20/-
- 300 2/3 4/6 6/6 22/-
- 400 2/6 6/6 7/6 25/-
- 500 3/- 6/- 8/6 28/-
- 800 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**

Giro No. 388-7006



**500 CHESHAM HOUSE  
150 REGENT STREET  
LONDON, W.1**

**0-0005 mFd TUNING CONDENSER**  
Proved design, ideal for straight or reflex circuits. 9/6 each. 24/- doz.

**ELLIOT SEALED CONTACT REED RELAY**  
Three circuits closed by 3V or 100 MA. 9/6 each.

**SLIM TUBULAR MICROPHONE**  
For hand holding or frontal suspension—lever switch—high impedance with lead and plugs for cassette tape recorder but suitable for most amplifiers. 19/6.

**500 MICRO AMP MOVING COIL METER**  
2in flush mounting round meter ex Government but unused and perfect. 17/6.

**PP3 BATTERY ELIMINATOR**  
Run your small transistor radio from the mains—full wave circuit—made up ready to wire to your set and adjustable high or low current. 9/6 each.

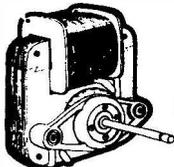
**5000 mFd 12V CONDENSER**  
Tubular size 3 1/2in dia., made by Plessey. 4/9 Each, 49/- doz.

**5A, 3 PIN SWITCH SOCKETS**



An excellent opportunity to make that bench die board you have needed or to stock up for future jobs. This month we offer 6 British made (Hicraft) bakelite flush mounting shuttered 5A switch sockets for only 10/- plus 3/6 post and insurance. (20 boxes post free.)

**5in x 5in PRINTED CIRCUIT BOARD**  
Ideal for dozens of projects. Heavy copper on 3/4 sheet. 1/8 each or 15/- per dozen.



**MAINS MOTOR**  
Precision made—as used in record decks and tape recorders—ideal also for extractor fans, blower, heater, etc. New and perfect. 8/6p at 9/6. Postage 3/- for first one then 1/- for each one ordered. 12 and over post free.



**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.

**ATLAS SLIMLINE FLUORESCENTS THE TWENTYLITE**



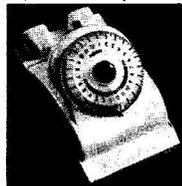
A Fluorescent lighting unit made by the famous Atlas company, with super silent polyester filled choke and radio suppressed starter. The tube springs in and out and the whole unit is beautifully made and finished white enamel. Amazingly economical. If left on all the time costs only one penny per day (uses 1 unit). Measures 2ft long. Is ideal in Kitchen, Bedroom, Hallway, Porch, Loft, etc. Don't miss this amazing offer, 39/6 with tube. Assembled ready to install. 4ft. twin model 59/6. Postage and insurance 6/6 extra.

**1 WATT AMPLIFIER & PREAMP**

5 transistors—highly efficient made for use with tapehead 64 but equally suitable for microphone or pick up—limited quantity 29/6. Full circuit diag. also shows tape controls 5/-.



**DREAMLAND CLOCK SWITCH**



The wonderful DREAMLAND mains operated clock switch will automatically switch your blanket on and off each evening and you will always have a warm bed. It's luminous; you can always see the time and it's a really beautiful unit. An ideal gift. Can also control tape recorder, radio, lamp, etc., up to 500 watts. 39/6 plus 3/6 post and ins.

**LIGHT CELL**



Almost zero resistant in sunlight increases to 10 kΩ in dark or dull light, epoxy resin sealed. Size approx. 1in. dia. by 1in. thick. Rated at 500MW, wire ended, 9/6 with circuit.

**INSTRUMENT BUZZER**

4-12 volts, adjustable tone, a very neat metal cased U.S.A. made unit, approx. 1 1/2in. x 1in. x 1in. thick. 6/6 each.

Where postage is not stated then orders over £3 are post free. Below £3 add 2/9. Semiconductors add 1/- post. Over £1 post free. S.A.E. with enquiries please.

**ELECTRIC BLANKET BARGAIN**

Famous Norvic electric blanket claimed to be the most reliable in Britain. We offer at less than wholesale price "Corona de luxe" model, this has flame resistant super safe element and double thick fleecy cover attached by press studs—just undo the press studs to wash cover—double bed size 60 x 48in—with control switch giving choice of three heats—in presentation box showing regular price 29.3.9—we offer at 25.10.6.

**THERMAL CUTOUT**

A miniature device 3in dia. on one screw fixing mount—can be used for motor overload protection—fire alarm—soldering iron switch off, etc. etc.—15 amp contacts open with flame, radiant or conducted heat. 1/6 each, 15/- doz., 25 100.

**TELESCOPIC AERIAL**

for portable, car radio or transmitter. Chrome plated—six sections, extends from 7 1/2 to 47in. Hole in bottom for 6BA screw. 7/6.

**2 1/2kW FAN HEATER**

Three position switching to suit changes in the weather. Switch up for full heat (2 1/2 kW), switch down for half heat (1 1/2 kW), switch central blows cold for summer cooling—adjustable thermostat acts as auto control and safety cut-out. Complete kit 25.15.0. Post and ins., 7/6 or made up model 24.15.0. Post & ins. 7/6.

**COPPER CLAD ELEMENT**

1250 watts—4ft. long but bent to U shape, ideal for overhead heater—just mount reflector above, 12/6 each, plus 4/6 post. 26 doz. post paid.

**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. 19/6, post and insurance 1/6. 12v. car model also available.



**ELECTRONICS (CROYDON) LTD**

Dept. PE, 266 London Road, Croydon CRO 2TH  
Also 102/3 Tamworth Road, Croydon

**STEREOGRAM CABINET \$19**

An elegant Stereogram Cabinet in modern Veneered Mahogany and cloth covered Front Panel  
BLACK LEATHERETTE SIDE PANELS  
Dimensions: 52" x 17 1/2" x 12". Speaker positions for Twin 10" x 5" Speakers



**SPEAKERS 6/6**

2"—75Ω. 2 1/2"—35Ω. P. & P. 2/6.

ACOS MICS. 35/- STANDARD

STICK MIC. 2gns. P. & P. 3/6.

ASSORTED CONDENSERS

10/- for 50. P. & P. 7/6.

ASSORTED RESISTORS

10/- for 50. P. & P. 4/6.

ASSORTED CONTROLS

10/- for 25. P. & P. 7/6.

TRANSISTORS

MULLARD MATCHED

OUTPUT KIT

9/- OC81D—2 OC81's.

P. & P. FREE.

FERRITE RODS 3/6

6", 8" x 3/8" complete with

LW/MW COILS. P. & P. FREE.

17in.—£11.10.0 Carr. 30/-

**19in. SLIM-LINE FERGUSON 24 gns.**

**TWO-YEAR GUARANTEE EX-RENTAL TELEVISIONS**

FREE ILLUSTRATED LIST OF TELEVISIONS  
17"—19"—21"—23"



WIDE RANGE OF MODELS  
SIZES AND PRICES  
DEMONSTRATIONS DAILY

**RECORD PLAYER CABINET**

49/6.  
Cloth covered. Size 16 1/2" x 14 1/2" x 8"  
Takes any modern autochanger.  
P. & P. 7/6.

**SINGLE PLAYER CABINETS**

15/6. P. & P. 7/6.  
TRANSISTOR CASES 19/6.  
Cloth covered, many colours.  
Size 9 1/2" x 6 1/2" x 3 1/2". P. & P. 3/6.  
Similar cases in plastic 7/6.

**TWO-YEAR GUARANTEED REGUNNED TUBES**

70" & 90" 14in.—59/6, 17in.—  
59/6, 21in.—59/6, 110" 17in.—  
15in. & 21in.—59/6. 23" (not  
bonded)—119/6. Exchanged  
Bowls. Carr. 10/6.

**DUKE & CO. (LONDON) LTD.**  
621/3 Romford Road, Manor Park, E.12  
Phone 01-478 6001-2-3 Stamp for Free List.



**for fast, easy, reliable soldering**

Contains 5 cores of non-corrosive flux, instantly cleaning heavily oxidised surfaces. No extra flux required.

**SAVBIT ALLOY ALSO REDUCES COPPER BIT WEAR.**

Economically packed for general electrical and electronic soldering. 90 ft. 18 gauge on plastic reel. Recommended retail price 15/-



**THIN GAUGE SOLDER, ESSENTIAL FOR soldering small components and thin wires.**

High tin content, low melting point, 60/40 alloy, 202 ft. 22 gauge on plastic reel. Recommended retail price 15/-



**A RANGE OF SOLDERS IN HANDY DISPENSERS.**

REF. ALLOY SWG

|               |        |    |      |
|---------------|--------|----|------|
| 4A            | 60/40  | 18 | 2/6* |
| Size 5        |        |    |      |
| (Illustrated) | Savbit | 18 | 2/6* |
| 15            | 60/40  | 22 | 3/6* |

\*Recommended Price



**INVALUABLE FOR STRIPPING FLEX, THE NEW AUTOMATIC OPENING BIG WIRE STRIPPER AND CUTTER,**

easily adjustable for all standard diameters. Plastic covered handles can also be used as wire cutter. Recommended retail price 8/6

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

# DUXFORD ELECTRONICS

## ELECTROLYTIC CAPACITORS (Mullard). -10% to +50%.

| Working Voltage (V)—Capacitance (μF) |       | Price |       | Pack Prices |     |      |         |        |         |
|--------------------------------------|-------|-------|-------|-------------|-----|------|---------|--------|---------|
| 4V                                   | 6.4V  | 10V   | 16V   | 25V         | 40V | 64V  | 100 off | 25 off | 100 off |
| 8                                    | 6.4   | 4     | 2.5   | 1.6         | 1   | 0.64 | 1/4     | 12/4   | 28/6    |
| 32                                   | 25    | 16    | 10    | 6.4         | 4   | 2.5  | 1/2     | 10/6   | 23/-    |
| 64                                   | 50    | 32    | 20    | 12.5        | 8   | 5    | 1/2     | 10/4   | 22/6    |
| 125                                  | 100   | 64    | 40    | 25          | 16  | 10   | 1/-     | 8/9    | 18/9    |
| 250                                  | 200   | 125   | 80    | 50          | 32  | 20   | 1/1     | 9/6    | 20/9    |
| 400                                  | 320   | 200   | 125   | 80          | 50  | 32   | 1/2     | 10/4   | 22/6    |
| 800                                  | 640   | 400   | 250   | 160         | 100 | 64   | 1/6     | 13/4   | 23/6    |
| 1,250                                | 1,000 | 640   | 400   | 250         | 160 | 100  | 2/-     | 18/10  | 37/9    |
| 2,000                                | 1,600 | 1,000 | 640   | 400         | 250 | 160  | 2/6     | 22/8   | 44/8    |
| 3,200                                | 2,500 | 1,600 | 1,000 | 640         | 400 | 250  | 3/-     | 28/9   | 59/-    |
|                                      |       |       |       |             |     |      |         |        | 204/8   |
|                                      |       |       |       |             |     |      |         |        | 165/6   |
|                                      |       |       |       |             |     |      |         |        | 348/9   |
|                                      |       |       |       |             |     |      |         |        | 427/-   |
|                                      |       |       |       |             |     |      |         |        | 541/8   |
|                                      |       |       |       |             |     |      |         |        | 848/9   |
|                                      |       |       |       |             |     |      |         |        | 1,000/- |

## POLYESTER CAPACITORS (Mullard)

| Tubular, 10%, 160V:<br>Prices per Capacitance value (μF) |     | each  |       | 10 off |       | 25 off |       | 100 off |       |
|--|-----|-------|-------|--------|-------|--------|-------|---------|-------|
| 0-01, 0-015, 0-022                                       | 7d  | 5/1   | 10/11 | 36/5   | 11/10 | 37/6   | 11/10 | 38/5    | 11/10 |
| 0-033, 0-047   | 7d  | 5/8   | 10/11 | 37/6   | 11/10 | 38/5   | 11/10 | 39/4    | 11/10 |
| 0-068  | 8d  | 6/6   | 12/6  | 43/9   | 12/6  | 43/9   | 12/6  | 44/8    | 12/6  |
| 0-1  | 9d  | 6/8   | 14/8  | 47/7   | 14/8  | 47/7   | 14/8  | 48/6    | 14/8  |
| 0-15   | 11d | 7/6   | 16/6  | 51/5   | 16/6  | 51/5   | 16/6  | 52/4    | 16/6  |
| 0-22   | 1/3 | 8/2   | 17/9  | 51/5   | 17/9  | 51/5   | 17/9  | 52/4    | 17/9  |
| 0-33   | 1/3 | 10/11 | 23/8  | 57/7   | 18/11 | 57/7   | 18/11 | 58/6    | 18/11 |
| 0-47   | 1/6 | 13/2  | 28/1  | 61/5   | 19/11 | 61/5   | 19/11 | 62/4    | 19/11 |
| 0-68   | 2/3 | 19/6  | 42/3  | 65/7   | 20/11 | 65/7   | 20/11 | 66/6    | 20/11 |
| 1-0  | 2/9 | 23/4  | 48/9  | 65/7   | 21/10 | 65/7   | 21/10 | 66/6    | 21/10 |

| Tubular, 10%, 400V:<br>Prices per Capacitance value (μF) |     | each |       | 10 off |       | 25 off |       | 100 off |       |
|--|-----|------|-------|--------|-------|--------|-------|---------|-------|
| 0-001, 0-0015, 0-0022                                    | 8d  | 4/6  | 9/9   | 33/4   | 9/10  | 33/4   | 9/10  | 34/3    | 9/10  |
| 0-0033, 0-0047   | 8d  | 4/6  | 9/10  | 33/4   | 9/10  | 33/4   | 9/10  | 34/3    | 9/10  |
| 0-0068, 0-01   | 7d  | 5/1  | 10/11 | 36/5   | 11/10 | 36/5   | 11/10 | 37/4    | 11/10 |
| 0-015  | 7d  | 5/2  | 11/10 | 36/5   | 11/10 | 36/5   | 11/10 | 37/4    | 11/10 |
| 0-022  | 7d  | 5/3  | 12/-  | 37/9   | 12/-  | 37/9   | 12/-  | 38/8    | 12/-  |
| 0-033  | 8d  | 5/8  | 12/7  | 42/7   | 12/7  | 42/7   | 12/7  | 43/6    | 12/7  |
| 0-047  | 9d  | 6/7  | 14/5  | 49/-   | 14/5  | 49/-   | 14/5  | 50/4    | 14/5  |
| 0-068  | 11d | 7/8  | 16/7  | 51/-   | 16/7  | 51/-   | 16/7  | 52/6    | 16/7  |
| 0-1  | 11d | 8/-  | 17/2  | 57/4   | 17/2  | 57/4   | 17/2  | 58/3    | 17/2  |
| 0-15   | 1/2 | 10/3 | 22/-  | 61/5   | 18/11 | 61/5   | 18/11 | 62/4    | 18/11 |
| 0-22   | 1/6 | 14/8 | 28/5  | 65/7   | 19/11 | 65/7   | 19/11 | 66/6    | 19/11 |
| 0-33   | 2/3 | 19/7 | 42/3  | 65/7   | 20/11 | 65/7   | 20/11 | 66/6    | 20/11 |
| 0-47   | 2/9 | 23/4 | 48/9  | 65/7   | 21/10 | 65/7   | 21/10 | 66/6    | 21/10 |

| Modular, metallised, P.C. mounting, 250V:<br>Prices per Capacitance value (μF) |     | each  |       | 10 off |       | 25 off |       | 100 off |       |
|--|-----|-------|-------|--------|-------|--------|-------|---------|-------|
| 0-01, 0-015  | 7d  | 5/2   | 11/3  | 38/7   | 11/3  | 38/7   | 11/3  | 39/6    | 11/3  |
| 0-022  | 7d  | 5/4   | 11/9  | 41/8   | 11/9  | 41/8   | 11/9  | 42/7    | 11/9  |
| 0-033, 0-047   | 8d  | 5/11  | 12/10 | 43/9   | 12/10 | 43/9   | 12/10 | 44/8    | 12/10 |
| 0-068  | 8d  | 6/7   | 14/11 | 47/11  | 14/11 | 47/11  | 14/11 | 48/10   | 14/11 |
| 0-1  | 9d  | 6/9   | 14/9  | 51/-   | 14/9  | 51/-   | 14/9  | 52/8    | 14/9  |
| 0-15   | 11d | 8/2   | 18/-  | 62/6   | 15/10 | 62/6   | 15/10 | 63/5    | 15/10 |
| 0-22   | 1/- | 8/9   | 18/11 | 63/6   | 16/11 | 63/6   | 16/11 | 64/5    | 16/11 |
| 0-33   | 1/5 | 12/6  | 27/-  | 61/5   | 17/10 | 61/5   | 17/10 | 62/4    | 17/10 |
| 0-47   | 1/8 | 14/8  | 31/9  | 65/7   | 18/11 | 65/7   | 18/11 | 66/6    | 18/11 |
| 0-68   | 2/3 | 19/10 | 42/2  | 65/7   | 19/11 | 65/7   | 19/11 | 66/6    | 19/11 |
| 1-0  | 2/9 | 23/8  | 49/8  | 65/7   | 20/11 | 65/7   | 20/11 | 66/6    | 20/11 |

## CAPACITORS

Subminiature Polyester film, Modular for P.C. mounting. Hard epoxy resin encapsulation. Radical leads.

| ±10% tolerance. 100V working.<br>Prices—per Capacitance value (μF) |     | each |       | 10 off |      | 25 off |      | 100 off |      |
|--|-----|------|-------|--------|------|--------|------|---------|------|
| 0-001, 0-002, 0-005  | 8d  | 4/3  | 8/4   | 30/-   | 4/3  | 30/-   | 4/3  | 31/9    | 4/3  |
| 0-01, 0-02   | 8d  | 6/-  | 12/6  | 41/8   | 6/-  | 41/8   | 6/-  | 42/7    | 6/-  |
| 0-05   | 10d | 7/1  | 15/6  | 51/-   | 7/1  | 51/-   | 7/1  | 52/6    | 7/1  |
| 0-1  | 10d | 7/1  | 15/6  | 51/-   | 7/1  | 51/-   | 7/1  | 52/6    | 7/1  |
| 0-2  | 1/2 | 10/- | 20/10 | 68/6   | 10/- | 68/6   | 10/- | 69/5    | 10/- |

Polyethylene film, Tubular, Axial leads. Unencapsulated. ±5% or ±1μF tolerance. 160V working.

| Prices—per Capacitance value (μF) |    | each |       | 10 off |     | 25 off |     | 100 off |     |
|-----------------------------------|----|------|-------|--------|-----|--------|-----|---------|-----|
| 10, 12, 15, 18, 22, 27, 33        | 8d | 3/7  | 7/9   | 24/-   | 3/7 | 24/-   | 3/7 | 25/8    | 3/7 |
| 39, 47, 56, 68, 82, 100, 120      | 5d | 4/-  | 8/8   | 26/8   | 4/- | 26/8   | 4/- | 27/7    | 4/- |
| 180, 220, 270, 330, 390           | 5d | 5/-  | 10/10 | 32/4   | 5/- | 32/4   | 5/- | 33/3    | 5/- |
| 470, 560, 680, 820, 1,000         | 5d | 6/-  | 12/12 | 38/4   | 6/- | 38/4   | 6/- | 39/3    | 6/- |
| 1,500                             | 5d | 7/-  | 14/14 | 44/4   | 7/- | 44/4   | 7/- | 45/3    | 7/- |
| 2,200, 3,300, 4,700, 5,600        | 5d | 8/-  | 16/16 | 50/4   | 8/- | 50/4   | 8/- | 51/3    | 8/- |
| 6,800, 8,200, 10,000, 15,000      | 5d | 9/-  | 18/18 | 56/4   | 9/- | 56/4   | 9/- | 57/3    | 9/- |
| 22,000                            | 5d | 9/9  | 18/18 | 56/4   | 9/9 | 56/4   | 9/9 | 57/3    | 9/9 |

## POTENTIOMETERS (Carbon)

Miniature, fully enclosed, rear tags, carbon brush wiper, Long Life, low noise. Body dia, 1/2 in. Spindle, 1/8 in. 1W at 70°C. ±20% below 1M, ±30% over 1M. Lin. 100 Ohms to 10 Megohms. Log. 5 Kohms to 5 Megohms.

| Prices—per ohmic value |     | each |      | 10 off |  | 25 off |  | 100 off |  |
|------------------------|-----|------|------|--------|--|--------|--|---------|--|
|                        | 2/- | 18/4 | 41/8 | 150/-  |  |        |  |         |  |

## GANGED STEREO POTENTIOMETERS (Carbon)

1W at 70°C. Long Spindle. Logarithmic and Linear: 5k + 5k to 1M + 1M.

| Prices—per ohmic value |     | each |       | 10 off |  | 25 off |  | 100 off |  |
|------------------------|-----|------|-------|--------|--|--------|--|---------|--|
|                        | 8/- | 70/- | 162/6 | 578/-  |  |        |  |         |  |

## SKELETON PRE-SET POTENTIOMETERS (Carbon)

High quality pre-sets suitable for printed circuit boards of 0.1in P.C.M. 100 ohms to 5 Megohms (Linear only). Miniature: 0.3W at 70°C. ±20% below 1M, ±30% above 1M. Horizontal (0.7in + 0.4in P.C.M.) or Vertical (0.4in P.C.M.). Subminiature: 0.1W at 70°C. ±20% below 2.5M, ±30% above.

| Prices—per ohmic value |     | each |      | 10 off |  | 25 off |  | 100 off |  |
|------------------------|-----|------|------|--------|--|--------|--|---------|--|
| Miniature (0.3W)       | 1/- | 8/9  | 18/9 | 66/8   |  |        |  |         |  |
| Subminiature (0.1W)    | 10d | 7/1  | 14/7 | 46/8   |  |        |  |         |  |

## RESISTORS

High stability, carbon film, low noise. Capless construction, molecular termination bonding.

Dimensions (mm): Body: 1W; 8 2.8  
1W; 10 4.3

Leads: 35

10% ranges; 10 Ohms to 10 Megohms (E12 Renard Series).

5% ranges; 4.7 Ohms to 1 Megohms (E24 Renard Series).

Prices—per Ohmic value.

|    |     | each |     | 10 off |      | 25 off |      | 100 off |      |
|----|-----|------|-----|--------|------|--------|------|---------|------|
| 1W | 10% | 2d   | 1/6 | 3/8    | 10/4 | 10/4   | 10/4 | 10/4    | 10/4 |
| 1W | 5%  | 2/4  | 1/9 | 3/8    | 11/4 | 11/4   | 11/4 | 11/4    | 11/4 |
| 1W | 10% | 2/4  | 1/9 | 3/8    | 11/4 | 11/4   | 11/4 | 11/4    | 11/4 |
| 1W | 5%  | 2/4  | 1/9 | 3/8    | 11/4 | 11/4   | 11/4 | 11/4    | 11/4 |

## SEMICONDUCTORS

| Prices |     | 1 off |       | 10 off |  | 25 off |  | 100 off |  |
|--------|-----|-------|-------|--------|--|--------|--|---------|--|
| Type   |     |       |       |        |  |        |  |         |  |
| AC107  | 3/6 | 28/3  | 62/-  | 232/9  |  |        |  |         |  |
| AC127  | 2/6 | 18/9  | 45/-  | 166/2  |  |        |  |         |  |
| AC128  | 2/6 | 18/9  | 45/-  | 166/3  |  |        |  |         |  |
| AD140  | 3/- | 30/-  | 144/- | 533/4  |  |        |  |         |  |
| AD149  | 6/- | 67/6  | 188/- | 600/-  |  |        |  |         |  |
| AF115  | 7/6 | 18/9  | 45/-  | 166/8  |  |        |  |         |  |
| AF116  | 2/6 | 18/9  | 45/-  | 166/8  |  |        |  |         |  |
| AF117  | 2/6 | 18/9  | 45/-  | 166/8  |  |        |  |         |  |
| BC107  | 3/6 | 28/3  | 62/-  | 232/9  |  |        |  |         |  |
| BC108  | 3/- | 22/6  | 54/-  | 199/8  |  |        |  |         |  |
| BC109  | 3/6 | 28/3  | 62/-  | 232/9  |  |        |  |         |  |
| BY234  | 2/9 | 24/8  | 58/4  | 177/-  |  |        |  |         |  |
| BY235  | 3/- | 26/3  | 56/3  | 187/6  |  |        |  |         |  |
| BY236  | 3/3 | 28/8  | 61/9  | 208/4  |  |        |  |         |  |
| BY237  | 3/6 | 30/8  | 65/6  | 218/9  |  |        |  |         |  |
| BY238  | 3/9 | 34/4  | 71/6  | 227/6  |  |        |  |         |  |
| BY210  | 6/- | 45/-  | 108/- | 389/-  |  |        |  |         |  |
| BY211  | 6/4 | 40/-  | 96/-  | 310/4  |  |        |  |         |  |
| BY212  | 4/9 | 35/-  | 84/-  | 254/8  |  |        |  |         |  |
| BY213  | 4/- | 30/-  | 72/-  | 206/-  |  |        |  |         |  |
| OA5    | 2/- | 15/-  | 36/-  | 133/4  |  |        |  |         |  |
| OA81   | 2/- | 15/-  | 36/-  | 133/4  |  |        |  |         |  |
| OA202  | 2/- | 15/-  | 36/-  | 133/4  |  |        |  |         |  |
| OC25   | 7/4 | 65/8  | 132/- | 497/8  |  |        |  |         |  |
| OC26   | 6/- | 45/-  | 108/- | 389/-  |  |        |  |         |  |
| OC28   | 9/- | 67/6  | 162/- | 598/6  |  |        |  |         |  |
| OC35   | 6/- | 45/-  | 108/- | 389/-  |  |        |  |         |  |
| OC44   | 3/- | 22/6  | 54/-  | 199/8  |  |        |  |         |  |
| OC45   | 2/8 | 18/9  | 45/-  | 166/3  |  |        |  |         |  |
| OC71   | 2/- | 15/-  | 36/-  | 133/4  |  |        |  |         |  |

# prepare now for tomorrow's world

Today there is a huge demand for technologists such as electronics, nuclear and computer systems engineers, radio and television engineers, etc. In the future, there will be even more such important positions requiring just the up-to-date, advanced technical education which CREI, the Home Study Division of McGraw-Hill Book Co., can provide.

CREI Study Programmes are directly related to the problems of industry including the latest technological developments and advanced ideas. The individual tuition given by the CREI panel of experts in each specialised field is comparable in technological content with that of technical colleges.

**Take the first step to a better job now — enrol with CREI, the specialists in Technical Home Study Education.**

### CREI Programmes are available in:

Electronic Engineering Technology \* Industrial Electronics for Automation \* Computer Systems Technology \* Nuclear Engineering \* Mathematics for Electronics Engineers \* Television Engineering \* Radar and Servo Engineering \* City and Guilds of London Institute: Subject No. 49 and Advanced Studies No. 300.

**CREI (London), Walpole House,  
173-176 Sloane Street, London S.W.1.  
A Subsidiary of McGraw-Hill Inc.**

Post this coupon today for a better future

To C.R.E.I. (London), Walpole House, 173-176 Sloane Street, London S.W.1.  
Please send me (without obligation) details of your Educational Programmes

please tick  
My interest is City and Guilds  General

Name .....

Address .....

Electronics experience .....

PE 20

## R.S.T. VALVE MAIL ORDER CO. BLACKWOOD HALL, WELLFIELD RD., S.W.16 SPECIAL EXPRESS MAIL ORDER SERVICE

|        |      |           |       |        |        |        |         |        |         |        |      |
|--------|------|-----------|-------|--------|--------|--------|---------|--------|---------|--------|------|
| AZ31   | 10/- | KT81(7C6) | UCH31 | 7/-    | 12AU7  | 5/9    | 2N2068  | 20/-   | GET880  | 9/-    |      |
| CIC    | 20/- | 22/6      | UCL82 | 6/9    | 12AX7  | 6/3    | 2N2147  | 12/6   | GET885  | 5/-    |      |
| CY30   | 12/6 | KT81(GRC) | UCL83 | 10/-   | 12BA6  | 6/-    | 2N2160  | 15/0   | GET84   | 2/6    |      |
| DAF91  | 4/6  | KT88      | UFA1  | 10/6   | 12BE6  | 4/3    | 2N2388A | 4/6    | GET541  | 3/6    |      |
| DAF96  | 7/6  | KTW61     | UL41  | 12/-   | 12K7GT | 7/-    | 2N2904  | 30/-   | GET3    | 3/6    |      |
| DF81   | 10/6 | KTW02     | UL84  | 7/-    | 12K8GT | 8/-    | 2N2904A | 12/6   | GET6M   | 3/6    |      |
| DF96   | 7/6  | ML4       | UU6   | 21/-   | 12Q7GT | 6/-    | 2N2926  | 5/6    | GET7M   | 6/6    |      |
| DB3/91 | 4/6  | N78       | UU7   | 21/-   | 20L1   | 20/-   | 2N2819  | 13/-   | HD2967  | 4/-    |      |
| DH77   | 4/9  | PC88      | UU8   | 21/-   | 20P4   | 20/-   | 28002   | 20/-   | HG6002  | 4/-    |      |
| DK91   | 6/-  | PC97      | UY85  | 5/6    | 28Z4   | 6/3    | 28004   | 11/-   | JK9A    | 22/6   |      |
| DK96   | 9/-  | PC900     | UY48  | 25/-   | 28Z5GT | 8/-    | 28005   | 48/-   | JK10A   | 18/-   |      |
| DL66   | 2/9  | PCC84     | UY41  | 5/6    | 28Z6GT | 8/6    | 28006   | 20/-   | JK10B   | 22/6   |      |
| DL92   | 6/3  | PCC89     | UY41  | 5/6    | 30C15  | 18/-   | 28012   | 50/-   | JK19A   | 22/6   |      |
| DL94   | 6/9  | PCC189    | W81   | 12/6   | 30C17  | 16/-   | 28012A  | 55/-   | JK21A   | 12/6   |      |
| DL96   | 7/9  | PCF86     | X81   | 12/6   | 30C18  | 15/-   | 28013   | 50/-   | K885A   | 6/6    |      |
| DL810  | 12/6 | PCF80     | X81   | 12/6   | 30F5   | 17/-   | 28018   | 60/-   | KEAT101 | 9/6    |      |
| DL816  | 30/- | PCF801    | Z319  | 25/-   | 30FL1  | 16/-   | 28108   | 60/-   | MEAT120 | 7/9    |      |
| DL819  | 30/- | PCF802    | Z759  | 23/-   | 30FL12 | 19/-   | 28301   | 12/6   | NET128  | 6/6    |      |
| DW4350 | 7/6  | PCF806    | Z803U | 15/-   | 30FL14 | 18/6   | 28320   | 9/-    | NET142  | 6/6    |      |
| DY86   | 6/-  | PCL82     | 7/9   | OA2    | 6/-    | 30L15  | 17/-    | 28702  | 15/-    | NET211 | 6/6  |
| DY87   | 5/-  | PCL84     | 10/3  | OB2    | 0/-    | 30L17  | 17/-    | 44L    | 46/-    | NET214 | 4/6  |
| EB88CC | 12/- | PCL85     | 9/3   | OC3    | 5/6    | 30P4   | 15/6    | AC107  | 10/-    | NET216 | 7/6  |
| E180F  | 17/6 | PCL86     | 9/3   | OD3    | 4/6    | 30P12  | 16/-    | AC128  | 6/6     | NET217 | 6/6  |
| E182C  | 22/6 | PEN84     | 20/-  | 1BCP31 | 7/3    | 30P19  | 15/-    | AC127  | 7/6     | NET218 | 6/6  |
| EB450  | 6/6  | PEN450D   | IR5   | 6/-    | 30PL1  | 16/-   | AC128   | 6/6    | NET221  | 5/6    |      |
| BAF42  | 10/- | 2D21      | 6/6   | 30PL13 | 18/6   | AC176  | 7/6     | NET223 | 6/6     |        |      |
| EB91   | 3/-  | PFV200    | 20/6  | 30PL14 | 18/-   | AC177  | 7/6     | NET224 | 4/6     |        |      |
| EB333  | 8/6  | PL36      | 10/9  | 3A4    | 12/6   | AC178  | 6/9     | NET225 | 3/6     |        |      |
| EB341  | 10/6 | PL81      | 8/-   | 3B24   | 70/-   | 35V4   | 4/6     | NET227 | 6/6     |        |      |
| EB350  | 4/9  | PL82      | 8/0   | 3B28   | 40/-   | 3E24GT | 8/6     | NET251 | 5/6     |        |      |
| EB353  | 9/6  | PL84      | 7/-   | 3C45   | 65/-   | 50C5   | 6/3     | NET265 | 9/6     |        |      |
| EBF89  | 6/6  | PL600     | 14/6  | 3E29   | 15/-   | 50C0DG | 31/-    | AC128  | 4/6     |        |      |
| EBF89  | 6/6  | PL509     | 37/6  | 4A150A | 90/-   | 80     | 16/-    | AD140  | 16/-    | NET304 | 8/6  |
| EBL21  | 12/6 | PX4       | 14/6  | 8ACV   | 10/6   | 85A1   | 20/-    | 85A1   | 19/6    | NET305 | 8/6  |
| EBL31  | 27/6 | PX25      | 14/-  | 5U4G   | 6/6    | 85A2   | 7/3     | 8A1F   | 11/-    | NET352 | 8/6  |
| EC333  | 12/6 | PY32      | 10/9  | 5V4G   | 8/-    | 90AG   | 46/-    | AF115  | 6/6     | NET452 | 12/6 |
| EC333  | 17/6 | PY33      | 10/9  | 5Y3GT  | 6/-    | 90AV   | 48/-    | AF116  | 6/6     | NET475 | 5/6  |
| EC333  | 17/6 | PY81      | 5/9   | 8Z5G   | 7/-    | 90C1   | 12/-    | AF117  | 6/6     | NET476 | 5/6  |
| EC333  | 17/6 | PY82      | 4/9   | 6/80L2 | 10/-   | 90C2   | 25/-    | AF118  | 10/-    | NET477 | 5/6  |
| EC333  | 17/6 | PY83      | 4/9   | 6/80L2 | 10/-   | 90C3   | 25/-    | AF119  | 10/-    | NET478 | 5/6  |
| EC333  | 17/6 | PY84      | 4/9   | 6/80L2 | 10/-   | 90C4   | 25/-    | AF120  | 10/-    | NET479 | 5/6  |
| EC333  | 17/6 | PY85      | 4/9   | 6/80L2 | 10/-   | 90C5   | 25/-    | AF121  | 10/-    | NET480 | 5/6  |
| EC333  | 17/6 | PY86      | 4/9   | 6/80L2 | 10/-   | 90C6   | 25/-    | AF122  | 10/-    | NET481 | 5/6  |
| EC333  | 17/6 | PY87      | 4/9   | 6/80L2 | 10/-   | 90C7   | 25/-    | AF123  | 10/-    | NET482 | 5/6  |
| EC333  | 17/6 | PY88      | 4/9   | 6/80L2 | 10/-   | 90C8   | 25/-    | AF124  | 10/-    | NET483 | 5/6  |
| EC333  | 17/6 | PY89      | 4/9   | 6/80L2 | 10/-   | 90C9   | 25/-    | AF125  | 10/-    | NET484 | 5/6  |
| EC333  | 17/6 | PY90      | 4/9   | 6/80L2 | 10/-   | 90C10  | 25/-    | AF126  | 10/-    | NET485 | 5/6  |
| EC333  | 17/6 | PY91      | 4/9   | 6/80L2 | 10/-   | 90C11  | 25/-    | AF127  | 10/-    | NET486 | 5/6  |
| EC333  | 17/6 | PY92      | 4/9   | 6/80L2 | 10/-   | 90C12  | 25/-    | AF128  | 10/-    | NET487 | 5/6  |
| EC333  | 17/6 | PY93      | 4/9   | 6/80L2 | 10/-   | 90C13  | 25/-    | AF129  | 10/-    | NET488 | 5/6  |
| EC333  | 17/6 | PY94      | 4/9   | 6/80L2 | 10/-   | 90C14  | 25/-    | AF130  | 10/-    | NET489 | 5/6  |
| EC333  | 17/6 | PY95      | 4/9   | 6/80L2 | 10/-   | 90C15  | 25/-    | AF131  | 10/-    | NET490 | 5/6  |
| EC333  | 17/6 | PY96      | 4/9   | 6/80L2 | 10/-   | 90C16  | 25/-    | AF132  | 10/-    | NET491 | 5/6  |
| EC333  | 17/6 | PY97      | 4/9   | 6/80L2 | 10/-   | 90C17  | 25/-    | AF133  | 10/-    | NET492 | 5/6  |
| EC333  | 17/6 | PY98      | 4/9   | 6/80L2 | 10/-   | 90C18  | 25/-    | AF134  | 10/-    | NET493 | 5/6  |
| EC333  | 17/6 | PY99      | 4/9   | 6/80L2 | 10/-   | 90C19  | 25/-    | AF135  | 10/-    | NET494 | 5/6  |
| EC333  | 17/6 | PY100     | 4/9   | 6/80L2 | 10/-   | 90C20  | 25/-    | AF136  | 10/-    | NET495 | 5/6  |
| EC333  | 17/6 | PY101     | 4/9   | 6/80L2 | 10/-   | 90C21  | 25/-    | AF137  | 10/-    | NET496 | 5/6  |
| EC333  | 17/6 | PY102     | 4/9   | 6/80L2 | 10/-   | 90C22  | 25/-    | AF138  | 10/-    | NET497 | 5/6  |
| EC333  | 17/6 | PY103     | 4/9   | 6/80L2 | 10/-   | 90C23  | 25/-    | AF139  | 10/-    | NET498 | 5/6  |
| EC333  | 17/6 | PY104     | 4/9   | 6/80L2 | 10/-   | 90C24  | 25/-    | AF140  | 10/-    | NET499 | 5/6  |
| EC333  | 17/6 | PY105     | 4/9   | 6/80L2 | 10/-   | 90C25  | 25/-    | AF141  | 10/-    | NET500 | 5/6  |
| EC333  | 17/6 | PY106     | 4/9   | 6/80L2 | 10/-   | 90C26  | 25/-    | AF142  | 10/-    | NET501 | 5/6  |
| EC333  | 17/6 | PY107     | 4/9   | 6/80L2 | 10/-   | 90C27  | 25/-    | AF143  | 10/-    | NET502 | 5/6  |
| EC333  | 17/6 | PY108     | 4/9   | 6/80L2 | 10/-   | 90C28  | 25/-    | AF144  | 10/-    | NET503 | 5/6  |
| EC333  | 17/6 | PY109     | 4/9   | 6/80L2 | 10/-   | 90C29  | 25/-    | AF145  | 10/-    | NET504 | 5/6  |
| EC333  | 17/6 | PY110     | 4/9   | 6/80L2 | 10/-   | 90C30  | 25/-    | AF146  | 10/-    | NET505 | 5/6  |
| EC333  | 17/6 | PY111     | 4/9   | 6/80L2 | 10/-   | 90C31  | 25/-    | AF147  | 10/-    | NET506 | 5/6  |
| EC333  | 17/6 | PY112     | 4/9   | 6/80L2 | 10/-   | 90C32  | 25/-    | AF148  | 10/-    | NET507 | 5/6  |
| EC333  | 17/6 | PY113     | 4/9   | 6/80L2 | 10/-   | 90C33  | 25/-    | AF149  | 10/-    | NET508 | 5/6  |
| EC333  | 17/6 | PY114     | 4/9   | 6/80L2 | 10/-   | 90C34  | 25/-    | AF150  | 10/-    | NET509 | 5/6  |
| EC333  | 17/6 | PY115     | 4/9   | 6/80L2 | 10/-   | 90C35  | 25/-    | AF151  | 10/-    | NET510 | 5/6  |
| EC333  | 17/6 | PY116     | 4/9   | 6/80L2 | 10/-   | 90C36  | 25/-    | AF152  | 10/-    | NET511 | 5/6  |
| EC333  | 17/6 | PY117     | 4/9   | 6/80L2 | 10/-   | 90C37  | 25/-    | AF153  | 10/-    | NET512 | 5/6  |
| EC333  | 17/6 | PY118     | 4/9   | 6/80L2 | 10/-   | 90C38  | 25/-    | AF154  | 10/-    | NET513 | 5/6  |
| EC333  | 17/6 | PY119     | 4/9   | 6/80L2 | 10/-   | 90C39  | 25/-    | AF155  | 10/-    | NET514 | 5/6  |
| EC333  | 17/6 | PY120     | 4/9   | 6/80L2 | 10/-   | 90C40  | 25/-    | AF156  | 10/-    | NET515 | 5/6  |
| EC333  | 17/6 | PY121     | 4/9   | 6/80L2 | 10/-   | 90C41  | 25/-    | AF157  | 10/-    | NET516 | 5/6  |
| EC333  | 17/6 | PY122     | 4/9   | 6/80L2 | 10/-   | 90C42  | 25/-    | AF158  | 10/-    | NET517 | 5/6  |
| EC333  | 17/6 | PY123     | 4/9   | 6/80L2 | 10/-   | 90C43  | 25/-    | AF159  | 10/-    | NET518 | 5/6  |
| EC333  | 17/6 | PY124     | 4/9   | 6/80L2 | 10/-   | 90C44  | 25/-    | AF160  | 10/-    | NET519 | 5/6  |
| EC333  | 17/6 | PY125     | 4/9   | 6/80L2 | 10/-   | 90C45  | 25/-    | AF161  | 10/-    | NET520 | 5/6  |
| EC333  | 17/6 | PY126     | 4/9   | 6/80L2 | 10/-   | 90C46  | 25/-    | AF162  | 10/-    | NET521 | 5/6  |
| EC333  | 17/6 | PY127     | 4/9   | 6/80L2 | 10/-   | 90C47  | 25/-    | AF163  | 10/-    | NET522 | 5/6  |
| EC333  | 17/6 | PY128     | 4/9   | 6/80L2 | 10/-   | 90C48  | 25/-    | AF164  | 10/-    | NET523 | 5/6  |
| EC333  | 17/6 | PY129     | 4/9   | 6/80L2 | 10/-   | 90C49  | 25/-    | AF165  | 10/-    | NET524 | 5/6  |
| EC333  | 17/6 | PY130     | 4/9   | 6/80L2 | 10/-   | 90C50  | 25/-    | AF166  | 10/-    | NET525 | 5/6  |
| EC333  | 17/6 | PY131     | 4/9   | 6/80L2 | 10/-   | 90C51  | 25/-    | AF167  | 10/-    | NET526 | 5/6  |
| EC333  | 17/6 | PY132     | 4/9   | 6/80L2 | 10/-   | 90C52  | 25/-    | AF168  | 10/-    | NET527 | 5/6  |
| EC333  | 17/6 | PY133     | 4/9   | 6/80L2 | 10/-   | 90C53  | 25/-    | AF169  | 10/-    | NET528 | 5/6  |
| EC333  | 17/6 | PY134     | 4/9   | 6/80L2 | 10/-   | 90C54  | 25/-    | AF170  | 10/-    | NET529 | 5/6  |
| EC333  | 17/6 | PY135     | 4/9   | 6/80L2 | 10/-   | 90C55  | 25/-    | AF171  | 10/-    | NET530 | 5/6  |
| EC333  | 17/6 | PY136     | 4/9   | 6/80L2 | 10/-   | 90C56  | 25/-    | AF172  | 10/-    | NET531 | 5/6  |
| EC333  | 17/6 | PY137     | 4/9   | 6/80L2 | 10/-   | 90C57  | 25/-    | AF173  | 10/-    | NET532 | 5/6  |
| EC333  | 17/6 | PY138     | 4/9   | 6/80L2 | 10/-   | 90C58  | 25/-    | AF174  | 10/-    | NET533 | 5/6  |
| EC333  | 17/6 | PY139     | 4/9   | 6/80L2 | 10/-   | 90C59  | 25/-    | AF175  | 10/-    | NET534 | 5/6  |
| EC333  | 17/6 | PY140     | 4/9   | 6/80L2 | 10/-   | 90C60  | 25/-    | AF176  | 10/-    | NET535 | 5/6  |
| EC333  | 17/6 | PY141     | 4/9   | 6/80L2 | 10/-   | 90C61  | 25/-    | AF177  | 10/-    | NET536 | 5/6  |
| EC333  | 17/6 | PY142     | 4/9   | 6/80L2 | 10/-   | 90C62  | 25/-    | AF178  | 10/-    | NET537 | 5/6  |
| EC333  | 17/6 | PY143     | 4/9   | 6/80L2 | 10/-   | 90C63  | 25/-    | AF179  | 10/-    | NET538 | 5/6  |
| EC333  | 17/6 | PY144     | 4/9   | 6/80L2 | 10/-   | 90C64  | 25/-    | AF180  | 10/-    | NET539 | 5/6  |
| EC333  | 17/6 | PY145     | 4/9   | 6/80L2 | 10/-   | 90C65  | 25/-    | AF181  | 10/-    | NET540 | 5/6  |
| EC333  | 17/6 | PY146     | 4/9   | 6/80L2 | 10/-   | 90C66  | 25/-    | AF182  | 10/-    | NET541 | 5/6  |
| EC333  | 17/6 | PY147     | 4/9   | 6/80L2 | 10/-   | 90C67  | 25/-    | AF183  | 10/-    | NET542 | 5/6  |
| EC333  | 17/6 | PY148     | 4/9   | 6/80L2 | 10/-   | 90C68  | 25/-    | AF184  | 10/-    | NET543 | 5/6  |
| EC333  | 17/6 | PY149     | 4/9   | 6/80L2 | 10/-   | 90C69  | 25/-    | AF185  | 10/-    | NET544 | 5/6  |
| EC333  | 17/6 | PY150     | 4/9   | 6/80L2 | 10/-   | 90C70  | 25/-    | AF186  | 10/-    | NET545 | 5/6  |
| EC333  | 17/6 | PY151     | 4/9   | 6/80L2 | 10/-   | 90C71  | 25/-    | AF187  | 10/-    | NET546 | 5/6  |
| EC333  | 17/6 | PY152     | 4/9   |        |        |        |         |        |         |        |      |



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

**BASF TAPE 25% OFF**

5in 600ft. 14/- 900ft. 19/- 1200ft. 30/-  
5½in 900ft. 19/- 1200 ft. 24/- 1800ft. 39/-  
7in 1200ft. 24/- 1800ft. 35/- 2400ft. 57/-  
P/P 2/- per reel—over £5 FREE

**SPECIAL PURCHASE**

**12in 15watt HI-FI LOUDSPEAKERS**

Made by famous British manufacturer to very high standards, heavy duty cast chassis, twin cone construction, smooth extended range, with very low level of distortion.—Response 35-17,500Hz.—impedance 15 ohms—flux, 11,000 gauss.

**WALDON PRICE 97/6** each plus 6/6 P. & P.

**E.M.I. HI-FI SPEAKERS**

**SET 450:** 13×8 with two built-in tweeters and cross-over unit. **Our Price 69/6.** 3 or 15 ohm, 10W, 40-13,000Hz.

**SET 850:** 6½in bass plus 3½in tweeter and cross-over unit. 8 ohm, 10W, 65-20,000Hz. 79/6.

**SET 250:** 5in heavy duty bass plus 3in tweeter and cross-over unit. 8 ohm, 6W, 80-20,000Hz. 65/-

Add 5/6 p/p for each speaker set.

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

**GARRARD UNITS**

|                    |    |    |   |
|--------------------|----|----|---|
| <b>SP25 Mk. II</b> | £  | s  | d |
|                    | 11 | 9  | 6 |
| <b>AP75</b>        | 17 | 19 | 6 |
| <b>SL65</b>        | 14 | 9  | 6 |
| <b>*3500</b>       | 11 | 9  | 6 |

\*Denotes including Sonotone 9TA-Stereo/Diamond Cartridge. Elegantly styled plinth and cover to suit the above units. From 5 gns. Please add 10/- p/p each on all above items.

**SPEAKER ENCLOSURES**

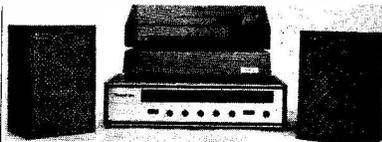
Designed to accept the full range of E.M.I. loudspeakers. Beautifully styled in teak.

Prices from **89/6** each.

**25 WATT GROUP SPEAKERS**

**Guitar group 25.** 12in round, heavy duty cone, with solid aluminium chassis, 15 ohms imp. 12,000 gauss. Response 30-10,000c/s. **OUR SPECIAL PRICE**

**£5.9.6** plus 6/6 P. & P.



The greatest budget system available today—can't be beaten—price or quality anywhere—look at these great features—then compare:

**Teleton FZ000 Mk. II.** Tuner amp. Latest version with all the new features. Tuning indicator—fused circuit protection, AM-FM fitted multiplex, A.F.C. 2×5 watts per channel. A truly outstanding unit. £ s d 43 1 8

**Garrard 3500 (Auto/single).** Latest in the great new Garrard range, provides facilities and controls that are usually found only on much more expensive units 13 11 0

**Teleton SA1003** matching speaker systems 10 0 0

**Sonotone 9TA** stereo cartridge with diamond stylus—a perfect match 4 2 0

**Plinth/Cover** elegantly styled 7 0 0

**Plugs and Leads** all supplied 1 5 0

Normal Retail Price £78 19 8

Exclusively offered by **WALDON** +25/- at the remarkably low price of **63 gns** Carrg.

All items may be purchased separately.

**WALDON ELECTRONICS, 707 Blackburn Road, Bolton, Lancs. Bolton 54280**

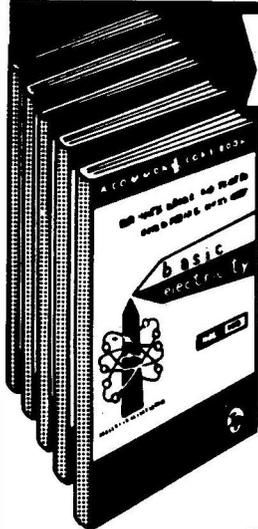
PLEASE ENCLOSE 1/0 IN STAMPS WITH ENQUIRIES

**YOURS FREE FOR 7 DAYS**

The 'New Picture-Book' way of learning **BASIC ELECTRICITY (5 VOLS.)** **BASIC ELECTRONICS (6 VOLS.)**

You'll find it easy to learn with this outstandingly successful **NEW PICTORIAL METHOD**—the essential facts are explained in the simplest language, one at a time, and each is illustrated by an accurate, cartoon-type drawing. The books are based on the latest research into simplified learning techniques. This has proved that the **PICTORIAL APPROACH** to learning is the quickest and soundest way of gaining mastery over these subjects.

**TO TRY IT, IS TO PROVE IT**



The series will be of exceptional value in training mechanics and technicians in Electricity, Radio and Electronics.

**WHAT READERS SAY**

"I am more than pleased with these publications and I have learnt more in Part 1 than I have learnt in any other books."

S.S., Dagenham.

"I am highly delighted with the books: I didn't know a complicated subject could be so easily presented."

J.K., Earlsfield.

"I am pleased to say how understandable your books are. I have now quite a sound knowledge of Electronics."

P.S., Southgate.

A TECH-PRESS PUBLICATION

**POST NOW FOR THIS OFFER !!**

To The SELRAY BOOK CO., 60 HAYES HILL, HAYES, BROMLEY, KENT BR2 7HP

Please send me **WITHOUT OBLIGATION TO PURCHASE**, one of the above sets on **7 DAYS FREE TRIAL**, I will either return set, carriage paid, in good condition within 7 days or send the following amounts. **BASIC ELECTRICITY 75/-**. Cash Price or Down Payment of 20/- followed by 3 fortnightly payments of 20/- each. **BASIC ELECTRONICS 90/-**. Cash Price or Down Payment of 20/- followed by 4 fortnightly payments of 20/- each. This offer applies to **UNITED KINGDOM ONLY**. Overseas customers cash with order, prices as above.

Tick Set required (Only one set allowed on free trial)

**BASIC ELECTRICITY**  **BASIC ELECTRONICS**

Prices include Postage and Packing.

Signature ..... (If under 21 signature required of parent or guardian)

NAME ..... BLOCK LETTERS

FULL POSTAL ADDRESS.....

# SEMICONDUCTORS & COMPONENTS

**BRAND NEW**

(Saturday callers only 5% Discount)

**GUARANTEED**

## TRANSISTORS

|         |      |         |      |        |      |        |      |         |      |          |      |
|---------|------|---------|------|--------|------|--------|------|---------|------|----------|------|
| 2G301   | 4/-  | 2N3014  | 7/6  | 2N5367 | 11/6 | BC108  | 3/6  | BFY56A  | 11/- | NKT238   | 6/-  |
| 2G302   | 4/-  | 2N3053  | 6/6  | 2N5457 | 7/6  | BC109  | 3/6  | BFY75   | 6/-  | NKT240   | 6/-  |
| 2G303   | 4/-  | 2N3054  | 11/6 | 2S005  | 15/- | BC113  | 6/6  | BFY76   | 6/-  | NKT241   | 6/-  |
| 2G306   | 8/6  | 2N3055  | 15/- | 2S020  | 15/- | BC115  | 6/6  | BFY77   | 11/6 | NKT10419 | 6/-  |
| 2G308   | 6/6  | 2N3133  | 6/6  | 2S102  | 6/6  | BC116  | 12/6 | BFY90   | 12/6 |          |      |
| 2G309   | 6/6  | 2N3134  | 6/6  | 2S103  | 6/6  | BC118  | 6/6  | BFW58   | 7/6  | NKT10439 | 6/-  |
| 2G371   | 3/-  | 2N3135  | 6/-  | 2S104  | 6/6  | BC121  | 4/-  | BFW59   | 5/6  |          | 6/-  |
| 2G374   | 5/6  | 2N3136  | 6/-  | 2S501  | 5/6  | BC122  | 4/-  | BFW60   | 6/6  | NKT10519 | 6/-  |
| 2G381   | 4/6  | 2N3390  | 10/6 | 2S502  | 5/6  | BC125  | 13/6 | BSX19   | 5/6  | NKT2032  | 6/-  |
| 2N404   | 6/6  | 2N3391  | 7/6  | 2S503  | 5/6  | BC126  | 13/6 | BSX20   | 5/6  |          | 8/6  |
| 2N696   | 5/-  | 2N3391A | 6/-  | 3N83   | 37/6 | BC140  | 11/- | BSX21   | 8/6  |          | 10/6 |
| 2N698   | 4/6  | 2N3392  | 6/6  | 3N128  | 18/6 | BC147  | 4/6  | BSX26   | 10/6 | NKT20339 | 10/6 |
| 2N706   | 2/6  | 2N3394  | 5/6  | 3N140  | 19/6 | BC148  | 4/6  | BSX27   | 10/6 |          | 15/6 |
| 2N706A  | 2/6  | 2N3402  | 7/6  | 3N141  | 21/6 | BC149  | 5/6  | BSX28   | 6/-  | NKT80111 | 15/6 |
| 2N708   | 4/6  | 2N3403  | 7/6  | 3N142  | 16/6 | BC157  | 4/-  | BSX60   | 19/6 |          | 19/6 |
| 2N709   | 12/6 | 2N3404  | 8/6  | 3N143  | 19/6 | BC158  | 3/6  | BSX61   | 12/6 | NKT80113 | 19/6 |
| 2N710   | 5/6  | 2N3405  | 12/6 | R.C.A. | 24/- | BC160  | 12/6 | BSX76   | 4/6  |          | 22/6 |
| 2N726   | 5/-  | 2N3414  | 5/6  | 40250  | 16/6 | BC167  | 3/6  | BSX78   | 6/6  |          | 18/6 |
| 2N727   | 5/-  | 2N3415  | 6/6  | 40251  | 17/6 | BC168  | 3/6  | BSY10   | 5/6  | NKT80211 | 18/6 |
| 2N743   | 4/6  | 2N3416  | 9/6  | 40253  | 8/6  | BC169  | 3/6  | BSY11   | 5/6  |          | 18/6 |
| 2N744   | 4/6  | 2N3417  | 11/6 | 40254  | 10/6 | BC170  | 3/6  | BSY24   | 4/-  | NKT80212 | 18/6 |
| 2N753   | 5/6  | 2N3570  | 12/6 | 40309  | 10/6 | BC171  | 3/6  | BSY25   | 4/-  | NKT80214 | 18/6 |
| 2N914   | 4/6  | 2N3572  | 12/6 | 40310  | 13/6 | BC172  | 6/6  | BSY26   | 4/-  |          | 18/6 |
| 2N916   | 3/6  | 2N3645  | 12/6 | 40311  | 10/6 | BC182  | 4/6  | BSY27   | 4/-  |          | 18/6 |
| 2N918   | 6/6  | 2N3606  | 5/6  | 40312  | 13/6 | BC183  | 4/6  | BSY28   | 4/-  | NKT80214 | 18/6 |
| 2N929   | 5/6  | 2N3607  | 9/6  | 40314  | 11/- | BC184  | 4/6  | BSY29   | 4/-  |          | 18/6 |
| 2N930   | 6/6  | 2N3662  | 9/6  | 40315  | 11/- | BC121L | 5/6  | BSY32   | 5/-  | NKT80215 | 18/6 |
| 2N987   | 10/6 | 2N3663  | 10/- | 40316  | 12/6 | BCY10  | 5/6  | BSY36   | 5/6  |          | 18/6 |
| 2N1090  | 6/6  | 2N3702  | 4/6  | 40317  | 11/6 | BCY12  | 5/6  | BSY37   | 5/6  | NKT80211 | 18/6 |
| 2N1091  | 6/6  | 2N3703  | 4/6  | 40319  | 14/6 | BCY38  | 4/6  | BSY38   | 4/6  |          | 18/6 |
| 2N1131  | 8/6  | 2N3704  | 5/6  | 40320  | 11/- | BCY31  | 4/6  | BSY39   | 4/6  | OC20     | 21/6 |
| 2N1132  | 8/6  | 2N3705  | 4/6  | 40323  | 10/6 | BCY32  | 7/6  | BSY40   | 6/6  | OC22     | 8/6  |
| 2N1302  | 4/-  | 2N3706  | 4/6  | 40324  | 12/6 | BCY33  | 5/6  | BSY51   | 10/6 | OC23     | 8/6  |
| 2N1303  | 4/-  | 2N3707  | 4/6  | 40326  | 10/6 | BCY34  | 5/6  | BSY52   | 6/-  | OC24     | 7/6  |
| 2N1304  | 4/6  | 2N3708  | 4/6  | 40329  | 7/6  | BCY38  | 5/6  | BSY53   | 9/-  | OC25     | 8/6  |
| 2N1305  | 4/6  | 2N3709  | 4/6  | 40347  | 10/6 | BCY39  | 6/6  | BSY54   | 6/6  | OC26     | 6/6  |
| 2N1306  | 5/6  | 2N3710  | 4/6  | 40348  | 10/6 | BCY40  | 7/6  | BSY56   | 6/-  | OC28     | 8/6  |
| 2N1307  | 5/6  | 2N3711  | 4/6  | 40348  | 11/- | BCY42  | 3/-  | BSY78   | 9/6  | OC30     | 8/6  |
| 2N1308  | 6/6  | 2N3819  | 9/6  | 40360  | 12/6 | BCY43  | 3/-  | BSY79   | 9/6  | OC35     | 6/6  |
| 2N1309  | 6/6  | 2N3820  | 21/6 | 40361  | 12/6 | BCY54  | 7/6  | BSY82   | 10/6 | OC36     | 6/6  |
| 2N1420  | 7/6  | 2N3823  | 17/6 | 40362  | 14/6 | BCY58  | 4/6  | BSY83   | 11/6 | OC38     | 10/6 |
| 2N1507  | 5/6  | 2N3854  | 5/6  | 40370  | 8/6  | BCY59  | 4/6  | BSY84   | 12/6 | OC41     | 4/6  |
| 2N1525  | 7/6  | 2N385A  | 5/6  | 40468  | 16/6 | BCY60  | 5/6  | BSY85   | 13/6 | OC42     | 4/6  |
| 2N1526  | 7/6  | 2N385B  | 5/6  | 40468A | 16/6 | BCY70  | 5/6  | BSY87   | 10/6 | OC44     | 4/6  |
| 2N1527  | 7/6  | 2N3855A | 6/-  | AC107  | 6/-  | BCY71  | 9/6  | BSY90   | 11/6 | OC45     | 2/6  |
| 2N1605  | 9/6  | 2N3856  | 6/-  | AC126  | 4/-  | BCY72  | 5/6  | BSY95A  | 3/6  | OC46     | 3/6  |
| 2N1613  | 8/6  | 2N3856A | 6/-  | AC127  | 5/-  | BCZ10  | 4/6  | BSW41   | 8/6  | OC70     | 3/6  |
| 2N1631  | 8/6  | 2N3858  | 5/-  | AC128  | 4/-  | BCZ11  | 4/6  | BSW70   | 5/6  | OC71     | 2/6  |
| 2N1632  | 8/6  | 2N3858A | 6/-  | AC176  | 6/-  | BD131  | 19/6 | D161    | 7/6  | OC72     | 2/6  |
| 2N1637  | 8/6  | 2N3859  | 5/6  | AC179  | 6/-  | BD132  | 23/6 | D162    | 8/6  | OC74     | 4/6  |
| 2N1638  | 8/6  | 2N3859A | 6/6  | AC188  | 12/- | BD124  | 17/6 | D16P3   | 7/6  | OC75     | 4/6  |
| 2N1639  | 8/6  | 2N3860  | 6/-  | ACY17  | 5/-  | BF115  | 5/6  | D16P4   | 8/6  | OC76     | 3/6  |
| 2N1711  | 6/6  | 2N3877  | 9/-  | ACY18  | 5/-  | BF117  | 10/6 | GET102  | 6/6  | OC77     | 4/6  |
| 2N1889  | 8/-  | 2N3877A | 9/6  | ACY19  | 5/-  | BF167  | 6/6  | GET113  | 4/6  | OC78     | 3/6  |
| 2N1893  | 8/-  | 2N3900  | 10/6 | ACY20  | 5/-  | BF173  | 7/6  | GET116  | 6/6  | OC78D    | 3/6  |
| 2N2147  | 17/6 | 2N3900A | 11/6 | ACY21  | 5/-  | BF177  | 11/6 | GET118  | 6/6  | OC81     | 4/6  |
| 2N2148  | 12/6 | 2N3901  | 19/6 | ACY22  | 4/-  | BF178  | 10/6 | GET118  | 4/6  | OC81D    | 3/6  |
| 2N2160  | 14/6 | 2N3903  | 8/6  | ACY28  | 4/-  | BF179  | 11/6 | GET119  | 4/6  | OC82     | 3/6  |
| 2N2193  | 5/6  | 2N3904  | 8/6  | ACY40  | 4/-  | BF180  | 7/6  | GET120  | 6/6  | OC82D    | 3/6  |
| 2N2193a | 5/6  | 2N3905  | 8/6  | ACY41  | 5/-  | BF181  | 6/6  | GET873  | 3/6  | OC83     | 4/6  |
| 2N2194A | 4/6  | 2N3906  | 8/6  | ACY44  | 4/-  | BF184  | 7/6  | GET880  | 6/-  | OC84     | 5/6  |
| 2N2217  | 6/-  | 2N3958  | 6/6  | AD140  | 8/6  | BF185  | 5/6  | GET887  | 4/6  | OC123    | 6/6  |
| 2N2218  | 6/6  | 2N3959  | 5/6  | AD149  | 8/6  | BF186  | 5/6  | GET889  | 4/6  | OC139    | 6/6  |
| 2N2219  | 6/6  | 2N4060  | 5/-  | AD150  | 15/6 | BF195  | 5/6  | GET890  | 4/6  | OC140    | 6/6  |
| 2N2220  | 5/-  | 2N4061  | 5/-  | AD161  | 7/6  | BF196  | 5/6  | GET896  | 4/6  | OC170    | 6/6  |
| 2N2221  | 5/-  | 2N4062  | 5/6  | AD162  | 7/6  | BF197  | 5/6  | GET897  | 4/6  | OC171    | 6/6  |
| 2N2222  | 5/-  | 2N4244  | 5/6  | AF106  | 11/6 | BF198  | 5/6  | GET898  | 4/6  | OC201    | 6/6  |
| 2N2287  | 21/6 | 2N4255  | 8/6  | AF114  | 5/6  | BF200  | 10/6 | MAT100  | 6/-  | OC202    | 8/6  |
| 2N2297  | 6/6  | 2N4285  | 6/6  | AF125  | 5/6  | BF203  | 10/6 | MAT110  | 6/-  | OC203    | 5/6  |
| 2N2302  | 12/6 | 2N4288  | 3/6  | AF116  | 5/-  | BF225  | 6/6  | MAT120  | 6/-  | OC204    | 5/6  |
| 2N2303  | 7/6  | 2N4286  | 3/6  | AF117  | 5/-  | BF237  | 6/6  | MAT121  | 6/-  | OC205    | 7/6  |
| 2N2368  | 6/6  | 2N4287  | 3/6  | AF118  | 12/6 | BF238  | 6/6  | MJ400   | 21/6 | OC207    | 7/6  |
| 2N2369  | 7/6  | 2N4288  | 3/6  | AF119  | 4/-  | BFX12  | 5/6  | MJ420   | 22/6 | OC208    | 8/6  |
| 2N2369A | 5/6  | 2N4289  | 4/6  | AF124  | 5/-  | BFX13  | 5/6  | MJ421   | 22/6 | ORP12    | 8/6  |
| 2N2410  | 10/6 | 2N4290  | 3/6  | AF125  | 5/6  | BFY29  | 17/6 | MJ430   | 20/6 | ORP12    | 8/6  |
| 2N2411  | 6/6  | 2N4291  | 6/6  | AF126  | 5/6  | BFX30  | 9/-  | MJ440   | 19/6 | ORP60    | 10/6 |
| 2N2412  | 6/6  | 2N4292  | 3/6  | AF127  | 5/6  | BFX43  | 8/6  | MJ480   | 20/6 | ORP61    | 10/6 |
| 2N2483  | 5/6  | 2N4433  | 5/6  | AF139  | 7/6  | BFX44  | 8/6  | MJ481   | 27/6 | P346A    | 5/6  |
| 2N2484  | 5/6  | 2N4434  | 5/6  | AF178  | 12/6 | BFX68  | 13/6 | MJ490   | 22/6 | TIS34    | 17/6 |
| 2N2539  | 4/6  | 2N4435  | 5/6  | AF179  | 11/6 | BFX68A | 13/6 | MJ491   | 29/6 | TIS43    | 8/6  |
| 2N2540  | 4/6  | 2N5027  | 10/6 | AF180  | 12/6 | BFX84  | 8/6  | MPF102  | 8/6  | TIS44    | 4/6  |
| 2N2613  | 7/9  | 2N5028  | 11/6 | AF181  | 9/6  | BFX85  | 10/6 | MPF103  | 7/6  | TIS45    | 4/6  |
| 2N2614  | 7/6  | 2N5029  | 9/6  | AF239  | 7/6  | BFX86  | 8/6  | MPF104  | 7/6  | TIS46    | 4/6  |
| 2N2645  | 6/6  | 2N5030  | 8/6  | AF279  | 13/6 | BFX87  | 10/6 | MPF105  | 8/6  | TIS47    | 4/6  |
| 2N2646  | 11/6 | 2N5172  | 4/6  | AF280  | 13/6 | BFX88  | 5/-  | MPS3638 | 6/6  | TIS48    | 4/6  |
| 2N2696  | 6/6  | 2N5174  | 12/6 | AFZ11  | 5/6  | BFY92A | 12/6 | NKT0013 | 8/6  | TIS49    | 4/6  |
| 2N2711  | 8/6  | 2N5175  | 12/6 | AFZ12  | 6/6  | BFY10  | 4/6  | NKT124  | 8/6  | TIS50    | 5/6  |
| 2N2712  | 8/6  | 2N5176  | 13/6 | AFZ13  | 6/6  | BFY11  | 5/6  | NKT125  | 6/6  | TIS51    | 5/6  |
| 2N2713  | 8/6  | 2N5177  | 13/6 | AFZ14  | 6/6  | BFY12  | 6/6  | NKT126  | 7/6  | TIS52    | 4/6  |
| 2N2714  | 9/6  | 2N5232A | 9/6  | ASY28  | 5/6  | BFY18  | 4/6  | NKT128  | 5/6  | TIS53    | 6/6  |
| 2N2865  | 12/6 | 2N5245  | 12/6 | ASY29  | 4/6  | BFY19  | 4/6  | NKT135  | 5/6  | TIS60    | 6/6  |
| 2N2904  | 8/-  | 2N5246  | 12/6 | ASY36  | 5/-  | BFY20  | 12/6 | NKT137  | 6/6  | TIS61    | 6/6  |
| 2N2904A | 8/-  | 2N5249  | 13/6 | ASY50  | 5/-  | BFY21  | 8/6  | NKT210  | 6/-  | ZTX107   | 3/6  |
| 2N2905  | 8/-  | 2N5249A | 13/6 | ASY51  | 6/6  | BFY24  | 9/-  | NKT219  | 6/6  | ZTX108   | 3/6  |
| 2N2905A | 8/-  | 2N5253  | 13/6 | ASY53  | 6/6  | BFY25  | 4/6  | NKT212  | 6/6  | ZTX109   | 3/6  |
| 2N2906  | 8/-  | 2N5256  | 8/6  | ASY54  | 5/6  | BFY26  | 4/6  | NKT213  | 6/6  | ZTX300   | 4/6  |
| 2N2906A | 8/-  | 2N5307  | 7/6  | ASY62  | 5/6  | BFY29  | 10/6 | NKT214  | 4/6  | ZTX301   | 4/6  |
| 2N2907  | 8/-  | 2N5308  | 7/6  | ASY63  | 3/6  | BFY30  | 10/6 | NKT215  | 4/6  | ZTX302   | 5/6  |
| 2N2923  | 4/6  | 2N5309  | 12/6 | ASY72  | 5/6  | BFY32  | 5/6  | NKT216  | 6/6  | ZTX303   | 5/6  |
| 2N2924  | 4/6  | 2N5310  | 12/6 | ASY83  | 5/6  | BFY37  | 5/6  | NKT217  | 8/6  | ZTX304   | 7/6  |
| 2N2925  | 4/6  | 2N5354  | 5/6  | ASY86  | 6/6  | BFY41  | 10/6 | NKT219  | 6/6  | ZTX500   | 5/6  |
| 2N2926  | 4/6  | 2N5355  | 5/6  | ASZ20  | 7/6  | BFY43  | 13/6 | NKT223  | 6/6  | ZTX501   | 5/6  |
| 2N2926  | 4/6  | 2N5355  | 5/6  | ASZ20  | 7/6  | BFY50  | 4/6  | NKT224  | 5/6  | ZTX502   | 5/6  |
| 2N2926  | 4/6  | 2N5355  | 5/6  | ASZ21  | 7/6  | BFY51  | 4/6  | NKT225  | 5/6  | ZTX503   | 5/6  |
| 2N2926  | 4/6  | 2N5355  | 5/6  | ASZ21  | 7/6  | BFY52  | 4/6  | NKT229  | 6/6  | ZTX504   | 12/6 |
| 2N3011  | 5/-  | 2N5366  | 10/- | BC107  | 3/6  | BFY53  | 5/6  | NKT237  | 8/-  |          |      |

## PANEL METERS

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

# Practical Electronics Classified Advertisements

## MISCELLANEOUS

### 6 OR 12 VOLT FLUORESCENT LIGHTS

12 ins. 8 Watt tube ample light for caravan, tent, etc. Fully transistorised, low battery drain Unstable at **£2.19.6** post paid.  
or in kit form **50/-**

### 4 WATT GRAM AMPS.

Volume and tone controls, mains operation, 3Ω output, new and boxed **65/- POST PAID**

**SALOP ELECTRONICS** Callers welcome  
23 Wyle Cop Shrewsbury, Shropshire S.A.E. for lists

## MORE ROBOTS

Synthetic Animals with "BRAINS" of their own. The LATEST range of projects include: an electronic 'animal' which "LEARNS", an Electro Chemical device capable of "REPRODUCING" itself! Other projects SURE TO INTRIGUE YOU are an audio transmitter/receiver which has quite an amazing range and requires NO LICENCE; also TEN new projects, one of which is an electronic dice machine. HOSTS OF EASY-TO-CONSTRUCT projects, for anyone with a basic knowledge of Electronics. DON'T WAIT! SEND 3/- for your list—NOW!

### To: 'BOFFIN PROJECTS'

incorporating  
BIONIC DESIGNS, 4 CUNLIFFE RD.  
STONELEIGH, EWELL, SURREY  
Designed by GERRY BROWN and  
JOHN SALMON and presented  
on T.V.

**PROFESSIONALLY MADE CONTROL PANELS** from 4d. sq. in. 16/18 gauge aluminium, cut, drilled, spray painted and legend. Send full size drawing for quotation. C. S. CONDUIT, 7 Millbrook, Sallsbury, Wilts.

**HI-FI** loudspeaker systems for the home constructor, cabinet kits, the new range of Peerless speakers, speaker kit systems and cross-over networks. BAF wadding, speaker fabric (samples on request) and all other necessary components. Send 5d in stamps to: AUDIOSCAN, Dept. PE, 4 Princes Square, Harrogate, Yorks.

**ONE OFF PRINTED CIRCUIT BOARDS.** Cheaply made to customers' requirements. Send s.a.e. for details: D. R. MANN, 12 Randolph St., Nottm.

**CLEARING LABORATORY**, scopes, V.T.V.M.'s, V.O.M.'s, H.S. recorders, transcription turntables, electronic testmeters, calibration units, P.S.U.'s, pulse generators, D.C. null-potentiometers, bridges, spectrum analysers, voltage regulators, sig-gens, M/C relays, components, etc. Lower Beeding 236.

**COMPUTER IN YOUR POCKET.** Home, college, workshop. 5in pocket slide rules, 17/6, 10in desk/bench slide rules, 25/- Full instructions. DEPT. PE, 19 Paynesfield Avenue, S.W.14.

Send 1/- for

### STATE OF THE ARTISTS LIST OF

Comps and full data, applications on latest dc/uhf low noise N/FET. 2NS245, 10/- ea also Sprague 'UNICIRCUIT' ULN2111A, d.i.l. for FM/SSB det, 60db wdbnd amp/lm, etc. £1.10.6 ea. C.W.O. 6d. p.p. per order to: T. ADVISER  
2 Crown Acre, Brockenhurst, Hants

RATES: 1/3 per word (minimum 12 words). Box No. 1/6 extra.

Advertisements must be prepaid and addressed to Advertisement Manager, "Practical Electronics" IPC MAGAZINES LTD., Fleetway House, Farringdon Street, London, E.C.4

## MISCELLANEOUS (continued)

**MUSICAL MIRACLES.** Send S.A.E. for details of Rhythm Modules, Versatile Bass-pedal unit, self-contained with unique effects, kits for waa-waa pedals. Also new 50uA meters 25/- post paid. HURRY! D.E.W. LTD. 254 Ringwood Road, Ferndown, Dorset.

**UFO DETECTOR CIRCUITS**, data. 10s. (refundable). Paraphysical Laboratory (UFO Observatory), Downton, Wilts.

**ETCHED PRINTED CIRCUIT BOARD KITS.** Full instructions. 19/6, c.w.o. CIRCUITETCH, 12 Cambridge Rd., St. Albans, Herts.

**A CORNUCOPIA OF COMPONENTS!** Scarce valves, selected TV Components, Educational and Projects kits, Speakers and Cabinets, Transistors, Resistors and valves, 1 watt, 3d each. State your requirements. S.A.E. for details. MAIL-MART, 6 Eastbourne Road, Pevensey Bay, Sussex.

**YOUR KITS** professionally assembled and tested, write: A. M. BAYNES, Capitol Buildings, Longford, Coventry.

**NOTES ON USE OF TV** for Aircraft or UFO Detection. Optical Detector Set and Instructions, 7/6 each. RADAR & ELECTRONICS PUBLICATIONS, 1 Stowmarket Road, Needham Market, Suffolk.

**PSYCHEDELIC LIGHTING UNIT.** A brand new design that adds a new dimension to music. Ideal for use by pop groups and disco's. Used in conjunction with a record player it can turn a house party into a psychedelic freak out! It modulates up to 1.5kW of light and sensitivity is fully variable. Money back if not "turned on". They come complete with instructions either as a kit or ready built and tested. Kit form: 14 gns; Built: 16 gns (inc. P/T). Send now to: SOUND ELECTRONICS, 30 S-concord Avenue, Newcastle upon Tyne, NE6 5XS. For further details send S.A.E.

**BUILD IT IN A DEWBOX** quality cabinet 2in x 2in x any length. DEW LTD., Ringwood Road, Ferndown, Dorset. S.A.E. for leaflet. Write now—right now.

## FOR SALE

### MORSE MADE !!

**FACT NOT FICTION.** If you start RIGHT you will be reading amateur and commercial Morse within a month (normal progress to be expected). Using scientifically prepared 3-speed records you automatically learn to recognise the code RHYTHM without translating. You can't help it, it's as easy as learning a tune. 18 W.P.M. in 4 weeks guaranteed. For details and course C.O.D. ring S.T.D. 01-660 2896 or send 8d. stamp for explanatory booklet to: GSHSC (Box 19), 45 GREEN LAKE, PURLEY, SURREY

## FOR SALE (continued)

**MINIATURE DYNAMIC MICROPHONES.** High impedance, size  $\frac{7}{8} \times \frac{3}{8} \times \frac{1}{8}$  in. Also work as mini speakers, suit transistor circuits, 7/6 each, 3 for 20/-. Tested, guaranteed. Ardent 10kΩ edgewise volume controls, 3/6 each, 3 for 10/-. DREW, 77 The Crescent, Southwick, Sussex.

**SEEN MY CAT?** 5,000 items. Mechanical and Electrical Gear, and materials. S.A.E. K. R. WHISTON, Dept. PE, New Mills, Stockport.

## BOOKS AND PUBLICATIONS

### SURPLUS HANDBOOKS

19 set Circuit and Notes ..... 6/6 P.P. 6d  
1155 set Circuit and Notes .... 6/6 P.P. 6d  
H.R.O. Technical Instructions ... 5/6 P.P. 6d  
38 set Technical Instructions ... 5/6 P.P. 6d  
46 set Working Instructions ... 5/6 P.P. 6d  
88 set Technical Instructions ... 7/- P.P. 6d  
BC. 221 Circuit and Notes ..... 5/6 P.P. 6d  
Wavemeter Class D Tech. Instr 5/6 P.P. 6d  
18 set Circuit and Notes ..... 5/6 P.P. 6d  
BC.1000 (31 set) Circuit & Notes 5/6 P.P. 6d  
CR.100/B.28 Circuit and Notes 10/- P.P. 9d  
R.107 Circuit and Notes ..... 7/- P.P. 6d  
A.R.88D. Instruction Manual ..... 18/- P.P. 6d  
62 set Circuit and Notes ..... 6/6 P.P. 6d  
52 set Sender & Receiver Circuits 7/6. post free  
Circuit Diagrams 5/- each post free.  
R.1116/A, R.1224/A, R.1355, R.F. 24, 25, & 26.  
A.1134, T.1154, CR.300, BC.342, BC.312.  
BC.348, J.E.M.P., BC.624. 22 set.  
Colour Code Indicator ..... 2/6 P.P. 6d  
S.A.E. with all enquiries please.  
Postage rates apply to U.K. only.

Mail order only to:

**Instructional Handbook Supplies**  
Dept. P.E., Talbot House, 28 Talbot Gardens  
Leeds 8

## ELECTRICAL

**240 VOLT  
ELECTRICITY  
ANYWHERE**



**BEST EVER 200/240 VOLT "MAINS" SUPPLY FROM 12 VOLT CAR BATTERY**  
Exclusive World Scoop Purchase. The fabulous Mk.2D American Heavy Duty Dynamo Unit with a Massive 200 watt output and giving the most Brilliant 200/240 volt performance of all time. Marvellous for Television, Drills, Power Tools, Mains Lighting, AC Fluorescent Lighting and all 200/240 volt Universal AC/DC mains equipment. Made at tremendous cost for U.S.A. Govt. by Delco-Remy. This magnificent machine is unobtainable elsewhere. Brand New and Fully Tested. Only £4.19.6 + 10% postage. C.O.D. with pleasure, refund guarantee. Please send S.A.E. for illustrated details.  
Dept. PE, STANFORD ELECTRONICS  
Rear Derby Road, North Promenade  
BLACKPOOL, Lancashire

## WANTED

**WANTED:** November 1968 copy of "Practical Electronics". Any reasonable cash offers? Box No. 25.

**CAN ANYONE SUPPLY** a working circuit of a 1-5 Volt Sub Miniature F.M. Transmitter? Box No. 24.



# GEC-Marconi Electronics

## ELECTRONIC TECHNICIANS

are required to work on calibration, fault-finding and testing of telecommunications measuring instruments. The work is varied and will enable technicians with experience of r.f. circuits to broaden their knowledge of the latest techniques employed in the electronics and telecommunications industries by bringing them into contact with a wide range of the most advanced measuring instruments embracing all frequencies up to u.h.f.

Entrants may be graded as Testers, Test Technicians, Senior Test Technicians and Technician Engineers according to experience and qualifications. Our expanding production and servicing programme, geared to our recognised export achievement, provides security of employment combined with good prospects of advancement, not only within these grades, but into other technical and supervisory posts within the Company at St Albans and Luton.

Salaries are attractive and conditions excellent. A Pension Scheme includes substantial life assurance cover provided by the Company. Assistance with removal may also be given in appropriate cases. Please write or telephone for application forms to:



Mr. P. Elsip,  
Personnel Officer,  
Marconi Instruments Ltd,  
Longacres, St. Albans, Herts.  
Tel: St. Albans 59292

Member of GEC-Marconi Electronics



THE QUEEN'S AWARD  
TO INDUSTRY

**SEMICOmps**  
LIMITED  
*try harder*

Semiconductor enthusiast wanted living in Wembley region with interest in semiconductors and integrated circuits to train as inside sales engineer. Good starting salary and prospects. Apply to Managing Director, Semicomps Limited, Station Wharf, Alperton, Middlesex. 01-903 3161.

**SERVICE ENGINEERS**—we are an old established electronics company, but headed by a young management team, and we need you to help us. Age is no barrier to a high salary as you will find out when you join us. If you have experience in T.V., Radio or H-FI Service and want a job that looks ahead, phone MICHAEL ADLER at 01-636 9606.

### RECEIVERS AND COMPONENTS

**INTEGRATED CIRCUITS** at lowest price. GE Type PA234, 1 watt Audio Amplifier, 17/6 each inc. data. Newest GE Silicon *npn* planar transistor 2N5172, 25V, 200mW, hfe 100 min.; epoxy for economy; passivated for reliability, 1/9 each. C.W.O. P. & P. 1/- per order. JEF ELECTRONICS, 12 York Drive, Grappenhall, Warrington, Lancs. Mail Order Only.

### RECEIVERS AND COMPONENTS (continued)

#### TAPE HEADS

|                     |                  |
|---------------------|------------------|
| BSE BRAD. 39/6 pair | REUFER — COLLARO |
| 2-TRACK             | ERASE 12/6       |
| BSE MARC. 39/6 pair | 4-TRACK          |
| 4-TRACK             | BOGEN ERASE      |
|                     | UL218/6 25/-     |
| MICHIGAN REC./PLAY  | 4-TRACK          |
| MED. IMP. 35/-      | OGEMCORD ERASE   |
| 4-TRACK             | T.E. 2/8 12/6    |
|                     | 4-TRACK          |

**TRANSISTOR LW/MW/FM TUNER CHASSIS**  
The most compact three-band Tuner chassis ever engineered. Output 50mV, exceptional sensitivity and selectivity on all bands. Operates from single 9 volt battery. Complete with aerials, 3-band tuning dial, mounting bracket circuit and instructions. **£13**

**TUNER DULCI FM7S STEREO £23**  
LIST £31 FEW ONLY AT  
Sens. 14mV, O.P. 100mV, 88-108 m/c, dim. 134 x 94 x 7".

**COMPACT TRANSISTOR FM TUNER**  
Oiled Walnut cabinet, brushed gold front panel, vertical styling, internal batteries. Sensitivity: Better than 10uV. Audio Output: More than 500 mV (input level 25db). Signal to Noise Ratio: More than 36db (input level 25db). 6 **£8.19.6**  
Transistors, 3 diodes.

**FM MULTIPLEX STEREO ADAPTOR**  
Printed circuit biscuit, 4 trans. 6 **£4.19.6**  
diodes 9V with full instructions

#### LOUDSPEAKERS

**GUITAR, P.A., or HI-FI**  
12" 25 watt, 15 ohm, 25-13K, Ceramic **£5.7.0**

|                      |               |     |
|----------------------|---------------|-----|
| 10" 10 watt, 15 ohm, | 2" 40 ohm     | 6/6 |
| CERAMIC — 49/6       | 2 1/2" 80 ohm |     |
| MAGNET               |               |     |

**SPEAKER CABINET £8**  
Takes 12" or 10" Speaker and a 4" or 3" Tweeter. Ht. 21", W. 15", D. 7 1/2". Polished Teak, matching vynair grille, list price £9.5.0.

**CABINET** Teak 23 1/2 x 13 1/2 x 9 1/2", contemp. 12" **89/6**  
legs for Tape Recorder and Tuner or Amplifier, etc.

4 pole changerover, ideal for models.  
1 1/2" x 1 1/2" x 7, 700 ohm 9-24V, 185-ohm  
6-12V, 430 ohm 9-18V **10/-**

**TWEETER** 3" 16 ohm, 10 watt **19/6**  
Horn type Hi-Fi 18,000 c/s  
crossover 3k Ω,

**CROSSOVER NETWORK 15/-**  
3kc/s, 16 or 3 or 8 ohm.

|                           |                             |
|---------------------------|-----------------------------|
| <b>CHARGER RECTIFIERS</b> | <b>CHARGER TRANSFORMER.</b> |
| F.W. 12 volt 1 Amp. 5/-   | 2/6 12 volt, 3/- P/P        |
| F.W. 12 volt 4 Amp. 10/6  | 1A 18/-, 2A 16/6            |
|                           | 4 Amp £1/6                  |

**SUPER SILICON RECT. T.V., etc., 1,200 PIV**  
800mA, 5/-; or complete with instr. resistor, condenser, 6/6; 400 PIV HW 6A, 6/-, BY100 type, 6 for 10/-.

**MULTIMETERS** from **32/-**

**TRANSISTORS**  
2N3638A 5/-, 2N3643 5/6, AC138 5/-, AC141 5/-, ACY20 8/6, ACY21 4/-, AF178 11/8, AF186 10/-, BC108 2/8, BC109 2/6, BCY23 4/6, BF181 7/-, NKT213 5/6, NKT226 5/6, OA91 1/8, OA2270 3/6, OC35 5/-, OC45 2/-, OCS1D 2/3, OC82 4/-, OC200 3/8, GET103-113-118-119-887-889-890-896-7-8 3/-

**SWITCH ROTARY RECIPROCATING 4**  
Position, 15amp. Single hole fixing, with instructions. List 14/7 **5/6**

**C90 CASSETTE 10/3.** C90 14/3. 3 Post free  
Stamped envelope for full selection and bargain offers in MULTIMETERS, RADIOS, BABY ALARMS, INTERCOMS, WALKIE-TALKIES, RECTIFIERS, SINCLAIR, DULCI  
UNDER £1-P. & P. 6d., £1 to £3-1/6, over £3-2/6. C.O.D. 3/6. MAIL ORDER ONLY. U.K. ONLY

**DURHAM SUPPLIES**  
367 KENSINGTON STREET  
BRADFORD 8, YORKSHIRE

#### 5% RESISTORS 3d EACH

High stability, Carbon Film, 1/2 Watt, 10, 11, 12, 13, 15, 16, 18, 20, 22, 24, 27, 30, 33, 36, 39, 43, 47, 51, 56, 62, 68, 75, 82, 91Ω etc. to 1MΩ.

PRINTED CIRCUIT KITS only 17/6  
**TRANSISTORS 2N3708A 1/6 EACH**  
Hfe 20-60, Vce30, 230mW, 200 Mc/s Silicon, Brand new, Fully guaranteed. P. & P. 1/-.

**J. M. KING (A)**

14 Acton Street, London, W.C.1

Single channel Radio Control at a price you can afford

# RADIO CONTROL PRODUCTS

**EXCELLENT RANGE AND PERFORMANCE**

**TRANSMITTER—**

- Crystal controlled tone Tx. 12v. operation. Silicon transistors. In smart case with micro-switch.

Tx only **£6 - 5 - 0**

**RECEIVER—**

- Sub-miniature Wt 40 grms. Size only 3.5 x 2.8 x 2 cms. Working voltage 4.5v.

Rx only **£4 - 5 - 0**

SUITABLE FOR MODELS OF ALL KINDS  
ONLY £10 - 10 - 0 COMPLETE

DIRECT FROM RADIO CONTROL PRODUCTS  
38 FRANCHE ROAD  
KIDDERMINSTER, WORCS.

## WE ARE BREAKING UP COMPUTERS

**EX COMPUTER PRINTED CIRCUIT PANELS** 2in x 4in packed with semi-conductors and top quality resistors, capacitors, diodes, etc. Our price, 10 boards 10/-, P. & P. 2/-. With a guaranteed minimum of 35 transistors.

**SPECIAL BARGAIN PACK.** 25 boards for £1. P. & P. 3/6. With a guaranteed minimum of 85 transistors. 100 boards 55/-, P. & P. 7/6. With a guaranteed minimum of 350 transistors.

**GIANT PANELS.** 5 1/2in x 4in, min. 20 transistors, 9 x 56 µH inductors, resistors, diodes, etc. 3 for £1. P. & P. 2/-. As above, only 21 transistors, 70 diodes, 62 min. 1/2th.W resistors. 3 for 25/-, P. & P. 2/-. **PANELS** with 2 power transistors sim. to OC28 on each board + components. 2 boards (4 x OC28) 10/-, P. & P. 2/-. **TRIM POTS.** On 2in x 4in boards + Ta caps and other components. Ideal for organ keyboard tuning, etc. 100Ω, 500Ω, 15K, 20K. State requirements. 5 boards 10/-, P. & P. 2/-. **NPN GERMANIUM 10S 1 WATT POWER TRANSISTORS.** On small heat sink, on 2in x 4in panel. 5 for 10/-, P. & P. 2/-. **POWER TRANSISTORS.** Sim. to 2N174 ex-act. On Finned Heat Sink (10D). 4 for £1. P. & P. 5/-. **DIODES.** Ex eqpt., Silicon, 150 PIV, 10 amp. 4 for 10/-, 150 PIV, 20 amp. 4 for £1. Post free. **OVERLOAD CUT OUTS.** Panel mounting in the following values... 5/- each. 3, 4 amp. P. & P. 1/-. **MINIATURE GLASS NEONS,** 13/6 doz. **PAPST FANS.** Powerful Extractor/Blower fans, 4 1/2" x 4 1/2" x 2", 230/250V. 100 c.f.m., 2,800 r.p.m. 50/- post free. **MICRO SWITCHES.** Miniature button type. 10/- doz. P. & P. 1/6. **NEW SPRAGUE.** 0.22µF 250V small capacitors. 5/- doz. P. & P. 1/-. **NEW SPRAGUE ELECTROLYTICS.** 4µF 150V. 5/- doz. P. & P. 1/-. **NON-POLAR TANTALUM CAPS.** 2.2µF 50V. 10/- doz. P. & P. 1/-. **LARGE CAPACITY ELECTROLYTICS.** 4 1/2in, 2in diam. Screw terminals. 7/6 each post free. 4,000µF 72V d.c. wkg. 10,000µF 25V d.c. wkg. 25,000µF 12V d.c. wkg. 4 1/2" x 1 1/2". Plessey 5,000µF 55V d.c. wkg. 8/- each. 3" x 1" Plessey 2,000µF 25V d.c. wkg. 6/- each. 4 1/2" x 1 1/2" screw terminals 2,500µF 55V d.c. wkg. 6/- each. **KEYTRONICS,** 52 Earls Court Road London, W.8. Mail order only Tel. 01-478 8499

### TRANSISTOR PANELS

**INTEGRATED CCT'S TAKEN FROM PANELS**

|                     |     |             |
|---------------------|-----|-------------|
| A—Dual 2 I/P Gate   | 5/- | With Pin    |
| B—Dual 4 I/P Gate   | 5/- | Connections |
| C—Dual 2 Level Gate | 5/- |             |
| F—Single I/P Gate   | 5/- | Post Paid   |

**EX GOVMT. RECEIVER R.209** covering 1—20 mc/s 12V D.C. Input £12.10.0 Post Paid (Tested).

**50 VARIOUS TRANSISTORS** on Panel<sup>s</sup> 15/- Post Paid.

|          |       |    |
|----------|-------|----|
| 20—OC45  | ..... | £1 |
| 20—OC76  | ..... | £1 |
| 40—TK28c | ..... | £1 |

**COMPUTER PANELS** with 40 sil. pnp or npn transistors, Diodes and res., 22/6 Post Paid.

**COMPUTER PANELS WITH SEMI-CONDUCTORS.** Postage 6d per panel

|   |       |            |
|---|-------|------------|
| 8—OC43 or GET875 + 24—OA81                | ..... | 7/6        |
| 24—A1678 (V405A) 550 mc/s PNP + 24 Diodes | ..... | 15/-       |
| 4—OC170 + 2—OC139 + 2—OC42                | ..... | 7/6        |
| 9—ASZ20 + 1—T2040 + 27 Diodes             | ..... | 7/6        |
| 4—OC42 + 6—GET875 + Diodes                | ..... | 7/6        |
| 2—OC170 + 1—2G306 + OC42                  | ..... | 4/-        |
| 5—OC23 + 15—OA10                          | ..... | 25/-       |
| 8—ASZ20 + 80 Diodes                       | ..... | 7/6        |
| 6—ASZ21 + 15—OA91                         | ..... | 6/-        |
| 9—SB240 + 18—OA47                         | ..... | 10/-       |
| 12—2G106 + 24 Diodes                      | ..... | 9/6        |
| 8—OC72 + 8—OA10                           | ..... | 10/-       |
| 8—OC76 + 8—OA10                           | ..... | 7/6        |
| 12—A1678 (V405A) 550 mc/s PNP + 22 Diodes | ..... | 10/-       |
| 36—OA5                                    | ..... | 6/-        |
| 6—GET872 + 8—OA10                         | ..... | 5/-        |
| 4—OC42                                    | ..... | 3/-        |
| 12—ASZ20 + 80 Diodes                      | ..... | 9/6        |
| 4—GET872 + 8—OA10                         | ..... | 3 for 12/- |
| 4—2G106 + 1—2N2410                        | ..... | 4/-        |
| 2—OC42 + 8—OA47                           | ..... | 3/-        |
| 2—GET872 + 4—OA10 + RF Chokes 3 for       | ..... | 10/-       |
| 24—Sil. h.f. Transistors                  | ..... | 15/-       |
| 3—GET872 + 3—GEX541, ETC.                 | ..... | 22/6       |
| 3—OC23 + 6—OA10 + 2—OAS                   | ..... | 16/-       |

**ELECTROLYTICS** 25,000 @ 12V, 16,000 @ 12V, 15,000 @ 10V, 10,000 @ 30V, 4,000 @ 60V, 2,000 @ 50V, 1,200 @ 180V, 8/6 Post Paid.

**ZENER DIODES**—2.4, 2.7, 3.6, 4.75, 6.2, 6.8, 7.5, 13, 15, 16, 18, 20, 27, 30, 33 volts. 3/6 each, mostly 1 watt

**POLYSTYRENE CAPACITORS.** 125V, 18, 22, 120, 220, 270, 330, 390, 560, 820, 1,000, 1,200, 1,800, 2,200, 2,700, 3,300, 3,900, 5,600, 6,800, 8,200, 0-01, 0-012, 0-015, 2/6 doz. Post/Packing, 1/-.

**BRAND NEW BOXED CHASSIS** containing 2—OC35, 2—OC29 12 WVV resistors 25/-, Postage 1/6

**NEW CROSS RADIO**  
6 OLDHAM ROAD, MANCHESTER 4

## TERRIFIC TRANSISTORS!

New. No seconds. No re-marks  
Orders over 10/- post free.

**AD161/2** high-gain (80-250) complementary audio power pair. **SPECIAL OFFER:** AD161 and AD162 WITH TWO INSULATING KITS, ONLY 12/-, UK post paid.

**BC168B**, high-gain (250-500), small-sized exact equivalent of BC148, only 2/3.  
**BC169C**, high-gain (450-900) equiv. BC149, 2/6; **BC107**, 3/-; **BF167**, 5/3; **2N706**, 2/7; **40468A**, 7/6, etc., etc.

**9V MINI MAINS PACK COMPS. 17/6**

**Mini Mains Trans.**

**MT9**, 9-0-9V, 80mA 12/6  
**MT6**, 6-0-6V, 100mA 13/6  
**MT12**, 12-0-12V, 50mA 13/6

Submin. bridge rect., 30Vrms, 150mA, 3/6

**AMATRONIX LTD.** (Mail order only)  
396 Selsdon Rd., South Croydon, Surrey CR2 0DE

## NEW VHF KIT

Receives Television Sound, Ambulances, Aircraft, Radio 2, 3 and 4 on VHF, etc.

This novel little set will give you endless hours of pleasure and can be built in one evening. The Kit comes with easy to follow instructions and circuit. Powered by 9v Battery. Complete with built in Jack Plug Socket for use with Earphones or Amplifier.

**ONLY 57/-, P. & P. FREE U.K. ONLY**

2 Watt general purpose Power Amplifier in very attractive Cabinet covered in black leatherette with polished alloy trim. Size 10" high x 4 1/2" x 4". Very versatile, suitable for use with above kit or use as Baby Alarm, Intercom, Record Player Amplifier, etc. Uses P66 Battery. **ONLY 90/-, P. & P. included U.K. only.**

Postal Orders, Cheques to Dept. P.E.4  
**GALLEON TRADING CO.**  
298A Lodge Lane, Romford, Essex

## R & R RADIO

51 Burnley Road, Rawtenstall  
Rossendale, Lancs  
Tel.: Rossendale 3152

**VALVES BOXED, TESTED & GUARANTEED**

|       |     |       |     |        |     |
|-------|-----|-------|-----|--------|-----|
| BF80  | 3/- | PCC84 | 3/- | PY81   | 3/6 |
| EBF89 | 3/6 | PCF80 | 3/- | PY82   | 3/- |
| ECC82 | 3/- | PCF82 | 3/6 | U191   | 4/6 |
| ECL80 | 3/- | PCL82 | 4/- | 6F23   | 5/- |
| EF80  | 1/6 | PCL83 | 4/- | 30F5   | 2/6 |
| EF85  | 3/- | PL36  | 5/- | 30L15  | 5/- |
| EY86  | 4/- | PL81  | 4/- | 30P12  | 4/6 |
| EZ40  | 4/6 | PL83  | 4/- | 30C15  | 5/6 |
| EBC41 | 4/6 | PY33  | 5/- | 50CD6G | 7/6 |

Transistor Audio Pack, 2G339A, 2G381A, 2G371B  
10/- each post 6d.

POST, ONE VALVE 9d. TWO TO SIX 6d.  
OVER SIX POST PAID.

**BRAND NEW ELECTROLYTICS,** 15/16 volt 0-5, 1, 2, 5, 6, 8, 10, 15, 20, 30, 40, 50, 100, 200 mF, 8d. Mullard 25 volt 6-4, 12-5, 25, 50, 80 mF, 10d. 1-6, 160 mF, 1/-. Minimum order 7/6, postage 1/-. **THE C.R. SUPPLY CO.,** 127 Chesterfield Rd., Sheffield S8 0RN.

Whether Buying or Selling a Classified Advertisement in PRACTICAL ELECTRONICS, could be the answer to your Problem. For details write to:—

Classified Advertisement Dept., PRACTICAL ELECTRONICS Fleetway House, Farringdon Street, London, E.C.4

### BATTERY ELIMINATORS

The ideal way of running your TRANSISTOR RADIO, RECORD PLAYER, TAPE RECORDER, AMPLIFIER, etc. Types available: 6v, 9v, 12v, 18v (single output) 39/6 each. P. & P. 2/9. 9v + 9v; 6v + 6v; or 4 1/2v + 4 1/2v (two separate outputs) 42/6 each. P. & P. 2/9. Please state output required. All the above units are completely isolated from mains by double wound transformer ensuring 100% safety. R.C.S. PRODUCTS (RADIO) LTD. (Dept. P.E.), 31 Oliver Road, London, E.17

## ORGAN BUILDERS!

Use our bistable dividers for your tone sources and cut your costs by more than half.

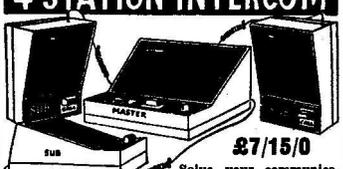
A small printed board with four complete transistor dividers will cost you only 18/6 including postage so why pay more?

Removed from working equipment, each circuit is meticulously inspected and tested before dispatch.

Just send a S.A.E. for free details to:

Roger Allen  
13 Millways  
Great Totham, Essex

### 4-STATION INTERCOM



**£7/15/0**

Solve your communication problems with this 4-Station Transistor Intercom system (1 Master and 3 Subs), in de-luxe plastic cabinets for desk or wall mounting. Call/talk/listen from Master to Subs and Subs to Master. Ideally suitable for Business, Surgery, Schools, Hospital, Office and Home. Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft. and other accessories. P. & P. 7/6.

### MAINS INTERCOM

No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On/off switch and volume control. Price **£10.10.6**. P. & P. 8/6 extra.

### INTERCOM/BABY ALARM



**3 Gns.**

Same as 4-Station Intercom for two-way instant communication. Ideal as Baby Alarm and Door Phone. Complete with 66ft. connecting wire. Battery 2/6. P. & P. 4/6.

### Transistor TELEPHONE AMPLIFIER



**59/6**

Why not boost business efficiency with this incredible De-Luxe Telephone Amplifier. Take down long telephone messages or converse without holding the handset. A useful office aid. On/off switch. Volume control. Battery 2/6 extra. P. & P. 3/6. Full price refunded if not satisfied in 7 days.

WEST LONDON DIRECT SUPPLIES (PE/3)  
169 KENSINGTON HIGH STREET, LONDON, W.8

SEND S.A.E. **WENTWORTH RADIO** 01-449 3087  
FOR NEW STOCK 104 SALISBURY ROAD  
LIST HIGH BARNET Packing and Postage 1/-

|       |     |       |     |       |     |          |      |
|-------|-----|-------|-----|-------|-----|----------|------|
| AF114 | 4/3 | BCY38 | 5/6 | BF195 | 3/3 | 2N1304   | 5/-  |
| AF115 | 3/9 | BCY39 | 5/6 | 2N696 | 5/- | 2N1305   | 5/-  |
| AF116 | 3/6 | BCY40 | 8/- | 2N697 | 4/- | 2N1306   | 5/6  |
| AF117 | 3/6 | BF115 | 6/6 | 2N706 | 3/- | 2N1307   | 5/-  |
| AF118 | 8/6 |       |     |       |     | 2N1308   | 6/6  |
| AF124 | 5/- |       |     |       |     | OC44     | 2/9  |
| AF125 | 5/- |       |     |       |     | OC45     | 2/9  |
| AF126 | 3/6 |       |     |       |     | OC70     | 2/6  |
| AF127 | 5/- |       |     |       |     | OC71     | 2/6  |
| BC107 | 3/6 |       |     |       |     | OC72     | 2/6  |
| BC108 | 3/6 |       |     |       |     | OC170    | 2/6  |
| BC109 | 3/6 |       |     |       |     | OC171    | 3/3  |
| BC113 | 6/6 |       |     |       |     | OC172    | 3/6  |
| BC118 | 5/6 |       |     |       |     | NKT274   | 4/6  |
| BC147 | 5/6 |       |     |       |     | NKT275   | 5/-  |
| BC148 | 4/6 |       |     |       |     | NKT674F  | 6/-  |
| BCY31 | 5/6 |       |     |       |     | NKT713   | 6/-  |
| BCY32 | 5/6 |       |     |       |     | NKT773   | 5/-  |
| BCY33 | 6/6 |       |     |       |     | NKT774   | 6/-  |
| BCY34 | 5/6 |       |     |       |     | NKT20329 | 11/6 |

### SPECIAL OFFERS

2N2924 3/- BY126 3/6  
AC128 3/- BY127 3/6

|       |      |        |      |
|-------|------|--------|------|
| BF117 | 11/6 | 2N706A | 2/6  |
| BF167 | 3/6  | 2N708  | 4/6  |
| BF173 | 4/2  | 2N709  | 11/6 |
| BF180 | 5/-  | 2N914  | 3/6  |
| BF181 | 3/3  | 2N916  | 4/-  |
| BF184 | 3/6  | 2N918  | 6/6  |
| BF194 | 3/3  | 2N919  | 4/6  |

## VALVES SAME DAY SERVICE

NEW! TESTED! GUARANTEED!

SETS 1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94.  
Set of 4 for 18/6. DAF96, DF96, DK96, DL96, 4 for 28/6

|        |      |             |      |            |      |            |      |           |      |       |      |
|--------|------|-------------|------|------------|------|------------|------|-----------|------|-------|------|
| 0Z64   | 4/6  | 12AX7       | 4/9  | DK91       | 5/9  | EH90       | 6/9  | PCL83     | 9/6  | UBC41 | 8/6  |
| 1A7GT  | 7/6  | 12K8GT      | 7/-  | DK92       | 8/9  | EL33       | 8/9  | PCL84     | 7/6  | UBF80 | 5/9  |
| 1H6GT  | 7/3  | 19BG6G17/6  |      | DK96       | 7/-  | EL34       | 9/6  | PCL86     | 9/6  | UBF89 | 6/9  |
| 1N9GT  | 7/9  | 30P2        | 13/6 | DL96       | 5/-  | EL41       | 10/6 | PCL86     | 8/3  | UC92  | 5/9  |
| 1R5    | 5/9  | 30P3        | 13/6 | DL99       | 5/9  | EL54       | 4/6  | PEN44     | 12/6 | UC94  | 7/6  |
| 1R5    | 4/3  | 30P4        | 18/6 | DL94       | 6/-  | EL60       | 4/6  | FL20012/6 | UC98 | 6/9   |      |
| 1T4    | 2/9  | 25L6GT      | 5/-  | DL96       | 7/-  | EL60       | 12/6 | FL36      | 9/9  | UCF80 | 7/3  |
| 3S4    | 5/9  | 25V4GT11/6  |      | DY86       | 5/9  | EM80       | 7/6  | FL81      | 7/3  | UCH49 | 11/6 |
| 3V4    | 6/-  | 30C1        | 6/6  | DY87       | 5/9  | EM81       | 7/6  | FL82      | 6/6  | UCH81 | 6/6  |
| 6U4G   | 4/6  | 30C18       | 13/6 | EABCO80    | 6/6  | EM84       | 7/6  | FL83      | 6/6  | UCL82 | 6/6  |
| 6Y9GT  | 5/9  | 30C17       | 18/6 | EAF42      | 8/9  | EM87       | 7/6  | FL84      | 6/6  | UCL83 | 13/6 |
| 6Z4G   | 4/6  | 30C18       | 11/6 | EB91       | 2/3  | EY51       | 7/6  | FL90      | 13/6 | UF41  | 10/6 |
| 6J90L2 | 15/- | 30F5        | 16/6 | EB33       | 8/6  | EY96       | 6/6  | FL90      | 13/6 | UF80  | 7/-  |
| 6AL5   | 2/3  | 30FL1       | 13/9 | EB41       | 9/9  | EZ40       | 7/6  | FL94      | 13/6 | UF85  | 6/9  |
| 6AM6   | 2/9  | 30FL12/14/6 |      | EBF80      | 6/9  | EZ41       | 7/6  | FL92      | 14/6 | UF89  | 6/9  |
| 6AQ5   | 4/6  | 30FL14      | 12/6 | EBF89      | 6/3  | EZ80       | 4/6  | PMS4      | 7/6  | UL41  | 10/6 |
| 6AT6   | 4/6  | 30L1        | 6/6  | ECC81      | 3/9  | EZ81       | 4/9  | PK25      | 10/6 | UL44  | 80/- |
| 6AT6   | 4/6  | 30L15       | 14/6 | ECC82      | 4/9  | EZ82       | 8/9  | PY32      | 10/6 | UL84  | 7/6  |
| 6AA4   | 4/6  | 30L17       | 15/6 | ECC83      | 7/-  | G234       | 9/9  | PY32      | 10/6 | UM84  | 6/6  |
| 6BE6   | 4/9  | 30P4        | 12/6 | ECC85      | 5/-  | KT61       | 8/9  | PY83      | 10/9 | UV41  | 8/3  |
| 6BJ6   | 6/6  | 30P12       | 13/9 | ECC91      | 3/-  | KT66       | 16/9 | PY81      | 5/9  | UY85  | 5/9  |
| 6BW6   | 13/6 | 30P19       | 12/6 | ECC80A12/6 |      | N78        | 17/6 | PY82      | 6/9  | VP46  | 10/6 |
| 6F13   | 3/6  | 30FL1       | 13/9 | ECC80      | 6/6  | PABC80     | 7/6  | PY83      | 6/9  | W119  | 7/-  |
| 6F14   | 9/6  | 30FL13      | 15/6 | ECC82      | 5/9  | PC86       | 10/3 | PY80      | 7/6  | Z77   | 2/9  |
| 6F23   | 13/6 | 30FL14      | 18/6 | ECC85      | 9/9  | PC88       | 10/3 | PY81      | 6/9  | AC107 | 2/6  |
| 6F25   | 12/6 | 35L6GT      | 8/6  | ECC82      | 11/6 | PC86       | 8/6  | PC89      | 10/6 | AF127 | 2/6  |
| 6J6    | 3/6  | 35V4        | 4/6  | ECH81      | 8/6  | PC87       | 8/6  | R19       | 6/9  | OC26  | 5/6  |
| 6K7G   | 2/6  | 35Z4GT      | 5/6  | ECH84      | 7/6  | PC90       | 7/6  | R90       | 12/6 | AD140 | 7/6  |
| 6K8G   | 2/9  | 6063        | 12/6 | ECL80      | 6/9  | PC84       | 6/6  | U26       | 13/6 | AF116 | 3/6  |
| 6L18   | 6/-  | AC/VP210/6  |      | ECL82      | 6/9  | PC85       | 6/6  | U26       | 12/6 | AF117 | 3/3  |
| 6V8G   | 3/3  | AZ31        | 9/6  | ECL83      | 8/6  | PC88       | 9/6  | U47       | 13/6 | AF126 | 3/6  |
| 6Y6GT  | 6/6  | BY29        | 12/6 | ECL86      | 8/6  | PC89       | 10/6 | U49       | 13/6 | AF127 | 2/6  |
| 6Z4    | 4/3  | CC835       | 10/6 | EF34       | 6/6  | PC8189     | 11/6 | U62       | 4/6  | OC26  | 5/6  |
| 6X56GT | 5/9  | CL33        | 18/6 | EF99       | 4/9  | PCF80      | 6/6  | U78       | 4/6  | OC44  | 2/3  |
| 7B7    | 7/-  | CY31        | 6/9  | EF41       | 10/9 | PCF82      | 6/6  | U91       | 13/6 | OC46  | 2/3  |
| 7C6    | 6/9  | DAC32       | 7/3  | EF80       | 4/6  | PCF86      | 11/6 | U93       | 8/6  | OC71  | 2/6  |
| 10F1   | 14/- | DAF91       | 4/3  | EF85       | 5/3  | PCF20013/6 |      | U251      | 14/6 | OC72  | 2/6  |
| 10F18  | 7/-  | DAF96       | 6/6  | EF86       | 6/3  | PCF80      | 13/6 | U301      | 10/6 | OC75  | 2/6  |
| 10P13  | 16/6 | DF38        | 7/9  | EF89       | 5/3  | PCF81      | 6/9  | U329      | 14/6 | OC81  | 2/6  |
| 12A8B  | 23/6 | DF91        | 2/9  | EF91       | 2/9  | PCF82      | 9/6  | U801      | 19/6 | OC81D | 2/6  |
| 12A77  | 3/9  | DF96        | 6/6  | EF94       | 4/6  | PCF85      | 11/6 | UABC80    | 6/6  | OC82  | 2/6  |
| 12AU6  | 4/9  | DE77        | 4/6  | EF183      | 5/9  | PCF80812/6 |      | UAF42     | 9/6  | OC82D | 2/6  |
| 12AU7  | 4/9  | DK32        | 7/6  | EF184      | 5/6  | PCL82      | 7/-  | UB41      | 6/6  | OC170 | 2/6  |

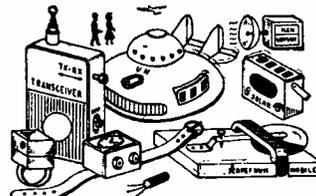
**READERS RADIO (P.E.)**  
85 TORQUAY GARDENS, REDBRIDGE, ILFORD, ESSEX.  
Tel. 01-550 7441

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

## PRINTED CIRCUIT KIT

BUILD 40 INTERESTING PROJECTS on a PRINTED CIRCUIT CHASSIS with PARTS and TRANSISTORS from your SPARES BOX

CONTENTS: (1) 2 Copper Laminate Boards 4 1/2" x 2 1/2". (2) 1 Board for Match-box Radio. (3) 1 Board for Wristwatch Radio, etc. (4) Resist. (5) Resist Solvent. (6) Etchant. (7) Cleanser/Degreaser. (8) 16-page Booklet Printed Circuits for Amateurs. (9) 2 Miniature Radio Dials SW/MW/LW. Also free with each kit. (10) Essential Design Data, Circuits, Chassis Plans, etc. for 40 TRANSISTORISED PROJECTS. A very comprehensive selection of circuits to suit everyone's requirements and constructional ability. Many recently developed very efficient designs published for the first time, including 10 new circuits.



EXPERIMENTER'S  
PRINTED CIRCUIT KIT  
**8/6**

Postage & Pack. 1/6 (UK)

Commonwealth:  
SURFACE MAIL 8/-  
AIR MAIL 8/-  
Australia, New Zealand  
South Africa, Canada.

- (1) Crystal Set with biased Detector.
- (2) Crystal Set with voltage-quadrupler detector.
- (3) Crystal Set with Dynamic Loudspeaker.
- (4) Crystal Tuner with Audio Amplifier.
- (5) Carrier Power Conversion Receiver.
- (6) Split-Load Neutralised Double Reflex.
- (7) Matchbox or Photocell Radio.
- (8) "TRI-FLEXON" Triple Reflex with self-adjusting regeneration (Patent Pending).
- (9) Solar Battery Loudspeaker Radio.
- (10) The smallest 3 designs yet offered to the Home Constructor anywhere in the World.
- (11) 3 Subminiature Radio Receivers based on the "Triflexon" circuit. Let us know if you know of a smaller design published anywhere.
- (12) Postage Stamp Radio.
- (13) Ring Radio 70 x 70 x 35.
- (14) Bacteria-powered Radio. Runs on sugar or bread.
- (15) Radio Control Tone Receiver.
- (16) Transistor P/P Amplifier.
- (16) Intercom.
- (17) 1-valve Amplifier.
- (18) Reliable Burglar Alarm.
- (19) Light-Sensing Animal, Guided Missile.
- (20) Perpetual Motion Machine.
- (21) Metal Detector.
- (22) Transistor Tester.
- (23) Human Body Radiation Detector.
- (24) Man/Woman Discriminator.
- (25) Signal Injector.
- (26) Pocket Transceiver (Licence required).
- (27) Constant Volume Intercom.
- (28) Remote Control of Models by Induction.
- (29) Inductive-Loop Transmitter.
- (30) Pocket Triple Reflex Radio.
- (31) Wristwatch Transmitter/Wireless Microphone.
- (32) Wire-less Door Bell.
- (33) Ultrasonic Switch/Alarm.
- (34) Stereo Pre-amplifier.
- (35) Quality Stereo Push-Pull Amplifier.
- (36) Light-Beam Telephone "Phonophone".
- (37) Light-Beam Transmitter.
- (38) Silent TV Sound Adaptor.
- (39) Ultrasonic Transmitter.
- (40) Thyristor Drill Speed Controller.

## YORK ELECTRICS

333 YORK ROAD, LONDON, S.W.11

Send a S.A.E. for full details, a brief description and Photographs of all Kits and all 52 Radio, Electronic and Photoelectric Projects Assembled.

# BI-PRE-PAK LIMITED

## FULLY TESTED AND MARKED

|        |      |                   |      |
|--------|------|-------------------|------|
| ACI07  | 3/-  | OC170             | 3/-  |
| ACI26  | 2/6  | OC171             | 4/-  |
| ACI27  | 2/6  | OC200             | 3/6  |
| ACI28  | 2/6  | OC201             | 7/-  |
| AC176  | 5/-  | 2G301             | 2/6  |
| ACY17  | 3/-  | 2G303             | 2/6  |
| AFI14  | 4/-  | 2N711             | 10/- |
| AFI15  | 3/6  | 2N1302-3          | 4/-  |
| AFI16  | 3/6  | 2N1304-5          | 5/-  |
| AFI17  | 3/6  | 2N1306-7          | 6/-  |
| AF239  | 12/6 | 2N1308-9          | 8/-  |
| AF186  | 10/- | 2N3844A           | 5/-  |
| AF139  | 10/- | Power Transistors |      |
| BFY50  | 4/-  | OC20              | 10/- |
| BSY25  | 7/6  | OC23              | 10/- |
| BSY26  | 3/-  | OC25              | 8/-  |
| BSY27  | 3/-  | OC26              | 5/-  |
| BSY28  | 3/-  | OC28              | 7/6  |
| BSY29  | 3/-  | OC35              | 5/-  |
| BSY95A | 3/-  | OC36              | 7/6  |
| OC41   | 2/6  | ADI49             | 10/- |
| OC44   | 2/6  | AUY10             | 30/- |
| OC45   | 2/6  | 2N3055            | 15/- |
| OC71   | 2/6  | Diodes            |      |
| OC72   | 2/6  | AA742             | 2/-  |
| OC73   | 3/6  | OA95              | 2/-  |
| OC81   | 2/6  | OA70              | 1/9  |
| OC81D  | 2/6  | OA79              | 1/9  |
| OC82   | 4/-  | OA81              | 1/9  |
| OC139  | 2/6  | IN914             | 1/6  |
| OC140  | 3/6  |                   |      |

# FREE!

PACKS OF YOUR OWN CHOICE UP TO THE VALUE OF 10/- WITH ORDERS OVER £4

## TRY OUR X PAKS FOR UNEQUALLED VALUE

### XA PAK

Germanium PNP type transistors, equivalents to a large part of the OC range, i.e. 44, 45, 71, 72, 81, etc.

PRICE £3 PER 1000

POST & PACKING 4/6 U.K.

### XB PAK

Silicon TO-18 CAN type transistors NPN/PNP mixed lots with equivalents to OC200-1, 2N706A, BSY27/29, BSY95A.

PRICE £4.5.0 PER 500  
PRICE £8 PER 1000

POST & PACKING 2/6 U.K.

### XC PAK

Silicon diodes miniature glass types, finished black with polarity marked, equivalents to OA200, OA202, BAY31-39 and DK10, etc.

PRICE £4.10.0 PER 1000

POST & PACKING 2/6 U.K.

ALL THE ABOVE UNTESTED PACKS HAVE AN AVERAGE OF 75% OR MORE GOOD SEMICONDUCTORS. FREE PACKS SUSPENDED WITH THESE ORDERS. ORDERS MUST NOT BE LESS THAN THE MINIMUM AMOUNTS QUOTED PER PACK.

## NEW TESTED AND GUARANTEED PAKS

|     |     |   |      |
|-----|-----|---|------|
| B2  | 4   | Photo Cells, Sun Batteries inc. Book of Instructions                              | 10/- |
| B77 | 2   | AD161-AD162 NPN/PNP Trans. Comp. Output. Pair                                     | 10/- |
| B79 | 4   | IN4007 Sil. Rec. Diodes 1000 P.I.V. 1 amp. Miniature                              | 10/- |
| B81 | 10  | Reed Switches, mixed types large and small  | 10/- |
| B89 | 2   | 5SP5 Light Sensitive Cells. Light Res. 400 Ω Dark 1M Ω                            | 10/- |
| B91 | 8   | NKT163/164 PNP Germ. TO-5 equivalent to OC44, OC45                                | 10/- |
| B92 | 4   | NPN. Sil. Trans. AO6 = BSX20, 2N2369 500 MHz, 360mW                               | 10/- |
| B93 | 5   | GET113 Trans. equiv. to ACY17-21 PNP Germ.  | 10/- |
| B94 | 6   | NPN Sil. Planar Epitaxial Trans. CS4 similar to BSY38 or BC108                    | 10/- |
| B96 | 5   | 2N3136 PNP Sil. Trans. TO-18, HFE 100-300 I.C. 600mA, 200 MHz                     | 10/- |
| B98 | 10  | XB112 and XB102 equiv. to AC126, AC156, OC81/2, OC71/2, NKT271, etc.              | 10/- |
| B99 | 200 | Capacitors, Electrolytics paper, silver mica, etc. Post and packing, this Pak 2/6 | 10/- |
| H4  | 250 | Mixed Resistors. Post and Packing 2/-   | 10/- |

## RETURN OF THE UNBEATABLE P.I PAK. NOW GREATER VALUE THAN EVER

FULL OF SHORT LEAD SEMICONDUCTORS AND ELECTRONIC COMPONENTS, APPROX. 170. WE GUARANTEE AT LEAST 30 REALLY HIGH QUALITY FACTORY MARKED TRANSISTORS PNP AND NPN, AND A HOST OF DIODES AND RECTIFIERS MOUNTED ON PRINTED CIRCUIT PANELS. IDENTIFICATION CHART SUPPLIED TO GIVE SOME INFORMATION ON THE TRANSISTORS.

PLEASE ASK FOR PAK P.I ONLY 10/-  
2/- P. & P. on this Pak.

Make a Rev. Counter for your Car. The 'TACHO BLOCK'. This encapsulated block will turn any 0-1mA meter into a linear and accurate rev. counter for any car. **20/-each**

## FREE CATALOGUE AND LISTS FOR:-

ZENER DIODES  
TRANSISTORS, RECTIFIERS  
FULL PRE-PAK LISTS  
& SUBSTITUTION CHART

MINIMUM ORDER 10/- CASH WITH ORDER PLEASE. Add 1/- post and packing per order. OVERSEAS ADD EXTRA FOR AIRMAIL.

MULLARD DATA BOOK  
Semiconductor and Valve  
Data and Equivalents.  
Postage 6d.

**3/6**  
EACH

## Huge Clearance of UHF/VHF TUNER UNIT REJECTS

Stocks almost exhausted! Place your orders now !!!  
FANTASTIC TRANSISTOR VALUE

TU. 2. CONTAINING 2 AF186's & 2 AF178's. PRICE 10/- EACH UNIT.

TU. 3. CONTAINING 2 AF186's & 2 AF178's.

PLUS WAVEBAND SLIDER SWITCH.

PRICE 12/6 EACH UNIT.

P & P

2/6d.  
EACH UNIT

All the Units have many other components, e.g., Capacitors, Resistors, Coils, and Tuning Condensers, etc. ALL TUNER UNITS ARE SUPPLIED WITH CONNECTION DATA.

## NEW UNMARKED UNTESTED PAKS

|     |     |   |      |
|-----|-----|---|------|
| B78 | 12  | Integrated Circuits, Data and Circuits of types, supplied with orders | 10/- |
| B80 | 8   | Dual Trans. Matched O/P pairs NPN. Sil. in TO-5 can                   | 10/- |
| B82 | 10  | OC45, OC81D and OC81 Trans. Mullard glass type                        | 10/- |
| B83 | 200 | Trans. manufacturer's rejects all types NPN, PNP, Sil. and Germ.      | 10/- |
| B84 | 100 | Silicon Diodes DO-7 glass equiv. to OA200, OA202                      | 10/- |
| B86 | 150 | High quality Germ. Diodes. Min. glass type                            | 10/- |
| B86 | 50  | Sil. Diodes sub. min. IN914 and IN916 types                           | 10/- |
| B87 | 100 | Germ. PNP Trans. equiv. to OC44, OC45, OC81, etc.                     | 10/- |
| B88 | 50  | Sil. Trans. NPN, PNP, equiv. to OC200/1, 2N706A, BSY95A, etc.         | 10/- |
| B60 | 10  | 7 Watt Zener Diodes Mixed Voltages                                    | 10/- |
| H5  | 16  | 1 Amp. Plastic Diodes 50-1000 Volts                                   | 10/- |
| H6  | 40  | 250mW. Zener Diodes DO-7 Min. Glass Type                              | 10/- |

## SPECIAL OFFER

12 VOLT STABILISED  
POWER UNITS  
INPUT 110-250 V. AC.  
OUTPUT 11-13V Stabilised  
Brand New makers surplus  
at the unrepeatable  
Price of £5 each  
Post & Packing 7/6



FREE! A WRITTEN GUARANTEE WITH ALL OUR TESTED SEMICONDUCTORS

# BI-PRE-PAK LTD

DEPT. A, 222-224 WEST ROAD, WESTCLIFF-ON SEA, ESSEX  
TELEPHONE: SOUTHEND (0702) 46344

# S.E.S. YOUR COMPLETE SUPPLIER

196 Regent Road, SALFORD 5, Lancashire

TELEPHONE 061-872 5187

(Member of the Harrop Industrial Group)

C.W.O. please 1/- p. & p. for orders of components under £1  
Orders of Lektrokitt: 2/- handling charge on orders under £1  
5/- handling charge on orders under £5

**RESISTORS:** All brand new, Hi-Stab, low noise, 5% tol. carbon film.  $\frac{1}{2}$ W E12 series 4.7 ohm to 10M, 2d. each or 15/- per 100 of one value.  $\frac{1}{2}$ W E24 series 4.7 ohm to 10M, 2d. each or 15/- per 100 of one value.  $\frac{1}{2}$ W E12 series 2.2 ohm to 3.9 ohm, 8d. each. 1W E12 series 10 ohm to 10M. (10% tol.), 3d. each. 3W—wirewound—0.5 ohm to 12 ohm, 1/6 each. 5W—wirewound—15 ohm to 820kohm, 1/9 each. S.E.S. Pre-Pack gives you 5 off each, 5% resistors from 4.7 ohm to 1M either  $\frac{1}{2}$  or  $\frac{1}{4}$  watt. 65 different values (E12)—ONLY £2.12s. 6d. \*\*\*NOW— $\frac{1}{2}$ W carbon film 5%, E12 series 10 ohm to 100kohm, 2d. each.

**PRE-SETS:** Min. skeleton carbon track, low noise with good stability; Values—Lin: 1k, 2.5k, 5k, etc., to 5M; Log: 5k, 10k, 25k, etc., to 10Mohm, only 10d. each. Sub-Min skeleton Lin. track: 1k, 2.5k, 5k, etc., to 5M, only 9d. each. Slider pre-sets wirewound  $\frac{1}{2}$ W rating Lin: 10 ohm to 5k, 2/3 each. 3W wirewound fully enclosed Lin. tracks. 10 ohm to 30k, 3/9.

**POTENTIOMETERS:** Min. enclosed, carbon track and wiper contact only 2/6; Values—Lin: 1k, 2.5k, 5k, etc., to 10M; Log: 5k, 10k, 25k, etc., to 5Mohm. Min. with double-pole switch, insulated spindles only 5/6. Values Lin: 25k, 50k, 100k; Log: 3k, 5k, 10k, 250k, 500k, 1M, 2M. 3W wirewound Lin. tracks 50 ohm to 100kohm, 7/4 each.

**CAPACITORS:** New genuine Mullard Electrolytics

| (Min.)  |      |     |      |           |     | (Small) |       |
|---------|------|-----|------|-----------|-----|---------|-------|
| 6.4V    | 25   | 50  | 100  | 200       | 320 | 640     | 1,200 |
| 10V     | 4    | 16  | 32   | 64        | 125 | 250     | 500   |
| 16V     | 2.5  | 10  | 20   | 40        | 80  | 125     | 250   |
| 25V     | 1.6  | 6.4 | 12.5 | 24        | 50  | 80      | 160   |
| 40V     | 1    | 4   | 8    | 16        | 32  | 50      | 100   |
| 64V     | 0.64 | 2.5 | 5    | 10        | 20  | 32      | 64    |
| Prices: | 1/-  |     |      | 10d. each |     |         | 1/3   |

| (Large) |     |       |       |       |       | (Multiplies) |         |
|---------|-----|-------|-------|-------|-------|--------------|---------|
| 25V     | 800 | 1,250 | 2,000 | 4,000 | 6,400 | 500V         | 8-30uF  |
| 40V     | 500 | 800   | 1,250 | 2,500 | 4,000 | 500V         | 16-16uF |
| 64V     | 320 | 500   | 800   | 1,600 | 2,500 | 350V         | 32-32uF |
| Prices: | 5/- | 6/6   | 8/-   | 12/6  | 15/-  | 350V         | 50-50uF |

(all values in Microfarads)

Mullard Miniature Metallised Polyester 250V. 0.01, 0.015, 0.022, 0.033, 0.047, 0.068uF, 6d. each. 0.1, 0.15, 0.22uF, 7d. each.  
Mullard Polyester Film and Foil 400V. 0.001, 0.0015, 0.0022, 0.0033, 0.0047, 0.0068, etc., to 0.033uF, 6d. each. 0.047 to 0.1uF, 8d. each. 0.15uF, 10d. 0.22uF, 1/-, 0.33uF, 1/6, 0.47uF, 1/9.  
Disc Ceramics (Erie) 500V, 1,000, 4,700pF, 5d. each. Silver Micas 1% tol. 500V, 2.2pF to 820pF, 1/- each. Polystyrene 160V, 100-1,000pF, 5d. each.  
\*\*\*NOW—Bead Tantals (polarised) 35V, 0.47, 0.68, 1uF, 2/6 each. 2.2, 3.3, 4.7, 6.8uF, 3/4 each. 20V 10uF, 15V 22uF, 10V 33uF, 6V 47uF, 3/9 each. Low Voltage Disc Ceramics 20V—0.01, 0.022, 0.047uF, 10d. each. 0.1, 0.22, 1/3 each. Midget Tubular Ceramics—0.002, 0.003uF, 10d. each.

**SEMICONDUCTORS: All New and Unused**  
Mullard: OAS 4/6; CA81 3/4; CA202 2/3; OCT71 4/-; OCT2 4/6; OC44 7/9; OC45 1/-; BC107, 109 3/9 each; BC108 3/6; BFV51 4/6; MPF 105 9/6.  
Silicon Rectifiers—(0.5A) 400piv 2/9; 800piv 3/-; 1,500 piv 3/6; (1.2A) 400piv 6/-; 800piv 7/-; 1,500piv 7/6; (2.5A) 400piv 6/6; 800piv 7/6; 1,500piv 10/6. (1.2A and 2.5A types are stud mounted—Anode). \*\*\*NOW—2N2924 3/6; 2N2926 (Brown or Red) 2/6, (Orange) 2/9, (Yellow) 3/-, (Green) 3/3; 2N3643 8/6; 2N3794, 2N4289 4/- each; IN4148 1/6.

**SWITCHES:** 100 series—SPST 3/8; SPDT 3/11; DPST 4/6; DPDT 4/8. 400 series SPST 3/2; SPDT 3/6; SPDT (with centre position) 3/8. Series 500—push-to-make or push-to-break 3/11 each (push buttons available in white, red, black, green). Slide Switch 3/4; Wave Change switches 5/9 each. Miniature "Make-Switch" also available—Shafts 5/-; Wafers 5/4 each.

**PLUGS AND SOCKETS:** Min. Plugs (black or red) 6d. Min. Sockets to fit 7d. Banana Plugs (black or red) 9d. 4mm Sockets to fit (black, red, green) 9d. Co-Ax Plugs 1/2. Co-Ax Sockets 11d. Sub-Min Jack Plugs and Sockets 2/- each. Min. Jack Plugs and Sockets 3/- each. Recorder Plugs 3-way 2/7 5-way 3/- Recorder Sockets 3-way 1/2, 5-way 1/4.

**WIRE:** Min. Stranded (available in 10 colours) 3d. yd. Solid Core 3d. yd. 14/0-0076in. Stranded 4d. yd. Min. Mains Lead 1/3 yd. Min. Microphone cable 1/6 yd. Co-Ax cable 1/3 yd.

**LAMPS:** Min. Wire Ended Neons 2/-; Panel Neon Indicator 6/4; Pilot Light + 12V bulb 8/-; Min. Flange Light + 12V bulb 11/-.

**SOLDERING IRONS:** A.N.T.E.X. CN240 15W mains operated, small, 32/6. E240 20W mains operated, specially shaped handle, 35/- Spare bits and elements available. Also stands for above irons, 11/6 each. \*\*\*NOW—SOLDER by Multicore—At Reduced Prices to Everyone! Size A—Approx. 20ft coil 60/40 Alloy 22 s.w.g. in dispenser. Recommended retail price 3/-, OUR PRICE 2/9. Size B—Approx. 200ft reel 60/40 Alloy 22 s.w.g. individually packed. Recommended retail price 15/-, OUR PRICE 12/6. 818 Wire Strippers strips insulation without nicking wire. Recommended retail price 4/-, OUR PRICE 4/-.

**LEKTROKIT:** Chassis construction system—the professional look to a home construction. Starts to build a chassis  $8\frac{1}{2} \times 4\frac{1}{2}$ in.—2 chassis rails 1/10 each, 2 side plates 4/4 each. Front panel (covered in crack-proof paint) 8/3. Perforated cover 5/5. 2 plain covers 4/5 each. 4 rubber feet 9d. 7 boards available each  $4\frac{1}{2} \times 4$ in.—Thus 2 boards fit above chassis. Plain perforated aluminium board 2/2. Aluminium board drilled for 6 valveholders B7G, B8A, B9A, 2/6. Aluminium board drilled for 2 valveholders international octal, UX4, etc., 2/4. 0.1in. perforated grid SRBP board, 2/9. Veroboard 0.1in. and 0.2in. 6/6 each. Cloverleaf aluminium board 6/- (Cloverleaf lead throughs 6d. each. Pins for SRBP board 4/6 100).

For full details of all our stocks send 3/6 for our bright explanatory 120 page catalogue, or 6d. stamp for Data Sheets.

## CITY AND COUNTY OF BRISTOL BRISTOL POLYTECHNIC CAREERS IN RADIO AND RADAR

### Marine Radio Officers

2-year full time course leading to the Second and First Class P.M.G. Certificates and the B.O.T. Radar Maintenance Certificate.

Conversion Course (Second Class to First Class).

R.T. Licences (Full or Restricted).

### Licensed Aircraft Radio Engineers

2-year full-time course covering the Aircraft Radio Engineers Licences categories A & B, issued by the Board of Trade (Civil Aviation) followed by a six-months course for Radar Rating (A & B) in association with the above.

### Courses for Qualified Marine Radio Officers

Single Side Band Techniques (2 weeks).

Marine Electronics Diploma Course (3 months).

Advanced Marine Electronics Diploma Course (3 months).

Training is given on the latest types of Marine and Aircraft equipment in approved Laboratories at THE SCHOOL OF RADIO AND RADAR.

Senior Lecturer-in-Charge: F. E. Barltrop.

For further information, apply:

**Chief Administrative Officer**  
Bristol Polytechnic  
Ashley Down BS7 9BU

## W. E. C. LTD.

### Quality Components

#### BARGAIN OF THE MONTH

NEW 13 Amp Flat Pin White Plugs 5 for 11/- or 10 for £1.

#### MULTI-RANGE TEST METER

1000 o.p.v. D.C. 0 1000V 3 ranges  
A.C. 0—1000V 3 ranges  
D.C.I. 0—160 mA  
Res. to 100K  
Mirror Scale Test Leads  
£2.10 6 each.

#### AUTOMATIC PARKING: BOAT MOORING LIGHT

Using latest techniques devised by prominent manufacturer.

**KIT** includes Cad/Sulph. Cell, Semiconductors, Resistors, Circuit Veroboard, Connecting Wire.

All NEW manufacturers items.

FREE comprehensive data and circuit. PRICE 36/-.

Suitable Parking Light for use with above 6/11.

TERMS C.W.O. plus 3/- P. & P.

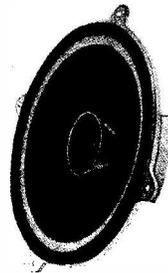
SEND FOR FREE CATALOGUE

## W. E. C. LTD.

73 THE STREET, ASHTEAD, SURREY

## 12in. "SUPERB" £15

The exceptional quality and performance of the "Superb" brings truly exceptional sound from a single loudspeaker, recreating the musical spectrum virtually flat  $\pm 5$ db. 20 to 17,000 c.p.s. The unit consists of the latest double cone, woofer and tweeter cone together with a massive Baker "FERROBA" magnet assembly having a flux density of 16,500 gauss and a total flux of 176,000 Maxwells. Bass resonance 22-26 c.p.s. Rated 20 watts. Voice coils available 8 or 15 ohms. Suitable for all High Fidelity Systems. A high quality loudspeaker providing clear reproduction of the deepest bass and highest treble.



Further details and 48 page Enclosure paid.  
Manual 5/9 post paid.

**Baker Reproducers Ltd**

Bensham Manor Road Passage, Thornton Heath, Surrey. 01-684-1665

# VALUABLE NEW HANDBOOK

# FREE TO AMBITIOUS ENGINEERS

Have you had your copy of "Engineering Opportunities"?

The new edition of "ENGINEERING OPPORTUNITIES" is now available—without charge—to all who are anxious for a worthwhile post in Engineering. Frank, informative and completely up to date, the new "ENGINEERING OPPORTUNITIES" should be in the hands of every person engaged in any branch of the Engineering industry, irrespective of age, experience or training.

## On 'SATISFACTION OR REFUND OF FEE' terms

This remarkable book gives details of examinations and courses in every branch of Engineering, Building, etc., outlines the openings available and describes our Special Appointments Department.

## WHICH OF THESE IS YOUR PET SUBJECT?

**ELECTRONIC ENG.**  
Advanced Electronic Eng.—  
Gen. Electronic Eng.—Applied  
Electronics—Practical  
Electronics—Radar Tech.—  
Frequency Modulation —  
Transistors.

**ELECTRICAL ENG.**  
Advanced Electrical Eng.—  
General Electrical Eng.—  
Installations—Draughtsmanship  
— Illuminating Eng. —  
Refrigeration — Elem. Elec  
Science — Elec. Supply —  
Mining Elec. Eng.

**CIVIL ENG.**  
Advanced Civil Eng.—  
General Civil Eng. — Municipal  
Eng. — Structural Eng.  
—Sanitary Eng.—Road Eng.  
— Hydraulics — Mining —  
Water Supply—Petrol Tech.

**RADIO & T.V. ENG.**  
Advanced Radio — General  
Radio—Radio & TV Servicing  
— TV Engineering — Tele-  
communications — Sound  
Recording — Automation —  
Practical Radio — Radio  
Amateurs' Examination.

**MECHANICAL ENG.**  
Advanced Mechanical Eng.—  
Gen. Mech. Eng.—Maintenance  
Eng. — Diesel Eng. —  
Press Tool Design — Sheet  
Metal Work — Welding —  
Eng. Pattern Making —  
Inspection - Draughtsmanship  
— Metallurgy — Production  
Eng.

**AUTOMOBILE ENG.**  
Advanced Automobile Eng.—  
General Auto. Eng. — Auto.  
Maintenance — Repair —  
Auto. Diesel Maintenance —  
Auto. Electrical Equipment—  
Garage Management.

WE HAVE A WIDE RANGE OF COURSES IN OTHER SUBJECTS INCLUDING CHEMICAL ENG., AERO ENG., MANAGEMENT, INSTRUMENT TECHNOLOGY, WORKS STUDY, MATHEMATICS, ETC.

Which qualification would increase your earning power?  
A.M.I.E.R.E., B.Sc.(Eng.), A.M.S.E., A.M.I.P.E., A.M.I.M.I., A.R.I.B.A.,  
A.I.O.B., A.M.I.Ex., A.R.I.C.S., M.R.S.H., A.M.I.E.D., A.M.I.Mun.E., C.ENG.,  
CITY & GUILDS, GEN. CERT. OF EDUCATION, ETC.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY  
316A ALDERMASTON COURT, ALDERMASTON, BERKSHIRE

## THIS BOOK TELLS YOU

- ★ HOW to get a better paid, more interesting job.
- ★ HOW to qualify for rapid promotion.
- ★ HOW to put some letters after your name and become a key man . . . quickly and easily.
- ★ HOW to benefit from our free Advisory and Appointments Depts.
- ★ HOW you can take advantage of the chances you are now missing.
- ★ HOW, irrespective of your age, education or experience, YOU can succeed in any branch of Engineering.

164 PAGES OF EXPERT CAREER - GUIDANCE

### PRACTICAL EQUIPMENT

Basic Practical and Theoretic Courses for beginners in Electronics, Radio, T.V., Etc., A.M.I.E.R.E. City & Guilds Radio Amateurs' Exam. R.T.E.B. Certificate P.M.G. Certificate Practical Electronics Electronics Engineering Practical Radio Radio & Television Servicing Automation

### INCLUDING TOOLS

The specialist Electronics Division of B.I.E.T. NOW offers you a real laboratory training at home with practical equipment. Ask for details.

## B.I.E.T.

You are bound to benefit from reading "ENGINEERING OPPORTUNITIES" — send for your copy now—FREE and without obligation.



## POST COUPON NOW!

TO B.I.E.T., 316A ALDERMASTON COURT, ALDERMASTON, BERKSHIRE.

Please send me a FREE copy of "ENGINEERING OPPORTUNITIES." I am interested in (state subject, exam., or career).

NAME .....

ADDRESS .....

WRITE IF YOU PREFER NOT TO CUT THIS PAGE

THE B.I.E.T. IS THE LEADING INSTITUTE OF ITS KIND IN THE WORLD

# HENRY'S RADIO LTD.

# ENGLAND'S LEADING COMPONENT AND EQUIPMENT CENTRES

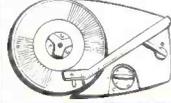


## BUILD A QUALITY 4 TRACK TAPE RECORDER

To get the best out of your MAGNAVOX DECK, you need a MARTIN RECORDAKIT. This comprises a special high quality 6 valve amplifier and pre-amplifier which comes to you assembled on its printed circuit board - in fact everything for making a superb Tape Recorder. You need no experience or technical skill to bring this about. THE INSTRUCTIONS MANUAL MAKES BUILDING EASY, AND SUCCESS IS ASSURED. Kit comprises Deck, Amplifier, Cabinet and speaker, with microphone, 7" 1200 ft. tape, and spare spool. ASK FOR BROCHURE 6. TODAYS VALUE £60. PRICE 39 gns. p.p. 22/6. NOTHING ELSE TO BUY

## SCOOP! STAAR RECORD PLAYER

Deck plays 33, 45, 78, R.P.M. records 9 volt operated, with mono cartridge BRAND NEW as illustrated.



PRICE 59/6.  
p.p. 3/6.  
Send for leaflet No. 2.

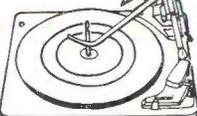


## MULLARD 1 WATT AMPLIFIER

Portable Transistor Unit-Ideal for Intercoms, Baby Alarms, Tele phone, Record Players or Guitar Practice. 9 Volt 5 transistors with volume control, output 3 ohms. Ideal for use with STAAR RECORD DECK. PRICE 45/- p.p. 2/6.

OTHER ITEMS. Suitable 7 x 4 inch. 3 ohm speaker 17/6 p.p. 1/6. Revere covered cabinet 12 x 9 x 4 12/6 p.p. 2/6 P.P. 9 Volt battery 3/9. Write for leaflet No. 2.

## GARRARD RECORD DECKS



All the latest models BRAND NEW and guaranteed - TERRIFIC SAVINGS!

- \*2025 STEREO £ 7 19.6
- \*2025TC DIAMOND, 9TAH.C. £ 9 19.6
- \*3000 STEREO 9TAH.C. £ 11 19.6
- \*SP 75 Mk.II £ 11 19.6
- \*SL 55 £ 12 10.0
- \*A70 Mk.II. £ 14 14.0
- \*AT 50 K.II. £ 13 10.0
- \*SL 65 £ 14 14.0
- \*AP 75 £ 19 0.0
- \*401 £ 28 7.8
- \*SL 75 £ 29 0.0
- \*SL 95 £ 35 0.0
- \*GL 75 GOLDRING £ 33 0.0
- \*GL 75 P £ 46 15.0

ALSO IN STOCK - THORENS - Lenco - B.S.R. Carriage/insurance 7/6 extra on any model. W84 BASES £3.19.6. PERSPEX COVERS £3.10.0. \*Special offer base and cover available for these models at £4.15.0. Carriage 5/-. Complete range of Cartridges/Plinths/Covers. SEND FOR 8 PAGE BROCHURE 16/11 TODAY.

## BUILD YOURSELF A QUALITY RADIO



New printed circuit design with full power output. Fully tuneable on both m/w/lw bands. 7 Mullard transistors. Fitted 5" speaker, Room Filling Power. Easy to build with terrific results. All local and continental stations. Complete detailed instructions. TOTAL COST £6.19.6. p.p. 4/6. ASK FOR LEAFLET No. 1.

## TRANSISTORS DIODES RECTIFIERS

WE HAVE THE MOST COMPREHENSIVE STOCK IN GREAT BRITAIN. NEW 1969 LIST OF 1000 TYPES. SEND FOR FREE COPY TODAY (LIST 36) Whether you require one or 1000, devices can fulfil your order from stock! For quantity quotations telephone (011 723 0401 Ex. 4 or 1011 402 6823.

## HENELEC 5-5 STEREO AMPLIFIER

Excellent low priced British designed Stereo Amplifier for use with Record Decks, Mikes, Tuners

16 transistor mains operated Output 545 watts for 8 15 ohm speakers. Black, silver and wood finish, size 13" x 3" x 6". PRICE £13.10.0. p.p. 7/6. (Leaflet on request).

Complete Stereo System 5-5 Garrard 2025 stereo, 5-5 Amplifier, Plinth/Cover, Two 10 watt speakers with tweeters in polished cabinets.

Usual price £47.0.0. OUR PRICE £39.10.0. p.p. 20/- ASK FOR BROCHURE 13



## SINCLAIR EQUIPMENT

The SINCLAIR IC-10 is the worlds first monolithic integrated circuit high fidelity power amplifier and pre-amplifier. The circuit itself has an output power of 10 watts, yet with an overall-size of 1 x 0.4 x 0.2 in.



| IC-10 Integrated Circuit Amplifier | 59/6    | OTHER TYPES OF INTEGRATED CIRCUITS |      |   |
|------------------------------------|---------|------------------------------------|------|---|
| Z30                                | 89/6    | RCA CA3014                         | 29/6 | G.E. PA246*   |
| P225 60                            | £9 19.6 | RCA CA3018                         | 22/6 | SL402 Plessey   |
| 1250 Power Supply                  | £4 19.6 | RCA CA3020                         | 29/6 | S.G.S. UL910  |
| O16 Loud Speaker                   | £8 19.6 | RCA CA3036                         | 18/6 | S.G.S. UL900  |
| 212 Amplifier                      | 89/6    | Sinclair I.C.10.                   | 59/6 | S.G.S. UL914  |
| P2 4 Power unit                    | 99/6    | G.E. PA230*                        | 22/6 | Mullard TAA263  |
| Stereo 25                          | £9 19.6 | G.E. PA234*                        | 20/0 | *Data sheets 3/6 set for these, for others see catalogue. |
| O14 Speaker system                 | £7 19.6 | G.E. PA237*                        | 37/6 |   |

All post paid, delivery from stock.

## BUILD THIS VHF FM TUNER

5 MULLARD TRANSISTORS. 300 kc/s BANDWIDTH. PRINTED CIRCUIT. HIGH FIDELITY REPRODUCTION MONO & STEREO. A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it - VHF FM gives the REAL sound.

PARTS TOTAL COST £6.19.6. DECODER £5.19.6. ASK FOR LEAFLET No. 3. (FOR STEREO)



## HENRY'S RADIO Fully Illustrated CATALOGUES

A ALL TYPES OF ELECTRONIC COMPONENTS TEST EQUIPMENT KITS BUILT UNITS



B HIGH FIDELITY & GENERAL AUDIO EQUIPMENT CATALOGUE

COMPREHENSIVE · CLEAR · CONCISE · CATALOGUES  
A Over 300 pages fully detailed and illustrated with more than 6,000 stock items. Everything for amateur and professional use. Complete with 5 vouchers. 10/- value, for use with purchases

ORDER AS CATALOGUE A PRICE 7/6. p.p. 2/-.

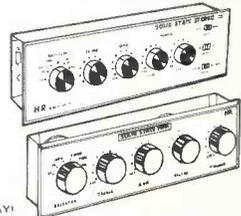
B New audio and high fidelity catalogue. 120 pages containing ideas and equipment for every application. Special low prices for all leading makes Plus 12/6 extra discount voucher.

ORDER AS CATALOGUE B PRICE 5/- p.p. 1/-.

WHY NOT SEND AWAY TODAY!

## AUDIO EQUIPMENT

Mono or Stereo Audio equipment developed from Dinsdale Mk.II - each unit or system will compare favourably with other professional equipment selling at much higher prices. COMPLETE SYSTEMS AND MIXERS from £11.12.6. to £38.17.6. (all units available separately)



THE FINEST VALUE IN LOW COST HIGH FIDELITY - CHOOSE A SYSTEM TO SUIT YOUR NEEDS AND SAVE YOURSELF POUNDS.

SEND FOR BROCHURES No. 12/14 and 21 TODAY!

## HI-FI equipment to suit EVERY POCKET

### HIGH FIDELITY AUDIO EQUIPMENT CATALOGUE 5/- p.p. 1/-



VISIT OUR NEW HI-FI CENTRE AT 309 EDGWARE ROAD, for all leading makes of - AMPLIFIERS, TUNERS, DECKS, SPEAKERS, MICROPHONES, TEST EQUIPMENT. ALL WITH DISCOUNTS - IT WILL PAY YOU TO PAY US A VISIT. AUDIO SYSTEMS £40 - £300 TO SUIT EVERY POCKET. DEFERRED TERMS AVAILABLE. SEND FOR ILLUSTRATED BROCHURE 16/17. TWO DEMONSTRATION ROOMS

## ELECTRONIC ORGANS

COMPLETE KITS FOR THE HOME CONSTRUCTOR

STAR FEATURES:  
\*ALL TRANSISTOR PRINTED CIRCUIT DESIGNS.  
\*BRITISH DESIGN. \*STEP BY STEP DETAILED INSTRUCTIONS. \*SAVES UP TO 50% ON COMMERCIAL EQUIPMENT!  
\*EVERYTHING SUPPLIED DOWN TO THE LAST ITEM. \*FULL AFTER-SALES SERVICE & ADVICE. \*CREDIT SALE & H.P. TERMS AVAILABLE

We are pleased to offer the choice of FOUR British designs from a single manual portable at £99 THE MAYFAIR for light or classical music - to a two manual five octave deluxe model with OAK CONSOLE from £285 for the serious musician

These kits are the result of years of research and design and offer the best that is essential to good organ design, coupled with excellent value are within the reach of most pockets. No technical skill or knowledge is required in construction, with the aid of the STEP BY STEP illustrated manuals will produce an instrument that will be a delight to own and use and will give years of trouble free entertainment for the whole family.

SEND FOR ILLUSTRATED BROCHURES 9/10/11 TODAY! When in LONDON... CALL IN SEE, HEAR, PLAY FOR YOURSELF. Organ Demonstration Room 1st Floor.

PRACTICAL ELECTRONICS ORGAN - ORGAN COMPONENTS

We are able to supply all items for this series, details on request.

START BUILDING FOR AS LITTLE AS £10. MODELS FROM £99 - £350.



ILLUSTRATION of GROSVENOR ELECTRONIC ORGAN

Built models available from £124.

# HENRY'S RADIO LTD.

Mail Order Dept., Components, Organ Dept.  
303 EDGWARE ROAD, LONDON W.2.  
Telephone: 01-723 1008/9

OPEN MON-SAT 9am-6pm THURS 9am-1pm

High Fidelity and Equipment Centre  
309 EDGWARE ROAD, LONDON W.2.  
Telephone: 01-723 6963