PRACTICAL WIRELESS

NOVEMBER 1970

3½p

(17½p new)

PW 25/25 STEREO AMPLIFIER

RESISTANCE CAPACITANCE BRIDGE
SHORT-WAVE TRANSISTOR PREAMP

AUDIO * FAIR PREVIEW
ADCOLA Soldering Instruments add to your efficiency

ADCOLA 64
for Factory Bench Line Assembly
A precision instrument—supplied with standard 3/16" (4.75 mm) diameter, detachable copper chisel-face bit*.
Standard temp. 360°C at 23 watts.
Special temps. from 250°C—410°C.

*Additional Stock Bits (illustrated) available

ADCOLA PRODUCTS LTD...
(Dept. M), ADCOLA HOUSE, GAUDEN RD., LONDON, S.W.4.

Telephone: 01-622 0291/3 − Telegrams: Soljoint London Telex: Adcota London 21851

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

ADCOLA Ex-Rental Televisions
TWO-YEAR GUARANTEE

17" SLIMLINE 405 only
£11 10 0
19" SLIMLINE 405/625
39 Gns.
Carriage and Insurance 30/-
FREE ILLUSTRATED LIST OF TELEVISIONS
17"—19"—21"—23"
WIDE RANGE OF MODELS, SIZES AND PRICES
DEMONSTRATIONS DAILY

TWO-YEAR GUARANTEED TUBES 100%, REGUNNED
Slim Line Tubes 110 17" and 19 109/6, 21" and 23 129/6.
Normal Tubes 70" and 90 17" 99/6, 21" 19/6, 14" and other sizes 79/6.

SPEAKERS 10", 21" 8Ω, 3" 25Ω, 4" 8Ω, 5" 8Ω, 7" 8Ω, 10" 8Ω, 15" 8Ω, and 18" 8Ω, BRAND NEW P. & P. FREE.
Transistors: Mullard marked output kit 7/6, OCB1D = OCB1B, P. & P. FREE.
Transistor Radio Cases: 4 for £1. Size 9½" x 3½" x 3" ¼" (BRAND NEW) P. & P. FREE.
Ferrite Rods 3½, 6" and 8" complete with LW/MW Coils. P. & P. FREE.

STRIP LIGHT TUBES 3½ each.
1½" (38mm), 210/240 watts, 30 watts. Ideal for cocktail cabinets, illuminating pictures, diffused lighting, etc.
6 for £1. P. & P. FREE.

PHOTOELECTRIC KIT

PHOTOELECTRIC KIT
3½/6
Postage and Pack. 2½(U.K.) Commonwealth SURFACE MAIL ½
AIR MAIL £1.00
Australia, New Zealand. S. Africa, Canada and U.S.A.
Also Essential Data Catalogue and Plans for Building 3½ Advanced Designs.

INVISIBLE BEAM OPTICAL KIT
CONTENTS: An adjustable beam which can be used as a lamp or to replace a standard lamp. For building blocks, etc. Price 2½(U.K.) Commonwealth SURFACE MAIL ½, AIR MAIL 1½.

JUNIOR PHOTOELECTRIC KIT

YORK ELECTRICS
335 BATTERSEA PARK RD., LONDON S.W.11
Send to S.A.E. for details, a brief description and Photographs of all Kits and all 52 Radio, Electronic and Photonic kit Projects Asssembled.
Due to huge purchase these superb U.S.A. construction kits can be offered at 25% - 50% off recommended list prices. Absolutely complete with most detailed construction and operating books. Available from all branches or by mail order for 7/6 CARRIAGE AND PACKING on each kit. Two kits or more carr. free.

**KG-685 50 Watt Stereo Amplifier Kit**

**DELUXE FEATURES**

- All Silicon Transistors for Stability, Cleaner Sound @ Extremely Wide Power Bandwidth and Frequency Response
- 40W R.F. Power Output
- Special Selected Low-Noise Preamplifier Transistors
- Two Printed Circuit Boards for Fast Easy Assembly
- Convenient Front-Panel Stereo Headphones Jack
- Two AC Coupled Outputs

<table>
<thead>
<tr>
<th>Output</th>
<th>50W L.P.R., 55W per channel</th>
<th>34W continuous sine wave @ Response: 1kHz to 16kHz, plus stereo headphones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Sensitivity</td>
<td>Magnetic Phones, 5mV, Tuner or Auxiliary, 500mV</td>
<td>5kHz Power Requirement: 220V - 250V, 50Hz</td>
</tr>
</tbody>
</table>

Recommended List Price £24.19.6: 96 GRS. Assembled 90 GRS. Test Kit 55 extra.

**ALL SILICON TRANSISTORS**

The NEW KG-980
Stereo FM Receiver Kit

**STAR ROARER 5-Band Shortwave Receiver Kit**

Bandspread: electrical, calibrated 0-100 for 10kHz Bandspread -20kHz for 10kHz
Bandwidth: 1kHz at 5dB down
Best sensitivity: variable
Speaker: 6in permanent magnet type
Power Supply: fixed, transformer operated
Headphone Output: less than 0.5W
Impeance: Relay, Volt Settings
- 0-80-160-320 - 640 Ohms
- 3 kHz Power Requirement: 25W - 150W
5kHz ± 15W @ Covers 600 to 1200kHz and 30kHz to 1200kHz in 5 Band-switched Ranges: Superhetronyde Special includes calibrated regenerative L.P. stage
A.V.C. reduces fading and bistoring: A.M. Resist value to a minimum
Aerial Tuning: Electrically peaked transmitting signals for best reception: Illuminated "F" Meter: Large, Easy-to-Read 7 1/2cm Dial

Recommended List Price £21.19.6: 14 GRS. Assembled 19 GRS.

**100-in-1 Electronic Science Lab**

**LOOK AT THE PROJECTS YOU CAN BUILD**

- Electronic Scale
- Electronic Timer
- Signal Generator
- Hybrid Meter
- Signal Indicator
- Morse Code Trainer
- Electronic Cat
- Microscope
- Osmometer
- Boat Horn
- Hybrid Radio
- Hybrid Voltage Supply
- Potted Type
- Pointer Check
- V.F.O. Checker
- Includes: Dual Meter and Photocell
- Speaker
- Meter
- Aerial
- Trimmer

Recommended List Price £18.0.6: 9 GRS.

**KG-640 20,000 ohms/Volt VOM Kit**

**BIG PROFESSIONAL BAND RANGE MULTIMETER**

- A.C. Voltage (Ranges): 0 - 15 - 25 - 40 - 60 - 80 - 100 - 200 - 400 - 600 - 800 - 1000 - 2000 - 4000 - 6000 - 8000 - 10,000 - 15,000 - 20,000 - 30,000 - 40,000 - 60,000 - 80,000 - 100,000 - 200,000 - 400,000 - 800,000
- Frequency Range: 20Hz to 1,200kHz
- Resistance Range: 0 - 19 - 99 - 999 - 9999 - 99999 - 999999 - 9999999

Recommended List Price £16.19.6: 9 GRS. Assembled 19 GRS.

**JASON TAPE**

We offer you fully tensioned polyethylene and fine waxed recording characteristics at low grade tape. Quality control manufacture. They are truly worth a few more pennies than aches, vintage, obsolete or cheap imports. TRY ONE AND PROVE IT YOURSELF.

Stockists of Leak, Quad, Chapman, Goodman, Armstrong, Tripletone, Linear, Drives, Truvox, Ferrograph, Wharfedale, etc., etc.

**TECHNICAL TRADING**

All Mail Orders:

- **ARUNDELL** 15-17 Queen Street Tel. 7373
- **BRIGHTON** 5 Queen's Road Tel. 23975
- **LONDON** 10 Tottenham Court Road Tel. 605160
- **PORTSMOUTH** 350-352 Fratton Road Tel. 23034
- **SOUTHAMPTON** 72 East Street Tel. 20551

**PERSONAL CALLERS Welcome at all Branches where there are large Hi-Fi and component stocks at the keenest prices including:**

GARRARD 1925 Autochangers complete with GARRARD STEREO CARTRIDGE 7 GNS.
MAGNETIC CARTRIDGES Goldring 800H 7½ GNS.
Shrino AT33 £7.10.0 (Both listed over £10)

**FANTASTIC LOW PRICES!**
Train for tomorrow's world in Radio and Television at The Pembridge College of Electronics.

The next full-time 2 year College Diploma Course which gives a thorough fundamental training for radio and television engineers starts on 5th January, 1971.

The course includes theoretical and practical instruction on Colour Television receivers and is designed to cover the syllabus of the new City and Guilds Radio, Television and Electronics Technicians' Course. Pembridge College diplomas are awarded to successful students.

The way to get ahead in this fast growing industry—an industry that gives you many far-reaching opportunities—is to enrol now. Minimum entrance requirements Senior Cambridge or 'O' Level, or equivalent in Mathematics and English.

To: The Pembridge College of Electronics
(Dept. PW16), 34a Hereford Road, London, W2. 5AJ

Please send, without obligation, details of the Full-time Course in Radio, Television and Electronics.

NAME

ADDRESS

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

GOLDRING & GARRARD PRICES SLASHED

G. 850 £64.17.6d p.p. 2/6. SP 25 Mk 11 £50.15.0d p.p. 10/-
SEE BELOW FOR OTHER MODELS

Goldring 800/E Elliptical Transcription Arm Cart. £11.15.0d p.p. 4/-

PLINTHS AND COVERS
Suitable for A700, SP 25, 3000, 2500, 3500. Superbly finished Plinth, ready cut for use, complete with Tinted Perspex Cover. This unit is finished in Teak Polish and will blend in any modern home. 79s. 4d. p. p. 7/6.

<table>
<thead>
<tr>
<th>TURNTABLES</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Garrard 30S5 TC</td>
<td>Son 9 TMC Diamond</td>
<td>£8.10.0d</td>
</tr>
<tr>
<td>Garrard MXC</td>
<td>Son 9 TMC Diamond</td>
<td>£8.12.0d</td>
</tr>
<tr>
<td>Garrard A70</td>
<td>Mk 11 Less Cart.</td>
<td>£11.15.0d</td>
</tr>
<tr>
<td>Garrard SLSB</td>
<td>Less Cart.</td>
<td>£12.19.6d</td>
</tr>
<tr>
<td>Garrard AP7S</td>
<td>Less Cart.</td>
<td>£15.19.6d</td>
</tr>
<tr>
<td>Garrard SL75</td>
<td>Less Cart.</td>
<td>£32.00.0d</td>
</tr>
<tr>
<td>Garrard SL75</td>
<td>£10.00.0d p.p.</td>
<td>£25.00.0d</td>
</tr>
</tbody>
</table>

MISCELLANEOUS

Teleton CR 10T £35.0.0d p.p. 10/-
Teleton FP 4000 £45.0.0d p.p. 10/-
Best Stereo Headphones £15.0.0d 5/-
"Master" Magnetic Cart. Diamond Stylus £5.0.0d 5/-
LL Nova Amp. 5 + 5 Mag and Car-Input £15.10.0d p.p. 10/-
3-Way Speaker System in Cabinet, size 14" x 8" x 8", 10 Watts Peak, each £5.10.0d p.p. 5/-
Nova 7100 VHF Tuner Plus 7 x 7 Amp. £39.0.0d p.p. 10/-
3-Way Speaker System in Cabinet, size 21" x 11" x 8" 20 Watts Peak, each £11.15.0d p.p. 10/-
Prices for goods not listed, sent by return of post. S.A.E. please.

LEAK SANDWICH

Enclosure (8" x 15" x 2") oiled (mat) walnut 8 ohms—up to 35w handling capacity.
List price £45. 10. each.
Our price £35. each p.p. 10/6.

GARRARD EP 2 O N PLINTH WITH COVER

Complete, not wired, £14.12.6d p.p. 15/- Ready wired with 5-pin Din or Phone, 10/- extra.
For any other Deck, 3000, 2025TC, add price of Plinth and Cover to Deck and add 15/- p.p.

Send P.O. Order, Cheques, etc., to:
AUDIO SUPPLIES
Callers welcome: 50 STAMFORD HILL, LONDON, N.16
Phone: 01-608 3611
Open Sun. 10 a.m. to 2 p.m., Mon. to Sat. 9.30 to 6 p.m., Thurs. 1 p.m.

AMAZING MINI-DRILL

De Luxe Professional Kit with 17 tools 130/- p.p. 4/6. Money ref. g.t.e.

MIRROR SUPPLY CO.
Dept. PW11 D, Nailsea, Bristol BS19 2LP
New for Project 60

the world’s first high fidelity phase lock loop FM tuner

It has always been our policy at Sinclair Radionics to employ new and highly advanced circuitry in our products so that we can offer better performance at competitive prices. Our new F.M. tuner is the first in the world to use the phase lock loop principle. We have also incorporated such advanced features as varicap diodes for the tuning, printed circuit coils for the tuner and I.F. strip. A.G.C., A.F.C., an excellent squelch circuit to silence the tuner between stations, an integrated Circuit stereo decoder and the option of remote control and push button switching.

The phase lock loop principle was first applied to receivers for reception from satellites because of the important improvements in signal to noise ratio that could be obtained by this technique. In addition there were the benefits of greatly improved selectivity and sensitivity. The Project 60 tuners, as the specifications show, are unsurpassed by any tuner now available yet we are able, because of the new circuitry, to sell the product at a fraction of the price.

From the high fidelity point of view this new circuit has the very important advantage of very much lower distortion than any other tuner known to us.

A voltage controlled oscillator (V.C.O.) in a phase lock loop tuner is kept in phase with the incoming signal by a phase comparator or detector which compares the two and feeds a control voltage to the oscillator. This control voltage is the audio output in the case of an F.M. signal. Since it is possible to design a V.C.O. which has an extremely linear voltage to frequency transfer characteristic excellent audio fidelity can be readily achieved. Furthermore, the oscillator can track a signal whilst completely rejecting a nearby stronger signal which would cause interference in a conventional receiver.

In use the tuner is especially attractive because the squelch circuit gives complete silence between stations and because fine tuning is accomplished automatically by the tuner. Accurate tuning is therefore ensured.

The use of an integrated circuit for the stereo decoder part of the circuit helps to give improved performance as it enables us to use a far more sophisticated circuit than would otherwise be possible. In particular stereo separation is excellent. Switching from mono to stereo is automatic and is indicated by a bulb.

The Project 60 tuner is supplied completely built and tested and ready to be mounted into any cabinet you choose. It may be used with any high fidelity amplifier including of course the Project 60 amplifier systems. The remarkable selectivity and sensitivity will make it possible to receive stereo transmissions in many more areas and foreign broadcasts will also be received far more readily. It is worth remembering that the Project 60 tuner will operate well on only a few inches of wire in most areas should this be necessary.

Project 60 F.M. tuner specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of transistors</td>
<td>16 plus 20 in I.C.</td>
</tr>
<tr>
<td>Tuning range</td>
<td>87.5 to 108 MHz.</td>
</tr>
<tr>
<td>Capture ratio</td>
<td>1.5dB</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>2µV for 30dB quieting</td>
</tr>
<tr>
<td>Squelch level</td>
<td>7µV for full limiting</td>
</tr>
<tr>
<td>A.F.C. range</td>
<td>20µV</td>
</tr>
<tr>
<td>Signal to noise ratio</td>
<td>± 200 KHz.</td>
</tr>
<tr>
<td>Total harmonic distortion</td>
<td>&gt;65dB</td>
</tr>
<tr>
<td>Stereo decoder operating level</td>
<td>0.15% for 30% modulation</td>
</tr>
<tr>
<td>Pilot tone suppression</td>
<td>2µV</td>
</tr>
<tr>
<td>Cross talk</td>
<td>30dB</td>
</tr>
<tr>
<td>I.F. frequency</td>
<td>40dB</td>
</tr>
<tr>
<td>Output voltage</td>
<td>10.7 MHz</td>
</tr>
<tr>
<td>Aerial Impedance</td>
<td>2 x 150mW R.M.S.</td>
</tr>
<tr>
<td>Indicators</td>
<td>75 Ohms</td>
</tr>
<tr>
<td>Mains on; Stereo on; tuning</td>
<td></td>
</tr>
<tr>
<td></td>
<td>indicator</td>
</tr>
</tbody>
</table>

Price: £25 built and tested. Post free.

Sinclair Radionics Ltd.
Project 60

Laboratory standard modular high fidelity

Sinclair Project 60 comprises a range of modules which connect together simply to form a compact stereo amplifier with really excellent performance. So good, in fact, that only 2 or 3 amplifiers in the world can compare in overall performance and now the constructor has choice of assemblies with either 20 or 40 watts output per channel, with or without filter facilities.

The modules are: 1. The Z.30 and Z.60 high gain power amplifiers. 2. The Stereo 60 preamplifier and control unit. 3. The Active Filter Unit. 4. 4 supply units—PZ.5; PZ.6; PZ.7 and PZ.8. In a normal domestic application, there will be no significant difference between PZ.5 or PZ.6 unless loudspeakers of very low efficiency are being used, in which case the PZ.6 will be required. For assemblies using two Z.50's there is the PZ.8 supply unit to ensure maximum performance from these amplifiers. No skill or experience are needed to build your system and the Project 60 manual gives all the instructions you can possibly want, clearly and concisely. Perhaps the greatest beauty of the system is that it is not only flexible now but will remain so in the future as new additions are made to the range. A stereo F.M. tuner is next to come. These and all other modules introduced will be compatible with those already available and may be added to your system at any time. And because Sinclair are the largest producers of constructor modules in Europe, Project 60 prices are remarkably low.

<table>
<thead>
<tr>
<th>System</th>
<th>The Units to use</th>
<th>In conjunction with</th>
<th>Year Project 60 Units will cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Car Radio</td>
<td>Z.30</td>
<td>Existing car radio, Sinclair Micromatic 89/6</td>
</tr>
<tr>
<td>B</td>
<td>Simple battery powered record player</td>
<td>Z.30</td>
<td>Crystal pick-up, 12 V or more battery supply and volume control 89/6</td>
</tr>
<tr>
<td>C</td>
<td>Mains powered record player</td>
<td>Z.30 and PZ.6</td>
<td>Crystal or ceramic P.U., Vol. control etc. £9.9.0</td>
</tr>
<tr>
<td>D</td>
<td>20-20 watts RMS stereo amplifier for most needs</td>
<td>Two Z.30s, Stereo 60 and PZ.5</td>
<td>Crystal, ceramic or magnetic P.U., most dynamic speakers, FM tuner, etc. £23.18.0</td>
</tr>
<tr>
<td>E</td>
<td>20-20 watts RMS stereo amplifier for use with low efficiency (high performance) speakers</td>
<td>Two Z.30s, Stereo 60 and PZ.6</td>
<td>High quality ceramic or mag. P.U., F.M. Tuner, Tape Deck, etc., All dynamic spks. £26.18.0</td>
</tr>
<tr>
<td>F</td>
<td>40-40 watts RMS deluxe stereo amplifier</td>
<td>Two Z.50s, Stereo 60 PZ.8 and mains transformer</td>
<td>As for E £32.17.6</td>
</tr>
<tr>
<td>G</td>
<td>Outdoor public address system</td>
<td>Z.50</td>
<td>Microphone, up to 4 P.A. speakers, 12V car battery with converter, or 45V d.c. and controls £6.9.6</td>
</tr>
<tr>
<td>H</td>
<td>Indoor P.A.</td>
<td>One Z.50, PZ.8 and mains transformer</td>
<td>Mic., guitar, heavy duty speakers etc., controls £17.8.6</td>
</tr>
<tr>
<td>J</td>
<td>High pass and low pass filters</td>
<td>AFU</td>
<td>D, E or F as above £6.19.6</td>
</tr>
<tr>
<td>K</td>
<td>Stereo F.M. tuner</td>
<td>To be released shortly</td>
<td></td>
</tr>
</tbody>
</table>

How to assemble and use Project 60 modules to best advantage in the above and other applications will be found in the fully descriptive Project 60 manual included with Project 60 systems. This 48 page manual is available separately, price 2/6d including postage.

SINCLAIR RADIONICS LTD., 22 NEWMARKET ROAD, CAMBRIDGE

Telephone 0223 52731
Z.30 & Z.50 Power amplifiers

The Z.30 together with the Z.50 are both of advanced design using silicon epitaxial planar transistors to achieve unsurpassed standards of performance. Total harmonic distortion is an incredibly low 0.02% at full output and all lower outputs. Whether you use the Z.30 or Z.50 power amplifiers in your Project 60 system will depend on personal preference, but they are the same physical size and may be used with other units in the Project 60 range equally well. For operating from mains, for the Z.30 use PZ.5 for most domestic requirements, or PZ.6 if you have very low efficiency loudspeakers. For Z.50, use the PZ.8 described below.

SPECIFICATIONS (Z.50 units are interchangeable with Z.30s in all applications.)

Power Outputs

Stereo 60 Pre-amp/Control unit

Designed for the Project 60 range but suitable for use with any high quality power amplifier. Silicon epitaxial planar transistors are used throughout, achieving a really high signal-to-noise ratio and excellent tracking between channels. Input selection is by means of push buttons and accurate equalization is provided for all the usual inputs.

- Input sensitivities — Mag. p.u. — 3mV correct to R.I.A.A. curve 1 dB: 20 to 25,000Hz. Ceramic p.u., Radio and Aux, each up to 3mV.

Active Filter unit

For use between Stereo 60 unit and two Z.50s or Z.50s, the Active Filter Unit matches the Stereo 60 in styling and is as easily mounted. It is unique in that the cut-off frequencies are continuously variable, and as attenuation in the rejected band is rapid (12dB/octave), there is less loss of the wanted signal than has previously been possible. Amplitude and phase distortion are negligible. The Sinclair A.F.U. is suitable also for use with any other amplifier system.

Two stages of filtering are incorporated — rumble (high pass) and scratch (low pass). H.F cut-off (—3dB) variable from 28kHz to 5kHz. L.F cut-off (—3dB) variable from 25Hz to 100Hz. Filter slope, both sections 12dB per octave. Distortion at 1kHz (35V supply) 0.02% at rated output.

Power Supply units

Designed specially for use with the Project 60 system of your choice. Illustration shows PZ.5 power supply unit to left and PZ.8 (for use with Z.50s) to the right. Use PZ.5 for normal Z.30 assemblies and PZ.6 where stabilised supply is essential.

PZ.5 30 volts unstabilised £4.19.6
PZ.6 35 volts stabilised £7.19.6
PZ.8 45 volts stabilised (less mains transformers £5.19.6
PZ.8 mains transformer £5.19.6

GUARANTEE If within 3 months of purchasing Project 60 modules directly from us, you are dissatisfied with them, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 3 years of the purchase date. There will be a small charge for postage by surface mail. Air-mail charged at cost.

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

Please send

NAME

ADDRESS

For which I enclose cash/cheque/money order

PW11
Sinclair IC-10

the world’s most advanced high fidelity amplifier

Specifications
Output: 10 Watts peak, 5 Watts R.M.S. continuous
Frequency response: 5 Hz to 100 KH/±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.

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

The IC-10 is primarily intended as a full performance high fidelity power and pre-amplifier, for which application it only requires the addition of such components as tone and volume controls and a battery or mains power supply. However, it is so designed that it may be used simply in many other applications including car radios, electronic organs, servo amplifiers (it is d.c. coupled throughout), etc. Once proven, the circuits can be produced with complete uniformity which enables us to give a full guarantee on every IC-10, knowing that every unit will work as perfectly as the original and do so for a lifetime.

To: SINCLAIR RADIONICS LTD., 22 NEWMARKET RD., CAMBRIDGE
Please send SINCLAIR IC-10 with IC-10 manual Post free.

SINCLAIR IC-10

At the International Audio
and Music Fair, Olympia, Stand 44
Q.16 High fidelity loudspeaker

Developed out of the revolutionary and much praised design of the original Sinclair Q.14 comes this more advanced version to meet the requirements of even greater numbers of high fidelity enthusiasts. The Q.16 employs the same well proven acoustic principles in which a special driver assembly is meticulously matched to the physical characteristics of the uniquely designed housing. In reviewing this exclusive Sinclair design, technical journals have been loud in their praise for it and it comfortably stands comparison with very much more expensive loudspeakers.

The shape of the Q.16 enables it to be positioned and matched to its environment to much better effect than is the case with conventionally styled enclosures, and with its improved styling, the Q.16 presents an entirely new and attractive appearance. A solid teak surround is used with a special all-over cellular black foam front chosen as much for its appearance as for its ability to pass all audio frequencies unimpaired.

The Q.16 is compact and slim and is the ideal shelf-mounted speaker, and brings genuine high fidelity within reach of every music lover.

Specifications
Construction: A sealed seamless sound or pressure chamber is used with internal baffle, all of materials carefully chosen to ensure freedom from spurious tone coloration.
Loading: Up to 14 watts R.M.S.
Input impedance: 8 ohms.
Frequency response: From 60 to 16,000Hz, as confirmed by independently plotted B & K curve.
Driver unit: Specially designed high compliance unit having massive ceramic magnet of 11,000 gauss, aluminium speech coil and special cone suspension. Excellent transient response is achieved.
Size and styling: 9½" square on face x 4½" deep with neat pedestal base. Black all-over cellular foam front with natural solid teak surround.
Price: £8 19 6.

Micromatic Britain’s smallest radio

Considerably smaller than an ordinary box of matches, this is a multi-stage A.M. receiver meticulously designed to provide remarkable standards of selectivity, power and quality. Powerful A.G.C. is incorporated to counteract fading from distant stations, bandspread at higher frequencies makes reception of Radio 1 easy at all times. Vernier type tuning plus the directional properties of the self-contained special ferrite rod aerial makes station separation very much easier than with many larger sets.

The plug-in high fidelity type magnetic earpiece which matches exactly with the output of the Micromatic provides wonderful standards of reproduction both for speech and for music. Everything including the batteries is contained within the attractively designed case. Whether you build your Micromatic or buy it ready built and tested, you will find it as easy to take with you as your wristwatch, and dependable under the severest listening conditions.

Specifications
Size: 1½" x 1½" x 3½" (46 x 33 x 13mm), 1 oz. (28.35gm) approx.
Weight including batteries: Medium wave band with bandspread at higher frequency end.
Tuning: High-fidelity magnetic type.
Earpiece: Two Mallory Mercury Cells, type R.M. 675, for long working life.
Battery requirements: Black plastic with anodised aluminium front panel, spun aluminium dial.
Case: Tuning dial, and on/off switching by means of earpiece plug.
Controls: Available in kit form complete with earpiece, case, instructions and supply of solder in fitted pack. 49/6.
Price: Ready built, tested and guaranteed. 59/6.
Crescent Radio Limited
11 & 40 Mayes Rd., N.22 888-3206

Transformer Scoop
Primary 110, 220, 250 v. fused. Secondary 220 v. at 50HzA, 6v. at 1 amp. Overall size 9½ x 2½ x 2½ high. 12½ each. P. & P. ½.

Model Makers Motor
Rated up to 1,5 volt 400mA, torque 13e. ½, Size 12½ x 3½ x 1 high. Shaft - 4/32 long x ½ diam. (25-60A, 60-100. 2½ x 3½ x 1½ deep. 60. 2½ x 3½ x 1½ deep. 60. P. & P. 5/6 each.

Component Centre
6½ x 07 one sided printed circuit board
BY166 type rectifier 800 pF 70mA
4 pin transistor holder
2/8 ohm loudspeaker
2/8 ohm loudspeaker
2/8 ohm loudspeaker
U7 battery holders (blue Plastic)
10 ohm w/w pots
001 double base clips
Tape recorder rev. counters
Transistors, Diodes, B.C.R.s etc.

Send for free lists of Semi Conductors

Dwell Time Unit
These small units contain the following components 790 ohm D.841 relay with base, l/p 250v, paper, 0-413 400v, paper, 50µF 25v, electrolytic, 3 diodes, 025052 transistor, a 2N2956 type transistor unit, a diode clipper circuit, a transistor, a dpdt pot. 4 pin dip plug & 4½, 4 foot of 5 more. All housed in a small neat metal box. Can be made into many timing devices.

12½, Plus 1½ P. & P.

Crescent Chromosonic Sound Operated Light Display
The unit is connected directly across the speaker output of an amplifier, it will then convert audio signals into a spectacular three colour psychedelic light display.

Send S.A.E. for further details.

Chrome TV Stand
38 x 2½ x 100 in. high. This modern design TV stand would make an ideal base for a coffee table and is a bargain at
32½, Plus 1½ P. & P.

Dimmaswitch
This is an attractive dimmer unit which fits in place of the normal modern light switch. The ivory mounting plate matches modern fittings and the control knob is bright chrome. An ON/OFF switch is incorporated to control 60-600 watts of all lights except fluorescents at mains voltages from 200-250V, 50 Hz.

Competitive prices. Call at £4.19 ld, our price is £4 3½. We also offer at £3 1¼ a complete kit of parts with instructions enabling you to build this dimmer yourself.
The circuit uses a miniature RCA triac and a diac triggering device to give complete reliability. No Radio interference suppression is included.

Post and Packing 1½d. extra.
Please send cash with order to:
Dexter & Company
Oliver House, 11 King Street.
Chester CH1 2AH.
Tel: Chester 25881

As supplied to H.M. Govt, Department of Health, Local Authorities, etc.

New Books

Making & Repairing Transistor Radios
by W. G. Oliver (G.3XT)
(Pub. by Foulsham Technical)
(Oct.) 21/6

Security Electronics
by John E. Cunningham
(Oct.) 34/6

101 Questions and Answers About Transistor Circuits
by Leo. G. Sands
(Oct.) 26/6

Hi-Fi Stereo Servicing Guide
by Robert G. Middleton
(Nov.) 35/6

101 Easy Ham Radio Projects
by Robert M. Brown and Tom Knettel
(Nov.) 30/6

Foulsham-Sams Technical Books
(W. Foulsham & Co. Ltd.)
Yeovil Rd., Slough, Bucks, England
CRYSTAL RADIO KIT  
Model R.125

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

PRICE £1.10.0.

2 OCTAVE ELECTRONIC ORGAN KIT  
Model R.129

Complete with a music book containing 15 easy-to-play songs the R.129 solid state organ kit covers 2 full octaves.  
Roc Kit includes a fitted hardwood case the top panel carries the key assemblies and all the components including the loudspeaker.  
Like all Roc Electronic Kits every item is included down to the last nut and bolt so that the constructor can start assembly within minutes of opening the package.

PRICE £4.10.0.

2 TRANSISTOR SOLAR RADIO KIT  
Model R.126

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

PRICE £2.10.0.

10 PROJECT INTEGRATED CIRCUIT KIT  
Model R.127

Using a robust solid state integrated circuit the R.127 kits forms the basis for any one of these projects:  
(1) Germanium Radio,  
(2) Test Oscillator,  
(3) Morse Telegraph Training Set.  
(4) L.C.I. Transistor Radio,  
(5) Germanium 1 Transistor Radio,  
(6) Record Player Amp,  
(7) Continuity Tester,  
(8) A.F. Signal Trainer,  
(9) Radio Transmitter,  
(10) Water Purity Tester.

PRICE £3.10.0.

5 WATT STEREO INTEGRATED AMPLIFIER  
CHASSIS  
Model R.123

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

SPECIFICATION:  
Output: 5W total. 2.5W per channel.  
Input sensitivity: 600mV at 250Ohms.

PRICE £4.19.0.

5 WATT 8 TRACK CARTRIDGE STEREO AMPLIFIER  
Model R.133

Just slot in one of the many 8 track cartridge tapes available for a continuous programme of your favourite music.  
A manual programme override switch enables you to switch from one track to the next at the push of a button at the same time a numbered indicator lights up to show which track is playing.  
Beautifully finished in an old walnut cabinet the R.133 is mechanically engineered to provide long and reliable service.

SPECIFICATION—Tape speed: 9-10 cm/sec (31 1/2ips).  
Wow & Flutter: better than 0.3% at 45-12,000Hz.  
Cross talk: better than 60dB at 1,000Hz.  
Output: 5W total. 2.5W per channel.  
Amplifier output: 200mV.

PRICE £36.0.0.

STEREO HEADPHONES  
Model R.328

Built up to a standard not down to a price, the R.328 stereo headphones represent a breakthrough in value for money.  
A valuable addition to any stereo installation they will provide many hours of listening pleasure.

SPECIFICATION:  
Matching impedance: 9-15 ohms.  
Frequency range: 20-15,000Hz.

PRICE £2.8.0.

20 PROJECT SOLAR ELECTRONIC KIT  
Model R.128

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

PRICE £4.10.0.

50 PROJECT ELECTRONIC KIT  
Model R.130

King of the Roc Electronic Kits is the Giant R.130 which makes up no less than 50 separate projects including Radio Receivers, Transmitters, Telegraph, R.A.M., Alarm, Testers, Electronic Switches, Amplifiers and even某 Electronic Target Game.  
As well as earphone, speaker, meter, oscillator, solar cell, buzzer, etc., etc., the R.130 is supplied complete with a fitted hardwood case and clear detailed instructions for all 50 projects.

PRICE £7.19.0.

AM/FM/MPX STEREO TUNER  
Model R.132

Matching the R.131 amplifier in both styling and performance the R.132 tuner covers AM and FM including stereo multiplex channels.  
A separate meter indicates signal strength and tuning on both AM and FM Bands.  
A useful FM sensitivity of 5µV means that the R.132 can be used anywhere, even in different stereo reception areas.

SPECIFICATION:  
FM: frequency range: 87-108MHz.  
Usable sensitivity: 5µV for 50dB quieting.  
Stereo separation: 50dB at 1kHz.  
Image rejection: 60dB.  
AM: frequency range: 500-1600Hz.  
Usable sensitivity: 250µV.

PRICE £36.0.0.

40 WATTS STEREO AMPLIFIER  
Model R.131

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

SPECIFICATION—Output: 40W total 20W per channel.  
Frequency Range: 20-20,000Hz.  
Inputs: Phone: Mag. 5-50mV R.I.A.A.; Xtal, 1kHz; Tape, 250mV; tuner, 500mV.  
Controls: Bass, treble, volume left, volume right, selector/mute/remote speakers, power on/off, loudness and stereo/mono.

PRICE £25.0.0.

RETURN OF POST MAIL ORDER SERVICE

Orders under £10 please add 5/- post and packing. Orders over £10 sent post free.

ROC ELECTRONICS LIMITED
193 EDGWARE ROAD LONDON W2 1ET
TELEPHONE 01-723 9211
Audio Tronics 70

Send your name and address now to receive the immediately the New 1971 Edition of LASKY'S famous Audio-Tronics pictorial catalogue larger and more comprehensive than ever before. Packed with 1000's of items for the Radio and Hi-Fi enthusiast. Send 6d (50p) to: Lasky's, 1120 High St. 5141, Sinacola. Cover every aspect of Hi-Fi (including Lasky's budget Stereo Systems, and Package Deals) plus Lasky's annual money saving voucher worth over £32.

Send your name and address and 2/6 for and Inclusion on our regular mailing list.

THORNY GROVE PLUG-IN
A compact plug-in unit on an 8-pin base with D.P.D.T. contacts rated to 10A. (Some type are 3 P.D.T. on an 11-pin base):

<table>
<thead>
<tr>
<th>RN TYPE</th>
<th>Contacts</th>
<th>Base</th>
<th>Coil Voltage</th>
</tr>
</thead>
<tbody>
<tr>
<td>C20144</td>
<td>P.D.T.</td>
<td>8 pin</td>
<td>48V AC/DC</td>
</tr>
<tr>
<td>C20504</td>
<td>P.D.T.</td>
<td>8 pin</td>
<td>40V DC</td>
</tr>
<tr>
<td>210560</td>
<td>P.D.T.</td>
<td>8 pin</td>
<td>60V AC/DC</td>
</tr>
<tr>
<td>305101</td>
<td>P.D.T.</td>
<td>11 pin</td>
<td>60V DC</td>
</tr>
<tr>
<td>200904</td>
<td>P.D.T.</td>
<td>8 pin</td>
<td>24V DC</td>
</tr>
<tr>
<td>210942</td>
<td>P.D.T.</td>
<td>8 pin</td>
<td>42V DC</td>
</tr>
</tbody>
</table>

Other sizes available on application.

LASKY'S PRICE 12/6 post 3/6

JUST ARRIVED

Lasky's C60, C90, C120.

Exclusively made for us in U.S.A. Great Savings!

- Each Post Five for Ten for
- C60 -— 7/6 1/- 33/- 2/- 62/- 3/-
- C90 — 12/6 1/- 3/6 2/- 139/6 3/-
- C120 — 17/- 1/- 35/- 2/- 139/- 3/-

U.S.A. Casette head cleaner, 10/- Post 1/6

- Post 1/- each, free for 5/-, ten for 3/6.

SKYROVER MkII

COMMUNICATION RECEIVER

A shrewd, wave receiver, exclusive to Lasky's, at a real economy price. Four valve line up using one each 805E, 6AB6, 6AV6 and 8AR5 valves, gives high sensitivity and powerful gain. Switch selects the SW frequency range, and full AM modulation and full AM wave, hand cover in one range 500-6,000 kHz. 1.500 kHz, Reduction drive tuning with hair line cursor. Controls include volume control, BFO, Band selector, Power on indicator lamp, External antenna connections and mains fuse at rear. Internal speaker plus standard 3mmin. socket for phones on front. For 200V AC mains operation. Strong metal cabinet finished in grey cradle, with moulded silver front panel. Size 9 x 5 x 4.5 in. Complete with mains lead and full instructions.

LASKY'S PRICE 13/13.0

TMK METER KITS

This meter kit by TMK offers the unique opportunity of building a really first-class precision multimeter at a worthwhile saving in cost. The cabinet, movement and range selector mounted in position is supplied with the meter scale. The highest quality components and 1% tolerance resistors are used throughout. Supplied complete with full constructional, circuit and operating instructions.

MODEL 200

24 measurement ranges with minor scale. Large 3 x 2 in metal, full scale accuracy; DCV and current: ±3%, ACV: ±3%, resistance: ±3%. Special 0.6V DC range for transistor circuit measurement.

SPECIFICATION

- DCV: 0-0.6-0.6-3-12-20-30-200-1000-1200V at 20kΩ (0); ACV: 0-0.6-0.6-3-12-20-30-200-1000-25000V at 1000V (0); DC Current: 0-2.5-5-10-20-50-500mA, 0-5-10-20-50mA (0); AC Current: 0-2.5-5-10-20-50mA, 0-5-10-20mA (0); Milliamperes: 0-5mA; 0-25µA; 0-5A; 0-50mA at 125mV. DC Amps: 0-5A at 125mA, 0-10A at 250mA.

- Resistance: 0-10MΩ; Output: Capacitor: 0.1µF, 400V in series with ACV ranges.

- Decibels: —20 to —81.5dB. Operates on two 1.5V batters. Black bakelite cabinet, size 5 x 6 x 2 in.

KIT PRICE £10.10.0

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 indicated on the meter face. High speed rotary range selector, polarity reversal switch, shielded meter movement with overload protection circuit, Special µA and mA measurement ranges.

SPECIFICATION

- DCV: 0-0.6-2-5-10-25-50-250-500-1000V at 20kΩ (0); ACV: 0-10-50-250-500-1250V at 1000V (0); AC Current: 0-10-50-250mA, 0-5-10-20mA, 0-50mA at 125mA. DC Current: 0-50mA at 250mA, 0-5mA at 125mA. DC Amps: 0-5A at 125mA, 0-10A at 250mA. Resistance: 0-10MΩ; Output: Capacitor: 0.1µF, 400V in series with ACV ranges.

- Decibels: —20 to —81.5dB. Operates on two 1.5V batters. Black bakelite cabinet, size 5 x 6 x 2 in.

KIT PRICE £10.10.0

SL55

OTHER GARRARD UNITS FROM STOCK

AUTOCHANGERS

SL21B £25 0

SL202TC with stereo cartridge £21 6

3000 complete with STAHC stereo cartridge £35 6

SLSB £10 0

SL33B £35 0

SL7B £28 0

SILVER PLAYERS

AP 75 £31.6. APT5 with ADNM mag. cart., £31.6. 401 Transmission

Unit £29.0.0

BASED AND COVERS FOR GARRARD UNITS

Type WB1 and WB5 for models A760 Mk II, 202TC, 2000, SL50B, SL65B, 1000, SP55 Mk II. Price for WB1 £33 6 6, WB5 £13 6 6. The WB4 for models SL7B, SL7B, SL75B Price £13 17.6, Pépiniére covers for WB1 £33 14.1. £5p for WB4 and WB5 allows unit to be played with the cover in place—Price £5 0 0.

SPECIAL OFFER

One of the famous Garrard Synchro- Lab Series. Takes 8 LPs. Four speed auto-changer, incorporating a tube pickup arm and adjustable stylusforce. Wired for Mono and Stereo, NOW at LASKY'S SPECIAL PRICE. Complete with SONOTONE 7TA STEREO CART. £10.19.6

SL55
Scoop Mt-65 Special Offer

Exclusive Hi-Fi Stereo Tuner Amp. Offer

The Mt-65 Chassis


Overall size 20x3x16in. List price £75.

SPECIAL PRICE £66.00

CARRIAGE

De-Luxe "Compact" Package Offer

HIFI Classic

Garrard AP-73 Single Turntable

Audio-Technica AD-84Nk Magnet Head Cartridge

2 Kweekdale Denton Speaker Systems

Telex Kit Cabinet (as shown)

TOTAL RECOMMENDED LIST PRICE £148.5

Project 60 is a range of modules which connect together to form a complete stereo amplifier. The modules are: 1. Input 0.1-11 Base input pre-amp. 2. Stereo 60 control unit. 3. The PZ-5 unbalanced and PZ-4 balanced power supplies. A complete system comprises two PZ-4, one Stereo-60 and a PZ-5 or PZ-4.

Stereo 60 Specification

Input sensitivity: Radio up to 3mV. Magnetic Pick-up up to 3mV. Correct to R.I.A.A. curve -169. 0 to 25.0kHz. Ceramic Pick-up up to 3mV. Auxiliary up to 3mV. Output: 1 volt. Signal to noise: better than 70dB. Frequency: 20Hz to 20kHz. Volume: 0 to 15dOU. Frequency: 20Hz to 20kHz. Volume: 0 to 15dOU.

Z-30 Specification

Input sensitivity: Radio up to 3mV. Magnetic Pick-up up to 3mV. Correct to R.I.A.A. curve -169. 0 to 25.0kHz. Ceramic Pick-up up to 3mV. Auxiliary up to 3mV. Output: 1 volt. Signal to noise: better than 70dB. Frequency: 20Hz to 20kHz. Volume: 0 to 15dOU. Frequency: 20Hz to 20kHz. Volume: 0 to 15dOU.

PZ-5

Output sensitivity: 80mV. Balanced output: 80mV. Frequency: 20Hz to 20kHz. Volume: 0 to 15dOU. Frequency: 20Hz to 20kHz. Volume: 0 to 15dOU.

PZ-6


International

Magnetic Recording Tape from the U.S.A.

At Lasky's Record Low Prices

Sn. Message tape. 1000ft. 2.8 5m/m. Long play. 1200ft. Mylar 15.0

Sn. Message tape. 2250ft. 2.9 5m/m. Triple play. 2400ft. Mylar 15.0

Sn. Message tape. 3000ft. 2.9 5m/m. Double play. 3000ft. Mylar 15.0

Sn. Long play. 1000ft. 10.0 5m/m. Standard play. 1200ft. Mylar 12.0

Sn. Loud play. 1000ft. 10.0 5m/m. Loud play. 1200ft. Mylar 12.0

Sn. Double play. 1000ft. 10.0 5m/m. Double play. 1200ft. Mylar 12.0

Sn. Long play. 2000ft. 10.0 5m/m. Long play. 2400ft. Mylar 16.0

Sn. Double play. 2000ft. 10.0 5m/m. Double play. 2400ft. Mylar 16.0

Sn. Long play. 3000ft. 10.0 5m/m. Long play. 3600ft. Mylar 16.0

Sn. Double play. 3000ft. 10.0 5m/m. Double play. 3600ft. Mylar 16.0

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

Lasky's Radio Limited

207 Edgeware Road, London, W.2.

Tel: 01-772 3271

33 Tottenham Court Road, London, W.1

Tel: 01-333 2685

244 Tottenham Court Road, London, W.1

Tel: 01-353 5912

315 Street, London, E.C.2

Tel: 01-353 2833

All mail orders and correspondence to: 3-15 Cavell Street, Tower Hamlets, London, E1 2BN

Tel: 01-479 723

High Fidelity Audio Centres

44 Tottenham Court Road, London, W.1

Tel: 01-772 3271

42-45 Tottenham Court Road, London, W.1

Tel: 01-353 5912

186 Endwell Street, London, E.C.4

Tel: 01-353 2833

105a Endwell Street, London, E.C.4

Tel: 01-353 5912

118 Edgeware Road, London, W.2

Tel: 01-772 3271

42-45 Tottenham Court Road, London, W.1

Tel: 01-353 5912

105a Endwell Street, London, E.C.4

Tel: 01-353 2833

All mail orders and correspondence to: 3-15 Cavell Street, Tower Hamlets, London, E1 2BN

Tel: 01-772 3271

High Fidelity Audio Centres

44 Tottenham Court Road, London, W.1

Tel: 01-353 5912

186 Endwell Street, London, E.C.4

Tel: 01-353 2833

All mail orders and correspondence to: 3-15 Cavell Street, Tower Hamlets, London, E1 2BN

Tel: 01-772 3271
The Duetto is a good quality stereo amplifier, attractively styled and finished. It gives superb reproduction previously associated with amplifiers costing far more.

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

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

The Viscount F.E.T. MkI £14.5 plus 7/6 p. & p. High fidelity transistor stereo amplifier employing field effect transistors. With this feature and accompanying guaranteed specifications below, the Viscount F.E.T. vastly surpasses amplifiers costing far more.

The £29-10-0 Stereo system

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

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

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

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

This superb stereo system is a real price break through. It comprises the VISCONT F.E.T. MkI amplifier on which full details are given below, the famous Garrard SP 25 (including teak veneer base and transparent cover with diamond cartridge or 2025 TC and the very successful DUO type 2 speakers. Measuring 17½in x 10½in x 6½in, the DUO type 2 speakers are beautifully finished in teak veneer with matching synair grills. They incorporate a 10½in x 6½in drive unit and high frequency speaker, both of which are of 3 ohms impedance. The DUO speaker system is also available separately at £6.6.0 each plus 15/- p.&p.

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

Duetto integrated transistor stereo Amp. Garrard Changer from Cover and teak finish plinth £6.15.0 + 7/6 p&p. £6.15.0 + 7/6 p&p. £4.15.0 + 7/6 p&p. £4.15.0 + 7/6 p&p. £25.10.0 + 7/10 p&p.

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

Output Power: 45 watts R.M.S. (Sine wave drive). Frequency response: 3dB points 30Hz at 18KHz. Total distortion: less than 2% at rated output. Signal to noise ratio: better than 60dB.

Speaker Impedance: 3, 8 or 15 ohms. Bass Control Range: ± 13dB at 60Hz. Treble Control Range: ± 12dB at 10 KHz. Inputs: 4 inputs at 5mV to 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV to 470K.

To protect the output valves, the incorporated fail safe circuit will enable the amplifier to be used at half power.

**SPEAKERS!** Size 20” x 20” & 10” incorporating Baker’s 12” heavy duty 25 watt high flux, quality loudspeaker with cast frame. Cabinets attractively finished in two tone colour scheme—Black and grey.

**COMPLETE SYSTEM** £45 plus 60/- P. & P.

or available separately.

Amplifier £28.10.0 plus 20/- P. & P.

Speakers £12.10.0 each plus 30/- P. & P.

---

**LIQUIDATED STOCK**

**DANSETTE**

**TOURISTE MK3 CAR RADIO**

**ALL TRANSISTOR**

Beautifully designed to blend with the interiors of all cars. Permeability tuning and long wave loading coils ensure excellent tracking, sensitivity and selectivity on both wave bands. R.F. sensitivity at 1 MHz is better than 8 micro volts. Power output into 3 ohm speaker is 3 watts.

Originally sold complete for £15.4.6.

Pre-alignment of F.P. module and tuner in factory with comprehensive instructions guarantees success first time. 12 volts negative or positive earth.

Size 7in x 21in x 43in deep.

See top of previous page for address.
Build working radio receivers and electronic circuits in an evening

*NO SOLDERING*

Beginner or advanced student— you learn fast with Radionic kits

Circuits work first time with the Radionic ‘no soldering’ method. With the X30 kit, build 33 experiments: a printed circuit transistor radio, burglar alarm, morse code buzzer etc.

The more advanced kits are suitable for G.C.E., City and Guilds, National Certificate and Higher. Every set includes construction notes and all circuit diagrams.

It’s so easy for you to build and learn because you construct circuits that resemble the theoretical diagram. Re-use components easily, too—they’re screw-in-mounted.

Send off this coupon today.

TO: RADIONIC PRODUCTS LTD., St. Lawrence House, Broad Street, Bristol BS1 2HF

Please send me full details of all Radionic Kits, please send me one Radionic Kit X30, for which I enclose £7 19s. 6d.

(delete where inapplicable)

Name
Address

RADIONIC RADIOTELEVISION CONSTRUCTIONAL KITS

510
The FERROGRAPH SENSATION!

JUST LOOK AT THESE FABULOUS LOW PRICES!
SERIES 7 RECORDERS

<table>
<thead>
<tr>
<th>MODEL NO.</th>
<th>LIST PRICE</th>
<th>CASH PRICE</th>
</tr>
</thead>
<tbody>
<tr>
<td>724/722</td>
<td>£242 10 0</td>
<td>£199 10 0</td>
</tr>
<tr>
<td>702/704</td>
<td>£207 7 0</td>
<td>£169 10 0</td>
</tr>
<tr>
<td>713</td>
<td>£188 10 0</td>
<td>£156 0 0</td>
</tr>
</tbody>
</table>

AVAILABLE ON NO DEPOSIT CREDIT TERMS.
CARRIAGE 30/- EXTRA.
PORTABLE OR WOOD CABINET.

FERROGRAPH STEREO AMP F307

The famous 20 watt per channel amplifier from Britain's most respected manufacturer. A fabulous range of facilities rarely ever available in equipment at this price. Finished in wood veneered cabinet. Brand new with instructions and guarantee.

SEND FREE!
THE KJ CATALOGUE
PACKED FULL OF ALL THINGS AUDIO. BIG MONEY SAVING OFFERS FOR EVERYONE FROM A REEL OF TAPE TO A FERROGRAPH. OVER 200 ILLUSTRATED PAGES.

EXCLUSIVE TO

The NATIONAL RS766 US 4 TRACK STEREO TAPE-DECK. This superb unit contains pre-amplifiers suitable for feeding a Hi-Fi system or external amplifier. \* Three tape speeds 14, 31/2, 16 I.P.S. \* Takes up to 7" reels \* Freq. Response 30-18,000 cps at 75 I.P.S. \* Wow and flutter less than 0.1% at 75 I.P.S. \* 2 x Record level VU meters \* Monitoring through headphones \* DIN connection for record/playback \* Magnificent wood cabinet - Size 13½" (w) x 11" (h) x 5½" (d) \* Brand new with full instructions and guarantee.

FANTASTIC SPECIAL OFFER
SAVE £25
LIST PRICE £59/13/7

PHILIPS STEREO TUNER BARGAINS!

GH 944 AM/FM STEREO TUNER
SAVE £23. LIST PRICE £72.18.4.

CASH PRICE £49.18.0.

GH 927 FM STEREO TUNER
SAVE £15. LIST PRICE £44.19.6.
Receives VHF Stereo broadcasts, can be used in conjunction with your amplifier or tape recorder. A.F.C. on FM. Tuning meter, and low line teak cabinet. Brand new and guaranteed.

CASH PRICE £29.19.6.

AVAILABLE ON NO DEPOSIT INSTALMENT CREDIT.

KJ ENTERPRISES (DEPT PW) 33 BRIDLE PATH WATFORD HERTS
Tel 25634  Showrooms 101 ST ALBANS ROAD WATFORD (close to Watford Junction Station)

511
RSC HIGH FIDELITY STEREO PACKAGE OFFERS

Four fully wired units ready to plug in:
1. Super 30 Amplifier (15 + 15 watt) in veneered housing
2. Garrard SP 25 mk II Turntable on Plinth with cover
3. Goldring CS90 Ceramic P.U. Cartridge with diamond stylus
4. Pair of Stanway II Speakers, Special Total Price

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

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

ATTRACTIVE TEAK OR AFRORMOSIA VENEERED CABINETS AND PLINTHS

TERMS AVAILABLE ON ALL PACKAGE OFFERS

TA12 Amplifier 6.5 + 6.5 watt in veneered housing
Garrard SP25 mk II Player unit on Plinth
Goldring CS90 Ceramic P.U. Cartridge with diamond stylus
Pair of Dorchester Loudspeaker Units
Special Total Price
Or Deposit £19.6 and 9 monthly payments £6.40 (= Total £75.60) Transparent Plastic Cover 3 gns. extra.

AS ABOVE BUT WITH GARRARD 2000 AUTOCHASSER AND SONOTONE 95A Ceramic Cartridge in lieu of SP25 and CS90

LOW DEPOSIT CREDIT TERMS

Available on purchases over 8 KITS of parts excepted

INTEREST CHARGES REFUNDED

On Credit Sales settled in 3 months

RSC G66 6+6 WATT HIGH QUALITY STEREO AMPLIFIER


Useful for the home enthusiast with flexible choice of cabinet and matching control knobs.

Complete Kit or Parts including Fully Wired Printed Circuit and comprehensive wiring diagram and instructions £9.19.9

Or FACTORY BUILT in Teak veneered cabinet No leaflet supplied for this unit as illustrated £12.10.0 (Customer 7/0 or dep. £7.9 and 9 yearly. pmt. 29/6 (Total £53.80).

PACKAGE OFFER SAVE £4 approx Above G66 assembled in cabinet.

plus pair DORCHESTER LOUDSPEAKER UNITS £27.10.0 Carr £3 Or deposit 5% and 9 monthly payments £8.7 (Total £50.17.0)

R.S.C. TFMI SOLID STATE VHF/FM TUNER

High sensitivity. 30-200V, A.C. mains operation. Shiny A.B.S. Resinjection. 
Dip-drill free-screw. Output amplifiers for each channel. Tuner panel: 450 x 450 mm. Includes Bass, Treble, Volume and Balance.

TEDS MULTIPLIERS with full wiring diagram and instructions £3.13.6

R.S.C. TA12 MKIII 6+5 6 WATT STEREO AMPLIFIER

FULLY TRANSISTORIZED SOLID STATE CONSTRUCTION HIGH FIDELITY OUTPUT OF 6+5 WATTS PER CHANNEL

Designed for optimum performance with any crystal or ceramic Gramm. P.R. cartridge. Radio tuner, Tape recorder, 'M.D.E' or 2 separate switched input sockets on each channel. Separate Bass, Treble volume and Tone controls. Slide Switch for tuning mode. Speaker Output: 300 ohms. Input: 300V. Frequency Response 3.0 to 20,000 c.p.s. - 25dB Harmonic Distortion 0.1% at 200mw. Sensitivity (1) 100mV (2) 400mV (3) 1000mV. Output rating 1.H.F.M.

FACIA PLATE Attractive design in rigid plastic, silver background black lettering. Silver finish matching control knobs as available.

Eminently suitable for use with any make of pick-up or Mic. (Ceramic or Magnetic, Moving Coil, Ribbon or Crystal) currently available. Superb sound output quality can be obtained by use with first rate ancillary equipment.

COMPLETE KIT OF PARTS Point to point wiring diagram and detailed instructions.

22 Gns. Carr.15/-

UNIT FACTORY BUILT 29 Gns.

With 12 months guarantee.

Or Deposit £6, and 9 monthly payments £5.60 (Total £60.18.0) In Teak or Afromosia veneer having Carr. £7 11s. 6d. and 9 monthly payments £4.7 (Total £58.8.0).

BRADFORD BLACKPOOL BIRMINGHAM DERBY EDINBURGH GLASGOW HULL
31 North Parade (Half-day Wed.) Tel. 25349 10 North Parade (Half-day Thurs.) Tel. 57-5 County (Mecca) Arcade, Bridgewater St. Tel. 20525 30/1 1st Western Arcade (Half-day Wed.) 021-236-1279 36 Osmond Rd., The Spot (Half-day Tues.) Tel. 41361 21 Leis St. (Half-day Thurs.) Tel. 21467

Street 313 Leith St. (Half-day Wed.) Tel. Waverley 5 325 Argyle St. (Half-day Tues.) Tel. City 4158 91 Paragon Street (Half-day Thursday) Tel. 20505

32 High Street (Half-day Thurs.) Tel. 56429 35733 228 Edgware Road, W2 (Half-day Thurs.) Tel. 21467 60A Oldham Street (Half-day Wed.) Tel. 21467

R.C. AMPLIFIERS

HI-FI CENTRES LTD.

MAIL ORDERS TO: Audio House, Hinchsonn Lans, Leeds 13

No C.O.D. under £25. Terms C.O.D. or C.D. Postage 4/- per item. £5 extra on £5 orders. £5 extra on £5 orders. £5 extra on £5 orders. £5 extra on £5 orders. £5 extra on £5 orders.

TAKE ADVANTAGE OF OUR SERVICE SALES ON SAVING OFFERS

CEASES 49 Yerby Road (Half-day Wed.) Tel. 21467

Branches open all day Sat. MAIL ORDERS MUST NOT BE SENT TO SHOPS

LEICESTER LIVERPOOL LONDON MANCHESTER MIDDLESBROUGH NEWCASTLE UPON TYNE SHEFFIELD

41 Blackburn Street (Opp Fenwicks) (Half-day Wed.) Tel. 21467 13 Exchange Street (Castle Market Bldgs.) (Half-day Thursday) Tel. 21466

313 Leith St. (Half-day Thurs.) Tel. Waverley 5

5-7 County (Mecca) Arcade, Bridgewater St. Tel. 20525

73 Dale St. (Half-day Tues.) Tel. CE/2373

228 Edgware Road, W2 (Half-day Thurs.) Tel. 35733

60A Oldham Street (Half-day Wed.) Tel. 35733

106 Newport Rd. (Half-day Wed.) Tel. CE/2373

41 Blackburn Street (Opp Fenwicks) (Half-day Wed.) Tel. 21467

13 Exchange Street (Castle Market Bldgs.) (Half-day Thursday) Tel. 21466
**AUDIONETE Hi-FI SPEAKER SYSTEMS**

- Consisting of matched 12", 11,000 ohm 25watt, high quality multilayer cone and integral. Smooth response and extended frequency range
- Impedance 800 mohms. 
- £5.10.0. 0

**HI-FI SPEAKER ENCLOSURES**

- No or Achromatic coaxial units. Modern design. Acoustically tuned.
- All sizes approx. Carr. 6/- per enclosure.

**RECORD PLAYING UNITS**

- **RPZC**
  - Garrard 3012 Mk II turntable.
  - £57.15.0
- **RPSC**
  - Garrard 3020 Auto Dual.
  - £63.15.0

**LINER L10 HIGH FIDELITY 10W AMPLIFIER**


**R.S.C. COLUMN SPEAKERS**

- **TYPE CS4100**
  - £109.50.0
  - £79.00.0
  - £59.50.0

**HIGH QUALITY LOUDSPEAKERS IN TEAK OR AFRICOMIA VENEERED CABINETS**

- **153** 2x15" 120 watt.
- **183** 2x15" 180 watt.
- **213** 2x15" 210 watt.

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

- Top quality all-metal chassis, fitted pair of 50 watt Bass and Treble controls. Current value, Peak output rating. "Brass" Obcared cabinets, built-in attractive black finished. For 200-250, A.C. mains. For 3 or 180w speakers, send S.A.E. for details. Deposit 25/- and 9 monthly payments £5.10.0. (Total £85.14.6)携. Carr. £1

**FREE PHASE 50 AMPOLER 50 Watt**

- Solid State 3 Separately controlled Input Bass and Treble Controls. Supply 50 watts. £50.00.0. 10Gns.

**R.S.C. AIO 30 WATT ULTRA LINEAR Hi-FI AMP**

- High quality, high output with Pre-amp Tone Control Stages. Phase level—0dB. Frequency response 25Hz-20kHz. Input 400-600K. Out 150 watts. £110.15.0

**R.S.C. TRANSFORMERS and L.F. CHOLES**

- Full list of transformers and L.F. Chokes.

**R.S.C. ALL Hi-Fi 12-14 WATT AMPLIFIER**

- £13.9.9

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

- Top quality all-metal chassis, fitted pair of 50 watt Bass and Treble controls. Current value, Peak output rating. "Brass" Obcared cabinets, built-in attractive black finished. For 200-250, A.C. mains. For 3 or 180w speakers, send S.A.E. for details. Deposit 25/- and 9 monthly payments £5.10.0. (Total £85.14.6)携. Carr. £1

**FREE PHASE 50 AMPOLER 50 Watt**

- Solid State 3 Separately controlled Input Bass and Treble Controls. Supply 50 watts. £50.00.0. 10Gns.

**R.S.C. AIO 30 WATT ULTRA LINEAR Hi-FI AMP**

- High quality, high output with Pre-amp Tone Control Stages. Phase level—0dB. Frequency response 25Hz-20kHz. Input 400-600K. Out 150 watts. £110.15.0

**R.S.C. TRANSFORMERS and L.F. CHOLES**

- Full list of transformers and L.F. Chokes.

**R.S.C. ALL Hi-Fi 12-14 WATT AMPLIFIER**

- £13.9.9

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

- Top quality all-metal chassis, fitted pair of 50 watt Bass and Treble controls. Current value, Peak output rating. "Brass" Obcared cabinets, built-in attractive black finished. For 200-250, A.C. mains. For 3 or 180w speakers, send S.A.E. for details. Deposit 25/- and 9 monthly payments £5.10.0. (Total £85.14.6)携. Carr. £1

**FREE PHASE 50 AMPOLER 50 Watt**

- Solid State 3 Separately controlled Input Bass and Treble Controls. Supply 50 watts. £50.00.0. 10Gns.

**R.S.C. AIO 30 WATT ULTRA LINEAR Hi-FI AMP**

- High quality, high output with Pre-amp Tone Control Stages. Phase level—0dB. Frequency response 25Hz-20kHz. Input 400-600K. Out 150 watts. £110.15.0

**R.S.C. TRANSFORMERS and L.F. CHOLES**

- Full list of transformers and L.F. Chokes.

**R.S.C. ALL Hi-Fi 12-14 WATT AMPLIFIER**

- £13.9.9
a new 4-way method of mastering ELECTRONICS
by doing — and — seeing . . .

1own and handle a complete range of present-day ELECTRONIC PARTS and COMPONENTS

2build and use a modern and professional CATHODE RAY OSCILLOSCOPE

3read and draw and understand CIRCUIT DIAGRAMS

4carry 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
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.W. 11
TOPIC OF THE MONTH

Keep it Clean, Lads

SOMEWHAT belatedly, everyone is becoming concerned about pollution, and 'Conservation' is the new 'in' word. The atmosphere is being poisoned by industry and the internal combustion engine, the seas and rivers are being polluted by industrial waste, foodstuffs and livestock are being contaminated by insecticides and other toxins, the countryside is being despoiled by pylons, roadworks and lanes and woods being used as dumping tips for junk. The list is long and depressing, not only for homo sapiens but for the rest of the animal world too.

Although this is not the place to set up a platform for action against such obvious causes of pollution, it is worth remembering that we (meaning radio enthusiasts, broadcasters and users of electronic equipment) are by no means absolved from blame in adding certain contributions to the overall mess.

Relative to transmitting, how about all those international shortwave stations who have (with a few notable exceptions) evolved from goodwill broadcasters to blatant provocative propagation machines? How about those who retaliate by swamping the bands with jammers? How about pirate broadcasters and pirate amateur stations? These are only a few activities which can be classified as pollution of the airways.

Even the humble home constructor may (usually unconsciously) add his contribution. We like to think that readers of P.W. are not numbered among those who invade the peace of other individuals by playing radios or cassette tape recorders at full and gloriously distorted volume in public places, but a few may be unsuspectingly annoying neighbours by the incredible noises which emanate from the shed where a new piece of gear is being tested. Those without sheds to work in should sometimes pause to think if they are not causing domestic pollution by using the loudspeaker to listen to DX in the small hours, spilling solder on the Axminster, burning or drilling holes in the kitchen table, scattering the floor with dust capacitors and other such unsocial activities.

On the major scene, pollution can be nailed to the masthead of Irresponsibility. On the domestic front, perhaps Thoughtlessness is a fairer term. So, however ardent you may be in your chosen hobby, spare a thought for others and keep it clean, lads.

W. N. STEVENS—Editor.

DECEMBER ISSUE WILL BE PUBLISHED ON NOVEMBER 6

NEWS AND COMMENT

Leader 515
News...News...News... 516
Practically Wireless by Henry 546
Showtime 1970 560
On the Short Waves by Malcolm Connah and David Gibson, G3JDG 565
MW Column by Charles Molloy 573

CONSTRUCTIONAL

Tuning Facilitated by F. G. Rayer 540
I.C. of the Month (Mullard TAA320 Bi-fet Preamp) by L. A. J. Ireland 544
Capacitance and Resistance Bridge by John Thornton Lawrence 548
S.W. Transistor R.F. Preamp by P. Cairns, G3IS 552
Vibrasonic 25-50 Guitar Amplifier, Part 3 by F. C. Judd G2BCX 555
Take 20—General Purpose Preamplifier by Julian Anderson 589
500kHz Crystal Calibrator by R. W. Bunney 570

SPECIAL FEATURES

Audio Fair Preview by David Cameron 519
Win a DECCA 3000 Hi-Fi System—Full details on page 525
Dolby and Kellar

One of the drawbacks of obtaining quality reproduction from the tape cassette has been the problem of background noise. Tape hiss increases as the tape speed is lowered and the track width decreased.

The Dolby system of noise reduction enables these problems to be overcome and full use to be made of the features of the tape cassette. By reducing the level of the background hiss by 10dB, the Dolby system gives the opportunity to use the wide frequency and dynamic range necessary to provide the serious listener with high quality reproduction of music.

The Dolby system works by boosting the strength of the signal (the subject being recorded) whenever it falls below a predetermined level, thus increasing the signal-to-noise ratio of the master tape. During playback of the master tape the circuits that increased the low level signals during the recording now lower them back to the correct value. As they do so, they automatically reduce the system background noise.

The Kellar DTA 50 (illustrated) uses the Dolby 'B' system. It has a continuous power output of 25W per channel, input for magnetic pickup cartridges or radio tuner, wide range tone controls with 12dB of boost and cut at 100Hz and 10kHz, a noise level of -70dB and the facility of recording from any source, including microphone, using the Dolby 'B' noise reduction system during the recording and replay process. The DTA 50 also gives the best possible reproduction from pre-recorded tape cassettes whether Dolby processed or not.

Price of the DTA 50 is £150 including purchase tax. Kellar Electronics Limited, Maryland Works, 9 Brydges Road, Stratford, London, E.15.

Cassette case

The Bib Division of Multicore Solders Limited announce the introduction of their new Bib Cassette Case which has been specially designed to hold up to 12 tape cassettes in their containers in a way that they can be easily withdrawn and replaced. This case is a neat method of storing and carrying cassettes which is covered in black deerskin PVC. The folding lid is held fast by two button fasteners and the overall appearance is most attractive. Price 17s. 7d., plus 7s. 3d. Purchase Tax.

The whole truth

Rank Audio Visual Ltd. are marketing in the U.K. the Empire Scientific Corporation (U.S.A.) range of stereo magnetic cartridges under the trade name of 'Empire'. These cartridges are manufactured in the U.S.A. and the range includes models for high-performance playback systems. In the popular 808 series for automatic record changers, there are two models the 808 at £9 and the 808E at £12 17s. The de-luxe 808 series includes four models ranging in price and specification.

The 999VE has a frequency response (within ±2.2dB) from 20-20,000Hz, elliptical stylus and a recommended tracking force of 0-5 to 1-5 grams. This retails at £44 10s. The 1000ZE (stereo calibration standard) is individually calibrated to have a flat frequency response within ±1dB from 20-20,000Hz (overall frequency response 4-40,000Hz) and has the ability to track effectively at stylus forces as low as 0-1 gram. The price is £63. For further technical details write to: Rank Audio Visual Ltd., Great West Road, Brentwood, Middlesex.

Martin Audiokits

It is announced that after a period of reorganisation, these constructional units for building a high fidelity amplifier and f.m. tuner systems are again in production.

Martin Audiokits were probably the very first to exploit the advantages of using transistorised modular units for the constructor to assemble and they quickly gained a reputation for reliability, good performance and value.

The range is now to be extended and updated but owners of existing equipment will still be able to add any new items to what they already have. Full servicing facilities are available and enquiries should be addressed to Martin Audiokits, 154 High Street, Brentford, Middlesex. (Telephone 01-560 1161) which is now a division of Louis and Lewis (Electronics) Ltd., The Boat House, 15 Thames Street, Hampton, Middlesex.
Slant Polarization

At certain of the BBC's local radio stations, where it is feasible to do so, slant polarization will be used instead of the horizontal polarization which has been used previously for all the v.h.f. radio services. Slant polarization, with the electric field at 45° to the horizontal and perpendicular to the direction of propagation, will improve v.h.f. reception in cars and with portable receivers used in the open air.

Vertical and horizontal aerials are equally suitable for receiving signals with slant polarization and satisfactory reception, with the vertical rod aerials used on many cars and portable v.h.f. receivers, will be better maintained toward the limit of the nominal service area. The effect is equivalent to the use of 6dB or more additional transmitter power, thus doubling the signal strength. There will be substantially no effect on reception in the home with receivers using built-in aerials, because the passage of a signal through a building tends to mix the polarization. On an outdoor horizontal aerial at roof level, slant polarization will give slightly less pick-up (about 70 per cent or -3dB).

The Invaders

Shown for the first time on their stand at the recent "R.S.G.B." Exhibition was the Adcola 'Invader' soldering iron. The instrument is based on the Adcola thermally controlled heating element. The handle is made from a relatively new plastic which does not retain heat, so keeping the handle always cool. A handy hook is also another feature of the handle design. The heating element can be removed should it become damaged and replaced within 90 seconds. Seven stock voltages are available from 6V to 250V and in temperature ranges of 250°C-440°C. Price is 37s. plus 1s. p.p. Adcola Products Limited, Adcola House, Gauden Road, London, S.W.4.

Motorola Design Note

The commonest causes of failure in control circuits used to switch flashing indicator lamps on and off are overloads due to cold lamp filament during starting, current surges during starting due to the charging of associated capacitive loads, and short-circuited lamps. Such failures can be eliminated with the use of this circuit.

The circuit holds the lamp driver transistor Q5 cut-off until the lamps have heated enough so that the 28V supply voltage will not cause excessive current. When switch S1 is closed, the free-running multivibrator applies a square wave with a 1 sec period and a 50 per cent duty cycle to the quad gate pins 9 and 6. Gates 1 and 2 comprise a monostable multivibrator; when pin 6 goes high (+5V), the output of gate 2 at pin 3 will go high for about 75 millisecond, then return to the low state. When the output of gate 2 is high, Q1 and Q4 turn on, supplying current to the lamps through resistor R2. If the lamp circuit is not short-circuited, the voltage across the lamps continues rising as the filament heat and their resistances increase. When the lamp voltage increases to between 7.5 and 10.0V, gate 3 is driven on through R1, and the output of gate 4 goes high. This action turns Q2, Q3 and Q5 on, applying the full supply voltage to the lamps in 0.5 sec pulses, as triggered by the multivibrator, and causing the lamp to flash. If the lamp circuit is shorted, gate 3 will not be turned on to turn on Q5. Instead, Q4 will continue to cycle, sending a current pulse of 75 millisecond duration once each second through the short-circuit. The maximum pulse current is limited to about 20A by R2. Normal 1 sec flashing will be resumed when the short-circuit is removed. Second and subsequent pulses will not be delayed in supplying full power, because the lamp filaments will have been preheated by the first pulse.

The advantage of this circuit is that it automatically resets to normal operation once an overload or a short-circuit fault has been cleared. This aids in fault finding and maintenance and ensures that intermittent faults do not result in a disruption of operation.

Catalogue

A useful catalogue for the home constructor, the Electrovalue catalogue contains everything from aerials to washers. Also, it is a useful reference for semiconductor characteristics and connections. The catalogue retails at 28 St Judes Road, Englefield Green, Egham, Surrey.

Lothians Society

Meetings of the Lothians Radio Society are now held at Theatre Workshop, 66 Hanover Street, on the 2nd and 4th Thursdays of each month. The Society holds lectures, films, visits, etc. This year, it is hoped, talks will be included on neon signs, colour TV, and radar. D. E. Ferguson, 1 Braidburn Crescent, Edinburgh, EH10 6QL.
Last year we introduced something new to the stereo scene: Deccasound simplicity.

Our new systems made it possible for anyone to enjoy good stereo sound—simply by plugging in and adjusting a few controls.

We made four Deccasound systems in all—two of 6 watts and two of 12, each with perfectly matched playing deck, amplifier and two speakers (plus FM Tuner and stereo decoder as optional extras).

So successful was our idea that we've since made a console version, with an AM/FM tuner built in. And this year we're extending the principle to hi-fi, with the result you see below.

Our Deccasound 3000 system gives you an impressive choice of decks, an amplifier of a hairy 30 watts per channel, plus two muscular speakers. Plus a choice of FM or AM/FM Tuners, as an optional extra. All perfectly matched for sound, as well as for appearance, to give you a lot of very high fidelity—without expertise or fuss.

See it at your Hi-fi stockist, or drop us a line for full details.

Decca, Ingate Place, Queenstown Road, London, SW8.

Deccasound
No-fuss stereo. For the very fussy.

Now up to 60 watts. And looking good.
ALBA (47)

Newcomers to the Audio Fair, but by no means newcomers to the world of sound equipment, Alba have been around for 53 years, having started in the sound business in the days of the acoustic gramophone. Concentrating on the low- and medium-price range, they will be showing a number of interesting items.

In the lower price bracket is the £42 portable stereo "all-round-the-house" player, the second speaker fitting into the lid for transportation; price is £39 19s.

The audio units start off with the UA 552 which comprises a combined amplifier/record player (with Garrard C110 autochanger) feeding 3W r.m.s. per channel into two matched speaker units. Complete, the price is £45 10s. Another version, the UA662, sells at £59 19s. and features a 5W per channel amplifier, the latest BSR C137 autochanger with aueing device, and a pair of speaker enclosures each housing a 6in. and 3in. unit. DIN sockets for radio input and tape connections are fitted.

Another product is the UA 400 tuner-amplifier, covering l.w., m.w. and f.m. band, with switchable a.f.c. and incorporating a Garrard 2025TC autochanger. Price is £57 2s. plus £6 1ls. extra if a decoder is required. Matching pair of speakers (UA500) are available at £17 18s. the pair.

The highlight of the Alba exhibit is their UA100 Series. The UA100 is a tuner-amplifier employing 30 transistors and covering l.w., m.w., s.w. and v.h.f./f.m. bands, and providing 15±15 W r.m.s. at less than 0.3% distortion. Specification 2µV sensitivity for 500mV f.m. (f.m.), amplifier figures include frequency response 20Hz to 20kHz ±2dB (excluding bass compensated volume control), bass control ±12dB at 70Hz, treble control ±12dB at 12kHz, feedback factor of main amplifiers 40dB. Features include stereo beacon, switchable a.f.c., quiet tuning control. Input sockets are provided for pickup and tape and a tape output socket is fitted. Price, £65 8s. (decoder £6 11s. extra).

The second unit is the UA200 record player deck which incorporates a Garrard SP25 (2) player with high compliance magnetic cartridge, cueing device, wow less than 0.2% r.m.s. and flutter less than 0.08% r.m.s. Price is £30 10s. To match these units are the UA300 speaker enclosures, each housing a 6Jin. main unit and a 3in. tweeter, which sell at £24 the pair.

There is also a new amplifier (UA700) which can be used as an alternative to the UA100. It employs 20 transistors, provides 15±15W output and sells at £34 10s.

ARMSTRONG (35)

We have no news of any brand new models, but Armstrong will be showing their well established and successful Series 500 range of amplifiers, tuner and tuner-amplifiers. A new demonstration of music with matching commentary has been specially prepared for this event and will be played through the 526 a.m.-f.m. stereo tuner-amplifier. This unit has been chosen as it represents the complete range, having the same performance and specification as the separate 50W amplifier and tuners. Figures include (f.m. tuner section) 5µV sensitivity for 30dB signal/noise ratio at 75kHz deviation, full limiting at 5µV, i.e. rejection 90dB, (decoder) 30-15,000Hz ±1dB frequency response, 30dB at 1kHz channel separation, hum and noise 60dB below full output, 40dB suppression (38kHz). Features include switchable loudness control (reduces overall gain by 20dB giving range of volume control for low level listening while at the same time increasing bass and treble), quieting control to suppress interstation noise while tuning on f.m., rumble filter, two treble filters (1, providing 3dB attenuation at 6.5kHz increasing to 25dB at 10kHz; 2, providing 3dB attenuation at 4.5kHz increasing very steeply to 40dB at 9kHz), tape monitor sockets, inputs for pickup 1, pickup 2, tape playback and radio, tuning meter with centre zero tuning on f.m. The 526 sells at £104 14s. 3d.

AEG (23)

The full range of current Telefunken products will be shown, in addition to the following new models.

The Musikus 108V is a portable domestic stereo record player/amplifier giving 6+6W output, the speakers being detached for playing or attached to the player unit for transportation. The 3-speed player unit has adjustable stylus pressure facilities and automatic end of disc cutout.
The Stereo Centre 2080K is another unit. Price, 63gns. domestic stereo ensemble, priced at 66gns.

The Stereo Compact 2080R is a novel flat stereo layout incorporating central record player unit with 6+6W amplifier on one end and a 4-band a.m.-f.m. tuner at the other end. Dimensions are only 26½ x 12 x 5½in. The separate speaker enclosures are hexagonal.

AUDIX (24)

Main features on the Audix stand will be the Studio 80 laboratory/monitor power amplifier, the MXT/800 series of professional mixers and the new Graphic Stereo preamplifier which will be on show for the first time. The conventional treble and bass controls have been replaced by five-section graphic equalisers operating independently in each channel to permit correction or shaping of the whole audio spectrum and to obviate less flexible facilities such as presence and loudness controls. Each low level input has its own preamplifier section. Function switching is simpler than usual and both mono and mixing operation are provided, making further use of the separate channel gain controls. There is ample power to drive any high quality headphones or 600-ohm line.

BELL & HOWELL (48)

A new loudspeaker system, the AR-6, from Acoustical Research will make its first appearance at the Audio Fair. Weighing 20lb. and measuring only 19½ x 12 x 7½in., it is small enough for bookshelf fitting and light enough to hang on a wall. It is, however, claimed to have an extremely good bass response and will accept the output of virtually any hi-fi domestic amplifier up to 100W r.m.s.

The AR-6 is equipped with three drivers. One is a specially designed 8in. bass unit with urethane polymer suspension, mounted in an acoustically sealed enclosure, and the others are a special passive radiator and a 1½in. tweeter with a response beyond 20kHz and exceptionally wide dispersion. Recommended retail price is £63 (in oiled teak) or £55 (in pine). The pine finish is ready sanded for painting or staining by the customer.

Denis Wratten, head of the Bell & Howell Audio Products Division says "the harmonic distortion of the AR-6 at 40Hz is less than that of most conventional loudspeaker systems of higher cost and vastly greater size." The enclosure itself has been designed to reduce interference patterns between the drivers and diffraction effects around the cabinet edges. These phenomena are inaudible in normal listening but they can have greater significance in small, acoustically dead rooms where the listener is very close to the speakers.

B & W ELECTRONICS (21)

Although B & W will be showing their complete range of high quality loudspeaker systems, interest will surely centre on the new release of the Continental Style Model 70 System. The concept of the Model 70 is based on six factors: (1) new thinking on the acoustical distribution pattern especially within the vitaly important mid-frequency region on 400Hz to 5kHz, aiming towards exploring the advantages of a distribution pattern approximating to spherical, (2) a mid-frequency unit capable of handling input powers in the region of 30W r.m.s. with distortion of 2% or lower, (3) a very low distortion bass radiator capable of truly complementing aspects (1) and (2) above without occupying an unduly large enclosure volume (4) exploration of the listening advantages by increasing reverberant to direct sound, (5) all units to be designed and built within the B & W factory, (6) styling and general appearance to be acceptable in the world market.

In the resultant system, the bass unit is of 12in. diameter mounted in an infinite baffle type chamber with complex internal absorbents making it almost aperiodic. The system resonance is below 40Hz, with a free air resonance in the region of 18-22Hz. It will handle high powers at low distortion and covers frequencies up to 400Hz. Frequencies above 400Hz are covered entirely by an 11-module electrostatic mid- and high-frequency unit with a virtually circular distribution pattern in a vertical plane through mid-band frequencies, providing a wide and uniform arc in a frontal direction with a strong rear radiating pattern which can be controlled to vary the reverberation for ambient listing conditions and personal judgment.

New standards for distortion have been set. Although Model 70 is rated at 25W r.m.s., we understand that distortion figures of less than 0.5% are being obtained from production samples with 35W r.m.s. input. Frequency response of the system is better than ±3dB from 50Hz to 15kHz, ±5dB from 40Hz to 20kHz.

BRITISH RADIO CORPORATION (58)

Products under the BRC banner are Ultra, Ferguson, HMV and Marconiphone. The emphasis will be on audio unit systems. Among those shown will be the 2416 stereo amplifier integrated with an f.m. radio and record playing unit which, with two speaker enclosures, is priced at £129 14s. The amplifier delivers 15+15W r.m.s. at better than 0.5% total harmonic distortion and has a frequency response of 40Hz to 16kHz +0-5dB, −1dB. The radio section has five v.h.f. channels and record playing is taken care of by a Garrard type SP25 Mk II with Goldring 800H free field magnetic cartridge.

Ferguson will be represented by four separate unit systems ranging in price from £84 14s to £138 5s. Marconiphone will show the Unit 3 and Unit 4 systems and Ultra have two audio systems.

BSR (17)

As readers will know, the policy of BSR has recently been changed to enter into the field of more expensive record player units. These are to be known as the McDonald series of units and these will be seen for the first time at this Audio Fair.

The MP60 is a single player unit equipped with low mass pickup arm with calibrated stylus pressure adjustment, bias compensator, heavy large turntable and viscous cueing device. Similar in styling to the Model 70 it combines the functions of a stereo record changer, a fully automatic single record player and a repeating turntable. It has four speeds, an automatic stop, synchronous motor, tracking control, bias compensator, viscous cueing device.

The 510 is an autochange unit and the 310 is another autochange unit with similar stand to the other models. All these units are available unmounted or mounted on an aformosia plinth with smoked styrene cover.

DECCA (59)

The new extended range of Deccasound unit audio equipment will be on display - the philosophy being simplicity of installation and operation which Decca sum up as "no fuss stereo for the very fussy". In addition to 6W, 12W and 30W systems a newcomer to the range is the Compact 3 which combines a.m. and f.m. tuners with 6W amplifiers and record playing facilities in a free-standing unit. The speaker enclosures are detachable to obtain better stereo effect. Deccasound 604 consists of four units—a 6+6W amplifier (A600), turntable unit (D1000) and two bookshelf speakers (L100). Deccasound 603 is similar except that the playing deck and amplifier are combined in one unit. Deccasound 1204 consists of a 12+12W amplifier (A1200), a turntable unit (D1000) and two free standing speakers (L200). The alternative 1203 system combines deck and amplifier.

The 3000 Series is the top system. It is a 30+30W system built around the Decca ffis pickup and employing a specially developed Garrard AP76 turntable. If you miss seeing this system at Decca's stand, you can see it in the Practical Wireless studio where it is being displayed as the prize in our special Audio Fair Competition (see page 525).
The latest version of the Model 70 speaker system from B & W, setting new standards in low distortion.

A view of the new Mordaunt Short MS 077 compact bookshelf speaker system with front grille removed to show the constituent units.

A selection of the new loudspeaker systems from Sonab claimed to be the first to be truly omnidirectional.

A cross sectional view of the popular Monitor Gold dual concentric loudspeaker system from Tannoy.

One of the new bookshelf speaker systems by Leak, employing a Sandwich bass unit.

Novel speaker system from Grundig—the Troika, designed to allow the maximum flexibility in the placing of the units.
**DIAMOND STYLUS CO (27)**

All users of audio equipment will find something of interest in Diamond Stylus’ display of accessories. For instance, the company have a range of diamond styli varying from unmounted points to a variety of nearly 300 types of cantilevers mounted with diamonds and individually packaged. Also on show is the Record-Matic automatic record selector which allows a choice of records at the touch of a finger tip while at the same time serving as a storage unit. Showing for the first time are two new products—a special cloth for cleaning record grooves which can be revitalised by sprinkling with water, and a sponge pad which cushions turntable to provide a quiet record drop when using autochangers, eliminates record slip, prevents damage to the stylus and decreases static pull from turntable to cartridge.

Other exhibits include a new stylus cleaner and a set of matched record/replay and erase heads made specifically for use with Philips stereo type cassettes.

**DYNATRON (60)**

Dynatron will be featuring their range of audio separates. The heart of the 1970 range is the SXR25A tuner-amplifier which covers l.w., m.w. and f.m. bands, employs 3 transistors and features a.f.c., tuning indicator on all wavebands, stereo beacon, built-in decoder, tone compensated volume control, switched scratch filter, loudness contour switch, stereo headphone socket and an output of 32W music rating. The audio units include a variety of designs from modern to period styling and takes in record storage units and stereo headphones.

Also being shown will be the new 90 Series range of audio separates comprising an amplifier, amplifier-player, tuner-amplifier and tuner-amplifier-player. The amplifiers each have an output of 45+45W r.m.s. and the record player unit in all cases is the Goldring-Lenco GL75 fitted with the Goldring G800 cartridge. The amplifier uses silicon transistors throughout and features high and low pass filters, tape monitor socket, channel reverse switching, A and B speaker switching and provision for crystal and magnetic pickups. The tuner has four preset v.h.f. channels in addition to manual tuning, all using varicap diodes. The v.h.f. front-end uses two dual gate FETs with crystal block filters in the i.f. stages. Five I.C.s are incorporated. Prices are £62 (SA90 amplifier), £122 (HFC90 amplifier-player), £165 (STA90 tuner-amplifier), £215 (HFC91 tuner-amplifier-player). Speaker enclosures for use with this equipment are LS1608 infinite baffle system (£50 pair), LS4008 bass reflex system (£84 pair).

**FARNELL-TANDBERG (16)**

The complete range of Tandberg tape recorders, tuner-amplifiers and loudspeakers will be on show. Of particular interest will be the new Tandberg Model 3000X four-head tape deck which will be demonstrated with the 15+15W f.m. tuner-amplifier and the Tandberg-Thorens turntable and Tandberg speakers.

The Professional Series II 11 battery-operated tape recorder will also be shown in its new form as the Model 11-12M, with complete synchronising units which enable the user to compile high quality lip synchronised sound tracks. This system will be demonstrated with complete units throughout the exhibition. A completely new tuner-amplifier will be shown (model S/S11) incorporating four wavebands, separate tuning for a.m. and f.m. and 15+15W r.m.s. output. Two high new performance mini loudspeakers will also be shown.

Of special interest to the travelling music lover will be the Tandberg TLF470B recording player which incorporates a lightweight unit offering outstanding performance as an f.m. tuner or as a complete small tuner-amplifier system.

Although we had no firm information at going to press it is understood that the company hope to mount a demonstration of four channel stereo sound from a completely new recorder.

**GARRARD (7)**

Although Garrard will be showing their complete range of record playing units, two new models will be on display for the first time. The late production run of the AP76, a transistorised four channel record playing unit which features a 4-pole induction motor, slide-in cartridge carrier, bias compensator, calibrated stylus force adjustment, cue and pause facility and tab controls. The second is the SP25 Mk III, an updated version of the popular Mk II widely used in hi-fi ensembles.

**GOLDRING (34)**

From the established range will be the Goldring-Lenco transcription turntable units including the GL75 with its heavy, dynamically balanced turntable and precision pickup arm with knife-edge bearings, and the GL69 Mk II turntable unit which in common with the GL75 features infinitely variable speed adjustment, viscously damped pickup levering device and bias compensation. A wide range of stereo magnetic cartridges will be shown, including the G800 Super E which is individually calibrated and supplied with its own frequency response curve and, at the other end of the price scale, the GB50 cartridge which was designed for budget hi-fi systems.

Newcomers will be a stereo amplifier (ST3000) which has a hi-fi specification and delivers 15+15W r.m.s. A tuner-amplifier (ST4000), which has the same high quality audio section as the ST3000 is also on show. Finally, a new and inexpensive turntable unit (Model 705), which has belt drive and synchronous motor, will be introduced.

**GRUNDIG (18)**

As to be expected Grundig will be showing a big selection of tape recorders. Among the newcomers is the TK147, which at £96 4s. is designed for the more avid enthusiasts. It is a single speed (3 1/2 i.p.s.) four-track fully automatic recorder incorporating delayed auto-record level setting and two fully automatic recording amplifiers serving as preamplifiers on playback. This system, composed of an elaborate circuit arrangement, is claimed to keep distortion level, frequency response and dynamic range constant whatever the conditions, the composition or volume of the recording. Two of the four recording tracks can be played back together so that a commentary may be added to background music. Recording can also be monitored through headphones. The circuit employs 28 semiconductors and specification figures include frequency response of 40-12,500Hz, wow and flutter less than 0.2%, signal-to-noise ratio better than 47dB.

For the professional wanting a sophisticated portable, the new TK3200 will be interesting. It can be powered by batteries, rechargeable DEAC accumulators, car or boat batteries and mains supply with the aid of a power unit. It is a 2-track machine, operating at 1, 3, 5, 7 1/2 i.p.s., and has a fully automatic recording level setting with manual override. Two separate automatic delay levels are provided for speech and music and there are individual controls for manual record level, volume, bass and treble. Features include steel chassis, moving coil meter recording level/battery level indicator, frequency response from 40Hz to 8kHz (1%), 12,500Hz (3%) or 16kHz (7%), S/N ratio better than 48dB (7%), two speakers (4R×28in, bass unit and 12in. tweeter). Price is £17B 3s.

Also on show will be the new and unique Troika loudspeaker system, specially designed to allow greater flexibility in the placing of the units. The system consists of two 7in. cubes each containing six loudspeakers; these provide omnidirectional radiation of middle and treble frequencies and are said to give a remarkably wide stereo effect. The troika cubes are supplied with small tripod stands and a complete mounting ring so that they may be placed on a shelf, table or floor or hung from the ceiling or wall. The one bass speaker which completes the system may be placed in any convenient part of the room.

522
A compact audio system from Alba, comprising UA100 tuner-amplifier, UA200 record player deck and matching loudspeakers.

Telefunken 2080R Stereo Compact system presented in a novel flat layout and featuring hexagonal speaker enclosures.

One of the new units from BSR under the McDonald marque—the 610 hi-fi autochanger.

The MD3, a new miniature pencil microphone on desk base MS500 from Resiosound.

The SME model 2000 plinth system incorporating the well known Series II arm and a Thorens TD125 record player unit.

Novel styling is a feature of the Ultra 6405 amplifier-tuner-record player, shown with matching speaker enclosures.

A versatile hi-fi amplifier at a modest price—the SQ707 from Lux.
The advantages of the system are that it takes up a minimum amount of space, there is little restriction on the placing of the speakers and the listener is not confined to one small area of the room to enjoy the full stereo image. Power handling is 30W per channel (40W peak). The bass unit handles frequencies from 40-400Hz and the cube units take over from 400-20,000Hz. Price is £97 5s. 6d.

HEATH (15)

All readers of P.W. will make sure they have a good look at the Heathkit exhibit. A selection of the audio models will be on show and will be demonstrated in the studio. Among the new models are two stereo tuner-amplifiers.

The AR-19 covers m.w. band and the f.m. band and its amplifier has a continuous power output of 20W per channel. Features include a new FET front end, four IC stages, electronically regulated power supply, less than 0-25% THD at full power, tuner sensitivity 2μV, f.m. stereo separation 35dB, bass middle frequencies, comprehensive key tab switching, linear slider controls for bass, treble, balance and volume. Price is £118 as a kit.

The AR-29 is in a similar type of presentation but has a more impressive performance, at a price of £168 for the kit. Output is 35W continuous power per channel at less than 0-25% THD. A new FET front end plus IC design gives the tuner 1-BuV sensitivity. Stereo separation (mid frequencies) is 40dB. Modular plug-in unit construction is used. Both this and the AR-19 features "black magic" panel lighting plus heavy chrome plated diecast front panels.

Also worth noting is the new Trent loudspeaker. The enclosure measures only 19 x 1 x 9.8in. and houses an 8in. bass unit and a 4in. h.f. unit. The cabinet is provided ready assembled and finished in teak or walnut veneers to match other Heathkit equipment. Kit price is £14.

HOWLAND WEST (52)

Howland West will be showing their complete ranges of audio products from Dynaco, Lux, Nikko, Neat, JP, IMF and the company's own Scandinavian range of speaker systems and Clearview equipment cabinets.

New from the Japanese company of Nikko are three models. The FM-10 is an a.m.-f.m. multiplex tuner selling at £48 10s. 7d. with sensitivities of (a.m.) 200μV/m for 20dB S/N and (f.m.) 2μV. Figures for the f.m. section include stereo separation of more than 32dB at 1kHz, image rejection of 50dB and a capture ratio of 4-5dB. Features include separation control (factory preset), rotating ferrite rod aerial, signal strength meter and stereo beacon.

The TRM-1200, which sells at £98, is described as a professional stereo amplifier. It employs two ICs, 29 semiconductors, and features circuit breaker protection, stereo headphone socket, output level meters for both channels, provision for driving two sets of stereo speakers simultaneously, high and low pass filters, loudness control, four input sockets and A/B speaker switching. Specification figures include frequency response (main input) 15-50kHz ± 1dB, 40-400W r.m.s. outputs at 0-3% distortion (full power).

The third new Nikko item is the STA-1101 multiplex a.m.-f.m. tuner-amplisher which features all plug-in circuitry, four FETS, 12 ICs, separate a.m. and f.m. tuning controls, sliding light tuning indicators, separate volume control for remote speaker system, linear slide type volume, bass and treble controls, an i.f. section that includes two crystal filters and ceramic filter, extra tape recorder output socket; a triple circuit breaker protection system, speaker compensator to eliminate i.f. response loss in low efficiency speakers, separate amp/preamp output and two VU meters. The main amplifier frequency response is 10Hz to 70Hz ± 1dB and the r.m.s. output per channel is 37W at 8Ω with a distortion figure of 0-3% at full power. The price is £246. 5s. 7d.

Also on show is the interesting range of GG Control Units. These useful products are basically small control boxes to enable the user to switch amplifiers to various speaker and headphone outlets in a number of different ways, and the series includes Input/Output comparators used for dealer demonstration, and for use at exhibitions etc.

Another new Japanese product is the JP601 transcription turntable unit which incorporates a 4-pole synchronous motor and belt drive. Running at 33⅓ or 45 r.p.m., the wow figure is less than 0-1% and the S/N ratio more than 40dB. The pickup arm is of a new design and the playing weight is set by means of coarse and fine adjustments. A lowering device is fitted. Price is £42 10s.

High performance amplifiers and tuners by Lux are also on show. These include the 507, which incorporates 48 semiconductors and gives an r.m.s. output of 60+60W into 8Ω and features a 3-stage direct coupled preamplifier, automatic resetting protection circuit, high and low pass filters, a low boost switch to improve performance of bookshelf IB speaker systems, facilities for two separate speaker systems, monitor socket, tone controls which may be used coupled or separately. Frequency response is 20-50,000Hz -1dB, total harmonic distortion less than 0-25% at maximum output, residual noise less than 2mV. Price is £124.

For the budget conscious, the SQ707 amplifier fills the bill at £59. It uses 23 silicon semiconductors and features A/B speaker switching (with attenuator which cuts the gain by 18dB), tape monitor socket, headphone jack, power output of 17+17W r.m.s. into 8Ω, frequency response of 30-30,000Hz ± 1dB, distortion less than 1% at full power, residual noise level less than 2mV and S/N ratio more than 60dB at pickup socket.

KELLAR ELECTRONICS (69)

Readers will have their first opportunity to see the new cassette tape recorders from Kellar incorporating Dobby B noise reduction circuitry, details of which will be found on page 516 of this issue. There will also be two new products with the same theme. These are 'black boxes' for use with existing reel-to-reel tape recorders to convey the advantages of the Dobly system. Model I is for use with combined record/replace head type machines and Model II is for use with machines having separate record and replay heads, thus permitting monitoring from the tape via Dobly. Both models incorporate stabilised power supplies, VU meters and the necessary level controls for the correct setting up of the equipment.

LEAK (49)

The established Leak audio units such as the Stereo 70 amplifier, the Stereo 30 Plus amplifier and the Stereofetic f.m. tuner will need no introduction to keen audiophiles and they will be on show and demonstrated at the Fair. A new departure for Leak, however, is the range of sandwich loudspeakers.

The Model 200 is a three speaker system employing the Sandwich bass unit plus a mid-range and a treble unit. Power handling capacity is 18W r.m.s. Price is £23 each. The Model 300 is a similar system except that the cabinet is larger and the price is £29 10s. The Model 600 is the big brother of the series employing a Sandwich bass unit, a plastics coated mid-range unit and a new Leak tweeter. Power handling capacity is 40W r.m.s. and the price is £45 each.

LEE PRODUCTS (94)

Among the range of more conventional audio equipment, visitors can see a novel new product from the Lee stable—the Elizabethan Audio Chair. This is an apparently normal, though very comfortable, winged armchair, but inserted into the wings are two concealed loudspeakers. These enable the occupant of the chair to listen in comfort and privacy to stereo sound without unduly disturbing other people in the same room. We tried one of these chairs at the recent trade exhibition and found it very effective.

The nylon covers, which zip off for easy washing, are available in a choice of four plain colours—turquoise, tan, gold
A FREE competition organised by Practical Wireless in co-operation with Decca Radio and Television Ltd.

The 3000 System combines all the simplicity of the Deccasound philosophy with the best in sound reproduction. This 36-watt per channel system has been designed around Decca's fsf pick-up whose capabilities as a transducer are world-renowned. A specially developed version of the Garrard AP76 turntable matches the high quality potential of the pick-up while the amplifier has such refinements as HF and LF filters and other facilities required in hi-fi equipment. Twin floor-standing speaker enclosures incorporating speaker units specially developed in Decca's hi-fi loudspeaker division have been designed to ensure optimum performance from the system.

HOW TO ENTER...

Listed below are eight features applying to the Decca 3000 Series audio unit system. All you have to do is to place these features in what you consider to be their order of importance for choosing the units as a hi-fi system. For example, if you think that Good stereo separation is most important of all, write E in the box marked 1st on the entry coupon. The key letter of your next choice goes into the box marked 2nd, and so on for all eight.

Complete the form, all in ink or ballpoint pen, with your full name and address, then post in a sealed envelope to: PRACTICAL WIRELESS HI-FI COMPETITION, 1-2 Bear Alley, Farringdon Street, London, EC4X 1AJ (Comp.), to arrive not later than the closing date: Monday, 16th November, 1970.

IMPORTANT Before sealing your envelope, copy out on the back of the envelope eight key letters in exactly the same order as they appear on your completed coupon. Do not enclose any correspondence or matter other than your entry form.

RULES

There is no entry fee, but each attempt must be fully completed in ink on the proper printed coupon cut from Practical Wireless, and bear the entrant's own full name and address.

Every accepted entry will be examined and the prize, as described, will be awarded to the entrant who, in the opinion of an expert panel of judges, and in any one attempt, has shown the most skill and judgment in listing the eight features in order of importance.

In the event of a tie or ties, a further eliminating test will be conducted by post between the tying competitors to determine the winner.

Any entry which does not comply with the printed instructions or is received after the closing date will be disqualified, as will any received mutilated or illegible, incomplete, bearing alterations, or with more than one key letter in each space. No responsibility will be accepted for entries lost or delayed in the post or otherwise.

The judges' decision, and that of the Editor of Practical Wireless in all other matters affecting the competition, is final and legally binding. No correspondence can be entered into. The competition is open to all readers in Great Britain, Northern Ireland, and the Channel Islands except employees (and their families) of IPC Magazines, the printers of Practical Wireless, and Decca Radio & Television Ltd., all of whom are ineligible. The winner will be notified, and the result announced in the earliest possible issue of this magazine.

A. Ease of interconnection of units
B. Low turntable rumble figure
C. Bias compensator and arm lifting device
D. Power handling and frequency response of speakers
E. Good stereo separation
J. Accurate matching between units
K. Low distortion figures
L. Low hum and noise figures of system

<table>
<thead>
<tr>
<th>FREE ENTRY COUPON</th>
<th>PRACTICAL WIRELESS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hi-Fi Competition</strong></td>
<td></td>
</tr>
<tr>
<td>My order of importance for the eight points is given on the left. I agree to the rules as final and legally binding.</td>
<td></td>
</tr>
<tr>
<td>(Signed) Mr./Mrs./Miss.</td>
<td></td>
</tr>
<tr>
<td>Full Address</td>
<td></td>
</tr>
</tbody>
</table>

Post to: PRACTICAL WIRELESS Hi-Fi Competition 1-2 Bear Alley, Farringdon Street, London, EC4X 1AJ (Comp.).

Closing date: 16th November, 1970

please cut out along this line
or avocado green, as well as two floral patterns in blues or browns. Two or even three chairs can be connected to any stand, while a suitable choice from Elizabethan being the Windermere stereo unit, which is available with matching swivel pedestal. Prices for the units are £52 for the Audio Chair, £65 for the Windermere stereo unit and £10 for the swivel pedestal.

MORDAUNT SHORT (33)

A compact bookshelf loudspeaker system which makes its international debut at the exhibition can be seen on this stand. The cabinet measures 152 x 94 x 8in. and the complete unit weighs about 14lb. It comprises three drive units (6, 3 and 2in.) with a power handling capacity of 15W music rating and a frequency range of 40-20,000Hz. The treble and mid-range units are virtually identical to the larger MS 100. Price is £27.

MULTICORE (51)

Great strides have been made in recent years by the Bib Division of Multicore in devising and making available all manner of very useful accessories and other aids—tape splitters, maintenance kits, cleaners, and so forth. A good deal of attention has also been directed towards the tidying up of enthusiasts collections of records and tapes, leading to the various packs of tape cassette and spool labels, etc. The latest development in this field will be seen for the first time at the Audio Fair—a new low cost system of indexing record collections.

The system is suitable for 1-100 records and costs 34s. It comprises a simulated pigskin finish padded PVC index book with 12 clear slip-in filing pockets into which pre-printed and colour-coded index pages can be slotted (and extracted, updated and refilled as further information is added when the record collection grows). Columns provided permit the compilation of such details as date, number of record, title, composer and artists etc. Also included in the pack are 100 pairs of self-adhesive labels numbered 1-100 and 40 general purpose self-adhesive labels so that works can be filed under appropriate headings such as classical, jazz, pop, etc.

NATIONAL RADIO (14)

One of the highspots here will be a demonstration of Panasonics quadrasonics (4-track stereo), the dem. unit being flown in from the USA where it has been on show at the New York Fair. Other tape equipment on show will be the RN-77US 8-track 3-head tape deck and, it is hoped, a new model—the RS-763US—which uses hot-pressed ferrite heads and incorporates a 4-pole hysteresis motor with wow and flutter of less than 0.09%.

There will also be various other audio units, including the SA-65 de-luxe tuner-amplifier which features FETs, ICs and silicon transistors, two r.f. stages, filter switching, 7-position input selector.

POWER JUDD (107)

This company is exhibiting record storage units under the name of Paddock.

The self-adjusting conical-spring-loaded mahogany support panels in a Paddock 'tidy' hold records upright and pressed together in a neat and tidy condition. Whether it holds 1 or 100 records, each one is held upright with the correct pressure applied, yet allowing easy removal or replacement of records. The unit is sturdily constructed in resin-bonded mahogany ply to prevent warping and is spray finished. Price is 59s.

RANK-WHARFEDALE (49)

Undoubtedly the highlight of exhibit will be the new 100.1 tuner-amplifier which boasts a most impressive specification at a competitive price. (£125 gns.). The tuner section includes FETs and ICs and covers L.W., M.W. bands in addition to F.M. Sensitivity on F.M. is 1µV, to give 30dB signal/noise ratio at 75kHz deviation. Stereo crosstalk is better than 35dB at 1kHz. Tuning is by meter and a stereo beacon is fitted.

The amplifier, which delivers 35W per channel r.m.s., has impressive distortion figures—at any power up to 35W per channel into 8Ω it is less than 0.07%. Weighted noise level (gain at minimum) is—90dB; weighted noise level (disc input, gain at maximum)—75dB. The frequency response is 12-5Hz to 50Hz +3dB. Facilities include low pass filter, v.h.f. muting switch, local and remote speaker switching, stereo headphone socket, tape socket, three separate input sockets.

Two new Wharfedale speakers make their debut. The Triton is a 3-speaker 3-way bookshelf system using an 8in. bass unit, 5in. mid-range unit and a 1in. dome treble unit, giving a system frequency range of 30-18,000Hz. Power handling is 18W r.m.s. The Aston is a slim line shelf or wall mounting unit incorporating an 8in. bass unit, 3in. treble unit and a 4-element crossover unit. Frequency range is 65-17,000Hz and power handling capacity 20W r.m.s. Price per pair is £42.

Audio enthusiasts will also be wise to have a look at the range of loudspeaker kits (Unit 3, Unit 4 and Unit 5) which are supplied boxed with full instructions for assembly.

RESLOSSOUND (52)

A wide range of public address and associated equipment includes amplifiers up to 50W. line source loudspeakers, re-entrant horn speakers, floor stands, boom arms, table stands and desk bases, plus a wide selection of all types of microphones. Also on show, and being demonstrated, will be the Reslo-Audac range of radio microphones which have a range of 500 yards or more and eliminate the problems of trailing cables associated with the conventional type of microphone.

A new addition to the Reslo range is a highly portable PA system known as the 1SR/10. Weighing only 30lb. and measuring 34 x 12 x 9in., it contains three 8in speaker units, 10W amplifier with three microphone inputs, together with a radio microphone receiver. Other new products which will be displayed include the SR530 30W amplifier, a new desk base, two new pencil microphones, a new ribbon microphone and a radio guitar. Further details were not available at time of going to press.

ROGERS (28)

On show will be the basic Rogers range comprising the Ravensbrook and Ravensbourne stereo amplifiers, together with their respective matching f.m. tuners. The tuners feature FET front ends, IC i.f. strips and a decoder with automatic electronic switching. Interesting constructional feature is the use of high grade fibreglass for virtually all the printed circuit boards, a Rogers exclusive.

In addition, Rogers will be showing the first three instruments in an entirely new range of audio test equipment, designed and developed by Sign Electronics. These comprise a low distortion oscillator, an a.f. millivoltmeter and a distortion factor meter.

SINCLAIR (44)

Two major additions to their range of products are being shown by Sinclair. To start with, a new f.m. tuner claimed to be the first in the world to use the phase lock loop principle. This principle was first used in receivers for reception from satellites because of the improvements in signal/noise ratio and improved selectivity and sensitivity.)A voltage controlled oscillator in a phase lock loop tuner is kept in phase with the
One of the Armstrong 500 Series audio units—the Model 526 tuner-amplifier.

The Sonab R7000 has only one tone control which lifts bass and cuts treble or lifts treble and cuts bass.

Described as a "professional stereo amplifier", the Nikko TRM1200 is priced at under one hundred pounds.

The latest p.a. amplifier from Reslosound, the SR530 has an output of 30 watts and flexible mixing facilities.

The latest tape recorder from Grundig and incorporates a number of new features and facilities.
incoming signal by a phase comparator or detector which compares the two and feeds a control voltage to the oscillator. This control voltage is the audio output in the case of an f.m. signal. Since it is possible to design a VCO which has an extremely linear voltage/frequency characteristic, excellent audio fidelity can be achieved. Also, the oscillator can track a signal while completely rejecting a nearby stronger signal which would cause interference in a conventional receiver. The tuner also features printed circuit coils for the second and third circuits to silence the tuner between stations, an i.c. stereo decoder and the option of remote control and push button switching. The price of the tuner, designated Project 60, is £25.

The other new product is the System 3000 amplifier which has a total harmonic distortion of less than 0.4% at full output (17W per channel r.m.s.) at 1kHz. It has a stabilised power supply with automatic overload protection and uses silicon transistors throughout. Price is £45.

SME (9)

Still going strong—the SME Series II arm, considered by many to be the ultimate in precision pickup arm design. Electronic low pivot friction is achieved by the use of high precision ball races protected against the entry of dust and the tone arm is carried on knife-edge bearings. Approximately 0.02 gramme applied at the stylus will deflect the arm vertically or laterally. Dynamic damping of the arm mass/stylist compliance resonance is obtained by dividing the arm mass into two portions joined by an elastic coupling which also effectively ejects rumble frequencies. That is, of course, all the required modern adjuncts such as lever operated hydraulic raising/lowering control, bias adjustor graduated to correspond with tracking force, and a base plate sliding through fin on bed plate for precise tracking adjustment.

SONAB (61)

This will be a new name to many readers, but not for long for the company have some very interesting products. The Sonab range of hi-fi equipment is to initially comprise five loudspeaker systems (one in kit form), a turntable unit and a tuner-amplifier.

The loudspeakers are claimed to be the first in the world to be truly soild state and omni-directional and they have their drive units mounted in the upper surface of the cabinet. The OA6 has a frequency range of 26-18,000Hz, the bass performance being attributed to the fact that the bass unit is driven by its own power amplifier incorporated within the speaker cabinet. This amplifier provides electronic compensation for the frequency response curve of the speaker and is used to extend the response down to the limits of human hearing.

The OA6 has six speaker elements (an 8in. bass unit, an 8in. mid-range unit and four 2in. tweeters, the latter being mounted in the top of the cabinet crosswise with the rear pair facing diagonally upwards and backwards). It is claimed that when the speaker unit stands on the floor with its back no further than 8in. from a wall, the response curve will be ±4dB within 29-15,000Hz. This superb system costs £137 5s.

The OA5 has five elements and dispenses with the built-in amplifier and thereby costs far less (£68 10s.). Response is 37-18,000Hz, and deviation from flat is ±4dB from 42-15,000Hz. This system is available as a kit at £49 10s.

The OA4 is a small version employing only one 8in. unit plus the four tweeters. Frequency range is 44-18,000Hz, power handling is 35W and the price £45. The smallest of the range is the V-1 which although based on similar principles to the other models contains only a single drive unit of 8in.

to cover the claimed frequency range of 40-17,000Hz.

It differs from the other models in that it can be placed and directed in any position within a room like a conventional speaker. Price is £65 15s. 3d.

The tuner-amplifier, model R7000, has an output of 35+35W r.m.s. at 8Ω, with a frequency response of 25Hz to 25kHz ±0.5dB at a harmonic distortion of less than 0.1% at all levels up to rated power output. Signal-to-noise ratio is better than 70dB. The price of this pocket-sized 3W, better than 80dB at the high level inputs. With volume control at minimum the noise level is 95dB. Features include full protection against short circuits and overload conditions, loudness and volume controls, rumble filter (5dB at 100Hz), choice of three high pass filter slopes, f.m. capture ratio of 1-5dB and outputs for tape, centre channel, two speakers and headphones. A novel feature is the provision of only one tone control based on a principle developed by Stig Carlsson. The adjustment range of the control at 100Hz is ±7dB and at 10kHz ±6dB, the control affecting both channels simultaneously, either lifting the bass and cutting the treble or lifting the treble and cutting the bass. This unit will retail around £200.

Also to be shown is the TSS turntable unit, all functions being controlled by two buttons. It has a synchronous motor and belt drive, with a wow and flutter figure of 0.08% and rumble of less than 60dB weighted. Sonab will additionally display a range of high quality stereo headphones from Clark, which are recommended for use with the Sonab equipment.

TANNOY (29)

Highlighted will be the established range of Monitor Gold loudspeaker systems which range in price from £41 to £170, together with separate units for mounting in the customers own cabinets. Also on display will be a range of pickups cartridges and spare stylis.

TRANSCRIPTORS (54)

Apart from the well known precision Transcriptor turntables, one new model will be on show at the Audio Fair. Supplied complete with tone arm and moulded clear acrylic top, it features a synchronous motor driving a 6lb. non-ferrous turntable via a belt. The acoustic and mechanical feedback properties are such that the whole boardbase floats at a resonance below 5Hz and a fluid dashpot may be used to damp this movement. The tone arm is designed for use with the most advanced cartridges and the frictional characteristics of the stabilised jewelled unipivot are exceptionally good. All the expected facilities are included, such as hydraulic lowering and cueing device and bias compensator. The price of the new unit is £57 12s.

3M (3)

Visitors to the Scotch magnetic tape stand this year will be able to enter a free contest featuring mystery animal voices. Six Cybervox language laboratory booths will be used for the competition, which offers a portable cassette recorder and a supply of tape cassettes as first prize.

Entry forms will be available for the 3M wildlife sound recording contest, now in its third year, and there will be a bank of quality tape recorders from makers such as Tandberg, Ferrograph, Teac, Revox and Akai on which visitors will be able to compare, via headphones, identical musical excerpts pre-recorded on Scotch Dynarange tape.

The newly introduced Scotch 360/361 helical scan video tapes, which feature a unique textured backing for improved handling and cleaner performance, will also be demonstrated on VTR equipment.

DON'T FORGET TO VISIT STAND 68 WHERE PRACTICAL WIRELESS WILL BE PUTTING ON DEMONSTRATIONS OF AUDIO EQUIPMENT.
Just what is this ABR, that makes such a vital difference to the 'DITTON 15'?

1. Studio quality high frequency unit (HF1300 Mk. 2).
2. Anechoic cellular foam wedge and lining eliminates standing waves.
3. High hysteresis panel loading material to eliminate structural resonances.
4. Auxiliary Bass Radiator (ABR)—plastic foam diaphragm of high rigidity and low mass having a free air resonance of only 8 Hz, double roll suspension allowing excursions up to 3/4" with virtual absence of distortion.
5. 8" bass unit, with free air resonance of 25 Hz, and massive Ferroba II magnet structure for optimum magnetic damping and cone treated with viscous damping layer to suppress resonances.
6. Units mounted flush to eliminate diffraction effects and tunnel resonances; covered by acoustically transparent grille cloth for maximum presence.
7. Full L-C Crossover network.

Please write for details.

VISIT US ON STAND No. 2
and listen to the acknowledged 'DITTON' Hi-Fi Speaker Systems, and hear the vital differences.

INTERNATIONAL AUDIO FAIR
OLYMPIA 20-24 OCTOBER '70

HEAR CELESTION'S NEW SPEAKER!

Celestion Studio Series

LOUDSPEAKERS FOR THE PERFECTIONIST

ROLA CELESTION LTD., FOXHALL ROAD, IPSWICH, SUFFOLK
Goodmans Loudspeakers
speak for themselves

This is a range which offers a truly superlative loudspeaker system for every requirement. From the tiny Maxim which offers true High Fidelity quality for the smallest of rooms, to the massive Magister easily capable of filling a concert hall with perfect sound, every one is outstanding in its class for design, for performance and for value. Your local Goodmans’ dealer has full details, or write directly to us for the latest colour brochure.

Maxim
The first miniature, truly High-Fidelity loudspeaker system. Only 10½" x 5½" x 7½" deep. Design Centre approved. Range: 45 - 20,000 Hz. Power: 12 watts. Impedance: 8 to 16 ohms.

Minister
A superb system designed to meet the public demand. Using an 8" Bass unit and Goodmans Special 1" dome Tweeter. Size 19" x 10½" x 10" deep. Range: 45 - 22,000 Hz. Power: 20 watts. Impedance: 4 to 8 ohms.
£18. 0. 0. plus £4. 9. O. P. Tax. (£18.000 plus £4.450)
Packed in pairs.

Mezzo 3
The Goodmans bookshelf speaker system, it incorporates a 12" bass unit and Goodmans special 1" Dome Tweeter. Distinctive styling. 12" x 19½" x 9" deep. Range: 40 - 22,000 Hz. Power: 30 watts. Impedance: 4 to 8 ohms. Design Centre approved.
£30.18. 0. nil P. Tax. (£30.900)

Magnum K-2
Studio quality three speaker system, 12" bass unit, 4" mid range and 1" Dome Tweeter. Design Centre approved. 15" x 24" x 11½" deep. Range: 30 - 22,000 Hz. Power: 40 watts. Impedance: 4 to 8 ohms.
£40. 2. 0. nil P. Tax. (£40.100)

Magister
This is the loudspeaker system for the perfectionist. Three speaker assembly incorporating a 15" bass unit, 4" mid range and Goodmans 1" Dome Tweeter. 27" x 20" x 14½" deep. Range: 26 - 22,000 Hz. Power: 50 watts. Impedance: 4 to 8 ohms.
£57. 0. 0. nil P. Tax. (£57.000)

All these cabinets are available in Teak or Walnut to order.
THE stereo amplifier to be described in this article is based on commercially made power amplifier modules and a suitable matching power supply chosen from the wide range now currently available.

The use of ready made power amplifier stages and a power supply does overcome certain technical problems for those with a very limited range of test equipment. For example, an oscilloscope as well as an audio signal generator would be necessary for checking a home constructed power output module for full power output i.e., to clipping point and there is of course the ever present risk of damaging or even completely destroying expensive power transistors in the event of a wiring error or accidental short circuit.

The Henelec PA-25 power modules chosen for the PW 25-25 stereo amplifier are fully protected against all but the most drastic treatment and have a high electrical performance. They require around 700mV for the development of full r.m.s. power output which is 25 watts per module.

Facilities

The pre-amplifier section employs fairly conventional hi-fi amplifier circuitry and provides for input signals from a radio tuner, magnetic or ceramic pick-up cartridges, tape head and tape replay from a tape recorder or tape record/replay unit. The controls cater for volume, stereo balance, bass and treble lift and cut, rumble filter and heterodyne whistle filter. The latter is useful for reducing surface noise from old records. At full gain, the pre-amplifier provides over 1V r.m.s. signal so that full output is produced from the power stage modules with a volume control setting at approximately three-quarters of its full rotation from zero. The stereo balance control reduces the signal level of either channel from maximum to zero and at midway travel equalizes the signal level from each channel to within ±1dB.

Performance

Performance shown in Table 1 J should be readily obtainable providing the amplifier is constructed with the components specified and according to the layout described in this article.

| TABLE 1 |
|-----------------|-----------------|-----------------|
| **Power Output** | 8 ohm load      | 25W r.m.s. per channel |
|                  | 15 ohm load     | 15W r.m.s. per channel |
| **Distortion**   | Less than 0.25% at rated power output |
| **Inputs**       | Radio           | 90mV at 100kΩ |
|                  | Mag pick-up (PU1) (RIAA) | 4mV at 5kΩ |
|                  | Ceramic pick-up (PU2) | 80mV at 1.5MΩ |
|                  | Tape Head (CCIR) | 8mV at 10kΩ |
|                  | Tape Replay     | 200mV at 220kΩ |
| **Outputs**      | Loudspeakers    | 8 or 15 ohms only |
|                  | Tape record outlet | Up to 1V at 10kΩ |
| **Frequency Response** | 10-30,000Hz ± 1dB |
| **Signal to Noise** | Radio and Tape | Better than -60dB |
|                  | Pick-up inputs  | Better than -56dB |
| **Crosstalk**    | All inputs      | Better than -50dB |
| **Bass Control** | ±15dB lift or cut at 50Hz |
| **Treble Control** | ±15dB lift or cut at 15,000Hz |
| **Rumble Filter** | -5 to 6dB at 40Hz |
| **Whistle Filter** | -20dB at 10,000Hz |
It is worth noting here that a polished wood cabinet finished in teak or walnut is available to constructors from Fircastle Limited, of Hockley, Essex. (see components list). The cabinet costs £3 6s. 0d, inclusive and has been designed to accommodate the PW 25-25 amplifier constructed to the dimensions given.

Circuit

The pre-amplifier circuits for each channel are identical, Fig. 1. The circuitry is conventional and each channel consists of an input stage (Tr1 and Tr2) which, with suitable input attenuation and a negative feedback network, provides frequency response equalization for magnetic pick-up and tape head and maintains matching input sensitivity and gain for the linear inputs i.e., ceramic pick-up, radio and tape replay.

This is followed by the stereo balance control VR1 formed by two 10kΩ potentiometers, one a log type and one an anti-log type, which equalize the signals through each channel. The range of balance control is from maximum to zero signal level through either channel.

The second section of the pre-amplifiers begins with the bass and treble control networks formed around VR3 (bass control) and VR2 (treble control). The tone control network is an "active" type and operates in conjunction with negative feedback between the collector and base of Tr3. Part of the feedback circuitry is used for the rumble filter (C15, R23, C16 and S3) and for the whistle filter (C17, R27, R28, C21 and S4). The final stage consists of a buffer amplifier (Tr4) the gain of which is attenuated by negative feedback at the emitter circuit. The output from Tr4 goes to the power modules via VR4 (volume control) and also to phono sockets for connection to a tape recorder. Recording can therefore, be carried out with the volume control turned off i.e., no signals from the loudspeakers.

The positive supply for the pre-amplifiers is derived from the MU442 power supply unit via R35 which brings the +35V rail from this unit down to approximately +22V. The pre-amplifier positive rail is decoupled by C24 (5000µF) to ensure the least possible mains ripple.

Construction

The layout for the pre-amplifiers, power output modules and power supply unit is shown in Fig. 2. The dimensions of the chassis and front panel are such that the finished amplifier will exactly fit the Fircastle cabinet mentioned earlier. The chassis itself is simply a flat sheet of 16 s.w.g. aluminium and the front panel is secured to it by means of ½ x ½in. aluminium angle.

Note: Do not under any circumstances use duralumin for the construction of the chassis and front panel or the pre-amplifier screens. The oxidation that forms on Dural can produce high resistance earthing connections between the pre-amplifiers and power output modules resulting in both h.f. and l.f. instability. A prototype of this amplifier was in fact assembled on a Dural chassis with resultant h.f. and l.f. instability and hum loops.

Details of the front panel size and drilling are given in Fig. 3. Note, that the dimensions of the
Complete Soldering Kit 55/-
This contains the iron fitted with a $\frac{1}{8}$" bit, interchangeable spare bits $\frac{3}{4}$" and $\frac{1}{2}$", resin cored solder; felt cleaning pad; stand for soldering iron, and a booklet "How to solder." From Electrical and Radio Shops or send cash to Antex.

Model CN 240/2
15 watts - 240 volts 34/-
Fitted with nickel plated bit $\frac{1}{8}$" and in handy transparent pack. From Electrical and Radio Shops or send cash to Antex.
### MATCHED TRANSISTOR

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Qty</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>6934</td>
<td>16/6; 2000mfd</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

### Suppliers

- **BENTLEY**
  - 60136
  - 60D60
  - 6BW7
  - 6B87
  - 186
  - 42
  - 36D5
  - 18/8
  - 30PL1
  - 30P18
  - 301
  - 30C

### Business Information

- **23/-**
- **14/6**
- **8/0**
- **9/-**
- **6/9**
- **3/8**
- **10/6**
- **8/6**
- **9BW8**
- **6/0**

### Other Details

- **IC3**
- **7/-**
- **4/6**

### Save Postal Costs, Cash and Carry Callers Welcome!

Terms of Business: Cash with order only. Post/Packing 6d per item. Orders over 45 post free. No C.O.D. Any parcel insured against damage in transit for 6d extra per order. Hours of business Mon. 10am to 6pm. Tues. 10am to 9pm. Wed. 10am to 9pm. Thurs. 10am to 9pm. Fri. 8am to 7pm. Sat. 9am to 5pm. All orders subject to our General Conditions, terms and conditions, etc. with terms of business 1/. Please ensure for any items not listed with B.A.E. Please note that no enquiries can be answered unless a B.A.E. is enclosed with reply. Minimum export order 25.00

---

**SOLAR OFFER**

Solar energy panels and components now available. For further details contact customer service.

---

**BENEFIT**

Benefit from our special offers on selected products. Contact us for more details.

---

**SPECIAL OFFER**

Special offer on selected items. Limited stock available. Act fast to avoid disappointment.

---

**AVAILABILITY**

Check our availability list for the latest updates on product availability. Contact us for more information.

---

**.feedback**

Please provide feedback on our services to help us improve. Contact us with your thoughts and suggestions.

---

**ENQUIRIES**

For any enquires, please contact us directly for prompt service and assistance.

---

**Customer Service**

Contact our customer service team for support and inquiries. They are available to answer your questions or concerns.

---

**Contact Information**

- **Telephone:** 01-722-9000
- **Address:** 38 Chalcot Road, London, N.W.I
cut-outs for the mono/stereo switch (S5) the rumble filter switch (S3) and the whistle filter switch (S4) have not been given as these will depend on the physical size of the switches obtained. The front panel must be bolted to the chassis so that the lower edge is \( \frac{1}{4} \) in. below the chassis as shown in Fig. 4.

The next assembly, as shown in Fig. 5, is the U shaped screen the back section of which carries the five pairs of phono type input sockets and a pair for the tape recording outlet. No drilling details have been given for these as the fixing holes will depend on the type of sockets obtained. They should however, all be mounted centrally on the back of the screen as can be seen in the photograph. The actual mounting of the screen onto the chassis should be left until the pre-amplifiers have been assembled, wired and secured in place.

The attenuator resistors for the inputs, which are wired directly to or across the sockets, should be fitted before the screen is secured into position. The remaining metalwork is that of making the mounting 'bracket for the selector switches S1 and S2. Details for this are given in Fig. 6.

Note, that all fixing screws for the power output modules, power supply, selector switch bracket and the large 'U' shaped pre-amplifier screen must be secured with counter-sunk screws with the heads beneath the chassis. The front panel must also be secured to the chassis angle piece with counter-sunk screws and with the heads on the front of the panel. These are covered with an aluminium strip as will be shown later.
### Components List

**Resistors:**

<table>
<thead>
<tr>
<th>R1</th>
<th>100kΩ</th>
<th>R5</th>
<th>10kΩ</th>
<th>R14</th>
<th>18kΩ</th>
<th>R18</th>
<th>68kΩ</th>
<th>R2</th>
<th>47kΩ</th>
<th>R26</th>
<th>6.8kΩ</th>
<th>R30</th>
<th>18kΩ</th>
<th>R34</th>
<th>10kΩ</th>
</tr>
</thead>
<tbody>
<tr>
<td>R2</td>
<td>1.5MΩ</td>
<td>R6</td>
<td>56kΩ</td>
<td>R15</td>
<td>6.8kΩ</td>
<td>R19</td>
<td>22kΩ</td>
<td>R23</td>
<td>3.9kΩ</td>
<td>R27</td>
<td>1kΩ</td>
<td>R31</td>
<td>100kΩ</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R3</td>
<td>220kΩ</td>
<td>R7</td>
<td>390kΩ</td>
<td>R16</td>
<td>22kΩ</td>
<td>R10</td>
<td>22kΩ</td>
<td>R24</td>
<td>47kΩ</td>
<td>R28</td>
<td>10kΩ</td>
<td>R32</td>
<td>270Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R4</td>
<td>5.6kΩ</td>
<td>R13</td>
<td>560Ω</td>
<td>R17</td>
<td>390kΩ</td>
<td>R21</td>
<td>15kΩ</td>
<td>R25</td>
<td>3.9kΩ</td>
<td>R29</td>
<td>6.8kΩ</td>
<td>R33</td>
<td>2.2kΩ</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All ¥ 10%. Note: 2 of each required.

**Capacitors:**

<table>
<thead>
<tr>
<th>C1</th>
<th>2.5µF Electrolytic</th>
<th>C9</th>
<th>2.5µF Electrolytic</th>
<th>C17</th>
<th>6800pF</th>
</tr>
</thead>
<tbody>
<tr>
<td>C2</td>
<td>10µF Electrolytic</td>
<td>C10</td>
<td>3300pF</td>
<td>C18</td>
<td>10µF Electrolytic</td>
</tr>
<tr>
<td>C3</td>
<td>100µF Electrolytic 6.3V</td>
<td>C11</td>
<td>3300pF</td>
<td>C19</td>
<td>10µF Electrolytic</td>
</tr>
<tr>
<td>C4</td>
<td>100µF S.M. Electrolytic</td>
<td>C12</td>
<td>10µF Electrolytic</td>
<td>C20</td>
<td>2.5µF Electrolytic</td>
</tr>
<tr>
<td>C5</td>
<td>3300µF Electrolytic</td>
<td>C13</td>
<td>0.01µF Electrolytic</td>
<td>C21</td>
<td>0.01µF Electrolytic</td>
</tr>
<tr>
<td>C6</td>
<td>0.01µF Electrolytic</td>
<td>C14</td>
<td>0.01µF Electrolytic</td>
<td>C22</td>
<td>100µF Electrolytic 6.3V</td>
</tr>
<tr>
<td>C7</td>
<td>0.01µF Electrolytic</td>
<td>C15</td>
<td>0.01µF Electrolytic</td>
<td>C23</td>
<td>1.5µF Electrolytic</td>
</tr>
<tr>
<td>C8</td>
<td>10µF Electrolytic</td>
<td>C16</td>
<td>10µF Electrolytic</td>
<td>C24</td>
<td>5000µF 25V W</td>
</tr>
</tbody>
</table>

All electrolytics not less than 25V W except C3 and C22 (6.3V). Two of each required except C24, 1 only.

**Semi-conductors:**

- Tr 1 BC109 Mullard 2 off
- Tr 2 BC108 Mullard 2 off
- Tr 3 BC109 Mullard 2 off
- Tr 4 BC108 Mullard 2 off

**Power Modules and Supply:**

- 2 Power Amplifier module Henlec Type PA25 (Henlys Radio)
- 1 Power Supply unit Henlec Type MU442 (Henlys Radio)

**Miscellaneous:**

- 3 Switches, DPDT, (S3, S4, S5) Slide type.
- 1 Switch, 2 pole 5 way with 2 wafers, ganged. (S1, S2) long spindle or use coupler.
- 1 Switch, SPST, mains toggle.
- 4 Control knobs (Eagle K303)
- 1 Control Knob (Eagle K304)
- 6 Pairs phono sockets (Henlys Radio)
- 1 Mains neon pilot lamp
- 2 Circuit boards plain s.r.b.p. 6× 3½ in. 0.15 matrix
- 1 Aluminium screen 20 s.w.g. same size.
- 2 Circuit boards plain s.r.b.p. 5 × 3½ in. 0.15 matrix
- 1 Aluminium screen 20 s.w.g. same size

Note: Speaker plugs and mains input plug are supplied with the power unit Type MU442. Connecting cables and connectors ready for connection between the power amplifier modules and power supply are supplied with orders for the three units.

**Chassis:**

- 1 Chassis plate, 16½ x 8½ in. 16 s.w.g. aluminium.
- 1 Panel, 16½ x 4½ in. 16 s.w.g. aluminium.
- 1 Screen, 18½ x 3½ in. 16 s.w.g. aluminium (may be made from separate pieces, see Fig. 5).
- 4ft. Aluminium angle, ½ x ½ in.

**Cabinet:**

- Amplifier cabinet, colour teak, PW1.
- Amplifier cabinet, colour walnut, PW2.

Either of the above cabinets, to take a chassis to the dimensions given, can be obtained from Fircastle Ltd., 4 Eldon Way, Hockley Trading Estate, Hockley, Essex, at £3.60 inc. packing and postage, C.W.O. only. Cabinet includes chassis fixing screws and plastic feet.
Many New Models!
in the FREE
HEATHKIT 1971 Catalogue..

Here's the bumper Heathkit catalogue for you. Read about the wonder and fascination of kit building ... see in full colour the world's best values in Hi-Fi ... Radio, and even model radio control. Get up to date with what's new in scientific instrumentation ... instruments for test and service ... in fact there is a Heathkit for almost every purpose, in every walk of life. A wealth of information is all yours for the price of a postage stamp, in the Free Heathkit Catalogue.

★ No previous knowledge of electronics required.
★ The constructional manual supplied with every kit shows you how.
★ Building Heathkit models is so economic.
★ Save up to 50% over factory built equipment.
★ Money saving direct from factory prices.
★ They make excellent Christmas gifts.

HEATH (Gloucester) LTD, GLOUCESTER GL2 6EE

(Fill in the coupon for your free catalogue today.)

A Schlumberger Company

Many other models in wide range . . .

Name .................................................................
Address .............................................................
.................................................................
Post Code ........................................................
Radio Mechanics—read this now
£100 a year for a fortnight’s camp plus 2 week ends

You are paid the above minimum amount for a fortnight’s camp in the Summer, sometimes abroad, plus two week ends in the Winter by joining the ROYAL ELECTRICAL & MECHANICAL ENGINEERS, TERRITORIAL AND ARMY VOLUNTEER RESERVE as an Army Telecommunications Technician—Existing Volunteers find it great for a change from the same dull routine and faces. Adventure and comradeship as a member of an Army Unit are the keynotes, but full use is made of your trade skills and at least one year in every three you will be taught new techniques and new equipment as an individual at one of REME’s Ultra Modern Technical Schools. As a Telecommunications Technician you will work on Army receivers and transmitters employing both valves, transistors, printed circuits and their ancillary equipment, using modern electronic test equipment. You are not expected to know it all on entry.

We are interested in men between 18 and 40 years of age with or WITHOUT former service. We want men with apprenticeships and several years’ practical experience plus a good basic theoretical knowledge and are also interested in the enthusiastic amateur who does another job but spends much of his time working on (and not dreaming about) radio. We need practical men who can do a job of work.

If you are one of these tell us about your experience.

Let us send you details. Fill in the coupon and post it now.

Be a soldier, go abroad—and get paid for it

TO: CVHQ REME
BROXHEAD HOUSE, BORDON, HANTS.

Please send me details of the T & AVR REME:
Name: __________________________ Age: _______
Address: ___________________________________
__________________________________________
Details of experience _______________________
__________________________________________
__________________________________________
Input sockets mounted on this panel.

Fig. 4: (top right) Fixing of panel to chassis.
Fig. 5: (above) Details of pre-amplifier screening.
Fig. 6: (bottom right) Mounting bracket for selector switches S1 and S2.

PART 2
NEXT MONTH
WILL INCLUDE FURTHER CONSTRUCTIONAL DETAILS AND INFORMATION ON TESTING THE PW25-25 STEREO AMPLIFIER.

ORDER YOUR COPY NOW!

To 
(Name of Newsagent)

Please reserve/deliver the DECEMBER issue of PRACTICAL WIRELESS (3s. 6d.), on sale NOVEMBER 6th, and continue every month until further notice.

NAME

ADDRESS
The ease of tuning and band coverage of home-constructed receivers can often be increased and extended without much difficulty. Some modifications, such as adding a fine tuning control, are very simple. Other changes, such as providing "Luxembourg bandspread" or adding an extra waveband, require more changes but can greatly increase the utility of a receiver.

Except for some points, miniature, pocket-size and commercially manufactured receivers do not usually lend themselves well to conversion.

**Fine Tuner**

This is a device found on certain commercial receivers, and has a vernier effect to ease the precise tuning of a transmission. Fig. 1 is a typical circuit. VC1/VC2 are the usual ganged tuning capacitor sections, with trimmers TC1 and TC2. The fine tuner VC3 is connected across the oscillator tuning capacitor VC2, and is of very small value—about 2.5pF to 4pF.

VC3 is connected to VC2 with reasonably short leads, and has a knob for panel operation. Because VC3 is so small, the practical loss of efficiency from possible mis-alignment with the circuit tuned by VC1 is ignored. With VC3 half closed, TC2 is slightly unscrewed to trim the circuits as usual (as at the h.f. end of the m.w. band). VC1/VC2 is then used as before, with VC3 as fine tuner when required.

**Ganged Bandspeeding**

This is most appropriate in a receiver having one or more ranges, with perhaps a rather small or low-ratio drive. In Fig. 2 VC1/VC2 is the usual tuning capacitor, with trimmers TC1/2. VC3/VC4 is a 2-gang capacitor with its sections in parallel with VC1/VC2.

Since the ganged bandspeeding capacitor places additional capacitance across both VC1 and VC2, it can be of larger value than VC3 in Fig. 1. About 15 to 20pF is generally best. Miniature 2-gang 17pF v.h.f. f.m. capacitors, available with built-in reduction drive if wanted, will do well. To maintain previous calibration of VC1/VC2, place VC3/VC4 half closed, and unscrew TC1 and TC2 a little to compensate.

**"Luxembourg Bandspeed"**

This is really a system which extends a small portion of the h.f. end of the m.w. band, so that it occupies the whole of the tuning capacitor swing. As an example, the usual m.w. band may be about 190-550m. Of this, the portion around 190-210m will occupy only an extremely small part of the tuning range, with the capacitor almost fully open. With "Luxembourg bandspeed" a further range is obtained, about 185-210m, over the whole movement of the tuning capacitor.

Fig. 2: Bandspeeding applied to aerial and oscillator circuits.

Bandspeeding in this way can be of enormous advantage when tuning s.w. signals, and also occasionally on other ranges, such as at the h.f. end of the m.w. band.

Fig. 3: Circuit providing bandspeed over a part of a band.

Fig. 3 is a "Luxembourg bandspeed" circuit for the usual m.w./l.w. receiver having a 208/176pF ganged tuning capacitor. A similar arrangement can be used with other receivers. The wavechange switch
WAY OUT—of the component finding maze .......

It may be fun finding your way out of the maze at Hampton Court, but it's not so funny trying to locate and obtain just the components you need for a particular job. In fact, the number of problems and frustrations you can meet is quite a maze-ing!

There is an easy way out however. Simply get a copy of the Home Radio Catalogue and order whatever you need from the comfort of your easy chair. This famous radio and electronic constructor's "Bible" lists over 8,000 items, more than 1,500 of them illustrated. At only 12/6d. (8.6d. plus 4/- post & packing) it's a gift—especially as each copy contains 6 vouchers, each worth 1/- when used as directed.

Once you have your Home Radio Catalogue you can make life even easier for yourself by joining our Credit Account Service. Then you can order by telephone any time of day or night, Sundays included! No need to bother with postal orders, cheques, registering envelopes every time you order. We send prepaid envelopes and you make only one payment each month. So simple! Write for details or telephone 01-648 8422.

YOUR FIRST STEP out of the maze—Post the Coupon with your cheque or P.O. for 12/6d

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

Please write your Name and Address in block capitals

NAME .................................................................
ADDRESS .............................................................
.............................................................................
.............................................................................
.............................................................................
.............................................................................
HOME RADIO (Components) LTD., Dept. PW, 234-240 London Road, Mitcham, Surrey, CR4 3HD
SHORTWAVE TRANSISTOR RADIO
Can be built in one evening
ONLY 45/-

At last! After trying countless circuits searching for easy build, work-first-time short wave, giving advanced world wide performance, we chose this "Sky Ham" Anyone from 9 years up can follow the step-by-step, easy-to-read circuit diagram, fully illustrated instructions. We built ten prototypes and everyone worked first time on完美ing necessary. The stations logged on were: Australian West Indies, Africa, Europe, Asia, South America, North America, etc. Experience thrilled by world wide news, sport, music, etc. Brevelling on unusual broadcasts. Use 27F battery. Transistorised (no valves). Size only 3" x 4" x 3". A tremendous demand anticipated prior to only 45/- + 3/6 F. A p. n. for all parts including cabinet, artwork, instructions, etc. (Parts available separately.) Money back guaranteed.

ULTRA-SIMPLE TREMOLO UNIT
Using very simple circuit techniques, this economic design is capable of providing tremolo modulation of an electric musical instrument which is controllable both in depth and speed.

FREE
A three-page art paper cut-out colour supplement featuring Circuit Diagram, Components List, Printed Board Details, Point-to-Point Wiring Diagram and Cabinet Details for this 2-transistor (ACY-19, OC44) unit.

WELBROOK HI-FI AMPLIFIER KIT
During last year Welbrook introduced to the Hi-Fi field their unique output stage which was a completely new break-through in high-fidelity Audio Design. It enabled us to produce an amplifier, giving a level of distortion at low output levels, normally associated with CLASS A or truly complimentary output stages, but still retaining the low relative cost and advantages of a CLASS B quasi-complimentary stage.

To maintain our position as a forerunner in the audio field, we now introduce this amplifier in kit form.

Consider the following brief specification and then note the price.

POWER OUTPUT:
10 watts R.M.S. per channel (8 ohms).

T.H.D.:
Typically less than 0.1% for all output levels up to 10 watts.

INPUTS:
Magnetic — ceramic — crystal P.U.
Tuner.
Tape.

OUTPUTS:
4 - 8 - 15 ohms.
Tape Output.
The kit consists of a fibre-glass P.C.B., 20 silicon transistors, 12 silicon diodes, approximately 140 electronic components, and all materials required to complete a chassis mounted amplifier, including front panel and knobs.

PRICE: £32 0s. 0d.
(Cabinet Extra).

Further details and fully illustrated leaflets available.

Welbrook Engineering and Electronics Limited
Brooks Street, Hr. Hillgate, Stockport, Ches.

Phone: 061-480 4268.

LOOK AT THESE PRICES
CARTRIDGES
Acoe GP9-2, GP9-3UC 22/6; Acoe GP93-1 8/6; Acoe GP96-1 22/9; Somersons STAVIC 22/6; All above in makers cartons: BSR X49 8/6-

1 WATT AMPLIFIER
Complete with volume control, rectifier, smoothing filter, transistorised, OUR PRICE 27/6

PLUGS & SOCKETS
Phono plugs, red, white, yellow, green, grey, blue, black 1d per pair; DIN plugs, aluminium 6d; DIN couplers 1d; 2 pin DIN plugs 3d; 3 pin DIN plugs 5d; 5 pin DIN plugs 8d; 3 pin DIN sockets 1/5; 4 pin DIN sockets 2/10; Enhanced plugs 8d; sockets 8d; Banana plugs 1/6; sockets 1/8; 3.5mm J/Plugs 1/8 & 2/9; Standard J/Plugs with solder terminals 1/2; Chrome 3/8; Slotted Entry J/Plugs black and chrome 3/6; Insulated J/sockets 3/10, 8/6, 1/2.

ELECTROLYTIC CAPACITORS
4uF, 1.05v 9d; 6uF 500v 5d; 8uF 12v 1/4; 10uF 350v 8d; 15uF 12v 9d; 22uF 450v 6d; 30uF 12v 9d; 47uF 12v 9d; 50uF 10v 15d; 100uF 15v 8d; 150uF 12v 9d; 220uF 9v 1/2; 1000uF 20v 8d; 220uF 20v 8d; 330uF 20v 8d; 500uF 30v 18d; 1000uF 30v 18d; 4700uF 30v 18d; 5000uF 30v 18d; 10,000uF 30v 18d.

MICROPHONES
Acoe Mic 45 £2; Acoe Mic 60 18s/11: Planet CM 70 26/-; Hand Mike 18/-; Hobie 201 £2; Hobie 444 £16.0.

VALVES
FP51/2; FC12; 75/2; EF183 £2/-; EF184 £.- PLEASE NOTE CHANGE OF ADDRESS.

GEORGE FRANCIS (Dept PW),
18-14, Middle Gate, Newark, Notts.
Telephone: Newark 4723.
is removed, and replaced by a small 3-way, 4-pole rotary switch. This has three positions, Bandspread, Medium Waves and Long Waves.

VC1/VC2 tunes aerial and oscillator inductors, and has trimmers TC1 and TC2. For l.w. reception, L1 and L2 are in series, tuned by VC1. S2 switches the mixer transistor base to the coupling winding of the long wave section of the ferrite rod aerial, L2. S3 brings the capacitor C2 across L3, for oscillator tuning, while S4 connects VC2. For m.w. tuning, S3 shorts out L2 and S2 switches to L1 coupling winding. After fitting the 3-way switch, normal l.w. and m.w. reception should be obtained with the switch in its appropriate position.

With the switch at Bandspread, S2 and S3 are for m.w. coverage as before, S4 places C3 in series with VC2, so that the capacitance swing for the full rotation of VC2 is greatly reduced. S1 brings TC3 into series with VC1, for a similar limited frequency coverage here. This circuit is aligned in the usual way for m.w. reception. The switch is then put to Bandspread and a transmission tuned in with VC1/VC2 fairly well closed. TC3 is then carefully adjusted for best results. TC1 and TC2 may be adjusted, if necessary, for a coverage of about 185-210m.

Some circuits have separate trimmers for m.w. and l.w. If so, these can generally remain unchanged. Bandspread coverage can be changed by altering C3 which can be a pre-set trimmer. In some circuits both TC3 and C3 are fixed.

Manual Control

Many receivers have a 208/176pF capacitor with knob or dial directly on the shaft. Some capacitors of this kind are available with an integral ball drive, requiring no additional space. This will be found to ease manual adjustment of tuning.

In some home-built and other receivers it is possible to fit a 6:1 or other small ball drive to the capacitor spindle, setting the capacitor back a little on a bracket, or long bolts.

Adding 1,500m or Long Waves

Some receivers cover medium waves only, but in some parts of the country long wave coverage is extremely useful. This may tune a band around 1500m only, or give full l.w. coverage of about 1100-2000m.

Fig. 4 has the advantage that the aerial needs a m.w. winding only. This is L1, tuned by VC1 with trimmer TC1. L2 is the osc. coil, with usual padder Cp, and tuned by VC2. For 1500m, the switch places C1 across L1. Oscillator tuning is changed by C2, in a similar way to circuits with full l.w. coverage. This circuit does not give full l.w. band coverage, but allows VC1 to tune around 1500m.

The values for C1 and C2 were suitable for an actual typical receiver, but should be checked by experiment first. C1 can be fixed and pre-set capacitors in parallel, adjusted until 1500m is reached with VC1 about half closed. A quite large trimmer (say 500pF) is required. C2 may also be a combination, such as 175pF fixed capacitor with 60pF parallel trimmer.

If the receiver is a midsize design with no free space, a large variable ganged capacitor can be temporarily used at C1, and a smaller variable at C2. These are adjusted to tune 1500m, then disconnected. Their capacitances are measured, and suitable silver-mica fixed capacitors used in their place. With some simple t.r.f. receivers covering m.w. only, adding a suitable capacitor C1 will allow 1500m to be tuned with reasonable efficiency.

Two-band Tuning

When full medium wave and long wave coverage is required, a l.w. winding is used on the ferrite rod. Fig. 5 is a circuit which requires only a miniature 2-way slide switch.

VC1 tunes L1 for m.w. coverage, L3 being shorted out, and L2 being for base coupling. VC2 tunes the oscillator coil L4, with padder C1. M.W. trimming is by adjustment of TC1 and TC2 with alignment at the l.f. end of the band by moving L1 on the ferrite rod and adjusting the core of L4 in the usual way.

For l.w. coverage, the switch leaves L1 and L3 in series, and also brings in the additional capacitor C2, with trimmer TC3. L.W. alignment is by adjusting the position of L3 on the ferrite rod, and by TC3.

![Fig. 5: Simple circuit for two-band coverage.](image)

Ferrite rod aerials and oscillator coils for long and medium wave coverage are produced by several manufacturers. They are designed for particular capacitor values at C1 and C2, and some employ further switching, such as of base coupling windings. So the circuit and component values specified by the maker of the actual aerial fitted must be adhered to.

A Short Wave Band

A receiver may cover l.w. and m.w. only, and it is often possible to add a short wave band, if certain important points are not overlooked. Other receivers may have a s.w. band, but another range to cover other wanted frequencies may be required.

Fig. 6 is a typical multi-band circuit for which long, medium, and short wave coils are available (Denco) giving coverage up to 30MHz, or 10 metres.

---continued on page 573---
It is difficult to decide whether to regard our topic this month as an i.c. or as a novel type of discrete circuit element developed and manufactured by the methods employed for integrated circuits. I am referring to the Mullard TAA320, which the supplier describes as an "Integrated metal oxide silicon I.F. preamplifier," or more imaginatively in the U.S.A. as a "bifet."

It is obvious by now that a few terms will have to be defined before designs and applications can be discussed. Readers will be familiar with the fact that as well as the now familiar transistor operating with two opposed p.n. junctions (and therefore properly described as a "bipolar" device) there exists also the more recent "field effect transistor" or f.e.t.

Description

This device, as the name implies, does not depend on the conduction characteristics of junctions, but is more nearly equivalent to the valve in its mode of operation, with a gate electrode controlling the current from source to drain. The gate is insulated from the conduction channel between source and drain by a very thin layer of a metallic oxide, and as would be expected, the standard modern f.e.t. is based on silicon technology. Hence the full title, metal oxide silicon field effect transistor, or m.o.s.f.e.t. (Just to add to the complexity, some references will indicate that the m.o.s.f.e.t. is a specialised form of the i.g.f.e.t. the name deriving from the fact that it has an insulated gate).

As is well known, the bipolar transistor is a current operated device, with the injection of charge carriers into the base from the emitter region. The f.e.t. is much more like the valve in its mode of operation, being a purely voltage controlled ("field") device. It therefore shares with the valve the high input impedance characteristic so useful in sensitive low noise amplifiers, yet requiring some complicated feedback system in bipolar circuits. It is therefore a "natural" for use with crystal pick-ups, strain gauges, electrometers and similar signal sources with very low current levels but with voltages of the order of tens of millivolts.

**Table 1: Ratings of TAA320**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drain to source volts ($V_{oss}$)</td>
<td>$20\text{ V max}$</td>
</tr>
<tr>
<td>Gate to source volts ($V_{gs}$)</td>
<td>$20\text{ V max}$</td>
</tr>
<tr>
<td>Gate to source max. non repeating surge</td>
<td>$100\text{ V max}$</td>
</tr>
<tr>
<td>Drain Current ($I_D$)</td>
<td>$25\text{ mA max}$</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$200\text{ mW max}$</td>
</tr>
<tr>
<td>Gate to source resistance</td>
<td>$10^{11}\text{ ohms min.}$</td>
</tr>
<tr>
<td>Noise voltage (typical, 50Hz-15kHz)</td>
<td>$10\mu\text{V}$</td>
</tr>
</tbody>
</table>

The voltage gain of an f.e.t. alone is less than unity (typically 0.9) but the current gain is up to 1000, and therefore a good power amplification is associated with a very low noise figure. The advance which the TAA320 represents is that it associates the low output impedance and associated ease of matching to following circuits which is typical of the bipolar transistor with the input characteristics which give the f.e.t. its attractions. Finally, the price of around 13s. is strikingly less than an f.e.t. alone cost only a year or so ago.
Applications

Now for a few ideas on applications. The feature which will be noted first is the shorting clip with which the device is fitted when supplied. The reason is that the insulation of the gate, while inherently of a very high resistance, is subject to failure before the device is installed should it be subject to static charges, such as those workers may induce through friction with synthetic fabrics.

These charges, though small, represent voltages much higher than the hundred or so which will "punch through" the gate insulation. After incorporation in equipment, however, the device is protected against such an event by the presence of the associated bias resistor and other external circuitry, and thereafter shares the reliability which is associated with modern silicon semiconductors.

2 watt audio amplifier for high-impedance microphone or pickup.

This should be taken as a warning, though, not to accept units lacking this clip, since they may have been damaged in transit, and further, not to remove the clip until the unit is safely soldered in place.

The application circuit diagram given shows a 2 watt silicon semiconductor amplifier designed to match a crystal pickup or microphone signal source; the BD115 stage may, of course, be replaced by any power amplifier of higher power at the discretion of the constructor. Further, a basic electrometer (microammeter) or instrumentation amplifier is also shown, which can be used for strain gauges, pH meters, or other devices in the amateur laboratory or for "science fair" projects.
IT was once again underlined at a recent IEA Exhibition at Olympia: engineers are children at heart.

Among the gleaming computers, the hardware and software of this electronic age, the queues could be seen forming for the Honeywell, Computer Technology and Electronic Associates stands. And why? because these lads had learned the secret of audience participation.

Hardworking electronic engineers had saved and scrimped—their energy if not their cash—towards this day’s outing, and were not to be cheated. To heck with the hard facts, one could read those up tomorrow: let’s have a go at some competitive pastime and try to win a week with a dolly-bird in remotest Canvey Island—or something.

More often than not it was less than nothing.

The sort of prize that the intellectual gentlemen on the computer stand tends to offer is merely the satisfaction of competing. Not, you will note, of having won. Like the Mullard “Grasp the Ball” gimmick that caught attention when the Radio Show was a one-piece exhibition (do you remember that far back, Joe?) the principle of electronic games is usually to demonstrate that frailty is human and the machine will always win.

Of course, there is a serious purpose behind these games: the need to demonstrate the wide range of parameters the computer can handle, and the speed with which it churns out its solutions. But when Henry reads those wonderful “ten thousand decisions in only ten seconds” claims, he is sorely tempted to ask what was done with the minutes saved. Did some clever fellow find time to polish up a sonnet?

But let’s not think that all was serious study at Olympia—although the concentration of some of those gamesters was in direct contrast to the open grins and carefree words of some of the fortune hunters on the peripheral stands. (Henry is no tipster, but if he had a few quid to spare, they would go into computer peripherals, where there seems to be no limit to development).

Some of the more rewarding games included a free holiday from MCP Electronics for the solution to a simple word game, and a free bottle of Scotch from the Marconi-Elliott Microelectronics stand. One does not easily obtain the products of Glenrothes, even by paying, so it is as well to mention that the prize was only offered to visitors who could pick a dud microcircuit in a batch of 10,000 randomly shipped from the factory.

Beauty of this competition was that it gave the trier a chance to do a spot of fault-finding with the Tetradyne. After seeing the recent Mullard film on microcircuit testing and reading about the RCA tester that vets a phenomenal number of ICs daily, Henry began to wish he could rig up a universal tester in his workshop into which all the tough dogs could be fed. But what would I do with the time I saved?

Oh yes, there was a treasure hunt. There had to be a treasure hunt. What would any electronics exhibition be without its treasure hunt, I ask you? This one had a serious portent. Beckman Instruments are rather proud of the fact that they introduced the first commercially available pH meter 35 years ago. They are celebrating their anniversary (thirty-fifth, what’s that?) They hope that some hoarder will have an old instrument tucked away in the loft—or, to be even more satisfying, still in operation. The winner to be flown to the company headquarters at Fullerton, California, to receive his prize.

The irony is that the prize will be a new pH meter, a digital version, no less.

It is hard not to accuse Celdis of opportunism when one reads—one dared not participate—that their competitive venture was a chance to specify the design and equipment for their new application laboratory at Reading. The winner did not get the offer of the job of chief designer, but merely pocketed 100 guineas.

There, we fell to discussing the layout and design of wireless repair workshops.

It would not be a bad idea to start PW readers along those lines—Henry offers two guineas for the most fruitful and original idea towards the design and equipment of a small workshop. How’s that for a game worth playing?
<table>
<thead>
<tr>
<th>List</th>
<th>Cash Price</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACETATE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goldring Garrard TURNTABLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TURNTABLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MacDonald MP60</td>
<td>£15</td>
<td>£10 10</td>
</tr>
<tr>
<td>MacDonald 510</td>
<td>£16</td>
<td>£13 10</td>
</tr>
<tr>
<td>MacDonald 520</td>
<td>£18</td>
<td>£14 10</td>
</tr>
<tr>
<td>Macdonald 310</td>
<td>£19</td>
<td>£16 10</td>
</tr>
<tr>
<td>Macdonald B-400 &amp; Case Cover</td>
<td>£20</td>
<td>£17 10</td>
</tr>
<tr>
<td>Dual 1219</td>
<td>£21</td>
<td>£18 10</td>
</tr>
<tr>
<td>Dual 1019</td>
<td>£22</td>
<td>£19 10</td>
</tr>
<tr>
<td>Transcriptor Reference</td>
<td>£23</td>
<td>£20 10</td>
</tr>
<tr>
<td>Garrard 401</td>
<td>£24</td>
<td>£21 10</td>
</tr>
<tr>
<td>Garrard SL66B</td>
<td>£25</td>
<td>£22 10</td>
</tr>
<tr>
<td>Garrard SL5B</td>
<td>£26</td>
<td>£23 10</td>
</tr>
<tr>
<td>Garrard APT6</td>
<td>£27</td>
<td>£24 10</td>
</tr>
<tr>
<td>Garrard M60 M. II</td>
<td>£28</td>
<td>£25 10</td>
</tr>
<tr>
<td>Garrard AP76 Transcription</td>
<td>£29</td>
<td>£26 10</td>
</tr>
<tr>
<td>Send for details</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SPEAKERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B &amp; W DM1</td>
<td>£22 10</td>
<td>£21 00</td>
</tr>
<tr>
<td>B &amp; W DM1 Monitor</td>
<td>£23 10</td>
<td>£22 00</td>
</tr>
<tr>
<td>EMIR M 10</td>
<td>£24</td>
<td>£20 10</td>
</tr>
<tr>
<td>EMIR M 12</td>
<td>£25</td>
<td>£21 10</td>
</tr>
<tr>
<td>Celestion Ditton 15</td>
<td>£26</td>
<td>£22 10</td>
</tr>
<tr>
<td>Celestion Ditton 20</td>
<td>£27</td>
<td>£23 10</td>
</tr>
<tr>
<td>Goodman Magister</td>
<td>£28</td>
<td>£24 10</td>
</tr>
<tr>
<td>Goodman Magnum K</td>
<td>£29</td>
<td>£25 10</td>
</tr>
<tr>
<td>Goodmans Mezzo II Walnut</td>
<td>£30</td>
<td>£26 10</td>
</tr>
<tr>
<td>KEF Celeste M 2</td>
<td>£31</td>
<td>£27 10</td>
</tr>
<tr>
<td>KEF Chorister</td>
<td>£32</td>
<td>£28 10</td>
</tr>
<tr>
<td>KEF Concordo</td>
<td>£33</td>
<td>£29 10</td>
</tr>
<tr>
<td>KEF Cresono</td>
<td>£34</td>
<td>£30 10</td>
</tr>
<tr>
<td>Leak Mini—Sandwich Walnut</td>
<td>£35 10</td>
<td>£32 10</td>
</tr>
<tr>
<td>Leak Mini—Sandwich Rosewood</td>
<td>£36 10</td>
<td>£33 10</td>
</tr>
<tr>
<td>Leak Speaker Teak</td>
<td>£37</td>
<td>£34 10</td>
</tr>
<tr>
<td>Oak Acoustofoam</td>
<td>£38</td>
<td>£35 10</td>
</tr>
<tr>
<td><strong>LISTENERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dual 900</td>
<td>£39</td>
<td>£36 10</td>
</tr>
<tr>
<td>Dual 1000</td>
<td>£40</td>
<td>£37 10</td>
</tr>
<tr>
<td>Dual 1007</td>
<td>£41</td>
<td>£38 10</td>
</tr>
<tr>
<td>Dual 1109</td>
<td>£42</td>
<td>£39 10</td>
</tr>
<tr>
<td>Dual 1109</td>
<td>£43</td>
<td>£40 10</td>
</tr>
<tr>
<td><strong>CARTRIDGES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Audio Technica AT-56</td>
<td>£45</td>
<td>£42 00</td>
</tr>
<tr>
<td>Audio Technica AT-66</td>
<td>£46</td>
<td>£43 00</td>
</tr>
<tr>
<td>Audio Technica AT-76</td>
<td>£47</td>
<td>£44 00</td>
</tr>
<tr>
<td>Audio Technica AT-86</td>
<td>£48</td>
<td>£45 00</td>
</tr>
<tr>
<td>Audio Technica AT-96</td>
<td>£49</td>
<td>£46 00</td>
</tr>
<tr>
<td><strong>TUNERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tuner TK500X</td>
<td>£75 10</td>
<td>£72 00</td>
</tr>
<tr>
<td>Tuner PX500</td>
<td>£76</td>
<td>£73 10</td>
</tr>
<tr>
<td>Quad FM</td>
<td>£81 00</td>
<td>£78 00</td>
</tr>
<tr>
<td><strong>AMPLIFIERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£112 10</td>
<td>£109 10</td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£123</td>
<td>£120 00</td>
</tr>
<tr>
<td><strong>RECEIVERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotel RX90</td>
<td>£134 10</td>
<td>£131 00</td>
</tr>
<tr>
<td><strong>ACETATE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CAJIVE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>av Tec Street</td>
<td>5 Bridge Street</td>
<td>Rivern But 01 949 1441 till 8pm</td>
</tr>
</tbody>
</table>

Our demonstration rooms are equipped to enable you to listen to at least 40 different speakers and a large range of amplifiers, turntables and turntable systems, and higher more sophisticated systems.

L.P. RECORDS—Up to 15% off. Send S.A.E. for lists. Our stock of new equipment is extensive and carries full manufacturers' guarantee. The above list is only representative of the equipment stocked by us. Equipment can be installed in any part of London, customers rarely being kept waiting. Overseas customers welcome. Personal Export arranged.

P & C on most units is 12½% Insurance 2/- per £10 value. P & C on Tape Recorders is 17½. P & C on cartridge is 3½%.

Prices quoted above are our selling prices at the time of going to press and are subject to change without notice. Special Carriage Charges for deliveries.

**LISTENERS**

<table>
<thead>
<tr>
<th>List</th>
<th>Cash Price</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMPLIFIERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£112 10</td>
<td>£109 10</td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£123</td>
<td>£120 00</td>
</tr>
<tr>
<td><strong>RECEIVERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotel RX90</td>
<td>£134 10</td>
<td>£131 00</td>
</tr>
<tr>
<td><strong>ACETATE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TUNERS**

<table>
<thead>
<tr>
<th>List</th>
<th>Cash Price</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMPLIFIERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£112 10</td>
<td>£109 10</td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£123</td>
<td>£120 00</td>
</tr>
<tr>
<td><strong>RECEIVERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotel RX90</td>
<td>£134 10</td>
<td>£131 00</td>
</tr>
<tr>
<td><strong>ACETATE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TUNERS**

<table>
<thead>
<tr>
<th>List</th>
<th>Cash Price</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMPLIFIERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£112 10</td>
<td>£109 10</td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£123</td>
<td>£120 00</td>
</tr>
<tr>
<td><strong>RECEIVERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotel RX90</td>
<td>£134 10</td>
<td>£131 00</td>
</tr>
<tr>
<td><strong>ACETATE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TUNERS**

<table>
<thead>
<tr>
<th>List</th>
<th>Cash Price</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMPLIFIERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£112 10</td>
<td>£109 10</td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£123</td>
<td>£120 00</td>
</tr>
<tr>
<td><strong>RECEIVERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotel RX90</td>
<td>£134 10</td>
<td>£131 00</td>
</tr>
<tr>
<td><strong>ACETATE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TUNERS**

<table>
<thead>
<tr>
<th>List</th>
<th>Cash Price</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AMPLIFIERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£112 10</td>
<td>£109 10</td>
</tr>
<tr>
<td>Pioneer SX440</td>
<td>£123</td>
<td>£120 00</td>
</tr>
<tr>
<td><strong>RECEIVERS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rotel RX90</td>
<td>£134 10</td>
<td>£131 00</td>
</tr>
<tr>
<td><strong>ACETATE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
FOLLOWING THE TRANSISTOR AND DIODE TESTER OF LAST MONTH WE ARE PLEASED TO PRESENT THE SECOND PIECE OF TEST EQUIPMENT IN OUR NEW SERIES

THE Capacitance and Resistance Bridge, to be described, can be used to check capacitors in the range 10 pF to about 100 µF and resistors in the range 10 ohms to several megohms.

It consists of a transistor oscillator generating a sine wave voltage at 2 kHz, the isolated output of this oscillator powering a Wheatstone bridge, where one side of the detector is earthed. The basic circuit is shown in Fig. 1.

The condition for balance of the bridge, that is when there is zero output to the detector, occurs when

\[ \frac{Z_a}{Z_b} = \frac{VR_1}{VR_{1b}} \]

The dial associated with VR1 is calibrated in terms of the ratio between the 'standard' and the unknown and is therefore direct reading in terms of capacitance and resistance.

\[ \text{Fig. 1: Basic circuit of CR bridge.} \]

The accuracy of a simple CR bridge is dependent on the accuracy of the components used for the 'standards', and in keeping the stray capacitances and leakage to a minimum. The oscillator transformer, T1, has a secondary winding which has low stray capacity. This transformer is home made and for easy construction it uses a plastic slotted bobbin on a pair of Mullard 'Ferroxcube' 'E' cores.

The detector can conveniently be a small earphone of medium to high impedance. However, it is possible to improve the sensitivity by using a small audio amplifier feeding into a headphone or loudspeaker. A suitable Audio Monitor, for this purpose, will be described in a later article in this series.

Circuit Description

The complete circuit is shown in Fig. 2. The oscillator is a Hartley type employing a pnp transistor, OC72, operating in common emitter mode. Base biasing is provided by R1 and R2 and the operating current is determined by R3. This resistor also provides a measure of negative feedback to reduce the harmonic content of the oscillator output.

The oscillator transformer, T1, has a tapped primary winding, tuned to 2 kHz by C2. The secondary winding has low stray capacity and relatively low output impedance which is suitable for powering the bridge circuit even when used on the low resistance and high capacitance ranges.

The bridge potentiometer, VR1, is a good quality wire-wound type which will give adequate resolution and accuracy. The dial, shown in the heading, full size, has been calibrated for this particular make and type of potentiometer and may not be correct if any other type of potentiometer is used.

The 'standards' built into the bridge determine
the accuracy of the various ranges and these components specified have an accuracy of 1%, or better. Some relaxation of this ideal requirement may have to be accepted, on the grounds of cost and availability. A suggested compromise range of standards is given later.

Transformed Construction

Winding details:

Primary 800 turns of 42 s.w.g. enamelled copper wire tapped at 200 turns.
Secondary 15 turns of 42 s.w.g. enamelled copper wire.

The transformer consists of two Mullard FX1105 E-cores assembled face-to-face inside a plastic bobbin. The bobbin has four winding slots, the primary being wound in two slots at one end of the bobbin and the secondary winding wound in the slot at the opposite end, leaving an empty slot between the two windings.

The easiest way to wind the bobbin is by using a geared hand drill which has been clamped in a vice. Firstly, a small piece of wood, about two inches long is shaped so that it will just slide through the centre hole of the plastic bobbin, so forming a mandrel. A 2BA clearance hole is then drilled down the centre of the wood and a long 2BA screw or length of studding with two nuts is used to fit the wood block to the drill chuck.

The plastic bobbin is then slipped over the wood to the centre and wedged in place with a sliver of paper or card. By checking the gear ratio of the hand drill it will be possible to calculate how many revolutions of the mandrel are required to produce the desired number of turns on the bobbin. The reel of winding wire should be fixed, at some convenient position above the drill, so that it will revolve freely, a pencil, large nail, or screwdriver blade can be used for this purpose.

Before commencing winding it is useful to have cutters or scissors and a few short (\(\frac{1}{4}\) in.) lengths of plastic tape ready cut and easily to hand. These can be used to anchor the winding ends as the job proceeds and will avoid the desire to have three hands for certain parts of the job!

The winding should be started by sticking the end of the wire to the wood mandrel with tape, leaving about three inches of spare end which is wrapped around the mandrel and again stuck with tape.

Completed transformer assembly with, right, a wound bobbin before insertion of the E-cores.

The wire is fed into the end slot through the gap in the end cheek and 200 turns are wound on. The wire should be guided into the slot with the fingers so as to keep a nice even winding. Winding at an even pace is best, as this avoids ‘snatching’ and the possibility of snapping the wire.

At the end of 200 turns, lead out a loop of wire about four inches long and fasten this to the mandrel with tape. Continue winding a further 200 turns in the end slot and then cross the gap into the second slot and wind on 400 turns. Bring out the end of the winding for about four inches and stick down with tape as before.

The secondary winding of 15 turns can now be wound in the slot at the opposite end of the bobbin using the same method.

Having completed the winding it is advisable to fix the outside lead-out wires by putting a drop of ‘Denfix’ polystyrene solution on the top of the winding. When this has set, the winding may be taped over with ‘Sellotape’ or similar tape. The lead-out wires may now be untaped from the mandrel.
and sorted out, taking care not to damage them. The wires then require cleaning and tinning with solder; an operation which requires reasonable care. It is advisable to practise with a spare piece of wire from the reel before attempting to clean the wires on the bobbin.

The tools required are a cigarette lighter or other source of a small flame, a small piece of very fine sandpaper, soldering iron, cored solder, cutters, etc.

The method is to hold the wire above the flame so that the enamel on the wire burns off but the wire remains undamaged, the correct amount of heat can be judged fairly easily after a little experimenting. The sooty copper wire is then cleaned by very gently drawing it through the sandpaper, which has been folded with the abrasive on the inside, remembering that 42 s.w.g. wire has a diameter of only four thousandths of an inch.

The wire should be tinned by applying the cored solder and the iron at the same time so that the wire is in the centre of the active flux. A continuity test should be made of all the windings and if in order, the bobbin can be assembled in between the 'E' cores and a band of tape fixed around the edges of the cores to hold them together.

The core and bobbin may now be clamped between the tag panel and the chassis, and the lead-out wires connected to the appropriate tags. Sleeving may be used on the lead-out wires if required.

If the connections to the tag panel, which are given in Fig. 3, are followed, then the oscillator circuit components may be mounted on top of the panel, as shown.

The phase of the secondary winding is unimportant and connection of the winding either way round will not affect the performance of the bridge.

**Construction**

The CR bridge is built in an Eddystone die-cast box, type 6357P. The controls and components are mounted on the lid of the box, which serves as the front panel of the instrument. The PP9 battery rests inside the box, which forms the main case of the instrument, and, as such, is fitted with plastic feet and a carrying handle.

The drillings for the front panel are given in Fig. 4. The size of hole D should be checked against the terminals used if these are different from those listed. The oscillator transformer is mounted on an aluminium bracket attached to the front panel, details are given in Fig. 5. The bracket is fixed to

---

*Fig. 3: Exploded view of transformer assembly with details of terminal board and bobbin windings.*

*Fig. 4: Drilling plan of panel, viewed from the front. Note: The markings of the two pairs of terminals at the left side should be reversed.*

*Fig. 5: Details of transformer mounting bracket.*
**Components list**

<table>
<thead>
<tr>
<th>Resistors:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>22kΩ 5%</td>
<td>R5</td>
</tr>
<tr>
<td>R2</td>
<td>5.6kΩ 5%</td>
<td>R6</td>
</tr>
<tr>
<td>R3</td>
<td>3.9kΩ 5%</td>
<td>R7</td>
</tr>
<tr>
<td>R4</td>
<td>100Ω 2%</td>
<td>R8</td>
</tr>
<tr>
<td>VR1</td>
<td>10kΩ 3W</td>
<td></td>
</tr>
</tbody>
</table>

All resistors ±W

<table>
<thead>
<tr>
<th>Capacitors:</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>0-01µF 250v 20% moulded tub. polyester</td>
<td></td>
</tr>
<tr>
<td>C2</td>
<td>0-0047µF 250v 20% moulded tub. polyester</td>
<td></td>
</tr>
<tr>
<td>C3</td>
<td>68pF 500V 1% silver mica</td>
<td></td>
</tr>
<tr>
<td>C4</td>
<td>0-001µF 1% (Home Radio Type 2FG25)</td>
<td></td>
</tr>
<tr>
<td>C5</td>
<td>0-01µF 1% (Home Radio Type 2FG29)</td>
<td></td>
</tr>
<tr>
<td>C6</td>
<td>0-1µF 1% (Home Radio Type 2FG33)</td>
<td></td>
</tr>
<tr>
<td>C7</td>
<td>1-0µF 1% (see text)</td>
<td></td>
</tr>
<tr>
<td>TC1</td>
<td>3-30pF concentric (beehive) trimmer</td>
<td></td>
</tr>
</tbody>
</table>

Transformer:

- T1 'E' cores FX1105 (2 off) and bobbin (Henrys Radio)

Miscellaneous:

- Transistor OC72 or similar. Die-cast box (Eddystone Type 6357P). Single pole toggle switch. Single pole 12 way wafer switch. Terminals, 6 off (Belling Lee, 4 mm type) Jack Socket, open type. Battery PP9 and connectors. Plastic feet and handle. Knobs (one modified by fitting pointer). Small quantity 42 s.w.g. enamelled wire. Material for bracket and tag panel.

the front panel by means of a 6BA screw and nut through the smaller hole and by the upper 'detector output' terminal, which passes through the larger hole and clamps the bracket to the front panel.

The oscillator components are mounted on a tag panel, on top of the oscillator transformer and the 'standard' components are mounted directly on the switch, S2, as shown in the photograph.

The wiring from the range switch, S2, and VR1, to the CR terminals should be made in 18 or 20 s.w.g. tinned copper wire, dressed well clear of the panel, to keep stray capacitance to a minimum. The earthed outer cover of VR1 should be carefully removed, to reduce, still further, the stray capacitances from the bridge circuit to chassis.

The die-cast box may be sprayed with one of the usual car touch-up aerosol sprays, BMC Farina Grey was used on the prototype, and then lettered using Letraset, sheet 208.

The dial is fixed to the front panel using 'Cow Gum' adhesive, as this is very clean to work with. The whole front panel may then be protected by spraying with Letracote clear lacquer.

**Calibration**

The overall calibration depends on having the dial pointer set correctly with respect to the scale. To do this, the potentiometer should be slightly loosened from the front panel and the pointer knob fitted to the shaft and tightened up against the spindle flat.

The position of the potentiometer body is then set so that the pointer goes past each end of the scale by the same amount. The knob is then removed, the potentiometer is tightened and the knob re-fitted and checked again for the correct position.

The only range which requires individual calibration is the 100pF range and this is due to the unknown stray capacitances existing in S2 and the associated wiring. This range is calibrated by connecting a 100pF 1% silvered mica capacitor to the CR terminals, setting the dial to the 1:1 position, at the top of the scale, and adjusting TC1 for balance.

**Accuracy**

It is difficult to specify the overall accuracy as this varies with the scale reading, but the greatest accuracy will occur around the centre of the scale and will be about 1-2% worse than the accuracy of the standard. Measurement above about 5MΩ and below about 10pF are subject to greater errors due to the unavoidable stray capacitances.

It is somewhat difficult to find a source of 1µF close tolerance capacitors (for C7) and it may be necessary to accept a 20% type. Alternatively a number of 1µF capacitors could be checked on the 0-1µF range of the bridge and the most accurate one used. Occasionally surplus polystyrene capacitors become available and these are usually 5% or 2½% tolerance and therefore quite suitable.

—continued on page 574

View of the completed CR bridge mounted on the panel of the die-cast box. Note the method of mounting the various 'standard' components on the range switch, top left, to reduce stray capacitance.
THIS article describes a unit which can be used in conjunction with almost all types of short wave receiver. It should prove of particular value used with some of the older models or "surplus" receivers whose sensitivity is not always what one could wish. Basically the unit is a two stage r.f. transistor amplifier with switched broadband pretuned circuits to give a good measure of r.f. signal gain over the bandwidths quoted. In the unit described the three main amateur bands are selected, though the coils can be wound to allow for the selection of the broadcast bands instead, details of alternative channel selection will be given later. The amplifier has the advantage of small size and compact construction with standard 9V to 12V battery or power unit supply and low current drain. It is simple to operate, having only one switched control with input and output sockets, no tuning being required. The amplifier is simply connected between the incoming aerial lead and the receiver aerial socket, no internal connections or adjustments to the receiver are needed.

THE CIRCUIT

The circuit is shown in Fig. 1. The aerial is coupled via C1 directly into the emitter of Tr1, this being connected as a grounded base r.f. amplifier. The advantage of such a circuit is that it provides a very low input impedance with a high output impedance while giving a good measure of gain with optimum bandwidth. The very low input impedance allows direct matching with most types of receiving aerial while the high output impedance allows a tuned circuit of reasonable Q to be used. R1 provides the d.c. return path for the emitter while the base is maintained at a constant voltage level by zener diode ZD1 the current bleed for this being via R3 and base decoupling by C5. The collector load is composed of a number of tuned circuits, these being selected by SI. Collector d.c. feed and decoupling is via R2 and C4. The Q of the tuned circuits allows a reasonable gain to be achieved over the required bandwidth. A higher gain, but narrower bandwidth, is obtained on the l.f. channels, the gain for each band decreasing by a factor of one third, while the bandwidth increases by a factor of three for increasing frequency. The output from the first stage is a.c. coupled to the second stage via C2.

The second stage, Tr2, is a normal emitter follower, R6 being the emitter load while d.c. base bias is obtained through R5. The series resistor R4 prevents parasitic oscillation and, while slightly reducing the input drive to Tr2, makes for a much more stable circuit. The purpose of the output stage is to provide a low impedance output suitable for matching into the receiver, this normally being low impedance. Thus, correct matching is achieved at both ends of the unit. The emitter follower input, having quite a high input impedance, imposes the minimum of damping across the tuned circuit. Tr2, therefore, besides providing the necessary impedance matching, also provides isolation between the r.f. amplifier circuit and the final signal output. C3 provides d.c. blocking to the output socket and load resistor R7. Decoupling of the supply is through C6.

The transistors chosen are both of the same type, being p-n-p germanium alloy diffused types, these having a good gain/frequency characteristic. They also allow for earthing of the outer shield, this proving an advantage at higher frequencies. The power supply can be either a 9V battery or 9-12V power unit. As the current drain at 9V is similar to the average transistor radio, about 10mA, any of the standard range of batteries are suitable.
ALTERNATIVE COILS

The coils specified and used in the unit are for the 3.5, 7 and 14MHz amateur bands, the 14MHz tuned circuit giving a usable gain as high as the 21MHz amateur band. If the broadcast bands are required instead, however, the following data should prove useful, the coils specified being replaced by any other coils selected from the list; 49 metres—17 turns; 31 metres—11 turns; 25 metres—9 turns; 19 metres—6 turns. All 3½in. diameter and 18 s.w.g., close wound.

CONSTRUCTION

The construction is not particularly critical as it can be adapted to suit individual requirements. While the type of construction used by the writer is described, being about the minimum practical volume into which the circuit can be put, other forms of construction may be used. For those with no facilities for chassis work, a ready made case can be bought in one of the familiar ‘Minibox’ or ‘Diecast Box’ ranges which are advertised in various sizes. If required, a larger case than specified may be used so as to contain the battery internally and also provide a little more “elbow room” for construction. Where, as with the writer, minimum size was of importance, the construction illustrated should prove of value. No matter what form of case or construction is used, the two basic sections described, Veroboard layout for components and coil pack assembly, should be adhered to. Also, wiring between coil pack, SI, and Veroboard, should be as short and direct as possible.

All components except the tuned circuit items and R7 are mounted on a piece of Veroboard 2½in. x 1½in. The layout of these components is shown in Fig. 2. This board should be completed first, including fly-leads for external connections, before mounting in the case. Next the coil pack is constructed as shown in Fig. 3. The base is made from paxolin sheet or similar material, six solder tags being fitted as shown.

With the mechanical construction complete, mount switch and sockets on the front panel, an earth tag being placed under a fixing screw on each socket. The coil pack and Veroboard are now mounted on each side. The boards are stood off the sides by about ½in. by means of limiting nuts on the fixing screws. R7 is connected between the output socket and earth tag. The fly-leads previously soldered to the boards are now connected between the different points, being kept as short and direct as possible. The output from the Veroboard to the output socket is by means of a short length of co-axial cable. The d.c. supply leads are brought out from the rear of the Veroboard, a hole with grommet being made in the rear of the case for this purpose. By splitting the unit into two circuit sections, both of which are completed before being mounted in the frame or case, only the minimum amount of wiring is required afterwards.

With the unit completed, alignment should take very little time. First set SI to select the 3.5MHz band, set the three trimmers to about mid-position and connect the d.c. supply. The simplest method of alignment is by means of a signal generator and oscilloscope or valve voltmeter. The gener-
Almost inevitable, particularly at the higher frequencies, the trimmers should be adjusted in small steps, the trimmer being removed at each step to prevent false settings. With the first channel set up a similar procedure is carried out on the other channels, the signal generator being set to the appropriate frequency and the trimmer adjusted for maximum output.

If no instruments are available the unit can be aligned using the receiver itself. First tune in a quiet spot in the 3.5-3.6MHz range and reduce the r.f. gain until the background noise is just audible. Now connect up the unit, the 3.5MHz channel being selected. The background noise should be appreciatively louder. Now adjust the trimmer for maximum output. Again adjust it in steps to eliminate the effects of hand capacity. The effect of the unit can best be appreciated by reducing the r.f. gain to a very low level, first having taken the unit out of circuit. Tune across a selected portion of the band noting a number of stations and relative signal strengths. Then, without altering the r.f. gain, connect the unit in circuit, tune across the same portion of the band and note the difference in signal strength for the same stations.

The other channels are aligned in a similar manner. The audible differences in signal or noise level may not be quite so obvious on the 14MHz channel and exact trimming may be more difficult to achieve without the use of instruments. This is because of the greatly extended bandwidth and much flatter response at these frequencies. As the gain is constant over a much greater bandwidth, however, very accurate trimming is not vital, thus the problem tends to be self-cancelling. When alignment is complete and the unit has been satisfactorily tried out on all bands, a spot of shellac on each of the trimmers will lock them in place.

In practice the amplifier should prove of value with most receivers. Its compact size and low power requirements make it extremely useful for field days, portable and mobile rigs, etc. Being small and robust it will withstand a great deal of rough usage without ill effect. A final point which may be mentioned is that like all such devices it amplifies all signals within the quoted bandwidth which appear at the aerial. Thus, both noise and signal are amplified equally and an acceptable signal-to-noise ratio is still required from the aerial to obtain acceptable results. Unfortunately, no one yet seems to have come up with a device which discriminates against unwanted noise in favour of wanted signal.

An inside view of the complete preamplifier.

A simple chassis to hold the Veroboard, the coil pack and the switch.

\[ \text{components list} \]

<table>
<thead>
<tr>
<th>Resistors:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>6.8kΩ</td>
</tr>
<tr>
<td>R2</td>
<td>1kΩ</td>
</tr>
<tr>
<td>R3</td>
<td>390Ω</td>
</tr>
<tr>
<td>R4</td>
<td>100Ω</td>
</tr>
<tr>
<td>R5</td>
<td>12kΩ</td>
</tr>
<tr>
<td>R6</td>
<td>5.6kΩ</td>
</tr>
<tr>
<td>R7</td>
<td>150Ω</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacitors:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>C1</td>
<td>500pF</td>
</tr>
<tr>
<td>C2</td>
<td>500pF</td>
</tr>
<tr>
<td>C3</td>
<td>500pF</td>
</tr>
<tr>
<td>C4</td>
<td>0.01µF</td>
</tr>
<tr>
<td>C5</td>
<td>0.01µF</td>
</tr>
<tr>
<td>C6</td>
<td>0.01µF</td>
</tr>
<tr>
<td>C7</td>
<td>100pF</td>
</tr>
<tr>
<td>C8</td>
<td>100pF</td>
</tr>
<tr>
<td>C9</td>
<td>40pF</td>
</tr>
<tr>
<td>TC1, TC2, TC3</td>
<td>3-30pF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semiconductors:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr1</td>
<td>AF114</td>
</tr>
<tr>
<td>ZD1</td>
<td>BZY88</td>
</tr>
<tr>
<td>C3V3</td>
<td>3.3V</td>
</tr>
<tr>
<td>Tr2</td>
<td>AF114</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coils:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>32 turns, 18 s.w.g. on 1in. diameter former, close wound</td>
</tr>
<tr>
<td>L2</td>
<td>15 turns, 18 s.w.g. on ½in. diameter former, close wound</td>
</tr>
<tr>
<td>L3</td>
<td>7 turns, 18 s.w.g. on ½in. diameter former, air spaced</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Miscellaneous:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>1-pole, 3-way rotary switch; Veroboard, 0-15in. matrix, 12 x 18 holes; pointer knob; 2 off co-ax sockets; chassis to specification</td>
</tr>
</tbody>
</table>
This concluding article will deal with the electrical performance of the PW25-50 Amplifier, with testing for correct performance and with the optional extras: the tremulant on-off foot control and a foot controlled wah-wah effect.

The Henelec power amplifier module and its MU422 power supply require no adjustment and it is only necessary to ensure that they are correctly and securely positioned as shown in the layout diagrams in Part 2. Do not run the power amplifier unless the loudspeakers are connected and take great care not to short circuit the output whilst the amplifier is running at full power. The power unit and the module are both fuse protected.

### Power Module

The specified performance of the Henelec PA50 amplifier module is as follows:

- **Power Output with 4Ω load (2-8Ω speakers):** 50 watts r.m.s.
- **Power Output with 8Ω load (1-8Ω speaker):** 25 watts r.m.s.
- **Power Bandwidth:** 12Hz to 60kHz.
- **Signal Input, for rated output:** ±3dB
- **Distortion, at full power:** not more than 1%.
- **Hum and Noise:** -75dB

In order to drive fully the power module and to allow some reserve gain for low level input signals the pre-amplifier has been designed for a maximum output of 1.5V r.m.s. from an input of 40mV at the guitar inputs or 2mV at the microphone input. The guitar input sensitivities are more than sufficient for all standard guitar pick-ups of medium to high impedance.

### Testing for performance

If test equipment, such as an audio frequency generator, a valve-voltmeter and an oscilloscope, is available the following tests can be carried out to ensure performance to specification. Constructors with only a multi-range meter can check the voltages and currents at various points which will be indicated. On initially testing the amplifier do not turn the master control to maximum. Ensure that the pre-amplifiers are operating properly before running the amplifier at full power.

The following table may assist in checking the function of the pre-amplifiers and tremulant circuit:

<table>
<thead>
<tr>
<th>Voltage at top of C28</th>
<th>28 to 30mA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current drawn by circuit Board 1</td>
<td>20 to 22V</td>
</tr>
<tr>
<td>Current drawn by circuit Board 2</td>
<td>2-8 to 3mA</td>
</tr>
<tr>
<td>Voltage at junction R46 &amp; R45 (circuit Board 2)</td>
<td>6 to 7mA</td>
</tr>
<tr>
<td>Voltage at junction R29-C17 (circuit Board 2)</td>
<td>16 to 17V</td>
</tr>
<tr>
<td>Voltage at junction R8-C6 (circuit Board 1)</td>
<td>13 to 14V</td>
</tr>
<tr>
<td>Voltage at collector of Tr4 (AD161)</td>
<td>18V</td>
</tr>
<tr>
<td>Collector current Tr4 (AD161)</td>
<td>Average 14V</td>
</tr>
</tbody>
</table>

If a sinewave audio signal generator and v.v.m. are available, the following signal level checks can be made. The master volume control VR8 should be set almost off, i.e., with just enough gain to make the signals audible.

1. **Guitar input (guitar gain control max) 40mV in—signal at top of VR8 junction with C26 should be approx 1.5V r.m.s.**
2. **Microphone input (microphone gain max) 2mV—signal at top of VR8 junction with C26 should be approx 1.5V r.m.s.**
3. **Guitar input (gain max) 40mV in—signal at junction C16-R30 approx 800mV.**
4. **Guitar input (gain max) 40mV in—signal at mixing pre-amplifier input C22 approx 20mV.**
5. **Guitar input (gain max) 40mV in—signal at tremulant amplifier (Tr6) output junction C21-VR7 approx 1V r.m.s.**

If an oscilloscope is available the sine wave output at the various points previously indicated can be checked as well. The output of the tremulant phase shift oscillator Tr3 and its amplifier Tr4 can be checked with an oscilloscope. The low frequency sine wave at Tr3 collector should be approximately 10V peak-to-peak and at Tr4 collector approximately 8V peak-to-peak.

It is most important that Tr4 runs at the specified collector current which in turn determines the correct brilliance of the l.d.r. and the panel tremulant.
indicator lamp. With the tremulant turned off (S1 closed) both lamps should glow at about a quarter of their normal brilliance and the collector current of Tr4 should be a steady 18 to 20mA with the tremulant depth control at minimum (anti clockwise).

If the collector current is more than this the lamp will be brighter and the gain of the guitar pre-amplifier will be reduced. If the current is lower the 1.d.r. will not produce the correct tremulant depth. Adjustment to the collector current of Tr4 can be made by changing the value of R18 (nominally 270 ohms) a little one way or the other.

When the tremulant circuit is switched on the lamps will flicker between extinction and the steady level of brilliance hitherto obtained. When the tremulant depth control is increased (clockwise) the lamps will glow slightly brighter and the collector current of Tr4 will rise by a milliamp or so.

Operational Notes

The treble control in the guitar pre-amplifier provides approximately 15dB lift at 10,000Hz and excessive treble lift could cause distortion if signals between about 6 and 10kHz are equal in amplitude to those in the mid frequency range. The treble control should therefore be used sparingly for signal sources such as a portable electronic organ. The 'tone tremulant' control can also cause severe distortion if used to excess particularly on signal sources other than an electric guitar.

For average use with a treble guitar and to obtain a distortion free tremulant, particularly on chord playing, the tremulant tone control and the treble control should both be set at about their midway position and the tremulant depth at minimum.

With guitar pick-ups of average sensitivity the master volume control should be set at about three quarters of its travel and the guitar input volume control adjusted accordingly. The same applies to the microphone input and as the microphone pre-amplifier is completely independent of the guitar circuitry it is not affected by the tremulant circuit.

The frequency response of the amplifier is more than adequate for guitar bass and whilst a single speaker and 25 watts output will provide good quality bass, the full 50 watts with two speakers will be much more suitable for group playing. The speakers are well within rating as a pair will in fact

<table>
<thead>
<tr>
<th>PW25-50 AMPLIFIER</th>
<th>Overall performance specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Max power output 4Ω load</td>
<td>50 watts (r.m.s.)</td>
</tr>
<tr>
<td>Max power output 8Ω load</td>
<td>25 watts (r.m.s.)</td>
</tr>
<tr>
<td>Input sensitivity (guitar)</td>
<td>Min 30 to 40mV (for rated output)</td>
</tr>
<tr>
<td>Input impedance (guitar)</td>
<td>100kΩ</td>
</tr>
<tr>
<td>Input sensitivity, (microphone)</td>
<td>2mV (without transformer)</td>
</tr>
<tr>
<td>Input impedance, (microphone)</td>
<td>100kΩ</td>
</tr>
<tr>
<td>Treble lift control</td>
<td>+15dB at 10kHz.</td>
</tr>
<tr>
<td>Frequency response (guitar)</td>
<td>-3dB at 35Hz to</td>
</tr>
<tr>
<td>Frequency response (microphone)</td>
<td>-3dB at 20,000Hz.</td>
</tr>
<tr>
<td>Hum and noise level (guitar)</td>
<td>Better than 60dB below rated output</td>
</tr>
<tr>
<td>Hum and noise level (Microphone)</td>
<td>Better than 56dB below rated output</td>
</tr>
<tr>
<td>Distortion</td>
<td>Not greater than 1% at rated output</td>
</tr>
<tr>
<td>Tremulant speed</td>
<td>Approx. 5 to 10Hz</td>
</tr>
<tr>
<td>Tremulant depth</td>
<td>Variable between approx. 30 and 50% as a modulation function</td>
</tr>
</tbody>
</table>
DELIVERY BY SECURICOR 

WITHIN 72 HOURS 
ALL IN-STOCK items delivered by SECURICOR within 72 hrs. Add 9/- only for Security delivery. Articles are fully insured against loss or damage whilst in transit.

WHAREFDALE Speakers
Aiirecda ... £69 10 0 £55 18 0
Degenrux ... £72 10 0 £58 16 0
Super Linton ... £72 10 0 £68 16 0
Motion ... £73 9 0 £63 19 0
Dovedale 3 ... £73 9 0 £63 19 0
Dovedale C ... £71 4 0 £57 12 0
UNIT 3 Speaker Kit ... £41 9 0 £36 18 0
UNIT 5 Speaker Kit ... £23 10 0 £19 18 0

ROGERS

ROGERS

PHILIPS

ROGERS

VOLTEX

ROGERS

LL. Stereo CARTRIDGES
ally discotheque electronic
in teak case
207
sealed cartons.

Ravensbrook Tuner
FM 200/1C £60

ERATR Controller £9

3090
Cassette, Stereo tepe
facilities

12

1501

4

17

19

21

23

25

27

29

31

33

35

37

39

41

43

45

47

49

51

53

55

57

59

61

63

65

67

69

71

73

75

77

79

81

83

85

87

89

91

93

95

97

99

101

103

105

107

109

111

113

115

117

119

121

123

125

127

129

131

133

135

137

139

141

143

145

147

149

151

153

155

157

159

161

163

165

167

169

171

173

175

177

179

181

183

185

187

189

191

193

195

197

199

201

203

205

207

209

211

213

215

217

219

221

223

225

227

229

231

233

235

237

239

241

243

245

247

249

251

253

255

257

259

261

263

265

267

269

271

273

275

277

279

281

283

285

287

289

291

293

295

297

299

301

303

305

307

309

311

313

315

317

319

321

323

325

327

329

331

333

335

337

339

341

343

345

347

349

351

353

355

357

359

361

363

365

367

369

371

373

375

377

379

381

383

385

387

389

391

393

395

397

399

401

403

405

407

409

411

413

415

417

419

421

423

425

427

429

431

433

435

437

439

441

443

445

447

449

451

453

455

457

459

461

463

465

467

469

471

473

475

477

479

481

483

485

487

489

491

493

495

497

499

501

503

505

507

509

511

513

515

517

519

521

523

525

527

529

531

533

535

537

539

541

543

545

547

549

551

553

555

557

559

561

563

565

567

569

571

573

575

577

579

581

583

585

587

589

591

593

595

597

599

601

603

605

607

609

611

613

615

617

619

621

623

625

627

629

631

633

635

637

639

641

643

645

647

649

651

653

655

657

659

661

663

665

667

669

671

673

675

677

679

681

683

685

687

689

691

693

695

697

699

701

703

705

707

709

711

713

715

717

719

721

723

725

727

729

731

733

735

737

739

741

743

745

747

749

751

753

755

757

759

761

763

765

767

769

771

773

775

777

779

781

783

785

787

789

791

793

795

797

799

801

803

805

807

809

811

813

815

817

819

821

823

825

827

829

831

833

835

837

839

841

843

845

847

849

851

853

855

857

859

861

863

865

867

869

871

873

875

877
who wants a £2,000+p.a. opportunity in the dynamic new computer industry?

In only 4 weeks you’re in – and only the incredible Eduputer can make it possible.

Now for the first time anybody can train outside the computer industry for a lucrative career as a computer operator, with actual experience on an Eduputer.

Who created Eduputer? The internationally famous company Programming Science International. They developed it to the specific requirements of the massive New York city training board and its practical results have been one amazing success story.

We are proud to have been selected as the only commercial training organisation permitted to use the Eduputer in the U.K.

Thanks to Eduputer, nine out of every ten can learn to operate the most advanced computers in only four weeks. Unlike Computer Programming, no special educational qualifications and no maths required. Just you and the incredible Eduputer!

Jobs galore! The moment you qualify, our exclusive computer appointments bureau introduces you to computer users everywhere with good jobs to offer (up to £40 a week full-time, £50 a week as a temporary). More than enough to go round, too — because 144,000 new operators will be needed over the next five years alone.

This is your big opportunity to get out of a rut and into the world’s fastest-growing industry. And remember—LCCOT is the only commercial computer school to have Eduputer. It means a lot to employers.

Telephone: (01) 437 9906 NOW!

Or post the coupon today for full details FREE and without obligation.

---------------------------
London Computer Operators Training Centre,
Telephone: (01) 437 9906
127/131 The Piazza, Dept. B8, Piccadilly Plaza, Manchester 1.
Telephone: (061) 236 2935.

Please send me your free illustrated brochure on exclusive Eduputer “hands on” training for computer operating.

Name

Address

Tel:

---------------------------
handle 100 watts r.m.s. In other words distortion through overloading would occur in the amplifier but never in the speakers. The overall frequency response of the amplifier is shown in Fig. 17 and the effect of the treble lift and tremulant tone controls in Fig. 18. The reduction in bass response due to the tremulant tone control produces a considerable reduction in the level of lower frequency fundamental notes but ensures a strong build up of third and higher harmonics. The tremulant tone control should be used very little or not at all with bass guitar because of the effect on low frequencies.

Optional Extras
The tremulant control circuit can be switched on or off quite easily by means of a foot operated switch. It is only necessary to provide an extra jack socket on the front panel wired across the tremulant on/off switch (S1) as shown in the circuit (Fig. 5 Part 1). A suggested method of making a suitable foot switch is shown in Fig. 19. The switch must be a press on—press again-off type. Screened leads are not necessary for this, twin flex will do.

The 'wah-wah' effect can be produced by means of a foot controlled potentiometer and capacitor (VR9 and C29 in Fig. 5 part 1). When VR9 resistance

* components list—optional extras

<table>
<thead>
<tr>
<th>Tremulant Foot Control:</th>
<th>Wah-Wah Foot Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>1—Panel jack socket and plug.</td>
<td>1—Panel jack socket and plug.</td>
</tr>
<tr>
<td>1—Press on/press off switch.</td>
<td>Screened cable.</td>
</tr>
<tr>
<td>Twin flex. Materials for foot control as in Fig. 19.</td>
<td>Materials for foot control as in Fig. 20.</td>
</tr>
</tbody>
</table>

is at minimum (foot pedal off) the capacitor C29 is shunted directly across the primary of T3 and severely attenuates the treble response of the tone tremulant amplifier. When the potentiometer is opened (foot pedal on) the shunt effect of C29 is reduced to zero.

The tremulant tone control must be on about three quarters of its travel to produce the pronounced oom-wah effect when the foot control is operated. A suggested method of constructing a foot control is shown in Fig. 20. When the foot plate is pressed back the potentiometer should be at zero resistance. Screened lead must be used to connect the foot control to the amplifier the inner lead going to the junction C8-T3 IP.

Notes
When the amplifier is finally installed in the cabinet the main input socket panel is screwed to the beading at the rear of the amplifier compartment. The front panel can be secured all round with screws into the beading at the front and by means of two long self tapping screws at the rear as shown in Part I Fig. 2D.

The back panel of the speaker compartment must be a close fit and well secured with at least four screws on each side and top and bottom. Do not run the amplifier at full power unless the back panel is fitted and secured. The spaces each side of the mains input panel at the rear can be fitted with hardboard panels to prevent dust getting in and to protect the rear of the amplifier.

The performance of the PW25-50 amplifier has been checked in every respect and has been used with satisfaction by a semi-professional guitarist with treble and bass guitar. It has been tested with microphone and music sources and with the direct signal level output from an electronic organ.

The writer strongly recommends that only the components, power module and loudspeakers etc. specified are used in order to obtain a performance equal to that specified and he is not prepared to provide modifications to the circuitry for use with other components or for other purposes.
FOR the fourth year in succession, this year’s radio-trade exhibitions took place in London at the end of August. Most companies showed their products in hotels, but one or two were “at home” to visitors. One enterprising firm ran cruises along the Thames from Westminster.

Altogether, some 40 firms exhibited their products with more than 50 brand-names being in evidence. Once again, the main emphasis was on television, particularly colour television, but one or two trends were apparent in radio.

(Details of new TV receivers and techniques are contained in a special report in the November issue of our companion magazine *Television*, on sale on 23rd October.)

**Power Supplies**

Although the majority of small portable radio receivers are battery-operated, several of the newly announced models feature internal mains-supply units, so that the sets will work from batteries or the mains supply as required. Two reasons are given for this trend—some firms say that the cost of batteries is now so high that the public is looking for mains-operated sets, and other firms say that most receivers, even very small portables, are used quite often in only one location, so mains operation is just as convenient as battery operation. Whatever the reason, battery/mains receivers are certainly making a come-back.

Readers with long memories will remember the old style battery/mains sets which used “all-dry” valves. Those receivers were not renowned for their reliability. Trouble often occurred in the mains-derived filament supply, and certain faults caused the filaments to burn out. However, running transistorised receivers from the mains is a comparatively simple matter, and the reliability of the modern mains/battery set should be high.

**Local Radio**

The number of portable sets covering the v.h.f./f.m. band seems to be growing, and this may be due to the increasing popularity of local radio stations. The stations operate only on v.h.f./f.m.
at the moment, and the original 8 are now being supplemented by a further 20 (details of frequencies etc. are available from BBC Engineering Information Department, Broadcasting House, London, W.1).

Incidentally, certain local stations will use slant polarisation of signals instead of the horizontal polarisation used previously for all v.h.f./f.m. services. The stations involved are at Blackburn (96-4MHz), Derby (96-5MHz), and Manchester (95-1MHz). Leicester (95-05MHz, later 95-2MHz) and Nottingham (94-8MHz) will be converted to slant polarisation later. The use of s.p. should improve reception of v.h.f. in cars and in other circumstances where vertical receiving aerials are used (see News pages).

The Murphy B866 two-band l.w. and m.w. radio. Price, £11 10s.

The BBC states that it is not necessary or advisable to adjust outdoor v.h.f./f.m. aerials for slant polarisation. However, if for some reason such adjustment is made, the correct position is obtained by turning the aerial 45° from the horizontal, clockwise when looking towards the transmitter.

More v.h.f./f.m. receivers for cars made their appearance at the trade shows, and should be of particular use in the areas of local radio stations, since warnings of local traffic conditions will be featured in the programmes. The resulting increased awareness of v.h.f./f.m. radio should help manufacturers to sell their portable v.h.f. sets too.

Push-Button Tuning

While on the subject of v.h.f./f.m., we note another interesting development: pre-set selection of programmes by push-button. Older readers will remember the days of a.m. radios with push-button tuning in which intricate mechanisms were employed to enable pressure on the buttons to rotate or position the ganged tuning capacitor in exactly the spot corresponding to the desired station. Many service engineers will remember the time spent trying to repair or set up the systems which often included gears, stranded-wire drives, and complicated detent mechanisms.

The modern push-button set covers v.h.f./f.m. and if push-button selection of stations is held to be valuable on a.m., it is of even greater use on v.h.f./f.m., since most people seem to have difficulty in tuning in f.m. signals correctly, even when a tuning indicator is fitted.

The TRC 530M combined a.m./f.m. radio and cassette recorder from Teleton. Output is 1-6W and price is £47 10s.

The old mechanical system of push-button tuning is of course unsuitable for the high frequencies of the f.m. broadcast band, although no doubt a mechanical system could be made to operate if a very good a.f.c. circuit were included. The modern push-button system has been made possible by the variable capacity diode: a reverse-biased junction diode is connected in the signal circuits as part of the tuning capacitance, and variation of the reverse bias varies the thickness of the depletion layer of the diode, thus varying the effective capacitance. Tuning of the various circuits is carried out by varying the magnitude of the potential fed to the controlling diode or diodes. The push-buttons simply
Radio with Tape

Components continue to reduce in size, and many cassette tape recorders now feature an internal radio, the extra circuitry being accommodated with very little change in dimensions. These new recorders should be very popular since they enable radio programmes to be recorded without the use of a special tuner, and there is no longer the difficulty of connecting a portable set or mains receiver to the recorder.

Sockets

To enable receivers to be coupled to tape recorders, many of the new sets have special output sockets. This trend is to be welcomed especially as many of the new sets cover v.h.f./f.m., and are capable of delivering a high quality audio output. Many receivers have input sockets too, to be used to amplify the outputs from tape recorders, record-players, and, in some instances, microphones.

Semiconductors

Integrated circuits have now begun to make their appearance in domestic equipment, though their use is still on quite a small scale. Field-effect transistors are increasingly encountered in front-ends, and as a result, performances are steadily improving. Crystal filters are used in i.f. strips in several receivers; they should be welcomed by service engineers since there are then fewer cores for customers to adjust!

Origins

Apart from equipment made in this country, most of the items shown were from Japan. However, there were receivers from Hong Kong, Germany and India. The Indian sets are being marketed here after a successful trial import of 10,000. The company concerned hopes to extend the range to include v.h.f./f.m. receivers.

Combination

The small size of modern components is continuously having effects and is one of the reasons for the emergence of the combined tuners and amplifiers being shown by many firms. The old-style radiogram is less popular now, and the trend is to separate loudspeakers, record decks, and tuner/amplifiers. The radiogram will no doubt retain its popularity with the older generation, but younger ears seem to prefer the better standard of reproduction now obtainable from other types of equipment.

Cabinets

The square-cut cabinets of recent years were continued this year, but some makers introduced a rounded line, perhaps in the hope of starting a new trend. Novelty radios were seen again, with some sets made to resemble old fashioned telephones. Another set was housed in a fur poodle! On rather more sedate lines, a new receiver from another maker was designed to look like a cine camera.

Radios with built-in clocks (or clocks with built-in radios?) were seen at a number of the shows.

Summary

There were no really startling developments in the radio sets shown this year, but this is not to say that progress is not being made. The introduction of i.e.'s and the attention being paid to audio quality, power supplies, and ease of tuning, show that the radio market is still a healthy one. As local radio spreads, whether commercial or not, interest in radio should continue to revive, with radio no longer a poor relation of TV, but an entertainment and information medium in its own right.

Change of Date

By agreement among the various firms, next year's trade shows are scheduled for the end of May instead of the end of August.
The ‘KIT IDEA’ by HEATHKIT

kit building is so easy the Heathkit way.

TRY IT FOR YOURSELF

START WITH A SMALL BUT VERY USEFUL KIT

THE NEW HEATHKIT BATTERY CHARGER

PRICE ONLY £2.18.0. plus carr. 6/-

POWERFUL OUTPUT—UP TO 4 AMPS • FULLY FUSED • SOLID KNOCKABOUT CASE • SAFE DOUBLE WOUND TRANSFORMER • FOR 6V OR 12V CARS • ROBUST AMMETER

Here's the easy to build, inexpensive kit to introduce you to kit building. As well as the fun and fascination of building it yourself you get Do-it-Yourself savings. The clear, simple, fully illustrated instructions make assembly foolproof. This is the battery charger to keep your car battery in top working condition.

Hurry, and make sure of your order today.

P.S. This also makes an excellent seasonal present...

HEATH (Gloucester) LTD GLOUCESTER GL2 6EE

Please send me a battery charger kit for which I enclose £3.4.0, including carriage.

(Block capitals please)
Name
Address
Post Code

51/11A
**BSR 4-SPEED SUPERLIM AUTO RECORD CHANGER**

Plays 12" or 7" records. Auto Changeover. Slowly and quietly lifted by BSR "Inertia" mechanism. Ideal for 78 BSR. 11½ in. Above ground types below 8½ in. AC 250/300 volts.

with STEREO MICRO XL¥.

**TOGGLE SWITCHES, WIRE**

PORTABLE AMPLIFIER

**564**

List

cps.

HER

LOW RESISTANCE HEADPHONES 3-5 ohms

Sensitivity 200mV.

TEAKWOOD BASE. Ready for use as a Baby

8in.

SPACED LONG 5/8in. Spaced

Spare Cores 6d.

with separate controls into single output.

Recommended Teak Cabinet

Pott 9/8in.

Free magnetic 300W. Space 18 in. Separate

and ceramic

or 12in. Twin cone

Practical

Stereo Handbook 8/8

M. Heid.sk. 100/25V.

S-50 100/25V

low. 20/6

FAMOUS

19/8in.

Miniature 1000 PF, 2/6-18K c.p.s. to

Recommend Teak Cabinet

WATT TRANSISTORS

SEMI-Conductor...75mA 9/8 1.1.

8in.

of 5,000, or 12in. Round Loudspeaker.

LOUDSPEAKER CABINET WADDING 1ins. wide, ½

TWO-WAY XOVER NETWORK 3000 c/s.

with variable resistor attenuator gives a high/midrange frequency balance. Mounted on panel 5½ in. × 4½ in. with control knob, tweeter and woofer leads and input and output plugs.

BARGAIN AM TUNER, Medium Wave. Trapezoid Enclosure. £3.25

RECEIVERS

with separate controls into single output.

with separate controls into single output.

Recommended Teak Cabinet

Pott 9/8in.

Free mag. 300 W. Space 18 in. Separate

and ceramic

or 12 in. Twin cone

Practical

Stereo Handbook 8/8

M. Heid.sk. 100/25V.

S-50 100/25V

low. 20/6

FAMOUS

19/8 in.

Miniature 1000 PF, 2/6-18K c.p.s. to

Recommend Teak Cabinet

WATT TRANSISTORS

SEMI-Conductor...75mA 9/8 1.1.

8 in.

of 5,000, or 12in. Round Loudspeaker.

LOUDSPEAKER CABINET WADDING 1ins. wide, ½

TWO-WAY XOVER NETWORK 3000 c/s.

with variable resistor attenuator gives a high/midrange frequency balance. Mounted on panel 5½ in. × 4½ in. with control knob, tweeter and woofer leads and input and output plugs.

BARGAIN AM TUNER, Medium Wave. Trapezoid Enclosure. £3.25

RECEIVERS

with separate controls into single output.
ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

DESPITE the warm weather I have received a record number of reports and I will start with one from:

C. R. S. Stacey of Tunbridge Wells who has a Lafayette HA-700 and a Joystick and an a.t.u. which enabled him to:

3306 Tentative logging of Rhodesia B.C. in English with much interference. 2000-2030, SINPO 21531
6175 O.R.T.F. relay of France Inter, 1920-1940, 45454
9520 Kuwait B.S. in Arabic from 1937 to 2024, 33533
9525 Polish Radio in English at 1931-1956, 33543
9625 Israel B.A. in English at 2052-2130, 33343
21535 Radio RSA to Africa in Eng., 1251-1550, 35232

Roderick Downes of Bournemouth does not have a communications receiver but he used his seven-valve domestic superhet. and 60ft. long-wire to hear some interesting stations including:

11552 R. Pakistan, Karachi in English at 2030, 155344
15018 R. Hanoi, in Eng. at 2000 and French at 2030
15265 R. Afghanistan to Europe, // to 17745, 1800
15345 Kuwait B.S. in English from 1830, 45344
17825 NHK, Japan also on 21535 in English at 0800

Richard Read of Portsmouth is only fourteen years old but this did not prevent him from using his Practical Wireless Modular Three-Band Short-Wave receiver and 17ft. vertical aerial to hear the following stations:

11710 ABC, Australia, English to Asia from 0900 to 1100
11720 R. Trans Europe in English, 0900-1000
15120 Colombo B.S., Ceylon at 2000
17760 Radio New York Worldwide at 1900
21500 Vatican Radio in English from 1145 to 1205

Terry Gibbs of Swindon who is a regular reporter to this column has heard some very interesting stations recently including:

3338 Radio Mozambique, // with 4805 at 1500
3390 Radio Rhodesia in English at 2200
5985 Radio Tangiers at 1900-0300
6130 Radio Halifax, Nova Scotia at 0350-0400
9720 Radio Haiti at 1100-1500. (New freq. to me.—MC)

Philip Batt of Littleborough in Lancashire has sent in another interesting report which included:

4865 PRC5, R. Belem, Brazil in Port. 0300, 32323
4920 YVKR, R. Caracas, Venezuela, Spanish at 0400
4980 YVOC, Ecos del Torbes, Venezuela in Sp. 0405
5095 HJGG, R. Sutatenza, Colombia, Indent. at 0300
17710 R. Mali, Bamako, French at 1745. (New freq.—MC)

C. J. Craven of Bexhill-on-Sea used his Eddystone EC10 and Joystick antenna to hear:

6125 Voice of America, ‘The Breakfast Show’ 0245
6230 Radio Tirana, Albania, Indent. at 0250
15165 Damascus, Syria in English at 1930

John Adams has recently moved to Cleethorpes where he has set up his Eddystone EC10 and 100ft. long-wire and managed to hear:

11765 CBC, Canada, Eng. to S. Africa at 0738
11825 Radio Sofia, with sign-off in English, 1930
17810 R. Nederland, Bonaire in Spanish at 2130
21640 R. Nederland, Bonaire in English at 1840

Regular reporter, S. R. Wainwright of St. Helens has again used his Skyrover Mk II and 100ft. long-wire to hear stations from all over the world:

4970 YVLK, R. Rhombus, Venezuela in Spanish, 0400
4990 YVMQ, R. Barquisimeto, Ven. with 24 hour sched.
1145 R. Trans Europe, Portugal in Eng. 1345-1415
21545 Radio Ghana at 1445-1530 in // with 17870
S. J. Plant of Cwmbran in Monmouthshire has sent in another log which contained:

9515 R. Ankara, Turkey in Turkish at 2025
11765 HCJB, Ecuador in English from 2300 to 0000
11815 Trans World Radio, Bonaire, Eng. 0040-0130
15220 R. Vilnius, Lithuania in English, 2230-2300

Amongst those who sent in their reports in the form of news was Roy Patrick of Derby who contributed the following items:

KENYA The Voice of Kenya on 4915 now provides a good signal in the evening until sign-off at 2000. The programming is mainly pop and African music with commercials in Swahili.

GHANA Radio Ghana on 4915 is audible after Kenya signs-off on the same frequency. The signals are of fair strength and the programmes are in English.

LIBYA has been heard on the frequency of 9895 in the evenings and is at present providing a very strong signal.

UNITED ARAB REPUBLIC The Voice of Africa in Cairo has been heard in English at 2030 on 17725 with an excellent signal.

Robert Bruce of Angus in Scotland was amongst the many who sent in reports about Radio Trans Europe. The latest news of this station is that they are beaming test transmissions to the United Kingdom from 1345 to 1415 daily on 9625 and 11865.
ON THE SHORT WAVES

W H A T E V E R happened to all those i.f. lovers?

More logs are coming in for 144MHz than 14MHz. 24MHz and 14MHz put together. About 90% of the thuds on my doorstep were logs for 20 metres which must win the award of the mostly listened to band this past month.

Things will doubtless change, but the propagation experts say that conditions should improve for the h.f. enthusiast so the 28MHz band might be worth a listen.

Regarding listening procedures. Many listeners switch straight to their favourite band (usually 14 or 21MHz) and prorl round with the dial logging everything which titivates the headphones. It is suggested that all serious listeners should check all bands before making a final selection. Many people will only switch to another band if their particular r.f. hero is dead.

John Moore (Leicester), queries ZA1AA who was asking for QSLs to be sent to P.O. Box 295, Tirana. John says he knows that there is no official amateur radio in Albania but thinks this one is legit. and probably operating underground. John is learning c.w. but says copy is difficult due to the hot weather making his b.f.o. drift. (How about negative temp. capacitor coefficients or perhaps a sun blind over the b.f.o?)

Logs

Peter Baldwin (Peterborough), has a home-brew transistor receiver with 70ft. of wire round the attic. He reports 3.5MHz heavily laden with EU-type signals but managed to hook VS5RG.

John Moxham (Somerset), HRO5 plus a.t.u. and a 67ft. end-fed at 40ft., had a sniff around 80 metres. Best on s.s.b. were: UK9AA, PY3BBD, PY4BL5, PY7BHWH, while c.w. raised ZS1MH and ZD9BH.

A quick nip up the r.f. ladder brings us to 21MHz.

Tom Maxwell (Lanarkshire), CR70A, 18ft. end-fed, is a man of few words. Amongst those few this month were; CR6MT, CX9CO, DK2WV/CN8, EA8GZ, EL2CB, ET3DS, HB9YC/4W1, HS1ACW, IT1SEZ/P1U (Ustica Is.), JA1SQI, JY1 (King Hussein of Jordan), KP4DAL, KV4FQ, KZ5AM, LU1ZE, MP4BH, OA4LM, PY1JZ, SWOY, VE7EL, VP2MM, W6MSM, XW8DM, 4N2HV, 4U1ITU, 4Z4AB, 5H3JR, 5K3LR, 6W8DY, 9H1BX, 912PV, 9Q5WF, 9X3BP. Type of emission not specified—probably s.s.b.

14MHz Happenings

Anderson strikes again! This time, Tim has an HRO MX of his own complete with 66ft. end-fed. Squeaks of s.s.b. on 14MHz from: AX6MK, CE3WN, CR6GA, HC6MJ, HI5SO, HK3CA, HK6AVR, HR2VFB, JY1, K6lhW, KZ5KB, LI5KG, LU2DAW, PY2EA1, TG7WT, TI2JO, VE1TC, VK3XW, VP2VI, VP7CT, W6KH, W0CJZ, WA7CQA, WB6OC/MM/TG, XE1KV, YN1ZZ, YV1YC, ZC4MT, ZL1AJ1, ZM3ON, ZM4BO, 3A2CP, 4N2BR, 4X4RW, 5Z4MO, 6W8DY.

M. Cranage (Birmingham), P.W. superhet as per April 1967 plus “modifications” and a 50ft. end-fed. sends in some goodies gleaned from 14MHz. Among the s.s.b. was: AX2VK, AX3TG, AX5AZ, AX7IL, CE6GY, CO2FA, CR6CA, HK5AZ, HPICU, HR1KRF, K2ALO/P/0H0, K6UXT/KL7, OA4XN, SV1EC, TF3BV, VE1CF, VK3ZL, VK7IZ, VS5RG, WA1NGK/TF, W6CYU, WSBEZN, 5N2ABG.

Another son of sideband is C. Smith (Sollulli), whose R1155 and 40ft. end-fed showed great affection for: CN8BG, CR6MR, CR6S, CR7GJ, ET3DS, HK4MP, HR2WTA, HS4ADB, KP4CQ, PY1CAD, PZ5RK, SV1BV, TA1INC, TF3HS, UW9EA, XW8DK, YO4CT, 4N2KO, 4U1ITU, 4X4AE, 4Z4HE/5Z4MO, 9H1CB, 9M6BA, 9N1MM.

I. Bousher (Glamorgan), describes his set up as 110ft longwire, home brew a.t.u. and one Virgin R1155. (Oah, ain't he bold!). Sideband sigs. from: AP2KS, AP5HQ, CR6MR, CR7LE, EA8HB, EL2K, EP2DA, JAIITE, JA3DWA, JA0CFJ, JH6OR, JY1, KR6EZ, KV4FA, LU3OAC, LU8ATB, MP4BIR, OX5AP, OY7JID, PY4FQ, PY6BP, PY7AEG, SM6ALJ/MM (Persian Gulf), TR8LB, VE1WZ, VK5NS, VP2AU, VQ6E, WX8DK, YW4WT, ZB2A, ZD7SS, ZS2HL, 4N2SO, 4S7AD, 4X4HF, 5Z4AL, 6W8DY, 6Y5SR, 7X2SM, 9H1CF, 9K2AG, 9Q5CO, 9V1QE, For all the technological revolution, you wonder if transistors could pull in very much more.

Award for persistence and courage this month must surely go to H. Goodwin who, despite attempts by a neighbour to stop him with a hedge clipper, carried on listening on 20 metres.

Higher Still

No brave soul has sent in a 70cm. log yet although threats to do so have been received. Nearest band to date is 144MHz which, it seems, is attracting quite a number of listeners.

Lurking near Canterbury at a place called Chilham is a two element yagi hidden in a loft. Tracing the feeder will lead you to a converter feeding an R107 tuning 14-16MHz. The enraptured creature listening to the signals will almost certainly be Stephen Lloyd. Observe the smile and squeaks of delight as the following are logged: F9UP/P, ON4FL, ON4HV, ON4RY, ON4VB, ON4ZN, ON5QW, PA0I.CD, PA0PAL, PA0OSWS.

Contests

Contests are appearing to go on ad infinitum. For October we’ve got: October 3-4, I.A.R.U. Region 1 u.h.f./s.h.f. listeners contest (gen. from the R.S.G.B.); 10-11, ten metre phone contest (should be interesting); 24-25, 40 metre c.w. contest (this one really separates the men from the boys); 24-25, CQ WW d.x. contest; November 7-8, 40 metre phone contest; 7-8, 2 metre c.w. contest.
NEW from Mullard! UNILEX Audio Modules

Now you can build your own stereo units as you want them, and entirely in your own home.

A good quality stereo amplifier can be built with no electrical knowledge. All solid static—highly reliable circuit control—no soldering—terminal block connections throughout.

Everything you need to know about UNILEX SYSTEMS is in the Mullard book "Do it yourself, "Stereos". Superb designs, detailed plans, simple instructions in non-technical language covering 4 systems in 4 price ranges. Send for your copy now 5/- Post Free.

UNILEX Audio Modules

Amplifier
Module EP2000 £2.19.6 each
Pre Amplifier
Module EP9001 £3.2.0
Power Supply
Module EP1005 £4.12.6
Control Panel
Assembly and
Echocentre
Plate £3.5.0

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

SOLDERING GUN


SOLIDER GUN

600 WATT LIGHT DIMMER SWITCH

Size as standard wall unit. Cast in moulded plastic. Ideal for all rooms. Light is independent of pull on to off. Heavy plastic box with control knob. LIND-AIR PRICE £2.10.6 P. & P. 3/6.

Garrard HI-FI TURNTABLES

LIND-AIR AUDIO

British Made. Solderless breadboard panels, for fast reliable component connections. Single & Double. Use 6-Dec with Control Panel. Jigs and Accessories for solderless connections to controls, etc., with booklet "Projects on 6-Dec" giving construction details for a variety of circuits. 2/6. 5/6. 2/6. 4-Dec KIT. Four 6-Decs with two Control Panels, Jigs and Accessories and the booklet "Projects on 6-Dec" all contained in a strong attractive plastic case. Ideal for the professional user. £5.17.6 P. & P. 3/6.

DE-DEC BREADBOARD

SOLIDER GUN


SOLIDER GUN

600 WATT LIGHT DIMMER SWITCH

Size as standard wall unit. Cast in moulded plastic. Ideal for all rooms. Light is independent of pull on to off. Heavy plastic box with control knob. LIND-AIR PRICE £2.10.6 P. & P. 3/6.

Garrard HI-FI TURNTABLES

LIND-AIR AUDIO

British Made. Solderless breadboard panels, for fast reliable component connections. Single & Double. Use 6-Dec with Control Panel. Jigs and Accessories for solderless connections to controls, etc., with booklet "Projects on 6-Dec" giving construction details for a variety of circuits. 2/6. 5/6. 2/6. 4-Dec KIT. Four 6-Decs with two Control Panels, Jigs and Accessories and the booklet "Projects on 6-Dec" all contained in a strong attractive plastic case. Ideal for the professional user. £5.17.6 P. & P. 3/6.

DE-DEC BREADBOARD

SOLIDER GUN


SOLIDER GUN

600 WATT LIGHT DIMMER SWITCH

Size as standard wall unit. Cast in moulded plastic. Ideal for all rooms. Light is independent of pull on to off. Heavy plastic box with control knob. LIND-AIR PRICE £2.10.6 P. & P. 3/6.

Garrard HI-FI TURNTABLES

LIND-AIR AUDIO

British Made. Solderless breadboard panels, for fast reliable component connections. Single & Double. Use 6-Dec with Control Panel. Jigs and Accessories for solderless connections to controls, etc., with booklet "Projects on 6-Dec" giving construction details for a variety of circuits. 2/6. 5/6. 2/6. 4-Dec KIT. Four 6-Decs with two Control Panels, Jigs and Accessories and the booklet "Projects on 6-Dec" all contained in a strong attractive plastic case. Ideal for the professional user. £5.17.6 P. & P. 3/6.

DE-DEC BREADBOARD

SOLIDER GUN

LOW PRICE, HIGH QUALITY SPEAKER SYSTEMS

All cabinets are new and carefully designed acoustically with speakers mounted on 5in. chipboard baffles.


CAXTON COLUMN. This is a column cabinet 22x 54 x 3 in. deep finished in black or wood grain cloth with blue Vynair front. Keyhole slot for wall mounting. Fitted with three speaker units 15 ohms impedance. Handles 8 watts. Makes all the difference in quality and volume of tape recorders and record players. Retail bargain at 59/6. P. & P. 11/- each.

PEAK PLINTH AND PERSEPB DUST COVER for SP25 etc. £5.5.0. P. & P. 5/-.


VYNAIR Widths from 40 to 54in., 15/4yd off roll. P. & P. 1/9, 1 yard, 8/-, P. & P. 1/9. Send 1/- stamps for catalogues.

EAPPIES WITH CORD and 3.5mm, plug, 8 ohm magnetic, 35/- 250 ohm 4/- 180 ohm with clip. £5.6. Xtal. & P. 6d.

PIANO KEY PUSH BUTTON SWITCHES. Button inc. made on off 6s. 6/2, X. & P. 7/6.

CARTRIDGES. Sterling: Sonitone 9TA/HC Diamond 4/76, Ronette 5/05 Medium Output, 28/6, 5/05 High Output 28/6. Acos GP35 1 Sapphire, 37/6, GP30 1 Sapphire, 37/6, GP35 Stereo Compatible (High, Medium or Low Output) 35/-, TA700 equivalent to B.S.R. 5X11M, 35/- Japanese equivalent to B.S.R. TC6s, 50/-, P. & P. 1/6.


THE SHELLEY. Size 21x11 x 51/2. An extremely elegant speaker system made of 12mm chipboard covered with leathercloth with dark Vynair front (same S.A.E. for cloth samples). This unique system uses direct coupled T.V. speaker 9in. for the Bass, 7" x 3" for the Middle and 5in. round for Treble. Carefully matched and tested. Will handle 12-15 watts and will warrant 3 ohm impedance. A real bargain at £4.19.6. plus 10/6 P. & P. MATCHING TRANSFORMER for 15 ohms 1/- post free.

SCOTT. This elegant tapered cabinet 19x 16 x 51/2 in. deep is attractively finished in black cloth with striped grey Vynair front. Suitable for table or for wall mounting. Fitted with 13x5 in. speaker unit and volume control, 3 or 15 ohms impedance—please state impedance required. £4.6.8. P. & P. 7/6 each. Fitted with E.M.I. 13 x 5in. speaker unit and twin tweeters. 15 ohms impedance, capacity 15 watts. 35/- extra.


FERROX RODS: 6 x 5in., 2/6, 4 x 5in. 2/5. P. & P. 1/6 each.

FERROX RODS WITH COILS: 41 x 5in. 2/6, 8 x 5in. 5/- P. & P. 1/- each.

ROTARY SWITCHES: 2 Pole Main Switch, 31/2; 1 pole 12 way, 2 pole 3 way, 3 pole 3 way, 3 pole 4 way, 4 pole 5 way, 5/6 each. P. & P. 1/-.

TRANSISTOR SPEAKERS 8 ohm 2in. 2/6, 3in. 10/6, P. & P. 1/-.


BROADWAY ELECTRONICS

92 MITCHAM ROAD, TOOTING BROADWAY, LONDON S.W.17 61-672 3964

(Closed all day Wednesday)

WRITE NOW FOR YOUR FREE CATALOGUE CONTAINING THOUSANDS OF COMPONENTS From: W.E.C. LTD., 74, THE STREET, ASHTEAD, SURREY

RADIO COMMUNICATION HANDBOOK over 22,000 copies sold

Now in its second printing

The standard work in its field

832 pages of everything in the science of radio communication. The handbook's UK origin ensures easy availability of components.

Obtainable from:

RADIO SOCIETY OF GREAT BRITAIN
35 DOUGHTY STREET, LONDON, WC1N 2AE

22s post paid

23s post paid

69s post paid

69s post paid

568

AMATEUR RADIO TECHNIQUES

By Pat Hawkcr, G3VA


22s post paid

THE VHF-UHF MANUAL

By George Jessop, G6JP

A complete manual for frequencies above 30 MHz. Covers aerrals, receivers, transmitters and test equipment. The first book of its kind outside the USA.

23s post paid

PRINTED CIRCUIT PROBLEMS

Prototype circuits produced from your artwork: 25/- per sq. in. 276 p.p.

Small size medium batch production at reasonable rates

Complete design and manufacture from circuit diagrams.

Fairchild

PC 914 sssss! X STOCK 8/-

Quadplex 400v 44 A (as used in our lamp dimmer) 29/6

Dotted SCR's 300v 2A 705 case 2/- 3AE for full list.
THE circuit shown in Fig. 1 is one that I have used on a number of occasions for boosting low level audio signals; the gain is high—about 40dB—and the input and output impedances nicely match most transistor equipment. It can be used to boost the output from a crystal set or tuner with inadequate output or raise the output of a microphone, tape head or magnetic pick-up for feeding into an insensitive amplifier. Note that no frequency correction is incorporated and so, although this little signal booster will provide a much higher level, correction is still necessary when used with tape heads or magnetic pick-ups.

The Take 20 series is aimed mainly at the beginner and, since this month's circuit is extremely simple, we are going to go into the circuit in great detail and discuss why the circuit is so designed, why certain choices are made and discuss the function of every component.

TRANSISTOR CHOICE

First of all we decide that we want a preamplifier with high gain for audio frequency usage and that we want to use a readily available power source—namely a 9V battery.

Transistors can be used in three modes—common emitter, common base and common collector. Since we want to match normal transistor impedances for input and output and we want the highest overall gain we shall settle for the common emitter mode. Now for the choice of transistor; we already know that we want a high gain one which will operate well at 9V. In any early stages (which is where this stage will be used) we want to keep the noise as low as possible so the choice of a low noise type would be best. We then look through manufacturer's or supplier's lists and we find quite a variety which will fit the bill, so we go for the cheapest which is a BC169C, which happens to be a silicon NPN type.

Since we are unlikely to use the preamp in extremes of temperature and since silicon transistors are not greatly affected by temperature (at least compared to germanium) we need not worry about having a resistor and by-pass capacitor in the emitter circuit, this can be connected directly to the negative rail.

COLLECTOR LOAD

We know that we shall have to supply current to the collector through a load resistor. For efficient, low noise operation the collector current should be about 0.5mA in such a stage and the collector voltage half the supply volts—namely 4.5V.

A simple application of Ohm's Law (V=IR) shows that the collector resistor should be 9,000Ω, we use the nearest preferred value, 10kΩ.

BASE BIAS

For the transistor to operate, a bias must be applied to the base. Now before we calculate it's value, we must first decide where we get it from. We could take the supply from the 9V connection or from the nominal 4.5V at the collector of the transistor. If we take it from the collector we will be applying a measure of a.c. negative feedback and helping to maintain d.c. stability, so we take it from there.

Now the gain of a BC169C can vary from about 500 to 900, we shall take the lowest figure for the purpose of calculation and we know that the collector current has been set at 0.5mA or 500μA therefore the base current should be 1μA. The voltage at the base of the transistor should be 0.6V (typical value for silicon transistor and the collector voltage is 4.5V so the base bias resistor should drop 4.5-0.6=3.9V while passing 1μA. Reverting to our sums and Ohm's Law we find the value coming to 3.9MΩ. In fact this very high value should always be reduced slightly and we use a 1.8MΩ, though it will be found that there will be no noticeable difference between any value from 1.5MΩ to 3.9MΩ. We have to couple the input to the base and to block the d.c. path this must be connected through a capacitor. The input impedance is about 10kΩ (the usual value for common emitter stages) and for good quality the time constant of the input capacitor and the input impedance should be five times lower than the lowest frequency we wish to amplify which we will assume to be 100Hz therefore the time constant should be 20Hz or 50mS. The time constant is the input impedance (10kΩ) times the input capacitor so this comes out at 5μF. If we wanted to amplify lower frequencies than 100Hz the value of this capacitor would have to go up.

The output capacitor is calculated in a similar way. As far as voltage ratings are concerned, we can see that no more than 9V will ever be applied to either so 9V capacitors are ideal.
Due to purchasing a new receiver, to replace an old B40/b unit, there was a need for a 500kHz crystal calibrator. (The B40/b has an internal 500kHz calibrator.) Accordingly the following very simple circuit was constructed, and over the past months has given reliable service. Pips are available up to and exceeding 30MHz at good strengths.

Circuit

The circuit has an OC171 oscillator stage, followed by a second OC171 as a buffer amplifier. The current taken by the unit is in the order of 4mA at 9 volts.

The crystal obtained is an FT-241A type, marked ‘Channel 70’. This is in fact a 54th harmonic type giving 27MHz, hence giving pips at 500kHz intervals. The advantage of using this type is that the price is about one-third that of a standard 500kHz crystal, and is considerably smaller than 10X types. In fact this crystal cost only 5/-.

Adjustment

In the event of the crystal oscillating slightly h.f., a 3-30pF concentric trimmer capacitor should be shunted across the crystal, and adjusted to obtain zero beat. If too l.f. in frequency, a series capacitor of the same value should be inserted, and adjusted accordingly. Zero beating with one of the standard frequency stations is the best method of setting up the oscillator.

* components list

<table>
<thead>
<tr>
<th>Resistors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1 270kΩ</td>
</tr>
<tr>
<td>R2 47kΩ</td>
</tr>
<tr>
<td>R3 10kΩ</td>
</tr>
<tr>
<td>R4 4.7kΩ</td>
</tr>
<tr>
<td>R5 2.2kΩ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Capacitors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>C1 0.005μF</td>
</tr>
<tr>
<td>C2 100pF</td>
</tr>
<tr>
<td>C3 0-005μF</td>
</tr>
<tr>
<td>C4 10-25pF</td>
</tr>
<tr>
<td>TC1 3-30pF trimmer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Semi-conductors:</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC1/2 OC171 or OC170 or AF114</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Miscellaneous:</th>
</tr>
</thead>
<tbody>
<tr>
<td>R. F. Choke (Denco RFC10). Diecast box (Eddystone 6906P). SPST switch. 2 Co-axial sockets. Crystal holder and crystal Type FT-241A marked “Channel 70” (Henry’s Radio).</td>
</tr>
</tbody>
</table>

The unit has been arranged to be in parallel with the aerial input to the receiver, simply switching it on to check calibration. Other crystals can of course be used in this position, but a 500kHz crystal seems to be the best frequency for broadcast station working.

Depending on the coupling required, a value of between 10pF and 25pF to connect with the aerial connection seems to be adequate. An Eddystone diecast box was used but if this seems extravagant any similar metal container will suffice.

**QUERY COUPON**

This coupon is available until 9th October and must accompany all queries in accordance with the rules of our Query Service.

PRACTICAL WIRELESS, NOVEMBER 1970

BINDERS AND INDEX

Don’t let your copies of PRACTICAL WIRELESS become torn and dirty: hard-cover binders are available at 14s. 6d. from:

BINDING SECTION,
IPC MAGAZINES, LTD.,
SOUTHAMPTON STREET,
LONDON, W.C.2.

Indexes to Vol. 44, 1968-69, are also available at 1s. 6d. These prices include post and packing.
INCREASE YOUR KNOWLEDGE

Established 1891

MANY COURSES TO CHOOSE FROM incl.
RADIO & TV ENGINEERING & SERVICING,
TRANSISTOR & PRINTED CIRCUIT SERVICING,
COLOUR TV SERVICING, ELECTRONICS,
NUMERICAL CONTROL, ELECTRONICS,
TELEMETRY TECHNIQUES, CONTROL SYSTEMS,
ELECTRONICS FOR AUTOMATION,
COMPUTERS, etc.

ALSO EXAMINATION COURSES FOR
C. & G. Telecommunication Technicians' Certificates
C. & G. Electronic Servicing
R.T.E.B. Radio/TV Servicing Certificate
Radio Operator Certificates
Radio Amateurs' Examination
General Certificate of Education, etc.

BUILD YOUR OWN RADIO AND INSTRUMENTS
With an ICS Practical Radio & Electronics Course you gain a sound knowledge of circuits and applications as you build your own 5-valve Superhet Receiver, Transistor Portable, and high-grade test instruments (shown below). Everything simply explained. All components and tools supplied. For illustrated brochure, post coupon below.

MEMBER OF THE ASSOCIATION
OF BRITISH CORRESPONDENCE COLLEGES

THERE IS AN ICS COURSE FOR YOU

Whether you need a basic grounding, tuition to complete your technical qualifications, or further specialized knowledge, ICS can help you with a course individually adapted to your requirements.

There is a place for you among the fully-trained men. They are the highly paid men—the men of the future. If you want to get to the top, or to succeed in your own business, put your technical training in our experienced hands.

ICS Courses are written in clear, simple and direct language, fully illustrated and specially edited to facilitate individual home study. You will learn in the comfort of your own home—at your own speed. The unique ICS teaching method embodies the teacher in the text; it combines expert practical experience with clearly explained theoretical training. Let ICS help you to develop your ambitions and ensure a successful future. Invest in your own capabilities.

FILL IN AND POST THIS COUPON TODAY
You will receive the FREE ICS Prospectus listing the examination and ICS technical courses in radio, television and electronics PLUS details of over 150 specialized subjects.

Please send free book on

NAME

ADDRESS

OCCUPATION

AGE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Dept. 170, INTEXT HOUSE, STEWARTS ROAD, London, SW8
**PREMIER STEREO SYSTEM “ONE”** Consists of an all transistor stereo amplifier. Garrard 205 T/C auto manual record player unit fitted to 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 34 x 34in high (Amplifier available separately if required £14.19.6. Carr. 716.) NOW AVAILABLE = MATCHING FM TUNER £15.00.

**AURIGA 8 WAVEBAND TRANSISTOR PORTABLE**

**TELETON SAQ203E STEREO AMPLIFIER**
A small but powerful amplifier designed for stereo re- production. 10 watts per channel stable power. Inputs for Gram (Magnetic and Crystal), Tuner and Auxiliary. Tape Record output. Controls: Volume, Balance, Bass, Treble, true mono wide switch, Stereo headphones socket. Attractive alloy walnut cabinet with brushed aluminium front panel. List Price £2.97.0

**PREMIER STEREO SYSTEM “FOUR”**
Telenton SAQ203E Amplifier (as above) £23.20
Garrard SP25 £11.19.6
Shure M3D £5.19.6
Teak base and cover £5.10.0
Pair of Hi-Fi Enclosures fitted £26.50
Total cost if purchased separately £73.16.0

**PREMIER PRICE** 22 Gns. P. & P.

**VERITAS V-149 MIXER**
Battery operated 4-channel mixer after powering four separate inputs. Size 8 x 5 x 3in. Will take 4-core microphone low impedance units, switch, with transformer, radio, tape, etc. Max. input 1w. Max. output 2v. (±1) 6dB. Standard jack plug socket inputs, phono plug, output. Attractive teak wood grain finish case.

**PREMIER PRICE** 18 Gns. P. & P. 10/-

**POCKET SIZE MULTI-TESTER**
Ideal for regular home and service work. 100 to 140 volts a.c. 250 to 500 volts d.c. 10,000 ohms resistance. Precision jewelled meter movement, ceramic 100/140 mix. Case. Soldering in the factory. £4.19.6

**PREMIER EXCLUSIVE MIDLAND CASSETTE TAPE RECORDER**
Null state-in-operating plan key controls for trouble-free 3-track recording, inputs for mike and electrics and earphone. Size 16 x 4 x 5 3/4in. £16.10.0

**TAPE CASSETTES**
CD6 £6.00. 7/6 3 fee
C90 £9.00. 12/6 3 fee
C120 £12.00. 17/6 3 fee

All cassettes can be supplied with library cases at 6d. extra each
Coils for one band only are shown. L1 is the aerial coil, and L2 the oscillator coil.

The band-switch has six poles, and positions or "ways" for the number of ranges required. (E.g., 3-way, for three bands.) S1 switches aerial coupling windings and S2 base windings. S3 allows each coil to be tuned by VC1, and each coil has a trimmer TC1.

In the oscillator section, S4 and S5 switch collector and emitter circuits, and S6 the tuned winding. Cp is the coil padder, and each range has its own particular value here. For the coils mentioned, the padder is 110pF for long waves, 350pF for medium waves, 110pF for 180-57m, and 3000pF for 60-20m. The 28-9-5m coil requires no padder.

The changes involved in such a modification depend on the receiver. With a l.w./m.w./s.w. receiver, substituting an additional s.w. range for the l.w. range could be a simple change. But other circuits may need more extensive modifications, and even a change of the mixer transistor, because the type fitted in a m.w./l.w. receiver may be unsuitable for s.w. With most ready-made receivers, conversion to a circuit like that in Fig. 6 will be too difficult. In the case of home-built equipment, it may be felt that it is worth while to retain the i.f. and audio sections, and re-build or modify the first stage so that an all-band circuit such as Fig. 6 can be incorporated. Provided wiring is short and direct, with a reasonably good layout, snags are not likely. Fig. 6 is for a 465kHz i.f. amplifier.

---

**PRACTICAL WIRELESS**

**QUERY SERVICE**

Before using the query service it is important to read the following notes:

The PW Query Service is designed primarily to answer queries on articles published in the magazine and to deal with problems which cannot usually be solved by reference to standard textbooks. In order to prevent unnecessary disappointment, prospective users of the service should note that:

(a) We cannot undertake to design equipment or to supply wiring diagrams or circuits, to individual requirements.

(b) We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuits.

(c) It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.

(d) We regret we are unable to answer technical queries over the telephone.

(e) It helps us if queries are clear and concise.

(f) We cannot guarantee to answer any query not accompanied by the current query coupon and a stamped addressed envelope.

---

**THE MW COLUMN**

Medium wave reception from South and East Asia starts in the autumn, the season extending right through until spring. Two times of the day are favourable for DXing; the first covering the period before close down (local time is 4) to 9 hours ahead of GMT) while the second coincides with morning sign-on. Start about one hour before sunset and look for All India Radio Calcutta on 1130kHz. This 1000kW station signs-off at 1700 hrs GMT and has an English programme from 1530 to 1600 hrs. The Voice of America in Okinawa on 1178kHz is another megawatter. It broadcasts in Far Eastern languages but identifies in English on the hour and half hour and it can often be heard mixed with the Swedish station on the same frequency until 1700 hrs. KSBU 1360kHz is a gospel broadcaster in the Philippines who has programming in Chinese and Japanese until 1730 hrs but can be identified by it's Western style religious music. Look for Peking on 1000, 1230 and 1290kHz; Kabul Afghanistan on 1280 (until 1830 hrs); HLKK 1190 in Incheon South Korea; BED2 on 750 and BED88 on 1200kHz in Taiwan (Formosa). By mid-winter, DX can be heard as early as 1430 hrs GMT, Chinese stations often being prominent until they become submerged in European QRM as darkness approaches.

Chinese stations are also heard when they sign-on for the day, Lanchow 860; Anweh 940; Peking on 1090 and 1250; Urumpi 1525 along with Hanoi 1010kHz in North Vietnam were all logged after 2300 hrs GMT last winter. Indians are audible at this time too and some of them carry a news bulletin in English at 0110 hrs GMT. Try for Rajkot 1070; Calcutta 1130; Jabalpur 1180; Bibaker 1330. Western Asians are logged during the evenings, Baghdad 760 being a regular until 2230 hrs while from Iran there is Radio Iran Teheran on 895; Radio Kermanshah 985 and Radio Ahiwaz 1390kHz.

CKGA 730kHz is a new 1kW station in Gander Newfoundland which was logged by the writer on the 12th August and belongs to the CBS network referred to last month. VOCM 590 St John's is the key station of the network and is often audible by 2300 hrs, while CKCM 620 in Grand Falls is usually strong at 0100 hrs when the Egyptian and RNE Tenerife on the same frequency have signed-off. North Americans are usually heard from 2300 hrs onwards once the band starts to clear of Europeans. The easiest is CBA in Moncton New Brunswick, a 5kW main station of the Canadian Broadcasting Corporation on 1070kHz, CBA shares the channel with Paris 2 but can be logged after the latter goes off at 2300 hrs. Others logged regularly include CBN 640 St John's Newfoundland; WHDH 850 Boston; CJON 930 St John's; CHER 950 Sydney N.S; WHN New York City on 1050kHz (after the BBC on 1052 closes down); WNEW 1130 also in NYC. Conditions are rather variable on the North American path so try again a few days later if you do not hear DX at the first attempt. When reception is good, many North Americans can be heard by 0100 hrs, an ordinary outdoor TV aerial being quite adequate.

Charles Molloy
Operation
A headphone is connected to the jack socket, or an audio amplifier and speaker to the detector terminals. The unknown capacitor or resistor is connected to the CR terminals and the bridge is switched on. The range switch and bridge potentiometer are then adjusted for balance (zero output), and the value read off the dial.

If the value of the component is completely unknown set the potentiometer to 1:1, centre scale, and turn the range switch to the position which appears nearest to a balance point and then adjust the potentiometer to give the final balance.

Test Voltages
Tr1. Emitter —1.9V
Base —2.1V
Collector —9.0V

Transformer winding resistances
T1. Primary 1—2 25 ohms
2—3 80 ohms
Secondary 4—5 2 ohms

The terminals marked 'x' are included so that an external standard may be used, or two components may be compared. For example, if two matched resistors are required for some purpose, one resistor may be connected to the 'x' terminals and a number of resistors of nominally the same value tried in the CR terminals until a balance at 1:1 is obtained. The positions of balance which occur for each of the resistors can be read off as a ratio of their value to the one connected at 'x'. The same applies for capacitors, but on the 'C' range of the dial.

FREE WALL CHART!!
In the December issue of PW we shall be presenting the first of two new free wall charts on AUDIO STANDARDS. Full details of the DIN audio specifications and test conditions for hi-fi systems and record/tape/tuner/amplifier combinations presented in a format convenient to both the professional engineer and the home constructor.

HF COMMUNICATION RECEIVER
All the amateur bands from 1.8 to 29.5 MHz are covered in this double-conversion all-transistor receiver. Adequate selectivity for good reception on s.s.b. is obtained using a special arrangement of standard i.f. transformers. Full details are given for the construction of all the tuning inductors together with precise alignment procedure.

AUDIO-VISUAL TESTER
A very useful little piece of equipment for the workshop allowing continuity testing to be carried out easily without the usual constant visual reference to a testmeter.

TELEPHONE AMPLIFIER
This device picks up the stray magnetic fields around a telephone and amplifies them to feed a loudspeaker which can be of great benefit in noisy locations.

TELEVISION in the NOVEMBER issue
OSCOPYSCPE PREAMPLIFIER
A further feature in our series on i.c.s for the constructor. This preamplifier uses two MC-1709CG i.c.s and is primarily intended for increasing the sensitivity of oscilloscopes though it can also be used as a general-purpose accessory, for example as an r.f./i.f./a.f. signal tracer. It provides stable voltage gain up to 200 and when used with the P.TV. VideoScope MV3 boosts the basic sensitivity from 100 mV/cm. to a maximum of 0.5 mV/cm.

625 CONVERSION UNIT
Some well-built 625-line conversion units by the original Murphy firm are currently available on the surplus market. The kit includes valves and u.h.f. tuner and is therefore a complete u.h.f. receiver unit. David Robinson describes the unit and suggests ways in which the constructor can adapt it for his own purposes.

PLURAL THE REGULAR FEATURES

On Sale OCTOBER 23rd price 3s. 6d.
MULTIMETERS for EVERY PURPOSE!

TECH PT-34, 1,000 V, 20 mA, 100 kΩ, 10 meg Ω, 100 mA, 1000 V, 10 MΩ, 10 A, 1000 V, 10 MΩ, 10 A, 1000 V, 10 MΩ.

MODEL TE-850, 9,000 V, 20 mA, 100 kΩ, 10 meg Ω, 100 mA, 1000 V, 10 MΩ, 10 A, 1000 V, 10 MΩ.

MODEL TE-850, 9,000 V, 20 mA, 100 kΩ, 10 meg Ω, 100 mA, 1000 V, 10 MΩ, 10 A, 1000 V, 10 MΩ.

HORNER TE-10A, 20 V/O, 200 OHM, 1000 V, 100 mA, 1000 V, 100 mA, 10 A, 1000 V, 10 MΩ.

MODEL TE-200, 10,000 V, 20 mA, 100 kΩ, 10 meg Ω, 100 mA, 1000 V, 10 MΩ, 10 A, 1000 V, 10 MΩ.

MODEL TE-200, 10,000 V, 20 mA, 100 kΩ, 10 meg Ω, 100 mA, 1000 V, 10 MΩ, 10 A, 1000 V, 10 MΩ.

BELCO DA-20 SOLID STATE DUAL AUDIO OSCILLATOR

10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output.

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

10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output, 10 MHz output.

TE-40 HIGH SENSITIVITY A.C. VOLTMETER

High quality instrument with full ranges, 0-1000, 1-1000, 10-1000, 10-1000, 10-1000, 10-1000, 10-1000, 10-1000.

TE-55 VOLTOMETER

High quality instrument with full ranges, 0-1000, 1-1000, 10-1000, 10-1000, 10-1000, 10-1000, 10-1000, 10-1000.

AUTO TRANSFORMERS

9/13/23/240V. Step up or step down. Fully shrouded.

350 W, 500 W, 700 W, 1000 W, 1500 W, 2500 W, 5000 W, 10,000 W.

SOLID STATE VARIABLE A.C. VOLTAGE REGULATORS

Compact and panel mountable, ideal for control of lamp, chassis, operational amplifiers, etc. Input 250/480V. A.C. output continuously variable from 3V-200V, 3V-200V, 3V-200V, 3V-200V, 3V-200V, 3V-200V, 3V-200V, 3V-200V.
I'D RATHER HAVE A MINITEST"

The SEI MINITEST has made a remarkable impact in the pocket-sized multi-range meter market, by making itself a firm favourite with discerning people in the industry. Let's look into the reasons why.

First, the appearance. Diminutive, neat, wipe-clean cycolac case with shock and magnetic field proof steel liner. Controls are simple and easy to use.

Second, the range. The Minitest measures a.c. and d.c. voltages d.c. current and resistance over 20 ranges to a sensitivity of 20,000 and 2,000 ohms per volt d.c. and a.c. respectively.

Third, high voltage probes. These extend the range to 25 or 30kV d.c. Little wonder the Minitest is preferred!

SALFORD ELECTRICAL INSTRUMENTS LTD
Peel Works, Barton Lane, Eccles,
Manchester M30 0HL
Telephone 061-789 5081 Telex 66711
A Member Company of GEC Electrical Components Ltd.

"NO"

"I'D RATHER HAVE A MINITEST"

The SEI MINITEST has made a remarkable impact in the pocket-sized multi-range meter market, by making itself a firm favourite with discerning people in the industry. Let's look into the reasons why.

First, the appearance. Diminutive, neat, wipe-clean cycolac case with shock and magnetic field proof steel liner. Controls are simple and easy to use.

Second, the range. The Minitest measures a.c. and d.c. voltages d.c. current and resistance over 20 ranges to a sensitivity of 20,000 and 2,000 ohms per volt d.c. and a.c. respectively.

Third, high voltage probes. These extend the range to 25 or 30kV d.c. Little wonder the Minitest is preferred!

SALFORD ELECTRICAL INSTRUMENTS LTD
Peel Works, Barton Lane, Eccles,
Manchester M30 0HL
Telephone 061-789 5081 Telex 66711
A Member Company of GEC Electrical Components Ltd.

"NO"

"I'D RATHER HAVE A MINITEST"

The SEI MINITEST has made a remarkable impact in the pocket-sized multi-range meter market, by making itself a firm favourite with discerning people in the industry. Let's look into the reasons why.

First, the appearance. Diminutive, neat, wipe-clean cycolac case with shock and magnetic field proof steel liner. Controls are simple and easy to use.

Second, the range. The Minitest measures a.c. and d.c. voltages d.c. current and resistance over 20 ranges to a sensitivity of 20,000 and 2,000 ohms per volt d.c. and a.c. respectively.

Third, high voltage probes. These extend the range to 25 or 30kV d.c. Little wonder the Minitest is preferred!

SALFORD ELECTRICAL INSTRUMENTS LTD
Peel Works, Barton Lane, Eccles,
Manchester M30 0HL
Telephone 061-789 5081 Telex 66711
A Member Company of GEC Electrical Components Ltd.

"NO"

"I'D RATHER HAVE A MINITEST"

The SEI MINITEST has made a remarkable impact in the pocket-sized multi-range meter market, by making itself a firm favourite with discerning people in the industry. Let's look into the reasons why.

First, the appearance. Diminutive, neat, wipe-clean cycolac case with shock and magnetic field proof steel liner. Controls are simple and easy to use.

Second, the range. The Minitest measures a.c. and d.c. voltages d.c. current and resistance over 20 ranges to a sensitivity of 20,000 and 2,000 ohms per volt d.c. and a.c. respectively.

Third, high voltage probes. These extend the range to 25 or 30kV d.c. Little wonder the Minitest is preferred!

SALFORD ELECTRICAL INSTRUMENTS LTD
Peel Works, Barton Lane, Eccles,
Manchester M30 0HL
Telephone 061-789 5081 Telex 66711
A Member Company of GEC Electrical Components Ltd.
TRANSISTOR RADIOS
TO BUILD YOURSELF
Backed by after sales service

NEW! roamer eight mk 1
WITH VARIABLE TONE CONTROL
7 Tunable Wavebands: Medium Wave 1, Medium Wave 2, Long Wave, SW1, SW2, SW3 and Trawler Band. Easy to follow instructions and diagrams make the Roamer Eight a pleasure to build.

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

NEW! trans eight
SIX WAVEBAND PORTABLE WITH 3in. SPEAKER
Attractive case in black with red grille and cream knobs and dial with polished brass inserts. Price £5.19.6. Retractable 4 section 60 cm telescopic aerial for Medium and Long Waves. Eight improved type transistors plus 3 diodes. Push pull output. Battery economiser switch for extended battery life. Aimed power to drive a larger speaker. Parts price list and easy build plans 5/- (FREE with parts).

Total building costs £89.6 P. & P. 9/6

roamer seven mk IV
SEVEN FULLY TUNABLE WAVEBANDS: SW1, SW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial and retracted 4 section 75 cm telescopic aerial for best performance. Power output using 600 mW transistors. Socket for car aerial. Tape record socket. Selectivity switch. Switched earpiece socket complete with earpiece for private listening. Eight transistors plus 3 diodes. Price £5.19.6. Easy to follow instructions and diagrams make the Roamer Seven a pleasure to build.

Total building costs £5.19.6 P. & P. 7/6

pocket five
MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE WITH SPEAKER
Attractive black and gold case. Size 9 x 3 x 3in. Tunable over both Medium and Long Waves. New extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—6 transistors and 3 diodes. Price £2.30. Easy to follow instructions and diagrams make the Pocket Five a pleasure to build. Parts price list and easy build plans 5/- (FREE with parts).

Total building costs £4.6 3/6 P. & P.

IMPROVED MODEL!
roamer six
SIX WAVEBAND PORTABLE WITH 3in. SPEAKER
Attractive black case with red grille and cream knobs and dial with polished brass inserts. Size 9 x 3 x 3in. Price £5.19.6. Tunable over Medium and Long Waves, six wavebands. Improved Trawler Band plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and 50 cm telescopic aerial for Short Waves. Eight transistors, 8 stages—8 transistors and 2 diodes. Price £5.19.6. Parts price list and easy build plans 5/- (FREE with parts).

Total building costs £7.9 4/6 P. & P.

* Callers side entrance Stylo Shoe Shop
* Open 10–1, 1.30–4.30 Mon.–Fri. 9–12 Sat.
LOW COST ELECTRONIC AND SCIENTIFIC EQUIPMENT AND COMPONENTS

NUMERATORS

Price 1/8 each. P. & P. 10/.

DOUBLE AUDIO FADEOUT

A great handi- portable for general purpose applications. 250,000 minute. simple control of tone. Minimum string voltage 5000V. Side reading Type XN 3 XN 2 XN 12 and XN 23.
Price 1/8 each. P. & P. 10/.

KEYNECTOR

Connects anything earthed in without plugs or sockets. No worry about dangerous live wires. Now you can make electrical connections safely, in seconds with the revolutionary new Keynector. Cuts out plugs, sockets and saves time. A hundred different uses in the house, and a must for the do-it-yourself enthusiast. Only 4/8 price p. & p. 5/-. Or send for a leaflet.

LAMP,

2A15 1.5W. N.S. Panel lamps. Ideal making up displays, etc. Length 7 in. 1 1/4 dia. Special offer, 10 for 81. P. & P. 5/-. SYNCHRONOUS MOTORS

200/250V 50/Hz. New condition, equipment. 81 R.P.M. Self starting, complete with gear box. Size 1/4 4 mm. 5/-. Special price 30/-. P. & R. 10/.

RIGHT ANGLED GEAR BOXES

Gear boxes give a drive of 415.1 at right angles to the input. Drives through the 1/8 shaft only. Dimensions 4 in. wide, 4 in. high, 4.75 in. thick. Robust construction in cast iron. Price 5/6. With pulley and ball race guides. Suitable for driving transmitter equipment. Price 7/6, CARR. 15/-. SHADED POLE MOTORS 120V 50Hz.

Precision made as used in record decks and tape recorders. Suitable many other applications. Suitable for 60/60, 75/75, P. & P. 6/-. ELECTRIC CLOCK MOTOR

N.V. 250 250V. Synchronous induction motor. 9 revs. per hour. O/P shaft, 11 mm dia. 4 in. long. Clock side plate. Three hole mounting at 120 in. 2 in. PCD. Price 20/-. P. & P. 5/-. DELAY LINE

1 microsecond. 4,000 ohms. Type M2180. 15 ft. length. 6.5 mm. Insulated. Encapsulated module. Price 20/-. P. & P. 5/-. ELECTRO DEVICES

4 DIGIT DIGIT AVAILABLE COUNTER

Totalising 10 impulses per second. Length 3 1/2 in. 1 1/2 in. 1 1/4 in. J. J. 24V d.c. 3000 ft. length. Price 10/-. P. & P. 5/-. TEST EQUIPMENT


EAC DIVISOR Mk. II DIGITAL READ-OUT DISPLAY

Low cost suitable for use in conjunction with decoder circuitry etc. The Digital Divider incorporates a moving coil movement to provide an accurate display of the input frequency. It is ideal for audio and video applications. Price 8/6. P. & P. 1/4.

TRANSISTORS, DIODES & SEMI-CONDUCTORS

K1080 125V 5/-. BY205A 8/-. BY225A 8/-. OC203 6/-. OC240 6/-. TX143 (Germany).
Price 1/8. P. & P. 1/0. LONGLEY LAKE, GATLEY, CHEADLE, CHESHIRE, SK5 4EE

TERMS: Cash with order or within 28 days of delivery. All orders subject to current price list and terms of sale. Prices subject to change without notice. All prices quoted exclude VAT. VAT @ 17.5%. A.C.E. items are subject to VAT at 17.5%.
The ‘PICTURE BOOK’ way of learning

BASIC ELECTRICITY
(5 VOLUMES)

BASIC ELECTRONICS
(6 VOLUMES)

You’ll find it easy to learn with this outstandingly successful 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

Below are extracts from the many letters received.

What readers say...

“TERRIFIC TECHNICAL EDUCATIONAL MANUALS”
“As you know I have had from you both sets of Basic Electronics and Basic Electricity, these are terrific technical educational manuals, the best I have ever read.”

K.F.H., Llford.

“IDEAL TEACHING AGENTS”
“The books are ideal teaching agents. Thank you.”


“ASTONISHED AT THE EASE OF LEARNING”
“I am astounded at the ease of learning and understanding they provide.”


“KEY TO LEARNING”
“I cannot say enough in praise of these Manuals. I shall recommend them to anybody interested in electricity and wireless that I know. They are the key to learning.”


“ABSOLUTELY DELIGHTED”
“I am absolutely delighted with the books and hope to learn quite a lot from them.”

H.A.H., Rhymney.

“HELPED ME TO UNDERSTAND”
“I am a qualified electrician. Your set of excellent books has helped me to understand matters in the field of electronics which I thought previously were above me. Indeed these books are well worth the money.”

T.E.D., Aberdare.

“MOST PERFECT BOOKS”
“I have decided to send you the full payment for the books you mailed to me. In my mind they are the most perfect books for any Beginner to Electronics.”


“BEST BOOKS IN THIS COUNTRY”
“On account through these books I have found they are the best books I have ever had in this country.”


“KEY’ TO THE KNOWLEDGE”
“Your books have been the ‘key’ to the knowledge I have needed.”

J.M., Manchester.

“UNDERSTAND THE BASIC FACTS”
“This is the first time I have been able to understand the basic facts as all other books are too complicated.”

L.W., Sheffield.

“T.V. ENGINEER”
“So in two years I have come from a labourer on a building site to a T.V. Engineer, with the help of your books.”

C.G., Shepperton.

“SIMPLE, CLEAR AND CONCISE”
“I would like to endorse the feelings of many purchasers that they are a simple, clear and concise introduction to the study of electronics.”


“MONEY WELL SPENT”
“I consider this as money well spent. Thank you.”

F.A., Barton-on-Trent.

The series will be of exceptional value in training mechanics and technicians in Electricity and Electronics.

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 buyers 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

(No under 11 signature required of parent or guardian)

NAME

BLOCK LETTERS

FULL POSTAL ADDRESS

SIGNATURE

PW

581
MICRO SWITCH  5 amp, changeover contacts, 1/8 inch. Model N0-2. 2 each or 8/- dozen.

TOGGLE SWITCH  3 amp 50v. with fixing lug. 1/8 each, 16/- dozen.

CONSTRUCTORS PARCEL
1. A new patent 3 gang tuning condenser with built in trimmer and wave gang switch. 2. Ferrite stab aerial with coil to suit the above tuning condenser. 3. A good range of diagrams giving all component values for tube circuits covering over 90% of them. 4. A large range of crock around Radio 2. The three items for only 7/6 which is half the price of Radio 2. Ideal for the amateur graph technician.

SLOW MOTION DRIVES
For coupling to tuning condensers etc. One end 1/4 inch and the other end 1/8 inch shaft with grub screws. Price 4/6 each. 4 dozen.

LARGE PANEL MOVING MOIL COIL METER
Blue silvered. No. 200-000-200 micro amp made by Bangsman Weston. Regular price probably 8/6. Our price 4/15, 100 at 4/- 70/-.

A.C. AMMETER
0-60 amp, flush mounting—moving iron. Ex-equiptment has been priced at 2/-.

CIRCUIT BOARDS
Heavy copper on 3/22 parox sheet ideal for making power packs etc. As sheet is very strong and thick enough to allow copper to be cut away with hack saw blade. 8 x 8, 1/8 x 16, 1/4 x 5, 1/4 x 6, 5/8 x 6.

4KVA AUTO-TRANSFORMER
In ventilated sheet steel case—tapped 110v-140v 170v-200v 230v-250v. 38/6 kva, 3 phase. Proved design, ideal for Heavy copper grab tuning condenser. Micro Switch. ".

VENTILATED SHEET 6KVA core 8/6 screws. Price 4/6 each 48/- dozen.

POWER SAVING SLAB AERIAL with larger fixing hole. The aerials are exactly set to any position around the drum which is rotated to a desired moment. (Motors with other specifications available.

Circuit diagram available at 10/- per copy. Reduced price only 8/3 each post free. Credited when you order IC's value of 50 and upwards.

MOTORISED SWITCH For Animated signs etc.
This is a motorised programmer, mains operated, with 11 step switches. A special design operated by triggers on a rotating drum. Six triggers will put switches on, six triggers will put switches off. Simple operation or change of program is immediate. It is a useful device for various purposes. Over 7000 triggers have been sold to 5000 satisfied customers.

Manufacturer of 50 cycle 60 cycle inductors for American equipment.

BARGAIN OF THE YEAR
MICROSCONIC KEYCHAIN RADIO

24-HOUR TIME SWITCH
Micro Switches are in stock. Maintained Contacts give 2 seconds per 24 hours. Contacts raised 15 amps. Repeating mechanism so ideal for shop window control, or to switch ballot lights (anti-hoarding prevention) while you are on holiday. Made by the famous Smiths Company. This month only 40/6 with power cover, plus 3/- postage and insurance, a real dup which should not be missed.

MOST AMAZING BARGAIN
PRINCESS AUTO CHANGER
The most amazing bargain ever! A brand new Princess Auto Changer in stock, which automatically cleans stylus after each record playing and at the same time the record is automatically played on the record changer. The Balfour has two unique features (1) A precision cutting mechanism which automatically cleans stylus after each record playing and (2) a precision record changer. Its Record changer: 3 speed Autochanger—a really fine machine at a very reasonable price of 6/6 each.

24/7 SERVICE
Micro Switches are in stock. Maintained Contacts give 2 seconds per 24 hours. Contacts raised 15 amps. Repeating mechanism so ideal for shop window control, or to switch ballot lights (anti-hoarding prevention) while you are on holiday. Made by the famous Smiths Company. This month only 40/6 with power cover, plus 3/- postage and insurance, a real dup which should not be missed.

Mains Transformers
Note all these are first grade transformers and all have guaranteed performance.

Mains Transformer Type No. 56780
Upright mounting, approx. 90 mm vertical and 125 mm horizontal. 11.5 volts 1.2 amp at 51.5 volts 1.5 amp. 80/6 no order for this transformer.

Mains Transformer Type No. 56787
Chassis mounting type, size approximately 3 x 3 x 2 in. 2 seconds one 250 volt 1 amp and the other 0.5 volt 0.5 amp. This has been primary and secondary—this transformer will give 8 volts output at 0.5 amp which can be cut down at 80/6 no order for this transformer.

Mains Transformer Type No. 56786
Chassis mounting type, size approximately 2 x 2 x 2 in. 2 seconds one 250 volt 1 amp and 0.5 volt 0.5 amp. This has been primary and secondary. This transformer will give 6 volts output at 0.6 amp. 80/6 no order for this transformer.

Output Transformers
Opt. ref. 66934
Chassis mounting type size approximately 2 x 2 x 1 in. Primary 500 ohms at 150 watts output using transformer type A1640 (Circuit diagram available at 5/6. Price 8/6 each, no extra for postage, sold with marking transformer type 56780.

Opt. ref. 65965
Upright mounting type, size approximately 2 x 2 x 2 in. Primary 800 ohms at 100 watts or 1500 ohms at 50 watts output using transformer type A1640. Price 8/6 each. 48/- dozen.

Heavy Duty Mains Transformers
30V, 37VA, Primary 250/500 in 16 steps. A really beautiful heavy duty transformer made by Parkevco, impregnated and varnished. Weight 24 lb. 10 oz. 50 lb. 10 oz. 3 phase. Price 1.5/- each 6/- dozen.

90 CYCLE TO 60 CYCLE CONVERTERS
For operating American instruments and other equipment made of 60 cycles 115 volts 230/240 volt mains. These units have an output of 110 volts 50/60, and will handle a load of up to 100 watts. These are precision made and have a wide type frequency meter which vibrates when the frequency is exactly 60 c.p.s. Adjustment of the frequency is made by a knob on control panel. Input by 3 core output from 3 pin socket. Original cost of 8/- each. A limited available at 6/- each.

MINIATURE SWITCHES
2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—3 pole, 4 way—4 pole, 2 way. Price 2/- each 50/- dozen. Price 2/- each. 50/- dozen, your assortment.

WATERPROOF HEATER
26 Yard lengths. Self-regulating temperature control. 15/- post free.

MAINS OPERATED CONTACTOR
Contactor model 45-2. Chassis operated motor contacts, with laminated core so very well with Transformer. Operate circuits by circuits each rated at 10 amps. Extremely well made by a German electrical company. Overall size 3 x 2 x 2.5 in.

AUTO ELECTRIC CAR AERIAL
Wedge type aerial head. This type of aerial is fully extensible to 40" or fully retracted to 12". Suitable for all types of cars, trucks etc. Supplied complete with fitting instructions and ready to fit to dashboard switch. Price 3/- post free.

Mains Transformer
Precision made—accuracy to 100,000th of an inch. Comes in all types, finishes, etc. Insulated and fully tested. Price 4/- post free.
Whether you are a new or experienced in radio and electronics, or are engaged in the industry and wish to prepare for a recognized examination, ICS can further your technical knowledge and provide the specialized training so essential to success. ICS has helped thousands of ambitious men to move up into higher paid jobs—they can help you too! Why not fill in the coupon below and find out how?

Many diploma and examination courses available, including expert coaching for:

- C. & G. Telecommunication Techns.' Certs.
- C. & G. Electronic Servicing
- Colour T.V. Servicing
- Radio Amateurs' Examination
- Radio operator Certs
- General Certificate of Education, etc.
- Now available Colour T.V. Servicing

Examination Students coached until successful

**NEW SELF-BUILD RADIO COURSES**

Learn as you build. You can learn both the theory and practice of valve and transistor circuits, and servicing work while building your own 5-valve receiver, transistor portable, and high-grade test instruments—all under expert tuition. Transistor Portable available as separate course.

**POST THIS COUPON TODAY**

for full details of ICS courses in Radio, T.V. and Electronics.

---

**A. H. Supplies**

57, Main Road, Sheffield. S9. SFL.

---

Stabilised P.U. 200/250v IP, made by Solartron O/Ps 250 or 350v stab at 100 Ma also 6.3v 3 times, use 7 valves on chassis size 7 x 10 x 6" x equip 65/- Amplifier Units for 200/250v uses 7 valves as P.P. 6BW6 in O/P as int monitor speaker and current meter, O/P is 600 ohm in table cabinet size 19 x 12 x 10" used condition limited number £4.10s. Rack Cabinets 19" size overall 33" high, 22" wide 12½" deep hammer grey finish good cond. £3, Transformers 230v plug Sa 490-0-490 at 200 Ma, 5v 3a, 6.8 4a, 6.3 1.6a, 12v 1a C core ex equip 51/- L.T. type sec 12v 1.5a 10/6, Osc Unit contains valves 1A1, 7 T, x 2, LA2 pot core, jack sk, coax sk, 10 & 500K pots, misc parts new cond 14/6, Metal Rect 12v 3a F.W. bridge new ex equip 10/6, Cond 8uf 750v Wk Dubiler 2 for 15/-, LA66 Pot Cores 3/6 ea 4 for 10/-, Coax cable H.D. 80 ohm 3/8th dia approx 30ft new 14/6, Plugs & sks miniature type 14 half 2/6 18 way 3/-, Meters 270" scale approx 1.5 Ma basic calibrated in altitude front 33" sq. new cond 19/6, Helipots 500 ohm, 2.5K & 50K 16/6 ea, Helipot dials 10tr 16/6. Circuits 1475 & 1392 Rx 5/- ea.

Prices include post, S.A.E. with enquiry.
The Codar CR.70A is an excellent general coverage communications receiver for the keen short wave listener. Very reasonably priced at just £22.10.0 the CR.70A is outstanding value for money.

In four stable ranges, the receiver covers from 540 metres medium wave, right through the shipping and coastguard frequencies all the way up to and including 10 metres.

The CR.70A has a high 'Q' aerial input stage using exclusive CODAR COIL air space inductor. Double tuned, iron cored L.F. transformers produce high selectivity. Ready to plug into 200-250 volt A.C. mains, the CR.70A needs only your aerial and a 2-3 ohm loudspeaker. The cabinet measures only 13" x 53" x 71" and the control panel is finished in black and white with chrome trim knobs.

Fully guaranteed for 12 months!

New model has separate direct output socket for feeding tape recorder, H.F. equipment, etc.

TRADE DESCRIPTION ACT 1968

Under the Trade Description Act 1968, it is illegal to give a misleading description or claim. We quote a few extracts from the hundreds of letters from satisfied customers and we claim that every testimonial letter is genuine, unsolicited and can be inspected at our offices.

Mr. J. Nicholson, Elphinstone Road, HASTINGS, Sussex. I am delighted with the CR.70A, at present I am working on an indoor aerial, and getting really fine results, as you rightly say this receiver has a high standard with a brilliant performance.

Mr. J. Walker, Bisceo Drive, ABINGDON, Berks. I received the CR.70A quite safely. I must say I am very pleased with it indeed. I have used other communication receivers in my time, and the CR.70A is beyond my expectation and was well worth waiting for. My friends are amazed at its performance.

Mr. F. Rose, Oak Lane, HIGH WYCOMBE, Bucks. You can be proud of your equipment, your name is held in great esteem by Radio Amateurs.

Mr. A. Sherwood, Norfolk Road, MAIDENHEAD, Berks. I have recently purchased from you a CODAR CR.70A. May I at this moment congratulate you on a first class piece of equipment and will certainly buy from you again. I remain a very satisfied customer.

Mr. W. Morris, Berch Avenue, ROMILEY, Cheshire. May I take the opportunity to congratulate you upon the excellent quality and performance of CODAR Products.

Mr. D. Foster, Wansford Road, DRIFIELD, Yorkshire. I am very pleased with the quality of the parts and consider this fine set excellent value for money.

More extracts next month. Send 10d stamps for literature on CODAR COMMUNICATION EQUIPMENT. Start your own Short Wave Station now, and listen to world-wide commercial and amateur stations, shipping, trawlers, Ship to shore telephone, Lifeboat Services, Met stations, etc., etc.

CODAR RADIO COMPANY

UNIT I - MEADOW ROAD INDUSTRIAL ESTATE - EAST WORTHING - SUSSEX
WEYRAD

COILS & TRANSFORMERS FOR CONSTRUCTORS

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

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

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

I.F. TRANSFORMERS FOR "PRACTICAL WIRELESS" CIRCUITS

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

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

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

WEYRAD (ELECTRONICS) LIMITED
SCHOOL STREET, WEYMOUTH, DORSET

VALVES

SAME DAY SERVICE
NEW! TESTED! GUARANTEED

**SETS** 188, 185, 174, 241, 401, 509, 1104, 1509, 1709, 2509, 3009, 3509, 4009, 4509, 5009

**SAME DAY SERVICE** 18/6, 150/9, 151/9, 170/9, 190/9, 210/9, 230/9, 250/9, 270/9, 290/9, 310/9, 330/9, 350/9, 370/9, 390/9, 410/9, 430/9, 450/9, 470/9, 490/9, 510/9, 530/9, 550/9, 570/9, 590/9, 610/9, 630/9, 650/9, 670/9, 690/9, 710/9, 730/9, 750/9, 770/9, 790/9, 810/9, 830/9, 850/9, 870/9, 890/9, 910/9, 930/9, 950/9, 970/9, 990/9

When in LUTON, BEDS, you must visit the...

SELF-SERVICE RADIO COMPONENTS SHOP

Serve yourself from a selection of 1,200 boxes of Manufacturer's surplus stocks and save money.

9 a.m. to 5.30 p.m. every day.
Closed all day Wednesday.

SURPRELECTRONICS
216 LEAGRAVE ROAD, LUTON, BEDS

BAKER 12in. MAJOR £9

The remarkable quality and performance of the "Major" makes possible truly brilliant and rich sound from a single loudspeaker. It recreates the entire musical spectrum from 30 to 14,500 c.p.s. The unit consists of the latest double cone, woofer and tweeter cone together with a special Baker CERAMIC magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c.p.s. For Hi-Fi or P.A. Rated 20 watts. Voice coils available 3 or 8 or 15 ohms.

Major Module 30-17,000 cps with tweeter, crossover, buffer 19-12in. and instructions. **£11.10.0**

Baker Reproducers Ltd
Bensham Manor Road Passage, Thornton Heath, Surrey.
Telephone 01-604-1665

Send 4d Stamp for New Catalogue
A really high fidelity mono-aural receiver with performance characteristics to suit the most discriminating listener.

**Pre-amplifier**
Integrated circuit with intergrated audio, i.e. first transistors to be specified on special price list. **Price £45.14.0d**

**Output Transformers** 200/340v in-2 Secondary combinations M.E.R.S.

**Telescopic Aerials** I.F. 5:1 angle. Rating 500mA. P. 7/6-

**High Impedance microphone** P. 7/6-.

**BRAND NEW.**

**PRICES:** AMPLIFIER KIT £10.16.0; POWER PACK £7.10.0; COMPLETE TRANSISTOR KIT £15.10.0; All new in box with instructions P. 1/6 E.A.E.

**GENERAL PURPOSE HIGH STABILITY PICK-UP ARM**

For F.U., Tape, Microphone, etc. and suitable for use with any equipment. 300mm arm; 0-5v output; 5000 Hz response; 100-20000va; Power input toLf. 90-120v. Price 28.15.0 P.

**PRICE** £20.5.6 E.A.E. (as above). P. 1/6 E.A.E.

**DE LUXE STEREO AMPLIFIER**

A.C. mains 200-340v. V.H.F. tubes. "A.F." headphone. Heavy duty fully isolated transformer with full wave rectification. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A.C. mains supply is provided. Balance of the left and right hand diaphragms can be adjusted by means of a separate bass and boost filter, set at the rear of the chassis. Input sensitivity is approx. 300mv for full treble and bass boost, or 250mv (8 ohms) into 3 ohm speakers. Full neon readout on gain control. Ceiling volume levels to be used with negligible distortion. Supplied complete with knobs, choice size 1" x 2" x 4". Overall height including valves 3.2. Ready built and tested to a high standard. Price £38.15.6 P. & P. 8/8.

**4-SPEED RECORD PLAYER BARGAINS**

Maina models. All brand new in maker's packing.

**SPECIAL OFFER** Famous Garrard 3060 mated with E.M.I. Lightweight Pick-up Arm. Only 20/-. P. 2/6.

**SPECIAL OFFER** The latest E.M.I. Lightweight Pick-up Arm. **Type AF117** £28.15.6 P. & P. 2/1.

**LATEST GARRARD MODELS.** All types available 1000, 1005, 1006, 1007, 1425 etc. Price £15.10.0; FILIPHT UNITS cut out for Garrard Models, 1205, 2025, 3020, 3025, 7026 etc. with rigid transformer mounts. Special design enables models above to be used with cover in position. Also suitable for housing AF117 and EPF2. *OUR PRICE* £15.10.0 complete. P. & P. 8/8.

**LATEST ACPS111E/MC mono compatible cartridge with 1000, 1005, 1006, 1007 etc. £13.10.0 P. & P. 2/6.

**SPECIAL OFFER** Famous Garrard 3060 mated with E.M.I. Lightweight Pick-up Arm.

**HIGH GAIN 4 CHANNEL TRANSPORTER**

**AMPLIFIER KIT**

**PRICE** £40.15.0 P. & P. 8/8.

**EQUIPMENT PRODUCE**

**SMOKES**

**MONO TRANSISTOR AMPLIFIER HSL 700**

**SPECIAL OFFER!! HI-FI LOUDSPEAKER**

Beautifully made teak finish enclosures with most attractive detail. Give full value for money in each channel. 15 x 8" deep. Fitted with P.I.M. Ceramic Magnet 150v 8" x 150v 8" audio, crossover and power handle 10 watts 6 Gns. Care Available 8 or 16 ohms impedance. Also available 15 x 8" 150v 8" bass speaker with pathetic treble 10 6 Gns. Care 15.-

**TRANSISTOR STEREO 8 + 8 MK II**

Now using Silicon Transistors in each channel resulting in a low noise level. A really first-class Hi-Fi Stereophonic Amplifier Kit, Uses 10 transistors giving high audio peak output (in each channel) 150mv. Integrated pre-amp with Bass, Treble and Volume controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers up to 15 ohms. Compact, all parts, including cradled metal voice. C.Kit board is same as for transistors, knobs, wire, etc. Fully soldered, no extras to buy. Simple step by step instructions enable any competent builder to produce a splendid set.

**SPECIFICATION:** Prog: response 2.1db. 50-20,000 c/d base band output. 12" open treble. Cut off approx. 16/- at 1G. Negative feedback 18db over main amp. Power requirements 240-50v, 150mA.-

**PRICES:** AMPLIFIER KIT £10.16.0; POWER PACK £7.10.0; TRANSISTOR KIT £15.10.0; Complete transistor kit with cover £25.15.0.

**GENERAL PURPOSE HIGH STABILITY PICK-UP ARM**

For F.U., Tape, Microphone, etc. and suitable for use with any equipment. 300mm arm; 0-5v output; 5000 Hz response; 100-20000va; Power input to Lf. 90-120v. Price 28.15.0 P. & P. 2/1.

**PRICE** £20.5.6 E.A.E. (as above). P. 1/6 E.A.E.

**DE LUXE STEREO AMPLIFIER**

A.C. mains 200-340v. V.H.F. tubes. "A.F." headphone. Heavy duty fully isolated transformer with full wave rectification. Two dual potentiometers are provided for bass and treble control, giving bass and treble boost and cut. A.C. mains supply is provided. Balance of the left and right hand diaphragms can be adjusted by means of a separate bass and boost filter, set at the rear of the chassis. Input sensitivity is approx. 300mv for full treble and bass boost, or 250mv (8 ohms) into 3 ohm speakers. Full neon readout on gain control. Ceiling volume levels to be used with negligible distortion. Supplied complete with knobs, choice size 1" x 2" x 4". Overall height including valves 3.2. Ready built and tested to a high standard. Price £38.15.6 P. & P. 8/8.
Learn at home... First Class Radio and TV Courses

After brief, intensely interesting study—undertaken at home in your spare time—YOU can secure a recognised qualification or extend your knowledge of Radio and TV. Let us show you how.

FREE GUIDE
The New Free Guide contains 120 pages of information of the greatest importance to both the amateur and the man employed in the radio industry. Chambers College provides first rate postal courses for Radio Amateurs, Examiners, F.E.B. Servicing Cert., C & C Telems., A.M.I.E.E. Guide also gives details of range of certificate courses in Radio/TV/Service, electronics and other branches of engineering, together with particulars of our remarkable terms of "Satisfaction or money back".
Write now for your copy of this valuable publication. It may well prove to be the turning point in your career.

Founded 1885—Over 150,000 successes

CHAMBERS COLLEGE (Dept. R15), College House 29/31 Wrights Lane, W.8.

SEND S.A.E. FOR LIST OF 3,000 TYPES
## BI-PAK SEMICONDUCTORS

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

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 A 14 A</td>
<td>1400 V, 3A, TO-3-BC-6 (TO-4-GB)</td>
</tr>
<tr>
<td>2 A 14 A</td>
<td>1400 V, 3A, TO-3-BC-6 (TO-4-GB)</td>
</tr>
<tr>
<td>3 A 14 A</td>
<td>1400 V, 3A, TO-3-BC-6 (TO-4-GB)</td>
</tr>
</tbody>
</table>

### PRINTED CIRCUITS EX-COMPUTER

Packed with semiconductors and components, 10 boards guaranteed. 30 day. Our price 10 boards.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI-PAK</td>
<td>Dual in-line</td>
</tr>
</tbody>
</table>

### TRANSISTOR EQUIVANT BOOK


<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2N3904 NPN BJT 15/6 6/5 8/6</td>
<td>Power NPN, OUR PRICE 1/8/6</td>
</tr>
</tbody>
</table>

### MULLARD I.C. AMPLIFIERS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAA243, Operational amplifier, 70 each.</td>
<td></td>
</tr>
<tr>
<td>TAA293, General purpose amplifier, 21 each.</td>
<td></td>
</tr>
</tbody>
</table>

### CA320 RCA (U.S.A.) LINEAR INTEGRATED CIRCUITS

Audio Power Amplifier, 30-19 each.

### BI-PAK—LOW COST I.C.'s

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

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BF09 7400 N</td>
<td>Quad 2-input NAND GATE</td>
</tr>
<tr>
<td>BF01 7401 N</td>
<td>Quad 2-input NAND Gate—OPEN COLLECTOR</td>
</tr>
<tr>
<td>BF04 7404 N</td>
<td>HEX INVERTER</td>
</tr>
<tr>
<td>BF10 7406 N</td>
<td>Dual 4-input NAND GATE</td>
</tr>
<tr>
<td>BF10 7407 N</td>
<td>Single 4-input NAND GATE</td>
</tr>
<tr>
<td>BF10 7408 N</td>
<td>Dual 4-input Nleurs Gate</td>
</tr>
<tr>
<td>BF10 7409 N</td>
<td>Single 4-input Nleurs Gate</td>
</tr>
<tr>
<td>BF10 7410 N</td>
<td>Dual 4-input Nleurs Gate</td>
</tr>
<tr>
<td>BF41 7411 N</td>
<td>4-Bit to decimal decoder and NIT</td>
</tr>
<tr>
<td>BF42 7412 N</td>
<td>EBC to decimal code (TTL 01)</td>
</tr>
<tr>
<td>BF50 7405 N</td>
<td>Dual 2-input AND/OR/NOT Gate —expandable</td>
</tr>
<tr>
<td>BF53 7453 N</td>
<td>32-pin 2-input NAND Gate</td>
</tr>
<tr>
<td>BF70 7407 N</td>
<td>Single JK Flip-flop—edge triggered</td>
</tr>
<tr>
<td>BF73 7425 N</td>
<td>Master Slave JK Flip-Flop</td>
</tr>
<tr>
<td>BF73 7423 N</td>
<td>Dual Master Slave JK Flip-Flop</td>
</tr>
<tr>
<td>BF74 7424 N</td>
<td>Dual MasterSlave Flip-Flop</td>
</tr>
<tr>
<td>BF75 7425 N</td>
<td>Quad Master Slave Flip-Flop</td>
</tr>
<tr>
<td>BF76 7426 N</td>
<td>Quad Master Slave Flip-Flop with preset and clear</td>
</tr>
<tr>
<td>BF77 7427 N</td>
<td>Dual Master Slave Flip-Flop with preset and clear</td>
</tr>
<tr>
<td>BF83 7433 N</td>
<td>Bipolar 8-bit adder</td>
</tr>
<tr>
<td>BF80 7430 N</td>
<td>EBC Decade Counter</td>
</tr>
<tr>
<td>BF92 7402 N</td>
<td>Divide by 2 or 4 binary counter</td>
</tr>
<tr>
<td>BF93 7403 N</td>
<td>Divide by 4 or 16 binary counter</td>
</tr>
<tr>
<td>BF94 7404 N</td>
<td>Dual 4-bit Shift Register</td>
</tr>
<tr>
<td>BF95 7405 N</td>
<td>4-bit Up-Down Shift Register</td>
</tr>
<tr>
<td>BF96 7406 N</td>
<td>8-bit shift register</td>
</tr>
</tbody>
</table>

Data is available for the above series of integrated circuits in booklet form, price 9/6.

### NEW BI-PAK UNTESTED SEMICONDUCTORS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>U101 120 Glass Sub-mini. General Purpose Germanium Diodes</td>
<td></td>
</tr>
<tr>
<td>U102 60 Mixed Germanium Transistors APF100 N/D</td>
<td></td>
</tr>
<tr>
<td>U103 30 Small Silicon Diodes</td>
<td></td>
</tr>
<tr>
<td>U104 50 Planar Planar Transistors NPN 2SF4A, 2N606</td>
<td></td>
</tr>
<tr>
<td>U105 30 Silicon Rectifiers Top-Hat 700mA up to 1000V</td>
<td></td>
</tr>
<tr>
<td>U106 15 Bi-Silicon Diodes 25mA 2000V</td>
<td></td>
</tr>
<tr>
<td>U107 20 1 watt Zener Diodes 5/8 5/8</td>
<td></td>
</tr>
<tr>
<td>U108 30 PNP Planar Transistors Top-5 sm. 2N1192</td>
<td></td>
</tr>
<tr>
<td>U109 35 NPN-NPN Sil. Diodes OC100 28104</td>
<td></td>
</tr>
<tr>
<td>U110 15 Mixed Germanium and Germanium Diodes</td>
<td></td>
</tr>
<tr>
<td>U111 25 NPN Planar Planar Transistors Top-5 2N597</td>
<td></td>
</tr>
<tr>
<td>U112 10 3-amp Silicon Rectifiers Stud Type up to 1000V</td>
<td></td>
</tr>
<tr>
<td>U113 40 Germanium/FNP 17 Transistors</td>
<td></td>
</tr>
<tr>
<td>U114 8 6-Am Silicon Rectifiers HY123 Top up to 1000V</td>
<td></td>
</tr>
<tr>
<td>U115 25 NPN Transistors like BC108</td>
<td></td>
</tr>
<tr>
<td>U116 12 5 amp Silicon Rectifiers Top-list up to 1000V</td>
<td></td>
</tr>
<tr>
<td>U117 30 AF German alloys transistors 2S006 0.2C7</td>
<td></td>
</tr>
</tbody>
</table>

Price each: 25-99 1/8/6 100 up 4/6

### TTL INTEGRATED CIRCUITS

Manufacturers: "Pack out"—out of stock, devices including functional units and parts purchased from manufacturers. Not classified as "out of stock." Ideal for learning about I.C.'s and experimental work, on testing some will be found perfect.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>U100 74340 N</td>
<td>10/6</td>
</tr>
<tr>
<td>U101 74S75N</td>
<td>10/6</td>
</tr>
<tr>
<td>U102 74S40N</td>
<td>10/6</td>
</tr>
<tr>
<td>U103 74S20N</td>
<td>10/6</td>
</tr>
<tr>
<td>U104 74S34N</td>
<td>10/6</td>
</tr>
<tr>
<td>U105 74S54N</td>
<td>10/6</td>
</tr>
<tr>
<td>U106 74S76N</td>
<td>10/6</td>
</tr>
<tr>
<td>U107 74S90N</td>
<td>10/6</td>
</tr>
<tr>
<td>U108 74S02N</td>
<td>10/6</td>
</tr>
</tbody>
</table>

Price each: 1-99 10/6 100 up 24/6

### TTL INTEGRATED CIRCUITS

Dual-in-line LOW PROFILE SOCKETS

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T4014 14 pin type</td>
<td></td>
</tr>
<tr>
<td>T4016 16 pin type</td>
<td></td>
</tr>
</tbody>
</table>

### DUAL-IN-LINE LOW PROFILE SOCKETS

Order No. | Description |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1-4</td>
<td>25-99 5/8</td>
</tr>
<tr>
<td>5-99</td>
<td>5/8</td>
</tr>
<tr>
<td>100 up</td>
<td>7/8</td>
</tr>
</tbody>
</table>

### RETAIL FAIRCHILD (U.S.A.) I.C.'s

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>DTL2001</td>
<td>Dual in-line package.</td>
</tr>
<tr>
<td>DTL2002</td>
<td>Dual in-line package.</td>
</tr>
</tbody>
</table>

Price each: 1-99 10/6 100 up 24/6

### FULL DATA SUPPLIED WITH UNITS

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

### BI-PAK SEMICONDUCTORS

P.O. BOX 6, WARRENTON

Postage and packing add 1%. Overseas add extra for Airmail. Minimum order 10/6. Cash in order please.

---

**I.C. AMPLIFIER**

Identical specification and pin configuration to the following: SLA03-1C109 and F4062. Each incorporates a pre-amp and class A.B. Power amplifier for delivering up to 3 watts E.R.M.P. Fully tested and guaranteed. Sold complete with circuit design. Please specify unit. ORDER NO. BP1010. OUR LOWEST PRICE OF 12/6 PER PAIR.

---

**ADH1 PNPN PNP TRANSISTOR PAIRS OF GERM/PWR-TRANSISTORS**

No manufacturing output stages of Amplifiers and Receivers. OUR LOWEST PRICE OF 12/6 PER PAIR.

---

**UNIJUNCTION**

UTC6, Equ. 2N2664 BC107, 2N2665, 5/6 each.

---

**NPN TRANSISTORS**

ัก-used 500 each. 1 off, if 1 each. Fully tested and coded-100 series.

---

**PNP/DISULFIDE/SILICON TRANSISTORS**

TYPE 15701 (2N1792) 9-21-60. Fully tested and guaranteed. OVER 90% of these are sold.

---

**FETS**

2N3189 9-6/10 5/8 MIP100 8/6

---

**TTL INTEGRATED CIRCUITS**

Manufacturers: "Pack out"—out of stock, devices including functional units and parts purchased from manufacturers. Not classified as "out of stock." Ideal for learning about I.C.'s and experimental work, on testing some will be found perfect.

---

**DUAL-IN-LINE LOW PROFILE SOCKETS**

Order No. | Description |
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>14 AND 16 Lead Sockets for use with Dual-In-Line Integrated Circuits.</td>
<td></td>
</tr>
</tbody>
</table>

---

**DTL DIGITAL IC**

DTL dual in-line package. Type M38444 expandable dual 4-input NAND Power Gate

---


**D.J. DISCO-AMP**

Designed specifically for use with discotheques and has many exclusive features not normally found on P.A. amplifiers. The unit will be of use to the professional D.J. as well as in clubs and mobile discotheques.

A complete Pre-fade listen (P.F.L.) cueing monitor section is featured with separate input for headphones (either stereo or mono) with an independent Volume control for headphone monitoring, and a P.F.L. switch, so that either turntable can be monitored for accurate cueing up of records. A mic over-ride switch is also added which cuts the music volume by half.

Specification: Output power 70 watts R.M.S. ± 1db at 8 ohms. Frequency response: 10-20,000 Hz ± 1db. Harmonic distortion: Less than 1% at full output. Signal/noise ratio: Better than -65db. Inputs: Mic 1 & 2 5 mV at 50 K ohms. Turntable 1 & 2 100mV at 1 Meg ohm.

The unit has 30 ohm or 800 ohm mic inputs may be ordered at extra cost.

Size: Front Panel 16in x 7in. Cut out 151in x 6in. Fuses A.C. 1.5 amp (B.S.) mounted on back panel.

**PRICE £85.0.0 inc. P & P.**

---

**D.J. 102 DISCOTHEQUE MIXER PREAMPLIFIER**

Consists of a 4 channel mixer each with its own volume control and a complete P.F.L. monitoring system. Also features a mike cut down switch. For use with amplifiers having tone controls but not having the above facilities. Frequency response 20-20,000 Hz ± 2db. Distortion less than 1%. Signal to noise ratio better than -65db. Size 10in x 4in x 4in. Self powered.

**PRICE £25.0.0 inc. P & P.**

---

**DJ 30L PSYCHEDELIC LIGHT CONTROL UNIT**

3 channel light control unit that handles up to 1,000 watts per channel. Separate bass, middle and treble controls for full frequency separation. Completely built and tested.

**PRICE £37.10.0 inc. P & P.**

---

For full details of these and all Discosound Products write direct to:-

**DISCOSOUND,**

122 BALLS POND ROAD, LONDON, N.1.

Telephone: 01-254 5779

Full money back guarantee if returned within 10 days. All Discosound Products are guaranteed for 12 months. Demonstrations given at any time.

---

**Mullard TECHNICAL BOOKS**

**Power Engineering using Thyristors**

Part I: Techniques of Thyristor Power Control

A new book to bridge the gap between electrical power engineering and electronics. Including postage 32/-

---

**Data Book 1970**

Gives Mullard abridged data on valves, picture tubes, semiconductors and components used in consumer electronics.

Paper bound. Including postage 4/9

---

**Transistor Audio and Radio Circuits**

For radio receivers, radiograms, record players, tape recorders, hi-fi equipment.

Over 200 pages packed with the most up to date information.

Bound in cloth. Including postage 32/-

---

**Electronic Counting**

Circuits, Techniques, Devices.

The increasing use of mechanization and automation in factories has given rise to an increased interest in counting. This present book is intended to help engineers to use electronics to solve their counting problems as simply or as cheaply as possible.

220 pages fully illustrated. With diagrams.

Including postage 29/-

---

**Semiconductor Devices**

This book is an introduction to Semiconductor Electronics and its contents should be readily understood. The subject is treated non-mathematically. Numerous illustrations and diagrams.

Including postage 8/6.

---

**A programmed book on Semiconductor Devices**

This book is an integral programme which is a form of self instructional text.

Size 12ins. x 8ins. Numerous illustrations and diagrams.

Including postage 14/-

---

**Magnadur magnets for dc motors**

Magnadur is a ceramic magnetic material characterised by an exceptionally high coercive force and extremely high resistivity. The book deals solely with the use of permanent magnets in D.C. motors.

Bound in board. Numerous illustrations and diagrams.

Including postage 16/6.

---

Post now to: Dept. M

**SELRAY BOOK COMPANY**

60 Hayes Hill Bromley BR2 7HP
NEW RANGE U.H.F. TV AERIALS

All U.H.F. aerials now fitted with 


TRIMMER BARGAINS.

These are 15/6 sub-mini, air 
spaced trimmers, with and with. w/ide wiring X1. Brand new. Details: Contents 12 trimmers, some ceramic caps, X1 frequency 28/50 overste 25/0/0 Meas. 355 Meas. No choice.

2. Trimmers with 25/0. mand. new air spaced.

1/6. per. 6/6. per. pack.

NEW TONE SWITCHES.

250 volt 3-doacps. 2 pole 2 way. 10/6. 12 inch. 30/6. post. and packing.

SIGNAL GENERATORS- OSCILLATOR No. 2. Size 1/2x3. 3/4 1/2. Ideal for U.H.F. work. 60/0. Meas. Functions are: A/MWP, Decoupling up to 400 KHz RF input. Measuring levels, reading up to 1500 microvolts. Twist-lock barrel connectors. Good equipment for test, 1500V AC/DC. £15.00.00 p.i.

TP 144 0 Signal Generators 5/6 Knobs to 25 Meas. Good condition and complete with accessories. £12.00.00 p.i.


New lengths 50ft coaxial cable 70 lbs. approx. coax plugs each end. price 2/6. - 1/6. post. and packing 3/6.

Magnetic Transmitters etc. price 7/6 post and packing 7/6.


New small face boxes 150 volts 15/6. 17/6 each post and packing 2/6.

Meters, moving coil e equipment, good condition. Also 100/0. 150/0. 200/0. Amp Dc. 60/0. Amp Dc. Voltmeter 6-15 and 15-30. Voltmeter 120-6. 150/0. - 1/6. pack.

C.W.O. BARRIE CHARGE MAINLAND ONLY.

A. H. THACKER,
Radio Dept.
HIGH STREET, CHESLYN HAY.
Mr. Walsall, Staffs.
PEAK SOUND PRODUCTS

ENGELFIELD CABINET KITS

Build it 12 - 12 or 25 - 25

Stereo amplifier in modular kit form 12 watts per channel.

£9.00. 25 watts £18.00. Cabinet kit only 68. Three
prices nett.

As recently reviewed in Hi-Fi Sound.

BAXANDALE SPEAKER SYSTEM

Designed by Peter Baxandale.

Superb reproduction for its price.

Hilates 10 watts with ease. True

ELAC 13.2 30W/5000 speaker kit


STEREO AMPLIFIER S.A. 10-10

Developed from the very

successful B.A.-8 amplifier.

amplification, featuring separate volume controls for each

channel, bass and treble controls, 10 watts per channel

2N3708 AC28 6/6 AC127 9/-

all prices nett: built 2/8/14/48 nett.

Suitable 8Ω wide range speakers with tweeter &

cabinet available.

MACHINE AMPLIFIER KITS

RCA/818F designed twin amplifier kits.

Input sensitivity 500-2000W for full output into 8Ω.

Power kit price Suitable module.

including components:

kit

12W 18/- nett 9/-

25W 19/- nett 19/-

40W 23/- nett 23/-

70W 26/- nett 26/-

30 WATT BAILEY AMP. PARTS

Special summer reduction (to Sept. 30th 1975 only)

Sensitivity 3F7V for full output into 8Ω.

Transistors for one channel £1/4/10 nett. £6 only.

Components for 8Ω as above 1/4/45 nett.

Complete unregulatable power supply kit 87/6 nett.

ZENER DIODES

5% full range 264A values. 200W - 200W for each 3W.

$2.50. 10W - 10W only.

Carbon track resistors 1/4/40 each 1/4/45 each.

Please note only decades of 10, 22 and 47 are available.

Within ranges quoted.

CARBON SKELTON PRE-SETS

10% on orders for components for £5 or more. 10% on

orders for components for £10 or more (No discount on

nett items).

COMPONENT DISCOUNTS

POSTAGE AND PACKING

Free on orders over £. Please add 1/6 if under.

Overseas orders welcome: carriage charged at cost.
YOUR CAREER in RADIO & ELECTRONICS?

Big opportunities and big money await the qualified man in every field of Electronics today—both in the U.K. and throughout the world. We offer special courses for training for all subjects in radio, television, etc., especially for the CITY & GUILDS EXAMS (Technicians' Certificates) and the Grad. Brit. I.E.R. Exam.; the RADIO AMATEUR'S LICENCE; P.M.G. Certificates; the R.T.E.B. Servicing Certificates; also courses in Television; Transistors; Radar; Computers; Servo-mechanisms; Mathematics and Practical Transistor Radio course with equipment. We have OVER 20 YEARS' experience in teaching radio subjects and an unbroken record of exam. successes. We are the only privately run British home study College specialising in electronics subjects only. Full details will be gladly sent without any obligation.

To: British National Radio School, Reading, Berks.

Please send FREE BROCHURE to NAME_________________________________________ Block
ADDRESS_________________________________________ Caps.

BRITISH NATIONAL RADIO SCHOOL

---

M & B RADIO
38 BRIDGE END, LEEDS 1
Telephone: 0531-35649

VHF FM/MW/LW TRANSISTOR RADIO
BRAND NEW 10 transistor plus 4 diode table model of well known British manufacture. The highly polished wood cabinet, speaker and pre-assembled chassis are supplied separate and only require fitting together and the 2 speaker connections making.

CHASSIS & CABINET £310.00, SPEAKER 25/-
carr. paid.

STC STEREO/MONO HEADPHONES. Brand new lightweight high quality confirming padded headphones for stereo or mono use. Weight 10 oz. approx 20 c's to 20 Kc/s 300 ohms per earpiece. Supplied with details of matching circuit for 15 omics using only 3 resistors, 5/- plus 4/- pp.

2 VOLTS TRANSISTOR INVERTERS. 12vdc input. 230v ac output. Transformer 21 in x 21 in x 4 in mounted on aluminium case 18 in x 21 in x 4 in, Weight 150x, 65/- plus 4/- pp.

TRANSISTOR MODULATOR PRE-AMP PANEL. BRAND NEW 4 transistors plus 1 diode. 41x in x 21 in, Fitted with pre-set microphone gain control and filter. Output on standard 6.6K ohms but 4K ohms when driven by a pair of NKT404s. Supplied new c/w circuit of complete modulator. 22/6d plus 1/-

TRANSISTOR AUDIO AND MUTING PANELS. Brand new set of 3 panels. Audio panel with transistor base originally used to drive an NKT404 output transistor. 2 muting panels with Schmitt trigger circuit to operate the gate on the audio panel. 8 transistors in all. Supplied with full circuit 22/6d plus 2/6 pp.

5456S FM LF PANEL. Brand new but faulty 6 transistor panel usually low in gain. 12/6 plus 1/6 pp.

HAND TELEPHONES. Brand new radiotelephone type press to talk headsets. 12/6 plus 1/6 pp.

VHF AERIALS/CFR RELAYS. Used but OK. 6 or 12v. 4 1/2 or 4 1 2/6 plus 1/6 pp.

ALL UNTESTED MIXED TRANSISTORS 1 plus 1/-

ALSO VARIOUS VHF EQUIPMENT IN STOCK
S.A.E. and 64. STAMP FOR LISTS

---

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

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

MANY OTHERS IN STOCK inc. Colombo Bay Tubes and Special Valves, U.K. Orders up to 10/-; 1/2 - to 81/2/-; over 81/2/- per set; over 83 post free. C.O.D. 4/- extra

ALL valves guaranteed

---

FULLY GUARANTEED INDIVIDUALLY PACKED VALVES

---
Now! A FAST EASY WAY TO LEARN BASIC RADIO AND ELECTRONICS

Build as you learn with the exciting new TECHNATRON Outfit! No mathematics. No soldering—but you learn the practical way.

Now you can learn basic Radio and Electronics at home—the fast, modern way. You can give yourself the essential technical 'know-how' sooner than you would have thought possible—read circuits, assemble standard components, experiment, build...and enjoy every moment of it. B.I.E.T.'s Simplified Study Method and the remarkable new TECHNATRON Self-Build Outfit take the mystery out of the subject—make learning easy and interesting.

Even if you don't know the first thing about Radio now, you'll build your own Radio set within a month or so!

...and what's more, YOU'LL UNDERSTAND EXACTLY WHAT YOU ARE DOING. The Technatron Outfit contains everything you need, from tools to transistors...even a versatile Multimeter which we teach you how to use. You need only a little of your spare time, the cost is surprisingly low and the fee may be paid by convenient monthly instalments. You can use the equipment again and again—and it remains your own property.

You LEARN—but it's as fascinating as a hobby.

Among many other interesting experiments, the Radio set you build—and it's a good one—is really a bonus; this is first and last a teaching Course. But the training is as rewarding and interesting as any hobby. It could be the springboard for a career in Radio and Electronics or provide a great new, spare-time interest.

A 14-year-old could understand and benefit from this Course—but it teaches the real thing. Bite-size lessons—wonderfully clear and easy to understand, practical projects from a burglar-alarm to a sophisticated Radio set...here's your chance to master basic Radio and Electronics, even if you think you're a 'non-technical' type. And, if you want to carry on to more advanced work, B.I.E.T. has a fine range of Courses up to A.M.I.E.R.E. and City and Guilds standards. Send now for free 164-page book. Like to know more about this intriguing new way to learn Radio and Electronics? Fill in the coupon and post it today. We'll send you full details and a 164-page book—ENGINEERING OPPORTUNITIES—Free and without any obligation.
**Practical Wireless Classified Advertisements**

The pre-paid rate for classified advertisements is 1/8d. per word (minimum order 20/-), box number 1/6d. extra. Semi-displayed setting £5 10s. 0d. per single column inch. All cheques, postal orders, etc., to be made payable to PRACTICAL WIRELESS and crossed "Lloyds Bank Ltd." Treasury notes should always be sent registered post. Advertisements, together with remittance, should be sent to the Classified Advertisement Manager, PRACTICAL WIRELESS, IPC Magazines Ltd., Fleetway House, Farringdon Street, London, E.C.4 for insertion in the next available issue.

**MISCELLANEOUS**


**ALL THOSE LITTLE ITEMS** which you can never find are available from our stock. Also speaker fabrics, BAF and wallpaper. Peerless speakers, cabinet kits, cross-overs. For full details send 9d. in stamps to Audiosean, Dept. P.W. 4 Principles Square, Harrogate, Yorks.

**SOCKETS TO YOU** will be a thing of the past, and also your bare and bare wires when you make a quick electrical connection with the revolutionary new Keynor ideal for the speed testing of electrical equipment. . . a must for the do-it-yourself fan. Send for a leaflet to E.B. Instruments, Dept. P.W. 45/53 Pancras Road, London N.1. (837 7781). Only 46/6 plus postage.

2 WATT TRANSISTOR AMPLIFIERS (not a kit). Standard 3 ohm output. Frequency response 2-20db from 12 to 12000 cps, on board measuring 21 x 34 in. Ideal for record players, etc., 22s 6d each, pp 1s 6d. A. Manley, 13 Sandiroushe Gardens, Bromley Road, London, S.E.6.

**Top Transistors**

ACY12 1/9 OCT/1 1/9 2N2920 1/9
BC168 1/9 OC200 1/9 2N3702 1/9
BC49 1/9 OC201 1/9 2N3703 1/9
BY27 1/9 OC202 1/9 2N3705 1/9
OC45 1/9 ZT300 1/9 2N3706 1/9
OC71 1/9 2N706 1/9 2N708 1/9

All the above types are available at 16 1/2d. Brand New. Individually Tested, unmarked but guaranteed to be within their correct specifications. Refund if not.

**Antex solder iron**

A lightweight iron with a 15 watt nickel plated bit. Designed to enable you to weld reliable joints accurately. Model CN240 volts. Special low price. Act Now! Only £2 11/-

**Money back guarantee**

P. & P. 1/-

J. M. KING (N)

17 Buckridge, Portswood Road, London, E.C.1

**Enamelled copper wire**

S.W.G. Per lib reel Per lb reel
18-22. 11/3d 16/6d
18-23. 11/3d 16/6d
31-35. 12/3d 18/6d
36-40 15/- 24/-
41-44 20/- 29/6d

Orders dispatched by return of post. Please add 1/- per item P. & P. Supplied by: Banner Transformers, 34 Old Lansdowne Rd, West Didsbury, Manchester, 20.

**Trade enquires invited**

VICTORIA STREET’S unique magazine and paperback centre, Hills Westminster. "Practical Wireless" to your specifications. HILLS WESTMINSTER LTD., 5 Artillery Row, Victoria Street, S.W.1 (01-222 6165).

**Concrete speaker cabinets**

For those constructors who want to get the best from their speakers, in the form of unsurpassed crispness, and clarity of bass, a seamless precision-cast reflex cabinet in high-grade concrete has now been designed.

S.A.E. for details to: R. J. COOPER, 120 Castle Lane, Solihull, Warks.

**Big Bargain Parcel**

BUILD IT in a DEWBOX quality cabinet. 2n.a 2J1n. a vol steady. D.E.W. Ltd., Ringwood Road, FERNDOWN, Dorset. S.A.E. for leaflet. Write now—right now.

**6 or 12 Volt Fluorescent Lights**

12 ins. 8 Watt tube inside light for caravan, tent etc. Fully transistorised, low battery drain. Unbreakable at 65/6 or in kit form 57/6 post paid.

**4 Volt Gram Amps**

Volume and tone controls, mains operation, £2 0/1 new and boxed 72/6 POST PAID

**Salop electronics**

Callers welcome 33 Write Got, Shrewsbury. Shropshire. S.A.E. for lists.

**The New Electronic Music for You**

Then how about making yourself an electric organ? Constructional data available—full circuits, drawings and notes! It has 5 octaves, 2 manuals and pedals with 31 slopes—uses 41 valves. With its variable attack you can play Classics and Swing. Write now for free leaflet and further details to C. & S., 25 Maude Street, Dartington, Durham. Send 4d. stamp.

**Service Manuals**

For Pre 1958 H.V.M. and E.M.I. MODELS, Radio and Record Player Manuals 5/- each. Television Manuals 7/6 each. Send C.W.O. stating model required. Also limited range of components and spares. Send details of your requirements. R.J. Liddell, Chilton Works, Garden Road, Richmond, Surrey.

**Musical Miracles!**


**Miscellaneous (continued)**


**Wanted**


**Wanted New Valves Only**

Must be new and boxed Payment by return WILLIAM CARVIS LTD., 103 North Street, Leeds 7.

**Wanted New Valves, televisions, radiograms, transistors, etc. STAN WILL- ETTIS, 37 High Street, West Bromwich. Staffs. Tel.: WES 0186.**

WE BUY New Valves, Transistors and clean new components, large or small quantities, all details, quotation by return. WALTON'S WIRELESS STORES, 55 Worcester Street, Wolverhampton.

**Wanted Early Wireless Items**


**Hi-Fi Equipment**


**Metal Work**

METAL WORK: All types cabinets, chasis, parts etc. T. Christiansen, 2 Princess Terrace, Brighton 7, Sussex BN2-3JS.

**Miscellaneous (continued)**

MORSE MADE EASY !

PACT 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 lose it. It's easy to learn a tune. 15 W.P.M. in 4 weeks guaranteed.

For details and course C.O.D., ring, 4.44, 01-660 2896 send 8d. stamp for explanatory booklet to: EDDYSTONE EC 10, new, £50.— Garton, 24 Park Drive, Sandiacre, tel. Long Eaton 4753.

LARGE SUPPLIER OF SERVICE SHEETS

(T.V., RADIO, TAPE RECORDERS, RECORD PLAYERS, TRANSISTORS, STEREOSGRAMS, RADIOGRAMS, CAR RADIOS)

Only 5/- each, Manuals from 10/- plus large S.A.E.

( Uncrossed P.O.'s please, original returned if service sheets not available.)

C. CARANNA
71 BEAUFORT PARK
LONDON, N.W.11

We have the largest supplies of Service Sheets (strictly by return of post). Please state make and model number alternative.
Free TV fault tracing chart or TV list on request with order. Mail order only.

RADIO & TV SERVICE SHEETS 4/- S.A.E. Service manuals 12/6d each, P.&P. 1/6d, State make and model No. to—Bell's Television Service, Albert Place, Starbeck, Harrogate, Yorks.

SERVICE SHEETS. Radio. TV etc. 8,000 models. List 2/-, S.A.E. enquiries. TEL-RAY, 11 Maudland Bank, Preston.

TRADE SERVICE SHEETS

5/- each plus postage

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

Cheques and open P.O.s returned if sheets not available.

OAKFIELD ENTERPRISES

LIMITED

30 CRAVEN STREET, STRAND

LONDON WC2

Make Model Radio/TV

1970 List now available at 2/- plus postage

From

Address

enclose remittance of

(a and stamped addressed envelope)

s.a.e with enquiries please

MAIL ORDER ONLY (February PW)

SERVICE SHEETS (1923-1970) for Televisions, Radios, Transistors, Tape Recorders, Record Players, etc., by return post, with free Fault-Finding Guide. Prices from 1/- Over 8,000 models available. Catalogue 2/-.
Please send S.A.E. with all orders/enquiries. Hamilton Radio, 54 London Road, Bexhill, Sussex.

RADIO. TELEVISION

over 3,000 models.


EDUCATIONAL

TRAIN FOR SUCCESS WITH ICS

Write for FREE prospectus and find out how ICS can help you in your career.

ICS, DEPT. 541 INTERTEXT HOUSE, STEWARTS ROAD, LONDON, SW8.

RADIO OFFICER training courses. Write: Principal, Newport and Monmouthshire College of Technology, Newport, Mon.

SITUATIONS VACANT

TV and Radio, A.M.I.E.R.E., City & Guilds, R.T.E.B. Certs., etc. on 'Satisfaction or Refund of Fee' terms. Thousands of passes. For full details of exams and home training Courses (including practical equipment) in all branches of Radio, TV, Electronics, etc. Write for 32 page Handbook FREE. Please state subject. BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY (Dept 137K), Aldermaston Court, Aldermaston, Berks.

EDUCATIONAL (continued)

CITY & GUILDS (electrical, etc.) on 'Satisfaction or Refund of Fee' terms. Thousands of passes. For full details of exams and home training Courses in radio, TV servicing and maintenance, T.T.E.B., City & Guilds, etc.: highly informative 120-page Guide—free. CHAMBERS COLLEGE (Dept. 1857K), Aldermaston Court, Reading, RG7 4PF.

Radio Operators

There will be a number of vacancies in the Composite Signals Organisation for experienced Radio Operators in 1971 and subsequent years.

Specialist training courses lasting approximately 3 months are held at intervals. Applications are now invited for the course starting in September 1971.

Salary Scales

During training with free accommodation provided at the Training School—

The Training School:

<table>
<thead>
<tr>
<th>Age</th>
<th>Pay per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>£468</td>
</tr>
<tr>
<td>22</td>
<td>£491</td>
</tr>
<tr>
<td>23</td>
<td>£514</td>
</tr>
<tr>
<td>24</td>
<td>£537</td>
</tr>
<tr>
<td>25</td>
<td>£560</td>
</tr>
<tr>
<td>26</td>
<td>£583</td>
</tr>
</tbody>
</table>

On successful completion of course—

<table>
<thead>
<tr>
<th>Age</th>
<th>Pay per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>£595</td>
</tr>
<tr>
<td>22</td>
<td>£618</td>
</tr>
<tr>
<td>23</td>
<td>£641</td>
</tr>
<tr>
<td>24</td>
<td>£664</td>
</tr>
<tr>
<td>25</td>
<td>£687</td>
</tr>
<tr>
<td>26</td>
<td>£710</td>
</tr>
</tbody>
</table>

Exemption conditions and good prospects of promotion. Opportunities for service abroad.

Applicants must be United Kingdom residents, normally under 25 years of age at start of training course, and must have at least 2 years operating experience or 'O' level qualifications. Preference given to those who also have 'O' level or similar qualification.

Interviews will be arranged throughout 1971.

Application forms and further particulars from:

RECRUITMENT OFFICER (T RO 37)
GOVERNMENT COMMUNICATIONS HEADQUARTERS,
Oakley, Priors Road,
CHELSEHAM, Glos.
GL52 5AJ
Tel: No. Cheltenham 21491 Ext 2270

RECEIVERS & COMPONENTS

A CORMOCOPA OF COMPONENTS! Scarce valve, selected TV, components, Speakers, cabinets, Computer panels—long leads NOT printed circuits. Transistors, resistors—new and recovered. State requirements. S.A.E. (F.S.) for details. MAIL MART, 6 Eastbourne Road, Pevensey Bay, Sussex.

597
**RECEIVERS & COMPONENTS**

**ABRAZIL**

We make four types of r.f. high gain transistorized pre-amplifiers:

**Wideband Radio Type L10 39/1**

This covers the Medium and Short wave.

V.H.F. F.M. Radio Type L11 59/1

This covers the High Band.

V.H.F. Television Type L12 59/1

-Electric and 1 and 11

U.H.F. Television Type L45 59/1

Tunable over the U.H.F. band.

S.A.E. for Details. P. & P. £1/.

**VALVE BARGAINS**

Any 5—91; 10—14; 100—25 10a: ECC82, ECL80, EF80, EF85, EF183, EF89, EF91, EF96, ECC80, ECC97, PCF80, PCF180, PCF86, PCL82, PCL83, PCL84, PCL85, PLS6, PY33, PY81, PY82, PY801, PY800, 30UL1.

7 day Money Back Guarantee.

VELCO ELECTRONICS

62 Bridle St, Ramsbottom, via Bury, Lancs.

**EX-GOVT. COMMUNICATIONS RECEIVERS**

receivers, signal generators, components, etc., with money back guarantee.

S.A.E. lists. Callers welcome, please phone first.—P. R. Gollan, G3EDW, Glen Tor, Turrington. Devon. (STD 88-052) 2411.

**CONSTRUCTOR UNITS**

R.F. General. Supplied with coils, tuning cap., switch and panel, for wiring and calibration. Covers 100KHz. to 30MHz. 89/6 + 3/- pp.

A.F. Unit. Osc, operates at 2 freq.'s. for R.F., A.F. checks, connects as amp. for continuity, etc. Dual freq. square wave o/p for audio/HiFi tests. Provides modulation for R.F. unit. 39/6 - 4/- pp.

S.A.E. for Details. Tweeter Electronics (PW), 9 The Green, Hatfield Peverel, Chelmsford, Essex.

**BRAND NEW ELECTROLYTICS**

15/16V, 0.5, 1, 5, 10, 20, 40, 50, 100 mfd. 8.5V, E12, E12, 25V, special suspension, 8 ohms, 37/6, 34V tweeters, 8 ohms, 16/6. Transistors, 2N5172, 2N5172, 1/2 pence each. £1 cork don't post free. "Sonelt" Dept. X. 183 Clapham Manor St., London. S.W.4. Tel: 01-720 3559.

**JEFF FOR VALUE**

NEW BRANDED FULL SPEC. DEVICES

SL402A 35/- / PA237 31/6

N5709A 13/6 / MEL11 9/6

D4060 24/- / D5083 5/3

2N3055 14/-

2N5172 / W005 7/6

2N4001 1/5

2N4002 5/2

2N4004 3/5

P. & P. 1/- per order. Overseas 7/6.

Cash with order. Mail order only.

JEFF ELECTRONICS (P.W.11)

York House, 12-24, Dray, Grappenhall, Warrington, Lanes.

Money back if not satisfied.

**NEW MODEL V.H.F. KIT MK2**

Our latest kit, improved design and performance plus extra Amplifier Stage.

receives Aircraft, Amateurs, Mobile, Radio 2, 3, 4, etc.

This novel little set will give you endless hours of pleasure and can be built in one evening. Powered by 9 Volt battery, complete with easy to follow instructions and built in Jack Socket for use with Earphones or Amplifier.

Only 48/-, P.P. Free U.K. only

Postal Orders and Cheques to:

Dept. P.W.

Galleon Trading Co., 25 Avolon Road, Romford, Essex

598

---

**STELLA NINE RANGE CASES**

Manufactured in Black, Grey, or Blue Stelvetile and finished in Plastic-coated Steel, Morooco Finish with Aluminium end plates. Rubber feet are attached and there is a removable front panel in 18 s.w.g. Alloy.

Now all Aluminium surfaces are coated with a strippable plastic for protection during manufacture and transit. All edges are polished.

**LIST OF PRICES AND SIZES**

Width Depth Weight

<table>
<thead>
<tr>
<th>Case No.</th>
<th>4&quot; x 6&quot;</th>
<th>5&quot; x 7&quot;</th>
<th>6&quot; x 8&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN4001</td>
<td>3.5 kg</td>
<td>4.5 kg</td>
<td>5.5 kg</td>
</tr>
<tr>
<td>IN4002</td>
<td>2.5 kg</td>
<td>3.5 kg</td>
<td>4.5 kg</td>
</tr>
</tbody>
</table>

**CHASSIS in Aluminium, Standard Sizes, with Gasket Plates**

Sizes to fit Cases. All 23" Walls

<table>
<thead>
<tr>
<th>Case No.</th>
<th>3&quot; x 6&quot;</th>
<th>4&quot; x 8&quot;</th>
<th>5&quot; x 10&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN4001</td>
<td>2.5 kg</td>
<td>3.5 kg</td>
<td>4.5 kg</td>
</tr>
<tr>
<td>IN4002</td>
<td>1.5 kg</td>
<td>2.5 kg</td>
<td>3.5 kg</td>
</tr>
</tbody>
</table>

Chassis—Post 3s. 0d. per order.

Discounts available on quantities.

E. R. NICHOLLS

Manufacturer of Electronic Instrument Cases

46 LOWFORD ROAD

STOCKPORT - CHERSHIRE

Tel: 061-480 2179

**COMPLETE RANGE** of receivers by Trio, Lafayette, Hallicrafters, etc. Chassis, panels, cabinets, S.A.E. for lists. Stephen-James Ltd. 70 Priory Road, Liverpool 4. Tel: 051-263-7829.

**BOOKS & PUBLICATIONS**

**SURPLUS HANDBOOKS**

19 set Circuit and Notes... 7/6 p/p 9d.

1155 set Circuit and Notes... 7/6 p/p 9d.

H.R.O. Technical Instructions... 6/6 p/p 9d.

38 set Technical Instructions... 6/6 p/p 9d.

41 set Working Instructions... 6/6 p/p 9d.

88 set Technical Instructions... 6/6 p/p 9d.

BC251 Circuit Notes... 7/6 p/p 9d.

There is a removable back plate.

Chassis—Post 3s. 0d. per order.

Discounts available on quantities.

---

**ELECTRICAL**

**240 volt ELECTRICITY ANYWHERE**

**BEST EVER 200/340 VOLS "MAINS" SUPPLY FROM 12 VOLT CAR BATTERY**

Exclusive World Scope Purchase. The fabulous L.D. American Heavy Duty Dynamo Vais with a Massive 220 volt output giving the most brilliant 200/340 volt performance of all time. Marvelous for Television, Dining, 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. in Detroit-Reney. This magnificent machine is unobtainable elsewhere.

Brand New and Fully Tested, only £21.6. plus 10/- postage. O.D. with pleasure.

Money back if not delighted. Please send S.A.E. for interesting details.

Dept. PW, STANFORD ELECTRONICS

Rear Deery Road, North Promenade, Blackpool, Lancashire.

**AERIALS**

**BAKER AND BAINES**

**UHF AERIALS**

**BBC and ITV 625 Colour**

10 elec., 42/-: 14 elec., 47/:-; 18 elec., 65/:-; 22 elec., 75/:-; Double 22 elec., 160/.-; BBC Aerials £55/:- £43/:-; £48/:-; ITA Aerials: 5 elec., 39/:-; 8 elec., 54/:-; 11 elec., 66/-; double 5 array, 98/:-; Combined Aerials: Solo, £5, 54/:-; HT plus 5, 82/:-; X plus 5, 90/:-. Special Loft Dipole plus 5, 42/.-

Dipolex—Tripoles—Matched Diplexers UHF—VHF Poles, Lashing, Clamps, Couplers, etc., Co-Ax 1/3 and 2/3.

Postage paid inland on Aerials only. Please state channels when ordering.

S.A.E. for full lists.

**11 DALE CRESCENT, TUTION, CHESTERFILD**

Est. 1943

**JOHNSONS**

Tel: 24864

New CV2—a unique triple-purpose VHF kit for the Amateur enthusiast. Integrated converter, receiver, and tuner-feeder. Fantastic simple, single-con-"istor performance! Comprehensive kit of high grade parts with three coils covering 80—178 MHz, 9v battery, etc., together with simplified diagrams and instructions. Price complete, £4, post, packing and insurance paid, direct from makers. S.A.E. for literature.

**JOHNSONS (RADIO)**

St. Martin's Gate, Worcester WR1 2DT

**KEYNECTOR**

The safe quick way to connect electrical equipment to the mains

Send for full details

EB INSTRUMENTS

49-53 PANCERS ROAD, LONDON NW13

Tel: 01-837 7744
**DOOR INTERCOM**

Know who is calling and speak to them without leaving your chair. Outfit comprises microphone with wall plate, button, connectors and master intercom. Rubber plugs to gather. Originally sold at 4/6. Special offer price 3/6, plus 2/- postage.

---

**SA. 3 PIN SWITCH SOCKETS**

An excellent opportunity to make that bench dish board you have needed or to pick up for future jobs. This month we offer British made (Blackett) brass plate mounting switch, 6a, 250 volts, 10a, plus 1/- post and insurance. 20 boxes post free.

---

**TELESCOPIC AERIAL**

For portable, car radio or television. Channels plu-solidity, six sections, extends from 71 to 520. Base in bottom for SMA 7/8" knuckle mode. P.M. 6/6.

---

**PHILIPS TRIMMER**

0-30ft an old design but one which has never been bettered. 17" each. 10/- doz. 8/- 60 per 100.

---

**MINIATURE WAFER SWITCHES**

2 pole, 1-1/2 amp, 10 volts. 3 pole, 3-1/2 amp, 10 volts. 4 pole, 4-1/2 amp, 10 volts. 6 pole, 6-1/2 amp, 10 volts. All at 3/6 each. 36/- doz. 3/- 1/2 doz. 1/- each.

---

**WATERPROOF HEATING VEST**

26 yards length 70/72 self-regulating temperature control. 1/10th post free.

---

**BLANKET SWITCH**

Double pole with neutral, isla eso twinless in dark, ideal for dark room light or for use with waterproof element, new plastic case 5/6 each, 3 brad model 7/6.

---

**COPPER CLAD ELEMENT**

1500 watts long bold 14" length. U-shaped, ideal for overbed heater—must mount reflector above. 18/6 each, plus 4/6 post. 6/6 doz. post paid.

---

**ERGOTRON UNITS**

These units made by the Mullard Group, are for operating and controlling d.c. Motors and equipment from A.C. mains. Thermostats are used and these adjust to a variable d.c. resulting in motor speed control and operating efficiency for superior to most other methods.

The units are contained in wall mounting cabinets with front control panel on which are fused both safety and the variable thermostat firing controls. 4 modules are available—all are brand new in makers cases.

- Model 2410 for up to 10 amps .
- Model 2411 for up to 10 amps .
- Model 2412 for up to 45 amps .
- Model 2414 for up to 60 amps .

Note: 2415 is a floor mounting unit.

---

**'GLADIATOR' 2 WAVE BAND TRANSISTOR RADIO**

3-transistor, 2 wave band (medium and long) pocket radio with tv receiving full in circuit and handles. These radio use a ferrite solid element and are conventional signal circuit with built-in moving coil speaker. Completely built so, ready to go. Offered at importers price due to bankrupt purchase. A remarkable bargain 5/6 plus 2/6 post and insurance.

---

**COMPONENT SNIP**

Wire Wound Controls by Welwyn Standard size approximately 1" (dia) with integral Bakelite control knob.

Suitable for preset or selector circuits. Following values available: 12 Ohm, 25 Ohm, 55 Ohm, 100 Ohm, 200 Ohm. Normal retail price 6/- each. Special snip price 2/- each or 1/- per dozen.

**THE FULL-FI SH STUDIO SIX**

The amplifier... a sensation of the year.

You will be amazed at the fullness of reproduction and at the speed and clearness of the sound. Amplifier with normal pick-ups and an integrated solid state circuit with an output power of 8 watts. R.M.S. over the two channels. The amplifier is ideal for use with normal pick-ups and, if desired, the double audio band transformer used to control volume and tone controls—a switch for Mono or Stereo, or for pick-up. Other controls include clean HI and cut, 'balance' and separate mains on/off switch.

UNREPEATABLE PRICE 20/- 6/- 6/- plus post and insurance.

Where postage is not included then orders over 2/- are post free. Below 20/- add 3/6. S.A.E. with requires postages.

---

**MULTI-DRAWER STORAGE UNITS NEW! HANDY! TIDY! I-N-T-E-R-L-O-C-K-I-N-G**

Nearest, newest system ever devised for storing records and compact discs. Resistors, capacitors, diodes, transistors, etc. Rigid plastic units, interlock together in vertical or horizontal combinations. Transparent plastic drawers have label slots—removeable drawer slides. Build up any size cabinet for wall, bench or table top.

**BUT AT TRADE PRICES!**

SINGLE UNITS (5ins x 24ins x 24ins) Usually 210 each. Our Price 4/- doz.

DOUBLE UNITS (5ins x 24ins x 48ins) Usually 410 each. Our Price 40/- doz.

PLUS 20% DISCOUNTS**

Orders £5 and over Deduct 15/- in the £.
Orders £10 and over Deduct 25/- in the £.
Orders £20 and over Deduct 35/- in the £.

Packaging/Postage/Carriage: Add 6/- to all orders under £1. Orders £3 and over, packing/postage/carriage free.

Quotations for Larger Quantities

---

**ELECTRONICS (CROYDON) LTD**

Dept. PW, 266 London Road., CROYDON CR0 2TH

Also 102/3 Tamworth Road, Croydon

---

**PADDGETS RADIO STORE**

OLD TOWN HALL, LIVERSEDGE, YORKS.

Tel. Heckmondwike 4285

---

**AMPLIFIER UNITS TYPE A1413**


---

**ARMATURE UNITS**

Complete with 24 Volt Motor, and Gears, etc... 14/6 low rate. Complete A1413. Price 15/- Carriage B.5.

---

**NEW CHASSIS IN METAL CASE 51 x 51 x 4” 4”**

Complete with McMurdo Micrometer 18 way Plus and Socket, also 1000 Ohms Relay. A1413.

---

**Amplifier and Diode Bridge Unit Type 17626**

Complete with miniature sealed Relay and miniature Plug and Socket. Ex Units Bargain Price 7/6 Post Paid.

---

**SPECIAL OFFER**

Bush 17" T.V. Sets Series 75. 12 Chanelles Complete and Tested with normal tube 66/109. Cigarette Fait and insurance Passenger Train G.B. only 35/-.

---

**SPEAKERS REMOVED FROM T.V. Sets. All P.M. 3 Ohms. 5/" round 2-1/2 each 4 x 3 1/2 each. 7 x 4 1/2 each. Slot Speakers 8 x 2 1/2 each. Post on any Speaker 4/-.

---

**P.M. Speakers in Cabinet with Volume Control 3 Ohm. Cabinet Condition Poor, Speaker First Class. 5/6. Post and Packing 10/- Reclaimed T.V. Tubes with 6 month Guarantee 17" A.W. 43/30 AW 43/88 40/-, MW 43/69 30/- each. All Tubes 15/- Carriage.

---


---

**IF YOU HAVE DIFFICULTY IN OBTAINING PRACTICAL WIRELESS**

Please place a regular order with your newsagent or send 1 year's subscription (£2-50) to Subscription Department, Practical Wireless, Tower House, Southampton St., London, W.C.2

---

**THERMOSTAT WITH PROBE**

It is suitable to control soil heating and listed heating especially when in baskets or portable vessels as the sensor can be raised out and lowered slowly to heat the vessel. This thermostat could also be used to control a bell or other alarm when kept warm. The chamber is heated by a gas or electric means not controlled by a clock. Made by the famous Tooting Co., we offer these at 15/6 each. Post free.

---

**CORONET CAMERA**

A fraction of a frame's price. Finish this frame already drop-out-case and shoulder strap. British made with precision camshafts and bearers. Perfect pictures in colour and in W & B. 12 pictures on Kodak 127 films. Extremely strong and robust. 14 days" free trial. We guarantee to return your money in full if you can't make perfect pictures. 18/- 6/- 1/2 p. & p.

---

**NEON MAINS TURNT, 1/2 each. 12/- doz. Flood Lamp Control. One and full switch in series with control photo flood lamp; it gives two lamps in series, two lamps brilliant and lamps off. Similar control of other appliances can be arranged where used in parallel or series circuit can be splitter and full switch. Time control is known as a double-delte change over with off. Series of lamps can be arranged in any position. Sub-Minature Silicon Diodes. General purpose diodes to control soil heating. 3/6 each.

---

**ELECTRONICS TAPERS. 24/28 Taps 3 in. screw, normally 4/- each, we offer 4 taps for 10/-.

---

**CIRCULAR TEST. Non-inductive. Ideal for vacuum cleaners etc... W.W. made by BICC. Usually 8d., 10/- yd. coil for 8/-, plus 6/- postage.**
In just 2 minutes, find out how you can qualify for promotion or a better job in Engineering...

That's how long it will take you to fill in the coupon below. Mail it to B.I.E.T. and we'll send you full details and a free book. B.I.E.T. has successfully trained thousands of men at home — equipped them for higher pay and better, more interesting jobs. We can do as much for YOU. A low-cost B.I.E.T. Home Study Course gets results fast — makes learning easier and something you look forward to. There are no books to buy and you can pay-as-you-learn on 'SATISFACTION OR REFUND OF FEE' terms. If you'd like to know how just a few hours a week of your spare time, doing something constructive and enjoyable, could put you out in front, post the coupon today. No obligation.

**WHICH SUBJECT WOULD INTEREST YOU?**

**Mechanical**
- A.M.S.E. Mech. Inst. of Engineers
- Mechanical Eng.
- Maintenance Eng.
- Welding
- General Diesel Eng.
- Sheet Metal Work
- Eng. Inspection
- Eng. Metallurgy
- C. & G. Eng. Crafts

**Draughtsmanship**
- A.M.I.D.
- Gen. Draughtsmanship
- Dye & Print Tools
- Elec. Draughtsmanship
- Engg. & Tool Design
- Design of Elec. Machines
- Technical Drawing
- Building

**Electrical & Electronic**
- A.M.S.E. Elec.
- General Elec. Eng.
- Installations & Wiring
- Electrical Maths
- Electrical Science
- Computer Electronics
- Electronic Eng.

**Radio & Telecoms**
- C. & G. Telephony
- C. & G. Radio Servicing
- Radio Amateurs' Exam
- Radio Operators' Cert.
- Radio & TV Engineering
- Radio Servicing
- Practical Television
- TV Servicing
- Colour TV
- Practical Radio 
- Electronics (with kits)

**Auto & Aero**
- A.M.I.A.
- A.M.I.E. Diploma
- C. & G. Auto Eng.
- General Auto Eng.
- Aerodynamic Machinery

**Management & Production**
- Computer Programming
- Inst. of Marketing
- A.C.G.A.
- Works Management
- Work Study
- Production Eng.
- Storekeeping
- Estimating
- Personal Management
- Quality Control
- Electronic Data Processing
- Numerical Control
- Planning Engineering
- Materials Handling
- Operational Research
- Metrology

**Constructional**
- C. & G. Structural
- Road Engineering
- Civil Engineering
- Building
- Air Conditioning
- Heating & Ventilating
- Carpentry & Joinery
- Clerk of Works
- Building Drawing
- Surveying
- Painting and Decorating
- Architecture
- Builders' Quantities

**General**
- Civil Eng.
- Petroleum Tech.
- Practical Maths.
- Refrigeration
- Servicing
- Rubber Technology
- Sales Engineer
- Timber Trade
- Firemen & Serv.
- Agricultural Eng.
- General Plastics

**General Certificate of Education**
- Examinations at O and A Level
- Exams including: English
- Chemistry
- General Science
- Geography
- Physics
- Mathematics
- Technical Drawing
- French
- German
- Italian
- Spanish
- Russian
- Italian

**Free!**

Why not do the thing that really interests you? Without losing a day's pay you could quietly turn yourself into something of an expert. Complete the coupon (or write if you prefer not to cut the page). We'll send you full details and a FREE illustrated book. No obligation and nobody will call on you...but it could be the best thing you ever did.

**BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY**

Dept D258, Aldermaston Court, Reading RG7 4PF.

**POST THIS COUPON TODAY**

To: B.I.E.T., Dept D258, Aldermaston Court, Reading RG7 4PF

Please send me book and details of your Courses in

Name

Address

Occupation

They did it — so could you

"My income has almost trebled...my life is fuller and happier." — Case History G/321.

"In addition to having my salary doubled, my future is assured." — Case History H/493.

"A turning point in my career — you have almost doubled my standard of living." — Case History K/662.

"Completing your Course meant going from a job I detested to a job I love." — Case History B/461.

**Find out for yourself**

These letters — and there are many more on file at Aldermaston Court — speak of the rewards that come to the man who has given himself the specialised know-how employers seek. There's no surer way of getting ahead or of opening up new opportunities for yourself. It will cost you a stamp to find out how we can help you.

Over 3,000 of our Students have obtained City & Guilds Certificates. Thousands of subsidy exam successes.

B.I.E.T. — IN ASSOCIATION WITH THE SCHOOL OF CAREERS — ALDERMASTON COURT, BERKSHIRE
Choose PRICES 100 range of NEW RADO EQUIPMENT SINCLAIR transistors. Fitted both power output. New printed ASK FOR sound. There TUNER.

BUILD THIS VHF FM TUNER
SMULLARD TRANSISTORS 300kc./B WIDE PRINTED CIRCUIT. HIGH FITTED HEADPHONE. REDUCTION. MONO AND STEREO. A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately.

PARTS TOTAL COST £4.15. p.p. 3/-
DECODER £1.95. (FOR STEREO) p.p. 3/-
ASK FOR BROCHURE No. 7.


B UILD YOURSELF A QUALITY RADIO

SINCLAIR EQUIPMENT
Z30 75/- each, stereo 60 (6-10-0, PZ5 79/6, PZ6 6-14-9, Z50 3-9-6, PZ9 5-19-6.

SPECIAL OFFER 2 of Z30 stereo 60, PZ5 (usually £3.10) or with PZ6 in place of PZ5 £15

WHEN IN LONDON visit the new Disco Centre at "356" and component shop at "356" Edgeware Road, W.2

TEST EQUIPMENT FOR YOUR HOME

AF105 50kV multimeter (illus.), price £8-10, p.p. 3/-, leather case 28/6
P26 20kV multimeter price £3-17-6, p.p. 3/-, case 12/6
TEN9 RF Generator (illus.), price £15, p.p. 7/-
TEN5 Receiving Amplifier, price £17, p.p. 7/-
TEN4 Valve Voltmeter, price £17-10-0, p.p. 7/-

Full details and complete range in catalogue.

SLIM POCKET TEST GEAR

* SIGNAL INJECTOR 35/- p.p. 1/-
* SIGNAL TRACER 29/- p.p. 1/6

NEW

WORLD'S LOWEST COST STEREO MAGNETIC CARTRIDGE 0.7Nv, 20 c/s-20 Kc/s. Diamond stylus. Fits most decks. Recommended for Quality and Performance. Price £3.50 Model 940

FREE Stock List No. 16/17 on request.

BEST VALUE IN U.K.
Choose from 100 complete stereo systems—Complete range of individual units also in stock. Demonstrations all day. Visit the new Hi-Fi Store.

100 STEREO SYSTEMS
LOW CASH AND CREDIT/HP PRICES
(Credit terms from £30 purchase-callers only).

HENRY'S LATEST CATALOGUE
New price—Now 350 pages, 6th impression

* COMPONENTS, TEST GEAR
* EQUIPMENT, MODULES
* SPECIAL OFFERS ETC. ETC.
Everything for the constructor

WHY NOT SEND AWAY TODAY?
NEW 8 piece SEMICONDUCTOR LIST FREE no. 36 new ranges and a few circuits.

NEW 25watt and 50watt RMS SILICON AMPLIFIERS

LOOK AT THE SPECIFICATIONS!

• 0.1% Distortion at full power
• less than 40db at full power
• Response -1db 40db at full power

PA25 10 Silicon Transistors Differential input, 25watts rms into 8ohms, 200V output. Size only 5" x 3" x 2 1/2. Only £25. Supplied with edge connector and harness.

PA50 12-Silicon Transistors, 50watts rms into 8ohms. £64. Power supply for one or two PA25 or PA50.

PA25 £7-10-0, PA50 £9-10-0, PA50 £44-6

NEW SELF POWERED PREAMPLIFIERS

Mains operated slim design. Pre-amplifiers for use with any Power Amplifier. All Silicon FET/Transistor designs. Can be driven up to 4-PA25 Amplifiers. Push Button selection. All facilities.

MODEL FET154 STEREO PREAMPLIFIER

Input for Mag. Pickup, Tuner/Aux., Tape in and out. Response -10 db at 40kc/s. Outputs adjustable up to 10 volts ±20dB Boost or Cutoff Controls. Slim design. Size 12" x 41/2 x 11/2 Price £16-10-0

MODEL FET 9/4
Mono Preamplifier with built-in MIC, MC XEC, Inputs for all Crystal and Ceramic cartridges. Tuner, Tape in and out. O/P and Response as FET154. Size 10" x 4_3 x 11/2 Price £13-16-0

NO SOLDERING, JUST PLUG-IN CONNECTORS

ELECTRONIC ORGANS

COMPLETE RANGE OF COMPONENTS IN STOCK FOR ALL PURPOSES

★ MODERN ALL BRITISH TRANSISTOR DESIGNS AVAILABLE AS KITS OR READY BUILT VENEERED CABINETS FOR ALL MODELS
★ 49 NOTE, 61 NOTE SINGLE MANUAL DESIGNS ALSO TWO MANUAL 49 NOTE
★ KITS AVAILABLE IN SECTIONS AS REQUIRED
★ NEW PAX DISCOTHEQUE CENTRE AT "308"