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B 44 LL $\frac{1}{4}$ " — 4.75 mm SCREWDRIVER FACE



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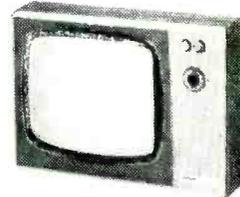
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KG-865 50 Watt Stereo Amplifier Kit

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

Recommended List Price £34.19.6: 24 GNS Assembled 89 GNS. Teak Case 85 extra

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The NEW KG-980 Stereo FM Receiver Kit



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R.F. and I.F. Panels Assembled and Aligned ● Front Panel Stereo Headphone Jack and Speaker Muting Switch ● Full Controls including Tape Monitor ● 50W I.F.H. Output ● Usable I.E.F. Sensitivity: $3\mu V$ ● Frequency Response: $\pm 1dB$, 30 to 15,000Hz. ● Harmonic Distortion: less than 1.0% ● A.M. Suppression: more than 30dB ● Channel Separation: 30dB ● Complimentary Transformerless ● Power Output: 50W I.F.H. (25W per channel); 34W continuous sine wave ● Frequency Response: $\pm 1dB$, 18 to 30,000Hz ● Power Bandwidth: 20-20,000Hz at 1% harmonic distortion ● Two R.F. Stages ● Stereo Indicator Light. Recommended List Price £82.19.6: 89 GNS. Assembled 49 GNS. Teak Case 5 GNS. Extra.

KG-375A Deluxe Solid-State Auto Analyzer Kit

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

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Set Engine Idle and Automatic Transmission Shift Points ● Detect Condition of Point Surfaces ● Detect Distributor Wear ● Check Voltage and Current Regulators ● Check Generators for both Current and Voltage Output ● Find Poor or Open Earth Circuits ● Detect Variation in Dwell Angle. Recommended List Price £23.17.6: 16 GNS. Assembled Price: 21 GNS.

KG-625 Deluxe 6in Vacuum Tube Volt Meter Kit

Huge 6in Meter Scale ● Ranges: a.c. 0-0.5-1.5-5-15-50-150-500-1,500V full scale. ● Accuracy: $\pm 3\%$ of full scale reading ● Input Resistance: 11M Ω to 1,500V ● Ranges: a.c. 0-1.5-5-15-50-150-500-1,500V full scale. 0-4-2-14-42-140-420-1,400-4,200V full scale ● Accuracy $\pm 5\%$ ● Frequency Response $\pm 1dB$, 30Hz to 3MHz; $\pm 3dB$, 30Hz to 5MHz ● Ohmmeter Ranges: 1-1,000-10,000 ohms; 0-1-10-100-1,000M Ω ● Battery 1½V Z. Recommended List Price £24.19.6: 12 GNS. Kit 620 as KG 625 (same Ranges) but 4in Scale: Recommended List Price £18.5.6 9½ GNS.



— WHY NOT BUY THE PAIR? —

KG-371 Deluxe Solid-State Timing Light

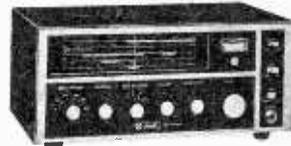
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STAR ROAMER 5-Band Shortwave Receiver Kit

Bandspread: electrical, calibrated 0-100 ● Sensitivity: 10 μV for 10dB signal-to-noise ratio ● I.F. Bandwidth: 3kHz at 6dB down ● Beat Frequency: variable, 0-5kHz ● Speaker: its permanent-magnet type ● Power Supply: fused, transformer operated ● Headphone Output: low impedance ● Valve Complement: 1-5BE6, 1-6X8, 1-12AX7, 1-6AK5 or 1-6AR5 ● Power Requirements: 230-250V, 50Hz a.c.; 15W ● Covers 200 to 400kHz and 550kHz to 30MHz in 5 Band-switched Ranges ● Superheterodyne Circuit includes controlled regenerative I.F. stage ● A.V.C. reduces fading and blasting; A.N.L. cuts noise to a minimum ● Aerial Trimmer effectively peaks incoming signals for best reception ● Illuminated "S" Meter; Large, Easy-to-Read 7½in Slide Rule Dial. Recommended List Price £21.19.0: 14 GNS. Assembled Price 19 GNS.



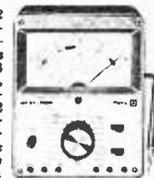
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KG-640 20,000 ohms/Volt VOM Kit

BIG PROFESSIONAL SIZE 62 RANGE MULTIMETER ● A.C. Volts (12 Ranges): 0-2-4-8-16-40-80-200-400-800-1,600-2,000-4,000V ● D.C. Volts (12 Ranges): 0-0.8-1.6-8-16-40-80-400-800-1,600-2,000-4,000V ● Output Volts (8 Ranges): 0-2-4-8-16-40-80-200-400V ● Resistance (3 Ranges): 0-1,000-100,000 ohms-10 mega. Centre scales at 12, 1,200 and 120K Ω ● D.C. Current (10 Ranges): 0-0-100-400-800 μA , 8-16-200-400mA, 8-16A ● Decibels (12 Ranges): -12 to +74 ● D.C. Sensitivity: 20,000 ohms per volt or 10,000 ohms per volt (function of scale multiplier switch). ● Frequency Response: 80Hz to beyond 200kHz ● Accuracy: D.C. 3%, A.C. 5% ● Test Leads: one red, one black, each 48in long ● Multiplier Resistors: AU 1% carbon film. Recommended List Price £16.19.6: 9½ GNS. Assembled Price 12 GNS.



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5in. 900ft.	10/6	5 1/2in. 1,200ft.	13/-	5 1/2in. 1,800ft.	19/-	7in. 3,600ft.	44/-	7in. 1,200ft.	18/6	7in. 1,800ft.
										7in. 2,400ft.
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Enclosure (26" x 15" x 12") oiled (matt) walnut 8 ohms—up to 35w handling capacity.
List price £45. 10. each.
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Complete, not wired, £14.12.8d p.p. 15/- Ready wired with 5-pin Din or Phono, 10/6 extra.
For any other Deck, 3000, 2025TC, add price of Plinth and Cover to Deck and add 15/- p.p.

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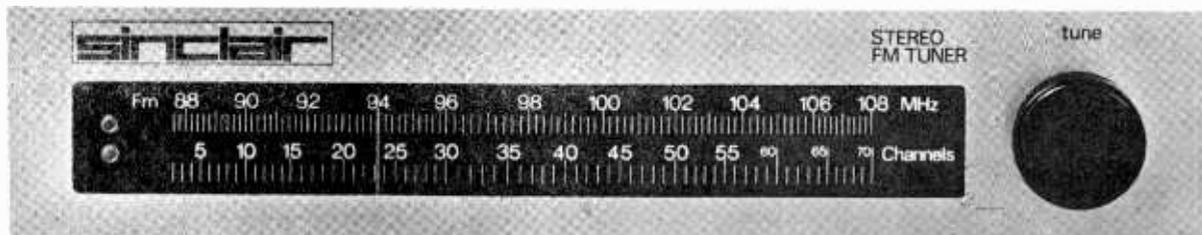
Indispensable for precision drilling, grinding, polishing, etching, gouging, shaping. Precision power for the enthusiast. Shockproof. Completely portable power from 4½ volt external battery. So much more scope with MINI-DRILL. Super Kit (extra power, interchangeable chuck) 79/6, p.p. 2/6. De Luxe Professional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

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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 tuner, as the specifications show, is 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.

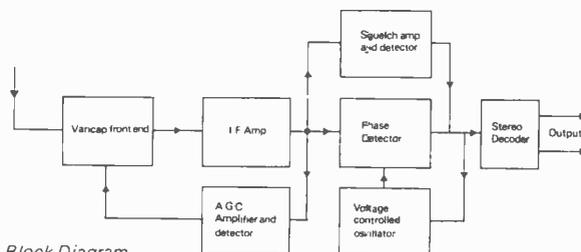
The use of an integrated circuit for the stereo decoder part of the circuit helps to give improved performance as it enables us to use a far more sophisticated circuit than would otherwise be possible. In particular stereo separation is excellent. Switching from mono to stereo is automatic and is indicated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

Number of transistors	16 plus 20 in I.C.
Tuning range	87.5 to 108 MHz.
Capture ratio	1.5dB
Sensitivity	2 μ V for 30dB quieting 7 μ V for full limiting
Squelch level	20 μ V
A.F.C. range	\pm 200 KHz.
Signal to noise ratio	>65dB
Total harmonic distortion	0.15% for 30% modulation
Stereo decoder operating level	2 μ V
Pilot tone suppression	30dB
Cross talk	40dB
I.F. frequency	10.7 MHz
Output voltage	2 x 150mV R.M.S.
Aerial Impedance	75 Ohms
Indicators	Mains on; Stereo on; tuning indicator



Block Diagram

Price: £25 built and tested. Post free.

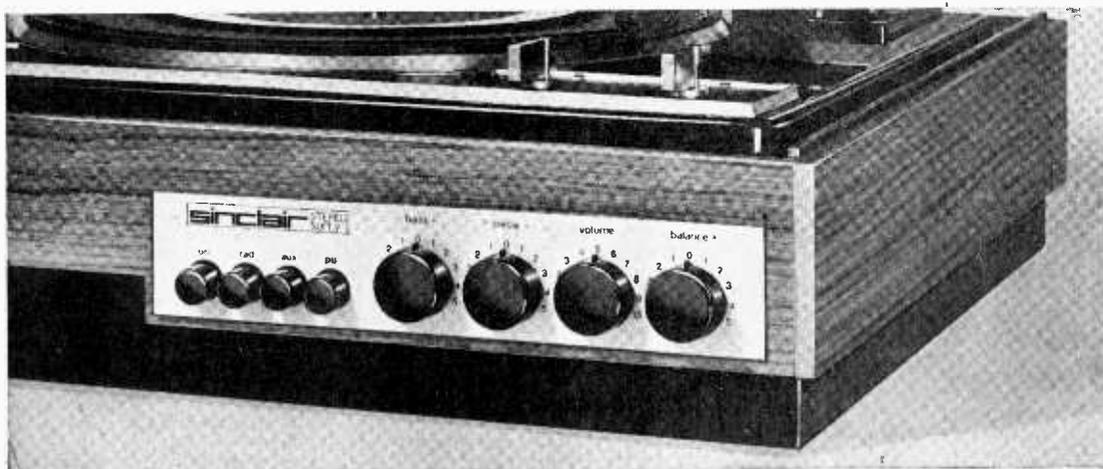
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44

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.

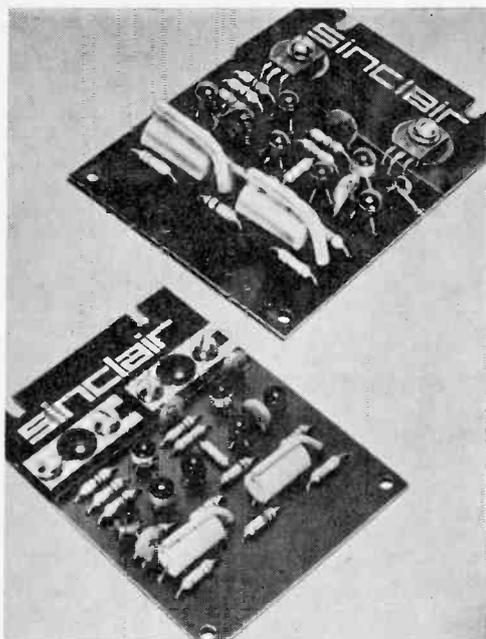
The modules are: 1. The Z.30 and Z.50 high gain power amplifiers. 2. The Stereo 60 preamplifier and control unit. 3. The Active Filter Unit. 4. 4 supply units—PZ.5; PZ.6; PZ.7 and PZ.8. In a normal domestic application, there will be no significant difference between PZ.5 or PZ.6 unless loudspeakers 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.

System	The Units to use	In conjunction with	Your Project 60 Units will cost
A Car Radio	Z.30	Existing car radio, Sinclair Micromatic	89/6
B Simple battery powered record player	Z.30	Crystal pick-up, 12 V or more battery supply and volume control	89/6
C Mains powered record player	Z.30 and PZ.5	Crystal or ceramic P.U. Vol. control etc.	£9.9.0
D 20+20 watts RMS stereo amplifier for most needs	Two Z.30s, Stereo 60 and PZ.5	Crystal, ceramic or magnetic P.U., most dynamic speakers, FM tuner, etc.	£23.18.0
E 20+20 watts RMS stereo amplifier for use with low efficiency (high performance) speakers	Two Z.30s, Stereo 60 and PZ.6	High quality ceramic or mag. P.U., F.M. Tuner, Tape Deck, etc. All dynamit spkrs.	£26.18.0
F 40+40 watts RMS deluxe stereo amplifier	Two Z.50s, Stereo 60 PZ.8 and mains transformer	As for E	£32.17.6
G Outdoor public address system	Z.50	Microphone, up to 4 P.A. speakers, 12V car battery with converter, or 45V d.c. and controls	£5.9.6
H Indoor P.A.	One Z.50, PZ.8 and mains transformer	Mic., guitar, heavy duty speakers etc., controls	£17.8.6
J High pass and low pass filters	AFU	D, E or F as above	£5.19.6
K Stereo F.M. tuner		To be released shortly	

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.

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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

Z.30 15 watts R.M.S. into 8 ohms, using 35V; 20 watts R.M.S. into 3 ohms using 30 volts.

Z.50 40 watts R.M.S. into 3 ohms from 40 volts; 30 watts R.M.S. into 8 ohms, using 50 volts.

Frequency response 30 to 300,000 Hz \pm 1dB

Distortion 0.02% into 8 ohms

Signal to noise ratio better than 70 dB unweighted

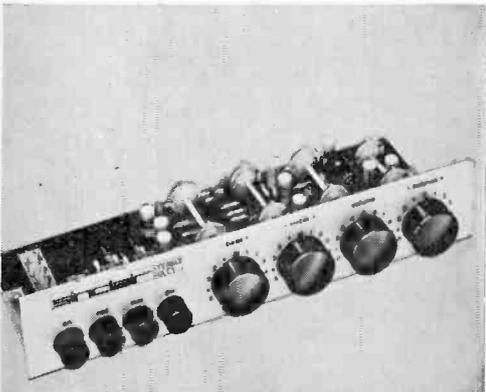
Input sensitivity 250mV into 100 Kohms.

For speakers from 3 to 15 ohms impedance

Size $3\frac{1}{2} \times 2\frac{1}{4} \times \frac{1}{2}$ ins. (90 x 58 x 13 mm)

Z.30 *Built, tested and guaranteed* **89/6**

Z.50 *Built, tested and guaranteed* **109/6**



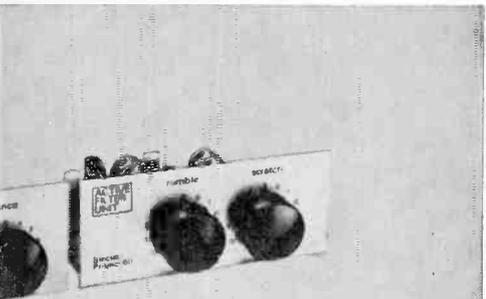
Stereo 60 Pre-amp/Control unit

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 equalisation is provided for all the usual inputs.

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

- Output — 250mV.
- Signal-to-noise ratio — better than 70dB.
- Channel matching — within 1dB.
- Tone controls — TREBLE +15 to -15dB at 10kHz; BASS +15 to -15dB at 100Hz.
- Front panel — brushed aluminium with black knobs and controls.
- Size $8\frac{1}{2} \times 1\frac{1}{2} \times 4$ ins. (210 x 138 x 102 mm)

Built, tested and guaranteed **£9.19.6**

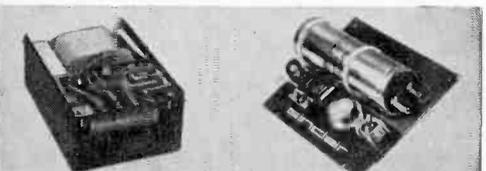


Active Filter unit

For use between Stereo 60 unit and two Z.30s or Z.50s, the Active Filter Unit matches the Stereo 60 in styling and is as easily mounted. It is unique in that the cut-off frequencies are continuously variable, and as attenuation in the rejected band is rapid (12dB/octave), there is less loss of the wanted signal than has previously been possible. Amplitude and phase distortion are negligible. The Sinclair A.F.U. is suitable also for use with

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

Built, tested and guaranteed **£5.19.6**



Power Supply units

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

PZ6-35 volts stabilised £7.19.6

PZ-8 45 volts stabilised (less mains transformers) £5.19.6

PZ-8 mains transformer £5.19.6

GUARANTEE If within 3 months of purchasing Project 60 modules directly from us, you are dissatisfied with them, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail, Air-mail charged at cost.

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

NAME

ADDRESS

For which I enclose cash/cheque/
money order

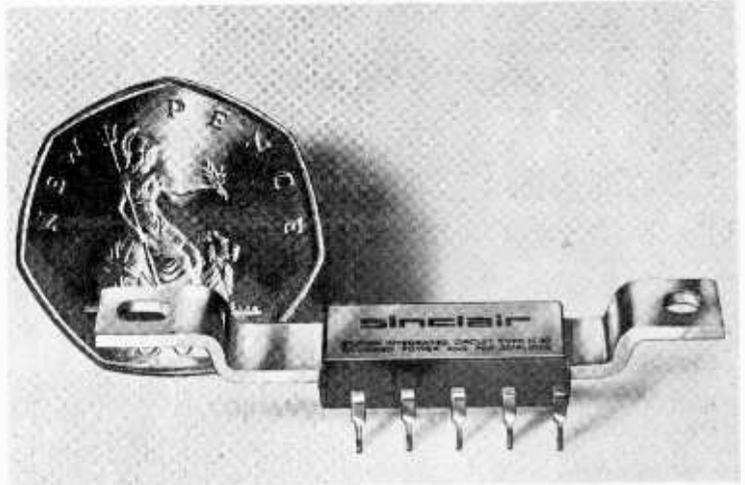
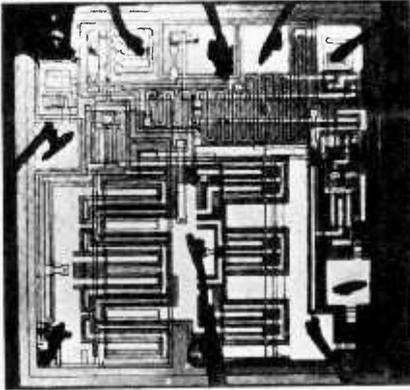
PW11

At the International
Audio & Music Fair, Stand

44

sinclair

Sinclair IC-10



the world's most advanced high fidelity amplifier

Specifications

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

SINCLAIR
IC-10 with IC-10 manual
 Post free. **59/6**

To: SINCLAIR RADIONICS LTD., 22 NEWMARKET RD., CAMBRIDGE	
Please send	
.....	NAME
.....	ADDRESS
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.....
for which I enclose cash/cheque money order	PW 11

sinclair

At the International Audio
and Music Fair, Olympia, Stand

44

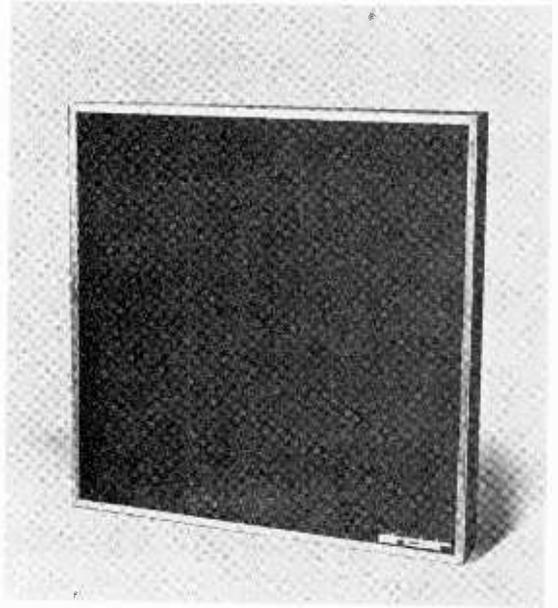
Q.16 High fidelity loudspeaker

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:	9 $\frac{3}{4}$ " square on face \times 4 $\frac{3}{4}$ " deep with neat pedestal base. Black all-over cellular foam front with natural solid teak surround.
Price:	£8 19 6.



Micromatic Britain's smallest radio

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

Specifications

Size:	1 $\frac{1}{8}$ " \times 1 $\frac{7}{16}$ " \times $\frac{1}{2}$ " (46 \times 33 \times 13mm).
Weight including batteries:	1 oz. (28.35gm) approx.
Tuning:	Medium wave band with bandspread at higher frequency end.
Earpiece:	High-fidelity magnetic type.
Battery requirements:	Two Mallory Mercury Cells, type R.M. 675, for long working life.
Case:	Black plastic with anodised aluminium front panel, spun aluminium dial.
Controls:	Tuning dial, and on/off switching by means of earpiece plug.
Price:	Available in kit form complete with earpiece, case, instructions and supply of solder in fitted pack. 49/6. Ready built, tested and guaranteed. 59/6.



CRESCENT RADIO LTD.

11 & 40 MAYES RD. N.22 888-3206

MAIL ORDER DEPT.
No. 11
MAYES RD.
LONDON
N22
6TL



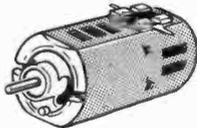
TRANSFORMER SCOOP

Primary 110, 220, 250 v. fused. Secondary 220 v. at 50mA, 6.3v. at 1 amp. Overall size 2 1/2" x 2" x 2 1/2" high. 12/6 P. & P. 3/-

2 x 3-15 volt, 1 amp. Secondary 250 volt Primary. Can be used as 6-8v. heater transformers. 7/6 each. P. & P. 3/-

SEND FOR FREE LISTS OF SEMI CONDUCTORS

MODEL MAKERS MOTOR



Rated up to 11.5 volt 400mA, torque 12g-cm. Size—1 1/4" long x 7/8" diam. Shaft—1/8" long x 1/16" diam. 4/6 P. & P. 1/8.

COMPONENT CENTRE

8" x 6" one sided printed circuit board	2/- each
BY100 type rectifier 800 piv 750mA	3/3 each
4-pin transistor holders	6d. each
2 1/2" 8 ohm loudspeaker	5/8 each
2 1/2" 8 ohm loudspeaker	6/8 each
2 1/2" 8 ohm loudspeaker	5/8 each
U2 battery holders (blue plastic)	1/- each
10 ohm w/w pots	2/8 each
OC81 double heat clips	6d. each
Tape recorder rev. counters	5/- each
Transistors, Diodes, S.C.R.s etc.	Send for list now

Please include P. & P.
Send 3/- for our Component Catalogue and Flog Lists.



SHELF UNIT

Two teak finish shelves on a black frame (overall size: 28in. x 25in. x 12in.). Ideal for hi fi equipment: amplifiers, speaker cabinets, etc. The perfect answer for housing unit audio and equipment. This unit is wall mounting

50/-

PLEASE NOTE P. & P. IS FREE



WESTON MILLIAMMETER

Modern clear plastic design. 1mA full scale, calibrated 0-100. 2 1/2" x 2 1/2" x 1 1/2" deep.

30/- Plus 2/6 P. & P.

IMPORTED PANEL METERS

KA-38C 1 1/2" x 1 1/2" 50µA, 100µA, 500µA, 1mA, 5mA. S meter 1mA, 300v. All at

KA-65C 3 1/4" x 3 1/4" 300v., S meter 500µA, 1mA. All at

29/6 Plus 1/- P. & P.

39/6 Plus 1/6 P. & P.

All modern design and made to high standards.

FLICK SWITCHES

250 volt 3A. Single Pole on-off. 1 1/2" nylon Toggle. 3/6 P. & P.



E.M.I. SET 450

3, 8 or 15 Ω, 10 watts. 65/- Plus 7/6 P. & P.

DWELL TIME UNIT

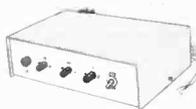


These small units contain the following components: 700 ohm DPDT relay with base, 1µF 250v. paper, 0.01µF 400v. paper, 50µF 35v. electrolytic, 3 diodes, OC200 transistor, a 2N2928 type transistor unmarked, a skeleton pre-set pot, 4 pin din plug & skt., 4 foot of 4 core screen. All housed in a small neat metal box. Can be made into many timing devices.

12/- Plus 1/6 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



Size 8 1/2" x 5 1/2" x 3" high. 500 watts each channel light output. A total of 15 x 100 watt lamps can be used! Input—jack socket. Controls vary the input to each channel.

£18-10-0 each

Plus P. & P. 7/6.

CHROME TV STAND

28 x 8 1/2 x 16in. high. This modern design TV Stand would make an ideal base for a coffee table and is a bargain at

32/6 Plus 6/- P. & P.

MAINS UNITS for all types of TRANSISTOR EQUIPMENT

PLUS-3 MAINS UNIT

Provides three separate switched output voltages 6v., 7 1/2v. and 9v. DC. attractive case with indicator light, mains lead output socket, plug and lead. Size 4 1/2" x 3 1/2" x 2 1/2" in.

57/6 P. & P. 2/6



(Extra lead with DIN plug for Cassette Recorders 7/6)

MAINS UNIT

for transistor equipment using 7 1/2v. Complete with DIN plug for power socket. Can also be supplied for a 6-volt output complete with suitable plug. (State make, model and voltage required.) 45/- P. & P. 2/6



UNIT FOR USE WITH 12v CAR BATTERY

Suitable for running transistor radios etc. (State output reqd. - 6v, 7 1/2v or 9v) Price 35/- including fused lead P. & P. 2/6

MAINS UNITS

For single outputs, 6v, 9v, 12v, 18v, 39/6. For two separate outputs, 4 1/2v + 4 1/2v, 6v + 6v., 9v + 9v. 42/6. P. & P. 2/6 per unit. (Please state outputs reqd.)

MAINS UNIT FOR ALL TRANSISTOR RADIOS ETC., USING PP3 TYPE BATTERY. (ALSO AVAILABLE FOR 6V.)

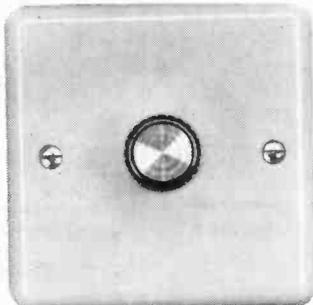
20/- P. & P. 2/-



All units are completely isolated from mains by double wound transformer ensuring 100% safety.

R.C.S. PRODUCTS (RADIO) LTD.
(Dept. P.W.), 31 Oliver Road, London, E.17

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 40-600 watts of all lights except fluorescents at mains voltages from 200-250V, 50 Hz.

Competitive products sell at £4.19.6d.—our price is £3 4s. We also offer at £2 14s. 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. Radio interference suppression is included.

Post and Packing 1/6d. extra.

Please send Cash with Order to:—

DEXTER & COMPANY
OLVER HOUSE, 19 KING STREET,
CHESTER CH1 2AH.

Tel: Chester 25883

As supplied to H.M. Govt. Departments, Hospitals
Local Authorities, etc.

NEW BOOKS

MAKING & REPAIRING TRANSISTOR RADIOS

by W. G. Oliver (G.3XT)
(Pub. by Foulsham Technical)

(Oct.) 21/-

SECURITY ELECTRONICS

by John E. Cunningham

(Oct.) 34/-

101 QUESTIONS AND ANSWERS ABOUT TRANSISTOR CIRCUITS

by Leo. G. Sands (Oct.) 26/-

HI-FI STEREO SERVICING GUIDE

by Robert G. Middleton

(Nov.) 35/-

101 EASY HAM RADIO PROJECTS

by Robert M. Brown and Tom Knettel

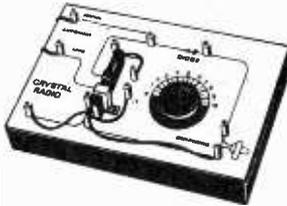
(Nov.) 30/-

FOULSHAM-SAMS TECHNICAL BOOKS
(W. FOULSHAM & CO. LTD.)
YEovil RD., SLOUGH, BUCKS, ENGLAND

ROC ELECTRONICS

CRYSTAL RADIO KIT Model R.125

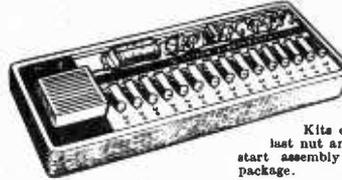
This easy to build Radio is based on the same circuit developed by Marconi for the very first radio transmission but uses a modern ferrite aerial for maximum efficiency.
A perfect introduction to Radio Theory.



PRICE £1.10.0.



2 OCTAVE ELECTRONIC ORGAN KIT Model R.129

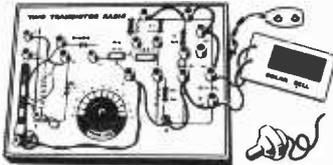


Complete with a music book containing 10 easy to play songs the R.129 solid state organ kit covers 2 full octaves.
Slotting into a fitted hardwood case the top panel carries the key assemblies and all the components including the loud-speaker. Like all Roc Electronic

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-solder connections to produce a complete 2 transistor radio in under 2 hours. As well as battery operation the kit is supplied complete with a solar cell to provide power from the Sun or any strong light source.

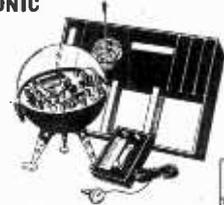
PRICE £2.10.0.



20 PROJECT SOLAR ELECTRONIC KIT Model R.128

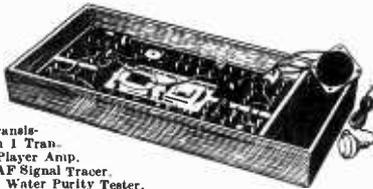
This ultra modern Project Kit is shaped for the space age. Carried inside a transparent domed 4 1/2 in capsule the R.128 comes complete with a self-contained solar cell to power any one of 20 projects ranging from a one transistor radio to a Morse set complete with key and Morse training code. Supplied complete with easy to follow instructions and even the cement to assemble this unique electronic space capsule.

PRICE £4.10.0.



10 PROJECT INTEGRATED CIRCUIT KIT Model R.127

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



PRICE £3.10.0.

50 PROJECT ELECTRONIC KIT

Model R.130



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

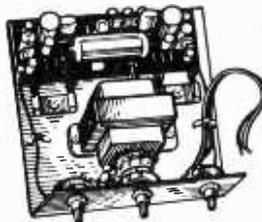
PRICE £7.19.0.

5 WATT STEREO INTEGRATED AMPLIFIER CHASSIS Model R.123

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

SPECIFICATION:
Output: 5W total. 2.5W per channel.
Input sensitivity: 600mV at 2-2Mohms.

PRICE £4.19.0.



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 usable FM sensitivity of 3µV means that the R.132 can be used anywhere, even in different stereo reception areas.

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

PRICE
£36.0.0.



5 WATT 8 TRACK CARTRIDGE STEREO AMPLIFIER Model R.133

Just slot in one of the many 8 track cartridge tapes available for a continuous programme of your favourite music. A manual programme override switch enables you to switch from one track to the next at the push of a button at the same time a numbered indicator lights up to show which track is playing. Beautifully finished in an oiled walnut cabinet the R.133 is mechanically engineered to provide long and reliable service. **SPECIFICATION**—Tape speed: 9.5 cm/sec (31 i.p.s.). Wow & flutter: better than 0.3%. Frequency range: 40-12,000Hz. Cross talk: better than 40dB at 1,000Hz. Output: 5W total. 2.5W per channel. Amplifier outputs: 200mV.

PRICE £36.0.0.



40 WATTS STEREO AMPLIFIER

Model R.131



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

SPECIFICATION—Output: 40W total 20W per channel. Frequency Range: 20-35000Hz. Input: Phone: Mag, 3-6mV R.I.A.A.; Xtal, 100mV; tape, 200mV; tuner, 200mV. Control: Bass, treble, volume left, volume right, selector main/remote speakers, power on/off, loudness and stereo/mono.

PRICE £25.0.0.



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: 8-16 ohms.
Frequency range: 30-15,000Hz.

PRICE £2.8.0.



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 8211

Lasky's

Audio Tronics 70

Send your name and address now to receive 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. Electronics Hobbles, Servicemen, and Communications Ham. Covers every aspect of Hi-Fi (Including Lasky's budget Stereo Systems, and Package Deals) plus Lasky's amazing money saving vouchers worth over £32. Send your name and address and 2/6 for post and inclusion on our regular mailing list.

THORN PYGMY PLUG-IN

A compact pygmy relay 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).

RN TYPE	Contacts	Base	Coil Voltage
215048	D.P.D.T.	8 pin	48V AC/DC
235004	D.P.D.T.	8 pin	40V DC
215060	D.P.D.T.	8 pin	60V AC/DC
305030	3 P.D.T.	11 pin	60V DC
205024	D.P.D.T.	8 pin	24V DC
215042	D.P.D.T.	8 pin	42V DC

Others available in limited quantities.

LASKY'S PRICE 12/6 post 3/6



MODEL 5025 50,000 O.P.V. FEATURING 57 MEASUREMENT RANGES

Uses an entirely new range selection mechanism which permits the use of a really large meter in a more compact cabinet. The range selected is indicated on the meter face. High speed rotary range selection knob; polarity reversal switch, shielded meter movement with overload protection circuit; Special μ A and mA measurement ranges.

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



KIT £10.10.0 Post 5/-
ALSO AVAILABLE READY BUILT AND TESTED £12.10.0 Post 5/-

JUST ARRIVED

Lasky's C60, C90, C120.

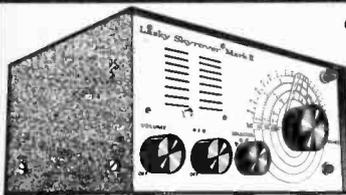
Exclusively made for us in U.S.A. Great Savings!

	Each	Post	Five for	Ten for		
C 60	7/6	1/-	33/-	2/-	62/-	3/-
C 90	12/6	1/-	56/-	2/-	110/-	3/-
C 120	17/-	1/-	75/-	2/-	139/-	3/-

U.S.A. Cassette head cleaner, 10/6, Post 1/-
Post 1/- each, five for 2/-, ten for 3/-



SKYROVER Mk II



COMMUNICATION RECEIVER

A short wave receiver, exclusive to Lasky's, at a real economy price. Four valve line up using one each 6BE5, 6BA6, 6AV6 and 6AR5 valves, gives highly sensitive reception and powerful gain. Switch selected SW frequency range cover: 1.5 to 30MHz in three separate bandspread ranges and full AM medium wave-band cover in one range 550-

1,600kHz. Reduction drive tuning with hair line cursor. Controls include volume on/off BFO, Band selector. Power on indicator lamp. External antenna connections and mains fuse at rear. Internal speaker plus standard 5mm jack socket for phones on front. For 220/240V a.c. mains operation. Strong metal cabinet finished in grey crackle with anodised silver front panel. Size 9 1/2 x 5 1/2 x 5 1/2 in. Complete with mains lead and full instructions.

LASKY'S PRICE £13.13.0 Post 5/-

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 20,000 O.P.V. Multimeter. Features 24 measurement ranges with mirror scale. Large 3 x 2 in meter. Full scale accuracy: DCV and current: $\pm 2\%$. ACV: $\pm 3\%$. resistance $\pm 3\%$. Special 0.6V DC range for transistor circuit measurements.

SPECIFICATION
● DCV: 0-0.6-6-30-120-600-1,200V at 20K/OPV. ● ACV: 0-0.6-30-120-600-1,200V at 10K/OPV. ● DC Current: 0-0.6-6-600mA. ● Resistance: 0-10K 100K 1M-10M/ohms (58-580-5.8K-58K at mid-scale). ● Capacitance: 0-0.02-0.2 μ F (AC 6V range). ● Decibels -20 to +63dB. ● Output: 0.05 μ F blocking capacitor. Uses two 1.5V (U7 type) batteries. Black bakelite cabinet—Size 5 1/2 x 3 1/2 x 1 1/2 in. Complete with test leads.



KIT PRICE ONLY 92/- Post 3/6

EXCLUSIVE TMI & TM5

MODEL TM-1 MINI TESTER

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

- DCV: 0-10-50-250-1,000 at 1K/OPV.
- ACV: 0-10-50-250-1,000 at 1K OPV.
- DC CURRENT: 0-1mA, 100mA.
- Resistance: 0-150k Ω .
- Decibels: -10dB to 22dB.
- Complete with test leads, battery and instructions.



Size Only 3 1/2 in. x 2 1/2 in. x 1 1/2 in.

LASKY'S PRICE 39/6 POST 2/6 MODEL TM-5 5K OHMS/V POCKET MULTIMETER

Another new look pocket multi-meter from Lasky's providing top quality and value. The "slimline" impact resistant case—size 4 1/2 in x 2 1/2 in x 1 in, fitted with extra large 2 1/2 in square meter. Readability is superior on all low ranges; making this an excellent instrument for servicing transistorised equipment. Recessed click stop selection switch. Ohms zero adjustment. Buff finish with crystal clear meter cover.

- DCV: 3-15-150-300-1,200 at 5K OPV.
- ACV: 6-30-300-600 at 2.5K OPV.
- DC Current 0-300 μ A, 0-300mA.
- Resistance: 0-10k Ω , 0-1M Ω .
- Decibels: -10dB to 16dB.
- Complete with test leads, battery and instructions.



LASKY'S PRICE 49/6 POST 2/6

Garrard

SL-55

OTHER GARRARD UNITS FROM STOCK

AUTOCHANGERS	
SL72B	£25 0 0
2025TC with stereo cartridge	£8 17 6
3000 complete with 9TAHC stereo cartridge	£9 19 6
SL65B	£15 10 0
SL95B	£35 0 0
SL75B	£28 0 0

SINGLE PLAYERS
AP 75, £18.10.0. AP75 with AD76K mag. cart., £21.10.0. 401 Transcription Unit, £20.0.0

BASES AND COVERS FOR GARRARD UNITS
Type WB1 and WB5 for models AT60 Mk II, 2025TC, 3000, SL65B, SL55, 1025, SP25 Mk. II. Price WB1 £3 16 6. WB5 £5 12 6. Type WB4 for models SL72B, SL75B, SL95B Price £5 12 6, Perspex covers: SP1C for WB1 £3 14 1, SP4C for WB4 and WB5 (allows unit to be played with the cover in place—Price £4 8 0.



SPECIAL SL-55 OFFER

One of the famous Garrard Synchro-Lab Series. Takes 8 L.P.s. Four-speed auto-changer; incorporating a tubular pickup arm and adjustable stylus force. Wired for Mono and Stereo. NOW AT LASKY'S SPECIAL PRICE. Complete with SONOTONE 9TA STEREO CARTRIDGE. £10.19.6

SCOOPMT-65 SPECIAL OFFER

EXCLUSIVE HI-FI STEREO TUNER AMP. OFFER THE MT-65 CHASSIS

Solid state AM/FM multiplex tuner with FET front-end/17 +17 watts stereo amplifier by world famous manufacturer. Frequency response 20-45KHz. Inputs—2.3mV mag. p/u and 140mV tape play. Tape record output. Controls: Left/right volume, bass, treble, loudness, monitor. Tuning meter and stereo beacon. Stereo 'phone jack. Machined stainless steel front panel. Overall size 20x34x16in. List Price £75.

SPECIAL PRICE £66.0.0

CARRIAGE 12/6

DE-LUXE "COMPACT" PACKAGE OFFER

MT-65 Chassis	£75 0 0
GARRARD AP-75 3-speed Single Player	£23 16 7
AUDIO DEVELOPMENT AD-36K Magnetic Cartridge	£5 18 6
2 WHARFEDALE DENTON Speaker Systems	£36 0 0
"Compact" Teak Cabinet (as shown)	£7 10 0
TOTAL RECOMMENDED LIST PRICE	£148.5.1

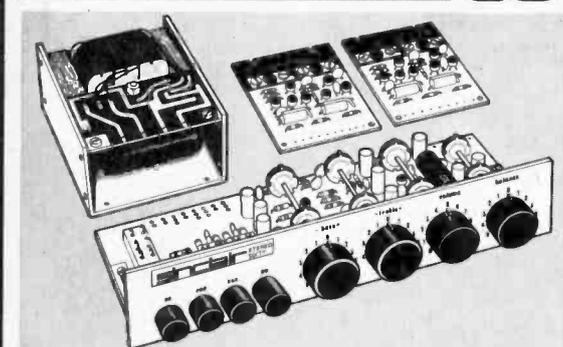
LASKY'S PACKAGE PRICE



£132.0.0

U.K.: carriage 40/-
All units available separately

Sinclair Project 60



Project 60 is a range of modules which connect together to form a complete stereo amplifier. The modules are: 1. Z-30 high gain power amp. 2. Stereo-40 pre-amp. control unit. 3. The PZ-5 unbalanced and PZ-6 stabilised power supplies. A complete system comprises two Z-30's, one Stereo-40 and a PZ-5 or PZ-6.

STEREO 60 SPECIFICATION

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

£9.19.6

post 3/6

Z-30 SPECIFICATION

Power output: 15W R.M.S. into 8ohms using a 35 volt supply. Frequency response: 30 to 300,000Hz - 1dB. Distortion: 0.02%. Signal to noise: better than 70dB. Input sensitivity: 250mV into 100K ohms. Loudspeaker imp: 3 to 15 ohms. Power requirements: from 8 to 35V DC (The Z30 will operate from batteries if required) - Size: 3½ x 2¼ x 1½in.

89/6

post 3/6

PZ5

30V unbalanced - sufficient to drive two Z-30's and a Stereo 60 for domestic applications.

99/6

Post 2/6

PZ6

35V stabilised - ideal for driving two Z-30's and a Stereo 60 for low efficiency speakers.

£7.19.6

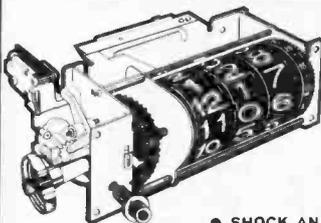
Post 2/6

PACKAGE PRICE For Stereo 60, two Z-30 and one PZ-5

£19.19.6

Post 10/-

EXCLUSIVE DIGITAL CLOCK SCOOP!



- SHOCK AND VIBRATION PROOF
- BUILT IN ALARM BUZZER

SPECIAL QUOTATIONS FOR QUANTITIES

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

This unique DIGITAL CLOCK is now available EXCLUSIVELY FROM LASKY'S in chassis form for you to mount in any housing that you choose. All settings are achieved by two dual-concentric controls at the front including: ON-OFF-AUTO and AUTO ALARM, "sleep" switch, 10 minute division "click" set alarm (up to 12 hour delay), time adjustment. Ultra simple mechanism and high quality manufacture guarantee reliable operation and long life. The sleep switch will automatically turn off any appliance—radio, TV, light, etc., at any pre-set time up to 60 min. and in conjunction with the AUTO setting will switch on the appliance again next morning.

The clock measures 4½ x 1½ x 3½ (overall from front of drum to back of switch). SPEC: 210/240V AC, 50Hz operation; switch rating 250V, 3A. Complete with instructions. HUNDREDS OF APPLICATIONS.

COMPLETE WITH KNOBS.

LASKY'S PRICE £6.19.6

Post 3/6

AUDIO DEVELOPMENT



AD-309K
PRECISION PICK-UP ARM COMPLETE WITH AD-76K MAGNETIC CARTRIDGE

The new AUDIO DEVELOPMENT precision counter-balanced pick-up arm—ready fitted with the outstanding AD-76K magnetic

cartridge is constructed of brass throughout, heavily chrome-plated; uses needle and miniature ballrace bearings; both coarse and fine balance adjustment is provided. The fixed head has standard ¼in. mounting centres and is finished in black enamel with chrome lifting spur. Completely wired, with all fixing nuts and washers. Arm rest also supplied. Tech. details: Overall length 285mm; needle to pivot length 223mm; offset angle 24°; overhang 10mm. Requires single 7/16in dia. mounting hole.

LASKY'S PRICE £9.19.6

Post 3/6

INTERNATIONAL

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

3in. Message tape, 150ft.	2 8	5¼in. Long play, 1200ft. Mylar	15 0
3in. Message tape, 225ft.	3 9	5¼in. Triple play, 2400ft.	35 0
3in. Message tape, 300ft.	7 8	7in. Standard play, 1200ft. Acetate	12 6
3¼in. Triple play, 600ft. Mylar	10 0	7in. Standard play, 1200ft. Mylar	12 6
5in. Double play, 1200ft.	15 0	7in. Long play, 1800ft. Mylar	18 6
5in. Long play, 900ft. Acetate	10 0	7in. Double play, 2400ft. Mylar	25 0
5in. Standard play 600ft.	8 6	7in. Long play 1800ft. Acetate	15 0
5¼in. Double play, 1800ft. Mylar	22 6	7in. Triple play 3600ft. Mylar	50 0
5¼in. Long play 1200ft. Acetate	15 0		
5¼in. Standard play 900ft. PVC	12 6		

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

Lasky's Radio Limited

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Complete Stereo System £41

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



This superb stereo system is a real price break through. It comprises the VISCOUNT F.E.T. Mk I amplifier on which full details are given below, the famous Garrard SP 25 (including teak veneer base and transparent cover) with diamond cartridge or 2025 TC and the very successful DUO type 2 speakers. Measuring 17½in x 10½in x 6½in, the Duo type 2 speakers are beautifully finished in teak veneer with matching vynair 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 Mk II Amplifier and Magnetic Cartridge £45 & £2 10 p. & p.

The Viscount F.E.T. Mk I £14.5 plus 7/6 p. & p.

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

Specification—Output per channel 10 watts r.m.s. Frequency bandwidth 20 Hz to 20 kHz + 1db at 1 watt. Total distortion at 1 kHz at 9 watts 0.5%. Input sensitivities CER. P.U. 100mV into 3 meg ohms. Tuner 100mV into 100K ohms. Tape 100mV into 100K ohms. Overload Factor Better than 26db.

Signal to noise ratio—70db on all inputs (with vol. max). Controls—6 position selector switch (3 pos. stereo and 3 pos. mono). Separate volume controls for left and right channels. Bass ± 14db at 60 Hz. Treble (with D.P.S. on off) ± 12 db at 10 KHz. Tape recording output sockets on each channel. Size 12½in. 6in. 2½in. in simulated

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

The £29-10-0 Stereo system

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

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

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

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

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

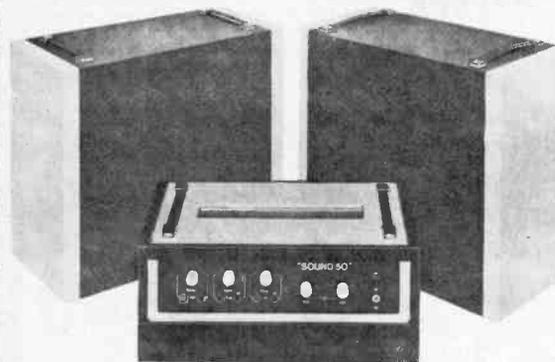


Duetto integrated transistor stereo Amp. Garrard Changer from Cover and teak finish plinth Duo Type 1 speakers (see opp. page) The above items purchased together

£9.10.0 + 7/6 p&p.
 £7.19.6 + 7/6 p&p.
 £4.15.0 + 7/6 p&p.
 ea. £4. 4.0 + 7/6 p&p.
 £29.10.0 + £1.10 p&p.

SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



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

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

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

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

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

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

or available separately.

Amplifier £28.10.0 plus 20/- P. & P.

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

LIQUIDATED STOCK

DANSETTE

TOURISTE MK3

CAR RADIO

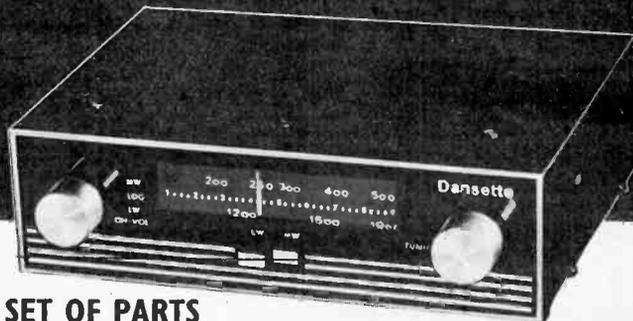
ALL TRANSISTOR

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 £154.6.

Pre-aligned I.F. module and tuner together with comprehensive instructions guarantees success first time. 12 volts negative or positive earth. Size 7in x 2in x 4½in deep.

See top of previous page for address



SET OF PARTS

£6.6.0

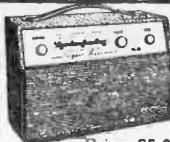
plus 7/6 P. & P.

Circuit diagram 2/6. Free with parts

Speaker, baffle and fixing kit 25/- extra plus 4/- p. & p. Postage free when ordered with parts.

The ELEGANT SEVEN Mk. III

(350mW Output)



7 transistor fully-tunable M.W.—L.W. superb portable. Set of parts. Complete with all components, including ready etched and drilled printed circuit board—back printed for foolproof construction. MAINS POWER PACK KIT: 9/8 extra.

Price £5.0.0 plus 7/6 P. & P. Circuit 2/6 FREE WITH PARTS

The DORSET

(600mW Output)



7-transistor fully tunable M.W.—L.W. superb portable with baby alarm facility. Set of parts. The latest modular and pre-alignment techniques makes this simple to build. Sizes: 12 x 8 x 3in. MAINS POWER PACK KIT: 9/8 extra.

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

The Classic

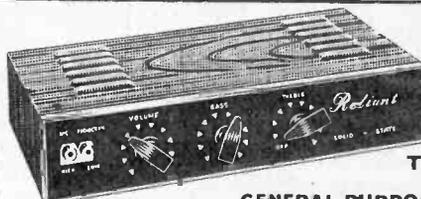
Simulated teak case

£9.10

Plus P. & P. 7/8



SPECIFICATION: Sensitivities for 10 watt output at 1KHz into 3 ohms. Tape Head: 2 mV (at 2.1 p.p.s.) Mag. P.U.: 2 mV. Cer. P.U.: 80mV. Tuner: 100mV. Aux. 100mV. Tape/Rec. Output. Equalisation for each input is correct to within ± 2 dB (E.I.A.A.) from 20Hz to 20KHz. Tone Control Range: Bass: 13dB at 60Hz. Treble: ± 14 dB at 16KHz. Total Distortion: (for 10 watt output) < 1.5%. Signal Noise: < -60dB. A.C. Mains 200-250V. Size 12½in long, 4½in deep, 2½in high. Built and tested



THE RELIANT

SOLID-STATE

GENERAL PURPOSE AMPLIFIER

SPECIFICATIONS
Output ± 10 watts. Output impedance—3 to 4 ohms. Inputs ± 1 .x-tal mic 10mV Tone Controls—Treble control range ± 12 dB at 10KHz. 2 .gram/radio 250mV. Bass control range ± 15 dB at 100Hz. Frequency Response—(with tone controls central) ± 15 dB points at 20Hz and 40KHz. Signal to Noise Ratio—better than -60dB. Transistors—4 silicon Planar type and 3 Germanium type. Mains input—220/250V. A.C. Size of chassis—10½in. x 4½in. x 2½in. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Separate bass and treble lift control. Two inputs with control from gram. and mike. Built and tested.

RELIANT Mk. II in simulated teak case £7.5 plus 7/6 P. & P.

THE DUO SPEAKER SYSTEM

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

Type 1 SPECIFICATION—Impedance 3, 8 or 10 ohms (please state requirement). It incorporates Goodmans high flux 6in. x 4in. speaker and 2½in. speaker. Teak finish 12in. x 6½in. x 5½in. 4 guineas each. 7/6 P. & P.

RADIO & TV COMPONENTS

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Build working radio receivers and electronic circuits in an evening



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.

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

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1N4004 2/6	AC126 5/-	BKX76 3/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
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2N918 7/6	AF117 5/-	OA10 5/-	2N3819 15/-	2N3819 15/-	2N3819 15/-
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2N920 5/-	AF124 6/-	OA70 2/-	2N3819 15/-	2N3819 15/-	2N3819 15/-
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2N1304 5/-	AF181 8/6	OA85 2/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N1305 5/-	AF186 8/6	OA86 2/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N1306 5/-	AF239 8/-	OA90 2/-	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N1307 5/-	AFY19 22/6	OA91 1/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N1308 6/-	AFZ11 12/6	OA95 1/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N1309 5/-	AFZ12 15/-	OA200 1/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N1613 4/6	ASV26 5/-	OA202 2/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N2147 15/-	ASV27 6/6	OA210 7/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
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2N2904 6/-	ASZ21 8/6	OA2229 9/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
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2N3703 2/6	BC118 8/-	OC24 10/-	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N3704 3/6	BC118 7/6	OC25 7/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N3705 3/6	BC134 7/6	OC26 5/-	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N3707 3/-	BC135 6/-	OC28 12/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N3709 2/6	BC136 7/-	OC29 12/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
2N3710 2/6	BC137 8/-	OC30 10/-	2N3819 15/-	2N3819 15/-	2N3819 15/-
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2N3730 10/-	BCY30 5/6	OC41 6/-	2N3819 15/-	2N3819 15/-	2N3819 15/-
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2N3794 2/6	BCY32 10/-	OC43 8/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
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2N3820 17/6	BCY34 6/-	OC45 8/6	2N3819 15/-	2N3819 15/-	2N3819 15/-
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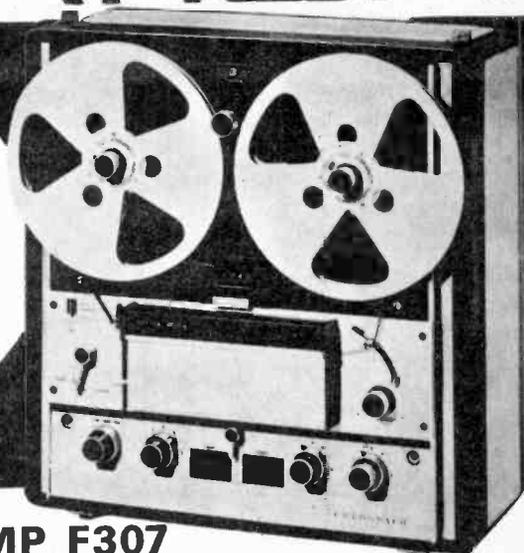
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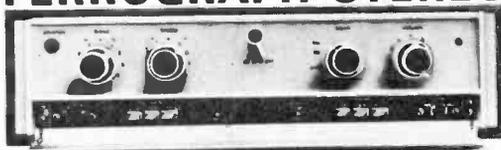
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Four fully wired units ready to 'plug in.'
 ★ Super 30 Amplifier (15 + 15 watt) in veneered housing
 ★ Garrard SP25 mk II Turntable on Plinth with cover
 ★ Goldring CS90 Ceramic P.U. Cartridge with diamond stylus
 ★ Pair of Stanway II 'Speaker Units'
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 Special Total Price

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AUDIOTRINE A55 HIGH QUALITY STEREO SYSTEM

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



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

PAIR OF LOUSPEAKER UNITS

incorporating high flux 8" x 5" speaker. Size approx. 13 x 7 1/4 x 8 1/2 ins.

Price complete **39 Gns.** Carr. 25/- ONLY

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

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Complete KIT of 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** carr. 7/9 Or dep. 37/6 and 9 monthly pymts. 29/6 (Total £15.3.0).

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

plus pair DORCHESTER LOUSPEAKER UNITS **£27.10.0** Carr. £1 Or Deposit £5 and 9 monthly payments 57/8 (Total £30.17.6).

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

★ High-sensitivity. ★ 200-250v. A.C. Mains operation. ★ Sharp A.M. Rejection ★ Drill-free reception. ★ Output ample for any amplifier (approx. 500 m.v.). ★ Output for feeding Stereo Multiplexer. ★ Tuner head using allison Planar Transistors. ★ Designed for standard 80 ohm co-axial input. Visually matching our Super 15 and 30 amplifiers and of the same high standard of performance and reliability. Printed circuitry. A quality product at considerably less than the cost of comparable units. FACTORY BUILT 18 gns. Or in Teak finished cabinet as illustrated **£1 gns.** Terms: Deposit **£6.1.0** and 9 monthly payments. 22s. Total **£24.18.0**. Stereo version. 23 1/2 gns. Carr. 10/6 extra.



HIGH FIDELITY LOUSPEAKER UNITS

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

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

STANWAY II Size 20 x 10 1/2 x 9 1/2in. appr. Rating 10 watts. Inc. 13 x 8in. speaker with highly flexible cone surround, long throw voice coil and 11,000 line magnet. High flux tweeter. Handsome Scandinavian design cabinet. Range 35-20,000 c.p.s. Imp. 15 ohms. Gives smooth realistic sound output. **16 Gns.** See top of page for illustration

R.S.C. TA12 MKIII 6.5 + 6.5 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 Gram. P.U. cartridge, Radio tuner, Tape recorder, 'Mike' etc. ★ 3 separate switched input sockets on each channel ★ Separate Bass and Treble control ★ Slide switch for mono use ★ Speaker Output 3-15 ohms ★ For 200-250v. A.C. mains ★ Frequency Response 20-20,000 c.p.s. - 2dB ★ Harmonic Distortion 0.3% at 1,000 c.p.s. Hum and Noise - 70dB ★ Sensitivities (1) 50mV (2) 400mV (3) 100mV. Output rating I.H.F.M. ★ Handsome finish Facia plate and Knobs. Complete kit of parts with full wiring diagrams & instructions. Factory built with 12 months guarantee **17 gns.** or Deposit **£8.0.0** and 9 monthly pymts 39/- (Total £20.11.0). Or in Teak or Afrormosia Carr. 7/6 veneer housing **20 1/2 gns.** Dep. 3 Gns. and 9 monthly payments 47/- (Total £24.6.0).



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

High Grade Components - Specifications - comparable with units costing considerably more.

TRANSISTORS 9 high quality types in each channel.

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

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

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

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

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

HUM LEVEL -80 dB.

HARMONIC DISTORTION 0.1% at 10 watts 1,000 c.p.s.

Employing Twin Printed Circuits.

200/250v. A.C. mains operation.

CROSS TALK 52 dB at 1,000 c.p.s.



CONTROLS 5 Position Input Selector, Bass, Treble, Vol., Bal., Stereo/Mono Switch, Tape Monitor Switch, Mains Switch.

INPUT SOCKETS (1) P.U. (2) Tape Amp. (3) Radio, (4) Mic. or Tape Head. (Operation of Input Selector assures appropriate equalisation).

CHASSIS Strong Steel construction. Approx. 12 x 3 x 8in.

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

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

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

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200-250v. AC mains operated. Frequency Response 30-20,000 c.p.s. -2dB. Harmonic Distortion 0.3% at 1,000 c.p.s. Separate Bass and Treble. 'hit' and 'cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input selector switch. Output for 3-15 ohm spkrs. Max. sensitivity 5mV. Output rating I.H.F.M. Fully enclosed enamelled case, 9 1/2 x 2 1/2 x 4 1/2 in. Attractive brushed silver finish face plate 10 1/2 x 3 1/2 in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **7 Gns.** Carr. 7/6

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ALL TYPES 15 OHMS COVERED IN REXINE/VYNAIR, IDEAL FOR VOCALISTS AND PUBLIC ADDRESS.

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 Fitted four 8" high flux 8 watt speakers.
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30 WATT HI-FI AMPLIFIER

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5 Gns. £8-19-9
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FAL PHASE 50 AMPLIFIER 50 Watt

Solid state 3 Separately controlled inputs Ind. Bass and Treble Controls. Output for Speaker/s 3-30 ohms. Size 17" x 7" x 7 1/2" 200-250 A.C. mains. Peak Output rating. For fuller details of Phase 29 Gns. Carr. Free 50 see Manufacturers advert. page 578 or send S.A.E. for leaflets.

FAL PHASE 100 AMPLIFIER

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

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All power ratings are R.M.S. continuous 3 years' guarantee. High flux ceramic magnets. Veneer cast chassis. All carr. free.

'POP' 100
 18" 100 Watt
 14,500 gauss
 8/150
21 gns.
 Dep: £6 and 9 monthly payments 22 (Total £24).
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£12.18.0.
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 12" 50 Watt
 10,000 gauss
10 GNS. 150
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 Pair suitable all purposes

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'POP' 30C
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 Dual Cone 15Ω (For uses other than Bass Guitar or Elect. Organ)
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Highly sensitive. Push-Pull high output, with Pre-amp/Tone Control Stages. Hum level-70dB. Frequency response ±3dB 30-20,000 c/s. All high grade components. Valves EF86, EF85, ECC83, 807, 807, GZ54. Separate Bass and Treble Controls. Sensitivity 30 millivolts. Suitable for High Impedance microphones. Designed for Clubs, Schools, Theatres, Dance Halls or Outdoor Functions, etc. For use with Electronic Organ, Guitar, String Bass, etc. Gram, Radio or Tape. Reserve L.T. and H.T. for Radio Tuner. Two inputs with associated volume controls so that two separate inputs such as Gram and "Mikes" can be mixed. 200-250 v. 50 c/s A.C. mains. For 3 and 15 ohm speakers. Complete Kit of parts with point to point wiring diagram and instructions. Twin handled perforated cover 35/-.

OR factory built with EL34 output valves and 12 months' guarantee for 18 Gns. Carr. 12/6
TERMS: Deposit £3.0.0 and 9 monthly payments of £2.8 (Total £21.0.0). Send S.A.E. for leaflet. **15 Gns.**

RSC TRANSFORMERS AND L.F. CHOKES

FULLY GUARANTEED. Impregnated and Interleaved where necessary

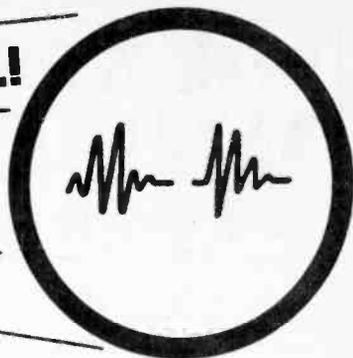
Primarys 200-250v. 50c/s. Screened		FILAMENT or TRANSFORMER POWER PACK	
MIDGET CLAMPED TYPE 2 1/2 x 2 1/2 in.		Types 6.3v. 1.5a. 8/9; 6.3v. 2a. 9/9; 6.3v. 3a. 13/9;	
250v., 60mA, 6.3v. 2a.	17/11	6.3v. 6a. 22/9; 12v. 1a. 9/11; 12v. 3a. or 24v. 1.5a. 28/9; 0.9 13v. 1.5a. 18/11; 0.12-25-42v. 2a. 31/9	
FULLY SHEATHED UPRIGHT MOUNTING		CHARGER TRANSFORMERS 0.9-15v. 1.1a. 18/9;	
250-0-250v. 60mA, 6.3v. 2a., 0-5-6.3v. 2a.	24/9	24a. 19/11; 3a. 21/11; 6a. 25/11; 6a. 29/9; 8a. 36/9;	
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	29/9	AUTO (Step Up/step Down) TRANSFORMERS	
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9	150 watts, 34 1/8 250 watts 50, 80, 500 watts 105/-	
300-0-300v. 130mA, 6.3v. 4a., c.t., 6.3v. 1a.	47/11	OUTPUT TRANSFORMERS	
For Mullard 10A Amplifier	47/11	Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω	8/9
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9	Push-Pull 8 watts EL84 to 3 Ω or 15 Ω	14/9
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	47/9	Push-Pull 10 watts 6V6, ECL86 to 3, 5, 8 or 15 Ω	24/9
425-0-425v. 200mA, 6.3v. 4a., c.t., 5v. 3a.	89/9	Push-Pull EL84 to 3 or 15 Ω 10-12 watts	28/9
450-0-450v. 200mA, 6.3v. 4a., c.t., 6.3v. 3a., 5v. 3a.	93/9	Push-Pull Ultra Linear for Mullard 510, etc.	39/9
460-0-460v. 250mA, 6.3v. 4a., c.t., 5v. 3a.	99/9	Push-Pull 15-18 watts, sectionally wound G1G, KT66, etc., for 3 or 15 Ω	35/9
TOP SHEATHED DROP-THERM TYPE		Push-Pull 20 watt high quality sectionally wound EL84, 6L6, KT66 etc. to 3 or 15 Ω	59/9
250-0-250v. 100mA, 6.3v. 2a., 0-5-6.3v. 2a.	27/9	SMOOTHING CHOKES 100mA, 7-10H. 250 Ω	
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9	12/9; 100mA, 10H. 200 Ω 10/9; 80mA, 10H. 350 Ω 9/9; 50mA, 10H, 400 Ω 7/11.	
300-0-300v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9	SELENIUM RECTIFIERS F. W. (Bridged)	
Suitable for Mullard 510 Amplifier	46/9	All 12v. D.G. output. Max. A.C. input 18v.	
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/9	1a. 4/3. 2a. 7/11. 3a. 9/9. 4a. 12/9. 6a. 15/9.	
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	46/11		

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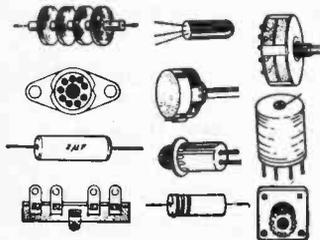
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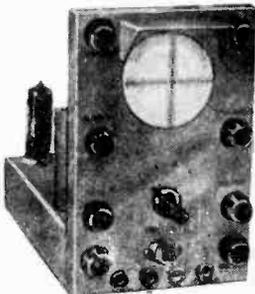
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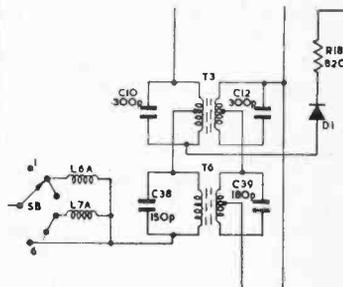
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- A.C. EXPERIMENTS
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This new style course will enable anyone to really understand electronics by a modern, practical and visual method—no maths, and a minimum of theory—no previous knowledge required. It will also enable anyone to understand how to test, service and maintain all types of Electronic equipment, Radio and TV receivers, etc.

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PRACTICAL WIRELESS

VOL 46 NO 7

Issue 765

NOVEMBER 1970

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 toxics, 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 dud 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**

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Win a DECCA 3000 Hi-Fi System
—Full details on page 525

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

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 deer-skin 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.



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.

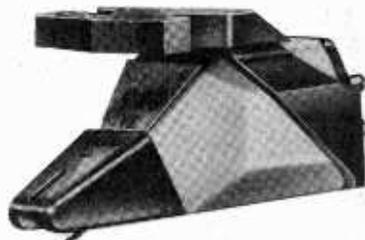
Martin Audiokits were probably the very first to exploit the advantages of using transistorised modular units for the constructor to assemble and they quickly gained a reputation for reliability, good performance and value.

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.*

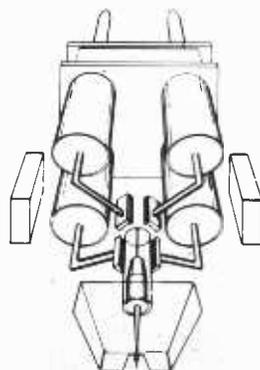
The whole truth

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 ± 2.2 dB) 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 ± 1 dB 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.*



THE 999VE CARTRIDGE



EXPLODED VIEW OF THE EMPIRE CARTRIDGE

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.

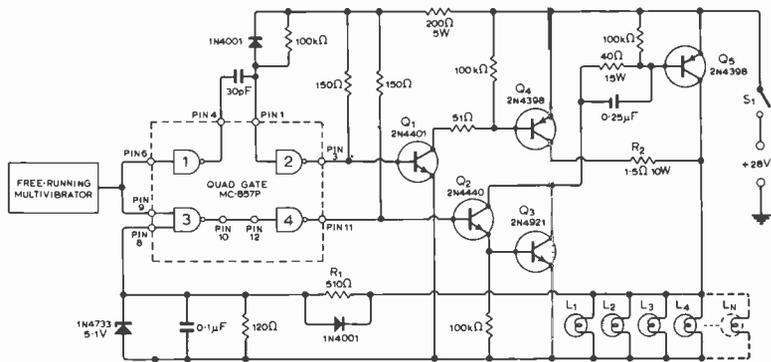
Vertical and horizontal aeri- als are equally suitable for receiving signals with slant polarization and satisfactory reception, with the vertical rod aeri- als used on many cars and portable v.h.f. receivers, will be better maintained toward the limit of the nominal service area. The effect is equivalent 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 aeri- als, 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 filaments 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 millise- c, 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 filaments 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 millise- c 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 aeri- als to washers. Also, it is a useful reference for semiconductor characteristics and connections. The catalogue retails at 2s post free from: *Electrovalue, 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, EH10.6EL.*

No-fuss stereo. For the very fussy.



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.

2 speaker enclosures each with 12" bass unit plus 2 x 1" tweeters. dimensions 27" x 18" x 14"

Deccasound 3000 stereo amplifier. Output 30 watts per channel; frequency response 20Hz to 30KHz; Full range of ancillary controls and input and output sockets.



Choice of decks; latest Garrard AP76 with special refinements to obtain best results from Decca C4E magnetic cartridge or BSR MA 75 using a Decca Deram cartridge.

AUDIO FAIR

PREVIEW



by David Cameron

This will be the second of the new-style Audio Fairs to be held at Olympia, London, occupying some 100,000 square feet of the National Hall and gallery. The organisers hope that it will be the most comprehensive hi-fi exhibition ever launched and they have certainly made great efforts to draw in the audio crowds. Most of the audio exhibitors (there are record companies and photographic exhibitors, too) will be running demonstrations in studios similar to those used last year but with various improvements—notably much better ventilation and construction materials more sympathetic audiowise. The International Audio Festival and Fair will be open from 10 a.m. to 9 p.m. each day from Tuesday, October 20th to Saturday, October 24th inclusive, with a special day (October 19th) set aside for press and trade only.

One of the attractions this year will be a series of lectures and presentations which will be running at 2, 4, 6 and 8 p.m. on each day (October 20–24th inc.) in a lounge seating about 400. Some of the highlights will be "Progression of Electric Music Synthesisers" by Dr. R. A. Moog; "How good is your Gramophone" by John Borwick; Sir Arthur Bliss discussing his new recording of Beethoven's Pastoral Symphony; "Types of Recorded Sound Quality" by John Crabbe; on Saturday at 8 p.m.—a Jazz Festival. There will also be a continuous film show running from noon to 6 p.m.

If you want to attend any of these activities, tickets will be available at the Olympia main entrance. No charge is made but owing to the limited seating accommodation seats for all performances must be obtained by ticket only. There will also be programmes for the entire 20 events—again available at the main entrance to the exhibition.

Owing to having to obtain information well before the opening of the exhibition, it has not been possible to provide details of what every audio exhibitor is showing. However, in the pages that follow, you will find the highlights from the exhibits of companies able to supply us with information before going to press. There may well, however, be last minute surprises. Companies are listed alphabetically with the stand number in parenthesis.

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 442 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 6½in. and 3in. unit. DIN sockets for radio unput 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 11s. 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.l./f.m. bands, and providing 15+15W r.m.s. at less than 0.3% distortion. Specification 2μV sensitivity for 500mW (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 6½in. 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.f. 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.

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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 $26\frac{1}{2} \times 12 \times 5\frac{1}{2}$ in. 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 pre-amplifier 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 earphones 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 $19\frac{1}{2} \times 12 \times 7$ in., 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 $1\frac{1}{2}$ in. tweeter with a response to 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 vitally 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 35W r.m.s. with distortion factors in the order of 0.5% 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 listening conditions and personal judgement.

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 ± 4 dB from 50Hz to 15kHz, ± 5 dB 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 ± 0.5 dB, -1 dB. 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 is the Model 610 which 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.

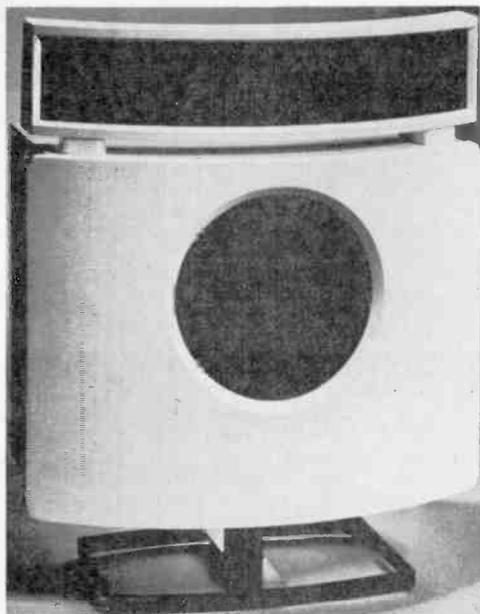
The 510 is an autochange unit and the 310 is another auto-changer with similar features to the other models. All these units are available unmounted or mounted on an afromosia plinth with smoked styrene cover.

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.

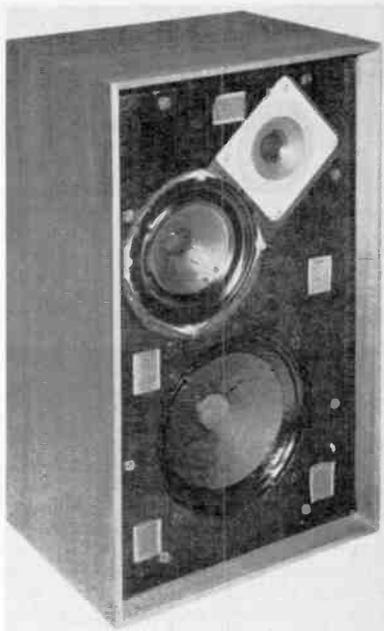
Deccasound 604 consists of four units—a 6+6W amplifier (A600), turntable unit (D1000) and two bookshelf speakers (L100). Deccasound 603 is similar except that the playing deck and amplifier are combined in one unit. Deccasound 1204 consists of a 12+12W amplifier (A1200), a turntable unit (D1000) and two free standing speakers (L200). The alternative 1203 system combined deck and amplifier.

The 3000 Series is the top system. It is a 30+30W system built around the Decca ffs 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).

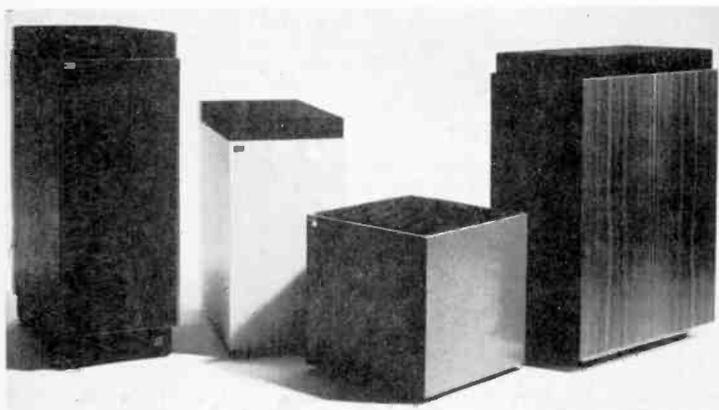


◀ The latest version of the Model 70 speaker system from B & W, setting new standards in low distortion.

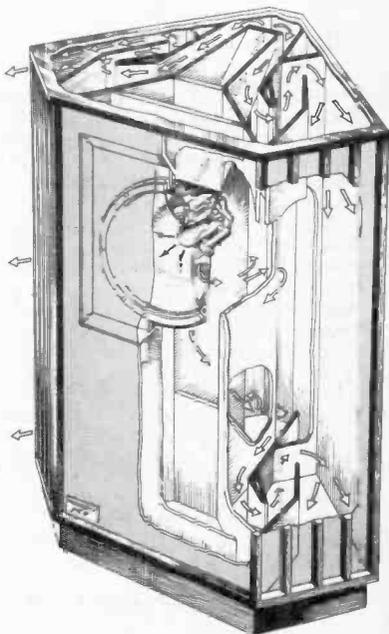
A view of the new Mordaunt Short MS 077 compact bookshelf speaker system with front grille removed to show the constituent units. ▶



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

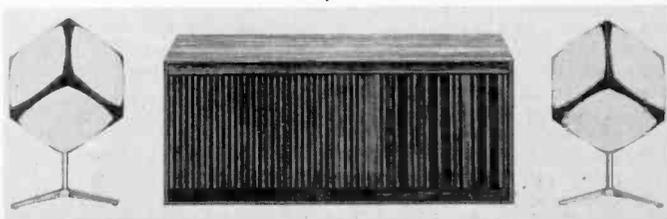
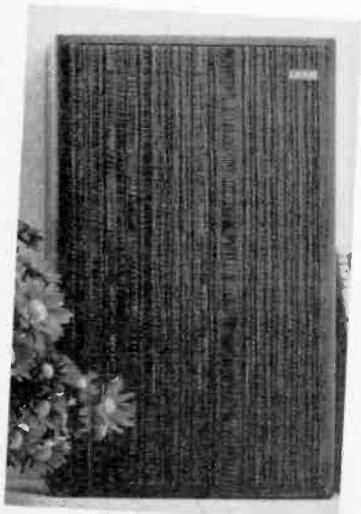


A cross sectional view of the popular Monitor Gold dual concentric loudspeaker system from Tannoy. ▶



◀ 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. ▼



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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 SRX25A tuner-amplifier which covers l.w., m.w. and f.m. bands, employs 30 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 ICs 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 battery-operated tape recorder will also be shown in its new form as the Model II-12M, with complete synchronising units which enable the user to compile high quality lip synchronised sound tracks. This system will be demonstrated throughout the run of 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 new high performance mini loudspeakers will also be shown.

Of special interest to the travelling music lover will be the Tandberg TP4-1 portable radio, a compact and 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 first is the AP76, a transcription single 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 lowering 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 G850 cartridge which was designed for budget hi-fi systems.

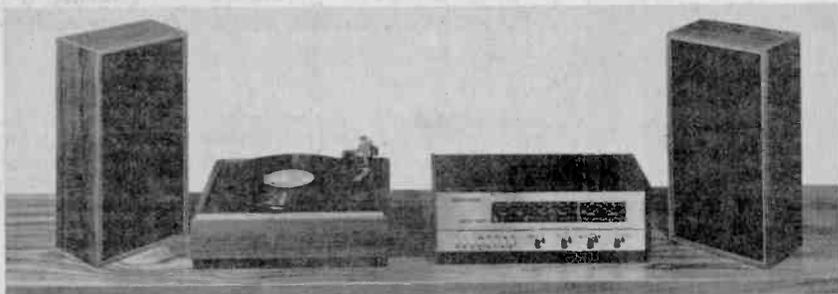
Newcomers will be a stereo amplifier (ST3000) which has a hi-fi specification and delivers 15+15W r.m.s. A tuner-amplifier (ST4000), which has the same high quality audio section as the ST3000 is also on show. Finally, a new and inexpensive turntable unit (Model 705), which has belt drive and synchronous 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 $\frac{3}{4}$ 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 $\frac{7}{8}$, 3 $\frac{3}{4}$, 7 $\frac{1}{2}$ 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 $\frac{7}{8}$), 12,500Hz (3 $\frac{3}{4}$) or 16kHz (7 $\frac{1}{2}$), S/N ratio better than 48dB (7 $\frac{1}{2}$), two speakers (4 $\frac{1}{2}$ " x 2 $\frac{1}{2}$ " in. bass unit and 1 $\frac{1}{2}$ " in. tweeter). Price is £178 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 ceiling attachment 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.

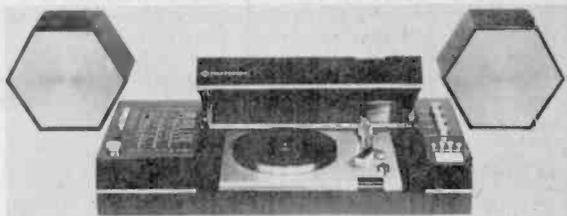


▲ Compact audio system from Alba, comprising UA100 tuner-amplifier, UA200 record player deck and matching loudspeakers.

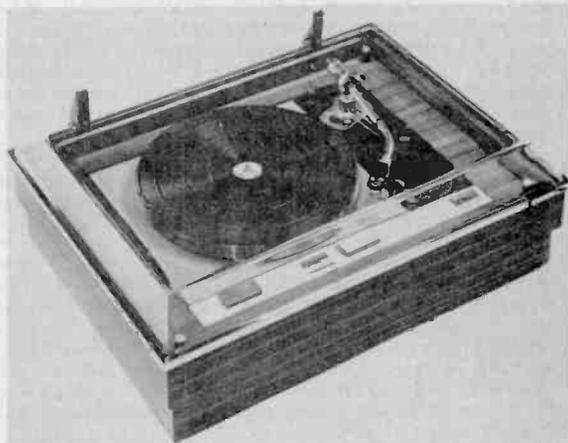


▶ The MD3, a new miniature pencil microphone on desk base MSE00 from Reslosound.

▶ 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 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.



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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 2 μ V, f.m. stereo separation 35dB at 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 1.8 μ V 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 10 x 8 $\frac{1}{2}$ in. 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 (53)

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 FAM-10 is an a.m.—f.m. multiplex tuner selling at £48 10s. 7d. with sensitivities of (a.m.) 200mV/m for 20dB S/N and (f.m.) 2mV. 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) 13-50kHz \pm 1dB, 40+40W r.m.s. output at 0.3% distortion (full power).

The third new Nikko item is the STA-1101 multiplex a.m.-f.m. tuner-amplifier 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 \pm 1dB and the r.m.s. output per channel is 37W at 8 Ω 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 demonstrations or 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 33 $\frac{1}{3}$ 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 4s. 10d.

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 8 Ω 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 0.2% 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 8 Ω , frequency response of 30-30,000Hz \pm 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 Dolby 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 Dolby system. Model 1 is for use with combined record/replay head type machines and Model 2 is for use with machines having separate record and replay heads, thus permitting monitoring from the tape via Dolby. 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. each. 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 there 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

WIN! THIS DECCASOUND 3000 SERIES HI FI SYSTEM! WORTH OVER £200!!



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 30-watt per channel system has been designed around Decca's *ffss* 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.

- 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

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AUDIO FAIR PREVIEW 70

or avocado green, as well as two floral patterns in blues or browns. Two or even three chairs can be connected to any stereo unit, 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 $15\frac{3}{4} \times 9\frac{1}{2} \times 8$ in. and the complete unit weighs about 14½ lb. It comprises three drive units (6, 3 and 2 in.) 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 splicers, 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 refiled 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 Panasonic 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 RS-678US 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 $1\mu\text{V}$, 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 \pm 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 50-18,000Hz. Power handling is 18W r.m.s. Price £27 10s. 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.

RESLOSOUND (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 ISR/10. Weighing only 30lb. and measuring $34 \times 12 \times 9$ in., 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.

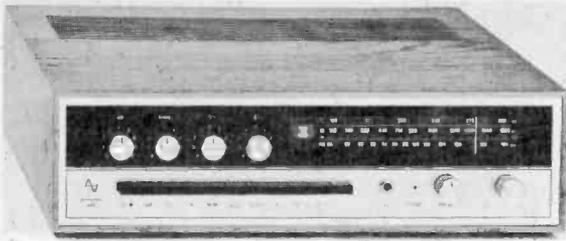
ROGERS (28)

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.

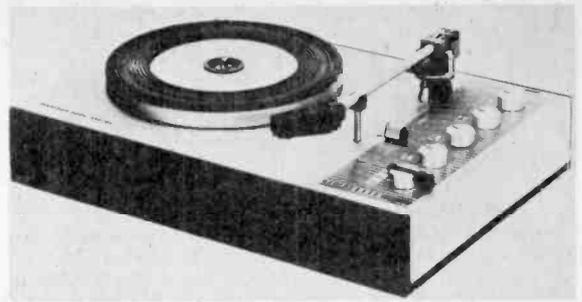
In addition, Rogers will be showing the first three instruments in an entirely new range of audio test equipment, designed and developed by Sign Electronics. These comprise a low distortion oscillator, an a.f. millivoltmeter and a distortion factor meter.

SINCLAIR (44)

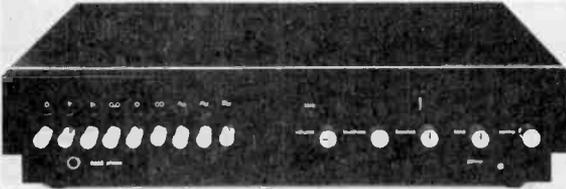
Two major additions to their range of products are being shown by Sinclair. The first is a new f.m. tuner claimed to be the first in the world to use the phase lock loop principle. This principle was first used in receivers for reception from satellites because of the improvements in signal/noise ratio 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 Musikus 108V, a portable domestic stereo record player/ amplifier from Telefunken.



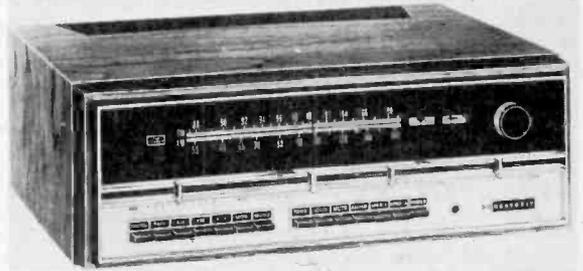
The Sonab R7000 has only one tone control which lifts bass and cuts treble or lifts treble and cuts bass.



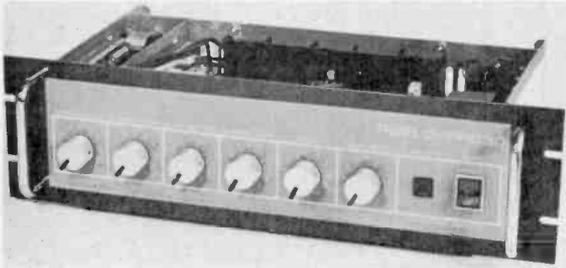
High grade tuner-amplifier by Wharfedale is the 100.1 which has an impressive performance at comparatively modest cost.



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



One of the new tuner-amplifiers from Heathkit, the AF29 incorporates all the latest features.



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

A novel product that may solve a domestic problem is the Elizabethan audio chair which contains two concealed loudspeakers in the chair wings.



◀ The TK147 is the latest tape recorder from Grundig and incorporates a number of new features and facilities.

AUDIO FAIR PREVIEW 70

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 tuned circuits, a squelch circuit 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. Extremely 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/stylus compliance resonance is obtained by dividing the arm mass into two portions joined by an elastic coupling which also effectively ejects rumble frequencies. It has, 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 lin. 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 have been the first in the world to be truly 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 8½in. bass unit, an 8½in. 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 8½in. 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 8½in.

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 at the pickup socket and 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 75S 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 styli.

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 baseboard 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.

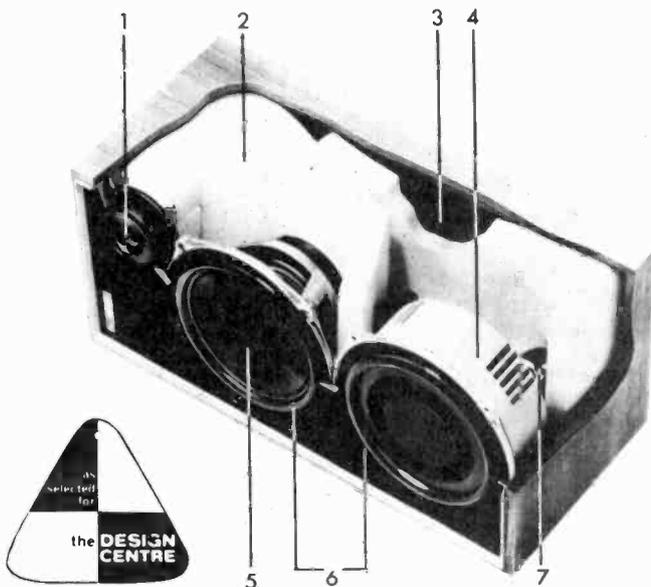
Entry forms will be available for the 3M wildlife sound recording contest, now in its third year, and there will be a bank of quality tape recorders from makers such as Tandberg, Ferrograph, Teac, Revox and Akai on which visitors will be able to compare, via headphones, identical musical excerpts pre-recorded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

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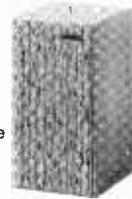


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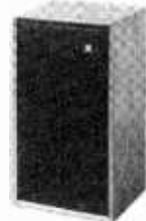
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The first miniature, truly High-Fidelity loudspeaker system. Only 10½" x 5½" x 7½" deep. Design Centre approved. Range: 45 - 20,000 Hz. Power: 12 watts. Impedance: 8 to 16 ohms. £16. 7. 0. plus £4. 0. 9. P. Tax. (£16.350 plus £4.038)



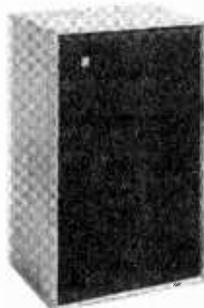
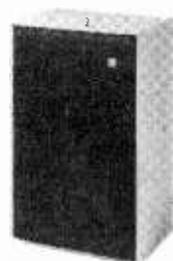
Minister

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. 0. P. Tax. (£18,000 plus £4.450) Packed in pairs.



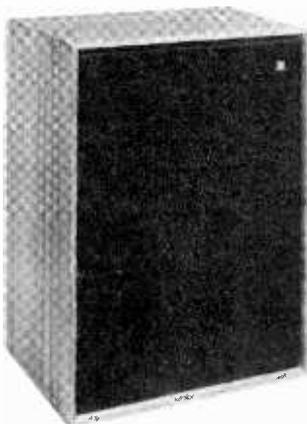
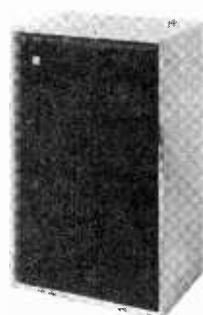
Mezzo 3

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)



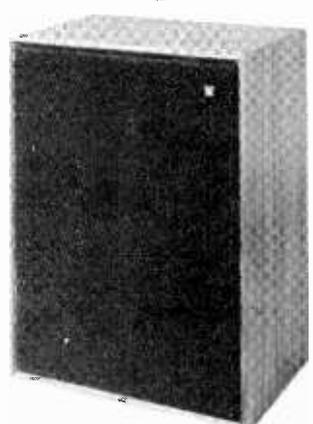
Magnum K-2

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.

PW7/70

pw 25/25



STEREO

AMPLIFIER

F.C. JUDD

PART 1

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 ± 1 dB.

Performance

Performance shown in Table 1 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 100k Ω
Mag pick-up (PU1) (RIAA)	4mV at 56k Ω
Ceramic pick-up (PU2)	80mV at 1.5M Ω
Tape Head (CCIR)	8mV at 10k Ω
Tape Replay	200mV at 220k Ω
Outputs	
Loudspeakers	8 or 15 ohms only
Tape record outlet	Up to 1V at 10k Ω
Frequency Response	
10-30,000Hz ± 1 dB	
Signal to Noise	
Radio and Tape	Better than -60dB
Pick-up inputs	Better than -56dB
Crosstalk	
All inputs	Better than -50dB
Bass Control	
± 15 dB lift or cut at 50Hz	
Treble Control	
± 15 dB 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 $\frac{1}{8}$ x $\frac{3}{16}$ in. 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

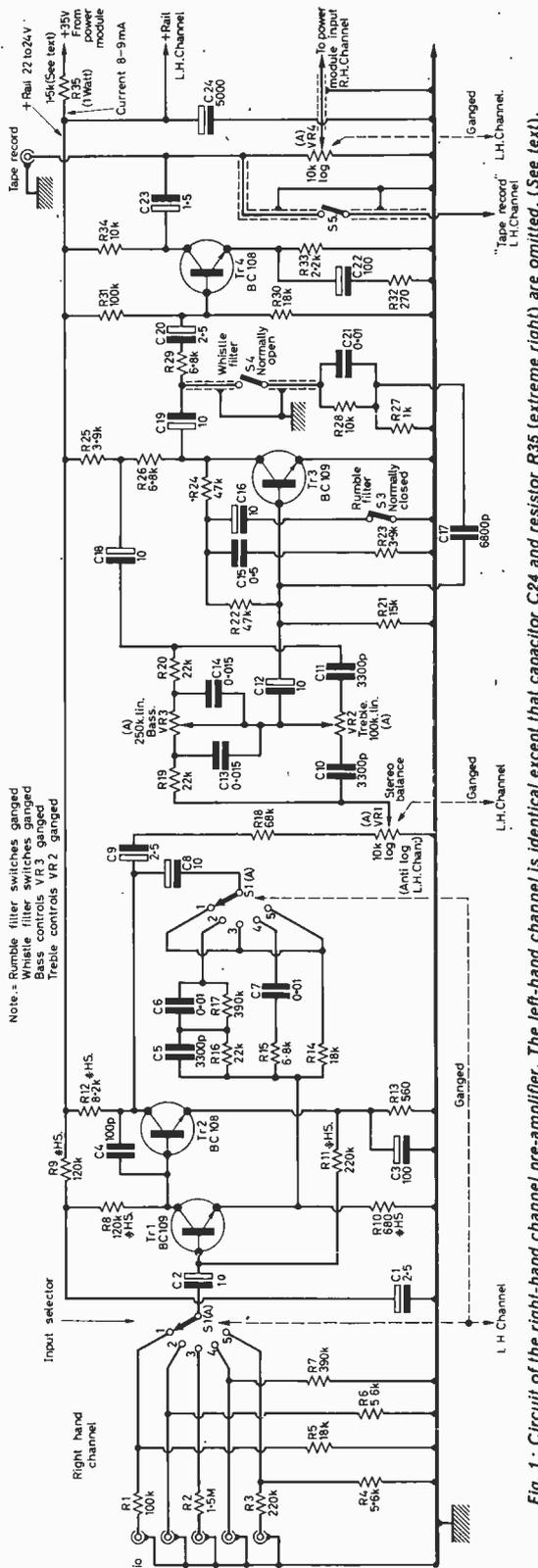


Fig. 1: Circuit of the right-hand channel pre-amplifier. The left-hand channel is identical except that capacitor C24 and resistor R35 (extreme right) are omitted. (See text).

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OA2 5/8	6D6 3/8	10PL12 7/8	78	4/8	E180C0 8/8	E183 7/8	PC84 8/8	SP61 6/8	VT501 3/4	ASY27 8/8	OA9 2/8
OB2 6/8	6E5 7/8	12A6 12/6	85A2 4/8	8/8	E180F 10/8	E184 4/8	PC85 6/8	TH4B 10/8	VU111 7/8	ASY28 6/8	OA10 8/8
OZ4 4/8	6F1 12/6	12AC6 7/8	85A3 4/8	8/8	E182CC 22/6	E185 8/8	PC88 9/8	TH23 13/6	VU120 12/8	ASY29 10/8	OA47 2/8
LA3 4/8	6F8G 5/8	12AD6 7/8	90AG 6/7/8	6/8	E1184 10/6	E186 8/8	PC89 9/8	TP22 11/8	VU120A12/8	BI181 10/8	OA70 3/8
LA5 5/8	6F8M 12/6	12AE6 12/6	90AV 6/7/8	6/8	E450 1/6	E191 4/8	PC189 10/6	TP25 6/8	VU133 7/8	BA109 9/8	OA73 3/8
LA7GT 7/3	6F12 3/8	12AT7 3/8	90C3 24/8	8/8	E474 13/6	E192 5/8	PC630 13/6	TP26 10/8	W63 10/8	BA115 2/8	OA79 1/8
IC1 5/8	6F13 3/8	12A7T 3/8	90CV 3/8/6	6/8	EABC80 6/8	EM80 7/8	PC806 15/6	UABC80 6/8	W68 10/8	BA116 2/8	OA81 1/8
IC2 9/8	6F15 10/8	12AU6 4/8	90C1 1/6	6/8	EAC91 3/8	EM81 7/8	PC800 13/6	UAF42 10/8	W77 2/6	BA129 2/8	OA85 1/8
IC3 7/8	6F18 7/8	12AU7 4/8	150B2 14/6	6/8	EAF42 10/8	EM84 6/8	PCF80 6/8	UB41 6/8	W81M 13/6	BA130 2/8	OA86 4/8
IC5 4/8	6F23 14/8	12AV6 5/8	150CZ 5/8	5/8	EB34 3/8	EM87 7/8	PCF82 6/8	UBC41 9/8	W101 26/2	BCY10 5/8	OA90 2/8
ID5 7/8	6F24 13/8	12AV7 9/8	201 20/8	20/8	EB41 4/8	EY51 7/8	PCF84 8/8	UBC81 7/8	W107 8/8	BCY12 5/8	OA91 1/8
ID8 9/8	6F25 13/8	12AX7 4/8	302 15/6	6/8	EB91 2/8	EY81 7/8	PCF85 10/8	UBF80 5/8	W29 12/8	BCY33 5/8	OA95 1/8
IFD1 6/8	6F26 5/8	12AY7 9/8	303 15/6	6/8	EBC1 6/8	EY82 5/8	PCF87 13/6	UBF89 6/8	XF12 9/8	BCY34 4/8	OA200 1/8
IFD9 4/8	6F28 14/8	12BA6 6/8	305 16/6	6/8	EBC81 6/8	EY84 10/8	PCF90 13/6	UBL21 9/8	X24 18/6	BCY38 5/8	OA202 2/8
IG6 6/8	6F29 6/8	12BE6 5/8	306 13/8	6/8	EB90 4/8	EY86/87 6/8	PCF800 13/8	UC92 5/8	X41 10/8	BCY39 4/8	OA210 9/8
1H6GT 7/8	6F30 6/8	12BH7 6/8	807 11/8	6/8	EB91 5/8	EY88 8/8	PCF801 7/8	UC84 8/8	X61 5/8	BCZ11 6/8	OA211 13/6
ILA 2/8	6F32 3/8	12E1 17/8	956 2/8	6/8	EBF80 6/8	EY91 3/8	PCF802 9/8	UC85 7/8	X63 6/8	BCI07 4/8	OA2200 12/6
ILD5 6/8	6G6G 15/8	12J5GT 2/6	1821 10/8	10/8	EBF83 8/8	EZ35 5/8	PCF805 12/8	UCF80 8/8	X64 12/6	BCI08 3/8	OA2201 10/6
LN5 8/8	6H6GT 6/8	12J7GT 6/8	6763 6/8	6/8	EBF89 5/8	EZ40 7/8	PCF806 11/8	UCI21 8/8	X65 10/8	BCI13 5/8	OA2202 9/8
INSGT 7/8	6J5G 3/8	12K7GT 6/8	6980 5/8	5/8	EEL21 12/6	EZ41 6/8	PCF807 11/8	UCI22 12/8	X66 10/8	BCI15 3/8	OA2203 9/8
1PI 7/8	6K5G 3/8	12K7GT 6/8	7193 10/8	10/8	EBC1 12/6	EZ42 7/8	PCF808 11/8	UCI23 12/8	X67 10/8	BCI16 5/8	OA2204 9/8
1PI0 5/8	6J6 3/8	12Q7GT 5/8	7475 14/8	14/8	EC54 10/8	EZ81 4/8	PCL82 7/8	UCL82 7/8	X109 28/8	BCI18 4/8	OA2204 9/8
1PI1 6/8	6J7G 4/8	12SA7GT8/8	A1834 20/8	20/8	EC70 4/8	EZ90 4/8	PCL83 10/8	UCL83 10/8	X119 6/8	BD119 9/8	OA2205 9/8
1R5 5/8	6J7 6/8	12S7 6/8	A1234 19/8	19/8	EC86 12/6	FC4 12/6	PCL84 7/8	UF41 10/8	Z63 4/8	BFY50 4/8	OA2207 10/6
1R4 4/8	6K7G 2/8	12S7 6/8	A3042 15/6	15/6	EC88 12/6	FW4/500 15/8	PCL85/805 8/8	UF42 9/8	Z152 4/8	BFY51 4/8	OA2210 7/8
1S5 4/8	6K8 4/8	12S7 6/8	AC2PEN 19/8	19/8	EC91 6/8	FW4/800 15/8	PCL86 8/8	UF80 9/8	Z159 16/8	BFY52 4/8	OA2211 7/8
1T4 2/8	6K7 4/8	12S7 6/8	AC2PEN 19/8	19/8	EC92 4/8	FW4/800 15/8	PCL86 8/8	UF85 6/8	Z199 4/8	BFY53 4/8	OA2212 10/6
1U4 5/8	6K1 19/8	12S7 6/8	AC2PEN 19/8	19/8	EC93 4/8	FW4/800 15/8	PCL86 8/8	UF86 9/8	Z219 6/8	BFY54 5/8	OA2214 7/8
2A7 12/6	6L6GT 7/8	12S7GT8/8	DD 19/8	19/8	EC93 8/16	GZ30 17/8	PCL86 8/8	UF89 9/8	Z249 14/8	BFY55 4/8	OC19 25/8
2D13C 7/8	6L7 12/6	14H7 9/8	AC6PEN 7/8	7/8	EC94 11/8	GZ32 9/8	PCL86 8/8	UF10 10/8	Z259 50/8	BFY56 4/8	OC22 7/8
2D21 6/8	6L12 5/8	14H7 15/8	AC044 23/8	23/8	EC98 3/8	GZ33 12/6	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
2X2 4/8	6L18 8/8	18 12/6	AC044 23/8	23/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
3A4 4/8	6L19 8/8	18A45 4/8	AC/TH11 19/8	19/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
3A5 10/8	6L1D2 6/8	19H 40/8	AC/TH11 19/8	19/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
3B7 5/8	6LD20 6/8	20D1 13/8	AC/TH11 19/8	19/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
3D6 3/8	6N7GT 6/8	20D4 20/8	ARF3 7/8	7/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
3Q4 7/8	6P15 4/8	20F2 14/8	ATP4 2/3	2/3	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
3Q8GT 6/8	6P28 25/8	20L1 20/8	AZ1 8/8	8/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
3B4 5/8	6PL12 6/8	20A5 17/8	AZ21 9/8	9/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
3V4 6/8	6Q7G 6/8	20P3 18/8	AZ41 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
4D1 3/8	6Q7GT 6/8	20P4 18/8	B36 6/8	6/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
5R4GY 10/6	6R7G 7/8	20P5 20/8	B39 6/8	6/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
5U4G 5/8	6R7 11/8	25A6G 5/8	B719 5/8	5/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
5V4G 7/8	6R8A7GT 7/8	25L6G 5/8	B729 12/8	12/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6Y3GT 5/8	6R8A 7/8	25Y6G 8/8	BL63 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
5Z3 9/8	6R8G 6/8	25ZAG 6/8	CL33 15/6	15/6	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
5Z4G 7/8	6R8G 6/8	25ZAG 6/8	CV6 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6J30L2 12/6	6R87 3/8	25Z6G 3/8	CV63 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6A8G 6/8	6R87 6/8	30C1 6/8	CV271 12/6	12/6	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6A7 3/8	6R87GT 4/8	30C1 6/8	CV428 19/8	19/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6A65 4/8	6R87GT 4/8	30C15 13/8	CY1C 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6A35 9/8	6R87GT 7/8	30C17 18/8	CY31 7/8	7/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6A38 5/8	6R87GT 7/8	30C18 18/8	D1 12/6	12/6	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AK5 5/8	6U4GT 12/8	30F5 16/8	D41 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AK6 6/8	6U7G 10/8	30FL1 13/8	D63 5/8	5/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AK8 6/8	6V6G 3/8	30FL2 15/8	DAC32 7/8	7/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AL5 2/8	6V6GT 6/8	30FL12 16/8	DAF91 4/8	4/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AM6 3/8	6X4 4/8	30FL13 8/8	DAP96 6/8	6/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AQ5 5/8	6Y3GT 5/8	30FL14 14/8	DC390 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AR6 20/8	6Y6G 8/8	30L1 13/8	D14 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AT6 4/8	6Y7G 12/6	30L15 13/8	DF33 7/8	7/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AU6 5/8	7A7 12/6	30L17 15/8	DF91 2/8	2/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6AV6 5/8	7AN7 6/8	30P4 12/8	DP96 6/8	6/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6B6G 2/8	7B6 10/8	30P4AMR17/6	DF97 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6B4 6/8	7B7 7/8	30P12 13/8	DE130 15/6	15/6	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6B6E 4/8	7C8 8/8	30P18 8/8	DF34 12/6	12/6	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6B6G 20/8	7D6 15/8	30P19 12/8	DIH76 5/8	5/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6B6E 7/8	7F8 12/6	30P11 13/8	DIH77 4/8	4/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6B6E 8/8	7H7 5/8	30PL13 15/8	DH81 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6BQ5 4/8	7H7 13/8	30PL14 15/8	DH101 25/8	25/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6BQ7A 7/8	7J7 7/8	30PL16 15/8	DH107 17/11	17/11	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6BR7 15/8	7Z4 6/8	30L1 13/8	DK2 10/8	10/8	EC98 3/8	GZ34 10/8	PEN45 7/8	UL46 12/6	Z314 12/6	BFY57 4/8	OC23 7/8
6BR8 12/6	9R6 7/8	30L15									

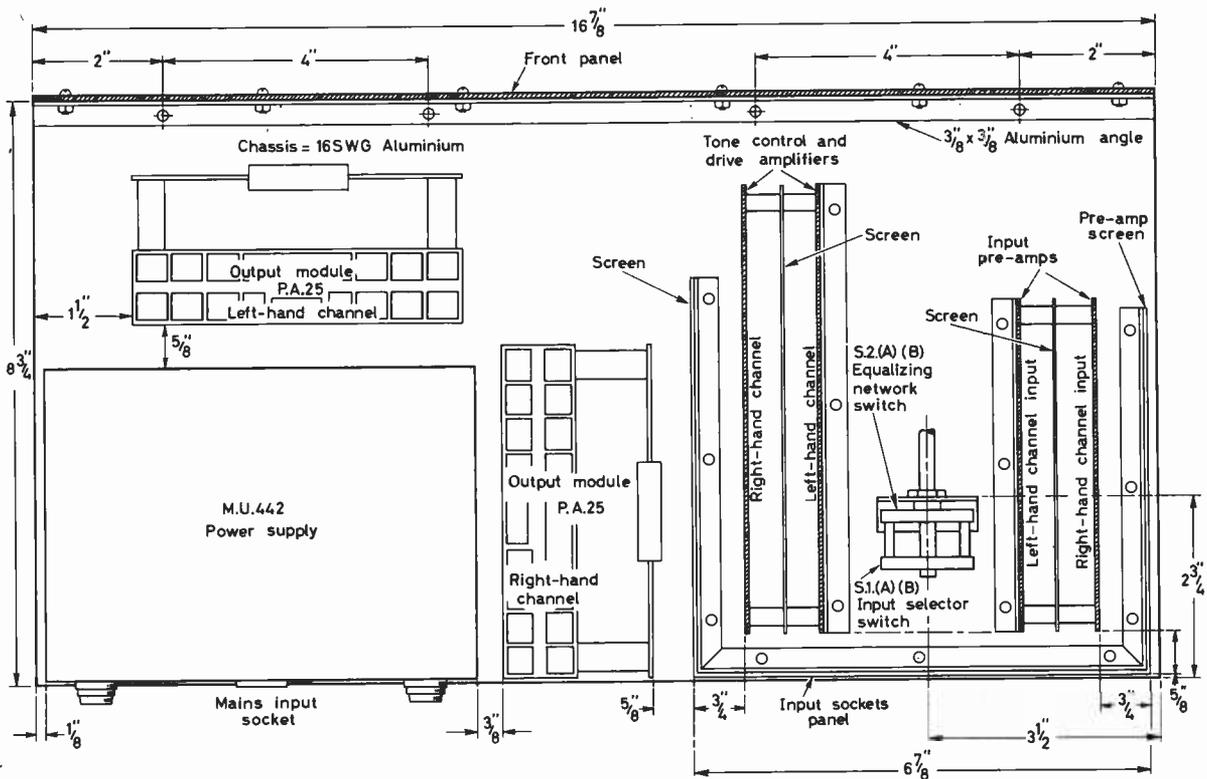


Fig. 2. Layout of units on chassis. Chassis dimensions must be adhered to if specified cabinet is to be used.

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 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.

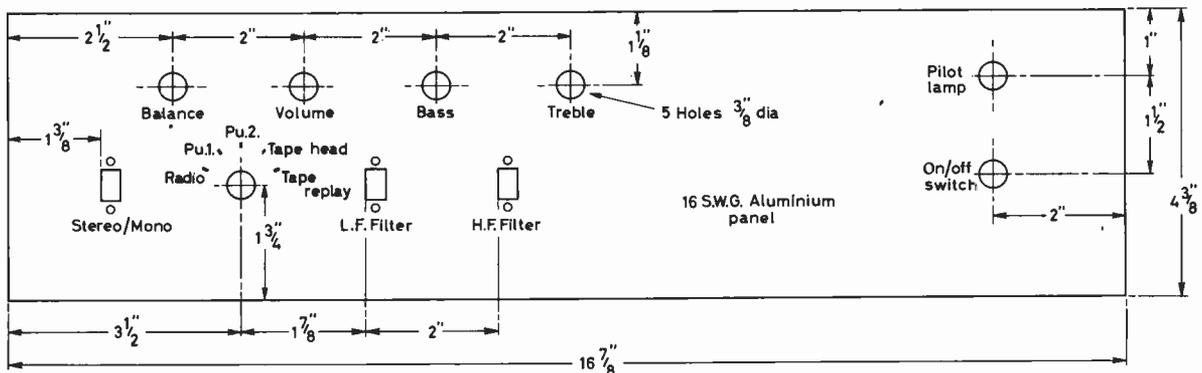


Fig. 3: Panel drilling information. Cut-outs for switches will depend on actual components used.

★ components list

Resistors:

R1 100kΩ	R5 18kΩ	R14 18kΩ	R18 68kΩ	R22 47kΩ	R26 6.8kΩ	R30 18kΩ	R34 10kΩ
R2 1.5MΩ	R6 56kΩ	R15 6.8kΩ	R19 22kΩ	R23 3.9kΩ	R27 1kΩ	R31 100kΩ	—
R3 220kΩ	R7 390kΩ	R16 22kΩ	R10 22kΩ	R24 47kΩ	R28 10kΩ	R32 270Ω	R35 1.5kΩ 1W
R4 5.6kΩ	R13 560Ω	R17 390kΩ	R21 15kΩ	R25 3.9kΩ	R29 6.8kΩ	R33 2.2kΩ	(one only)

All $\frac{1}{4}$ W 10%. Note: 2 of each required

R8 120kΩ R9 120kΩ R10 680Ω R11 220kΩ R12 8.2kΩ

All Hi-stability. Note: 2 of each required

VR1 (Balance control) 10kΩ anti-log + 10kΩ log (Henrys Radio)

VR2 (Treble control) 100kΩ + 100kΩ linear

VR3 (Bass control) 250kΩ + 250kΩ linear

VR4 (Volume control) 10kΩ + 10kΩ log.

Capacitors:

C1 2.5μF Elec.	C9 2.5μF Elec	C17 6800pF
C2 10μF Elec.	C10 3300pF	C18 10μF Elec.
C3 100μF Elec. 6VW	C11 3300pF	C19 10μF Elec.
C4 100pF S.M.	C12 10μF Elec.	C20 2.5μF Elec.
C5 3300pF	C13 0.015μF	C21 0.01μF
C6 0.01μF	C14 0.015μF	C22 100μF Elec. 6VW
C7 0.01μF	C15 0.5μF	C23 1.5μF Elec.
C8 10μF Elec.	C16 10μF Elec.	C24 5000μF 25VW

All electrolytics not less than 25V W except C3 and C22 (6V W). 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 Henelec Type PA25 (Henrys Radio)

1 Power Supply unit Henelec Type MU442 (Henrys 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 K30/3)

1 Control Knob (Eagle K30/4)

6 Pairs phono sockets (Henrys Radio)

1 Mains neon pilot lamp

2 Circuit boards plain s.r.b.p. $6\frac{1}{2}$ x $3\frac{1}{2}$ in. 0.15 matrix

1 Aluminium screen 20 s.w.g. same size.

2 Circuit boards plain s.r.b.p. 5 x $3\frac{1}{2}$ 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, $16\frac{7}{8}$ x $8\frac{1}{2}$ in. 16 s.w.g. aluminium.

1 Panel, $16\frac{7}{8}$ x $4\frac{1}{2}$ in. 16 s.w.g. aluminium.

1 Screen, $18\frac{7}{8}$ x $3\frac{1}{2}$ in. 16 s.w.g. aluminium (may be made from separate pieces, see Fig. 5).

4ft. Aluminium angle, $\frac{3}{8}$ x $\frac{3}{8}$ in.

Cabinet:

Amplifier cabinet, colour teak, PW1.

Amplifier cabinet, colour walnut, PW2.

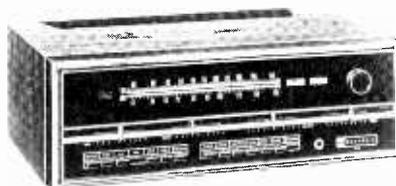
Either of the above cabinets, to take a chassis to the dimensions given, can be obtained from Fircastle Ltd., 4 Eldon Way, Hockley Trading Estate, Hockley, Essex, at £3.6.0 inc. packing and postage, C.W.O. only. Cabinet includes chassis fixing screws and plastic feet.

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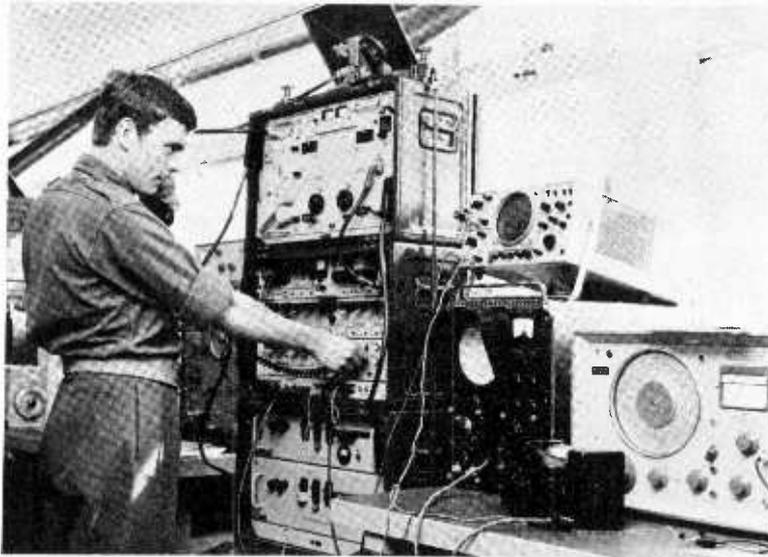
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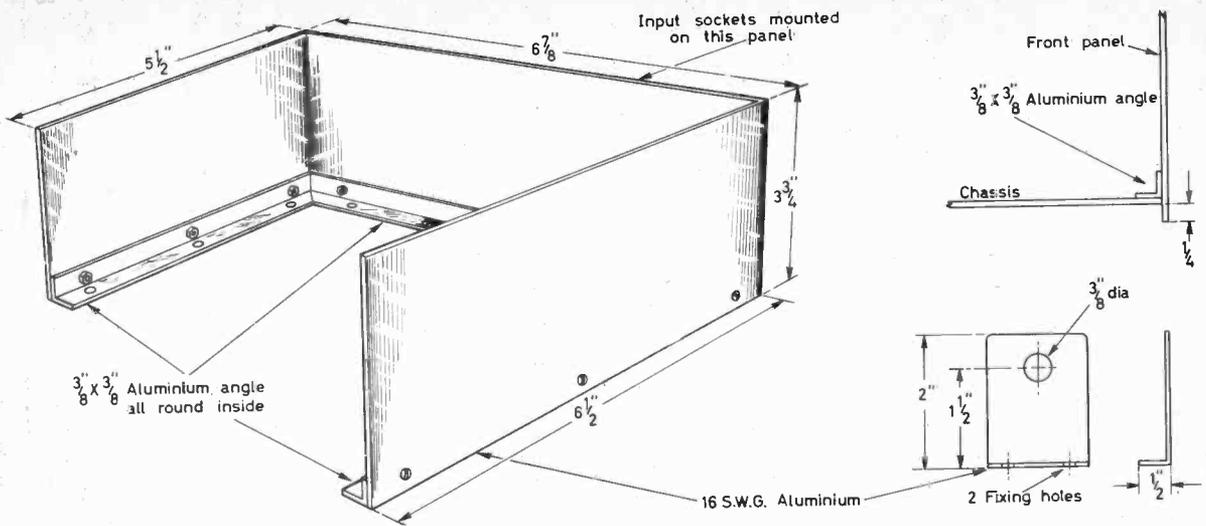
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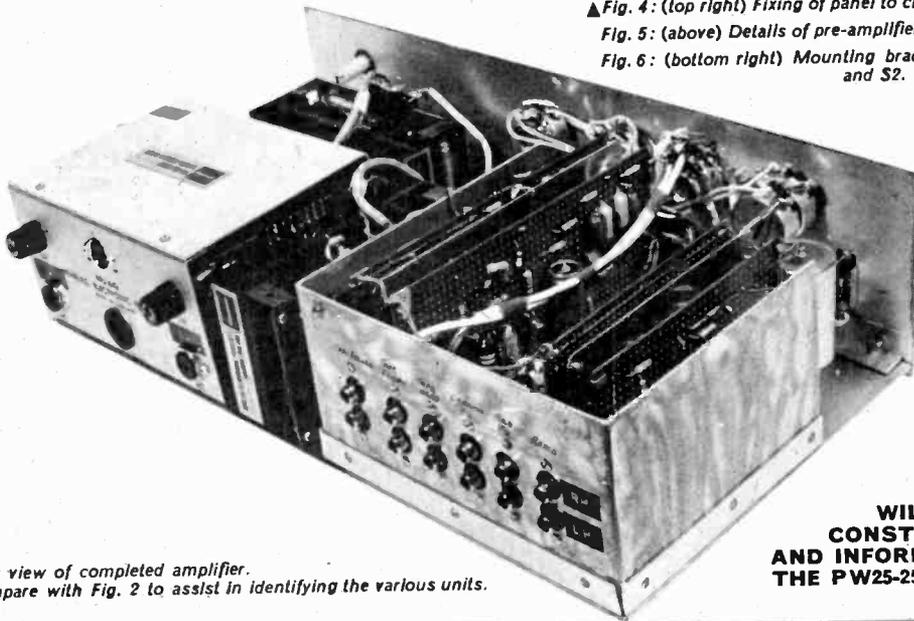
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▲ Fig. 4: (top right) Fixing of panel to chassis.

Fig. 5: (above) Details of pre-amplifier screening.

Fig. 6: (bottom right) Mounting bracket for selector switches S1 and S2.



Rear view of completed amplifier.
Compare with Fig. 2 to assist in identifying the various units.

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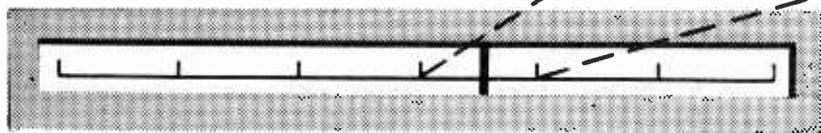
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TUNING FACILITATED



R. F. GRAHAM

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.

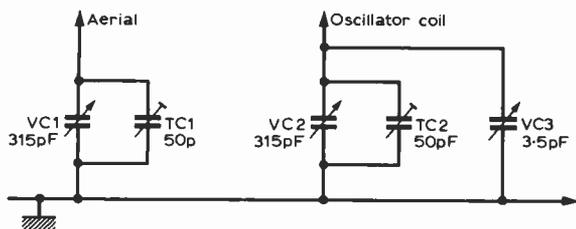


Fig. 1: The simplest form of bandspreading.

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 Bandspreading

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 bandspreading 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.

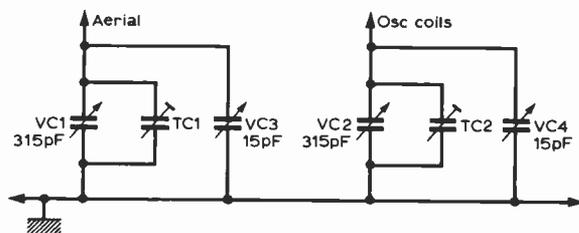


Fig. 2: Bandspreading applied to aerial and oscillator circuits.

Bandspreading 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.

"Luxembourg Bandspread"

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 bandspread" a further range is obtained, about 185-210m, over the whole movement of the tuning capacitor.

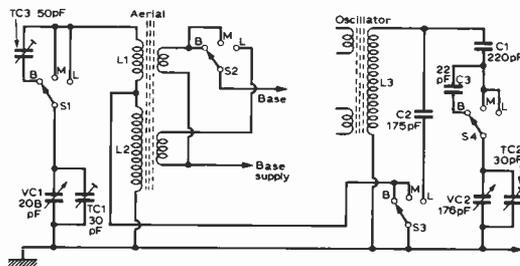


Fig. 3: Circuit providing bandspread over a part of a band.

Fig. 3 is a "Luxembourg bandspread" 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

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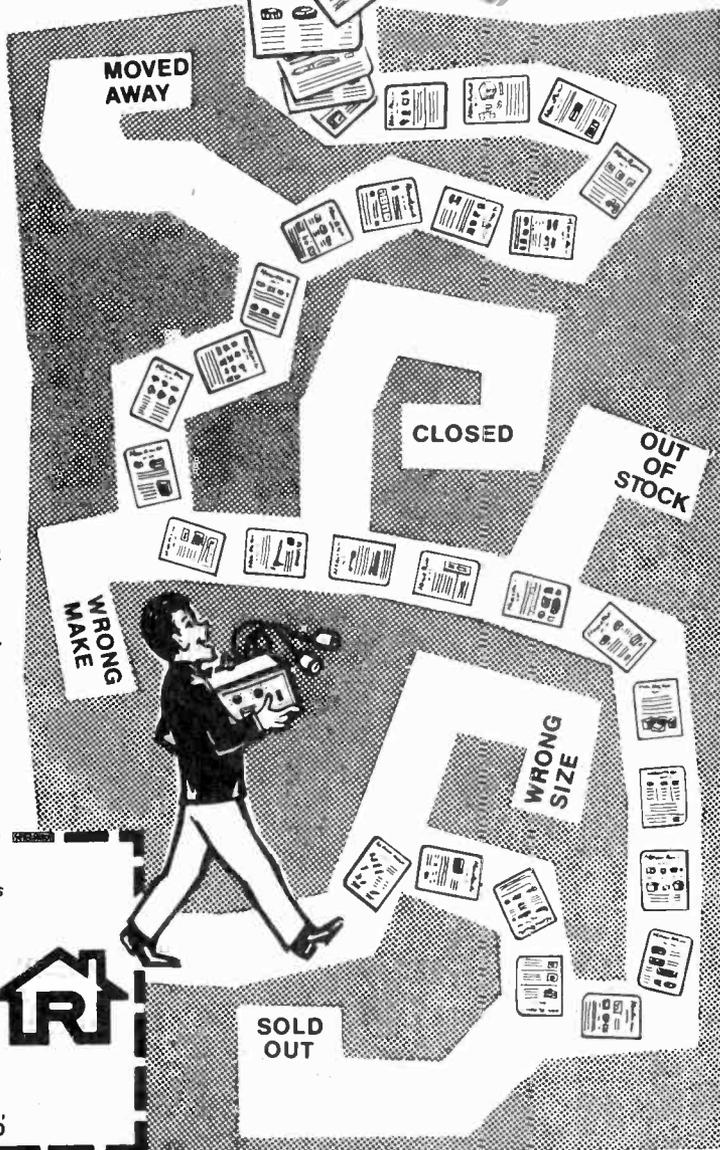
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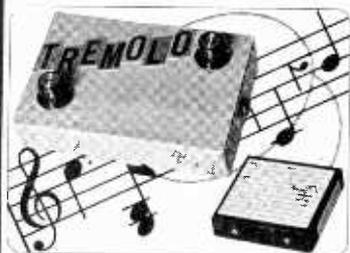
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is removed, and replaced by a small 3-way, 4-pole rotary switch. This has three positions, Bandsread, Medium Waves and Long Waves.

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 Bandsread, 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 Bandsread 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. Bandsread 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.

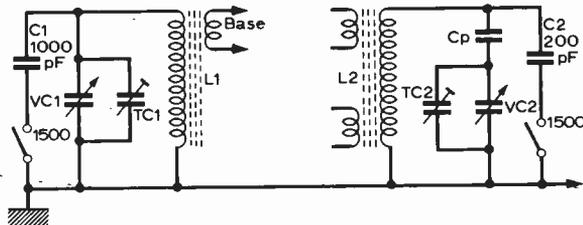


Fig. 4: Adding l.w. coverage to a receiver.

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 midget 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.

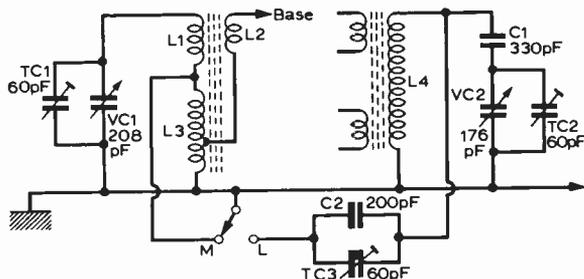


Fig. 5: Simple circuit for two-band coverage.

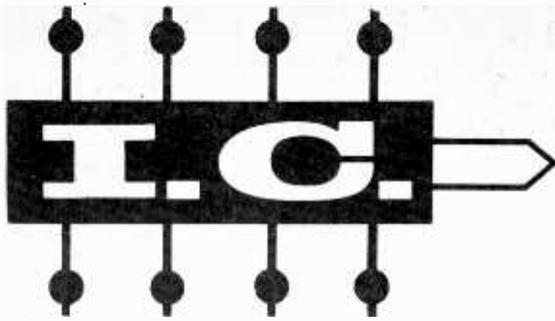
Ferrite rod aerials and oscillator coils for long and medium wave coverage are produced by several manufacturers. They are designed for particular capacitor values at C1 and C2, and some employ further switching, such as of base coupling windings. So the circuit and component values specified by the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



OF THE MONTH

L.A.J. IRELAND

Number 13

Mullard TAA320 Bi-fet Pre-amplifier

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 l.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).

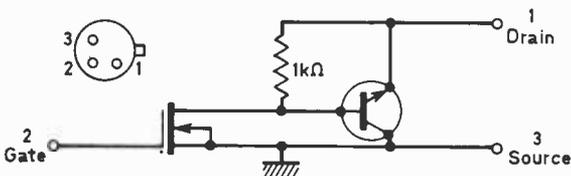
As is well known, the bipolar transistor is a current operated device, with the injection of charge carriers into the base from the emitter region. The f.e.t. is much more like the valve in its mode of operation, being a purely voltage controlled ("field") device. It therefore shares with the valve the 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.

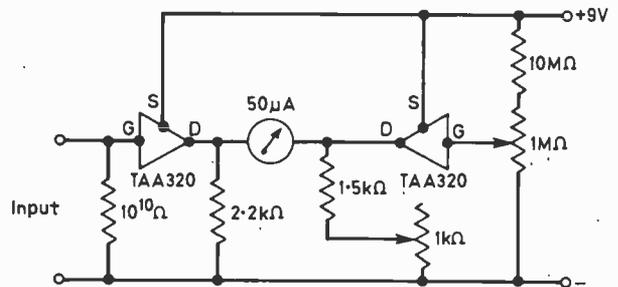
Table 1: Ratings of TAA320

Drain to source volts	V_{DS}	20V max
Gate to source volts	V_{GS}	20V max
Gate to source max. non repeating surge		100V max
Drain Current	I_D	25mA max
Power dissipation		200mW max
Gate to source resistance		10^{11} ohms min.
Noise voltage (typical, 50Hz-15kHz $I_D=10mA., V_{DS}=10V$)		25 microvolts

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.



Circuit diagram of the TAA320.

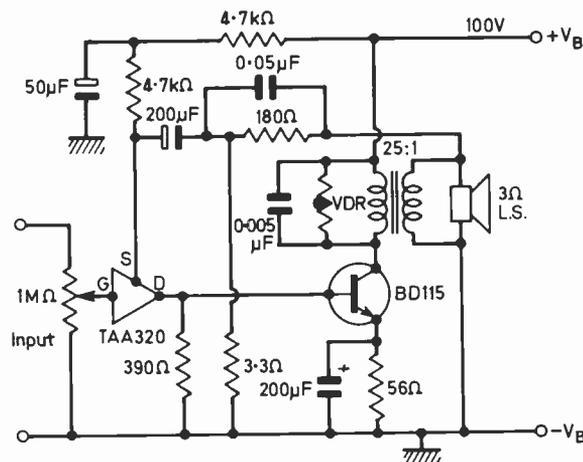


Electrometer or Instrumentation amplifier using two TAA320's.

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. ■

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2. Articles should, preferably, be typed using double spacing, leaving wide margins, and on one side only of each sheet. Circuit diagrams and any other drawings should be on separate sheets and numbered to agree with the text. Author's roughs must be clear enough to permit re-drawing. Component lists must also be separate and laid out to the standard PW format.
3. Photographs of the equipment are desirable and should be in black and white, sharp and clear. Each photograph should be identified by sticking a piece of paper on the back rather than by writing on the photograph itself.
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commentary by **HENRY**

Games
People play

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.



A week with a dolly-bird in Canvey.

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



What's done with the time saved?

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?

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Shure M44-S	£10 3 10	£8 19 0
Shure M44 Elip.	£12 11 0	£9 19 0
Shure M55 Elip.	£12 19 5	£11 5 0
Shure M75-E	£16 13 6	£14 0 0
Shure M75-EI	£21 6 2	£17 17 0
Shure M75 Mk. 2	£40 15 3	£32 10 0
Shure V-15-7	£38 18 0	£27 10 0
Shure M75-G	£17 12 0	£14 15 0
Shure M91-E	—	£17 17 0
Goldring G800	£13 0 1	£8 19 0
Goldring G800E	£16 17 0	£13 12 0
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Pioneer TX900	£151 19 6	£126 15 0
Quad FM	£51 0 0	£46 0 0
Quad AM3	£48 0 0	£44 12 0
Rotel 120 ST	£49 17 8	£42 10 0
Teleton GT101	£45 10 0	£38 0 0
Wharfedale WFMT 1	£53 6 10	£37 10 0
Armstrong 524	£53 15 3	£47 19 0
Armstrong 523	£41 17 8	£37 14 0
Dual CT15	£81 15 6	£71 17 0
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Lux WL313	£143 14 7	£92 11 0
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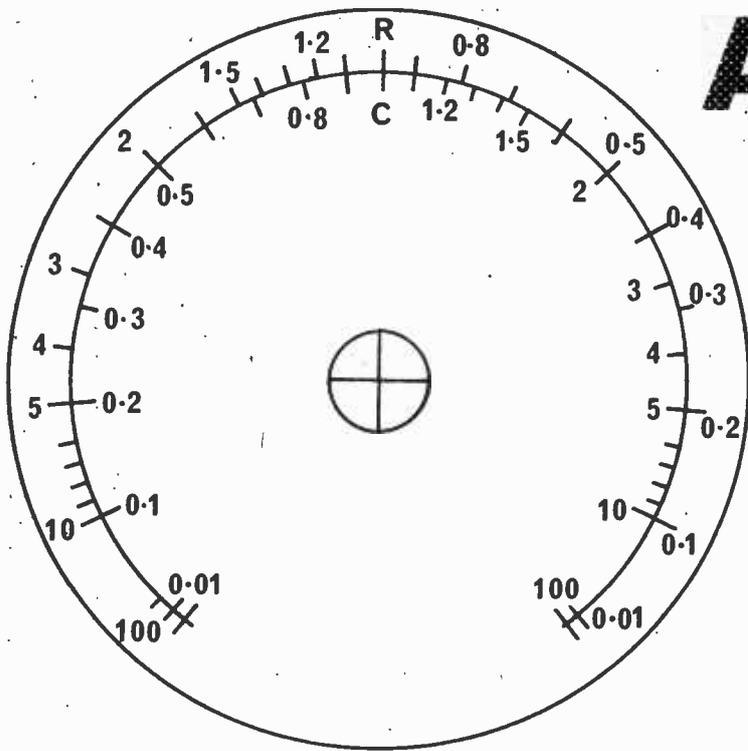
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Grundig TK141	£59 8 0	£47 19 0
Grundig TK146	£68 2 10	£57 3 0
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Rogers Ravensbrook	£42 10 0	£36 19 0
Rotel 100AMP	£45 10 0	£37 10 0
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Sansui AU222	£62 17 7	£53 10 0
Sansui AU555	£90 9 7	£68 8 0
Teleton SA Q203E	£27 5 0	£19 19 0
Teleton SA Q150/205	£26 5 0	£22 5 0
Teleton GA101	£33 1 5	£23 19 0
Armstrong 521	£56 0 0	£48 10 0
Dual CV80	£89 10 0	£76 0 0
Ferrograph F307	£59 0 0	£49 0 0
J. E. Sugden A21	£59 0 0	£49 0 0
Lux 1220	£124 10 0	£89 13 0
Lux 77T	£66 7 6	£52 10 0
Lux 505	£97 10 0	£69 12 0
Lux 606	£84 0 0	£59 19 0
Leak 30 Chassis	£53 0 0	£43 19 0
Leak 70 Chassis	£83 0 0	£53 11 0
Metrosound ST20	£36 0 0	£29 19 0
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Sinclair 2.50	£5 9 6	£4 3 0
Sinclair Stereo 60 Pre-Amp	£9 19 6	£8 10 0
Sinclair S60 Filter Unit	£5 19 6	£5 2 0
Sinclair PZ-5	£7 19 6	£6 16 0
Sinclair PZ-6	£5 19 6	£5 2 0
Sinclair PZ-8	£5 19 6	£5 2 0
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Sinclair Z12	£4 9 6	£3 16 0
Sinclair PZ4	£4 19 6	£4 5 0
Sinclair Stereo 25	£2 19 6	£2 10 0
Sinclair 2000	£30 9 0	£22 19 0
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Sinclair Decoder	£4 4 0	£3 19 0

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A CAPACITANCE RESISTANCE BRIDGE



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 10pF to about 100μF and resistors in the range 10 ohms to several megohms.

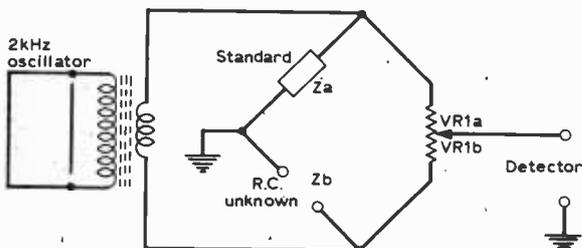
It consists of a transistor oscillator generating a sine wave voltage at 2kHz, the isolated output of this oscillator powering a Wheatstone bridge, where one side of the detector is earthed. The basic circuit is shown in Fig. 1.

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

$$\text{when } \frac{Z_a}{Z_b} = \frac{VR1a}{VR1b}$$

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.

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 2kHz 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

PRECISION AND ACCURACY BRIDGE

JOHN THORNTON LAWRENCE

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.

Transformer 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.

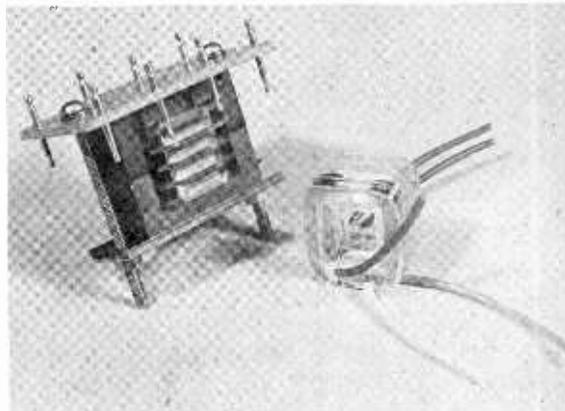
The easiest way to wind the bobbin is by using a geared hand drill which has been clamped in a vice. Firstly, a small piece of wood, about two inches long is shaped so that it will just slide through the centre hole of the plastic bobbin, so forming a mandrel. A 2BA clearance hole is then drilled down 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 revolu-

tions of the handle 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 (¼ 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.

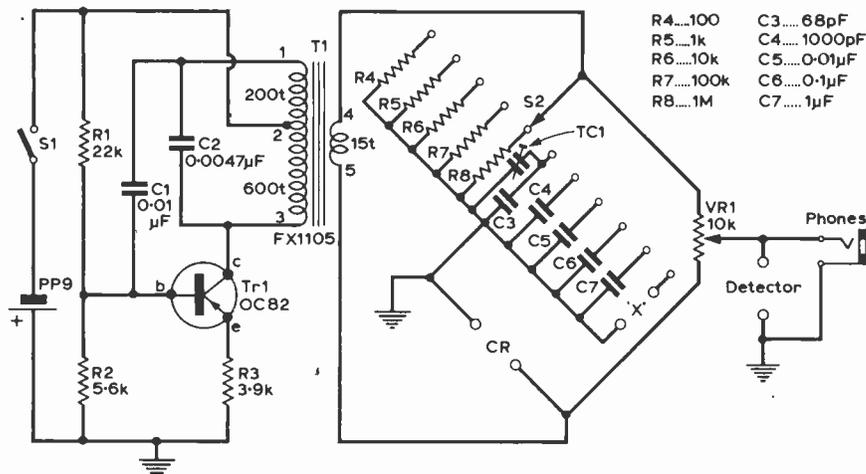
The wire is fed into the end slot through the gap in the end cheek and 200 turns are wound on. The wire should be guided into the slot with the fingers so as to keep a nice even winding. Winding at an even pace is best, as this avoids 'snatching' and the possibility of snapping the wire.

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 through 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 'Selltape' or similar tape. The lead-out wires may now be untaped from the mandrel

Fig. 2: Full circuit diagram of CR bridge.



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 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

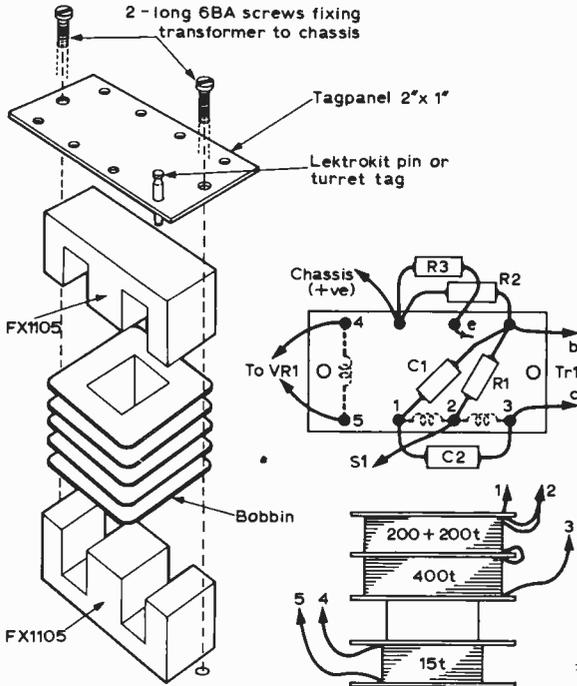
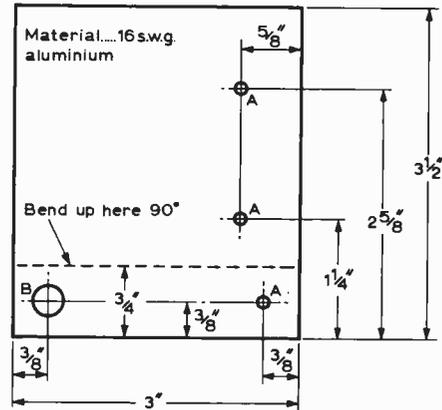


Fig. 3: Exploded view of transformer assembly with details of terminal board and bobbin windings.

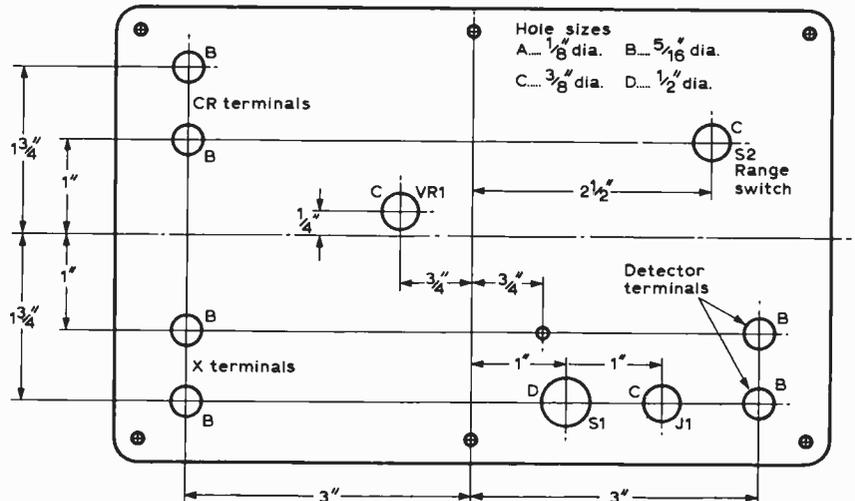
The method is to hold the wire above the flame so that the enamel on the wire burns off but the wire remains undamaged, the correct amount of heat can be judged fairly easily after a little experimenting. The sooty copper wire is then cleaned by very gently drawing it through the sandpaper, which has 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.



▲ Fig. 5: Details of transformer mounting bracket.

▼ 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.



★ components list

Resistors:

R1	22k Ω 5%	R5	1k Ω 2%
R2	5.6k Ω 5%	R6	10k Ω 2%
R3	3.9k Ω 5%	R7	100k Ω 2%
R4	100 Ω 2%	R8	1M Ω 2%

All resistors $\frac{1}{2}$ W

VR1 10k Ω 3W wirewound (Radiospares standard wirewound volume control)

Capacitors:

C1	0.01 μ F 250v 20% moulded tub. polyester
C2	0.0047 μ F 250v 20% moulded tub. polyester
C3	68pF 500V 1% silver mica
C4	0.001 μ F 1% (Home Radio Type 2FG25)
C5	0.01 μ F 1% (Home Radio Type 2FG29)
C6	0.1 μ F 1% (Home Radio Type 2FG33)
C7	1.0 μ F 1% (see text)
TC1	3-30pF concentric (beehive) trimmer

Transformer:

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

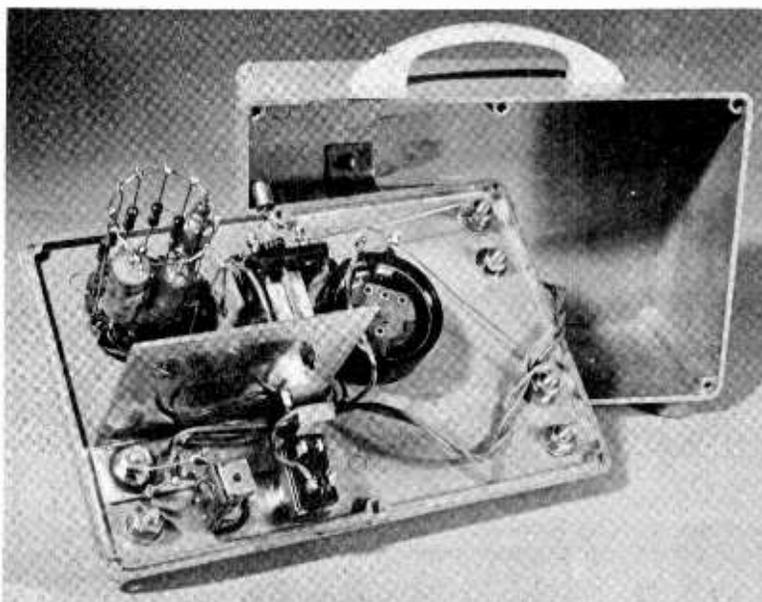
Miscellaneous:

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.



◀ 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.

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.

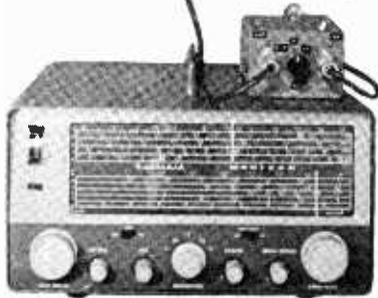
Accuracy

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 5M Ω and below about 10pF are subject to greater errors due to the unavoidable stray capacitances.

It is somewhat difficult to find a source of 1 μ F close tolerance capacitors (for C7) and it may be necessary to accept a 20% type. Alternatively a number of 1 μ F capacitors could be checked on the 0.1 μ F range of the bridge and the most accurate one used. Occasionally surplus polystyrene capacitors become available and these are usually 5% or 2 $\frac{1}{2}$ % tolerance and therefore quite suitable.

—continued on page 574

S.W. transistor R.F. preamp



**P. CAIRNS
G3ISP**

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 S1. 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.

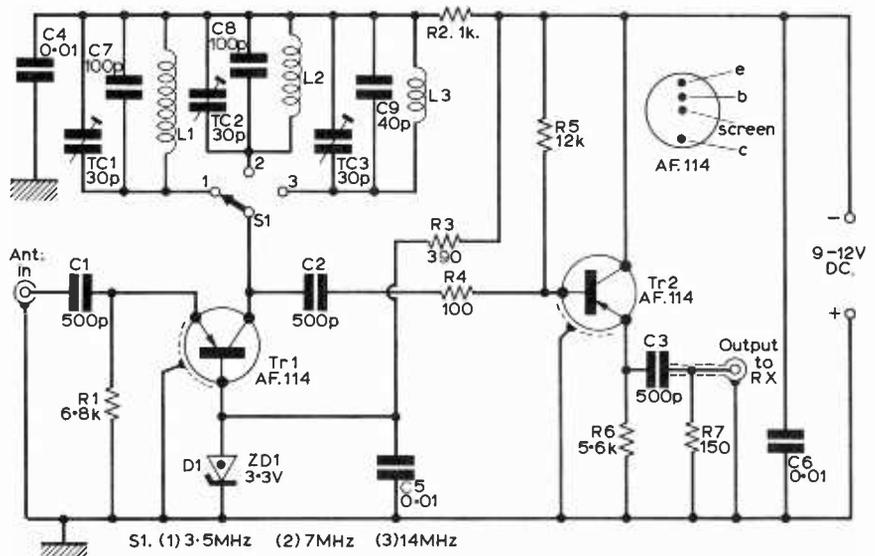


Fig. 1: The circuit of the switched r.f. preamplifier.

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 useable 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 $3\frac{1}{4}$ in. 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 popular "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 $2\frac{1}{2}$ in. x $1\frac{1}{2}$ in. 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.

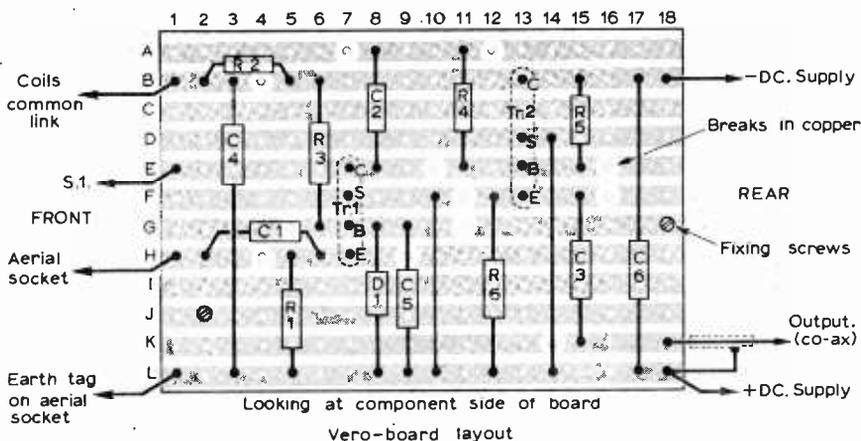


Fig. 2: The component layout on Veroboard.

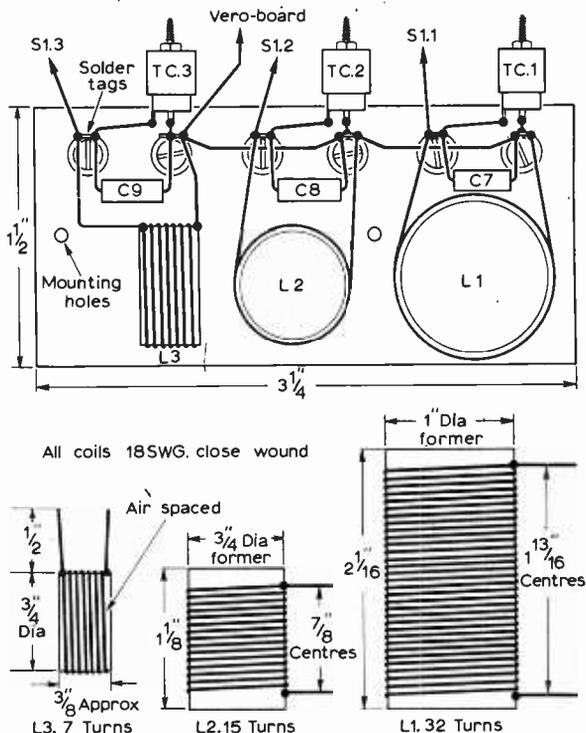


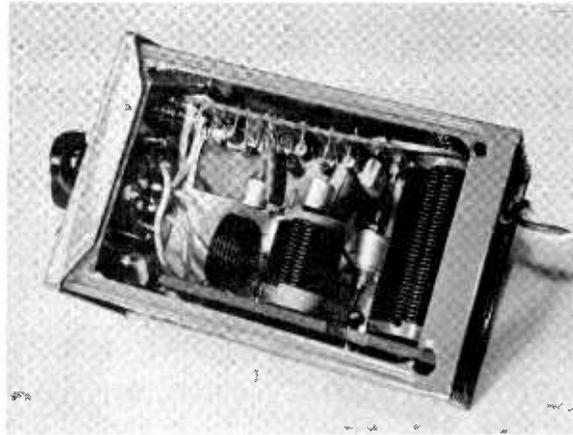
Fig. 3: The coil pack and coil winding details.

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 $\frac{1}{2}$ in. 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-

ator is set to 3.5MHz (or about 3.7MHz if the phone band is of major importance) and a small level of signal applied to the aerial input socket. The valve-voltmeter or scope is connected across the output socket. The 3.5MHz trimmer is then adjusted for maximum output. As some hand capacity effect is



An inside view of the complete preamplifier.

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

★ components list

Resistors:

R1	6.8kΩ	R5	12kΩ
R2	1kΩ	R6	5.6kΩ
R3	390Ω	R7	150Ω
R4	100Ω		

Capacitors:

C1	500pF	silver mica
C2	500pF	silver mica
C3	500pF	silver mica
C4	0.01μF	polyester
C5	0.01μF	polyester
C6	0.01μF	polyester
C7	100pF	silver mica
C8	100pF	silver mica or ceramic
C9	40pF	silver mica or ceramic

TC1, TC2, TC3 3-30pF concentric trimmers.

Semiconductors:

Tr1	AF114	ZD1	BZY88 C3V3 (3.3V) zener diode
Tr2	AF114		

Coils:

- L1 32 turns, 18 s.w.g. on 1in. diameter former, close wound.
- L2 15 turns, 18 s.w.g. on ½in. diameter former, close wound.
- L3 7 turns, 18 s.w.g. on ¾in. diameter former, air spaced.

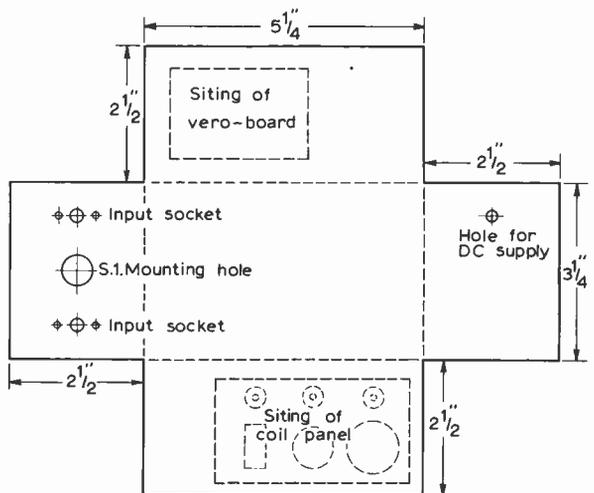
Miscellaneous:

S1, 1-pole, 3-way rotary switch; Veroboard, 0.15in. matrix, 12 x 18 holes; pointer knob; 2 off co-ax sockets; chassis to specification.

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



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

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. ■



25-50

GUITAR AMPLIFIER

Part 3

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.	+3dB
Signal Input, for rated output.	max 600mV
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:

Total current drawn from pre-amplifier supply	28 to 30mA
Voltage at top of C28	20 to 22V
Current drawn by circuit Board 1	2.8 to 3mA
Current drawn by circuit Board 2	6 to 7mA
Voltage at junction R46 & R45 (circuit Board 2)	16 to 17V
Voltage at junction R29-C17 (circuit Board 2)	13 to 14V
Voltage at junction R8-C6 (circuit Board 1)	18V
Voltage at collector of Tr4 (AD161)	average 14V
Collector current Tr4 (AD161)	Average 18/20mA

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

Fig. 17: (Right) Frequency response for guitar and microphone inputs.

Fig. 18: (Below) Responses obtainable with treble lift and tremulant tone control.

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 l.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.

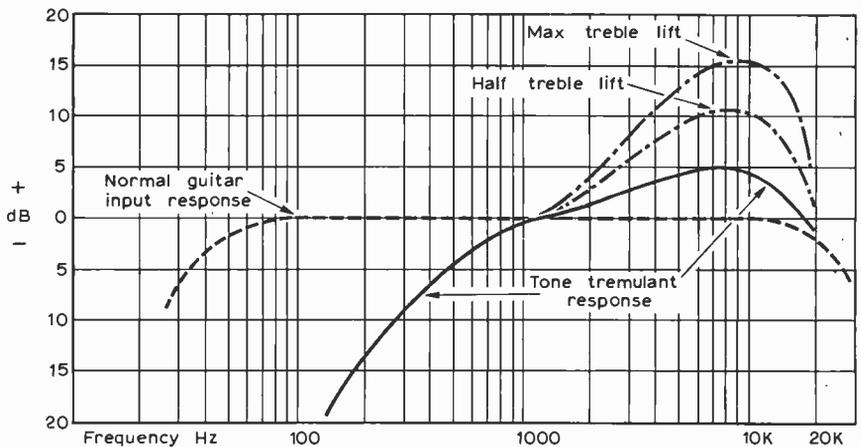
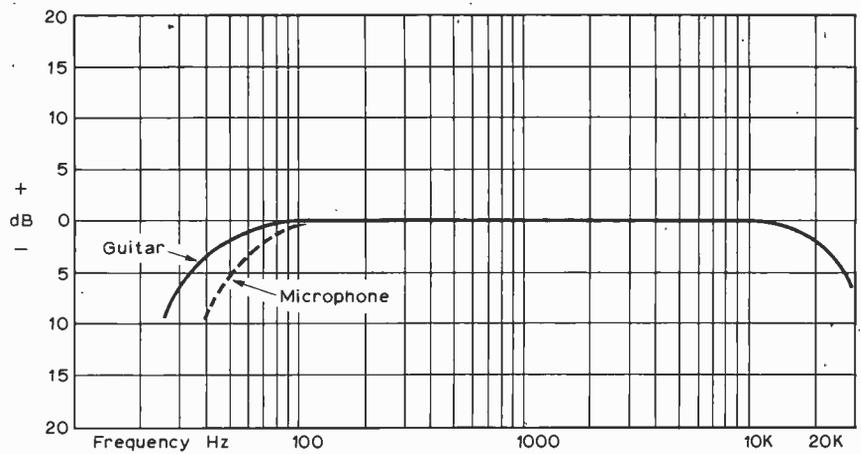
Operational Notes

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



PW25-50 AMPLIFIER Overall performance specification

Max power output 4Ω load	50 watts (r.m.s.)
Max power output 8Ω load	25 watts (r.m.s.)
Input sensitivity (guitar)	Min 30 to 40mV (for rated output)
Input impedance (guitar)	100kΩ
Input sensitivity, (microphone)	2mV (without transformer)
Input impedance, (microphone)	100kΩ
Treble lift control	+15dB at 10kHz.
Frequency response (guitar)	-3dB at 35Hz to -3dB at 20,000Hz.
Frequency response (microphone)	-3dB at 45Hz to -3dB at 20,000Hz
Hum and noise level (guitar)	Better than 60dB below rated output
Hum and noise level (Microphone)	Better than 56dB below rated output
Distortion	Not greater than 1% at rated output
Tremulant speed	Approx. 5 to 10Hz
Tremulant depth	Variable between approx. 30 and 50% as a modulation function

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CELESTION Dilton 25	£59	17 0	£46 19 6
DULCI AS 3	£8	8 0	£6 19 6
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KEF Celesta	£29	0 0	£21 19 6
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Denton	£19	0 0	£14 19 6
Super Linton	£22	10 0	£18 10 0
Melton	£29	10 0	£22 19 6
Dovedale 3	£39	10 0	£24 19 6
Rosedale	£59	10 0	£46 19 6
UNIT 3 Speaker Kit	£11	19 6	£9 10 0
UNIT 4 Speaker Kit	£16	0 0	£13 5 0
UNIT 5 Speaker Kit	£23	10 0	£18 19 6

	Rec. Price	Retail Price	Comet Price
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GOODMANS Twlnaxlette 8	£8	8 8	£6 19 6
GOODMANS Twlnaxiom 10	£9	8 5	£7 15 0
GOODMANS Axiom 10	£8	16 8	£6 19 6
GOODMANS Axiom 201	£13	9 0	£9 19 6
GOODMANS Axiom 301	£19	17 8	£14 19 6
GOODMANS Axidom 51	£12	3 0	£9 19 6
GOODMANS Audiom 61	£17	12 0	£12 19 6
GOODMANS Audiom 81	£29	13 0	£22 10 0
GOODMANS Audiom 91	£33	12 0	£25 19 6
GOODMANS Axiom 80	£26	1 4	£21 12 6
GOODMANS Audiom 91/100	£34	17 0	£26 2 9
GOODMANS ARU 180	£37	17 8	£28 19 6
GOODMANS ARU 280	£37	17 8	£28 19 6
GOODMANS ARU 480	£5	8 5	£4 1 3
GOODMANS ARU 172	£37	17 8	£28 19 6
GOODMANS Trebas 100	£7	9 0	£5 11 6
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GOODMANS Midax	£11	4 0	£9 8 0
GOODMANS Attenuator	£3	1 4	£2 6 0
GOODMANS Crossover			
Networks XO/950/5000	£8	7 7	£6 6 0
GOODMANS Crossover			
Networks XO/950	£6	7 9	£4 15 9
GOODMANS Crossover			
Networks XO/5000	£2	6 0	£1 14 6
WHARFEDALE 8 inch Bronze/RS/DD	£4	8 0	£3 13 6
WHARFEDALE Super 8/RS/DD	£7	12 0	£6 6 0
WHARFEDALE Super 10/RS/DD	£12	14 0	£10 10 0
WHARFEDALE WMT 1 Matching Transformer	16	9	13 6

	Rec. Price	Retail Price	Comet Price
HI-FI STEREO TAPE DECKS AND TAPE RECORDERS			
AKAI X-360	£339	0 0	£284 0 0
AKAI X-360D deck	£290	0 0	£243 0 0
AKAI 1710L	£89	17 0	£69 19 6
AKAI 1800	£158	0 0	£133 0 0
AKAI 1800SD	£199	0 0	£167 0 0
AKAI 4000	£124	18 0	£99 19 6
AKAI 4000 D deck	£69	19 1	£69 19 6
ALBA R22 Battery/Mains	£50	5 0	£29 19 6
BUSH TP 60 Cassette Tape Recorder	£29	8 0	£24 19 6
BUSH TP 70 Cassette, 4-track	£29	19 0	£23 19 6
FERGUSON 3246	£43	0 0	£33 19 6
FERGUSON 3247 4-track	£48	9 0	£38 19 6
FERGUSON 3248 4-track	£54	6 0	£41 19 6
FERGUSON 3249 4-track	£64	6 0	£49 19 6
FERGUSON 3244 Stereo	£97	18 0	£79 19 6
GRUNDIG C200 Cassette	£37	19 10	£29 19 6
GRUNDIG TK 120 Continental	£39	5 0	£29 19 6
GRUNDIG TK 124	£44	18 0	£34 19 6
GRUNDIG TK 144	£49	19 6	£39 19 6
GRUNDIG TK 149	£57	12 8	£47 19 6
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PHILIPS N4404 (4 track stereo)	£43	0 0	£69 19 6
PHILIPS N4407 Stereo	£105	0 0	£89 19 6
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8

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 - 3-pin to 3-pin Din 12/6
 - 3-pin to open end 10/6
 - 5-pin to 5-pin Din 16/-
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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

Tremulant Foot Control:

- 1—Panel jack socket and plug.
- 1—Press on/press off switch.
- Twin flex. Materials for foot control as in Fig. 19.

Wah-Wah Foot Control

- 1—Panel jack socket and plug.
- Screened cable.
- Materials for foot control as in Fig. 20.

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 by 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 1 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. ■

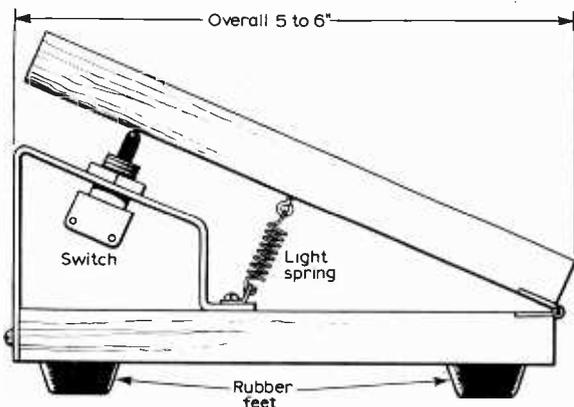
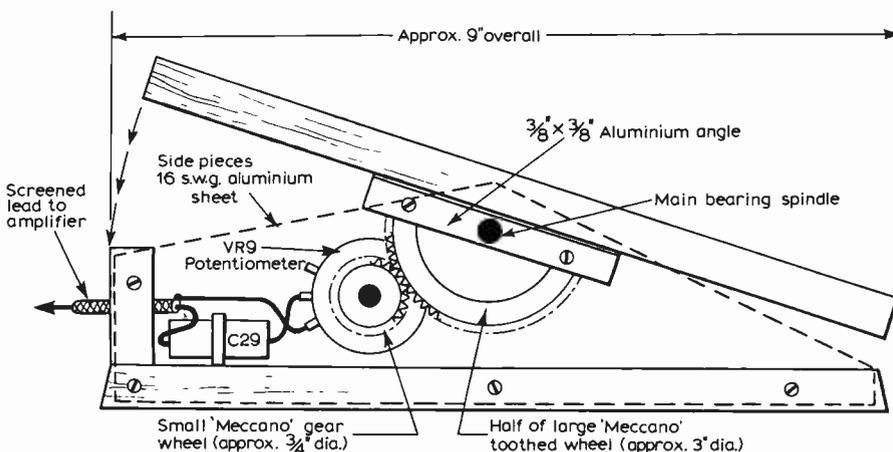


Fig. 19: Suggested construction of foot operated tremulant switch.

Fig. 20: (Below) Practical construction of foot operated wah-wah control.



SHOWTIME 1970

A LOOK AT THE LONDON-BASED TRADE SHOWS

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.)

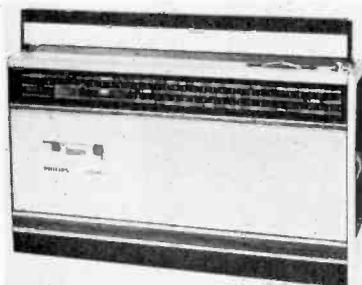
Power Supplies

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.



Philips RR392 radio cassette recorder for mains/battery operation. Price is £56.



ITT-KB Junior Super v.h.f./f.m. and m.w. has 10 transistors and 400mW output.

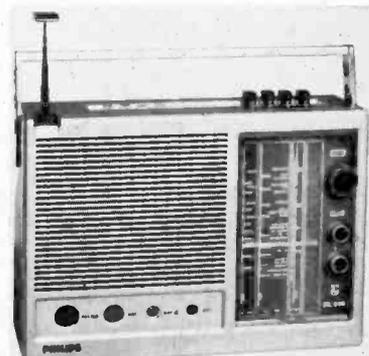


Crown TRF-2900L 4-band portable (f.m., m.w., l.w., and 49m. bandspread) Ten transistors. Price is £44 15s. inc. tax.



The Sony TR 1300 5-band portable (medium wave plus four short waves.) Price is £45.

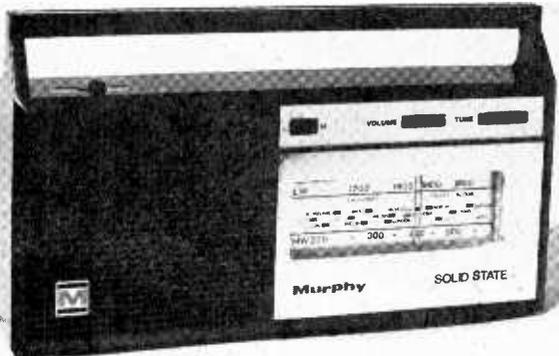
(Below) Philco T 240 13-transistor 5-band portable priced at £43 19s.



The Philips RL500 portable receiver with input/output sockets on the cabinet front. Price is £50.

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.

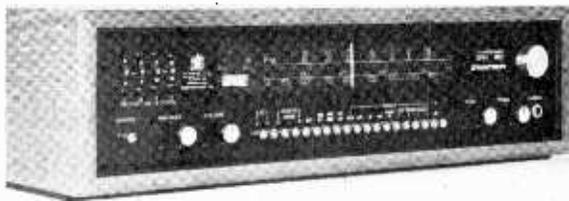
More v.h.f./f.m. receivers for cars made their appearance at the trade shows, and should be of particular use in the areas of local radio stations, since warnings of local traffic conditions will be featured in the programmes. The resulting increased awareness of v.h.f./f.m. radio should help manufacturers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



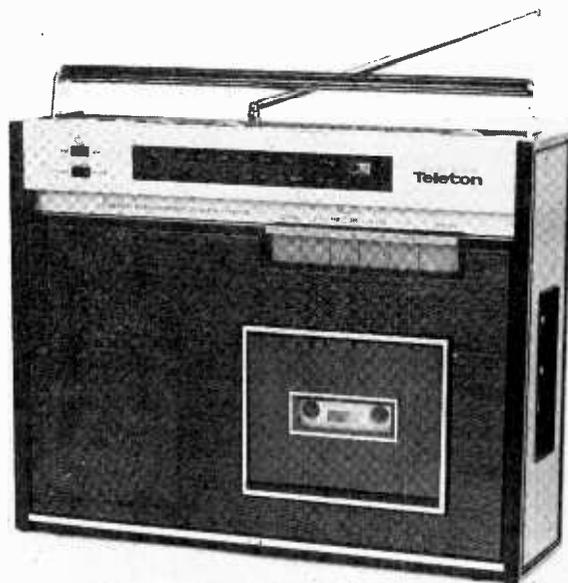
GEC2807 audio outfit with 15W music power per channel. Features Garrard deck and f.m. tuner. Price is £125.



The Dynatron STA 90 stereo tuner/amplifier priced at £165.

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

actuate switches, and therefore need very little pressure to operate them. The "tuning" of each button is accomplished by adjusting a corresponding pre-set potentiometer.

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 com-

pany concerned hopes to extend the range to include v.h.f./f.m. receivers.

Combination

The small size of modern components is continually 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.c.'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.

CQ! CQ! CQ! CQ! CQ!

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CORRESPONDENTS WANTED

... someone of my own age (13) who is studying for the R.A.E.—Kenneth May, 71 West Street, Erith, Kent.
... any reader who has modified and HRO. Also any reader who would be willing to sell me coil packs for this set and anyone who can give me information on the QP166.—Ian Burr, The Hollands, Lower Icknield Way, Chinnor, Oxon.
... a shortwave listener who is also interested in radio and electricity in England.—G. Eveleigh, 28 Reigate Avenue, Sutton, Surrey.
... anyone of my own age (18) who is interested in amateur radio in general.—W. J. Cowell, 35 Bare Avenue, Bare, Morecambe, Lancashire.
... anyone of my own age (11) who is interested in semiconductors.—Paul Mallon, 522 Tay Street, Invercargill, New Zealand.

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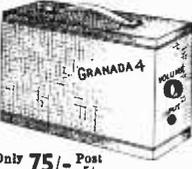
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SHORT WAVES

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 hear:

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:

11652 *R. Pakistan*, Karachi in English at 2030, 55344

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

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz ● Times in GMT

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. Rhumbos*, Venezuela in Spanish, 0400

4990 *YVMQ, R. Barquisimeto*, Ven. with 24 hour sched.

11865 *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.

SHORT WAVES

THE AMATEUR BANDS

David Gibson, G3JDG

Frequencies in kHz • Times in GMT

WHATEVER happened to all those l.f. lovers? More logs are coming in for 144MHz than 1.8, 3.5 and 7MHz put together. About 90% of the thuds on my doorstep were logs for 20 metres which must win the award of the most 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 prowl 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. coefficient capacitors 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: UK9AAN, PY3BAD, PY4BLS, PY7BHW, 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, LU2ZE, MP4BHH, OA4LM, PY1JZ, SVOWY, VE7EL, VP2MM, W6MSM, XW8DM, 4N2HV, 4U1ITU, 4Z4AB, 5H3JR, 5K3LR, 6W8DY, 9H1BX, 9J2PV, 9Q5WF, 9X5PB. 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, H1ISO, HK3CA, HK6AVR, HR2VFB, JY1, K6JW, KZ5KB, LI5K, LU2DAW, PY2EAL, TG7WT, T12JO, VE1TC, VK3XB, VP2VI, VP7CT, W6KH, WØCJZ, WA7CQA, WB6OC/MM/TG, XE1KV, YN1ZZ, YV1YC, ZC4MT, ZL1AJ1, ZM3QN, 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, HP1CU, HR1KRF, K2ALO/P/OHØ, K6UNT/KL7, OA4XN, SV1EC, TF3BV, VE1CF, VK3ZL, VK7IZ, VS5RG, WA1NGK/TF, W6CYU, WB6EZN, 5N2ABG.

Another son of sideband is **C. Smith** (Solihull), whose R1155 and 40ft. end-fed showed great affection for: CN8BG, CR5SP, CR6YS, CR7GJ, ET3DS, HK4MP, HR2WTA, HS4ADB, KP4CQB, PY1CAD, PZ5RK, SV1BV, TA1NC, TF3HS, UW9EA, XW8DK, YO4CT, 4N2KO, 4U1ITU, 4X4AE, 4Z4HE, 5Z4MO, 9H1CB, 9M6BA, 9N1MM.

L. Boucher (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, JA1ITE, JA3DWA, JAØCJF, JH6OR, JY1, KR6EZ, KV4FA, LU3OAC, LU8ATB, MP4BIR, OX5AP, OY7JD, PY4FQ, PY6BP, PY7AEG, SM6ALJ/MM (Persian Gulf), TR8LB, VE1WZ, VK5NS, VP2AD, VQ9E, XW8DK, YV4WT, ZB2A, ZD7SD, ZS2H, 4N2SO, 4S7AB, 4X4HF, 5Z4MI/A, 6W8DY, 6Y5SR, 7X2SMA, 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.

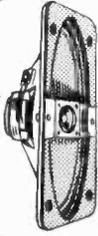
Lurking near Canterbury at a place called Chilham is a two element yagi hidden in a loft. Tracing the feeder will lead you to a converter feeding an R107 tuning 14-16MHz. The enraptured creature listening to the signals will almost certainly be **Stephen Lloyd**. Observe the smile and squeaks of delight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

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.



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C60	Cassette	(Library cased)		8/6	P & P 1/-
C90	Cassette	(Library cased)		13/-	P & P 1/-
C120	Cassette	(Library cased)		18/-	P & P 1/-



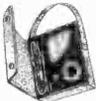
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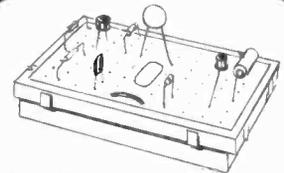
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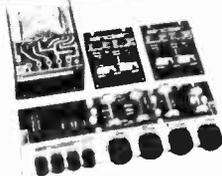
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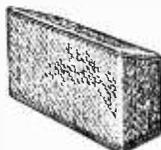


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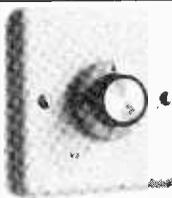
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TAKE 20

JULIAN ANDERSON

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

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.

No. 19 GENERAL PURPOSE PREAMPLIFIER

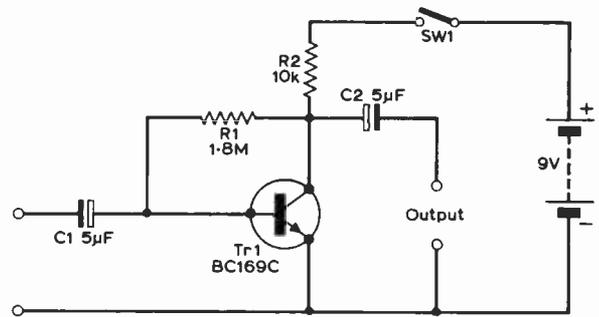


Fig. 1: The circuit of the preamplifier, the calculation of the values are shown in the text.

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 its 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. ■

500kHz CRYSTAL CALIBRATOR

R.W.Bunney

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.

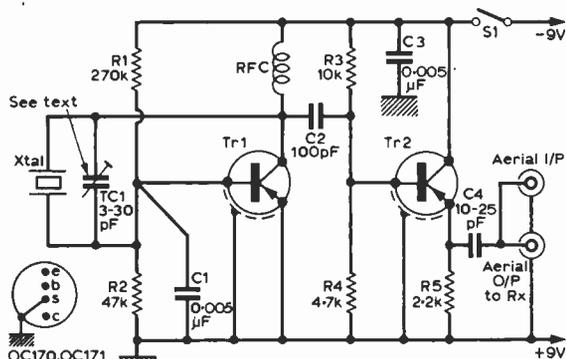
Circuit

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.



Circuit of the crystal calibrator.

★ components list

Resistors:

R1	270kΩ	
R2	47kΩ	
R3	10kΩ	All ½W 10%
R4	4.7kΩ	
R5	2.2kΩ	

Capacitors:

C1	0.005µF
C2	100pF
C3	0.005µF
C4	10-25pF
TC1	3-30pF trimmer

Semi-conductors:

TR1/2 OC171 or OC170 or AF114

Miscellaneous:

R. F. Choke (Denco RFC10), Diecast box (Eddystone 6908P), SPST switch, 2 Co-axial sockets, Crystal holder and crystal Type FT-241A marked "Channel 70" (Henry's Radio).

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

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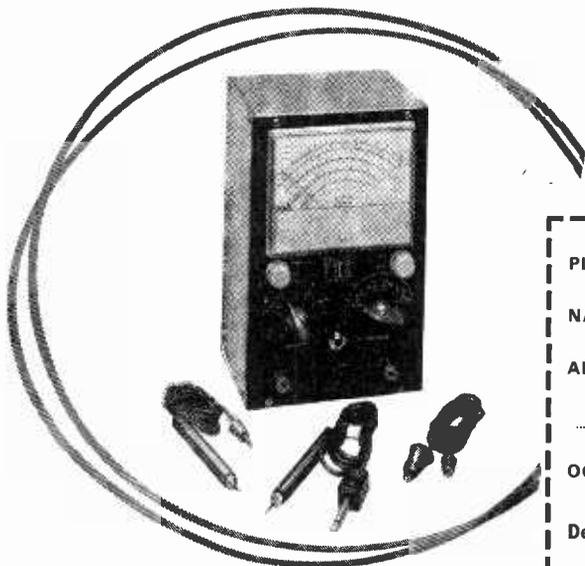
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11/70

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.

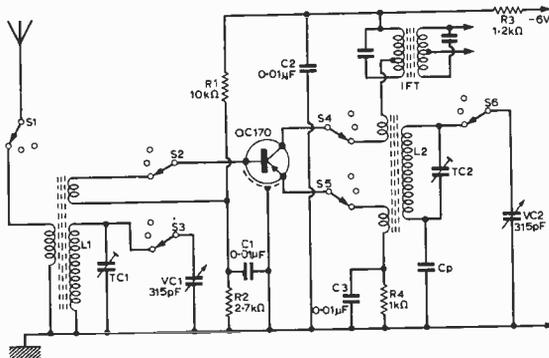


Fig. 6: Adding a s.w. band to a m.w./l.w. receiver.

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 easily be solved by reference to standard textbooks. In order to prevent unnecessary disappointment, prospective users of the service should note that:

- We cannot undertake to design equipment or to supply wiring diagrams or circuits, to individual requirements.
- We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuitry.
- It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.
- We regret we are unable to answer technical queries over the telephone.
- It helps us if queries are clear and concise.
- 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 4½ 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 which has programming in Chinese and Japanese until 1730 hrs but can be identified by its western style religious music. Look for Peking on 1000, 1230 and 1290kHz; Kabul Afghanistan on 1280 (until 1830 hrs); HLKX 1190 in Inchon 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; Anwei 940; Peking on 1090 and 1250; Urumchi 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 Asiatics are logged during the evenings, Bagdad 760 being a regular until 2230 hrs while from Iran there is Radio Irana Teheran on 895; Radio Kermanshah 985 and Radio Ahwaz 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 50kW 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. ■

TELEVISION in the NOVEMBER issue

OSCILLOSCOPE 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.T.V. 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.

PLUS ALL THE REGULAR FEATURES

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NEXT MONTH IN

PRACTICAL WIRELESS

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.

PLUS THE REGULAR "TAKE 20" AND "I.C. OF THE MONTH" SERIES AND OTHER CONSTRUCTIONAL ARTICLES AND FEATURES

Don't miss your copy of the December issue of Practical Wireless—on sale 6th November—price 3s. 6d.

TYPE 13A DOUBLE BEAM OSCILLOSCOPES



An excellent general purpose 17" H. oscilloscope. T.B. 2 cps-750 Kc/s. Bandwidth 5.5 Mc/s. Sensitivity 33mV/C.M. Operating voltage 0/110/200/250V. A.C. Supplied in excellent working condition. £22.10.0. (Carriage 30/-).

AVO CT471A MULTIMETER

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

CRYSTAL CALIBRATORS NO. 10



Small portable crystal controlled frequency meter. Size 7 x 7 1/2 x 4in. Frequency range 500 Kc/s-10 Mc/s (up to 30 Mc/s on harmonics). Calibrator dial. Power requirements 300V D.C. 15mA and 12V D.C. 0.3A. Excellent condition. 89/8. Carr. 7/6.

CLASS D WAVEMETERS



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Oscillator Test No. 2. High quality precision instrument made for the industry by Alrmec. Frequency coverage 20-80 Mc/s. AM CW FM. Incorporates precision dial level meter, precision attenuator 1μV-100mV. Operation from 12 volt D.C. or 0/110/200/250 volt A.C. Size 12 x 8 1/2 x 9in. Supplied in brand new condition complete with all connectors fully tested. £45. Carr. 20/-.

AVO CT.38 ELECTRONIC MULTIMETERS

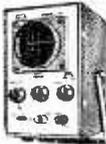
High quality 97 range instrument which measures A.C. and D.C. Voltage, Current, Resistance and Power Output. Ranges D.C. volts 250mV-10,000V. (10 meg Ω-110 meg Ω input). D.C. current 10μA-25 amps. Ohms. 0-1,000 meg Ω A.C. volt 100mV-250V (with R.F. measuring head up to 250 Mc/s). A.C. current 10μA-25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

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A general purpose low cost economy oscilloscope for everyday use. Y amp. Bandwidth 2 CUPS-1 MHz. Input imp. 2 meg Ω 25 P.P. Illuminated scale. 2in. tube. 115 x 160 x 230mm. Weight 8lb. 220/240 V a.c. Supplied brand new with handbook. £22.10.0. Carr. 10/-.



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500μA	62/6	5 amp. D.C.	59/6
1mA	59/6	300V. A.C.	59/6
		VU Meter	75/-

BAKELITE PANEL METERS

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80 mm.
square fronts

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

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100μA	62/-	500μA	52/-
100-0-100μA	62/-	1 amp.	52/-
500μA	57/8	5 amp.	52/-
500-0-500μA	55/-	15 amp.	52/-
1mA	52/-	30 amp.	52/-
1-0-1mA	52/-	20V. D.C.	52/-
5mA	52/-	50V. D.C.	52/-
10mA	52/-	150V. D.C.	52/-
		300V. D.C.	52/-
		15V. A.C.	52/-
		300V. A.C.	52/-
		8 Meter Ima	52/8
		VU Meter	72/-
		1 amp. A.C.*	52/-
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100-0-100μA	47/8	300V. D.C.	40/-
500μA	45/-	15V. A.C.	40/-
1mA	40/-	300V. A.C.	40/-
10μA	40/-	8 Meter Ima	42/-
50μA	40/-	VU Meter	42/-
100μA	40/-	1 amp. A.C.*	40/-
500μA	40/-	5 amp. A.C.*	40/-
1 amp.	40/-	10 amp. A.C.*	40/-
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10 amp.	40/-	30 amp. A.C.*	40/-

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100μA	55/-	50V. D.C.	42/-
100-0-100μA	52/-	150V. D.C.	42/-
200μA	52/-	300V. D.C.	42/-
500μA	47/8	15V. A.C.	42/-
500-0-500μA	42/-	50V. A.C.	42/-
1mA	42/-	150V. A.C.	42/-
5mA	42/-	300V. A.C.	42/-
10mA	42/-	500V. A.C.	42/-
50mA	42/-	8 Meter Ima	47/6
100mA	42/-	VU meter	67/6
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15 amp.	42/-	1 amp. A.C.*	42/-
20 amp.	42/-	5 amp. A.C.*	42/-
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500μA	30/-	2 amp.	27/6
500-0-500μA	27/6	5 amp.	27/6
1mA	27/6	10 amp.	27/6
1-0-1mA	27/6	3V. D.C.	27/6
2mA	27/6	10V. D.C.	27/6
5mA	27/6	15V. D.C.	27/6
10mA	27/6	20V. D.C.	27/6
20mA	27/6	100V. D.C.	27/6
50mA	27/6	150V. D.C.	27/6
100mA	27/6	300V. D.C.	27/6
150mA	27/6	300V. A.C.	27/6
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100-0-100μA	37/6	50V. D.C.	30/-
200μA	37/6	300V. D.C.	30/-
500μA	32/-	15V. A.C.	30/-
500-0-500μA	30/-	300V. A.C.	30/-
1mA	30/-	8 Meter Ima	37/6
10mA	30/-	VU meter	45/-
50mA	30/-	1 amp. A.C.*	30/-
100mA	30/-	5 amp. A.C.*	30/-
500mA	30/-	10 amp. A.C.*	30/-
1 amp.	30/-	20 amp. A.C.*	30/-
		30 amp. A.C.*	30/-

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5 amp.	35/-	5 amp.	35/-
15 amp.	35/-	15 amp.	35/-
30 amp.	35/-	30 amp.	35/-
50 amp.	35/-	50 amp.	35/-
5V. D.C.	35/-	5V. D.C.	35/-
10V. D.C.	35/-	10V. D.C.	35/-
20V. D.C.	35/-	20V. D.C.	35/-
50V. D.C.	35/-	50V. D.C.	35/-
150V. D.C.	35/-	150V. D.C.	35/-
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150V. A.C.*	35/-	150V. A.C.*	35/-
300V. A.C.*	35/-	300V. A.C.*	35/-
500mA A.C.*	35/-	500mA A.C.*	35/-
1 amp. A.C.*	35/-	1 amp. A.C.*	35/-
5 amp. A.C.*	35/-	5 amp. A.C.*	35/-
10 amp. A.C.*	35/-	10 amp. A.C.*	35/-
20 amp. A.C.*	35/-	20 amp. A.C.*	35/-
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500μA	42/-	500mA A.C.*	35/-
1mA	42/-	1 amp. A.C.*	35/-
5mA	42/-	5 amp. A.C.*	35/-
10-0-10mA	35/-	10 amp. A.C.*	35/-
10mA	35/-	20 amp. A.C.*	35/-
50mA	35/-	30 amp. A.C.*	35/-
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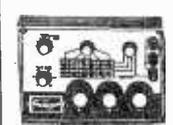
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Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, at battery and leads. £8.18.6 P. & P. 3/-.



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A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω-111 meg Ω. C. Ranges ± 1% L.T. 1μH-111 HENRYS 6 Ranges -2% C. 10pF-1110mF. 4

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

TE-20 RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s-290 Mc/s on 6 bands. Directly calibrated variable R.F. attenuator. Operation 200/240V a.c. Brand new with instructions. P. & P. £15.0.0. P. & P. 7/6. S.A.E. for details.

LELAND MODEL 27 BEAT FREQUENCY OSCILLATORS

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

TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20c/s to 200 Kc/s on 4 bands. Square: 20c/s to 30 Kc/s. Output impedance 500 ohms, 200/250V. A.C. Supplied brand new and guaranteed with instruction manual and leads. £18.10.0. Carr. 7/6.

LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYSER

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

270° 500 MICROAMP METER

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

ADVANCE TEST EQUIPMENT

Brand new and boxed in original sealed cartons
TB5. AUDIO SIGNAL GENERATOR. 15 c/s to 50 Kc/s. Sine wave. Output 600 ohms or 5 ohms £30.0.0.
VM79. UHF MILLIVOLT METER. 100 Kc/s up to 1,000 Mc/s. A.C. 10mV to 3V. D.C. 10 mV to 3V. Current 0.01 uA to 0.3 mA. Resistance 1 ohm to 10 megohm. £25.0.0.
TT15. TRANSISTOR TESTER. Full range of facilities for testing PNP or NPN transistors in or out of circuit. £37.10.0. Carriage 10/- per item.

MARCONI TF195M BEAT FREQUENCY OSCILLATORS

0-40 Kc/s. £20. Carr. 30/-.

G. W. SMITH & CO (RADIO) LTD.
Also see next two pages

SEMI-CONDUCTORS/VALVES

BRAND NEW & FULLY GUARANTEED

TRANSISTORS

IN914	1/8	AC176	5/8	BSY95A	2/8	OA2	6/6	30C15	15/-	EY51	8/-
IN4001	2/8	AC187	12/8	BY100	3/8	OB2	6/6	30C17	18/-	EY86	8/-
IN4002	2/8	AC188	7/8	BY124	3/-	OA4	6/-	30C18	15/-	EY87	8/8
IN4003	2/8	AC177	5/8	BY126	4/-	IL4	2/6	30F5	17/-	EZ40	7/8
IN4004	3/8	AC185	7/8	BY127	4/8	IR5	7/-	30FL1	15/-	EZ41	9/-
IN4005	3/8	AC189	5/8	BY210	7/8	IK5	6/-	30FL2	18/-	EZ80	5/8
IN4006	3/8	AC191	5/8	BY211	6/8	IT4	4/8	30FL4	16/8	EZ81	5/8
IN4007	4/8	AC192	5/8	BY212	8/-	IU4	6/8	30L15	17/-	GZ32	9/8
IN4148	1/8	ACY22	4/8	BY213	5/8	IU5	9/8	30L17	17/-	GZ34	11/-
IN6054	4/8	ACY28	4/8	MJ480	19/8	2D21	6/8	30P12	16/-	KT66	27/8
2G301	4/8	ACY40	4/8	MJ481	25/-	3Q4	4/8	30P19	15/-	KT88	33/8
2G302	4/8	AD140	8/8	MFP102	8/8	3S4	7/8	30P1L	15/8	MU14	8/-
2G303	4/8	AD149	11/8	MFP103	7/8	3V6	6/-	30P1L3	18/-	PCB80	9/-
2G306	7/8	AD161	7/8	MFP104	7/8	5B4	11/-	30PL14	17/-	PC86	11/8
2G308	6/8	AD162	7/8	MFP105	7/8	5U4	6/-	35L6	9/8	PC88	13/-
2G309	6/8	AF114	5/8	NKT213	5/8	5V4	8/-	35W4	9/8	PC97	8/8
2G371	3/8	AF115	6/8	NKT214	4/8	5Y3	6/-	35Z4	5/8	PC900	9/8
2G374	4/8	AF116	5/8	NKT216	7/8	5Z4G	7/8	35Z5	7/8	PC84	7/8
2G381	4/8	AF117	5/8	NKT217	7/8	6/30L2	15/-	50B5	7/8	PC85	8/8
2G696	4/8	AF118	5/8	NKT222	8/8	6A7	4/8	50C5	7/8	PC86	12/8
2N697	4/8	AF119	4/8	NKT241	5/8	6AG7	7/8	80	9/8	PC89	10/8
2N698	5/8	AF124	4/8	NKT261	4/8	6AK5	6/-	85A2	7/8	PC189	11/-
2N706	2/8	AF126	4/8	NKT271	4/8	6AK6	11/8	802	9/8	PC80	6/8
2N706A	2/8	AF127	4/8	NKT272	4/8	6AL5	3/8	1625	6/8	PC82	6/8
2N708	3/8	AF139	6/8	NKT274	4/8	6AM6	4/8	5783	13/-	PCF84	9/8
2N714	3/8	AF178	11/8	NKT275	4/8	6AQ5	6/8	6146	30/-	PCF86	11/-
2N916	3/8	AF180	8/8	NKT282	8/8	6B6	11/8	6149	10/8	PCF80	10/8
2N918	6/8	AF181	8/8	NKT281	5/8	6AT6	5/8	CY31	7/8	PCF80	10/8
2N929	4/8	AF186	9/8	NKT403	15/-	6AU6	5/8	DAF91	5/8	PCF801	10/8
2N930	5/8	AF239	8/8	NKT404	15/-	6AV6	6/8	DAF96	7/8	PCF802	10/8
2N1131	5/8	ASV26	5/8	NKT405	12/8	6BA6	4/8	DF91	4/8	PCF805	15/-
2N1132	6/8	ASV77	7/8	NKT406	12/8	6BE6	5/8	DF96	7/8	PCF806	15/8
2N1302	3/8	ASV78	7/8	NKT407	15/-	6BES	6/8	DF97	7/8	PCF806	15/8
2N1303	3/8	ASV77	8/8	NKT408	15/-	6B6	8/8	DK92	9/8	PC82	7/8
2N1304	4/8	ASU10	30/8	NKT775	5/8	6B7A	7/8	DK96	8/8	PCL83	13/8
2N1305	4/8	BAV31	1/8	NKT10439	7/8	6BR7	17/-	DL92	7/8	PCL84	8/8
2N1306	5/8	BC107	3/8	OA5	2/8	6BR8	13/8	DL94	8/8	PCL85	9/8
2N1307	5/8	BC109	3/8	OA47	1/8	6BW6	18/-	DL96	7/8	PCL86	9/8
2N1308	5/8	BC113	5/8	OA47	1/8	6BW7	13/8	DM70	6/8	PCF80	11/8
2N1613	5/8	BC116	12/8	OA70	1/8	6C4	6/8	DY87	7/8	PL1	9/8
2N1711	5/8	BC125	11/8	OA79	1/8	6CD6	23/-	E88CC	12/8	PL82	9/8
2N1889	6/8	BC126	11/8	OA81	1/8	6CL6	10/8	E180F	15/8	PL83	8/8
2N1893	6/8	BC147	3/8	OA85	1/8	6CW4	12/8	EABC80	6/8	PL84	7/8
2N2147	14/8	BC148	3/8	OA90	1/8	6EAF	12/8	EAF42	10/8	PL500	12/8
2N2160	11/8	BC149	3/8	OA91	1/8	6F6G	6/8	EB01	3/8	PL404	18/-
2N2193	9/8	BC167	3/8	OA95	1/8	6F13	7/8	EBC41	10/8	PY32	11/8
2N2217	5/8	BC172	3/8	OA200	2/8	6F14	12/8	EBC81	6/8	PY33	12/8
2N2218	5/8	BC177	7/8	OA202	1/8	6F15	11/8	EBF80	8/8	PY80	6/8
2N2219	5/8	BC186	7/8	OA210	3/8	6F18	8/8	EBF83	8/8	PY81	6/8
2N2268	5/8	BC192L	4/8	OC20	15/8	6F23	18/8	EBF89	8/8	PY82	6/8
2N2369	3/8	BC184L	4/8	OC20	15/8	6G6	3/8	EJL21	15/8	PY83	7/8
2N2369A	4/8	BC122L	4/8	OC22	10/8	6J4	4/8	EC86	12/8	PY88	8/8
2N2444	6/8	BCY30	5/8	OC23	10/8	6J5	4/8	EC88	12/8	PY800	10/8
2N2613	7/8	BCY31	5/8	OC24	11/8	6J5GT	6/8	EOC40	11/8	PY801	10/8
2N2646	11/8	BCY32	7/8	OC25	10/8	6J6	3/8	EOC84	6/8	U25	15/8
2N2920	2/8	BCY33	4/8	OC26	6/8	6J7	8/8	EOC85	5/8	U26	15/8
2N2923	2/8	BCY34	4/8	OC27	10/8	6K8G	6/8	EOC88	8/8	U50	6/8
2N2924	3/8	BCY38	4/8	OC29	12/8	6L6GT	6/8	EU92	6/8	U92	6/8
2N2925	3/8	BCY42	3/8	OC35	8/8	6LD20	6/8	ECF82	7/8	UI91	14/8
2N2926	2/8	BCY43	3/8	OC36	12/8	6Q2	7/8	ECF86	12/8	U281	8/8
2N2926A	2/8	BCY71	8/8	OC41	4/8	68A7	7/8	ECH21	11/8	U282	8/8
2N2926B	2/8	BCY72	3/8	OC42	4/8	6807	6/8	ECH35	12/8	U301	11/8
2N3053	4/8	BC211	7/8	OC45	2/8	6837	7/8	ECH42	13/8	U302	20/8
2N3054	11/8	BD121	13/8	OC45	2/8	6847	6/8	ECH81	8/8	UABC80	6/8
2N3055	15/8	BD123	16/8	OC46	3/8	68L7	6/8	ECH83	8/8	UAF42	10/8
2N3391A	6/8	BD124	12/8	OC70	3/8	68N7	5/8	ECL80	9/8	UBC41	9/8
2N3416	7/8	BF115	5/8	OC71	3/8	68Q7	8/8	ECL82	6/8	UBC81	9/8
2N3470	17/8	BF117	9/8	OC72	2/8	6U4	12/8	ECL83	12/8	UBF80	7/8
2N3702	3/8	BF147	6/8	OC73	5/8	6V6G	5/8	ECL86	8/8	UBF89	7/8
2N3703	4/8	BF173	6/8	OC74	6/8	6X4	5/8	UCF7A	8/8	UCF7B	9/8
2N3704	4/8	BF180	7/8	OC75	4/8	6X4	5/8	EY85	8/8	UCY85	8/8
2N3705	4/8	BF181	6/8	OC76	4/8	6X6G	5/8	EF40	10/8	UCF80	10/8
2N3706	4/8	BF182	6/8	OC77	6/8	6X6GT	5/8	EF41	12/8	UCH21	11/8
2N3707	4/8	BF184	6/8	OC78	7/8	10C2	10/8	EF42	14/8	UCH42	13/8
2N3708	3/8	BF185	6/8	OC79	5/8	10P1	18/8	EF80	5/8	UCH81	8/8
2N3709	3/8	BF194	4/8	OC81D	5/8	10P1	18/8	EF86	4/8	UCL82	7/8
2N3710	4/8	BF195	5/8	OC83	5/8	10P14	20/8	EF88	4/8	UCL83	12/8
2N3711	4/8	BF200	10/8	OC84	5/8	12A16	5/8	EF89	5/8	UF41	10/8
2N3819	7/8	BF224	6/8	OC139	6/8	12A17	4/8	EP91	4/8	UF80	7/8
2N3903	7/8	BF225	6/8	OC140	6/8	12A17	5/8	EP92	7/8	UF85	7/8
2N3904	7/8	BF146	9/8	OC149	4/8	12A17	5/8	EP183	6/8	UF89	7/8
2N3905	7/8	BF152	8/8	OC170	6/8	12A16	6/8	EP184	7/8	UL41	12/8
2N3906	7/8	BF153	4/8	OC171	6/8	12B16	6/8	EL84	10/8	UL84	6/8
2N4058	5/8	BFX29	7/8	OC200	6/8	12B16	6/8	EL80	8/8	UY41	8/8
2N4059	5/8	BFX30	9/8	OC201	9/8	12BH7	6/8	EL33	17/8	UY85	6/8
2N4061	4/8	BFX44	7/8	OC292	12/8	19AQ5	6/8	EL41	11/8	VR105/30	5/8
2N4062	4/8	BFX45	7/8	OC293	8/8	20D1	9/8	EL42	11/8	VR105/30	5/8
2N4286	3/8	BFX86	6/8	OC296	8/8	20P2	15/8	EL81	10/8	VR105/30	5/8
2N4287	3/8	BFX87	6/8	OC295	8/8	20P1	10/8	EL84	5/8	VR105/30	5/8
2N4288	3/8	BFX88	5/8	OC207	12/8	20P1	10/8	EL85	3/8	VR105/30	5/8
2N4289	3/8	BFY18	6/8	OC71	8/8	20P3	12/8	EL91	5/8	VR105/30	5/8
2N4290	3/8	BFY20	12/8	ORP12	10/8	20P4	20/8	EL95	7/8	VR105/30	5/8
2N4291	3/8	BFY21	4/8	ORP60	10/8	20P5	20/8	EM80	8/8	VR105/30	5/8
2N4292	2/8	BFY81	4/8	P846A	4/8	25L6	7/8	EM81	8/8	VR105/30	5/8
2N5354	5/8	BFY52	4/8	PL4001	2/8	25Z4	6/8	EM84	7/8	VR105/30	5/8
2N5355	5/8	BFY90	13/8	PL4002	3/8	25Z5	6/8	EM85	11/8	VR105/30	5/8
28102	6/8	B8X19	3/8	PL4003	3/8	25Z6	11/8	EM87	11/8	VR105/30	5/8
28103	6/8	B8X20	3/8	PL4004	3/8						
28194	6/8	B8X21	7/8	PL4005	3/8						
40250	10/8	B8Y78	3/8	PL4006	4/8						
40381	12/8	B8Y28	3/8	P1007	4/8						
40382	12/8	B8Y27	3/8	T1843	4/8						
AC107	6/8	B8Y28	3/8	T1844	2/8						
AC126	4/8	B8Y38	4/8	T1845	3/8						
AC127	5/8	B8Y39	4/8	T1846	3/8						
AC128	5/8	B8Y39	4/8								
AC154	4/8	B8Y36	15/8								

THYRISTORS

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

VALVES

OA2	6/6	30C15	15/-	EY51	8/-
OB2	6/6	30C17	18/-	EY86	8/-
OA4	6/-	30C18	15/-	EY87	8/8
IL4	2/6	30F5	17/-	EZ40	7/8
IR5	7/-	30FL1	15/-	EZ41	9/-
IK5	6/-	30FL2	18/-	EZ80	5/8
IT4	4/8	30FL4	16/8	EZ81	5/8
IU4	6/8	30L15	17		

RUSSIAN C1-16 DOUBLE BEAM OSCILLOSCOPES

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



MARCONI T/44/TF956

AF Absorption Wattmeter
1 μ/watt to 6 watts.
£20. Carr. 10/-.

TEIII. DECADE RESISTANCE ATTENUATOR



Variable range 0-11dB. Connections. Unbalanced T and Bridge T. Impedance 600 Ω range (0.1dB x 10) + (1dB x 10) + 10 + 20 + 30 + 40dB. Frequency: d.c. to 200KHz (-3dB). Accuracy: 0.05dB. + Indication ±B x 0.01. Maximum input less than 4W (50V). Built in 600 Ω load resistance with internal/external switch. Brand new £27.10.0. P. & P. 5/-.

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

Sine 18-200,000 Hz; Square 18-50,000 Hz Output max. + 10 dB (10 K ohms) Operation internal batteries Attractive 2-ton case 7 1/2" x 5" x 2". Price £17.10.0. Carr. 3/6.



TE-18A Transistorised Signal Generator

5 ranges 400Hz-30MHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5 1/2" x 5 1/2" x 3 1/2". Complete with instructions and leads. £7.18.8. P. & P. 4/-.



BELCO DA-20 SOLID STATE DECADE AUDIO OSCILLATOR

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



TE-40 HIGH SENSITIVITY A.C. VOLT METER

10 meg. input 10 ranges: 01/003/1/3/1/3/10/30/100/300V. R.M.S. 4eps.-1.2 Mc/s. Decibels -40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. £17.10.0 Carr. 5/-.



TE-65 VALVE VOLT METER

High quality instrument with 28 ranges. D.C. volts 1.5-1,500V. A.C. volts 1.5-1,500V. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. £7.10.0. P. & P. 6/- Additional probes available: R.F. £2/6. H.V. 50/-



AUTO TRANSFORMERS

0/115/230V. Step up or step down. Fully shrouded.
150 W. £2. 2.6. P. & P. 3/6.
300 W. £3. 5.0. P. & P. 4/6.
500 W. £4.10.0. P. & P. 6/6.
1,000 W. £8.10.0. P. & P. 7/6.
1,500 W. £8.18.8. P. & P. 8/6.
7,500 W. £15.10.0. P. & P. 20/-.

SOLID STATE VARIABLE A.C. VOLTAGE REGULATORS

Compact and panel mounting. Ideal for control of lamps, drills, electrical appliances etc. Input 230/240v. A.C. Output continuously variable from 20V-230V. Model MR 2305 5 amp 68 x 46 x 48mm £8.7.6 Model MR 2310 10 amp 90 x 68 x 60mm £11.19.8 Postage 2/6



MULTIMETERS for EVERY purpose!

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

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

MODEL TE-300. 30,000 O.P.V. Mirror scale, overload protection 0/8/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/80uA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm. -20 to +63 db. £5.19.8. P. & P. 3/-.

MODEL TE-70. 30,000 O.P.V. 0/3/15/60/300/600/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30uA/3/30/300mA. 0/16K/160K/1.6M/16 MegΩ. £5.10.0. P. & P. 3/-.

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

TMK MODEL TW-50K 48 ranges, mirror scale. 50K/Volt. D.C. 5K/Volt A.C. D.C. Volts: 125, 25, 1.25, 2.5, 5, 10, 25, 50, 125, 250, 500, 1000V. A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1000V. D.C. Current: 25, 50mA, 2.5, 5, 25, 50, 250, 500mA, 5, 10 amp. Resistance: 10K, 100K, 1 MEG, 10 MEGΩ. Decibels: -20 to +81.5 dB. £8.17.6. P. & P. 3/6.

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

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

TMK LAB TESTER. 100,000 O.P.V. 6 1/2in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K Ω/Volt A.C. D.C. Volts: 5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 50, 50, 250, 500, 1,000V. D.C. Current: 10, 100mA, 2.5, 10 amp. Resistance: 1K, 10K, 100K, 10MEGΩ, 100 MEGΩ. Decibels: -10 to 49 db. Plastic Case with Carrying Handle. Size 7 1/2in. x 6 1/2in. x 3 1/2in. £18.18.0. P. & P. 6/-.

LAFAYETTE HA-600 SOLID STATE RECEIVER
General coverage 150-400kc/s, 550 kc/s - 30mc/s. FET front end, 3 mech. filters, product detector, variable B.F.O., noise limiter, 8 Meter, Bandspread, RF Gain. 15" x 8 1/2" x 8 1/2". 18 lbs, 220/240v. A.C. or 12v. D.C. Brand new with instructions. £45. Carr. 10/-.

RCA COMMUNICATIONS AR88D RECEIVER
Brand new. 6 bands 630kc/s-32mc/s. Fully tested and checked. 110-250V. A.C. £85. Carr. £2.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS
Excellent quality. Low price. Immediate delivery

MODEL S-280	General Purpose Bench Mounting	MODEL S-280 B	Panel Mounting
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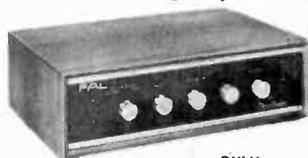
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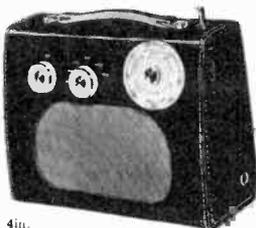
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P. & P. 7/6



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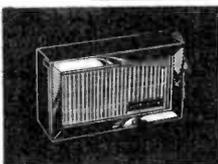
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P. & P. 7/6

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Total building costs

44/6

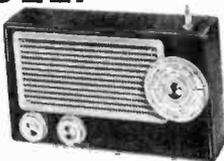
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Total building costs

79/6

P. & P. 4/6

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Total building costs **89/6**

P. & P. 5/6

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Total building costs

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Parts price list and plans for

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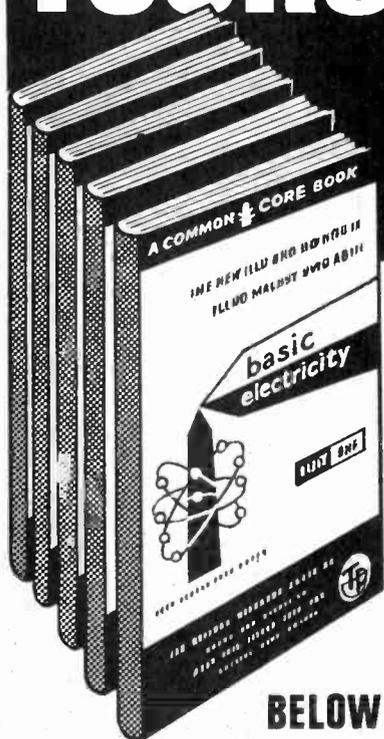
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MW/LW TRANSISTOR RADIO

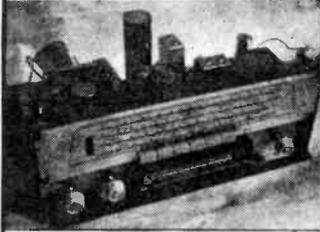


Complete set of parts for this MW/LW Transistor Radio. Originally sold by world-famous company as a set for more than £17. Coverage 192-555m + 1070-1870m. 4 1/2" loudspeaker. Transistors 3 x AF117, OC81D + 2 OC81. Also works off car-aerial. Full instruction book 2/6, free with parts. State preference red, blue or tan and give alternative. Requires PPT battery, price 4/6 extra. All parts £6.17.6 + 4/6 post or £10.10.0 fully built + 4/6 post.

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Heavy copper on 3/32 paxolin sheet ideal for making power packs etc. as sheet is very strong and thick enough to allow copper to be cut away with hacksaw blade. 5in. x 5in. 1/6 each, 15in. x 5in. 4/6d. each.

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In ventilated sheet steel case—tapped 110v-140v-170v-200v-230v. Ex equipment but guaranteed perfect 119.10.0. carriage at cost.

PP3 BATTERY ELIMINATOR

Run your small transistor radio from the mains—full wave circuit—made up ready to wire into your set and adjustable high or low current. 8/6 each.



REED SWITCHES

Glass encased, switches operated by external magnet—gold welded contacts. We can now offer 3 types:

Miniature. 1in. long x approximately 1/4 in. diameter. Will make and break up to 1/4 A up to 300 volts. Price 2/6 each, 24/- dozen.
Standard. 2in. long x 3/16in. diameter. This will break currents of up to 1A, voltages up to 250 volts. Price 2/- each, 18/- per dozen.
Flat. Flat type, 2in. long, just over 1/16in. thick, approximately 1/4 in. wide. The standard type flattened out, so that it can be fitted into a smaller space or a larger quantity may be packed into a square solenoid. Rating 1 amp 200 volts. Price 6/- each, 23 per dozen.
 Small ceramic magnets to operate these reed switches 1/6 each, 18/- dozen.

0.005mFd TUNING CONDENSER

Proved design, ideal for straight or reflex circuits 2/6 each, 24/- doz.



SUB-MINIATURE MOVING COIL MICROPHONE

as used in behind the ear deaf aids
 A.C. also as earphone size only 1in. x 1in. x 1/4 in. Regular price probably 23 or more. Our price 19/6. Note these are ex-equipment but if not in perfect working order they will be exchanged.



CHART RECORDER MOTOR

Small 2" diameter (approx) instrument motor with fixing flange and spindle (1/4" long, 1/4" diameter) integral gear box gives 1 rev per 24 hours. 19/6

IGNITION (E.H.T.) TRANSFORMER

made by Parmeko Ltd., Primary 240V 50 cps. Secondary 5KV at 25 mA. Size approx. 4 1/2" x 3 1/2" x 2 1/2" thick. 22V each 4/6 p. & p.

12V EXTRACTOR FAN BY DELCO

Ideal for ventilation in Caravan, Car or Boat. 6 Bladed 5" diameter fan inside heavy duty cylinder with 3 point fixing flange. 5 1/2" diameter fixing hole. Length approx. 8 1/2". Exceptional bargain 27/6 plus 5/6 post and insurance.

NEED A SPECIAL SWITCH

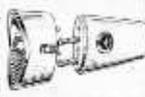
Double Leaf Contact. Very slight pressure closes both contacts 1/8 each, 12/- doz. Plastic pusher suitable for operating, 1/- each, 9/- doz.

COMPUTER MULTI-CORE CABLES

12, 14/0076 copper cores, each one insulated by coloured P.V.C. then separately screened, the 12 metal braided cores laid together and P.V.C. covered overall making a cable just under 1/2 in. dia. but quite pliable. Price 7/6 per ft. Any length cut. Other sizes available 7 core 5/- ft., 6 core 4/- ft., 4 core 3/6 ft.

25 AMP ELECTRICAL PROGRAMMER

Learn in your sleep! Have Radio playing and kettle boiling as you awake—switch-on-lights to ward off intruders—have warm house to come home to. All these and many other things you can do if you invest in an Electrical Programmer. Made by the famous Smiths Instrument Company. This is essentially a 230/240 volt mains operated Clock and a 20 amp Switch, the switch-off time of which can be delayed up to 12 hours (continuously variable not Stepped). Similarly the switch-on-time can be delayed. This is a beautiful unit, size 5 1/2" x 3 1/2" x 2 1/2" deep. Metal encased, glass fronted with chrome surround. Offered at 47/6 plus 3/6 postage and insurance.



HI-FI SPEAKERS (15, 30, 40 & 100W)

FULL FI 12 INCH LOUDSPEAKER. This is undoubtedly one of the finest loudspeakers that we have ever offered, produced by one of the country's most famous makers. It has a die-cast metal frame and is strongly recommended for Hi-Fi load and Rhythm Guitar as public address. Flux Density 11,000 gauss—Total Flux 44,900 Maxwells—Power Handling 15 watts R.M.S. Cone Moulded fibre—Freq. response 30-10,000 c.p.s.—Specify 3 or 15 ohms—Mains resonance 60 c.p.s.—Chassis Diam. 12in.—12in. off mounting lugs—Baffle hole 11in. Diam.—Mounting holes 4, holes—1/4 in. diam. on pitch circle 11in. diam.—Overall height 5 1/2 in. A 25 speaker offered for only 23.18 plus 7/6 p. & p. 12in. 40watt 25.19.6. carr. 8/8. 15in. 25 watt 27.18.6. carr. 10/6. 18in. 100 watt 219.10.0. carr. 30/-.



INTEGRATED CIRCUIT BARGAIN

A parcel of integrated circuits made by the famous Plessey Company. A once-in-a-lifetime offer of Micro-electronic devices well below cost of manufacture. The parcel contains 5 ICs all new and perfect, first-grade device, definitely not sub-standard or seconds. The ICs are all single silicon chip General Purpose Amplifiers. Regular price of which is well over 21 each. Full circuit details of the ICs are included and in addition you will receive a list of 50 different ICs available at bargain prices 5/- upwards with circuits and technical data of each. Complete parcel only 21 post free; or List and all data 10/- post free. Credited when your order IC's value of 30/- and upwards.

MOTORIZED SWITCH For Animated signs etc.

This is motorised programmer switch, mains operated, with six 15 amp changeover contacts operated by triggers on a rotating drum. Six triggers will put switches up and another six triggers will put switches down. Also simple on/off operation or changeovers are possible. The triggers are exactly set to any position around the drum which is rotated by a one rev. per hour motor. (Motors with other speeds available). A beautifully made precision switch which probably cost in excess of 20. Limited quantity only 29.15. each post free.



DISTRIBUTION PANELS

Just what you need for work bench or lab. 4 x 13 amp sockets and on/off switch with neon warning light (in metal box). Takes standard 13 amp fused plugs. Supplied complete with 7 feet of heavy cable. 39/6 wired up, ready to work plus 4/6 post & insurance. 5 amp 3 pin model 35/-, 15 amp 3 pin model 45/-

BARGAIN OF THE YEAR

MICROSONIC KEYCHAIN RADIO

7 transistor Keychain Radio in very pretty case, size 2 1/2 x 2 1/4 x 1 1/4 in.—complete with soft leather zipped bag. Specification—
 Circuit: 7 transistor superheterodyne.
 Frequency range: 530 to 1600 Kc/s. Selectivity: 5 mv/m. Intermediate frequency: 465 Kc/s or 455 Kc/s. Power output: 40mW. Antenna: ferrite rod. Loudspeaker: Permanent magnet type.
 In transit from the East, these sets suffered slight corrosion as the batteries are left in them but when this corrosion is cleared away they should work perfectly—offered without guarantee except that they are new. Price only 24/6 less batteries plus 2/6 post 6 for 27 post free. Rechargeable batteries 8/6 pair.



24-HOUR TIME SWITCH

Mains operated. Adjustable contacts give 2 on/off per 24 hours. Contracts rated 15 amps. repeating mechanism so ideal for shop window control, or to switch hall lights (anti-burglar precaution) while you are on holiday. Made by the famous Smiths Company. This month only 49/6 with perspex cover, plus 3/6 postage and insurance, a real snip which should not be missed.

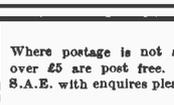
MOST AMAZING BARGAIN

PRINCESS AUTO CHANGER

The most amazing bargain ever! A brand new Auto change record player for less than the price of a single player... due to a frustrated export order we are able to offer the Balfour Princess 4 speed Autochanger—a really fine machine at about one third of its regular price.

The Balfour has two unique features (1) A patented brush system which automatically cleans styus after each record playing and (2) at shut off the pick-up locks itself into its recess—other features include pick-up height and styus pressure adjustments, and motor suitable for our 230/240 or for 115v. continental mains.

Beautifully styled—this is a high class expensive instrument but you can purchase one this month for only 59/6 plus 8/6 post and packing. One point, these changers have been to France and back and the vibrations of the journey, etc., may have loosened screws or otherwise put them out of adjustment. However, with each we supply a 16 page service manual and fault finding chart which is so detailed that if necessary you could completely re-build the changer. So this is truly a bargain that you will not want to miss so order today.



Where postage is not stated then orders over 25 are post free. Below 25 add 2/9. S.A.E. with enquires please.

MAINS TRANSFORMERS

Note all these are first grade Transformers and all have normal 200/240 volt 50 cycle primary. Mains Transformer Type No. 56786

Upright mounting, size 3 x 2 1/2 x 2 1/2 in. approximately, 2 secondaries one 230 volt 1 amp and the other 0.5 volt 1.5 amp. Earth screen between primary and secondaries—this transformer will power a 5.5 watt stereo amplifier (circuit diagram available, price 2/6). Suitable output transformer is type 56787 described below. Our price 17/6. Plus 4/6 post.

Mains Transformer Type No. 56783
 Chassis mounting type, size approximately 3 x 2 1/2 x 3in., 2 secondaries one 230 volt at 60 ma and other 6.3 volts 1.5 amp. Earth screen between primary and secondaries. This will power a 5 watt amplifier (circuit available 2/6). Matching OPT. 56734 described below. Price 18/6 plus 4/6 post. Mains Transformer Type No. 56896

Upright mounting, size approximately 4 x 3 x 2 1/2 in. 2 secondaries 275-0-275 at 90 ma and 6.4 volts at 3.1 ma. There is a screen between primary and secondaries. This is a partner to output transformer 56694 described below. Price 19/6 plus 4/6 post.

OUTPUT TRANSFORMERS

OPT. ref. 56684
 Chassis mounting—size 2 x 2 x 2 1/2 in. approximately 7 watts. A push pull transformer for matching 2/EL84 or similar valves to 15 ohm Loud Speaker. 14/6 no extra for post if ordered with Transformer 56695. Circuit diagram of amplifier available, price 2/6.

OPT. ref. 56787
 Upright mounting, size approximately 3 1/2 x 2 x 2 1/2 in. Matching impedance 60 ohms to 15 ohms. 5 watts output using transistor type AD140 (Circuit diagram available price 2/6). Price 8/6 each, no extra for postage if ordered with mains transformer type 56786.

OPT. ref. 56504
 Upright mounting, size approximately 2 x 2 1/2 x 2 1/2 in. Primary impedance 60 ohm, secondary impedance 3 ohm, otherwise this is as 56787. Price 8/6.

OPT. ref. 56784
 Chassis mounting, size approximately 2 1/2 x 2 x 1 1/2 in. Primary 500 ohm centre tapped. Ratio 271.5 watts output using twin ELL80 or similar. Price 12/6. No extra for postage if ordered with 56733.

HEAVY DUTY MAINS TRANSFORMER

30V. 37A. Primary tapped 200/240 in 10v. steps. A really beautiful "C" core transformer. Made by Parmeko, Impregnated and varnished. Weight approx. 50 lb., size approx. 8in. wide 4 1/2 in. deep and 8 1/2 in. high. Metal framed for free standing and fitted with E.S. screen. Probably priced 240-250 from Parmeko. Ex equipment, but perfect, 217.10 each, plus carriage at cost.

50 CYCLE TO 60 CYCLE INVERTERS

For operating American instruments and other equipment made for 60 cycles 115 v. from 230/240 50 cycle mains. These units have an output of 115 volts A.C. and will handle a load of up to 100 watts. These are precision made and have a reed type frequency meter which vibrates when the frequency is exactly 60 c.p.s. Adjustment of the frequency is by a knob on control panel. Input by 3 core output from 3 pin socket. Original cost of this in excess of 250. A limited quantity available 217/10 each.

MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at 3/6 each, 36/- dozen, your assortment.



WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. 10/- post free.

MAINS OPERATED CONTACTOR

220/240v. 50 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10 amps. Extremely well made by a German Electrical Company. Overall size 2 1/2 x 2 x 2 1/2 in. 19/6 each.



AUTO ELECTRIC CAR AERIAL

With dash board control switch—fully extendable to 40" or fully retracted. Suitable for 12V positive or Neg. earth supplied complete with fitting instructions and ready wired dash board switch 25.18.6 plus 5/- p. & p.



MAINS MOTOR

Precision made— as used in record decks and tape recorders— ideal also for extractor fan, blower, heaters etc. New and perfect. Snip at 9/6. Postage 3/- for first one then 1/- for each one ordered, 12 and over post free.

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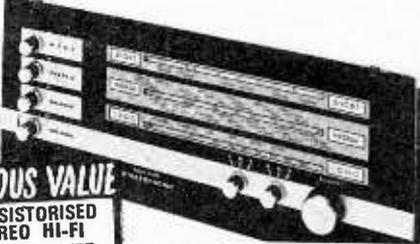
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Stabilised P.U. 200/250v I/P, made by Solartron O/Ps 250 or 350v stab at 100 Ma also 6.3v 3 times, use 7 valves on chassis size 7 x 10 x 6" ex equip 65/-. Amplifier Units for 200/250v uses 7 valves as P.P. 6BW6 in O/P as int monitor speaker and current 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 overhaul 33" high, 22" wide 12½" deep hammer grey finish good cond. £3, Transformers 230v pria Sec 490-400-0-400-490 at 200 Ma, 5v 3a, 6.8 4a, 6.3 1.6a, 12v la C core ex equip 51/L.T. type sec 12v 1.5a 10/6, Osc Unit contains valves 12AT7 x 3, EF91 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, Conds 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 way 2/6 18 way 3/-. Meters 270' scale approx 1.5 Ma basic calibrated in altitude front 3½" 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.

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TRANSISTORISED STEREO HI-FI RECORD PLAYER

Build your own Hi-Fi Record Player with the Sirenade fully transistorised amplifier which comes complete with 2-10" x 6" speakers and the latest BSR 4 Speed Stereo/Mono Record Changer.

Advanced solid state amplifier only 4½" deep, 14 transistors plus 4 diodes, separate Bass and Treble—10 watts total power. Frequency response 50-15,000 c/s.

EASY TO INSTALL
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Callers Welcome

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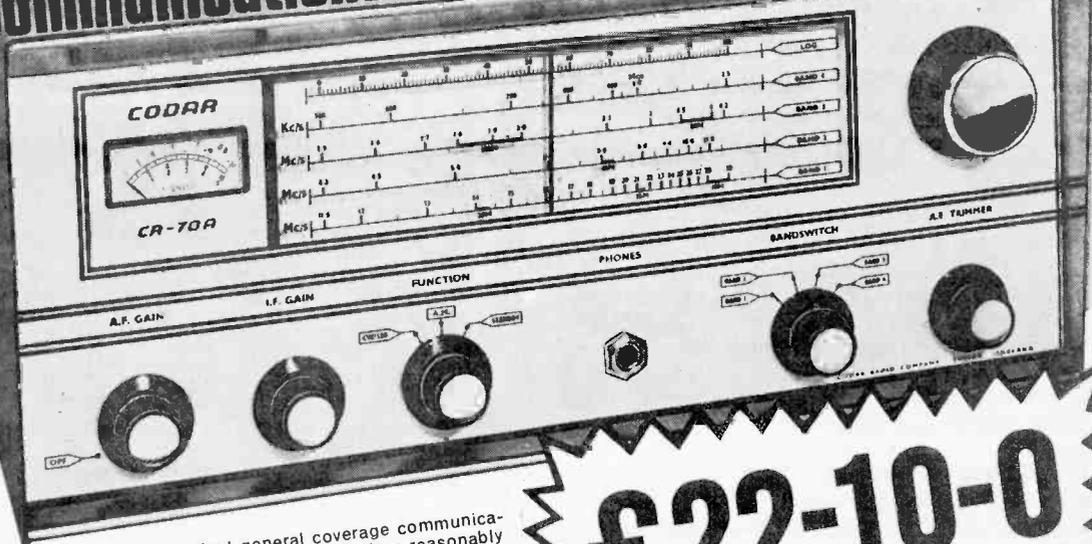
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CODAR CR.70A

Communications Receiver 540-10 metres



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 short wave and international amateur bands 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 I.F. transformers produce high selectivity. Ready to plug into 200-250 volt AC mains, the CR.70A needs only your aerial and a 2-3 ohm loudspeaker. The cabinet measures only 13" x 5½" x 7½" 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, Hi-Fi equipment, etc.

£22-10-0

Carriage 13/- extra

- *Ideal for SWLs *5 valves (inc. two twin triodes) giving 7 valve line-up
- *Excellent on amateur and shipping frequencies
- *Calibrated signal strength meter (illuminated)
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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 CR70A, 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, Biscoe Drive, ABINGDON, Berks.
I received the CR70A quite safely. I must say I am very pleased with it indeed. I have used other communication receivers in my time, and the CR70A 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 CR70A. 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, DRIFFIELD, 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.

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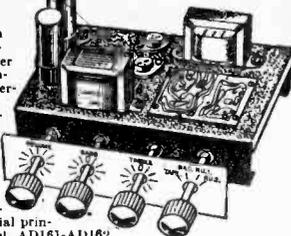
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MONO TRANSISTOR AMPLIFIER HSL 700

A really high fidelity monaural amplifier with performance characteristics to suit the most discriminating listener.



6 transistor circuit with integrated pre-amplifier assembled on special printed sub panel. AD161-AD162 operating in symmetrical complementary pair. Output transformer coupled to 3 ohm and 15 ohm speaker sockets. Standard phono input sockets. Full wave bridge rectifier power supply for AC mains 200-240v. Controls: Bass, Treble, Volume/on/off. Function selector for P.U1, P.U2, Tape, Radio. The HSL 700 is strongly constructed on rigid steel chassis bronze hammer enamel finish, size 8 1/2 x 5 x 4 1/2 in. high.

Construction: P.U1-50m/v. 56K input impedance. P.U2-110m/v. 1 meg input impedance. Tape-110m/v. 1 meg input impedance. Radio-110m/v. 1 meg input impedance. Power measured at 1Kc. 4.5 watts RMS into 3 ohms. 1.58 watts RMS into 15 ohm. Overall frequency response 30 c/s-18 Kc/s. Continuously variable tone controls: Bass, +8db to -12db at 100c/s. Treble, +10db to -10db at 10Kc/s. The HSL 700 has been designed for true high fidelity reproduction from Radio Tuner, Gramophone deck and Tape Recorder preamp. Supplied ready built and tested, complete with knobs, attractive anodised aluminium front escutcheon panel, long spindles (can be cut to suit your housing requirements) full circuit diagram and operating instructions.

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PRICES: AMPLIFIER KIT £10.10.0; POWER PACK KIT £3.0.0; CABINET £5.0.0. All Post Free. Carr. Also available STEREO 14 + 10. As above but 10 watts per channel. PRICES: AMPLIFIER KIT £12; POWER PACK KIT £3.10.0 Circuit diagram, construction details and parts list (free with kit) 1/6 (S.A.E.).

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For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9-18v. battery or from H.T. line 200/300v. Frequency response 15Hz-25KHz. Gain 26dB. Solid encapsulation size 1 1/2" x 1 1/2" x 1/2". Brand new complete with instructions. Price 17/6 P. & P. 2/6.



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QUALITY RECORD PLAYER AMPLIFIER MK II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide x 3in. deep x 6in. high. Ready built and tested. PRICE 75/- P. & P. 6/-

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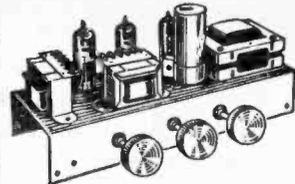
10/14 WATT HI-FI AMPLIFIER KIT A stylish finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other.

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Valve line up: -2 x ECL86 Triode Pentodes, 1 x EZ80 as full wave rectifier. Two dual pentodes are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 30mV for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11" w x 4" d. Overall height including valves 5". Ready built and tested to a high standard. PRICE 28.18.6 P. & P. 8/-

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BP04	7404N	HEX INVERTER	6/6 5/6 4/6
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BP20	7420N	Dual 4-Input NAND GATE	6/6 5/6 4/6
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BP60	7460N	Dual 4-Input - expandable	6/6 5/6 4/6
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BP76	7476N	Dual Master Slave Flip-flop with preset and clear	11/- 10/- 9/6
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BP90	7490N	BCD Decode Counter	22/6 20/- 17/6
BP92	7492N	Divide by 12 4 Bit binary counter	22/6 20/- 17/6
BP93	7493N	Divide by 16 4 Bit binary counter	22/6 20/- 17/6
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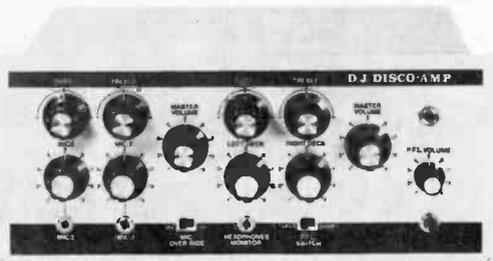
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2N2925	4/6	2N5192	25/-	ABY28	6/8	BF167	8/6	ZTX302	4/6
2N2926	2/3	2N5195	28/3	B5041	15/-	BF178	10/6	ZTX303	4/8
2N2953	5/8	2N5457	9/9	BA102	9/-	BF180	12/-	ZTX304	6/9
2N3054	7/3	2N5458	9/9	BA156	4/-	BF194	7/3	ZTX500	5/-
2N3055	16/-	2N5459	9/9	BA130	4/8	BF195	10/9	ZTX501	5/-
2N3225	10/9	40250	14/3	BA145	5/6	BFX29	7/5	ZTX503	6/-
2N3663	11/8	40361	12/8	BC107	2/8	BFX64	8/3	ZTX504	5/-
2N3702	3/8	40362	16/-	BC108	2/8	BFX86	8/3	ZTX504	12/-
2N3703	3/3	40406	16/3	BC109	2/9	BFX87	8/6	ZTX530	5/5
2N3704	3/9	40408	14/6	BC125	12/-	BFX88	6/9	ZTX531	6/9
2N3705	3/5	40430	37/-	BC126	12/-	BFY50	4/8		

RESISTORS

Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99 (see note below)	100 up
C	1/20W	5%	82 Ω-220K Ω	E12	15	16	15
C	1/8W	5%	4.7 Ω-330K Ω	E24	2.8	2	1.75
C	1/4W	10%	4.7 Ω-10M Ω	E12	2.5	2	1.75
C	1/2W	5%	4.7 Ω-10M Ω	E24	3	2.5	2.25
C	1W	10%	4.7 Ω-10M Ω	E12	6	5	4.5
MO	1/2W	2%	10 Ω-1M Ω	E24	9	8	7
WW	1W	10% ± 1/20 Ω	0.22 Ω-3.9 Ω	E12		15d all quantities	
WW	3W	5%	12 Ω-10K Ω	E12		15d all quantities	
WW	7W	5%	12 Ω-10K Ω	E12		15d all quantities	

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

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

INTEGRATED CIRCUIT AMPLIFIERS

SINCLAIR IC10 complete with instruction book giving amplifier circuit details and range of applications. 59/8 nett.

PLESSEY SL403A Now only 42/8 nett 3W into 7.5 Ω for 18V supply. Application data sent with two more.

WAVELENGTH SWITCHES LONG SPINDLES

1P 12W: 2P 6W: 3P 4W: 4P 3W 4/9 each
SLIDER SWITCHES D.P.D.T. 3/- each

NEON INDICATOR LAMPS

all 200/250V. Square bezel, red only 3/9
Round chrome bezel red, amber, clear 4/9 each

Toggle switches, 250V a.c. 1.5A.
chrome dolly and chrome milled nut S.P.S.T. 3/9; S.P.D.T. 4/8; D.P.D.T. 5/8; S.P.D.T. Centre off 5/-.

S-Dec's put an end to "birdnesting". Components just plain in. Saves valuable time. Use components again and again. S-Dec only 30/-, Compact T-Dec, increased capacity, may be temperature-cycled. T-Dec only 50/- post free. Full range stocked.

MULLARD polyester C280 series

250V 20%: 0.01; 0.022; 0.033; 0.047 8d ea. 0.068; 0.1 8d ea., 0.15 11d., 0.22 1/-, 10%: 0.33 1/5, 0.47 1/8, 0.68 2/3, 1µF 2/8, 1.5µF 4/2, 2.2µF 4/9.

MULLARD SUB-MIN ELECTROLYTIC

C428 range axial lead 1/3 each
Values (µF/V): 0.64/64; 1/40; 1.6/25; 2.5/16; 2.5/84; 4/10; 4/40; 5/64; 6.4/64; 6.4/25; 8/4; 8/40; 10/2.5; 10/16; 10/84; 12.5/25; 16/40; 20/16; 20/64; 25/64; 25/25; 32/4; 32/10; 32/40; 32/64; 40/16; 40/2.5; 50/6.4; 50/25; 50/40; 64/4; 64/10; 80/2.5; 80/16; 80/25; 100/8.4; 125/4; 125/10; 125/16; 160/2.5; 200/6.4; 200/10; 250/4; 320/2.5; 320/6.4; 400/4; 500/2.5.

LARGE CAPACITORS

High ripple current types: 1000/25 5/8; 1000/50 8/2; 1000/100 16/3; 2000/25 7/4; 2000/50 11/4; 2000/100 28/8; 2500/64 15/5; 2500/70 19/8; 5000/25 12/6; 5000/50 21/11; 5000/100 58/8; 10000/15 17/-; 10000/25 24/8; 10000/50 44/-; 10000/70 61/-.

MEDIUM RANGE ELECTROLYTICS

Axial leads: 50/50 2/-; 100/25 2/-; 100/50 2/8; 250/25 2/8; 330/25 2/8; 250/50 3/8; 500/25 3/8; 500/50 4/8; 1000/25 4/-; 1000/50 6/-; 2000/25 6/-.

SMALL ELECTROLYTICS

Axial leads: 4.7/10; 4.7/25; 5/50 1/- ea. 10/10; 10/25; 10/50, 33/10; 50/10 1/- ea. 22/25; 25/50; 47/25; 100/10; 220/10 1/3 ea.

THE NEW 1970 ELECTROVALUE CATALOGUE

48 pages—thousands of items—packed with information 2/- post free. Add 4/- if sent overseas by air mail.

PEAK SOUND PRODUCTS

ENGLEFIELD CABINET KITS

Build it 12 + 12 or 25 + 25



Stereo Amplifier in modular kit from 12 watts per channel £38/9/-; 25 watts £58/15/- Cabinet kit only £8. These prices nett.
As recently reviewed in Hi Fi Sound.

BAXANDALL SPEAKER SYSTEM

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

STEREO AMPLIFIER S.A. 10-10.

Developed from the very successful SA.8-8 amplifier giving first class stereo amplification featuring separate volume controls for each channel, bass and treble controls. 10 watts per channel into 5 to 8 Ω. Kit £19/7/8 nett; built £24/13/8 nett. Suitable 8 Ω wide range speakers with woofer, tweeter & x-over in cabinet available £13/15/- nett.

MAINLINE AMPLIFIER KITS

RCA/808 designed main amplifier kits. Input sensitivity 500-700mV for full output into 8 Ω.
Power Kit price including components Suitable unreg. power supply
12W 188/- nett 92/-
25W 190/- nett N/A
40W 210/- nett 115/1
70W 252/- nett 138/10

30 WATT BAILEY AMP. PARTS

Special summer reduction (to Sept. 30th 1970 only)
Sensitivity 1.2V for full output into 8 Ω
Transistors for one channel £7/5/8 list. £6 only nett.
Transistors for two channels £14/11/- list £11 only nett.
Capacitors and resistors (metal oxide) 30/- per channel nett.
Complete unregulated power supply kit 87/6 nett.

ZENER DIODES

5% full range E24 values: 400mW: 2.7V to 30V 4/8 each
1W: 6.8V to 82V 9/- each 1.5W: 4.7V to 75V 12/- each
Clip to increase 1.5W rating to 3 watts (type 268P) 8d.

CARBON TRACK

POTENTIOMETERS, long spindles
Double wiper ensures minimum noise level.
Single gang linear 220 Ω to 2.2M Ω 2/6
Single gang log 4.7K Ω to 2.2M Ω 2/6
Dual gang linear 4.7K Ω to 2.2M Ω 8/6
Dual gang log 4.7K Ω to 2.2M Ω 8/6
Log/antilog 10K, 47K, 1M Ω only 8/6
Any type with 1A D.P. mains switch, extra 2/3
Please note: only decades of 10, 22 and 47 are available within ranges quoted.

CARBON SKELETON PRE-SETS

Small high quality, type PR, linear only 100 Ω, 250 Ω, 470 Ω, 1K, 2K, 4K, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M, 5M, 10M Ω vertical or horizontal mounting 1/4 each.

COMPONENT DISCOUNTS

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

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Free on orders over £2. Please add 1/8 if under. Overseas orders welcome: carriage charged at cost.

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

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



**ALL valves
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CY31 7/-	ECL86 8/-	PC97 8/-	OA5 2/8	OC29 15/-	OC172 7/6	3FR5 6/6	AF118 10/-	CR83/20 10/-	6P25 11/-	19AQ5 7/9	2051 10/-
DAF96 7/9	EF36 3/6	PC90 9/6	OA10 6/-	OC35 8/6	OC200 6/6	3N123 17/8	AF139 10/-	CR83/30 10/-	6BA7 7/-	19G3 70/-	5933 22/6
DF96 7/6	EF37A 7/-	PC94 6/6	OA70 2/-	OC38 8/6	OC201 7/6	3N139 35/-	AF178 12/6	CR825/025 15/-	68A7GT 6/6	19G8 20/-	6057 10/-
DK96 7/6	EF39 6/-	PCC89 9/-	OA71 2/-	OC44 4/-	OC206 10/-	3N140 19/6	AFY19 22/6	6/6	68C7 13/-	19H4 25/-	6060 7/6
DL92 6/6	EF40 10/-	PCC189 11/-	OA79 1/8	OC45 2/6	IN21 3/6	3N154 19/6	ASY26 5/6	CR83/40 12/6	68CTGT 6/6	20P4 15/-	6066 13/6
DL94 8/-	EF41 12/6	PC8800 18/-	OA81 1/8	OC70 3/6	IN21B 5/-	3N159 29/-	ASY28 5/6	GET103 4/6	68G7 6/6	25L6GT 7/6	6064 7/6
DL96 7/6	EF80 5/-	PCF80 6/6	OA200 1/8	OC71 2/6	IN25 12/-	3FR5 7/6	BAW19 5/6	GET115 9/6	68H7 6/6	30P14 15/-	6065 13/6
DM70 6/6	EF83 9/7	PCF82 6/6	OA202 4/-	OC72 4/-	IN43 4/-	12J60 14/6	BC107 3/6	GET116 3/6	68J7 7/6	30C15 15/-	6080 27/6
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EABC80 6/6	EP95 5/6	PCF802 9/9	OA2206 9/6	OC81DM 8/-	IN825A 25/-	40696 29/-	BB1 9/-	V405A 7/6	68Q7GT 7/9	30FL14 15/6	9006 2/6
EAF42 10/-	EP183 6/6	PCF805 14/6	OA2207 9/6	OC82 5/-	I2MT5 7/6	40699 29/-	BB2 9/-	Z Range 9/6	68Q7GT 7/9	30FL15 17/-	C.R. Tubes
EB91 2/-	EP184 7/6	PCF806 13/6	OA2208 to 2/-	OC82DM 3/-	I2MT10 6/6	AC126 4/6	BB2 9/6	Zener diodes 3/6 ea.	68Q7GT 7/9	30FL16 17/-	CR297 22/6
EB91 2/-	EP184 7/6	PCF806 13/6	OA2213 6/6	OC83 3/-	I2T10 12/9	AC128 6/-	BU100 26/-	BYZ13 5/-	68Q7GT 7/9	30FL17 17/-	VCR27 22/6
EB91 2/-	EP184 7/6	PCF806 13/6	OA2223 to 2/-	OC83B 3/-	I2T10 12/9	AC128 6/-	BYZ13 5/-	Z2A range 7/6 ea.	68Q7GT 7/9	30FL18 17/-	VCR517 50/-
EB91 2/-	EP184 7/6	PCF806 13/6	OA2225 to 2/-	OC84 5/-	IN1306 6/6	AC128 6/-	BYZ16 15/-	Z3B range 7/6 ea.	68Q7GT 7/9	30FL19 18/-	VCR517B55/-
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC122 10/-	IN1307 6/6	AC128 6/-	BYZ16 15/-	Z3B range 7/6 ea.	68Q7GT 7/9	30FL20 18/-	VCR517C45/-
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC139 6/6	2N3053 6/6	AD149 11/-	CR81/20 9/6	ZL range 5/- ea.	68Q7GT 7/9	30FL21 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC140 11/-	2N3054 12/6	AD161 7/-	CR81/30 10/-	ZL range 5/- ea.	68Q7GT 7/9	30FL22 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC141 11/-	2N3055 12/6	AD162 7/-	CR81/35 11/6	ZL range 5/- ea.	68Q7GT 7/9	30FL23 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC142 11/-	2N3056 12/6	AD162 7/-	CR81/40 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL24 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC143 11/-	2N3057 12/6	AD162 7/-	CR81/45 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL25 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC144 11/-	2N3058 12/6	AD162 7/-	CR81/50 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL26 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC145 11/-	2N3059 12/6	AD162 7/-	CR81/55 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL27 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC146 11/-	2N3060 12/6	AD162 7/-	CR81/60 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL28 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC147 11/-	2N3061 12/6	AD162 7/-	CR81/65 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL29 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC148 11/-	2N3062 12/6	AD162 7/-	CR81/70 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL30 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC149 11/-	2N3063 12/6	AD162 7/-	CR81/75 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL31 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC150 11/-	2N3064 12/6	AD162 7/-	CR81/80 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL32 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC151 11/-	2N3065 12/6	AD162 7/-	CR81/85 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL33 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC152 11/-	2N3066 12/6	AD162 7/-	CR81/90 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL34 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC153 11/-	2N3067 12/6	AD162 7/-	CR81/95 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL35 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC154 11/-	2N3068 12/6	AD162 7/-	CR81/100 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL36 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC155 11/-	2N3069 12/6	AD162 7/-	CR81/105 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL37 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC156 11/-	2N3070 12/6	AD162 7/-	CR81/110 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL38 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC157 11/-	2N3071 12/6	AD162 7/-	CR81/115 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL39 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC158 11/-	2N3072 12/6	AD162 7/-	CR81/120 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL40 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC159 11/-	2N3073 12/6	AD162 7/-	CR81/125 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL41 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC160 11/-	2N3074 12/6	AD162 7/-	CR81/130 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL42 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC161 11/-	2N3075 12/6	AD162 7/-	CR81/135 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL43 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC162 11/-	2N3076 12/6	AD162 7/-	CR81/140 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL44 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC163 11/-	2N3077 12/6	AD162 7/-	CR81/145 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL45 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC164 11/-	2N3078 12/6	AD162 7/-	CR81/150 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL46 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC165 11/-	2N3079 12/6	AD162 7/-	CR81/155 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL47 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC166 11/-	2N3080 12/6	AD162 7/-	CR81/160 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL48 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC167 11/-	2N3081 12/6	AD162 7/-	CR81/165 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL49 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC168 11/-	2N3082 12/6	AD162 7/-	CR81/170 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL50 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC169 11/-	2N3083 12/6	AD162 7/-	CR81/175 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL51 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC170 11/-	2N3084 12/6	AD162 7/-	CR81/180 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL52 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC171 11/-	2N3085 12/6	AD162 7/-	CR81/185 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL53 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC172 11/-	2N3086 12/6	AD162 7/-	CR81/190 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL54 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC173 11/-	2N3087 12/6	AD162 7/-	CR81/195 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL55 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC174 11/-	2N3088 12/6	AD162 7/-	CR81/200 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL56 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC175 11/-	2N3089 12/6	AD162 7/-	CR81/205 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL57 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC176 11/-	2N3090 12/6	AD162 7/-	CR81/210 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL58 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC177 11/-	2N3091 12/6	AD162 7/-	CR81/215 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL59 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC178 11/-	2N3092 12/6	AD162 7/-	CR81/220 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL60 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC179 11/-	2N3093 12/6	AD162 7/-	CR81/225 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL61 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC180 11/-	2N3094 12/6	AD162 7/-	CR81/230 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL62 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC181 11/-	2N3095 12/6	AD162 7/-	CR81/235 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL63 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC182 11/-	2N3096 12/6	AD162 7/-	CR81/240 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL64 17/-	5FP7 26/7
EB91 2/-	EP184 7/6	PCF806 13/6	OC16 18/-	OC183 11/-	2N3097 12/6	AD162 7/-	CR81/245 12/6	ZL range 5/- ea.	68Q7GT 7/9	30FL65 17/-	5FP7 26/7
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2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole, 6 way—1 pole, 12 way. All at 3/6 each. 38/- dozen, your assortment.



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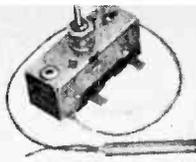
Wire Wound Controls by Welwyn
Standard size approximately 1" (dia) with integral Bakelite control knob. Suitable for preset or variable circuits. Following values available: 15 Ohms, 22 Ohms, 33 Ohms, 100 Ohms, 300 Ohms. Normal retail price about 6/- each. Special snip price 2/- each or £1 per dozen.

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The amplifier sensation of the year. You will be amazed at the fullness of reproduction and at the added qualities your records or tuner will reproduce. Built into metal cabinet elegantly styled in simulated teak finished to blend with modern furnishings, this amplifier uses an integrated solid state circuit with an output power of 6 watts R.M.S. split over the two channels. The amplifier is ideal for use with normal pick-ups and tuners, it has a double wound mains transformer and ganged volume and tone controls—also switching for Mono to Stereo, tuner or pick-up. Other controls include "treble lift and cut", "balance" and separate mains on/off switch. UNREPEATABLE PRICE is £28.18 plus 7/6 post and insurance.



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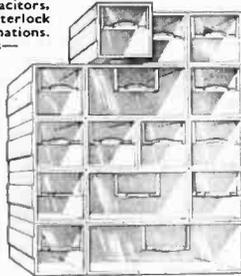
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OA3	0.45	6AR6	0.40	6EW6	0.65	7Y4	0.85		
OB2	0.35	6AS5	0.35	6F1	0.70	9BW6	0.50		
OB3	0.60	6AS7G	0.80	6F5	0.60	10C2	0.50		
OC3	0.38	6AT6	0.30	6F6G	0.30	10D1	0.50		
OD3	0.35	6AB3	0.35	6F7	0.35	10P2	0.40		
1B3GT	0.38	6AV6	0.30	6F13	0.38	10F1	0.90		
1L4	0.20	6AW8A	0.55	6F14	0.65	10F9	0.50		
1R4	0.35	6BA6	0.25	6F15	0.65	10F18	0.45		
1R5	0.35	6BE6	0.30	6F18	0.45	10L1	0.45		
1R4	0.27	6BF5	0.80	6F23	0.80	10LD11	0.60		
1R5	0.25	6BF6	0.50	6F24	0.75	10P13	0.55		
1U4	0.25	6BH5	0.45	6F25	0.75	10P14	1.10		
1U4	0.27	6BJ6	0.45	6F26	0.38	12AB5	0.60		
1U5	0.50	6BK7A	0.55	6F28	0.60	12AC8	0.40		
1V2	0.45	6BL7GA	0.45	6J4	0.50	12AD6	0.40		
1X2B	0.40	0.85	6J5GT	0.30	12AL5	0.45	30A5	0.45	
2D21	0.35	6BN5	0.40	6J7	0.45	12AL5	0.45	30A3	0.40
3A4	0.35	6BN6	0.40	6K6GT	0.55	12AT9	0.30	30C1	0.30
3B28	2.15	6BQ5	0.25	6K7	0.35	12AT7	0.33	30C15	0.50
3BP1	2.75	6BR8	0.65	6K8G	0.35	12AU6	0.30	30C17	0.85
3Q4	0.40	6B8T	1.30	6K23	0.55	12AU7	0.30	30C18	0.75
3S4	0.35	6BW6	0.85	6K25	0.75	12AV6	0.33	30F5	0.65
3V4	0.46	6BW7	0.70	6L6GT	0.45	12AV7	0.50	30FL1	0.70
6R4GY	0.60	6BX6	0.25	6L7	0.40	12AX7	0.30	30FL12	0.33
6U4G	0.33	6BQ5	0.25	6L8	0.40	12AY7	0.55	30FL14	0.75
6U4GB	0.42	6C4	0.33	6LD20	0.40	12BA4	A0.55	30L1	0.40
6V4G	0.42	6C9GT	0.40	6N7GT	0.40	12BA6	0.35	30L15	0.85
6Y3GT	0.32	6CA4	0.28	6P1	0.60	12B7	0.35	30L17	0.70
6Z3	0.50	6CA7	0.50	6P28	0.68	12BE6	0.35	30P12	0.80
6Z4G	0.40	6CB6	0.30	6Q7	0.40	12BH7	0.40	30P19	0.50
6Z6/30L2	0.75	6CD6G	0.45	6S47	0.40	12B17	0.55	30P11	0.70
6B4	0.35	6C4	1.15	6H7G	0.85	12K5	0.55	30PL13	0.83
6B4F4	0.50	6C67	0.70	6H8K	0.85	12K7GT0.35	0.30	30PL14	0.90
6A07	0.40	6CH6	0.55	6LLGT0.35	0.30	12Q7G	0.30	35A3	0.55
6A1H	0.50	6CL6	0.50	6N8GT0.35	0.35	12R87	0.35	35A5	0.75
6A78	0.30	6CV4	0.93	6H87	0.40	14H7	0.80	35B5	0.65
6AK3	0.30	6D3	0.65	6H7	0.40	15B7	0.45	35C5	0.40
6AK6	0.57	6D3	0.45	6T8	0.35	20L1	1.10	35D5	0.70
6AL3	0.43	6D6	0.75	6U4GT	0.80	20P1	0.50	35L6GT	0.60
6AL5	0.20	6DK6	0.48	6V8A	0.40	20P4	1.10	35W4	0.30
6AM6	0.32	6DQ6B	0.83	6V8GT	0.38	20P5	1.20	35Z3	0.60
6AM6	0.33	6DR4	0.75	6X4	0.40	25C3	0.50	35Z4G	0.30
6AQ6	0.35	6E4	0.58	6L8GT	0.45	28D7	0.40	35ZGT	0.40
6AQ6	0.55	6EH7	0.30	6X4	0.55	25Z4G	0.70	50A5	0.70
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30A3	0.40	50C4	0.40	DAF96	0.42	ECC82	0.30
30A3	0.40	50C6	0.40	DF96	0.42	ECC83	0.30
30C1	0.30	50D0G0.15	0.15	DK40	0.55	ECC84	0.30
30C15	0.50	50LGGT0.50	0.50	DK92	0.50	ECC85	0.60
30C17	0.85	83A1	1.50	DK92	0.50	ECC85	0.60
30C18	0.75	85A2	0.40	DK96	0.42	ECC88	0.40
30F5	0.65	90A1	2.50	DY86	0.33	ECC89	0.60
30FL1	0.70	90C1	0.60	DY87	0.35	ECC89	0.60
30FL12	0.33	90C2	1.25	DY87	0.35	ECC89	0.60
30FL14	0.75	90C3	0.70	DY87	0.35	ECC89	0.60
30L1	0.40	90C4	1.50	DY87	0.35	ECC89	0.60
30L15	0.85	90C5	0.60	DY87	0.35	ECC89	0.60
30L17	0.70	90C6	1.25	DY87	0.35	ECC89	0.60
30L18	0.75	90C7	0.60	DY87	0.35	ECC89	0.60
30L19	0.50	90C8	0.60	DY87	0.35	ECC89	0.60
30L20	0.40	90C9	1.50	DY87	0.35	ECC89	0.60
30L21	0.70	90C10	0.60	DY87	0.35	ECC89	0.60
30L22	0.80	90C11	0.60	DY87	0.35	ECC89	0.60
30L23	0.80	90C12	0.60	DY87	0.35	ECC89	0.60
30L24	0.80	90C13	0.60	DY87	0.35	ECC89	0.60
30L25	0.80	90C14	0.60	DY87	0.35	ECC89	0.60
30L26	0.80	90C15	0.60	DY87	0.35	ECC89	0.60
30L27	0.80	90C16	0.60	DY87	0.35	ECC89	0.60
30L28	0.80	90C17	0.60	DY87	0.35	ECC89	0.60
30L29	0.80	90C18	0.60	DY87	0.35	ECC89	0.60
30L30	0.80	90C19	0.60	DY87	0.35	ECC89	0.60
30L31	0.80	90C20	0.60	DY87	0.35	ECC89	0.60
30L32	0.80	90C21	0.60	DY87	0.35	ECC89	0.60
30L33	0.80	90C22	0.60	DY87	0.35	ECC89	0.60
30L34	0.80	90C23	0.60	DY87	0.35	ECC89	0.60
30L35	0.80	90C24	0.60	DY87	0.35	ECC89	0.60
30L36	0.80	90C25	0.60	DY87	0.35	ECC89	0.60
30L37	0.80	90C26	0.60	DY87	0.35	ECC89	0.60
30L38	0.80	90C27	0.60	DY87	0.35	ECC89	0.60
30L39	0.80	90C28	0.60	DY87	0.35	ECC89	0.60
30L40	0.80	90C29	0.60	DY87	0.35	ECC89	0.60
30L41	0.80	90C30	0.60	DY87	0.35	ECC89	0.60
30L42	0.80	90C31	0.60	DY87	0.35	ECC89	0.60
30L43	0.80	90C32	0.60	DY87	0.35	ECC89	0.60
30L44	0.80	90C33	0.60	DY87	0.35	ECC89	0.60
30L45	0.80	90C34	0.60	DY87	0.35	ECC89	0.60
30L46	0.80	90C35	0.60	DY87	0.35	ECC89	0.60
30L47	0.80	90C36	0.60	DY87	0.35	ECC89	0.60
30L48	0.80	90C37	0.60	DY87	0.35	ECC89	0.60
30L49	0.80	90C38	0.60	DY87	0.35	ECC89	0.60
30L50	0.80	90C39	0.60	DY87	0.35	ECC89	0.60
30L51	0.80	90C40	0.60	DY87	0.35	ECC89	0.60
30L52	0.80	90C41	0.60	DY87	0.35	ECC89	0.60
30L53	0.80	90C42	0.60	DY87	0.35	ECC89	0.60
30L54	0.80	90C43	0.60	DY87	0.35	ECC89	0.60
30L55	0.80	90C44	0.60	DY87	0.35	ECC89	0.60
30L56	0.80	90C45	0.60	DY87	0.35	ECC89	0.60
30L57	0.80	90C46	0.60	DY87	0.35	ECC89	0.60
30L58	0.80	90C47	0.60	DY87	0.35	ECC89	0.60
30L59	0.80	90C48	0.60	DY87	0.35	ECC89	0.60
30L60	0.80	90C49	0.60	DY87	0.35	ECC89	0.60
30L61	0.80	90C50	0.60	DY87	0.35	ECC89	0.60
30L62	0.80	90C51	0.60	DY87	0.35	ECC89	0.60
30L63	0.80	90C52	0.60	DY87	0.35	ECC89	0.60
30L64	0.80	90C53	0.60	DY87	0.35	ECC89	0.60
30L65	0.80	90C54	0.60	DY87	0.35	ECC89	0.60
30L66	0.80	90C55	0.60	DY87	0.35	ECC89	0.60
30L67	0.80	90C56	0.60	DY87	0.35	ECC89	0.60
30L68	0.80	90C57	0.60	DY87	0.35	ECC89	0.60
30L69	0.80	90C58	0.60	DY87	0.35	ECC89	0.60
30L70	0.80	90C59	0.60	DY87	0.35	ECC89	0.60
30L71	0.80	90C60	0.60	DY87	0.35	ECC89	0.60
30L72	0.80	90C61	0.60	DY87	0.35	ECC89	0.60
30L73	0.80	90C62	0.60	DY87	0.35	ECC89	0.60
30L74	0.80	90C63	0.60	DY87	0.35	ECC89	0.60
30L75	0.80	90C64	0.60	DY87	0.35	ECC89	0.60
30L76	0.80	90C65	0.60	DY87	0.35	ECC89	0.60
30L77	0.80	90C66	0.60	DY87	0.35	ECC89	0.60
30L78	0.80	90C67	0.60	DY87	0.35	ECC89	0.60
30L79	0.80	90C68	0.60	DY87	0.35	ECC89	0.60
30L80	0.80	90C69	0.60	DY87	0.35	ECC89	0.60
30L81	0.80	90C70	0.60	DY87	0.35	ECC89	0.60
30L82	0.80	90C71	0.60	DY87	0.35	ECC89	0.60
30L83	0.80	90C72	0.60	DY87	0.35	ECC89	0.60
30L84	0.80	90C73	0.60	DY87	0.35	ECC89	0.60
30L85	0.80	90C74	0.60	DY87	0.35	ECC89	0.60
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30L88	0.80	90C77	0.60	DY87	0.35	ECC89	0.60
30L89	0.80	90C78	0.60	DY87	0.35	ECC89	0.60
30L90	0.80	90C79	0.60	DY87	0.35	ECC89	0.60
30L91	0.80	90C80	0.60	DY87	0.35	ECC89	0.60
30L92	0.80	90C81	0.60	DY87	0.35	ECC89	0.60
30L93	0.80	90C82	0.60	DY87	0.35	ECC89	0.60
30L94	0.80	90C83	0.60	DY87	0.35	ECC89	0.60
30L95	0.80	90C84	0.60	DY87	0.35	ECC89	0.60
30L96	0.80	90C85	0.60	DY87	0.35	ECC89	0.60
30L97	0.80	90C86	0.60	DY87	0.35	ECC89	0.60
30L98	0.80	90C87	0.60	DY87	0.35	ECC89	0.60
30L99	0.80	90C88	0.60	DY87	0.35	ECC89	0.60
30L100	0.80	90C89	0.60	DY87	0.35	ECC89	0.60
30L101	0.80	90C90	0.60	DY87	0.35	ECC89	0.60
30L102	0.80	90C91	0.60	DY87	0.35	ECC89	0.60
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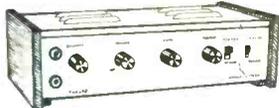
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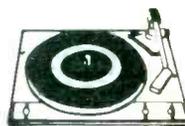
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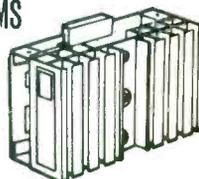
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