

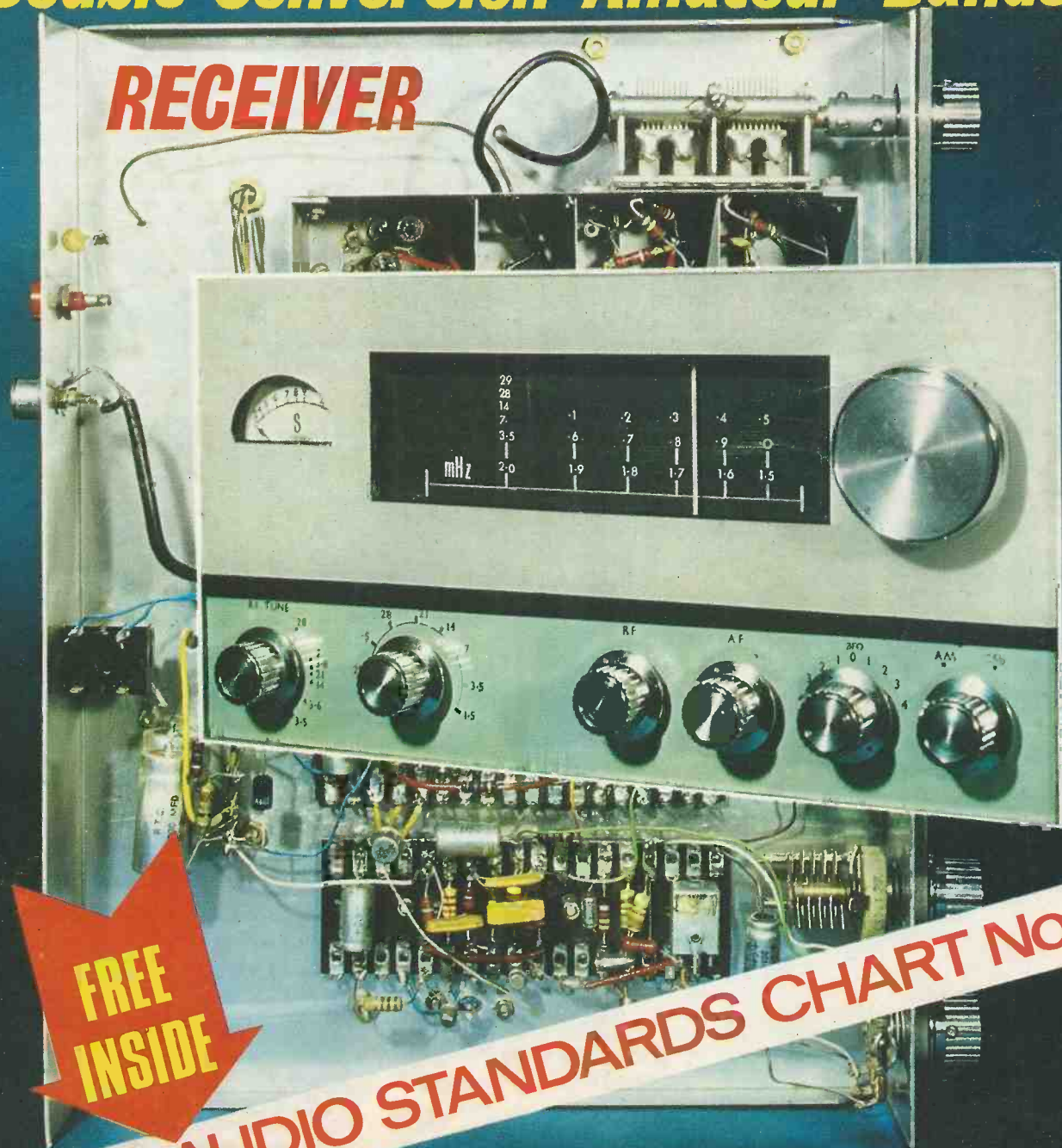
PRACTICAL WIRELESS

DECEMBER
1970

316
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Double Conversion Amateur Bands

RECEIVER



FREE
INSIDE

AUDIO STANDARDS CHART No.1

ADCOLA Soldering Instruments add to your efficiency

ADCOLA 64

for Factory Bench Line Assembly

A precision instrument—supplied with standard 3/16" (4.75 mm) diameter, detachable copper chisel-face bit*.

Standard temp. 360°C at 23 watts.

Special temps. from 250°C—410°C.

*Additional Stock Bits

(illustrated) available

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B 38 $\frac{1}{4}$ " — 3.2 mm CHISEL FACE

B 14 $\frac{3}{16}$ " — 2.4 mm CHISEL FACE

B 24 $\frac{1}{8}$ " — 4.75 mm SCREWDRIVER FACE

B 12 $\frac{1}{16}$ " — 4.75 mm EYELET BIT

B 58 $\frac{1}{2}$ " — 6.34 mm CHISEL FACE

LONG LIFE

B 42 LL $\frac{1}{4}$ " — 4.75 mm CHISEL FACE

B 38 LL $\frac{1}{8}$ " — 3.2 mm CHISEL FACE

B 14 LL $\frac{3}{16}$ " — 2.4 mm CHISEL FACE

B 44 LL $\frac{3}{16}$ " — 4.75 mm SCREWDRIVER FACE



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



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JACKSON BROTHERS

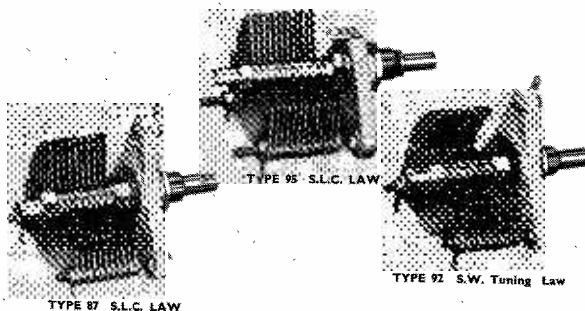
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WAVEMASTER

VARIABLE CAPACITORS



'Wavemaster' variable capacitors have brass vanes and a single ceramic end plate. All have .248" spindles, extended both ends for ganging by means of our Universal Couplings. All are designed for S.W. working and for one hole fixing. 6mm spindles to order if required. Various capacitances. Largest vane packs 300 pF .017 air gap, 50 pF 0.64 air gap.



Type 87
S.L.C. Law
Plain bearings $\frac{3}{16}$ "
fixing bush. Front
area $1\frac{1}{2}$ " w. x $1\frac{1}{2}$ " h.

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S.L.C. Law
Ball bearings $\frac{7}{16}$ "
dia. fixing bush.
Front area $1\frac{1}{2}$ " w. x
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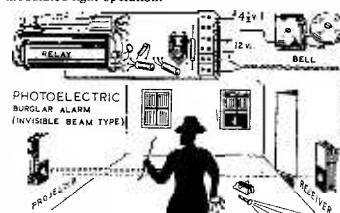
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S.L.C. Law
(S.W. Tuning)
Plain bearings $\frac{3}{8}$ " dia.
fixing bush. Front
area $1\frac{1}{2}$ " w. x $1\frac{1}{2}$ " h.

JACKSON BROTHERS (London) LTD

Kingsway, Waddon, Croydon, CR9 4DG. 'Phone: 01-688 2754-5
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PHOTOELECTRIC KIT

CONTENTS: 2 P.C. Chassis Boards, Chemicals, Etching Manual, Infra-Red Photo-transistor, Latching Relay, 2 Transistors, 3 Diodes, Resistors, Gain Control, Terminal Block, Elegant Case, Screws, etc. In fact everything you need to build a Steady-Light Photo-Switch/Counter/Burglar Alarm, etc. (Project No. 1) which can be modified for modulated-light operation.



PHOTOELECTRIC KIT

39/6

Postage and Pack. 2/6 (UK)
Commonwealth:
SURFACE MAIL 3/6
AIR MAIL £1.0.0
Australia, New Zealand,
S. Africa, Canada and U.S.A.
Also Essential Data Circuits
and Plans for Building
10 Advanced Designs

INVISIBLE BEAM OPTICAL KIT

Everything needed (except plywood) for building: 1 Invisible-Beam Projector and 1 Photocell Receiver (as illustrated). Suitable for all Photoelectric Burglar Alarms, Counters, Door Openers, etc.

CONTENTS: 2 lenses, 2 mirrors, 2 45-degree wooden blocks, Infra-red filter, projector lamp holder, building plans, etc. Price 19/6. Postage and Pack. 1/6 (U.K.). Commonwealth: Surface Mail 2/-; Air Mail 8/-.

LONG RANGE INVISIBLE BEAM OPTICAL KIT

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

JUNIOR PHOTOELECTRIC KIT

Versatile Invisible-beam, Relay-less, Steady-light Photo-Switch, Burglar Alarm, Door Opener, Counter, etc., for the Experimenter.

CONTENTS: Infra-Red Sensitive Phototransistor, 3 Transistors, Chassis, Plastic Case, Resistors, Screws, etc. Full Size Plans, Instructions, Data Sheet "10 Advanced Photoelectric Designs".

Price 19/6. Postage and Pack. 1/6 (U.K.). Commonwealth 2/-; Air Mail 4/-.

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CONTENTS: 2 Lenses, Infra-red Filter, Lampholder, Bracket, Plans, etc. Everything (except plywood) to build 1 miniature invisible beam projector and photocell receiver for use with Junior Photoelectric Kit.

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335 BATTERSEA PARK RD., LONDON S.W.11

Send a S.A.E. for full details, a brief description and Photographs of all Kits and all 52 Radio, Electronic and Photoelectric Projects Assembled.

knight-kits

FANTASTIC LOW PRICES!

Due to huge purchase these superb U.S.A. construction kits can be offered at 25%—50% off recommended list prices. Absolutely complete with most detailed construction and operating books. Available from all branches or by mail order for 7/6 CARRIAGE AND PACKING on each kit. Two kits or more carr. free.

KG-865 50 Watt Stereo Amplifier Kit

DELUXE FEATURES

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



● Output: 50W I.H.F., 25W per channel; 34W continuous sine wave ● Response: $\pm 1\text{dB}$, 18 to 30,000Hz ● Output Impedance: 4 through 16ohms, plus stereo headphones ● T.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 29 GNS. Teak Case £5 extra

ALL SILICON TRANSISTORS

The NEW KG-980 Stereo FM Receiver Kit

Designed to Satisfy the Most Critical Listener



R.F. and I.F. Panels Assembled and Aligned ● Front Panel Stereo Headphone Jack and Speaker Muting Switch ● Full Controls including Tape Monitor ● 50W I.H.F. Output ● Usable I.H.F. Sensitivity: 3 μV ● Frequency Response: $\pm 1\text{dB}$, 30 to 15,000Hz ● Harmonic Distortion: less than 1.0% ● A.M. Suppression: more than 30dB ● Channel Separation: 30dB ● Complimentary Transformers ● Power Output: 50W I.H.F. (25W per channel); 34W continuous sine wave ● Frequency Response: $\pm 1\text{dB}$, 18 to 30,000Hz ● Power Bandwidth: 20-20,000Hz at 1% harmonic distortion ● Two R.F. Stages ● Stereo indicator light. Recommended List Price £42.19.6: 39 GNS. Assembled 49 GNS. Teak Case 5 GNS. Extra.

KG-375A Deluxe Solid-State Auto Analyzer Kit

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

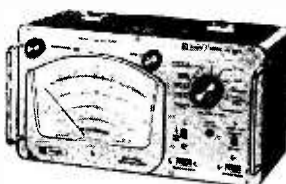
Its several testers in one . . . do all this

Set Engine Idle and Automatic Transmission Shift Points ● Detect Condition of Point Surfaces ● Detect Distributor Wear ● Check Voltage and Current Regulators ● Check Generators for both Current and Voltage Output ● Find Poor or Open Earth Circuits ● Detect Variation in Dwell Angle. 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. 0-0.5-1.6-6-15-50-100-500-1,500V 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. ● Accuracy: $\pm 5\%$ ● Frequency Response: 1dB, 30Hz to 3MHz; $\pm 3\text{dB}$, 30Hz to 5MHz ● Ohmmeter Ranges: 1-1,000-10,000 ohms; 0-1-10-100-1,000M Ω ● Battery 11V U2. Recommended List Price £24.19.6: 12 GNS. KG 625 as KG 625 (same Ranges) but 4in Scale: Recommended List Price £18.5.6 9: 3NS.



WHY NOT BUY THE PAIR?

KG-371 Deluxe Solid-State Timing Light

Performance surpasses assembled units costing much more

Helps Set Ignition Timing ● Checks Synchronisation of Double Breaker Arms ● Checks for Sticking Automatic Spark-Advance Mechanism ● Checks Distributor Cam Wear ● Built-in D.C. Power Supply ● Reliable Solid-State Circuit ● Your car gives more miles per gallon; improved performance; Greater reliability. Recommended List Price £12.10.0: 9 GNS. Available Assembled Only.



100-in-1 Electronic Science Lab

LOOK AT THE PROJECTS YOU CAN BUILD

Electronic Scale ● Electronic Timer ● Signal Generator ● Hybrid Light Meter ● Signal Injector ● Morse Code Buzzer ● Electronic Cat ● Metronome ● Code Flasher ● CW Monitor ● Ohmmeter ● Boat Horn ● Hybrid Radio ● Hybrid Voice Relay ● Air-Powered Radio ● Polarity Checker ● Valve Checker. Includes: ● Dual Headset ● Photocell ● Speaker ● Meter ● Aerial ● Transistors. Recommended List Price £16.8.0: 9: 3NS.



KG-640 20,000 ohms/Volt VOM Kit

BIG PROFESSIONAL SIZE 62 RANGE MULTIMETER ● A.C. Volts (12 Ranges): 0-2-4-8-16-40-80-300-400-800-1,500-2,000-4,000V ● D.C. Volts (12 Ranges): 0-0.8-1-2-3-16-40-80-400-800-1,600-2,000-4,000V ● Output Volts (8 Ranges): 0-2-4-8-16-40-80-200-400V ● Resistance (8 Ranges): 0-1,000-100,000 ohms-10 megs. Centre scales at 12, 1,200 and 120K Ω ● D.C. Current (10 Ranges): 0-80-160-400-800 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: 20Hz to beyond 200kHz ● Accuracy: D.C. 3%, A.C. 5% ● Test Leads: one red, one black, each 48in long ● Multiplier Resistors: All 1% carbon film. Recommended List Price £16.19.6: 9: 3NS. Assembled Price 12 GNS.



JASON TAPE

We offer you fully tensilised polyester/nylon and P.V.C. tapes of identical quality hi-a, wide range recording characteristics as top grade tapes. Quality control manufacture. They are truly worth a few more pence than acetate, sub-standard, jointed or cheap imports. TRY ONE AND PROVE IT YOURSELF.

Postage 1/- reel. Post free less 5% on three reels. Quality and Trade enquiries invited. NOTE. Large tape stocks at all branches.

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

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 - ★ SOUTHAMPTON 72 East Street Tel. 25851

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

GARRARD 1025 Autochangers complete with GARRARD STEREO CARTRIDGE 7 $\frac{1}{2}$ GNS.

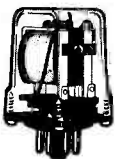
MAGNETIC CARTRIDGES Goldring 800H 7 $\frac{1}{2}$ GNS.

Shriro AT33 £7.10.0 (Both listed over £10)

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 Hobbyist, Serviceman, 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 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

JUST ARRIVED

Lasky's C60, C90, C120.

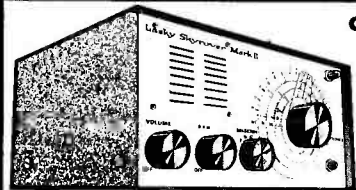
Exclusively made for us in U.S.A. Great Savings!

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

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



SKYROVER mkII



COMMUNICATION RECEIVER

A short wave receiver, exclusive to Lasky's, at a real economy price. Four valve line up using one each 6BE6, 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 bands spread 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: ± 2%, ACV: ± 3%, resistance ± 3%. Special 0-6V DC range for transistor circuit measurements.

SPECIFICATION

● DCV: 0-0.6-6-30-120-600-1,200V at 20K/OPV. ● ACV: 0-6-30-120-600-1,200V at 10K/OPV. ● DC Current: 0-0.6-6-60mA. ● Resistance: 0-10K 100K-1M-10M/ohms (58-580-5.8K-58K at mid-scale). ● Capacitance: 0-0.02-0.2μF (AC 6V range). ● Decibels — 20 to ± 63dB. ● Output: 0-0.5μF blocking capacitor. Uses two 1.5V (UT 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

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 μA 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. DCμA: 0-25μA at 125mA; 0-50μA at 250mA. DCmA: 0-0.25-2.5-25-250mA at 125mV; 0-5-50-500mA at 250mV. DC Amps: 0-5A at 125mV; 0-10A at 250mV. Resistance: 0-10M/ohms. Output: Capacitor (0-1μF, 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/-

EXCLUSIVE TMI & TMS

MODEL TM-1 MINI TESTER

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

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



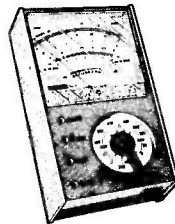
Size Only 3 1/2 in. x 1 1/2 in.

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 1/2 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.

- DC/V: 3-15-150-300-1,200 at 5K OPV.
- AC/V: 6-30-300-600 at 2.5K OPV.
- DC Current 0-300μA, 0-300mA.
- Resistance: 0-10kΩ, 0-1MΩ.
- Decibels: —10dB to 16dB.
- Complete with test leads, battery and instructions.



LASKY'S PRICE 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: SPCL for WB1 £3 14 1. SPCL for WB4 and WB5 (allows unit to be played with the cover in place)—Price £4 8 6.



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—23mV 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 20x3½x16in. 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 3,000Hz Single Player £13 6 7
AUDIO DEVELOPMENT AD-36K Magnetic Cartridge £5 18 4
2 WHARFEDALE DENTON Speaker Systems £34 0 0
"Compact" Teak Cabinet (as shown) £7 10 0
TOTAL RECOMMENDED LIST PRICE £148.5.1

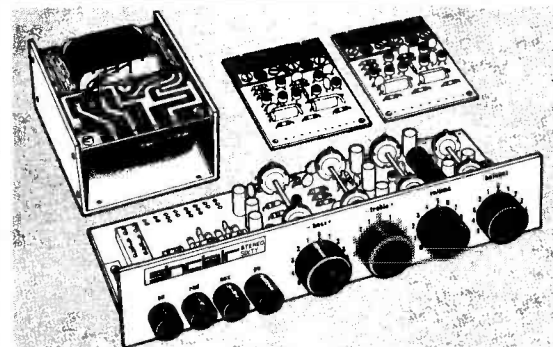
**LASKY'S
PACKAGE
PRICE**



£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-60 pre-amp. control unit. 3. The PZ-30 unbalanced and PZ-4 stabilised power supplies. A complete system comprises two Z-30's, one Stereo-60 and a PZ-3 or PZ-4.

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: 15 w. R.M.S. into 8 ohms using a 35 volt supply • Frequency response: 30 to 300,000Hz = 1dB • Distortion: 0.02% • Signal to noise: better than 70dB • Input sensitivity: 250mV into 100 K ohms • Loudspeaker imp: 3 to 15 ohms • Power requirements: from 8 to 35V DC (The Z30 will run from batteries if required) • Size: 3½ x 2¼ x 1½in. **89/6** post 3/6

30V unbalanced — sufficient to drive two Z-30's and a Stereo 60 for domestic applications. **99/6** Post 2/6

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-3 **£19.19.6** Post 10/-

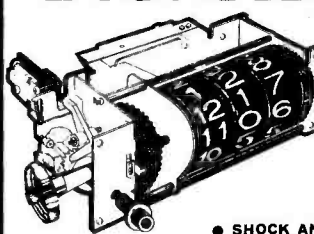
INTERNATIONAL

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 0	5¼in. Triple play, 2400ft.	35 0
3in. Message tape, 300ft.	7 8	7in. Standard play, 1200ft.	12 6
3¼in. Triple play, 600ft. Mylar	10 0	7in. Standard play, 1200ft.	12 6
5in. Double play, 1200ft.	15 0	7in. Long play, 1800ft. Mylar	19 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 8	7in. Triple play, 3600ft. Mylar	30 0
5¼in. Long play, 1200ft. Acetate	15 0		
5¼in. Standard play, 900ft. PVC	12 8		

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

EXCLUSIVE DIGITAL CLOCK SCOOP!



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

- SHOCK AND VIBRATION PROOF
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SPECIAL QUOTATIONS FOR QUANTITIES

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



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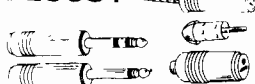
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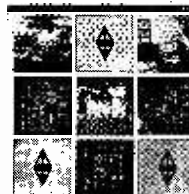
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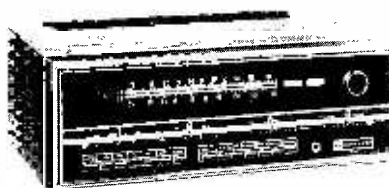
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 - ★ **PAIR OF STANWAY II** Loudspeaker units
- 76 Gns.** Carr. 30/-
Units Special Total Price

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

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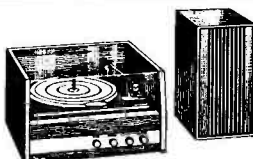
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GARRARD 5200 Changer

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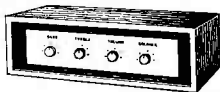
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HIGH FIDELITY OUTPUT OF 6.5 WATTS PER CHANNEL

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TRANSISTORS 9 high quality types in each channel.

OUTPUT 10 Watts R.M.S. continuous into 16Ω (per channel). 15 Watts R.M.S. continuous into 3Ω.

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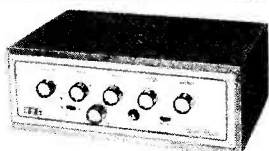
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Employing Twin Printed Circuits.

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TYPE BM1 An all-day battery eliminator. Size 5 1/2 x 4 1/2 x 2 1/2 in. approx. Completely replaces batteries supplying 1.5v. and 90v. where A.C. mains 200/250v. 500c/s is available. Complete kit with diagram 59/9 or assembled 69/9.

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



200-250v. A.C. mains operated. Frequency Response 30-20,000 c.p.s. -20dB. Harmonic Distortion 0.3% at 1,000 c.p.s. Separate Bass and Treble. 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 5 1/2 in. Attractive brushed silver finish 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

OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE £8.19.9

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



PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP. Two input sockets with mixing facilities High sensitivity. 5 valves. Independent Bass and treble controls. Frequency response ± 3dB 30-20,000 c/s. Hum level -60dB. Sensitivity 40 mV. Output rating I.H.F.M. For Crystal or Ceramic P.U.s. High Impedance "mikes". For Musical Instruments etc. **10. Gns**

Std. A.C. mains. For 3 & 15 ohm spkrs. Complete kit. Full instructions and point-to-point wiring diagrams. Carr. 11/6. SAR for leaflet. Twin handled metal cover 35/-. Price Factory built 14 gns. or Deposit 23 and 9 monthly payments of 21/6 (Total £17.8.8.)

R.S.C. COLUMN SPEAKERS

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

TYPE C4100 also suitable for Bass Guitar or Electronic Organ.

TYPE C485 20-30 WATTS Fitted four 8" high flux 8 watt speakers.

Overall size approx 48 x 10 x 5 in. Carr. 10/-

Terms: Dep 23 and 9 monthly payments 35/6 (Total £18.19.8) **16 Gns.**

TYPE C4100 100 watts inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Acoustically filled and pressurised.

Terms: Deposit 23 and 9 monthly payments £5.10.6 (Total £57.14.8).

30 WATT HI-FI AMPLIFIER

FOR GUITAR, VOCAL OR INSTRUMENTAL GROUP.

A 2 or 4 input. 2 vol. control Hi-Fi unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/gold P.V.A. fascia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. Terms: Deposit £3.14.0 and 9 monthly payments of 42/- (Total £32.12.0) Carr. 12/6



HI-FI CENTRES LTD.



HIGH QUALITY LOUSPEAKER UNITS

IN TEAK OR AFRORMOSIA VENEERED CABINETS

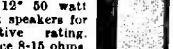
L13 13" x 8" 10 Watt 10,000 lines 3 or 15 ohms. State impedance required. **5 Gns.** Carr. 7/6

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

£8-19-9

L125 50 WATT

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



R.S.C. BASS REGENT 50 WATT AMPLIFIER

A powerful high quality all-purpose unit for lead, rhythm, bass guitar.

vocalists, gram, radio, tape. Peak Output rating. Loudspeaker unit horizontal or vertical mounting.

★ Two extra heavy duty 12in. Loudspeakers.

★ Four Jack inputs and two Volume Controls for simultaneous use of up to four pick-ups or "mikes". Bass and Treble controls. Send S.A.E. for leaflet.

Deposit £13.4.9 and 9 monthly payments of £5.11.9 (Total 60½ gns.)



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 618 or send S.A.E. for leaflet.

guard against damage from accidental shorts

I.H.F.M. Output rating **59 Gns.**

FAL PHASE 100 AMPLIFIER

100 Watt Solid State 4 Separately controlled inputs Plus master volume Control. Ind. Bass and Treble Controls. Output for speaker/s 3-30 ohms. Protective circuit to

guard against damage from accidental shorts

I.H.F.M. Output rating **59 Gns.**

FANE ULTRA HIGH POWER LOUSPEAKERS

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

'POP' 100 18" 100 Watt 14,500 gauss 8/150 **21 gns.**

Dep: 26 and 9 monthly payments 26/6 (Total £16.1.6.)

FOR BASS GUITAR OR ELECT. ORGAN, ETC.

'POP' 60 15" 60 Watt 14,000 gauss 8/150 **£12.18.0.**

Dep: 3 gns. and 9 monthly payments 26/6 (Total £16.1.6.)

FOR BASS GUITAR OR ELECT. ORGAN, ETC.

'POP' 50 12" 50 Watt 14,000 gauss 10 GNS. 150

Dep 22 and 9 monthly payments 22/6 (Total £12.2.6)

Pair suitable all purposes (Total £17.0.)

FOR BASS GUITAR OR ELECT. ORGAN, ETC.

FANE LOUSPEAKERS

'POP' 30C 12in. 25 WATT Dual Cone 15Ω

(For uses other than Bass Guitar or Electronic Organ)

£5-19-9 Carr. free

or Dep. 21 and 9 monthly payments 13/- (Total £17.0.)

FOR BASS GUITAR OR ELECT. ORGAN, ETC.

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

Highly sensitive. Push-Pull high output with Pre-amp/Tone Control Stages. Hum level -70dB. Frequency response ±3dB 30-20,000 c/s. All high grade components. Valves EF86, EF86, EOC83, 807, 807, 0234. Separate Bass and Treble Controls. Sensitivity 36 millivolts. Suitable for High Impedance microphones. Designed for Clubs, Schools, Theatres, Dance Halls or Outdoor Functions, etc. For use with Electronic Organ, Guitar, etc. Complete kit of parts with point to point wiring diagram and instructions. Twin-handled perforated cover 35/-. **15 Gns.**

OR factory built with EL34 output valves and 12 months' guarantee for 18 gns. Carr. 12/6

TERMS: Deposit £3.9.0 and 9 monthly payments of £2 (Total £21.9.0). Send S.A.E. for leaflet.

RSC TRANSFORMERS, L.F. CHOKES & RECTIFIERS

FULLY GUARANTEED. Impregnated and Interleaved where necessary

Primary 200-250v. 500c/s. Screened MIDGET CLAMPED TYPE 2 1/2 x 2 1/2 in.

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

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

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v., 60mA, 6.3v. 2a., 0-5-6.3v. 2a. 24/9

250-0-250v., 100mA, 6.3v. 4a., 0-5-6.3v. 3a. 36/8

425-0-425v., 200mA, 6.3v. 4a., e.t., 5v. 3a. 39/9

300-0-300v., 100mA, 6.3v. 4a., e.t., 5v. 3a. 39/9

300-0-300v., 130mA, 6.3v. 4a., e.t., 5v. 3a. 47/11

For Mullard 510 Amplifier

350-0-350v., 100mA, 6.3v. 4a., 0-5-6.3v. 3a. 39/9

300-0-350v., 150mA, 6.3v. 4a., 0-5-6.3v. 3a. 47/9

425-0-425v., 200mA, 6.3v. 4a., e.t., 5v. 3a. 89/9

350-0-425v., 200mA, 6.3v. 4a., e.t., 5v. 3a. 93/9

450-0-450v., 250mA, 6.3v. 4a., e.t., 5v. 3a. 99/9

TOP SHROUDED DROP-THERO TYPE

250-0-250v., 70mA, 6.3v. 2a., 0-5-6.3v. 2a. 23/9

250-0-250v., 100mA, 6.3v. 3.5a. 27/11

FILAMENT OR TRANSFORMER POWER PACK

Types 6.3v. 1.6a. 8/9; 6.3v. 2a. 9/9; 6.3v. 3a. 13/9;

6.3v. 6a. 22/9; 12v. 1a. 9/11; 12v. 2a. or 24v. 1.6a. 23/9; 0.9-18v. 1.1a. 19/11; 0-12-25-42v. 2a. 31/9

CHARGER TRANSFORMERS 0-9-15v. 1.1a. 18/9;

24a. 19/11; 3a. 21/11; 5a. 25/11; 6a. 29/9; 8a. 36/9

ATRO (Step Up/Step Down) TRANSFORMERS

0-110/120v. 200-250/350v. 50-80 watts 18/9;

150 watts, 33/6 250 watts 49/9; 500 watts 105/-

OUTPUT TRANSFORMERS

Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω 8/9

Push-Pull 8 watts EL34 to 3 Ω or 15 Ω 14/9

Push-Pull 10 watts 6V6, 6CL6 to 3 Ω, 5 Ω, 8 Ω 15/-

Push-Pull EL284 to 3 Ω or 15 Ω 16-12 watt 18/9

Push-Pull Ultra Linear for Mullard 510, etc. 39/9

Push-Pull 15-18 watts, sectionally wound 616, KT66, etc., for 3 Ω or 15 Ω 35/9

Push-Pull 20 watt high quality sectionally wound EL34, 616, KT66 etc. to 3 Ω or 15 Ω 59/9

SMOOTHING CHOKES 150mA, 8-10H, 250 Ω 12/9; 100mA, 10H, 200 Ω 19/9; 80mA, 10H, 350 Ω 8/9; 60mA, 10H, 400 Ω 4/11

SELENIUM RECTIFIERS F.W. (Bridged) All 12v. D.C. output. Max. A.C. input 18v. 1a. 4/8. 2a. 6/11. 3a. 9/9. 4a. 12/9. 5a. 16/9.

CRESCENT RADIO LTD.

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

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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 3 1/2" x 2" x
2 1/2" high. 12/6 each. P. & P. 3/-.

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



SHELF UNIT

Two teak finish shelves on a black frame
(overall size: 28in. x 26in. 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 1/4" x 2 1/4" x 1 1/4" deep.

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

IMPORTED PANEL METERS

KA-38C 1 1/2" x 1 1/2" 50μA,
100μA, 500μA, 1mA,
5mA. 8 meter 1mA, 300v.
All at

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

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

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

All modern design and made to high standards.



E.M.I. SET 450

3, 8 or 15 Ω, 10 watts.

65/- Plus 7/6 P. & P.

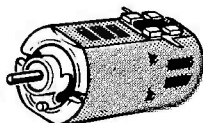
E.M.I. SET 150

This speaker has a flared
centre tweeter cone and
handles up to 10 watts
Size—13" x 5" x 5"
3, 8 & 15 ohms

50/- each
+7/6 P. & P.

SEND FOR FREE LISTS OF SEMI CONDUCTORS

MODEL MAKERS MOTOR



Rated up to 11.5 volt 400mA, torque
12g-cm. Size—1 1/2" long x 7/8" diam.
Shaft—1/8" long x 1/16" diam.
4/6 each. P. & P. 1/6.

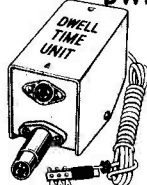
COMPONENT CENTRE

8" x 6" one sided printed circuit board	2/- each
BY100 type rectifier 800 pV 750mA	3/3 each
4-pin transistor holders	6d. each
2 1/2" 80 ohm loudspeaker	5/6 each
2 1/2" 8 ohm loudspeaker	6/6 each
2 1/2" 25 ohm loudspeaker	5/6 each
U2 battery holders (blue plastic)	1/- each
10 ohm w/w pots	2/6 each
OC81 double heat clips	6d. each
Tape recorder rev. counters	5/- each
Transistors, Diodes, S.C.B.s etc.	Send for list now

Please include P. & P.

Send 3/- for our Component Catalogue and Flog Lists.

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 2N2926 type transi-
stor 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.

FLICK SWITCHES



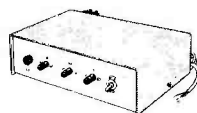
250 volt, 3A Single Pole
on-off. 1 1/2" nylon Toggle.
3/6 Plus 1/- P. & P.

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

SEND IN S.A.E. WITH YOUR LIST OF COM-
PONENTS FROM THE CONSTRUCTIONAL
PROJECTS OUT OF PRACTICAL WIRELESS/
ELECTRONICS FOR A RETURN OF POST
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WE STILL ARE THE LARGEST COM-
PONENT STOCKIST IN LONDON



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 7/6. P. & P.

MAINS UNITS for all types of TRANSISTOR EQUIPMENT

PLUS-3 MAINS UNIT

Provides three separate
switched output voltages
6v., 7.5v. 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/- in-
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MAINS UNITS

For single outputs, 6v, 9v, 12v, 18v, 20v.
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.).

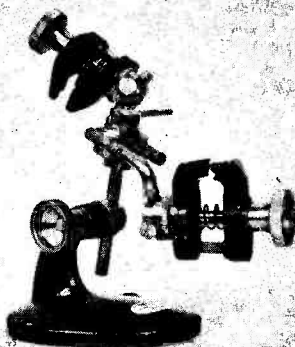
MAINS UNIT FOR ALL TRANS-
ISTOR RADIOS ETC., USING
PP3 TYPE BATTERY.
(ALSO AVAILABLE FOR 9V.)

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

The Unique MULTI-MINI TWIN-VICE



An extra "Pair of hands" for
those tricky jobs

ASSEMBLY—SOLDERING—
GLUING—WIRING—DRILLING
ETC.

- INDEPENDENT ADJUSTMENT OF
THE TWO VICE HEADS TO ANY
ANGLE WITH POSITIVE LOCKING.
- JAWS WILL FIRMLY GRIP, ROUND,
FLAT, SQUARE, OR HEXAGONAL
PARTS.

TWIN VICE: £5-18-0 (4/6 P & P)

ALSO AVAILABLE

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Metrosound Audio Products



ST.20 Stereo Amplifier

Good looks apart the ST.20 offers outstanding performance equal to amplifiers selling at two or three times the price which makes it one of the best buys on the High Fidelity market. All silicon solid state circuitry using 20 transistors and 2 diodes provides a full 20 watts r.m.s. output (10 watts r.m.s. per channel). Conservatively rated components are used throughout to ensure long term reliability and stability. Press button selector switches are a feature of the ST.20 for magnetic phono, crystal phono, radio tuner, tape, mono/stereo and on/off facilities. The slimline cabinet in teak veneers and the front panel fascia of

brushed anodised aluminium finish with gleaming silver trims combine to give a look of expensive and stylish elegance.

Size 15½" x 3½" x 10".

Price £36.0.0.

"Its performance is not just on the fringe of the specification – as happens with many low-priced amplifiers – it is well within it and well within the requirements for hi-fi"

F. C. Judd "Hi-Fi Sound" August 1970

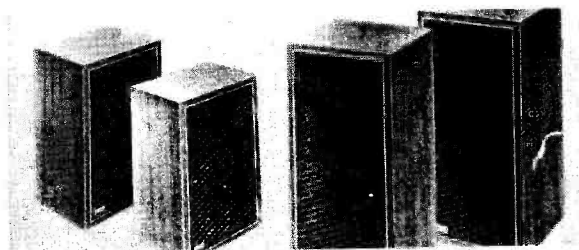


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DESIGN FOR INCLUSION
IN DESIGN INDEX



Stereo 10-10 Compact System

Expertly designed and providing outstanding quality reproduction. Not just another compact system but a true "sound centre" incorporating an all silicon transistor amplifier, Garrard 3000 autochanger and two Metrosound HFS.10 speaker systems. Output 20 watts rms. (10 watts rms. per channel) Bass, Treble, Volume and Balance controls. Input for tuner. Tape record outlet. Price £77.6.4.



Metrosound Speaker Systems

MODEL HFS.10 10 watts handling capacity. 8 ohm impedance. Teak finish. Size 14" x 9" x 7". As used in the Stereo 10-10 Compact System and available in matched pairs at £26.3.8.

MODEL HFS.20 20 watts handling capacity. 8 ohm impedance. Teak finish. Size 23" x 11½" x 10½". Price £18.10.0. each.

Available from all leading high fidelity dealers
Designed and Manufactured in England by

metrosound

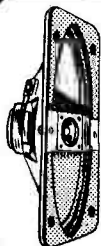
Metrosound Manufacturing Co. Ltd., Audio Works,
Cartersfield Road, Waltham Abbey, Essex.
Telephone: Waltham Cross 31933

Please send full details of

☐ ST.20 Amplifier ☐ 10-10 Compact ☐ Speakers

NAME _____

ADDRESS _____



E.M.I. LOUDSPEAKERS
MODEL 450 13 1/2" x 8" elliptical with twin tweeters. 8 ohm impedance. 10 watts. Brand New, guaranteed. Lind-Air Price 79/6 P. & P. 4/6.
MODEL 150 13 1/2" x 8" elliptical, 3 and 15 ohm impedance. 10 watts. Lind-Air Price 59/6 P. & P. 4/6.
TEAK FINISH SPEAKER CABINETS
 Size 16" x 10" x 9". Ideal or above units 49/6

C1001 MULTI-TESTER

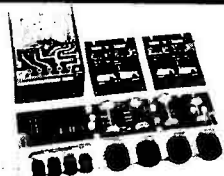


Overload protection. 20,000 opv. AC volts 10, 50, 250, 1,000v. DC volts 5-25, 125, 500, 2500v. D.C. Current 0-50 uA, 0-250 mA. Resistance 0-80K, 0-6 Meg ohm. Decibels -20 to +22dB. Size of meter 4 1/2 x 3 1/2 x 1 1/2 in. Complete with case. 85/- P. & P. 3/6

G2D MULTI-TESTER

20,000 p.p.v. DC voltage 5-25-50-250-500-2500v. (20,000 ohms per volt). AC voltage: 10-50-100-500-1000 volts (10,000 ohms per volt). DC Current: 0-50 uA, 0-2.5 mA, 0-250 mA. Resistance: 0-6K, 0-6 Mg (300 ohm and 30K at centre scale). Capacitance: 10f, to .001 mfd. .001 uf to .1 uf. Decibels: -20 to +22dB. Size 4 1/2 x 3 1/2 x 1 1/2 in. 71/- P. & P. 3/6.

SINCLAIR PROJECT 60



An attractive alternative for the enthusiast prepared to assemble these excellent modules to make a stereo assembly. Z30 24 watt Power Amplifier 89/6 (2 required). Stereo Sixty Control/Pre-amplifier 29.19.6 P.Z.5 Power Supply Unit 24.19.6. **SINCLAIR PROJECT 60** Package deal price 19 GNS. P. & P. 12/6. Project 60 is supplied complete with instruction manual and templates for plinth mounting.

SINCLAIR IC-10 INTEGRATED CIRCUIT

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

"HI-TEN" LOUDSPEAKER

British made full-range 10" unit handles up to 10W. Ceramic magnet. Frequency response, 40Hz-10kHz; imp., 15Ω; flux density, 10,000 lines. 49/6. P. & P. 4/6.



HI-TONE RECORDING TAPE

BRITISH MADE TOP QUALITY

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



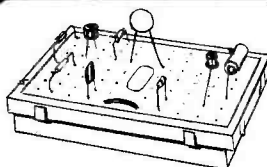
DE-LUXE STEREO HEADPHONES
 With soft rubber earpieces. Impedance 8-16 ohms. Frequency response 23-13,000 cps. With lead and stereo plug. **59/6 P. & P. 3/6.**

SOLDERING GUN



Comfortable grip with trigger control. "T" shaped 3/8" bit to multi-mine wear. Light beam is automatically directed on to end of bit when ON/OFF trigger is in use 230-250 volts. 85 watt element 49/6 P. & P. 3/6.

S-DEC BREADBOARD



British Made
 Solderless breadboard panels, for fast reliable component connections. Single DeCs. One 8-DeC with Control Panel, Jig and Accessories for solderless connections to controls, etc., with booklet "Projects on 8-DeC" giving construction details for a variety of circuits. 29/6. P. & P. 2/6.
 4-DeC KIT. Four 8-DeCs with two Control Panels, Jigs and Accessories and the booklet "Projects on 8-DeC" all contained in a strong attractive plastic case. Ideal for the professional user. 25.17.6. P. & P. 3/6.
 T-DeC KIT 22.10.0. P. & P. 3/6.

Garrard HI-FI TURNTABLES



2025 T/C with stereo cartridge .. 28.19.6
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 Base and cover for above 45.19.6
 AP78 219.10.0
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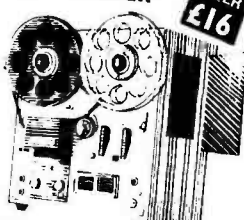
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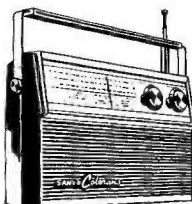
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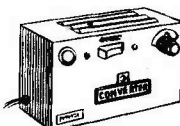
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Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99 (see note below)	100 up
C	1/20W	5%	89 Ω-220K Ω	E12	18	16	15
C	1/8W	5%	4.7 Ω-330K Ω	E24	2-5	2	1-75
C	1/4W	10%	4.7 Ω-10M Ω	E12	2-8	2	1-75
C	1/2W	5%	4.7 Ω-10M Ω	E24	3	2-5	2-25
C	1W	10%	4.7 Ω-10M Ω	E12	6	3	4-5
C	1/2W	2%	10 Ω-1M Ω	E24	9	8	7
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WW	3W	5%	12 Ω-10K Ω	E12		1/6 all quantities	
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Codes: C = carbon film high stability low noise
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WW = wire wound Plessey.

Values:
E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
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Complete stereo system £41 plus £2 10 p. & p. or with Mk II Amplifier and Magnetic Cartridge £45 & £2 10 p. & p.

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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.

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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

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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.

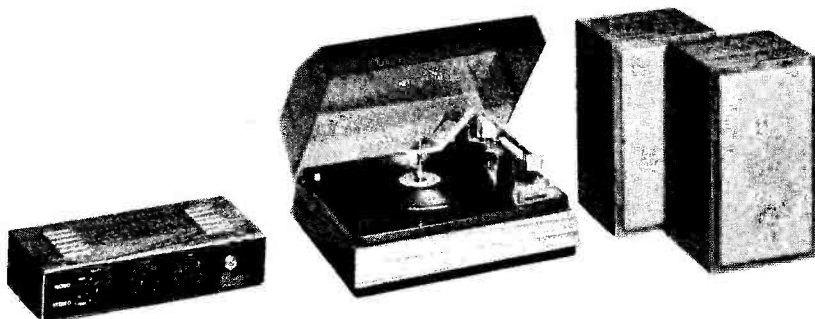
SPECIFICATION—

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

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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.

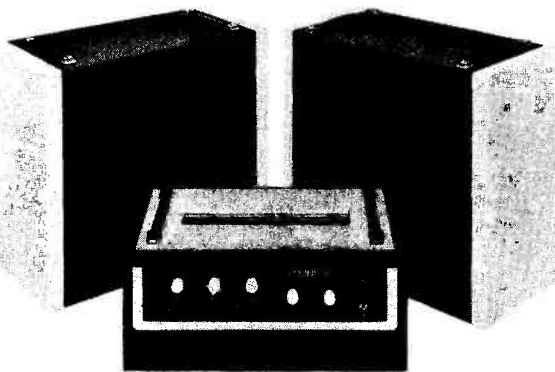


Duetto integrated transistor stereo Amp. Garrard Changer from Cover and teak finish plinth Duo Type I speakers (see opp. page) The above items purchased together

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SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



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

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

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

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

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

COMPLETE SYSTEM £45 Plus 60/- P. & P.

Sound 50 amp and 2 speakers

or available separately.

Amplifier £28.10.0 plus 20/- P. & P.

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

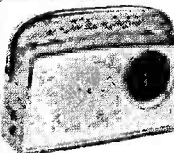


The ELEGANT SEVEN Mk. III (350m W Output)

7 transistor fully-tunable M.W.—L.W. superhet portable. Set of parts. Complete with all components, including ready etched and drilled printed circuit board—back printed for foolproof construction.

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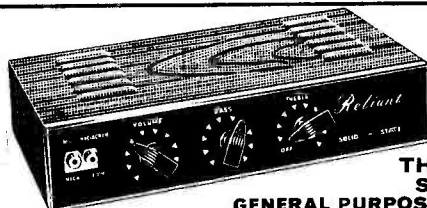
Simulated teak case

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SPECIFICATION:

Sensitivities for 10 watt output
at 1KHz into 3 ohms. Tape Head: 3 mV at 31.
p.s.) Mag. F.U.: 2 mV. Cor. P.U.: 80mV. Tuner: 100mV.
Aux: 100mV. Tape/Rec. Output. Equalisation for each
input is correct to within \pm 2dB (R.I.A.A.) from 20Hz to 20KHz.
Tone Control Range: Bass: 13dB at 60Hz. Treble: \pm 14dB at 15KHz. Total Dis-
tortion: (for 10 watt output) < 1.5%. Signal Noise: < -60dB. A.C. Mains 200-250V.
Size 12 1/2in long, 4 1/2in deep, 2 1/2in high. Built and tested



THE RELIANT SOLID-STATE GENERAL PURPOSE AMPLIFIER

SPECIFICATIONS

Output \pm 10 watts. Output impedance—3 to 4 ohms.
Inputs \pm 1. xtal mic 10mV Tone Controls—Treble control range \pm 12dB at 10KHz.
2. gram/radio 250mV. Bass control range \pm 13dB at 100Hz.
Frequency Response—(with tone controls central) Minus 3dB 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—10 1/2in. x
4 1/2in. x 2 1/2in. 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
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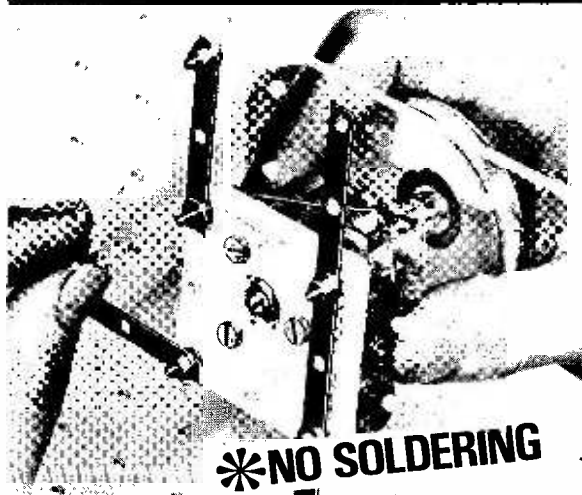
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Circuit diagram 2/6. Free with parts

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Garrard 401	£31 14 0	£28 10 0
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Armstrong 526 Tun./Amp.	£104 14 0	£93 19 0
Armstrong M8 Decoder	£9 10 0	£7 15 0
Armstrong M8 Decoder	£9 10 0	£7 15 0
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Dual CV40 Amp.	£73 10 0	£62 10 0
Dual CV80 Amp.	£89 10 0	£76 0 0
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Dual CT16 Tun.	£106 0 0	£93 3 0
Dual CR40 Tun./Amp.	£178 1 0	£156 10 0
Decca A3000 Amp.	£69 10 0	£60 15 0
Decca T1000 Tun.	£32 0 0	£28 16 0
Decca T2000 Tun.	£59 0 0	£52 19 0
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Philips RH590 Amp.	£51 15 0	£43 19 0
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Philips 4308	£26 7 0	£21 10 0
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Teleton SAQ203 Amplifier ...
Two full size 30" x 10" x 7 1/2" internationally acclaimed Musette Speakers...

	Rec. Retail Price	Our Price
Garrard SP25 record player with Goldring G800 magnetic cartridge complete with plinth and cover and ready wired to 5-pin Din plug ...	34 15 0	21 0 0
Teleton SAQ203 Amplifier ...	28 7 0	20 0 0
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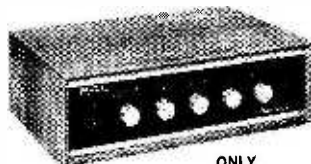
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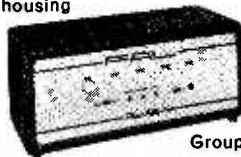
'PHASE 12'

An extremely attractive solid state stereo amplifier ideal for unit audio use. Facilities include MAGNETIC and CERAMIC P.U. RADIO, TAPE etc. Output 6 watts per channel Freq. Response 40-40,000 c.p.s.—3 dB. Hum level 7—4 dB. Controls include Input Selector, Volume, Balance, Bass, Treble and Stereo/Mono Switch. Black and silver facia panel with satin silver control knobs. Slimline finish enhanced by good quality Teak cabinet housing



ONLY **24 Gns.**

Recommended Retail Price



'PHASE 50' P.A. AMPLIFIER

A solid state A.C. mains unit for Vocal and Instrumental Groups and General Public Address use.

29 GNS. ★ 50 watts output (Peak) ★ High sensitivity
★ 3-30 ohms matching
★ 3 separately controlled inputs
★ Freq. Response 22 c.p.s.—30 Kcs

For heavy demands on power, 'Phase 100' will provide 100 watts at music rating. 4 Inputs. Master volume etc.

59 GNS.

For leaflets on the above and other models in the FAL range please send SAE to:—

FUTURISTIC AIDS LTD, 104 Henconner Lane, Leeds 13



for fast, easy, reliable soldering

Contains 5 cores of non-corrosive flux, instantly cleaning heavily oxidised surfaces. No extra flux required.

SAVBIT ALLOY. ALSO REDUCES COPPER BIT WEAR.

Economically packed for general electrical and electronic soldering. 75ft. 18 gauge on plastic reel. Recommended retail price 15/-



THIN GAUGE SOLDER, ESSENTIAL FOR

soldering small components and thin wires. High tin content, low melting point, 60/40 alloy, 170ft. 22 gauge on plastic reel. Recommended retail price 15/-



A RANGE OF SOLDERS IN HANDY DISPENSERS.

REF. ALLOY SWG

4A	60/40	18	3/-
Size 5 (ill. ultra-std)	Savbit	18	3/-
15	60/40	22	4/-

*Recommended Price



INVALUABLE FOR STRIPPING FLEX, THE NEW AUTOMATIC OPENING BIB WIRE STRIPPER AND CUTTER, easily

adjustable for all standard diameters. Plastic covered handles can also be used as wire cutter. Recommended retail price 8/6



From Electrical and Hardware shops. If unobtainable, write to: Multicore Solders Ltd., Hemel Hempstead, Herts.

TYPE 13A DOUBLE BEAM OSCILLOSCOPES



An excellent general purpose D/B oscilloscope. T.B. 2 cps-750 Kc/s. Bandwidth 5.5 Mc/s. Sensitivity 38mV/CM. Operating voltage 0/110/200/250V. A.C. Supplied in excellent working condition. \$22.10.0. Carriage 30/-.

AVO CT471A MULTIMETER

Battery operated, fully transistorised. Sensitivity 100mΩ/v. Measures AC/DC Voltages 12mV to 1,200V. AC/DC Current 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 wavemeter. Size 7 x 7 1/2 x 4in. Frequency range 500 Kc/s to 10 Mc/s (up to 30 Mc/s on harmonics). Calibrated dial. Power requirements 300V. D.C. 15mA and 12V D.C. 0.3A. Excellent condition. \$9/8. Carr. 7/6.

CLASS D WAVEMETERS



A crystal controlled heterodyne frequency meter covering 1-7.8 Mc/s. Operation on 6 volts D.C. Ideal for amateur use. Available in good used condition. \$23.6. Carr. 7/6. Or brand new with accessories. \$7.18.6. Carr. 7/6.

B.C. 221 FREQUENCY METERS

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



Oscillator Test No. 2. A high quality precision instrument made for the Ministry by Airco. 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 200mV-10,000V. (10 meg Ω -11 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 500 micro-watts-5 watts. Operation 0/110/200/250V. A.C. Supplied in perfect condition complete with circuit lead and R.F. probe. \$25. Carr. 15/-.

ADMIRALTY B.40 RECEIVERS

High quality 10 valve receiver manufactured by Murphy. Coverage in 5 bands 650 Kc/s-30 Mc/s. I.F. 500Kc/s. Incorporates 2 R.F. and 3 I.F. stages, bandpass filter, noise limiter, crystal controlled B.F.O. calibrator I.F. output, etc. Built-in speaker, output for phones. Operation 150/230 volt A.C. Size 19 1/2 x 13 1/2 x 16in. Weight 114lb. Offered in good working condition. \$22.10.0. Carr. 30/-.



TO-3 PORTABLE OSCILLOSCOPE
8in. tube. Y amp. Sensitivity 0.1v p-p/CM. Bandwidth 1.5 cps-1.6 MHz. Input imp. 2 meg Ω 25pF. X amp. sensitivity 0.9v p-p/CM. Bandwidth 1.5 cps-800KHz. Input imp. 2 meg Ω 25pF. Time base. 5 ranges 10 cps-300 KHz. Synchronisation. Internal external. Illuminated scale 140 x 215 x 330 mm. Weight 154 lb. 220/240V. A.C. Supplied brand new with handbook. \$37.10.0. Carr. 10/-.

SEW PANEL METERS

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

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

NEW "SEW" DESIGNS! CLEAR PLASTIC METERS BAKELITE PANEL METERS

TYPE SW.100	TYPE S-80
100 x 80 mm.	80 mm.
square fronts	square fronts
50μA 69/6	50μA 82/6
50-0-50μA 67/6	50-0-50μA 59/6
100μA 67/6	100μA 59/6
100-0-100μA 65/-	100-0-100μA 57/6
500μA 62/6	500μA 49/6
1mA 59/6	1mA 49/6
20V. D.C. 59/6	20V. D.C. 49/6
50V. D.C. 59/6	50V. D.C. 49/6
300V. D.C. 59/6	300V. D.C. 49/6
1 amp. D.C. 59/6	1 amp. D.C. 49/6
5 amp. D.C. 59/6	5 amp. D.C. 49/6
300V. A.C. 59/6	300V. A.C. 52/6
VU Meter 75/-	VU Meter 67/6

"SEW" CLEAR PLASTIC METERS

Type MR.85P. 4 1/2in. x 4 1/2in. fronts.	Type MR.38P. 1 1/2in. square fronts.
50μA 52/-	200mA 27/6
100μA 52/-	300mA 27/6
500μA 52/-	500mA 27/6
1mA 52/-	750mA 27/6
5mA 52/-	1 amp. 27/6
15mA 52/-	2 amp. 27/6
30 amp. 52/-	5 amp. 27/6
20V. D.C. 52/-	10 amp. 27/6
50V. D.C. 52/-	3V. D.C. 27/6
150V. D.C. 52/-	10V. D.C. 27/6
300V. D.C. 52/-	15V. D.C. 27/6
15V. A.C. 52/-	20V. D.C. 27/6
300V. A.C. 52/-	100V. D.C. 27/6
8 Meter 1mA 52/-	150V. D.C. 27/6
VU Meter 75/-	300V. D.C. 27/6
1 amp. A.C. 52/-	500V. D.C. 27/6
5 amp. A.C. 52/-	750V. D.C. 27/6
10 amp. A.C. 52/-	15V. A.C. 27/6
20 amp. A.C. 52/-	50V. A.C. 27/6
30 amp. A.C. 52/-	10 amp. A.C. 27/6
	20mA 27/6
	50mA 27/6
	100mA 27/6
	150mA 27/6
	S Meter 1mA 32/-
	VU meter 42/-

Type MR.52P. 2 1/2in. square fronts.	Type MR.45P. 2in. square fronts.
50μA 42/-	50μA 45/-
50-0-50μA 42/-	50-0-50μA 42/-
100μA 42/-	100μA 42/-
100-0-100μA 42/-	100-0-100μA 37/6
500μA 42/-	200μA 37/6
1mA 42/-	500μA 32/-
5mA 42/-	500-0-500μA 30/-
15mA 42/-	1mA 30/-
30 amp. 42/-	5mA 30/-
20V. D.C. 42/-	10mA 30/-
50V. D.C. 42/-	50mA 30/-
300V. D.C. 42/-	500mA 30/-
15V. A.C. 42/-	1 amp. 30/-
300V. A.C. 42/-	
8 Meter 1mA 42/-	
VU Meter 42/-	
1 amp. A.C. 42/-	
5 amp. A.C. 42/-	
10 amp. A.C. 42/-	
20 amp. A.C. 42/-	
30 amp. A.C. 42/-	

Type MR.65P. 3 1/2in. x 3 1/2in. fronts.	"SEW" BAKELITE PANEL METERS
50μA 42/-	Type MR.65. 3 1/2in. square fronts.
50-0-50μA 42/-	500mA 35/-
100μA 42/-	1 amp. 35/-
100-0-100μA 42/-	5 amp. 35/-
500μA 42/-	15 amp. 35/-
1mA 42/-	30 amp. 35/-
5mA 42/-	50 amp. 35/-
15mA 42/-	5V. D.C. 35/-
30 amp. 42/-	10V. D.C. 35/-
20V. D.C. 42/-	20V. D.C. 35/-
50V. D.C. 42/-	50V. D.C. 35/-
300V. D.C. 42/-	150V. D.C. 35/-
8 Meter 1mA 42/-	300V. D.C. 35/-
VU meter 42/-	30V. A.C. 35/-
1 amp. A.C. 42/-	150V. A.C. 35/-
5 amp. A.C. 42/-	500mA A.C. 35/-
10 amp. A.C. 42/-	1 amp. A.C. 35/-
15 amp. A.C. 42/-	5 amp. A.C. 35/-
20 amp. A.C. 42/-	10 amp. A.C. 35/-
30 amp. A.C. 42/-	20 amp. A.C. 35/-
50 amp. A.C. 42/-	50 amp. A.C. 35/-
5V. D.C. 42/-	VU meter 62/-

MARCONI
TF885 VIDEO OSCILLATORS
0-5 mc/s Sine Square Wave 245. Carr. 20/-.

MOVING IRON-
ALL OTHERS MOVING COIL
Please add postage

EDGWISE METERS	TYPE PE.70. 3 1/2in. x 1 1/2in. x 1 1/2in. deep.
50μA 60/-	50μA 52/-
50-0-50μA 57/6	1mA 47/6
100μA 57/6	300V. A.C. 47/6
100-0-100μA 55/-	
500μA 55/-	
1mA 55/-	
1-0-1mA 55/-	
5mA 55/-	
10mA 55/-	
100mA 55/-	
	VU meter 65/-

SEND FOR ILLUSTRATED BROCHURE OF SEW PANEL METERS-DISCOUNTS FOR QUANTITIES

POWER RHEOSTATS
High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush work. Continuous rating. Wide range available ex-stock. Single hole fixing, 1/2in. dia. shafts. Bulk quantities available.
25 WATT. 10/25/50/100/250/500/1000/1500/2500 or 5000 ohms, 14/6. P. & P. 1/6.
50 WATT. 10/25/50/100/250/500/1000/1500/2500 or 5000 ohms, 21/- P. & P. 1/6.
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms, 27/6 P. & P. 1/6.

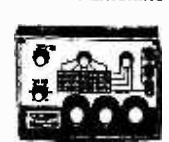
FTC-401 TRANSISTOR TESTER

Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. \$26.19.6 P. & P. 3/-.



MARCONI TF142E DISTORTION FACTOR METERS. Excellent condition. Fully tested. \$20. Carr. 15/-.

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



A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω-11.1 meg Ω. 6 Ranges ±1%. L1 μH - 111 HENRY'S. 6 Ranges -2% C. 10pF - 1110mF. 1000-11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7 1/2 x 5 x 2in. \$20. P. & P. 5/-.

COSSOR 1049 DOUBLE BEAM OSCILLOSCOPES
D.C. coupled. Band width 1Kc/s. Perfect order. \$25. Carr. 30/-.

TE-20D RF SIGNAL GENERATOR



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

LELAND MODEL 27 BEAT FREQUENCY OSCILLATORS
Frequency 0-20 Kc/s. on 2 ranges. Output 500 Ω or 5k Ω. Operation 200/250V. A.C. Supplied in perfect order. \$12.10.0 Carr. 10/-.

TY75 AUDIO SIGNAL GENERATOR
Sine Wave 20c/s to 200 Kc/s. Square Wave 200c/s to 30Kc/s. High and low impedance output. Output variable up to 6 volts 220/240 volts A.C. Size 210 x 150 x 190 mm. Brand new with instructions. \$16. Carr. 7/6.



LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYSER
2 pF-2000 mF
2 ohm-200 megohms. Also checks impedance, turns ratio, insulation, 200/250V. A.C. Brand New \$17.10.0 Carr. 7/6.



270° 500 MICROAMP METER
Incorporated in Radio Altitude Indicator 1D-14APN. Ideal for rev. counter etc. 15/6. P. & P. 3/-.

ADVANCE TEST EQUIPMENT

Brand new and boxed in original sealed cartons
J1B. AUDIO SIGNAL GENERATOR.
15 c/s to 50 Kc/s. Sine wave. Output 600 ohms or 5 ohms \$20.0.0.
VKT75. UHF MILLIVOLT METER.
100 Kc/s to 1,000 Mc/s. A.C. 10mV to 3V. DC 10 mV to 3V. Current 0.01 uA to 0.3 mA. Resistance 1 ohm to 10 megohm. \$125.0.0.
T21. 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

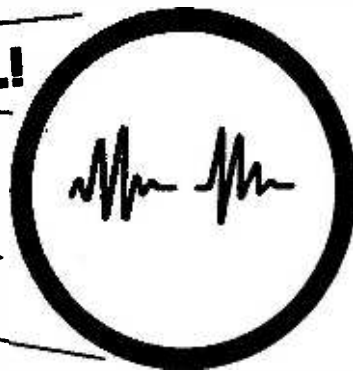
BRAND NEW & FULLY GUARANTEED

TRANSISTORS

IN4001	1/6	AC176	5/6	BSV95A	2/6
IN4014	2/6	AC187	12/6	BY100	3/6
IN4002	2/6	AC188	7/6	BY124	3/6
IN4003	2/6	AC177	5/6	BY126	4/6
IN4004	3/6	AC178	5/6	BY127	4/6
IN4005	3/6	AC179	5/6	BY210	7/6
IN4006	4/6	AC180	5/6	BY211	6/6
IN4007	4/6	AC181	5/6	BY212	6/6
IN4148	1/6	AC222	4/6	BY213	6/6
IN5054	4/6	AC223	4/6	BY214	6/6
2G301	4/6	AC240	4/6	MJ481	25/6
2G302	4/6	AD140	8/6	MPP102	8/6
2G303	4/6	AD149	11/6	MPP103	7/6
2G306	7/6	AD161	7/6	MPP104	7/6
2G308	6/6	AD162	7/6	MPP105	7/6
2G309	6/6	AF114	5/6	NKT213	6/6
2G371	3/6	AF115	6/6	NKT214	4/6
2G374	4/6	AF116	6/6	NKT216	7/6
2G375	4/6	AF117	6/6	NKT217	8/6
2N696	4/6	AF118	12/6	NKT224	5/6
2N697	4/6	AF119	4/6	NKT241	5/6
2N698	5/6	AF124	4/6	NKT261	4/6
2N706	2/6	AF126	4/6	NKT271	4/6
2N706A	2/6	AF127	4/6	NKT272	4/6
2N708	3/6	AF130	6/6	NKT274	4/6
2N914	3/6	AF178	11/6	NKT275	4/6
2N916	3/6	AF180	10/6	NKT278	3/6
2N918	6/6	AF181	8/6	NKT281	5/6
2N929	4/6	AF186	9/6	NKT403	6/6
2N930	5/6	AF239	8/6		
2N1131	5/6	ASV26	5/6	NKT404	6/6
2N1132	6/6	ASV27	7/6		
2N1133	6/6	ASV28	7/6	NKT405	6/6
2N1303	3/6	AY101	20/6	NKT773	5/6
2N1304	4/6	AY131	1/6	NKT1043	6/6
2N1305	4/6	BC107	3/6		
2N1306	5/6	BC108	3/6	OA5	2/6
2N1307	5/6	BC109	3/6	OA10	2/6
2N1308	6/6	BC110	3/6	OA11	2/6
2N1309	6/6	BC111	3/6	OA12	2/6
2N1613	5/6	BC116	12/6	OA70	1/6
2N1711	5/6	BC125	11/6	OA79	1/6
2N1889	6/6	BC126	11/6	OA81	1/6
2N1893	8/6	BC147	3/6	OA85	1/6
2N2147	14/6	BC148	3/6	OA90	1/6
2N2160	11/6	BC149	3/6	OA91	1/6
2N2193	8/6	BC167	3/6	OA92	1/6
2N2217	5/6	BC172	3/6	OA200	2/6
2N2218	6/6	BC177	7/6	OA202	1/6
2N2219	6/6	BC186	7/6	OA210	3/6
2N2368	3/6	BC182L	4/6	OC19	8/6
2N2369	3/6	BC184L	4/6	OC20	15/6
2N2369A	4/6	BC212L	4/6	OC22	10/6
2N2484	6/6	BCY30	6/6	OC23	10/6
2N2613	7/6	BCY31	6/6	OC24	11/6
2N2646	11/6	BCY32	7/6	OC25	10/6
2N2904	7/6	BCY33	4/6	OC26	6/6
2N2923	3/6	BCY34	4/6	OC28	10/6
2N2924	3/6	BCY35	4/6	OC29	12/6
2N2925	3/6	BCY36	4/6	OC30	12/6
2N2926	3/6	BCY37	4/6	OC31	12/6
2N2927	3/6	BCY38	4/6	OC32	12/6
2N2928	3/6	BCY39	4/6	OC33	12/6
2N2929	3/6	BCY40	4/6	OC34	12/6
2N2930	3/6	BCY41	4/6	OC35	12/6
2N2931	3/6	BCY42	4/6	OC36	12/6
2N2932	3/6	BCY43	4/6	OC37	12/6
2N2933	3/6	BCY44	4/6	OC38	12/6
2N2934	3/6	BCY45	4/6	OC39	12/6
2N2935	3/6	BCY46	4/6	OC40	12/6
2N2936	3/6	BCY47	4/6	OC41	12/6
2N2937	3/6	BCY48	4/6	OC42	12/6
2N2938	3/6	BCY49	4/6	OC43	12/6
2N2939	3/6	BCY50	4/6	OC44	12/6
2N2940	3/6	BCY51	4/6	OC45	12/6
2N2941	3/6	BCY52	4/6	OC46	12/6
2N2942	3/6	BCY53	4/6	OC47	12/6
2N2943	3/6	BCY54	4/6	OC48	12/6
2N2944	3/6	BCY55	4/6	OC49	12/6
2N2945	3/6	BCY56	4/6	OC50	12/6
2N2946	3/6	BCY57	4/6	OC51	12/6
2N2947	3/6	BCY58	4/6	OC52	12/6
2N2948	3/6	BCY59	4/6	OC53	12/6
2N2949	3/6	BCY60	4/6	OC54	12/6
2N2950	3/6	BCY61	4/6	OC55	12/6
2N2951	3/6	BCY62	4/6	OC56	12/6
2N2952	3/6	BCY63	4/6	OC57	12/6
2N2953	3/6	BCY64	4/6	OC58	12/6
2N2954	3/6	BCY65	4/6	OC59	12/6
2N2955	3/6	BCY66	4/6	OC60	12/6
2N2956	3/6	BCY67	4/6	OC61	12/6
2N2957	3/6	BCY68	4/6	OC62	12/6
2N2958	3/6	BCY69	4/6	OC63	12/6
2N2959	3/6	BCY70	4/6	OC64	12/6
2N2960	3/6	BCY71	4/6	OC65	12/6
2N2961	3/6	BCY72	4/6	OC66	12/6
2N2962	3/6	BCY73	4/6	OC67	12/6
2N2963	3/6	BCY74	4/6	OC68	12/6
2N2964	3/6	BCY75	4/6	OC69	12/6
2N2965	3/6	BCY76	4/6	OC70	12/6
2N2966	3/6	BCY77	4/6	OC71	12/6
2N2967	3/6	BCY78	4/6	OC72	12/6
2N2968	3/6	BCY79	4/6	OC73	12/6
2N2969	3/6	BCY80	4/6	OC74	12/6
2N2970	3/6	BCY81	4/6	OC75	12/6
2N2971	3/6	BCY82	4/6	OC76	12/6
2N2972	3/6	BCY83	4/6	OC77	12/6
2N2973	3/6	BCY84	4/6	OC78	12/6
2N2974	3/6	BCY85	4/6	OC79	12/6
2N2975	3/6	BCY86	4/6	OC80	12/6
2N2976	3/6	BCY87	4/6	OC81	12/6
2N2977	3/6	BCY88	4/6	OC82	12/6
2N2978	3/6	BCY89	4/6	OC83	12/6
2N2979	3/6	BCY90	4/6	OC84	12/6
2N2980	3/6	BCY91	4/6	OC85	12/6
2N2981	3/6	BCY92	4/6	OC86	12/6
2N2982	3/6	BCY93	4/6	OC87	12/6
2N2983	3/6	BCY94	4/6	OC88	12/6
2N2984	3/6	BCY95	4/6	OC89	12/6
2N2985	3/6	BCY96	4/6	OC90	12/6
2N2986	3/6	BCY97	4/6	OC91	12/6
2N2987	3/6	BCY98	4/6	OC92	12/6
2N2988	3/6	BCY99	4/6	OC93	12/6
2N2989	3/6	BCY00	4/6	OC94	12/6
2N2990	3/6	BCY01	4/6	OC95	12/6
2N2991	3/6	BCY02	4/6	OC96	12/6
2N2992	3/6	BCY03	4/6	OC97	12/6
2N2993	3/6	BCY04	4/6	OC98	12/6
2N2994	3/6	BCY05	4/6	OC99	12/6
2N2995	3/6	BCY06	4/6	OC00	12/6
2N2996	3/6	BCY07	4/6	OC01	12/6
2N2997	3/6	BCY08	4/6	OC02	12/6
2N2998	3/6	BCY09	4/6	OC03	12/6
2N2999	3/6	BCY10	4/6	OC04	12/6
2N3000	3/6	BCY11	4/6	OC05	12/6
2N3001	3/6	BCY12	4/6	OC06	12/6
2N3002	3/6	BCY13	4/6	OC07	12/6
2N3003	3/6	BCY14	4/6	OC08	12/6
2N3004	3/6	BCY15	4/6	OC09	12/6
2N3005	3/6	BCY16	4/6	OC10	12/6
2N3006	3/6	BCY17	4/6	OC11	12/6
2N3007	3/6	BCY18	4/6	OC12	12/6
2N3008	3/6	BCY19	4/6	OC13	12/6
2N3009	3/6	BCY20	4/6	OC14	12/6
2N3010	3/6	BCY21	4/6	OC15	12/6
2N3011	3/6	BCY22	4/6	OC16	12/6
2N3012	3/6	BCY23	4/6	OC17	12/6
2N3013	3/6	BCY24	4/6	OC18	12/6
2N3014	3/6	BCY25	4/6	OC19	12/6
2N3015	3/6	BCY26	4/6	OC20	12/6
2N3016	3/6	BCY27	4/6	OC21	12/6
2N3017	3/6	BCY28	4/6	OC22	12/6
2N3018	3/6	BCY29	4/6	OC23	12/6
2N3019	3/6	BCY30	4/6	OC24	12/6
2N3020	3/6	BCY31	4/6	OC25	12/6
2N3021	3/6	BCY32	4/6	OC26	12/6
2N3022	3/6	BCY33	4/6	OC27	12/6
2N3023	3/6	BCY34	4/6	OC28	12/6
2N3024	3/6	BCY35	4/6	OC29	12/6
2N3025	3/6	BCY36	4/6	OC30	12/6
2N3026	3/6	BCY37	4/6	OC31	12/6
2N3027	3/6	BCY38	4/6	OC32	12/6
2N3028	3/6	BCY39	4/6	OC33	12/6
2N3029	3/6	BCY40	4/6	OC34	12/6
2N3030	3/6	BCY41	4/6	OC35	12/6
2N3031	3/6	BCY42	4/6	OC36	12/6
2N3032	3/6	BCY43	4/6	OC37	12/6
2N3033	3/6	BCY44	4/6	OC38	12/6
2N3034	3/6	BCY45	4/6	OC39	12/6
2N3035	3/6	BCY46	4/6	OC40	12/6
2N3036	3/6	BCY47	4/6	OC41	12/6
2N3037	3/6	BCY48	4/6	OC42	12/6
2N3038	3/6	BCY49	4/6	OC43	12/6
2N3039	3/6	BCY50	4/6	OC44	12/6
2N3040	3/6	BCY51	4/6	OC45	12/6
2N3041	3/6	BCY52	4/6	OC46	12/6
2N3042	3/6	BCY53	4/6	OC47	12/6
2N3043	3/6	BCY54	4/6	OC48	12/6
2N3044	3/6	BCY55	4/6	OC49	12/6
2N3045	3/6	BCY56	4/6	OC50	12/6
2N3046	3/6	BCY57	4/6	OC51	12/6
2N3047	3/6	BCY58	4/6	OC52	12/6
2N3048	3/6	BCY59	4/6	OC53	12/6
2N3049	3/6	BCY60	4/6	OC54	12/6
2N3050	3/6	BCY61	4/6	OC55	12/6
2N3051	3/6	BCY62	4/6	OC56	12/6
2N3052	3/6	BCY63	4/6	OC57	12/6
2N3053	3/6	BCY64	4/6	OC58	12/6
2N3054	3/6	BCY65	4/6	OC59	12/6
2N3055	3/6	BCY66	4/6	OC60	12/6
2N3056	3/6	BCY67	4/6	OC61	12/6
2N3057	3/6	BCY68	4/6	OC62	12/6
2N3058	3/6	BCY69	4/6	OC63	12/6
2N3059	3/6	BCY70	4/6	OC64	12/6
2N3060	3/6	BCY71	4/6	OC65	12/6
2N3061	3/6	BCY72	4/6	OC66	12/6
2N3062	3/6	BCY73	4/6	OC67	12/6
2N3063	3/6	BCY74	4/6	OC68	12/6
2N3064	3/6	BCY75	4/6	OC69	12/6
2N3065	3/6	BCY76	4/6	OC70	12/6
2N3066	3/6	BCY77	4/6	OC71	12/6
2N3067	3/6	BCY78	4/6	OC72	12/6
2N3068	3/6	BCY79	4/6	OC73	12/6
2N3069	3/6	BCY80	4/6	OC74	12/6
2N3070	3/6	BCY81	4/6	OC75	12/6
2N3071	3/6	BCY82	4/6	OC76	12/6
2N3072	3/6	BCY83	4/6	OC77	12/6
2N3073	3/6	BCY84	4/6	OC78	12/6
2N3074	3/6				

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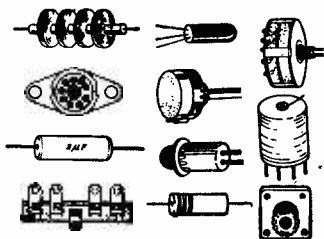


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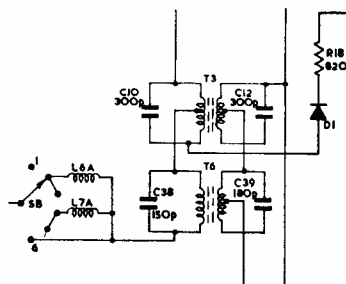
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PRACTICAL WIRELESS

VOL 46 NO 8

Issue 766

DECEMBER 1970

TOPIC OF THE MONTH

What went wrong?

WHATEVER happened to the Radio Hobbies Exhibition?" asks an advertiser who has pulled out of the RSGB exhibition. Other journals have posed the same sort of question and readers of Practical Wireless seem to be equally bemused. And viewing the event objectively, we have no hesitation in declaring that to our eyes the recent RSGB show was a bit of a flop.

This is not a dyspeptic editorial gripe. As a major exhibitor, P.W. has a right to be concerned, not only as a participant but as a voice for those at which this exhibition is aimed. It must also be made clear that we are not knocking the RSGB as such; the future of amateur radio relies on a healthy, prosperous and influential RSGB. We do feel, however, that in the organisation and conception of their annual exhibition they have gone sadly adrift. Falling attendance figures and lack of stand support show this clearer than any words.

What has gone wrong? What has caused this downhill spiral of diminishing support both by traders and visitors? The reasons may be complex, but no doubt one contributory cause is the problem of TVI which has resulted in most amateurs buying their equipment rather than making it. This is supported by the appalling lack of support for the RSGB constructional trophies—only *eight* entries all told and none at all for the John Rouse Trophy (which is for constructional entries from the under 16's)! Another contributory reason must surely be the evolution of title from the humble "RSGB Exhibition" to the cumbersome, pompous and pretentious International Radio Engineering and Communications Exhibition. Whoever thought that one up deserves an OBE for sheer effrontery!

But what of the future? The RSGB would be ill-advised to embark on a similar venture next year without a major re-think. What is needed is an all-embracing show revolving around the hobbyist, possibly run by a consortium of interests, covering not only purely amateur radio, but taking in all types of associated interests, be it hi-fi, tape recording, electronics and the like. And give it a title that means something and sounds more attractive than something from 1984. Then we might find companies more willing to take stands and the lost visitors starting to flock back again.

W. N. STEVENS—Editor.

**JANUARY ISSUE WILL BE PUBLISHED
ON DECEMBER 4**

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

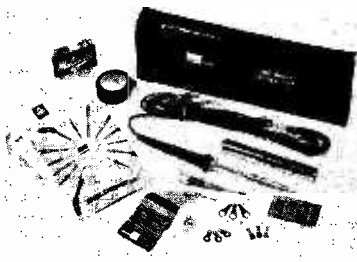
12V Iron

Solderstat Ltd announce a P.V.C. button-down-pack with a 12 volt "HMS Series" soldering iron, with 15 feet of cable fitted with battery clips.

This specially designed soldering iron has a consumption of only 12 watts consuming appreciably less than parking lights.

A unique heatshield/transit cover has been developed to allow the soldering iron to be packed away immediately after use.

Other accessories included are a coil of cored solder, P.V.C. insulation tape, solder tags, wiper pad, screwdriver/wire stripper and a desolder braid dispenser. Recommended List Price is 57s. 6d. *Solderstat Ltd., P.O. Box 10, Bush Fair, Harlow, Essex.*



Magnetic Mic.

A hand microphone has been introduced by the communications division of *S. G. Brown Ltd., of King George Avenue, Watford, Herts.* It can be used with both mobile equipment and for base installations.

Known as the 'Classic', this lightweight instrument has a powerful magnet fitted in the grip which enables it to 'stick' to any ferrous surface. A user in a motor vehicle can place the instrument in the most convenient position on the vehicle's dashboard, eliminating the need for a conventional microphone holder.

Impedance at 1000Hz is 300Ω nominal. Frequency response: Rising at 10dB per decade over the range 100-2000Hz, substantially linear over the range 2000-14000Hz, falling off rapidly thereafter. Sensitivity is 85dB below IV/Dyne/cm² (typical) and output for normal speech is approximately 1mV true r.m.s.

Mr. Mullard

Mullard Ltd. announce that Mr. Stanley Mullard, M.B.E.(Mil.), Hon.C.G.I.A., F.I.E.E., who founded the company 50 years ago, retired from the Board at the end of September, after completing nearly 72 years with the electrical and electronics industry.

Stanley Robert Mullard was born on November 1st, 1883, and was apprenticed to an electrical engineering firm at the age of 15. In 1910 he joined Ediswan. Three years later he became head of their lamp laboratory and in 1915 invented the Pointolite arc lamp, widely used in projection apparatus.

During World War I he enlisted in the Engineers' Battalion of the Royal Naval Division and in 1916 was commissioned in the Royal Naval Volunteer Reserve and attached to the Royal Naval Air Service.

As a member of a small team of scientists and technologists at H.M. Signal School, Portsmouth, he was involved with the invention and development of high-power transmitting valves in fused silica bulbs which were urgently needed by the Navy. In 1920, after his demobilisation, he was invited by the Admiralty to produce these valves in quantity.

The first company to bear his name—the Mullard Radio Valve Company—was founded in 1920. It occupied premises rented from the 'Z' Lamp & Electrical Company of which Mullard had become managing director.

With the spread of radio, Mullard became involved in the manufacture of small receiving valves. Under the trade name



ORA these were soon being turned out at the rate of hundreds a week. Demand rapidly outstripped factory capacity and the firm moved to larger premises at Hammersmith. And in 1923 Mullard acquired still larger accommodation at Balham. By the end of 1924 production stood at 2½ million valves a year.

In 1927 a large factory at Mitcham was purchased and this is still the main centre for silica high-power transmitting valves for industrial electronic applications.

In 1930 Mullard reluctantly decided to relinquish his leadership of the company. He had been working at full pressure since 1910 and his doctors had warned him to ease up.

He has since been far from inactive. He has retained his seat on the Mullard Board and has continued to participate in company affairs. Since 1945 he has also interested himself in new horticultural and other industrial developments. And he has seen the company he founded 50 years ago grow to occupy a leading position in the world electronics industry.

The Tilley Go-Torch

A new product from The Tilley Lamp Company is a useful butane gas blow-lamp complete with paint stripper and soldering bit attachment. Called the Tilley Go-Torch, it operates on a Tilley Go-Gas 6oz disposable cartridge.

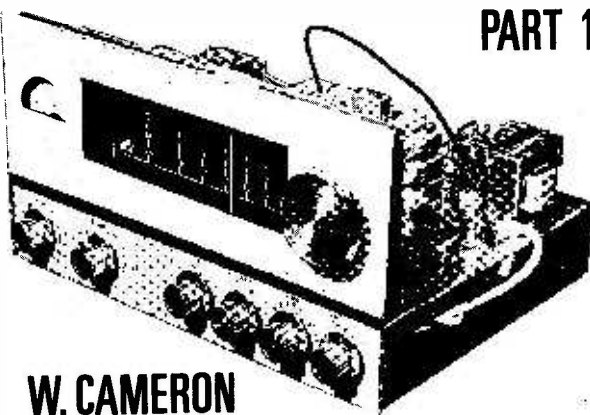
Made from high quality chrome-plated steel, brass and aluminium,

the Go-Torch will make a useful addition to the equipment in the radio shack.

Price of the Tilley Go-Torch is £2 19s. 6d., including general purpose burner, soldering bit attachment, a steel flame spreader for paint stripping and a full cartridge of Tilley Go-Gas. The latter is replaceable at around 4s 6d. each. *The Tilley Lamp Company Ltd., Dunmurry, Belfast, Northern Ireland.*

AMATEUR BANDS COMMUNICATIONS RECEIVER

PART 1



W. CAMERON

- **CIRCUIT** : Double-conversion superhet
- **SYSTEMS** : AM/SSB/CW
- **COVERAGE** : 1.8MHz to 29.5MHz
- **SENSITIVITY** : 1.5 μ V for 0.25V a.g.c. and 100mV into detector and S/N ratio of 12dB
- **I.F. BANDWIDTH** : 4kHz at -6dB points; 10kHz at -30dB points
- **IMAGE REJECTION** : 60dB at 1.5MHz; 80dB at 3.5MHz; 40dB at 28MHz
- **SPURII** : -80dB on all bands
- **INPUT IMPEDANCE** : 300 ohms on 1.5MHz; 80 ohms 3.5 to 28MHz
- **OUTPUT** : 1 Watt into 15 ohms
- **POWER SUPPLY** : 12V d.c. or a.c.mains

A HIGH performance amateur band communications receiver is necessarily rather complex and usually expensive, mainly because of the use of mechanical or crystal i.f. filters, and (in the case of double conversion receivers) crystal controlled oscillators.

The receiver to be described lacks little in selectivity and stability, and in the interests of economy does not use either crystal i.f. filters or crystal controlled oscillators.

The selectivity is not as sharp as can be obtained with a good mechanical filter, but is at least twice as sharp as can be obtained using conventional i.f. circuits, and results in an i.f. bandwidth of less than

4kHz at -6dB. This is just adequate for a.m., while results on s.s.b. are very good indeed.

By taking special care with the oscillators, a stability of a very high order is achieved.

The receiver uses the double conversion principle, in which the second converter is tuned, covering the range 1.5-2.0MHz. This frequency range is chosen so that this unit with the following i.f. amplifier, serves on its own as a complete Top Band receiver.

The oscillator of the first converter is switched to cover all the remaining bands, which are fixed tuned. The r.f. stages are peaked by a front panel control.

This double conversion system has the very great advantage that the same scale calibration, and the same tuning rate, holds good for all bands (with the minor exception that the Top Band calibration is reversed). This means that the entire scale length covers only 500kHz, and is the same on each band.

Another advantage is that because the i.f. has been raised to nominally 1.7MHz (1.5-2.0) from 470 kHz, by the second converter, the image rejection on the h.f. bands is improved. Typically, the image rejection at 2MHz with a 470kHz i.f. can be expected to be -10 or -12dB, but with an i.f. of 1.7MHz improves to -40 to -45dB.

A block diagram of the receiver is shown in Fig. 1, with typical gains per stage.

Important considerations are the avoidance of interference by cross modulation, and unwanted reception of signals caused by beating with oscillator harmonics. These considerations call for good pre-mixer selectivity, and that no oscillator signal or harmonics appear in the r.f. circuits. Also to this end, the r.f. amplifier transistors must always operate in the linear part of their characteristic, which means special methods of applying a.g.c. These considerations are taken care of in the design and will be enlarged on later.

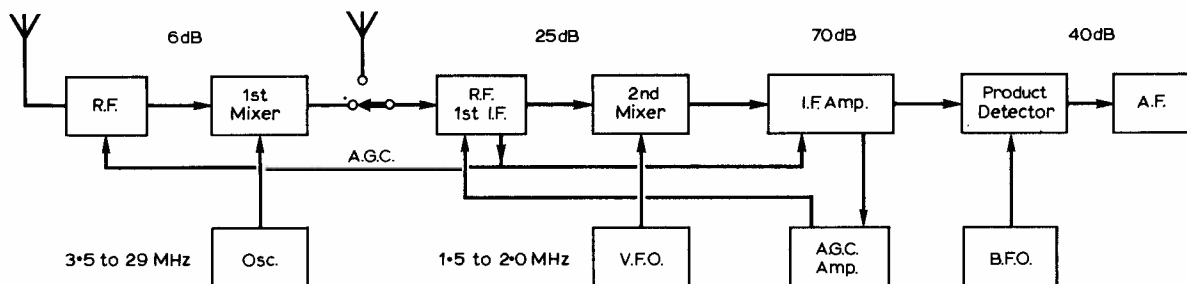


Fig. 1: Block diagram of the complete receiver with typical stage gains.

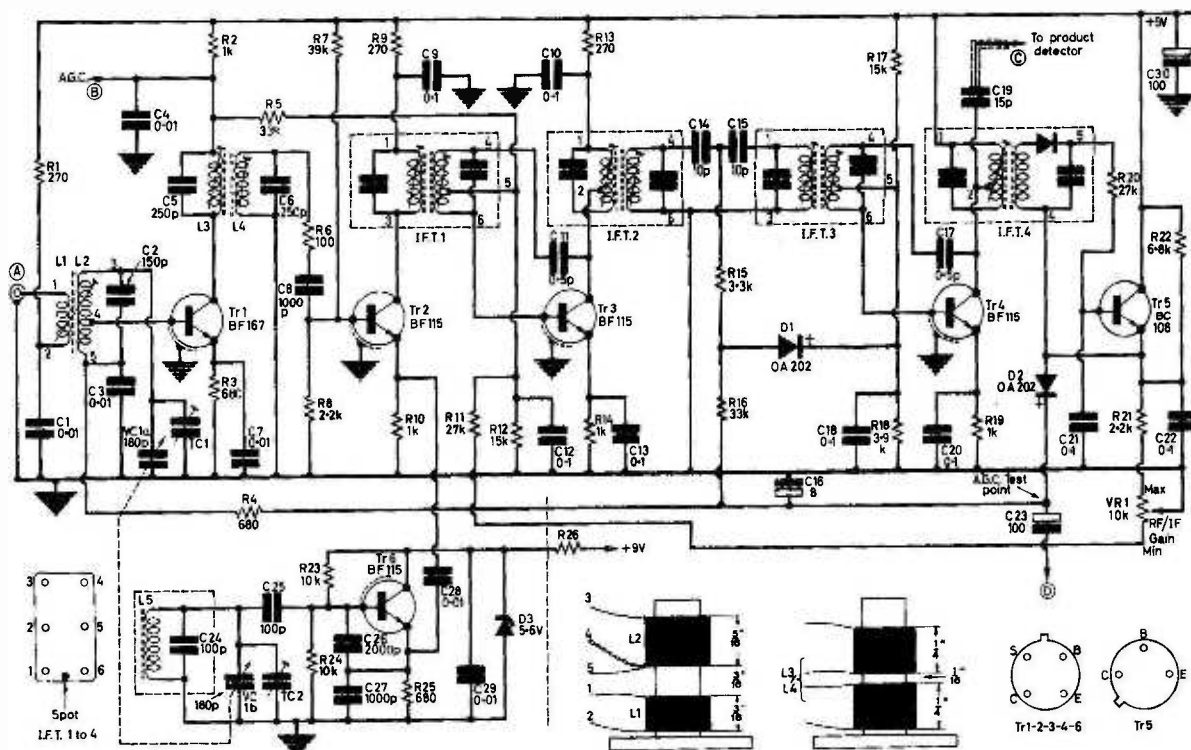


Fig. 2: Circuit of the second converter/i.f. amplifier.

TABLE 1

	Collector	Base	Emitter
Tr1	7.15	1.8	1.15
Tr2	9.0	0.5	0.05
Tr3	8.8	1.6	1.0
Tr4	9.0	1.6	1.0
Tr5	9.0	1.8	2.0
Tr6	5.6	2.6	2.0

Voltages measured with a meter of 20kΩ/V.

INDUCTORS

L1 20 turns pilewound.
 L2 65 turns pilewound, tapped 6 turns from earthy end.
 L3 55 turns pilewound.
 L4 55 turns pilewound.
 See Fig. 2 for winding details.
 L5 55 turns closewound.
 All inductors wound on ½ in. dia. formers, with dust cores (Radiospares), 36 s.w.g. enamelled copper wire.

In order to simplify construction the receiver is built up in units. In the prototype all the completed units are mounted on or within a common chassis 12 x 9 x 2 in. made of 18 s.w.g. aluminium. A panel 12 x 4½ in. (12 x 4½ in. with flange) is bolted to the front to carry the scale, drive and S meter. This panel is mounted with the flange forward so that the scale is recessed behind the front panel proper which can also be of aluminium with cut-outs to show the scale and S meter.

A description of the circuit functions, constructional data and alignment information will be given in the following order:

1. Second converter and i.f. amplifier.
2. B.F.O./product detector, audio amplifier and power supply.
3. Pre-selector and first converter.

Second converter/i.f. amplifier

As already mentioned, this unit, Fig. 2, is, on its own, a receiver covering the 160 metre amateur band

and shipping, in the range 1.5 to 2.0 MHz, the front end of which, in the complete receiver, becomes the second converter (or tunable first i.f.).

To ensure a good Q factor in the aerial tuned circuit, the aerial is loosely coupled to L2 via L1 and similarly the base of Tr1 is tapped well down on L2. L1 is returned to the supply line via R1, as this will later carry the supply voltage to the first mixer. The r.f. stage Tr1 is coupled to the mixer by the wide band transformer L3/L4. This has a relatively flat response over the range 1.5 to 2.0 MHz, with a sharp cut-off at the ends.

The oscillator, Tr6, is a highly stable Colpitts circuit, voltage stabilised by a zener diode, D3. Stability against changes in ambient temperature is achieved by using polystyrene capacitors, which offset the positive temperature coefficients of transistor and coil. If anything, the oscillator may be over compensated, and, if desired, it is not too difficult to be precise by using a combination of polystyrene and silver mica capacitors for C24.

The ganged tuning capacitor VC1a-VC1b must be

a good one, with adequate screening between stators. Most capacitors tried had too much stray coupling between sections so that oscillator voltage appeared on the r.f. section. With the capacitor used no oscillator voltage was measurable on the r.f. section. In the prototype this is a Jackson Bros. Type F, "H" law, but it has later been found that this type can also be supplied in "SLF" and this is specified as it will provide a linear scale calibration.

Two methods of improving i.f. selectivity are adopted: i.f.t.2 and i.f.t.3 are connected back to back to provide four tuned circuits instead of the usual two, and because of the small amount of coupling, the reduced loading results in higher circuit Q's. Also Tr3 and Tr4 are each given a small amount of positive feed-back via capacitors C11 and C17 respectively. These provide only a moderate amount of regeneration, well below the point of oscillation, but give a marked increase in selectivity. The output from the last i.f. is coupled to the product detector via a small capacitor (C19) so that a signal of about 100mV appears at the product detector input.

Tr5 is the a.g.c. amplifier, and in the absence of a signal, only the voltage resulting from the potential divider R21-R22 appears on the a.g.c. line as standing bias for Tr1. With the r.f./i.f. gain control at maximum (R21 to earth) this voltage will be 1.8 volts and is referred to as the a.g.c. reference level. In this condition Tr5 is non-conducting.

On receipt of a signal, the rectified output from the diode in i.f.t.4 is applied between base and emitter of Tr5 and the base will be made positive with respect to the emitter and Tr5 will conduct. The increase in voltage across R21 will be proportional to signal strength and is applied to Tr1 as forward a.g.c.

This reduces the gain of Tr1 in two ways, first, as the transistor is turned more into the "on" mode its current will increase resulting in a greater voltage drop across R2 and R3, so that with a very strong signal the voltage available across the transistor between collector and emitter will be very small. At the same time, the base-emitter impedance becomes very low, further attenuating the signal.

The reducing voltage at R2 serves as reverse a.g.c. for the i.f. amplifier Tr3, and also for the r.f. stage in the pre-selector.

The diode D1 is reverse biased until the voltage on the a.g.c. line rises, when the diode will conduct, attenuating the signal at i.f.t.3.

The result of these a.g.c. combinations is that a good range of a.g.c. is provided, without any of the controlled stages being biased into cut-off.

The purpose of the diode D2 and capacitor C23 is to give the fast attack—slow decay characteristic required for s.s.b. and c.w.

Fig. 3 shows the signal a.g.c. characteristic of the complete receiver. "S" readings are also shown in the scale, relative to signal strength and a.g.c. voltage, which may be found useful in adjusting the "S" meter. This follows accepted practice of 6dB per S point. On the 160 metre band, signals should be given the benefit of another "S" point as the gain is 6dB down compared to the other bands which have the benefit of the pre-selector.

Construction

The second converter and i.f. amplifier unit is built on a chassis 8 x 4 x 1 in. and the main details of

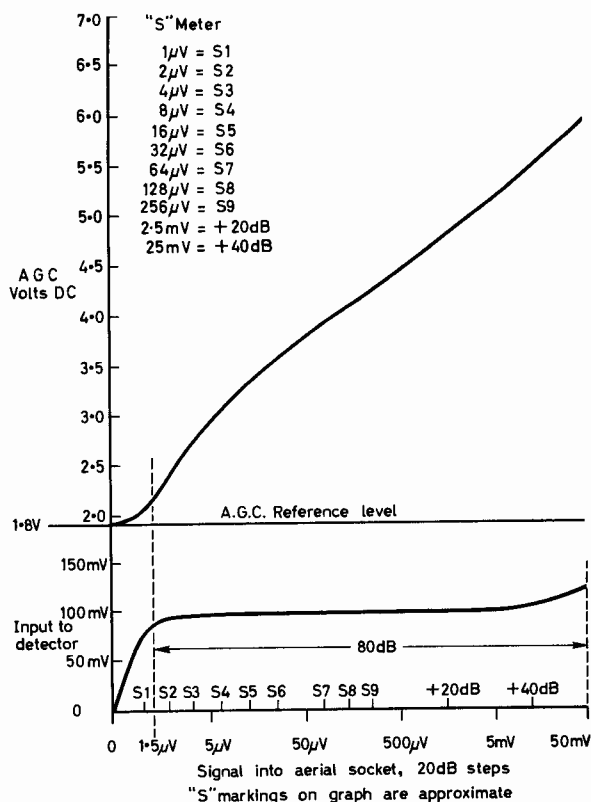


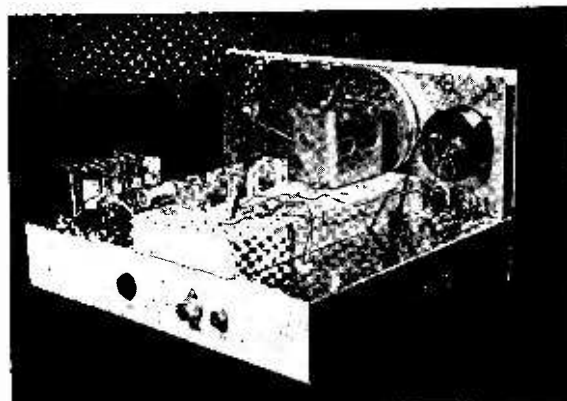
Fig. 3: The signal a.g.c. characteristic of the complete receiver.

this are shown in Fig. 4. The chassis is made from grade 1 tinned plate (about 24 or 26 s.w.g.), with end plates of 18 s.w.g. aluminium. Screened compartments are provided for the r.f. and oscillator sections.

The i.f. transformers are mounted with the identification spots nearest the centre of the chassis.

Paxolin strips are secured under the $\frac{1}{4}$ in. holes as transistor mounts, four tiny holes being drilled through these, through which the transistor leads are passed. The transistors should be pushed right down, and the shield lead bent over and soldered direct to the underside of the chassis.

After winding, the coils L1/2 and L3/4 and L5 are secured in position on the chassis with a contact adhesive such as Evostik. When winding the close-



A rear view of the completed receiver.

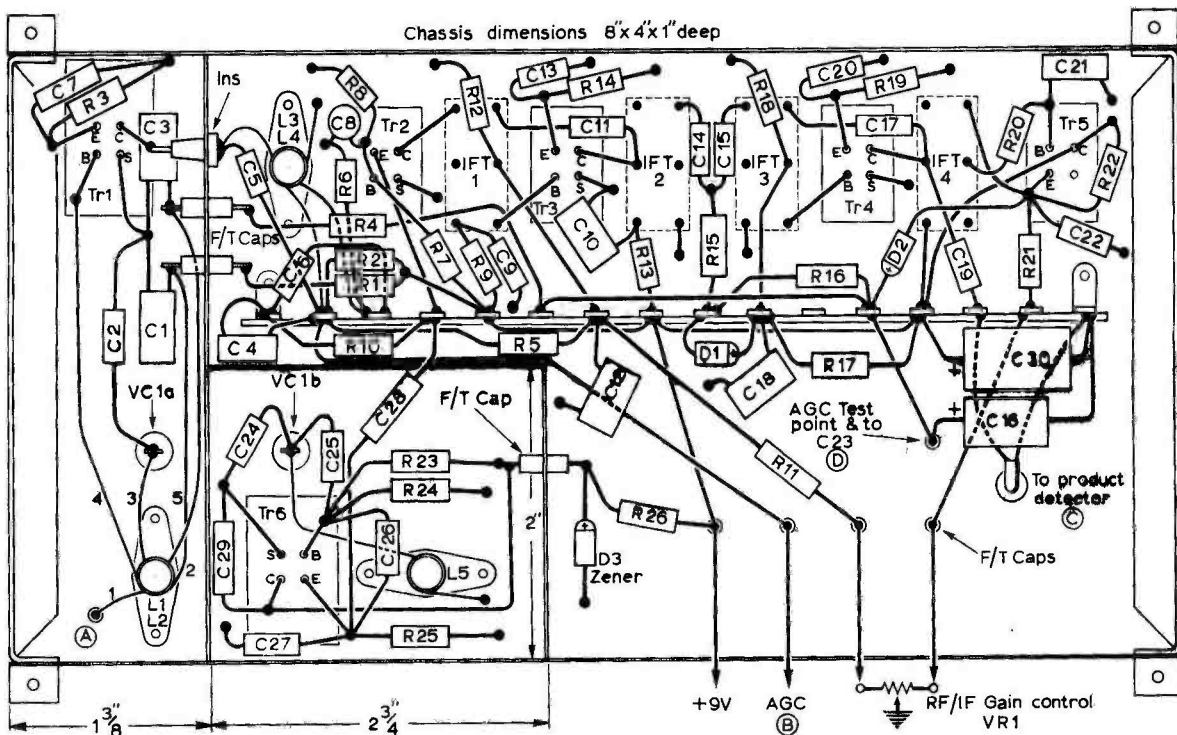


Fig. 4: Underchassis wiring of the second converter (i.f. amplifier).

wound single layer coils, it will be found easier to wind five turns or so at a time, pushing each five turns down before the next five are wound. In this way all the turns of the completed coil are close together and neat. Finish with a spot of polystyrene cement or a coating of wax.

Where d.c. wiring passes through the chassis or screened compartments, it is convenient and good practice to use fed-through capacitors. R.F. wiring can simply pass through holes in the chassis or else feed-through insulators can be used. These can be made by glueing a short length of sleeving in the hole and passing a small piece of thick wire through the sleeving.

Wiring in of components can now proceed as in Fig. 4. The tag strip has 16 tags, mounting lugs being left only at each end, the remainder being cut off. The strip is mounted by soldering each end lug to the chassis. When completed, the unit should be connected to a 9V supply and the voltages checked against Table I.

Alignment

Alignment can be carried out at this stage, or if audible results are required, can wait until the product detector and a.f. amplifier are completed.

Connect a voltmeter between the a.g.c. test-point and chassis, and a signal generator via an isolating capacitor (0.01 μ F) to the base of Tr2 and turn VR1 to maximum.

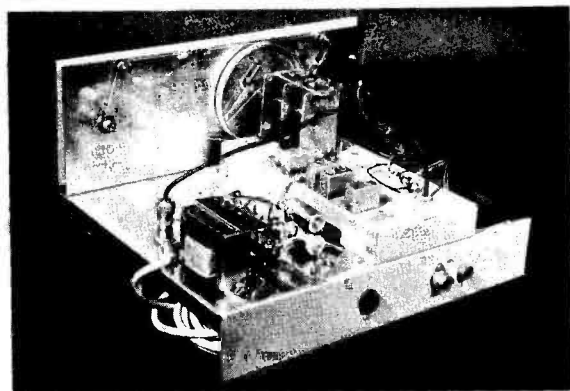
Inject an unmodulated signal of 470kHz and adjust i.f.t.'s in the order i.f.t.4 to i.f.t.1, for maximum reading on the meter. Reduce the output from the signal generator until the meter reads about 3V and again peak the i.f.t.'s for maximum. Repeat until no improvement can be obtained, and the i.f.'s are then tuned.

As a guide, the output from the signal generator

for the final conditions above will be of the order of 150 μ V.

Transfer the generator to the input of the receiver and inject a signal of 1450kHz. Turn the ganged capacitor to maximum capacity and adjust L5 and then L2 for maximum output. To do this correctly the cores must be screwed in from the top or "hot" end of the coil (furthest from the chassis) as it will be possible to tune the signal twice with L5. The correct signal is the first position.

Now turn the capacitor to minimum and inject a signal of 2050kHz and adjust TC2 and then TC1



The chassis shown at the top of the page fits on top of the main chassis and it can clearly be seen in this photograph and the one on the facing page

for maximum. Inject a signal of 1800kHz, tune to it, adjust the cores of L3 and L4 for maximum.

Inject a signal of 1600kHz, tune to it, adjust the core of L2 to maximum. Inject 1900kHz and tune to it, adjust TC1 for maximum. Repeat these two last adjustments until no further improvement is obtained.

In all of these adjustments, the output from the signal generator should be kept down so that the meter reading (the voltage at the a.g.c. test-point) does not exceed 3V.

Although the use of a signal generator is strongly recommended, it is possible to align the unit reasonably well without one, but it will then be necessary to complete the product detector and audio amplifier.

The ganged tuning capacitor in the second converter provides the main tuning for the complete

★ components list

Resistors:

R1 270Ω	R10 1kΩ	R19 1kΩ
R2 1kΩ	R11 27kΩ	R20 27kΩ
R3 680Ω	R12 15kΩ	R21 2.2kΩ
R4 680Ω	R13 270Ω	R22 6.8kΩ
R5 33kΩ	R14 1kΩ	R23 10kΩ
R6 100Ω	R15 3.3kΩ	R24 10kΩ
R7 39kΩ	R16 33kΩ	R25 680Ω
R8 2.2kΩ	R17 15kΩ	R26 270Ω
R9 270Ω	R18 3.9kΩ	

All resistors $\frac{1}{2}$ W 10%

VR1 10kΩ potentiometer, linear

Capacitors:

C1 0.01μF ceramic	C16 8μF 12VW/elec
C2 150pF 5% poly	C17 0.5pF *
C3 0.01μF ceramic	C18 0.1μF ceramic
C4 0.01μF ceramic	C19 15pF 5% poly
C5 250pF 5% poly	C20 0.1μF ceramic
C6 250pF 5% poly	C21 0.1μF ceramic
C7 0.01μF ceramic	C22 0.1μF ceramic
C8 1000pF poly	C23 100pF 5% poly
C9 0.1μF ceramic	C24 100pF 5% poly
C10 0.1μF ceramic	C25 100pF 5% poly
C11 0.5pF *	C26 2200pF poly
C12 0.1μF ceramic	C27 1000pF poly
C13 0.1μF ceramic	C28 0.01μF ceramic
C14 10pF 5% poly	C29 0.01μF ceramic
C15 10pF 5% poly	C30 100μF 12VW/elec

* These low value capacitors are obtained by using high value resistors (4.7 MΩ).

VC1a-b 180 + 180pF ganged (Jackson Type F/SLF)

TC1-2 30pF trimmers (part of VC1a-b)

Semi-conductors:

Tr1 BF167	Tr4 BF115
Tr2 BF115	Tr5 BC108
Tr3 BF115	Tr6 BF115
D1 OA202	
D2 OA202	
D3 5.6V 250mW Zener	

IF Transformers:

1FT-1 T41/1E (Weyrad)	1FT-2 T41/2E (Weyrad)
1FT-3 T41/2E (Weyrad)	1FT-4 T41/3T (Weyrad)

Miscellaneous:

Feedthrough capacitors (8). Cord drive with $\frac{3}{4}$ in. drive drum and two $\frac{1}{2}$ in. pulleys. Chassis 8 x 4 x 1 in. (see text). Tag strip, 16 way.

receiver and the scale should be initially calibrated from 1.5 to 2MHz with the aid of the signal generator, in 100kHz steps, which can be subdivided into 10kHz steps if desired.

Note. The cores of L1-4 and L5 must each be treated with a core locking compound or high viscosity grease before they are screwed into the coils. In addition, the core of L5 should have a thin rubber band screwed in with it.

TO BE CONTINUED

NEXT MONTH IN

PRACTICAL WIRELESS

FREE WALL CHART No. 2

In the January issue we shall be presenting free the second wall chart on AUDIO STANDARDS. A must for all hi-fi enthusiasts.

PW. STEREO TAPE RECORDER

A project that has been specifically designed with the constructor in mind, the PW. Stereo Tape Recorder can be used with almost any tape deck which can be fitted with the specified Marriott tape heads. The prototype is based on the R.T.C. 249 push button, three speed deck. Careful thought has been given to both the electronic and constructional design to make it possible for the recorder to be built by the comparative newcomer to electronic construction. Simple switching has been made possible by using an unusual equalisation principle and although 16 transistors are used, the cost of the complete project should be only around £30.

LUXEMBOURG BANDSPREAD POCKET 7

This compact seven transistor superhet radio, in addition to covering the full medium wave-band, has a second band from 1400-1625kHz which enables the user to easily tune the popular stations in this band. The receiver is built in a readily available plastic case using widely available components.

PORTABLE SIGNAL TRACER

This versatile signal tracer is a further addition to our "build your own" test equipment series. This unit has three probes; for checking a.f., r.f. and e.h.t.—the latter for checking corona and high voltage breakdown.

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 January issue of Practical Wireless—on sale 4th December—price 3s. 6d.

SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

The first report this month comes from regular contributor **C. R. S. Stacey** of Tunbridge Wells who used his Lafayette HA-700 receiver and Joystick antenna to hear:

9665 *R. Trans Europe*, ident. in German at 1955
9705 *R. Voice of the Gospel* from 1815 to 1850
15410 *VOA, Tinang* in Chinese from 1611 to 1659.

Ian Howes of Lowestoft used his Unica 30 receiver with a TV aerial to send in an excellent first report which included:

4850 *Mauritania* noted at 2210
4900 *Radio Juventud*, Venezuela at 2240
4940 *R. Abidjan*, Ivory Coast at 2330
4967.5 *Radio Kuwait* noted at 2000
11805 *Radio Globo*, Brazil at 2220
11925 *Radio Bandeirantes*, Brazil at 0030
12175 *Radio Tehran*, Iran at 2000
15245 *Radio Kinshasa*, Congo noted at 2240
15410 *VOA, Philippines* at 1445

Robert Cork of Basingstoke has built the 'PW' modular short-wave receiver and connected it to a 15 foot antenna with the following results:

9540 *Radio New Zealand* to Pacific Islands at 0545

11672 *Radio Pakistan* noted at 2005
11675 *CBC, Radio Canada*, news in English at 0745

11745 *Voice of Nigeria*, news and comment at 2000

11750 *BBC Far East relay*, Tebrau, s-on at 0900

John Trewick of London Colney has sent in another report which contained:

6540 *Radio Pyongyang*, North Korea at 1930
9715 *Radio Nederland*, Bonaire at 0800
15330 *United Nations Radio Service* at 2100

Chris Vernon of South Ruislip made his own super-het receiver and used it with a 20ft. long-wire to hear:

6620 *Radio Peking* in English from 2155 to 2215
9625 *CBC, Radio Canada* in English from 0715 to 0745

11710 *ABC, Australia* in English from 0840 to 0920

11950 *Radio Japan* in English from 2030 to 2100
15255 *Radio Vilnius*, Lithuania in English at 2235-2300.

Simon Hamer of New Radnor in Wales has two receivers, a Mullard domestic receiver and a 10 transistor portable and two aerials, 25 and 60 foot long-wires. This line-up enabled him to hear:

11710 *ABC, Australia* from 0645 to 0915 in English

11790 *ABC, Australia* in Vietnamese, Eng. ID. at 2130

15105 *BBC, Atlantic relay*, Ascension Island at 0730

21690 *Windward Islands* to U.K., s-off at 2200

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz ● Times in GMT

Colin Blanchard of Sutton Coldfield has a 5 valve Mullard domestic superhet and a 50 foot long-wire and he has heard the following stations:

9625 *Radio Israel* with news in English at 2100
9912 *All India Radio* with music, Id. in Eng. at 2050

11720 *VOA, Tangier* with Jazz Hour from 2345 to 2400

11725 *Radio Peking* in English from 2100 to 2130
15320 *ABC, Australia*, Id. at 2255, news in Eng. at 2300

Nicholas Brooks of Naseby used his Astrad Auriga receiver and 120 foot long wire to hear several stations including:

11620 *All India Radio*, Delhi in English at 1930
11660 *Radio Pakistan*, Karachi in English at 2110
21440 *HCJB, Quito*, Ecuador in English at 2055
21650 *Radio Nederland*, Bonaire in English at 2030.

Roy Patrick of Derby has sent in some more interesting items including:

SOUTH KOREA, The Voice of Free Korea in Seoul has been heard in English at 0900 on the frequency of 9646kHz.

SYRIA, Radio Damascus is now on 9670 and the frequency of 15165 has been dropped.

DXing Tips

Now that the winter season is with us once again I have decided to give some hints about the tricks of the trade to help newcomers to become better DXers.

The subject for this month is the identification of stations using languages other than English. I have noticed that the majority of reports to this page concern broadcasts in English whereas the most interesting stations use other languages.

It is easier to catch the name of a station if one knows the words which precede the name. In English the most frequently used expressions are: This is... You are tuned to... You are listening to... In Spanish we have: Esta es... Aqui... Habla... In Portuguese: Aqui... Fala... Fala-vos... In French: Ici... Vous écoutez... Vous êtes à l'écoute. In Italian: Qui... Transmette... Questa é... In German: Hier ist... Hier spricht... In Russian: Govorit... Vy slushaite... In Arabic: Huna... Hadha... Hadihi... In Standard Chinese: po tien tai... Cantonese: bor deen toy... Vietnamese: Day la... Thai: Thini... Japanese: Kochirawa... desu. Mongolian: ...yarsh; Swahili: Hii ni... Afrikaans: Dit is... Hindi, Urdu: Yeh...hai. I hope that the above will be of use to some of you.

All reports, which should be in frequency order, must reach me by the 17th. of the month at the following address: 5 Ranelagh Gardens, Cranbrook, Ilford, Essex.

SHORT WAVES

THE AMATEUR BANDS

David Gibson, G3JDG

Frequencies in kHz • Times in GMT

CONDITIONS have varied quite a lot this past month. The l.f. bands, true to form, have begun to improve and it can only be hoped that this will continue thus enabling Santa to fill waiting ears with Christmas DX.

Talking l.f., **Paul Leach** (Cheshire) informs that a listen on 1880kHz in the evenings will often be rewarded by sigs from HBØXKZ (QSL via G3TXF). Paul hopes to take the R.A.E. in December before going to school in GD-land.

Twenty metres have proved its worth for those who were prepared to go on owl watch. Late nights and early mornings appear the most fruitful times to QRX.

Surprise of the month was undoubtedly ten metres. True its a temperamental old band with a character all of its own, but there were some very good openings especially towards the end of the month. North America and Japan were heard on two occasions.

P. Fereyear (Essex), Marconi No. 9 set built in 1943, no mention of any antenna (boy, they really knew how to build sets in 1943). He says that PAØPN can usually be logged at 1100 around 1805kHz.

On 3500kHz, Paul logged; CR7GJ, F6ACM/FC, OY7JD, PY1HA, VO1FG, VS6DO, WA1IKG, 9V1PP.

The majority of logs this month owe their existence to either 14 or 21MHz. Certainly these are nearly always the easiest bands to pick up DX although the EU stations sometimes make the going a bit rough.

K. Hastie (Roxburghshire), CR100, 60ft. long-wire, Joymatch a.t.u., had a peep at 14MHz and got: HC8KKU, HS3ACV, HV3SJ, K6GUY, KJ6CF, MP4BBA, VE2BM, 5Z4KL, all s.s.b. except the two sidebands from the HC station.

Twenty-one megahertz was found to be harbouring; CR6FP, CX4CR, K7UIT, OHØNI, WBØDIR, 4S7TB and 9V1NR all on s.s.b.

J. Moore (Leicester), still titivating the dial on his CR100/2 fed with 130ft. of wire via an a.t.u. managed to bag these on 14MHz; AX2AAR, AX2AGN, AX3JW, AX4KS, C31CY, CN8BG, EA6BN, ET3USA, FM7WW, HT6GAF, LU2FAO, OB4OS (another prefix for Peru), OHØNK, PY2DSC, PY3AHJ, PY7VGP, TI2RSR, VK3AM, VK3QX/M, VK5FM, VK7AZ, YS1O, YV1ON, YV1ACT/5, YV5DFI, ZB2A, ZM4FX, 4N2KO (Korcula Island), 4X4RW, 6Y5GA, 9G1BF, 9Y4KR.

Fifteen metres gave a good account of itself where John heard; CR4BB, CR6GA, CR6JW, CR7AF, CT3AS, EL2BU, EP2DX, HK3AUE, HS1ABC, IT1SEZ/P (Ustica), fifteen JA stations, JH1JLR, JR1HRX, KC6RS, KR6JU, KS6DH, LU1ZE, OD5EP, PZ1AP, TI2ALG, VP8KL, VP9MI, VU2BEO, VU2OLK, WB6WQV, W7HFD, XW8DM, ZC4CB, ZM6QK, ZS5OE, 5N2AAE, 5R8AS, 5VZWT, 7Z3AB, 9E3USA, 9G1BF, 9H1BX, 9H1CB, 9J2PV, 9V1PA.

A. Crooks (Leicester), RA1, PR30, 45ft. end-fed,

reports 20 metre sigs from; AX2DD, AX2OZ, AX3AYT, AX5EJ, CR6MT, CR7IC, CT3AN, EP2DA, ET3DS, FG7TD, HBØXJK/M, HK3BLD, JA3XPO, LU8DX, MP4QBK, OHØNI, PJ2HT, PZ1AC, PZ1DF, TA1KT, TF2WKI, TI2ES, TU2BB, VE1YY, VE3FKD, VP8HZ, VP8KL, VU2BEO, VU2VAE, YA1MLX, YV4AU, ZD7SD, 4N2KO, 4S7PB, 5X5MP, 5Z4MO, 6W8DY, 6Y5GA, 7Z3AB, 9Y4VV.

On 21MHz Andy hooked; CE7DW, CR6LC, CR7IZ, CT2AK, CX9CO, JA7BSD, K5TSR, KP4BBK, KR6JU, KV4AD, LG5LG, LU7SE, PZ1AP, SV1CC, SVØWY, VE3AIU, VP2MM, VP2VI, VP8KD, VP8KL, VS5RG, W6MSM, W7APA, ZD8AB, ZE1DG, ZS1NL, 3V8AL, 4N2LO, 4Z4AQ/MM (20°N 18°W), 5N2AAE, 5VZWT, 5Z4KM, 6W8AL, 9G1GT/M, 9H1CB, 9J2PV, 9M2VI, 9Q5QR, 9U5DP, 9V1PQ.

A. Trelinski (Warks.) has a Lasky's Skyrover with a b.f.o. Hoards of G stations logged on 3.5MHz while on 14MHz; CE1FF, K6DXX, 5T5AD, VK9NT, WB6NDC. Alexander says that some of these stations were stronger than Radio 4 (I don't know that callsign—new country?).

T Thornton (Berks.), CR7OA, 132ft. end-fed, is pleased with the results of an eavesdrop on 28MHz. Stations immediately responsible for causing such pleasure are; CR6GA, CX9CO, DU1FH, EA8GZ, FG7XT, KV4CM, LU5FEH, MP4BFO, PY8GES, TR8MC, ZC4IK, 4X4WP, 9H1BL.

S. Davies (S. Wales), Murphy B40C, "full-wave" dipole for 28MHz at 20ft. claims great activity on ten metres. Included in his log are; CE8AA, CR6FA, CR7AF, CX8DM, CT1UN, EL2AW, HK3VK, KG4AM, KP4ATS, K4EBW, K8SMC, LU2DEK, LU7AAG, PY2DSQ, VE3BPX/4, WB4OSW, WB6ODA, W5BY, ZE2JO, ZK5DV, ZP5GS, ZS1UF, ZS4MZ, 7Q7AA, 9J2RO, 9J2AG.

N. Richardson (Bucks.) reckons that conditions have been good on 144MHz. The gear comprises an 8-element Yagi, Garex converter, PR30, CR7OA tuning 28-30MHz. Signals of the a.m. variety were received from; F1APQ, F1BCI, F5VH, F6ALH, ON4RY, ON5HH, ON5NY, PAØCML, PAØFHV, PAØTLX, PAØJHT. Solitary sidebands squeaks from; GM3OXD/P, HB9ADJ/P, PAØFWS.

November offers a good choice for the contest enthusiast and s.w.b. The diary reads, November 7-8th, 40 metre phone contest; 7-8th, two metre c.w. contest; 14-15th, top-band contest; 20-21st, Malta Independence Day phone/c.w. contest; 27-28th, CQ world-wide DX contest; December 6th, 2 metre fixed-station contest.

Please note. The address for all communications, which includes logs, for The Amateur Bands is now:

14, Manland Avenue, Harpenden, Herts.

Logs in alphabetical order please, to arrive by the 15th of the month.

LETTERS...

The Editor does not necessarily endorse the views expressed by correspondents

Light communication

Concerning the article in the June P.W. concerning the Light-Operated Telephone, I have some comments to make:

Some years ago I had cause to experiment with light-modulated beams and whilst doing this I noted the restriction of h.f. due to the delay in the bulb filament heating and cooling at h.f. The amplifiers used at this time to drive the bulb were ECC83/6V6 valved units with an output of about 2-3W into 3 ohms. I drove the bulb from the secondary of the output transformer. I experimented with various bulbs and found the pre-focus type gave the best performance (I recall I used a 6V type). To overcome the h.f. heating lag, I included a battery in series with the bulb/transformer secondary, under-running the bulb just enough to see the filament glowing. The battery was bypassed to a.f. with a 25 μ F capacitor. When signals were transmitted, the filament, already hot, was able to pass considerably more h.f., and overall a better performance was obtained.—**Roger Bunney** (*Hampshire*).

Musical pollution

I think it's about time something was done about piped music and background music. Music is supposed to soothe the savage breast but when one gets a juke box blaring in a pub when one is trying to talk business or has musical "inducement" when trying to buy clothes and to cap it all, music in the Hilton's lifts, it makes one's breast all the more savage to think that some cretin somewhere has conned some morons somewhere else into thinking that this intrusion induces sales and adds to enjoyment.—**M. Casey** (*London*).

Wiring colours

I am sorry about Mr. Gallacher's colour blindness but feel that this minority affliction hardly constitutes a valid argument against the well-recognised colour coding for mains wiring, red, black and green.

He does not mention the other widespread use of green and

red—namely road signs. I do not know if he drives a car, but if he does, although traffic signals can be recognised by position, what of the single lamps used at traffic control of roadworks, and the very many danger signs and direction signs. Also, what about the compulsory red rear lights on cars?

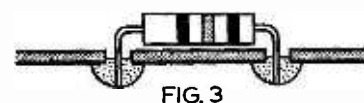
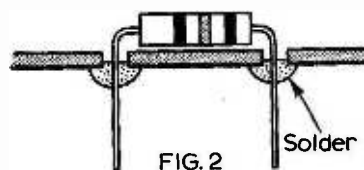
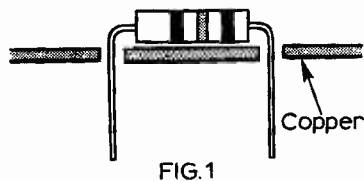
Although we now have to accept the new colours for mains wiring, I still cannot see the reason for the modification, or for the choice of these colours.

Often, I feel, they get together and decide on some new way, or new regulation (particularly on cars) to boost sales and profits.—**E. W. Baigent** (*Buckinghamshire*).

Printed circuits

I read Mr. R. A. Yates' article in the May edition of *Practical Wireless* concerning the making of printed circuit boards with some interest. However, Mr. Yates' advice to bend the ends of the leads to the wire becoming bonded to the copper laminate with a film of solder which does not remove easily on desoldering and removal of the component becomes more difficult and can result in a damaged laminate.

The method taught me is to leave the leads long and to push the leads through the holes drilled in the board as in Fig. 1. The iron is then rested with the



side of the bit on the laminate and the end on the lead. A quick application of the solder results in a neat mound of solder as in Fig. 2. It only remains then to cut off the lead at the top of the mound giving the result shown in Fig. 3 which can be desoldered quite easily for the component removal if this should become necessary at some later stage.

This is a well-tried method and I hope it may help readers to make better printed circuit boards.—**A. Morgan** (*Berkshire*).

Born too soon?

I am now 71 years of age and I fear have entered my second childhood. Some time ago, I found my old toy box with relics of my younger days and in it was a book by Maurice Child called "Small Power Wireless Installations," price 1s. There was another book entitled "Wireless Telegraphy for Amateurs," by Hawgrave Graham. I put the books down, rested my old head in my hands and lapsed into reverie. I remembered my first set, built in a cigar box from instructions from the "Scout." Next came a more ambitious one in a Hudson soap box with sliders, etc. I had a fine aerial with broomsticks as spreaders and aluminium wire. Alas, near me lived a police sergeant and when the 1914 War broke out, I was ordered to hand in the lot. When 2LO came on the air, I was off again!

Some time later I remembered an old domestic set for medium and long waves under the bench. I stripped the coils out, got new ones from Denco with a 3-gang 300pF capacitor and re-built the chassis for long, medium, short and trawler reception. It worked, but the hum was nearly as loud as the signal!

Now, I spend hours in my shed with this set and copies of P.W., wondering if I'll ever be able to master all this n.p.n. and p.n.p. business and zeners and all the other mysterious things happening today in the world of radio. So please tell those "size 8 heads" to have pity on us old ones—we can't help it—we were just born 60 years too soon!—**W. Wickins** (*Norfolk*).

I.C. Stereo Equalisers & Mixers

CALEB BRADLEY B.Sc.

INTEGRATED circuit flatpacks are now available containing two or more linear amplifiers with sufficient isolation for multi-channel audio use. Possible applications are in equalisers for stereo signal sources where two preamps with identical frequency responses are required and in audio mixers where two or more preamp stages are needed (two for each signal source for stereo). Each of the circuits described here consists of one i.c. and a few discrete components and can be constructed inside a very small space; for example, the equaliser circuits can be fitted easily into a matchbox. More space is occupied by the controls in the case of the mixers. Power requirements are small and are simply met by batteries which will have many months' useful life. Alternatively, these circuits will generally be feeding a main amplifier from which power can be taken.

The i.c.'s used here are the Motorola MC1303P which contains two linear amplifiers, and the R.C.A. CA3048 which contains four linear amplifiers.

MC1303P

This device forms an ideal basis for a stereo preamplifier. By adding suitable feedback components, the two amplifiers can be given a suitable frequency response for equalisation of stereo signal sources such as magnetic pickups or tape playback heads; alternatively, the MC1303P can serve as a high-gain, low-noise and low-distortion preamp stage with a flat frequency response suitable for two inputs from tuner, microphone, electric guitar, etc. The equaliser circuits can be added to any valve or transistor amplifier as the MC1303P has a low impedance output to suit both high and low impedance amplifier inputs. An output swing of up to 5.5V is available, enough to drive almost any audio amplifier. Lower distortion is obtained with smaller outputs, however.

The MC1303P consists of two separate high gain amplifiers in a 14-lead flatpack. The two amplifiers are arbitrarily labelled for left and right stereo channels in the circuit shown in Fig. 1, but there is no reason why they should not be used for any pair of mono signals. Only the power supply connections are common to both channels. From the characteristics listed in Table 1, it can be seen that the channel separation is high. The circuit consists of 16 transistors and 18 resistors, not an exceptionally large total to squeeze on a tiny silicon chip inside a plastic slab only $\frac{1}{4}$ in. long, by today's standards. Component references are given for the 'left' channel only as both amplifiers are identical. Operation is as follows.

Positive and inverted inputs are received by the long-tailed pair amplifier Tr1, Tr2. This is directly coupled to a second similar amplifier Tr4, Tr5. The tail current of Tr4, Tr5 is sampled by Tr3 which is a constant current source in the tail of Tr1, Tr2. This

MOTOROLA MC1303P Summary of Characteristics

Type:	Monolithic two-channel amplifier, silicon epitaxial structure, in standard 14-lead flatpack.
Max. supply voltage (25°C)	-15-0-15V d.c.
Temperature range	0-75°C
Channel separation (10kHz)	>60dB
Characteristics each channel:	
Open loop gain	>8000 (78dB)
Output voltage swing	4.5-5.5V r.m.s. max.
Input noise volts	0.5µV typical
Input bias current (mean of +ve & -ve inputs)	1-10µA
Input offset current	0.2-0.4µA
D.C. Power dissipation	300mW max.

TABLE 1

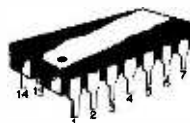
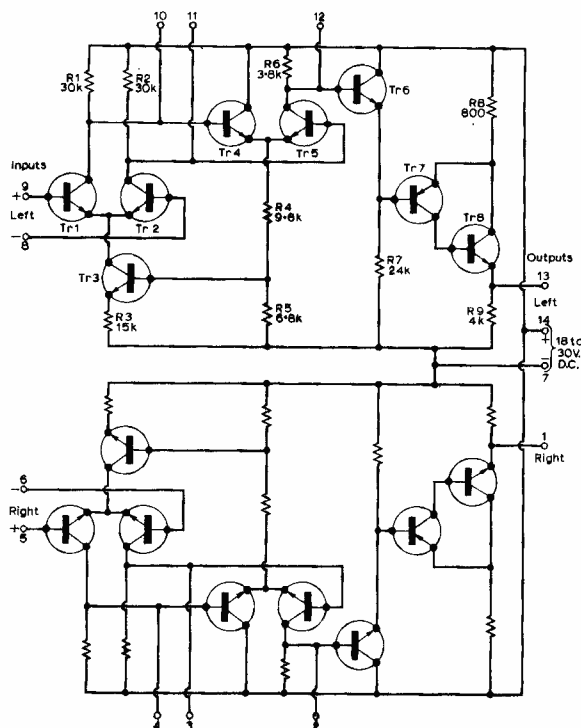


Fig. 1: The internal circuitry and packaging of the MC1303P i.c. two-channel amplifier.

Merry Christmas from Antex

Complete Soldering Kit 55/-

This contains the iron fitted with a $\frac{1}{16}$ " bit, interchangeable spare bits $\frac{3}{32}$ " and $\frac{1}{8}$ ", resin cored solder; felt cleaning pad; stand for soldering iron, and a booklet "How to solder." From Electrical and Radio Shops or send cash to Antex.

Model CN 240/2
15 watts - 240 volts 34/-
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ROC ELECTRONICS

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, Tachometer, 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

4 BAND SHORT WAVE RECEIVER KIT Mod. R.140



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

PRICE: £9.8.0

PROFESSIONAL SOLID STATE FOUR BAND COMMUNICATION RECEIVER Model R.135

This is the communication receiver that you have long been waiting for. Fully transistorised and continuous coverage from 555 KhZ-3 MHz in four bands including illuminated electronic bandspread for 160-10 metres. Also incorporated is an internal speaker, automatic noise limiter, SSB/AM/CW Switch, AVC Switch, S Meter, Receive and Standby Switch, external socket for headphone or speaker, bandspread control, BFO control, on/off/AF gain, band selector, antenna trimmer and RF gain. The R.135 will run off of 240v AC, dry batteries or any 12v DC negative ground source.



PRICE: £45.0.0

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.

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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 loudspeaker. Like all Roc Electronic Kits every item is included down to the last nut and bolt so that the constructor can start assembly within minutes of opening the package.

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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.T. 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

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

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.

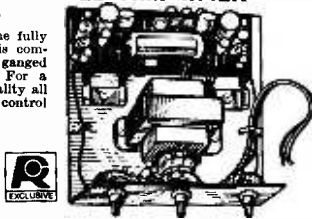
PRICE £1.10.0

5 WATT STEREO INTEGRATED AMPLIFIER CHASSIS Model R.123

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

SPECIFICATION: Output: 5W total, 2.5W per channel. Input sensitivity: 600mV at 2.2Mohms. A.C. 240v. operation

PRICE £4.19.0



5 WATT 8 TRACK CARTRIDGE STEREO AMPLIFIER Model R.133

Just slot in one of the many 8 track cartridge tapes available for a continuous programme of your favourite music. A manual programme override switch enables you to switch from one track to the next at the push of a button at the same time a numbered indicator lights up to show which track is playing. Beautifully finished in an oiled walnut cabinet the R.133 is mechanically engineered to provide long and reliable service. SPECIFICATION—Tape speed: 9.5 cm/sec (3 1/2 i.p.s.). Wow & flutter: better than 0.3%. Frequency range: 40-12,000Hz. Cross talk: better than 45dB at 1,000Hz. Output: 5W total, 2.5W per channel. Amplifier outputs: 200mV.

PRICE £36.0.0



AM/FM/MPX STEREO TUNER

Model R.134



Perfect Matching Unit to the R.136 Amplifier. The R.134 Stereo Tuner is designed to give years of reliable performance. The Tuning Band covers AM & FM with a separate stereo beacon to indicate when stereo broadcasts are being received.

SPECIFICATION: FM: Frequency Range: 88-108MHz. Usable Sensitivity: 18µV. Stereo Separation: 26dB at 1kHz. Image Rejection: 50dB. AM: Frequency Range: 535-1,605kHz. Usable Sensitivity: 280µV.

PRICE: £21.0.0

4 WATT STEREO FM/AM/MPX TUNER AMPLIFIER

Model R.124

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



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

PRICE £29.19.0



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

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arrangement provides d.c. feedback for stability and gives a high input impedance. As the circuit has a high gain extending far into the radio frequencies, some top cut must be introduced to ensure stability for audio use. This can be done by connecting an external capacitor (up to 1000pF) between tags 10 and 11.

The amplified signal across R6 is fed by emitter follower Tr6 to the complementary p-n-p/n-p-n amplifier Tr7, Tr8. This provides a low impedance emitter follower output on pin 13.

The basic wiring needed to operate the i.c. as a stereo preamp is shown in Fig. 2. Each channel has a feedback network wired from the output to the invert input to give an overall frequency response

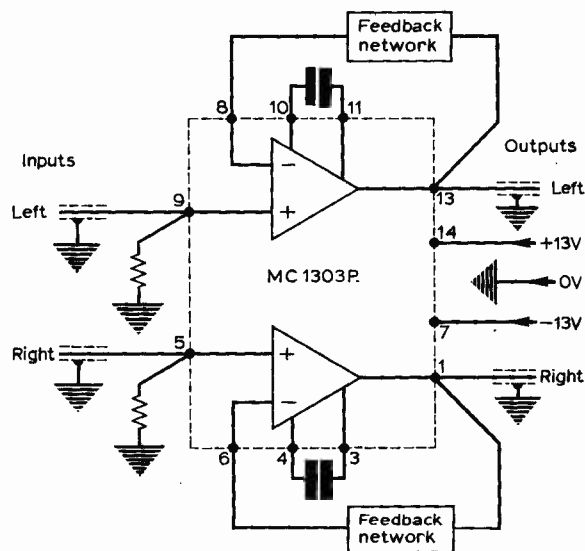


Fig. 2: Basic wiring of MC1303P for stereo preamp use.

appropriate to the signal source. The device needs a centre-tapped power supply of between $-9/0/9V$ and $-15/0/15V$ d.c. and the current drawn is only 22mA approx. The centre tap is needed to provide a bias connection for the input stages, and is a suitable earth point for the input and output cable screens.

PREAMP WITH LEVEL RESPONSE

The circuit in Fig. 3 is suitable for low level signal sources which do not require equalisation. It gives a signal gain of 40 dB (i.e. 100) with a response of 10Hz - 50kHz, $-3dB$. Since the lower end of R2 is returned to earth at a.f. by C3, the proportion of the output signal fed back to the invert input is approximately $R2/R3 = 1/100$. Since the open loop gain of the amplifier is very high, this sets the gain of this channel at 100 at audio frequencies. At higher frequencies, additional feedback is provided by C4 and the gain falls off.

Only 0.05V r.m.s. input is sufficient to drive either channel to full output (5V r.m.s.); beyond this distortion increases rapidly. Larger inputs can be handled if the gain is reduced by reducing the values of R3 and R6. The gain can be recalculated from the relation given.

MAGNETIC CARTRIDGE EQUALISER

The circuit in Fig. 4 is a useful addition to audio amplifiers with no provision for magnetic pickups,

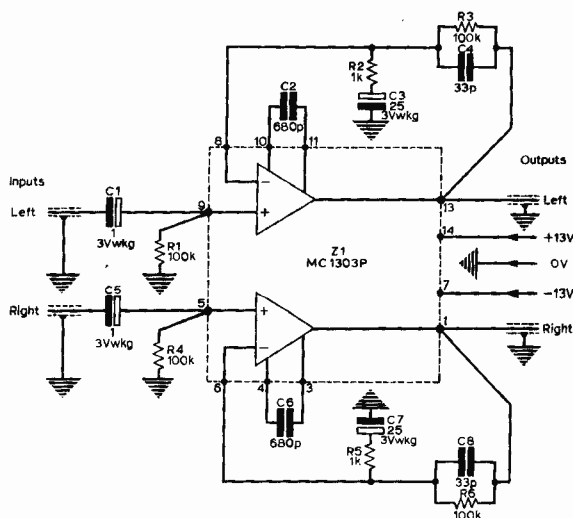


Fig. 3: General purpose stereo preamp with level frequency response.

and it also enables a record player to be improved by conversion to a magnetic pickup. The feedback network R3, R4, C4, C5 is chosen to give the standard RIAA LP record playback curve frequency response. Gain is 34dB (50) at 1kHz. For a maximum output of 5V r.m.s. at 1kHz, 100mV r.m.s. input is required and total harmonic distortion is 0.1 %. Noise

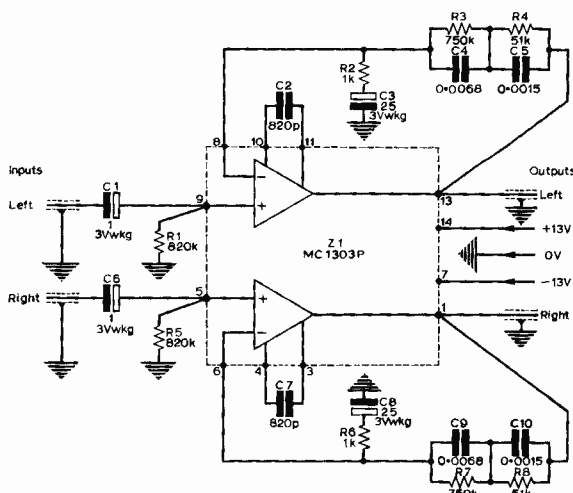


Fig. 4: R.I.A.A. equalised preamp for magnetic pickups.

is 70 dB below a 10mV input and hence the circuit is suitable for the lowest output stereo cartridges. As the input impedance is high, special care must be given to adequate screening of the input leads from the record deck to minimise hum pickup.

TAPE HEAD EQUALISATION

Very few commercial amplifiers or preamps provide for low level inputs from stereo (i.e. $\frac{1}{4}$ track) tape playback heads; an input labelled 'tape' is generally for medium level signals that have already been equalised in a tape recorder. The circuit in Fig. 5 provides NAB tape playback equalisation for either $7\frac{1}{2}$ or $3\frac{3}{4}$ inches per second playing speeds, depending on the values of feedback components R4, C4, etc.

For $1\frac{1}{2}$ i.p.s. speed, the values given for $3\frac{3}{4}$ i.p.s. are fairly satisfactory, or optimum values can be found by experiment. A two pole, three way switch will enable the component values to be switched for different speeds; on many tape decks this switch can be mechanically coupled to the deck speed selector.

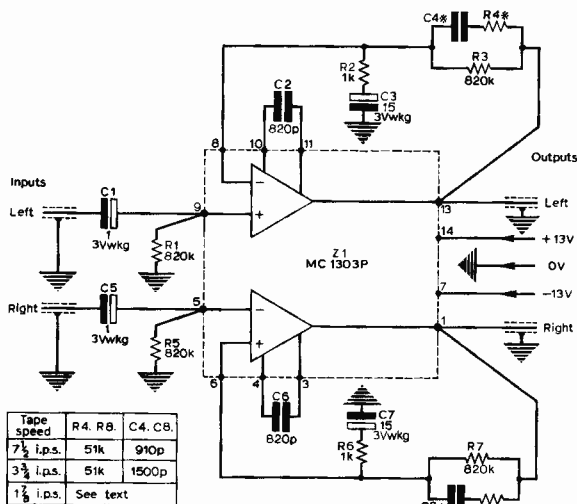


Fig. 5: Equaliser for stereo tape playback.

TWO-CHANNEL MIXERS

The MC1303P can serve as an active mixer for two mono signals if the two outputs in Fig. 3 are connected to potentiometers as in Fig. 6. Such a circuit would be useful for mixing two microphone signals. The $6.8k\Omega$ resistors serve to reduce interaction of the two level controls, and can be increased

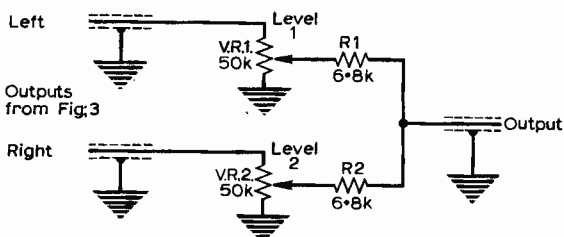


Fig. 6: Additional circuitry to convert Fig. 3 to an active two channel audio mixer.

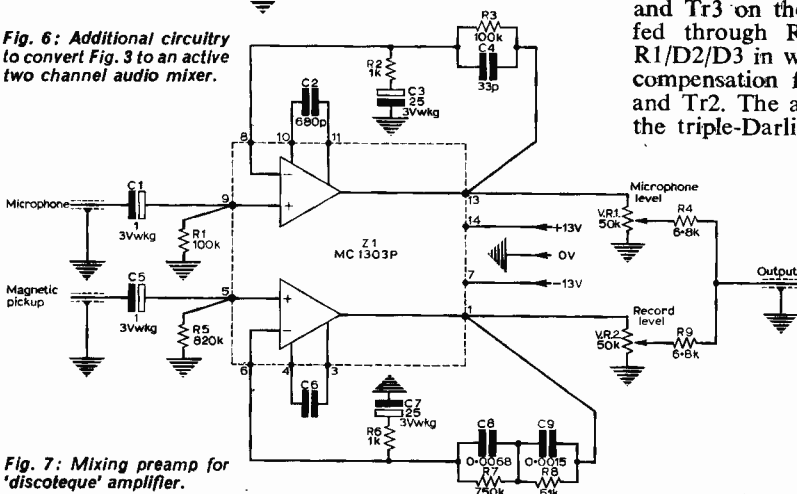
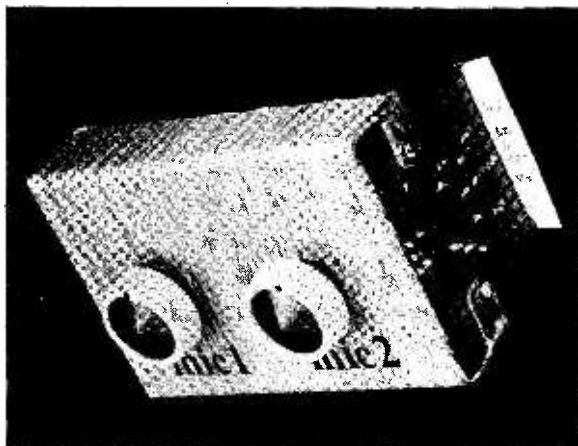


Fig. 7: Mixing preamp for 'discotheque' amplifier.

to $10k\Omega$ if the output loading is more than $50k\Omega$. The output loading should be not less than $10k\Omega$ unless lower values are chosen for VR1, R1, etc. Either amplifier in the MC1303P may be independently equalised using the component values in Figs. 4 or 5. An example is the mixer circuit in Fig. 7 which was designed for a 'discotheque' amplifier. One amplifier has a flat response and takes the signal from a disc jockey's microphone, the other amplifier provides RIAA equalisation for a mono magnetic record pickup.



The small physical size of the i.c.s. makes it possible to build the equalisers and mixers very small.

CA3048

The RCA CA3048 is a 16-lead flatpack containing no less than four separate identical amplifiers. Characteristics of each amplifier are shown in Table 2. The circuit of half the device (i.e. two amplifiers) is shown in Fig. 8 where component references are given for one amplifier only. The circuit of the other two amplifiers is identical and separate, except that all the earth connections are to one pin, pin 5. Each amplifier operates as follows.

Positive and inverted inputs are received by a long-tailed pair amplifier consisting of Darlington-connected pair Tr1, Tr2 on the positive input side, and Tr3 on the other. Base bias current for Tr1 is fed through R3 from the potential divider R2/R1/D2/D3 in which D2 and D3 provide temperature compensation for the emitter/base junctions of Tr1 and Tr2. The amplified signal across R6 is taken to the triple-Darlington amplifier Tr4, Tr5, Tr6 which provides a low impedance output at pin 1 with a voltage gain equal to $(R11+R12)/R10 = 5$ (14 dB).

Unlike the amplifiers in the MC1303P, each amplifier in the CA3048 has an in-built a.c. and d.c. negative feedback loop R7, R9 between the output and the inverted input. Temperature compensation for the emitter/base junction of Tr3 is provided by D1. The effect of this feedback is to give each

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

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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 over the two channels. The amplifier is ideal for use with reproduction and at the same time, 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 £28.19.6 plus 7/6 post and insurance.

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B84	100	Silicon Diodes DO-7 glass equiv. to OA200, OA202.	10/-
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B86	50	Sil. Diodes sub. min. IN914 and IN916 types.	10/-
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R.C.A. CA3048 Summary of Characteristics

Type: Monolithic four-channel amplifier, silicon epitaxial structure, in standard 16-lead flatpack. Each amplifier has a.c. and temperature-compensating d.c. feedback.

Max. supply voltage (25°C) +16V d.c.

Temperature range -25°C to 85°C

Channel separation (1kHz) >45dB

Characteristics each channel:

Open loop gain (a.c. feedback bypassed) >500 (54dB)

Gain with feedback 6 (16dB) approx

D.C. Power dissipation 150mW

TABLE 2

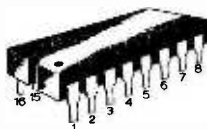
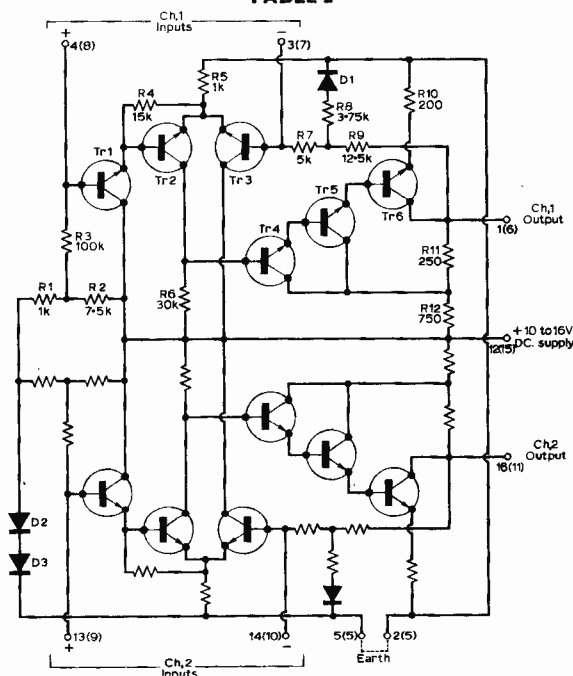


Fig. 8 (above): Internal circuit and pin identification of the CA3048 i.c. 4-channel amplifier. The circuit of half the device is shown; the other half is similar with connections to the pin numbers in brackets.

Fig. 9 (right): (a) Four channel active audio mixer using CA3048 (b) Modification for mixing two stereo signals (see text).

amplifier a very linear frequency response and a high input impedance of nearly 100k Ω , the value of R3. It also produces very low impedance at the inverted input. By bypassing pin 3 to earth through a large capacitor (50 - 100 μ F for audio frequencies), the feedback is removed at a.f. and the gain of the amplifier rises from about 16dB (6) to 57dB (700). A variable resistor

of 25k Ω in series with the capacitor can be used as a gain control over this range.

4-CHANNEL AUDIO MIXER

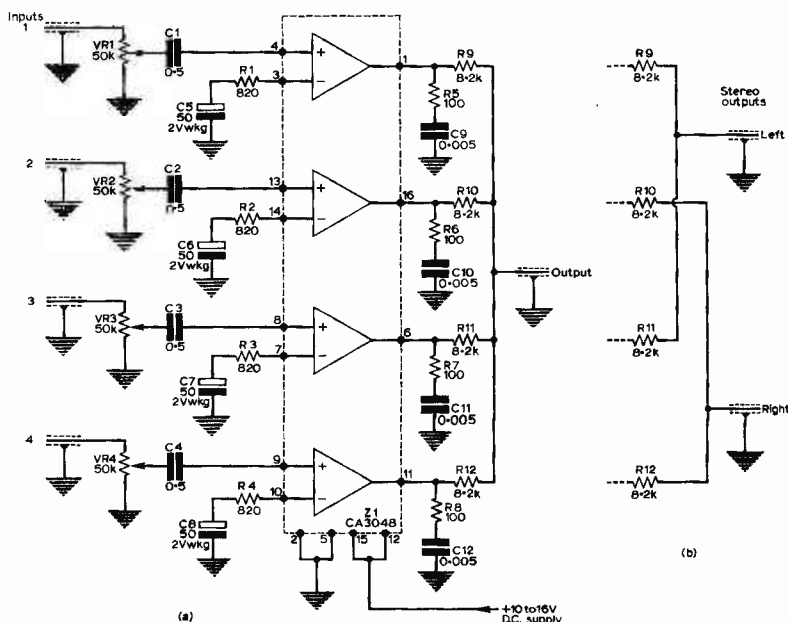
The circuit of a 4-channel active audio mixer based on the CA3048 is shown in Fig. 9a. Each input signal is brought through a level control (VR1 etc.) to an amplifier providing 34dB (50) gain, set by the value of R1, etc. The four outputs are combined by R9, etc. to produce a single output; the effect of these combining resistors is to reduce each channel's gain to approximately 20dB (10). As for the two -channel mixers described, the output loading should not be less than 10k Ω .

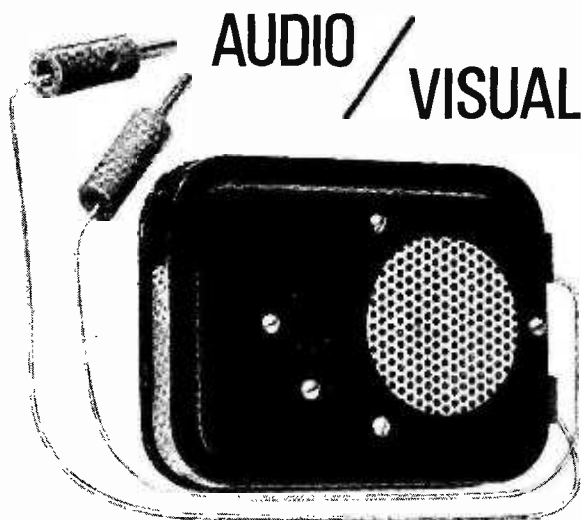
Instead of mixing four mono signals, the CA3048 can be used to mix two stereo signals. For this, double ganged potentiometers are used for VR1/VR3 and VR2/VR4, and the output arrangement is modified as shown in Fig. 9b. Each double ganged potentiometer then gives simultaneous control of the left and right channels of one stereo signal, and the maintenance of left/right balance will be as good as the tracking accuracy of the potentiometers used.

CONSTRUCTION

Since each of the circuits given consists of one i.c. and only a handful of discrete components, no firm layouts need be given. The pin arrangements of the i.c.s will suggest suitable layouts, and provided component leads are kept short there should be no stability problems. The circuits can be wired up conveniently on a small piece of drilled paxolin sheet or Veroboard, and put in a metal lozenge or tobacco box for screening. The screens of the input and output leads and the power supply earth should be connected to the metal box, ideally at the same point. The author's preference is to connect the i.c. in 'dead insect' fashion, i.e. on its 'back' with the pins sticking up. It is then possible to desolder the pins one by one at a later date and remove the i.c. intact.

—continued on page 651





CONTINUITY TESTER

M.A.SPARKS

WHEN only a few points have to be checked for continuity an ordinary ohm-meter is as convenient as any instrument to use. But if a large number of continuity tests have to be made, then the continued looking from test points to meter scale and back again can become rather tedious.

Sometimes, too, it is useful to be able to make continuity tests in a situation where a conventional meter would be inconvenient or even dangerous; at the top of an aerial mast for example. The unit to be described gives both an audible and visual indication of continuity between two points and will also give some indication of intermittent contacts and resistances in circuit up to about 1k Ω .

CIRCUIT

As can be seen from the circuit diagram in Fig.1, the tester consists basically of a low frequency free-running or astable multivibrator. Because the circuit is not exactly symmetrical, when the current

supply is completed through the probes the current through one transistor (say Tr1) increases faster than the current through the other. The collector voltage of Tr1 will rise to almost zero.

This voltage change will be fed to the base of Tr2, so reducing its collector current and making its collector voltage more negative. This change is fed back to the base of Tr1, so causing a further increase in the collector current of Tr1. This regenerative action will continue until Tr1 is hard on and Tr2 cut off.

Capacitor C1 now charges up through R2 until the base of Tr2 becomes sufficiently negative that Tr2 begins to conduct, regenerative feedback causing Tr2 to turn hard on and Tr1 to cut off. C2 now charges up through R3 and the cycle repeats.

With the values of C1, C2 and R2, R3 given in Fig.1 the circuit oscillates a few times per second, causing the bulb in the collector circuit of Tr2 to flash on and off, alternating with a pulse of sound from the speaker in the collector circuit of Tr1.

CONSTRUCTION

Almost any p-n-p transistors with a collector current rating of about 100mA. or more can be used. The frequency of oscillation can be varied by altering the values of C1 and C2. Increasing the value will

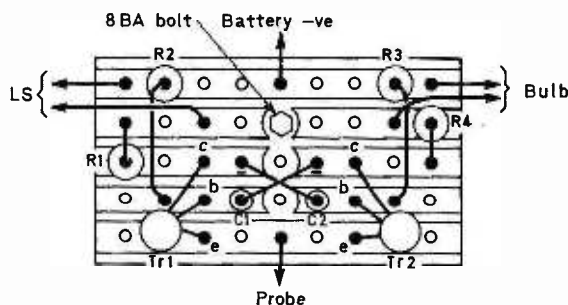


Fig. 2: Wiring of circuit board.

reduce the frequency; decreasing it will increase the frequency. If the frequency is increased very much, however, the bulb will appear to be on continuously owing to the thermal lag of the filament.

The small components are mounted vertically on a piece of Veroboard 9 holes long by 5 rows wide as shown in Fig.2. The centre hole of row two is

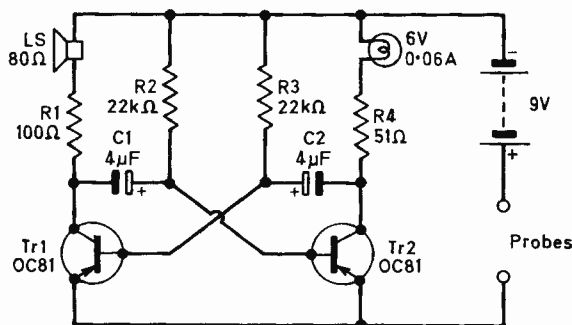
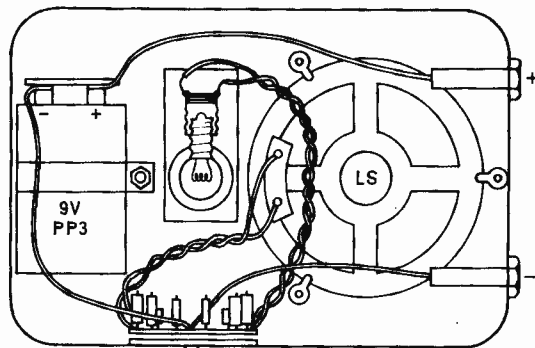


Fig. 1: Circuit of tester. All resistors are $\frac{1}{4}W$.



Positioning of major components and circuit board.

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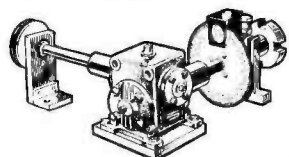
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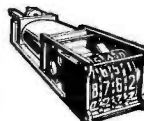
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drilled out to take an 8BA mounting bolt and the copper strip cut well back so that the two halves do not short circuit across the nut.

A two ounce tobacco tin makes a convenient case for the tester with holes for the speaker and bulb cut in the base. The speaker is protected by a piece of perforated zinc across the opening and the hole for the bulb to show through is covered by a thin piece of coloured plastic sheet which is also large enough to insulate the bulb holder from the tin case. To prevent the copper strips of the Veroboard from shorting to the tin they are covered by a piece of thin s.r.b.p. sheet.

NOTES ON USE

Any convenient pair of test leads plugged into the sockets form the probes. Continuity between the probes is indicated by the regular bleeping and flashing emitted by the tester. As the resistance between the probes increases, so the bleeps and flashes become weaker and cease altogether if the resistance is more than about $1k\Omega$.



Rear view of tester and cover with magnet attached.

Intermittent contacts are shown by random crackling noises from the speaker. A shallow pot magnet bolted to the lid of the tin enables the tester to be 'stuck' to any convenient iron or steel surface and thus leave both hands free for more important tasks. ■

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PRACTICAL WIRELESS, DEC. 1970

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There are so many standards, each valid in its own right, each different. Reading the specifications of a number of pieces of audio equipment, one could be forgiven for concluding that manufacturers set out deliberately to confuse. Usually, the reason for the great discrepancies is simply that each applies the standard to suit his own test procedures.

In an effort to clarify matters—or at least, to present the most important tests and measurements to the audiophile—*Practical Wireless* has whittled away the mass of standards and revealed the bare bones of facts and figures relating to international audio standards, and has included, where such inclusion may help, the methods and limits of testing and the types of test gear that must be used.

There are at least eighteen standards organisations publishing audio specifications. Space forbids their being listed here. Fuller details, including the addresses of standards-making organisations can be furnished to readers who apply to the Query Service in the usual way.

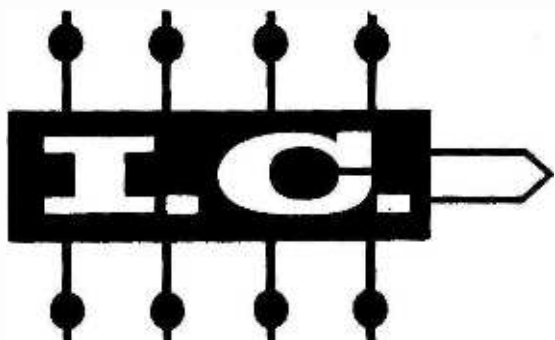
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OF THE MONTH

L.A.J. IRELAND

Number 14

The Motorola MC1596G Modulator/Demodulator

A NEW special purpose i.c. which will be of interest to the amateur radio fraternity is the Motorola MC1596G modulator/demodulator circuit. It can be applied to communications problems, in particular the generation of suppressed carrier signals; however, it will also act as a standard a.m. modulator, and in receiver circuits as a detector, not to mention its possibilities in laboratory instrumentation.

Circuit

The basic mode of operation can be deduced from the circuit diagram, Fig. 1. It should be remembered that in standard applications, a signal of considerable amplitude is supplied as the carrier, with the result that Tr1-Tr4 act in a switching, rather than a linear mode. The output is therefore the product of the signal input and a "square wave" of a frequency determined by the carrier signal; the signal input alone determines the amplitude of the output signal.

Theory

At this stage it is necessary to introduce a little mathematics. The Fourier analysis of a square wave is a sine wave of the same frequency plus a series of sine waves whose frequencies are the odd harmonics (multiples) of the basic square wave frequency, or fundamental. It follows then that if the modulator circuit is followed by a filter which passes the fundamental but blocks all the harmonics, the output of the complete assembly will be a sine wave whose amplitude is determined by the signal input. All the applications of the MC1596G are elaborations on this theoretical scheme.

A concept frequently found in electronics text books enters here, the idea of bandwidth. Only an infinitely long series of sine waves is definitively fixed in frequency: this, a further conclusion from Fourier theory, can be illustrated approximately as follows. To determine frequency, a number of sine waves must be counted and the corresponding time measured, from which the Hertz number (or cycles per second) can be calculated. The more cycles included in the count the more accurate the result will be; therefore to determine the frequency with absolute accuracy (zero bandwidth) an infinite series is required.

In a modulated signal the characteristics are constantly changing, in a manner determined by the modulating waveform; as a result only brief intervals are available for frequency determination, and the more complex the modulation the briefer the intervals, and therefore the greater the possible deviation from the precise frequency.

This deviation takes the name bandwidth, and it evidently applies as much to amplitude modulated signals as to f.m. transmissions. Those parts of the signal lying at frequencies other than the precise carrier frequency are referred to as the sidebands of the signal. Now, as it is the modulation which is responsible for producing the sidebands, it follows that the information can be reconstituted from the sidebands and the carrier may be regarded simply as a means of locating them. Therefore to transmit a given amount of information with the minimum radiated power, the carrier frequency should be omitted, and in a balanced circuit this is precisely the function the i.c. performs.

Moreover, as the sidebands are present symmetrically on each side of the carrier, either one carries

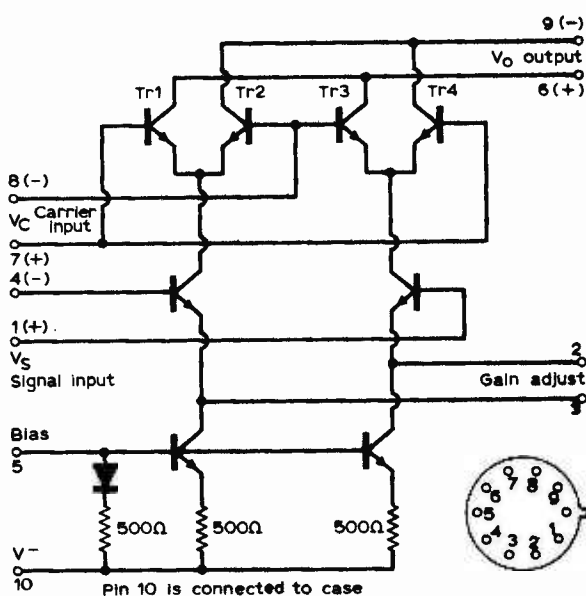


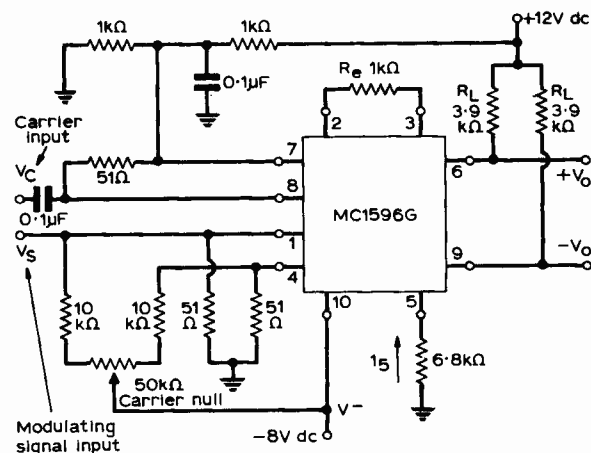
Fig. 1: Circuit of the MC1596G. Pin 10 is adjacent to the spigot.

the full information, so for even more effective use of available power, and to limit the bandwidth demands even further, one of the sidebands may be filtered out. The transmitted signal finally produced is referred to as "single sideband suppressed carrier" or s.s.b. (Sideband rejection, of course, is carried out by a series of LC circuits, not in the balanced modulator).

It should be noted that the analysis given above assumes accurate switching operation in the full wave gate section of the i.e. (Tr1-Tr4) so that the Fourier series of sine waves is produced. This is obviously dependent on the amplitude of the carrier signal applied to the modulator; should this be significantly lower than 300mV the transistors do not switch cleanly, with a consequent departure from precise squaring of the waveform, and therefore from the Fourier series. This implies a residual carrier-frequency component, to a degree determined by the extent of linear operation in the gate transistors, so the circuit output approaches the conventional amplitude modulation.

Applications

For use as a detector of either a.m. or s.s.b. signals, a carrier wave must be supplied in the same way as in the modulator case; however, this time the carrier is selected to be at the same frequency as the carrier of the signal to be detected. In a practical example, the signal is delivered by the final i.f. stage of a receiver, while the local carrier is generated by the receiver b.f.o. (beat frequency oscillator). The sideband will be displaced from the carrier by the amount of the modulation frequency, so it follows that if all the high frequency components of the i.c. output are rejected, the system output will be the audio modulation alone.



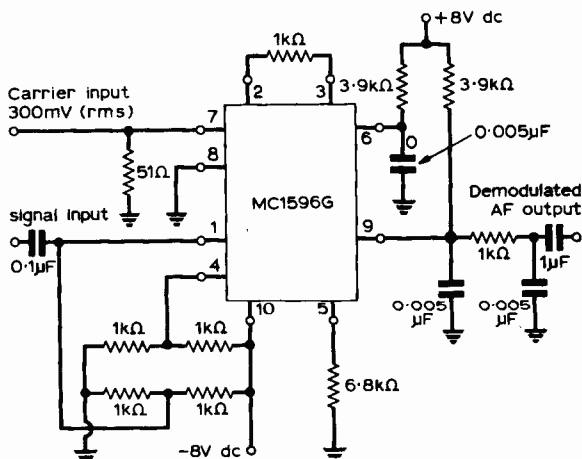
Operation of the MC1596G as a balanced modulator. If the circuit is unbalanced with the "carrier null" control a component at carrier frequency is introduced and a conventional a.m. signal results.

For morse reception, the b.f.o. is offset from the carrier, and the signal will be heard at a frequency determined by the extent of the offset. As before, for optimum results the b.f.o. amplitude should be 300mV and the a.m. or s.s.b. may be at any level between 5 and 500mV.

It will come as something of a surprise to find that this unit is also adaptable as a f.m. detector. In this case the i.f. output is applied to the carrier input of the i.c.; the signal input is fed through a linear phase shift network which may be adapted from an old f.m. i.f.t. The extent of the phase shift is frequency-dependent, and therefore varies with the audio modulation; the output of the i.c. will be a sum of the audio signal and a series of high frequency components which are rejected.

Other Uses

Those interested in instrumentation will recognise in the MC1596G the essential elements of a lock-in or phase sensitive amplifier, widely used in research and industry to recognise and identify synchronous signals once a reference frequency is available. In cases where a wideband, or even a tuned, amplifier is swamped with noise, a lock-in system is still able to follow a signal, since it switches in phase with that signal and adds the outputs, with the result that the signal becomes more evident while the noise, on average, cancels out.



The MC1596G as an s.s.b. demodulator or product detector. A carrier input (b.f.o.) level of 300mV (r.m.s.) is optimum. The composite s.s.b. signal input may be between 5 and 500mV (r.m.s.).

One point of caution: under certain circumstances, depending on driving source impedances, instability may occur. If this is a problem, the inputs should be shunted by suppressor networks, made up of a 510 ohm resistor and a 10pF capacitor in series.

Notes

It is also worth noting the wide bandwidth of the basic device: the signal input is only 3dB down at 80MHz, while the carrier response only drops at 300MHz. The price of around £3 is something of an inhibition, but if past experience with i.c.'s is any guide, it should drop rapidly, particularly in view of the versatility of the device.

The unit is currently available from Motorola distributors in the U.K., including:

Jermyn Industries, Vestry Estate, Sevenoaks, Kent.
Celdis Ltd., 43/45 Milford Road, Reading, Berks. ■

a sensitive telephone amplifier



ALMOST everybody who regularly uses a telephone will know the frustration caused by a poorly connected call where words are heard faintly and have to be repeated, making conversation difficult. In addition, use of the telephone can present a serious problem to the hard of hearing. The unit described here is a compact device which relieves these problems by amplifying telephone calls to loudspeaker volume. Its design was prompted by the author's frequent need to take down notes during telephone conversations. It can reduce the strain of using the telephone, and it could be especially useful in a noisy environment such as a factory. The unit can actually save money on long distance calls since it allows a conversation to flow faster. It also enables more than one person to listen to a telephone, making conferences by telephone possible.

The unit is portable and can be attached to a Post Office or private intercom in seconds, without any unauthorized electrical connection or modification to the telephone. It works by detecting the stray magnetic field which exists around a telephone. A special magnetic detector, which attaches to the telephone by a built-in rubber suction cup, produces a signal which the unit amplifies to loudspeaker volume. Depending on where the detector is attached to the telephone, the unit may deliver both sides of the conversation, or almost solely the incoming speech. Since it is hardly likely to be used for quality music reproduction, the unit's frequency response is deliberately restricted to give the best intelligibility of telephone speech. A somewhat unconventional volume control circuit is used to this end.

circuit

The circuit of the telephone amplifier is shown in Fig. 1, where typical voltage readings are shown. A silicon integrated circuit flatpack is used in the audio output stage. Besides simplifying construction, this tiny unit proves cheaper than the equivalent discrete components. It delivers just under one watt of audio power, quite adequate for this use, and operates here with the absolute minimum of external components.

The signal from the telephone pickup L is first amplified by two conventional common emitter

stages Tr1 and Tr2, coupled by C4. These transistors are very high gain but inexpensive silicon planar types and they are run at a fairly low collector current of about $200\mu\text{A}$ to minimise noise. High frequencies are attenuated by collector-base feedback capacitors C2 and C5 in each stage. This both ensures stability and gives a useful reduction in noise when the amplifier is used at full gain on a weak signal—there is no point in trying to amplify treble frequencies which simply are not present on the telephone line. For the same reason, bass is restricted by the values of C3 and C6 which are not large enough to decouple the transistor emitters at low frequencies.

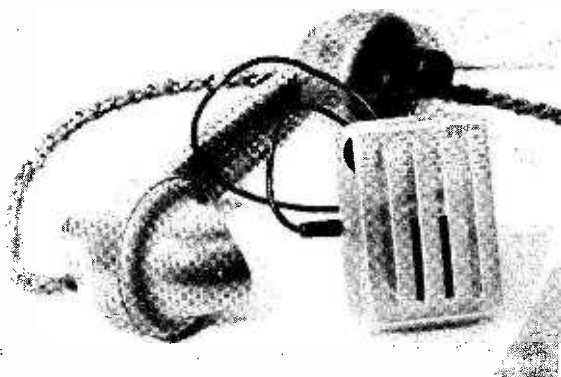
The amplified signal is coupled by C10 to the General Electric PA234 integrated circuit. This contains all the active components of a conventional Class B audio amplifier, equivalent to six n-p-n transistors, one p-n-p transistor, three diodes and three resistors. The voltage drop across the chain of diodes provides sufficient standing current in the output transistors to minimise crossover distortion, with automatic temperature compensation to prevent thermal runaway.

A.C. and d.c. negative feedback from the output to the input of the i.c. is provided by preset potentiometer VR2. This must be adjusted to obtain half the supply voltage at the i.c. output (pin 12).

The 15Ω loudspeaker is fed via d.c. blocking capacitor C11. Overall negative feedback is taken from the speaker to Tr1 base by R9 and VR1 to form the unusual volume control which operates as follows.

The arrow on VR1 indicates the direction of clockwise rotation. When this control is set fully clockwise, the slider is at earth and there is no feedback from R9. The amplifier then works at maximum gain. As the control is rotated anticlockwise, the amplifier gain is progressively reduced as more negative feedback is introduced from R9 into Tr1 base. The advantage over a conventional volume control in this application is that the advantages of negative feedback, namely reduced distortion and extended frequency response, are gained to the maximum at all volume settings. There is also an economy in components. At the high volume setting used with a very weak, noisy telephone signal, there is little or no feedback and the resulting restricted frequency response of the unit aids intelligibility.

small polythene soap box, sold by most chemists. The volume control, a standard miniature Japanese radio type, and most of the components are mounted on a small piece of Veroboard. This is shaped so it wedges tightly into the smaller half of the box, together with the loudspeaker and battery, without any other fixing being needed. The Veroboard layout is shown in Fig. 2 and is not critical. The components need not be so closely packed if a larger box is used, and the Veroboard can be shaped to suit the box. Careful soldering with a small, hot iron is essential. Resistors should be small $\frac{1}{4}$ watt types. The author chose to use a fractionally under-rated electrolytic capacitor (only 6.4V working) for C9 as this value is available in a very small size.



The sucker of the pickup coil should be located for best reception.

There are two breaks to be made in the Veroboard conductors, one of which is a break between two holes. These breaks can be made with a razor blade, which is also useful for cutting holes in the box for the loudspeaker, input socket, and the protruding volume control knob. The author intended to glue the i.c. to the Veroboard (there is still room there), but then succeeded in soldering it to the back of the loudspeaker by the heat sink tab. This way of mounting was thought more elegant, even though there is no indication that the i.c. needs the extra heatsink thereby obtained.

By choosing the smallest type of skeleton preset for VR2, it is possible to mount this component directly onto the i.c. pins. Capacitor C11 is the only remaining component and this is wired directly from the i.c. to the speaker. A piece of plastic insulating tape prevents any of the Veroboard conductors shorting against the speaker frame.

The only wires which have to be kept short are those from the input socket to the Veroboard. These should be tightly twisted. If, with some other layout, more than an inch or so length is required, a small screened cable should be used, with the screen connected to the earth side. The space occupied by the socket can be reduced if necessary by breaking off the shorting contact which is not needed.

After checking the wiring, with special attention to the lead connections of transistors, electrolytics and the i.c., and to possible shorts between Veroboard conductors caused by stray solder blobs, switch on. Check that the voltage at pin 12 of the i.c. can be varied by VR2, and set it to half the supply voltage. The unit should produce some hiss at

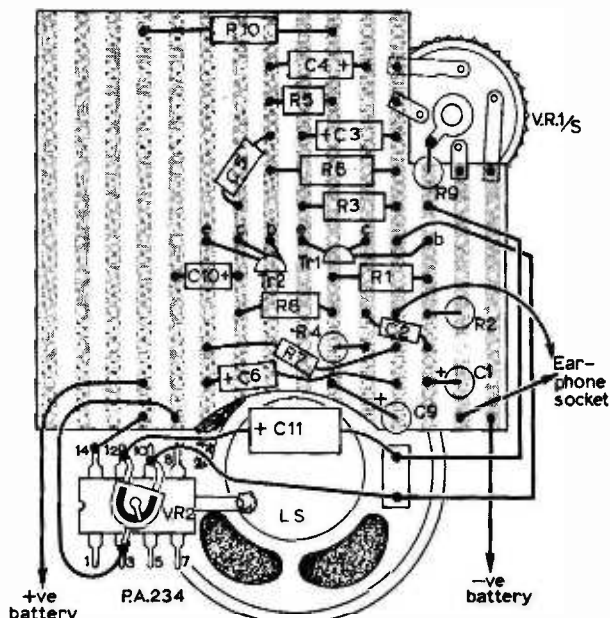


Fig. 2: The component layout. The heat sink tab of the i.c. is soldered to the magnet of the loudspeaker.

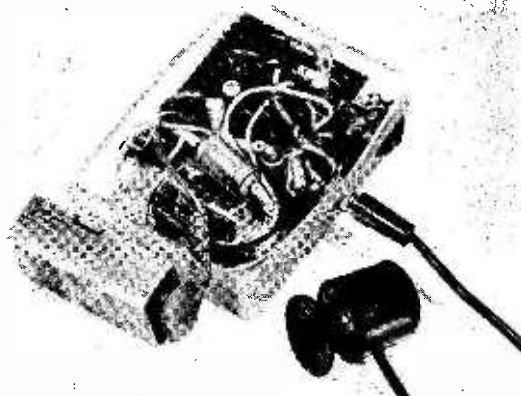
full volume. If not, check the remaining voltages in Fig. 1. Injecting an audio signal, or just touching with a screwdriver, at i.c. pin 3, Tr2 base, and Tr1 base should produce progressively louder response from the speaker.

With the pickup plugged in, some stray hum will probably be picked up from the mains. Loud positive feedback squeals will be produced if the pickup is brought near the unit, as it is sensitive enough to detect the stray field of the loudspeaker voice coil.

uses

The telephone pickup is extremely sensitive to stray field from the mains, and the unit will produce a loud hum if the pickup is near any mains appliance. This hum can always be minimised by setting the pickup at a certain angle.

On the modern pattern Post Office desk telephone, the best place to attach the pickup is usually high on the right hand side. On the older types it is at the back, and on STD pay telephones it is at about an



An internal view of the completed telephone amplifier.

inch below the cord entry on the left hand side of the case. In these positions, both sides of the conversation will be amplified to loudspeaker volume. The best point is easily found by experimenting for the loudest volume from the unit with the telephone producing a continuous sound, such as a dialling tone.

The maximum volume that can be used is limited by the onset of feedback whistles caused by the telephone handset picking up the sound from the loudspeaker. Feedback should be avoided as it sounds most perplexing to your caller! There is less danger of feedback if the pickup is attached to the telephone earpiece—the stray field is not very strong here, but there is the advantage that less of one's own speech is amplified. The best position for the pickup will be found slightly off the axis of the earpiece.

other uses

The pickup is extremely sensitive to any alternating magnetic field; it will pick up hum anywhere near a mains transformer, and will actually reproduce the signal from a radio if placed near the voice coil of the radio loudspeaker, or near the output transformer. Also, both field buzz and line whistle can be detected near a television set.

The unit can also be used for experiments in communication over short distances by magnetic field. As a starter, if about 12 yards of single core wire is laid under a carpet in a large coil of about 6 turns, and the ends of the wire connected to the loudspeaker output of an amplifier or radio, the telephone amplifier will pick up the signal several feet away from the coil. This is one form of 'wireless' communication for which no licence is required.

Without the telephone pickup the unit is an extremely sensitive amplifier plus speaker combination with a multitude of uses. It can be connected to any low level audio source, such as a radio tuner, microphone, record cartridge, tape playback head, or electric guitar, as long as hi-fi quality is not expected.

CORRIGENDA

Mini Organ—October 1970

In the circuit diagram, Fig. 1 the top end of the pre-set potentiometer network should not be returned to the negative rail. As shown the oscillator will function continuously. The circuit is completed only through the stylus.

The Genetracer—August 1970

The "brackets" at the top of Fig. 1. should be amended to show R1 to R4 inclusive as "Generator" and R5/C4 etc. as "Tracer". The earthy end of D1 and VR2 should be shown connected to the positive line of the "tracer" (i.e. SW2) and not that of the generator (SW1) as shown.

Delete the second wire from the right-hand tag of SW1, Fig. 2. "To positive", the necessary connection to the positive line is already provided by the lead from SW1 to the output socket (outer shield), as shown in Fig. 4.

I.C. Stereo Equalisers and Mixers

—continued from page 641

If the circuits are used to drive an amplifier with a d.c. blocking capacitor at the input, they can be connected directly to it. However, if they are to feed directly to a valve grid or a transistor base, a blocking capacitor of 0.1μF or 1μF 3V respectively should be inserted.

The voltage ratings of the d.c. blocking capacitors at the inputs of the circuits must naturally be sufficient to withstand any d.c. level present in the input signal, or the i.c. will be damaged.

POWER REQUIREMENTS

If a d.c. supply of somewhat higher voltage than the i.c. requirements can be "borrowed" from the main amplifier, a simple zener diode regulator circuit as shown in Fig. 10a can be used to power the i.c. Such a supply might be the positive h.t. line of a

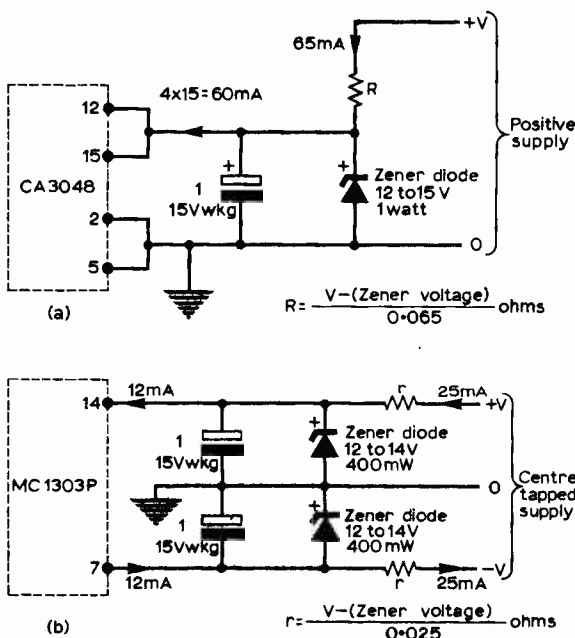


Fig. 10: Zener regulator power supply circuits for (a) CA3048 and (b) MC1303P.

transistor amplifier, or the voltage across a cathode bypass capacitor in a valve amplifier. The earth connection of the i.c. should be at the same potential as the chassis of the main amplifier, or else considerable attention will be needed to suitable decoupling arrangements. When the MC1303P is used in a preamp feeding a valve amplifier with a push-pull output stage, the bypassed output valve cathodes can generally provide the centre tapped supply needed for Fig. 10b.

The value of the dropping resistor(s) R or r depend(s) on the actual supply voltage and zener diode voltage; select the nearest 5% tolerance value to the resistance calculated from Fig. 10. The power dissipated in the resistor is, as always, the product of the voltage across it and the current flowing through it (answer in watts if the current is in amps).



STEREO AMPLIFIER

F.C. JUDD

PART 2

Circuit Boards

Details for the size and assembly of the pre-amplifier circuit boards and their internal screens are given in Fig. 7a, b and c. The boards are cut to size as in Fig. 7b, together with the 20s.w.g. aluminium (or tinplate) screens that are fitted between the boards as in Fig. 7a. The boards and screen are spaced $\frac{1}{2}$ in. apart from each other with spacers but note that one board has attached to it a length of $\frac{1}{8}$ x $\frac{3}{8}$ in. aluminium angle for securing the assembly to the chassis.

These angles must be fitted so that when each assembly is placed in position as in Fig. 7c the angles will be facing toward each other. It is best to assemble the blank circuit boards together with their screens and try them in position on the chassis to ensure that they comply with Fig. 7c. Then mark each board so that it can be identified as to which channel it belongs and which ends will be used for input and output respectively.

Although the circuitry for the right- and left-hand channels is identical *the component layout on the board is in opposition* as they are mounted back to back, hence the reason for identification with respect to channel allocation and input and output ends. The component layout and connection diagrams given in Fig. 8 should help in getting the boards the right way round and as can be seen, the layouts are virtually mirror copies of each other.

The input pre-amplifier for the right-hand channel is an exception however, as it also carries the large 5000 μ F positive rail decoupling capacitor C24 and the 1.5 k Ω voltage dropping resistor R35.

When the boards have been assembled and wired they should fit back-to-back with the wiring inside, the components outside and of course the screen in the middle.

Completion of the pre-amplifier circuit boards is by soldering flying leads to components and other points on the boards that connect with front panel controls, the selector switch S1 and S2 and supply

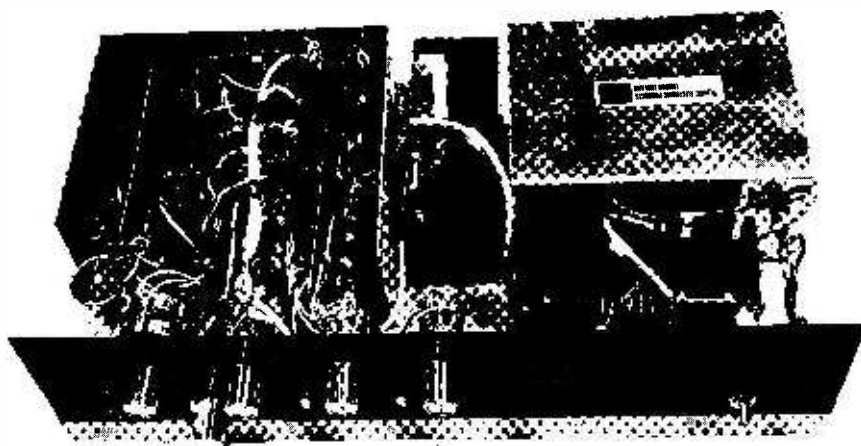
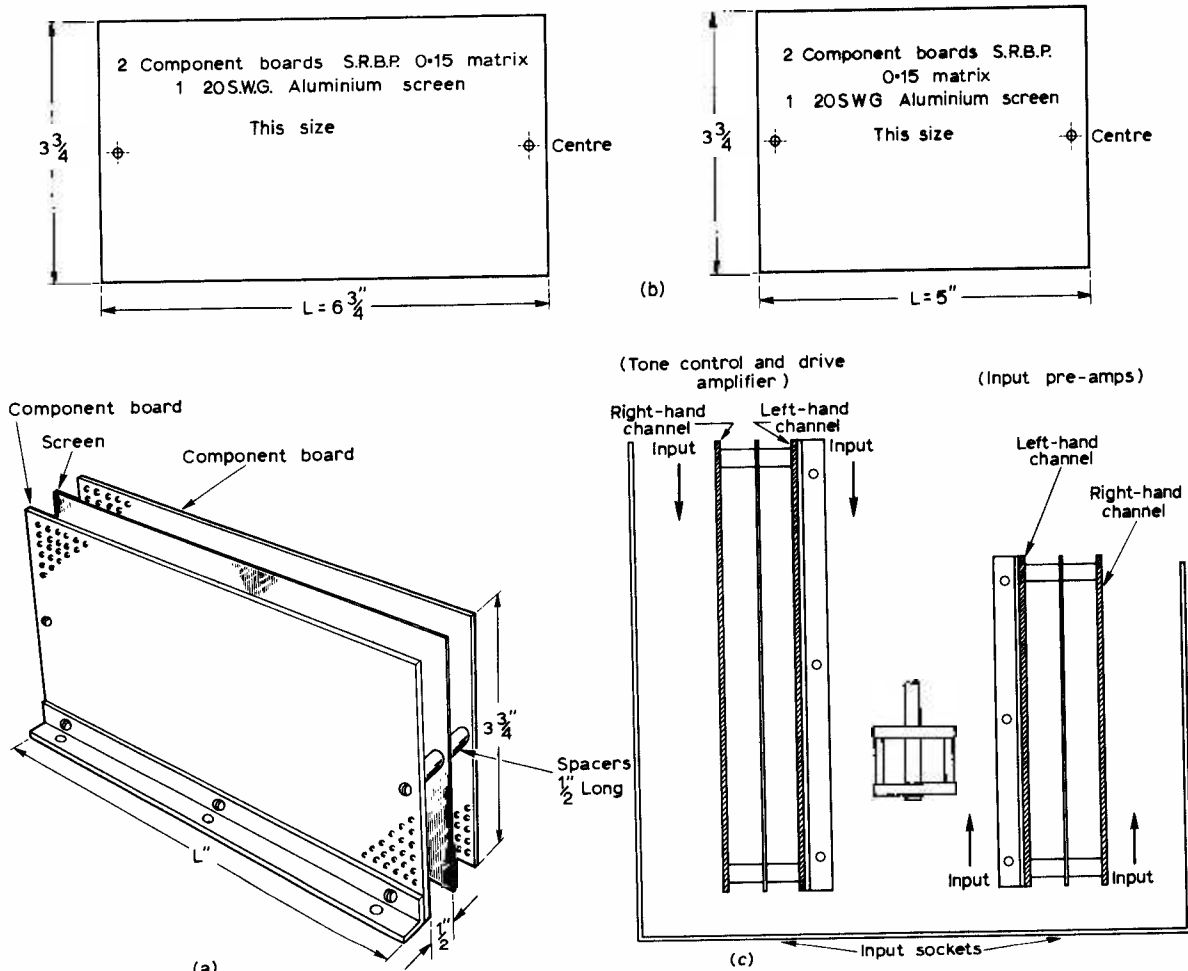
and earthing points. It is most essential that these leads are fitted before the circuit boards are mounted on the chassis as it would be very difficult to connect them afterwards. All leads shown coming away from the circuit boards as in Fig. 8 should be regarded as flying leads and the best way to identify them is to use coloured wires.

Panel Controls and Selector Switch

Connections to the volume, balance and tone controls etc., are shown in Fig. 9. Providing the leads from the input pre-amplifier boards (via R18) to the balance control VR1 are short, and they should be no more than two or three inches long, they need not be screened. This also applies to leads connecting the tone controls and the filter switches. The leads from the output of the tone control/drive amplifier boards (C23) to the volume controls and from these to the power output modules and to S5 the stereo/mono switch, must be screened. This is to prevent instability due to capacitive coupling since these leads are fairly long and pass close to the input ends of the boards.

Next come the wires connecting the selector switch S1 and S2 to the input pre-amplifier boards. Again no screening is necessary providing the leads are as short as possible and are kept clear of the other circuit boards. The connections are shown in Fig. 10 but note that the pictorial diagrams of the switch wafers may not agree with those actually purchased i.e., the contacts may be differently orientated. The remainder of the wiring is to S1A and B from the input sockets and this includes the input attenuators (R1, R2, R3, R4 etc.). The leads between the tape recording output sockets and the output from the pre-amplifiers (C23) need not be screened but must be as short as possible and kept clear of leads going to the input sockets.

Those who have test equipment such as an audio



Another view of the completed PW25/25 Stereo Amplifier in which the wiring to the Henelec Type PA25 output modules can be seen.

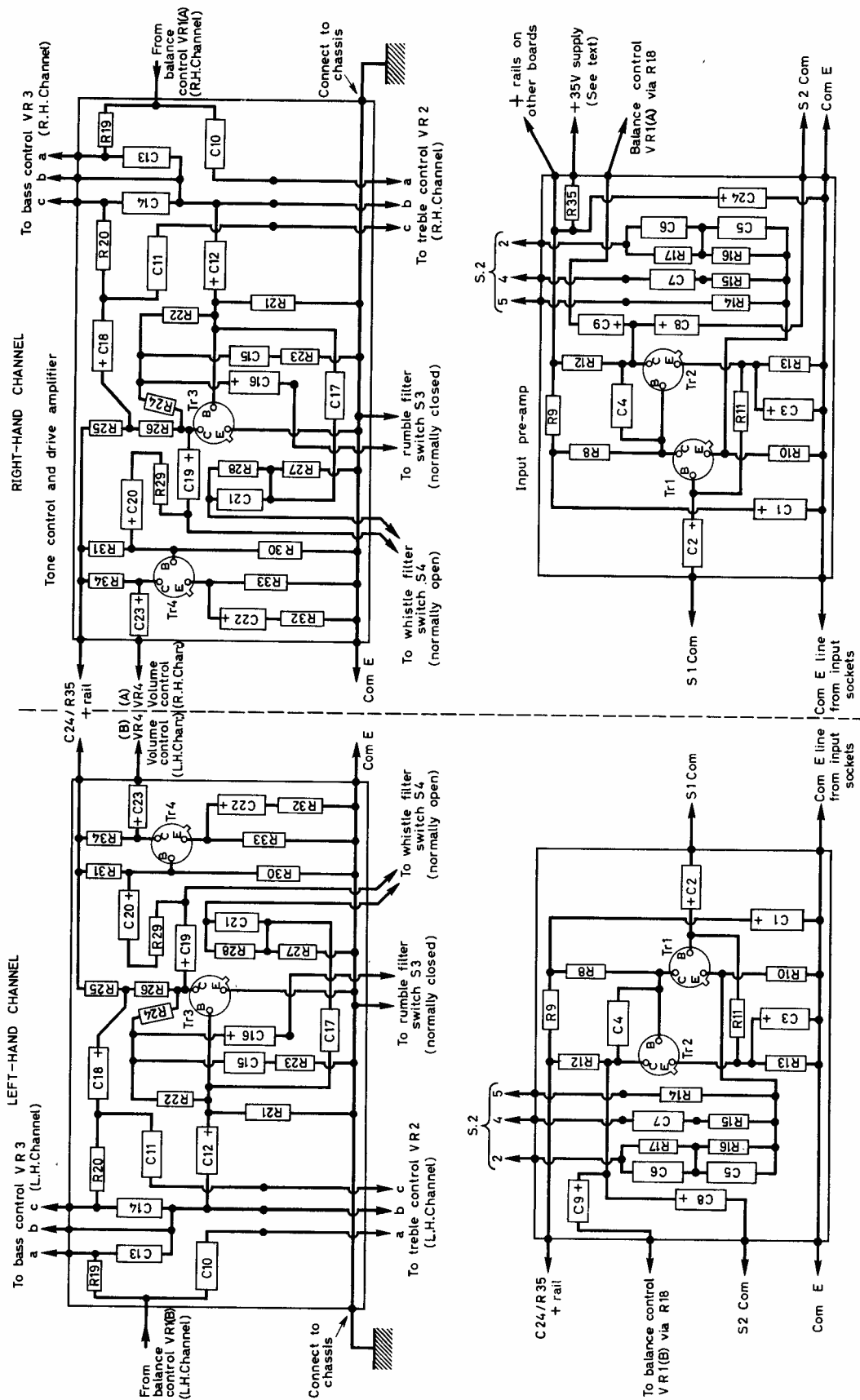
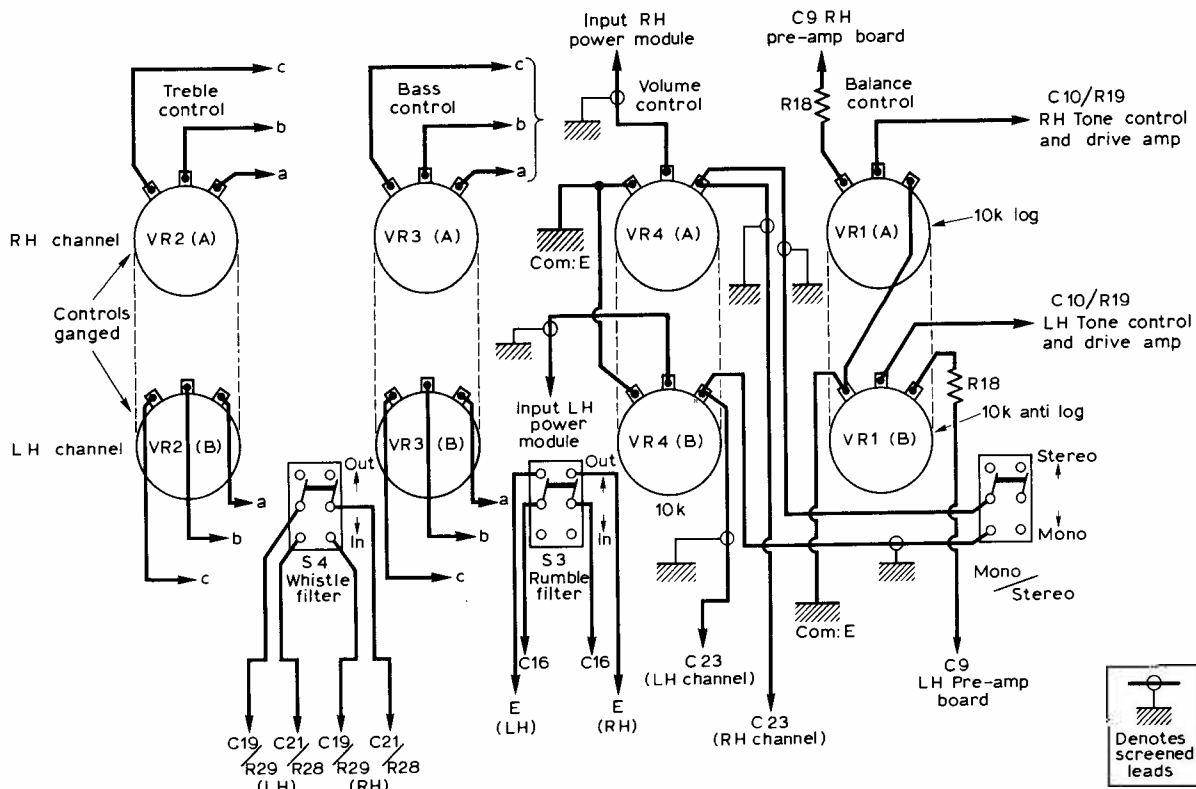
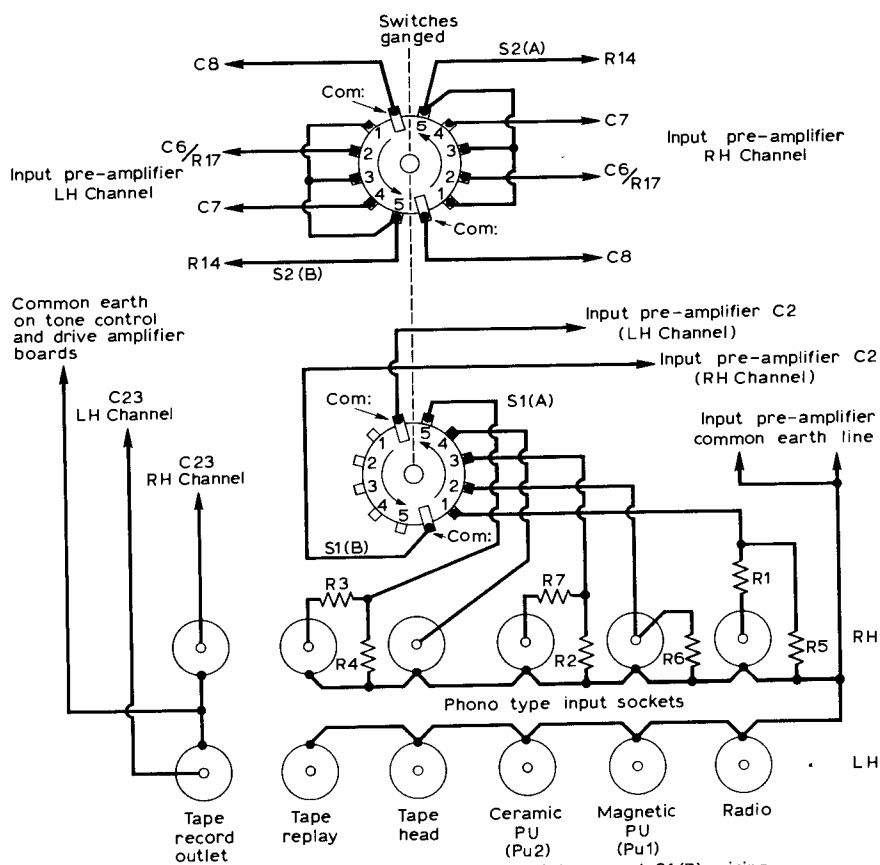


Fig. 8. Component layout of the pre-amplifier circuit boards. Note that, left to right, one is the mirror image of the other, except for C24/R35 on the R.H. channel input pre-amplifier board.



▲ Fig. 9. Rear view of the wiring to the various panel controls. See text for comments on the use of screened leads.



◀ Fig. 10. Wiring of the input selector switch wafers and the associated input sockets. For clarity the wiring to the L.H. channel input sockets is omitted but is similar to the R.H. channel.

signal generator and an audio milli-volt meter would do well to connect the pre-amplifiers to a 22V battery supply (5 x 4½V torch batteries) and check them for performance before connecting them to the power output modules and the MU442 power unit.

Output Modules and Power Supply

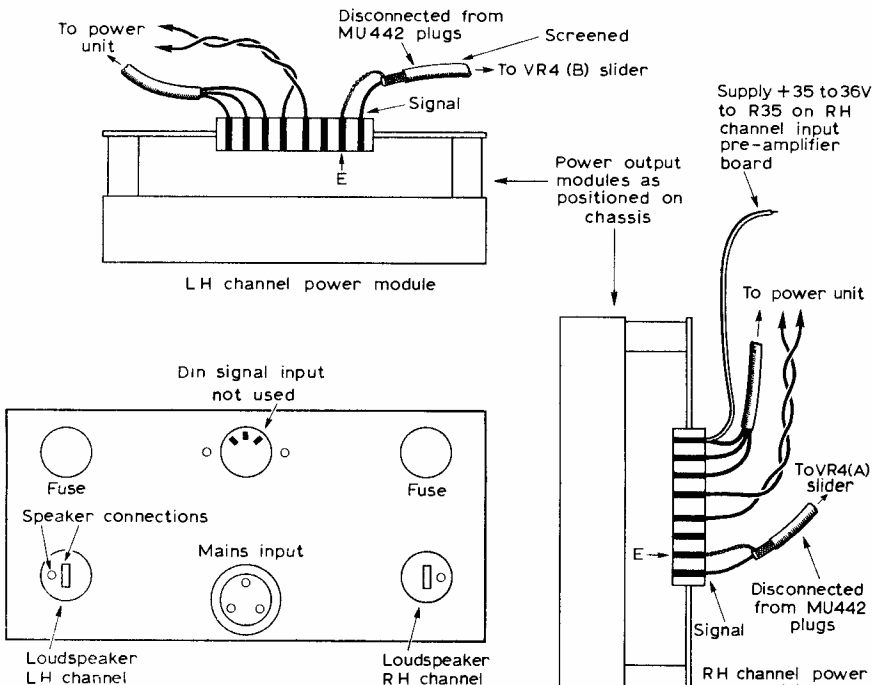
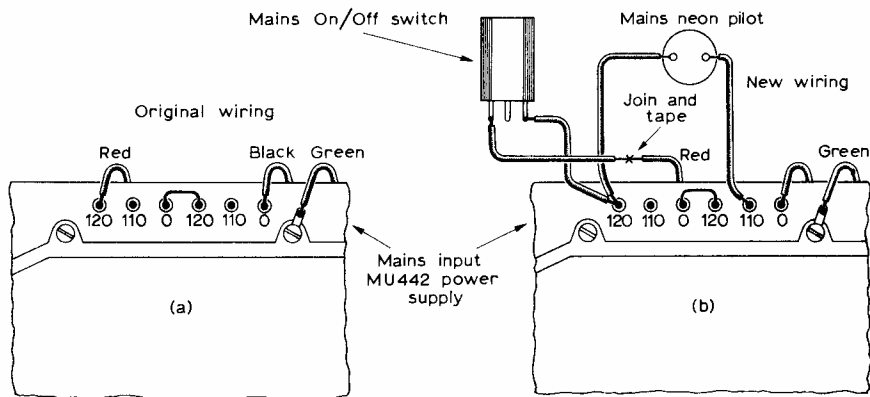
The power supply unit MU442 is supplied with a 3-pin mains input socket and the leads from this run internally to the mains and earth connections respectively on the printed circuit board inside. First remove the cover to obtain access to the mains connections inside which will be as shown in Fig. 11a. The 'red' lead to what is effectively the 240V terminal is disconnected and extended as shown in Fig. 11b to the mains on/off switch on the front panel. The return lead from the switch is connected to the 240V terminal. Two leads are then connected

as shown in Fig 11b to the mains neon pilot light. These and the leads going to the on/off switch should be taken out through the left hand side (looking from the rear) of the power supply unit.

Finally comes the connection of the PA25 power output modules to the output from the pre-amplifiers via the volume controls VR4. The PA25 modules and MU442 unit are supplied with connecting cables and plugs. The two screened leads between the PA25 modules and the power supply are disconnected from the plugs on the power supply itself. These are now taken to VR4 for the right and left hand channels respectively as in Fig. 12. The remaining connection is that of the positive supply line for the pre-amplifiers. This picks up the +35V rail from the right-hand channel PA25 module input plug as shown in Fig. 12. The negative supply line is obtained by contact between the power unit case and the main chassis.

Fig. 11. Modifications to the mains input wiring of the MU442 power supply unit.

Fig. 12. Details of the wiring to the inputs of the power modules together with the socket arrangement on the back of the power supply unit.



An outline of the rear of the MU442 power supply is also shown in Fig. 12. Note that the DIN signal input socket is not used, as the signal inputs to the PA25 modules have been re-routed to the volume controls (VR4). The loudspeaker sockets are also DIN type and the connections are as shown. Do *not* earth the loudspeakers at any point and do not connect one output to the other in any way. Do not short circuit the outputs with the amplifier running and developing power. There are fuses on the power supply and the modules which will protect them against voltage surges and accidental overloading. Do not tempt providence by poking around with a screwdriver whilst the units are running.

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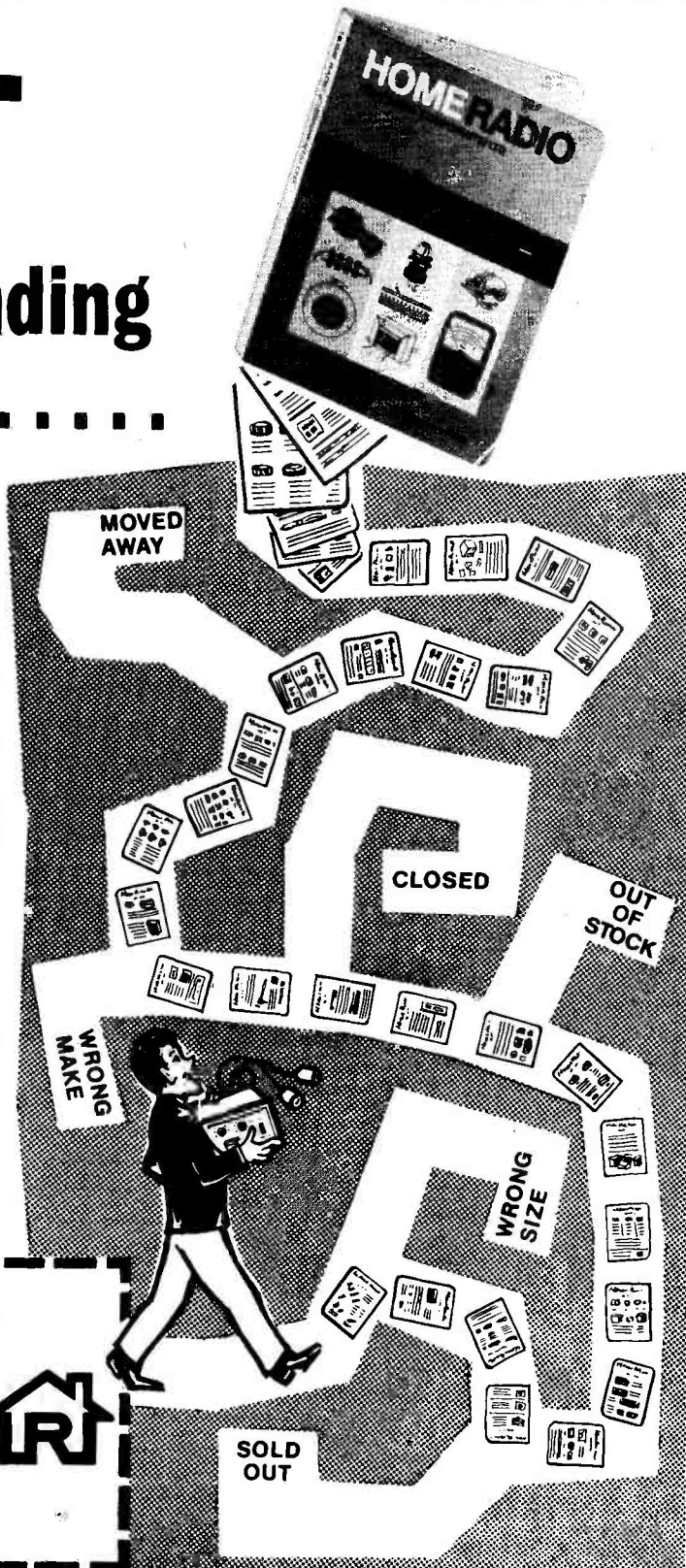
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Testing and Performance

In constructing and wiring a fairly complex piece of equipment like the PW 25-25 amplifier there is always the risk of a faulty component, wrong connection or dry soldered joint etc., hence the earlier suggestion that it might be worthwhile testing the pre-amplifiers before connecting the power output modules and supply. In making the prototype as shown in the photographs the writer tested each circuit board individually before assembling them and then again after assembly and wiring as a complete pre-amplifier on the chassis. This is quite easy to do if an audio signal generator and audio voltmeter are available. The tone controls etc., can be temporarily connected for individual testing and each board hooked up to a 22V battery. Those able to do this will find the table of input and output signal levels of some use.

Before switching on the completed amplifier ensure that loudspeakers and/or suitable dummy resistive loads are connected at the output (speaker) sockets. Set the volume control to zero and inject a signal at the 'radio' input—preferably a 90 to 100mV sine-wave at 1000Hz. Advance the volume control just sufficiently to lightly load the output stage and then repeat the procedure for the other channel. For those without an audio signal generator and audio voltmeter, further tests can only be made by listening and using appropriate signals from a radio tuner or pick-up etc., to ensure that the amplifier is operating correctly on both channels.

TEST CONDITIONS Input signal—1000 Hz sine-wave

Input Pre-amplifier (one only)

Input at C2 10mV

Output at C9 300mV

With equalising network switch S2 connected and set to 'Radio'.

Tone Control/Drive amplifier

Input at C10/R19 10mV

Output at C23 400mV

With tone controls connected and set at neutral. Filter switches connected and set to 'Off'.

Complete Pre-amplifier

	Input		Input
Radio	70/75mV	Tape Head	8/10mV
Mag.PU	6/7mV	Tape Replay	150/200mV
Cer.PU	70/80mV		

All inputs for 1 volt r.m.s. output at C23/VR4. Volume controls off. Balance control at neutral. Tone controls at neutral. Signal level at module inputs (sliders of VR4) for full output should be 700 to 800mV r.m.s.

DC Supply

Positive point on module/take-off point for pre-amplifiers 35/36V

Pre-amplifiers positive rail/junction of C24/R35 22/24V

Current consumption, pre-amplifiers only 2.5/3mA

Total consumption, both pre-amplifiers, complete, at 22V 8/9mA

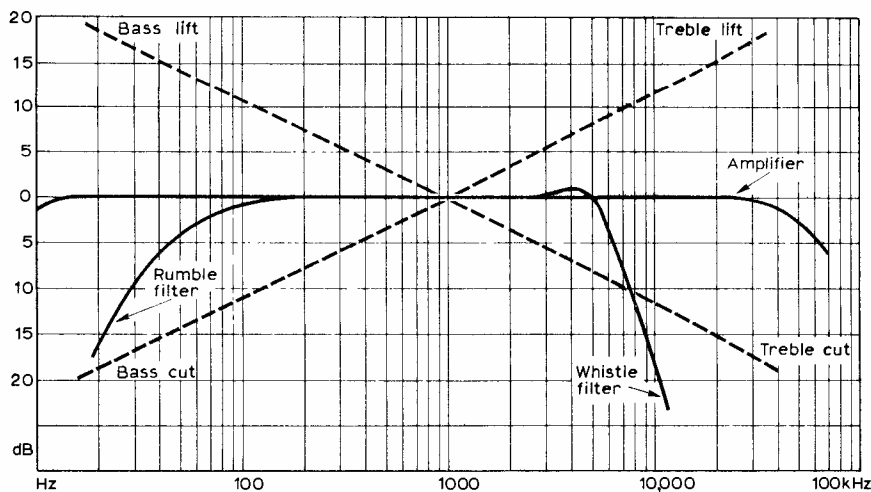
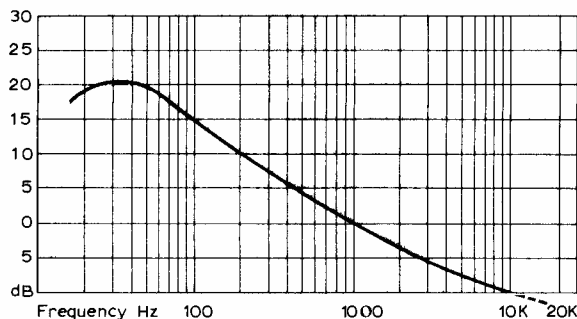
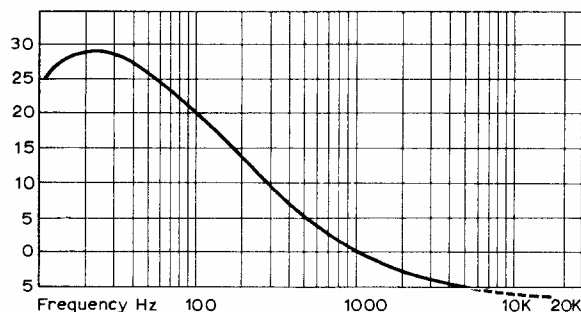


Fig. 13. Graph showing effect of the various controls on the amplifier's basic response curve.

Fig. 14. (below, left) Response from tape head input (CCIR). Fig. 15 (below, right) Response from magnetic pick-up input (RIAA).



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If the necessary test equipment is available the amplifier can be checked for overall frequency response, input sensitivity and power output. The frequency response curves given in Fig. 13, 14 and 15 were taken from the original amplifier and performance should agree closely with these. If an oscilloscope is available the power output can be checked at just below clipping point with an 8 ohm high wattage resistor across each output. Clipping, when it occurs at just over 25 watts r.m.s. should be quite symmetrical i.e., the same at top and bottom of the wave-form. The voltage across an 8 ohm load at just below clipping will be between 14 and 15V r.m.s.

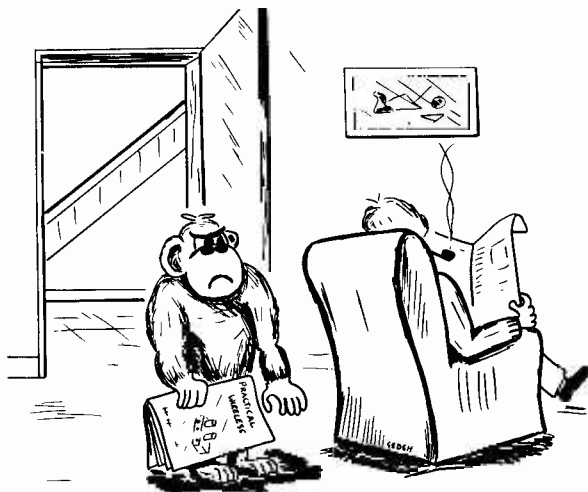
The amplifier will of course only develop its maximum power output of 25 watts per channel with 8 ohm loudspeakers. Nevertheless the output power of 15 to 18 watts that would be developed across 15 ohm speakers is still quite considerable for a domestic stereo hi-fi amplifier. At average listening power levels the difference in performance between 8 and 15 ohm speakers would be barely noticeable. It is only really necessary to use 8 ohm loudspeakers if one wants the resultant full power with life-size sound and thereby run the certain risk of becoming unpopular with neighbours.

When the amplifier has been finally tested the legends for the controls can be put on with Letraset or similar transfer lettering and a strip of thin aluminium (20 s.w.g.) glued along the lower edge of the panel. For the original amplifier, this strip was cut and polished, given one coat of clear varnish and glued on with Evostik. The upper section of the panel was painted matt black.

For its final listening tests the amplifier was used with a Lenco record transcription unit and Elac stereo magnetic cartridge, radio tuner (stereo output) a Ferrograph Series 7 half-track stereo recorder, and a pair of Goodmans Magnum 15 ohm speakers. The excellent performance of the amplifier did more than justice to the above signal sources and to the time and effort involved in construction. ■

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THE MW COLUMN

DURING November, medium wave stations in Middle East countries will be prominent in the late evening long after their normal signing-off times. The should be quite noticeable after 2230 hrs GMT when the band is becoming quiet. This situation is caused by Ramadan which ends this year on the 29th of the month. It provides the MW DXer with an opportunity to log the more difficult countries from this area while newcomers to the band should be able to hear several North Africans without difficulty. Look for Oujda 593kHz, Sebba Aioun 611 and 1043, Agadir 935, Tangiers 1232, all in Morocco; Ain Beida 529, Oran 548, Algiers 890, in Algeria; Tunis 629 and 962, Sfax 719 in Tunisia; Benghazi 674, Tripoli 1052, Beida 1124 and 1250, in Libya; Batra 620 and 818, Cairo 773, in Egypt. These stations stand out from their neighbours on account of the Arabic style programming though a few in Morocco, Algeria and Tunisia have European programmes with announcements in French. Farther east and rather more difficult are Riyadh 588kHz in Saudi Arabia; Jerusalem 677, Amman 800, in Jordan; Jeddah 647 in Saudi Arabia; Beirut 836 in Lebanon; Damascus 665, Dayr az Zawr 957 in Syria; Ankara Turkey on 1061; Kuwait 1345 in the Persian Gulf. Although many of these stations can be logged when using a non-directional aerial, a MW loop will give an added advantage when DXing to the east. The writer has heard Tunis 962kHz on a transistor portable, simply by rotating the receiver until interference is at a minimum.

The out of band Greek station reported recently, has been tracked down to Amphissa. It is privately owned, located near Delphi and signs-off daily at 2100 hrs GMT. The latest issue of the FBIS list gives the frequency as 1611kHz but variable. Reporters to Sweden Calling DXers from Austria, Germany, Italy and South Africa have heard Amphissa so it ought to be audible in the country in the winter. The highest authorised MW frequency is 1602kHz (187.3m), which is off-scale on many domestic receivers so it is rather surprising to learn of broadcasting beyond the band edge.

The sea path across the north and mid Atlantic favours reception of Latin American MW stations on the east coast of South America. After midnight is the time to search for the Venezuelan stations YVLH 650kHz Radio Giradot in Maracay, YVKS 750 Radio Caracas, YVRB 960 R. Monagas in Maturin, YVRS 1020 R. Margarita on the island of Margarita, YVMV 1150 Ondas del Caribe in Punto Fijo, YVOZ 1200 R. Tiempo Caracas. From the nearby Dutch island of Bonaire, Trans World Radio operates PJB on 800kHz with a power of 500kW and it is often a strong signal. HJED 820 La Voz de Rio Cauca in Cali, HJHN 960 R. Sutatenza in Barranquilla, HJCC 1010 Bogota, HJAH 1070 R. Atlantico Barranquilla are regularly heard Colombians. ZFY 760 in Georgetown Guyana and SRS 725 Paramaribo Surinam are heard regularly though a loop is essential for SRS on account of European QRM from 728kHz.

Charles Molloy

GOING MULTIBAND

ERIC DOWDESWELL G4AR

HAVING seen many amateur stations over the years it is apparent that the majority of operators do not make the most of the equipment that they possess. There is invariably a reasonable communications receiver capable of resolving c.w., a.m. and s.s.b. on the majority of the h.f. amateur bands but the transmitter is so often a one-band affair, usually for the 20 metre band, and then for the c.w. mode only.

While 20 metres is considered *the* band for DX working there are times when it can go dead for various reasons and when this happens the single-band operator can only switch off and go and join the family around the TV!

With a little effort and at almost no cost at all the transmitter could be modified to cover at least two more bands, thus permitting operation over much longer periods, by selection of the appropriate band that is active at the time.

The only other factor to be considered in going in for multiband operation is of course the aerial system but a suitable one is no more difficult to construct than the one-band dipole and certainly need not deter anyone from going multiband.

Basically the idea is to alter the various tuned circuits in the transmitter so that they each cover more than one band either by changing the inductance/capacitance ratio of the existing circuit or by simple switching.

With some circuits it is possible to obtain coverage of the 10, 15 and 20 metre bands with a single inductor and capacitor. While the L/C ratio may not be the optimum on each band this is mainly a theoretical consideration that will have little effect on the practical results. Grid drive to the following stage may be less than that which would be obtained with a properly designed circuit but the modern beam tetrode generally used in transmitters is very tolerant in this respect.

Practical Considerations

Consider a relatively simple transmitter designed for single band operation on 20 metres consisting of a v.f.o. on 40 metres followed by a buffer amplifier, frequency doubler and power amplifier and how it can be modified for multiband operation. Typical valve types are shown, Fig. 1. If the modifications are carried out over a period the transmitter need not be off the air for any significant time.

VFO/Buffer Amplifier

The v.f.o. will usually consist of an oscillator in which the circuit, components and construction have been carefully integrated in order to get the maximum degree of stability, and working, in this case, on the 40 metre band.

The buffer amplifier is a "must" in order to isolate the v.f.o. from the following stage which can influence the stability of the v.f.o. This is particularly so if the following stage is keyed. In general the lower the operating frequency of the v.f.o. the better will be its stability. However, there is no objection to tuning the output circuit of the buffer amplifier to the 20 metre band as a first step to improving the versatility of the transmitter. Fig. 2.

It is recommended that, at a later date, the v.f.o. itself be modified to function on 80 metres so that operation on 40 metres becomes possible.

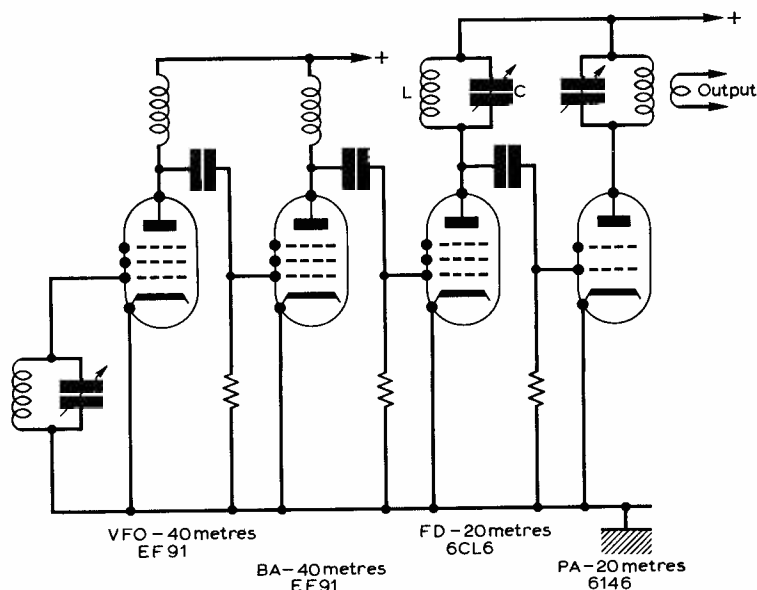
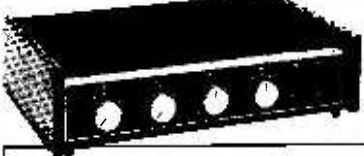


Fig. 1. A typical arrangement of a four valve transmitter for the 20m. band.

STEREO 8 + 8 MK II HI-FI AMPLIFIER KIT



Our popular Stereo 8 + 8 Mk II now further improved incorporating high quality ready drilled printed circuit board for easy construction.

A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and Volume controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 3 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled printed circuit board, attractive front panel, knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of.

Brief specification:
Power output: 8.5 watts r.m.s. per channel into 5 ohms.
Frequency response: $\pm 3\text{dB}$ 15-30,000 Hz
Sensitivity: 50 mV into 1 meg ohm
Full power bandwidth: 30 Hz to 20,000 Hz
(Readings taken at 8.5 watts into 5 ohms)
Bass boost approx. to $\pm 12\text{dB}$. Treble cut approx. to -16dB . Negative feedback 18dB over main amp.
Power requirements 25V at 0.6 amp.
PRICES: AMPLIFIER KIT £10.10.0. P. & P. 3/-
POWER PACK KIT £3.0.0. P. & P. 5/- CABINET £3.0.0. P. & P. 5/- (Post Free if all units purchased at same time)

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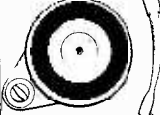
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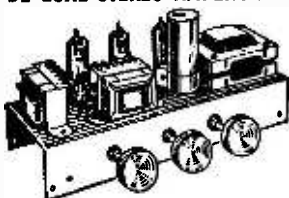
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A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum.

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Built on printed circuit panel size 6 x 3in. Generous size Driver and Output Transformers. Output transformer tapped for 3 ohm and 15 ohm speakers. Transistors (GET114 or S1 Mullard AC128D and matched pair of AC128 o/p) 9 volt operation. Everything supplied, wire, battery clips, solder, etc. Comprehensive easy to follow instructions and circuit diagram 2/6 (Free with Kit). All parts sold separately. SPECIAL PRICE 49/6. P. & P. 3/-
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Frequency Multiplier

Provided that the output tuning capacitor C of the frequency multiplier stage has a value of at least 100pF it is possible to reduce the value of the associated inductor L (Fig. 2) until the circuit is resonating at 20 metres with the capacitor at almost its maximum capacitance. It will then be found possible to tune the circuit to the 15 metre band and to the 10 metre band when the capacitor is almost at its minimum value.

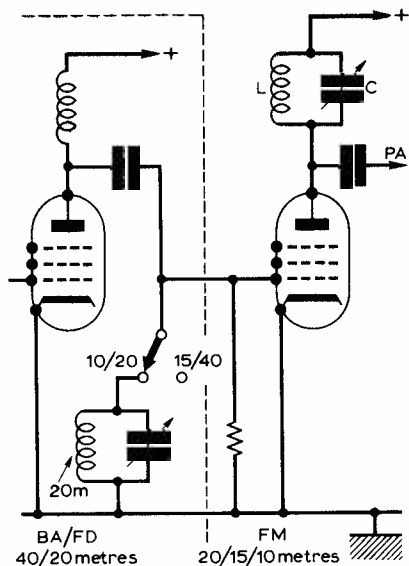


Fig. 2. Adding a 20m. tuned circuit to the buffer amplifier stage.

In setting up this circuit, first remove the h.t. from the p.a. stage and provide drive at 7MHz to the grid of the multiplier stage and tune the output circuit to 14MHz for maximum grid current to the p.a. stage. Check by means of a calibrated absorption wavemeter that the correct harmonic has been chosen. Now remove turns from the inductor L, one at a time, until the circuit resonates at 14MHz with the capacitor almost at maximum. If L is fitted with a dust core it may be possible to reach this condition by simply adjusting the core.

Now reduce the capacitance until another peak in grid current is found, which should correspond to the third harmonic on 21MHz but check again with the wavemeter. Reduce the capacitance still further, when the fourth harmonic on 28MHz should appear with the capacitor at almost minimum capacitance. Check again with the wavemeter.

If difficulty is experienced in reaching or covering all the 10 metre band, check the circuitry for stray capacitances such as those due to the tuned circuit wiring not being the shortest possible or being too close to earthed objects. The valveholder should be of ceramic or similar low-loss material.

The drive will fall off with increasing frequency but it should still be possible to get sufficient drive to permit the p.a. to be driven to a reasonable input on 10 metres. Twenty-five watts input is better than no input at all! If operation on 40 metres is contemplated, and the author thoroughly recommends it,

it will be necessary to add a switch to bring in a separate tuned circuit for this band, but this presumes that the v.f.o. has been modified to provide output on 80 metres, as previously suggested.

Power Amplifier

If the existing output circuit of the p.a. is of the type shown in Fig. 1 and designed solely for 20 metres this alone is sufficient reason to adopt the pi-network circuit shown in Fig. 3 which provides greater attenuation of harmonics and easier matching of the load to the p.a. valve.

Where TVI is a problem this could very well be the only circuit which is acceptable. The only additional component required is the loading capacitor which is usually of the broadcast receiving type and readily available.

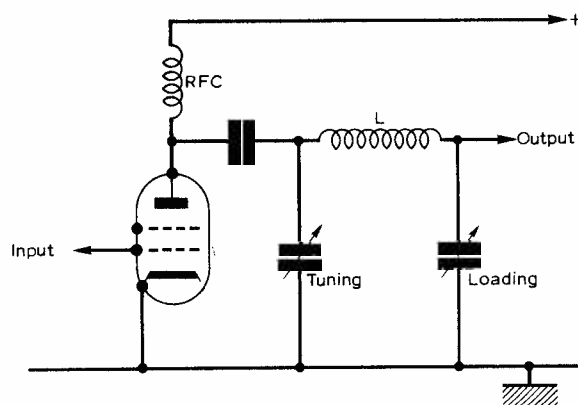


Fig. 3. Conventional pi-network circuit for the power amplifier.

All that is now required to convert this circuit into multiband capability is a band switch selecting appropriate taps on the inductor. A typical circuit with component values is shown in Fig. 4.

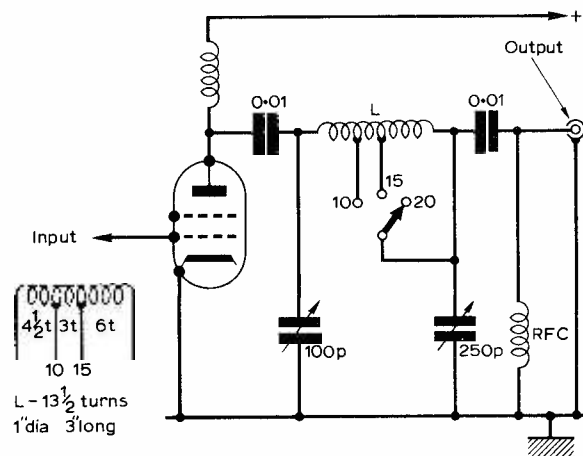


Fig. 4. Component values for a 10/15/20m. pi-network circuit using a 6146 valve.

other supports are not to be had then the extra wires may be sloped below the existing wires and secured to the same supports, Fig. 7.

If the basic dipole is cut for 40 metres then extra dipoles for 10 and 20 metres only are required since the 40 metre dipole will act as a $3/2$ wavelength aerial on 15 metres. There will be a slight mismatch but not enough to prevent satisfactory loading of the p.a.

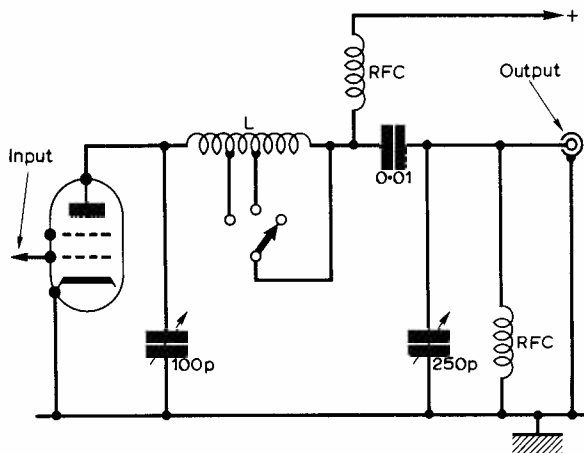


Fig. 5. A receiving type r.f.c. can be used in this circuit to feed h.t. to the p.a. valve.

A variation of this circuit, not often encountered, is shown in Fig. 5 in which a conventional receiving type r.f.c. can be used since it is now placed at a point of low r.f. potential. However the anode tuning capacitor and the bandswitch are now subject to the applied h.t.

Aerials

Converting the transmitter to multiband operation is fairly simple but it is not of much use unless the existing aerial system can also be converted by an equally simple method.

Assuming a conventional dipole aerial is already available for the 20 metre band it is very easy to add additional dipoles for the 15 and 10 metre bands in parallel with the existing wires, tying off the ends to the nearest available supports such as trees or chimney stacks or poles. Fig. 6. If such

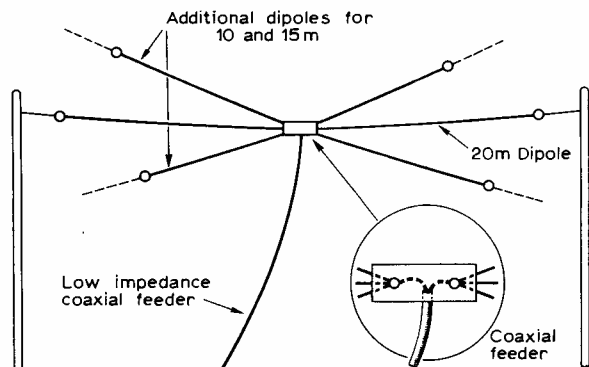


Fig. 6. Possibly the simplest method of converting a 20m. dipole to multiband operation.

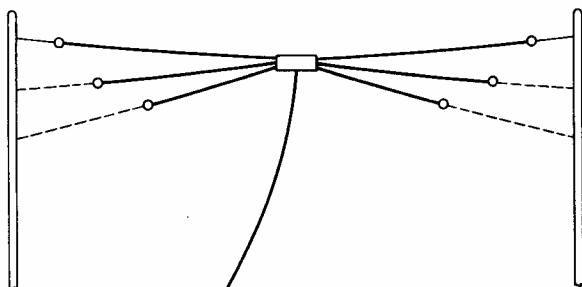


Fig. 7. If the ends of the additional dipoles are tied off to the supports used for the 20m. dipole the direction of maximum radiation will be the same for all three dipoles.

A very effective aerial, often neglected, is the ground plane, Fig. 8, which is simplicity itself to erect yet can provide very low-angle radiation which is so essential for DX working. It is omni-directional, however, and so will not give any discrimination against very strong Continental stations under conditions of short skip. A multiband version of the ground plane is shown in Fig. 9.

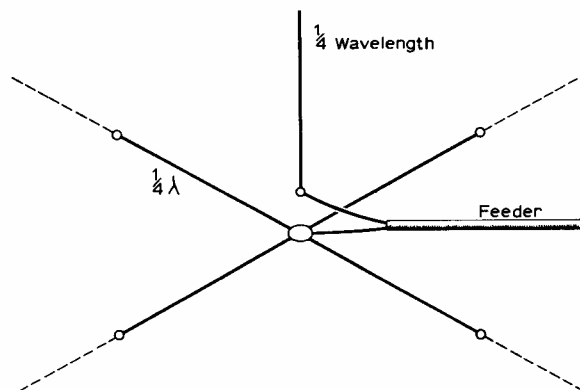


Fig. 8. The ground plane aerial. The four radials may be sloped downwards and may even be used as stays with a lightweight mast.

Provided the ground plane wires for 20 metres are fitted the others are not essential, although they should be erected if possible. Coaxial feeder of 50 Ω impedance should be used and the match between the aerial and the feeder can be much improved if the ground plane wires are sloped down at about 45 degrees to the horizontal.

Another useful multiband aerial that can be erected and forgotten is the well tried G5RV, Fig. 10. While the matching to the feeder is a compromise, no trouble will be found in loading the transmitter satisfactorily on all bands. On 160 metres the feeders may be joined together at the bottom and

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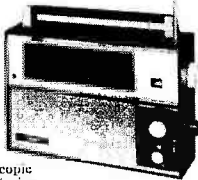
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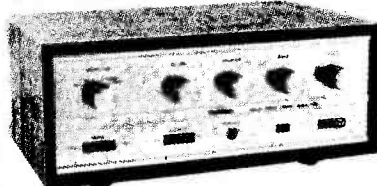
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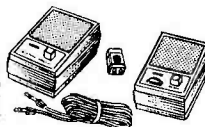


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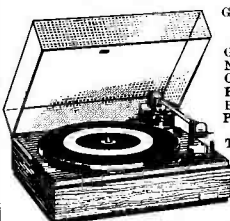
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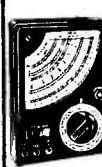
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BSY28 3/6	OA85 1/3	OC81D 2/6	TK6023 2/-	
BSY29 3/6	OA95 1/3	OC82D 2/6	XA701 3/6	
BSY65 3/6	OA202 4/-	OC139 5/-		

* WITH 4 LEADS. (Charges: Up to one dozen, can be assorted, 1/- Over 12 charges paid)

S.D.P.'s	BYZ10	TEN AMP SERIES	TWENTY AMP SERIES	THIRTY AMP SERIES
BY100 800piv 2/10 each	1200piv 7/-	50 piv 10/-	50 piv 9/6	100 piv 12/6
SIX AMP SERIES	TRANSISTORS FIVE AMP SERIES	100 piv 12/6	500 piv 13/6	400 piv 20/-
BYZ13 300piv 4/-	100 piv 7/6		800 piv 20/-	600 piv 22/6
BYZ12 600piv 5/-	200 piv 9/-			
BYZ11 900piv 6/-	300 piv 10/6			
	400 piv 12/6			
	500 piv 25/-			

Charges: up to 3 for 1/-, 3 to 11/6, 12 and over paid. Orders received after Nov. 12th will not be despatched until Nov. 23rd, nor will any mail be dealt with between these dates.

ELECTROLYTIC CONDENSERS

Full details of many types from 6d each in our list (see below).
SUB-MIN TRANSFORMER: Output (3 V for OC72 etc) 2/9 driver, 3/- (up to 6 either 1/-).
MULTIMETER: 20,000 Ω/V D.C., 24, 12, 6, (2/6), 1000 Ω/V 47/6 (2/6). Full details both in list.

SOLDERING IRON. Slim Mod. British High speed, 8½in., all parts replaceable, fully guaranteed for professional, radio and general D.I.Y. use, 21/- (1/6).

DIAMONDSTYLII Replacements for BSR TC8LP, TC8/S and TC8LP/STEREO: COLLARO "O"; RONETTE BF40LP; GARRARD GC2LP and GC8LP; ACOS GP65/67; all at 7/6 each (1/-). ACOS GP73 and GP91; BSR BT4 (ST3, ST5, ST8 (ST9); SONOTONE RTA, 9TA and 9TAHC; PHILIPS AG3306, 3060, (3063, 3069, 3301, 3302, 3304), all at 15/- (1/-). All are of the very highest quality.

DOUBLE DIAMOND Types: If you don't use the 78 side - this is the best buy - now available only in ST4 (ST3, ST5), ST9 (ST8), 9TA, 9TAHC, 3306, GP91 (for GP92, 93 and 94 Cartridges) and GP918C for GP918C cartridges. 30/- each (1/-).
SAPPHIRE all the above 77 types only, also ACOS GP27 at 3/8 each (1/-). ACOS GP91 at 7/6 (1/-). No other types at present, and no 78 rpm available in any type.

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TWO STATION TRANS. INTER-COM. Excellent baby alarm. Instant, easy fitting with leads plug and button. 20/- (1/6).

TRANSISTORISED AMPLIFIER, 3 watt, 9V operation, Size 2½ x 2½ x 1½ 52/6 (1/6).

Extra High Torque MINI-MOTOR, 4½ to 12V, 1½ x ½ in. 5/- (1/-), 9,000 r.p.m.

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TEST PRODS: Flexible, unbreakable 24in. Red and Black leads, thin 4½in. prods, 14in. Plugs 4/6 (1/-). CROC CLIPS: Plated with screw, or with red/black handles, 6d. each, 5/- doz. (1/-). Many other types in list.

RECORDING TAPE. Finest quality British Mylar. STANDARD: 5in. 600ft. 7/3

5½in. 900ft 10/-, 7in 1200ft. 11/3, LONG PLAY 5in. 900ft 10/-, 5½in. 1200ft. 11/3, 7in. 1800ft. 18/- (1/3 reel). Still the finest quality and value obtainable.

MICROPHONES - CRYSTAL MIC91, Hand/Desk, 16/3; MIC45, curved hand grip 19/6; CM21, two tone grey hand/Desk 10/6 (1/3), Stick "60" 20/3; (1/6 each type). Cream plastic hand type with "Strut" stand, switch and 2 leads with 2.5 and 3.5 plugs 12/6 (1/3). Lapel (or hand) with clip 6/6 (1/-). CM70. Machined metal tapered stick type with neck cord and adaptor to fit standard floor stands. 29/6 (1/6).

DYNAMIC: Cream hand/table 15/6 (1/6). ME10 50K Ω, 3½" x 1" with Base. Adaptor 39/6 (2/6). ME11, similar but fixed on flexible Swan neck to switch-fitted base 42/6 (2/6).

CARDIODYNAMIC OMNI-DIRECTIONAL: Highly successful "BALL" type, 209, 50K/600 ohms imp. Built in vol. control, on/off switch, special lead, handle 26.6.0.

Non-directional Ball type, 20K Ω, with on/off slide switch, 20" cable & connector & stand holder (½" thread) type DM160 23.17.6 (on both types 5/-).

MICROPHONE INSERTS: Diameter 1.75in. or 0.9in., either size 5/6 (1/-).

SPEAKERS: 12in. round, 16Ω, 6W, 3 or 1Ω (state which), 37/6 (5/6); or for stereo, 30/- per pair (charges paid), 2½in. 3 1/2 7/6 (1/-). Limited quantity powerful 24in. PM transistor replacement speaker, high ohms, excellent 6/- (1/-). HEADPHONES: Stereo Dyn 8-16 Ω 63/- (3/-). EARPIECES with lead and min. jack plug, magnetic 1/9. Crystal 4/9 (up to 3 for 1/- on either). State if 2.5 mm. of 3.5mm. plug required. (Crystal 3.5mm. only).

AERIALS CAR TYPES - Telescopic vandal proof locks retracted, 2 keys and all fittings 27/6 (2/6). Superior type, slightly longer, 30/- (2/6).

Extending Aerials for Portables & P.M. Sets - 4-section 61-23", 1" sliding threaded base, needs 1" hole 4/-; 6-section 54-25½", screw hole in base 4/-; 7-section 54-32", screw hole in base 7/6. DISAPPEARING, with swivel and sliding threaded socket, fixing nut on bottom section - 8-section 54-29½", 1 1/2 dia. 18/6; 10-section 74-56½", 1 1/2 dia. 18/6. All are strongly plated (P.P. & on all above, up to the 10" type).

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VIBRATORS: 12v 4 pin non-synch. 1½" x 3½" (EXCL. PINS) 4/6. Genuine PLESSEY 12v 4 pin non-synch. heavy duty type 121 HD4, 1½" x 2½" (EXCL. PINS) 8/6; 12v, 7 pin synch. type 12SR7, 12/6; 6v 7 pin, type 6SR7, 12/6 (All types 1/- per vibrator) a few other types in our list.

MAINS NEON TESTER: Fly leads 2/-; Pocket screwdriver type 3/6, (1/-).

CONNECTING WIRE: Packets of 5 coils asstd. cols., each coil 5 yds. Solid Core 2/9 (1/-). Flexible 3/3 (1/3). Super thin for transistor wiring etc. 3/3 (1/-). PICK-UP WIRE: Twin Super thin Flex, Screened, Sheathed, 1/3 yd. (6d up to 6 yds, over 6 yds. post free). TWIN NICK CABLE: 6d & 1. SINGLE MIKE CABLE: 9d. yd. Both flexible, screened and sheathed. (Up to 3 yds. 8d., each additional yard 1d. extra.)

RETRACTABLE FLEXIBLE LEADS, Space saving "Curly", many uses in car and home: with phono plug each end, 6ft., 4/6; 12ft., 7/6; With phono plug one end, phono socket at other, 6ft., 5/-, 12ft., 8/6 (1/- each all types).

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the whole system resonated against earth with a suitable tuning unit. This applies equally well to almost any aerial system of course.

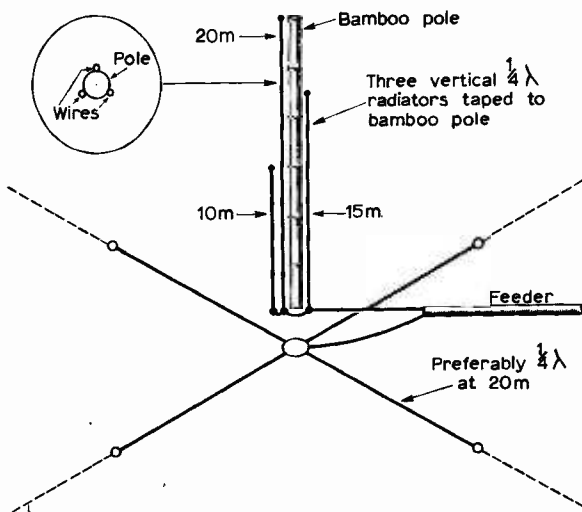


Fig. 9. Construction of a ground plane aerial for 10/15/20m.

If TVI is a problem, the use of open wire feeders or a long wire with a tuning unit should be avoided. Rather a low impedance coaxial feeder should be used, together with a balun transformer in order to reduce the radiation from the feeder. A balun can be made quite easily and cheaply and it will be effective over all the h.f. bands. (See RSGB Radio Communications Handbook p.13.30.)

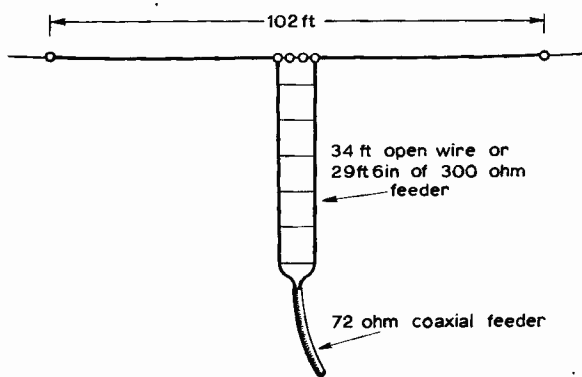


Fig. 10. The G5RV multiband dipole. At a height of about 32 feet the best match between aerial and feeder will be obtained on the 20m. band. If accurate matching is required on the other bands an aerial tuning unit may be interposed at the junction of the co-axial and open wire feeders.

Conclusions

These simple modifications to transmitter and aerial will permit operation on the 10, 15 and 20 metres bands which will greatly increase interest in DX working and often enable contacts to be made with those countries that have proved so elusive on 20 metres.



CORRESPONDENTS WANTED

... anyone of my own age (18) interested in Amateur Radio and Aeronautics.—P. Jones, 28 St. Fagans, Cardiff, CF5 4SP.
... penfriend of my own age (12) who is interested in short wave listening.—Stephen Champion, 16 The Orchard, Kings Langley, Herts., WD4 8JR.
... anyone who knows how to wire up a crossover network in an audio system. The unit I am particularly interested in is a Harrow 3-way crossover network, model MN-3.
—T. M. Bles, 'Tillings', Fair Mile, Henley-on-Thames, Oxon.
... anyone of my own age (18) who is interested in short wave listening.—I. Simpson, 2 Taylor Cottages, Derryhale, Portadown, Co. Armagh, N. Ireland.
... someone who speaks English, is about 17 years old and who likes anything connected with electronics.—B. Cameron, 84 Pownall Street, Masterton, New Zealand.

TAPESONDENTS WANTED

... boy or girl of my own age (17). I have Phillips cassette recorder and a Grundig 4-track machine with speeds of $\frac{1}{2}$, $3\frac{1}{2}$ and $7\frac{1}{2}$ i.p.s.—Louis Smit, 42 Langton Road, Montclair, Durban, South Africa.
... girl with interest in Amateur radio or electronics. About 16 years old.—R. Collins, 17 Heathfield, Chippingham, Wilts.
... near my own age (17) from the Hong Kong, Kowloon area who are living in this country. I already have a pen friend in Causway Bay, Hong Kong and know a little about the area. My tape speeds are: $\frac{1}{2}$, $3\frac{1}{2}$ and $7\frac{1}{2}$ i.p.s. and my hobbies are short wave listening, tape recording and photography and electronics.—A. M. N. Hoare, 4 Fairfield Drive, Whitburn, Sunderland, Co. Durham.
... someone of my own age (18) who is interested in electronics and radio. I have a Ferguson 2-track machine with speeds of $\frac{1}{2}$ and $3\frac{1}{2}$ i.p.s.—R. Richards, 33 Rogers Road, Canning Town, London, E.16.
... boy of 13 would like to tapespond at $3\frac{1}{2}$ i.p.s. Interested in pop records, disc jockeys (would like to be disc jockey himself one day). Can send interesting tape to someone own age.—Reggie Preston Jr., 7 Gordon House, Tarves Way, Greenwich, London, S.E.10.

ISSUES WANTED

... June, September and October 1961 and May, July and August 1962 issues of Practical Wireless.—A. Giles, 20 Fieldway, Dagenham, Essex.
... borrow only copies of P.W. for April, May and December 1966.—J. A. Foll, 104 Burnley Road, Rawtenstall, Rossendale, Lancashire, BB4 8HH.
... Issues of Practical Electronics containing plans for a bass guitar (May and July 1966).—J. Miller, 10 Cortina Avenue, High Barnes, Sunderland, Co. Durham.
... June 1968 issue of P.W.—A. D. Beales, 45 Railway Street, Southport, Lancs.
... November 1967 issue of P.E. containing fuzz box article.—John, 23 Manor Park Crescent, Edgware, Middx.
... copy of P.E. for May 1967, P.W. for July 1969 and P.T.V. for June 1962.—J. Glavin, North Lodge, Northlands, Salthill, Chichester, Sussex.
... issue of P.W. containing 7MHz Transceiver article.—A. Sutton, 11 Bennett Grove, Lewisham, London, S.E.13.
... April, May, June, July, August and October 1968 and February, April, May and June 1969 issues of P.W.—H. Lewis, c/o 18 Vickers Street, Motherwell, Lanarkshire, Scotland.
... Issues of P.W. containing articles on mods for No. 62 Mk. 2 transceiver.—Wim Kloosterman, P.O. Box 203 Penrith, N.S.W., 2750, Australia.
... January 1967 issue and all other issues of 1967 containing details of the "Explorer".—R. L. J. Winston, 82 Stephen's Firs, Mortimer, Reading, RG7 3UY.
... March 1965 issue of P.W. containing details of the key mechanism of the Solo Organ.—R. J. Perry, 42 Kirkstall Mount, Leeds, 5, LS5 3DP, Yorks.
... March 1969 issue of P.W.—H. E. Dunford, 10 Mounts Bay Road, Penzance, Cornwall.
... Issues of P.W. containing articles on the Pedal Steel Guitar.—T. J. Woods, 16 Bermuda Terrace, Deepcut, Camberley, Surrey.
... December 1969 issue of P.W. dealing with the Noise Limiter article.—H. N. S. Colborn, Court Cottage, Horton, Nr. Bristol, BS17 6QR.

EXCHANGE

... Practical Wireless and Television, Basic Electricity, Short Wave Mag., Tape Recorder, Wireless World, 40m transceiver, b.f.o. unit, aerial tuner, Morse code kit, 7W amplifier, Grundig TK23, and Radio & Television Servicing Vols.—Cummins, 14 Munster Sq., N.W.1.

INFORMATION WANTED

... handbook and circuit diagram for R209 Mk. 2 together with info. on mods.—A. A. Lightbody, 42 The Uplands, Harpenden, Herts.
... gen on converting the 38 set for Amateur band reception.—S. L. Lumb, 4 Rydall Street, Leeds, 11.
... info or mods to the Indicator unit type 26.—A. Milne, 67/1 Dumbryden Gardens, Edinburgh, EH14 2NU.
... info on the Armstrong A10 Mk. 2 amplifier and control unit.—P. L. Manley, 85 Nursery Drive, Sanbury, Oxon.
... any info on the Rectograph 500 tape recorder.—R. Marks, Cotswold, Barnet Lane, Elstree, Herts.
... copy of fault-finding chart No. 1 issued with April 1968 P.W.—S. M. Rashid, 49-M, Block-6 P.E.C.H.S., Drigh Road, Karachi, Pakistan.
... manual for Sony tape recorder TC771 not 777A.—S. Coles, Shatterly, Kingsley Avenue, Camberley, Surrey.
... circuit for Ekco RF364 record player.—G. Davies, Mochen Foch Farm, Lower Mochen, Nr. Newport, Mon., NP1 8UW.
... service manual on Philips TV model M236-805 which uses a A59-11W picture tube and works on 625-lines.—Lool Kok Cheow, Radio Malasia, Kajang, Selangor, Malaysia.
... circuit diagram and information on B44 Mk. 2 transceiver with or without mods.—G. Wheeler, 45 Kings Way, Billericay, Essex.
... information or manual for Hallicrafters Sky Champion and Canadian Mk. 1 58 Tx/Rx.—G. Whitwell, 90 Milverton Road, Erdington, Birmingham, 23.
... information, circuit, handbook, etc. on the indicator unit type 300.—Bell, 82 St. Catherine's Avenue, Luton, Beds.
... circuit of Nordie Mende 9050 radio.—D. P. Bourne, 25 Green Street, Georgetown, Guyana, South America.
... circuit diagram of the Veritone Vega unit.—M. J. Power, 66 Oakdale, Harrogate, Yorkshire.
... service sheet for an Ultra T491 radio.—D. Gregory, 53 Wellington Way, Leicester, LE3 1RG.
... the addresses of the agents for Japanese transistor receivers and in particular "Challenge" agent. Also details of connections to amplifier and switching connections of the Minister Transistor Royal 410 tape recorder.—G. Kingston, Kruse Cottage, Trevidland, Liskeard, Cornwall.
... loan of theoretical circuit of Sound Sales amplifier type A-Z serial A.50/75 and tone unit C51/2.—R. V. Flexman, Horseshoe Cottage, The Haven, Billingshurst, Sussex.

practically wireless

commentary by HENRY

IT will not have escaped the notice of our vigilant readers that there has been a gap in Henry's contributions lately.

Although these immortal lines will not be sullied with your marmalade until the jaunting season is over, they are being written—with the stub of a pencil on the back of an hotel bill—at the height of the holiday season. Henry's absence from the August issue was nothing to do with this.

That was a different matter! What our Editor, that mean and scrimping curmudgeon of a—ahem! sorry—what his "Highness" calls 'the exigencies of publication space.' Well, *he* knows what he means. So, to avoid another omission of this column, Henry is squatting atop a high mountain seeking inspiration.

The deadline happens to come smack in the middle of our annual fortnight, already curtailed to ten days by some last-minute panics in the workshop. A local Education Authority decided that the best time to wire out a derelict class room for visual aids and audio reinforcement was while the pupils were under the feet of the parents rather than the teachers.

But eventually the job was sorted out and the kiddiwinkies will be able to Watch with

Teacher when the term comes around again. And Mrs. Henry finally stopped huffing with impatience, went back to make sure the gas was turned off, collected yet another piece of luggage that we simply could not do without, and the Henries sailed off into the wild blue yonder.

Well, wild grey actually, for the vac. was spent in Snowdonia, and you may have read about the gales that uprooted venerable druidic trees and dismantled the weekender's small boats, around the middle of August. We were there, lad, we were there.

One of the structures that the wild wind uprooted must have been the local radio mast, for Henry's holiday punishment has been to 'maintain a radio silence.'

Despite Mrs. H. and her feminine tendency to bring along half the domestic equipage, we have landed in an alien world that appears not to believe in communications. There is no radio in the hotel bedrooms—and a portable wireless set is the one amenity we did not bring.

Musak there is, true, burbling away in its sugary fashion in the unreachable corners of lounge, dining room and hallway. Television there is with a picture that leaves too much to be desired. The mountains breed telegenic ghosts that make all programmes more interesting than informative—if you happen to have a taste for surrealism. But no wireless.

It could be argued that 'Top of the Pops' would sound sacrilegious in such surroundings. Perhaps the rural bumbblings of Walter Gabriel could be tolerated but we cannot even get that.

Gasping for news, we tried the car radio. We were even prepared to put up with Tony Brandon. But we then found the answer to the wireless-less community—those dratted mountains, no less. Reception varies between the impossible and the outlandish.



Gleefully skinning a heretic

You should worry, down there in Centralshire, about the vestige of a 19kHz beat. Up here, if Woman's Hour comes through with any clarity, the locals forecast rain.

So the Henries basked in back-to-Nature silence, relying on social encounters for the saving of sanity. And—guess what—the first family that we met included a teenage son who turned out to be a rabid P.W. fan. Intelligent type, obviously, with a father who works out mathematical problems to put himself to sleep, and a mother who is as erudite as she is charming.

But in the course of conversation this column was mentioned and Henry had his gaff blown—by the little woman, who else?

With painful memories of the chaffing and criticism suffered in his workshop, where colleagues have long since peeled off his aliases, like gleeful Inquisitors skinning a heretic, Henry was loth to stand up manfully and confess: 'I did it.' But we were soon launched on the sort of conversation that goes: '...do you remember...?'

You will be happy to know, Mr. Editor, that in the wilds of N. Wales, at least, Henry's absence was noted, and will have no excuse to do it again—if only I can find a carrier pigeon to help me make this deadline.



Squatting atop a high mountain

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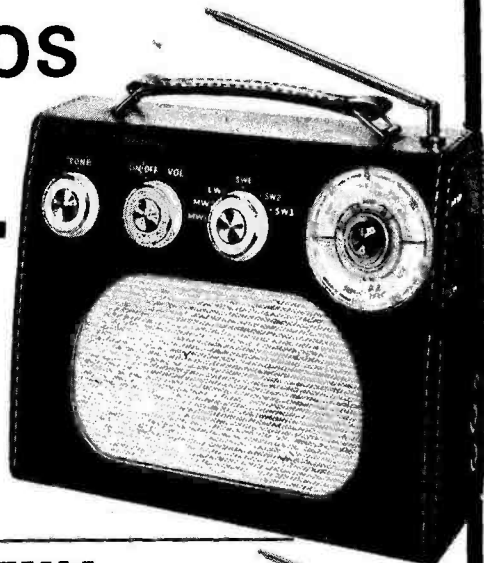
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P. & P. 7/6



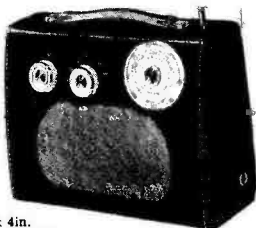
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P. & P. 7/6



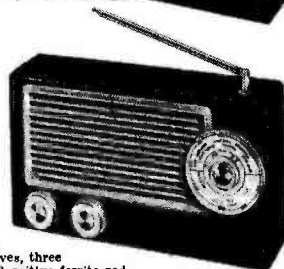
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P. & P. 5/6



pocket five

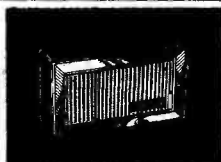
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44/6

P. & P.
3/6



transona five

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P. & P.
3/9



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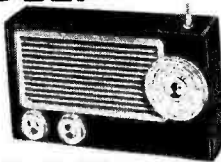
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WITH 3in. SPEAKER

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P. & P.
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WORLD'S MOST VERSATILE & COMPACT ALL BAND AERIAL

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VARIABLE FREQUENCY ANTENNA

PARTRIDGE MAKE DX EASY! OBTAINABLE FROM:—

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CARDIFF. Wesak Radio, Cathays.

CHELMSFORD. Radio Service, New St.

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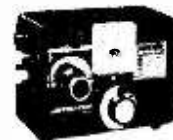
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(FREE BROCHURE 5d. STAMP)



TYPE LO-Z JOYMATCH

New one knob joystick VFA
tuner, 1/2 kw 80 thru 10m. 100W on
160m. Excellent S.W.R. all bands.
£7-19-6 + 5/6 p.p.

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SUNDERLAND. Red Radio Shop. Crowtree Rd.

SWANSEA. Holt High Fidelity.

WATFORD. Davis & Kays, Woodlands Pde.

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OR DIRECT FROM: PARTRIDGE ELECTRONICS LTD. (P.W.), BROADSTAIRS, KENT. (Tel: THANET 62535)

G3CED

GOLDRING & GARRARD PRICES SLASHED

G.850 £4.17.6d p.p. 2/6. SP25 Mk 11 £10.15.0d p.p. 10/-

SEE BELOW FOR OTHER MODELS

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



PLINTHS AND COVERS

Suitable for AT60, SP25, 3000, 2500,
3500. Superbly finished Plinth, ready
cut for use, complete with Tinted
Perspex Cover. This unit is finished
in Teak Polish and will blend in any
modern home. 79/6 p.p. 7/6.

TURNTABLES

Garrard 8025 TC	Son 9 TAHC Diamond	£9.10.0d
Garrard 3000	Son 9 TAHC Diamond	£9.12.6d
Garrard A70	Mk 11 Less Cart.	£11.15.0d
Garrard SL65B	Less Cart.	£13.19.6d
Garrard AP75	Less Cart.	£13.19.6d
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10/- P.P. FOR DECKS

SPEAKERS, AMPLIFIERS, ETC.

Teleton CR 107 £29.0.0d p.p. 10/-
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"Master" Magnetic Cart. Diamond Stylus
65/- p.p. 5/-
LL Nova Amp. 5 + 5 Mag and Cer-Input
£15.10.0d p.p. 10/-
3-Way Speaker System Teak Cabinet, size
14 1/2 x 8 1/2 x 6", 10 Watts Peak, each £5.19.6d
p.p. 7/6
Nova 7500 VHF Tuner Plus 7 x 7 Amp.
£39.0.0d p.p. 10/-
3-Way Speaker System Teak Cabinet, size
21" x 14 1/2 x 9 1/2", 20 Watts Peak, each
£11.19.6d p.p. 10/-
Prices for good not listed, sent by return
of post. S.A.E. please.

LEAK SANDWICH (SPEAKER)

Enclosure (26" x 15" x 12") oiled
(mat) walnut 8 ohms—up to 35w
handling capacity.
List price £45. 10. each.
Our price £32 each p.p. 10/-

GARRARD SP25 ON PLINTH WITH COVER

Complete, not wired, £14.12.6d
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.

Send P.O. Order, Cheques, etc., to:

AUDIO SUPPLIES

Callers welcome: 50 STAMFORD HILL, LONDON, N.16
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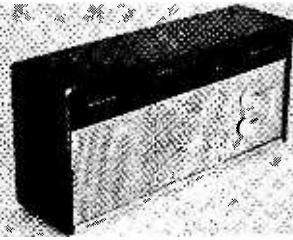
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M. & B. RADIO

38 BRIDGE END, LEEDS 1

Telephone: 0532-35649

VHF FM/MW/LW
TRANSISTOR RADIO
BRAND NEW 10 transistor plus 4 diode table
model of well known
British manufacture. The
highly polished wood
cabinet, speaker and pre-
assembled chassis are
supplied separate and
only require fitting to-
gether and the 2 speaker
connections making.
CHASSIS & CABINET
£9.10.0. SPEAKER 25/-
carr. paid.



STC STEREO/MONO HEADPHONES. Brand new lightweight high
quality comfortable padded headphones for stereo or mono use. Weight
10 oz. 20 c/s to 20 Kc/s 300 ohms per earpiece. Supplied with details of
matching circuit for 15 ohms using only 3 resistors. 54/- plus 4/- pp.
12 VOLT TRANSISTOR INVERTERS. 12vdc input. 270vdc at 150mA
approx output. Transformer 2in x 2in x 1 1/2in mounted on aluminium
case 1 1/2in x 2 1/2in x 4in. Weight 15oz. 65/- plus 4/- pp.

TRANSISTOR MODULATOR PRE-AMP PANEL. BRAND NEW 4
transistors plus 1 diode. 4 1/2in x 2 1/2in. Fitted with pre-set microphone gain
control and mod filter. Originally used to drive an NKT404 which
drove a pair of NKT404s. Supplied brand new c/w circuit of complete
modulator. 22/6d plus 1/6 pp.

TRANSISTOR AUDIO AND MUTING PANELS. Brand new set of
3 panels. Audio panel with transistor gate originally used to drive an
NKT404 output transistor. 2 muting panels with Schmitt trigger circuit
to operate the gate on the audio panel. 8 transistors in all. Supplied with
full circuit 22/6d plus 2/6 pp.

455Kc/s FM LF PANEL. Brand new but faulty 6 transistor panel
usually low in gain. 12/6 plus 1/6 pp.

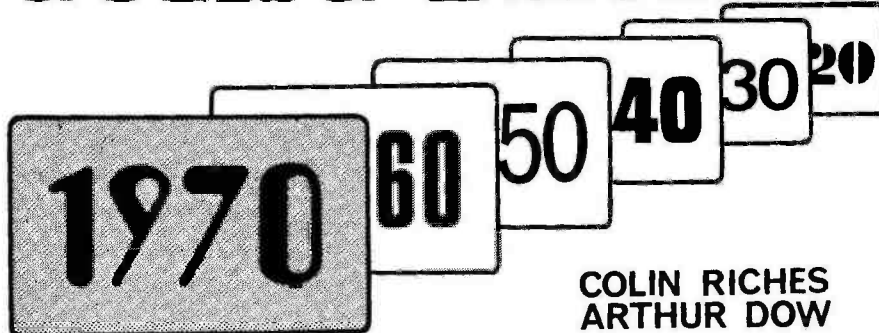
HAND TELEPHONES. Brand new radiotelephone type press to talk
handsets. 12/6 plus 1/6 pp.

VHF AERIAL C/O RELAYS. Used but OK. 6 or 12v. 4/- plus 1/6 pp
60 UNTESTED MIXED TRANSISTORS 5/- plus 1/- pp.

60 UNTESTED MIXED DIODES 2/6 plus 1/- pp.
USED TESTED VALVES. 12AX7/ECC83 2/6. 6BJ6 1/6. 6AQ5/EL90
2/6. ECF80 2/-, 6AT6 1/6.

ALSO VARIOUS VHF EQUIPMENT IN STOCK
S.A.E. AND 6d. STAMP FOR LISTS

GOING BACK...



COLIN RICHES
ARTHUR DOW



AT 6.0 p.m. on November 2nd, 1920 switches were thrown in a small shack on top of the Westinghouse Company's building in Pittsburgh, Pennsylvania, U.S.A. and the first broadcast was about to begin. Throughout the day, the American people had been to the election booths to cast their votes in the 1920 Presidential election and the broadcasting of the results had been chosen for the opening programme.

There were very few receivers, but the station had arranged for the programme to be relayed over loudspeakers to a nearby civic centre. These listeners were privileged to be the first to hear the famous station call-letters . . . "KDKA, East Pittsburgh".

The programme continued for some eighteen hours—long by even present day standards—and a few hours later the station was again on the air and has continued to this present day with regular programmes, still using the same call-sign.

The origins of KDKA dated many years earlier than 1920. As early as 1915 a Dr. Frank Conrad (who later became Assistant Chief Engineer of

Westinghouse) had built a radio receiver to enable him to hear the time signals broadcast from the Naval Observatory at Arlington. He did this primarily to test the accuracy of the watch and a \$5 bet was the motivating factor. The reception of these signals sparked the enthusiasm of Dr. Conrad and by July 1916 he was on the air with his amateur station, 8XK. Dr. Conrad was however unable to pursue his hobby for long because the entry of the United States into the First World War caused cancellation of amateur licences in April 1917.

During the emergency both Westinghouse and Dr. Conrad were able to gain invaluable experience as the station was allowed to operate under a special authorisation for the testing of new radio equipment for the British and U.S. Governments.

The ban on transmissions was lifted on October 1st 1919 and very shortly afterwards 8XK was back on the air incorporating all the advances made during the War, making it an extremely well equipped station for the times.

On the 17th of the same month Dr. Conrad



Harold W. Arlin, the world's first full-time radio announcer.



Picture taken during the first broadcast of KDKA.

became bored with continually speaking into the microphone and to enable him to make adjustments on his equipment while it was operating, he placed the microphone near his gramophone. During the next few days he made considerable use of this trick and was amazed to find that listeners began writing in to ask him to play a particular record, to convince sceptics that music could be transmitted over the radio.

The demand however became so heavy that Dr. Conrad had to stop playing individual requests and

instead went over to "broadcasting" gramophone records over the station for two hours every Wednesday and Saturday. Dr. Conrad's use of the term "broadcast" to describe these transmissions is the first recorded use of the word.

With four hours a week of transmission time to fill, the supply of records was soon exhausted and a local music store agreed to supply the records as long as Dr. Conrad agreed to announce where they could be bought, and so the first "commercial" was born.

The popularity of these programmes grew rapidly and from time to time live singers and bands were included in the programme with one of Dr. Conrad's two sons acting as the master of ceremonies. By the late summer of 1920 the broadcasts had grown so popular that a Pittsburgh store ran an advertisement in a daily newspaper for the sale of radio receivers on the strength of being able to hear these transmissions. The date was September 29th, 1920 and it was probably the one single event that brought about the first broadcast.

Among the people who saw the advertisement was H. P. Davies, Vice-President of Westinghouse. He was already a keen follower of the work being done

The Aeriola Jr. had range of 15 miles and used to cost about £10.



First orchestra developed for exclusive radio work was KDKA Little Symphony Orchestra, with Victor Saudek conducting.



How the family used to listen in.

by their company employee and the advertisement made him realise that if regular programmes were provided for the people, they would quickly want to buy receivers of their own.

Mr. Davies began by winning over the other officials of Westinghouse and this was done so quickly that the application for a licence was submitted to the authorities on October 16th and the forthcoming election night was chosen for the grand opening. The enthusiasm of the small group was such that it was under five weeks between the newspaper advertisement and the station opening.

For this first scheduled broadcast there was no studio; a single room accommodated the transmitter, the record turntable and the staff. William Thomas acted as the technician, L. H. Rosenberg as the announcer and John Frazier and R. S. McClelland handled the telephone lines to the newspaper offices. The chief engineer was D. G. Little, a long standing friend of Dr. Conrad. Oddly enough the main force behind the project was not there on that night. Fearful less the new equipment should fail Dr. Conrad was standing by with his station 8XK, five miles away, ready to take over in the event of trouble.

Between the election returns and the occasional music, listeners heard the same request over and over again: "Will anyone hearing this broadcast communicate with us as we are anxious to know how far and how well this programme is being heard".

The broadcast was a national sensation and newspapers all over the country carried reports on the broadcast. The mailbag over the next few days was massive. One of the reports came from H. W. Irving, now transmitter supervisor of KDKA. He heard the broadcast on the ship "Antigone", then off the coast of Virginia.

KDKA had a fair lead on other stations, and it was not until several months later that the second station came on the air, this one being WBZ in Springfield, Massachusetts which made its first trans-

—continued on page 677

ELECTRIC CLOCK WITH 25 AMP SWITCH

Made by Smith's, these units are as fitted to many top quality cookers to control the oven. The clock is mains driven and frequency controlled so it is extremely accurate. The two small dials enable switch on and off times to be accurately set. Ideal for switching on tape recorders. Offered at only a fraction of the regular price—new and unused only 39/6, less than the value of the clock alone—post and insurance 2/9.



FLUORESCENT CONTROL KITS

Each kit comprises seven items—Choke, 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A—15-20 w. 19/6. Kit B—30-40 w. 19/6. Kit C—80 w. 23/6. Kit D—65 w. 23/6. Kit F for 8ft. 125 w. tube 35/-. Kit MF1 is for 6in., 9in. and 12in. miniature tubes. 19/6. Kit MF2 for 21in. 13 w. miniature tube 29/-. Postage on Kits A and B 4/6 for one or two kits then 4/6 for each two kits ordered. Kits C, D and E 4/6 on first kit then 3/6 for each kit ordered. Kit F 6/6 then 4/6 for each kit ordered. Kit MF1 3/6 on first kit then 3/6 on each two kits ordered.

BLANKET SWITCH

Double pole with neon jet into side so luminous in dark. Ideal for dark room light or for use with waterproof element, new plastic case. 5/6 each. 3 heat model 7/6.



BLANKET SIMMERSTAT

Although looking like, and fitted as an ordinary blanket switch, this is in fact a device for switching on for varying time periods, thus giving a complete control from off to full heat. Although suitable for controlling the temperature of any other appliances using up to 1 amp. Listed at 27/6 each we offer these while our stocks last at only 12/6 each.

REED SWITCHES

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

Miniature. 1in. long x approximately 1/4in. diameter. Will make and break up to 1A up to 300 volts. Price 2/6 each. 24/- doz.

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 1/2in. 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. 25 per dozen.

Small ceramic magnets to operate these reed switches 1/6 each. 18/- dozen.

HIGH CAPACITY ELECTROLYTICS

Brand new, not ex-equipment.

100 mfd. 25v., 1/6 each 12/- doz.

200 mfd. 25v., 1/8 each 15/- doz.

250 mfd. 50v., 3/8 each 33/- doz.

400 mfd. 40v., 4/4 each 46/- doz.

500 mfd. 12v., 2/- each 21.0 doz.

500 mfd. 25v., 3/6 each 33/- doz.

500 mfd. 50v., 4/6 each 48/- doz.

500 mfd. 350v., 8/6 each 24.10 doz.

1000 mfd. 12v., 3/- each 31.10 doz.

1000 mfd. 18v., 3/4 each 34/- doz.

1000 mfd. 64v., 7/4 each 34/- doz.

2000 mfd. 25v., 6/6 each 79/- doz.

5000 mfd. 12v., 4/6 each 22.50 doz.

10,000 mfd. 6v., 5/6 each 23.00 doz.

10,000 mfd. 15v., 8/6 each 24.10 doz.

15,000 mfd. 10v., 10/6 each 25.00 doz.

60,000 mfd. 8v., 22/- each 210.00 doz.

70,000 mfd. 18v., 40/- each 220.00 doz.

TELESCOPIC AERIAL

For portable, car radio or transmitter. Chrome plated—six sections, extends from 7ft to 47in. Hole in bottom for 6BA screw 7/6. KNUCKLED MODEL FOR P.M. 10/-.

TOGGLE SWITCH

3 amp 250v. with fixing ring 1/6 each. 15/- doz.

80 OHM BALANCED ARMATURE EAR PIECE

Usable as a microphone or loudspeaker. 4/6 each.

3 STAGE PERMEABILITY TUNER

This Tuner is a precision instrument made by the famous "Clydon" Company for the equally famous Radiomobile Car Radio. It is a medium wave tuner (but set of longwave coils available as an extra (if required) with a frequency coverage 1620 Kc/s-525 Kc/s and intended to operate with an I.F. value of 470 Kc/s. Extremely compact (size only 2 1/2 x 2 1/2 in.) with reduction gear for fine tuning. Snip price this month 12/6, with circuit of front end suitable for car radio or as a general purpose tuner for use with Amplifier. Post free.



Horstmann "Time and Set" Switch

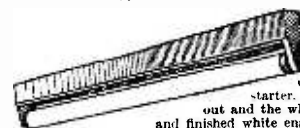
(A 15 amp Switch). Just the thing if you want to come home to a warm house without it costing you a fortune. You can delay the switch on time of your electric fires, etc., up to 14 hours from setting time or you can use the switch to give a boost period of up to 3 hours. Equally suitable to control processing. Regular price probably around 45. Special snip price 29/6, p. & ins. 4/6.

DOUBLE ENDED MAINS MOTOR

On feet with holes for screw-down fixing. To drive models, oven, blower heater, etc. 8/6 each, plus 3/6 post and insurance, 6 or more post free.



ATLAS SLIMLINE FLUORESCENTS



Fluorescent lighting units made by the famous Atlas company, with super silent, polyester filled choke and radio suppressed starter. The tube springs in and out and the whole unit is beautifully made and finished white enamel. Amazingly economical. Measures 2ft. long. Is ideal in Kitchen, Bedroom, Hallway, Porch, Loft, etc. Don't miss this amazing offer, 39/6 with tube. Assembled ready to install. Postage and insurance 6/6 extra. 4ft. twin model 59/6, post & ins. 6/6. 5ft. twin with diffuser, sharp price 2/1, our price 210, carr. 21.

230 VOLT MAINS OPERATED KLAXON HORN



This is small (about 10in. long) but has a very piercing and effective note hence it would make good Fire Alarm or Works stop and start Siren. Also useful for instance to scare birds off crops. Made for the G.P.O. so obviously best quality. Slightly used but OK. 39/6 plus 1/6 p.p.

THIS MONTH'S SNIP

40 WATT 12in. HI-FI SPEAKER. Is undoubtedly one of the finest loudspeakers that we have ever offered, produced by one of the country's most famous makers. It has a die-cast metal frame and is strongly recommended for Hi-Fi and public address. Handling 40 watts R.M.S.—Cone moulded fibre—Freq. response 30-10,000 c.p.s.—specify 3 or 15 ohms. Chassis diam. 12in.—12 1/2in. over mounting lugs. Overall height 5 1/4in. A £10 speaker offered this month for 25.15/6 plus 7/6 post and ins.



MOTORISED CAM SWITCH

Made by the famous meter company Chamberlain and Hookham, these have a normal mains 200-240V motor which drives a ratchet mechanism so geared to give one ratchet action per minute on a wheel with 60 teeth thus a complete revolution of the cam takes place in one hour. The cam operates 8 switches (6 changerover and 2 on/off thus 480 circuit changes per hour are possible). Contacts, rated at 15 amps have been set for certain switch combinations but can, no doubt, be altered to suit a special job. Also other switch wipers or devices can be attached to the shaft which extend approximately one inch. 47/6, p. & ins. 4/6.



BARGAIN OF THE YEAR

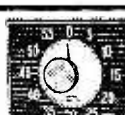
MICROSONIC KEYCHAIN RADIO

7 transistor Keychain Radio in very pretty case, size 2 1/4 x 2 1/4 x 1 1/4in.—complete with soft leather zipped bag. Specification—Circuit: 7 transistor superheterodyne. Frequency range: 530 to 1600 Kc/s. Sensitivity: 465 Kc/s or 485 Kc/s. Power output: 40mW. Antenna: ferrite rod. Loudspeaker: Permanent magnet type. In transit from the East these sets suffered slight corrosion as the batteries were left in them but when this corrosion is cleared away they should work perfectly—offered without guarantee except that they are new. Price only 24/6 less batteries plus 2/6 post for 27 post free. Rechargeable batteries 8/6 pair.



1 HOUR MINUTE TIMER

Made by famous Smith's companies, these have a large clear dial, size 4 1/4 x 3 1/4, which can be set in minutes up to 1 hour. After preset period the bell rings. Ideal for processing, a memory jogger or, by adding simple lever, would operate micro-switch 22/6.



3kW TANGENTIAL HEATER UNIT



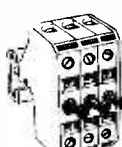
This heater unit is the very latest type, most efficient and quiet running. It is fitted in Heater and blower heaters costing £15 and more. Comprises motor, impeller, 2kW. element and 1kW. element allowing switching 1, 2 and 3kW. and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only need control switch. 79/8. Postage and insurance 6/6. 2kW. model 49/6 plus 6/6 p. & p. 2kW model 59/6 plus 6/6 p. & p.

MICRO SWITCH

5 amp. changerover contacts, 1/9 each. 18/- doz. 15 amp Model 2/- each or 21/- doz.



Mains Connector. A quick way to connect equipment to the mains safely and firmly—disconnection by plugs prevents accidental switching on; has sockets which allow insertion of meter without disconnection; cable inlets firmly hold bare wire on up to four 7,028 cables. 12/6 each.



DRILL CONTROLLER

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. 19/6 plus 2/6 post and insurance. Or available made up 37/6, plus 2/6 post & p.



BALANCED ARMATURE UNIT

500 ohm. operates speaker or microphone, so useful in intercom or similar circuits. 6/6 ea, 23.10.0 doz. 80 ohm model 5/6.



BATTERY OPERATED TAPE DECK

With Capstan control. This unit is extremely well made and measures approx. 6 x 5 x 2 in. deep. Has three piano key type controls for Record, Play, back and Rewind. Motor is a special heavy duty type intended for operation off 4.5 volts. Supplied complete with 2 spools ready to install. Record. Replayhead is the sensitive M4 type intended for use with transistor amplifier. Price 79/8. Post and insurance 4/6. Unused ex-equipment.



PROTECT VALUABLE DEVICES FROM THERMAL RUN-AWAY OR OVERHEATING

Thyristors, rectifiers, transistors, etc., which use heat-sinks can easily be protected. Simply make the contact thermostats part of the heat-sink. Motors and equipment can also be adequately protected by having thermostats in strategic spots on the casing. Our contact thermostat has a calibrated dial for setting between 90deg. to 190deg.F. or with the dial removal range setting is between 80 to 800deg.F. Price 10/-



THYRISTOR LIGHT DIMMERS

Will dim incandescent lighting up to 600 watts from full brilliance to out. Fitted on M.K. flush plate, same size and fixing as standard wall switch, so may be fitted in place of this, or mount on surface. Price complete in heavy plastic box with control knob 59/6.



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.

0.005mFd TUNING CONDENSER

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



MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: P1, P3, P4, P6, P7, P9 and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only 16/6, plus 3/6 postage.

ELECTRONICS (CROYDON) LTD
Dept. PW, 266 London Rd., Croydon CRO 2TH
Also 102/3 Tamworth Road, Croydon

VALVES

1A7	7/9	6B16	9/-	6K7	1/9	787	45/-	20P4	20/-	78	5/-	D992	3/6	ECF80	6/6	EM84	7/6	PCCR9	10/6	PY800	9/6	UCH81	7/-
1D5	7/8	6B17	17/-	6K7G	6/6	7Y4	9/6	20P5	20/-	80	7/6	D996	7/6	ECF82	6/6	ESU150	20/-	PCCR19	10/6	PY801	9/6	UCH82	7/6
1H5	7/8	6B87	25/-	6K8	2/9	10C1	20/-	25L6GT	7/-	150B2	11/6	DH77	4/9	ECH31	12/6	EY51	7/6	PCF80	9/6	R3	7/6	UCH83	11/6
1L7D5	6/-	6B87	25/-	6K8	2/9	10C2	12/6	25V5	6/6	150C4	9/6	DK91	6/-	ECH42	13/-	EZ35	6/-	PCF82	9/6	R19	7/6	UF41	10/6
IN6GT	6/-	6C4	5/-	6K8GT	11/6	10P1	14/9	25Z4	6/6	801	9/6	DK92	9/-	ECH81	5/9	EZ40	9/-	PCF84	8/-	RG5/500	80/-	UF49	7/6
IR5	6/-	6C5G	5/-	6K25	15/-	10P18	8/-	28D7	9/3		120/-	DK96	7/9	ECH85	8/6	EZ41	9/6	PCF86	9/-	S130	40/-	UL41	12/-
IR4	5/6	6C6	3/9	6L1	12/-	10L1	8/-	38C1	6/9	813	75/-	DL92	25/-	ECL80	7/-	EZ80	5/6	PCF88	9/-	SP4	8/-	UL84	7/-
IR5	4/6	6C8G	6/-	6L6G	7/9	10L1D11	10/6	30C15	15/-	864	15/-	DL93	6/3	ECL82	7/-	EZ81	5/6	PCF89	9/-	SP41	8/-	UM80	6/6
IT4	4/6	6C8G	24/-	6L18	6/-	10P13	13/6	30C17	15/-	864	15/-	DL94	6/3	ECL83	10/3	EY61	15/-	PCF90	15/-	SP61	8/-	UM81	6/6
3A4	4/6	6CH6	7/8	6Q7G	6/-	11B3	70/-	30C18	15/-	1825	6/3	DL95	7/9	ECL86	9/-	EY62	15/-	PCF91	15/-	SP62	8/-	UM82	6/6
3Q4	7/9	6CW4	13/6	6Q7GT	8/6	12AT6	4/9	30P5	17/-	4022AR	67/-	DM70	6/-	ECL87	10/3	EY63	15/-	PCF92	15/-	SP63	8/-	UM83	6/6
3Q5	7/9	6D6	3/9	6A7M	7/-	12AT7	6/-	30PL1	15/-	6763	12/-	DX86	6/-	ECL88	10/3	EY64	15/-	PCF93	15/-	SP64	8/-	UM84	6/6
384	6/3	6E5	7/6	68C7	7/-	12AU6	5/9	30PL12	19/-	7193	2/-	DX87	6/-	ECL89	10/3	EY65	15/-	PCF94	15/-	SP65	8/-	UM85	6/6
3V4	6/3	6F1	12/6	68G7	6/-	12AU7	5/9	30PL14	15/-	7475	14/-	DX88	12/-	ECL90	10/3	EY66	15/-	PCF95	15/-	SP66	8/-	UM86	6/6
5R4GY	10/6	6F5G	8/-	68H7	3/3	12AX7	6/3	30L15	17/-	A61	9/6	EAS0	3/6	ECL91	10/3	EY67	15/-	PCF96	15/-	SP67	8/-	UM87	6/6
5V4G	5/6	6F6G	5/-	68J7	6/-	12BA6	6/-	30L17	17/-	ATP4	2/3	EAB8C0	6/6	ECL92	10/3	EY68	15/-	PCF97	15/-	SP68	8/-	UM88	6/6
5V4G	8/-	6F8G	5/6	68K7GT	4/9	12BE6	6/3	30P4	22/6	ATP5	12/-	EAF42	10/-	ECL93	10/3	EY69	15/-	PCF98	15/-	SP69	8/-	UM89	6/6
5Y3GT	6/-	6F11	6/6	68L7GT	6/-	12C8GT	6/-	30P12	18/-	ATP7	8/6	EAF43	10/-	ECL94	10/3	EY70	15/-	PCF99	15/-	SP70	8/-	UM90	6/6
5Z4G	7/-	6F13	6/6	68N7GT	5/6	12E1	20/-	30P19	15/-	AU2	8/6	EAF44	10/-	ECL95	10/3	EY71	15/-	PCF100	15/-	SP71	8/-	UM91	6/6
630L2	15/-	6P23	15/-	6Q4GT	12/-	12J7GT	6/6	30PL13	18/-	AU5	8/6	EBC33	6/6	ECL96	10/3	EY72	15/-	PCF101	15/-	SP72	8/-	UM92	6/6
6A8G	12/6	6P24	15/-	6UG6	7/9	12K7GT	7/-	30PL14	15/-	AZ31	8/-	EBC41	9/6	ECL97	10/3	EY73	15/-	PCF102	15/-	SP73	8/-	UM93	6/6
6AC7	4/6	6F25	14/-	6V6M	12/-	12K8GT	8/-	35A5	12/6	CBL31	16/-	EBC90	9/6	ECL98	10/3	EY74	15/-	PCF103	15/-	SP74	8/-	UM94	6/6
6AK5	5/-	6F28	14/-	6V6G	4/6	12Q7GT	6/-	35L6	9/-	COH35	15/-	EBC91	9/6	ECL99	10/3	EY75	15/-	PCF104	15/-	SP75	8/-	UM95	6/6
6AM5	4/6	6F22	20/-	6V6GT	6/6	12SA7	8/-	35W4	4/6	CL39	20/-	EBC92	9/6	ECL100	10/3	EY76	15/-	PCF105	15/-	SP76	8/-	UM96	6/6
6AM6	3/6	6G6	3/6	6X4	4/6	12S8GT	6/-	35Z3	10/-	CV450	25/-	EBC93	9/6	ECL101	10/3	EY77	15/-	PCF106	15/-	SP77	8/-	UM97	6/6
6AQ5	3/6	6H6	3/-	6X3G	4/6	12SH7	3/-	35Z4GT	9/6	CV30	12/6	EBC94	9/6	ECL102	10/3	EY78	15/-	PCF107	15/-	SP78	8/-	UM98	6/6
6AS7G	15/-	6J5M	9/-	6X5GT	4/6	12SJT	3/9	35Z5	10/-	CV31	8/6	EBC95	9/6	ECL103	10/3	EY79	15/-	PCF108	15/-	SP79	8/-	UM99	6/6
6AT6	4/9	6J5G	4/-	7B6	11/6	12SRK7	4/9	37	6/6	DAC32	7/-	EBC96	9/6	ECL104	10/3	EY80	15/-	PCF109	15/-	SP80	8/-	UM100	6/6
6AT6	5/6	6J5GT	5/6	7B7	7/6	12SRK7	5/-	42	6/6	DAF91	4/6	EBC97	9/6	ECL105	10/3	EY81	15/-	PCF110	15/-	SP81	8/-	UM101	6/6
6B4G	20/-	6J6	3/6	7C5	22/6	14H7	9/6	50B5	6/6	DAF96	7/6	EBC98	9/6	ECL106	10/3	EY82	15/-	PCF111	15/-	SP82	8/-	UM102	6/6
6BS8	20/-	6J7M	8/6	7C6	15/-	19AQ5	5/-	50C5	6/3	DOCC90	20/-	EBC99	9/6	ECL107	10/3	EY83	15/-	PCF112	15/-	SP83	8/-	UM103	6/6
6BA6	5/-	6J7G	6/-	7D5	8/-	20D1	10/-	50C6GT	31/-	DP33	8/-	EBC100	9/6	ECL108	10/3	EY84	15/-	PCF113	15/-	SP84	8/-	UM104	6/6
6BE6	5/-	6J7GT	7/6	7H7	6/6	20P2	14/-	50L6GT	8/-	DP70	9/-	EBC101	9/6	ECL109	10/3	EY85	15/-	PCF114	15/-	SP85	8/-	UM105	6/6
6BH6	9/-	6K6GT	8/-	7R7	13/-	20L1	20/-	75	9/6	DP91	4/-	EBC102	9/6	ECL110	10/3	EY86	15/-	PCF115	15/-	SP86	8/-	UM106	6/6

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2N2160	12/6	AC128	5/-	AD161	7/6	AF118	5/-	BC158	4/-	BFY52	4/-	NKT214	5/-	OA10	3/6	OA200	1/6	OC36	10/-	OC77	8/-	OC83	4/6
2N2369A	4/-	AC17	6/-	AD162	7/6	AF119	5/-	BC159	4/-	BFY53	4/-	NKT215	5/-	OA15	2/6	OA202	2/-	OC44	3/6	OC78	5/-	OC84	4/6
2N2926	2/6	AC18	5/-	AD163	7/6	AF120	5/-	BC160	4/-	BFY54	4/-	NKT216	5/-	OA20	2/6	OA210	2/-	OC45	3/6	OC79	5/-	OC85	4/6
2N3055	14/6	AC19	5/-	AD164	7/6	AF121	5/-	BC161	4/-	BFY55	4/-	NKT217	5/-	OA25	2/6	OA215	2/-	OC46	3/6	OC80	5/-	OC86	4/6
2N3819	7/-	AD140	8/-	AF116	6/6	BC109	2/6	BFY50	5/-			NKT218	5/-	OA30	2/6	OC23	5/-	OC75	5/-				

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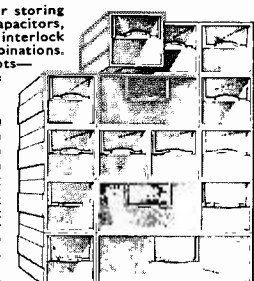
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Going Back

—continued from page 674

RADIO BROADCASTING NEWS

Fourth Week Broadcasting

March 26, 1922

KDKA Edition. Vol. 1. No.



Early copy of KDKA'S "Radio Times".

mission on September 19th, 1921. After that stations were opening every few days and within a year over a hundred stations were regularly broadcasting and a million receivers had been sold.

Even before the opening of WBZ, KDKA had broken ground with all sorts of transmissions. On January 2nd 1921 a religious service was relayed from a local church, on March 4th the inaugural address of the newly elected President Harding was read out on the station at the same time as the speech proper was being made in Washington. On April 11th the first sports commentary was carried, a boxing match, and on May 19th the first farm programme was started.

For the first six months programmes originated from the transmitter room, there was little need for a studio as most programmes consisted of either gramophone records or were relays from outside points. In May, however, regular live music was added to the schedule and although these at first took place in a small auditorium in the building, room resonance proved so serious that they were transferred to a tent on top of the main building and it was not until October 3rd that the first proper studio was built.

Dr. Frank Conrad however was a true innovator and having seen that the station was properly established he turned his interest to the short-wave bands. In conjunction with a few other amateurs he began some of the first tests on wavelengths below 100 metres, then considered of little value. In August 1922 8XK began relaying the programmes of KDKA and a year later all programmes were relayed on short waves and these were heard in Great Britain.

Conrad died in 1941 but in the intervening years did a great deal of research into f.m. and television. Others were also working in these fields but Dr. Conrad's contribution was considerable and he was the holder of innumerable patents.

TAKE 20

JULIAN ANDERSON

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

SINCE this series started we have had many requests for particular circuits. The less serious have asked for colour TV circuits and stereo systems but the vast majority have asked for simple circuits that are functional when finished.

One such request from a reader in Manchester asked for a megaphone or loudhailer suitable for use with a car battery. At first this seemed almost impossible, bearing in mind our limitations on a maximum of twenty components and twenty shillings, but after a little thought the circuit in Fig. 1 was evolved. Let me state straight away that the loudspeaker and the various items needed to form the cabinet and chassis are not included in the price and even so it will be a tight squeeze to stay under our price limit.

THE CIRCUIT

A careful study of the circuit in Fig. 1 will show that it is basically a mating together of two previously published circuits, the Gramophone Amplifier and last month's General Purpose Preamplifier; there are some minor differences but the basic circuit is the same. The amplifier produces an output in the order of 1 watt—quite adequate for a megaphone.

Megaphones—or loudhailers as they are often called—are designed so that both high and low frequencies are not only unnecessary but actually undesirable. The microphone used is one of the balanced armature earpieces that we used in our intercom circuit some time ago. These used to be used in military telephones and are not only very sensitive and cheap but have an ideal frequency response for our requirements here. Since there is little bass content in the voice and little output from the microphone in this region, a high value coupling capacitor is unnecessary, a $0.5\mu\text{F}$ one was used in the prototype, low value electrolytics ($1\mu\text{F}$ to $5\mu\text{F}$) are however much smaller physically and cheaper and they could be used instead. In this case the negative connection would go to the microphone.

One of the problems in building a megaphone is acoustic feedback, that is the sounds of the loudspeaker getting back into the microphone and causing a "howl-round". This problem can be reduced by attenuating the upper frequencies and C2, connected between the base of Tr1 and the negative line, achieves this.

R1 provides base bias. Note that if an electrolytic is used for C1 the value of R1 may have to be altered to allow for leakage. R2 acts as the collector supply and load and the output is coupled via C3 to the volume control VR1. C3 is $0.5\mu\text{F}$ and the same rules apply to it as to C1, that is an electrolytic could be used in its place.

C4 acts as a d.c. blocking capacitor and feeds the

No. 20

MEGAPHONE

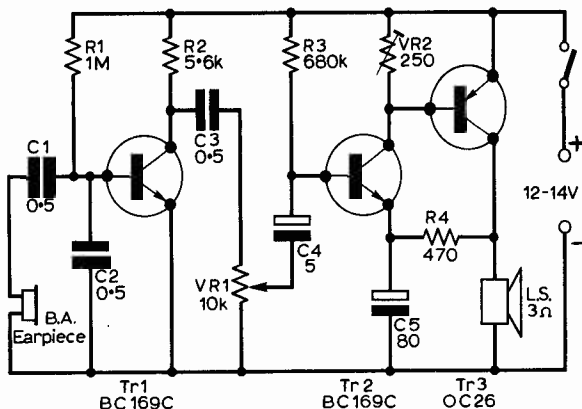


Fig. 1.: The circuit of the "Take 20" Megaphone

signal to the second transistor, Tr2 which, like Tr1, is a BC169C. The emitter of Tr2 is connected to the negative line via a 470Ω resistor connected through the loudspeaker; this tends to d.c. stabilise the conditions in the output stage. A positive feedback loop exists and it is essential that C5 is included to decouple the audio. VR2 is a small preset potentiometer which acts as the collector load, this sets the quiescent current through the output stage, Tr3. An OC26 has been specified for Tr3 but in fact almost any germanium power transistor would do—some of those available as unmarked surplus types would do well here.

The loudspeaker impedance is not all that important and a 3Ω type has been specified here only because these are more common than others, it is however essential that it has a cone diameter of over 6in. Speakers with smaller diameters will have their cones biased one way by the quiescent current through the output transistor and whereas this is acceptable on larger speakers it will cause intolerable distortion in smaller types.

The power supply is nominally 12V and the internal impedance of this will usually mean that no decoupling is needed, however, if stability problems arise a $250\mu\text{F}$ 16V capacitor connected across the two supply rails will probably cure this.

CONSTRUCTION

As the loudspeaker has to be fairly large it will be difficult to build a handheld unit and in any case it is far simpler to build the amplifier into the loudspeaker cabinet. Tr3 must be heat sunk. VR2 requires setting only once; before switching on set it to *minimum* resistance (so Tr3 base and emitter are shorted) and after applying the supply current increase this slowly until signals are relatively undistorted—increasing beyond this point will only raise the quiescent current.

In the region of high quiescent current the quality is good but Tr3 will become very hot and may blow, so care should be taken with the setting. ■

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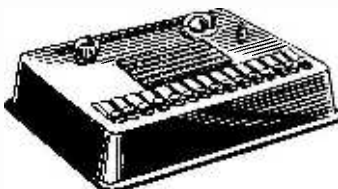
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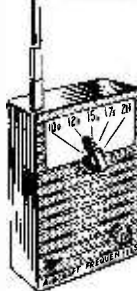
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NOW IT'S HERE AT LAST, after experimenting for four and a half months with a multitude of different designs, carrying out actual field tests with prototypes, our design team have come up with this real winner.

This fully portable transistorized metal locator detects and tracks down buried metal objects—it signals exact location with loud audible sound (no phones used). **FINDS GOLD, SILVER, LOSE COINS, JEWELLERY, KEYS, WAR SOUVENIRS, ARCHAEOLOGICAL PIECES, METALLIC ORE, NUGGETS ETC. ETC.** Outdoors or indoors. *Extremely sensitive, will signal presence of certain objects buried several feet below ground!* No knowledge of radio or electronics required. *Can be built with ease in one short evening by anybody from nine years of age upwards,* with the wonderfully clear, easy to follow, step-by-step, fully illustrated instructions—it really is easy as A.B.C. Fully transistorized—no valves. Uses standard PP3 battery. No soldering necessary. Size of detector head 13½ x 10 x 2½. Great demand expected at this remarkably low price—**ORDER WHILE PRESENT STOCKS LAST.** All parts including detector head case, nuts, screws, wire, simple instructions etc. etc. **ONLY 47/6d + 6/6d P. & P.** (Telescopic handle as illustrated 25/- extra). Parts available separately. Nicely boxed makes fantastic Christmas gift! Made up looks worth £15! Money back guarantee.

ONLY 47/6



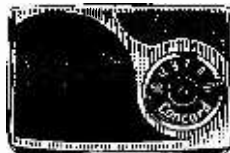
UNIQUE RADIO FOR BEDROOM OR OFFICE

No batteries, no electricity, never wears out

Tune in your favourite programmes or the news, or sports in the Office or in your bedroom. Uses sensitive, germanium diode which evolved from wartime radar. Never buy a battery. Never use electricity. Never replace. Covers all medium waves. Clear beautiful tone. Size 4½ x 2½ x 1½ in beautiful case. **ONLY 7 CONNECTIONS AND IT'S WORKING.** No soldering necessary. **CAN BE BUILT ALMOST BLINDFOLD IN UNDER 15 MINUTES!** Ideal for absolute beginner from 8 years of age upwards.

ONLY 19/6

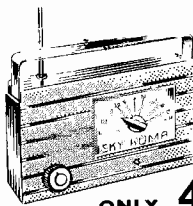
SPECIAL PRICE TO CLEAR STOCKS OF COMPONENTS ONLY 19/6d + 2/6d P. & P. for all parts including beautiful case, germanium semi-conductor, tuning condenser, personal phone, wire, nuts, screws. **SIMPLE AS A.B.C. INSTRUCTIONS.** Will make an exceptional Christmas present. (Parts available separately). Money Back Guarantee.



SHORTWAVE TRANSISTOR RADIO

Can be built in one evening

At last! After trying countless circuits searching for easy build, work-first-time short wave. Giving advanced world-wide performance, this "Sky Hunter". Anyone from 9 years up can follow the step-by-step, easy-as-ABC, fully illustrated instructions. (We built ten prototypes and easy-as-ABC, fully illustrated instructions. (We built ten prototypes and every one worked first time) no soldering necessary. 76 stations logged on rod aerial in 30 mins.—Russia, Africa, USA, Switzerland, etc. Experience thrills of world wide news, sport, music, etc. Eavesdrop on unusual broadcasts. Uses PP3 battery. Transistorized (no valves). Size only 3½ x 4½ x 1½. As tremendous demand anticipated price held to only 45/- + 3/6 P. & P. for all parts incl. Cabinet, screws, instr. etc. (Parts available separately). Money back guarantee.



ONLY 45/-

AMAZING TRANSISTORIZED CIGARETTE RADIO

Yes, a perfectly ordinary packet of cigarettes! But watch your friends' astonishment on hearing its range of stations loud and clear. Holds 10 cigarettes yet conceals sensitive, fully transistorized circuit (including tiny battery). A young boy can assemble it in under 2 hours. No soldering. Only 16 connections to make. **ALL PARTS** including semi-conductors. Simple as ABC Illustrated Plans, etc. **ONLY 29/6** plus 2/6 post, etc. Parts available separately. Money back guarantee.

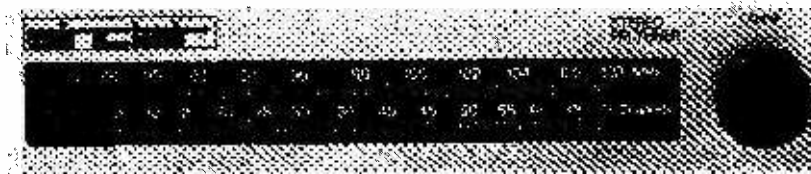
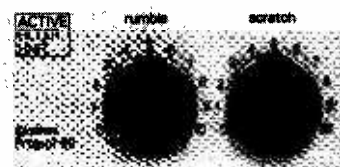
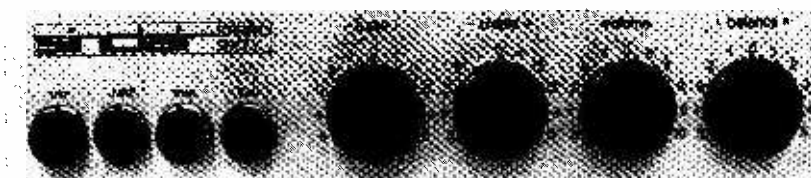
TOTAL BUILDING PRICE

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Project 60



the world's most advanced high fidelity modules

With the introduction of an entirely new and original high fidelity stereo F.M. tuner, the Project 60 range can be said at this stage to be complete. It offers the constructor a most attractive choice of modular arrangements whereby a high fidelity system can be selected to suit the user's personal requirements. Equally, it is possible to use any Project 60 modules separately or partially grouped and so benefit greatly from the flexibility in use these modules afford. The chart below shows some of the most popular applications for constructors to assemble. The Project 60 manual (free with the modules) suggests others as well and its 48 pages are packed with valuable information. The new tuner, for example can be used with any good high fidelity system as well as Project 60.

Project 60 now falls into four interdependent groups: - 1. The Z.30 and Z.50 amplifiers which have only 0.02% distortion at all output levels and are useful in a wide variety of other applications. 2. The control units comprising the Stereo 60 preamp and control unit and the Active Filter Unit (A.F.U.) with which both high pass and low pass filtering can be introduced between control unit and power amplifiers. 3. The Stereo F.M. tuner as described opposite, and 4. The power supply units PZ.5.

PZ.6 and PZ.8. For most requirements when using Z.30 power amplifiers, the PZ.5 will be perfectly adequate; if low efficiency (high quality) loud speakers are used, the PZ.6 stabilised power supply unit will be used. The PZ.8 will be needed with Z.50s which can be used for any Project 60 system.

Project 60 modules incorporate some of the most advanced circuitry in the world to achieve unsurpassed standards of high fidelity and modern manufacturing techniques enable these modules to be sold at exceptionally attractive prices. Assembling the modules requires no skill or previous experience since the manual supplied with the modules explains clearly how everything can be done with nothing more than the simplest of domestic tools.

Project 60 manuals

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

System	The Units to use	In conjunction with	Cost of Units	+ Project 60 tuner
A Car Radio	Z.30	Existing car radio, Sinclair Micromatic	89/6	
B Simple battery powered record player	Z.30	Crystal pick-up, 12V or more battery supply and volume control	89/6	
C Mains powered record player	Z.30 and PZ.5	Crystal or ceramic P.U. Volume control etc.	£9.9.0	£34.9.0
D 20+20 watts R.M.S. stereo amplifier for most needs	Two Z.30s, Stereo 60 and PZ.5	Crystal, ceramic or magnetic P.U., most dynamic speakers, F.M. tuner etc.	£23.18.0	£48.18.0
E 20+20 watts R.M.S. stereo amplifier for use with low efficiency (high performance) speakers	Two Z.30s, Stereo 60 and PZ.6	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc. All dynamic speakers	£26.18.0	£51.18.9
F 40+40 watts R.M.S. de-luxe stereo amplifier	Two Z.50s, Stereo 60 PZ.8 and mains transformer	As for E	£32.17.6	£57.17.6
G Outdoor public address system	Z.50	Microphone, up to 4 P.A. speakers, 12V car battery with converter, or 45V d.c., controls	£5.9.6	
H Indoor P.A.	One Z.50, PZ.8 and mains transformer	Microphone, guitar, heavy duty speakers etc., controls	£17.8.6.	
J High pass and low pass filters	A.F.U.	D, E or F as above	£5.19.6	

sinclair

Sinclair Radionics Limited, 22 Newmarket Road, Cambridge

Telephone (0223) 52731

Z.30 & Z.50 power amplifiers

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.



Z.30

Built, tested and guaranteed with circuits and instructions manual

Z.50

Z.30

Z.50

Built, tested and guaranteed with circuits and instructions manual

89/6

109/6

Stereo 60 pre amp/control unit

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

SPECIFICATIONS

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

● Output — 250mV.

● Signal-to-noise ratio — better than 70dB.

● Channel matching — within 1dB.

● Tone controls — TREBLE +15 to —15dB at 10kHz; BASS +15 to —15dB at 100Hz.



● Front panel — brushed aluminium with black knobs and controls.
● Size $8\frac{1}{2} \times 1\frac{1}{2} \times 4$ ins.

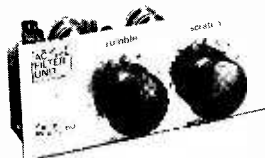
Built, tested and guaranteed

£9.19.6

Active Filter Unit

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

Two stages of filtering are incorporated — rumble (high pass) and scratch (low pass). Supply voltage — 15 to 35V. Current — 3mA. H.F. cut-off (—3dB)



variable from 28kHz to 5kHz. L.F. cut-off (—3dB) variable from 25Hz to 100Hz. Filter slope, both sections 12dB per octave. Distortion at 1kHz (35V supply) 0.02% at rated output

Built, tested and guaranteed

£5.19.6

Power Supply Units

The units below are designed specially for use with the Project 60 system of your choice.

Illustration shows PZ 5 power supply unit to left and PZ 8 (for use with Z.50s) to the right. Use PZ 5 for normal Z.30 assemblies and PZ 6 where a stabilised supply is essential.

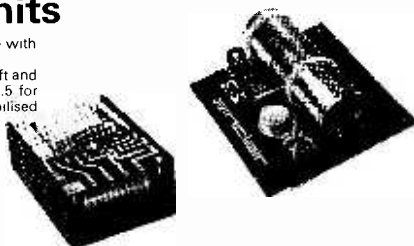
PZ-5 30 volts unstabilised £4.19.6

PZ-6 35 volts stabilised £7.19.6

PZ-8 45 volts stabilised

(less mains transformers) **£5.19.6**

PZ-8 mains transformer £6.19.6



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

sinclair

Stereo FM tuner



first in the world to use the phase lock loop principle

Before production of this tuner, the phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio over other systems. Now, for the first time the principle has been applied to an FM tuner with fantastically good results. By the inclusion of other original features such as varicap diode tuning, printed circuit coils and an I.C. in the specially designed stereo decoder, the tuner has an unsurpassed specification, which also incorporates a squelch circuit for silent tuning between stations, A.F.C. and A.G.C. Sensitivity is such that good reception becomes possible in difficult areas, foreign stations can be tuned in suitable conditions and often a few inches of wire are enough for an aerial. In terms of high fidelity, this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically as the tuning control is rotated, a panel indicator lighting up as the stereo signal is tuned in. Although the tuner is intended primarily for use with a Project 60 system, it can be used to advantage with any other high fidelity system. It is easily mounted into any cabinet as shown in the manual supplied with it.

Specifications

Number of transistors 16 plus 20 in I.C.

Tuning range 87.5 to 108 MHz

Capture ratio 1.5dB

Sensitivity 2μV for 30dB quieting
7μV for full limiting

Squelch level 20μV

A.F.C. range \pm 200 KHz

Signal to noise ratio > 65dB

Audio frequency response 10Hz—15kHz (\pm 1dB)

Total harmonic distortion 0.15% for 30% modulation

Stereo decoder operating level 2μV

Pilot tone suppression 30dB

Cross talk 40dB

I.F. frequency 10.7 MHz

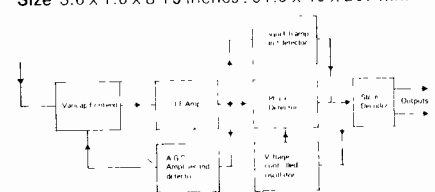
Output voltage 2 x 150mV R.M.S.

Aerial Impedance 75 Ohms

Indicators Mains on, Stereo on, tuning indicator

Operating voltage 25-30 VDC

Size 3.6 x 1.6 x 8.15 inches; 91.5 x 40 x 207 mm



Price: £25 built and tested. Post free.

To: Sinclair Radionics Ltd., 22 Newmarket Road, Cambridge

Please send

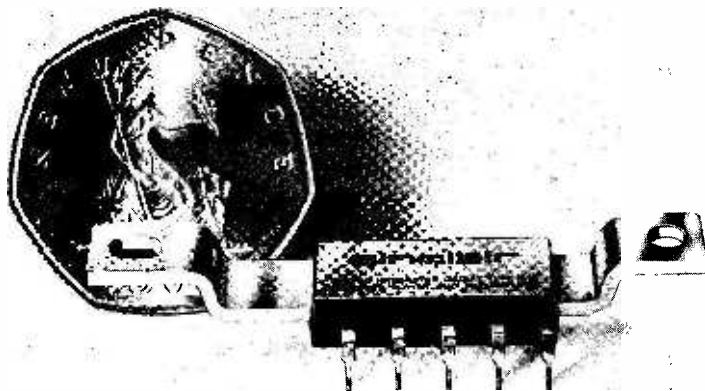
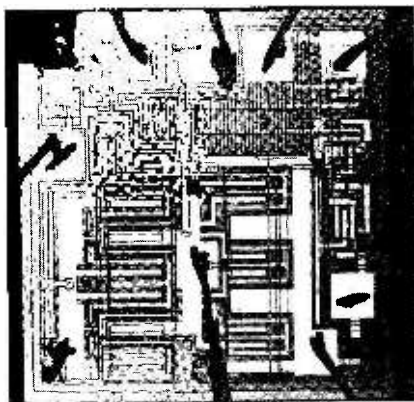
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for which I enclose cash/cheque money order

PW. 12A

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 \pm 1dB
 Total harmonic distortion Less than 1% at full output
 Load impedance 3 to 15 ohms
 Power gain 110dB (100,000,000,000 times) total
 Supply voltage 8 to 18 volts.
 Size 1 x 0.4 x 0.2 inches
 Sensitivity 5mV
 Input impedance Adjustable externally up to 2.5 M ohms

Circuit Description

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

Applications

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

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

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

SINCLAIR

IC-10 with IC-10 manual
Post free.

59/6

To: Sinclair Radionics Ltd., 22 Newmarket Road, Cambridge

Please send

NAME

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for which I enclose cash/cheque money
order

PW. 12A

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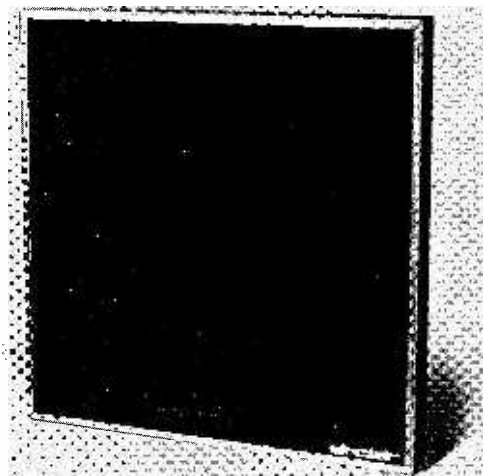
Q.16 High fidelity loudspeaker

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 $\frac{1}{2}$ " 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.

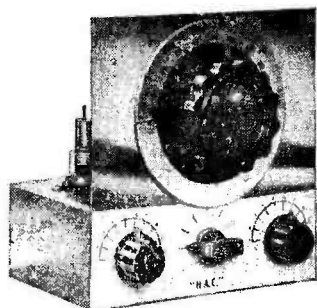
Specifications

Size:	1 $\frac{1}{8}$ " \times 1 $\frac{7}{8}$ " \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.



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Improved one-valve model "DX" mark 2. Complete kit—price 66/- (post & packing 4/-). Customer writes: "Australia, India and America at loud volume." "I am 14 years of age and have logged over 130 stations, plus countless Amateurs from all over the world." Send S.A.E. for test report.

This kit contains all genuine short-wave components, drilled chassis, valve, accessories and full instructions. Ready to assemble, and of course, as all our products—fully guaranteed. Full range of other S.W. kits, including the famous model "K" and "K plus" (illustrated above). All orders despatched by return. (Mail order only.) Send now for free descriptive catalogue & order form.

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BBC-ITV-FM AERIALS



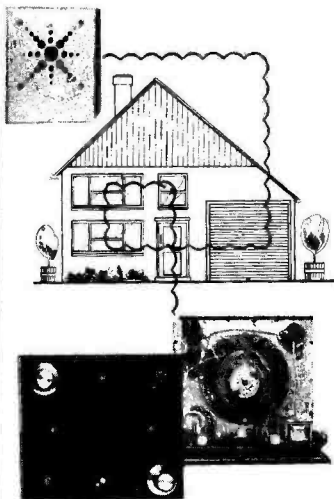
B.B.C. (Band 1) Loft. 25/-, Wall S/D. 32/6, 'H' array 60/-, I.T.V. (Band 3) 5 element loft array 45/-, 7 element 55/-, Wall mounting 5 element 65/-, Combined BBC/ITV loft 1 + 5 55/-, 1 + 7 67/6, Wall mounting 1 + 5 77/6, Chimney mounting 1 + 5 90/-, Preamps from 75/-, Combined BBC/ITV/BBC2 Aerials. 1 + 5 + 9 80/-, 1 + 5 + 14 90/-, 1 + 7 + 14 100/-, Available loft only. F.M. Radio Loft S/D 19/6, 'H' 38/6, 3 element array 57/6, Standard co-axial cable 1/- yd. Coax plugs 1/8, Outlet boxes 6/-, Diplexer crossover boxes 17/6, p.p. Aerials 8/-, accessories 3/-, C.W.O. or C.O.D. (min. C.O.D. charge 3/6). 1/- for fully illustrated Lists.

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1N4002	1/6	AAZ13	2/6	B8X20	3/6
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1N4007	4/-	AC128	5/-	B8Y29	5/-
1N4009	1/6	AC153	4/-	B8Y50	5/-
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2G210	12/6	AC169	3/-	B8Y66	5/-
2G240	48/6	AC176	5/-	B8Y67	5/-
2G261	4/-	AC187	6/-	B8Y68	5/-
2G292	4/6	AC188	6/-	B8Y69	5/-
2G303	5/-	AC17	6/-	BY100	3/6
2G306	6/-	AC18	4/-	BY103	4/6
2G308	6/-	AC19	5/-	BY126	3/-
2G309	6/-	AC20	4/-	BY127	4/-
2G371	4/6	AC21	4/6	BY210	8/-
2G374	4/6	AC22	3/6	BY211	7/-
2G381	5/-	AC28	3/6	BY212	6/-
2G382	6/-	AC34	4/-	BY213	6/-
2G383	5/-	AC36	5/-	BY215	20/-
2N404	4/6	AC39	11/-	BY216	12/6
2N686	3/6	AC40	3/-	GET102	6/-
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2N706	2/-	AD161	7/6	MFF103	7/-
2N706A	2/6	AD162	7/6	MFF104	7/6
2N707	9/6	AF102	12/6	MFF105	8/-
2N708	3/-	AF114	6/6	OA5	3/-
2N914	4/6	AF115	6/-	OA7	4/-
2N916	4/6	AF116	6/6	OA9	4/-
2N918	7/6	AF117	5/-	OA10	5/-
2N919	4/-	AF118	12/6	OA47	2/-
2N920	5/-	AF124	6/-	OA70	2/-
2N922	8/6	AF125	5/-	OA71	2/-
2N930	5/6	AF126	4/-	OA73	2/-
2N1131	6/-	AF127	4/-	OA74	2/-
2N1132	6/6	AF139	6/-	OA79	2/-
2N1303	4/6	AF178	8/6	OA81	2/-
2N1304	5/-	AF181	8/6	OA85	2/6
2N1305	5/-	AF186	8/-	OA86	4/-
2N1306	5/-	AF239	8/-	OA90	2/-
2N1307	5/-	AF219	20/6	OA91	1/6
2N1308	6/-	AF211	12/6	OA95	1/6
2N1309	5/-	AF212	15/-	OA200	1/6
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2N3054	10/-	BC108	2/6	OC20	19/6
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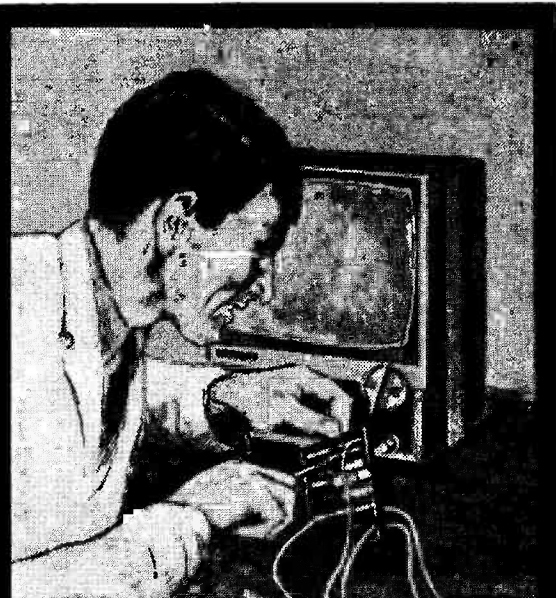
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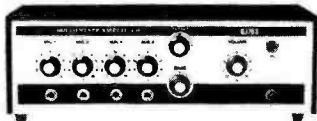
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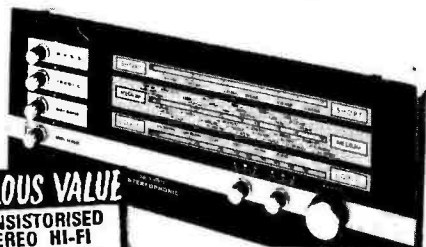
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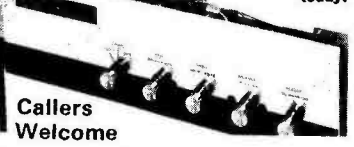
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UIC05 = 5 x 7405N	UIC47 = 5 x 7407N	UIC92 = 5 x 7492N
UIC06 = 5 x 7406N	UIC48 = 5 x 7408N	UIC93 = 5 x 7493N
UIC07 = 5 x 7407N	UIC49 = 5 x 7409N	UIC94 = 5 x 7494N
UIC10 = 5 x 7410N	UIC50 = 5 x 7410N	UIC95 = 5 x 7495N
UIC20 = 5 x 7420N	UIC51 = 5 x 7411N	UIC96 = 5 x 7496N
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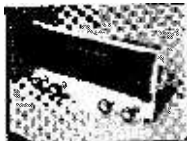
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2N2160	11/6	2N4058	3/6	AD150	12/6	BF163	7/6	D16P3	7/6	OC70	3/6
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2N2297	6/6	2N4289	3/6	AP125	4/6	BF195	4/6	GET189	4/6	OC139	6/6
2N2303	5/6	2N4290	3/6	AP126	4/6	BF196	8/6	GET189	4/6	OC140	6/6
2N2308	6/6	2N4291	3/6	AP127	5/6	BF197	8/6	GET189	4/6	OC171	6/6
2N2369	6/6	2N4292	3/6	AP128	5/6	BF198	8/6	GET189	4/6	OC171	6/6
2N2369A	3/6	2N4303	9/6	AP178	8/6	BF200	10/6	GET189	4/6	OC200	7/6
2N2410	8/6	2N5027	10/6	AP179	14/6	BF224	4/6	MAT100	6/6	OC201	9/6
2N2483	5/6	2N5028	11/6	AP180	10/6	BF225	4/6	MAT101	6/6	OC202	12/6
2N2484	6/6	2N5029	9/6	AP239	8/6	BF237	4/6	MAT120	6/6	OC203	8/6
2N2535	4/6	2N5030	9/6	AP238	9/6	BF238	4/6	MAT121	6/6	OC204	8/6
2N2540	4/6	2N5172	2/6	PF280	12/6	BF244	6/6	MC140	6/6	OC205	12/6
2N2613	7/6	2N5174	10/6	AP211	6/6	BFW58	5/6	MJ400	21/6	OC207	15/-
2N2614	5/6	2N5175	10/6	ASY26	5/6	BFW69	5/6	MJ420	22/6	OCRP1	8/6
2N2646	11/6	2N5176	9/6	ASY27	7/6	BFW60	5/6	MJ421	22/6	OCRP12	12/6
2N2696	6/6	2N5232	5/6	ASY28	5/6	BFW61	9/6	MJ430	20/6	OCRP1	10/-
2N2711	5/6	2N5233	5/6	ASY29	5/6	BFW62	9/6	MJ440	19/6	P346A	4/6
2N2712	5/6	2N5245	9/6	ASY36	5/6	BFX13	4/6	MJ480	19/6	TIP31A	16/6
2N2713	5/6	2N5246	8/6	ASY30	5/6	BFX29	6/6	MJ481	25/-	TIP32A	19/6
2N2714	6/6	2N5249	13/6	ASY34	5/6	BFX30	6/6	MJ490	20/6	T1834	12/6
2N2865	12/6	2N5265	55/-	ASY36	8/6	BFX43	7/6	MJ491	27/6	T1845	9/6
2N2904	6/6	2N5266	55/-	ASY20	7/6	BFX44	7/6	MJ1800	43/6	T1844	2/6
2N2904A	6/6	2N5267	52/6	ASY21	8/6	BFX68	13/6	MFJ340	12/6	T1845	2/6
2N2905	7/6	2N5305	7/6	AUY10	30/-	BFX68A	13/6	MJE520	17/6	T1846	2/6
2N2906A	5/6	2N5306	8/6	BC107	2/6	BFX84	5/6	MJE521	17/6	T1847	2/6
2N2906	5/6	2N5307	7/6	BC108	2/6	BFX85	6/6	MPF102	8/6	T1848	2/6
2N2906A	5/6	2N5308	7/6	BC109	2/6	BFX86	5/6	MPF103	7/6	T1849	2/6
2N2907	6/6	2N5309	12/6	BC113	5/6	BFX87	6/6	MPF104	7/6	T1850	3/6
2N2923	3/6	2N5310	8/6	BC115	8/6	BFX88	5/6	MPF105	7/6	T1851	2/6
2N2924	3/6	2N5354	5/6	BC116A	7/6	BFX89	12/6	MP83638	6/6	T1852	2/6
2N2925	3/6	2N5355	5/6	BC118	6/6	BFX92A	12/6	NKT0013	9/6	T1853	4/6
2N2926	3/6	2N5356	5/6	BC121	4/6	BFX93A	14/6	NKT124	8/6	T1860	4/6
" Green	2/6	2N5365	9/6	BC122	4/6	BFY10	6/6	NKT125	8/6	T1861	5/6
" Yellow	2/6	2N5366	9/6	BC125	11/6	BFY11	6/6	NKT126	5/6	T1862	5/6
" Orange	2/6	2N5367	11/6	BC126	11/6	BFY12	4/6	NKT128	5/6	ZTX107	3/6
2N3011	6/6	2N5457	7/6	BC134	6/6	BFY13	4/6	NKT135	5/6	ZTX108	3/6
2N3014	6/6	2N718A	6/6	BC135	8/6	BFY17	4/6	NKT137	6/6	ZTX109	3/6
2N3053	5/6	2N8005	15/-	BC136	7/6	BFY18	6/6	NKT140	6/6	ZTX300	3/6
2N3054	10/6	2N8020	40/-	BC140	7/6	BFY19	6/6	NKT141	6/6	ZTX301	3/6
2N3085	15/6	2N8102	10/6	BC147	3/6	BFY21	8/6	NKT212	6/6	ZTX302	4/6
2N3133	6/6	2N8103	5/6	BC148	2/6	BFY24	9/6	NKT213	6/6	ZTX303	4/6
2N3134	6/6	2N8104	5/6	BC149	3/6	BFY29	10/6	NKT214	4/6	ZTX304	4/6
2N3135	5/6	2N8501	6/6	BC152	3/6	BFY30	10/6	NKT215	4/6	ZTX500	4/6
2N3136	5/6	2N8502	7/6	BC154	8/6	BFY41	10/6	NKT216	7/6	ZTX501	5/6
2N3390	5/6	2N8503	5/6	BC157	4/6	BFY43	12/6	NKT217	6/6	ZTX502	5/6
2N3391	5/6	2N8504	5/6	BC158	3/6	BFY60	4/6	NKT219	6/6	ZTX503	5/6
2N3391A	6/6	2N128	14/6	BC159	4/6	BFY61	4/6	NKT223	5/6	ZTX504	12/6
2N3392	3/6	2N140	15/6	BC160	12/6	BFY52	4/6	NKT224	5/6		
2N3393	3/6	2N141	14/6	BC167	3/6	BFY53	3/6	NKT225	4/6		
2N3394	3/6	2N142	11/6	BC168B	2/6	BFY66A	11/6	NKT229	5/6		

Fully guaranteed Individually packed VALVES

CY31	7/-	ECL86	8/-	PC97	8/-
DAF96	7/9	EF36	3/6	PC900	9/6
DF96	7/6	EF37A	7/-	PC984	6/6
DK96	7/6	EF39	7/6	PC989	9/6
DL92	6/6	EF40	10/-	PC1189	11/-
DL94	6/6	EF41	12/6	PC1800	15/-
DM70	6/-	EF80	5/-	PCF80	6/6
DM71	6/-	EF83	9/7	PCF82	9/6
DY86	6/6	EF85	6/6	PCF84	9/3
DY87	6/6	EF86	6/3	PCF86	11/-
DY89	6/6	EF89	5/3	PCF91	15/6
DY892	9/9	EF91	7/6	PCF801	9/9
ES8CC/01		EF95	5/-	PCF802	9/9
		EF183	6/6	PCF805	14/6
EAB80	6/6	EF184	7/-	PCF806	13/-
EA243	10/-	EF1200	15/6	PCF808	14/6
EB33	8/-	EL34	10/6	PCF200	14/6
EB33	8/-	EL41	11/6	PCF81	9/6
EB34	10/6	EL42	10/6	PCF82	9/6
EB34	10/6	EL43	4/9	PCF83	13/6
EB38	7/6	EL45	7/3	PCF84	8/6
EB38	7/6	EL46	8/6	PCF85	8/6
EB38	7/6	EL47	6/6	PCF86	8/6
EB38	7/6	EL48	6/6	PCF87	11/6
EB38	7/6	EL49	6/6	PCF88	11/6
EB38	7/6	EL50	6/6	PCF89	11/6
EB38	7/6	EL51	6/6	PCF90	11/6
EB38	7/6	EL52	6/6	PCF91	11/6
EB38	7/6	EL53	6/6	PCF92	11/6
EB38	7/6	EL54	6/6	PCF93	11/6
EB38	7/6	EL55	6/6	PCF94	11/6
EB38	7/6	EL56	6/6	PCF95	11/6
EB38	7/6	EL57	6/6	PCF96	11/6
EB38	7/6	EL58	6/6	PCF97	11/6
EB38	7/6	EL59	6/6	PCF98	11/6
EB38	7/6	EL60	6/6	PCF99	11/6
EB38	7/6	EL61	6/6	PCF100	11/6
EB38	7/6	EL62	6/6	PCF101	11/6
EB38	7/6	EL63	6/6	PCF102	11/6
EB38	7/6	EL64	6/6	PCF103	11/6
EB38	7/6	EL65	6/6	PCF104	11/6
EB38	7/6	EL66	6/6	PCF105	11/6
EB38	7/6	EL67	6/6	PCF106	11/6
EB38	7/6	EL68	6/6	PCF107	11/6
EB38	7/6	EL69	6/6	PCF108	11/6
EB38	7/6	EL70	6/6	PCF109	11/6
EB38	7/6	EL71	6/6	PCF110	11/6
EB38	7/6	EL72	6/6	PCF111	11/6
EB38	7/6	EL73	6/6	PCF112	11/6
EB38	7/6	EL74	6/6	PCF113	11/6
EB38	7/6	EL75	6/6	PCF114	11/6
EB38	7/6	EL76	6/6	PCF115	11/6
EB38	7/6	EL77	6/6	PCF116	11/6
EB38	7/6	EL78	6/6	PCF117	11/6
EB38	7/6	EL79	6/6	PCF118	11/6
EB38	7/6	EL80	6/6	PCF119	11/6
EB38	7/6	EL81	6/6	PCF120	11/6
EB38	7/6	EL82	6/6	PCF121	11/6
EB38	7/6	EL83	6/6	PCF122	11/6
EB38	7/6	EL84	6/6	PCF123	11/6
EB38	7/6	EL85	6/6	PCF124	11/6
EB38	7/6	EL86	6/6	PCF125	11/6
EB38	7/6	EL87	6/6	PCF126	11/6
EB38	7/6	EL88	6/6	PCF127	11/6
EB38	7/6	EL89	6/6	PCF128	11/6
EB38	7/6	EL90	6/6	PCF129	11/6
EB38	7/6	EL91	6/6	PCF130	11/6
EB38	7/6	EL92	6/6	PCF131	11/6
EB38	7/6	EL93	6/6	PCF132	11/6
EB38	7/6	EL94	6/6	PCF133	11/6
EB38	7/6	EL95	6/6	PCF134	11/6
EB38	7/6	EL96	6/6	PCF135	11/6
EB38	7/6	EL97	6/6	PCF136	11/6
EB38	7/6	EL98	6/6	PCF137	11/6
EB38	7/6	EL99	6/6	PCF138	11/6
EB38	7/6	EL100	6/6	PCF139	11/6
EB38	7/6	EL101	6/6	PCF140	11/6
EB38	7/6	EL102	6/6	PCF141	11/6
EB38	7/6	EL103	6/6	PCF142	11/6
EB38	7/6	EL104	6/6	PCF143	11/6
EB38	7/6	EL105	6/6	PCF144	11/6
EB38	7/6	EL106	6/6	PCF145	11/6
EB38	7/6	EL107	6/6	PCF146	11/6
EB38	7/6	EL108	6/6	PCF147	11/6
EB38	7/6	EL109	6/6	PCF148	11/6
EB38	7/6	EL110	6/6	PCF149	11/6
EB38	7/6	EL111	6/6	PCF150	11/6
EB38	7/6	EL112	6/6	PCF151	11/6
EB38	7/6	EL113	6/6	PCF152	11/6
EB38	7/6	EL114	6/6	PCF153	11/6
EB38	7/6	EL115	6/6	PCF154	11/6
EB38	7/6	EL116	6/6	PCF155	11/6
EB38	7/6	EL117	6/6	PCF156	11/6
EB38	7/6	EL118	6/6	PCF157	11/6
EB38	7/6	EL119	6/6	PCF158	11/6
EB38	7/6	EL120	6/6	PCF159	11/6
EB38	7/6	EL121	6/6	PCF160	11/6
EB38	7/6	EL122	6/6	PCF161	11/6
EB38	7/6	EL123	6/6	PCF162	11/6
EB38	7/6	EL124	6/6	PCF163	11/6
EB38	7/6	EL125	6/6	PCF164	11/6
EB38	7/6	EL126	6/6	PCF165	11/6
EB38	7/6	EL127	6/6	PCF166	11/6
EB38	7/6	EL128	6/6	PCF167	11/6
EB38	7/6	EL129	6/6	PCF168	11/6
EB38	7/6	EL130	6/6	PCF169	11/6
EB38	7/6	EL131	6/6	PCF170	11/6
EB38	7/6	EL132	6/6	PCF171	11/6
EB38	7/6	EL133	6/6	PCF172	11/6
EB38	7/6	EL134	6/6	PCF173	11/6
EB38	7/6	EL135	6/6	PCF174	11/6
EB38	7/6	EL136	6/6	PCF175	11/6
EB38	7/6	EL137	6/6	PCF176	11/6
EB38	7/6	EL138	6/6	PCF177	11/6
EB38	7/6	EL139	6/6	PCF178	11/6
EB38	7/6	EL140	6/6	PCF179	11/6
EB38	7/6	EL141	6/6	PCF180	11/6
EB38	7/6	EL142	6/6	PCF181	11/6
EB38	7/6	EL143	6/6	PCF182	11/6
EB38	7/6	EL144	6/6	PCF183	11/6
EB38	7/6	EL145	6/6	PCF184	11/6
EB38	7/6	EL146	6/6	PCF185	11/6
EB38	7/6	EL147	6/6	PCF186	11/6
EB38	7/6	EL148	6/6	PCF187	11/6
EB38	7/6	EL149	6/6	PCF188	11/6
EB38	7/6	EL150	6/6	PCF189	11/6
EB38	7/6	EL151	6/6	PCF190	11/6
EB38	7/6	EL152	6/6	PCF191	11/6
EB38	7/6	EL153	6/6	PCF192	11/6
EB38	7/6	EL154	6/6	PCF193	11/6
EB38	7/6	EL155	6/6	PCF194	11/6
EB38	7/6	EL156	6/6	PCF195	11/6
EB38	7/6	EL157	6/6	PCF196	11/6
EB38	7/6	EL158	6/6	PCF197	11/6
EB38	7/6	EL159	6/6	PCF198	11/6
EB38	7/6	EL160	6/6	PCF199	11/6
EB38	7/6	EL161	6/6	PCF200	11/6

P. C. RADIO LTD.
170 GOLDHAWK RD., W.12
01-743 4946

Open 9-12-30, 1.30-5.30 p.m. Thursday 9-1 p.m.

MANY OTHERS IN STOCK 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

TRANSISTORS, ZENER DIODES etc.

DA5	2/6	OC29	15/-	OC172	7/6	3FR5	6/6	AF118	10/-	CR83/20	10/-
DA10	6/-	OC35	8/6	OC200	6/6	3N128	17/6	AF139	10/-	CR83/30	11/6
DA70	2/-	OC38	8/6	OC201	7/6	3N139	35/-	AF178	12/6	CR825/025	
DA71	2/-	OC44	4/-	OC206	10/-	3N140	19/6	AFY19	22/6		15/-
DA79	1/9	OC45	2/6	IN21	3/6	3N154	19/-	AS26	5/6	CR83/40	12/6
DA81	1/6	OC70	3/-	IN21B	5/-	3N159	29/-	AS28	5/6	GET103	4/6
DA200	1/9	OC71	2/6	IN23	12/-	6FR5	29/-	BAW19	5/6	GET115	9/6
DA202	2/-	OC72	4/-	IN43	4/-	12FR60	14/9	BC107	3/6	GET116	8/6
DA203	1/6	OC73	11/-	IN70	4/-	DI1	3/-	BC108	4/-	BD185	5/6
DA211	9/6	OC75	4/6	IN70A	4/-	38303	10/-	BCY10	9/-	BD928	6/6
DA2200	11/-	OC76	5/-	IN746A	4/6	40594	27/6	BCY72	7/9	BD948	6/6
DA2201	10/-	OC81	4/-	series	5/3	40695	27/6	BFY61	4/6	BD968	7/9
DA2202	10/-	OC81D	3/-	IN821A	21/-	40636	29/-	BFY62	4/6	BD988	9/3
DA2206	9/6	OC81DM	3/-	IN823A	28/-	40668	27/-	BS05	7/6	V405A	7/9
DA2207	8/6	OC82	3/-	IN825A	21/-	40669	29/-	BS1	9/-	Z Range	
DA2208	8/6	OC83	3/-	IN826A	21/-	40670	29/-	BS2	9/3	Zener diodes	
DA2213	6/6	OC83A	3/-	IN827A	21/-	40671	29/-	BU100	36/-	3/6 ea.	
DA2223	10/-	OC83B	3/-	IN828A	21/-	40672	29/-	BU13	5/-	Z2A range	
DA2225	10/-	OC84	5/-	IN829A	6/6	40673	29/-	BYZ16	15/-	7/6 ea.	
OC16	15/-	OC122	10/-	IN21307	6/6	ACV28	4/-	CRS1/10	5/-	Z3B range	
OC22	8/6	OC139	6/6	IN23053	6/6	AD149	11/-	CRS1/20	9/6		
OC23	7/6	OC140	6/6	IN23054	6/6	AD150	11/-	CRS1/30	10/-	ZL range	
OC28	12/6	OC171	6/6	IN23055	15/-	AD162	7/6	CRS1/35	11/6	5/- ea.	
OC28	12/6	OC171	6/6	F100	12/6	AF117	4/9	CRS1/40	12/6	ZS range	
								CRS1/45	13/6	7/6 ea.	
								CRS1/50	14/6		
QVQ03-10	25/-	UAF4C0	7/6	VR150/30	35/-	5144G	10/6	6A87G	16/-	6D6	8/11
QVQ06-40	85/-	UBC41	9/6	Z759	35/-	5144G	10/6	6A76	4/6	6EA8	11/12
QVQ06-40A	85/-	UBF80	7/6	Z800U	29/-	5X4G	7/6	6AUX	8/-	6EU7	7/7
QVQ06-40A	10/-	UF89	7/6	Z800U	29/-	5X4G	7/6	6AUX	8/-	6F23	15/16
RI7	8/-	UCH42	12/6	Z906T	12/-	5144GT	12/-	6B7	5/6	6H6M	3/4
RI7	8/-	UCH42	12/6	IR5	5/6	524	14/-	6BK7	8/-	6J4WA	14/15
RI7	17/6	UCH81	6/-	IR5	5/6	6A87	3/-	6BEA	4/6	6J5	7/7
STV280-40	60/-	UCL82	7/6	184	4/6	6AC7	3/-	6B8	5/-	6J5GT	5/6
STV280-40	60/-	UCL83	12/6	174	3/-	6A16	11/6	6B6G	11/6	6J7G	5/6
STV280-40	180/-	UP80	7/6	1X2B	7/6	6AK8	8/-	6BQ7A	6/6	6J7M	8/8
UT21	51/-	UP89	6/-	34A	4/-	6AL5	3/-	6BR7	16/-	6K6GT	8/8
UT25	14/6	UL41	12/-	3D6	3/-	6AL5W	7/-	6Bw6	16/-	6K7	8/8
UT26	14/6	UL84	6/-	304	7/6	6A86	8/-	6BW7	13/-	6K8GT	7/7
UT27	3/-	U5	7/6	6FR5	29/-	6A86	8/-	6C6	4/6	6C8	4/4
UT29	11/-	U6	11/6	5V4	3/6	6AQ3	6/-	6C9	4/-	6K8GT	7/7
UT301	6/6	U85	5/6	5B254A	36/-	6AQ5W	9/-	6CL6	11/6	6K23	14/14
U801	20/-	VR105/30	6/-	5B255M	35/-	6A86	6/-	6CL9	9/-	6LGT	9/9

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39 Gns.

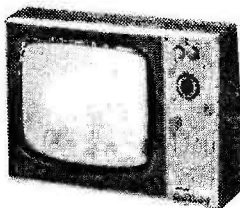
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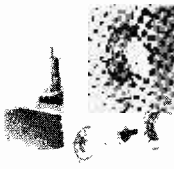


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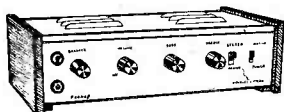
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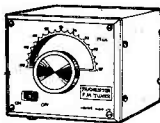
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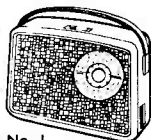
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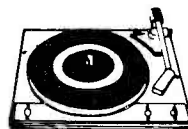
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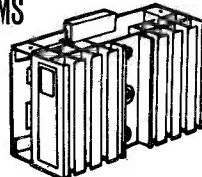
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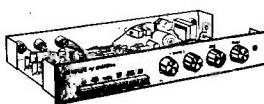
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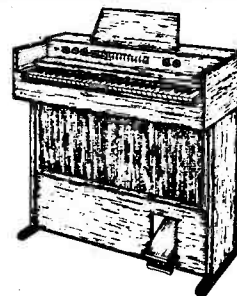
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