PRACTICAL WIRELESS

OCTOBER 1964

2/-

FREE inside

TRIMMER and ALIGNMENT SET

6 Tools · Bench Stand
Extension Handle

10-TRANSISTOR DOUBLE CONVERSION RECEIVER

S—Meter B.F.O. Mains Power Unit

LASKY'S RADIO

Offer the Finest Value and HOME CONSTRUCTORS

We consider our construction parcels to be the finest value on the home constructor market. If on receipt you feel not competent to build the set, you may return it as received within 7 days, when the sum paid will be refunded less postage.

THE SKYROVER & SKYROVER De Luxe

★ LONG WAVEBAND COVERAGE IS NOW AVAILABLE FOR THESE WELL-KNOWN SETS

A simple additional circuit provides coverage of the 1100/1950 M. band (including 1500 M. Light programme). This is in addition to all existing Medium and Short wavebands. All necessary components with construction data **Only 10/- extra** Post Free

This conversion is suitable for both models that have already been constructed.

GENERAL SPECIFICATION:
7 transistor plus 2 diode superhet, 6 waveband portable receiver. Operating from four 1.5 v. torch batteries. The SKYROVER and SKYROVER DE LUXE cover the full Medium Waveband and Short Waveband 31-94 M. and also 4 separate switched band-spread ranges. 13M, 16M, 19M and 25M, with Band Spread Tuning for accurate Station Selection. The coil Pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow stage by stage instructions.

SPECIFICATION:
Superhet 470 Kc/s. All Mullard Transistors and Diode. Uses 4-U2 batteries. 5in. Ceramic Magnet P.M. Speaker Easy to read Dial Scale. Band Spread Tuning. 500 MW Output. Telescopic Aerial & Ferrite Rod Aerial. **WAVEBAND COVERAGE:** 180-576M; 31-94M and Band Spread on 13, 16, 19 and 25 metre Bands.

The SKYROVER

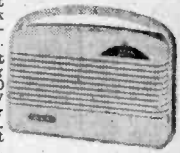
Controls: Waveband Selector. Volume Control with on/off Switch, Tuning Control. In plastic cabinet, size 10 x 6½ x 3½ in. with metal trim and carrying handle.
Can now be built for **£8.19.6** P. & P. 5/-.
H.P. Terms: 20/- deposit and 11 mnths. at 16/6.

The SKYROVER DE LUXE

Tone Control Circuit is incorporated, with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet size 11½ x 6½ x 3in. covered with a washable material with plastic trim and carrying handle. Also car aerial socket fitted.
Can now be built for **£10.19.6**
P. & P. 5/-.
H.P. Terms: 25/- deposit and 11 months, at 20/-.
Data for each receiver 2/6 extra. Refunded if you purchase the parcel. Four U2 batteries 3/4 extra.
All Components Available Separately.

The "REALISTIC" Seven

★ 7-transistor Superhet. ★ 350 milliwatt output into 4in. high flux speaker. ★ All components mounted on a single printed circuit board, size 5½ x 5½in. in one complete assembly.

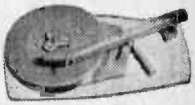


★ Plastic cabinet with carrying handle, size 7 x 10 x 3½in., Blue/Grey or all Grey. ★ Easy to read dial. ★ External socket for car aerial.
★ I.F. frequency 470 Kc/s. ★ Ferrite rod internal aerial. Operates from PP9 or similar battery. ★ Full comprehensive data supplied with each receiver. ★ All coils and I.F.'s etc. fully wound ready for immediate assembly.
An Outstanding Receiver. **LASKY'S PRICE** for the complete parcel including Transistors, Cabinet, Speaker, etc., and Full Construction Data. Can be built for **£5.19.6**
P. & P. 4/6
PP9 Batt. 3/9. Data and instructions separately 2/6. Refunded if you purchase the parcel.

REALISTIC Seven DE LUXE

With the same specification as standard model—PLUS a superior wood cabinet in contemporary styling. ALSO a full vision circular dial.
FOR ONLY **£1** EXTRA
P. & P. as std. model

RECORD PLAYERS



45 r.p.m. 6 volt Batt. operated. Complete with pick-up fitted crystal cartridge. Size only 7½in. x 6in. Fitted auto. stop and start. New and perfect.

45 r.p.m. Model 49/6 P. & P. 2/6
2 speed model for 33 and 45 r.p.m. (as illustrated). **69/6** P. & P. 2/6

The "Sixteen" Multirange METER KIT

This outstanding meter was featured by *Practical Wireless* in the Jan. '64 issue. Lasky's are now able to offer the complete kit of parts as specified by the designer.
RANGE SPECIFICATION: D.C. volts: 0-2.5-25-50-250-500 at 20,000 Ω/V. A.C. volts: 0-25-50-250-500 at 1,000 Ω/V. D.C. current: 0-50μA, 0-2.5-50-250 mA. Resistance: 0-2,000 Ω, 0-200k Ω, 0-20M Ω. Basic movement: 40μA f.s.d. moving coil. With universal shunt full scale deflection current is 50μA. Size/finish: Black plastic case, 3½ x 5½ x 1½in. Controls: 12 position range switch; separate slide switch for A.C. volts—D.C. ohms; ohms zero adjustment pot, meter; meter zero. External connections: Two 4mm. sockets for test lead plugs. Power requirements: One 15V. and one 1.5V. batteries. Complete with all parts and full construction details.
Data and circuit available separately 2/6 refunded if all parts bought. Pair of Batteries, 2/5 extra.
LASKY'S PRICE **£5.19.6** P. & P. 5/- **H.P. Terms: 21/- deposit and 5 months at 21/-**

DEAC RECHARGEABLE NICKEL CADMIUM CELLS

Rating 1.22 v. 3.5 AH at 10 hour rate. 1001 uses for model makers, miniature electronic equipment, portable radios and tape recs., trans receivers, photo flash etc. Hermetically sealed. Size 3½ x 1½ x 1½in. Listed at **35/- each.**
LASKY'S PRICE 15/-
Post Free Bank of 9 **79/6**

NEW SUPER MINIATURE POCKET RADIOS

THE SINCLAIR MICRO-6

Self-contained pocket radio Size only 1⅛ x 1⁷/₁₀ x ¼in.
A marvel of modern miniaturisation—truly amazing performance Without a doubt the most advanced transistor circuit ever offered to home constructors—yet may be built in an evening. Complete with earphone and detailed construction data. **Can be built for only 59/6**
Mercury cell 1/11 extra (2 required). All parts sold separately

THE SINCLAIR SLIMLINE

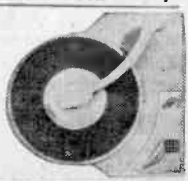
The new 2-transistor pocket radio size only 2¾in. x 1½ x 1¼in.
Micro alloy transistorised and printed circuit. All components available separately
Easy to assemble. **CAN BE BUILT FOR 49/6**

TRANSISTORISED TELEPHONE AMPLIFIER

Powerfully amplifies the incoming call. The pick-up is suction fixed to 'phone. Battery-operated at negligible cost. Fitted with on/off switch and vol. control. Size: 4½ x 3 x 1¾in. Complete with PP3 battery. **LASKY'S PRICE 69/6,** P. & P. 2/6.

E.M.I. 4-SPEED RECORD PLAYER

New, unused and individually boxed fitted with lightweight pick-up with ACOS G.P. 73/2 stereo cartridge. Cabinet space required 13½ x 12½ x 4¼in. A 9in. metal turntable is fitted. For use on 200/250 volt A.C. Mains, with Auto-stop. The stereo cartridge will play all types of Mono Records, 78's, L.P.s etc., but if desired a G.P. 67 LP/78 Mono cartridge will be supplied in lieu of the G.P.73 at no difference in cost.



LASKY'S PRICE **79/6** P. & P. 3/6 extra.

GUITAR PICK-UPS

CGM5 Crystal-high imp. Size only 1½ x ¾ x ¾in. Clips to finger board—no screws. Complete with cable.
LASKY'S PRICE 15/11. P. & P. 1/-.
CGM35. Fully adjustable pick-up position carrier. Simply fixed. Separate tone and volume control. Heavy chrome finish. Pick-up size 3½ x 1¼in., control size 2½ x 1¼in. Complete with long lead and jack plug. **LASKY'S PRICE 59/6** P. & P. 1/6

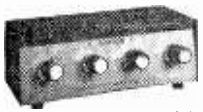
LASKY'S FOR D.I.Y. CONSTRUCTION BARGAINS

Service in Great Britain to both & HI-FI ENTHUSIASTS

TAPE RECORDERS · RECORD PLAYERS · AMPLIFIERS ETC.
COMPLETE MONO/STEREO SYSTEMS TO YOUR SPEC.

LASKY'S RADIO

TRANSISTORISED MICROPHONE MIXER



The Harrow will mix 4 high impedance channels: mikes, tape rec's, tuners, grams, etc. 9 v. battery operated. Neatly styled, size only 6 x 2½ x 2½in. Standard jack sockets. Complete with PP3 batt., full circuit diagram and operating instructions.

Model TM4 Mono 59/6 P. & P. 2/6
Model SM5 Stereo 72/6 P. & P. 2/6

SPEAKERS SPECIAL OFFER

12in. FANE HEAVY DUTY DUAL CONE HI-FI SPEAKER
Type 122/17A—listed at 12 gns. Power handling 25 watts—15 ohms imp. Flux density 17,000 gauss. Special Anisotropic magnet. Limited stock.

LASKY'S PRICE £6.19.6 P. & P. 5/-

TYPE 8CX1 8in. HI-FI SPEAKER.
Power handling 10 watts—15 ohms impedance.
LASKY'S PRICE 6 Gns. P. & P. 5/-

THE HARROW CV1 VARIABLE CROSSOVER

Gives variable volume control of Woofer and Tweeter. Strong metal construction. Size 4 x 2½ x 1½in. Screw tag connections.
LASKY'S PRICE 22/6 P. & P. 1/6

THE NEW STUDIO RANGE OF CELESTION HI-FI SPEAKERS NOW IN STOCK

"HARROW" POWER PACK

Battery eliminator—converts your battery portable to A.C. mains. Replaces 6 v., 4½ v. or 9 v. batteries. State voltage required when ordering. Size only 3 x 2 x 2½in.
LASKY'S PRICE 29/6 P. & P. 1/6

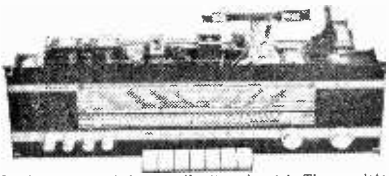
LAFAYETTE TAPE

Famous American Brand—Fully Guaranteed

5in. Double play, 1,200ft., Mylar base	15 0
5in. Long play, 900ft., Acetate base	10 0
5in. Standard play, 600ft., P.V.C. base	8 6
5½in. Long play, 1,200ft., Mylar base	15 0
5½in. Double play, 1,800ft., Mylar base	22 6
5½in. Long play, 1,200ft., Acetate base	12 6
5½in. Standard play, 850ft., P.V.C. base	11 6
7in. Standard play, 1,200ft., Mylar base	12 6
7in. Long play, 1,800ft., Mylar base	19 6
7in. Double play, 2,400ft., Mylar base	25 0
7in. Long play, 1,800ft., Acetate base	15 0
3in. Message tape, 150ft.	3 6
3in. Message tape, 225ft.	4 11
3in. Message tape, 300ft.	7 6
3in. Triple play, 450ft., Mylar base	12 6
4in. Triple play, 900ft., Mylar base	22 6
5in. Triple play, 1,800ft. Mylar base	42 6
5½in. Triple play, 2,400ft., Mylar base	55 0
7in. Triple play, 3,600ft., Mylar base	75 0

P. & P. 1/- extra per reel; 4 reels and over Post Free

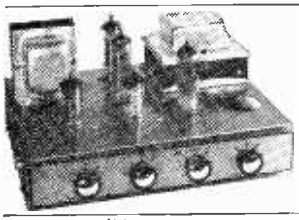
THE NEW "KUBA" CONTINENTAL AM/FM STEREO RADIOGRAM CHASSIS



Long, medium and short waveband coverage plus VHF/FM. Piano key wavechange. Separate flywheel tuning on AM and FM. Bass, treble and balance controls. Magic-eye tuning indicator. Ferrite rod aerial. The very latest printed circuitry. Provision for multiplex adaptor. 5 valves—line-up: ECC85, ECH81, ECC83, ELL80, EAF801. Full vision tuning scale size 21 x 6in. Overall dimensions: 21 x 6½ x 8in. Made to the very highest standards.

LASKY'S PRICE 29½ GNS. Carriage & Insurance 12/6 extra.

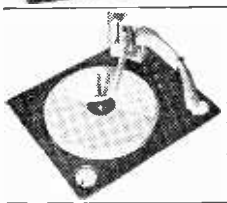
THE BH-14 HI-FI MONO 14 WATT AMPLIFIER KIT



High quality 14 watt output power amplifier with bass, treble and separate volume controls on each input. Inputs: 1—5 m/v; 2—40 m/v. Output impedance 3 or 15 ohms. 5 valves—line-up: 2 x EL84, 1 x ECC84, ECC83 and EZ81. Frequency response 15 c/s—20 Kc/s. Ideal for the discerning hi-fi enthusiast or for guitar amplifier. Gold hammer finish with distinctive Perspex front panel. Complete kit of parts with detailed construction data.

LASKY'S PRICE 9 GNS. P. & P. 7/6. Instruction book avail. acp.: 1/6.
AVAILABLE READY BUILT AND TESTED.
LASKY'S PRICE 11 GNS. P. & P. 7/6.

AUTOCHANGER SCOOP!!!



LASKY'S CAN NOW OFFER B.S.R. AUTOCHANGERS AT LOWEST EVER PRICES

All brand new and fully guaranteed—complete with cartridge and stylus.

UA14	£3.19.6
UA16 4 speed, mains	£4.19.6
UA14 4 speed, 9 v. battery operated	£5.19.6
UA20 4 speed	£5.19.6

Add 5/- P. & P. on each.

IT'S FABULOUS!! THE TRANSISTOGRAM

A portable battery operated fully transistorised Record Player for the music of your choice—any time and place! Made by famous British manufacturer, fully guaranteed. Size only 6½ x 12 x 10½in., weight 10 lbs. Operates on 6 U2 torch batteries. 4 speeds—16²/₃, 33¹/₃, 45 and 78 r.p.m. Goldring Sygnet record player unit with lightweight pick-up fitted with CM-60 turnover ceramic cartridge. Output 500 mw to 5in. ceramic magnet loudspeaker, fitted into lid for maximum sound distribution. Cabinet constructed of wood, covered in two tone (pale blue-grey) leathercloth. Fitted carrying handle and strong lid catches. High quality amplifier with tone and volume controls gives excellent reproduction at all speeds. Plays 7, 10 and 12in. records. Today's value 12 Gns.

LASKY'S PRICE £6.19.6

Carriage & Insurance 7/6
New, boxed and guaranteed—exc. batts

CRYSTAL PICK-UP CARTRIDGES *LOWEST EVER PRICES!*

All Complete with Styli L.P. and Standard (and Stereo where shown) fully guaranteed. Standard Fitting will fit most P.U. Arms and Heads. Postage 1/- each extra.

Acostereo 73/2. Diamond LP/Stereo and sapphire Std.	29 6
Ronette Stereo G.V. Turnover, 2 sapphires	25 0
Ronette Stereo type 105 and 106, 2 sapphires	25 0
Ronette Stereo type 105 and 106 Diamond LP/Stereo and sapphire Std.	35 0
STEREO	
Acostereo 73/1, 2 sapphires	25 0

MONO	
Garrard Magnetic T.O.M.2	15 0
Acos GP.59	14 0
Acos GP.65/3	15 0
Acos GP.65/1	17 0
Acos GP.67/1	14 0

AND EVEN LOWER PRICES!

Mono C.T.1	4 11
Collaro Type C, 2 sapphires, stereo	15 0
Collel S.C.1. Diamond LP/Stereo	17 6
Sonotone 8T, stereo	19 11
Sonotone 2TA, mono	15 0

Postage 1/- each extra.

207 EDGWARE ROAD, LONDON, W.2.
Near Praed St. PADDINGTON 3271/2

33 TOTTENHAM COURT ROAD, W.1.
Nearest Stn., Goodge St. MUSEUM 2605

152/3 FLEET STREET, LONDON, E.C.4.
Telephone: Fleet Street 2833

BOTH OPEN ALL DAY SAT. Early Closing Thurs. Mail Orders to Dept. P.W., Edgware Rd. Open all day Thursday. Early closing Sat

LASKY'S FOR SPEEDY MAIL ORDER SERVICE

CLEAR PLASTIC PANEL METERS

First grade quality, Moving Coil panel meters, available ex-stock S.A.E. for illustrated leaflet. Discounts for quantity. Available as follows. Type MR. 38P 21/22in. square fronts.

50µA	32/6	1A. DC	22/6
100µA	29/6	5A. DC	22/6
200µA	27/6	3V. DC	22/6
500µA	25/-	10V. DC	22/6
50-0-50µA	29/6	20V. DC	22/6
100-0-100µA	27/6	50V. DC	22/6
500-0-500µA	22/6	100V. DC	22/6
1-0-1mA	22/6	150V. DC	22/6
5mA	22/6	500V. DC	22/6
1mA	22/6	300V. DC	22/6
10mA	22/6	750V. DC	22/6
50mA	22/6	15V. AC	22/6
100mA	22/6	50V. AC	22/6
150mA	22/6	150V. AC	22/6
200mA	22/6	300V. AC	22/6
300mA	22/6	500V. AC	22/6
500mA	22/6	'S' Meter	
750mA	32/6	1mA	29/6

Type MR. 52P.	2½" sq. front.
50µA	57/6
100µA	47/6
500µA	37/6
50-0-50µA	57/6
100-0-100µA	47/6
300V. AC	32/6
1mA	32/6
10mA	32/6
100mA	32/6
1A. DC	32/6
300V. DC	32/6
'S' Meter	
1mA	39/6

Type MR. 65P. 3¼x3¼in. fronts.	
50µA	59/6
100µA	49/6
500µA	39/6
50-0-50µA	59/6
100-0-100µA	49/6
VU Meter	59/6
1mA	39/6
10mA	35/-
100mA	35/-
1A. DC	35/-
300V. DC	35/-
300V. AC	35/-

Type MR. 85P. 4"x4" sq. fronts	
50µA	69/6
100µA	59/6
200µA	55/-
500µA	49/6
50-0-50µA	69/6
100-0-100µA	59/6
500-0-500µA	49/6
1-0-1mA	45/-
1mA	45/-
10mA	45/-
50mA	45/-
100mA	45/-
1amp DC	45/-
5amp DC	45/-
300V. AC	45/-
300V. DC	45/-

Post extra

BAKELITE PANEL METERS

First grade quality. 3½in. square fronts.

25µA	65/-	100mA	29/6
50µA	42/6	1A. DC	29/6
100µA	39/6	5A. DC	29/6
500µA	35/-	*1A. AC	29/6
50-0-50µA	42/6	*5A. AC	29/6
100-0-100µA	39/6	*10A. AC	29/6
50mV	39/6	30A. AC	29/6
100mV	39/6	*50A. AC	29/6
1mA	29/6	300V. DC	29/6
5mA	29/6	*300V. AC	29/6
10mA	29/6	300V. AC	35/-
50mA	29/6	VU Mtr.	49/6

*Moving iron. All others moving coil.

ILLUMINATED 'S' METERS

Cal. in 'S' units. 1mA Basic. $1^{11}/_{32}$in. sq. front 29/6 P. & P. 1/-
$2^{1}/_{16}$ in. sq. front 39/6 P. & P. 1/-

MORE METER BARGAINS

100µA 6in. Flush sq.	92/6
100µA 2½in. Flush rd.	42/6
500µA 2in. Flush rd.	22/6
1mA 2½in. Flush rd.	22/6
30-0-30mA 2½in. Flush rd.	9/6
350mA R.F. 2in. Plug in	8/6
300V. AC 2½in. Flush rd.	25/-
500V. AC 2½in. Flush rd.	25/-
1mA Meter Rectifiers	8/6

Please add postage

SEMI AUTOMATIC BUG KEY

Super speed key, 7 speed adjustments. 10 WPM to as high as desired weight scale for reproducible settings. Precision-tooled anti rust nickel plated brass and stainless steel operating parts. Size 6½ x 3 x 2½in. Brand new. £4.10.0. P. & P. 2/6.

NEW FROM LAFAYETTE

HA-63 COMMUNICATION RECEIVERS

De luxe 7 valve plus metal rectifier communication receiver covering 550 Ko/s-30 Mc/s on 4 bands. All usual facilities including 'S' meter, bandspread tuning, B.F.O., noise limiter, etc. Output for speaker or phones. Operation 220/240 volt A.C. Supplied brand new and guaranteed with manual. Carr. 15/-

S.A.E. for leaflet. Part exchanges. **£27.10.0**

LAFAYETTE "PRECON" AMATEUR PRESELECTOR CONVERTER

★Crystal Controlled ★For 80-40-20-15-10 Metre Bands ★As a convertor—converts your receiver to dual conversion ★Improves selectivity ★Widens bandspread ★High signal to noise ratio ★Improved image rejection ★Self powered ★Modern styling

SPECIFICATIONS. 80, 40 Metres preselector only. 20, 15 and 10 metres preselector and convertor. GAIN: Preselector 36db at 80 metres: convertor, 22db at 20 metres. OUTPUT FREQUENCY: 3.5–3.85 M/c on 20M. Band. 3.5–3.95 M/c on 15M band. 3.5–5.2 M/c on 10M band. VALVES: 2-6BA6, 1-6BL8. CONTROLS: Aerial trimmer, function, bandswitch, gain. Two stages of R.F. AMP. Sensitivity and stability excellent. 3 crystals are included for 20, 15 and 10M Bands. SIZE: 10" x 6" x 8". Operation 220/240V A.C. 19 gns. Carr. 7/6. S.A.E. for full details.

LAFAYETTE PRECISION TEST EQUIPMENT

Modern range of precision test equipment for the service man. Supplied brand new and guaranteed with manual. For operation on 220/240 volts A.C.

TE-20 Signal Generator. 120Kc/s-260Mc/s on 6 Bands. Directly calibrated. Variable R.F. Attenuator. Variable audio output. £12. Carr. 5/-.

TE-46 Capacity Resistance Analyser. Ranges 2pF-2,000mFd; 2 ohms-200 Meg. Also checks impedance, turns ratio, insulation. £15. Carr. 5/-. S.A.E. for full details.

30,000 O.P.V. TEST METER MODEL 500

Reads voltages up to 1,000 D.C. at 30,000 ohms per volt and A.C. at 15,000 o.p.v.; D.C. current up to 12 amps. Resistance to 60 Megs; Decibels from —20 to +56. Incorporates internal buzzer for audible warning of direct shorts and blocking condenser for A.F. output measurements. Size 3 5/16x 65/16 x 2¼in. PRICE £8.17.6.

ERSKINE TYPE 13 DOUBLE-BEAM OSCILLOSCOPE

Time base 2c/s-750Kc/s. Calibrators at 100Kc/s and 1Mc/s. Separate Y1 and Y2 amplifiers up to 5.5Mc/s. Operation 110/230 volt A.C. Supplied in perfect working order. £27.10.0. Carr. 20/-.

TRIPLETT SIGNAL GENERATOR 1632

10 RANGES: 100Kc/s—120Mc/s on fundamentals. Six valves, stabilised H.T. FULLY ATTENUATED OUTPUT. 100 µamp carrier level meter. 1Mc/s xtal check. Operation 115V. A.C. Supplied in perfect working order £12. Carr. 10/-. (230/115V. Transformer 12/6 extra.)

OSCILLOSCOPE OS-57 USM-38

Brand new high quality American oscilloscopes incorporating 3in. tube, printed circuit and miniature valves. Time base 1, 10, 100 1K and 10K µs/in. Calibration markers 1, 10 and 100µS. Calibrated Y input volts, X expansion, sweep stability. Operation 115 V. A.C. Supplied brand new, fully tested with test leads, probe and circuit diagram. £29.10.0 each. Carr. 10/- (230/115V. Transformer 18/6 extra).

TS. 76 20,000 O.P.V. PUSH BUTTON MULTI-TESTER

Large clear plastic scale. Simple operation, DC and AC volts up to 1,000V. Resistance up to 11 megohm. Current up to 250 mA. Decibels —20 to +36db. Size 6 x 4 3/16 x 2¼in. Complete with leads, batteries and instructions. £5.19.6. P. & P. 2/-.

MINE DETECTOR No. 4A

Will detect all types of metals. Fully portable. Complete with instructions, 39/6 each. Carr. 10/-. Battery 8/6 extra.

MINIFLEX ¼ TRACK TAPE HEADS

Set of three, record, playback, erase. Only 29/6 set. P. & P., 9d.

12 VOLT A.C. TIME SWITCH

Vernier 0-14 hrs. 250 v. 5A. switch. 17/6, post 2/-. Suitable 230/12V. transformer 5/9.

FIELD TELEPHONES

Type "L". Two line connection. Generator bell ringing. Complete telephone intercom. Supplied in excellent condition, fully tested and complete with batteries. Only 69/6 per pair. Carr. 5/-. Type "F". As above but moulded bakelite case (as illustrated). Supplied complete with wooden transit case for field use. £4.19.6 per pair. Carr. 5/-.

TELEPHONES TYPE H

Sound powered, generator bell ringing 2 line connection. Fully tested. £4-19.6 pair. Carr. 5/-.

MODEL PV-58 VACUUM TUBE VOLTMETERS

Latest design with special circuit for stable and accurate measurements Resistors used are all within 1% tolerance. Specially designed 4in. 200µA meter. 11 meg inputs

Ranges:

—D.C.	V.	0-1.5-5-15-50-150-500-1500V.
+D.C.	V.	0-1.5-5-15-50-150-500-1500V.
A.C.	V.	0-1.5-5-15-50-150-500-1500V. RMS.
		0-1.4-4-14-40-140-400-1400-4000 P.

Resistance: 2 ohm to 1,000 megohm.

Decibels: —10dB to +85dB.

Operation 220/240 volt A.C. Size 7 x 4½ x 4in. Supplied brand new and guaranteed complete with probe and instructions. £13.19.6 P.P. 3/6.

CHASSIS PUNCH SET

Set of 5 popular size hole cutters ¼", ⅜", ½", ⅞", 1". Supplied complete with punches, dies, T drive handle, tapered reamer, fitted leather case and instructions 49/6. P. & P. 2/-.

PLUGS AND SOCKETS

Painton 15-pin in-line printed circuit connectors. 7/6 pair. Large quantities available. Ditto 32-pin. 12/6 pair.

Uniters. 4-pin. 2/6 pr; 8-pin 3/6 pr; 12-pin, 4/- pr; 18-pin, 4/6 pr.

Painton Miniature Jones. 4-pin, 3/6 pr; 6-pin. 4/- pr; 8-pin 4/6 pr; 18-pin, 7/6 pr; 24-pin, 10/6 pr; 33 pin. 12/6 pr.

Post extra.

L.T. METAL RECTIFIERS

FULL wave bridge connected.

12/18V 1A	3/9	23/36V 1A	7/3
12/18V 2A	6/3	24/36V 2A	13/6
12/18V 4A	8/6	24/36V 15A	45/-
12/18V 6A	12/3		
12/18V 10A	22/6	Post extra	

L.T. TRANSFORMERS

For chargers, models etc. A1 primaries tapped 200/250V.

(1) 3.5, 9 or 17V., 1 amp. 9/9; (2) ditto 2A., 14/3; (3) ditto 4A., 16/6; (4) ditto 6A, 26/-; (5) 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 24 or 30V., 2 amp., 18/6; (6) ditto 4A., 30/-; (7) ditto 5A., 37/6; (8) 50V. 1 amp, 13/6; (9) 50V. 1 amp., 15/6. Post extra.

AUTO TRANSFORMERS

Step up or step down. Tapped 0/115/200/230/250V. 20W., 9/-; 60W. 12/6; 75W. 15/6; 150W. 18/6; 200W. 27/6; 500W. 42/6; 500W. 67/6; 1,000W. 90/-; 1,500W. £6.19.6 3,000W.* £7.10.0. 7,500.* £15 (* only tapped 0/110/230V.) Post extra.

PETTIMAX 9 VOLT BATTERY ELIMINATOR

220/240V A.C. Same size as PP3. 15/6. P.P. 1/3.

SUBSTITUTION BOXES

Resistance—24 ranges .. 27/6
Capacitance—9 ranges .. 19/6
Post 1/6 extra.

LAFAYETTE HI-FI STEREO HEADPHONES

Air Cushioned headband, soft foam rubber ear pads, freq. response 25-15,000 cycles. high sensitivity, impedance 8 ohms per phone. Supplied complete with all cables, wires, overload junction box and 3-connector plug. 89/6. P. & P. 2/6.

G. W. SMITH & CO. (RADIO) LTD.
3 & 34 LISLE STREET, LONDON, W.C.2.
SEE OPPOSITE PAGE

TM-59 'er 'S' METER

Signal strength meter using VTVM principles. Calibrated in S units. Sensitivity and zero adjustments. For any superhet receiver with AVC. Requires 150/200V. and 6 or 12V. Complete with valve and full instructions. 82/6. P.P. 2/6.

MAINS ISOLATION TRANS.

230V. to 230V. 50W. 16/6. P.P. 3/-; 100W. 29/6. P.P. 3/6; 1,000W. £5. Carr. 10/-.

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Brand new. 2V. 1.5A. 4 x 1 x 1¼in., 5/6. P.P. 1/3. 12V. 0/75.A 4 x 3 x 1¼in. 15/6. P.P. 1/6.

MARCONI TF144G/4 STANDARD SIGNAL GENERATORS

First release of this late mark. 85Kc/s to 2Mc/s +1%. Output variable from 1μV to 1 volt. Internal sine wave modulation 400c/s up to 75% depth. Operation 200/250 volt A.C. Offered in really excellent condition, like new, fully tested and guaranteed. £25. Carr. 30/-.

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Input 200/250 volt A.C. Three H.T. outputs 2 x 400V. 175mA and 350V. 225mA. All fully smoothed. 2 x 6.3V. 5 amp, 6.3V, 4 amp, 12V. 0.5 amp. Supplied in perfect condition. £5.10.0. Carr. 20/-.

PRECISION PORTABLE VOLTMETERS

Polished wood case. 8in. scale with knife edge pointer. A.C. and D.C. volts: 0-160 volts, 59/6; 0-160-320 volts, £5.19.6. P.P. 3/6.

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200/250V. A.C. Twin concentric spindles. Either motor reversible. 14000 r.p.m. Brand new. 12/6. P.P. 2/6.

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24 amp. Pri, 230V. Sec. 185/250V. £12.10.0. Carr. 10/-.

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90 watts, 5,000 r.p.m. 4¾ x 3in. ¼in. spindle 22/6. P.P. 2/-.

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1.2 ohms 12 amp. 15/6. P.P. 3/6.

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Low imp. Fitted with std. jack plug. 15/6. P.P. 1/6.

DESK TELEPHONES

Std. type with handset and bell. No dial. Unused. 25/-. P.P. 3/6.

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12V. D.C. input. Output 310/360V. D.C. 30mA. New boxed. 10/-. P.P. 2/-.

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Brand new. 3 speeds, 1⅞", 3¾", 7½" i.p.s. 3 motors, digital counter. Complete with instructions. 2 Track, £10.10.0; 4 Track, £13.10.0. Carr. Paid.

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American type, low impedance, padded, 49/6. P.P. 2/6.

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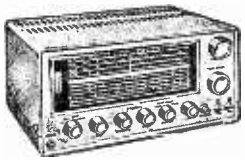

Superlative range of Modern Communication Receivers incorporating many special features at prices to suit every pocket

MODEL HE-40 4 Bands, 550Kc/s to 30Mc/s.	**£19.19.0**	Carr. 15/-
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MODEL HE-80 15 Valves, 5 Bands, 550Kc/s-30Mc/s and 142-148Mc/s.	**£52.10.0**	Carr. 15/-

Each receiver supplied brand new and fully guaranteed complete with manual. All models for operation on 220/240 Volt A.C. S.A.E. for illustrated leaflet. Generous part exchange allowances.

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A precision signal generator of extremely high accuracy and quality. Six ranges from 120Kc/s to 130Mc/s on fundamentals with calibrated harmonics from 120-390 Mc/s. 400 cps. INT. MOD. OR EXT. MOD. OUTPUTS MOD. RF UNMOD RF. or 400 c/s audio. RF. output in excess of 100 mv. Large clear 5 inch dial. Handsome grey metal case with handle. Size 7¾ x 10¾ x 4¾in. Complete with leads Operation 220/240 volts A.C. Supplied brand new and guaranteed £12.19.6. Carr. 5/-.

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HALL GUARANTEED WITH ARM AND CARTRIDGE

GARRARD SRP-10 PLAYER	£4.17.6
GARRARD AUTOSLIM CHANGER	£6. 9.6
GARRARD AT6 CHANGER MONO	£10. 9.6
GARRARD AT6 CHANGER STEREO	£10.19.6
GARRARD 4 H/F MONO	£14.19.6
GARRARD 4 H/F STEREO	£15.15.0
GARRARD TYPE A CHANGER	£17.15.0
GARRARD 301 STROBO, NO ARM	£19.10.0
B.S.R. GU7 SINGLE PLAYER	£4. 7.6
B.S.R. UA16 CHANGER	£6.12.6
B.S.R. UA15 NEW SLIMLINE CHANGER	£6.19.6

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MODEL PT- 34. 1,000 o.p.v.
0/10/50/250/1000V. A.C. and D.C.
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0/100KΩ
39/6. P.P. 1/6.

MODEL TE-12
20,000 o.p.v.
0/.6/6/30/120/600/1,200/3,000/6,000V.DC
0/6/30/120/600/1,200V. AC
0/60μA/6/60/600mA
6/6K/600K/6 Meg/60 Meg Ω
5pF—.2mFd
£5.19.6. P.P. 2/6.

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10,000 o.p.v.
0/.3/3/30/120/300/600/1,200V. DC.
0/12/60/120/300/1,200V. AC
0/120Ω A/30/300mA DC
0/2K/200K/2 Meg Ω
100pF—.2mFd
79/6. PP. 2/6.

MODEL AR-620
20,000 o.p.v.
0/10/50/250/500/1,000V. AC and DC
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0/10K/100K/1 Meg Ω
250pF—.02mFd
0-500 Henrys
92/6. P.P. 2/6.

MODEL NH-201
30,000 o.p.v.
0/.25/1/10/50/250/500/1,000V. DC
0/10/50/250/500V. AC
0/50μA/10/250mA
0/5K/500K/5 Meg Ω
99/6. P.P. 2/6.

MODEL ITI-2
20,000 o.p.v.
0/5/25/250/500/2,500V. DC
0/10/50/500/1,000V. AC
0/50μA/25/250mA DC
0/60K/6 Meg Ω
.01—.3mFd.
82/6. P.P. 2/6.

MODEL 250J
2,000 o.p.v.
0/10/50/500/2,500V. DC
0/10/50/500/2,500V. AC
0,2 Meg Ω
0/250mA
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49/6. P.P. 2/6.

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New improved "LAFAYETTE" Models.

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First grade quality American tapes. Brand new and guaranteed. Discounts for quantities.

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5in. 600ft. std. plastic	8/6
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5in. 1200ft. D.P. mylar	15/-
5½in. 1200ft. L.P. acetate	12/6
5½in. 1800ft. D.P. mylar	22/6
7in. 1200ft. std. mylar	12/6
7in. 1800ft. L.P. acetate	15/-
7in. 1800ft. L.P. mylar	20/-
7in. 2400ft. D.P. mylar	25/-

Postage 2/-. Over £3 post paid.

BRAND NEW R.C.A. AR88D RECEIVERS

Unboxed £65; Boxed with spare valves, copper aerial, headset, and manual, £85. Carr. 30/-.

VARIABLE VOLTAGE TRANSFORMERS

Pri. 230V. Sec. 0-250V. 1 amp. £4.10.0; 2½ amp. £5.17.6; 5 amp. £9; 8 amp. £14.10.0; 10 amp. £16.10.0; 12 amp. £18.15.0; 20 amp. £32.10.0. All fully shrouded.

CHAMOIS PADDED MOVING COIL HEADPHONES

Canadian noise excluding type. Complete with M/C microphone. New, boxed. 25/-. P. & P. 2/6.

Brand New Double Beam CRT's
Cossor 89D. 59/6. P.P. 4/6.
Dumont K1051P1. 59/6. P.P. 4/6.

SILICON RECTIFIERS

400 P.I.V. (SCR)	4 7 amp	7/6
200 P.I.V.	6 amp	5/6
1,000 P.I.V.	650mA	7/6
800 P.I.V.	500mA	5/6
200 P.I.V.	200mA	3/-
400 P.I.V.	500mA	3/6
150 P.I.V.	165mA	1/-
70 P.I.V.	1 amp	3/6
95 P.I.V.	3 amp	5/6

Post extra.

MINIATURE HIGH SPEED COUNTERS

4 Digit available. 6V, 24V, or 50V. ALL 7/6 ea. P. & P. 9d.

NEW LOW IMPEDANCE HEADSET

Latest Ministry Type. Rubber moulded. Fitted with Std. Jack Plug. Brand New, boxed. 17/6. P. & P. 1/6.

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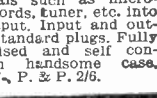

Add musical highlights and additional sound effects to your recordings.

The MM-4 permits mixing of four signals such as microphone, records, tuner, etc. into single output. Input and output take standard plugs. Fully transistorised and self contained in handsome case. PRICE 55/-. P. & P. 2/6.

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MARTIN RECORDAKITS

	Dep.	&	Mthly. pmts. of
HALF TRACK			
TAPE AMPLIFIER FOR STUDIO DECK with ready wired printed circuit, control and input panels, mains and output transformers, knobs, plans, screws etc. EF86, ECC83, EZ80, EM85 and 2 EL84. 3 watts output. Magic eye. Radio and Mic. inputs, ext. speaker socket, tone and monitor controls. Can be used as an amplifier £11.11.0	47/-	8	25/6
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CASE for above with 8 x 5in. speaker, two tone grey £5. 5.0			
COMPLETE KIT with tape and microphone .. £29.19.6	120/-	12	44/-
QUARTER TRACK			
TAPE AMPLIFIER FOR STUDIO DECK as described above but Quarter track £12.12.0	52/-	8	27/6
COLLARO STUDIO DECK fitted with Marriott "X" heads £13.19.6	56/-	12	20/6
CASE with speaker, two tone grey £5. 5.0			
COMPLETE KIT with tape and microphone £33.19.6	136/-	12	49/10
TAPE PRE-AMPLIFIERS			
HALF TRACK for STUDIO deck, 400m/Volts output £8. 8.0	34/-	6	25/8
QUARTER TRACK as above £9. 9.0	39/-	6	28/4

MARTIN AUDIOKITS

	Dep.	&	Mthly. pmts. of
The new Martin All Transistor TEN WATT AMPLIFIER kits represent excellent value for money. Each unit is complete, requiring only to be connected to the next. We show only the popular units here. Others are available. Newest leaflet upon request.	—	—	—
UNIT 1—FIVE INPUT SELECTOR. Size 3½ x 3in. Mag. P.U., Crystal P.U. Radio, Mic. Tape head 18 volts. Must be used with Unit 4 ..... £2. 7.6	—	—	—
UNIT 4—PRE-AMPLIFIER AND CONTROL. 6¼ x 2½in. Volume on/off. Bass and Treble controls. 18 Volts. Must be used with Unit 1 ..... £3. 2.6	—	—	—
UNIT 7—MAIN AMPLIFIER. 10 watts. 6 Translstor transformerless PUSH PULL output. Mounted on heat sink, 15 ohms output 40 volts £6.12.6	—	—	—
UNIT 8—POWER SUPPLY. 18 and 40 volts. Heavy duty transformer, rectifier and smoothing £2.15.0			
CONTROL PANEL for Units 1 and 4 ..... 10.6	—	—	—
ALL FOUR ABOVE UNITS WITH PANEL. 15 ohms output £15. 8.0	62/-	12	22/6
UNIT 5—MAIN AMPLIFIER as Unit 7, 3 ohms output. 24 volts £5.12.6	—	—	—
UNIT 6—POWER SUPPLY as Unit 8, for use with Unit 5 ..... £2.12.6			
ALL FOUR UNITS 1, 4, 5 and 6 WITH PANEL (3 ohms) £14. 5.0	57/-	12	20/10
STEREO VERSIONS NOW AVAILABLE LEAFLET ON REQUEST			

GRAMOPHONE UNITS, MOTORS, PICK-UPS

Decca DERAM Arm and Plug-in Shell	£5. 5.0	—	—	—
Decca DERAM Transcription Cartridge	£4.14.6	—	—	—
Decca DERAM Auto cartridge	£3.13.6	—	—	—
GARRARD SRP10 with Mono cartridge. Single player	£5.9.11	—	—	—
B.S.R. UA14 with TC8 mono cartridge, 4 speed Auto-changer	£6.19.6	28/-	6	22/-
GARRARD AUTOSLIM, Mono cartridge, 4 speed changer	£7.17.0	33/-	6	24/-
GARRARD AT6 Autoslim de Luxe. Mono cartridge	£11. 9.0	47/-	8	25/3
GARRARD 4H/F with Mono cartridge	£17. 0.0	68/-	12	24/11
GARRARD LAB. "A" Transcription Auto changer, Mono cartridge	£19.14.9	79/-	12	28/11
GARRARD 301 STROBE	£22. 0.0	88/-	12	32/3
PHILIPS AG 1016 Stereo cartridge, will change 7-in. records, with adaptor 10/- extra	£12.12.0	50/6	12	18/6
GOLDRING GL58, with arm but less cartridge	£17. 1.0	69/-	12	24/11
GOLDRING GL70, with arm, less cartridge ..	£27. 9.4	111/4	12	40/1
GOLDRING "88" Transcription. No arm ..	£18.18.5	76/5	12	27/6

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MONO				
224 F.M. only Self powered tuner	£22.10.0	90/-	12	33/-
223 A.M./F.M. Self powered tuner	£28.15.0	115/-	12	42/2
227M A.M./F.M. RADIO CHASSIS 10 watts	£36.15.0	147/-	12	53/10
STEREO				
227 A.M./F.M. RADIO CHASSIS. Stereo Gram. 10 watts each channel	£52.15.0	£11/-	12	77/4
226 A.M./F.M. RADIO CHASSIS Stereo Gram. 10 watts each channel. Filter. Mag. P.U. etc. ..	£61. 0.0	£60/-	12	88/-
SHELF MOUNTING TEAK CASE AVAILABLE FOR ALL THESE UNITS	£3.15.0	—	—	—
	All models			
SEND FOR NEW LEAFLET GIVING FULL DETAILS				
OTHER TUNERS				
TRIPLETONE F.M. TUNER less power	£13.19.6	56/-	12	20/6
TRIPLETONE F.M. TUNER with power	£15.14.6	63/-	12	23/1

STEREO AMPLIFIERS—VARIOUS

ARMSTRONG 222 Intergrated 10W per channel	£27.10.0	110/-	12	40/4
DULCI GA505. Intergrated 5W per channel	£18.18.0	76/-	12	27/8
ROGERS CADET Mk2 with P.A. 4 ELC86 valves	£26.15.0	107/-	12	39/2
LEAK STEREO 20 P.A. and MAIN amplifier. Complete.	£55. 9.0	229/-	12	80/8
QUAD 22 Control Unit. Pre-amp only	£25. 0.0	100/-	12	36/8

MONO AMPLIFIERS

LINEAR L45/A. 3 Valve 3 watts	£6. 6.0			
LINEAR DIATONIC. 12 watts, suitable Mic. or Guitar	£13. 2.6	52/6	12	19/8
LINEAR CONCHORD. 30 watts, ideal Guitar amp. with cover	£19. 2.0	78/-	12	27/10
DULCI GA5. Integrated amp. 5 watts. ECL86 valve	£13. 2.6	52/6	12	19/8
DULCI DPA15. 15 watt with 2 valve pre-amp	£26. 5.0	105/-	12	38/6
TRIPLETONE. Hi Fi Major with pre-amp., suitable Microphone or Guitar	£15.18.9	64/9	12	23/3
LEAK TL12 10 watt Main amp. only	£18.18.0	76/-	12	27/8
LEAK VARISLOPE MONO pre-amplifier	£15.15.0	63/-	12	23/1
QUAD 15 watt MAIN amplifier only	£22.10.0	90/-	12	33/-
QUAD Pre-amplifier MONO	£19.10.0	78/-	12	28/7

JASON F.M. AND TV SOUND TUNER KITS

FMT1, complete with 4 EF91 valves	£7. 4.6	29/-	6	22/8
FMT2, less power, complete with 4 EF80 valves	£9 4.6	37/-	6	28/-
FMT2, with power, complete with 4 EF80 valves and 1 EZ80	£11. 4.6	45/-	8	25/-
FMT3, less power **FRINGE**, complete with all valves	£10.19.0	45/-	8	24/8
FMT3 FRINGE with power, all valves	£12.19.0	53/-	12	18/10
JTV/2 Switched F.M. and T.V. sound. Self powered all valves	£15.12.6	62/6	12	22/11
MERCURY II, as JTV/2. but less power. All valves	£11. 0.0	44/-	8	24/6
Instruction book included in all kits. Available separately. 2/6 switched 3/6.				
JTV/2 READY BUILT STATE CHANNELS	£22. 5.0	89/-	12	32/7
MONITOR READY BUILT as Mercury II	£16.15.6	67/6	12	24/8

LOUDSPEAKERS

GOODMANS AXIETTE 8 inch	£5. 5.7	—	—	—
GOODMANS AXIOM 10 inch	£6.5.11	—	—	—
GOODMANS 5K/20/XL Tweeter and X/over	£7. 7.0	—	—	—
GOODMANS XO5000 Cross-over	£2.0.11	—	—	—
XO950	£5.10.11	—	—	—
FANE 12 inch unit 20 watts	£5. 5.0	—	—	—
W.B. HF 1012. 10in. unit 3.75. 7.5 and 15 ohms	£4.12.0	—	—	—
WHARFEDALE SUPER 3 Tweeter	£5.16.8	—	—	—
WHARFEDALE SUPER 5 Tweeter	£5.19.7	—	—	—
WHARFEDALE SUPER 8 RS/DD	£6.14.2	—	—	—
WHARFEDALE SUPER 10 RS/DD. Full range	£10.18.0	44/-	8	24/3
GOODMANS AUDIOM 51. 15 watt Bass unit	£9. 2.8	36/8	6	27/8
WHARFEDALE W12/EG. 12in. 15 watt Lead Guitar	£10.10.0	42/-	8	23/6
GOODMANS 201. Full range 12in. unit. 15 watt	£10.17.6	43/6	8	24/3
WHARFEDALE RS/12/DD. Full range unit	£11.10.0	46/-	8	25/6
GOODMANS 301. Full range. 12in. 20 watts	£15. 4.6	61/-	12	22/4
WHARFEDALE W15/EG. 15in. 15 watt. Bass Guitar	£17.10.0	70/-	12	25/8
GOODMANS AUDIOM 91. 18in. 50 watt. Bass Guitar	£29.15.0	119/-	12	43/7

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SHEFFIELD 13 Exchange Street. Castle Market Bldgs. (Half-day Thursday)

EX. GOV. 2V. ACCUMULATORS

16 A.H. Size 7 x 4 x 2 ins. Brand new. 4/9 each. Three for 12/6, carr. 5/-.

JASON FMTI

V.H.F./F.M. Radio Tuner design. Total cost of parts including valves, Tuning dial, Escutcheon, etc., £6.19.6.

LINEAR L45 MINIATURE 4-5 WATT QUALITY AMPLIFIER. Suitable for any record playing unit and most microphones. Negative feed-back 12 dB. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves EZ80, ECC83, EL84. Size only 7 x 5 x 5½ in. high. Guaranteed 12 months. Only 6 gns. Send S.A.E. for leaflet. Terms: Deposit 24/9 and 5 monthly payments of 24/9.

R.S.C. 30-WATT ULTRA LINEAR HIGH FIDELITY AMPLIFIER A10

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 dB down. Frequency response ±3 dB 30-20,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS**, etc. For use with Electronic **ORGAN, GUITAR, STRING BASS**, etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and "Mike" can be mixed. Amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required perforated cover with carrying handles can be supplied for 19/9. The amplifier can be supplied factory built with EL34 output valves and 12 months' guarantee, for 14 gns. Send S.A.E. for leaflet.

11 Gns. Carr. 10/-

TERMS: DEPOSIT 33/9 and 9 monthly payments of 33/9.

Suitable microphones and speakers available at competitive prices.

FANE HEAVY DUTY HI-FI SPEAKERS

12in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.

122/10 20watt, 5 gns.	122/10A 20watt, 6 gns.
122/12 20watt, 7 gns.	122/12A 20watt, 8 gns.
122/14 22watt, 9 gns.	122/14A 22watt, 10 gns.
122/17 25watt, £11.17.6	122/17A 25watt, £12.17.6

15in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.

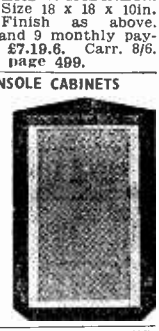
152/12 20watt, 12 gns.	152/12A 20watt, 13 gns.
152/14 27watt, 14 gns.	152/14A 27watt, 15 gns.
152/17 35watt, 16 gns.	152/17A 35watt, 17 gns.

"A" indicates dual cone type. 30-17,000 c.p.s. Send S.A.E. for leaflets. Terms available.

12in. 10 WATT HIGH QUALITY LOUDSPEAKER.

In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £4.19.6. Carr. 5/-. Terms: Deposit 11/3 and 9 monthly payments of 11/3. **12in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS.** Size 18 x 18 x 10in. Finish as above. Terms: Deposit 17/9 and 9 monthly payments of 17/9. Only £7.19.6. Carr. 8/6. **For larger types see page 499.**

R.S.C. CORNER CONSOLE CABINETS



Polished walnut veneer finish. Pleasing design.

JUNIOR MODEL. Size 20 x 11 x 8in. for 8 x 5in. or 10 x 6in. speakers, £2.9.9.

STANDARD MODEL Size 27 x 18 x 12in. for 8 or 10in. speakers, £4.11.9.

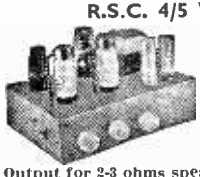
SENIOR MODEL. Size 30 x 20 x 15in. for 12in. Speaker. Suitable Speaker systems below. Only 7 gns.

AUDIOTRINE HI-FI SPEAKER SYSTEMS. Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; crossover unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating £4.19.9. Carr. 5/-. Or Senior 15 watt, £6.19.9. Carr. 7/6.

R.S.C. BASS REFLEX CABINETS, JUNIOR MODEL. Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only £3.19.6.

STANDARD MODEL. As above but for 12in. speakers. Size 20 x 15 x 13in. For vertical or horizontal use. £5.19.6. Set of legs with brass ferrules. 19/6.

R.S.C. 4/5 WATT A5 HIGH-GAIN AMPLIFIER



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest High-fidelity pick-up heads, in addition to all other types of pick-ups and practically all "mikes". Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 dB down. 15 dB of Negative feedback is used. H.T. of 300 v. 25 mA and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck preamplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohms speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue Hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4.15.0, or assembled ready for use 25/- extra. Plus 3/6 carr., or deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

THE SKYFOUR T.R.F. RECEIVER. A design for a 3 valve long and medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams, instructions and parts list 1/9, maximum building costs £4.19.6. inc. attractive walnut veneered wood cabinet 12 x 6½ x 5½in.

TWEETERS. R.A. 3 ohm. 25/9; 15 ohm. 25/9

R.A. 12in. DUAL CONE 3 ohm 8 watt Speakers. Ideal for Stereo. Only 39/9 ea.

P.M. SPEAKERS. 10in. W.B. "Stentorian" 3 or 15 ohms type HF 1012 10 watts, hi-fidelity type. Recommended for use with our A11 Amplifier. £4.12.6. 12in. R.A. 3 ohms 10 watts (12,000 lines), 59/9.

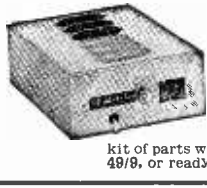
ARMSTRONG, DULCI, LINEAR, ROGERS, LEAK and JASON EQUIPMENT, GOODMANS, W.B. AND FANE SPEAKERS. GARRARD AND GOLDRING T/TABLES CASH or H.P.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers). Delayed A.V./C. Controls are Tuning, W/Ch. and Vol. Only 250 v. 15 mA H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size approx. 9 x 6 x 7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustrations, 2/6. Total building cost £5.5.0. S.A.E. for leaflet.

MULTI-METER, CABY MI. Sensitivity 2,000 ohms per volt. A.C. and D.C., 54/-. **A.10.** Basic Meter sensitivity 155 microamps A.C. and D.C. ranges £4.11.6. **B.40.** Sensitivity up to 10,000 ohms per volt A.C. and D.C., £6.2.6. TMK500 30,000 ohms per volt, with overload buzzer, £8.19.6.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

R.S.C. BATTERY TO MAINS Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 and 90 v.** This includes low consumption types. Complete kit with diagrams, 39/9, or ready to use, 46/6.



Type BM2. Size 8 x 5½ x 2½in. Supplies 120 v. 90 v. and 60 v. 40 mA and 2 v. 0.4 a. to 1 amp. fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators when connected to** A.C. mains supply 200/500 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulators. Complete kit of parts with diagrams and instructions, 49/9, or ready for use, 59/6.

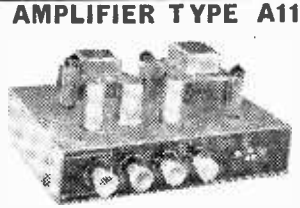
AUDIOTRINE HI-FI TAPE RECORDER KIT 25½ GNS. Carr. 17/6

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a Handsome Portable Carrying Cabinet tastefully covered in two contrasting shades of Rexine and Vynair, size 14½ x 15 x 8½in. high and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflets. **TERMS. Deposit £2.13.9** and 12 monthly payments of 44/-. Cash price if settled in 3 months.

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

PUSH-PULL ULTRA LINEAR OUTPUT 'BUILT-IN' TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram.. as in A10 High sensitivity. Includes 5 valves. ECC83, ECC83, EL84. EL84, EZ81. High Quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut". Frequency response ± 3 dB 30-30,000 c/s. Six negative feedback loops. Hum level 60 dB down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs for **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, LEAD OR RHYTHM GUITARS,** etc.
OUTPUT SOCKET with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-. (Or factory built 51/- extra.)
If required louvred metal cover with 2 carrying handles can be supplied for **18/9. TERMS ON ASSEMBLED UNITS. DEPOSIT 24/0** and 9 monthly payments of **24/9.** Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

LINEAR TAPE PRE-AMPLIFIER. Type LP/1, Switched Negative feedback Equalisation. Positions for Record 1½in., 3¾in., 7½in. and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriptor and a high fidelity amplifier, but suitable for almost any Tape Deck. Only 8 gns. S.A.E. for leaflet.

R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation for "lift" and "cut". Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point-to-Point wiring diagrams and instructions supplied. Send S.A.E. for leaflet **8 Gns.** Full constructional details and price list 2/6. Carr. 10/-.
Kit can be supplied assembled and ready to use for **59/6** extra.

R.S.C. GRAM. AMPLIFIER KIT. 3 watts output. Negative feedback. Controls Vol., Tone and Switch. Mains operation 200-250 v. A.C. Fully isolated chassis. Circuit, etc., supplied. Only **39/6.** Carr. 3/9.
HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Collaro. **16/9.** Acos Stereo-Monaural. **29/9.** Ronette Stereo-Monaural **39/6.** B.S.R. Stereo **39/9.**
BRADMATIC RECORDING HEADS. High Impedance Record/Playback **22/-.** Low Impedance Erase **12/6.**
MARRIOTT RECORDING HEADS. High Impedance, Record/Playback **15/-.** Low Impedance, Erase **10/-.**
PICK-UP ARMS. Complete and with latest Acos/hi-fi Turnover Cartridge **29/11.**
CRYSTAL MICROPHONES. Hand type NP110 **14/9.** R.T.C. **19/9,** Acos Mic 40 **25/9,** Acos Mic 45 **29/9,** Stick type Acos 39-1 **39/9,** BM3 with neck band and heavy table stand **59/9.** Lapel type **29/9.**
COLLARO JUNIOR. 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only **£3.19.6.**
B.S.R. UA14 4-sp'd AUTO-CHANGERS with hi-fi turnover head. **£6.19.8.** Carr. 4/6.
GARRARD AUTO-SLIM 4-SPEED AUTO-CHANGER with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains. **£7.17.6.** Carr. 4/6.
GARRARD AT6 AUTO-SLIM DE-LUXE 4-SPEED AUTOCHANGERS. Turnover GC8 head, for 200-250 v. A.C. mains. **£11.9.0.**
GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. A.C. mains. Size 11½ x 2½ x 2½in. Controls: Vol. and Tone with Switch. Only **59/6.**

SENSATIONAL STEREO OFFER

A complete set of parts to construct of a good quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head **19/9** extra with above only. **4 Gns.**

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps., variable output. Consisting of Mains Transformer 200-230-250 v.; F.W. (Bridge) Selenium Rectifier; Ammeter, Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit, **59/9.** Carr. 4/8.

R.S.C. BATTERY CHARGING EQUIPMENT

Guaranteed 12 months

All for A.C. Mains 200-250v., 50c/s.

ASSEMBLED 4 amps 6/12 v. Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved grey hammer finish. Fused and ready for use with mains and output leads and battery clips. Carr. 4/6. **59/9**
Terms: Deposit 12/- and 5 monthly payments of 12/-.

ASSEMBLED 6/12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Fused, ready for use with mains and output leads. **39/9** Carr. 3/9.
6/12v. 1amp. 27/9 Less meter.

BATTERY CHARGER KITS Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuse-holders, Grommets, Panels, Heavy Duty Clips, circuit. Carr. 3/6 extra.
6v. or 12v. 1 amp..... **22/9**
As above with Ammeter.. **28/9**
6 v. 2 amps. **19/9**
6 v. or 12 v. 2 amps. **25/9**
6 v. or 12 v. 2 amps. inclusive of Ammeter **35/9**
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector **52/9**

CHARGER AMMETERS
0-1.5 a., 0-4 a., 0-7 a., **8/9** each

CHARGER KIT, 12 v. 14 AMP or 24 v. 7 AMP Consisting of mains trans. 200-230-250 v. F.W. (Bridge) selenium Rectifier. Ammeter, Fuses. Variable Resistor. Heavy Steel Stove enamelled case and Circuit. Only **£9.19.6.** Carr. 15/-. Please state if 12 v. or 24 v. kit required.

CHARGER KIT, 12v. 10 Amp. with variable charge rate adjustment and ammeter. **£4.19.6.** Carr. 10/-.

R.S.C. MAINS TRANSFORMERS

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened

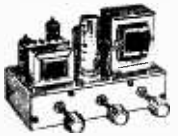
TOP SHROUDED DROP THROUGH
250-0-250v. 70mA. 6.3v. 2a. 0-5-6.3v. 2a **17/9**
250-0-250v. 80mA. 6.3v. 2a. 0-5-6.3v. 2a **19/9**
250-0-250v. 100mA. 6.3v. 2a. 6.3v. 1a .. **21/9**
250-0-250v. 100mA. 6.3v. 3.5a. C.T. .. **19/9**
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a **27/9**
300-0-300v. 130mA. 6.3v. 4a. 6.3v. 1a. for Mullard 510 Amplifier **39/9**
300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a **27/9**
350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a **27/9**
350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a **35/9**

FULLY SHROUDED UPRIGHT
250-0-250v. 60mA. 6.3v. 2a. 0-5-6.3v. 2a Midget type 2½ x 3 x 3in. **17/11**
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a **28/9**
300-0-300v. 100mA. 6.3v. 4a. 5v. 3a .. **28/9**
300-0-300v. 130mA. 6.3v. 4a. C.T. 6.3v. 1a. for Mullard Amplifier **35/9**
350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a **29/9**
350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a **37/9**

FULLY SHROUDED (GUARANTEED)
FULLY SHROUDED (continued)—
425-0-425v. 200mA. 6.3v. 4a. C.T. 5v. 3a **57/9**
425-0-425v. 200mA. 6.3v. 4a. C.T., 6.3v. 4a. C.T., 5v. 3a **59/9**
450-0-450v. 250mA. 6.3v. 4a. C.T. 5v. 3a **69/9**
OUTPUT TRANSFORMERS
Midget Battery Pentode 66:1 for 3S4, etc. **4/6**
Small Pentode, 5,000Ω to 3Ω **4/6**
Small Pentode 7/8,000Ω to 3Ω **4/6**
Standard Pentode 5,000Ω to 3Ω **5/9**
Standard Pentode 7,000Ω to 3Ω **5/9**
10,000Ω to 3Ω **5/9**
Push-Pull 8 watts, EL84, or 6V6 to 3Ω or matched to 15 Ω **9/9**
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 to 15 Ω **19/9**
Following types for 3 and 15Ω speakers
Push-Pull 10-12 watts 6V6 or EL81 .. **18/9**
Push-Pull 15-18 watts, 6L6, KT66 .. **22/9**
Push-Pull Mullard 510 Ultra Linear .. **29/9**
Push-Pull 20 watts, sectionally wound 6L6, KT66, EL34, etc. **49/9**

MIDGET MAINS Primaries 200-250 v. 50 c/s. 250v, 60mA, 6.3v. 2a **11/9**
250-0-250v. 60mA, 6.3v. 2a .. **12/11**
Both above size 2½ x 2¼ x 2¼in.
FILAMENT TRANSFORMERS
All with 200-250v. 50 c/s primaries 6.3v. 1.5a., **5/9**; 6.3v. 2a, **7/6**; 0-4-4.3v. 2a, **7/9**; 12v. 1a, **7/11**; 6.3v. 3a. **8/11**; 6.3v. 6a, **17/6**; 12v. 1.5a. twice, **17/6.**
SMOOTHING CHOKES
150mA. 7-10 H, 250 ohms **11/9**
100mA. 10H, 200 ohms **8/9**
80mA. 10H. 350 ohms **5/9**
60mA. 10H, 400 ohms **4/11**
CHARGER TRANSFORMERS
All with 200-230-250v. 50 c/s Primaries; 0-9-15v. 1a, **12/9**; 0-9-15v. 2a, **14/9**; 0-9-15v. 3a, **16/9**; 0-9-15v. 5a, **19/9**; 0-9-15v. 8a, **23/9**; 0-9-15v. 8a, **28/9.**
AUTO (Step up/Step down) TRANS. 0-110/120-230/250v. 50-80 watts, **13/9**; 250 watts, **39/9**; 150 watts, **27/6.**
MICROPHONE TRANSFORMERS
120: 1 high grade, clamped, **8/9.**

3-VALVE AUDIO AMPLIFIER MODEL HA34



Designed for Hi-Fi reproduction of records A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7¼in w x 4in, d x 4¼in. h. Incorporates ECC83. EL84, EZ80 valves. heavy duty double-wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls.

The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs, valves, etc., wired and tested for only **£4.5.0** P. & P. 5/-

TAPE DECKS

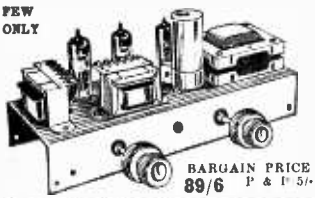
COLLARO STUDIO DECK. £10.10.0 plus 5/6 carr and ins

B.S.R. MONARDECK. Single speed, 3¾in per sec., simple control uses 5¼in. spools. £6.15.0 plus 5/6 carr. and ins. (Tapes extra on both.)

STEREO AMPLIFIERS

Incorporating 2 ECL82s and 1 EZ80 heavy duty double-wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete

FEW ONLY



BARGAIN PRICE **89/6** P & P 5/-

6 TRANSISTOR AND DIODE SUPERHET

A first-class 2 wavebands transistor superhet ● Printed circuit panel (size 8½ x 2¾in.). ● 3 pre-aligned I.F. transformers. ● High-grain Ferrite rod aerial. × All First-grade transistors. ● Car aerial winding. ● push-pull output. ● All parts supplied with simple instructions.

All parts sold separately. Set of parts if purchased at one time.

ONLY £4.5.0 P. & P. 2/6.

35 OHM SPEAKERS

Suitable for use with above. 2in. Goodmans. Ideal replacement for most pocket portables. **8/6** 3¼in., **12/6**; 5in., **17/6**; 7 x 4in., **21/-**. P. & P. 1/6 per speaker.

Portable CABINET

Size approx. 9½ x 6½ x 2¾in. Suitable for above using 3¼in. speaker. **25/-**. P. & P. 2/-.

COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 I.F. transformers, one oscillator coil, one driver transformer and wound Ferrite aerial (med., long and aerial coupling). **32/6** complete, post 1/-. 6 transistor printed circuit board to match. **8/6**. Post 9d. Circuit diagram 1/6 extra.

SPECIAL TRANSISTOR BARGAINS

ALL BRAND NEW

GET 15 (Matched Pair) 15/-

OC71	5/-	OC72	6/-	OC76	6/-
PXA101	6/6	XA103	6/6	V15/10p	12/6

Set of Mullard 6 transistors, OC44. 2—OC45. OC81D matched pair, OC81. 25/-.

EDISWAN MAZDA

R.F.1 Pack: 1—PXA102 Mixer: 2—PXA101 I.F. Amp.; (Equiv. OC44 and OC45).....10/6

B.F. 2 Pack: 2—PXA101 I.F.;—PXA102 Osc.; 1—PXA102 Mixer.....12/6

L.F.6 Pack: Consisting of PXB113 Driver. Matched pair PXC171, mounted complete with heat sinks (Equiv. OC81D and OC81) 12/6

ALL TRANSISTORS POST FREE

QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. Size 7in. w. x 2½in. d. x 5½in. h. This amplifier (which is used in a 29 gn. record player) employs ECC83 EL84, EZ80 valves. Bass treble and volume controls. Complete with output transformer matched for 3 ohm speaker. Ready built and tested.

PRICE 69/6 P. & P. 3/6

ALSO AVAILABLE. Mounted on board with output transformer and 6in. speaker, ready to fit into cabinet below. PRICE **89/6**. P. & P. 4/6.

QUALITY PORTABLE RECORD PLAYER CABINET

Uncut motor board. Will take above amplifier and B.S.R. or GARRARD Autochanger or single Record Player Unit. Size 18 x 14 x 8½in.

PRICE £3.9.6 Carr. 5/-.

EMBASSY PORTABLE RECORD PLAYER CABINET. Will accommodate amplifier, up to 7 x 4in. speaker and B.S.R. or GARRARD auto-changer or single player unit Attractive rexine covered finish. Overall size 17 x 15 x 8½in. Supplied with uncut motor board. PRICE **69/6**. Carr. 5/-.

4-SPEED PLAYER UNIT BARGAINS

All Brand New in Makers' Original Packing

SINGLE PLAYERS

B.S.R. TU/12..... **£3.10.0** Carr. 3/6.

B S R. GU7 with unit mounted pick-up arm **£4.18.8.** Carr. 4/-.

AUTO CHANGERS

B.S.R. UA14.....**£5.19.6**

Latest B.S.R. UA16.....**£6.19.6**

Garrard AT6 Mono.....**£10.10.0**

LATEST GARRARD AUTO-SLIM. With heavy duty, 4-pole motor. FEW ONLY £7.7.0. (Standard Auto-Slim **£6.10.0**). Carr. 5/- on each.

NEW CARTRIDGE BARGAINS!

B.S.R. TC88. High output compatible **Stereo Cartridge.** Brand new. Complete with Stereo/LP/78 sapphire stylii and universal mounting bracket. Original price 44/11. **OUR PRICE 22/6.** P. & P. 1/-.

RONETTE STEREO 105 CARTRIDGE. Stereo/LP/78. Complete with two sapphires. Original list price **67/9. OUR PRICE 24/-.** P. & P. 1/-.

COLLARO HI-FI STEREO T/O CARTRIDGE. Type "C". Complete with universal bracket and stylii for Stereo. L.P. and 78. Original list price **59/8. OUR PRICE 25/-.** P. & P. 1/-.

E.M.I. 4-speed Player and P.U.

FURTHER HUGE PURCHASE enables us to offer these at

67/6 P. & P. 4/6.

Heavy 8½in. metal turntable. Low flutter performance 200/250 v. shaded motor with tap at 45v. for amplifier valve filament if required. Turnover LP/78 head.

THE NEW HARVERSON KIT FOR THE HOME CONSTRUCTOR

A really excellent all purpose A.C. mains 200/240v. **AMPLIFIER KIT TYPE HSL 'FOUR' 3 VALVE, 4 WATT USING ECC83. EL84, EZ80 VALVES**

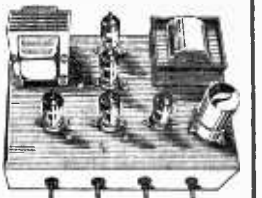
Special features include:

● Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss. ● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar, microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● All this builds onto a chassis size only 7¼in. wide x 4in. deep. Overall height 4¼in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves, output transformer (3 ohms only), screened lead, wire, nuts, bolts, solder etc (No extras to buy) **79/6** P. & P. 5/-

PRICE

Comprehensive circuit diagram, practical layout and parts list 2/6. (Free with Kit).

10/14 WATT HI-FI AMPLIFIER KIT



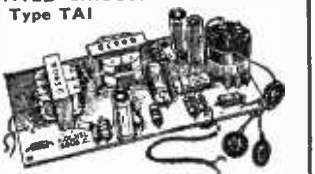
A stylishly finished monaural amplifier with an output of 14 watts, from 2 EL84s in push-pull Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram. allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and independent volume controls and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts).

All parts sold separately. ONLY **£6.19.6** P. & P. 6/6.

Also available ready built and tested complete with standard input jack sockets. **£8.15.0.** P. & P. 6/6.

HIGH GAIN 4-TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT

Type TAI



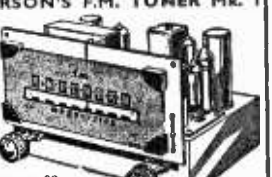
● Peak output in excess of 1½ watts. ● All standard British components. ● Built on printed circuit panel size 6 x 3in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (GET114) or S1 Mullard OC81D and matched pair of OC81 o/p) ●9 volt operation. ● Everything supplied, wire battery clips, solder, etc. ● Comprehensive, easy to follow instructions and circuit diagram 1/6 (Free with Kit). All parts sold separately.

SPECIAL PRICE 45/- P. & P. 2/6

Also ready built and tested, **52/6. P. & P. 2/6.**

A pair of TAI's are ideal for stereo.

HARVERSON'S F.M. TUNER Mk. I



● F.M. tuning head by famous maker. ● Guaranteed non-drift ● Permeability tuning. ● Frequency coverage 88 100 Mc/s. ● OA81 balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used ECC85, two EF80's, and EZ80 (rectifier). ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5¼in. ● All parts sold separately. Set of parts if purchased at one time **£8.19.6**, plus 8/6 P.P. and ins. Circuit diagram and instructions 1/6 post free. **Mark II Version** as above but complete with magic eye, front panel and brackets. **£9.12.6.** P. & P. 8/6.

Mark III Version as Mark I but with output stage (ECL82) and tone control. **£7.7.0.** P. & P. 8/6.

Handsome Metal Cabinets. Choice of Grey, Black or Green. To fit Mark I, **25/-**. P. & P. 2/6. To fit Mark II, **17/6**. P. & P. 2/6.

SPECIAL PURCHASE! TURRET TUNERS

By famous maker. Brand new and unused. Complete with PCC84 and PCF80 valves, 34-38 Mc/s I.F. Biscuits for Channels 1 to 5 and 8 to 9. Circuit diagram supplied. **ONLY 25/-** each. P.P. 2/6

BRAND NEW CYLDON F.M. TUNER HEAD Permeability tuned. 88-100 Mc/s Printed circuit. A completely screened unit ready for direct mounting in chassis. 10.7 Mc/s. I.F. O/P. Supplied complete with ECC85 valve and full circuit diagram. Aerial input circuit suitable for either 75 ohm unbalanced or 300 ohm balanced. Size only 3in. w. x 2¾in. d. x 1¾in. h. (2¾in. high with valve). Limited number only at **27/6.** P. & P. 1/6.

Also available 10.7 Mc/s. I.F. trans. and disc. trans. 11/6 pair. P. & P. 1/6

GÖRLER F.M. TUNER HEAD

88-100 Mc/s. 10.7 Mc/s I.F. **15/-**, plus 1/9 P. & P. (ECC85 valve, 8/6 extra.)

STERN-CLYNE

Electronics Centres throughout Great Britain

MULLARD 2-VALVE PRE-AMLIFIER TONE CONTROL UNIT

Employing two EF86 valves and designed to operate with the Mullard AMPLIFIERS but also perfectly suitable for other makes with input up to 250 mV.

★ Equalisation for the latest R.I.A.A. characteristics. ★ Inputs for Crystal Pickups and variable reluctance magnetic types. ★ Input (a) Direct from High imp. Tape Head. (b) From a Tape Amplifier or Pre-Amplifier. ★ Sensitive Microphone Channel. ★ Wide range BASS and TREBLE Controls.

KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£9.9.0** (Carr. & Ins. 5/-).

Instruction book and detailed price list (free with kits) available separately at 2/- Post Free.

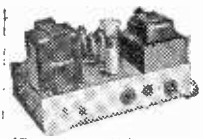
MULLARD 3-VALVE PRE-AMLIFIER TONE CONTROL UNIT

Designed mainly for Mullard Range of Amplifiers, also suitable for any Amplifiers requiring input up to 250mV. incorporates 5 input Channels, including for Tape and Magnetic Pickups. Separate Bass and Treble controls. High pass filter 20 to 160 c/s. low pass filter 5-9 Kc/s. Totally enclosed in case Size 11¼ x 4¼ x 4¼.

KIT OF PARTS **£10.0.0** (Carr. & Ins. 5/-). ASSEMBLED & TESTED **£13.13.0**

Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

MULLARD "5-10" MAIN AMPLIFIER



For use with MULLARD 2 or 3 valve pre-amplifiers with which an undistorted power output of up to 10 watts is obtained SPECIFIED COMPONENTS and MULLARD VALVES including PARTRIDGE MAINS TRANSFORMER and choice of PARMEKO or PARTRIDGE Output Transformer.

COMPLETE KIT (Parmeko Output Trans.) **£10.0.0**

ASSEMBLED AND TESTED **£13.13.0** (Carr. & Ins. 6/6).

ABOVE incorporating PARTRIDGE OUTPUT TRANS. **£1.6.0.** extra.

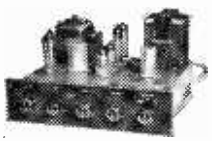
Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

COMBINED PRICE REDUCTION

MULLARD 5-10 Main amplifier and 2 valve Pre-Amp. Kit **£15.15.0.** C. & I. 8/6. Built and tested. **£21.10.0.** C. & I. 8/6.

MULLARD 5-10 Main Amplifier and 3 valve Pre-Amp. Kit **£19.10.0.** C. & I. 8/6. Built and tested. **£25.10.0.** C. & I. 8/6. With Partridge Transformer **£1.6.0** extra.

THE MULLARD 5-10RC AMPLIFIER

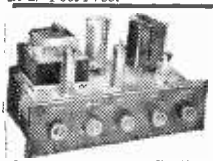


The popular complete "5-10" incorporating Passive Control Unit providing up to 10 watts high quality reproduction with input of 600mV. Specified components and new MULLARD VALVES. Includes PARTRIDGE MAINS TRANSFORMERS and choice of PARMEKO or PARTRIDGE Output Transformers. Surplus power available for Tuner.

COMPLETE KIT ASSEMBLED and TESTED **£16.0.0** (Carr. & Ins. 7/6). **£12.0.0**

With PARTRIDGE OUTPUT TRANS. **£1.6.0** ex.

Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.



THE MULLARD 3-3RC

A HIGH QUALITY AMPLIFIER DEVELOPED FROM THE VERY POPULAR 3-WATT MULLARD "3-3" DESIGN.

KIT OF PARTS **£8.8.0**

ASSEMBLED AND TESTED **£11.10.0** (Carr. & Ins. 6/6).

Complete to the MULLARD specification including PAMEKO OUTPUT TRANSFORMER. Switched inputs for 78 and L.P. records plus a Radio position. Extra power to drive a Radio Tuning Unit is also available. Please state L.S. impedance.

Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

TAPE PRE-AMPLIFIER MULLARD Type "C"

Suitable for most ¼ track, Mono Tape Decks. Incorporates Ferrox-cube Push-Pull Oscillator. Treble Inductor and 3-sp. Equalisation. Includes separate Power Unit.

KIT OF PARTS **£14.0.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.10.0**

Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

SEE PRECEDING PAGE FOR OTHER STERN-CLYNE PRODUCTS

THE "MONO-GRAM"

A small Amplifier of genuine high quality performance. Incorporates MULLARD ECL86 Valve separate BASS and TREBLE controls. PARTRIDGE output Transformer producing up to 3 watts undistorted output.

KIT OF PARTS **£4.10.0** (Carr. & Ins. 3/6). ASSEMBLED **£6.0.0**

Instruction book and detailed price list (free with kit) available separately at 2/6 Post Free.

Perfectly suited for Portable Installations for which purposes we offer PORTABLE CASE (£3.10.0). the AMPLIFIER (Kit £4.10.0) and 8" x 5" SPEAKER (£1.0.0). All for **£9.0.0**

Alternatively with ASSEMBLED AMPLIFIER (Carr. & Ins. 5/-). **£10.0.0**

The Case quoted above will accommodate some 4-speed Single Record Units. A larger model is available for extra 10/-. With this Equipment a COMPLETE PORTABLE RECORD PLAYER can be built for **£14.0.0**

MODEL CR3/S TAPE RECORDER

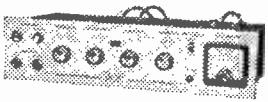
MODEL CR3/S incorporates the HF/TR3 Mk. II Tape Amplifier (described below) and the Collaro "Studio" Twin-Track 3-speed Deck operating at 1⅞in., 3¾in. and 7½in. speeds. Complete with microphones and 1,200ft. tape.

KIT OF PARTS **£33.0.0**

ASSEMBLED AND TESTED **£43.0.0**

(Carr. & Ins. 15/- extra).

STEREO TAPE PRE-AMPLIFIER



MODEL STP-1. For use with current TRUVOX, BRENELL or COLLARO "STUDIO" ¼ and ½ track Stereo Decks. Incorporates Ferrox-cube Oscillator, 4-speed Equalisation Signal Lever Meter and separate Gain Control. Includes separate Power Unit. KIT OF PARTS **£22.0.0** Carr. & (Ins. 8/6) ASSEMBLED **£28.0.0**

Instruction book and detailed price list (free with kit) available separately at 5/- Post Free.

MULLARD TAPE AMPLIFIER

MODEL HF/TR3 MK. II

Based on Mullard's Type "A" design and suitable for most ¼ track Mono Tape Decks. Incorporates Ferrox-cube Treble inductor, Gilson Output Transformer, and 3-speed Equalisation. Includes separate Power Unit, using PARTRIDGE Mains Transformer.

KIT OF PARTS **£13.13.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.0.0**

Instruction book and detailed price list (free with kit) available separately at 3/- Post Free.

COMBINATION TAPE UNITS

All our Tape Units can be supplied specially matched to any Tape Deck such as Collaro, Brenell Mk.5 Series II. also the Wearite. Specimen prices as below.

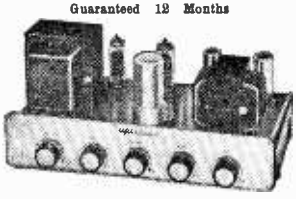
	Kit	Assembled
STP-1 Pre-amp with Collaro Studio Tape Deck..... Assembled with track switch fitted, **£44.2.0**	**£36. 0.0**	**£42. 0.0**
STP-1 with Brenell Mk. 5 Series II with Track Switch fitted	**£68. 4.0**	
STP-1 with Brenell Mk. 5 Series II, ¼ Track Deck....		**£74.15.0**
Type "C" Pre-amp with Collaro Studio Tape Deck.... Assembled with deck wired and matched, **£32.2.0**	**£24.10.0**	**£30. 0.0**
Type "C" Pre-amp with Brenell Mk. 5 Series II Deck Assembled with deck wired and matched, **£55.3.0**	**£46.11.0**	**£53. 1.0**
HF/TR3 with Collaro Studio Tape Deck..... Assembled with deck wired and matched, **£31.12.0**	**£24. 3.0**	**£29.10.0**
HF/TR3 with Brenell Mk. 5 Series II Deck..... Assembled with deck wired and matched, **£53.13.0.**	**£46. 4.0**	**£51.11.0**

Carr. & Ins. 15/- on above units. Send S.A.E. for comprehensive price list.

SEND FOR CURRENT PRICE LIST OF ALL LEADING RECORDING TAPES AND ACCESSORIES

THE TRIPLETONE HI-FI MAJOR

PRICE ONLY **£15.18.9** COMPLETE
Guaranteed 12 Months



A 12 watt quality amplifier incorporating negative feedback, with a pre-amp for mic. and provision for mic./gram mixing. Frequency response ± 1 dB 15-20,000 c/s. Distortion only 0.15%, with noise and hum —80 dB. Separate Bass, Middle and Treble lift controls. Valve line-up, 12AX7, 12AX7, EL84, EL84 and EZ81. Push-pull output with matching to 3 or 15 Ω. Fully isolated power supply from 200/250 v. A.C. input, with take-off for tuner etc. Size 12 x 5½ x 6in. high.

De Luxe Case: 14in. x 9in. x 7½in., **30/-** extra

New R.C.S. VALVES 90-day Guarantee

1R5	6/-	6Q7G	6/-	EBC41	8/-	PCL84	5/-
1S5	6/-	6S7N	5/-	EBC81	5/-	PL81	10/-
1T4	3/-	6V6G	5/-	EBF80	5/-	PL83	8/-
3S4	7/-	6X4	5/-	ECH42	9/-	PY80	7/-
3V4	7/-	6X5	6/-	ECH81	9/-	PY81	8/-
5U4	6/-	12AT7	6/-	ECL80	8/-	PY82	7/-
5Y3	6/-	12AU7	6/-	ECL82	10/-	SP61	3/-
5Z4	9/-	12AX7	7/-	EF183	7/-	U22	7/-
6AM6	4/-	12K7	5/-	EF184	7/-	UBC41	8/-
6AT6	6/-	12K8	14/-	EF86	10/-	UBC81	5/-
6BA6	7/-	12Q7	7/-	EF89	8/-	UBF89	5/-
6BE6	5/-	25Y5G	9/-	EL84	7/-	UCH81	9/-
6H6	3/-	35L6	9/-	EY51	9/-	UCL82	10/-
6J5	5/-	35Z4	5/-	EY86	9/-	UF89	5/-
6J6	5/-	954	2/-	EZ40	5/-	UL41	9/-
6J7G	6/-	DF96	8/-	EZ80	7/-	UY41	5/-
6K6	5/-	DK96	8/-	MU14	7/-	UY85	7/-
6K7G	5/-	DL96	8/-	PC97	7/-	UU9	7/-
6K8G	5/-	EABC80	5/-	PCC84	8/-	VR150	7/-
6N7M	5/-	EB91	4/-	PCF80	5/-	W81	6/-

I.F. TRANSFORMERS 7/6 pair
465 K/s Slug Tuning Miniature Can. 2 x 1 x 1in. High Q and good bandwidth. Data Sheets.

NEW ELECTROLYTICS

TUBULAR		TUBULAR		CAN TYPES	
1/350V	2/-	50/350V	5/-	8/8/600V	9/-
2/350	2/-	100/25V	2/-	16/450V	5/-
4/450V	2/-	250/25V	3/-	16/600V	12/-
8/450V	2/-	500/12V	3/-	16+16/500V	7/6
16/450V	3/-	1,000/12V	3/-	32+32/350V	6/6
32/450V	3/-	5,000/6V	5/-	32+32/450V	5/-
55/25V	1/-	8+8/450V	3/-	32+32+16/350V	6/-
25/50V	2/-	8+16/430V	3/-	50+50/350V	7/-
50/25V	2/-	16+16/450V	4/-	64+120/350V	7/-
50/50V	2/-	32+32/350V	4/-	100+200/275V	11/6

TELESCOPIC CHROME AERIALS. 12 to 33in., **8/6.**
TRIPLEXERS Bands I, II, III, 12/6. COAX PLUGS, 1/-.
LEAD SOCKET, 2/-. PANEL SOCKETS, 1/-.
OUTLET BOXES (Surface or flush), **4/-** ea.
BALANCED TWIN FEEDER yd. **6d.** 80 or 300 ohms.
TWIN SCREENED per yd. **1/-.** 80 ohms only.
Wirewound Ext. Speaker Control. 10 Ω **3/-,** 25 Ω **6/6.**
WIRE-WOUND POTS. 3 WATT. Pre-set Min. TV Types. All values to 10 ohms to 25 K., **3/-** ea. 30 K., **4/-.** (Carbon 30 K to 2 meg., **3/-**).
WIRE-WOUND 4 WATTS Pots. Long spindle. Value, 50 ohms to 50 K., **6/6:** 100 K., **7/6.**
PHILIPS TRIMMERS. 0-10 pF., 3-30 pF., **1/-.**
TRIMMERS, Ceramic. 30, 50, 70 pF., 9d.; 100 pF., 150 pF., 1/3; 250 pF., 1/6; 500 pF., 750 pF., 1/9. TV etc. **TRIMMER,** 1000 pF., with knob, **2/-.**
RESISTORS. Preferred values. 10 ohms to 10 meg. ½ w., ⅓ w., 1 w., **4d.**; 1½ w., **8d.**; 2 w., **1/-.** High Stability. ½ w., 1%, **2/-.** Preferred values 10 Ω to 10 meg. Ditto 5% 10 Ω to 22 meg., **9d.**
BRIMISTORS CZ1, **3/6;** CZ2, **2/6;** CZ3, **1/6.**

5 watt, 10 watt, 15 watt } **WIRE-WOUND RESISTORS** 10 ohms—10,000 ohms { 1/3, 2/-, 2/-

12.5 K to 25 K 10 w. **3/-**
Toggle Switches, s.p., **2/-;** d.p., **3/6,** d.p.d.t., **4/-.** Min. Slide d.p.d.t., **3/6.**

Volume Controls Linear or Log Tracks Long spindles. Midget 5 K ohms to 2 Meg. L.S., **3/-.** D.P., **4/6.** Stereo L/S **10/6;** D.P. **14/6** 1m. log + 1m.A/log, **7/6**

80 ohm CABLE **COAX** Semi-air spaced ¼in. 40 yds. **17/6** 60 yds. **25/-** **6d.yd.**

Ideal 625 lines. Low loss 5dB 100ft. 500 Mc/s **1/6yd.**

MAINS TRANSFORMER 200/250 v. A.C.
Postage 2/- each transformer
STANDARD. 250-0-250, 80mA, 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a., 5 v. 2 a. or 4 v. 2 a., **22/6,** ditto, 350-0-350 **29/6**
MINIATURE 200 v. 20 mA, 6.3 v. 1 a. **10/6**
MIDGET, 220 v. 45 mA, 6.3 v., 2 a. .. **15/6**
SMALL, 250-0250, 45 mA, 6.3 v. 2 a. .. **17/6**
STD. 250-0-250, 65 mA, 6.3 v. 3.5 a. .. **17/6**
HEATER TRANS., 6.3 v. 1½ a. **7/6**
Ditto, tapped 1.4, 2, 3, 4, 5, 6.3 v. .. **8/6**
Ditto, sec. 6.3 v. 4 amp. **10/6**
GENERAL PURPOSE LOW VOLTAGE, 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v. **22/6**
AUTO TRANSFORMERS, 150 w. .. **22/6**
0, 115, 200, 230, 250 v. 500 w. **82/6**
MULLARD "510" Mains Transformer .. **33/6**
MAINS POWER PACKS. Ready built with Transformers, Rectifiers, Condensers, providing H.T. and L.T. outputs.
200 v. 20 ma. D.C. 6.3 v. 1 a. A.C. .. **25/6**
220 v. 50 ma. D.C. 6.3 v. 2 a. A.C. .. **35/6**
250 v. 80 ma. D.C. 6.3 v. 3.5 a. tapped 4v. **45/6** and 6.3 v. 1 a. tapped 5v., 4v., 2a.

INTERVALVE TRANSFORMERS. 3:1 or 5:1, **9/-.**
O.P. TRANSFORMERS. Heavy Duty, **5/6.** Multiratio, **7/6.** Multiratio heavy duty push-pull, 10 w. **15/6.** Battery, **4/6.** Sub. min. DL96, 3V4, etc., **5/9.** 10w. O.P. matching trans., 3, 7, 15 Ω, **12/6.**
L.F. CHOKES. 15/10H. 60/65 mA. **5/-;** 10H. 85 mA, 10/6, 10H. 150 mA, **14/-.**

C.R.T. BOOSTER TRANSFORMERS for heater cathode short circuit or tubes with failing emission. Full instructions supplied. mains input. **Type A optional 25% and 50% boost 2v. or 4v. or 6.3v. or 10.8v. or 12.6v. State Voltage required. PRICE 10/6.**

TINNED COPPER WIRE 16 to 22 swg., ¼lb., **3/6.**
ENAMEL COPPER WIRE 16-22. **2/9:** 24-30, **3/6;** 32-40, **4/6;** D.C.C. 28, 34, 36 swg., 2oz., **3/6.**
FULL WAVE BRIDGE SELENIUM RECTIFIER: 2, 6 or 12 v., 1½ amp., **8/9;** 2 a. **11/3;** 4 a., **17/6.**
CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., **15/6;** 2 amps., **17/6;** 4 amps., **22/6.** Circuit included.
4 AMP CAR BATTERY CHARGER with ammeter, Leads, Fuse Case, etc., for 6 v. or 12 v., **59/6.**

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Valve and TV Tube Eqoivalents..	9/6
TV Fault Finding	5/-
Mullard Amplifier Manual ..	8/6
Radio Valve Guide, Books 1, 2, 3, 4 or 5	5/- each
Practical Radio Inside Out	3/6
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Transistor Controlled Models	7/6
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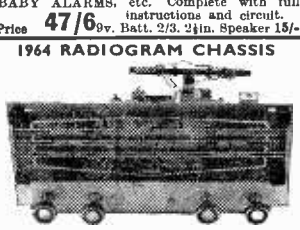
4 TRANSISTOR PUSH-PULL AUDIO AMPLIFIER

Size 3 x 1½ x 1in.

A ready built miniature push-pull amplifier with Driver and output transformers, 4 transistors. Ideal for use with record players, intercoms., BABY ALARMS, etc. Complete with full instructions and circuit.

Price **47/6** 9v. Batt. 2/3. 2½in. Speaker 15/-

1964 RADIOGRAM CHASSIS



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12-month Guarantee
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Post **1/-** (unless otherwise stated)
C.O.D. 2/- extra.

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"none genuine without this seal"

8in. JUNIOR SPECIAL 8w. **5 gns.**
Foam Suspension 40-20,000 c.p.s.

12in. STALWART HEAVY DUTY 15w. **5 gns.** 45-13,000 cps. 3 or 15 ohm voice coils. Unlimited Applications. Response 45 to 13,000 cps. magnet 12,000 lines. Quality unbeatable.

12in. STANDARD HEAVY DUTY 20w. **7 gns.** More powerful magnet 14,000 lines special suspension. 40-14,500 cps. Recommended wherever a high standard of reproduction is desired.

12in. BASS HEAVY DUTY 25w. **12 gns.** New 1964 high power model. Aluminium coil former with magnetic damping 25-15,000 cps. Ideal for all electric guitars.

15in. AUDITORIUM MODEL 35w. **18 gns.** Improved magnet alcomax with heavy plated steel plates, weight 16lbs., 17,000 lines, 20-12,000 cps. Solid heat provided Paxolin Coil Former. Ideal for all Electric Guitars.

LOUDSPEAKERS P.M. 3 OHM. 2½, 3, 4, 5in. 7 x 4in., **15/6;** 6½in. Rola, 16/6; 8in. Plessey, **17/6;** 9 x 6in., 8 x 5in., **21/-;** 10 x 6in., **22/6;** 10in. Rola **30/-;** 12in R A, **30/-;** EMI, Double Cone Ceramic magnet 10 w 13 x 8in, **45/-.** Horn Tweeter, **29/6.**
STENTORIAN HF1012. 10in. 3 to 15 ohms 10w., **92/-;** 8in. HF812, **76/-;** Crossover CX3000, **33/-.**
EXTENSION SPEAKER CABINET. 5in., **15/6;** 6½in., **18/6;** 8in., **19/6;** 10in., **29/6;** 12in., **60/-.**
TWIN GANG TUNING CONDENSERS. 365 pF., miniature 1in. x 1½in. x 1½in., **10/-;** 500 pF Standard with trimmers, **9/-;** midget, **7/6;** with trimmers, **9/-.** 500 pF slow motion tuning standard, **9/-.** Transistor gang 208+176 pF with trimmers, **10/6. SMALL.** 3 gang 500 pF, **17/-. SINGLE** 365 pF, **7/6. SINGLE** 10 pF, 25 pF, 50 pF, 75 pF, 100 pF, 150 pF, **5/6.** Solid dielectric 100, 300, 500 pF. **3/6.**
CONDENSERS. New stock. 0.001 mfd. 7 kV. T.C.C., **5/6;** Ditto, 20 kV., **9/6;** 0.1 mfd., 7 kV., **9/6;** Tubular 500 v. 0.001 to 0.05 mfd., **9d.;** 0.1, **1/-;** 0.25, **1/6;** 0.5/350v., **1/9;** 0.1/350v., **9d.;** 0.01/2,000v. 0.1/1,000v., **1/9;** 0.1 mfd., 2,000 volts, **3/6.**
CERAMIC CONDS. 500 v. 1 pF to 0.01 mfd., **9d.**
SILVER MICA CONDENSERS. 10% 5 pF to 500 pF, **9d.;** 600 pF to 3,000 pF., **1/-.** Close tolerance (+1 pF) 2.2 pF to 47 pF, **1/-.** Ditto 1% to 50 pF to 815 pF, **1/-.** 1,000 pF to 5,000 pF, **1/9.**

FERGUSON QUALITY AMPLIFIER 4 watts
Size 6½ x 5 x 4in. Mains Transformer, 200/250V. Volume and tone controls. Sensitivity 200 m.v. Response 25 to 20,000 cps. Price 49/6. or 2 units matched for Stereo, **89/6.**

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8 p. 4-way 2 wafer long spindle	6/6
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4 p. 2-way or 4 p. 3-way long spindle ..	3/6
3 p. 4-way or 1 p. 12-way long spindle ..	3/6

Wavechange "MAKITS". Wafers available: 1 p. 12 way, 2 p. 6 way, 3 p. 4 way. 4 p. 3 way, 6 p. 2 way, 1 wafer switch, **8/6:** 2 wafer switch, **12/6:** 3 wafer switch, **16/-:** additional wafers up to 12, **3/6** each extra.
Valveholders. EA50, **6d.** B12A, CRT, **1/3** Engl. and Amer. 4, 5 and 7 pin, **1/-.** MOULDED Mazda and int. oct., **6d.;** B7G. B8A. B8G, B9A, **9d:** Ceramic EF50, B7G, B9A, int. oct., **1/-.** B7G, B9A cans **1/-** each. Valve plugs B7G, B9A, int. octal., **2/3.**

HIGH GAIN TV PRE-AMPLIFIERS
B.B.C. Channel 1 to 5. Gain 18dB. ECC84 valve. Kit price **29/6** or **49/6** with power pack. Details **6d.** (PCC84 valve if preferred). Coils only **9/6.**
BAND III I.T.A.—Same prices. Tunable channels 7 to 13. Gain 17dB. Circuit and coils only. **9/6.** Chassis **4/9.**

THE ORIGINAL
RADIO COMPONENT

Our written guarantee with every purchase
NEW COMPONENTS LIST 1/-

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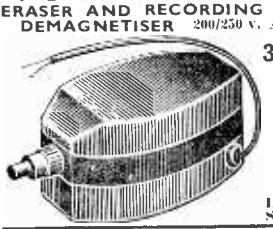
(Wed. 1 p.m.)

THE "INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER 200/250 v. A.C.



35/-

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PLASTIC RECORDING TAPE

		Spare Plastic Reels
Double Play	7in. reel, 2,400ft. 42/-	3in. 1/6
	5in. reel, 1,200ft. 25/-	4in. 2/-
Long Play	7in. reel, 1,800ft. 22/6	5in. 2/-
	5½in. reel, 1,200ft. 17/6	5½in. 2/-
	5in. reel, 900ft. 15/6	7in. 2/6
Standard	7in. reel, 1,200ft. 17/6	
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"EASISPLICE" Tape Splicer 5/- Leader tape 4/6; Splicing tape 3/-.

CRYSTAL SET BOOKLET 1/-.
CRYSTAL DIODE G.E.C. 2/-. GEX34, 3/-, OA81, 3/-. HIGH RES. PHONES. 4,000 ohms, 15/-. 2,000 ohms, 12/6. **MOVING COIL PHONES,** 100 ohms, 10/-. **SWITCH CLEANER.** Fluid squirt spout. 4/6 tin.

"6+1" TRANSISTOR RADIO

First class components to make a 6 transistor 2 waveband superhet chassis. Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, *with car aerial coil*, printed circuit, 8¾in. x 2¾in.. but EXCLUDING Speaker and cabinet. Speakers, 35 ohms, 6 x 4in., 21/- 5in.. 17/6: 3¼in.. 15/6. **£4.5.0**

BULGIN PLUGS AND SOCKETS. Non-reversible P74, 2-pin, 4/3; P73, 3-pin, 4/6; P194, 6-pin, 6/6. **JACKS.** English open circuits, 2/6. Closed circuit, 4/3, Grundig type, 3-pin, 1/3. Grundig lead jack, 3/6. **JACK PLUGS.** English, 3/-; Screened, 4/-; Grundig 3-pin, 3/6. Phono Plugs, 1/-; Sockets, 6d. **ALADDIN FORMERS** and cores, ¼in., 8d.; ⅜in., 10d. 0.3in. **Formers,** 5937 or 8 cans TV1 or 2, ⅜in. sq. x 2¼in., or ⅜in. sq. x 1¼in., 2/- with cores. **SLOW MOTION DRIVES.** 6:1, 4/3. 36:1, 10/6. **SOLON IRON.** 25W, 200V or 230V, 24/-. **ANTEX SUB-MIN IRON,** 15w, 200 or 250v., 32/6. **BENCH STAND** for above, 12/6. Spares in stock. **Paxolin Panels,** 10 x 8 x ⅛in., 2/-. **Miniature Contact Cooled Rectifiers,** 250V, 60mA, 7/6; 250V, 85mA, 9/6, **Selenium Rect.,** 300V, 85mA, 5/-. K3/25, 600V, 5mA, 5/-. RM4, RM5, 14A100, 14A116, 10/- each. FC31, 20/-. **TV etc. Silicon Sub-Min. Rectifiers,** 250V 450mA, 10/-; 250V 150mA, 5/6.

465 kc/s. SIGNAL GENERATORS Price 10/6, ready made with valve 1S5. **POCKET SIZE** 2¾x4¼x1in. One resistor to change, full instructions supplied. Battery 8/6 extra. Details Free.

Coils Wearite "P" Type, 4/- each. **Osmor Midget** "Q" type, adj. dust core, from 4/- each. All ranges. List S.A.E. **Repanco DRR2,** L. and Med. T.R.F. with reaction. 4/6. Med. wave D.R.. 3/6. **Ferrite Aerials,** M., 8/9; M. and L., 12/6. **Osmor Ferrite Rod Aerials,** L. and M. for transistor circuits, 10/- each. **Ferrite Rods,** 8 x ⅜in., 6 x ⅜in., 6 x ⅝ in., 3/-. **H.F. Cokes, 2/6. Osmor QCI, 6/9. T.R.F. Coils,** A/HF, 7/- pair; HAX 3/6. **Screwdriver, 5in., 6d. Test Prods, 2/9 ea. Neoside Trimming Tool, 1/9. Neon Mains Tester Screwdriver, 5/-. Multicore Solder, 4d. yd. Dispenser, 2/6.**

Blank Aluminium Chassis, 18 s.w.g. 4 sides, riveted corners, lattice fixing holes, 2½in. sides, 7 x 4in., 4/9; 9 x 7in. 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6. **Aluminium Panels,** 18 s.w.g., 12 x 12in., 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3; 8 x 6in., 2/-; 6 x 4in., 1/6.

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For Collaro 2 Track Decks 8 gns.
COMPLETE RECORDING & PLAY-BACK AMPLIFIERS
For 2 Track Collaro £11.11.0
TAPE DECKS
Collaro Studio 2 Track £10.15.0
BSR TD2 2 Track Tape Deck £7.5.0
Collaro Record/Erase Heads, ¼ track 35/- pair

MAINS DROPPERS. Midget adjustable sliders 0.3A, 1,000 ohms, 6/-, 0.2A, 1,200 ohms, 6/-; 0.15A, 1,500 ohms, 6/-; 0.1A, 2,000 ohms, 6/-. **LINE CORD.** 3-way 100 ohm ft., 1/- ft. **MIKE TRANSFORMERS.** 50-1, 3/9. **P.V.C. Covered Wire,** single or stranded, 2d. yd. **Sleeving,** 1 or 2 mm., 2d.; 4 mm., 3d.; 6 mm., 5d. yd.

B.T.H. TAPE MOTORS. 115 v. A.C., 12/6 ea. or pair for 230 v., (in series) 12/6.

SPEAKER-FRET. Gold Maroon or Green Cloth 17 x 25in., 5/-; 25 x 35in., 10/-. **Tygan,** various colours 52in. wide from 10/-ft.; 26in. wide from 5/-ft. Sample 1/-. Expanded Metal, Gold, 12 x 12in., 6/-. **Panel** mounting fuse holder, 2/-. Fuses 1¼in. 60mA-5A, 6d. Insulated side cutters, 3/6. 15b strippers, 3/6.

RADIO AND TELEVISION SPARES

All leading makes, volume controls, etc., line output transformers, etc., B. V. A. valves (current and obsolete types). Send S.A.E. for quotation.

WEYRAD P50

COILS AND TRANSFORMERS FOR 2-WAVE TRANSISTOR SUPERHET

Long and Medium aerial—RA2W 6in. rod 208 pF tuning, with car aerial coil 12/6
Osc. Coil P50/IAC 176 pF tuning 5/4
1st and 2nd I.F. P50/2CC 470 k/cs 5/7 each
3rd I.F. P50/3CC 6/-, Spare Cores 6d.
Driver Transformer—LFDT4 9/6
Wavechange Slide Switch d.p.d.t. 3/6
Printed Circuit—PCA1. Size 2¾ x 8¾in. Ready drilled and printed 9/6
Volume Control. 5K-DP 4/6
35 ohm Speakers, 3¼in.. 15/6: 5in., 17/6: 6 x 4in., 21/-.
J.B. Tuning Gang with trimmers 10/6
Constructor's Booklet 2/-
3 ohm O.P. Trans. O.P.T.1 10/6

NEW MULLARD TRANSISTORS
OC71 6/-, OC72 7/6, OC81D 7/6, OC81 7/6. OC44 8/-, OC45 8/-, OC171 10/6, AF117. 9/6.
Sub Miniature Condensers, 0.1 mFd. 30v.. 1/3, 1, 2, 4, 5, 8, 16, 25, 30, 50, 100 mFd. 15 volt. 2/6 ea. Transistor Holders, 1/3.

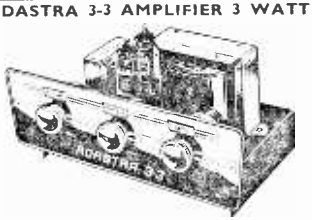
SINCLAIR "SLIMLINE" RADIO Med. wave kit, 2 transistors, 2 diodes, earphone, ferrite aerial. Cabinet 3 x 1¾ x 4in.. 49/6. No aerial required!

Transistor 4 Channel Mixer with 4 separate input/output controls 59/6.

"THE POWER MITE" 45/-

PM9 Mains Unit 9 volt for Transistor Radios. Same size as P.P.9 (200/250V.) Miniature PP3 model 19/6

ADASTRA 3-3 AMPLIFIER 3 WATTS



A.C. 200-250V. Valves ECL86 and EZ80. 3 ohms output. Controls: bass, treble and volume. Separate front panel with de luxe finish. Quality mains transformer. Enamelled chassis 6in. x 5in. x 3in. Price £4.19.6. Details S.A.E.

"Performs agreeably well" (The Gramophone)

BUILD YOUR OWN RECORD PLAYER FROM £9.19.6 AND SAVE POUNDS!!

4 Speed Autochanger or Single Player units with Brand New 2-tone de luxe Cabinets 17 x 15 x 8½in. Strong handle, gilt finish clips and hinges. Used by Famous Make for 20gns. models. Ready cutout motor board 14 x 13in. Front baffle with 7 x 4in. high flux loudspeaker and 3 watt 2 valve UY85, UCL82 amplifier built on metal chassis 12 x 3 x 2½in. Quality 3 ohm output transformer, low hum level circuit. Volume and Tone controls. 3-core safety mains lead. All items fit together perfectly. Special instructions enable assembly in 30 minutes, only 5 wires to join! 12-month written guarantee. Available separately or package deals as below.

AUTOCHANGE KITS COMPLETE (as above)	
B.S.R. Monarch	£11.10.0 P.P. 5/6
Garrard Autoslim ..	£12.18.0 P.P. 5/6
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OR SEPARATELY	
Cabinet with board 14 x 13in. cut out to your choice	£3.9.6 P.P. 3/6
Amplifier with 7 x 4in. speaker	£3.17.6 P.P. 2/6
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B.S.R. UA14	£5.19.6 P.P. 4/6
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Garrard Autoslim ..	£6.17.6 P.P. 4/6
SINGLE PLAYERS	
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BARGAIN XTAL PICK-UP ARM Complete with ACOS LP-78 Turnover Head. 20/-

Replacement sapphire styli 5/-. diamond 15/-. Mono GP59 Xtals 15/-; Stereo Ronnette 30/-.

BARGAIN SINGLE PLAYER KIT 200/250 v. A.C (less cabinet) **£5.15.0** Post 5/-.

With 2-stage Amplifier; 3 watt; 2 valves, UCL82. UY85, High-flux 5in speaker; 4-speed E.M.I. Turntable. 16. 33, 45, 78 r.p.m.; Crystal Pick-up for LP/STD. Records. 7in., 10in.. 12in..; Cut out Mounting Boards 12½ x 9¾in.

ARDENTE TRANSISTOR TRANSFORMERS

D3035, 7.3 CT; I Push-pull to 3 ohms output	11/-
D3034 1.74:1, C.T. Push-pull Driver	11/-
D3058, 11.5:1 Output to 3 ohms, etc.	11/-
D239, 4.5-1 Driver, ¾in. x ¼in. x ¼in.	11/6
D240, 3.5:1 Driver, ¾in. x ¾in. x ¼in.	11/6
ARDENTE TRANSISTOR VOLUME CONTROLS	
VC1545, 5K with switch dia. .9in.	5/3
SUB-MIN. EARPIECE Xtal or magnetic	7/6
SUB-MIN. JACK AND PLUG 2.5 or 3.5 min.	3/6 pair

MINIATURE PANEL METERS Size 1¼in. sq. Precision jewelled bearings, 2% accuracy, silvered dials, black numerals and fine pointers, zero adjustment screw on front of meter.

1 mA	27/6	50μA	39/6
5 mA	27/6	500μA	32/6
300V	27/6	"S" Meter	35/-

MOVING COIL MULTIMETER TK 20a 0-1000 v. A.C./D.C., ohms .0-100k, etc., 49/6. 0-150 ma. pocket size with 2 in. scale.

CRYSTAL MIKE INSERTS, 6/6 High output. Size 1¼in. dia. x ¼in. **ACOS MIC.** insert 1¼in. dia. x ⅛in..... 8/6

ACOS 39-1 DE LUXE STICK MIKE 35/-
TSL QUALITY STICK MIKE..... 25/-
TELEPHONE TAPE MIKE..... 10/6
GUITAR CONTACT MIKE 15/6
MOVING COIL MIKE, high or low impedance, with **FLOOR STAND 147/-**
TANNOY Carbon Hand Mike.... 7/6

Practical Wireless

Vol. XL No. 692 OCTOBER, 1964

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Contents

The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed; The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Owing to the rapid progress in the designs of wireless apparatus and to our efforts to keep readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Good Response

TO trim, or not to trim? That is the question that must have been asked a million times in radio shack or workshop, or the corner of the kitchen table.

A lot of nonsense has been talked about the unforgiveable sin of "twiddling the trimmers". The imputation is that the average radio enthusiast is quite incapable of making tuning adjustments. Such critics need an answer.

It would be foolish to ignore the fact that in the course of every year, many receivers find their way to the professional's service bench, hopelessly out of alignment due to inexpert and haphazard trimmer and core twiddling. Or that many gloomy hours are spent annually by home constructors in futile attempts to peak and calibrate newly constructed sets.

However, those that suffer in this way are usually raw novices, those with no contact with other amateurs, or those who with iron resolve refuse to put themselves out to learn a few elementary facts.

The majority of amateurs are unquestionably more competent and intelligent, and even if they do not have access to the proper test instruments they are able, under certain circumstances, to make adjustments to tune circuits without dire consequences.

When a receiver is known to be aligned—when it has been working, but a fault has developed—there is no objection to an exploratory movement of iron-dust cores and trimmers, provided a few obvious basic rules are observed.

First, cores or trimmers should be moved *one at a time*. If no improvement is noted, they should be returned to the original position before proceeding to the next. Second, a visual indication of output is very much better than trusting to the ear; more delicate adjustment is possible.

Third, where a set is completely out of alignment, the correct sequence of adjustments should be followed—and the possibility of an alternative fault should be investigated before re-tuning. A receiver that is known to be out of alignment, such as a newly-built model, should be aligned "according to the book".

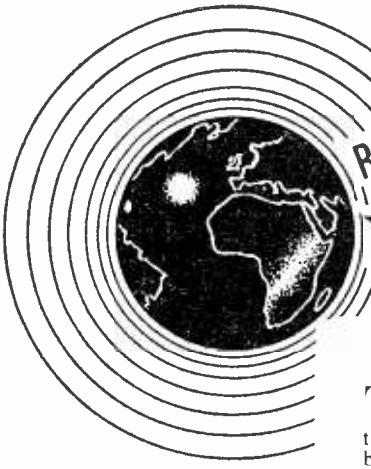
Now the critics must be well aware that most readers of magazines such as PRACTICAL WIRELESS are quite conversant with the above homespun rules. Why, then, their spleen?

It seems to be based on one main bad fault—the chewed-up slug or the trimmer with the cracked insulating washer. This is generally the result of using makeshift tools. Very seldom is it caused by the true enthusiast.

The only real restriction on trimming should be the necessity for test equipment when aligning those circuits that *must* be tuned to an exact response curve. A small movement of any one core of a TV or an f.m. receiver i.f. strip may seem to make little difference, but its effect on the overall response could be deceptively damaging.

We are sure that regular readers will know not only how but *when* to adjust a tuned circuit. And we hope that the trimming tools presented with this issue may prevent a few more slugs becoming chewed up or cracked!

Our next issue dated November will be published on October 7th



ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

Amateur Radio Contacts via the Moon

THE story of amateur radio reached another milestone recently, when radio amateurs in different countries achieved communication via the moon. Pairs of amateur stations have been using signal bounce off the moon to relay radio transmissions in the 2m and 70cm ham bands.

These experiments were undertaken with the new giant 300m radio telescope in Puerto Rico, soon after its completion. (This installation is from time to time being made available for such amateur experiments.) Several contacts have already been logged using this somewhat spectacular amateur set-up, the first being on 13th June, 1964, when KP4BPZ (Puerto Rico), using the giant telescope aimed at the moon as receiver antenna, received signals from a group of Swiss and German amateurs in Hedingen, near Zurich, and, some time later, signals beamed at the moon by the British station G3LTF (Peter Blair) running 80W into a parabolic aerial.

A further successful contact with Puerto Rico via the moon was established by the German station DJ3EN (Hinterzarten/Black Forest) on June 14th. On this occasion, DJ3EN ran 500W on the 2m band into a conventional ten-element Yagi aimed directly at the moon. By the time his signals had been received in Puerto Rico, they had travelled a distance of roughly half a million miles.

ELECTRONIC COMPONENTS CONFERENCE

A ONE-WEEK conference on components and materials used in electronic engineering will be held at the Institution of Electrical Engineres in London from 17th to 21st May next year, concurrent with the 1965 Radio and Electronic Component Show at Olympia.

Subjects to be discussed are recent developments in active and passive components, including integrated circuits, and in the materials of which they are made.

"Resistors", "dielectrics", "capacitors", "microwave ferrites", "electro-mechanical devices", "semi-conductor devices" are a few of the categories for which contributions have been invited for inclusion in the programme.

The conference is being organised jointly by the I.E.E. Electronics Division, the Institution of Electronics and Radio Engineers and the United Kingdom and Eire Section of the Institute of Electrical and Electronics Engineers.

450 Motorcycle Transceivers Ordered

FOLLOWING their successful introduction last year, an order for 450 Ultra 4A5 motorcycle transceiver sets for use by British Police Forces has been received by the Telecommunications Division of Ultra Electronics Limited from the Home Office.

The 4A5 set provides two-way communication on four channels with a standard spacing of 25kc/s. The single superhet receiver design is fully transistorised and uses a 10·7Mc/s i.f. crystal filter. The transmitter, now further transistorised, incorporates quick-heating valves to eliminate standby battery drain. It operates on 6 or 12V supplies.

Ultra have also received an initial order for 26 of their f.m. 4B6 Packsets for use by the Metropolitan Police.

Computer for Scottish University

A LARGE general purpose analogue computer, type 247, costing approximately £19.000, has been ordered by the University of Strathclyde, Glasgow, from the Solartron Electronic Group Ltd., of Farnborough, Hampshire.

This is the fourth 247 computer to be ordered this year, the others having already been installed at the University of Sheffield and two technical colleges. The Glasgow computer will be installed in the Electrical Engineering Department and will be used for the investigation of automatic control systems and general research.

MULLARD INTRODUCE CIRCUIT MODULES FOR TRANSISTOR SETS

A RECENT innovation from Mullard Ltd., which could have the probable effect of standardising more than ever before the design of transistor receivers, is a range of transistor circuit modules for a.m. radios being made available to manufacturers, having the obvious advantages of faster, easier production and greater freedom in cabinet styling.

With these devices a manufacturer will be able to build a receiver around two modules—one constituting the r.f./i.f. section, the other the complete audio amplifier — instead of assembling individual components.

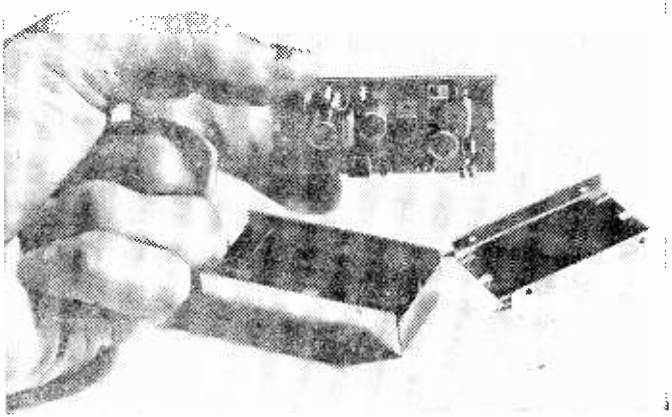
The r.f./i.f. module, type LP1156, is a fully-screened i.f. amplifier and mixer stage (see photograph on this page) covering the short, medium and long wavebands using external oscillator coils. (Other versions are available for medium and long wavebands only, using internal oscillator coils, but all versions measure the same: 2·44in. x 1·19in. x 0·64in.) The mixer stage uses an AF115 transistor and the two stages of i.f. amplification use AF117's, followed by a diode detector (OA90).

The whole module is designed to operate from a 7·6V supply line derived from the audio module.

This latter, type LP1153, is an a.f. amplifier giving an output of 500mW into a 10Ω loudspeaker. It is designed to operate from a 9V supply and it measures 2·01in. x 1·27in. x 1·08in.

The circuit uses an LFK4 transistor package and comprises a d.c.-coupled preamplifier stage and a complementary output stage. Overall d.c. feedback of 10dB is applied to stabilize the working condition and approximately 10dB of a.c. feedback reduces distortion and gain spreads.

To simplify manufacture further, the r.f./i.f. module comes pre-aligned, so reducing the alignment procedure of the complete receiver. In addition fault-finding by the set maker is virtually eliminated since both types of module are given stringent quality control tests during manufacture. Servicing is also simplified, the replacement of a module taking a few minutes only.



Mullard's new r.f./i.f. circuit module.

V.H.F. RELAY STATION IN FORFAR

THE BBC's new television and v.h.f. sound relay station for Forfar, which was brought into service earlier this year, is situated at Harecairn, near Monikie, Dundee. From here it serves an area including southern Angus, northern Fifeshire and small areas of eastern Perthshire and southern Kincardineshire, with transmissions of BBC-1 television and the three v.h.f. sound programmes.

The television transmissions are on channel 5 (vision 66·75Mc/s, sound 63·25Mc/s with vertical polarisation, with the Scottish Home Service on 92·7Mc/s, the Light Programme on 88·3Mc/s and the Third Programme/Network Three on 90·5Mc/s, all with horizontal polarisation.

New Radio Station in British Honduras

A NEW h.f. radio station is to built in British Honduras for Cable and Wireless Ltd., near the city of Belize. It will cost in the region of £100,000 to build and take about 18 months to complete.

The station will be built on a site at Pine Ridge and when finished will comprise two separate buildings, about 800 yards apart, for housing transmitters and receivers, the transmitters being remotely controlled from the receiver building

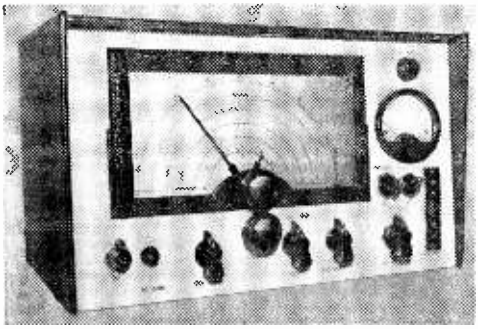
Belize is one of the youngest branches in the world-wide telecommunications network of Cable and Wireless Ltd., and its associated companies. Opened in April, 1962, it faced many difficulties as a result of the devastation caused by hurricane "Hattie", which struck Belize on October 31st, 1961.

A temporary wireless station set up in 1958 was destroyed and much of the equipment lost. An emergency station was set up while negotiations for the company to take over the external telecommunications of British Honduras continued with the Government.

The damage caused by flooding during hurricane "Hattie" emphasised the vulnerability of sites in the city of Belize and it was decided that the new station would be erected further inland on higher ground.

Four transmitters of 1kW each, and five receivers will be installed in the station. A link between the new station and the Central Telegraph Office in Cattouse Building, Belize, will be established by a multi-channel v.h.f. link.

THE "TEN-FIVE"



A 10-transistor double-conversion communications receiver

• s-meter •

• b.f.o. •

• mains powered •

BY A. S. CARPENTER G8ABG

NOW that suitable ready-made coils are available it is possible to construct an excellent Short Wave transistorised receiver possessing a high degree of sensitivity.

The receiver to be described was built primarily to provide signals in the various Amateur bands; it requires no valves and may be run either from a standard 9V dry battery or from the domestic mains supply at 220-240V a.c.. The semi-conductor complement comprises ten transistors and five diodes, two of which are used for a.c. rectification purposes in the mains power supply section.

The receiver is not inexpensive to construct and a fair amount of work is also involved since the design is moderately complicated. Other requirements in the workshop are: A suitable signal generator, a soldering iron fitted with a pencil bit, time, patience—and a pair of strong tweezers!

Sections of the Receiver

The block diagram of Fig. 1 shows the various sections and it will be observed that the "double conversion" principle is employed, for as is well known this technique proves most beneficial on the higher frequency bands. A tuned r.f. stage is also included and this ensures high gain whilst also acting as a buffer stage against oscillator radiation, via the aerial system.

The primary coverage afforded by the tuned section is 1·67—31·5Mc/s (9·5—180 metres) with additional optional coverage of 0·175—1·545Mc/s (194—1700 metres.) These additional ranges are rarely likely to be needed here, however, since they are more easily and conveniently covered using a conventional portable domestic medium/long waveband transistor receiver.

Mechanical bandspreading is provided for the tuned sections via the familiar Jackson "Caliband" drive, this providing by means of its two pointers reduction ratios of 6 and 48:1. Although adequate bandspreading is achieved even on the highest frequency ranges a small panel fitted device—to be described later—is also included, this being most useful for minimising interference caused by an adjacent station.

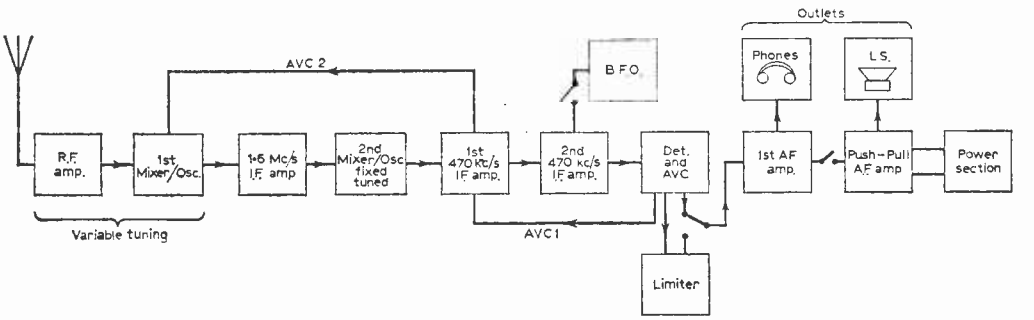


Fig. 1: Block diagram representation of the "Ten-Five" circuit.

It may be noted too that a beat frequency oscillator (b.f.o.) is also fitted together with a "pitch" control to vary the beat note. In addition, the b.f.o. may also usefully be employed in conjunction with the "Pitch" control to make single sideband (s.s.b.) transmissions intelligible.

A signal/tuning meter is fitted and operated by the receiver a.v.c system and because the a.v.c is made inoperative when the b.f.o. is in use the meter pointer reads full scale. In a permanent battery-powered construction it might then be beneficial to arrange for the meter to monitor the applied battery potential but this service was not needed in the prototype due to use of an a.c. mains power unit.

Outlets

Both phone and speaker outlets are provided on the front panel and may be selected as required by means of a switch. The phone outlet is high impedance whilst the "LS" outlet is low impedance and assumes use of an externally connected 3Ω unit. Some 500mW of audio is available under normal circumstances via the loudspeaker. The phones may be left connected or may be removed as required without in any way affecting the receiver.

Consumption

The total quiescent current drain from a 9V supply is 12mA when the speaker outlet is in use but falls to 5mA on phone because the output stages are switched out. Bringing in the b.f.o. adds 0·6mA (600μA) and may be considered negligible. Current consumption changes very little at any time when on phone but if the speaker is in use the demand varies with the signal strength and volume as is usual in push/pull systems of the type employed. The consumption can easily rise to 45mA or more on peaks so the mains transformer supply is obviously preferable on both regulation and replacement counts. The output stage could then be advantageously allowed a larger quiescent current drain. For general phone use, however, a battery is quite satisfactory and a reasonable life can be expected.

Bandchanging

The simple "plug-in" method is employed and because the converter section is fitted with an r.f. stage three coils have to be changed for each band. A total of three sets (nine coils) covers the ranges envisaged so the problem is not very serious.

Each coil is clearly colour coded and fits a standard noval 9-pin valve holder. "Padder" connections present no problem either, for on each coil this connection is brought out to a different pin so that if the holder is appropriately wired the correct padding capacitance is automatically connected for each oscillator coil. Details relating to this and to ranges covered, etc., are given below.

TABLE I

	Blue and Yellow Coils T1—T2				White coils T3				
Maker's range No.	Ls μH	Coverage Mc/s	Coverage Metres	"Q"	Lo	C9	pin	Cto	Copi
1	2350	0·175–0·525	570–1700	60	156	50	6	35	20
2	271	0·515–1·545	194–580	100	66	110	2	20	10
3	27·2	1·67–5·30	57–180	60	13·6	340	3	11	10
4	2·9	5–15·0	20–60	90	2·22	960	4	4·5	—
5	0·65	10·5–31·5	9·5–28	110	2·35	2000	6	1·5	—*

Aerial Coils—Blue, T1. Interstage Coils—Yellow, T2. Oscillator Coils—White, T3.

Ls —Nominal inductive value of tuned winding. (Approximately 15% variation obtainable via dust core).

'Q' —Approximate 'Q' value of tuned winding—mid scale tuning point.

Lo —Nominal inductive value of oscillator tuned winding.

Cq —Padder capacitance value required.

Cto —Oscillator pF trimmer capacitance extra to 39pF assumed circuit capacitance.

Copi —Additional fixed capacitance recommended across tuned winding as appropriate using plug-in band changing method. *Note:* panel fitted TC4 accomplishes this.

*Harmonic mixing used on this range, the second harmonic being automatically present at alignment.

Note that Table I shows all coils available although only ranges 3-5 are likely to be required here.

CIRCUIT DESCRIPTION

Converter and 1st 1·6 Mc/s I.F. Amplifier

The converter, intermediate frequency stages, a.v.c., demodulating and limiting sections are shown in Fig. 2. (a) and (b).

The first two transistors, Tr1, Tr2 (AF115) are the active elements of the converter, Tr1 being the r.f. amplifier feeding Tr2 as mixer oscillator. Signals from the aerial are here converted to the 1st intermediate frequency, viz., 1·6Mc/s and since no direct pick-up at this frequency is required a simple wavetrap is inserted in series with the aerial.

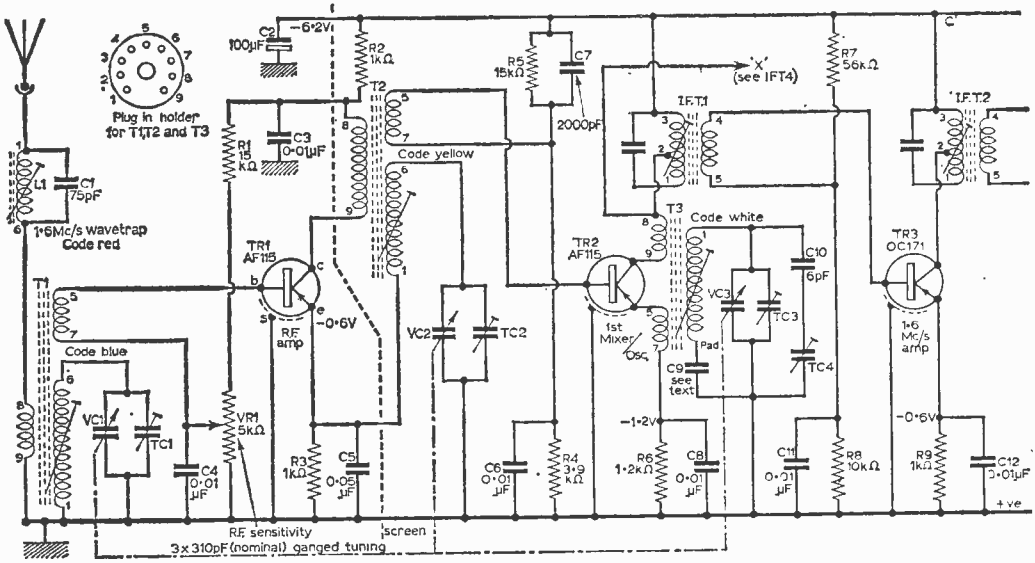


Fig. 2 (a): The r.f. amplifier, first frequency changes and 1·6 mc/s i.f. stages of the circuit.

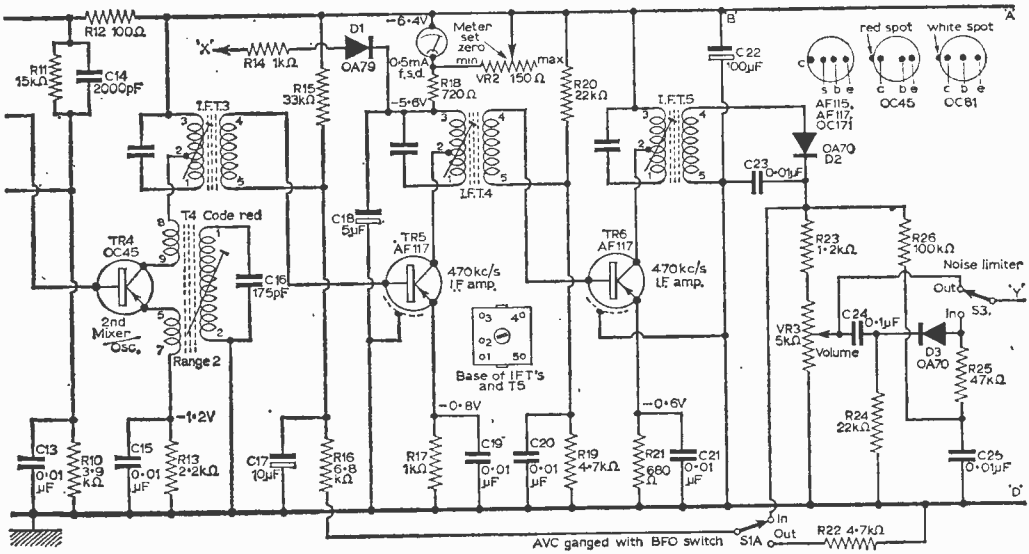


Fig. 2 (b): The second frequency changes, 470 kc/s i.f. amplifier and detector.

The coil (L1) used here is a range 2 (Denco) *valve* type, the quoted inductance value of which is 129µH for the main winding. This is roughly resonated at 1·6Mc/s by C1, fine adjustments being made using the variable core. A single winding high "Q", 1·6Mc/s filter coil could be used as an alternative.

The sensitivity of the r.f. stage is controllable to some extent by means of VR1 which is brought out to the panel. The control normally needs to be retarded when s.s.b. transmissions are being received but it has also been noted that the gain—as indicated by the signal meter—does not necessarily increase when VR1 is turned fully up. Sometimes the reverse is the case depending on the band in use and might be due to the transistor characteristics.

Coils T1, T2 and T3 are the plug-in types

already referred to, each being tuned by a section of the 3-gang capacitor VC1/2/3 fitted with trimmers. The tuned sections of each transformer are coupled to the appropriate circuit by mutual inductance.

Signals at 1·6Mc/s appearing at Tr2 collector are next applied via a transformer to the base of Tr3 (OC171) for further amplification at this frequency, so increasing the need for the aerial trap.

Converter Trimming

Although variable r.f. trimmers, panel mounted, are feasible to compensate for errors due to band-changing, the first oscillator is controlled by means of TC4, labelled (Osc. Trim). In use it is assumed that the first stage is damped by the aerial so that it remains either to trim the interstage circuit to fit the oscillator or vice versa, the oscillator adjustment being preferred here since it helps compensate for C_{to} and C_{opl}, Table I.

In practice TC4 is initially set to about half capacity and the tuning mechanism operated in the usual way to resolve a signal. Should this seem "pruned" away. C10 may also be made to limit maximum circuit capacitance as required.

Second Converter and 470kc/s I.F. Amplifier

When the 1·6Mc/s signals from Tr3 are applied to Tr4 a second frequency conversion takes place. The second i.f. amplifier operates at 470kc/s and because T4 can be fixed tuned the oscillator may operate at a frequency lower than that of the signal, i.e., at 1·13kc/s. The coil (code red—range 2) *must* be screened, using the can provided; it has a tuned winding, quoted inductance value of 129μH and so requires a capacitor of approximately 170pF across it, although in practice accurate setting is accomplished with its core. This second converter could be operated at 2·07Mc/s if preferred, but use of a different coil would be advisable to allow adequate shunt capacitance to be added whilst Tr4 would need to be an OC44.

The 470kc/s i.f. amplifier is conventional except that transistors from the Mullard "AF" range are used instead of the more usual OC45 types which would necessitate additional items in the form of neutralising components. All the i.f. transformers

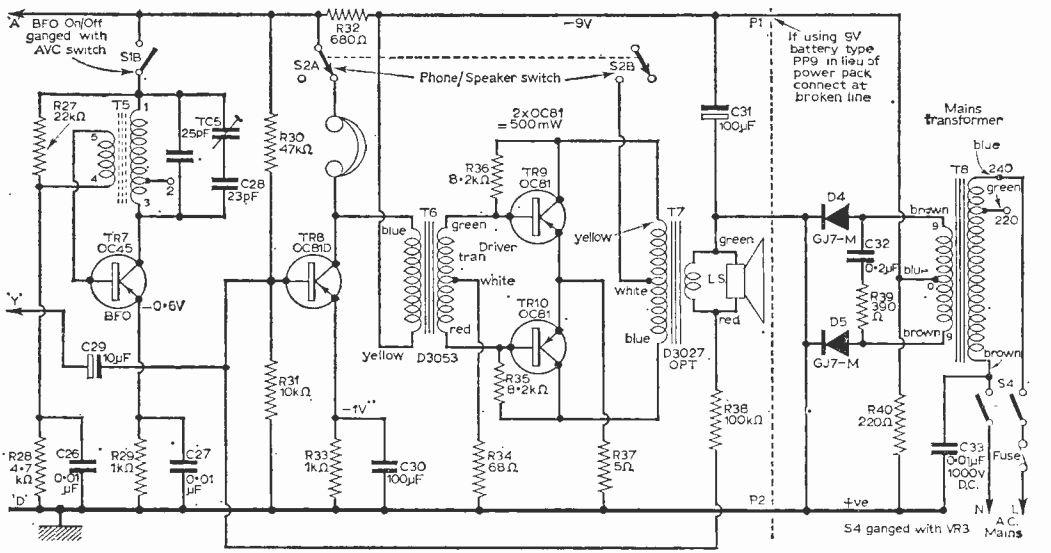


Fig. 2 (c): The b.f.o. and audio sections, plus the power supplies.

weak, the pointer mechanism is moved a fraction to one side of the transmission and TC4 experimentally adjusted. It is quickly evident which way the main pointer must go by watching the signal meter. TC4 is also useful for picking out a single transmission from a clutter, for losing adjacent c.w., etc., quality being unimportant. Sometimes a "returning" station is very slightly off frequency and TC4 is then particularly useful, for the main dial needs no alteration, both stations being heard in turn merely by moving TC4 to and fro. A large value capacitor must *not* be used for TC4 and the total number of vanes should be four, others being are single tuned and selectivity is quite good. The circled figures associated with all coils and i.f. transformers refer to their basing connections for which a key is provided (Fig. 2).

The signal meter in the collector circuit of Tr5 reads in reverse but this is not important. (It could, however, be mounted upside down to give a left to right needle movement but would require a new scale.)

As the bias varies at the base of Tr5 due to demodulator action, a large rectified signal tends to cut off the collector current thereby causing the meter pointer to fall back. The meter records

COMPONENTS LIST

Resistors:

R1	15kΩ	R21	680Ω
R2	1kΩ	R22	4·7kΩ
R3	1kΩ	R23	1·2kΩ
R4	3·9kΩ	R24	22kΩ
R5	15kΩ	R25	47kΩ
R6	1·2kΩ	R26	100kΩ
R7	56kΩ	R27	22kΩ
R8	10kΩ	R28	4·7kΩ
R9	1kΩ	R29	1kΩ
R10	3·9kΩ	R30	47kΩ
R11	15kΩ	R31	10kΩ
R12	100Ω	R32	680Ω
R13	2·2kΩ	R33	1kΩ
R14	1kΩ	R34	68Ω
R15	33kΩ	R35	8·2kΩ 5%
R16	6·8kΩ	R36	8·2kΩ 5%
R17	1kΩ	R37	5Ω
R18	720Ω	R38	100kΩ
R19	4·7kΩ	R39	390Ω
R20	22kΩ	R40	220Ω

All ± 10% ½W miniature carbon, unless otherwise stated.

Potentiometers:

VR1 5kΩ
VR2 150Ω
VR3 5kΩ with double-pole on/off switch (S4).

Coils and Transformers:

IFT1 I.F. transformer. Denco IFT16
IFT2 I.F. transformer. Denco IFT16
IFT3 I.F. transformer. Denco IFT13
IFT4 I.F. transformer. Denco IFT13
IFT5 I.F. transformer. Denco IFT14
T1 See Table 1; plug-in transistor coil. Denco (blue)
T2 See Table 1; plug-in transistor coil. Denco (yellow)
T3 See Table 1; plug-in transistor coil. Denco (white)
T4 Miniature valve-type coil. Denco range 2 (red)
T5 B.F.O. transformer. Denco IFT14
T6 Driver transformer. Ardente D3053 (with clamps)
T7 Output transformer. Ardente D3027 (with clamps)
T8 Mains isolating transformer. Norcol or Osmor MT9
L1 Miniature valve-type coil. Denco range 2 (red)

Variable Capacitors:

VC1, 2, 3 310pF (nominal) 3-gang tuning capacitor with feet and trimmers (TC1, 2, 3). Jackson "F".
TC1, 2, 3 Trimmers on VC1, 2 and 3.
TC4 See text. Jackson "Air Tune".
TC5 25pF. Jackson "Air Tune".

Capacitors:

C1 75pF mica
C2 100μF electrolytic 12V
C3 0·01μF ceramic or paper
C4 0·01μF ceramic or paper
C5 0·05μF paper
C6 0·01μF ceramic or paper
C7 2,000pF mica
C8 0·01μF ceramic or paper
C9 see Table 1
C10 6pF see text
C11 0·01μF ceramic or paper
C12 0·01μF ceramic or paper
C13 0·01μF ceramic or paper
C14 2,000 pF mica
C15 0·01μF ceramic or paper
C16 175pF mica
C17 10μF electrolytic 6V
C18 5μF electrolytic 12V
C19 0·01μF ceramic or paper
C20 0·01μF ceramic or paper
C21 0·01μF ceramic or paper
C22 100μF electrolytic 12V
C23 0·01μF ceramic or paper
C24 0·1μF paper
C25 0·01μF ceramic or paper
C26 0·01μF ceramic or paper
C27 0·01μF ceramic or paper
C28 23pF see text
C29 10μF electrolytic 6V
C30 100μF electrolytic 6V
C31 100μF electrolytic 12V
C32 0·2μF paper
C33 0·01μF paper 1,000V

Semiconductors:

Tr1	AF115	Tr5	AF117
Tr2	AF115	Tr6	AF117
Tr3	OC171	Tr7	OC45
Tr4	OC45	Tr8	OC81D
Tr9	OC81 } Matched		
Tr10	OC81 } pair		
D1	OA79	D4	GJ7-M
D2	OA70	D5	GJ7-M
D3	OA70		

Switches:

S1a, b 2-pole, 2-way
S2a, b 2-pole, 2-way
S3 Single-pole change-over toggle
S4 Double-pole on/off switch on VR3

Miscellaneous:

Meter 500μA f.s.d. movement. 9½in. x 6in. x $\frac{1}{16}$in. piece of paxolin. Nine tag strips. Lektrokit LK-2231. Aerial socket. 16 s.w.g. aluminium for flanges and screen. Two transistor mounting clips. Battery connectors. Phones/speaker outlet sockets. Jackson "Caliband" dial and drive assembly. 3 Noval low-loss valve-holders. Tags, wire, etc.

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all changes of signal strength and can thus be used usefully as a tuning indicator and alignment aid. A 500μA meter movement shunted by a preset variable resistor enables accurate f.s.d. setting as required, at the same time temporarily removing the a.v.c. bias, i.e., by rotating S1A to "Out". Small panel type meters are easily obtainable.

The A.V.C. System

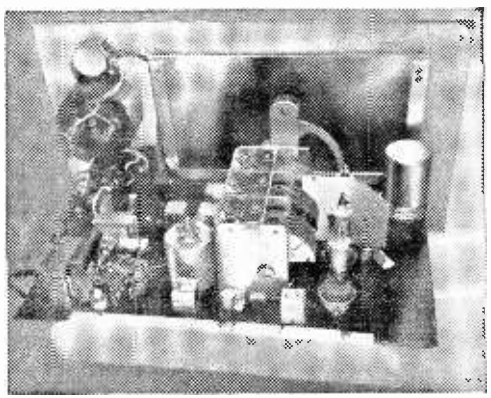
Diode D1 in connection with Tr5 collector circuit is arranged to be non-conductive on small or moderately strong signals, the reverse bias applied being in fact 0·6V. When a very strong signal is tuned in, however, a proportionately

greater bias is applied to Tr5 due to D2 which provides bias at all times, whereupon the potential at C18 changes sufficiently for D1 to conduct and thereby damp the first i.f. transformer to reduce gain still further. Simple undelayed a.v.c. thus initiates a delayed a.v.c. characteristic.

The B.F.O. and Audio Sections

The audio content of the demodulated signal appears across VR3 and is available as required via the slider, S3 determining whether the signals are extracted direct or via the simple series limiter circuit associated with D3. Carrier level maintains D3 in a conducting state but a sudden burst of noise results in cut-off so that the signal path is broken when the switch is set to "In". Distortion occurs particularly at high volume settings and there is heavy attenuation although the circuit proves useful when listening on 'phones.

The audio stages proper plus the b.f.o. are shown in Fig. 2(c). The b.f.o. calls for little comment since it is a conventional feedback-type



A rear view of the finished receiver.

oscillator operated close to the intermediate frequency, the precise value being controlled by panel-fitted TC5, labelled "Pitch". CW signals may then be conveniently heterodyned and in addition s.s.b. transmissions may be read. Sufficient b.f.o. injection results due to stray couplings; it may be noted that C28 is not required if a 15pF maximum capacity air-spaced variable trimmer is available for use at TC5.

The audio signal is fed via C29 to Tr8, this being a conventional audio driver transistor stage (OC81D) feeding the push/pull output pair, Tr9/10. Fitment of the phone outlet in the collector circuit of Tr8 has no adverse effect on performance for R32 is in series with the phones across the driver transformer when this function is in use. Signals of moderate phone strength are actually available at points "D" and "Y" but the amplification afforded by Tr8 is worth while using.

The output transistors bias arrangement calls for some comment. As is well known forward bias for a pair of output transistors worked in push/pull is frequently achieved by connecting the driver transformer secondary winding centre tap to a fixed potentiometer connected across the supply battery, etc. Here the lower member of such a potentiometer is R34 but the upper section (normally approximately 4·7kΩ) is not connected to the −9V line. Instead two resistors are used (R35/36) and connected between base and collector on each of the output pair. This arrangement not only simplifies phone/l.s. switching (Tr9/10 are completely disconnected at phone) but also introduces some degeneration due to a.c. feedback and this materially assists the overall performance in several ways, at the expense of a small amount of gain. A small portion of the output at T7 is also fed back degeneratively across the amplifier via R38 but apparent increased sensitivity results if the resistor is omitted. It may be noted that the driver and output transformers used in the prototype are Ardente, but there is no reason why equivalent types by other manufacturers should not be used.

Powering the Receiver

Power requirements were detailed earlier and although the prototype uses an internal mains unit this is by no means essential for the construction is such that a PP9 battery will stand neatly in the area here occupied by the mains components, rectifiers, etc. Expense may be minimised initially by using the battery and adding the mains items required later. In the main, however, battery powering is uneconomical for in common with all transistor receivers batteries have to be discarded when their potential has fallen by some 30% and many volts are thrown away.

As may be seen from the illustration the mains transformer, T8, is quite small physically and is only about one quarter the size of a conventional heater transformer! The primary winding is appropriately tapped and a single secondary supplies 9-0-9V which is rectified by a pair of sub-miniature GJ7M diodes. These require no heat sinks due to low current demands. The resultant d.c. potentials are fed to the positive and negative receiver rails, R40 being included to assist in some degree, voltage stabilisation in association with C31. An automatic "earth" results from fitting C33. No heating has occurred in the prototype even after allowing the receiver to run continuously for several hours. Constructors who do not wish to include this section should omit all items to the right of the broken line in Fig. 2(c) yet retaining "On/Off" facilities via the switches integral with the volume control. Care must be taken to check that polarity is correct.

continued next month

INEXPENSIVE INTERCOM SYSTEM

by P. D. de Lacey and A. T. Chattaway

THE intercom described here was designed to be built at low cost and to use, as far as possible, existing equipment. It provides a means of speech communication between house and workshop, and may also be used as a private telephone link between adjacent houses. It has the advantage that the sound is reproduced at sufficient volume to be heard throughout an average-sized room, leaving the user at the "slave station" free to continue his work while holding a conversation with his counterpart at the "master station".

Construction of the Master Station

The use of a loudspeaker as the microphone, whilst not giving an ideal frequency response, simplifies the construction to a great extent. Most enthusiasts will have at least one amplifier suitable for this purpose, the only features required being that (a) it will give a loud output using, as a microphone, a loudspeaker similar to that for which its output is matched, and (b) it has one terminal (earth or chassis) common to the input and output circuits (this avoids unnecessary complications in the switching arrangements). Most radiograms come into this category. The circuit of the master station is shown in Fig. 1.

Two sockets and a double-pole double-throw switch are screwed to the case of the amplifier. One of the sockets is connected to the earth or "common" lead of the amplifier, and the other to two diagonally opposed end terminals of the switch. The remaining two end terminals are connected to the side of the loudspeaker which is not earthed. The connection which formerly went to this terminal of the loudspeaker is now joined to one of the centre terminals of the switch, and the other centre terminal to the non-earthed side of the "gram-input" sockets. The switch should then look like Fig. 2.

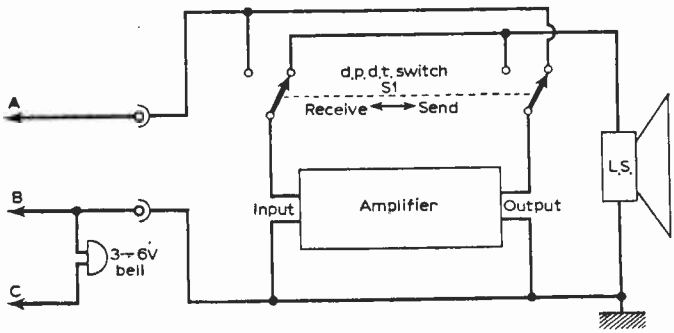


Fig. 1: Circuit of the master station.

Construction of the Slave Station

The slave station consists of a loudspeaker, as nearly as possible identical with that at the master station; a battery suitable for operating the bell (or buzzer) at the master station; and a push-button switch.

The circuit diagram is given in Fig 3. No constructional details are given since these will vary according to the cabinet used. The push-button S2 is to ring the bell at the master station, which should then call up the slave station.

Completion of the Intercom

The wires marked A, B and C in Fig. 1 are joined to the sockets marked A, B and C in Fig. 3 respectively. Suitable wire may be purchased for about 10s. per half-mile. A valuable saving can be made by using the earth connection of the mains power supply for the connection marked C. This cannot, of course, be done where the "two-pin" fixtures are in use. DO NOT USE THE MAINS EARTH FOR A OR B AS IT WILL INTRODUCE A LOUD HUM.

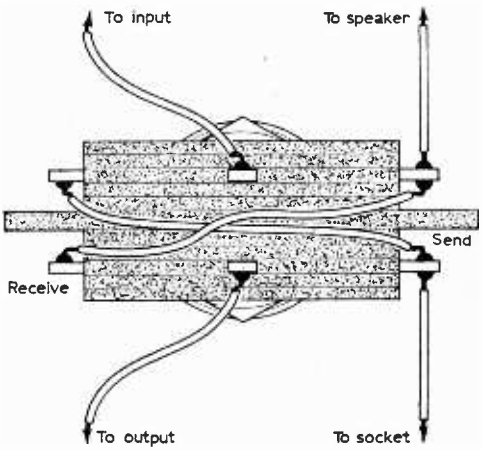


Fig. 2: Wiring of S1.

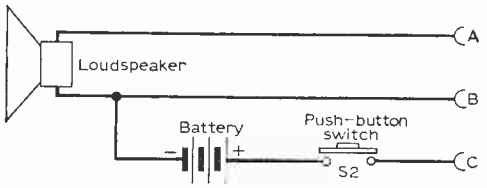


Fig. 3: Slave station circuit.

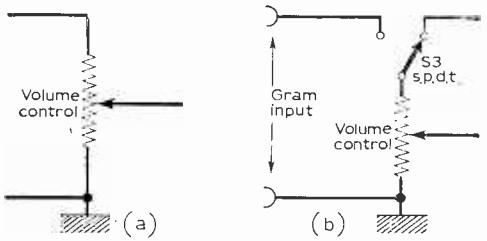


Fig. 4 (a) and (b): These show, respectively, the receiver volume control before and after the incorporation of a gram input socket and S3.

Transistorisation of the Unit

A valve amplifier needs to warm up before use and hurried calls may be delayed because of this. A transistor amplifier is therefore recommended. If a transistor radio is owned the chances are that it is not fitted with sockets for "gram input".

COMPONENTS LIST

R1	100kΩ	R2	1MΩ	R3	3kΩ
All	±20% ¼W miniature				
C1	2μF electrolytic 12V				
C2	2μF electrolytic 12V				
Tr1	OC71				
S1	D.P.D.T. switch				
S2	Bell-push switch				
S3	S.P.D.T. switch				
S4	D.P.D.T. switch				

These can be fitted very simply by connecting the sockets across the volume control (in most radios). A switch should be fitted to disconnect the radio while using the amplifier. Fig. 4 (a) shows the volume control before alteration and Fig. 4 (b) shows it afterwards.

If this gives insufficient volume, a pre-amplifier is needed. This will follow the circuit of Fig. 5. The transistor is a "red spot" or OC71.

The resistors in Fig. 5 may be ¼W, 20% tolerance types. The capacitors should have a voltage rating of at least 12V. The simplest method of construction is to solder the transistor, 100kΩ and 1MΩ resistors, and the capacitor direct to the sockets and the 3kΩ resistor and other capacitor direct to the switch.

Using the Intercom

After everything has been correctly connected up, the master station should be switched on, the "gram-radio" switch should be put in the "gram" position, the "send-receive" switch in the "send" position, and the volume control adjusted to about half its maximum value. The user should then make some suitable announcement and switch the "send-receive" switch to the "receive" position, when he should hear suitable comments from his colleague at the slave station. The best position to mount the "send-receive" switch is on the left-hand side of the cabinet, as it can then be operated with the left hand, leaving the right hand free to take notes if necessary. The volume control, if it incorporates the "on-off" switch, should be marked to enable the most convenient position to be selected each time it is switched on. The user soon acquires the knack of switching over the "send-receive" switch to listen or speak.

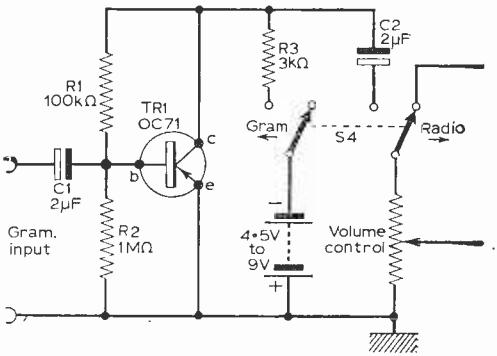


Fig. 5: Circuit of the preamplifier.

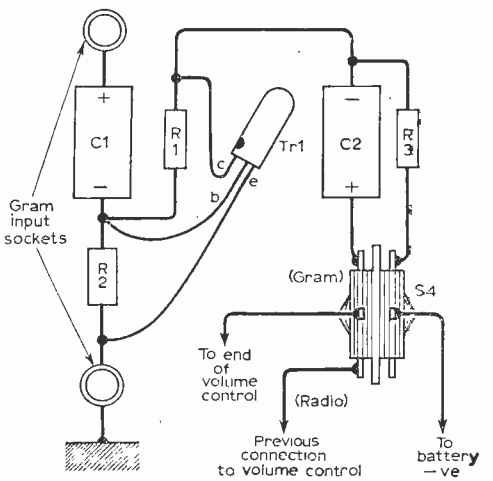
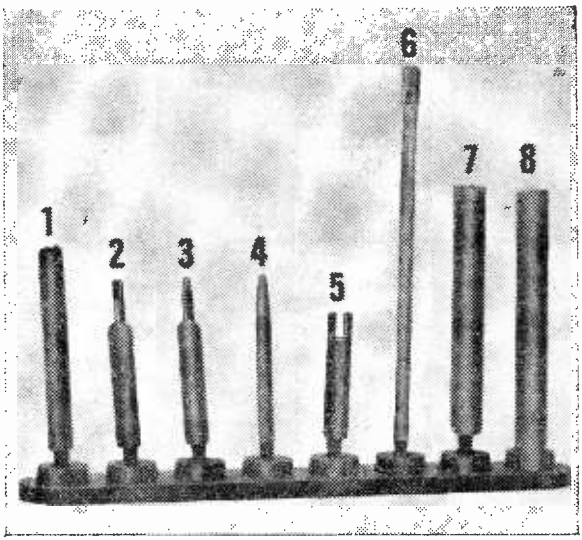


Fig. 6: Construction details of the preamplifier.

The PRACTICAL WIRELESS TRIMMER and ALIGNMENT SET



TRIMMING tools are not only essential to anyone undertaking serious constructional work on receivers, but they are expendable. This is not to say they necessarily get broken, but like the canteen spoon they are liable to become elusive at the critical moment—usually because someone else has borrowed them.

Many readers, no doubt, already have a set of trimming tools, in particular those who obtained the set we presented with the April issue this year. Others make do with improvised trimming tools fashioned from plastic knitting needles or other suitable materials. We are certain, however, that all readers will welcome the new set of tools being presented with this issue—whether they already have trimming tools or not.

The new set is based on the first set but is designed in a different way. Thus the two sets may be, in some ways, complementary. One great improvement is the material from which the new tools are made; this is a new very tough plastic, admirably suited for such applications.

The photograph in the heading shows the tools assembled, and a description of their uses follows:

No. 1 has a wide "screwdriver" blade (though it should not be used as such!) and is used to adjust mica and ceramic trimmers, ferrite pot cores, and slotted hex-nut compression trimmers.

No. 2 has a fine, narrow blade for the adjustment of slotted cores widely used in transistor radio receivers. The slots are often carried right through the core and the correct method of adjustment is to insert the trimming tool as far as possible before turning, to reduce torsion. Since this is a very popular size, two of these are provided in this kit, No. 3 being a duplicate.

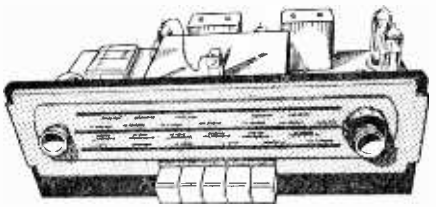
No. 4 has a blade suitable for the majority of iron dust cores employed in radio and television receivers (except transistor radios).

No. 5 has a slotted end which may be used for turning the flattened shank (usually brass) which is used to move a ferrite core in the coil of many radio sets and television turret tuners.

No. 6 is for adjusting tuning slugs with hexagon-shaped holes. This has a long shank so that it may be used with transformers fitted with two such slugs one above the other. The trimming tool is inserted through the upper slug without disturbing its setting, then inserted into the lower slug which can then be adjusted independently, the diameter of the shank is small enough for it to rotate in the hexagon bore of the upper slug.

Nos 7 and 8 are extension shanks. Each has a hole in the top for receiving the spigot of any of the other trimming tools. No. 7, in addition to the hole, also has a spigot, so that it may be inserted into the end of No. 8, thus exending even further the length of the composite tool.

BRAND NEW AM/FM (V.H.F.) RADIO GRAM CHASSIS AT £13.13.0 (Carriage Paid)



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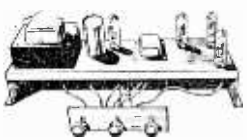

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7in. Long play, 1,800ft.	19/6	ACETATE BASE	
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3in. 450ft.	12/6		
4in. 900ft.	22/6	MESSAGE TAPES	
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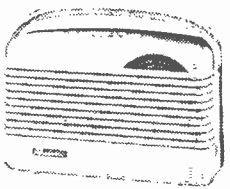

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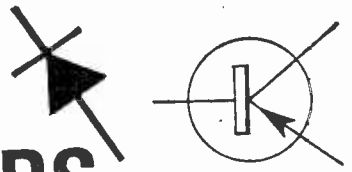


BY LESLIE MOORE

THE series aims to give the reader a basic knowledge in the use of semiconductors and the principle of operation of several different types of circuit. It also aims to give the amateur ability to design these basic circuits with a minimum knowledge of mathematics. A knowledge of Ohm's law and the basic operation of components such as inductors, capacitors, etc., will be taken for granted.

CONTENTS OF SERIES

The principle of operation of the crystal diode with a brief explanation of their atomic structure, the circuit symbol of the diode and an illustrated explanation of the junction diode as a half-wave rectifier.

Reasons for full-wave rectification, introduction to power supplies, rectification, smoothing, stabilisation. An explanation of the smoothing circuit will be given. The zener diode and its use as a stabiliser and the conversion of thermionic rectifiers to semiconductor rectifier circuits.

An explanation of the principle of operation of the transistor, its use as an amplifier and an explanation of the derivation of a formula for current gain. The grounded emitter amplifier, input impedance, output impedance, impedance matching between stages. Frequency response of the amplifiers, negative feedback, the emitter follower. Summary of amplifier.

Oscillators—comparing the oscillator to an amplifier with feedback; the Wein bridge, phase-shift oscillators; an L.C. oscillator.

The free-running multivibrator with a brief explanation of the other multivibrators that exist ($\div 2$ ccts, etc.).

No circuits will be given as typical examples of working models. It will not be possible to include the whole of one subject in one article except that of the explanation of the principles of operations of single articles, e.g. introductory passage.

THE OPERATION OF THE CRYSTAL DIODE

Since the introduction of crystal diodes as an electronic device an amazing revolution has taken place. The semiconductor has now become a part of the modern way of life; to enable a greater understanding of their uses and applications this series of articles has been written.

A basic knowledge of atomic structure is necessary to enable the understanding of the operation of semi-conductors.

An atom, the smallest obtainable particle of an element, consists basically of a nucleus encompassed by orbiting particles known as electrons.

The nucleus contains several different sized particles the largest of which are the neutron, an electrically neutral particles, and the proton, which is of equal mass to the neutron but holds a positive electrical charge. The number of protons in the nucleus is equal to the number of orbiting electrons. Electrons orbit the nucleus in a set manner as can be seen in Fig. 1.

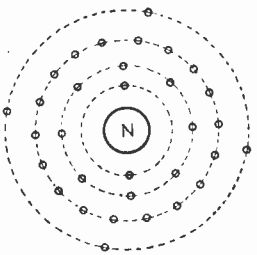


Fig. 1: The germanium atom.

The germanium atom has 32 orbiting electrons set in fixed paths known as shells. The first shell contains two electrons, the second eight, the third 18, the fourth four, but in other atoms is capable of holding as much as eight electrons.

Copper has only 29 orbiting electrons, hence it has only one electron in its outer shell. The nucleus has little influence over the single electron because of the comparatively large distance between the two; on the application of an external electrical force the single electron can be easily attracted away from the atom. This enables copper to be a good conductor of electricity, electricity being the flow of electrons.

Germanium, however, has four electrons in the outer shell, so that a greater attraction between the outer shell and the nucleus is established, making the attraction of electrons from the atom difficult. Because of this characteristic germanium is known as a semiconductor.

The atoms in a germanium crystal form themselves in such a manner so that each atom shares each one of the electrons in its outer shell, with another atom making it appear that each atom has a full outer shell of electrons. The formation is known as the crystal "lattice".

If small quantities of (a) arsenic and (b) gallium are added to germanium crystals the following will occur:

(a) Arsenic has five electrons in its outer

shell and an arsenic atom will take place in the lattice as a germanium atom: this will leave a single atom to orbit the arsenic atom. As electrons hold a negative charge this material is known as "n" type.

(b) Gallium has three electrons in the outer shell and if a similar occurrence happens as before, neighbouring atoms in the lattice will share their electrons with the gallium atom but

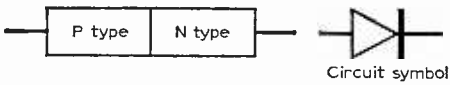


Fig. 2: Make-up of the semiconductor. The bar of the circuit symbol is equivalent to the cathode of the thermionic diode.

in return can only share three atoms with the germanium. Between two atoms, therefore, there will be a space, one electron missing, which is called a "hole". Because the electrons have a negative charge and the holes indicate a lack of negative charge the holes are said to have a positive charge; this material is called "p" type.

If an alternating voltage were to be applied to the diode the action previously described and as shown in Fig. 3 would occur.

It has been explained how a semiconductor diode could be used as a half-wave rectifier. The problem with this method is one of power consumption: the half-wave not seen in the output is returned back to the supply, so that half the current drawn from the supply is wasted. If the diode were to be connected as shown in Fig. 4, on the half-cycle which is not seen at the output, no current would be drawn from the supply.

The application of rectifying circuits in electronic circuitry is most prominent in power supply units.

For reasons of economy the vast majority of mains supplies in this country are alternating current (a.c.) rather than direct current (d.c.).

The majority of electronic equipment requires a direct current supply and to produce this an a.c. to d.c. power supply unit is used as shown in Fig. 5.

The rectifying circuit produces a pulsating direct voltage from an alternating voltage. A half-wave rectifier may be used for this purpose but the average output voltage is low compared with the

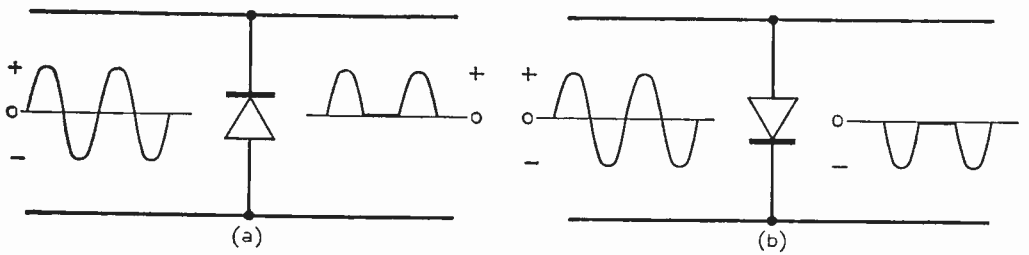


Fig. 3: The action of half-wave rectification: (a) obtaining a positive pulsating direct current; (b) a negative pulsating direct current.

When a junction is made by joining a "p" type crystal to an "n" type crystal the additional electrons in the "n" type begin to flow into the "p" type for a short period and form a barrier at the junction, preventing any further flow of electrons.

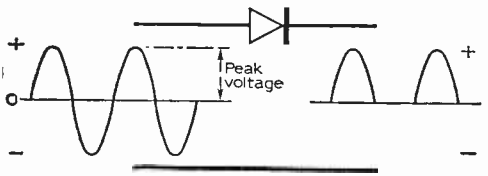


Fig. 4: Arrangement for drawing no current from the supply.

The junction barrier so formed is of such a manner to allow electron flow to take place when an external voltage source is applied to the junction, making the "p" type of positive potential with respect to the "n" type. When the voltage or "bias" is reversed the junction will not conduct.

peak voltage of the input. A more efficient but more expensive arrangement is the full-wave rectifier which is a combination of a number of semiconductor diodes. This is shown in Fig. 6.

(1) On the application of a positive half-cycle of alternating voltage it is seen that diode (a) will

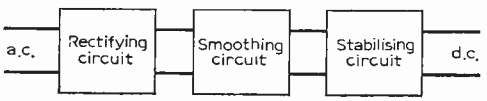


Fig. 5: Block diagram of a power supply.

conduct current but diode (b) will not, so that the positive half-cycle will appear at point A.

(2) On the negative half-cycle the signals will be seen by diodes (c) and (d). Diode (d) will not conduct current under this condition but diode (c) is biased to enable it to conduct current. The negative half-cycle will therefore appear at point B.

If the output terminal B is held at a steady voltage, usually zero voltage or "earth", the second half-cycle will appear as a positive voltage at A with respect to B.

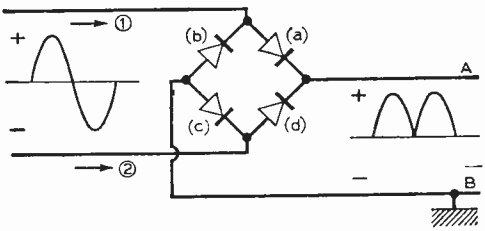


Fig. 6: The full-wave rectifier.

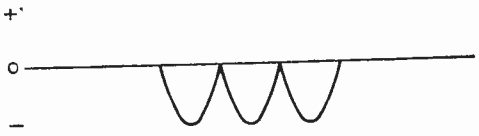


Fig. 7: The waveform obtained when terminal A is held at steady voltage instead of B.

If a "negative voltage" is required it is in order to hold terminal A at a steady voltage, instead of B, and the voltage at B will appear to be a pulsating negative direct voltage (see Fig. 7).

It is obvious that the full-wave rectifier produces an average voltage greater than that produced by the half-wave rectifier for the same input voltage.

Another advantage of the full-wave rectifier will become apparent when smoothing circuits are dealt with.

The basic component of a smoothing circuit is a capacitor as depicted in Fig. 8.

As the first input pulse is applied the capacitor draws current from the rectifier circuit and charges to the peak voltage. If a normal load (or a current drawing circuit) is placed across the capacitor, after the first pulse is applied, the capacitor will then supply current to the load.

Because current is being drawn from the capacitor the voltage across it will drop; the rate at which the voltage across the capacitor falls is much less than the rate at which the voltage from the rectifier falls. The voltage supplied to the load will begin to rise after the rising voltage of the second pulse from the rectifier coincides with the falling voltage across the capacitor.

The waveform due to the changing voltage difference across the capacitor is known as voltage ripple.

There are numerous types of smoothing circuits used, all of them employing the charging of one or several capacitors.

For very good smoothing a filter network, as shown in Fig. 9, is used.

The inductance or choke, L, opposes alternating voltages without dissipating excess power. The capacitor C' functions in a similar manner to capacitor C, reducing even more the voltage ripple.

A less expensive method is to replace the inductance by a resistor. The resistor opposes direct and alternating voltages equally. The effectiveness of smoothing in this case is less than the first.

The type of smoothing used for a circuit is entirely dependent on the degree of d.c. the circuit is required to produce.

The stabilising circuit involves more complex components and will be dealt with later in the series.

In many commercial radio receivers, etc., it would be uneconomical to stabilise the output from the smoothing circuit, so the stabilising circuit is omitted.

The resistor R is placed in the circuit (Fig. 10) to limit the peak rectifier current. If the peak current became excessive the semiconductor diodes would overheat and eventually break down.

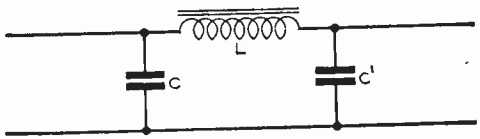


Fig. 9: A filter network.

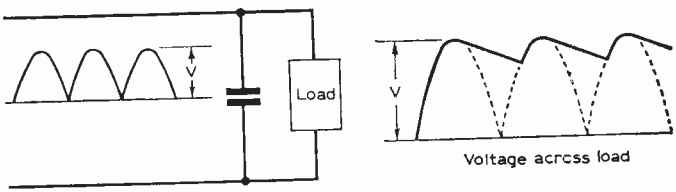


Fig. 8: The basic smoothing circuit and its action.

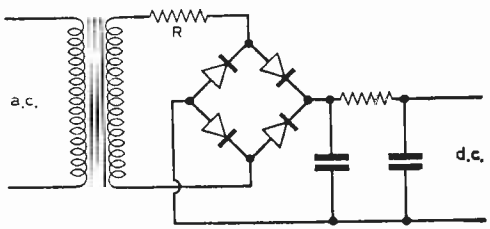


Fig. 10: A typical unstabilised power supply.

This resistor is also used to limit the effect of mains "surges" in the circuit. The mains voltage is by no means "stable" and can vary within values as much as 30V apart.

The voltage and current ratings on semiconductor diodes must be strictly adhered to; it is imperative that mains variations be taken into account when utilising this type of rectifier for a power supply unit.

Part 2 follows next month

BOOKS REVIEWED

EXPERIMENTAL RADIO ENGINEERING

By E. T. A. Rapson. Published by Sir Isaac Pitman & Sons Ltd.
214 pages, 8¼ x 5½ in., boards. Price 14s.

THIS is a fifth edition of an old favourite which dates back to the war years. It will be remembered by many old hands and in its up-to-date edition will, no doubt, be welcomed by newer students of radio.

A new chapter has been added which is devoted entirely to transistors, measurement of parameters, etc.

This book is not intended for the general reader and has, obviously, been written with the technical student in mind.

The entire volume consists of a series of experiments in radio engineering which range from the characteristics of attenuators and filters to electro-acoustic tests.

This volume would, as the preface rightly points out, be suitable for a student attending a three year course in radio engineering at a technical college. Would-be students and prospective radio engineers are referred to Mr. Rapson for further details.

At the price, this is extremely good value. —*D.L.G.*

COMPUTER CIRCUIT PROJECTS

By Lee Boschen. 144 pages. Price 21s.

THERE are many men in the realms of electronics, be they professional or amateur, who are bonded by one common tie—they are practical people. While they no doubt enjoy the odd spate of technical literature they are never more happy than when there is a trusty soldering iron in one hand and a reel of "resin cored" in the other.

This group should find **Computer Circuit Projects** of great interest, since it caters for just such tastes. It takes the terrifying and grand name of "computer" and transforms it into 143 pages of practical and interesting circuitry. There are 14 such projects ranging from a single stroboscope to a Rally Computer. Some of these circuits are very similar to others already published. The "Logic Lock" and the "Automatic Signal Flasher" for instance. However, there are numerous ideas to suit all tastes.

It should not be thought that this book is merely a collection of circuit diagrams printed on a few pages. Each project has photographs of it together with other illustrations, and with each there is a discussion of circuit action. The circuitry as a whole is right up to date, some using transistors, some diodes or valves, and in some cases an alternative circuit transistor and/or valve is offered.

For those who are tired of t.r.f.'s and audio amplifiers and would like to build something different but not too difficult, then you are advised to visit your local bookshop with 21s.—*D.L.G.*

ABCs OF COMPUTERS

By Allan Lytel. 128 pages. Price 16s.

THE word computer conjures up many things in the mind. Huge grey steel monsters with staring, winking eyes, rows of meters pulsing, and memory mechanisms buzzing. To the average man and to many electronic enthusiasts the word often means huge consoles and thousands of diodes, transistors and/or valves, and quite unconventional and frightening circuitry. Rumour even has it that the grids are taken direct to h.t.+ and that transistors are connected the wrong way round —on purpose.

For those who profess to be impartial, and prefer to think for themselves, together with those readers who would like to know some basic facts about computers, it is suggested that an outlay of 16s. of the realm be made. This modest sum will enable the "enquiring" to obtain a tome of knowledge aptly titled **ABCs of Computers**, and as this title implies it is a book which supplies the basic facts on this fascinating subject. Its 128 pages are generously sprinkled with illustrations and the text is well written and concise.

In a book of this size it is obviously not possible to enter deeply into the subject and the would-be reader, therefore, need not fear that he will be dragged into heavy technical discussions. The chapters 4 and 5 on "Numbers for computers" and "Arithmetic Operations" are a pleasure to read. The binary system seems easy enough, once it is understood, but understanding it in the first place can prove very tricky. Some writers never seem to present this binary business very clearly and often gloss over it in a few words.

However, it would not be true to say this of Allan Lytel. It would have been even more useful had values been given to all circuit diagrams, even more so in this case since the novice would not have any idea of values in these types of circuits shown.

Also, perhaps, having educated the reader to a certain standard it would have been helpful to have provided a list of suggested books for further reading. However, for the person wishing to scratch the surface of this fascinating field—**ABCs of Computers**—is recommended.—*J.D.G.*

ABCs OF ELECTRICITY

Howard W. Sams Editorial Staff. 96 pages. Price 16s.
These three books, originally published in the USA by Howard W. Sams & Co. Inc., and now published and distributed in this country by W. Foulsham & Co. Ltd. Each book has a preface for British readers written by W. Oliver, G3XT. The common format is 8½ x 5in., stiff covers.

IN any technical field there is one segment of learning more vitally important than any other—the ground work. It is essential that the basic theory be fully understood, and although this may prove a long "slogging" effort it is well worth while in the long run.

ABCs of Electricity is obviously written for the raw beginner and offers five chapters—Electricity (batteries), Magnetism, A.C. Theory and

—continued on page 535

on the Short Waves

A MONTHLY COMMENTARY BY J. GUTTRIDGE

HAVING gleaned and logged all the information we can about a station's signal we come to the business of sending off a reception report, and if possible getting it confirmed by a QSL card.

An ordinary piece of notepaper can be used for the actual report but a much neater report can be made on quarto lined paper. Neatness and simplicity are important because (except at the bigger stations) it will probably be in a language of which the evaluating engineers only have a limited knowledge.

As a general rule all stations except those in South America will accept a report in English. With South America, unless you are dealing with a station which you know to have an English section, the report should be in the local language Spanish or Portuguese. A suitable translation is contained in "How to listen to the World".

The first thing a report should contain is your name and address. Great care (block capitals) should be taken to see that this is legible. If the station can't even read your address it is unlikely to persevere with the rest of the report!

To start off you should say something to the effect that recently you were very pleased to hear the station concerned and are enclosing a report on its signal, mentioning the reporting code you are using e.g. SINPO, SINFO, RSI. After this you should ask the station to verify the report, if it finds it to be correct, with its QSL card.

The final part of your letter should deal with your receiving equipment. Details stations are interested in are the type of your receiver (domestic or communications) and the sort of aerial you are using—dipole or end fed, indoor or outdoor.

You should then set out your report. It should take a similar form to your log with columns for date, time (stating the zone you are using, Greenwich Mean Time being the most common), frequency (stating whether kilocycles or megacycles), the report (SINPO) and remarks.

Two items go in the last column. The first of these is interference details. These should include the type (jammer, broadcast, c.w.) of the interfering station and its frequency. The second item consists of details of the programme heard. The purpose of giving these details is to prove absolutely to the station that you really heard it. Unfortunately there are some unscrupulous QSL collectors who invent reception reports in the hope of gaining QSL cards. Some stations will waive the programme details after you have proved yourself if you report regularly to them.

Ideally your report should cover at least half an hour's listening time though this need not all be at the same time. Stations that use more than one frequency for a transmission especially appreciate comparative reports on the frequencies used. You can end your report with such things as a programme schedule request. Record requests or questions for special programmes are best sent in a special letter.

Finally there comes the question of return postage. With large and government stations this is normally unnecessary. Smaller stations, however, often appreciate it. A full list of stations requiring return postage is given in the "World Radio and Television Handbook". Postage if sent should be in the form of an International Reply Coupon which you can obtain at your Post Office. Don't forget, incidentally, that your report will usually require more than a threepenny stamp.

DX NEWS

News has just arrived from Radio Japan of its plans for broadcasting the Olympic Games to the world. An unenviable task this, as the games are taking place at about the worst time possible as far as reception conditions go. Because of this two new 100kW transmitters are being linked together to give an output of 200kW.

From October 10th to 24th when the games are in progress there will be special programmes during Radio Japan's normal transmissions and the general service will be especially extended. Normal transmissions to Europe in English will be at 0800-0820 GMT on 11.780/15.135kc/s. English broadcasts in the General Service consisting of both live and recorded items are as follows: On 9.505/15.195/15.310kc/s — 0645-0700, 0745-0800, 0845-0900, 0945-1000 and 1045-1100; on 9.505/9.740/11.815kc/s—1245-1300, 1345-1400, 1445-1500, 1545-1600, 1645-1700, 1745-1800 and 1845-1900; on 11.815/11.940/15.195—2145-2200; on 11.940/15.105/15.425kc/s—2345-0000; on 15.105/15.195/15.310kc/s—0245-0300, 0345-0400.

On October 10th the opening ceremony will be broadcast live from 0450/0700 and on October 24 the closing ceremony will be broadcast live from 0800-0900. Programme schedules giving full details are available free of charge from Radio Japan, Tokyo, Japan.

Radio Australia has been coming through well in the late evening recently. Two transmissions recently logged around 2245 in London were an Indonesian programme on 11.760kc/s and an English programme to Southern Asia. This station's U.K. transmission in English is from 0630-0730 on 9.570/11.710kc/s but is not coming through too well at present.

A Middle Eastern station presenting quite a challenge is the Kuwait Broadcasting and Television service. It is sometimes audible after 1930 through heavy CW on 4967kc/s.

For more DX news see page 573

UTILITY POWER PACK

A Compact Power Supply for the Workbench

by V. E. HOLLEY

MANY constructors have need from time to time of a bench power supply which usually takes the form of a self-contained pack from which h.t. and l.t. voltages can be taken by leads to the equipment to be supplied. The unit here described is somewhat different, being designed so that it can be fitted in a few minutes to any chassis with only three connections to be made and may remain there permanently if desired.

The basis of the pack is a mains transformer of the three-way mounting type, on to which are fitted all the components of the circuit shown in Fig. 1. Outputs of 250V 80mA and heater voltages of 6·3, 5 and 4 are provided.

Apart from bench use, the pack is especially suitable for compact equipment. The transformer selected for the prototype measures 4in. x 3½in. x 2½in. and the addition of the rectifying and smoothing components increases the 2½in. measurement by less than a quarter of an inch. The total heating effect is noticeably less than that of a pack using a valve or metal rectifier and this is an important advantage in equipment where temperature rise must be limited.

Rectifiers and Fuses

Silicon rectifiers are used. These have a very low forward resistance, 15 to 25Ω being typical, so that the protection against overload afforded by the relatively high resistance of a vacuum valve or metal rectifier is absent. If a large current rating is selected, say 500mA, the rectifiers do not require any protection against the accidental short circuit that may occur on the bench, but the transformer winding does. Fuses F1 and F2 are therefore included in series with the rectifiers. This arrangement is to be preferred to the more usual single fuse in the h.t. secondary centre tap because it gives protection against breakdown of a rectifier.

It will be seen from Fig. 1 that if such a breakdown occurred and there were no fuse, a very large current would pass around the h.t. secondary winding which would quickly be destroyed. The fuse ratings must be selected not with reference to the load current but to the larger value of the surge current which passes into the capacitors C1 and C2 when power is first applied. This is not

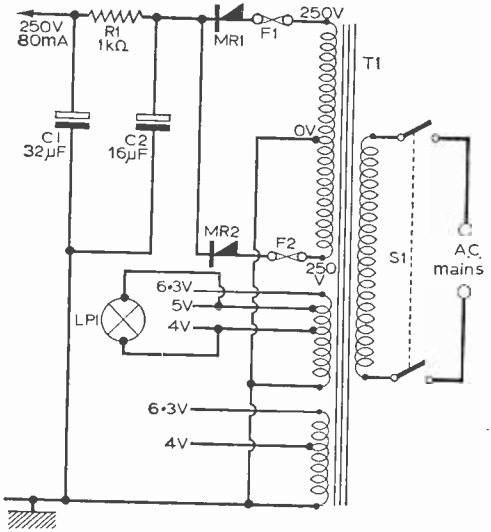
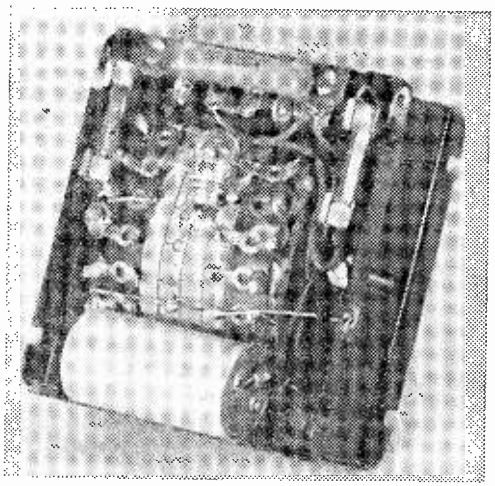


Fig. 1: The simple circuit for the power pack.

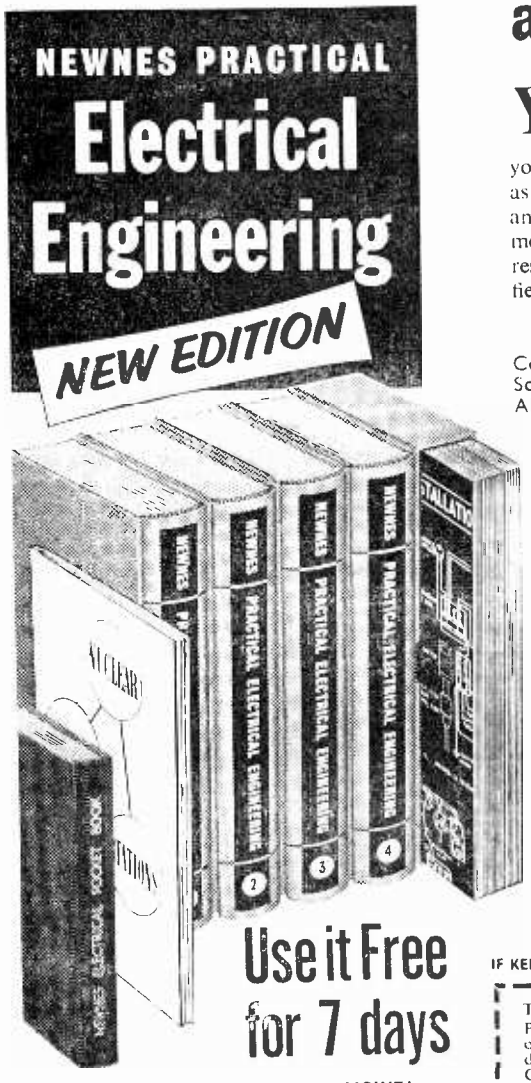


The finished power pack.

COMPONENTS LIST

T1	Mains transformer, 3-way mounting, 250-0-250V 80 mA, 6·3V 3 amps, tapped 4V, 6·3V 2 amps, tapped 5V and 4V
MR1, 2	Silicon rectifiers, BY100 or similar, 800V p.i.v., 500 mA
R1	Resistor—1kΩ, 10W
C1, C2	Capacitors—16 + 32μF electrolytic, 350V working in 1in. diameter can
F1, F2	Fuses rated at 150 mA each
	Fuseholders—two
LP1	Pilot lamp—2·5V 0·3A bulb
S1	Double pole on/off switch
	Length of tag strip
	Perspex for cover, self-tapping screws, wire and sleeving, etc.

87 Experts guide you to advancement and higher rewards



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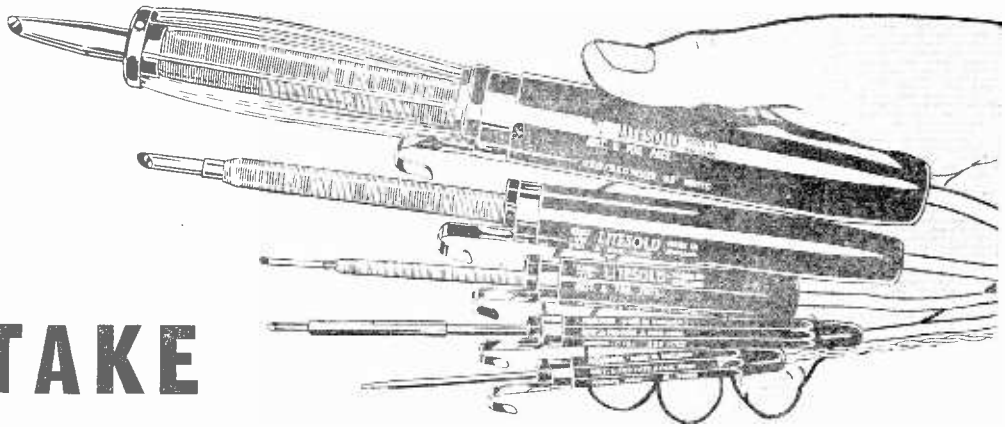

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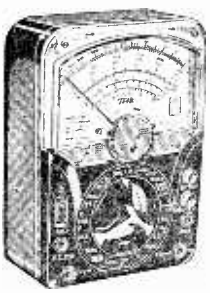

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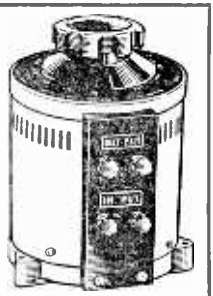

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easily measured but with the values of R, C1 and C2 shown, 150mA fuses are satisfactory.

It is important that the rectifiers should have adequate peak inverse voltage rating. Referring again to Fig. 1, when the right hand side of SR1 is 250V rms above earth, the peak voltage at this point will be 1·414 times as great, i.e., approximately 350V.

Capacitor C2 and the left hand side of SR2 will also be at this potential; but the right hand side of SR2 will at the same instant be 350V peak negative to earth so that the peak voltage across it in the non-conducting direction will be 700V. In practice, this theoretical figure may be increased somewhat by the effect of line surges, wave form distortion and such-like disturbances, so the rectifier peak inverse rating should not be less than 800V.

Construction

Fig. 2 shows the positions of the components and the connections to be made. The wiring should be no longer than necessary and if 20 s.w.g. tinned copper is used, it can be laid neatly in position and will stay there. The tag strip holding the smoothing resistor etc., must be soldered to the transformer frame, using a large iron, and the rectifiers tucked neatly beneath it as shown in the illustration.

Take care not to use the earthed tags for any of the connections. The outer metal bodies of the rectifiers are "live" so they must be firmly positioned clear of the transformer frame. The indicator lamp is considerably under-run and so is not likely to need replacement; it can therefore be soldered permanently into circuit without a lamp holder. The fuse holders are secured with impact adhesive.

Safety Precautions

In view of the exposed h.t. connections it is advisable, if the unit is for bench use, to fit some sort of cover over both sides of the transformer. This was done in the case of the prototype by bending two pieces of 1/16in. perspex to the required rectangular shape and securing them to the sides of the transformer frame with self-tapping screws.

The bending can be accomplished quite easily after clamping the perspex between two pieces of plywood along the line of bend and dipping the assembly in very hot water.

The cover should be about half an inch shorter than the height of the transformer so that an opening can be left at the bottom for through ventilation which the smoothing resistor at the top will promote by convection. The double pole on-off switch, S1, S2, is fitted to the cover on the mains input side of the transformer. If desired, an additional fuse can also be fitted here in the a.c. supply line as a protection against heater line short circuits etc.

A suitable rating, allowing for surge is 250 to 500mA.

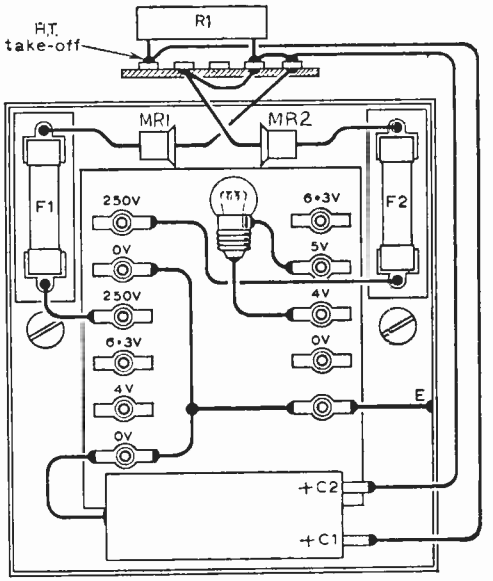


Fig. 2: Construction details of the unit.

BOOKS REVIEWED

—continued from page 530

Generators and Alternators. Although there is no question that this book offers a great number of basic facts there are one or two puzzling aspects of it.

In Figs. 1—13 and 1—14 the battery mysteriously reverses polarity and the voltages in Fig. 13 are given with respect to reference point D. The voltage then would be minus 6V and minus 5V and not just 6V or 5V as stated. In Fig. 1—17, page 24, we are told to note that 4 amps of current flow toward point A, but there is, in fact, no such reference point marked A in the Fig. 1—17 at all. In the photographs, Figs 2—4 and 2—6, the same battery is shown twice, and perhaps a different photograph would have been more educational. It would certainly prove more interesting.

A graph appears on page 62 and the vertical axis is marked in gausses, yet the word gauss does not appear to be included in the text at all. These points may appear small, but since the book is intended for beginners it is felt they should be mentioned.

Vector diagrams start to appear on page 73 and it is regrettable that no clear explanation of them appears, particularly as their importance is very great, as anyone who has studied a.c. theory will know.

The book is priced at 16s. and it is suggested that any reader contemplating purchasing it should be in a position to examine it first rather than send money "blindly" through the post. —*D.L.G.*

The "Spectreuphon"

SOME IDEAS FOR EXPERIMENTS WITH CHROMASONIC DISPLAYS

BY I. J. KAMPEL

DESCRIBING a unique device, which from an existing audio source, improves mono or stereo reproduction, *and* provides a visual conception of the music, by means of changing colours, to match the mood of the music.

There are many examples of how sound and colour can be subtly merged to produce an unparalleled emotional effect—producing not only extreme pleasure, but a pleasing relaxation of mind. This is offered as a supplement to all hi-fi and audio fans—so much more than the 'flat' sound from a single-speaker mono system, and much more pleasing than the simpler two-speaker stereophonic system.

The *Spectreuphon* provides a visual conception of the music to be provided from an existing audio source.

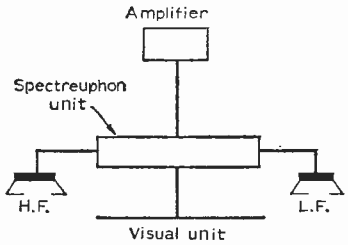


Fig. 1a (above): The basic layout of a mono system using the "Spectreuphon".

Fig. 1b (right): The arrangement for stereo.

Direct coupling to most modern radios, tape-recorders, record-players, is simply made through extension speaker sockets. It will be necessary, however, to fit a switch on the audio unit, if one does not exist, to cut out the internal speaker.

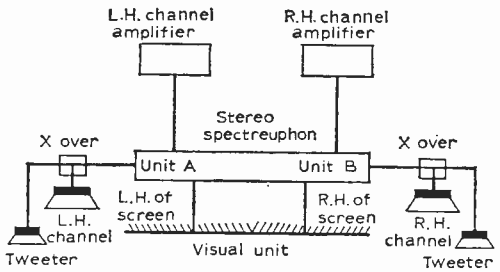
Before describing the unit in detail, a brief description of the effect would be in order.

Effect of Mono Spectreuphon

The author has previously described a unit for feeding two loudspeakers from an existing audio source (mono), giving an effect not unlike stereophonic sound to the unexperienced, average listener. No owner of a stereo set-up would mistake it for stereo, but if suitable speakers are used, he would be forced to admit there was a fair comparison. Some listeners to the system were in fact convinced that it was stereo, and found it just as satisfactory! (The original unit—the *Euphon*—appeared in the October, 1963, P.W.) The mono version of the *Spectreuphon* contains the original *Euphon* circuit. (Section 2, Fig. 2.)

The *Spectreuphon* should be listened to—and viewed—in a darkened room.

Let us suppose that the unit is connected to a record-player, and a record has just been put on. Until the record begins there will be complete darkness—then comes the music—and light. The coloured light thereafter faithfully follows the pitch, volume, beat, and general mood of the music. As the volume increases so the light becomes more intense; it follows visually if there is a distinct beat; if there is a predominance of treble, mid-range, or bass, so there is a predominance of one particular colour, and as the ranges merge together so do the colours, mixing, diffusing together, giving subtle intermediate shades and hues. If the record ends in a fade-out, so the light dies down to darkness with the sound.



Effect of Stereophonic Spectreuphon

Two inputs are required for this unit, these being taken from the sockets to which left-hand and right-hand channel speakers are usually connected. The audio to these speakers is then fed via the *Spectreuphon* unit. This is necessary, as the unit must have a volume level on it.

The left-hand audio channel then controls the left-hand side of the display unit—consider it as a screen for now—whilst the right-hand audio channel covers the other half. This means that beside the visual effects described in the mono version, the stereo version provides left and right emphasis according to speakers, and also a colour shift if there should be an audio movement shift.

The stereo *Spectreuphon* does not improve sound reproduction in itself. If, as later diagrams

indicate, two crossover networks are employed, and a four-speaker system set up, then there will be a great improvement. Many stereo systems have, however, these networks built in, with twin woofer and tweeter.

Single Speaker Spectreuphon

If for one reason or another, only a single speaker may be employed, or a single speaker unit, slight adaptions will have to be made to the circuit of the mono unit. Details of this will be given later. It is possible to use only the one existing speaker.

The Spectreuphon Circuit (Mono)

Fig. 1a is a block diagram of the basic principle and lay-out of the mono system. Actual visual units will be described later, but whatever type is used, basically, and from the electronic point of view, it consists simply of a number of lights.

There are three groups of lights, each group controlled by a different filter network and channel of the *Spectreuphon*. One set of bulbs responds to bass, one to treble, and the third to mid-range.

Fig. 2 is the complete mono *Spectreuphon*, which includes a two-channel audio network to feed two loudspeakers, to give an effect similar to stereophonic sound. This circuit diagram is divided into five sections so that reference to this circuit is simpler.

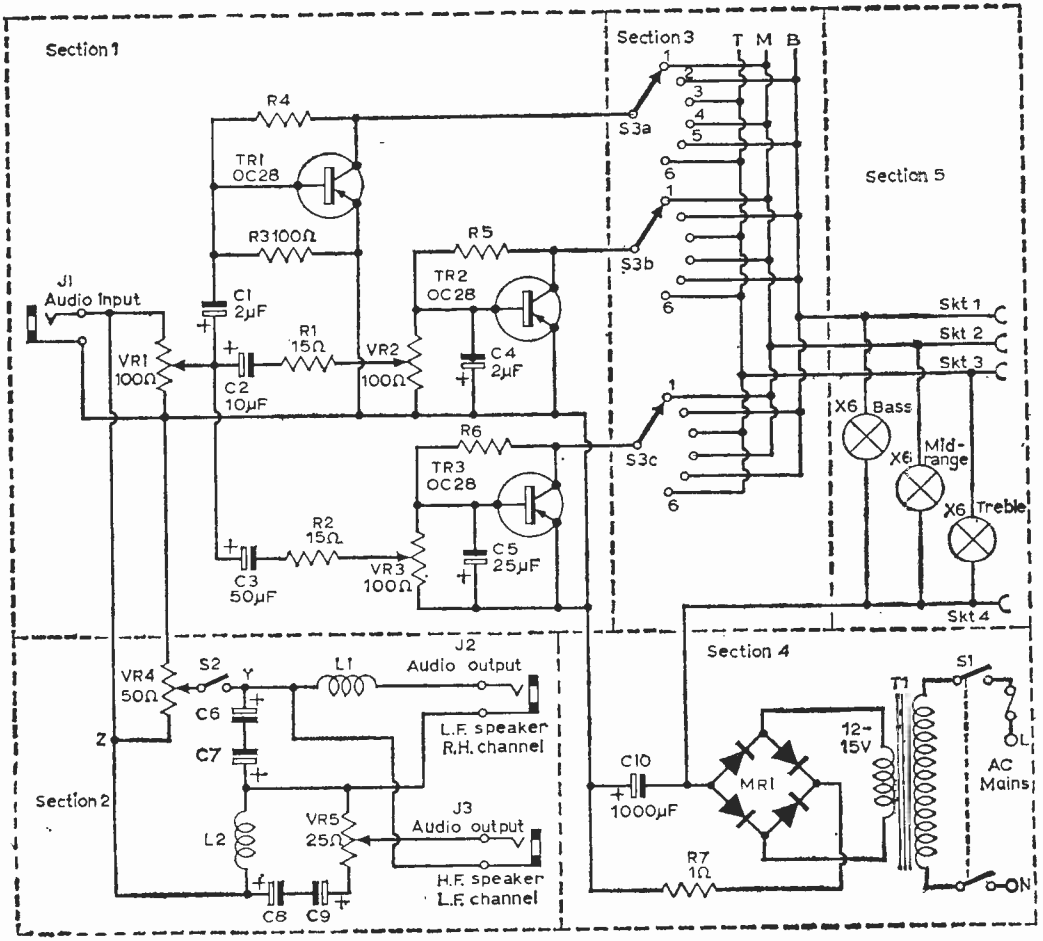


Fig. 2: The complete circuit of the mono "Spectreuphon".

Section 1 is the three-channel filter network which separates treble, mid-range, and base, and so controls a group of lights on each of these channels. An increase in one range, and the consequent additional transistor bias, increases the collector current, and consequently the lights brilliance, being connected directly in the collector line.

Section 2 is the two-channel audio network, which feeds J2 a low frequency output, and J3 a high frequency output, so the speaker connected to J2 produces mainly bass, and the speaker to J3 mainly treble. Coil and cap. details are to be found in **Table 1.**

Section 3 is simply a switching unit on the three outputs of Section 1. Each of these outputs feeds a different set of lights, **of a different colour.** Hence, the six-way, three-pole switch, allows any combination of colours and channels to be obtained, so giving a greater variety.

Section 4 is simply the smoothed power supply. There is little to say about this, as any suitable full-wave bridge rectifier and transformer are satisfactory.

TABLE I

C	L	Speaker Impedance	C	L
6–9	1–2	3Ω	30—32 μF electrolytic	3Ω 0·135 mH
		15Ω	5—8 μF electrolytic	15Ω 0·675 mH
X	Y	3Ω	30μF paper	3Ω 0·135 mH
		15Ω	6μF paper	15Ω 0·675 mH

Suitable makes	L1—L2		as below
X & Y		Hunts W54/1—WP44 (30μF) W49/1—B551 (6μF)	Denco divider network coils

Section 5 indicates the form the lights will take. Only one of six bulbs on each channel is indicated. It will be seen that they all have a common negative—the only contact with the negative side of the rectifier—except the smoothing capacitor.

Controls

VR1, VR2, VR3, are sensitivity controls, and require some patience to set for best performance from the visual unit.

VR4, is an audio volume control. The volume control on the existing audio unit is turned up until a suitable level is obtained in the lights unit. VR4 is then used to turn down audio to a comfortable level.

VR5, is a balance control, and with this it is possible to shift the treble-base emphasis, according to individual requirements.

Details of Construction

It will be seen from the circuit diagram (Fig. 2) that resistors R4, R5, and R6, have no value indicated on them. The reason for this is that they tend to vary according to particular transistors. To find the right value resistor, the method indicated in Fig. 3 should be employed. Here a variable resistor and a set resistor are connected, in series, collector to base. The six bulbs should be in circuit for this test, on each channel. Set this system up on each of the three transistors. For this test, the audio part of the circuit need not be operational, but it will probably be found that the level required to operate the unit will be too high for listening to, and hence the speaker on the audio unit will have to be cut out.

Firstly, in daylight, adjust each of the three 3K potentiometers until the filaments of the bulbs on each of these channels have just gone out. When this has been carried out on all channels, start the audio unit up. The lights should then light up and fluctuate in brilliance. Adjustment of VR1, VR2 and VR3 may be necessary, but if the lights are working as described, it is pointless at this stage, to try and adjust them for optimum treble—mid-range—bass performance.

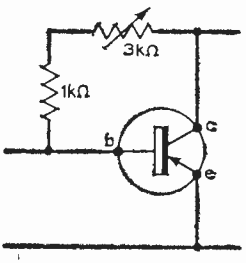


Fig. 3: Determining the values for R4, R5 and R6, see text.

In Fig. 3 the 1k resistor is in series with the potentiometer as a safety measure, and should not be omitted. If it is, a collector-base short could occur, causing permanent damage to the transistor. When the correct level has been found, the resistance then across the collector-base of each transistor should be measured, and replaced by a resistor of the same value. If space will permit, leave the potentiometers in circuit. These potentiometers should be mounted inside the unit,

COMPONENTS LIST

Number required Mono	Number required Stereo		
			Euphon Circuit (Sect. 2 Fig. 2)
2	—	L1, L2	See Table I
4	—	C6-C9	See Table I
1	—	VR5	25 Ω wirewound pot.
			LIGHTS FILTER NETWORK Etc. (Sect. 1)
3	4	J1-J3, Jx	Jack plugs and sockets
3	6	VR1-VR3 (x2)	100 Ω wirewound pots
1	—	VR4	50 Ω wirewound pot
—	1		Twin-ganged 50 ohm wirewound pot
2	4	R1, R2 (x2)	15 Ω ½ watt res.
1	2	R3 (x2)	100 Ω 1 watt res.
2	4	C1, C4 (x2)	2 μF elec. 25V
1	2	C2 (x2)	10 μF elec. 25V
1	2	C3 (x2)	50 μF elec. 25V
1	2	C5 (x2)	25 μF elec. 25V
4	7		Wander plugs and sockets
18	24		6·3V 150 mA bulbs
2	2	S1, S2	D.P. S.T. toggle switches
1	—	S3	6W. 3P. rotary switch (mono)
			6W. 6P. rotary switch (stereo) or as required
3	6	Tr1-Tr3 (x2)	OC20
			Test Requirements
3	6		1kΩ res.
3	6		3kΩ wirewound pots
			POWER SUPPLY (Sect. 4 Fig. 2)
One 3A	One 4A	T1	Transformer: primary to suit; secondary 15V
1	1	C10	1000 μF elec. cap. 25V
1	1	R7	1 Ω 1 watt res.
1	1		Full-wave rectifier 3A/4A
1	1		3A/4A Fuse

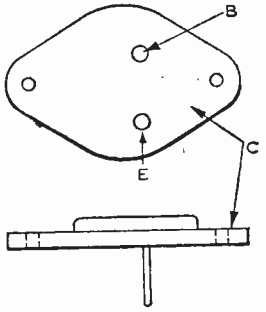


Fig. 4: Connections to an OC28 transistor.

so that they are only disturbed when required. The response of the lights is far more sensitive if adjusted as described.

Fig. 5 indicates the mounting of the power transistor.

Oversize holes are drilled in the chassis to ensure that the connections do not short to chassis. The transistor rests on a lead heat-sink, and underneath this is a mica washer to insulate the collector from the chassis.

Should it be found that the lights will not dim, then a higher value potentiometer or resistor should be fitted in place of the original.

Sk1, Sk2, Sk3, are the positive contacts of the three sets of bulbs. Six bulbs, in parallel, are connected to each of these sockets, their common negative on all sets, going to Sk4.

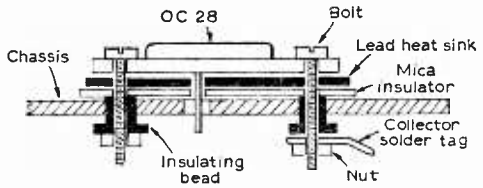


Fig. 5: Mounting details of the power transistor.

When ready for the final test of audio and visual unit, each of these sets of bulbs will be a different colour.

The Spectreuphon Without Additional Speaker Cabinet

If it is required to have the visual unit with original sound (mono), and it is found on test that the volume is not too high when turned up high enough to operate the *Spectreuphon* light-control unit, then you have no problem. Forget Section 2 and just plug in to extension speaker sockets for light control. If, however, as expected, it is too high, then the audio level has to be brought down by another control.

In Fig. 6, a two-way, two-pole switch is inserted between the speaker and output transformer. In one position there is a straight path through and in the other position, the path is through to socket. JA.

A lead is then taken from this, preferably screened, to JB or JI on Fig. 2.

The 50Ω potentiometer is then used to turn the volume down to a suitable level, and the signal is fed back to the original unit, and speaker, via JC on the *Spectreuphon* unit, and JD on the audio source.

If this is the method that is to be employed, because of reasons of expense or space, sound could be improved by the addition of a small tweeter in the record-player or what-have-you, in which the speaker is contained.

The circuit of Fig. 7, the usual crossover network, should then be employed. The coil and capacitor values given in this table are also suitable for the *Euphon* circuit.

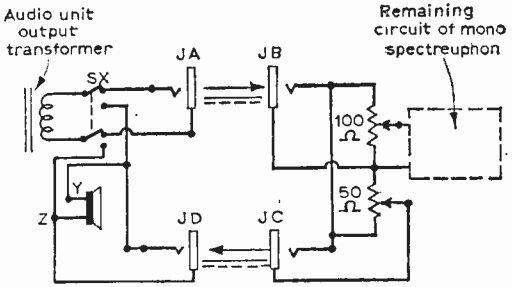


Fig. 6: Incorporating a two-way, two-pole switch between the speaker and output transformer.

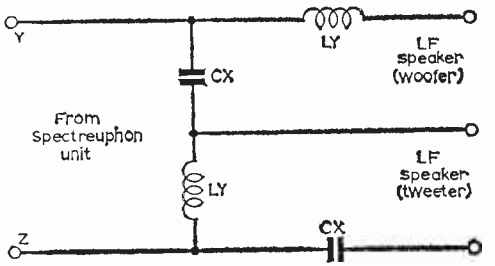
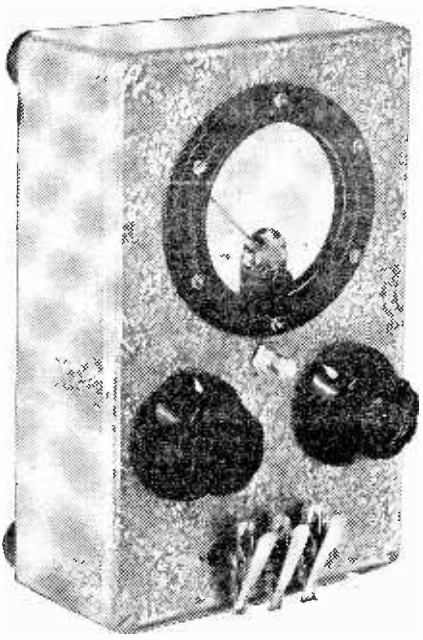


Fig. 7: A crossover network for the "Spectreuphon".

Unless the audio source is of the standard known to-day as hi-fi, the addition of this network is pointless. This also applies to some extent in the audio circuit of the *Spectreuphon*. If there is not any response below say 10kc/s, or a cut-off before it reaches the higher frequencies, little will be gained by the use of this unit.

If there is room for a single cabinet, a large woofer and small tweeter mounted together in the same cabinet, if large enough, will produce far superior audio to that previously experienced with a single—perhaps small—speaker, in a cabinet which did not allow the required resonance. The cross-over network of Fig. 7 should be used for this, connected across YZ on the original circuit (Fig. 2).

TO BE CONTINUED



A SIMPLE transis

THIS transistor tester was developed to facilitate rapid transistor testing in the workshop. The main purpose of this tester is to make what are primarily "go"—"no-go" tests, by measuring the transistor collector leakage current and current amplification factor in the common emitter configuration, i.e. Ico and ß. Experience has shown that a tester of this type is all that is required to tell whether a transistor is working or not or to measure or compare "Beta" for matching transistors etc. Furthermore testers of this type are generally used in preference to the more accurate and comprehensive transistor parameter test sets.

The basic tester is suitable for testing only low power receiving type transistors.

SPECIFICATION

Collector Leakage Current (Ico)	0-1mA	
Current Amplification Factor (ß)	0-100 ⎫	two
	0-250 ⎭	ranges
Transistor Type	pnp or npn	

CIRCUIT AND THEORY

The circuit of the tester is shown in Fig. 1. A 4½V dry battery is used as the power source, one of quite small capacity being suitable since the maximum drain is 10mA and that only for the few seconds required to take a reading.

Switch S1 selects the supply polarity required for either npn or pnp transistors with a central "off" position, whilst switch S2 is used to measure either Ico or "Beta." When switched to Ico the base circuit of the transistor is left open circuit and a 4·5kΩ resistor is connected in series with the meter to prevent it being damaged if a transistor having a short circuit between collector and emitter is tested. When the tester is switched to read Ico a check on battery voltage may be made by shorting the collector and emitter terminals, the meter should then read full scale or thereabouts, since the meter is connected as a voltmeter reading 4·5V full scale. It may, incidentally also be used as a continuity tester or ohmmeter! There are two positions of S2 for measuring "Beta," the first giving a full scale

COMPONENTS LIST

Resistors:

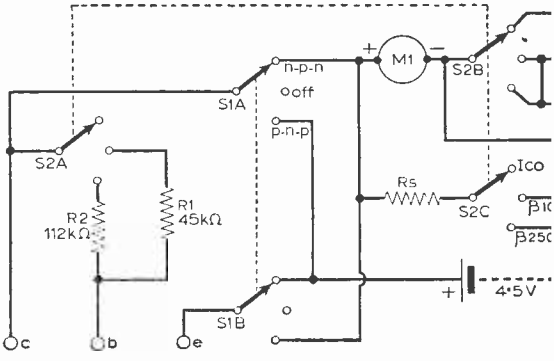
R1	45kΩ (33kΩ + 12kΩ) ¼W h.s.
R2	112kΩ (100kΩ + 12kΩ) ¼W h.s.
R3	4·5kΩ (3·3kΩ + 1·2kΩ) ¼W
R4	390Ω

Switches:

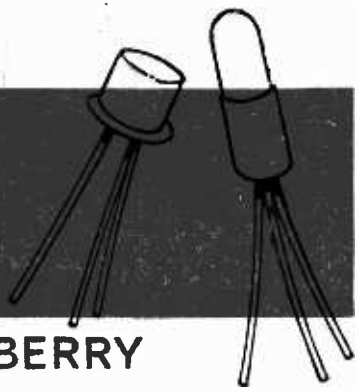
S1	2-pole 3-way rotary (or 4-pole 3-way, see text).
S2	3-pole 3-way rotary
S3	Bell-push type: push to make

Miscellaneous:

M1 1mA moving coil meter
4½V battery. Case. Knobs, terminals, crocodile clips, etc.



tor tester



By K. BERRY

reading of 100 and the second of 250. The measurement of "Beta" is effected by injecting a known current into the base of the transistor and measuring the resultant collector current. Thus when the meter is switched to the "Beta" range giving a full scale reading of 100, a current of

$$\frac{4{\cdot}5}{45{,}000} \times 1{,}000\text{mA} = 0{\cdot}1\text{mA}$$

is injected into the base of the transistor. Now

$$\text{"Beta"} = \frac{\Delta Ic}{\Delta Ib}$$

hence, assuming a linear characteristic,

$$\text{"Beta"} = \frac{Ic}{Ib} \text{ (approx.).}$$

If Ico is small compared with the collector current, Ic, this is a reasonable approximation. So if the meter reads 3mA

$$\text{"Beta"} = \frac{3}{0{\cdot}1} = 30.$$

With the meter having a full-scale deflection of 10mA the reading of 3mA so obtained will correspond to a "Beta" of 30, which is the correct result.

When S2 is switched to read "Beta" a 390Ω resistor is connected in series with the meter to protect it from damage should a transistor having an internal short circuit be connected to the tester. This resistor may be removed by pressing a push button, S3, which then shorts the 390Ω resistor, though in practice the value of "Beta" indicated varies very little whether the resistor is in or out of circuit.

In the circuit shown, the meter reads the collector current plus the base current, but since the latter is so small it makes very little difference to the indicated value of "Beta." This slight error can be overcome by moving the meter circuit from its present position to one where it is in the collector circuit. The only drawback is that S1 then becomes a four pole switch since the meter must be reversed as well as the battery when changing from pnp to npn transistors. The modified circuit is given in Fig. 2.

CONSTRUCTION AND COMPONENTS

The prototype tester made by the author is illustrated in Fig. 3 and was made as small as

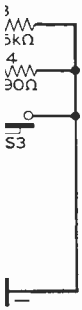
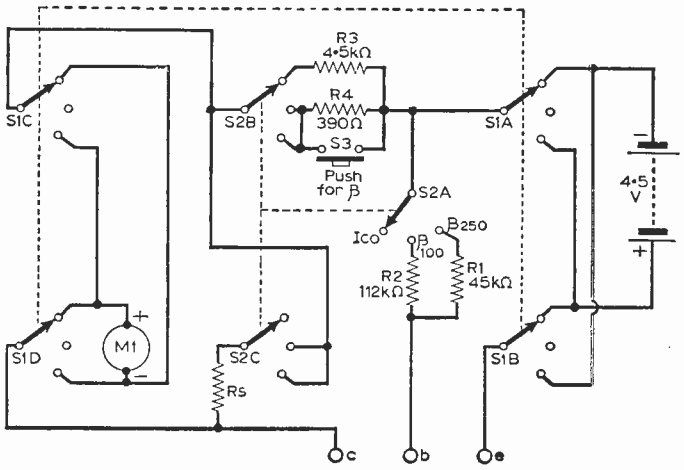


Fig. 1 (left): The basic circuit of the transistor tester.

Fig. 2 (right): The circuit modified to incorporate a 4-pole switch in the S1 position to give the instrument a slightly better degree of accuracy.



possible. It is housed in a small proprietary die-cast box measuring 7¼in. x 2¼in. x 4¾in. (Eddystone Cat. No. 845). Small rubber feet are fitted to the underside of the instrument to prevent it scratching polished surfaces.

The meter used originally was a 2½in. diameter moving coil meter with a resistance of 180Ω, but any 1mA meter will suffice. It will be seen that in the components list the value of Rs, the meter shunt, is not given. This is because the value of this resistor will depend on the resistance of the meter used. Its value may be calculated from the expression: $Rs = \text{meter resistance} \times \frac{10}{90}\Omega$.

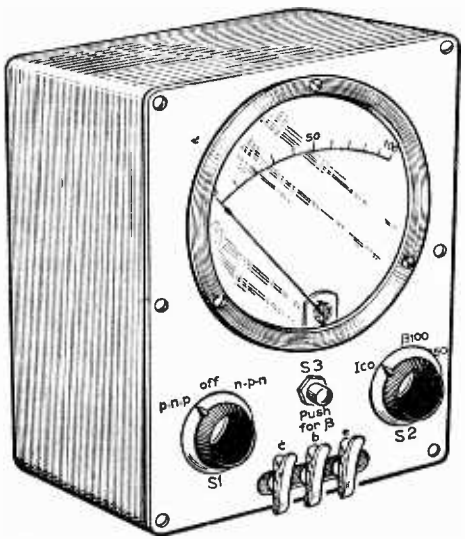


Fig. 3: A view of the finished instrument showing the front panel layout of controls, etc.

Hence in the original transistor tester, which used a meter with a resistance of 180Ω, the shunt Rs has a value of $180 \times \frac{10}{90} = 20\Omega$.

The type of components used is unimportant, though it is suggested that the resistors controlling the base current 100kΩ + 12kΩ and 33kΩ + 12kΩ should be 1/4W high stability types. Fig. 4 shows the internal layout of components and the wiring.

TEST CONNECTORS

The connections to the transistor under test are brought out to the front panel via sockets which take "wander" plugs such as are used for the older type of h.t. battery. To facilitate connecting a transistor to the tester, the standard "wander" plugs have been modified by cutting off their heads and soldering "crocodile" clips to them as shown in Fig. 5. The plug portion of the plug/crocodile clip assembly is then inserted in the tester socket.

USING THE TESTER

Having assembled and wired the tester it may now be given an initial test before being used. This may be done by switching to npn and Ico when once again the meter should read full scale. When this has been done a "known good" transistor should be tested as follows: First connect the transistor to the tester. Next select npn or pnp as required by S1. Then set S2 to Ico and note meter reading. Finally switch S2 to "Beta" 100 range and note reading. If reading is greater than 100 switch to "Beta" 250.

It should be appreciated that when testing a transistor on this tester there is no thermal stabilisation and in consequence measurements of "Beta" should be made quickly, otherwise the junction will rise in temperature, with the result that Ico will increase and thermal runaway might occur. ■

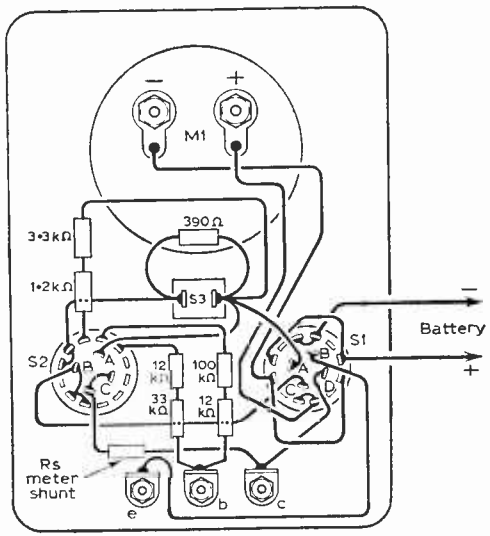


Fig. 4: The wiring inside the case. This diagram shows the wiring for the circuit of Fig. 2, i.e. with 4-pole switch.

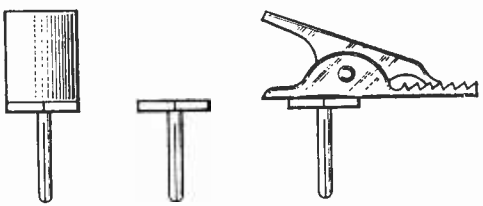
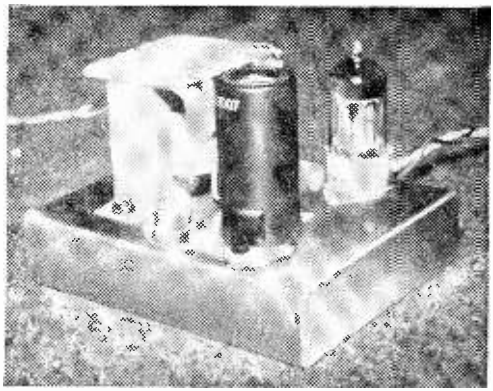


Fig. 5: The modified wander plug/crocodile clip transistor connector.

Miniature POWER Amplifier



by J. Harrison

THIS small power amplifier was developed while converting a mono radiogram to stereo, but since making the unit many other uses have been found, among them as a centre channel amplifier for experiments in 3 channel stereo, as the output stage of a domestic radio and as a monitor during tests on equipment when using an oscilloscope. No doubt the constructor will find plenty of other uses for this compact cool-running amplifier.

For constructors who are tired of the usual single-ended small amplifier designs (usually employing a valve of the ECL80, ECL82, ECL86 variety), this circuit makes an interesting and rewarding project, easily assembled in a few hours.

The two valves used are almost sure to be found in the spares-box and are 12AX7 (amplifier and phase-splitter) and 12AU7 (push-pull output). These can be bought for around 6s. 0d. each.

The advantages of push-pull operation are well known and 90% of all amplifiers with a hi-fi tag to them have push-pull output. The main advantage for an inexpensive amplifier is the fact that there is no d.c. flux in the output transformer and no signal currents flow around the power supply, which contributes greatly towards amplifier stability.

In a practical amplifier, due to slight unbalance of valve currents and signals, perfect cancellation is not achieved but even so there is a great improvement compared to single-ended working. The only disadvantage is, more signal drive is required because the signal is halved between the two output valves.

The Circuit

One half of the first valve is used as a voltage amplifier directly coupled to the other half used as a phase-splitter. The anode load of the first stage is large (470kΩ) and working into the high-impedance of the phase-splitter produces a greater than usual stage-gain.

Provision has been made in the circuit for a negative feed-back loop (if required) from the output transformer secondary to the cathode of V1A.

The amplifier should be tried out at first without any feedback, tested and if satisfactory then it should be incorporated. The amount of n.f.b. will depend upon how much gain the constructor can afford to lose, however, even without any n.f.b. sound is clean and well-damped.

Construction

Construction is quite simple and there is plenty of room on a 4½in. x 4in. x 1in. chassis. The layout shown in the diagrams is definitely the best for

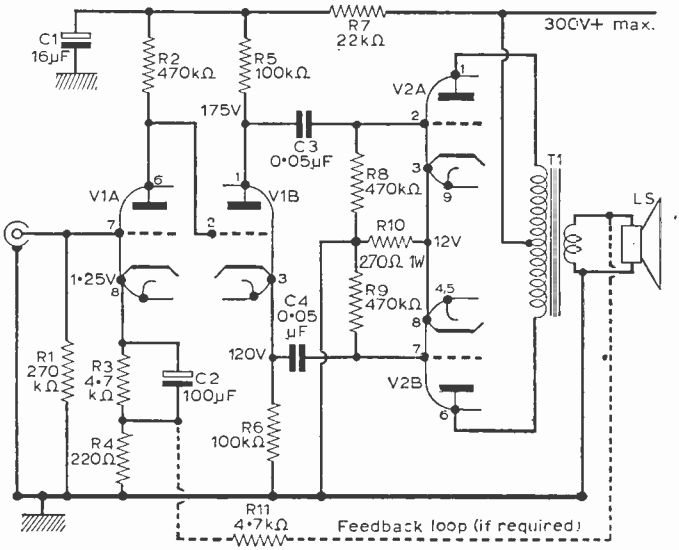


Fig. 1: The simple two-valve circuit.

short leads and constructors are recommended to follow it.

Most of the components are mounted on a small tag-board which has ten pairs of tags. These have been numbered for reference 1 to 20 in the wiring diagram. Some of the tags are linked together and wiring these first before mounting any components will make the job much easier.

There are three components not on the tag board:

(1) Input grid resistor R1 between pin 7 on V1A and earth solder tag.

(2) Output valves bias resistor R10 from the commoned cathodes of V2 to the centre

—*continued on page 566*

COMPONENTS LIST

Resistors:

R1	270kΩ	R7	22kΩ
R2	470kΩ	R8	470kΩ
R3	4·7kΩ	R9	470kΩ
R4	220Ω	R10	270Ω 1W
R5	100kΩ 1% h.s.	R11	4·7kΩ
R6	100kΩ 1% h.s.		

All ±5% ½W, unless otherwise stated.

Capacitors:

C1 16μF electrolytic 350V
C2 100μF electrolytic 6V
C3 0·05μF 350V
C4 0·05μF 300V

Valves:

V1 12AX7 (ECC83, CV4004)
V2 12AU7 (ECC82, CV4003)

Miscellaneous:

T1 Output transformer, to match 10kΩ anode load (see text).
Two B9A valveholders. 10-way tag strip. Coaxial socket.

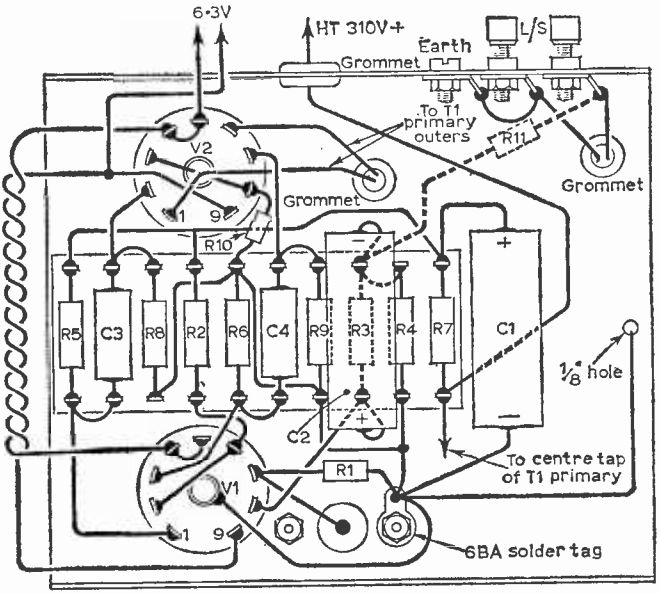
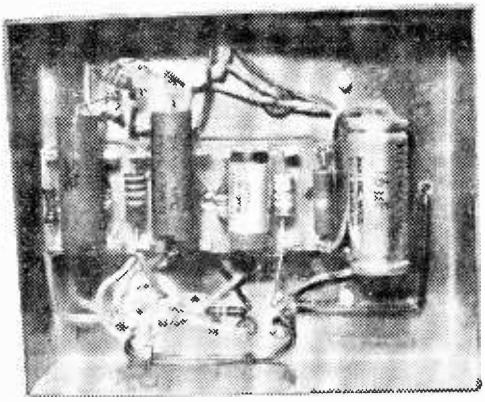


Fig. 2: The main wiring diagram; below is an underchassis view of the finished amplifier.



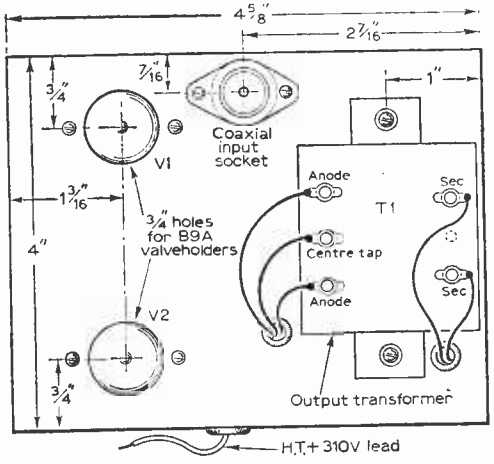


Fig. 3: Above-chassis layout and dimensions.

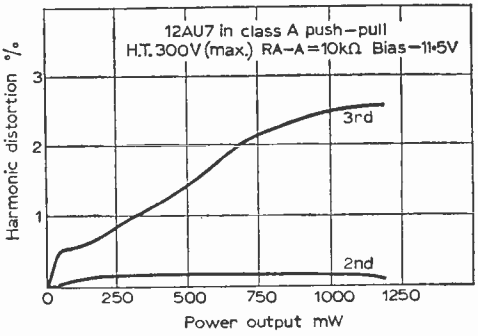


Fig. 4: Harmonic distortion plotted against output for the 12AU7 operated in Class A push-pull.

A COMMENTARY BY HENRY

PRACTICALLY WIRELESS

No. 2 Show-Biz

SOME like circuses, others prefer bread. The organisers of the Radio Show contrive to offer us both.

Some of the other exhibitions around town look with envy on the Earls Court Dichotomy. But radio and television are a natural gift to the show-biz-minded organiser. After all free samples of synthetic butter, or a static, unreal room, or even a bevy of this year's winners of the nursemaid stakes can hardly compete with the Fair of the Air.

Behind it all there is a pretty formidable feat of dovetailed planning. And not a little skull-duggery.

It is the aim of many exhibitors to unveil a last-minute surprise. *"You want a better set—we have it . . . at last"*, they seem to say. This leads to a frenzied rushing around on preview and opening days of the gentlemen of the Press. Dashing the free gin from their lips, they converge on the suspected harbour of secrets and attempt to lift the veils—or at least those ugly dust covers that so many exhibitions affect. (Haven't they heard of polythene?)

Hard on their heels come the rival representatives. They try to look unconcerned as they teeter on tiptoe, wondering whether that box behind the stand is going to turn out a trend-setter TV or merely contains the managing director's packaged chicken and champagne lunch.

Frenzied rushing around

Up in the Organiser's Office the headache grows yet more intense. Piles of statistics have to be sorted, analysed and sent to the corners of the world. The bloke with the late-entry surprise may find he has defeated himself by missing the Press boys' deadline. Or he may lose his impact entirely with the kind of oracle who sits in the Press Office and writes his report to the readers of Little Midmarsh from the wealth of exhibition handouts.

On the stands all is glitter and smiles. Bright new models look better than they ever will again. Silver and gold plated dissections revolve on their stands. Arty-crafty scenes vie with the blatantly humorous displays, while here and there, as if in defiance, some bold maker stacks his exhibits like a row of cheeses. One expects the immaculately dressed vendor to bark: *"Roll up, roll up. Every one a winner"*.

The annoying thing to some hardened visitors is the lack of information available on their favourite hobby-horse subjects. The deferential gent at the front of the stand is not quite sure. He will have to ask Mr. Mumblegum. This elusive character is hidden behind a phalanx of broad backs, within the drapes and hardboard, like a Rugby forward changing his tattered shorts.

In the meantime there is much else to see. The special attraction, for example, of the XYZ demonstration. We consult the guide, the official map, which even a child could understand. We are stupidly adult. We end up wandering in widening circles between towering walls of brick. When we finally reach the Dem. Room a forbidding clockface, its hands leering toward some impossible, future appointment, confronts us.

For the moment we must be satisfied with the information in the leaflets so lavishly displayed

Changing his shorts.

on every other stand save where we forage. Little boys with capacious satchels have long since skimmed the cream.

But there is still plenty to see. The designers of both the technical innards and the fashion-conscious cabinets and cases (for some modern sets can hardly be described as having cabinets) are at pains to cry their originality. Which makes it all the more surprising when we see the same styling on so many stands. Are we to believe that design has reached a saturation point of near-perfection? (Stand up that man who gave a hollow laugh!)

In our bemused wandering around this Aladdin's Cave of wonders we are likely to lose sight of the great amount of background work. The miles of specially laid cable, the carpentry, the decoration, the problem of assembling people and products under one roof at any given period.

Think of that next time you curse the unexpected hump on the floor of the main aisle, the confusing layout of stands that always seems to lead you past the same eye-catching display, the queues for lukewarm tea, the foot-wearying iron stairs, the heat, the draughts, the impassable crowd around the rostrum.

Whether your taste is for bread or circuses, remember we must have both.

AN INDUCTANCE/CAPACITANCE TESTER

by H. Webster

A simple but versatile two terminal oscillator which enables inductance and capacitance measurements to be carried out with good accuracy is described. In addition, gang capacitor sections and inductances, whether screened or unscreened, can be matched to a high degree of accuracy. Further suggestions are given for the construction of a signal generator which is a novel departure from the usual type of instrument.

A problem which is frequently encountered by the constructor is the measurement of inductance. In particular, one is often faced with the task of matching inductances to fairly close tolerances. Even when two coils are wound as physically similar as possible, the inductances of the respective coils may well vary by as much as 2%. In most cases the error will generally exceed this figure.

As a simple example consider an inductance of 100μH in parallel with a capacitance of 200pF. The resonance frequency of the combination is 1125 Kc/s. Replacement of the 100μH inductance with one of 99μH results in the new resonance frequency of 1131 Kc/s. Since the miss match between the two inductances is a mere 1%, the 6kc/s error is somewhat astonishing. Nevertheless, a simple calculation will convince the experimenter of the truth of this statement.

Two such coils used in the radio frequency stages of a receiver would give extremely bad alignment. Since hand wound coils are less reproducible than machine wound coils, these errors are frequently much greater than in the foregoing example.

For some time past the author has employed a simple unit which can be used to match inductances to a high degree of accuracy. In addition, the inductances of coils can be measured, capacitances determined and tuning capacitor sections equalised. Slight modification of the oscillator is necessary if inductance and capacitance measurements are contemplated. The modified circuit diagram is given in Fig. 1.

Principle of operation

Inductance measurement.

A simplified block diagram of the basic circuit for the measurement of inductance is given in Fig. 2.

The mode of operation is as follows. L, the unknown inductance, is placed in parallel with a standard capacitance C. The resonance frequency of the combination LC is determined by means of a calibrated receiver. A knowledge of this frequency enables one to determine the inductance utilising the formula

$$L = \frac{25{,}330}{C f^2}$$

where L is expressed in microhenries, C in microfarads and f in kilocycles/second. Since several

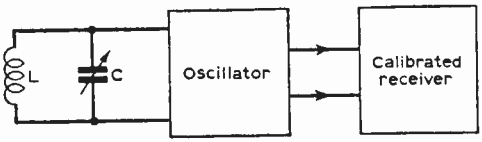


Fig. 2: The basic arrangement for making inductance measurements.

factors have been excluded, this method is only suitable for approximate measurements.

In the block diagram, the tacit assumption has been made that the capacitance C is the only capacitance in circuit. Since circuit wiring and valve electrode capacitances are present these so called stray capacitances must be taken into account.

Consider the following argument:

Let L = inductance μH.
C_s = stray capacitance μF.
C_1 = maximum capacitance of C μF.
C_2 = minimum capacitance of C μF.
F_1 = resonance frequency of combination L, C_1 C_s kc/s.
F_2 = resonance frequency of combination. L, C_2 C_s kc/s.

When C_1 is in circuit, total capacitance = $C_1 + C_s$.

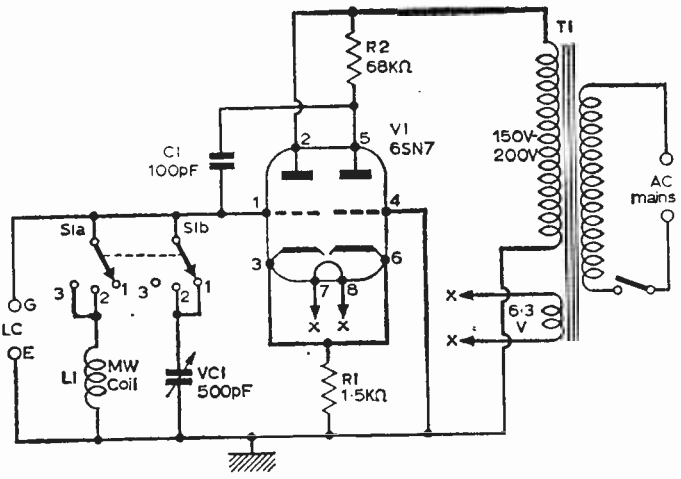


Fig. 1: The basic circuit of the instrument.

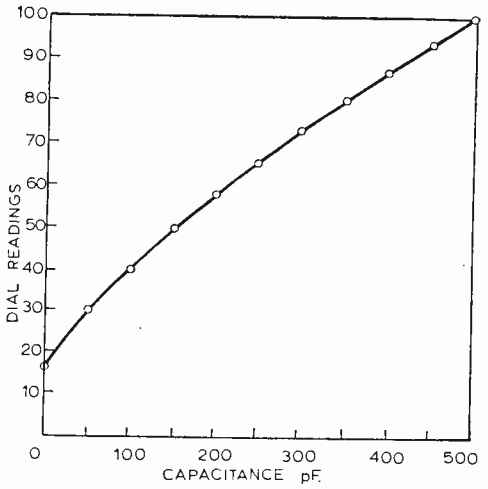


Fig. 3: Specimen graph of dial readings plotted against capacitance. The apparent zero capacitance at a dial reading of 16 occurs because of the arbitrary choice of 500pF as maximum capacity.

When C_2 is in circuit, total capacitance $= C_2 + C_s$.

$$\therefore \text{ since } LC = \frac{K}{f^2} \text{ where } K = 25{,}330$$

$$\text{then } L(C_1 + C_s) = \frac{K}{f_1^2}$$

$$\text{and } L(C_2 + C_s) = \frac{K}{f_2^2}$$

Subtracting

$$L(C_1 + C_s) - L(C_2 + C_s) = \frac{K}{f_1^2} - \frac{K}{f_2^2}$$

$$\text{or } LC_1 + LC_s - LC_2 - LC_s = \frac{K(f_2^2 - f_1^2)}{f_1^2 f_2^2}$$

$$\text{or } L(C_1 - C_2) = \frac{K(f_2 + f_1)(f_2 - f_1)}{f_1^2 f_2^2}$$

transposing

$$L = \frac{K(f_2 + f_1)(f_2 - f_1)}{f_1^2 f_2^2 (C_1 - C_2)}$$

Hence, if the resonance frequencies, f_1 and f_2, are found and $C_1 - C_2$ is known, then L can be calculated. Two points arising from this expression are worthy of note. First, the stray capacitance term C_s is automatically cancelled out in the derivation. Secondly, the expression contains in the denominator the factor $C_1 - C_2$. Since this is merely the difference, ΔC, between two quantities, the absolute value of C, the variable capacitor, is not required. What is required, however, is an accurate knowledge of ΔC.

Practical considerations

An accurate calibration of the variable capacitor is absolutely essential if reliable results are to be obtained. A method for the determination of ΔC will now be given.

With the switch in position 2 the standard medium wave coil is brought into circuit. The variable capacitor is turned to maximum capacity. In the author's instrument this capacitor had a nominal value of 500pF and was fitted with a dial calibrated from 0-100.

A table, divided into two columns, is drawn up. One column represents capacitance, the other column dial readings. The capacitance column is divided in 50pF intervals, starting with 500pF, corresponding to a dial reading of 100.

The modulated r.f. signal emitted by the oscillator is picked up on the calibrated receiver which is tuned to the medium wave band and placed a suitable distance from the oscillator. A knowledge of the frequency of the emitted signal is not necessary for calibration of the capacitor.

The receiver setting is left undisturbed and a close tolerance ($\pm 1\%$) capacitor of 50pF capacitance placed across the LC terminals. The variable capacitor is retuned until the signal is again picked up on the receiver. Since the inductance is constant, the reading of the variable capacitor must have decreased by 50pF. The dial reading must therefore correspond to 450pF. With the dial setting of the variable condenser unchanged the 50pF standard is removed and the signal again picked up on the receiver. The 50pF standard is replaced across LC and the variable capacitor retuned as before. In this way a series of capacitance points, each differing by 50pF can be obtained. The variable capacitor dial readings are then plotted against the appropriate capacitance readings on a sheet of graph paper as shown in Fig. 3. Reference to the graph will then enable the constructor to determine the capacitance difference between any two points on the dial.

The factors affecting the accuracy of the foregoing calibration will be apparent: First, the calibration is based on the accuracy of the fixed standard capacitor, and secondly, it is necessary to decide whether two signals are of equal magnitude. For all practical purposes a $\pm 1\%$ silver mica capacitor is adequate for calibration purposes. The second source of error can be largely eliminated by fitting the receiver with an output meter. Alternatively, if a.v.c. is fitted, a 0-10 v. d.c. meter may be connected across the bias resistor of one of the controlled valves.

Applications of instrument
Inductance measurements

The experimenter is often required to wind a coil to a given inductance value. In general the required number of turns can be obtained either by calculation, using some type of empirical formula, or by graphical methods. After winding the coil with the appropriate number of turns it is frequently found that inductance is quite different from the nominal value.

Now let us suppose that a coil of inductance 170μH is required for medium wave band coverage. Reference to tables or formulae will indicate that approximately 98 turns of 34 s.w.g. enamelled wire close wound on a 1 in. diameter former will give this value of inductance. Starting at the grid end of the coil, wind on 5 turns and space this section from the remaining 93 turns by approximately $\frac{1}{8}$ in. Switch the oscillator to position 1 and connect the coil across the LC terminals. Set the variable capacitor

to 400pF and tune in the resulting signal on the receiver. Note the frequency f_1. Reset the capacitor to 300pF and again note the new frequency f_2. The values obtained in this way are substituted in the formula and the inductance calculated. Adjustment of the inductance can be made either by spacing of the 5 turn section or by removal of turns.

As an example of an experiment by the author, a coil of nominal inductance 170μH, was required. It was found that with 400pF in circuit the resonance frequency was 600kc/s. With 300pF in circuit the resonance frequency was 680kc/s. Substitution in the formula gives

$$L = \frac{25330 \times (680 + 600) \times (680 - 600)}{680^2 \times 600^2 \times \cdot 0001}$$
$$= 156\mu H$$

Although the arithmetic is simple, the working out is a little heavy and the use of logarithms is recommended. In the above case the inductance was increased by bringing the 5 turn section into closer proximity with the main coil.

A serious source of error in the preceding experiment can arise in reading the frequency on the receiver dial. Unless the receiver calibration can be relied upon a better procedure is as follows. Tune the receiver to a station of known frequency at the l.f. end of the medium wave band. Adjust the oscillator variable capacitor until zero beat is obtained. With the aid of the graph note the capacitance corresponding to the dial reading. Retune the receiver to a station of known frequency near the h.f. end of the band. Adjust the variable capacitor for zero beat, again noting the capacitance reading. The inductance is calculated as in the preceding example.

When other inductance values are required a rough calculation will give the approximate frequency coverage and the receiver can be switched to the appropriate band.

Inductance matching

Although the foregoing experiments are of interest, particularly where an exact knowledge of the inductance of a coil is required, in practice, the constructor is more interested in the matching of coils rather than in the determination of absolute values. It will now be shown how exact matching of two or more coils is possible.

Let us assume that two coils L1 and L2, require matching. Insert L1 across the LC terminals and place the switch in position 1. Adjust the variable capacitor to any convenient value and the note the frequency f_2 of the resulting signal on the calibrated receiver. Remove L1 and insert L2 and again note the frequency f_1 of the signal. If f_1 and f_2 coincide the coils are perfectly matched. However, the author assures readers that this is extremely unlikely! In the more likely event of f_1 and f_2 being different, note whether f_2 is greater or less than f_1. If f_2 is greater than f_1 then L2 is *less* than L1 and conversely, if f_2 is less than f_1 then L2 is *greater* than L1. Since it is more practicable to remove turns from a coil, inductance matching is carried out on the higher of the two inductances. The following procedure is adopted.

With the lower of the two inductances determine the frequency with the calibrated receiver. Without disturbance of the generator or receiver settings, remove the inductance and insert the inductance of higher value. The coil is then adjusted, either by placing or removal of turns until the emitted signal coincides with the receiver setting. The coils are then matched.

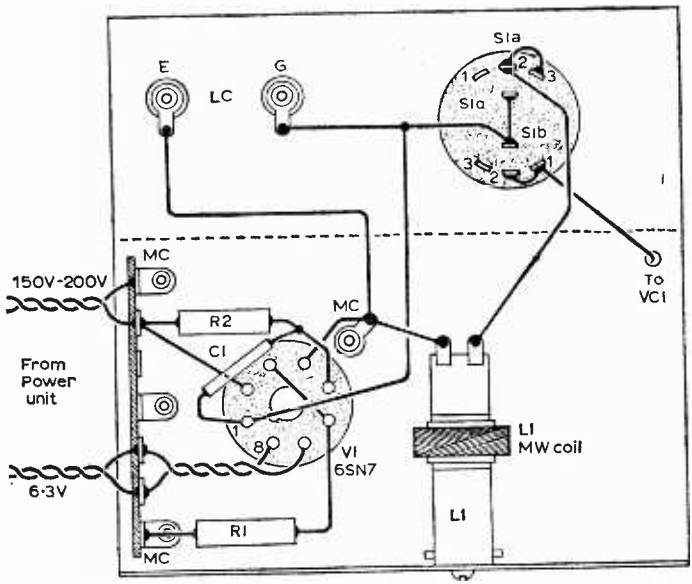


Fig. 4: The underchassis wiring diagram.

If greater accuracy is required the coils can be matched by zero beating against a station of known frequency. With practice, a high degree of accuracy can be achieved.

It is important to note that after each adjustment of the coil, the hand or any other earthed object should not be in close proximity with the coil. Since it is inevitable that the panel is near to the coil, each determination is carried out at exactly the same distance from the panel.

Gang capacitor matching

It is not generally realised that gang capacitor sections are rarely equal. In many cases the errors involved may be as great as 2%. For exact ganging of circuits not only must the inductances be matched and stray capacitances balanced out but also the gang capacitor should have equal capacitance in each section at every setting of the gang capacitor. Too often this source of error is overlooked when poor receiver alignment is obtained, Provision is generally

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made for the adjustment of gang capacitor inequalities by the provision of split end vanes in each section. Using the oscillator, excellent matching of gang capacitor sections can be achieved in the following manner.

For the purpose of illustration the matching of a twin gang capacitor will be described. With the oscillator switch in position 3 the medium wave coil is brought into circuit and the variable capacitor switched out of circuit. Connect one section of the gang capacitor across the LC terminals of the oscillator. Turn the gang capacitor from maximum capacity to minimum capacity until the first segment of the split end vane is completely in mesh with the stator plates. Tune the receiver to the h.f. end of the medium wave band until the oscillator signal is heard. Remove the clip from the stator tag of the first section and replace on the second section tag. The end segment is then gently bent out from the vertical and away from the other rotor vanes until the radiated signal coincides with the receiver setting.

Naturally the choice of section for adjustment depends on which section has the higher capacitance value. The higher the capacitance, the lower the frequency, conversely the lower the capacitance, the higher the frequency. The adjustment is always carried out on the section with the higher capacitance.

When equality has been obtained the process is repeated with the remaining segments until a perfect match is obtained at all settings of the gang capacitor.

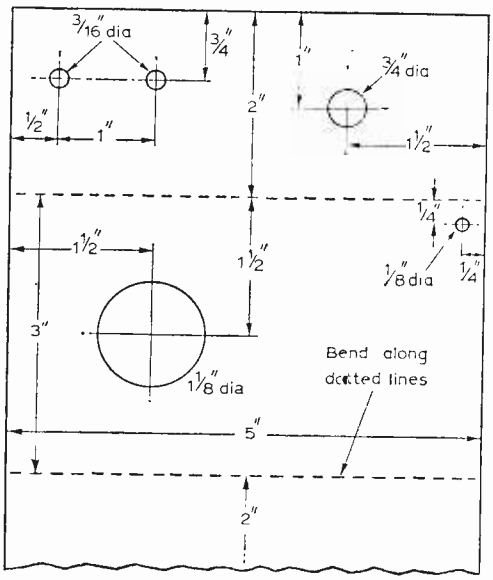

Fig. 5 (left): Principal chassis dimensions.

Capacitance measurement

Capacitors in the range 10-500pF can be measured with reasonable accuracy by means of the oscillator. The accuracy of measurement is limited only by the errors involved in the calibration of the oscillator variable capacitor. The principle of the method is similar to that employed in the calibration method.

With the variable capacitor set to maximum capacity (500pF) the resultant frequency is observed on the receiver. The unknown condenser is placed across the LC terminals and the variable capacitor tuned until the signal is again heard. The capacitance reading of the oscillator dial is noted. For example, if the setting of C without the unknown capacitance is 500pF and 450pF with the unknown capacitance in circuit, then the value of the unknown capacitance is 500—450=50pF. This method is unsuitable for capacitances greater than 500 pF since the greatest measurable capacitance can never be greater than the capacitance swing of the variable capacitor.

Constructional details

The oscillator is constructed on a 5in. × 3in. × 2in. chassis, the relevant dimensions being given in Fig. 5. Wiring of the instrument is not critical and most of the components will probably be to hand. The variable capacitor is the most critical item and it is strongly recommended that a good specimen manufactured by a reputable firm is used. Since the current consumed by the oscillator is negligible a small midget transformer will suffice for the power requirements. In the author's instrument the transformer is separate from the oscillator but there is no reason why other constructors should not make the transformer an integral part of the unit. A slightly larger chassis will of course be necessary if this is envisaged.

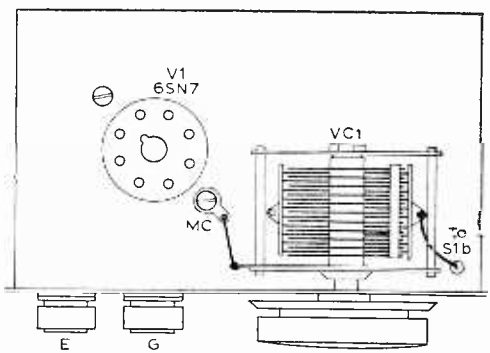

Fig. 6: An above-chassis view.

The connections of the unknown inductance or capacitance to the LC terminals are of considerable importance. These connections should be constructed from thick copper wire so that the leads are self supporting. The two leads terminate in crocodile clips which can be firmly attached to the component under test. When testing gang capacitor sections it is important that the frame of the capacitor is connected to the terminal marked E. Similarly, if screened coils are being tested the screen and earthy end of the coil should be firmly earthed to the same terminal.

The oscillator switch performs three functions. Position 1 is used for inductance testing and matching, position 2 for capacitance testing and position 3 for gang capacitor matching.

When testing or matching inductances it is essential to ensure that the two coils are tested in the same

position relative to the instrument panel. To avoid undesirable screening effects it is recommended that the test leads are not less than 3 in. in length.

The author has found that the instrument is greatly superior to the grid dip oscillator for the measurement of inductance and capacitance. If desired, the basic circuit could be embodied in a complete signal generator with the additional facilities of inductance and capacitance testing being incorporated. A suggested circuit for the experimenter who desires to elaborate on the test unit is given in Fig. 9.

Appendix

For the sake of completeness and as a convenient reference for constructors the following data is included.

Several expressions are available for the calculation of the number of turns required for a given inductance The author has used two well known formulae which have proved satisfactory in practice. The first formula is applicable to single layer coils.

$$N = LR\left[1+\sqrt{\frac{9}{aLR^2}}\right]$$

Where N is the required number of turns
L is the inductance in microhenries
a is the radius in inches
and $R = \frac{20}{nd^2}$ where
n is the number of turns per inch
d is the diameter in inches

The second formula is applicable to pile wound coils. See Fig. 8.

$$L = \frac{0{\cdot}2 \times a^2 \times N^2}{3a+9b+10c}$$

where a is the mean diameter
b is the winding length
c is the depth of winding
N is the number of turns
all dimensions being expressed in inches

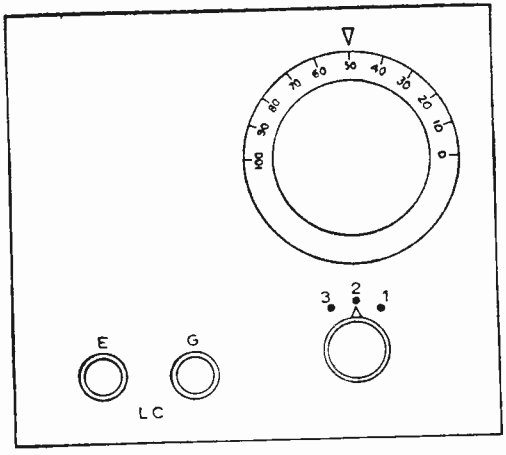

Fig. 7: Front panel layout of controls.

Applications to coil winding

The frequency coverage of a given coil and variable capacitor is given by the expression

$\frac{f_2}{f_1} = \sqrt{\frac{C_1}{C_2}}$ where C_1 is the maximum capacity of the variable capacitor and C_2 the minimum capacity. In practice, stray capacitances have to be taken into account. These extraneous capacitances have a bearing on the frequency coverage of the given combination of C and L. Now let us suppose that it is desired to cover the medium wave band with a given coil and a variable capacitor of 500pF nominal capacity. Average values for the maximum and minimum capacitances of such a capacitor are 500 and 15pF respectively. To these values must be added stray capacitances, which in general may be as high as 15pF. The capacitance coverage is now 515—30pF. The total minimum capacitance is now brought up to some predetermined value by the use of a trimmer capacitor. Let this excess capacitance be 20pF. The capacitance coverage is now 535—50pF. We can now calculate the frequency coverage using the previous expression. If we assume the lowest frequency we wish to cover is say 560kc/s then

$$\text{Since } \frac{f_2}{f_1} = \sqrt{\frac{535}{50}} = 3{\cdot}27$$

then $f_2 = 560 \times 3{\cdot}27 = 1753$kc/s.

The inductance of the required coil may be calculated utilising the expression

$$L = \frac{25{,}330}{Cf^2}$$

Substitution of the previous values of C and F gives

$$L = \frac{25{,}330}{{\cdot}000535 \times 560^2} = 165\mu H$$

The required coil may now be wound to this inductance value using the first inductance formula. Let the diameter of the former be 1 in. and assume that the given enamelled wire occupies a winding length of 100 turns per inch. e.g. 34 s.w.g.

$$\text{Since } R = \frac{20}{nd^2} \text{ then } R = \frac{20}{100 \times 1^2} = 0{\cdot}2$$

$$\therefore N = 165 \times 0{\cdot}2\left[1+\sqrt{1+\frac{9}{0{\cdot}5 \times 165 \times {\cdot}04}}\right] = 97$$

Hence the coil can be wound with 97 turns of 34 s.w.g. wire, close spaced and occupying a length of approximately 1 in.

An example of inductance calculation utilising the second formula will now be given. Assume that a coil of 2000μH inductance is required to be wound on a 1 inch former and using 34 s.w.g. wire. Any arbitrary value of b may be chosen. Let this value be $\frac{1}{8}$ inch. The number of turns of wire occupying this length is approximately 12. It is now necessary to try several trial solutions. Assume that 100 turns are required. The number of layers is therefore

$\frac{100}{12} = 8$ ca.

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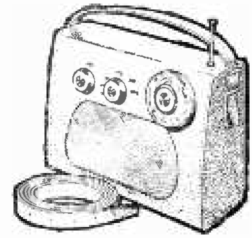

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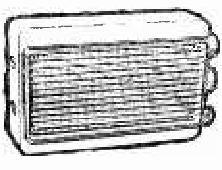

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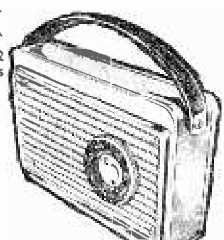

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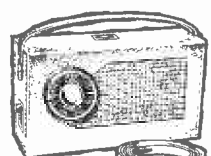

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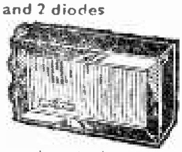

Covers Medium and Long Waves and Trawler Band, a feature usually found in only the most expensive radios. On test Home, Light, Luxembourg and many Continental stations were received loud and clear. Designed round supersensitive Ferrite Rod Aerial and fine tone 2½in. moving coil speaker. Built into attractive black case with red speaker grille. Size 5½ x 1½ x 3½in. (Uses 1289 battery available anywhere).

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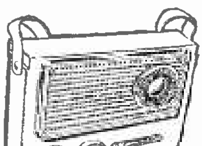

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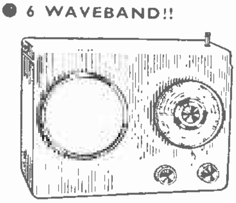

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Listen to stations half a world away with this 6 waveband portable. Tuneable on Medium and Long waves, Trawler Band and two Short Waves. Sensitive ferrite rod aerial and telescopic aerial for short waves. Top grade transistors, 3-inch speaker, handsome case with gilt fittings. Size 7½ x 5½ x 1½ in.

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The depth therefore is $\frac{8}{100}$ in. = C.

Substituting these values in the formula gives

$$L = \frac{0{\cdot}2 \times 1{\cdot}08^2 \times 100^2}{3{\cdot}24 + 1{\cdot}11 + 0{\cdot}8} = 454\mu H$$

thus giving one trial solution. The process is repeated for other values of N. A rough plot of N against

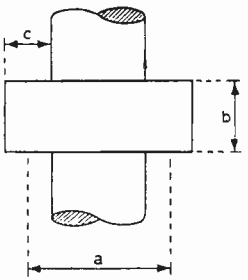

Fig. 8: Critical coil dimensions in inductance calculations.

COMPONENTS LIST

R1	1·5kΩ 1W R2 68kΩ 1W
C1	100pF silver mica
VC1	500pF variable
L1	Medium wave coil
S1a, b	2-pole 3-way switch
V1	6SN7
T1	Mains transformer: miniature type Octal valveholder, terminals, aluminium chassis, panel, etc.

COMPONENTS LIST

S1a, b	Altered to two-bank switch: single-pole 7-way each bank
L1	0·45μH
L2	2μH
L3	19μH
L4	1,500μH
L5	165μH

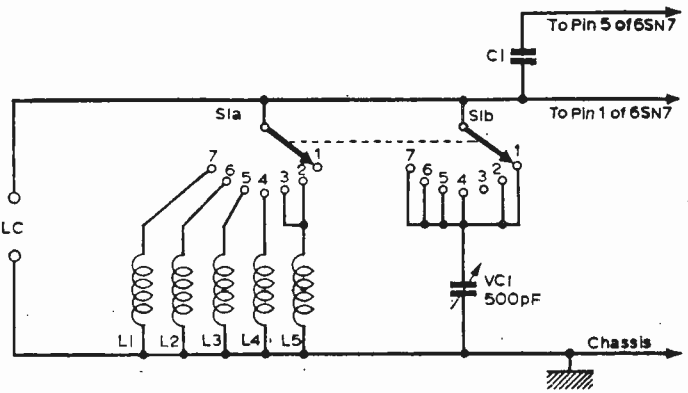

Fig. 9: Input circuit for combined signal generator and inductance/capacitance tester. S1: pos.1 inductance match and test; 2 capacitance test and 560-1600 kc/s; 3 gang capacitor match; 4 180-600 kc/s; 5 1·6-5 Mc/s; 6 5-15 Mc/s; 7 10-30 Mc/s.

inductance is made, when the required number of turns for the given inductance may be read off from the curve.

Another and possibly less tedious method of computation may be carried out with this formula

$$\text{Since } L = \frac{0{\cdot}2\, a^2 N^2}{3a + 9b + 10c}$$

Transposition gives

$$N^2 = \frac{L\,(3a + 9b + 10c)}{0{\cdot}2a^2}$$

The preceding 2000μH inductance may now be calculated as follows.

Two arbitrary valves are assigned to b and c. For the purpose of calculation let $b = \frac{1}{8}$ inch and $C = \frac{1}{8}$ inch, then since L = 2000 and $a = 1\frac{1}{8}$

$$\text{Then } N^2 = \frac{2000\,(3\frac{1}{8} + 1\frac{1}{8} + 1\frac{1}{4})}{0{\cdot}2 \times 1\frac{1}{8} \times 1\frac{1}{8}} = 49{,}400$$

$\therefore$ N = 222

The required gauge of wire is now calculated. Let n be the number of turns per inch.

Then the number of turns in length b = bn.

and the number of turns in depth c = cn

$\therefore$ Total number of turns = bn × cn = bcn^2

and this value is equal to N

$\therefore$ Since N = 222

then $bcn^2 = 222$ and since $b = c = \frac{1}{8}$ in.

$$\text{then } n = \sqrt{\frac{222}{\frac{1}{8} \times \frac{1}{8}}} = 120$$

From wire tables it is found that the nearest gauge which has a winding length of 120 turns per inch is 38 s.w.g. enamelled wire.

The required data is therefore 222 turns of 38 s.w.g. enamelled wire, pile wound to a length of $\frac{1}{8}$ in. and a depth of $\frac{1}{8}$ in.

The required number of turns for the inductances given in the suggested circuit of Fig. 9 can be calculated by means of these formulae. These calculations are left as an exercise for the experimenter. ■

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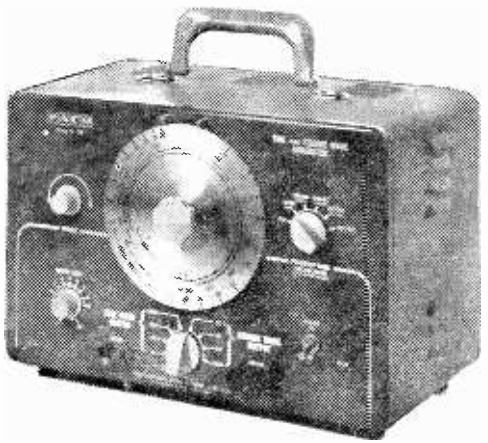
The output level is controlled by an attenuator, with three 20db steps, also a control for fine adjustment. The Paco G.34 is priced at £40 7s. complete, or may be purchased in kit form at £38 5s.

Also from Paco comes a new valve voltmeter, the V.70. This instrument has 7 d.c. ranges from 0—1500V, 7 a.c. ranges from 0—1500V r.m.s. and 0—4000V peak-to-peak, an ohmeter range of 0—1000MΩ and a decibel range of —6db to +66db.

The V.70 comes complete with a detachable 3-way probe, but the AV.1 high frequency crystal probe and the AV.2 high voltage probe are also available for use with the valve voltmeter permitting direct readings of voltages up to 60kV.

The Paco V.70 is priced at £22 12s. and may be purchased in kit form for £20 8s. *K.L.B. Electric Limited, 335 Whitehorse Road, Croydon, Surrey.*



This is the Paco G.34 sine-square wave generator.

Sony Agreement

THE Radio and Electrical Division of St Aldate Warehouse Ltd. (a Debenham Import & Distribution Company) have signed an agreement with the Sony Corporation of Japan, for exclusive distribution rights in the U.K. of Sony Products. The products included in the agency agreement are radios, tape recorders, and all future Sony products to be introduced into the United Kingdom markets.

The Sabafon TK230-S tape recorder.

New Equipment from SABA

NEW from SABA Electronics Ltd., is a range of audio equipment. Featured among this is a stereo/mono four track, two speed tape recorder, the Sabafon TK 230-S. This machine incorporates two amplifiers with matched transistor input stages, a built-in mixer unit with inputs for two sound stages, two push-pull output stages providing 5W per channel for stereo and 10W for mono, and a built-in tape cleaner. There are input sockets provided for gram, radio, pedal switch, slide synchroniser, time switch, stereo microphone, external loudspeakers and high impedance headphones. Weight is approximately 30lbs. and the price is 95 guineas. *SABA Electronics Ltd., Eden Grove, Holloway, London, N.7.*

Lighting Control Switch

A NEW lighting control switch has been introduced by Regentone, which enables room lighting to be adjusted easily to any level.

Called the "Varilite", the new control replaces the conventional wall switch and uses a new kind of rectifier which enables it to control up to 300W of lighting without generating wasteful heat and without taking up too much space.

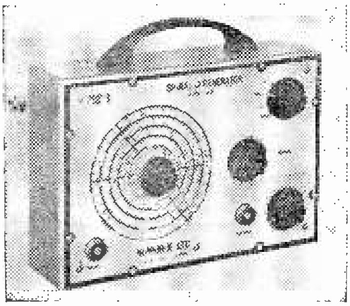
The "Varilite" uses no power itself, therefore reducing electricity bills—since payment is only made for the light selected—and prolonging the life of the bulb.

The "Varilite" costs 6½ guineas, fits any standard wall switch box and can be installed in a few minutes with the aid of a screwdriver. *Regentone Radio and Television Ltd., Footscray, Kent.*

New Portable from Ever-Ready

NEW from Ever-Ready is the "Sky Queen". It is one of a new range of Ever Ready transistor radio receivers. The Sky Queen is a 7 transistor superhet covering medium and long wavebands, and having an output power of 500mW. There is provision for car aerial and ear-

NOMBREX INSTRUMENTATION



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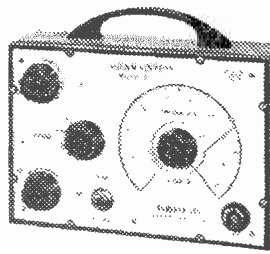

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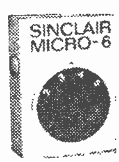

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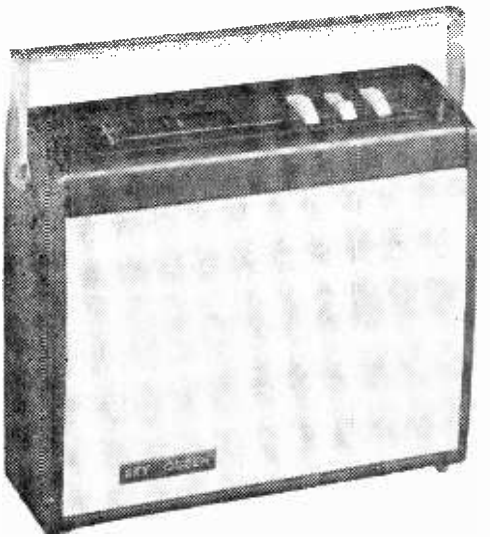
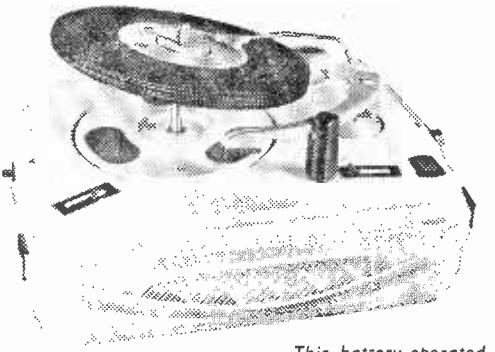
piece or tape recorder connection.

The set is powered by an Ever Ready PP9 battery giving some 190-200 hours playing time, and the price, including purchase tax, is fixed at 15 guineas. *Ever Ready Co., (Great Britain) Ltd., Hercules Place, Holloway, London, N.7.*



Ever Ready's new "Sky Queen" portable.



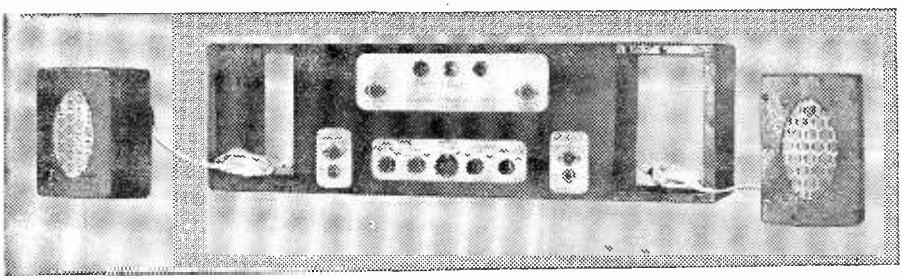
This battery-operated record player is made by W. H. Sanders (Electronics) Ltd.

Battery Autochange Player

BULK production has begun of a transistorised battery-powered record player, for 7in. 45 r.p.m. records, designed and manufactured by W. H. Sanders (Electronics) Ltd.

This automatic portable record player has been designed as a "take-anywhere" gramophone, its construction being exceptionally robust and featuring built-in transit protection for the pick-up and needle. Retail selling price is expected to be less than £15. *W. H. Saunders (Electronics) Ltd., Gunnels Wood Road, Stevenage, Hertfordshire.*

THE "MULTIPHONIC"



A 13-STAGE STEREO AMPLIFIER

BY MARTIN L. MICHAELIS

CONTINUED FROM PAGE 421 OF THE SEPTEMBER ISSUE

PROVIDED that the points outlined last month regarding h.t. voltage for the output stages are observed, almost any reasonable arrangement with available components may be used as h.t. supply if the exact specified items are not to hand.

If a transformer with a centre-tapped full-wave h.t. winding 250-0-250V (do not use a higher voltage one) is used operate one rectifier MR1, MR2 off each 250V end. The value of R20 will almost certainly need to be raised somewhat under such circumstances. If valves type ECC88 are available in place of PCC88 all heaters may be run in parallel off a single 6·3V winding, so that only one such winding (rating about 3A) is then needed. However, such valves are rarer than PCC88s. If a single heater winding used in this way has no tap earth one side and operate D1 and D2 off the other end.

The resulting increased bias voltage may be applied to V4 without further modification but C11 on each amplifier must now be shunted with a 5V Zener diode (cathode to chassis). If a 4V tap is present earth the "0" end and operate D1, D2 off the 4V tap. Naturally, when using ECC88s R41-R44 are not required.

Circuit Details of Input/Output Matrix

V4 and V5, on the one hand, and V3 on the other hand constitute two separate units, either or both of which may be omitted if not required. V3, with its function of splitting a monaural input into two channels, is the more important. It is hardly sensible to omit it if one is likely to operate with monaural signals in addition to pure stereo.

The output matrix section V4, V5 may be omitted if one never contemplates using outputs other than the two main speakers, and when the latter are substantial enough to give good bass reproduction themselves, not requiring the use of a common middle position bass amplifier and speaker operated off P4 when feeding a large audience in a large room with large baseline stereo signals.

The circuit arrangement of V3 is known as "anode-splitter". Both grids of the double triode are fed in parallel from the monaural input via separate grid-stoppers to prevent parasitic oscillation. The anode circuits are separate, giving two identical but electrically separate outputs.

The unbypassed cathode resistors both reduce gain (largely unwanted in this stage) and neutralise any would-be cross-talk between stereo signal channels due to this stage. R22/VR1/VR2 form an output voltage divider, coupling into the respective main amplifier channels; C14 is the normal h.t. voltage blocking capacitor.

This very high impedance voltage divider serves the purposes of further removal of unwanted gain of V3, thus not unnecessarily raising the hum and noise level, and it also prevents loading of the stereo input through the anode circuits of V3. R21 serves no electrical purpose, being merely a convenient anchorage point in the layout specified.

This sort of measure is a useful trick to remember: if a string of required components in series requires anchorage at a junction a very high value resistor or very low value capacitor can be used as a dummy tie-point to chassis or some other convenient anchorage. One must merely be certain that the electrical side effects are in all cases truly negligible.

V4 operates simultaneously as a pair of independent cathode-followers for the stereo output at P3 and as an additive anode amplifier developing a combined monaural signal across R34 from the stereo input to the two grids.

The monaural anode signal is passed on to V5 as output cathode-follower. R35 and R37 as voltage divider set an operating point of sufficient standing anode current for V5 as the d.c. voltage across R37 is repeated by d.c. cathode-follower action across R38. Such a method of positive grid bias on an h.t. bleeder is not usable for V4 because it would pass d.c. into the track of VR3, making operation of that control scratchy.

The use of extra blocking capacitors would produce unnecessary bass loss and phase shift, detrimental to stereo reproduction with a central common bass speaker. Thus cathode bias is used here as an alternative.

Speakers

The cabinet design used in the prototype for the complete unit aims at giving a complete self-contained installation for "personal" stereo listening in a small room. Two small oval speakers of about 3 x 5in. are specified and housed in niches at each end of the amplifier cabinet, giving a baseline of about 2ft. This gives a reasonable stereo impression when the unit is standing on the table in front of the listener about a yard from his head.

A more intense effect is obtained when the speaker units are removed from the niches and placed as far apart as the listener recedes from them. The room area in which stereo effect obtains is thereby also greatly increased, enabling larger audiences to be served.

However, with the small speakers specified the tone is likely to be very shrill and thin when they are moved apart, with a rather empty "middle". This defect may be combated either by using in addition, placed centrally, a third amplifier and large bass speaker, operated off P4, or simply by using an identical pair of much larger speakers in good cabinets.

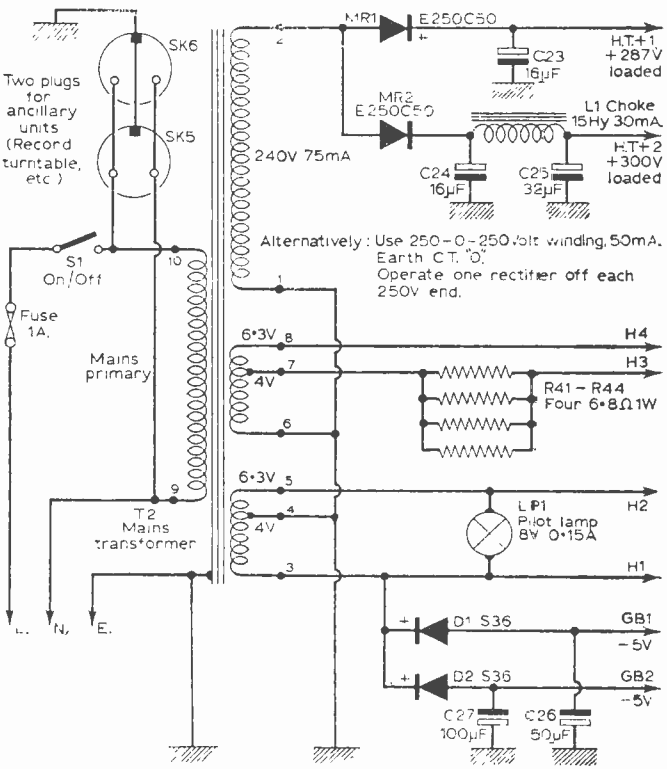
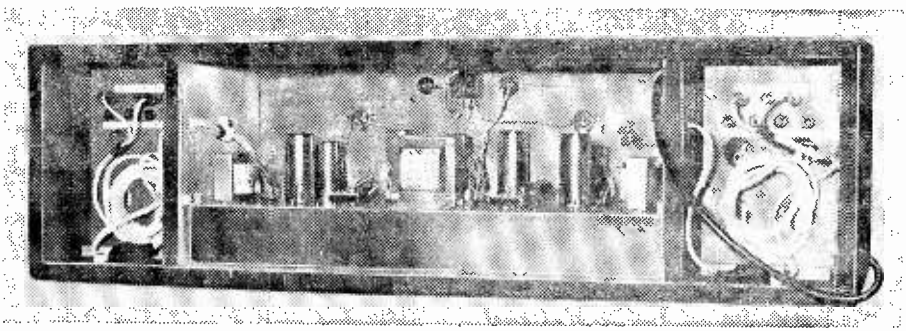


Fig. 4: The amplifier power supply



The "Multiphonic" viewed from the rear.

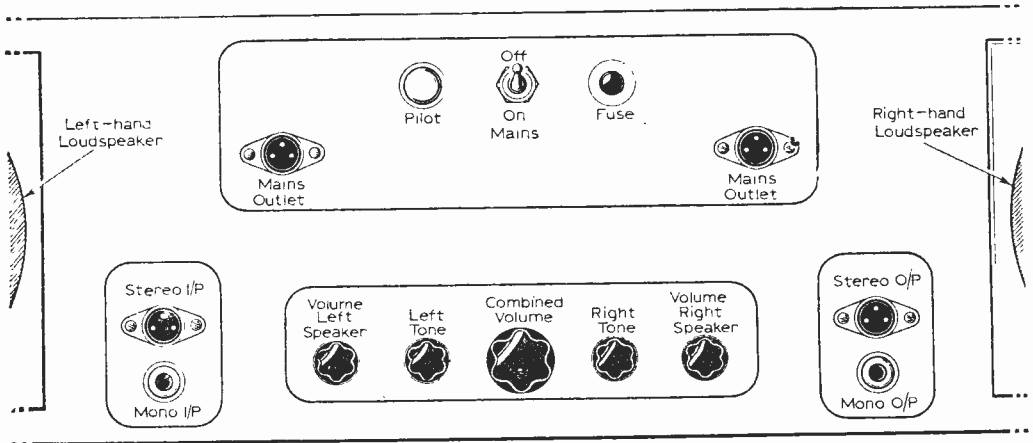


Fig. 5: Control layout on the front panel of the completed "Multiphonic".

Performance is very good indeed if a pair of 10in. speakers with 15Ω speech coils are mounted in bass reflex corner cabinets, stood in adjacent corners of the room and operated directly off the two amplifier channels.

A general rule for stereo listening is that the lines from the ideally positioned listener to the respective speakers should be approximately at right-angles. Frequencies below about 200c/s do not contribute greatly to the stereo effect as the human ear is not able to distinguish direction of origin very clearly at low frequencies.

Thus a common central speaker, obtaining bass from both channels, may be used. It is even possible to use passive cross-over networks for three speakers from the two amplifier outputs for this type of arrangement.

However, the use of two-channel speakers alone, both having adequate bass response, is generally preferable because—even though bass stereo contribution is negligible—the phasing is always purer in such an arrangement, thus definitely improving performance.

If a central bass speaker is used it is essential that a top-cut filter is used, preventing frequencies above at the most 500c/s reaching this speaker in audible amount. Otherwise the stereo effect is greatly weakened. ■

Miniature Power Amplifier

—continued from page 544

spigot on valve-holder No. 2.

(3) Decoupling capacitor C1 from tag No. 20 to earth.

Use rubber grommets in the holes in the chassis where wires pass through to prevent the plastic insulation being cut by sharp edges. Wiring should follow normal audio practice, twisted leads for heaters and single earth connection to chassis. When wiring-up do not forget the centre spigot on the valve-holders, which must be earthed, plus one side of the output transformer secondary.

Power Supplies

Almost any power unit will be able to supply the modest power necessary, smoothed h.t. of approximately 280/290V. at 20mA and 6·3V a.c. at 0·6A. An h.t. supply of 300V must not be exceeded.

Components

Resistors of 1/2 watt rating are adequate. Only two close-tolerance resistors are needed and these are the phase-splitter anode and cathode loads, where signal balance depends upon equality of the resistors. 1% tolerance must be used here.

Resistors for the rest of the circuit are preferably high stability of 5% tolerance, these are only slightly more costly than normal 10% carbon types and are well worth the slight extra cost.

Do not use a midget-sized o.p. transformer, otherwise low-frequency power output will be severely limited. A 3/4in. stack of laminations is the minimum for reasonable fidelity. The correct anode to anode load is 10kΩ and the turns ratio of the transformer for different loud speaker impedances is as follows:

Speaker Z	Ratio
3Ω	60 to 1
8Ω	35 : 1
15Ω	25 : 1

Testing

When connected to a suitable power supply and correctly matched to the loudspeaker, feed in a signal from tape-recorder or radio tuner and if satisfactory a test of voltages in the circuit can be made.

Voltages indicated are for no-signal conditions and should be within 5% of the indicated values. If voltages across the cathode bias resistors are low this indicates low emission of the valve(s). ■

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EF85	4/6	PL36	6/6	UBC41	5/-	7B6	6/-	6/30L2	7/-
EF91	2/3	PL81	5/6	UCC84	7/6	7C5	6/-	R19	6/6
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EY86	4/6	PY33	7/6	6X5	4/6				

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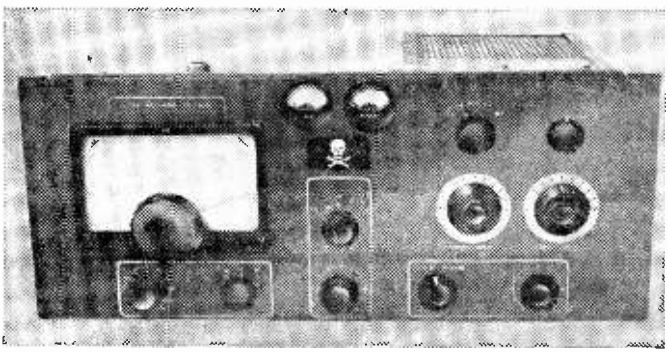


The BUCCANEER

MULTI-BAND TRANSMITTER

By J. E. Alban G3JEA

CONTINUED FROM PAGE 438 OF THE SEPTEMBER ISSUE

THE transmitter is assembled on a standard 16in. x 9in. x 2½in. deep chassis, and the valve base holes cut as shown in Fig. 4. If the Labgear unit is used, a drilling template is supplied by the makers and this should be positioned as indicated. The v.f.o. box is approximately 3in. high, 2½in. wide and 4in. deep, but should this not be readily available a small chassis could be used and a side cover fitted, access being made through the left hand side should repair be necessary. Alternatively, an Eddystone die-cast box can be used. The p.a. compartment is made rather on the large side to allow for ample ventilation.

All wiring should be carried out in 20s.w.g. tinned copper, covered with suitable insulated sleeving. Heater leads, h.t. leads other than those carrying r.f. must be screened. In each case the metal screening must be exposed and wherever leads cross one another or run parallel for more than 3 or 4in., they should be bound together with a few turns of tinned copper wire and soldered and bonded to the chassis. The modulator section clamper wiring, and bias supplies should also be screened and decoupled with disc ceramic conden-

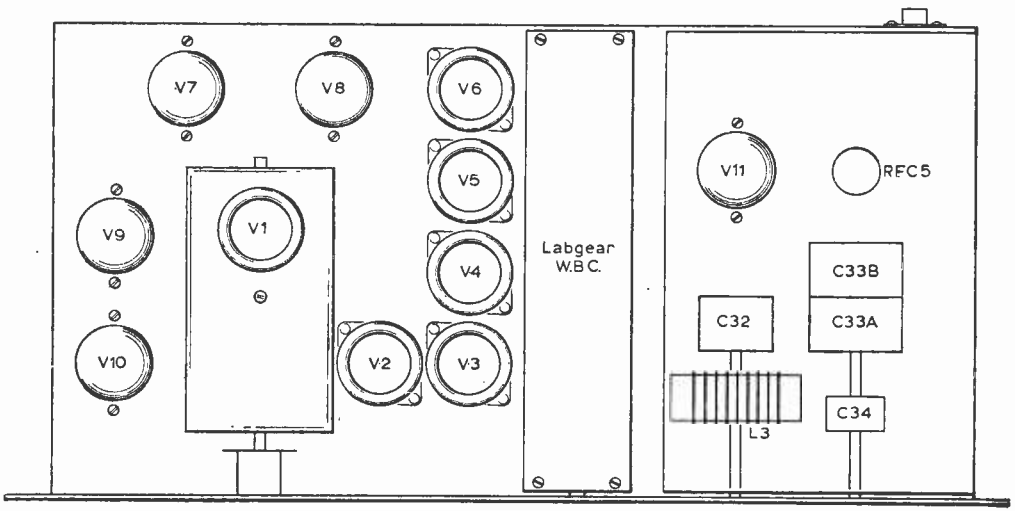


Fig. 4: Above-chassis layout of the major components.

MATERIALS FOR CHASSIS, PANEL, ETC.

Rack panel, 19 x 10in., black crackle finish
Chassis, 16 x 9 x 2½in.
Chassis bottom cover, 16 x 9in.
Box for v.f.o., 4 x 3 x 2½in.
V.F.O. box side cover, 4 x 3in.
All the above materials may be obtained from H. L. Smith & Co. Ltd. as standard ready-made items.
Two p.a. box side covers, 8¾ x 5¾in. with ½in. flange.
P.A. box rear and front panels, 6½ x 5¾in.
P.A. box top cover, 8¾ x 6½in. expanded aluminium.
32 x ½in. angle aluminium for top cover.

sers where indicated

When mounting the v.f.o. box on the chassis, care should be taken to see that the feed-through capacitors should be well clear of the holes drilled through the chassis, avoiding any possibility of short circuits or ineffectiveness of the condensers. Before any wiring is attempted, all holes indicated should be drilled in the front, rear, and top of the chassis. To avoid confusion, a Belling type of co-axial socket is used for the microphone, an Igranic socket for the key and ordinary banana-plug type of sockets for the station change-over relay connections. A Bulgin 5-way socket is used for the h.t. and l.t. connection to the power supply, there being ample spacing across the pins to wire in the r.f. decoupling chokes and condensers.

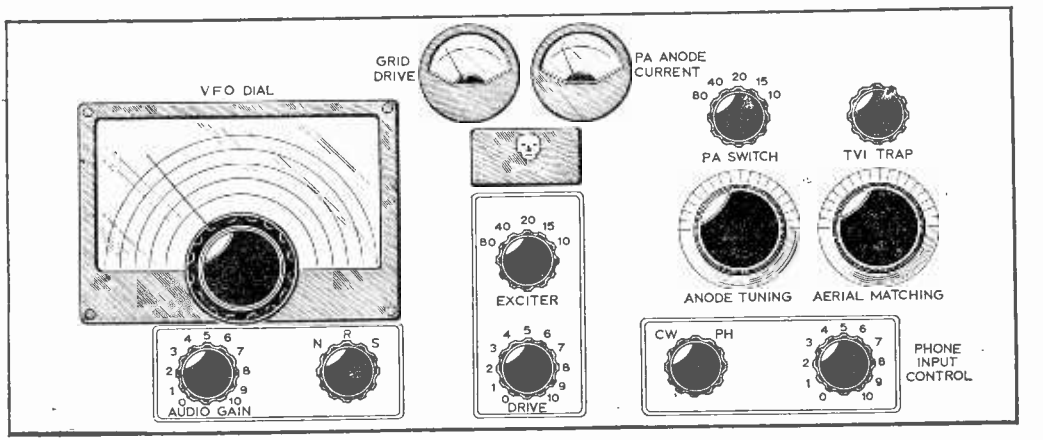
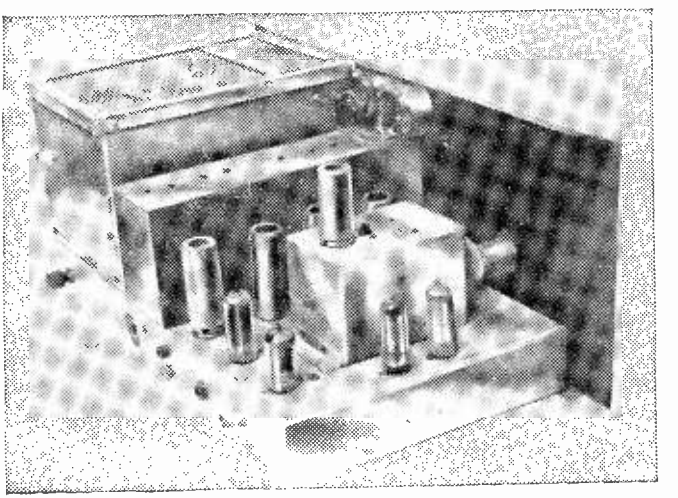


Fig. 5: Design for the front panel of the "Buccaneer".



The completed chassis of the "Buccaneer".

When assembling the p.a. stage, a small circular screen 3in. high and 2½in. diameter should be affixed to the chassis with the valve-holder screws. In the writer's case, this is a small aluminium can, obtained for the asking from the local chemist's shop, and used for the bulk packaging of tablets. The metal frames of the variable capacitors in the pi-network and that of the harmonic trap should be bonded together with copper braid or 16s.w.g. copper wire, and earthed to the chassis, as close to the cathode connection of the 807 as possible. Likewise, the 807 heater choke and decoupling capacitors should be soldered directly to the valve socket by the shortest lead possible.

Tuning Up Procedure

The v.f.o. should first be set to cover the bands as required. By using the bandset condenser and

the dust core of the inductance, some degree of variation is obtained in the bandspread coverage of the 15pF capacitor, TC1.

When satisfied with the coverage, the exciter bandswitch should be set to 3·5Mc/s and the main h.t. rail switched off. The drive control should be set at two-thirds open and key depressed. Some drive may be immediately apparent on the p.a.

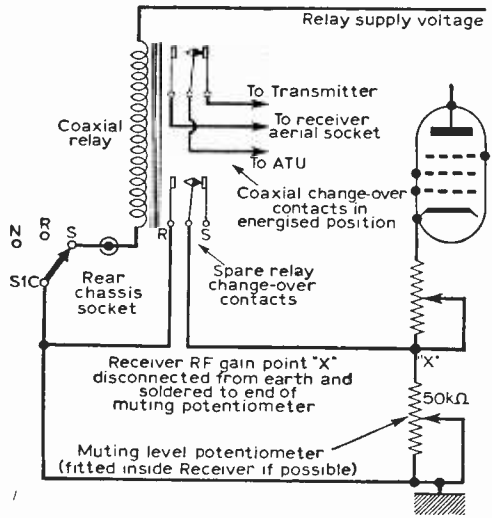


Fig. 6: The receiver muting and antenna change-over switching circuit.

grid current meter, but whether or not current is indicated, the first trimmer on the multiplier, that is, the one immediately behind the panel, should be peaked up for maximum drive. These adjustments to the wide band multiplier unit should only be made with reference to the manufacturers' details supplied with the unit. Reduce the level of the drive control by stages should the meter be overloaded. The v.f.o. should be set at 3·5Mc/s for this adjustment. When satisfied that the first trimmer is peaked at maximum, the v.f.o. should be tuned to the h.f. end of the band and the trimming procedure repeated, this time using the other trimmer. Now, should the drive fall off badly to one end or the other, further trimming should be carried out. The final adjustment should be carried out on the v.f.o. output capacitor TC2, situated at the rear of the v.f.o. box. As the latter is brought into resonance, it will be observed that the strength of the v.f.o. signal in the station receiver will decrease, allowing the oscillator to be left running all the time without hampering reception.

The other bands are then set up in turn, using the trimmers for 7Mc/s and 14Mc/s, etc., until all bands have been adjusted and drive is fairly linear across them. Final peaking adjustments can be carried out on these bonds with the Philips trimmers underneath the chassis. It is only necessary to obtain around 4mA with the drive control at maximum, to get more than sufficient power to drive the 807 to full input. In practice it is found that 1·5mA is ample when running at 90W input on phone and c.w. For phone operation the t.x. is adjusted in the c.w. position first, then the switch turned to the other mode, also, the input level control should be adjusted to give approximately 12mA standing anode current in the p.a. Using the mike gain control and speaking normally it should be adjusted until the anode current peaks reach the same level as when the key is pressed in the c.w. mode. The key is bypassed with a switch, so that it can be left in circuit if so desired.

The relay-control switching, shown in Fig. 6, is self-explanatory. Care should be taken to obtain a relay with reasonably wide spacing for the antenna change-over. Send-receive switching is a joy to use with just the one control to change over the antenna, mute the receiver, allow monitoring, and keep a snappy QSO going without the use of too many hands. ■

Amateur Band DX

by G3JDG

Top Band has been particularly disappointing. At one session only two stations were audible: G3SCP (RST599) and G3SVV (459) both calling CQ.

Eighty Metres has been rather "quiet" although some DX has appeared. Mostly Europeans in evidence, SM, DJ, OK, etc., and, of course, the usual G sideband net up the h.f. end discussing everything from rhombics to rhinoceros.

Forty Metres proves by far the noisiest band of the bunch and at times almost bedlam. The l.f. segment has been a hive (literally) of activity, but phone stations seem to be harder to find these days. For those who can stick at it the stations are there in amongst the noise, the commercials, and the many strange squeaks and whistles peculiar to the 7-7·1Mc/s portion of the short-wave bands.

Twenty Metres is by far the best DX band at the moment in spite of its annoying habit of fading out for a time. On July 28th 13 countries were heard in 14 minutes from 21·27 to 21·41 hrs. All Europe was in full swing: UT5, YO, F2, I1, OE, DJ, LZ, OH, UB5, UA1, DM, average report was 579. In the h.f. sector the "W's" were roaring in averaging 5 and 7 to 8 and easily readable in spite of the QRM and slight QSB. All these on an odd piece of wire for an aerial and no matching ATU.

Fifteen Metres rather dead and neglected. Rumours of exotic DX breaking through may well be true but they were not audible to your scribe. Anyone else hear anything on this band??

Ten Metres—Reputed to be dead as the proverbial Dodo—sunspot cycle at its lowest—waste of time—"Lucky if you hear a "G". Friends you have been misled! Sunday morning 26.7.64 from 1030 to 1400hrs—OK, UA3, OK1, SP8, DJ8, DL7, G3, LA8, DM3/P, OZ5, EI, HB9 and GM. ALL ON AM PHONE. Clearly there's life in the band and no doubt SWL reports would be appreciated.

CLUB NEWS

ACTON, BRENTFORD AND CHISWICK RADIO CLUB
Hon. Sec.: W. G. Dyer, 3GEH, 188 Gunnersbury Avenue, London, W.3.

At the September meeting of this society, to be held on the 22nd, G3IGM will be giving a talk entitled "Application of Theory to Practice".

BRADFORD RADIO SOCIETY
Hon. Sec.: E. G. Barker, G3OTO, 63 Woodcot Avenue, Baildon, Nr. Shipley, Yorkshire.

Members of this society who attended the August meeting on the 18th. heard a lecture on "Civil Defence".

The first meeting in September was on the 1st and was an informal evening.

CHESHUNT AND DISTRICT RADIO CLUB
J. V. Beavan, G3GBL, 41 Albury Ride, Cheshunt, Hertfordshire.

This society meets on the first Friday of each month at the Civil Defence Centre, Turners Hill, Cheshunt. The meetings begin at 7.30 p.m. when visitors and prospective members will be welcomed.

On August 7th the Club met to hear a tape recorded lecture on test gear and other subjects.

This Saturday—5th September—Club members will be operating a demonstration station in the playing field at Goffs Lane, Cheshunt, under the call-sign GB3CRC. Visitors to the site will be welcomed by the members and all communications will be by telephony to create more interest for the less technical amongst them. The station will be on the air from 11.30 a.m. to dusk on 160 and 80 m.

CHESTER AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: P. J. Holland, Field House, 19 Kingsley Road, Gt. Boughton, Chester, Cheshire.

After the activity of Net Night held at the beginning of August, members settled down to open discussion on the 11th. An open night on the 18th once again provided the opportunity for quite a ragchew amongst members.

CLIFTON AMATEUR RADIO SOCIETY
Hon. Sec.: J. Rose, G3OGE, 63 Broomfield Road, Beckenham, Kent.

Recent additions and alterations to the Club's aerial array have made it possible to increase activity on 144 Mc/s. and 70 cm.

On August 16th, members took part in the second 3.5 Mc/s. d.f. contest.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.

This Society's mobile rally which is held annually at Rykneld School, went off successfully on August 16th after preparations had been finalised a few days before at a meeting on the 12th.

GUILDFORD AND DISTRICT RADIO SOCIETY
Hon. Sec.: D. H. Mead, G3OXI, 41 Egley Road, Woking, Surrey.

Chobham Common was the venue for a group of members of this Society working portable gear on August 21st. At the meeting on the 28th, members discussed plans for the demonstration station they are manning at this year's Guildford Town Show, being held the following weekend.

NORFOLK AMATEUR RADIO CLUB
Hon. Sec.: A. W. Preece, G3TCO, School of Biological Sciences, Wilberforce Road, Norwich, NOR 77H.

Since its inception in January this year, membership of this society has risen to nearly 40 with Club activities likewise increasing. Recently a regular series of lectures has begun, to be followed by R.A.E. classes and morse practice sessions.

New members will of course be welcomed at any of the meetings held each Monday, beginning at 8 p.m.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

Members of this Society provided two demonstration stations during August, one being at the Halifax Agricultural Show held on the 8th, and the other at Crossleys Carpets Gala held on the 15th.

On the 16th of the month, a group of members paid a visit to the radio telescope station at Jodrell Bank, Cheshire.

August ended with a ragchew night on the 19th, with no more club activities until September 2nd, when Northern Heights A.R.S. played host to members of the Manchester Radio Society at a Pea and Pie Supper

READING AMATEUR RADIO CLUB
Hon. Sec.: R. G. Nash, G3EJA, "Peacehaven," 9 Holybrook Road, Reading, Berkshire.

The Club met on August 29th to hear several members describe various pieces of ancillary equipment made by them for use with typical transmitter rigs.

WEST KENT AMATEUR RADIO SOCIETY
Hon. Sec.: H. F. Richards, 17 Reynolds Lane, Tunbridge Wells, Kent.

The main event of this Society during August proved to be a very enjoyable one for all who attended. It was held on August 30th and was in fact, a picnic at Sussex's Sheffield Park.

COURSES OF INSTRUCTION

BIRKENHEAD TECHNICAL COLLEGE

It is expected that an R.A.E. course will be run at this college on Thursday evenings. Enquiries for membership can be made either to the college or to A Seed, 31 Withert Avenue, Bebington, Wirral, Cheshire.

BRENTFORD EVENING INSTITUTE

Several courses of interest to the radio enthusiast are being run by this Institute this autumn, including R.A.E. and morse. Enrolment for any of the classes may be made between 14th to 17th September at the Brentford Evening Institute, Clifden Road, Brentford, Middlesex.

CENTRAL EVENING INSTITUTE

R.A.E. classes are being held at the Lea Mason Centre of the Central Evening Institute in Birmingham, starting on 14th September. Enrolment week commences 7th September.

EAST HAM TECHNICAL COLLEGE

An R.A.E. course will begin at the East Ham Technical College, High Street South, London, E.6, on 21st September. Candidates should enroll on the 14th, 15th or 16th September.

NORTHSIDE SCHOOL

On 21st September, an R.A.E. course begins at Northside School, Percy Road, Finchley, London, N.12. Morse instruction will also be given later in the course. Enrolment for the course can be made between 14th and 17th September,

WEMBLEY EVENING INSTITUTE

At the Copland School of this Institute in Wembley High Road, R.A.E. classes will be held from 21st September. Enrolments will be accepted between 14th and 17th September.

WESLEY EVENING INSTITUTE

A radio and television course will begin at this Institute on 21st September. Enrolment can be made at the Institute in Wesley Road, London, N.W.10, between 14th and 18th September

AUDIO OSCILLATOR DESIGN

We wish to point out that the article "Audio Oscillator Design", which appeared in the August 1964 issue of PRACTICAL WIRELESS, was based on a chapter of the Mullard Reference Manual of Transistor Circuits, published by Mullard Limited.

LETTERS TO THE EDITOR

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying commercial or surplus equipment. We cannot supply alternative details for receivers described in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of the cover.

The Editor does not necessarily agree with the opinions expressed by his correspondents.

AMERICAN LITERATURE

SIR,—Recent issues of your journal have, more often than not, included a page of book reviews, and this, in my opinion, well reflects the state of the book market which is currently being flooded by technical publications both from home and abroad.

Many of the imported books come from the U.S.A. and while any additions to the amount of technical literature available is to be welcomed, much of the value of these books might be lost by an unwary reader in this country who does not allow for the very real language differences to be encountered in works of American origin. When reading books from the U.S.A. dealing with radio and electronics, I find it necessary to accustom myself to substitute automatically "earth" for "ground", "anode" for "plate", etc., for to stop, think and translate every unfamiliar term as it occurred in the text would be disastrous for any reader trying to absorb the contents.

There is then, I suggest, a strong case for making available information to explain and clarify these differences, a sort of English/American dictionary. It is probably true that English versions of technical works originally written in French, German or Russian suffer less from these difficulties than American books, as translators of foreign language books are aware of English expressions and take this into account, whereas books which come from the United States are left "raw" because officially both countries use the same language.

If it were just a matter of substituting one word for another, there would be little to worry about; however, very often the whole approach to a piece of theory differs in the U.S.A. and even circuit diagrams and symbols have a peculiar and confusing appearance to the British reader.—JAMES GOODWIN (Scarborough, Yorkshire).

PAST ISSUES OF P. W.

SIR,—With reference to your "Sell or Loan" column, I have available every copy of PRACTICAL WIRELESS from 1950 to 1962, also every copy of *Practical Television* from No. 1 to 1962, and I am willing to give any of these issues, free of charge, to anyone who cares to write, enclosing postage sufficient to cover any issues they require. This is a genuine offer now that I find I am forced to dispose of these magazines as they take up more space than I can afford.—J. F. HITCHCOCK (86 Reigate Avenue, Sutton, Surrey).

TRANSISTOR PREAMP

SIR,—Regarding the Transistor Preamp on page 358 of the August issue of PRACTICAL WIRELESS. When used with the power supply unit for a valve amplifier (Fig. 3) the output should be taken from C4 and the negative line. This will avoid having a potential difference between the preamp output and valve amplifier input circuits. The input circuits should be isolated by a 25μF 25V electrolytic in series with the +ve lead to the volume control and input sockets (negative to VR1 and sockets). This will prevent d.c. from reaching the tuners and gram p.u. if they are earthed to the amplifier chassis.

I would also like to correspond with any radio enthusiasts of my own age (13).—ALAN CAMPBELL (30 Barnsdale Road, St. Ninians, Stirling, Scotland).

POCKET SIGNAL INJECTOR

SIR,—It would be interesting to know the variety of containers used by your readers to make the Pocket Signal Injector and also the Signal Tracer when they found that the specified pencil torches were in short supply. I see that in your August issue Mr. Raymond Cruise used a film cassette tin. Myself I turned to the little clear plastic boxes in which "Desogen" throat tablets are packed. They measure 3in. x 1$\frac{1}{4}$in. x $\frac{1}{2}$in., will contain a U16 1·5V battery, but with difficulty, or Mallory cells very easily, and have the advantage that they do not need insulating for a.c./d.c. work. They enabled me to make neat jobs of both the Injector and the Tracer with which I am very satisfied. The printing on the boxes can be removed with metal polish and elbow grease!

Making the probe from 2B.A. threaded rod with a hand drill is by no means child's play. Unless the rod is supported very little filing effect is obtained from a file held on the rod and the file cannot be controlled and prevented from slipping all over the place. I found that I had to nail a thick block of soft wood to my bench and fix the hand drill in the vice so that the 2B.A. rod in the chuck lay flat on this block. Then I drove a good-sized staple into the block so that I could put the point of my file into it and utilise it to get pressure on the rod. Even then I found the file tended to be dragged into the staple so that it jammed and lateral movement of it was impossible. This meant another nail in the block for a file stop to prevent the jamming. Another nail near where the rod entered the chuck jaws

acted as a lateral stop and completed this Heath Robinson rig. After all this I had no difficulty in finishing two nicely tapered probes. I hope other readers will find this tip helpful for both of these neat and extremely useful instruments.—R. S. WELFORD (Sunbury-on-Thames, Surrey).

SHAKE-PROOF WASHERS

SIR,—No one these days seems to know what the shake-proof washers on such things as potentiometers and air-spaced condensers are for.

They are supplied to prevent the whole component from turning when heavy-handed people twist the knob; *not* to prevent the screw from turning. Therefore the washer should be fitted to the spindle of the component *before* it is fitted to its chassis.

It is true that some of these types of components are fitted with positioning lugs, in which case the washer should be placed on the *same* side of the chassis as the locknut.—A. MARTIN (London, S.W.19).

THE IMPORTANCE OF THE RAE

SIR,—While I am in favour of commercial broadcasting and think the BBC monopoly ought to be broken, I think the comments of W. Jenkins and A. Sidi, on Thermion's *Caroline* views should be put into proportion.

I would like to say that *Caroline's* operation outside Territorial Waters is merely a protest to the Postmaster General for his refusal to issue commercial broadcasting licences, and is not an advocate for the issue of licences to unqualified operators such as we would have in a "Citizen Band". The RAE is not an electronic wizard's examination. It merely tests one's knowledge of basic radio theory, and most important, the necessary knowledge to deal with any interference which may result from the operation of one's station.

If Mr. Jenkins or Mr. Sidi cannot be bothered to learn these few basic facts, then I suggest they try some other hobby. I can just imagine the answer they would give to their irate TVI-prone neighbours, to say nothing of the model enthusiast from down the street who has just lost a beautiful radio controlled plane. I should imagine it would be something to this effect, "Sorry mate, I don't know a thing about radio, I just operate it for fun".—A. MAYNARD, B.R.S. 26128 (Bognor Regis, Sussex).

(We endorse Mr. Maynard's remarks concerning the R.A.E.. The amateur transmitting licence is not a barrier to the real enthusiast. Readers interested in obtaining their "ticket" will find something of interest in the next issue—EDITOR.)

Sir—I would be grateful if any reader could sell or loan me . . .

. . . following issues of P.W.: Dec. 1961, Jan., Feb., Mar., Apl., May 1962, and Jan. 1963. I will pay full price for all copies in good condition.—J. J. BOWYER, 2 Chichester Street, Chester.

. . . the circuit and booklet of Marconi Communications Receiver CR100.—WAH KHAI LIANG, Department of Radio, Radio Malasia, Penang, Malasia.

. . . the March 1964 issue of P.W.—J. G. TANGNEY, 18 Green Park, Wilton Lawn, Cork, Irish Republic.

. . . the circuit and servicing data for the Defiant AF7.—R. W. SHEPPARD, 97 Hermitage Woods Crescent, St. John's, Woking, Surrey.

. . . circuit diagram and any other information regarding the PCR3 receiver.—B. GIBSON (ZS2PG), 69 First Avenue, Newton Park, Port Elizabeth, S. Africa.

. . . details or handbook on the Lavoie Laboratory Micro Wave Frequency Meter Model 105SM Serial 2876, covering 375 to 725Mc/s.—F. B. BLAKE, 2 Fair View, School Lane, Seer Green, Beaconsfield, Buckinghamshire.

. . . circuit or manual on the Super Skyrider Hallicrafter SX 16, also the data for the D.B.20 Preselector.—R. MCLACHLAN, 66 Haigh St., Halifax, Yorkshire.

. . . circuit diagram and manual for Hallicrafter receiver SX 28, and a circuit of about 60W c.w./phone v.f.o. transmitter with a suitable s.s.b. adaptor for the same. I shall arrange payment through a friend in U.K.—S. L. ANAND, 3066/5A Street No. 10, Ranjit Nagar, New Delhi -12, India.

. . . test instructions for Hansen Multimeter, Model T.S.—J. DUNNETT, 7 Lorne House, Kinlochleven, Argyll.

. . . the handbook, circuit or any other data on the R1132A communications receiver.—F. H. LADD, 4 Wellington Close, Melbourne Park, Chelmsford, Essex.

. . . the manual of the R.107 set ZA 3050.—B. CATCHPOLE, 45 Balmoral Drive, Borehamwood, Hertfordshire.

. . . circuit and any information on the receiver of Ex-Government Rx/Tx Model 3/11 (also known as B11).—A. PARKIN, 9 Dawsons Rough, Shawbury, Shropshire.

. . . circuit or any information as to the connections of the 12 pole outlet socket of the 38 a.f.v. transceiver.—D. K. COOPER, c/o R.E.C. & Co., Lefkara, Cyprus.

. . . list of valves or the circuit diagram for Philips Receiver, Type BX 516 A/10.—C. K. OCRAN, P.O. Box 205 Takoradi, Ghana.

. . . the February 1963 issue of PRACTICAL WIRELESS —S. SAETHERN, Roberg, Tonsberg, Norway.

. . . any aerial details or the circuit for Communications Receiver P.C.R.3.—A. GARGETT, 30 Dryden Road, West Cliff Est., Scunthorpe.

. . . any information on the Roding Transportable Tape Recorder.—H. WILSON, 59 Gatehope Drive, South Ockendon, Essex.

. . . circuit and any other details of a Crosley Prestotune set.—J. SMART-OKUOKA, 7 St. George's Road, Coventry.

. . . the August 1962 issue of PRACTICAL WIRELESS. —J. B. WHITE, 1 Lansdown Place West, Bath, Somerset.

. . . issues of PRACTICAL WIRELESS dealing with modifications to the R109 A receiver.—T. R. SMITH, 50b Aldershot Road, Guildford, Surrey.

. . . circuit diagram and component values for the Ekco Car Radio CR61/A.—P. HEARNE, 1 Derwent Close, Gossops Green, Crawley, Sussex.

CATALOGUE RECEIVED

MESSRS. Henry's Radio have recently published a new 1964 edition of their comprehensive catalogue. It comprises 86 pages and is fully illustrated, covering a very wide range of electronic components.

Cadmium sun-cells, crystal owens, dosimeters, deccatrons, printed circuit etching kits, ferrite pot cores, geiger tubes, gamma probes and mercury cells, are but a few of the items listed.

A wide range of transistors and associated components are included, plus a transistor equivalent chart and connection details.

It is a well-produced book and much thought obviously has been given to its preparation. The price is 2s. 6d. post free and copies may be obtained from *Messrs. Henry's Radio Ltd., 303 Edgware Road, London, W.2.*

that is, if you can see it from there!

What is it? It's a radio—a real honest-to-goodness station-getting six stage British set so small that not even the Japanese, Americans or Germans have got anywhere near it. A gimmick, did you say? Indeed not! If you're technical, you'll see on the pages which follow how this cute little Micro-6 works.

All I know is that it's loud, it's clear and there seems no end to the stations you can tune in. You have to build it yourself of course, but they say that's half the fun. This one was given to me . . . makes a lovely present for someone, doesn't it?

A BRITISH PRODUCT

ACTUAL SIZE

SINCLAIR MICRO-6

the smallest set on earth!

All parts including transistors, case, earpiece and instructions come to

59/6

- MEASURES $1\frac{4}{5}$" x $1\frac{3}{10}$" x $\frac{1}{2}$"
- WEIGHS LESS THAN 1 oz.
- BUILD IT IN AN EVENING

Technical details and more Sinclair designs on next pages.

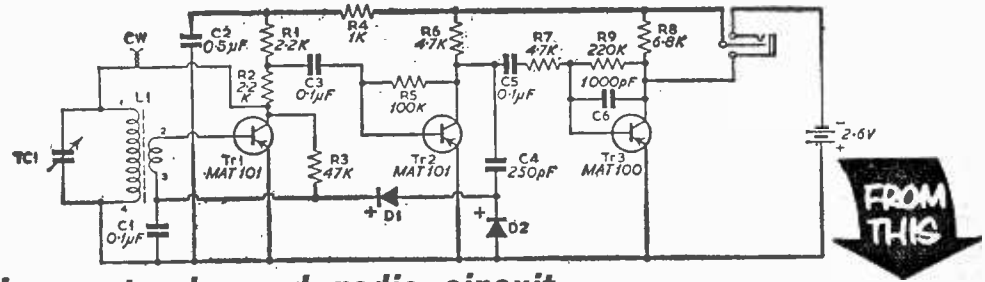
Now on to next pages

SINCLAIR RADIONICS LTD., COMBERTON, CAMBRIDGE *Phone 682*

WORLD-BEATING

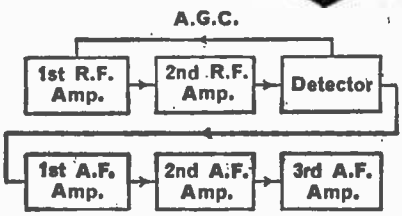
6 STAGES FROM ONLY 3 TRANSISTORS

IN A CIRCUIT THAT ONLY UNIQUE MATS AND APPLIED RESEARCH MAKE POSSIBLE



The most advanced radio circuit ever made available to constructors

The Micro-6 uses three Micro-Alloy Transistors (MATs) in a unique double reflex circuit. The signal selected by L1 and TC1 is amplified at R.F. by Tr1 and Tr2. The output from Tr2 is rectified by the detector stage D1 and D2, and the resultant A.F. signal passed back to Tr1. Tr1 and Tr2 then amplify the signal again—this time at A.F. Thus both Tr1 and Tr2 have been used twice and give a gain normally only obtainable with four transistors. The output from Tr2 drives Tr3, the output stage, which feeds into the featherweight earpiece (or the TR 750 power amplifier.) Tuning is over the medium waveband with bandspread for easy reception of Luxemburg and A.G.C. eliminates fading. It is important to realise that the Micro-Alloy Transistors which the Micro-6 uses not only give extremely high gains and low noise levels, but they consume only a fraction of a mA from the two minute batteries used to power the set. Battery working life is over 70 hours!



TO THIS

YOU CAN BUILD THIS SET IN AN EVENING!

The Micro-6 is simplicity itself to build when you follow the meticulously detailed instructions. No special tools are required to build it. All parts including three MAT transistors, two diodes, elegant white and gold case, lightweight earpiece and 8 page instructions manual come to **59/6**

"TRANSRISTA" STRAP for wearing your Micro-6 on the wrist. Black or grey nylon **7/6**

Mallory Mercury Cell type ZM312 (two required) each **1/11**
Pack of six — **10/6**

USE THIS ORDER FORM

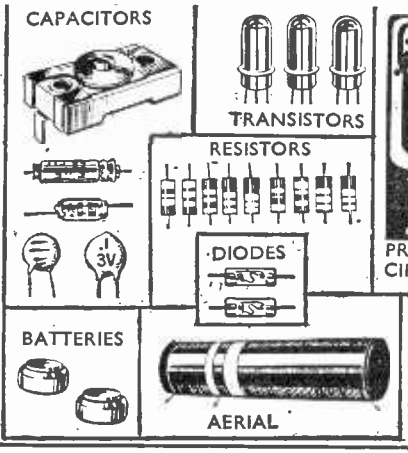
sinclair **MICRO-6**

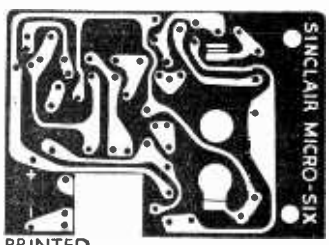
SINCLAIR RADIONICS LTD., COMBERTON, CAMBRIDGE Telephone COMBERTON 682

SINCLAIR DESIGNS

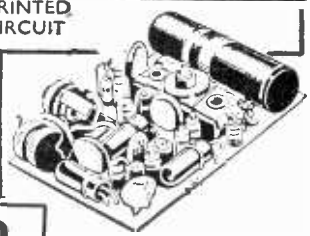
THE MICRO-6
uses the smallest components ever

We show here some of the components. We didn't have room for case, dial, earpiece and some of the capacitors, drawn to actual size. They include the smallest ever to be made available to domestic set constructors, being of the kind used in space and computor electronics, so they have to be reliable. The tuning system has ingenious vernier control for easy station separation. 8 page fully illustrated instruction manual and all parts including case, vernier dial and earpiece, come to **59/6**





PRINTED CIRCUIT



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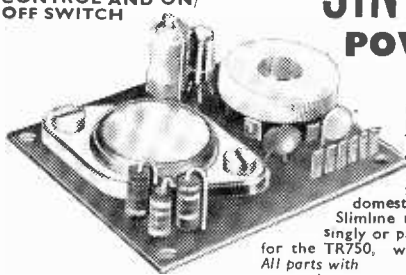

SINCLAIR TR750
POWER AMPLIFIER

PERFECT FOR USE WITH THE MICRO-6 AND SLIMLINE

Measuring only 2 x 2in. and having its own built-in volume control and on-off switch, the TR750 has a full 750 milliwatt transformer less output for 10mV into 10K ohms. Frequency response is from 30 to 20,000 c/s within ±1dB. This amplifier makes a powerful car, domestic or portable radio used with the Micro-6 or Slimline receivers, or a hi-fi record reporducer used singly or paired for stereo. There are many other uses for the TR750, which is available for building or ready built.

All parts with instructions come to **39/6**

Ready built and tested **45/-**

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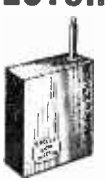
Invaluable to all constructors.



Parts and instructions come to **27/6**

Ready built **32/6**

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Smaller than a 3d. piece

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EXTRA EASY TO BUILD

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TOTAL £

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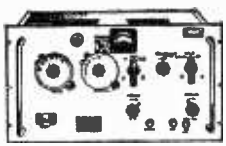

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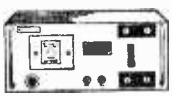

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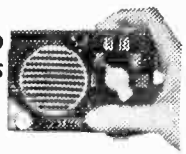

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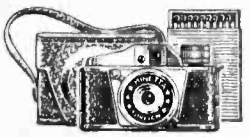

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World shattering Purchase by our FOREIGN AGENTS makes this exclusive scoop yours for ONLY 19/6. This exciting little 2 speed camera is not a toy but a precision-made photographic instrument in chromed steel and leather with minute milli-Magnifying Lens—each 14mm. film takes 10 pictures—size 1½ x 1½ x 2in.—Only 19/6. P. & P. 1/6 ex.

FREE Leather Carry-case. Six Rolls of Film.

TRANSISTOR POCKET RADIOS

ONLY **28/6**

No More To Pay

BULK PURCHASE ENABLES US TO MAKE THIS FANTASTIC OFFER—AND WITH MONEY BACK GUARANTEE! The "SAN REMO" . . . so tuned that it brings the voices of star entertainers and vocalists dramatically to life—in your home, office, etc. Only 4¾ x 2¾ x 1¼in. Fits easily into your pocket or handbag. Works for months off 1/2 battery. Should last a lifetime, anyone can assemble it in an hour or two with our easy plan. Miniature speaker, carrying case—everything only 28/6, 2/6 P. & P. C.O.D. 2/6 extra. (Parts can be bought separately.) Limited period—so rush your order before it's too late. DEMONSTRATIONS DAILY.

THE MINUTE TRANSISTOR RADIO

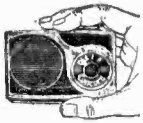
MIAMI

ONLY **17/6**

Unbelievably small—outrageously cheap. You will be amazed at the fine quality of tone and volume of this great little radio. Only a fantastic 3¼ x 2¾ x 1¼in., the MIAMI will bring you great entertainment for months on an 8d. battery. Simple assembly plan with each set. **ONLY 17/6. YES 17/6.** Plus 2/6 P. & P. (C.O.D. 2/- extra). Satisfaction Guaranteed. Demonstrations given daily. Parts available separately if required.

READY TO PLAY

TRANSISTOR RADIO FULLY TRANSISTORISED SKYROMA Mk. 7. This latest 1964 model is cheered by experts for its fantastically low price. Built in two-tone case, size 4¼ x 2¾ x 1¼in. Receives M.W. stations loud and clear. Every radio is fully tested before despatch. Price ready built 25/-. P. & P. 1/6 extra. Free earpiece with set.



FOR ONLY **25/-**

No more to pay

Fabulous ST. TROPEZ MK. 6

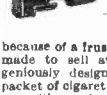
The Sensational Pocket Radio

This fantastic offer will amaze you—the beautifully compact **ST. TROPEZ**, measuring 4½ x 3 x 1½in. receives perfectly in bedroom, office or garden—over all medium waves including Luxembourg. Under 1d. per hour running cost. **ANYONE** can assemble it in one or two hours using our simple A.B.C. plan, 25/- (P. & P. 2/6 extra). (Case extra). Parts can be bought separately

AMAZING NEW INVENTION

AUTOMATIC CAR LIGHTER

ONLY **10/-**



We have been lucky enough to purchase 1,500 only of these fully automatic **Car Cigarette Dispenser/Lighters** because of a frustrated export shipment. Originally made to sell at about 45/-! Robust and ingeniously designed in heavy chromium. Holds packet of cigarettes (any make and size) you reach out with one hand, press a button and a lighted cigarette is in your hand! Can be fitted by anyone in 2-3 minutes. For 6 or 12 volts, full connecting details—only one wire to connect! Each one in own coloured box, brand new and untouched. **Only 10/-, add 2/- P. & P. (C.O.D. 2/6 extra).**

CONCORD ELECTRONICS LTD. (Dept. P.W.12) 9 Western Road, Hove, Sussex

Tubes

Carr. & Ins. 12/6

HIGHEST QUALITY—
COMPARE OUR PRICES

	GUARANTEED 6 months	GUARANTEED 12 Months	NEW TYPES
MOST MULLARD, MAZDA, COSSOR, EMITRON, EMISCOPE, BRIMAR, FERRANTI TYPES. PROCESSED IN OUR OWN FACTORY	12.	£2. 0.0	£3. 0.0
	14in.	£2.10.0	£3.10.0
	15–17in.	£3. 5.0	£4. 5.0
	21in.	£3.15.0	£5.15.0

MW 31/74 £3.15.0
MW 36/24 £4.15.0
CRM 172 MW 43/64 £6.0.0

SATISFACTION GUARANTEED

EKCO L.O.P.T. Unused replacements for Perspex cased 1954/7 models, complete with E.H.T. rect. unrepeatable. **39/-**

CO-AX, low loss, 6d. yd., 25 yards, 11/6, 50 yds., 22/-, 100 yds., 42/6 Co-ax Plugs, 1/3. Wall outlet boxes 3/6

SPECIAL C.R.T. OFFER
Due to huge Bulk Special Purchase we are offering MW 31/74 Tubes at the unrepeatable price of 29/-. MW 36/24 ditto, 39/-. P.P. 12/6. The above are guaranteed for 6 months.

LOUDSPEAKERS. 3 Ω Top Makes
6½in. 7/6 5in. 8/6
8in. 7 x 4in.

CONNECTING WIRE

P.V.C. Bright colours. Five 25ft. coils only. **4/-**

3 VALVE AMPLIFIERS

Kit of new parts, consisting chassis, mains and output transformers, valves (P61, 6G6G, 6X5G) and all components. With full instructions for making high gain amplifier with separate bass and treble controls, negative feedback, etc. Truly unusual value at **29/-**

MAINS TRANSFORMERS

Excellent Quality Guaranteed. Upright mounting 250-0-250 V 60 mA, 6.3 V 3 A (80mA 12/6) Ditto semi-shrouded 9/6. **9/6**

13 CHANNEL T.V.s

Table Models. Famous Makes. Absolutely Complete. These sets are unequalled in value due to huge purchase direct from source. They are untested and not guaranteed to be in working order. Carr. etc., 15/-.
12in. **£2.19.0** 14in. **£4.19.0**

LEAK AMPLIFIER SNIPS
Due to a fortunate purchase we are able to make the following unrepeatable offers. All amplifiers have line matching Output Transformers (Transformers to match these Amplifiers to 15Ω Speakers can be supplied at 22/6 each).
TL/25 WATT (new) £15
Note—These Leak Amplifiers all have the added facility of volume and tone controls so that they can be used without a pre-amp. if very high gain is not required.

★ BULK BARGAINS ★

12 POTS. Popular values. 5K to 2 Meg. Unused, mixed, pre-set, long sp., switch, etc. **4/6**
CONDENSERS, 25 Mixed. Electrolytic. Many popular sizes. List Value £5. Our price **10/-**

100 RESISTORS 6/6
Excellent. Sizes ¼-3 watt.

100 CONDENSERS 9/6
Miniature Ceramic and Silver Mica Condensers, 3 pF to 5,000 pF. LIST VALUE OVER £5.

25 TAG STRIPS 4/-
2, 4, 6, 8 way etc. Unused.

100 HI STABS 9/6
1% to 5% 100Ω to 5MΩ.

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GUARANTEED TOP QUALITY
Huge reduction. Red Spot standard L.F. type now only **1/6**
White Spot R.F. **2/-**

Mullard Matched Output Kits OC81D and 2-OC81. **12/6**
R.F. Kits (OC44, OC45 (2), 3 transistors. **12/6**

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AF115	7/6	OC45	5/6
AF116	7/6	OC72	5/6
AF117	7/-	OC81	5/6
AF127	9/6	OC81D	5/6
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GERMANIUM DIODES

General Purpose miniature detector, A.V.C., etc. or 6/6 doz. **8d.**

Gold Bonded highest quality. Individually tested. 9/6 doz. **1/-**

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Guaranteed performance. Top Make. Tested 250V working.
100mA (3 for 9/6) **3/9** 250mA (3 for 19/6) **7/6**

VALVE HOLDERS, B7G, 6d. ea., with Screen 8d. ea., B9A 6d. ea., with Screen 8d. ea. Int. Octal 6d., Mazda Octal 4d. B8A 6d. (less 15% in dozens).

TURRET TUNERS

Most makes, your choice if available, with valve 16/-, less valves 10/- S.A.E. enquiries.

COSSOR D.B. SCOPE TUBES, Type 09D Split Beam. Ideal for building your own quality oscilloscope whilst stocks last. **55/-**

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Huge quantity, most makes at only **29/-**
S.A.E. enquiries.

RECTIFIERS. 250 v., 80 mA, 5/; RM2, 6/9; RM3, 7/6; RM4, 19/6; RM5, 19/6; 14A86, 17/-; 14A97, 19/6; 14A100, 19/6; 16RC1-1-16-1, 7/9; 18RA1-1-1-16, 6/-; 18RD2-2-8-1, 14/-; 14RA1-2-8-2, 17/-; 14RA1-2-8-3, 20/-; ELECTRIC MOTORS. AC/DC 3-8 volts. Totally enclosed standard mounting, powerful V pulley, spare brushes, 2in. x 2in. **7/6**

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Fantastic offer. 7 valves plus 2 diodes. Contemporary Cabinet. Top quality and finish. A.F.C. A.V.C. Absolutely complete. Guaranteed 3 months. **11** gns

ENQUIRIES WELCOMED
Quantity Prices or Quotes for items not listed, particularly rare values. TELEPHONE C.O.D. ORDERS DISPATCHED THE SAME DAY.

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by return of post

THE MOST ATTRACTIVE COMPETITIVE VALVE LIST IN THE COUNTRY

All valves are new and unused unless otherwise advised

POST 1 Valve 6d., 2-11. 1/- FREE for 12 or more valves.

3 MONTHS GUARANTEE in writing with every valve.

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5Y4G	9/6	6V6G	4/6	50B5	7/9	ECC85	7/6	N78	17/-	UBF80	7/9
5Z4	9/-	6V6GT	6/9	50C5	8/6	ECC88	11/6	N108	17/-	UBF89	7/6
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6A6	3/9	7B6	10/6	61SPT	11/-	ECH35	11/6	AEC80	9/-	UCC85	7/3
6A7	9/-	7B7	7/9	62BT	13/6	ECH42	8/6	P61	11/6	UCF80	10/6
6A8G	7/9	7C5	7/9	75	5/6	ECH81	7/-	PC97	5/6	UCH21	9/6
6A8GT	12/6	7C6	7/6	78	5/-	ECH83	8/6	PCC84	6/6	UCH42	7/3
6AC7	3/-	7H7	7/8	80	5/6	ECL80	6/6	PCC85	7/9	UCH81	7/9
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6AM6	3/-	10C1	11/6	813	49/-	EF22	7/-	PCF82	7/-	UF80	3/-
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6AU6	7/-	10F9	10/6	954	3/9	EF39	7/6	PCL82	7/3	UL41	8/-
6AV6	5/9	10F18	10/-	955	2/3	EF40	11/-	PCL83	9/-	UL44	14/-
6B7	8/6	10LD11	14/6	956	2/-	EF41	8/-	PCL84	7/3	UL46	9/9
6B8G	3/-	10P13	8/6	1625	5/6	EF42	6/9	PCL85	10/6	UL84	8/-
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6C6	3/6	12BE6	6/6	CL33	9/-	EK32	7/6	PL820	8/3	VP41	5/6
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6CH6	6/6	12E1	17/6	DA30	11/6	EL34	11/6	PX25	9/-	W76	4/9
6D2	3/3	12H6	1/9	DAC32	8/-	EL35	6/-	PY31	8/-	W81	7/3
6D3	9/6	12J5GT	3/3	DAF91	4/6	EL38	12/8	PY32	10/-	X61M	11/-
6D6	3/-	12J7GT	8/-	DAF96	7/3	EL41	8/-	PY33	10/6	X63	8/6
6F1	4/9	12K7GT	4/9	DF33	8/9	EL42	9/6	PY81	6/6	X65	11/-
6F6	7/6	12K8	9/9	DF91	3/-	EL81	8/9	PY82	6/7	X66	7/9
6F6G	4/6	12K8GT	11/6	DF96	7/3	EL84	6/6	PY83	5/-	X76M	11/6
6F13	4/9	12Q7GT	4/9	DF97	7/6	EL85	9/9	PY88	6/9	X78	21/-
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6F15	9/6	12SG7	4/6	DH76	4/6	EL95	6/-	PY801	7/9	X81M	9/-
6F19	6/-	12SH7	3/6	DK32	9/6	EM34	8/9	PZ30	9/6	Y63	4/-
6F32	4/9	12SJ7	5/6	DK91	5/6	EM84	8/9	RL18	11/-	Z63	4/9
6F33	4/-	12SK7	4/6	DK92	7/-	EM80	7/6	RI9	8/6	Z66	8/6
6H6	1/6	12SN7GT	6/9	DK96	7/9	EM81	8/6	SP41	2/3		
6J5	4/3	12SQ7	8/6	DL33	7/6			SP61	2/-		
6J5G	3/-	13D3	6/6	DL35	7/8	EM85	9/6	SP81	2/-		
6J5GT	4/3	14S7	19/9	DL63	9/-	EN31	16/-	SU25	16/-		
6J6	3/6	19AQ5	7/9	DL75	6/-	EY51	7/6	SU2150	4/6		
6J7	8/6	19BG6	14/-	DL82	9/-	EY86	7/3	T41	6/9		
6J7G	4/9	20D1	8/9	DL92	5/-	EY88	9/8	TDD4	8/6		
6J7GT	7/6	20F2	9/6	DL94	6/8	EZ40	7/-	U14	7/6		
6K8GT	6/-	20L1	16/-	DL96	7/3	EZ41	7/-	U18	7/6		
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★ TRANSISTOR POCKET RADIOS

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6-Transistor MW/LW ... £5.19.6

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9-transistor Portable Trans-receivers. Supplied complete with leather cases, batteries, aerials, etc. in presentation case. Range up to 5 miles in favourable conditions. Sizes 6½ x 3 x 1½ inches. Superhet crystal controlled on transmit and receive. Price **£25 Per Pair.** P.P. 3/6.

TRANSISTOR TRANSCEIVER

3-transistor crystal controlled version of above. Range up to ½ mile. Price **£8.19.6 Per Pair.** P.P. 2/6.

A SELECTION FROM OUR STOCKS

See Catalogue for full details.

Sinclair Micro-6 (to build)	59/6
Sinclair TR 750 amp. (to build) ...	39/6
Sinclair Micro Injector (to build)	27/6
PP3 9 volt Battery Eliminator	18/6
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Two-channel Mixer	15/-
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Transistor Signal Injector	39/6
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4-channel transistor mixer	55/-
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★ 4-Transistor Superhet MW/SW Tuner	£7.9.6
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FM VHF TUNING HEART

Printed circuit construction. RF stage and osc./mixer stage, fully tunable 85 to 105 Mc/s. Completely screened. Requires UCC85 (8/6). Brand new in maker's cartons 15/-. P.P. 1/-. Supplied with circuit.

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Tape Demagnetiser	29/6
2K ohm 1in. diam. mag mic.	15/-
Antex 15 watt min. soldering Iron	29/6
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5in. 600ft., 12/6; 5in. 900ft., 15/-; 7in. 1,200ft., 18/6; 7in. 1,800ft.. 25/-; 7in. 2,400ft., 27/6. Excellent quality.

● **SCOTCH BOY TAPE.** 3¾in., 300ft. L.P. complete with spare spool. 5/6. P.P. 9d.

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★ 6 Valve Printed Circuit designs. 2-track or 4-track units. **11 gns.** 2-track, **12 gns.** 4-track.
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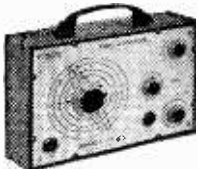

All transistor portable units supplied with full instructions.

Leaflets on Request.

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QUALITY MICROPHONES

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Practical Wireless

BLUEPRINT SERVICE

ALL of these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for those marked thus (*).

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, London W.C.2.

DOUBLE-SIDED BLUEPRINTS

Each blueprint in this series contains details of two separate instruments or items of equipment.

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The PT Olympic *	7/6
The PT Multimeter *	5/-

SOME EARLIER DESIGNS

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. *The majority of the components for these receivers are no longer stocked by retailers.*

Experimenter's Short Wave	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Simple S.W. One-valver	PW88	2/6
Pyramid One-valver	PW93	2/6
BBC Special One-valver	AW387	2/6
A One-valver for America	AW429	2/6
Short-Wave World Beater	AW436	3/6
Standard Four Valve S.W.	WM383	3/6
Enthusiast's Power Amplifier ..	WM387	3/6
Standard Four Valve	WM391	3/6
Listener's 5-Watt Amplifier	WM392	3/6

QUERY COUPON

This coupon is available until 7th October, 1964, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, OCTOBER, 1964.

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