DECEMBER 1962

Practical WIRELESS

2/-

FREE INSIDE! DOUBLE-SIDED **BLUEPRINT**

REFLEX LOUDSPEAKER ENCLOSURE and 208 metre PRE-SET TUNER

LUXEMBOURG Tuner

BERKELEY Bass Reflex Enclosure

SURBITON PARK RADIO LTD.

FOR POST HASTE—POST FREE SERVICE

MARTIN RECORDAKITS

The following recorders, available now in four track, are a proprietary range of machines in kit or assembled form. This enables you to take advantage of mass production techniques and prices, should you wish to assemble yourself. The components used are the finest available. with B.V.A. valves, and the decks are the latest having all the improvements B.S.R. and Collaro make from time to time. heads, etc. The amplifiers are packed in special cartons with instructions to enable anyone to build. We are confident you will find these recorders very good value, they have been built up to a standard and not down to a price.

HALF TRACK

B.S.R. TD2 Monardeck, latest model 5¾in. spool ....CASH £9.9.0
Deposit £1.0.0 and 9 monthly £1.1.0
Tape Amplifier for B.S.R. deck, printed circuit ready wired, with ECC83, ECL82, EM85 and EZ81. Complete with all plugs, sockets, panels, knobs, etc. The whole amplifier mounts onto the deck, making a self contained unit CASH £8.8.0
Deposit £1.0.0 and 8 monthly £1.1.0
Case with 7in. x 4in. speaker, in two tone grey..........CASH £4.4.0
Complete Kit as above ....CASH £22.0.0
Deposit £2.4.0 and 12 monthly £1.16.6
The above recorder can be supplied assembled, tested and complete with tape and microphone for..............CASH £25.0.0
Deposit £2.10.0 and 12 monthly £2.1.6
Collaro Studio Deck. Very latest model 3 speeds 7in. spools..CASH £12.10.0
Deposit £1.5.0 and 12 monthly £1.0.8
Tape Amplifier for study deck, with ready wired printed circuit control and input panels, mains and output transformers. Complete with valves, knobs, plans, screws, etc. EF86, ECC83, EM84, EZ81, OA81 and 2 EL84, 3 watts output. Magic eye, radio and mic. inputs, EX L/S socket, tone and monitor controls. Can be used as an amplifier CASH £11.11.0
Deposit £1.4.0 and 12 monthly.......................... 19/-
Case for above including 9in. x 5in. speaker £5.5.0
Total Kit as above ....CASH £29.0.0
Deposit £2.18.0 and 12 monthly £2.8.2
We can offer the above recorder, complete with tape and microphone, in a De Luxe two tone grey cabinet, assembled for £35.0.0
Deposit £3.10.0 and 12 monthly £2.18.2
This Machine is listed at 39 gns. by makers and is a very good buy.
Building Instructions available at 2/6 each kit (refunded if kit bought)

QUARTER TRACK

B.S.R. TD2 ....CASH £11.11.0
Deposit £1.4.0 and 12 monthly.......................... 19/-
Tape Amplifier as over, but quarter track ....CASH £9.9.0
Deposit £1.0.0 and 9 monthly £1.1.0
Case. two tone grey, with speaker.......................... £4.4.0
Complete Kit as above ....CASH £25.0.0
Deposit £2.10.0 and 12 monthly.......................... £2.1.6
Collaro Studio Deck, 4 track ....CASH £17.17.0
Deposit £1.18.6 and 12 monthly £1.9.5
Tape Amplifier, as over. but 4 track ....CASH £12.12.0
Deposit £1.7.0 and 12 monthly £1.0.8
Case with 9in. x 5in. speaker £5.5.0
Complete Kit 4 track Collaro ....CASH £34.0.0
Deposit £3.8.0 and 12 monthly £2.16.6
Tape Pre-amplifier for Collaro deck, with power supplies, ECC83, ECL82, EZ80 and EM85, Radio and Mic. sockets, gives an equalised output of 400 m/Volts
Half Track ....CASH £8.8.0
Deposit £1.0.0 and 8 monthly.......................... £1.1.0
Quarter Track ....CASH £9.9.0
Deposit £1.0.0 and 9 monthly £1.1.0
Marriott Tape Heads. 4 track type L/RPS/7 and L/ES/9 Record/ Playback and Erase with mounting bracket for Studio deck.
Pair Complete (Marriott list price is £8.14.0) ....CASH £4.4.0
Marriott 2 track type R/RP/1 Record/Playback only with bracket for Studio deck. Ideal 3rd head £1.7.6
Pressure pad (Studio deck only) 3/6
M.S.S. 2 track type DR1 and DE1 Record/Playback and Erase Sets only £1.2.6
THE ABOVE SETS ARE BRAND NEW. OBTAINED DIRECT FROM MAKERS

JASON F.M. TUNERS

FMT1, complete with valves ....CASH £6.17.6
Deposit £1.1.0 and 6 monthly £1.2.9
FMT2. complete with valves, Less Power ....CASH £7.17.6
Deposit £1.0.0 and 7 monthly £1.2.6
FMT2, complete with valves. Self powered ....CASH £9.15.0
Deposit £1.0.0 and 9 monthly £1.1.8
FMT3, complete with valves. Less power ....CASH £9.12.6
Deposit £1.0.6 and 9 monthly £1.1.4
FMT3, complete with valves. Self powered ....CASH £12.0.0
Deposit £1.4.0 and 12 monthly.......................... 19/10
Power pack kit ready drilled chassis for FMT1, etc. £2.12.6
The instruction books are included in all kits but are otherwise 2/6.
JTV/2, switched F.M. and TV. Sound self powered. All valves.
CASH £14.15.0
Deposit £1.9.6 and 12 monthly.......................... £1.4.5
Mercury 2, as JTV/2 but less power, with all valves ....CASH £10.15.0
Deposit £1.0.0 and 18 monthly*.......................... £1.6.6
The instruction book is again included but is otherwise 3/6 each.
All the above units are available ready built and aligned. Price on request.

ARMSTRONG RADIO CHASSIS

T4B V.H.F. Tuner, self powered ....CASH £21.18.0
Deposit £2.6.6 and 12 monthly £1.16.1
ST/3 Mk. 2 A.M./F.M. Tuner, self powered ....CASH £27.16.0
Deposit £2.16.8 and 12 monthly £2.6.1
AF208 A.M./F.M. Radio Chassis, bass and treble controls P.U. inputs, single ended output stage ....CASH £22.18.0
Deposit £2.8.6 and 12 monthly £1.17.9
Jubilee Mk. 2 A.M./F.M. Radio Chassis with push pull output CASH £30.12.0
Deposit £3.3.0 and 12 monthly £2.10.8
Stereo 55 A.M./F.M. Radio Chassis, single ended output stage on both channels. Separate tone and volume ......CASH £32.15.0
Deposit £3.5.6 and 12 monthly £2.14.5
Stereo 12 Mk. 2 A.M./F.M. Radio Chassis, push pull output, separate controls both channels.......................... £43.10.0
Deposit £4.7.0 and 12 monthly £3.12.4
Brass dial escutcheon is available for AF208 and Jubilee. Price 7/6.
Individual leaflets giving full description and technical details.

GRAMOPHONE EQUIPMENT

B.S.R. UA 14 TC8/H cartridge ....CASH £7.15.0
Deposit £1.0.0 and 7 monthly £1.2.3
Garrard Autoslim, new unit..........................CASH £8.14.6
Deposit £1.0.6 and 8 monthly £1.1.9
Garrard Autoslim De Luxe ....CASH £12.14.8
Deposit £1.5.6 and 12 monthly £1.1.1
Philips AG1016. new transcription unit (changes on 45 rpm) CASH £13.10.0
Deposit £1.7.0 and 12 monthly £1.2.4

REGENCY

Resistors 2/8, Controls 9/-, Condensers 15/-, Knobs 2/6, Station dial 5/6, J.B. gang 8/-, Mullard OC45 10/- each, OC72 matched pair 16/-, OA81 3/-, Battery 1/8, W/C switch 3/6, Repanco TT49, TT45, and TT46 all 5/- each, FR2 12/6, RFC1 2/6, 7in. x 4in. speaker 19/6, Groupboard 1/3.
Complete Kit, less cabinet ....CASH £6.12.6
Transistor Cabinet in two-tone grey "Vynair" 10 x 6 x 3½in. for 7 x 4 speaker. no control holes have been drilled. Ideal Regency, etc. £1.12.6

TRANSISTORS

Mullard have reduced the price of many Transistors to: OC44 11/-, OC45 10/-, OC70 6/6, OC71 6/6, OC72 8/-, OC75 8/-, OC76 8/-, OC81 8/-. These are their new list prices. Why buy surplus. OC72 in matched pairs only at 16/- pair (No other types.)

P.W. "POCKET SUPERHET" OSMOR PRINTED CIRCUIT VERSION

Osmor rod aerial 8/6. I.F.T.s and Osc. coils 22/-, Osmor driver 8/3. Osmor output 8/-, Set transistors and diode 43/-, J.B. gang 12/6, Trimmers 1/3 each, Set condensers 15/-. Set resistors 5/-, Ardente volume control 8/-, W/C switch 3/6. Speaker 17/10, Hardware 4/-, Printed Circuit 7/6, New case and dial 12/6, Battery PP4 2/3. Leaflet giving full illustrated details 1/6.
All the above components if ordered at one time ....CASH £8.10.0
Osmor undertake to align this receiver for 10/-.

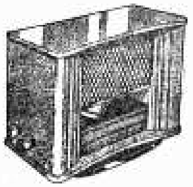
"WEYRAD"

Weymouth Radio 6 Transistor Superhet, using the P50 coils as they advertise in this journal. P50/1AC Osc. coil 5/4, P50/2CC 1st and 2nd I.F.T. 5/7 each, P.50/3CC 3rd I.F.T. 6/-, RA2W rod aerial 12/6, LFDT4 driver 9/6, PAC1 printed circuit 9/6, Instruction Book 2/-, set resistors 7/6, Vol. control D.P. 6/-, set condensers 20/-, J.B. gang 12/6, Beehive trimmers 1/3 each, W/C switch 3/6, dial and knob 5/6, battery PP11 5/6, Battery plug 1/-, OA81 3/-. Set of Mullard transistors 53/6. Car aerial coupling coil 1/-.
35 ohm 7in. x 4in. speaker, ideal for Weyrad circuit £1.7.6
Transistor Cabinet for 7in. x 4in. speaker. Ideal for Weyrad circuit, two tone grey £1.12.6

48 SURBITON ROAD, KINGSTON-UPON-THAMES, SURREY

Established over 30 Years Telephone KIN 5549

We pay all postage and insurance. All orders despatched same day. Money refund guarantee.
Hours: 9 a.m.—6 p.m. (1 p.m. Wednesday) We do not close for lunch. Open all day Saturday.



COMPLETE V.H.F./A.M. RADIO FOR £12.10.0

(carr. paid)

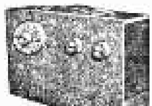
Brand new set, in superb walnut cabinet (size 19 x 8½ x 14½in. high). Covering 80-100 Mc/s. 16-49 M. and 200-500 M. Mains trans. 200-250 v. with 2 tappings. Ferrite rod aerial for A.M. Controls: volume on/off, tone tuning; w/change. Gram and ext. speaker position provided. Valves 12AT7, 12AH8, 6BJ6, EABC80, 6BW6 and metal rectifier. Fully guaranteed. Today's Value, £20.

TAPE TOP QUALITY BOXED. 5¾in.—850ft., 15/-; 1,200ft., 17/6; 7in.—1,200ft., 17/6; 1,800ft., 26/6 (all plus 1/6 post, 2/- for 2).

THE "CANTATA" 6-TRANSISTOR AND DIODE PORTABLE

COMPLETE KIT FOR ONLY

£7.19.6 (post 3/6)



500mW push-pull output. Ferrite rod aerial. Car aerial socket and coil. M.W. and L.W. full coverage. Operates on two 4.5v. cells. Printed circuit board 8½ x 2¾in. All holes drilled and component positions marked. Instructions 2/6 for 16 p. (refunded on purchase of kit). Size 9 x 3¾ x 7in. 8 x 2¾in. P.M. high quality speaker. Attractive Vynair covered cabinet two tone. Two batteries 5/6 the pair (Ever Ready 126). Mullard transistors OC44, 2 x OC45, OC81D, and 2 x OC81. Top grade Weymouth Radio coils and transformers. Alignment service if required 17/6 (inc. post). Write for list of prices. All parts supplied separately. Built in two hours.

BUILD YOUR OWN RECORD PLAYER

Price £12 carr. paid

Fully built 2-valve amplifier

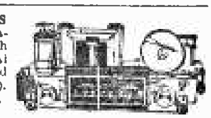
B.S.R. 4-sp. autochanger, case 17 x 15 x 8½in. Assembled in 15 mins. Similar cabinet for tape recorder with plain board only £3, carr. paid. Attractive colours.

or with 3-valve amplifier 15/- extra

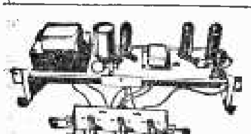
AUTOMATIC RECORD CHANGERS—LATEST MODELS. 4 SPEED CRYSTAL CARTRIDGE. All 5/- extra carr. B.S.R. UA14, £7.10.0. Garrard Slimline, Mono £8. Stereo, £8.5.0. Motor Board for UA8, UA20, UA14, Slimline, 5/- (post 1/6) or 3/6 post paid when purchased with Autochanger. Motor Board for Collaro C60, 4/-. Post paid.

TELEFUNKEN STEREO AMPLIFIERS. 2 ECL82—2 x 2½ watts, 12 x 9 x 2in. piano keys, £7.0.0, post paid. Complete with power.

SELF-POWERED VHF TUNER CHASSIS Covering 88-95 Mc/s. Mullard permeability Tuner. Dims. 10½ x 4½ x 5in. high ECC85, EF91, EF91 and 2 diodes. Metal Rectifier. Mains transformer. Fully wired and tested. Only £7.10. (carr. pd.). Some tarnished chassis otherwise O.K., £6.10.0.



Attractive Vynair Cabinet 20/-. Room dipole 12/6. Feeder. 6d. yd.



PUSH-PULL AMPLIFIER £5.5.0

(5/- Carr.)

Brand new 200-240 A.C. mains. Bass, treble and vol. controls. With valves EZ80, ECC83 and 2-EL84 giving full 8 w. Chassis 12 x 3½ x 3½in. With o.p. trans. for 2-3 ohm speaker. Front panel (normally screwed to chassis) may be removed and used as "flying panel." Stereo version 2 x 4 w. same price.

TAPE RECORDER AMPLIFIER

Type TR3. Fully built, high gain, low noise, printed circuit. Attractive grey and gold front panel 13 x 1½in. Height 5½in. overall. Front to back 5½in. Vol. and on/off tone. Mike radio, monitor and ext. speaker jacks. Valves ECC83, ECL82, EZ80. Mains trans. Ready to bolt to B.S.R. Deck. Complete with switch wafer wired. Our Price ONLY £6.2.6. (6/- Packing and Carr.). Similar model without magic eye. Type T.R.1. 3in. instead of 1½in., £5.15.0. (6/- Carr.). Also available for Collaro Deck. State which.

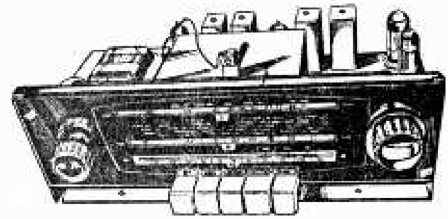
Transistor Set Battery Eliminator. Converts your 6 transistor receiver to mains operation. Size 1¾ x 1 x ¾in. With flex lead and battery charging attachment. 18/6.

Staar "Galaxy" or Garrard 9v. battery operated single 45 r.p.m. record player deck, with pick-up arm, and stylus etc. Only 50/-. P. & P. 4/-.

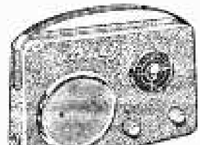
NEW LOUDSPEAKER BARGAINS. Good Makes.

2-3 ohms 13 x 8½in. 35/- (4/-); 7 x 4in. 14/6 (2/-); 6½ x 4½in. 12/6 (2/-); 10 x 6in. 25/- (3/-); 5in. 12/- (2/-); 4in. tweeter 7/6 (2/-); 7 x 5in. 17/6 (2/-); 9 x 6in. 22/- (2/6); 8in. circ. 18/6 (2/6); 10in. circ. 25/- (3/-). Postal charges bracketed.

BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £14.0.0 (Carriage Paid)



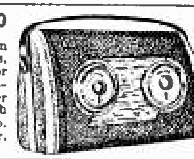
A.C. ONLY. Chassis size 15 x 6¾ x 5½in. high. New manufacture. Dia. 14½ x 4in. in 2 colours predominantly gold.
Pick-up. Ext. Speaker. Ae., E., and Dipole Sockets. Five push buttons—OFF L.W., M.W., F.M. and Gram. Aligned and tested. O.P. Transformer. Tone Control. 1000-1900 M.; 200-500 M.; 88-98 Mc/s. Valves EZ80 rect., ECH81, EF89, EABC80, EL84, ECC85.
Speaker and Cabinet to fit chassis (table model). 47/6 (post 4/-).
9 x 6in. ELLIPTICAL SPEAKER, 20/-, to purchasers of this chassis.
TERMS: (Chassis) £5 down and 5 monthly payments of £2.
Cheap Room Dipole for V.H.F., 12/6. Feeder 6d. yd. Circuit diagram 2/6.



6-TRANSISTOR PORTABLE—Fully Built

The "SCALA" for only £9.17.6, carr. paid. 8½ x 2 x 5½in. high. Choice of colours. Rexine. M.W. and L.W. Ferrite aerial. Battery included. Printed circuit. Nicely styled. A professional job. 3½in. speaker. Fully Tunable M.W. and L.W.

THIS SUPERB SET for £10



6-transistor radio covered in sponge clean Duracour fabric, in latest two tone shades, M.W. and L.W. ferrite rod, provision for car aerial. 2-colour scale. With PP9 battery giving 300 hours use. Weighs under 4 lbs. With carrying handle. 12 x 7½in. high x 4½in. at base tapering to 2in. at top. Brand new, fully guaranteed, £10. Carr. paid. Worth £16.

SUPERIOR GRAMOPHONE AMPLIFIER

Valves UY85, UF80 and UL84. Mains trans. 200-240 a.c. Covered baffle 13½ x 7½in. (6½in. speaker) or 11 x 7½in. (8 x 5in. speaker). 3 front controls, bass, treble, on-off/vol. 74/- (post 4/-) either type. Rexine cabinet to fit, with carrying handle, and lid (detachable) 14in. or 12 x 8½ x 5in., 16/- extra.

GRAMOPHONE AMPLIFIER. With 5in. SPEAKER Baffle 12½ x 6in. ECL82 and Rectifier, Tone and Volume. On/off switch. Two knobs. Useful for Stereo, 57/- (post 4/-).

SPECIAL OFFER

Brand new tape recorder, two tone beige case, "gold" trimmings. Magic eye, monitor, ext. speaker sockets. With 5¾in. tape and mike. Fully guaranteed. Price usually 19½ gns. Very high gain with low noise. Price £18 carr. paid.

COLLARO STUDIO TAPE TRANSCRIPTOR. 3 MOTORS, 3 SPEED. 1⅞, 3¾ and 7½ I.P.S. Push buttons, £10.17.6 (10/- carr.) inc. spool.

3-VALVE AMPLIFIER (Inc. RECT.)

2½ watts. ECC83, ECL82 and EZ80. Controls, volume, bass and treble. On/off switch. Mains and O.P. trans. Size as for Push-Pull Amp. Suitable for microphone input and for Guitar. **95/-** P. & P. 5/-.

Also acts as telephone amplifier using pick-up coil price 14/-. Chassis 12 x 3½ x 3½in. Fixed front panel. Price includes handsome walnut finish polished cabinet, 13 x 7½in. fascia containing high quality 3 ohm P.M. speaker 5½ x 4½in. (20/- less without cab and speaker).

BATTERY ELIMINATOR

For 4 Low Consumption Valves (96 range). 90v. 15mA and 1.4v. 125mA, 45/- (2/6 post). 200-250v. A.C. Also for 250mA, 1.4v. and 90v. 15mA at same price.

CHASSIS BATTERY RADIO

Valves DK96, DF96, DAF96, DL96. Two Short Wavebands 16 to 49 M. and 25 to 75 M. Size 10½ x 4½ x 5in. £4.16.0, carr. paid. MW and SW, £5, carr. paid. Or as Kit 75/-.

ALL ITEMS ARE NEW AND FULLY BUILT UNLESS OTHERWISE STATED. TESTED BEFORE DESPATCH.

Terms Available on Items over £5. Send 6d. (stamps will do) for 20 page illustrated catalogue. Delivered by return. C.O.D. 2/- extra.

ALL ITEMS GUARANTEED 12 MONTHS VALVES 3 MONTHS

GLADSTONE RADIO

"SCALA", CAMP RD., FARNBOROUGH, Hants.

(Farnborough 3371) and at 247 New Road, Copnor, Portsmouth.
FARNBOROUGH CLOSED SATS.—PORTSMOUTH WEDS.

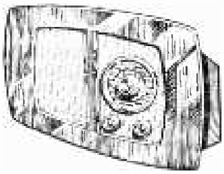
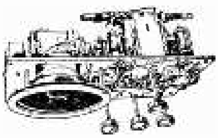


TABLE MODEL TRANSISTOR SET

£9.10.0 (carr. paid)

6 transistors and diode, 5in. circular speaker, superhet circuit. Cabinet 13 x 7¾ x 4½in., battery included. Fully tunable LW and MW. Polished walnut front.

MAINS OPERATED RADIO CHASSIS AND AMPLIFIER OF FAMOUS MANUFACTURE



Chassis 10 x 5½ x 4in. front to back. Valves: UBC41, UCH41, UF89, UL84 with metal rectifier. 5in. speaker. Ferrite rod aerial. Tone, vol. and gram. position. Covers L. and M. waves. Limited quantity at only £6 (5/- carr.) complete with small dial. Unused and in working order.

TELEFUNKEN

German made F.M. front end, 22/6 (post 2/6), with ECC85 valve. Permeability tuned, 88-99 Mc/s. 4 x 1¾ x 2in. high plus valve 2in. Circuit 2/-.

MULLARD

Permeability tuned F.M. front end 22/6 (post 2/6), with ECC85. 4 x 3 x 3½in. 88-95 Mc/s.

TRANSISTOR BABY ALARMS

Two attractive moulded units with connecting lead. Just plug the units together. FULLY BUILT, not a kit. Battery included, lasts months. Is excellent intercom. ONLY £5, carr. paid.

BRAYHEAD "TRANSTRONIC" TRANSISTOR CONSTRUCTION KIT

Two Mullard transistors and diode. Seven circuits can be built inc. transmitter and receiver. 15-page instruction book. Includes all necessary components. Just the gift for a beginner. Originally over £5. Our price 42/6 (post 2/6).

MINIATURE EARPHONES FOR TRANSISTOR RADIOS

3 foot cord. Miniature Jack and Socket. Crystal 8/-, magnetic 7/6.

4 TRANSISTOR MINIATURE PUSH-PULL AUDIO AMPLIFIER

For 3 ohm speaker. 200mW output suitable for intercoms. Portable radios, etc., with free instruction sheet and diagram. For mike or radio input 4 x 1½ x ¾. Printed circuit 47/6, post paid.

TRANSISTORS POST FREE

Set of 6 Mullard transistors OC44, 2-OC45, OC81D, 2-OC81 (matched) and OA70 diode 30/-; set of G.E.C. transistors 874, 2-873, 3-82 or 83, 17/6.

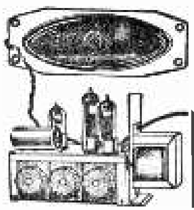
TEST LEAD KIT

Leads, prods, terminals clips in case, 10/-, post paid.

PANEL OF 7 POTS.

10 x 1½in.—4 x 1M and 3 x 2M. 4/- (post 1/-).

THREE-VALVE AMPLIFIER AND RECTIFIER



4 watts. Valves ECC83, EL84 and EZ80. Controls, volume, bass and treble. On/off switch. (Chassis size 6½ x 3 x 2½in.) 6½in. round or 7 x 4in. elliptical speaker. Not suitable for microphone input. A.C. only. 67/-. P. & P. 3/-.

PERSPEX

12¼ x 9⅝ by ⅛in. clear, 5/-.
16 x 14 x $^3/_{16}$in. clear, 7/6.
Postage on one sheet 2/-, on two or more 3/-.

TRANSISTOR COMPONENTS

M.W. and L.W. ferrite rod aerial, with car coupling coil. For 208pF condenser, 8/-; Osc. coil; 1st, 2nd and 3rd I.F's, all 5/6 ea.: Driver trans., 7/6; min. 64mF 10v; 10mF 16v; 30mF 6v, all 1/9 ea; Tuning cond. 208mF + 176pF 8/6; post 9d. on all orders.

NEW 5 WATT AMPLIFIER

By famous manufacturers made to sell at £6.10. Our price ONLY 45/- (post 4/-); a few hundred only; valves EF91 and EL84 with metal rectifier; 6 x 4 x 1¾in. high (5in. over EL84). Mains trans. and o.p. with vol. and tone controls; on-off; co-ax input.

100 RESISTORS

100 resistors 6/-; 100 condensers inc. ceramic and silver mica, 9/6.

A FEW EX-RENTAL 4-WATT AMPLIFIERS

With 10P14. U404, and 10F3 valves; used but in fair condition. 8in. speaker; useful for record player, baby alarm, general amplifier, etc., 15 x 12½ x 6½ins. Mains operated, 18/6 (6/- carr.). Some wood and some moulded cabinets.

SPECIAL OFFER OF RECORDER CABINET

Plain boards, polished walnut finish, 38 x 15½x 23in. high plus 8in. legs. Part delivery charge of £1, as offered elsewhere at over £22, brand new.
Fitted with 3 sliding doors.

PRICE **£13**

"READY TO USE" ITA CONVERTER

Direct switching ITA to BBC. metal rectifier, co-axial plug. Can be fitted in 5-10 mins.. and needs no alteration to your set. ALL AREAS. ALL SETS. ALL CHANNELS. 12 months' guarantee (3 months on valves). Separate gain controls. Valves ECF80 and ECC84. Switch positions OFF—ITA—BBC. Bakelite moulded cabinet. 8¾ x 4 x 6in. 70/- (3/- P. & P.).

AERIALS

Combined B.B.C. (Single Dipole) and Band 3 I.T.A. (5-Element) Aerial, with chimney lashings and Stand-off Arm. Carriage paid £3.15.0.

I.T.A. (Band 3) Aerials, for clipping to existing mast of diameter 1in. to 2in Alternatively with wall-fixing plate at same price: 3 element £1.2.0, 5 element £1.10.0, 8 element £2.10.0, 11 element £3.2.6. Chimney lashings and Stand-off Arm 20/- extra for each of above.

Loft Mounting I.T.A. Aerials. 3 element 20/-, 5 element 26/-. All aerial prices carriage paid. Larger aerials for I.T.A. and B.B.C. can be supplied to special order.

Double 6 Element I.T.A. Plus B.B.C. "H" Aerial with 10ft. pole and double chimney lashings, £8.10.0.

An I.T.A. Table Top Aerial with amazing performance. The Wolsey HI-Q at 19/6 (2/6 post). Good reception up to 20 miles. Cross-over unit in base with socket for B.B.C. aerial. Slightly tarnished at 12/6 (2/6 postage).

PERSPEX. 15 x 12 x ⅛in., tinted blue/grey, 6/6; 12¼ x 9⅝ x ⅛in., Clear, 5/-; 16 x 14 x 3/16ins., Clear, 7/6. Postage 2/- on 1; 3/- on 2 or more; 6 post paid.

A FANTASTIC OFFER OF EXTENSION SPEAKERS

Made by Goodman. Wooden Cabinet 12 x 7 x 10½in. Containing 8in. P.M. 3-ohm speaker; used but good condition. Vol. control fitted. Our price 12/6 (3/6 Post).

COMPONENTS FOR "P.W." AMPLIFIER, GENERATOR, ETC.

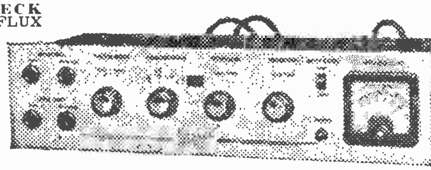
Tubular condensers 350v 0.01, 0.02, 0.05mFd, 6d. ea; 0.25 and 0.5mFd, 9d. ea; Resistors ¼w 10% 6d. ea, 20% 3d. ea; Contact rectifier 250v, 50mA, 6/6; 16-16mFd Elect. 500v, 3/6; D.P.S.T. toggle switch, 3/-; High stab resistors 1/- ea; Valve holders B7G and B9a with skirt and screen, 1/- ea; Co-ax socket 1/-; 1M and 25k pots. with spindle 2/6 ea; SK2, SK4, and SK5 sockets 3/- ea; ditto plugs 3/- ea; add postage Also many other items specified. S.A.E. enquiries.

Stereophonic Sound by Stern's

THE "STP-1" STEREO TAPE PRE-AMPLIFIER

DESIGNED TO OPERATE WITH

- BRENELL Mk. V TAPE DECK incorporating ¼-TRACK MINIFLUX TAPE HEADS.
- PUSH PULL OSCILLATOR CIRCUIT
- 4-SPEED EQUALISATION
- FERROXCUBE OSCILLATOR TRANSFORMER
- SENSITIVE METER FOR SIGNAL LEVEL
- SEPARATE GAIN CONTROLS IN EACH CHANNEL
- MULLARD VALVES



COLLARO "STUDIO" TAPE DECK incorporating the latest ¼-TRACK TAPE HEADS.

OVERALL SIZE CASE 13¼ x 3in. FRONT PANEL (choice of Black or White) 14 x 3½in.

PRICES . . . INCLUDES SEPARATE POWER UNITS

Kit of Parts **£22.0.0** Deposit £4.8.0 12 months of £1.12.3

Assembled and Tested **£28.0.0** Deposit £5.12.0 12 months of £2.1.1.

COMBINED PRICE SCHEDULE

(a) The BRENELL Mk. V ¼-TRACK DECK with the KIT to build the STP-1........................ **£61.0.0**
Deposit £12.4.0. 12 months of £4.9.6.

(b) The COLLARO "STUDIO" ¼-TRACK DECK with the KIT to build the STP-1........................ **£39.0.0**
Deposit £7.16.0. 12 months of £2.17.3.

(a) The BRENELL Mk. V ¼-TRACK DECK with the Assembled STP-1 and matched to the Deck...... **£67.0.0**
Deposit £13.8.0. 12 months of £4.18.3.

(b) The COLLARO "STUDIO" ¼-TRACK DECK with the STP-1 Assembled and matched to the Deck. **£45.0.0**
Deposit £9.0.0. 12 months of £3.6.0.

STEREOPHONIC RECORD PLAYER UNITS ARE AVAILABLE FROM STOCK

THE MULLARD "10 + 10" AMPLIFIER (described below) with the "STP-1" PRE-AMPLIFIER and one of the TAPE DECKS provide a complete STEREOPHONIC INSTALLATION
Details are readily available.

MULLARD'S "10 PLUS 10" STEREO AMPLIFIER

A high fidelity design provides up to 10 watts (per channel) Superb reproduction. Frequency response flat to within 3 db from c/s. to 60 Kc/s at 50 Mw Total Harmonic Distortion at 10 watts 0.1%.

(a) ASSEMBLED AMPLIFIER, including CONTROL UNIT (as illustrated).................. **£21.0.0**
Deposit £4.4.0, 12 months at £1.10.10.

(b) A complete KIT of PARTS...................... **£18.10.0**
Deposit £3.14.0, 12 months at £1.7.2.

We supply the assembled MAIN AMPLIFIER only for operation with the DUAL CHANNEL PRE-AMPLIFIER, this provides for a more versatile installation and is essential if a low output Magnetic Pick-Up is to be used.

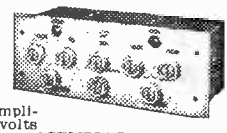
(a) THE ASSEMBLED AMPLIFIER and DUAL CHANNEL PRE-AMPLIFIER.................. **£30.0.0**
Deposit £6.0.0, 12 months at £2.4.0.

(b) A KIT of PARTS for both Units................ **£26.0.0**
Deposit £5.4.0, 12 months at £1.18.2.

Illustrated and Descriptive Brochure available. Please enclose S.A.E.

DUAL CHANNEL PRE-AMPLIFIER

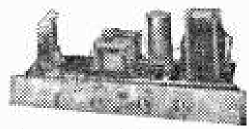
Two Mullard 2-valve Pre-amplifiers combined into a Single unit enabling it to be used for both STEREOPHONIC or MONOPHONIC operation. It is designed primarily to operate with our range of MULLARD MAIN AMPLIFIERS but will also operate equally well with any make of Amplifiers requiring an input of up to 250m/volts



KIT OF PARTS **£12.10.0** ASSEMBLED AND TESTED **£15.0.0**
H.P. £2.10.0 & 12 mths. at 18/4. H.P. £3.0.0 & 12 mths. at £1.2.0

STEREO "TWIN THREE" AMPLIFIER

ASSEMBLED and TESTED for **£7.15.0** (Carr. & Ins., 7/6 extra).



Based on a recent design by MULLARD LTD. Ideally suited for use in PORTABLE RECORD PLAYERS for which purpose we offer a specially designed Portable Case. Incorporates MULLARD ECL86 valves, separate BASS and TREBLE CONTROLS, and produces excellent reproduction of up to 3 watts per channel. Frequency response is 40 c/s to 30 Kc/s. Size 11½ x 3 x 5in.

To construct a STEREO PORTABLE RECORD PLAYER Assembled AMPLIFIER with two ROLA 8 x 5in. LOUDSPEAKERS and the PORTABLE CASE for **£14.0.0**
(Carr. & Ins., 10/- extra). Deposit £2.16.0. 12 months of £1.0.6.

SUITABLE RECORD PLAYERS FROM **£8.14.0**

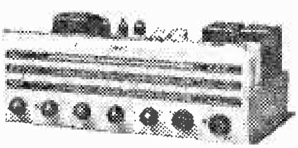
An alternative "TWIN THREE" can be supplied for DUAL CHANNEL MONOPHONIC operation producing output of 6 watts. PRICE AS ABOVE.

ARMSTRONG RADIOGRAM CHASSIS

FULL RANGE IN STOCK. please enclose S.A.E. for leaflets.

STEREO 12 Mk.2 £43.10.0

(ILLUSTRATED)



Deposit £8.14.0, 12 months at £3.3.10. Combines AM and FM Bands, a Stereo Control Unit and two High Fidelity Amplifiers in one compact unit, provides a total of 16 watts output. Other features include: inputs for tape recording, play back, pick-ups and stereo radio; separate bass and treble and balance controls.

STEREO 55 £32.15.0

Deposit £6.15.0 12 months at £2.7.8

A junior version of the Stereo 12 Mk. 2. Ten watts output. five watts from each amplifier. Covers the VHF and Medium wavebands.

JUBILEE Mk.2 £30.12.0

Deposit £6.4.0 12 months at £2.4.9

A Hi-Fi mono chassis giving eight watts push-pull output and covering VHF. medium and long bands. Tape Record and RC play inputs.

AF208 £22.18.0

Deposit £4.18.0 12 months at £1.13.0

An AM/FM chassis providing 5 watts output and covering the VHF and medium wavebands. Tape Record and RC play inputs.

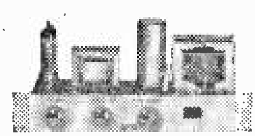
TVB VHF TUNER £21.18.0

Deposit £4.14.0 12 months at £1.11.7

A self-powered high-fidelity tuner of outstanding design. incorporating features which are normally found only in the most expensive tuners. The full VHF band (87-108 M/cs) is covered and an output control enables the output to be varied between 0 and 500 mV.

"HI-FI" LOUDSPEAKERS WE HAVE IN STOCK A COMPLETE RANGE BY GOODMANS—WHARFEDALE—W.B. ILLUSTRATED AND PRICE LEAFLETS ON REQUEST.

THE "MONO GRAM" AMPLIFIER



A small Amplifier of genuine high quality performance. It incorporates the new Mullard ECL86 Valve, separate BASS and TREBLE CONTROLS and when driven by the standard Crystal Pick-up a power output of 3 watts is achieved without distortion. PRICE . . . READY FOR USE

£4.19.6 Carr. & Ins. 5/- extra.

The MONO-GRAM is ideal for portable applications. an attractive case finished in two tone Rexine is available to accommodate the amplifier-speaker and a variety of record changers. Price £4.0.0. The 8" x 5" matching speaker £1.0.0.

Constructors Can Build a Really First-Class Record Player, Complete in all respects, for approx. £14. This will compare with known Record Players currently offered at much higher prices.

STERN RADIO
PREMIER RADIO
MAIL ORDERS and all POSTAL ENQUIRIES to

BUILD A HIGH QUALITY TAPE RECORDER LIKE THIS FOR £35.0.0

CARR. and INS. 10/- extra

Deposit £7.0.0 and 12 months of £2.11.4.

FOR THIS WE SUPPLY ......

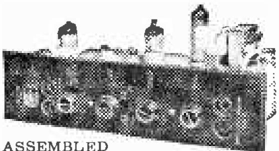
★ Complete Kit of Parts to Build the HF/TR3 Tape Amplifier. ★ The Latest Collaro "Studio" Tape Deck. ★ Portable Carrying Case (as illustrated). ★ Rola/Celestion 10 x 6in. p.m. Loudspeaker. ★ ACOS Crystal Microphone and 1,200 ft. Spool E.M.I. Tape.

ALTERNATIVELY WE SUPPLY THE COMPLETELY ASSEMBLED and GUARANTEED TAPE RECORDER FOR £39.10.0

H.P. Terms: Deposit £7.18.0 and 12 months of £2.17.11.

HF/TR3MKII TAPE AMPLIFIER

(Mullard Type "A" design)



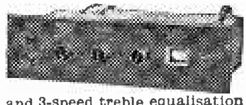
A very high quality Amplifier incorporating 3-speed treble equalisation, by the latest FEROXCUBE POT CORE INDUCTOR, FOR COLLARO-TRUVOX-BRENELL WEARITE Tape Decks, has GILSEN Output Transformer. Includes separate Power Supply Unit.

KIT OF PARTS **£13.13.0** Deposit £2.15.0 12 months at £1.0.0.

ASSEMBLED and TESTED **£17.0.0** Deposit £3.8.0, 12 months at £1.4.11.

ADD "HI-FI" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION WITH

MULLARD TYPE "C" TAPE PRE-AMPLIFIER—ERASE UNIT



The "Hi-Fi" link to add full tape recording facilities to High Fidelity home installations. Incorporates FEROXCUBE POT CORE PUSH-PULL OSCILLATOR and 3-speed treble equalisation by FEROXCUBE POT CORE INDUCTOR FOR WEARITE-COLLARO-TRUVOX OR BRENELL TAPE DECKS. Includes separate power Supply Unit.

KIT OF PARTS **£14.0.0** Deposit £2.16.0, 12 mths. at £1.0.6

OR ASSEMBLED **£17.0.0** Deposit £3.8.0, 12 months at £1.4.11

(Excluding power unit £11.15.0 and £14.10.0 respectively.)

SPECIAL "COMBINED ORDER" PRICES

For Constructors with their own cabinet—WE OFFER—

(a) KIT to build the HF/TR3 Amplifier together with the COLLARO "STUDIO" DECK........ **£26.0.0**
Deposit £5.4.0. 12 monthly payments of £1.18.2

(b) As above but with the HF/TR3 supplied ASSEMBLED and TESTED **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.4

(c) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENELL Mk. V TAPE DECK.... **£42.0.0**
Deposit £8.8.0. 12 monthly payments of £3.1.7

(d) As above but with HF/TR3 supplied ASSEMBLED and TESTED **£45.10.0**
Deposit £9.2.0. 12 monthly payments of £3.6.9

(e) THE ASSEMBLED AND TESTED HF/TR3 AMPLIFIER with the WEARITE MODEL 4A DECK, incorporates Wearite Head Lift Transformer etc. **£60.10.0**
Deposit £12.12.0. 12 monthly payments of £4.8.9

(Carriage and Insurance on each above is 10/- extra).

a) The COLLARO "Studio" Deck with the Model "C" Preamplifier and POWER SUPPLY UNIT ASSEMBLED AND TESTED **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.3

(b) As above but the TYPE "C" Unit and POWER UNIT supplied as COMPLETE KIT OF PARTS **£26.10.0**
Deposit £5.6.0. 12 monthly payments of £1.18.10

(c) The BRENELL Mk. V Deck with the Model "C" PREAMPLIFIER and POWER UNIT. ASSEMBLED and TESTED **£46.0.0**
Deposit £9.4.0 and 12 months at £3.7.6

(d) As above but the Model "C" PREAMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£43.0.0**
Deposit £8.12.0. 12 monthly payments of £3.3.1

(e) The WEARITE MODEL "4" DECK with ASSEMBLED and TESTED Model "C" PRE-AMPLIFIER and POWER UNIT incorporating WEARITE HEAD LIFT TRANSFORMER, Etc. **£60.10.0**
Deposit £12.2.0 and 12 months at £4.8.9

(carriage and Insurance on above is 10/- extra.)

The MODEL HFG/2R PORTABLE TAPE RECORDER

(Original Price £33.0.0)

FOR ONLY 22 gns.

Deposit £4.14.0. 12 months £1.13.9 Crystal Microphone £1.0.0 extra. *(Carr. and Ins. 10/- extra).* Incorporates THE GARRARD "MAGAZINE" TAPE DECK and a HIGH QUALITY AMPLIFIER based on the very successful MULLARD TYPE "A" DESIGN and specifically developed to operate the GARRARD DECK. Price INCLUDES THE GARRARD TAPE MAGAZINE and 4in. SPOOL OF DOUBLE PLAY TAPE. Comprises a Twin Track Recorder operating at 3¾in/sec. speed and providing up to 1 hour 10 mins. playing time. Truly "Portable", weighs only 22 lbs.

THE 'ADD-A-DECK'

Incorporating GARRARD TAPE DECK and MODEL HF/G2P PRE-AMPLIFIER

Supplied on ONE CHASSIS (as illustrated) READY FOR USE **18 Gns.**

(Carr. & Ins. 10/- extra.)

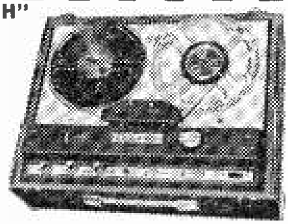
Price includes Garrard Magazine and a 4 in. Spool Double Play tape

H.P. Deposit £3.16.0, and 12 months of £1.7.8.

Provides complete tape recording facilities and designed to operate through the pick-up sockets of the standard type of RADIO RECEIVER, or an AMPLIFIER, from which really first class reproduction is obtained. It consists of a Twin Track Deck connected to the Pre-amplifier and operates at 3¾in/sec. speed providing up to 1 hr. 10 mins. playing time.

The TRUVOX "TOUCH"

With the New "SERIES 60" Recorders



Two Models are available

R62. A Twin Track Recorder with speeds of 1⅞ and 3¾ i.p.s.

R64. A Four Track Recorder with speeds of 3¾ and 7½ i.p.s.

PRICE FOR EACH MODEL **£40.19.0**

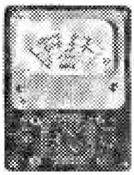
Deposit £8.4.0, 12 months of £3.0.1.

They offer full MIXING, MONITORING and SUPER-IMPOSING facilities.

There is an AUTOMATIC STOP, a REV. COUNTER and a storage compartment for 7 inch spools tape.

DESCRIPTIVE LEAFLETS READILY AVAILABLE

The JEMCO MODEL MT-955 MULTIMETER



50,000 ohms per volt—D.C.
5,000 ohms „ „ A.C.

A truly efficient Meter for the amateur or professional man, having features found normally in more expensive Meters. Ranges:

D.C. volts 2.5-10-50-250-1.K
A.C. „ 2.5-10-50-250-1.K
D.C. Current 100μA-10mA-100mA-500mA. 10 amps
Resistance 4 Ranges up to 20 meg.
Add D.B. 0-46 Size 7 x 5¼ x 3in.

PRICE, including Full Test Lead Kit .... **£12.19.6** 4/- p. & p.

109, FLEET ST., LONDON, E.C.4. TELEPHONE FLEET ST. 5812-3

23, TOTTENHAM COURT RD., LONDON W.1. TELEPHONE MUSEUM 3451

7-9 TUDOR PLACE, TOTTENHAM COURT RD., LONDON, W.1. TELEPHONE MUSEUM 6128/9

STEREO-MONO CRYSTAL CARTRIDGES AT GREATLY REDUCED PRICES

RONETTE Model "OV" Output 110m/Volts	29/6
RONETTE Model "105" Output 250m/Volts........	35/-
RONETTE Model "105" with DIAMOND STYLUS........	39/6
RONETTE Model "106" Output 500m/Volts	32/-
COLLARO "CERAMIC" Output 50m/Volts	25/6

All above are "TURNOVER" type Cartridges.

R.S.C. Manchester Ltd. *MAIL ORDERS to 5 County Arcade, Leeds 1. Terms: C.W.O. or C.O.D. No C.O.D. under £1. Postage 2/9 extra under £2. 4/6 extra under £5. Trade Suppliers. S.A.E. with all enquiries please.*

BIRMINGHAM: 6 Gt. Western Arcade Opp Snow Hill Stn Half-day Wed.
SHEFFIELD: 13 Exchange St. Castle Market Bldgs.
HULL: 51 Savile St. Half-day Thurs.
LIVERPOOL: 73 Dale St. 8 mins. from Lime St. or Exchange Stations
BRADFORD: 56 Morley St. above Alhambra Theatre Half-day Wednesday
MANCHESTER: 5-7 County Mecca Arcade, Briggate
LEEDS: 8-10 Brown St. Market St. No half-day

SENSATIONAL STEREO OFFER

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Including pair matched 6½in. speakers. 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.)**

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. 30-30,000 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 a **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.** **TERMS: DEPOSIT 33/9** and 9 monthly payments of 33/9.
11 Gns. Carr. 10/-
Suitable microphones and speakers available at competitive prices.

WE STOCK ARMSTRONG AND JASON EQUIPMENT GOODMANS AND W.B. SPEAKERS

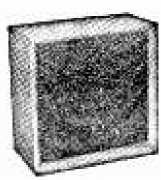
SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers). Delayed A.V/C. Controls are Tuning, W/Ch. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size approx. 9 x 6 x 7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustrations, 2/6. Total building cost £4.15.0. S.A.E. for leaflet.

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, **£4.12.9.** 12in. R.A. 3 ohms 10 watts (12,000 lines), **59/6.**
TWEETERS. Plessey 3 Ω 19/9, 15 Ω 25/9.

Jason FMT1 V.H.F./FM Radio Tuner design. Total costs of parts including valves Tuning dial, Escutcheon, etc., **£6.19.9.** Other Jason equipment in stock.

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for any record playing unit, and most microphones. Negative feed-back 12db. 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 7-5-5½in. high. Guaranteed 12 months. Only **£5.19.6.** Send S.A.E. for leaflet. Terms: Deposit 22/6 and 5 monthly payments of 22/6.

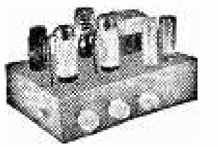
12in. 10 WATT HIGH QUALITY LOUD-SPEAKER



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 8 monthly payments of **11/3.**

12in. 20 WATT HI-FI LOUD-SPEAKERS IN CABINETS. Size 18 x 18 x 10 in. Finish as above. Terms: Deposit **17/9** and 9 monthly payments of **17/9.** Only **£7.19.6.** Carr. 8/6.

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. or 300 v. 25 mA. and L.T. or 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Bluehammer 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.

R.S.C. PORTABLE GUITAR AMPLIFIERS
(For 200-250 v. A.C. Mains)

Junior 5 watts High Quality output. Separate Bass and Treble "Cut" and "Boost" controls. Sensitivity 15 m.v. Twin inputs. High Flux 8in. Loudspeaker "built-in". Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in attractive and durable policrome, and fitted carrying handle. Terms Deposit £1 and 9 monthly payments of **£1.** Send S.A.E. for leaflet. Carr. 10/-. **£8.19.6**

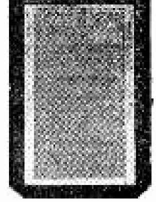
Senior 10 watts High Fidelity output Separate Bass and Treble "Cut" and "Boost" controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12in. for Bass notes and a 7 x 4 in. elliptical for Treble. Cabinet is well made and finished as Junior model. Size approx. 18 x 18 x 9in. H.P. Terms. Deposit 34/9 and 9 monthly payments of **34/9.** Carr. 10/-. Send S.A.E. for leaflet of this or 15 watt. **15 Gns.**

Super Hi-Fi 15 Watt. All facilities as 10 watt. Cabinet size 20 x 15 x 13ins. Terms: Deposit **£2.11.6**, and nine monthly payments of 51/6. Cash **22 gns.** Carr. 12/6.

R.S.A. Bass-major 30 Watt, incorporating massive 12in. high flux speaker and tweeter. Two separately controlled high impedance, high gain inputs for simultaneous connection of two Instruments, etc. Substantial cabinet attractively covered in two tone rexine. **39 Gns.** Terms: Deposit **£4.2.0** and 12 monthly payments of **£3.9.0.** Carr. 15/-

SPECIAL OFFER OF HIGH FIDELITY REPRODUCER. consisting of the very latest Axiette 8 Goodmans speaker (retailing at approx. £5.5.0) fitted in our Junior Bass Reflex Cabinet. Price complete **£7.19.6.**
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. Especially recommended for Audiotrine Loudspeaker systems. **£5.19.6.** Suitable legs with brass ferrules, **19/6** per set of 4.

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.**

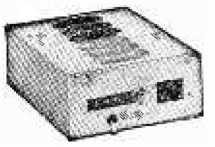
AUDIOTRINE HI-FI SPEAKER SYSTEMS. Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction Standard 10 watt rating **£4.19.9.**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

AUDIOTRINE EQUIPMENT CABINETS

Size 36 x 15 x 18in. Beautiful walnut veneered finish. Elegant contemporary design. Robust construction. Uncut removable baseboard Depth above baseboard 5½". Only **12½ gns.**

R.S.C. BATTERY TO MAINS CONVERSION UNITS

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** 200-250 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions, **49/9**, or ready for use, **59/6.**

TRANSISTOR RADIO CHARGER/ELIMINATOR UNITS. Ready for use, fitted "Snap On" clips. When connected to 200-250v. A.C. mains will charge 9 v. battery or replace same. PP3 Size **19/9.** Larger size **29/9.**

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

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR

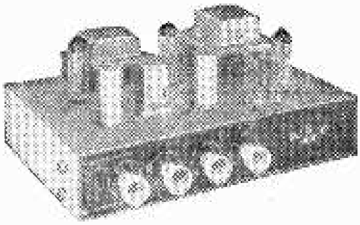
Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best quality Tape and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, 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

SPECIAL NOTE. The Tape Decks we supply are latest models. Where customers already have a Deck or wish to use one of those being offered cheaply we can supply Kit less Deck at 13 gns. carr. 10/-. Or deposit 2 gns. and 12 monthly payments 23/9. Also if required we can supply in lieu of portable cabinet and 7 x 4in. speaker, the Equipment Cabinet illustrated at foot of opp. page and a high flux 8½ x 5½in. speaker for 8 gns. extra.

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 D.B. 30-30.000 c/s. Six negative feedback loops. Hum. level 60 D.B. 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, 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. 12-9-7in. For A.C. mains 200-250 v. 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 24/9, and 9 monthly payments of 24/9.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets, Speaker, Microphones, etc., with cash and credit terms.

R.S.C. TRANSISTORISED GRAM AMPLIFIER. Output 1 watt, for 3 ohm speaker. Transistors Mullard OC71, OC81D, OC81, OC81. Fitted Vol. Control with switch. Assembled and tested. Suitable for any normal crystal pick-up. Only **59/9.**

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Collaro, **19/9.** Acos Stereo-Monaural **49/9.** Ronette Stereo-Monaural **59/6.**

BRADMATIC RECORDING HEADS. High Impedance Record/Playback **22/-.** Low Impedance Erase. **12/6.**

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 **35/9.**

COLLARO JUNIOR 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only **£3.19.6.**

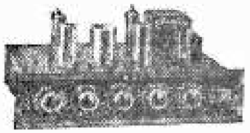
COLLARO CONQUEST 4-SPEED AUTO-CHANGER, with high fidelity Studio pick-up. Latest model. For 200-250 v. A.C. mains. **£6.19.6.** Carr. 5/6.

COLLARO RC 457 4-SPEED MIXER AUTO-CHANGERS. Turnover Studio head, for 200-250 v. A.C. **£7.19.6.** Carr. 4/6.

B.S.R. UA8 4-speed AUTO-CHANGERS with hi-fi turnover head. **£6.19.6.** Carr. 4/6.

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.**

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 of "lift" and "cut". Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3ohm 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/-.

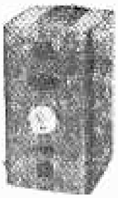
Kit can be assembled, ready to use. 59/6 extra.

R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. Mains 200-250v., 50c/s. Guaranteed 12 months.

HEAVY DUTY CHARGER KIT 6/12 v. 6 amps. variable output. Consisting of Mains Transformer 0-200-230-250 v.: F.W. (Bridge) Selenium Rectifier: Ammeter, Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit, 59/9. Carr. 4/6.

CHARGER KIT, 12v. 14 AMP or 24v. 7 amp. Consisting of mains trans. 200-230-250 v. F.W. (Bridge) selenium Rectifier. F Ammeter, Fuses, Variable Resistor and Circuit. Only 6 gns. Carr. 15/-. Please state if 12v. or 24v. kit required.



Assembled 4-5 amps. 6/12v.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for use with mains and output leads. **69/9** Carr. 5/-. Terms: Deposit 13/3 and 5 monthly payments 13/3. 6/12 v. 3a., all facilities as above. Only 59/9, carr. 3/9.

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 **49/9** Carr. 3/9

6/12v. 1 amp. 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 Ammeters **28/9**
6 v. 2 amps **21/9**
6v. or 12v. 2 amps **27/9**
6 v. or 12 v. 2 amps. inclusive of Ammeter.......... **35/9**
6 v. or 12 v. 4 amps......... **45/9**
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector.............. **52/9**

CHARGER AMMETERS. 0-1.5 a., 0-3 a., 0-4 a., 0-7 a., 0-25 a., 0-60 a., **8/9.**

SOLDERING IRONS. 230-250 v. 30 watts. First quality. For Radio work, **19/9.** Spare elements and bits available.

ASSEMBLED 12V. 10 Amp with variable charge rate adjustment, ammetor and strong louvred, stove enamelled case. Ready for use. Only **7 gns.** Carr. 10/- or in Kit Form **5 gns.**

R.S.C. MAINS TRANSFORMERS (FULLY GUARANTEED)

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**
350-0-350v. 80mA, 6.3v. 2a, 5v. 2a .. **18/9**
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 **25/9**
300-0-300v. 130mA, 6.3v. 4a, 6.3v. 1a, for Mullard 510 Amplifier.. .. .. **29/9**
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a **26/9**
350-0-350v. 100mA, 6.3v. 4a, 5v. 3a .. **26/9**
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a **29/9**
425-0-425v. 200mA, 6.3v 4a, 5v. 3a .. **40/9**

FULLY SHROUDED UPRIGHT

250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a. Midget type 2½-3-3in. **17/11**
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a **27/9**
300-0-300v. 100mA, 6.3v. 4a, 5v. 3a **27/11**
300-0-300v. 130mA, 6.3v. 4a, C.T. 6.3v. 1a, for Mullard Amplifier **33/9**
350-0-350v. 100mA, 6.3v. 4a, 5v. 3a **27/11**
350-0-350v. 150mA, 6.3v. 4a, 5v. 3a .. **35/9**

FULLY SHROUDED (continued)—

425-0-425v. 200mA, 6.3v 4a, C.T. 5v. 3a. **55/-**
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, 5000Ω 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 15Ω **9/9**
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 or 15Ω **19/9**
Following types for 3 and 15Ω speakers:
Push-Pull 10-12 watts 6V6 or EL84 .. **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. 250 v. 60 mA, 6.3 v. 2a **11/9**
250-0-250 v. 60 mA. 6.3 v. 2a. .. **12/11**
Both above size 2½ x 2½ x 2½ins.

FILAMENT TRANSFORMERS

All with 200-250 v. 50 c/s. primaries 6.3 v. 1.5a, **5/9**; 6.3 v. 2a, **7/6**; 0-4-6.3 v. 2a, **7/9**; 12 v. 1 a, **7/11**; 6.3 v. 3 a, **8/11**; 6.3 v. 6 a, **17/6**; 12 v. 1.5 a. twice, **17/6.**

SMOOTHING CHOKES

150 mA, 7-10 H H 250 ohms **11/9**
100 mA, 10 H 200 ohms **8/9**
80 mA, 10 H 350 ohms **5/9**
60 mA, 10 H 400 ohms **4/11**

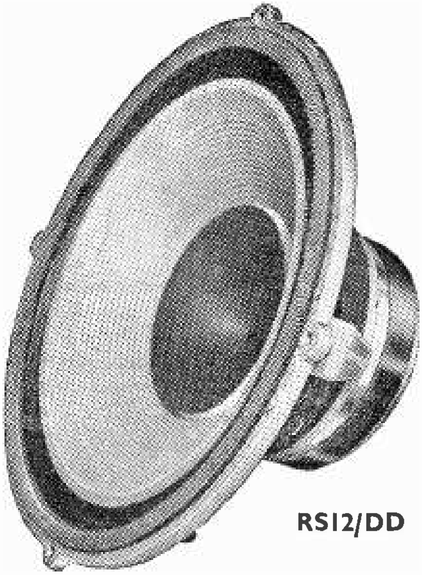
CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a. **12/9**; 0-9-15 v. 2a, **14/9**; 0-9-15 v. 3 a., **16/9**; 0-9-15 v. 5 a, **19/9**; 0-9-15 v. 6 a., **23/9**; 0-9-15 v. 8 a., **28/9.**

AUTO (Step up/Step down) TRANS: 0-110/120-230/250 v. 50-80 watts, **13/9.** 250 watts, **39/9**; 150 watts, **27/9.**

MICROPHONE TRANSFORMERS

120 : 1 high grade, clamped, **6/9**; 120 : 1 Potted, Mu-metal screened, **9/9.**



RS12/DD

A 12" SPEAKER for the HOME CONSTRUCTOR

A fine 12" Speaker employing a new type of double diaphragm and magnet assembly, the RS12/DD has been designed with the home constructor in mind—it is one of the few 12" models suitable for use in compact enclosures enabling a really high quality system to be assembled at a modest price.

Some important features of the RS12/DD—

- Very low bass resonance
- Synthetic Centring Device
- Ceramic Magnet
- Die-cast Chassis
- Foam edge Damping
- One-piece HF Flare Dome
- Airtight impregnated Roll Surround

£11.10.0 TAX FREE

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WIRELESS WORKS LTD

Complete the coupon for technical specification of the RS12/DD including Constructional details of suitable cabinets.

Post to Wharfedale Wireless Works Ltd., Idle, Bradford, Yorkshire

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ADDRESS ....

.... PW

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OSMOR

Transistor

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3 IFS & Osc. 22/- set

Driver & Output 16/3 pair

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it pays to have qualifications. Let us tell you what Britain's oldest and most successful radio correspondence school can do for you. We will tell you the facts. No follow-up letters, no high-pressure salesmanship, no callers.

Write for details, *today*, to:

Mr. J. SYKES
(M.I.E.E., M.Brit.I.R.E., M.I.N.)

Principal:

BRITISH NATIONAL RADIO SCHOOL
Red Lion Court, Stalbridge, Dorset.

Britain's premier Radio Correspondence School specialising in City and Guilds examinations.

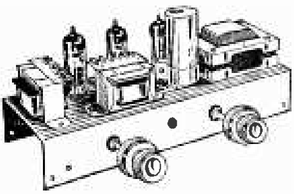
RECORD PLAYER AMPLIFIER

★ 2 watt output.

★ Ready built with valves and 6½in. speaker, tone and volume controls. Mounted on panel 13 x 7½.

75/-. P. & P. 2/-.

STEREO AMPLIFIER
Bargain Offer



★ 4 watts per channel.

★ Full tone and volume controls.

★ Complete with sockets, etc.

89/6 P. & P. 2/6.

QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. This amplifier (which is used in a 29gn. record player) employs ECC83, EL84, EZ80 valves. Bass, treble and volume. On/off controls.

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

DITTO. Mounted on board with output transformer and 6½ in. speaker. Complete at **89/6** P. & P. 4/6.

4-SPEED PLAYER UNIT BARGAINS

SINGLE PLAYERS

B.S.R TU/12, £3.15.0. Carr. 3/6

AUTO CHANGERS

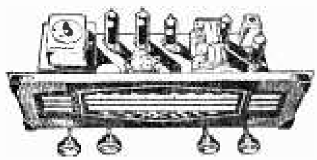
B.S.R. UA14, £6.19.6. Latest B.S.R. UA16, £7.19.6. Latest Garrard "Auto-Slim," £7.15.0.
Carr. 5/- on each.

LOUDSPEAKER SILKS
54in. wide

Heavily woven in ivory and gold. Originally 35/- per yard length. OUR SPECIAL PRICE 13/6 per yard length. P. & P. 1/6. Also Red Rexine, Dark Grey and Oatmeal fabrics for cabinet covering, 54in. wide, 13/6 per yard length. P. & P. 1/6.

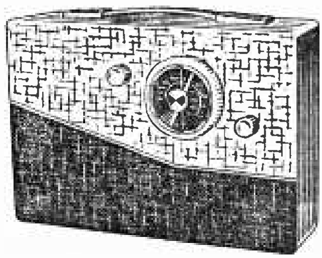
SEND STAMP FOR OUR SURPLUS VALVE LIST.

RADIOGRAM CHASSIS



A chassis of distinction, by a famous maker. Covering Long, Med. and Short Waves, plus gram position. (Size 15½ x 7 x 6½in. high). Incorporates the latest circuitry, using fully delayed A.V.C., and negative feedback. Controls: Tone, Vol. On/Off, W/Change (L.M.S. and Gram), Tuning. Tapped input 200-250 v. A.C. only. An attractive brown and gold illuminated dial with matching knobs, make this one of the most handsome, in addition to being one of the best performing chassis yet offered. Complete with valves (ECH81, EF89, EBC81, EL84, EZ81), knobs, output transformer, leads, etc. OUR PRICE ONLY **£9.19.6**
Plus 8/6 post and packing.
ALSO AVAILABLE: 6 valve. 3 waveband, F.M. M.W., L.W., ECC85, ECH81, EF89, EABC80, EL84, EZ80, £11.11.0. P. & P. 8/6. Deluxe version of above with F.M., S.W., M.W., L.W. and piano-key wavechange, same line up, £13.13.0. P. & P. 8/6.

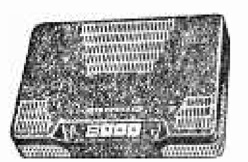
6 TRANSISTOR AND TWO DIODES RECEIVER



Easy to build, using 6 super transistors and 2 diodes 750 M/W output, full medium and long wave coverage, printed circuit, 5in. speaker, prealigned IFTS & OSC. Very fine tuning, ferrite aerial with car aerial socket, attractive 2-colour cabinet. Simple to follow instructions with circuit, everything complete.

£8.19.6 P. & P. 3/6 Battery 3/6 All parts sold separately.

BARGAIN OFFER!



TELEFUNKEN HI-FI STEREO AMPLIFIER 110/250 v. A.C. input. 5 watt undistorted output (10 watts nominal). Size 12 x 9 x 2in. Weight 9 lb. Complete with spec. and instructions.

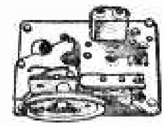
£5.19.6 Carr. 5/-.

Also **Model S82.** Similar specification but with balance control. £6.19.6. Carr. 5/-.

SPECIAL OFFERS!

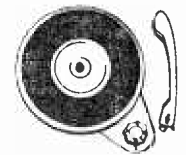
GAULER F.M. TUNER HEADS. 10.7 Mc/s. I.F., 15/-, plus 1/9 P. & P. (ECC85 valve 8/6 extra).
ELECTROSTATIC H.F. TWEETERS. Type L.S.H. 75. Size 3 x 3in., 2/6 each, plus 9d. P. & P.
MIDGET 2 GANG CONDENSERS. Capacity 195 and 100 PF. Polystyrene case with built in trimmers. Size ¾ x ¾ x ½in. Not used but removed from P/C Boards. 2 for 9/-. Plus 1/- P. & P.
ACOS CRYSTAL MIKES. Hi-imp., 18/6. P. & P. 1/6.
4 MFD MANSBRIDGE PAPER CONDENSERS. Ideal for Crossover Units. 4/6 each. P. & P. 1/-.
TRANSISTOR DRIVER and O/P TRANSFORMERS. (Tapped 3 ohms and 15 ohm o/p), plus 4 suitable Transistors giving approx. 1 watt o/p. 30/-. P. & P. 2/-.
MAINS TRANSFORMERS Tapped Primary. ½ wave or Bridge Rectifier. Secondary 250 v. at 75 m/a 6.3 volts at 2 amps. 7/6 each. P. & P. 3/-.
3 PUSH-BUTTON TRANSISTOR SWITCH. D.P.—D.T. Each Switch 5/6 and 1/- P. & P.

F.M. TUNER HEAD



A permeability tuned tuner head by a famous maker, supplied without valve (ECC85) and drum and spindle, 18/6, plus 1/9 P. & P. Valve 8/6 extra. Drum and spindle 3/6 extra.

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



Heavy 8¾in. metal turntable. Low flutter performance 200/250V shaded motor with tap at 80V for amplifier valve filament if required. Turnover LP/78 head.
PRICE 79/6
Plus 4/6 P. & P.

SPECIAL PURCHASE!

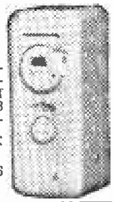
E.M.I. 4-speed. 9 v. battery operated Record Player Unit. Mounted on unit plate. Complete with turnover head and sapphire stylii. **69/6** P. & P. 3/6.

WE STOCK GOOD COMPANION AND MARTIN RECORDER KITS.

170, HIGH STREET, MERTON, S.W.19 CHE 3985/6

Open all day Saturday. Early Closing Wed., 1 p.m. A few minutes from South Wimbledon Tube Station.

Pullin Thermostat



This is a wall mounting Thermostat intended for the control of room heating up to 3 KW (A.C.) Scale calibrated from 30°—90°F. with neon lamp for on/off indication. Price **27/6.** plus 1/6 Post and Ins.

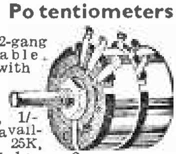
15 Amp Thermostat

You can make yourself a thermostat similar to the above using a "Sunvic" unit which we can offer at 9/6. This is adjustable over the same range as the Pullin and will control the same amount of heating. We can also offer a crackle finished calibrated case which can be used for containing the Sunvic. Price two items together **14/6.** plus 1/- Postage.

Ice-Stat

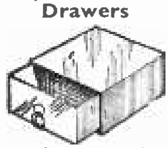
This is a small thermostat which cuts on and off at around freezing point. Has many uses, one of which could be an ice warning device to be fitted under your motor car. Price 7/6. Post 1/-.

Morganite Potentiometers



Single and 2-gang types available standard size with good length spindle, all new and boxed. **Single types.** 1/- each, values available: 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg. **Gange type** 3/- each—values available: 5K ± 5K, 100K ± 100K ½ meg. ± ½ meg. 2 meg. ± 2 meg.

Component Storage Drawers



Stout board construction, these drawers are ideal for small parts. Supplied complete with simple erection instructions—1/6 each or 12 drawers each 6 x 2¼ x 6½in., **13/6**, post 2/-.

Hi Fi Speakers

E.M.I. Ceramic magnet 12,000 lines, size 13 x 8in. (roughly equivalent to 12in. round speaker). Handles up to 10 watts. Price **33/6**. plus 5/- carriage and insurance. State whether 15 ohm or 3 ohm. Similar model but specially designed and hand made for very low frequencies (40 to 55 cycles). Price **£7.10.0.**

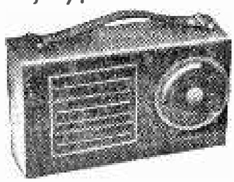
Miniature Transistor Sets

Cheaper than you can possibly make them, we are able to offer these made up, ready to work, complete with leather carrying case and earphone. **Astra 7** uses 7 transistors, covers 535-1065 kc/s. sensitivity 300 micro volts/M. output 150 mW. ferrite slab aerial. Size approximately 4½ x 2½ x 1½ins. Price **£6.19.6.** Post & Ins. 3/-. **Zephyr 6,** very similar specification to the above but only 6 transistors. Price **£5.19.6** with leather case and earphone plus Post & Ins. 3/-.

The 'Good Companion' Mk.II using Transfilters

In the 'de-luxe' cabinet as illustrated it costs **£10.19.6** to build—but What a set! Scan these pages: you will find nothing to compare with its specification. It uses transfilters instead of I.F transformers, has variable feedback as well as all the usual features. A.V.C., Push-pull output, Ferrite Aerial, Slow Motion Tuning, etc., etc., and is a very powerful Medium & Long Wave set, conservatively rated at 750mW. Every component used is by a famous maker, such as American Philco MADT R.F. transistors—Mullard A.F. transistors—Jackson Brothers' tuning condensers—Rola-Celestion loudspeakers—Dubilier—T.C.C.—Morganite resistors and controls. Also full after sales service available.
You will definitely be doing the right thing if you buy a Good Companion.

"A jolly fine set but deserving a better case"

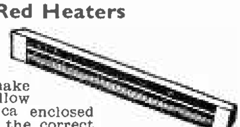


This is a comment which many constructors have voiced and therefore we now offer a de-luxe version of the Pocket Companion. This uses a solid hide case of very pleasant red with gold lettering and our Pocket Companion now has the 15 guinea look.

The most up-to-date Superhet portable of its type, it uses a transfilter in conjunction with Philco R.F. transistors and Mullard output transistors. Complete building costs with plastic case **£6.15s.** or with solid hide cast, **£7.15s.**

If you have already built and want to change your case, then return the plastic case with a postal order for £1 or if you wish to retain the plastic case then send **26/-**, plus 1/6 Post and Ins. for the hide case only.

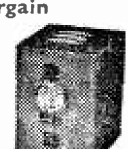
Infra-Red Heaters



Make up one of these latest type heaters ideal for bathroom, kitchen, bedroom, etc. They are simple to make from our easy to follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and instructions **15/6**, plus 2/6 post and insurance.

Battery Charger Bargain

Components Would Cost More

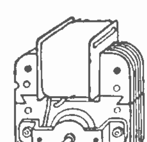


Car Battery Charger—ready-made high output battery charger in stove enamelled sheet steel louvred case. New, complete and ready to work. Rated at 12 v. 5 amps. and variable rate selector for trickle charging, also a meter to show charging rate. Suitable for 230/250. A.C. mains. Special snip price of **65/-**, plus 3/6 post and ins.

LIMITED QUANTITY ONLY!

Waterproof heater wire. 16 yds. length. 70 watts. Self regulating temperature control. **10/-.** Post Free.

THIS MONTH'S SNIP !!

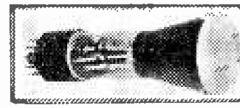


Silent running mains motor by very famous maker. Ideal for gramophone, tape recorder, fan, etc., etc. 200-250 volts, A.C., shaded pull start. Size approximately 2⅞ x 2½ x 1⅞in. 2,750 r.p.m. Spindle diameter 5/32in. Spindle length ⅞in. Brand new guarantee. Price **12/6,** plus 1/- post.

"Starlux 208"

Solderless '3' **TRANSISTOR.** Ideal for home and holidays as no Aerial or Earth required. Enjoy assembling and performance. Our solderless Terminals ensure perfect connections using first grade Transistors and all parts incl. Earpiece for private listening. Will receive Luxembourg (the station of the stars) and other stations on both Medium and Long waves. Penlight Battery operated. **37/6.** Post and insurance, 2/6.

Building A 'Scope?



3in. oscilloscope tube. American made type No. 3FP7, 6.3 v. 0.6 amp. heater, electrostatic deflection, brand new and guaranteed with circuit diagram of scope, **15/-** each, plus 2/6 post and insurance.

Tape Recorders

One of the easiest ways to learn anything, is to "tape" it and then keep playing it back. The industrious Japanese have really gone to town on tape recorders this year and many bargains are on offer. It is the writer's opinion that there is bound to be a big demand for them as Christmas presents so there is a good reason why you should buy your tape recorder immediately. Prices range as follows:

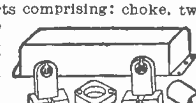
Child's Model	**£4.19.6**
Assemble yourself Model	**£6.19.6**
Model No. Hil-3...........	**£7.15.0**
The "Treasurer"	**£8.19.6**
The "Pocket Secretary"..	**£14.14.0**

The first two are not really good enough for music but they are quite good for speech. The last three are reasonable also for music. All have a value out of all proportion to their cost. Try this new learning technique—you will be amazed.

"Dipyt" Automatic Headlamp Dimmer

A transistorised device for automatically dipping headlamps so leaving driver's hands and feet free for emergency, could easily avoid an accident. We now offer such a device ready made and tested. The unit measures 5 x 2 x 5in. and fits under the dash, it is very easy to wire into the circuit and can also be used to control side lamps for parking. Price of unit is **£10.19.6.** Carr. paid. Diagram and instructions free with unit or separate 2/6. (Agents wanted.)

Fluorescent Light Bargain



Kit of parts comprising: choke, two lamp holders, starter holder and starter, 40 watt., **19/6**; 80 watt. **23/6.** Plus 2/- post and insurance

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; DP 14/6

80 ohm CABLE COAX Semi-air spaced ¼in. Stranded core. 6d.yd. 40 yds. 17/6 60 yds. 25/- Fringe Quality Air spaced. 1/- yd.

TELESCOPIC CHROME AERIALS. 13in. extending to 43in., 8/6 ea. Coax Adaptor Plug, 1/6 extra.
TRIPLEXERS Bands I, II, III 12/6
COAX PLUG .. 1/- LEAD SOCKET.. 2/-
PANEL SOCKETS 1/- OUTLET BOXES 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
Wirewound Ext. Speaker Control, 10Ω 3/-.
WIRE-WOUND POTS, 3 WATT. Pre-set Min. TV Types. All values 10 ohms to 25 K., 3/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 3/-).
WIRE-WOUND 4 WATT 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 knobs, 2/-.
RESISTORS. Preferred values. 10 ohms to 10 meg., ⅛ w., 4d.; ¼ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-. High Stability. ½ w., 1%, 2/-. Preferred values 10Ω to 10 meg. Ditto 5%, 10Ω to 22 meg., 9d.

WIRE-WOUND RESISTORS 10 ohms—10,000 ohms
5 watt 1/3
10 watt 2/-
15 watt 2/-
12.5K to 50K 10 w. 3/-

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

			Spare Plastic Reels
Double Play	7in. reel, 2,400ft.	60/-	
	5in. reel, 1,200ft.	37/6	
Long Play	7in. reel, 1,800ft.	35/-	3in. 1/6
	5¾in. reel, 1,200ft	23/6	4in. 2/-
	5 in. reel, 900ft.	18/6	5in. 2/-
Standard	7in. reel, 1,200ft.	25/-	5¾in. 2/-
	5in. reel, 600ft.	16/-	7in. 2/6

"Instant" Bulk Tape Eraser and Head Defluxer, 200/250 v. A.C., 27/6. Leaflet with full details. S.A.E.

CRYSTAL SET BOOKLET, 1/-.
CRYSTAL DIODE G.E.C., 2/-. GEX34, 4/-. OA81, 3/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 15/- pr.
SWITCH CLEANER. Fluid squirt spout, 4/6 tin.

HIGH GAIN TV PRE-AMPLIFIERS BAND I B.B.C.
Tunable channels 1 to 5. Gain 18dB. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valves if preferred.)
BAND III I.T.A.—Same prices. Tunable channels 8 to 13. Gain 17 dB

1/16in. Paxolin Panels. 10 x 8in., 2/-.
Miniature Contact Cooled Rectifiers, 250V 50mA, 7/6; 250V 60mA, 8/6; 250V 85mA, 9/6; 200 mA, 21/-; 300mA, 27/6.
TV etc., Silicon Sub-Min. Rectifier. 125V. 300mA, 6/6; 250V, 300mA, 14/6.
Selenium Rect., 300V 85mA. 5/-.
Coils Wearite "P" type, 3/- each.
Osmor Midget "Q" type, adj. dust core, from 4/- each. All ranges. List S.A.E.
Teletron D.W.R. L. and Med. T.R.F. with reaction, 4/-. 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., 3/-; 8 x 5/16in., 3/-.
H.F. Chokes, 2/6. Osmor QC1, 6/9.
T.R.F. Coils, A/HF, 7/- pair; HAX, 3/-, Repanco DRR2, 4/-. DRX1, 2/6.
Radio Screwdriver. 5in., 6d.
Neon Mains Tester Screwdriver, 5/-.
Solder Radiograde, 4d. yd., ½lb. 5/-.
Black Crackle Paint. Air drying, 3/- tin.

Aluminium Chassis. 18 s.w.g. Plain undrilled. 4 sides, riveted corners, lattice fixing holes, 2½in. sides, 7 x 4in. 4/6; 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 + 1" TRANSISTOR RADIO MEDIUM AND LONG WAVE KIT
First class components to make a 6 transistor 2 wave band superhet chassis Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, printed circuit, 8½in. x 2¾in., but EXCLUDING speaker and cabinet. Simple instructions 1/6 (Free with kit).
Speakers, 35 ohm, 7 x 4in. 25/- 5in. 22/6, 3½in. 19/6. **£4.5.0**

BULGIN PLUGS AND SOCKETS. Non-reversible P74, 2-pin, 4/3; P73, 3-pin, 4/6, etc.
JACKS. English open circuit, 2/6. Closed circuit, 4/3. Grundig type, 3 pin, 1/3.
JACK PLUGS. English, 3/-; Screened, 4/-; Grundig, 3 pin, 3/6.
ALADDIN FORMERS and cores, ¼in., 8d.; ⅜in., 10d.
0.3in. FORMERS 5937 or 8 cans TV1 or 2, ½in. sq. x 2½in. or ⅝in. sq. x 1½in., 2/- with cores.
SLOW MOTION DRIVES. 6 : 1, 2/3.
SOLON IRON, 25W, 200V or 230V. 24/-.
ANTEX SUB-MIN IRON 15w. 200 or 240 v., 29/6.

JASON FM TUNER COIL SET 29/-. H.F. coil, aerial coil, oscillator coil, two I.f. transformers 10.7 Mc/s detector transformer and heater choke. Circuit and component book using four 6AM6, 2/6. Complete Jason FMT.1 Kit. Jason chassis with calibrated dial, components and 4 valves, £6.5.0.

MAINS DROPPERS. Midget adjustable sliders, 0.3A, 1,000 ohms, 5/-; 0.2A, 1,200 ohms, 5/-; 0.15A, 1,500 ohms, 5/-; 0.1A, 2,000 ohms, 5/-.
MIKE TRANSFORMER. 50-1, 3/9.
P.V.C. Conn. Wire, single or stranded, 2d. yd.
Sleeving, 1 or 2 mm, 2d.; 4mm, 3d.; 6 mm, 5d. yd.
SPEAKER FRET. Gold cloth, 17 x 25in., 5/-; 25 x 35in., 10/-, Tygan, various colours, 52in. wide from 10/- ft.; 26in. wide, from 5/- ft. Samples, S.A.E. Expanded Metal, Gold, 12 x 12in., 6/-.

TELEVISION REPLACEMENTS
Line Output Transformers
from 45/- each, NEW Stock
and other timebase components. Most makes available. S.A.E. with all enquiries

WEYRAD
COILS AND TRANSFORMERS FOR 2-WAVE TRANSISTOR SUPER-HETS WITH PRINTED CIRCUIT AND FERRITE ROD AERIAL

Long and Medium Wave Aerial—RA2W. On 6in. rod, 208pF tuning.	12/6
Car Aerial Coil.	1/-
Osc. Coil P50/1AC. 176pF tuning.	5/4
1st and 2nd I.F. Trans.—P50/2CC. 470kc/s 11/16in. dia. by ⅞in.	5/7 each.
3rd I.F. Trans.—P50/3CC.	6/-
Spare Cores	6d. each.
Driver Transformer—LFDT4.	9/6
Wavechange Slide Switch.	3/6
Printed Circuit—PCA1. Size 2¾ x 8½in. Ready drilled and printed.	9/6
Volume Control. 5K8DP.	4/6
7 x 4in., 35 ohm Speaker.	25/-
3½in. round 35 ohm speaker.	19/6
24 Fixed Resistors.	10/6
16 Fixed Condensers.	21/-
Tuning Gang with trimmers.	10/6
6 Mullard Transistors and diode.	42/6
Constructor's Booklet.	2/-

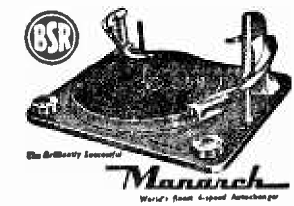
Circuit and Details S.A.E.

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

B.B.C. Pocket 2 Transistor. M.W. and L.W. Radio Kit, 22/6. Miniature earpiece, 7/6. Batt. 2/3.

MONARCH RECORD PLAYER

Kit with ready built amplifier, speaker and cabinet. carr. and ins. 5/- **£12.10.0**



Garrard deluxe auto-player kit

£12.19.6 Carr. and ins. 5/- details S.A.E.

GARRARD QUALITY AUTO-CHANGER, 4-speed, with plug-in xtal head. Ready built 2-valve amplifier, Loudspeaker and contemporary styled Portable Player Case.

All items guaranteed to fit together perfectly, can be assembled in thirty minutes, full instructions supplied.

4 Speed Autochanger, B.S.R., U.A.14	£7.10.0
B.S.R., U.A.12 Stereo/Mono ..	£8.5.0
Garrard Model Autoslim	£7.19.6
4 Speed Single Players, EMI	£6.5.0
Garrard TA Mk.II, GC8 Head ..	£8.0.0
Garrard Model 4SP GC2	£6.17.6
Garrard 4HF Transcription.. ..	£17.19.6
Amplifier player cabinets (except 4 H.F.)	70/-
2-valve amplifier and 6½in. speaker ..	95/-
3-valve amplifier and 6½in. speaker ..	105/-

Wired and tested ready for use with above.
Replacement sapphire styli available from 6/-.
Replacement Xtals from 21/-; Stereo from 35/-.

SINGLE PLAYER KITS

£8.15.0 post 4/6. **Ready Built**
With 2-stage, 3 watts output amplifier. High flux 5in. speaker. Handsome portable case 13 x 10½ x 7½in. Collaro 4-speed junior motor. LP/Std xtal pick-up for 7, 10, and 12in. records.
FEW ONLY KITS AS ABOVE but with 3-speed B.S.R. Motor **£7.15.0** complete. (Post 4/6)

CABY MULTIMETER

Model M.I. **54/-**
2 k ohm per volt, D.C. or A.C. 6 v., 30 v., 120 v., 600 v., 1200 v. D.C. 30 mA, 300 mA. Ohms 0-100k.

ARDENTE Transistor Transformers
Type D3035, 7.3 CT; Push-Pull to 3 ohms for OC72, etc., 1 x ⅞ x ⅞in. 9/6
Type D3034, 1.75 : 1CT. Push-Pull Driver for OC72, etc., 1 x ⅞ x ⅞in. 9/6
Type D3058, 11.5 : 1 Output to 3 ohms for OC72, etc., 1 x ⅞ x ⅞in. 9/6
Type D167, 18.2 : 1 Output to 3 ohms for OC72, etc., ⅞ x ⅞ x ⅞in. 12/-
Type D239, 4.5 : 1 Driver Transformer, 10/-
Type D240, 8.5 : 1 Driver Transformer, 10/-

ARDENTE VOLUME CONTROLS
Type VC1545, 5K with switch, dia. 0.9in., 5/3.
Type VC1760, 5K with switch, dia. 0.7in., 10/6
Deaf aid ear piece xtal or magnetic, 7/6.

COMPONENT SHOP SPECIALISTS

Post 1/-, unless otherwise stated. C.O.D. 2/-.

337 WHITEHORSE ROAD WEST CROYDON
Telephone: THO 1665
(Export welcome. Send remittance and extra postage).

Practical Wireless

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Contents

The Final Link

THIS month we present the last in the current series of free, double-sided blueprints and we feel we have produced two designs of widespread appeal and interest.

The first is the Luxembourg Tuner which, as the name implies, has been specifically designed for peak performance on 208m. This tuner incorporates some novel features which will appeal to those wanting to try something a little different, it is easy to build and is strongly recommended to readers who want better-than-normal reception of Radio Luxembourg.

The reverse side of our blueprint also breaks new ground, so far as PRACTICAL WIRELESS is concerned. It is probably true to say that of the thousands of enthusiasts who take the trouble to build good quality receivers and amplifiers, a good many make do with inferior or indifferent arrangements for the final link in the audio chain.

One can, of course, mount a loudspeaker on a solid baffle or insert it into a box of any convenient shape and size and get reasonable (even superb) results. Much depends, naturally, on the predominating acoustics and the degree of audio discernment in the ears of individual listeners.

But this hit-or-miss approach, while capable of relatively good results can lead to disappointment and, in any case, it seems odd to carefully design the electronics and take the acoustics for granted.

In general, then, a well-designed enclosure is the only real housing for a loudspeaker and the only acceptable device for disseminating high quality audio.

We feel it is appropriate, therefore, to conclude this series of blueprints with *The Berkeley*—a specially designed bass reflex speaker enclosure which is suitable for use with P.W. or other high quality amplifiers and which will give added pleasure to your record, radio or tape listening.

Our Query Service

ONCE again we must remind our readers of the rules of our Free Query Service. The following points should be carefully noted:

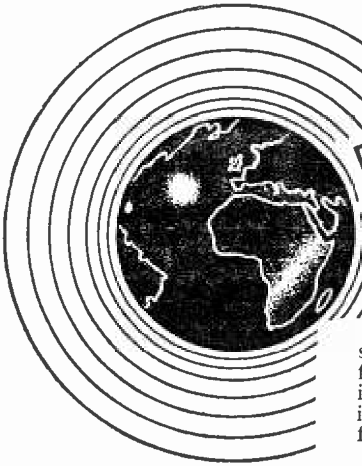
(i) We cannot undertake to answer technical queries over the telephone

(ii) All queries must be accompanied by the query coupon from the current issue

(iii) If a postal reply is required a stamped and addressed envelope must be enclosed with the query.

We must also point out that we cannot design circuits to readers' specific requirements. Nevertheless we shall continue to help readers as far as possible but it should be remembered that all information necessary for answering the query should be sent to us.

Our next issue dated January will be published on December 7th.



ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of August, 1962, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales. Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	Total
London	636,984
Home Counties	592,973
Midland	429,035
North Eastern	453,898
North Western	390,268
South Western	348,923
Wales and Border Counties	198,280
Total England and Wales	3,050,361
Scotland	325,608
Northern Ireland	109,518
Grand Total	3,485,487

High-power Radars for Ministry of Aviation

CONTRACTS by the Ministry of Aviation have been awarded to Marconi's for the provision and setting to work of three dual installations of 500kW, 50cm radars, type S264A. These will be sited at St. Annes (near Blackpool), Ash (near Sandwich, Kent) and Ventnor (Isle of Wight). These are the first radars ordered by the Ministry for the United Kingdom Airways System.

The dual installations consist of the complete transmitting/receiving and ancillary equipment in duplicate, feeding a common aerial head on a main/standby basis. One particular feature of the S264A equipment is that. being crystal controlled. it can be switched into operation from "cold" if necessary.

Marconi 50cm radars are currently in operation at many British airports. Service establishments and airfields.

Conference on the Design and Use of Microwave Valves

THE Electronics Division of the Institution of Electrical Engineers is organising a three-day national conference in September, 1963, on the design and use of microwave valves. This has been timed to fall between international conferences on microwave valves which are held every other year and the programme will be complementary to these conferences.

The forthcoming conference will review present techniques and developments and will cover fundamental valve design, present performance and the use of valves in systems, including matching system characteristics with achievable valve performance.

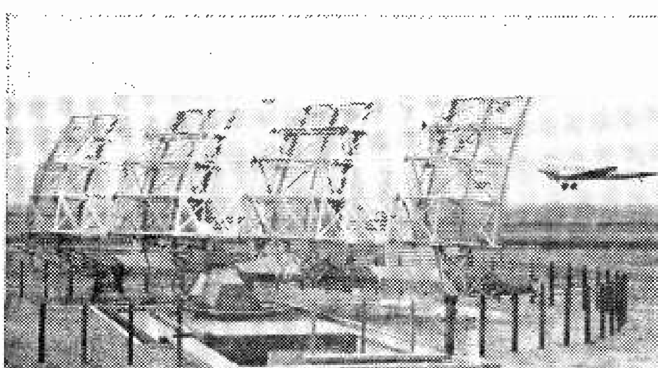
It will be of particular interest to engineers in this country who do not attend international conferences and among the subjects to be covered will be "signal amplification and physical measurement", "communications and industrial applications" and "radar".

New Headquarters Installation for R.A.F. Radio Amateurs

THE new headquarters of the R.A.F. Amateur Radio Society was opened recently at No. 1 Radio School, R.A.F. Locking.

The society, which was formed in 1939. includes a large number of professional wireless operators. both R.A.F. and ex-Service, in its membership and most local R.A.F. amateur radio clubs are affiliated.

A grant of £660 from the Nuffield Trust for the Forces has paid for the most expensive of the new installation which is used in conjunction with a beam aerial which can be directed to any part of the globe. A standby transmitter also capable of top band communication has also



A Marconi 50cm surveillance radar of the type recently ordered by the Ministry of Aviation.

been installed in addition to a 2m VHF set which is restricted to United Kingdom use.

Recording Noise

LONDON is the first city in the world to be systematically surveyed for noise. The information obtained will be useful for town planning generally and especially to architects when making provision for insulation in new buildings of all kinds in the central area.

Information about noise levels at selected sites throughout central London is also being recorded for use in particular town planning problems such as assessing the noise effects of elevated motorways and heliports and for siting hospitals and other buildings where noise may be detrimental to their use.

The London Noise Survey is being conducted by the Building Research Station of the Department of Scientific and Industrial Research and the London County Council. Two vans with equipment which includes TR52/2 professional tape recorders supplied by EMI Electronics Ltd. are sampling noise levels for 100 seconds once an hour over a 24-hour period at each of 540 points, distributed at 500yd. intervals on a rectangular grid over central London. The work has continued since early in 1961 and more than 350 sites have already been monitored.

Noises are automatically recorded on magnetic tape every hour on the unattended tape recorders. At the end of the 24-hour period the tape is taken to the Building Research Station at Garston for analysis.

A member of the LCC staff is seen here switching on an EMI tape recorder in a van at an Albert Embankment site, in London, to record sample noise levels (see "Recording Noise").

New T.I.M. Recording

THE Post Office is to make new recordings for T.I.M., the Speaking Clock.

The present Speaking Clock, which has been in use since 1936, is to be replaced early next year. While the timekeeping of the present clock is as good as it was a quarter of a century ago some parts of it are obsolete.

The new clock, which has been designed and built by Post Office engineers at the Research Station at Dollis Hill, London, will, with the new techniques employed, be cheaper to instal, maintain and operate. The quality of the recordings will also be improved.

The Great German Radio Exhibition

OVER 100 firms to date have registered for the Great German Radio Exhibition to be held at the Berlin Funkturm from August 30 to September 8, 1963. Final figures can only be estimated at the commencement of next year. However, it can already be determined that once again all halls and pavilions of the exhibition area occupied in 1961 will also be in demand for the Radio Exhibition of 1963.

The studios of the broadcasting stations will again participate with demonstrations in the exhibition. Formerly only one hall of the exhibition grounds was required to house the Channel 1 television programme; however, in the coming year a further hall is planned for the Channel 2 programme.

Temporary VHF Station on the Isle of Skye

THE BBC's plans for extending and improving reception of its sound and television broadcasting services in the West of Scotland and the outlying islands provide for several new transmitting stations, including a combined television and VHF sound station for the Isle of Skye. As the completion of this station and of the necessary radio links to connect it with the BBC's Scottish programme networks will take some time a temporary low-power VHF sound relay station has been brought into service at Penifiler to serve the town of Portree. This station is now transmitting the Scottish Home Service on 93·9Mc/s with horizontal polarisation, which means that VHF receiving aerials should be mounted horizontally.

It is hoped to complete the television station for the Isle of Skye and the permanent VHF sound station, which will radiate the Light and Third programmes as well as the Scottish Home Service, early in 1964.

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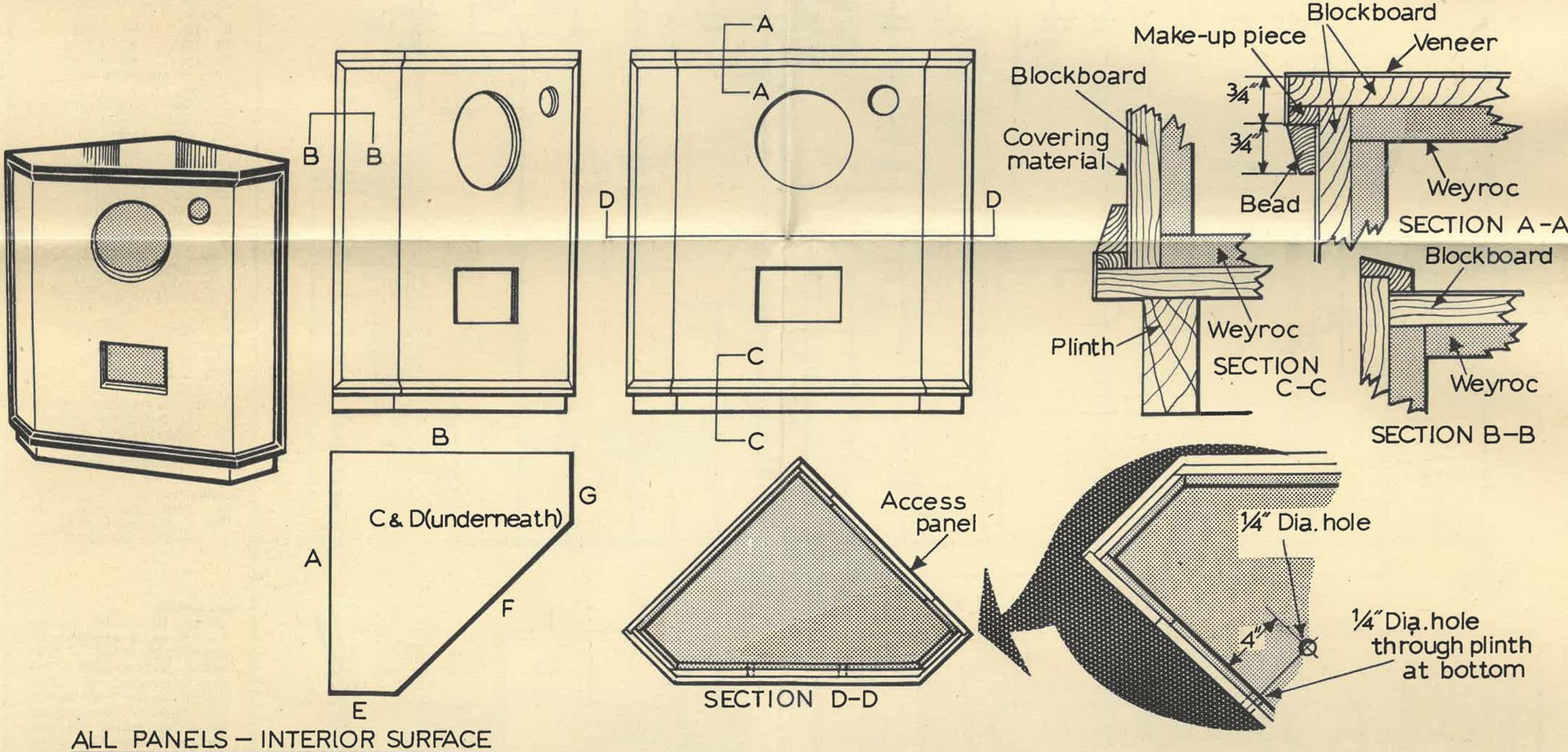

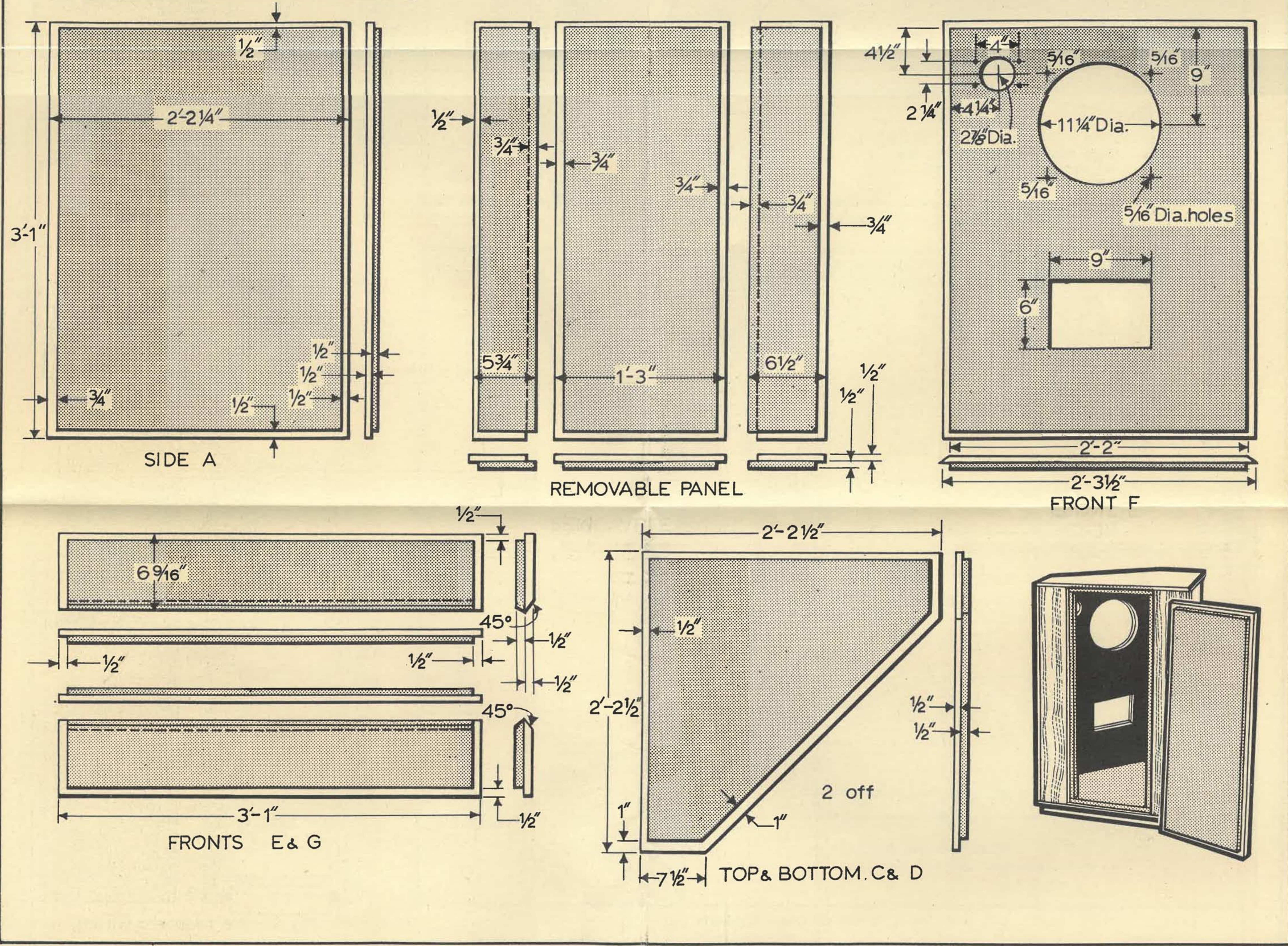

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3'-1"
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FRONT F
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9"
11¼" Dia.
5/16" Dia. holes
6"
2'-2"
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6 9/16"
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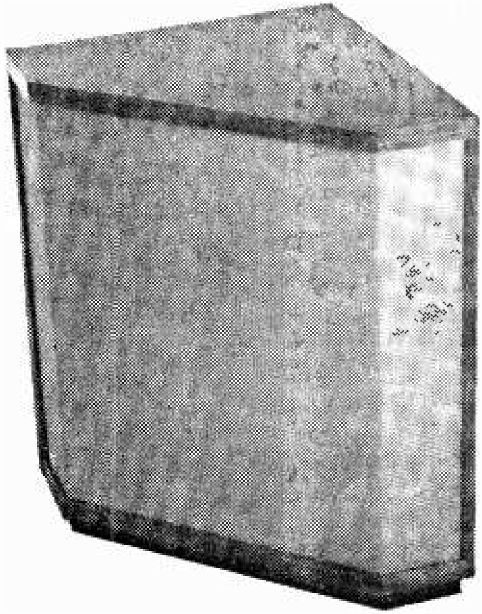


A HIGH QUALITY BASS REFLEX CABINET

By R. Edwards

The *BERKELEY* Loudspeaker Enclosure

THE bass reflex type of loudspeaker enclosure has been popular for many years on account of its ability to provide good smooth output down to the lowest frequencies normally reproducible by the particular moving coil unit employed.

In this type of enclosure, which is also known as a "vented enclosure" or "phase inverter cabinet", use is made of the sound waves radiated from the rear of the loudspeaker cone, and these waves are allowed to emerge at the front of the cabinet through an aperture or "vent" close to the loudspeaker opening. The interior of the cabinet forms a resonant cavity and its resonant frequency is determined by the volume of air enclosed and the area of the vent. It is usual practice for the enclosure to be tuned to the bass resonant frequency of the loudspeaker unit.

Due to the loading provided by the enclosure, the characteristic peak in the loudspeaker speech coil impedance curve at bass resonance resolves into a pair of peaks, one just above the enclosure resonant frequency, and the other just below. The amplitude of both peaks is considerably less than that of the original single bass resonant peak, consequently there is less mismatch with the amplifier at this frequency than there would be normally, and so more power is delivered to the speech coil.

Furthermore, in the region of resonance, greater air loading is offered to the cone resulting in improved efficiency of the system together with a reduction of amplitude distortion.

For sound frequencies equal to and just above the enclosure resonant frequency sound waves radiated from the rear of the cone undergo a 180° phase change and appear at the vent in phase with the radiation from the front of the cone, thus the effective sound output is the combined output of these two sources.

When the sound frequency is lowered below resonance the phase of the air in the vent changes abruptly and tends to oppose that from the front of the cone. The response of the system therefore falls off just below the enclosure resonant frequency.

On the other hand, as the frequency is raised above the enclosure resonance the enclosed volume of air becomes increasingly capacitive and the sound waves from the rear of the cone tend to become absorbed within the cavity, until eventually at high frequencies there is practically no output from the vent and the system performs as an infinite baffle.

Design Features

Optimum size for a bass reflex cabinet is governed by the particular loudspeaker to be used, the cone diameter and fundamental resonance being key factors in this respect. The Berkeley bass reflex enclosure is intended for use with a high power amplifier, such as the *Strand Amplifier* (described in the October issue of PRACTICAL WIRELESS), and has been designed around a 12in. dia-

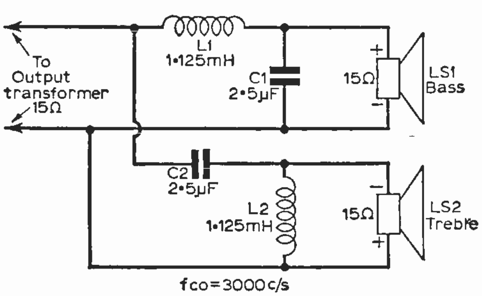


Fig. 1—A half-section, constant-resistance network; parallel connection.

meter moving coil unit having a power handling capacity of 15W. Provision is also made for the fitting of a H.F. tweeter unit.

The loudspeaker specified is WB Model H.F. 1216. This is a full range unit, covering 20c/s to 16,000c/s and has a fundamental resonance of 37c/s. A second choice would be the WB Model H.F. 1214. This is a less expensive unit and has a frequency coverage from 25c/s to 14,000c/s, while the bass resonance is at 39c/s.

A corner style enclosure has been adopted as this allows full advantage to be taken of the walls as reflecting surfaces and these improve the low frequency sound distribution. A triangular cabinet has good acoustical properties and is, of course, likely to prove the most convenient shape for installation in a room.

The dimensions of the *Berkeley* have been chosen to provide a volume of 9 cu. ft. which is about ideal for the type of loudspeakers specified, and it is tuned to just below 40c/s approximately by a plain vent. A smaller cabinet would result in inferior bass response and would also prove more critical in respect of tuning. The effects of standing waves are less serious in a large enclosure and can usually be dispelled by the use of only a small amount of lagging material.

To ensure rigidity and so prevent resonance effects from any of the surfaces, all panels are 1in. thick and are built up from equal thicknesses of blockboard and chipboard and glued together. All joints must be glued and must be air tight since any air leakage other than through the two apertures in the front panel will impair the proper functioning of the enclosure as a "bass reflex".

The small aperture to the right of the large loudspeaker opening is for an H.F. tweeter unit, but the fitting of such a unit is quite optional. It is certainly advisable to try the enclosure with only the 12in. unit in position before incurring further expenditure which, subsequently, may not perhaps appear fully justified.

The question of what is correct tonal balance is very much a matter for the individual to decide, and it is possible that due to the efficient bass response there may seem to be some deficiency in the upper register. In such a case the incorporation of a tweeter unit should restore the balance satisfactorily by adding the necessary brilliance to the reproduction.

It is considered prudent to carry out this drilling and to fit the four screws during construction, or at any rate before the covering material is fitted to the front panel, since it would obviously be an inconvenient task to perform once the cabinet has been completely finished.

If a tweeter is not to be installed initially this hole must be covered by means of a piece of ½in. plywood about 6in. x 4in. This should be drilled to accept the four captive screws, and then clamped tightly against the inside surface of the cabinet with nuts.

The drilling details given on panel F (Blueprint) are for the W.B. Model T.12 Tweeter Unit. Details of this unit and suitable crossover networks are given later.

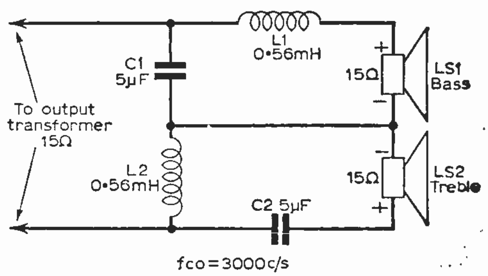


Fig. 2—A half-section, constant-resistance network; series connection.

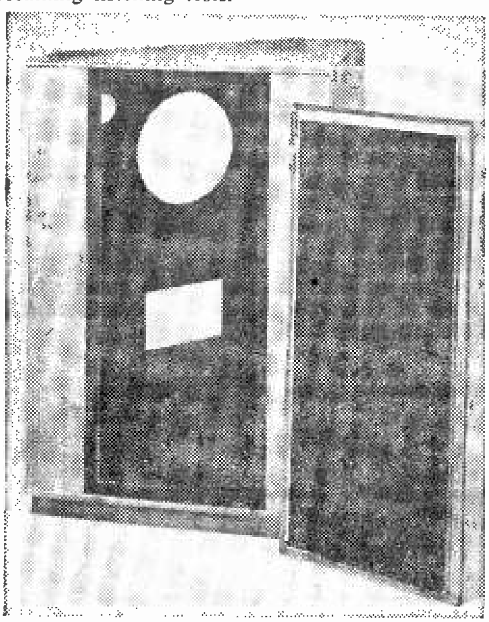
Lagging the Enclosure

Sound waves from the rear of the loudspeaker cone at middle and upper frequencies produce standing waves in the cavity, and these are sometimes of sufficient severity to disturb the smooth response characteristic of the system and so to "colour" the output. It may be necessary to lag the interior with absorbent material in order to eliminate such effects. The amount of lagging needed can be determined only by experiment.

Critical listening tests should be made with the completed (but unlined) enclosure installed in its final location. Such tests must be of fairly lengthy duration and should involve the reproduction of both music and speech, to permit a proper assessment of the loudspeaker enclosure performance to be made. Dry, unnatural colouration or tendency to boominess or over accentuation of the lower frequencies may be cured by partially lining the inside of the enclosure with felt or fibreglass blanket material ½in. to 1in. thick.

It is suggested that only two interior surfaces be lined, preferably the underside of the top panel and one of the side panels. An alternative and possibly better scheme is to suspend a curtain of the same material from the top panel so that it hangs diagonally across the interior of the cabinet.

The application of absorbent material must be carried out discriminately, since excessive damping of the enclosure can have an adverse effect on the high frequency response. The inspection panel must always be replaced firmly in position before resuming listening tests.



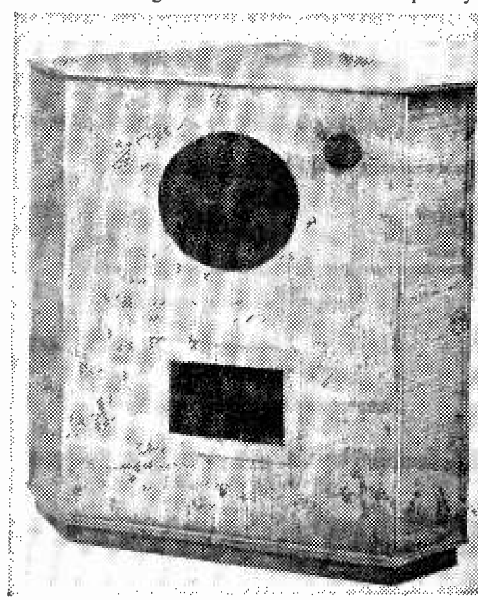
H.F. Tweeter Unit

The H.F. tweeter W.B. Model T.12 is a horn-loaded pressure driven moving coil unit. It has a frequency range of 3,000 to 17,000c/s, an impedance of 15Ω, and a power handling capacity of 15W.

When using the tweeter, a crossover or dividing network is also required in order to restrict the range of frequencies applied to each loudspeaker. The type of crossover network recommended is that known as a half-section constant-resistance network. This particular kind of crossover can take two forms, either "parallel connection" as shown in Fig. 1 or "series connection", Fig. 2. Actually there is very little to choose between these two forms. The series connection is often considered as being somewhat better in performance than the parallel arrangement; however, the latter circuit uses smaller value capacitors and so is cheaper and perhaps easier to make up.

A crossover frequency of 3,000c/s should be used, and the appropriate component values are given in the circuit diagrams. That part of the circuit feeding the L.F. unit forms a low-pass filter, and has an attenuation rate of 12dB per octave above the crossover frequency. The H.F. unit is fed from a high-pass filter, this having a similar rate of attenuation below the crossover frequency.

The input impedance of the crossover network is 15Ω and the matching to the amplifier is not altered at all by the addition of the tweeter, although a slight loss in the total output does occur in the region of the crossover frequency.



Above—The enclosure ready for the finishing touches. Left—A view inside the cabinet.

A suitable crossover unit (type CX300—series connection) can be obtained from the manufacturers of the loudspeakers. For those who may wish to construct their own networks details are given below.

Paper, or metallised plastic film type capacitors should be used and these should have a voltage rating of 50-100V. Electrolytic capacitors are not suitable. It will be necessary to use capacitors in parallel in order to obtain the values specified.

The coils can be easily constructed by winding 16s.w.g. enamelled wire on a cardboard or plastic former 1in. diameter and 1¼in. long. Cheeks about 3½in. diameter should be fitted at either end of the former. The 1·125mH coil requires 210 turns (about 16 layers) and the 0·56mH coil 145 turns (11 layers). All turns must be close wound and the layers even. Terminate the completed coil by passing each end of the wire through a pair of holes in the end cheeks then bringing out about 1in. of wire to provide the connection.

For convenience the filter components should be assembled on a small wooden panel and, after the wiring has been completed, this can be mounted on the floor of the cabinet. In order to avoid inductive coupling it is advisable to arrange the two coils so that there axes are at right angles to one another, and to space them about 3in. apart.

Since there is a 180° phase shift through the crossover network, the two loudspeakers must be connected in what would be normally anti-phase. Correct phasing can be established by reversing the two leads to one loudspeaker speech coil and observing which arrangement gives best sound output.

The Finish

Regarding the finish to the cabinet, use has been made of applied "Vinyl" or "Fablon" to the sides, and wood or plastic veneer to top and edges. This eliminates the necessity of polishing to great extent. The front is covering with approved loudspeaker fabric. It is suggested that the cabinet should be first made up "dry", then dismantled and finally glued up after any needful adjustments have been made.

Start by cutting all the blockboard panels to drawings on the Blueprint,, plane all edges square,

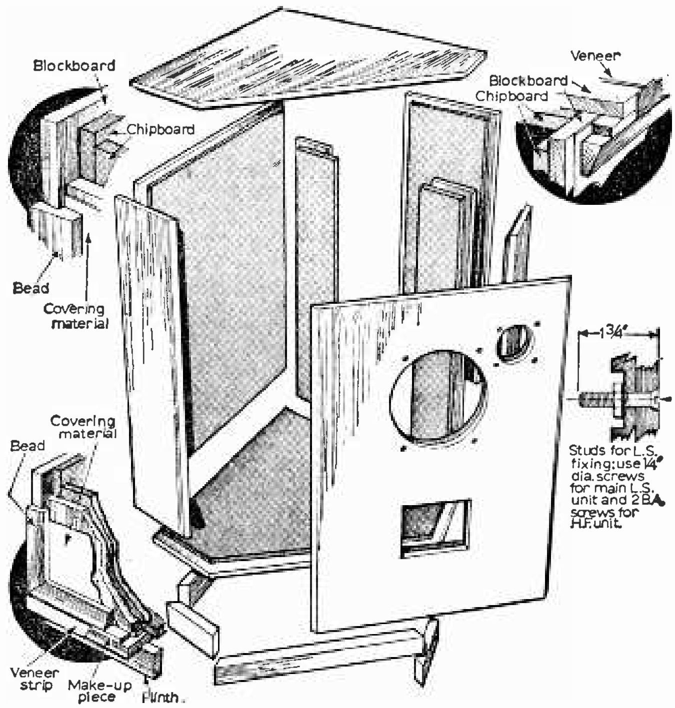


Fig. 3 (right)—An exploded view of the Berkeley.

The units undermentioned in this article are manufactured by Whiteley Electrical Radio Company Ltd., Mansfield, Notts., England.

Building the Cabinet

The construction of this corner cabinet is quite simple, complicated joints being eliminated entirely. A little care and attention to planing edges square and true will be well repaid when finally assembling.

Two types of board are used, both of half an inch thickness. The inside is of chipboard (Weyroc) and the outer of blockboard or laminated blockboard. This latter material is a superior board and is well worth the extra expense. Owing to the acoustic requirements regarding cubic volume of the inside of the cabinet it will be found that a 9ft. x 4ft. board of each material will be needed. Stock sized boards are usually 8ft. x 4ft., so enquiries should be made concerning the availability of material of suitable size.

and where required at 45°. Gauge a line to mark the boundary of the chipboard all around the inside face of each panel. Care must be taken to get these marks the right distance in from the edges. They vary, due to the overlapping.

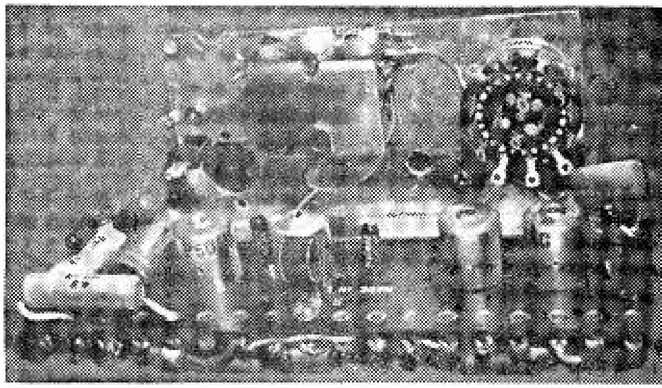
Now cut the chipboard panels to fit the markings and screw each pair together with ¾in. x No. 8 csk. screws at 1ft. centres. Having proceeded this far all sections should correspond to details on the Blueprint. Assemble the cabinet by screwing through the edges of the blockboard with 1in. x No. 6 csk. screws, making any adjustments to the meeting rabbeted edges, etc.

Glueing

Having checked for squareness and tight joints, dismantle and glue and screw the respective panel sections together. These should be placed one on top of each other on a flat surface and weighted on top. Leave for a day to thoroughly set. This

(Continued on page 749)

transistor tuner-receiver



By A. Sydenham

DESPITE many criticisms of transistorised receivers one must acknowledge the high sensitivity of the superhet form—the distinction immediately being drawn between it and the TRF configuration.

A simple TRF receiver employing regeneration might perform well enough in an area of high signal strength but when used under less favourable conditions cause disappointment due to the low reserve of gain and limited tuned circuits.

The superhet holds pride of place for reliability, stability, sensitivity and general performance and no TRF receiver can be made to equal it without becoming equally expensive. Beginners in particular are well advised to realise this for it is easy to become misled.

Criticism of the audio quality emitted by transistor receivers and which is often considered inadequate for home use, is, however, frequently justified and is the price that must be paid for using small loudspeakers in small cabinets driven by Class B output stages from depreciating batteries.

But listening to a radio programme on a mains powered A.M. receiver—where good quality audio is available—is, in many areas, rather unsatisfactory, due to the characteristic whistle caused by neighbouring TV receivers and/or the sundry bangs and pops due to radiated interference.

It is an interesting project therefore to construct a transistor superhet tuner—which can be kept physically small—and feed its output to a good quality amplifier or, alternatively, to the "Gram" sockets of a suitable receiver. In this way much of the radiated interference is avoided for no external aerial is needed and at the same time an adequate reserve of audio gain becomes available.

Details of a suitable tuner are presented here of a model recently constructed. When fed to the input sockets of a 10W mains powered audio amplifier similar to the "5-10" the unit gave an excellent performance equalling that of the 2-valve superhet tuner it displaced, the quality obtained being considered superior to that of the model using

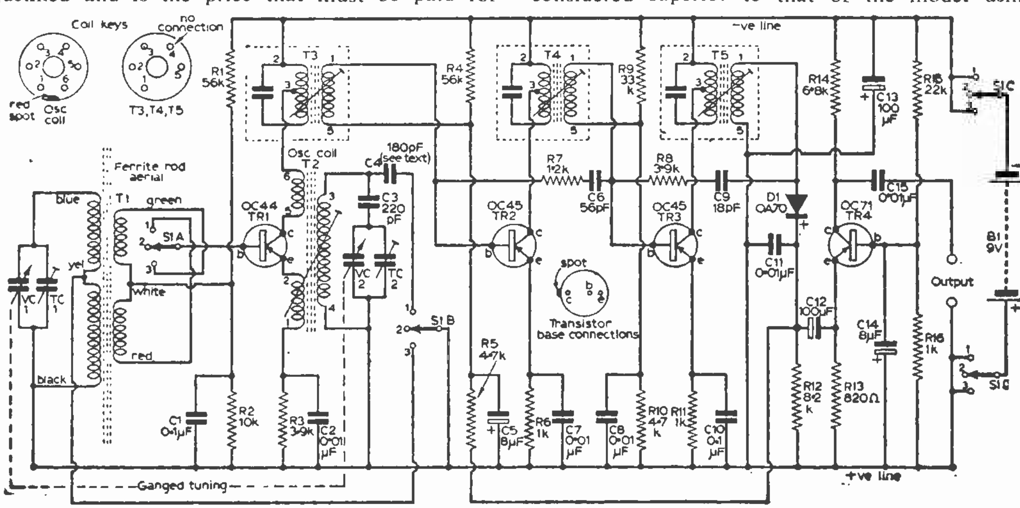


Fig. 1—Circuit diagram of the transistor tuner-receiver.

valves—which also had to have an aerial connected.

The unit has also been tested in connection with the "Gram" sockets of a standard broadcast receiver and it was further proved that the unit could be used as a complete headphone, or personal, receiver if so desired.

The Circuit

This is on conventional lines, reliability being the aim—see Fig. 1. No claims to originality are made; the circuitry is familiar and easily recognised. Practical problems arise, however, in converting a circuit diagram to a working model and a good layout is not always easily obtained. Here the difficulty is resolved.

Both the medium and long wavebands are covered, the switching being arranged so as to minimise the chance of the unit being left switched on accidentally. A standard 3-way, 4-pole rotary switch is employed: S1A and S1B selecting the waveband coverage, and the other two sections performing on/off duties and ensuring that the battery is completely disconnected at position "2". The central switch position is "off"; it is thus impossible to change from one band to the other without going through the "off" position.

TR1 (OC44) functions as the frequency changer with TR2 and TR3 (OC45) as intermediate frequency amplifiers. Following the demodulator diode, D1, is an additional transistor, TR4 (OC71) which is used to drive the subsequent amplifier. The average emitter current of TR4 is 400μA and the whole tuner consumes less than 4mA, thus making battery replacement only a minor problem.

If higher gain is required TR4 may be operated under common emitter conditions but the output impedance will be lowered to approximately 5kΩ. The necessary rearrangement of the stage is shown in Fig. 2 and if the unit is to be used as a headphone receiver this is the best method to adopt.

A minor economy can then also be effected by omitting the 5·6kΩ collector resistor together with the output capacitor connecting instead high impedance phones between the negative rail and TR4 collector. It might also become necessary to experiment slightly with the 100kΩ base feed resistor to obtain optimum results.

If the circuit of Fig. 2 is used to feed a valve amplifier it might also become necessary to vary the value of the upper base feed resistor, 100kΩ, since the collector resistor is, as specified, a little on the high side. Only a small emitter current is required — about 0·5mA.

Referring again to Fig. 1 it will be noted that all transistors are stabilised by the familiar potentiometer, emitter resistor form, and this together with the neutralising circuitry makes the unit completely stable.

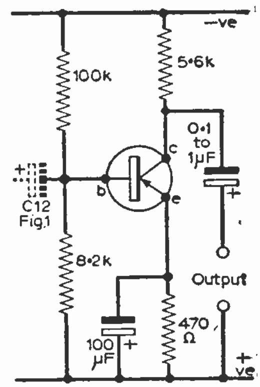


Fig. 2—Alternative circuit for Tr4 in common-emitter mode.

Mechanical Details

The whole tuner is constructed on a standard 18-way tag-board, the tags having been given imaginary numbers to assist correct identification. Although the appropriate figures can be marked on to the board it will usually be sufficient to locate No. 1 and No. 19 and count from there as required.

The oscillator coil and the three I.F. transformers are mounted so that their pins project through the tag side of the board and although a separate hole may be drilled for each pin it is generally simpler to use a single hole—just large enough for all the pins to pass through together—for each component. This also makes the cores available from either end of the can. An array of small holes lies along the centre of the tag-board when it is purchased and it is only necessary to enlarge as required.

Panel

The wavechange switch, twin gang tuning capacitor and outlet insulator are mounted on a metal panel affixed to the tag-board in such a way that the tags come at the bottom as may be seen in the appropriate illustration. For dimensions of this panel see Fig. 4. Because it is made of metal the $\frac{1}{8}$in. fixing holes must be arranged to coincide with tags 3 and 11 on the board as shown and

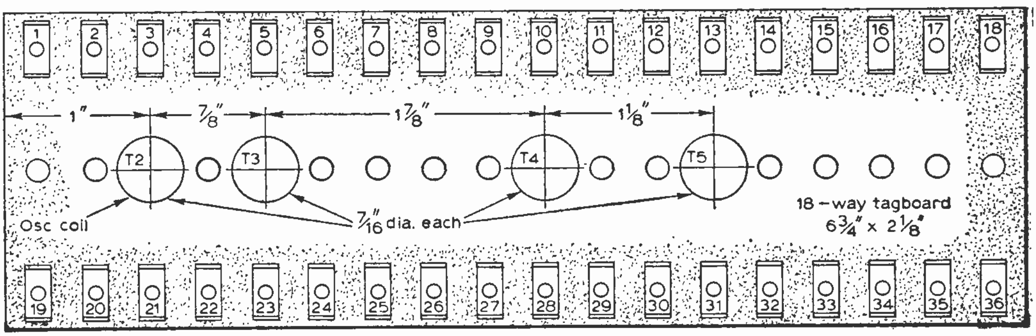


Fig. 3—Drilling details for the component tag board.

prior to bolting it in position $\frac{1}{16}$in. thick paxolin washers must be placed over the bolts before they are passed through the board to prevent the underside of the "L" from short circuiting all the tag eyelets it hides.

A very simple bracket will also be needed to hold the ferrite aerial (which should be left to one side at this stage) and this will be bolted to tag 28 on the same side as the panel.

Constructional Notes

Actual wiring construction should commence by fixing the canned transformers by letting their fixing lugs pass through small holes drilled for them. Care should be taken to check that the orientation agrees with that shown. These lugs are then pressed out flat and soldered as shown in Fig. 5.

Before proceeding further it is advisable to plug each core hole on the transformers with sleeving or something similar to prevent any blobs of solder accidentally spilling in and locking the cores which are rather fragile.

The remainder of the tag side of the board can then be wired as indicated in Fig. 5. The transistors should be left until last. Check that electrolytic capacitor C12 and diode D1 are connected in the correct sense as shown. The taut layout allows for all component lead-out wires to be snipped off short.

When wiring of the tag side of the board is complete (except for the transistors) the other side can be tackled and all wiring is illustrated in Fig. 6 where the panel is shown pressed out flat for

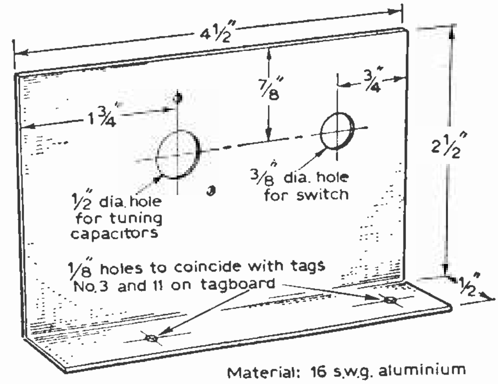


Fig. 4—Drilling details of wavechange switch panel.

clarity. C13 actually lies flush with the top of the board and must be slender enough not to foul the aerial (see illustration).

When the capacitors are in position—observe polarities—the transistor wires may be sleeved and passed through existing small holes on the board. Provided thin sleeving has been used the set of leads on each transistor will fit firmly yet not overtightly. The transistor shells thus remain on the top side of the board whilst their wires pass below and are soldered using the normal techniques.

The aerial may now be fixed in position as shown and wired allowing the connecting leads

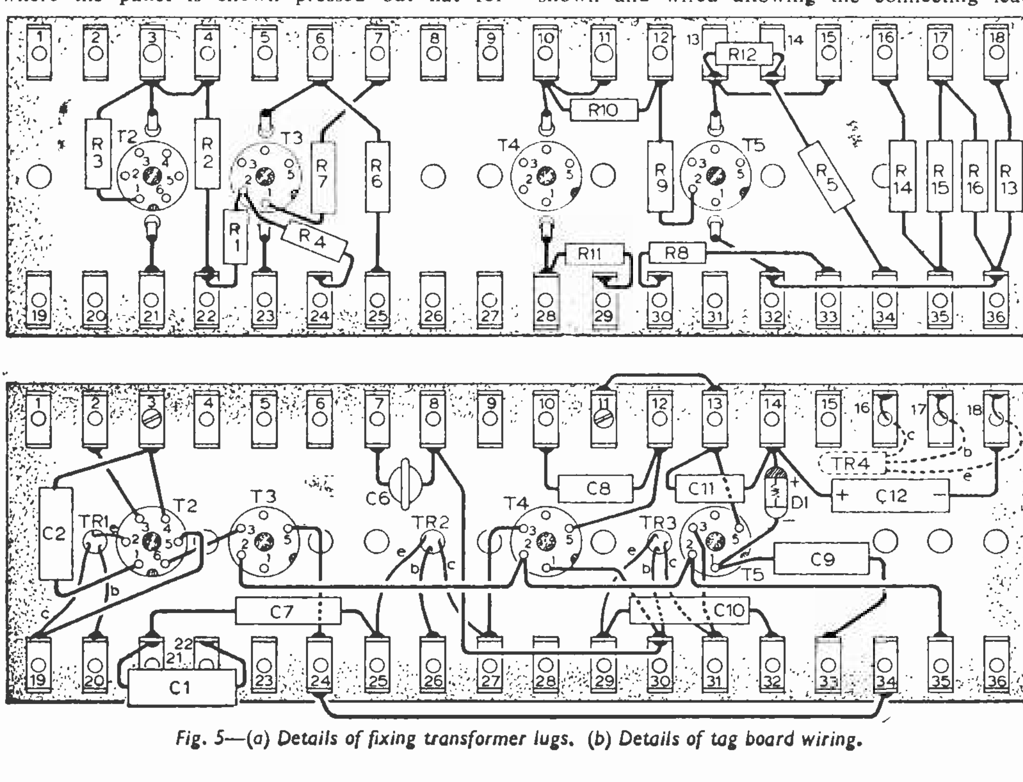


Fig. 5—(a) Details of fixing transformer lugs. (b) Details of tag board wiring.

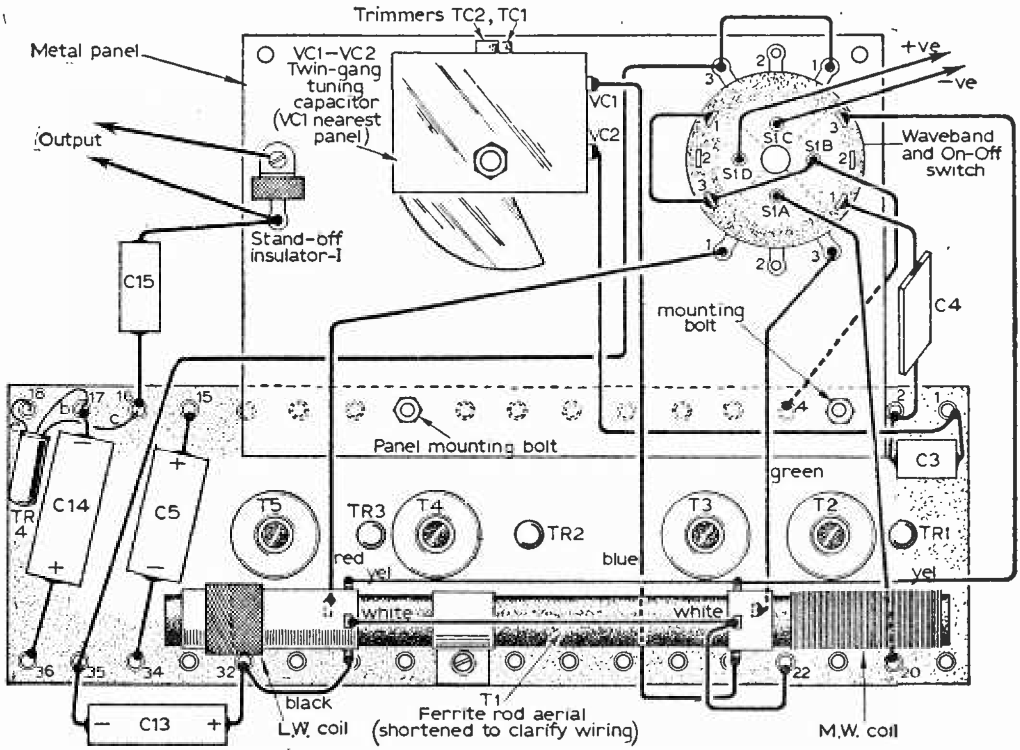


Fig. 6—Wiring diagram for top side of the tag board.

(which should be of stranded conductor) just loose enough to permit free movement of the two coils along the ferrite rod.

The Switch

Each of the four central "pole" tags control three of the "way" tags disposed around the rim of the switch and visual check is initially required to identify them correctly. It is then advisable to press flat alternate "way" sections as shown to obviate incorrect connections being made. If the battery flex leads are left until all the wiring has been checked over chances of damaging the transistors will be minimised.

When satisfied that all is well a black flexible lead approximately 6in. long is soldered to S1C rotor and a similar, but red, lead connected to S1D rotor. The switch should then be set to position "2", the central position, and the appropriate stud connectors affixed to the free ends of the flexible leads which may then be twisted together neatly.

Setting Up

A length of suitable cable (coaxial will do if not very long) should be connected to the stand-off insulator "1" (Fig. 6) the far ends being equipped suitably and connected to an amplifier or to the "Gram" sockets of a suitable broadcast receiver which may then be switched on and adjusted to normal three-quarter volume level setting. Alternatively high impedance phones may be used.

Control knobs are then fitted to the tuner spindles and a battery connected. The rotary switch should then be turned to position "3" (M.W.) and the vanes of the ganged tuning capacitor fully enmeshed.

The modulated output from a signal generator tuned to 470 kc/s is now applied to the fixed vanes connection of VC1. The cores of T5, T4 and T3 should be adjusted for maximum output in that order, the generator output being kept at a low level.

Next the generator is set to 600kc/s and the oscillator coil core adjusted to receive the signal which is then further strengthened by sliding the medium-wave coil along the ferrite rod until best results are obtained.

If the ganged capacitor is now rotated towards the other end of its travel the note should reappear again at 1,200kc/s, before the vanes are fully disengaged, to which frequency the generator may now be set before the aerial and oscillator trimmers TC1 and TC2 respectively, are carefully adjusted for best results.

Should the aerial trimmer need to be set fully home and the signal is still not considered correctly peaked then unscrew the oscillator trimmer slightly until the signal disappears. Now adjust VC1 to slightly fuller capacity when the signal will reappear; it should now be necessary to unscrew the aerial trimmer TC1 slightly to obtain a peaking point. The adjustments should then be made all over again, viz at 600kc/s and 1,200kc/s, until no improvement is possible.

The Long-wave Band

The rotary switch is next turned to position "1" and an attempt made at receiving the Light programme on 200kc/s with the vanes of VC1 approximately one-half enmeshed. It is quite possible that C4 will need padding a little and is located in such a way as to be easily accessible for this purpose. Values as small as 30pF connected in parallel make a good deal of difference. Experiment by temporarily connecting various small value capacitors (50-150pF) across VC2 in turn at the same time swinging the vanes over full travel.

Another quick method is to connect a 90pF trimmer across VC2 temporarily. Immediately the signal is received the long-wave coil should be slid gently along the ferrite rod to obtain best results in association with VC1, and an assessment made of the precise value of capacitance needed for C4.

COMPONENT LIST

Resistors

(All 10%, $\frac{1}{4}$W carbon unless otherwise stated):

R1	56k	R9	33k
R2	10k	R10	4·7k
R3	3·9k	R11	1k
R4	56k	R12	8·2k
R5	4·7k	R13	820
R6	1k	R14	6·8k
R7	1·2k 5%	R15	22k
R8	3·9k 5%	R16	1k

Capacitors:

C1	0·1μF paper
C2	0·01μF ceramic or paper
C3	220pF mica
C4	180pF mica (see text)
C5	8μF electrolytic 6V
C6	56pF 1% mica
C7	0·01μF ceramic or paper
C8	0·01μF ceramic or paper
C9	18pF 1% mica
C10	0·1μF paper
C11	0·01μF ceramic or paper
C12	100μF electrolytic 12V
C13	100μF electrolytic 12V
C14	8μF electrolytic 6V
C15	0·01μF ceramic or paper
VC1, VC2	208 x 176pF twin gang, with trimmers, Jackson 'OO'.
TC1, TC2	see VC1, VC2

Inductors:

T1	Ferrite aerial, MW/LW	RA2W	Weymouth Range
T2	Oscillator coil	P50/1	
T3	IF coils 470 kc/s	P50/2	
T4	IF coils 470 kc/s	P50/2	
T5	IF coils 470 kc/s	P50/3	

Transistors:

Mullard	TR1 — OC44 White	RFG3 Pack or Set	
	TR2 — OC45 Orange		
	TR3 — OC45 Blue		
	TR4 — OC71		
	D1 — OA70		

Switch:

S1 Miniature rotary, single wafer, 4-pole, 3-way.

Battery:

B1 PP4, or as suitable, plus stud connectors.

Miscellaneous:

Tagboard: 18-way 6¾ x 2⅛in. (Radiospares). Panel material (aluminium), two knobs, hardboard, quadrant beading, stand-off insulator, wire, solder, etc., etc.

Warning

The unit must not be used under any circumstances in connection with a receiver or amplifier of the A.C./D.C. class nor with a so called A.C. receiver that derives its H.T. from the mains direct. It may be used with a transistorised amplifier, however, if required.

Comparable results are not likely to be obtained if alternative components, or transistors of another make, are utilised; the use of any sub-standard items is almost certain to ensure disappointment.

Cabinet

Dimensions of a suitable easily made cabinet constructed are shown in Fig. 7. It is made from hardboard held together with internally glued reinforcement strips, little weight being involved.

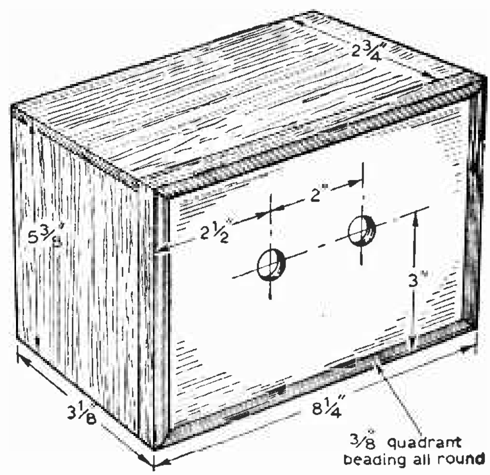


Fig. 7—Dimensions of suggested cabinet.

To avoid defacing the cabinet front the tuner can be locked by creating a sub-panel of hardboard through which four 4B.A. bolts may be passed and countersunk to coincide with holes in the metal tuner panel. This sub-panel can then be glued—with the bolts projecting—to the inside of the cabinet. When dry the tuner is placed in position and the four 4B.A. nuts applied and screwed home.

The actual cabinet front is cut ¼in. smaller than the dimensions given in Fig. 7, a frame of ⅜in. quadrant beading being allowed to overlap by ⅛in. all round to form a rebate for the sides, top, etc.

As mentioned earlier the unit can be used as a completely self-contained headphone receiver if required and in this case a phone outlet can be provided on the panel. ■

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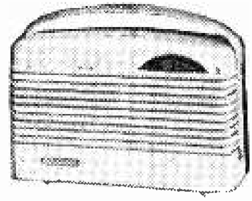

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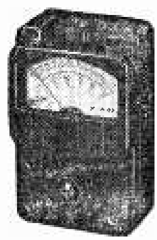

Sensitivity: 1,000 ohms per volt A.C. and D.C. Ranges: (A.C. and D.C.) 0-15-50-250-500-1,000 v. D.C. current 0-100-500 m/a, 0-1 m/a (used at 0-10 v. range). Resistance: 1-2,000 ohms (centre 24 ohms), 100-200,000 ohms (centre 2.4k.) Size: 5in. × 3in. × 2½in.

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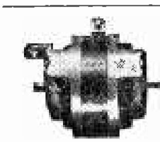

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Central Control Amplifier

By E. McLoughlin

A MASTER CONTROL UNIT FOR AN AUDIO INSTALLATION

(Continued from page 630 of the November issue)

IT must be stressed that voltages from the power supplies *must* be up to the full specified values. *Slight* deficiencies were found to produce immediate *huge* reductions in power in the prototype in both amplifiers, leading to inferior performance. If the H.T. is down by only 50V below specified value there is almost 40% power loss from the EL84. If the L.T. D.C. supply is down by only 1V at the points shown in the circuits, below the specified values, the available output power can be halved!

But do not use voltages in excess of those specified. Excesses (or deficiencies) can be cured to some extent by changing tappings on the mains transformer primaries (but watch the valve heater voltage!) or by altering the values of reservoir or smoothing capacitators or by using suitable droppers. The power unit *must* be trimmed to the specified voltages, using appropriate measures with the particular power supply components obtained. Rule-of-thumb methods using any old lash-up are here particularly likely to lead to such poor results as to make the whole unit rather disappointingly weak.

Inputs

The amplifier input is switched at will to "Laboratory" or "Line" by means of S4 (Fig. 2). In the position "Line" any signal on the line from apparatus at other stations can be fed into the amplifier and listened to in the laboratory/den on the internal loudspeaker in this unit provided that S3 is set to position "receive". In this position S3 breaks the mains feed to the L.T. power-pack on contacts A, breaks the base-drive on contacts B (so that the transistors are not damaged by receiving base-drive without emitter-collector voltage), breaks the connection of T5 to the line on contacts C (so that other signals are not fully or partially shorted, as explained above) and, finally, on contacts D, switches the incoming signals on the line through to R2 and R7 and hence to the amplifier input.

In the position "Laboratory" on S4 the amplifier input is connected to both of two sources within the laboratory simultaneously via the decoupling and impedance-transforming resistance network R3, 4, 5, 6. This network assures that both sources transfer virtually all of their signal voltage into the amplifier, but negligible amounts mutually to each other. Which of the sources actually feeds the amplifier then must be decided simply by switching the desired source on and the others off at their own switches. If both are on they will mix in the amplifier without otherwise interfering with each other.

Now, with S4 in the position "Laboratory", S3 may be at either position. The position "Receive" is then used as a "dummy" if the signal is merely to be listened to on the internal loudspeaker, confining it to the laboratory (e.g., when using the oscilloscope/signal tracer source for internal work in the laboratory—see below—and possibly somebody else in the flat or house has other apparatus feeding other signals on to the rest of the line). Such other signals on the line will, of course, not then be actually received until S4 is also switched to "Line".

If the signals from a laboratory source (S4 at position "Laboratory") are now required to be sent on to the whole line—with suppression of any other signals possibly present—then S3 is switched over to "Send". This switches mains on for the L.T. power-pack and connects the transistor amplifier input and output appropriately, also shorting R2 to prevent any possibility of instability.

The combination S3 at "Send" and S4 at "Line" serves no useful purpose, neither does any damage nor causes instability.

The internal loudspeaker can be switched on or off independently. If S3 is at "Send" and all loudspeakers in the system are of the same type the volume on the internal loudspeaker is a true replica of the volume on any other loudspeaker on the line when the series-resistors used as individual local volume controls on the line loudspeakers are cut out of circuit (maximum volume).

Mains/Distribution/Power Supplies

The unit described in this article contains all its own power supplies, which are built in tier fashion on to one side panel of the cabinet body, details of which will be given later.

Fig. 1 (last month) gives details of the mains distribution wiring. This follows the principles and general scheme sketched in the initial general article. Great care is essential in carrying out this wiring, which should be checked, checked, and rechecked before switching on mains power. Wrong connections or insecure, untidy connections could lead to highly dangerous conditions or to destruction of valuable equipment.

Note carefully the arrangements for the mains isolation transformer. This item is generally too heavy and bulky and has too great a stray magnetic field for inclusion within the cabinet of the present unit. It is thus attached via a four-core mains power cable of suitable length and quality and mounted separately at a suitable safe position in a proper and secure manner. The reasons for requiring this transformer were fully discussed in the introductory article. Take great care not to confuse the connections; errors could lead to dangerous conditions.

Cabinet Construction

This unit is to be considered as a fixed item of electrical installation. As such it will most easily satisfy supply company regulations regarding mains wiring.

If the laboratory/workshop wall is of good dry wood at the location where the unit is to be installed, as was the case for the prototype, then the wall itself may be used directly as the rear of the cabinet, of which sides are formed by wooden slats screwed on internally with angle-iron. The distribution tags and cables can then be screwed directly on to the rear wall, according to the drawings, using appropriate regulation fixtures available in the electrical trade. It is advisable to consult an electrician at the start of the whole project if one is not conversant with wiring regulations oneself.

The amplifier unit itself is seen, in the drawings and illustrations, to be built in more or less conventional form of construction on to a panel of wood forming the "lid" of the vertical cabinet. A good 12-pin connector, rated at 500V/2A on all pins relative to all other pins, is used to connect the "lid-unit" to the body. This enables rapid removal and replacement for servicing, especially if the take-off hinge and latch type of fixture is adopted.

The Amplifier

This is an excellent "hi-fi" circuit of low expense but fine performance specifically developed by Mullard engineers some time ago for their valves EF86 and EL84. Ample publication has occurred elsewhere, so that only brief comment on essentials is necessary here.

It is essential to mount the two valveholders such that R13 can be mounted as direct and short between the relevant pins as possible (Fig. 3). Furthermore, R10 must have its wire cut off very short and soldered direct on to pin 6 at the valveholder of V1. Failure to observe these conditions will cause treble-performance loss.

High gain is obtained in V1 by means of the unusually large anode load R10. D.C. coupling via the anti-parasitic R13 to V2 grid avoids one source of low-frequency phase-shift and losses. The positive D.C. thereby fed to V2 grid requires the unusually high cathode bias resistor R16 to compensate. The value of R16 is critical and a close-tolerance resistor is specified. The cathode voltage resulting for V2 is then sufficient for the screen of V1, which is thus D.C.-coupled to V1 cathode. This also represents D.C.-negative-feedback, which stabilises the operating points of the valves—otherwise such a circuit would drift. C11 is also critical. Too low a capacity causes bass loss, whereas too high a capacity causes pure low-frequency phase-shift oscillation at some or all settings of VR4, especially if inadvertently too high a ratio is used for T6. This oscillation may be of such a pure note and frequency that it can be mistaken for severe mains hum.

If the amplifier howls uncontrollably at full power, whatever settings of the controls are undertaken, reverse connections to the output transformer primary, T6, m and 1.

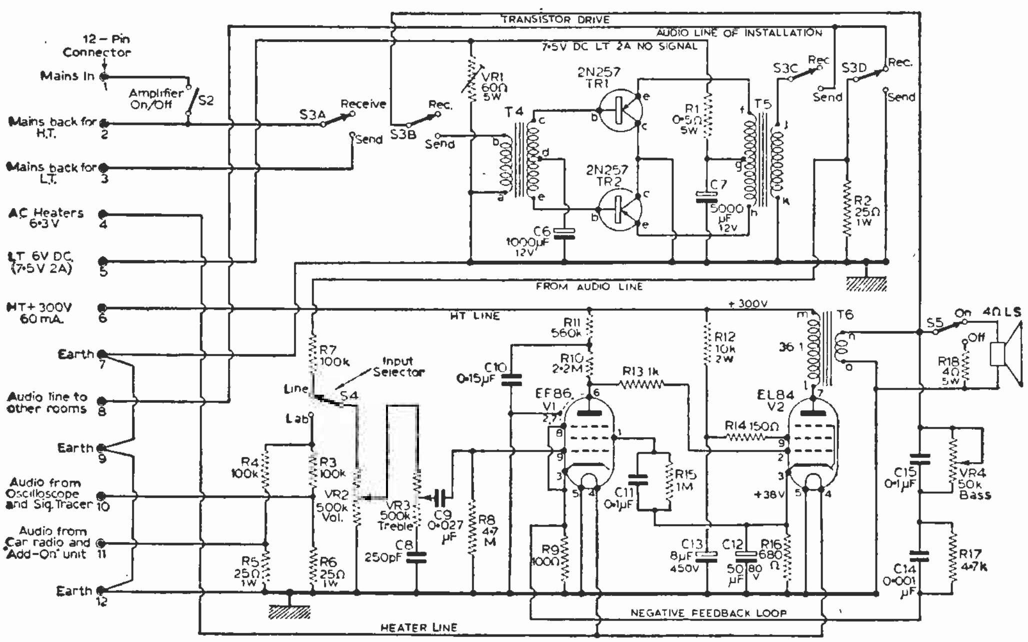


Fig. 2—The circuit of the "lid-unit".

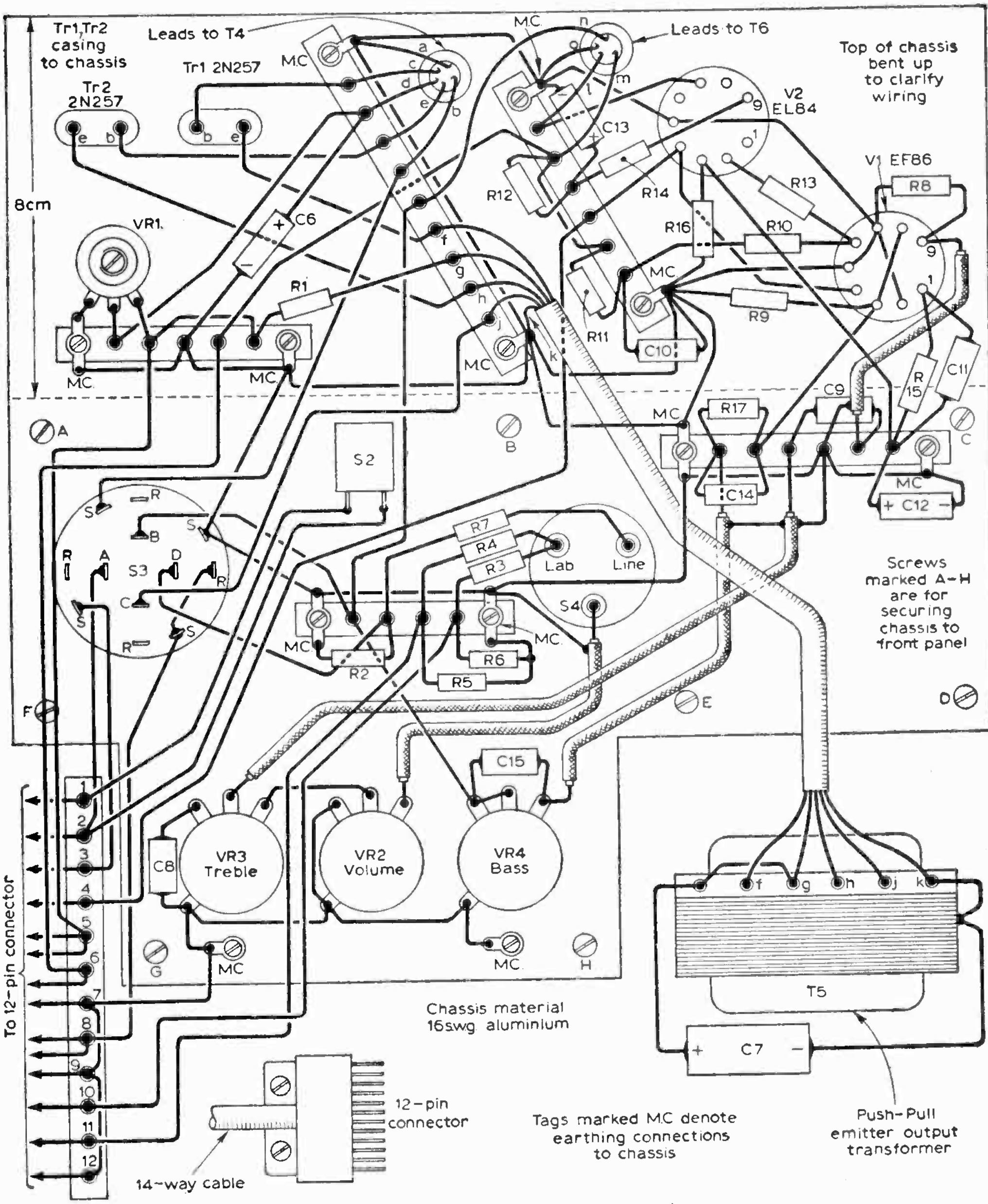


Fig. 3—The "lid-unit" and sub-chassis wiring diagram.

Use low-capacity coaxial cable for the leads shown screened in the wiring diagram, Fig. 3, to avoid treble loss. Note that all screens are bonded together and joined to chassis at only one point. This is highly important as hum is easily introduced if screens are earthed at several points because they can then carry random chassis-currents, which may be partially A.C. Use suitable sleeving or other measures to prevent the screening from touching the chassis at unwanted points. Note in this connection also the separate earth-busbar for VR2, 3, 4, connected locally to chassis at the earth-feed from the 12-pin plug and *not* connected to the earth-ring-busbar under the amplifier components.

(To be continued)

DX on MEDIUM WAVES

As a change from shortwaves try for some M.W. broadcast band DX this season. This article tells you how.

By S. A. Money

MANY radio enthusiasts will probably be surprised to learn that DX signals from many parts of the world can be heard on the medium wave broadcast band. In the early 1930's many trans-Atlantic stations were heard on quite simple domestic radio sets. With modern receivers it is possible to achieve quite remarkable results despite the great rise in the level of interference since those early days.

During the past two years the writer and a number of other enthusiasts have listened for DX stations on this band. Many stations from both North and South America were regularly heard and others from the more remote parts of Africa and Asia were also logged.

Optimum conditions for long distance reception on the medium waves occur in the winter during the hours of darkness. In the evening reception of DX signals is extremely difficult due to the high level of interference from the very strong European signals. After midnight most of the European stations have closed down and reception of the weaker DX stations is possible. During the summer a high level of "static" noise makes DX reception more difficult and less frequent.

Sunspot activity is well known to have a considerable influence on short wave reception conditions. In the case of medium waves it has been found that the best conditions for DX reception occur during the years around the sunspot minimum. With the next sunspot minimum due to occur around 1963/64 conditions should be excellent for the next few years.

Receivers and Aerials

Under favourable conditions it should be possible to receive the regularly heard North American stations on any good domestic receiver provided that a good aerial system is used.

For serious DX listening a communications type receiver with its high sensitivity and selectvity is almost essential. Ex-Service receivers such as the R1155 have proved to be very good in this respect.

Long wire aerials seem to be the best for DX reception. They should be mounted as high as possible and should be outdoors for the best results. Indoor aerials mounted in the loft or around the picture rail in an upstairs room can give very good results. In order to erect the necessary length of wire it may be necessary to bend it into the form of a square or rectangle. A wire 60 to 90ft long is suitable.

Ferrite rod aerials are not usually sensitive enough for DX reception. A good earth connection is usually needed with domestic radios and will often improve reception on a communications receiver.

North America

Reception from North America usually occurs for a period of from three to five days at a time every two or three weeks, in mid-winter however, the opening may last for as long as two weeks with the exception of one or two poor nights. On many nights there may be heavy "static" interference from thunderstorms over the Atlantic.

Generally reception is possible from just after midnight until about 5 a.m. when interference from local European stations starts to build up, although some trans-Atlantic stations can be heard as late as 7 a.m.

Programmes from North America are for local entertainment and are in English with the exception of a few French-speaking Canadian stations. Identification of stations is fairly easy since they all give their call-signs regularly, often during the breaks for "commercials".

East Coast, U.S.A.

Those stations located in the eastern coastal region of the U.S.A. are the most frequently heard here in Britain. There are no less than 16 radio stations in New York City and of these 14 were known to have been logged in England last winter.

Four of the stations in New York carry the major network programmes. The A.B.C. network broadcasts over station WABC on a frequency of 770kc/s. Further along the band on 880kc/s is WCBS, owned by the Columbia Broadcasting System. Both of these stations are regularly heard at excellent strength. Station WNBC (660kc/s), operated by the N.B.C. network, is not too well received here since its aerial is directed away from Europe. The fourth regularly heard station is WOR on 710kc/s run by R.K.O. and carrying the Mutual Network programme.

Of the independent stations in New York, WHN (1050kc/s), WINS (1010kc/s) and WNEW (1130kc/s) can be heard with very good signals on almost every opening to the U.S.A. These three stations broadcast popular music and newscasts. The New York equivalent to our Third Programme is provided by WQXR on 1560kc/s.

Two stations frequently heard from New York State are WPTR (1540kc/s) at Albany and WKBW (1520kc/s) at Buffalo. Other stations which give good signals from the New England states are WTIC (1080kc/s) Hartford, Conn., WEGP (1390kc/s) Presque Is., Maine, WTOP (1500ks/s) Washington D.C. and WMEX (1510kc/s) at Boston, Mass.

Hill-billy music and songs heard on 1530kc/s will probably be from station WCKY at Cincinnati, Ohio. Pennsylvania state can usually be heard over stations WCAU (1210kc/s) at Philadelphia and KDKA (1020kc/s) at Pittsburgh.

Those stations in the southern states which are near the coast, such as WAVY (1250kc/s) at Portsmouth, Virginia, WBT (1110kc/s) Charlotte, N. Carolina, WCSC (1390kc/s) at Charlston, S. Carolina and WLCY (1380kc/s) at St. Petersburg, Florida, are frequently heard at good strength.

The state of Georgia can sometimes be heard over station WSB in Atlanta which operates on 750kc/s. Some of the other stations which have been logged from time to time are, WHAS at Louisville, Kentucky, on 840kc/s, WSM (650kc/s) at Nashville, Tennessee, and WALA (1410kc/s) at Mobile, Alabama. Most of these stations can be difficult to receive but, with improving band conditions, they should be more frequently logged this coming winter.

Central U.S.A.

What might be considered to be the cream of the DX signals from the United States are those stations located in the central and mid-western states. The nearest and thus most frequently noted stations are WOWO (1190kc/s) Fort Wayne, Ind., WJR (760kc/s) Detroit, Michigan and WCFL (1000kc/s) Chicago, Illinois.

Station KXEL at Waterloo, Iowa can sometimes be heard through WPTR's signal on 1540kc/s and usually peaks up at around 0300 GMT. Another station which is often noted at about this time is KMOX at St. Louis, Missouri operating on 1120kc/s.

Texan stations which have been frequently logged here in Britain are WFAA at Dallas and WOAI at San Antonio using frequencies of 820kc/s and 1200kc/s respectively. Perhaps the most distant U.S. stations noted recently are WCCO (830kc/s) at Minneapolis, Minnesota and KOMA (1520kc/s) at Oklahoma City, Oklahoma.

Reception of these more distant stations does require quite a bit of patience since they are usually weak signals and are often only audible for five to ten minutes at a time.

Canada

The Canadian Broadcasting Corporation, which runs the main network, is a public body similar to the BBC. Station CBA at Sackville, New Brunswick (1070kc/s) is the most consistent of the CBC stations heard in this country. CBA can usually be heard at excellent strength just before midnight whenever the band is open to North America and is useful as an indicator of band conditions.

Other CBC stations which are often heard in England are CBC Montreal (940kc/s), CBI Sydney, N.S. (1140kc/s) and CBE Windsor, Ontario, on 1550kc/s.

Of the independent stations CJON (930kc/s) at St. John's, Newfoundland is usually an excellent signal from midnight and like CBA can be used to indicate the state of the band. Other Canadian stations which usually give good reception are CHNS (960kc/s) Halifax, N.S., CFNB (550kc/s) Fredericton, N.B. and CFCY (630kc/s) Charlottetown, Prince Edward Island.

Generally Canadian signals are not as frequently heard as those from the U.S.A. but reception will normally occur on the same nights as for the U.S.A.

South America

Most of the South American stations broadcast in either Spanish or Portuguese and can usually be heard on any night when the North American stations are not audible. Brazilian stations are the most frequently heard with programmes in the Portuguese language. *Radio Globo* on 1180kc/s, *R. Tupi* on 1280kc/s and *R. Jornal* on 780kc/s are three stations which are usually excellent signals.

Other countries which are frequently logged are Argentina (*Radio Nacional*, 870kc/s), Venezuela (*R. Ondas del Lago* on 1120kc/s) and Uruguay with stations CX6 (650kc/s) and CX14 (810kc/s).

Programmes in English can be heard from *Radio Demarara* (ZFY 760kc/s) in Georgetown British Guiana, which usually gives fair to good reception in the early morning.

Central American stations have been heard from Mexico, Cuba, Jamaica and Trinidad. Generally reception from this area is limited to a short period when the conditions change from the North American area to South America.

For details of these and other South American stations the reader is referred to the *World Radio Handbook* which lists the frequencies, operating times and addresses of nearly every broadcast station in the world.

Asia and Africa

North African stations can usually be heard during the evenings in the winter months and are often stronger signals than the more local European stations.

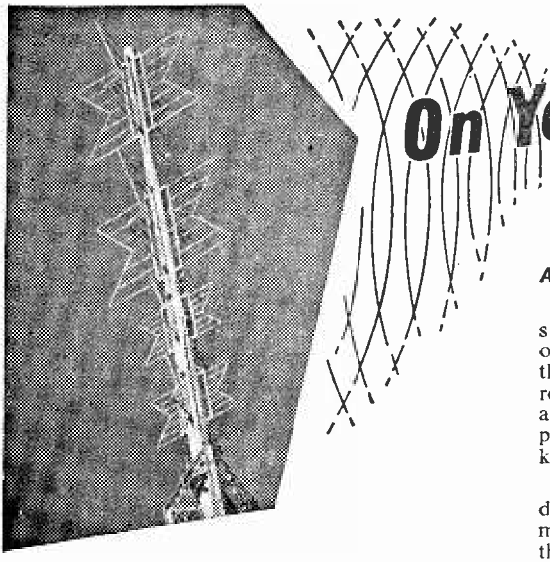
South Africa has been heard in the early mornings on frequencies of 1268kc/s and 1286kc/s. Other countries logged from Africa have been Kenya, Somalia, Nigeria and Senegal.

Middle East countries such as Syria, Iraq and Iran are best heard during the period of the feast of Ramadan when they operate all night with programmes in Arabic.

Indian, Pakistani and Chinese stations have been heard just after midnight with programmes in their native languages.

The *Voice of America* stations at Okinawa and in the Philippines Islands have been heard in the afternoon on 1140kc/s and 1180kc/s. Reports have been received of the reception in Scotland of stations from the Pacific islands such as Guam and Fiji but so far nothing has been heard from that area by listeners in England.

The BBC have however, received reports of reception of their Home Service stations in New Zealand so it would seem that reception of Pacific stations in England should be possible if conditions improve as expected. ■



On Your Wavelength

By THERMION

Electronic Organ Keying

SINCE there are now very many different makes of American electronic organs available in this country, a study of some of the techniques involved is very interesting, and although no all-transistor instruments appear to have arrived there are many interesting features to be seen which have hitherto not been used in any English designs.

One of the sections which has always interested me is that concerned with the keying of the instrument, not only from the electrical, but from the actual mechanical point of view. As most of my readers know, the depression of a key actuates some form of electrical contact; in its simplest form two metallic points being brought into contact, or opened, and in its most complicated form, 10 or more contacts being operated, all being opened or closed, or various combinations of them being operated.

Many organs suffer from defects in this part of the instrument, the contacts being very prone to oxidisation or the action of dust or fluff, and it is interesting to note the various methods of overcoming these defects.

The use of mixed metals for the contacts, or the introduction of some form of wiping or slight scraping action are well known, but the most interesting is, I think, that employed by the Baldwin Company, where a printed circuit resistance element is so arranged that when a key is operated a spring strip is lowered and travels across the resistance element, thereby gradually cutting it out of circuit.

In addition to getting rid of the difficulties of dirt, corrosion, etc., this also gives a gradual attack effect, and results in the note being sounded in a similar manner to a standard pipe instrument, but I still feel that there are better ways of doing the job.

Any Ideas?

Again, I wonder if any of my readers have spent any time on this aspect and have any ideas of their own they would like to air. Incidentally, the use of the scheme mentioned above does not restrict the instrument to sounding a single note, as the resistance elements can be stacked and practically any number can be operated by a single key.

Of course, the difficulties of suggesting or designing a keying system are restricted, as keys may be of two types, balanced or rear-hung, and thus the contact mechanism must be in the front of the instrument or at the rear, and may present difficulties in accommodating the mechanism.

A Salvage Tip

I know that many of my readers are interested in hints and tips such as are accumulated by the keen serviceman, and I am always anxious to pass on anything which is really worth while. I was recently shown a tip which, although originally used to salvage a valve, is also applicable to transistors. Here it is.

In the case of the valve it relates to the older type with a top cap, which often becomes loose and eventually pulls away leaving the merest piece of wire projecting from the glass. In the case of the transistor, a wire may break and leave a similar short stub of wire projecting. In both cases, the application of a soldering iron being impracticable.

The hint is to obtain a two or three inch length of suitable replacement wire, and to tin one end and then carefully to add solder to this end, holding it end downwards so that a fairly large "blob" of solder is formed.

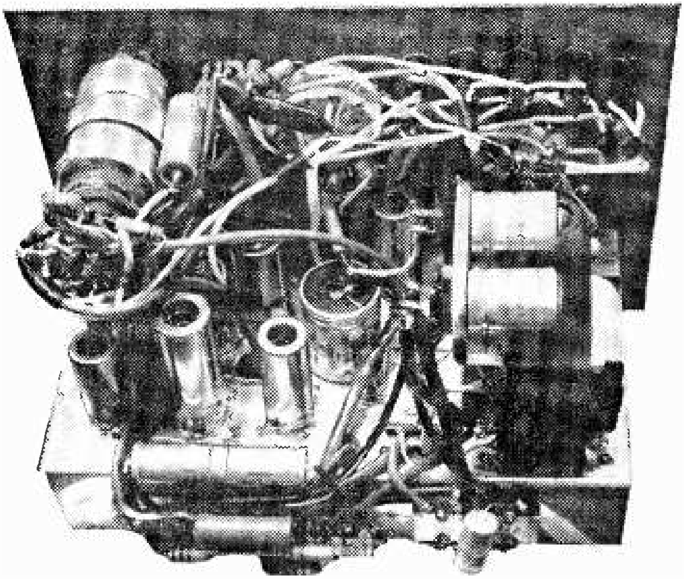
Now hold the piece of wire at its opposite end in a pair of pliers and lower the "blob" end until it nearly touches the protruding end of the wire you are repairing. Place the soldering iron on the wire being held, at a point midway between the pliers and the solder and as soon as the solder is seen to begin to run, lower it so that it touches the protruding end, and then quickly remove the soldering iron.

Provided that you can keep everything steady the two ends will unite, and the soldering iron will carry off the extra heat so that no damage will arise. You need a very steady hand, however, and will soon see how much solder to leave at the "blob".

THE AUDITRON

(This instrument was previously known as the MINISCOPE— see footnote)

By M. L. Michaelis, M.A.



(Continued from page 599 of the November issue)

A MILLER-TRANSITRON oscillator is a special form of multivibrator, in which, loosely speaking, the grid and anode function as one triode and the screen and suppressor as the other triode. The fact that both "triodes" are in one electron-path gives the new characteristics.

The action of one cycle is as follows, starting at the end of a timebase-run. This is reached when the grid voltage has risen to that value for which *anode* current ceases to show further rise, a condition known as pentode bottoming. (This has nothing to do with anode current saturation.)

All increase of total *cathode* current then resulting from further rise of the grid voltage (on the charging-curve of the capacitor selected on S5b, via VR9, etc.) is therefore suddenly diverted to the screen-grid at this point, which therefore suffers a sudden rise in current, i.e. fall in voltage. This sudden fall in voltage, at the end of the linear anode run-down, shown in the second lines of waveforms in Figs. 6 and 7 (last month), and shaped in V7 to blank out the flyback as already mentioned, is coupled to the suppressor grid via the capacitor selected on S5a, and thus reduces anode current.

But this reduction of anode current causes a rise of anode voltage, which is fed as a further sharp rise to the grid, via the capacitors on S5b, causing further cumulative transfer of current from anode to screen. The final result of this very rapid cumulative process is to cut off anode-current completely at the suppressor grid, and send the screen-current to saturation. The anode voltage then returns to H.T. as the capacitor selected on S5b charges via VR10 and grid-current in V6.

Being exponential, however, this process would take, theoretically, infinite time to go to full completion. But in the practical circuit used, it soon reaches the voltage on C18, this being less than H.T., and D5 arrests the process there, the flyback proper being therewith complete.

Conditions then remain stable as long as the negative blocking anode current at the suppressor-grid remains, i.e. as long as the capacitor selected on S5a is still charging through the combination R40, S6, R41. As soon as this charging process has progressed so far that the voltage drop across R40/R41 has become less than the suppressor-grid-base, a tiny bit of anode current can flow. This causes a few volts drop at the anode, immediately, which are of the order of the normal grid-base of the valve and are fed to the grid via the capacitor selected on S5b.

The result is that all cathode-current is immediately almost cut off, giving a sharp rise of screen voltage, fed as a similar sharp rise to the supressor, so that the valve is now fully "open" again for any further anode current that wants to flow.

But the anode current at first remains at the very low value giving a drop across VR10 no larger than the grid-base, because any further increase would cause a drop across VR10, fed to the grid via the capacitors on S5b, large enough to cut the valve off, i.e. such increase could not take place. At any rate, it can only take place *slowly* at a rate such that the charge on the capacitors on S5b,

THE "MINISCOPE"

The General Electric Company Ltd. have drawn our attention to the fact that the name "Miniscope" is a registered G.E.C. trade mark. In view of this we have changed the name of our instrument to "The Auditron". We apologise to G.E.C. for the unwitting infringement of their trade mark.

charging through VR9, R35, etc. can follow, thereby avoiding the checking-feedback at the grid.

This gives the relatively slow and very linear rise of anode current, and consequent fall of anode voltage, used for the timebase-sweep of the spot on the CRT. This terminates when the anode current has increased with slowly rising grid voltages up to the point where further rise of grid voltage has no further effect on *anode* current (bottoming), and we are back where we started.

Current is suddenly diverted to the screen, resulting in total cut-off of anode-current at the suppressor, the flyback takes place, is "caught" by D5, waits until anode current cuts on again at the suppressor, the value is almost cut off at the grid suddenly, a new linear timebase-run takes place, and another cycle is then complete, and so on repeatedly.

Speed-Influencing Elements

It is clear that each cycle consists primarily of two portions, as in any multivibrator, associated with independent CR-time constants, which may be influenced independently.

Thus we have *here* firstly the linear timebase run, determined by the time constant given by VR9 and R35 together with the selected capacitor on S5b, and secondly the anode-current cut-off time, determined by the time constant set by R40/R41/S6 together with the capacitor selected on S5a.

Each time-constant can, in principle, be controlled fully independently from the other, but a *purposeful* ganging is in practice desirable, and has been adopted.

Ganging of Time Controls

S5 constitutes the ganged coarse speed-control for the timebase. This is a three-position switch selecting capacitors of equal values for both time-constants simultaneously, in steps of 10:1 in capacity, and thus 10:1 in speed-ratio. VR9 is the time-base-run fine-speed control.

It has no effect on the anode current cut-off period including the flyback, but as a continuously—variable range of 20:1 for the timebase—run speed, because R35 has one twentieth the resistance of the full track of VR9. This gives sufficient overlap of all ranges for all purposes.

It is *not* the flyback-time, which determines the time from the end of one timebase-run until the circuit commences the next run, but rather the time for which the capacitors on S5a and R40 (and R41, if in circuit) hold the anode blocked at the suppressor. If the latter is shorter than the true flyback, the new run starts before D5 operates, resulting in decreased amplitude of the sawtooth and higher overall frequency. If the suppressor cut-off time is much longer than the true flyback, the anode simply waits resting at C18-potential until the suppressor is ready again (Figs. 6 and 7 respectively).

These two conditions can be selected by means of S6. In the position "short" for S6, only R40 is in circuit for the "recover" time constant, so chosen as to match the flyback proper, i.e. when the flyback has reached the C18/D5 catching-level, the suppressor is then just ready for the next run too.

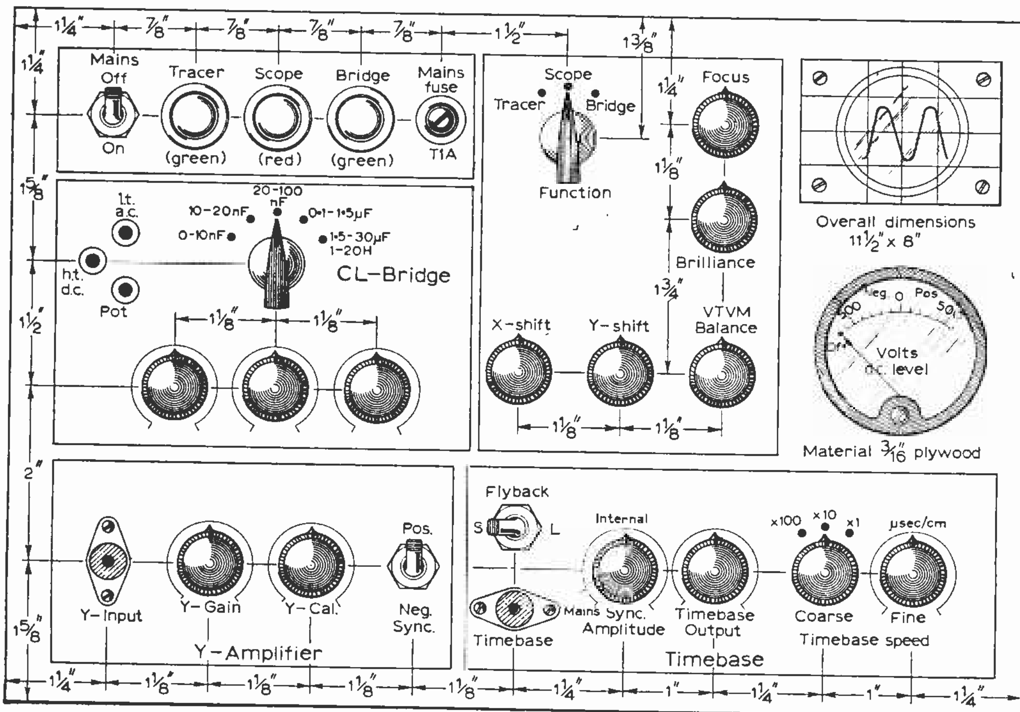


Fig. 8—The layout of the front panel.

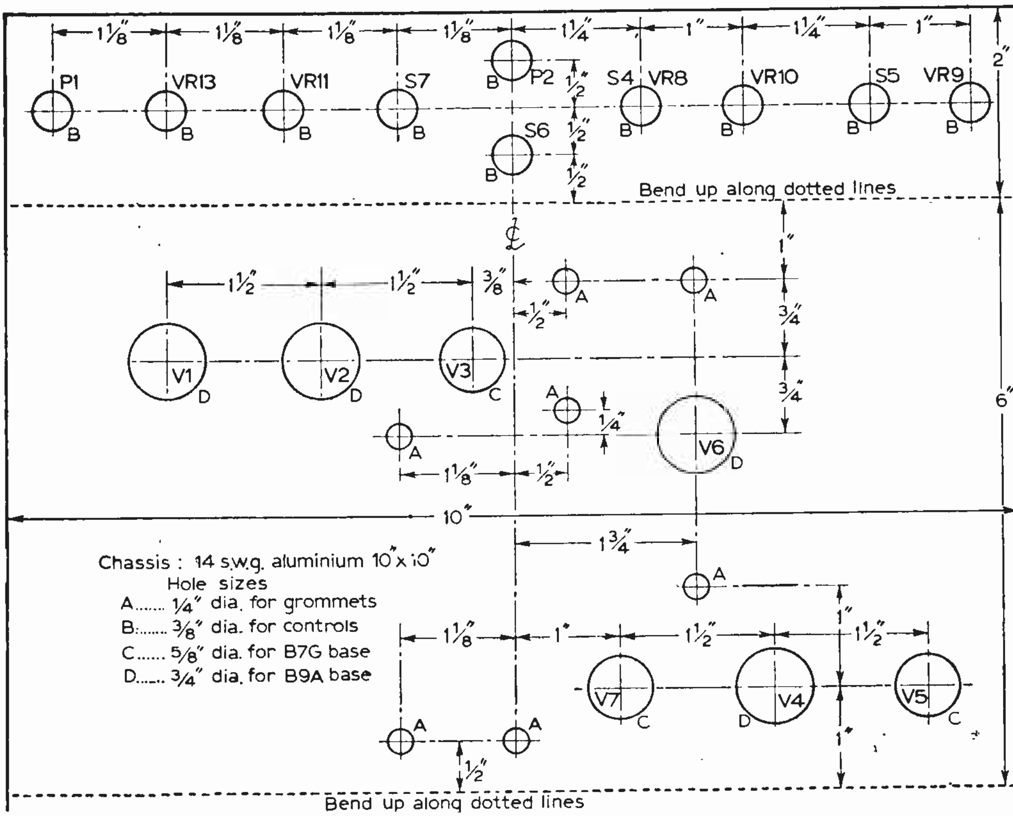


Fig. 9—The main chassis drilling.

In fact, the given value of 47kΩ for R40 is such that the suppressor is ready a little sooner than the flyback would be caught by D5, i.e. D5 never operates in the "short" setting of S6, and the timebase consequently runs at slightly reduced amplitude, with the advantage of the higher overall frequency.

However, constructors can trim R40 as they wish, using a 100kΩ preset potentiometer here, and adjusting it to the point where further reduction of resistance causes the length of the horizontal trace on the CRT *just* to begin to decrease. This is then the true matched condition, where D5 just starts to operate, i.e. flyback is just complete, when the suppressor gives the anode free for the next run, without any waiting time. Fig. 7 shows this condition. A new run starts *immediately* the flyback from the previous one is over, without any delay.

Switching S6 to "long" increases the "recovery" time-constant by a factor of about ten, so that now flyback is over long before the suppressor is ready for the next run, giving considerable waiting times seen in Fig. 6. The advantage of this form of operation is apparent when desiring to display very asymmetric signal waveforms, where the portion of interest is only a fraction of a cycle.

It is seen that, in the "long" setting, increasingly towards the faster end of the range of VR9, the actual timebase run (which is all that is displayed, across the *whole* CRT screen) is only a fraction of each cycle of the timebase oscillation, yet it is the latter which is locked to the signal frequency by means of the synchronisation.

Consequently a stationary display of a magnified version of the interesting portion of the asymmetric signal is possible, selected by suitable setting of polarity on the synchronisation switch on the signal amplifier. This arrangement gives similar effects to "triggering", though of course not successful in all cases of asymmetric signals, whereas true triggering is always successful.

Triggering

An oscilloscope may be operated, basically, in two modes: "sync" in which the timebase is allowed to oscillate, the sync signal merely forcing the frequency into step with the signal frequency, and "trigger" in which the timebase is never allowed to oscillate, but is "kicked" into single-responses.

Trigger operation frees one of the need to have the timebase run slowly enough to have at least one cycle of the signal frequency included in the timebase frequency period, which is the basic condition for "sync".

However, triggering is of far less importance for audio work than for TV or pulse work, and so sync facilities only have been provided in the

Auditron. The sync facilities incorporated, together with the "long/short" function, will satisfy all normal needs of the radio and audio experimenter.

Synchronisation

The Miller-Transitron timebase is synchronised by setting VR9 such that the overall frequency is somewhat lower than the signal frequency, when left to run uncontrolled. The positive pulses, in step with the signal frequency, amplified and shaped by V4 and V5, then jerk the suppressor to cut-on just that little sooner to bring the two frequencies into step.

The gain of V4 and the arrangements for extracting a sync signal from the signal amplifier are such that good strong sync is possible for all signals having at least 10% of the screen-size vertical amplitude, at all frequencies of operation for which the instrument is intended.

VR8 serves as gain-control for the sync signal, to control the strength of the effect with stronger signals, or to remove all sync if desired. VR8 carries a D.P. switch. S4, which switches over to 50c/s mains sync (for frequency-comparisons against the mains) if turned beyond the point of "no sync". The mains-sync signal is obtained from the heater-line via R23 and R24.

Calibrations for the Timebase

A special feature of the Auditron is that the conventional calibration of the timebase controls in terms of basic frequency has been abandoned in favour of a "time per centimeter" of CRT-screen display calibration, which is vastly more useful. A frequency-calibration is relatively useless, as the flyback and wait times are indefinite fractions of a timebase cycle, and thus even if exact number of cycles of the signal appear stationary in the display, the interpretation in terms of signal-frequency is very often rather ambiguous, because it is not clear how much is located on the invisible flyback.

The "time-per-centimeter", in conjunction with a centimeter-grid of lines on the perspex window in front of the CRT, represents a form of calibration removing every ambiguity. S6 has no effect whatsoever on the speed of the timebase run, which is controlled solely by VR9 and S5b. Fully unambiguous calibration of VR9 from 12 to 250micro-seconds per centimeter was thus possible in the prototype, with the three positions of S5 labelled approximately X1, X10, X100. Thus all times from 12 microseconds to 25 milliseconds per centimeter are covered. This enables time measurements to be read off direct, and frequency measurements to be made as follows.

The signal waveform is syncronised stationary, and the length of one cycle read off against the centimeter lines on the perspex window in front of the CRT, which is then multiplied by the time-per-centimeter readings on the timebase-controls. The result is the time for one cycle of the signal waveform, whose reciprocal gives the frequency.

It might be asked why here a once-and-for-all direct calibration of the timebase controls has been adopted, whereas for the signal *voltage* calibration an independent Zener-standard calibrator was used instead of direct calibration of the Y-gain control. The reason is that in the timebase our time-determining elements are largely the capacitors C22 to C27, and valve-ageing or voltage fluctuations can act only on the single stage V6, resulting in no drifts greater than tolerable for normal workshop standards of accuracy.

The Flyback-Blanking Circuit

In order to black-out the flyback of the spot on the CRT-screen we need to cut-off the CRT at its grid during all times except the linear timebase-run used for the display. This requires an accurately-timed squarewave, whose negative portion coincides with the "flyback and wait" portion of the timebase cycle, and whose positive portion coincides with the linear timebase run.

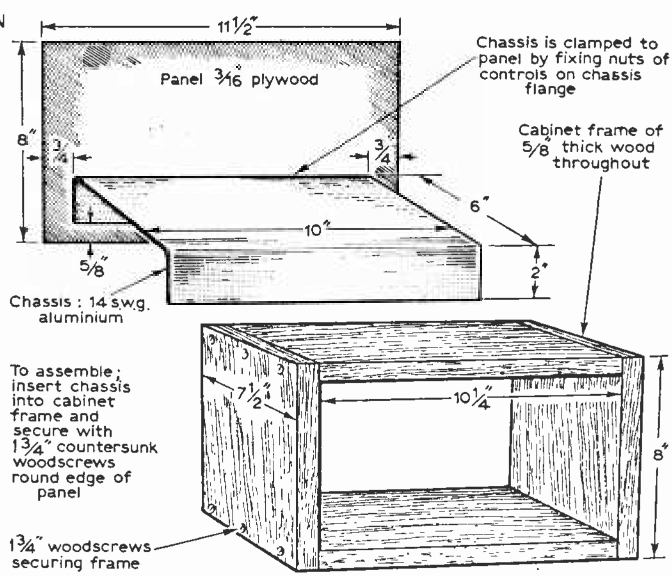


Fig. 10—The cabinet details.

In order to perform the blanking function properly, this must be as good a squarewave as possible. Furthermore, the D.C. level of this squarewave must be such that the positive part of the wave is coincident with the voltage set on the manual brilliance control, and the negative part goes negative to this level by an amount equal to the amplitude of the wave, the latter needing to be sufficient to cut the CRT off, even for the brightest setting of the manual brilliance control. In other words, the amplitude of the squarewave must be just a little more than the grid-base of the CRT, and 30V was thus found to be satisfactory.

The circuitry round V7, with associated diodes

D6, D7, D4, was devised to meet all these requirements to within sufficient limits of accuracy for all normal amateur purposes.

Shaping of the V6-screen Waveform

Figs. 6 and 7 show that the screen-grid waveform of V6 is already of the required form, very roughly, for the flyback-blanking function. Thus the screen goes negative during the flyback and wait time, because anode-current is then cut-off and heavy current diverted to the screen. During the timebase run, the screen is much more positive, because anode-current is flowing, and thus screen current is low or normal.

Yet the original screen waveform is anything but a good squarewave. At the fastest settings of VR9 the positive-going transition takes about the same time as the timebase run, so that at least half the trace on the CRT would still be dark, and the other half would increase progressivly in brightness, were this waveform used directly to bias the CRT grid.

At the slowest settings of VR9 the screen wave rises fairly soon to a maximum positive, and then gradually falls as the anode and screen draw increasing current during progression of the timebase-run. This wave, if applied to the CRT grid, would have the undesirable result of giving a trace which starts dark, rises fairly soon to maximum intensity, and then gradually tails off in intensity towards the end.

However, looking at this screen-grid waveform of V6, it is apparent that both positive and negative transitions *commence* with *steep* portions having at least the desired final amplitude of 30V, and pretty accurately coincident, in time, with the start and end of the timebase run. It is thus the purpose of V7, D6, D7, D4 to cut out this portion of the wave, and reject all else.

The D.C.-level of the screen waveform shifts with the setting of VR9, on account of the symmetry-changes thereby involved. It is therefore necessary to clamp the wave to a definite potential prior to introduction of clippers at the desired relative D.C. levels. The combination of C21, D6, R42 performs this function, clamping the wave to −18V (derived from the Y-amplifier bias circuit) as its most negative limit under all circumstances. R31 merely serves the purpose of reducing loading thereby imposed at the screen-grid of V6, which would otherwise react back to distort the timebase action. The function of such a clamp-circuit is identical to a peak-rectifier circuit.

The output waveform at V7 cathode is now clamped at chassis potential and is positive-going from there. All that is needed is to retain the first 30V, and chop off the rest, which is performed by the simple diode-limiter circuit D7, which is returned to the desired potential of plus 30V on R36, C19. D7 and C19 thus short-out all portions of the waveform lying above plus 30V.

We are now left with the desired waveform for flyback blanking. It is merely necessary, as a final step, to give this the desired D.C. level, i.e., to change over from positive-going-to-chassis to negative-going-to-brilliance-control-setting.

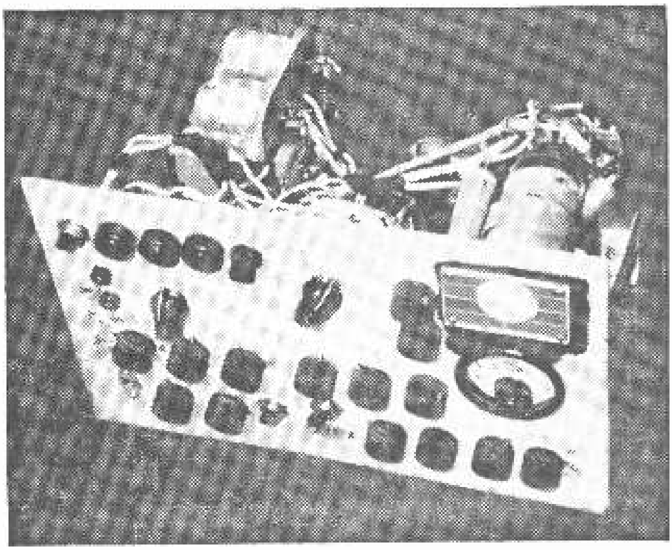
This is performed by another clamp-circuit, whose principles of operation are identical to those of the first. A coupling-capacitor C29 first of all removes all D.C., D4 is a negative peak rectifier, and the series-added D.C. is whatever voltage is present at the slider of VR1, the brilliance-control. R37 and C30 were introduced as an equaliser, to make the action of this clamp circuit slightly frequency-selective, speeding it up at the higher frequencies of operation to compensate for slight delays in rise of the original wave there.

The specified value of C30 should be found satisfactory, but if the trace on the CRT is found not to have a clean sharp start at the highest possible timebase-speed setting, *slightly* larger values should be tried.

Diodes

Although silicon diodes are less critical than germanium diodes, heat shunts should nevertheless be used when soldering these diodes. If diodes are unwittingly damaged during soldering, this circuit can give a variety of forms of erratic performance. Take care, also, to wire all diodes with the correct specified polarity. It is *NOT* permissible to use normal germanium diodes of the RF or low-voltage types *anywhere* in the Auditron, as the voltage ratings of such are far too low, and they would suffer immediate destruction. The peak inverse voltages appearing on the diodes in the Auditron amount to some one or two hundred volts in some cases, and thus the single type number specified throughout is a silicon diode of 350V peak inverse voltage rating.

(To be continued)



The Miniscope as it appears in an advanced stage of construction.

PRESENTED FREE
WITH
"PRACTICAL WIRELESS"
DECEMBER 1962

Practical Wireless

LUXEMBOURG TUNER

PUBLISHED BY GEO. NEWNES LTD., TOWER HOUSE, SOUTHAMPTON STREET, LONDON W.C.2.

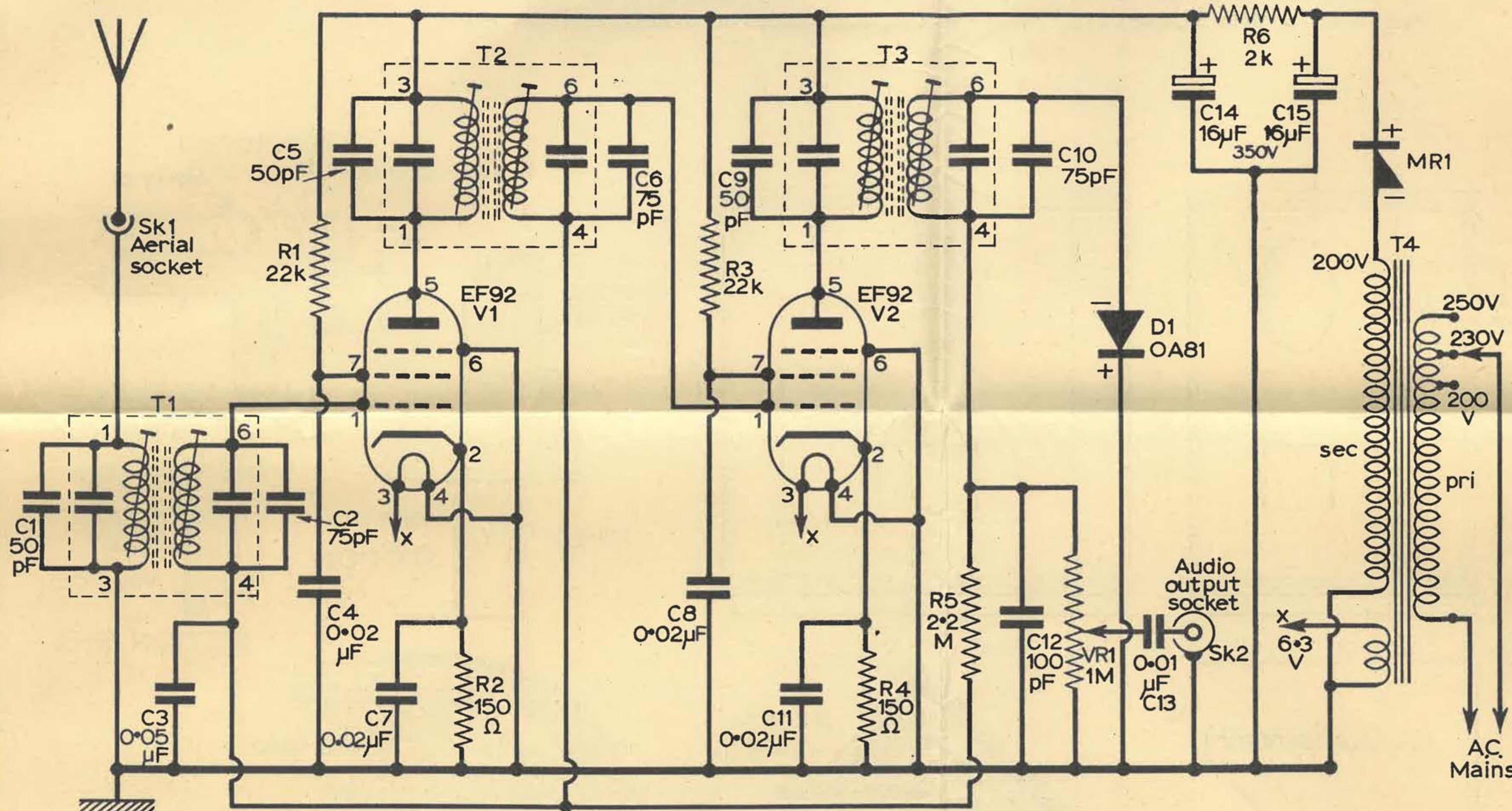


Fig.1 — The circuit diagram

COMPONENTS LIST

Resistors:
(All ¼W 10% unless otherwise stated)

R1	22k	R4	150Ω
R2	150Ω	R5	2·2M
R3	22k	R6	2k 3W

VR1 1M potentiometer

Capacitors:

C1	50pF 1% silver mica
C2	75pF 1% silver mica
C3	0·05µF paper 350V
C4	0·02µF paper 350V
C5	50pF 1% silver mica
C6	75pF 1% silver mica
C7	0·02µF paper 350V
C8	0·02µF paper 350V
C9	50pF 1% silver mica
C10	75pF 1% silver mica
C11	0·02µF paper 350V
C12	100pF 1% silver mica
C13	0·01µF paper 150V
C14, C15	16 + 16µF elec. 350V

Valves:
V1 EF92 V2 EF92

Sockets:
SK1 Wander-plug socket
SK2 Coaxial socket

Transformers:
T1, T2, T3 Miniature 1·6 Mc/s I.F. transformer (Denco)
T4 Mains transformer with tapped primary. Secondaries; 200V 25mA; 6·3V 1A

Rectifiers:
D1 OA81 signal diode
MR1 Contact-cooled H.T. rectifier 250V 50mA

Miscellaneous:
Chassis, 8in. × 3in. × 2½in. Two pieces of aluminium for screens, 3¾in. × 1½in. One insulated backing plate. Two B7G valveholders with skirts and screens. One 3-way tag strip One miniature 18-way group board. One capacitor clip (1in.). One control knob. One wander plug and one coaxial plug. Nuts, bolts, etc.

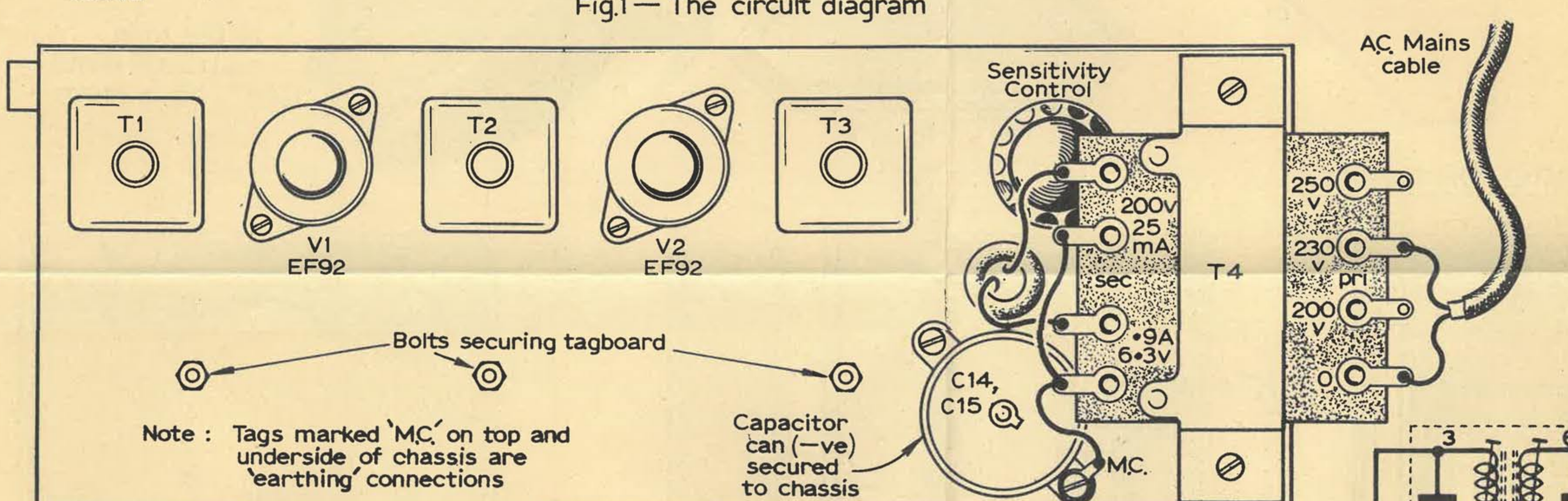
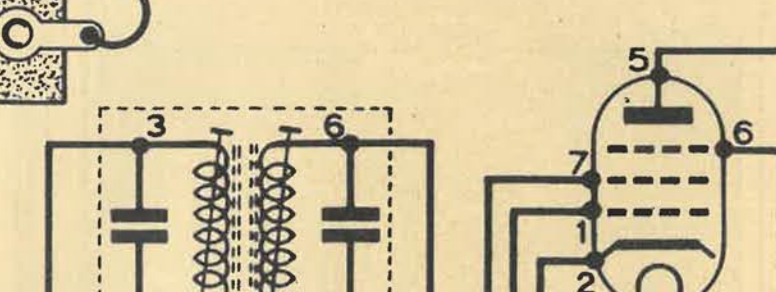


Fig. 2 — The above-chassis wiring



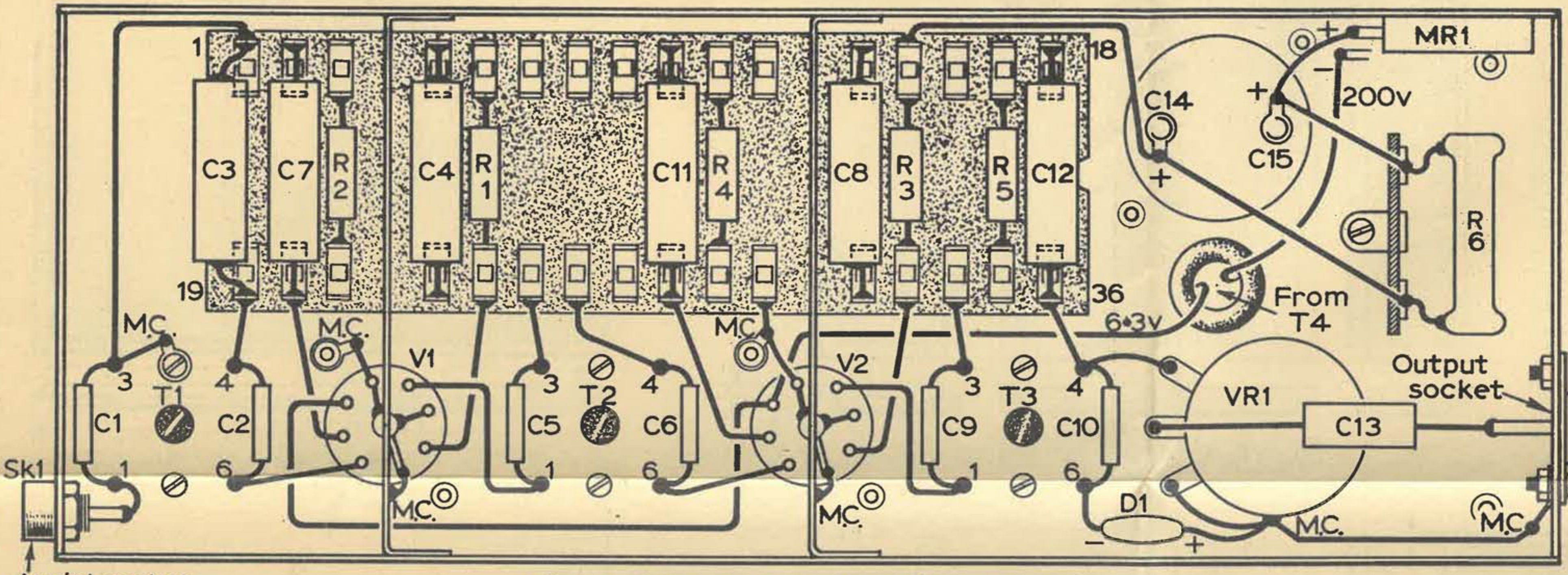


Fig. 3 — The under-chassis wiring

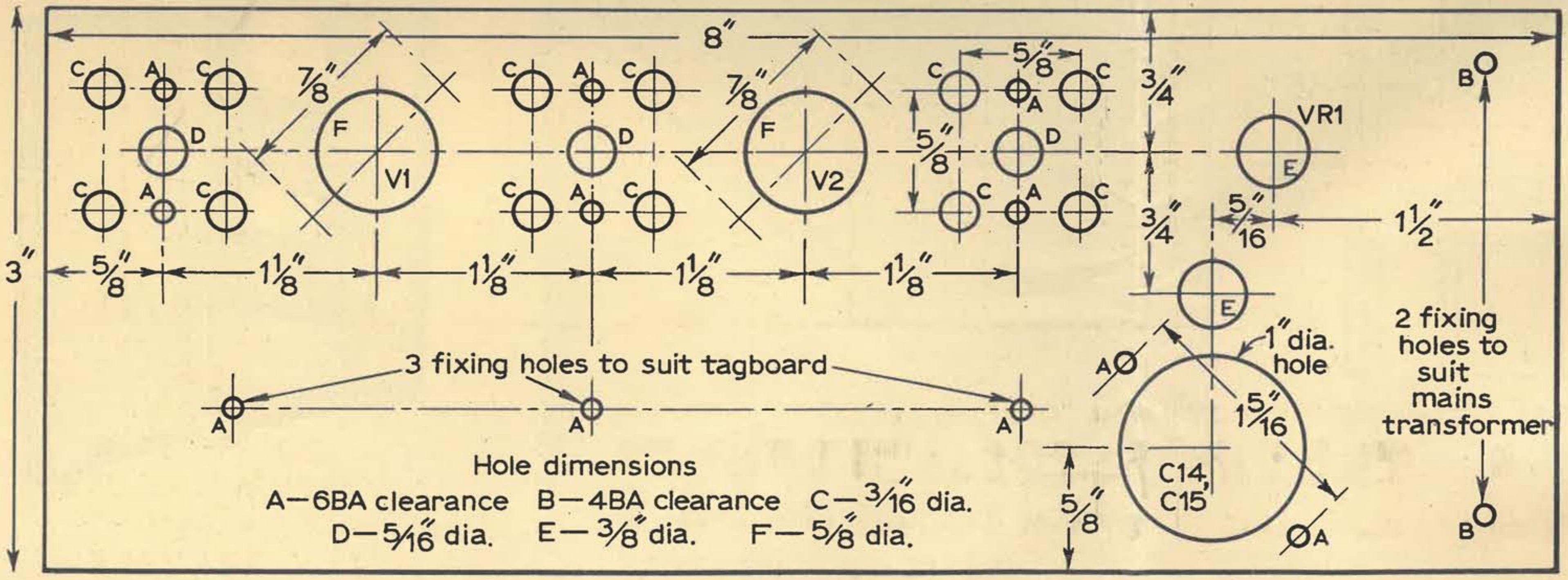


Fig. 4 — The chassis drilling diagram

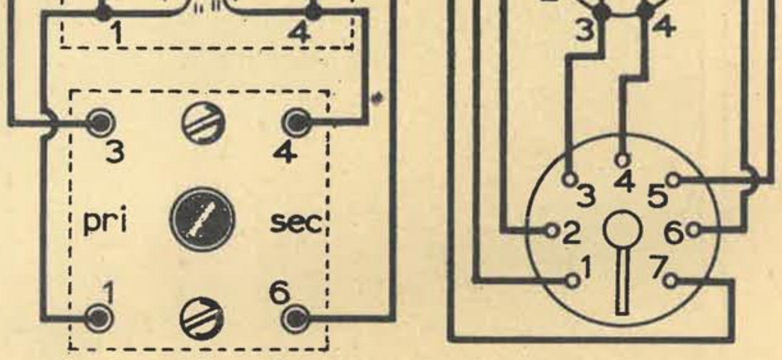


Fig. 5 — I.F. coils and valvebase details

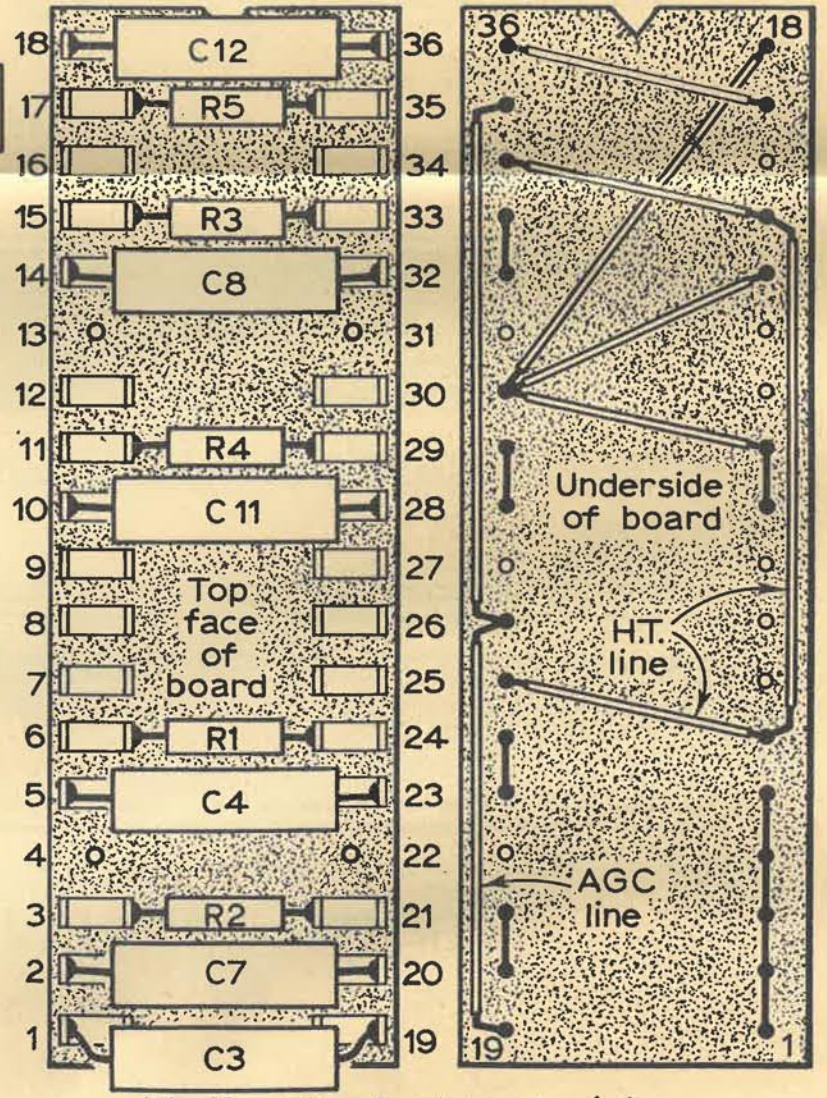
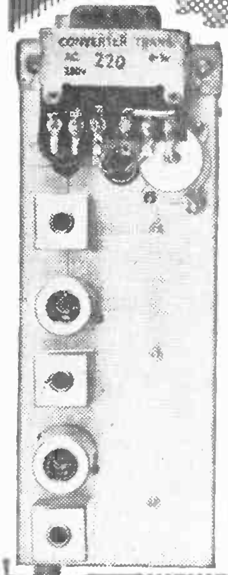
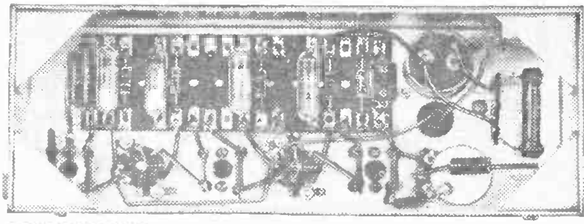


Fig. 6 — The tagboard wiring



THE LUXEMBOU TUNE



20
Pre-set

Nowadays most people have an F.M. tuner to give them high quality interference-free reception from their local BBC stations but there are numerous occasions when the programmes transmitted are not of the more popular light music type and an alternative is required.

Without doubt the most popular station for light entertainment particularly among the younger generation is Radio Luxembourg on 208m.

In order to receive this station it would normally be necessary to have a complete medium wave tuner but this novel design shows how a high gain and selective tuner pre-set to the Luxembourg frequency can quite easily be constructed.

The Design

The original idea for the circuit came from experiments carried out with a 1·6Mc/s I.F. amplifier strip when it was found that by adding a small fixed capacitor to each winding of the I.F. transformers it was quite simple to bring the tuning point down from 1·6Mc/s to 1·439Mc/s which is the exact frequency for Radio Luxembourg.

As miniature 1·6Mc/s I.F. transformers are available from all the component shops they provide a ready made perfectly screened band-pass coil unit adjusted for optimum coupling which can be easily tuned to 208m.

The circuit which is shown in Fig. 1 on the Blueprint is quite simple but has proved to be very sensitive and yet perfectly stable over long periods. It consists of two straightforward R.F. amplifiers followed by a germanium diode which provides detection and negative bias for non-delayed AVC. In practice the use of a miniature group-board to mount all the small components makes it both very easy to construct and at the same time gives the tuner a neat professional appearance.

It will be noticed that no audio amplifying stage has been included as it was found that feeding from the detector into a standard Mullard 3W amplifier sufficient signal was always available to overload the input and in fact a preset output control was included, which is normally set at about the halfway position. Good reception has been obtained with this tuner in various locations in and around London and also in parts of South East England using only 4ft of wire as an aerial, however in view of the characteristic fading that does occur from time to time on Luxembourg it is considered that the best aerial possible should always be used.

When the first prototype was completed a considerable amount of experiment was carried out with various different input circuits from the aerial including winding small coupling coils on to the first I.F. transformer to give a step-up ratio but the difference in results was so slight that it was not considered worth the additional time and trouble.

As a precaution against the possibility of some instability due to the high gain with two R.F. stages small screens were fitted across the centre of each valveholder but it would appear that these are not absolutely essential and some constructors may prefer to build on a try-it-and-see basis and only fit them afterwards if needed. The position occupied by the screens is shown dotted in the under chassis wiring diagram Fig. 3 but it should be noted that they were removed for the photograph (at the top of this page) in order to provide a clearer view of the wiring and components.

Construction

The chassis used was an aluminium type with reinforced corners and it measured 8in. x 3in. x 2½in. Actually a chassis having a depth of only 1in. would have been sufficient but the deeper one was chosen as it appeared to be a standard ready made component that was stocked by most of the well-known component shops.

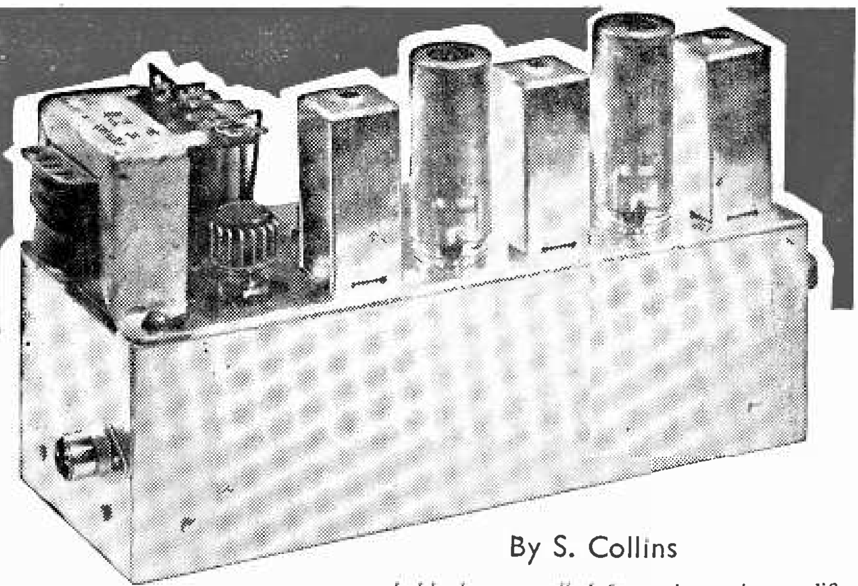
There is comparatively little metal work or drilling to be carried out as will be seen from the chassis drilling diagram Fig. 4. To simplify the

RG

R

m

Tuner



By S. Collins

marking out of the I.F. transformers a small paper template should be used and if desired this can be lightly stuck on to the chassis before drilling.

Having drilled all the holes in the chassis the various components can be fitted into position according to the diagrams Fig. 2 and Fig. 3 but care should be taken to ensure that the valve-holders are the correct way round. This also applies to the I.F. transformers and these can be checked quite easily by reference to the small numbers moulded on the base of the formers, 1 and 3 being primary and 4 and 6 the secondary.

Component Group-board

The secret of the clean layout and the easy assembly lies in the 18-way miniature group-board which takes practically all the small components, and by wiring up the various tags on the back first the majority of the work can be done before this item is fitted into the chassis.

The two views of this group-board given provide all the necessary information for carrying out the wiring, but in view of the ease with which it is possible to become confused when constantly turning this component over while working it is strongly advised to positively mark one end with a dab of paint or a small " V " notch as shown. It is recommended that all the wires on the rear of the group-board should either be PVC insulated or covered with 1mm sleeving to avoid the possibility of short circuits.

It is also essential that an insulated backing plate should be fitted between the group-board and the chassis or if preferred it can be mounted just clear of the chassis by two spacing nuts. It will be noted that the two pairs of tags in positions 4 and 13 have been removed and this was done to allow the screens across the valveholders if fitted to be taken close to the chassis.

Power Supply

No mains on/off switch has been included as it was thought that in most cases this unit would probably be controlled from the main amplifier, but this is a matter of personal requirements.

The mains side consists of a conventional double wound transformer T4 of the type used in most Band III convertors giving 200V half-wave H.T. and 6·3V for the heaters; this type of transformer also effectively isolates the chassis from mains to ensure complete safety. The H.T. is rectified by means of the usual contact-cooled rectifier MR1 which must be fixed to the chassis so that the smooth side makes good contact all over for cooling.

One side of the H.T. winding on the transformer goes to chassis together with one side of the 6·3V winding. The other side of the H.T. winding then goes to the tag on the rectifier marked −ve while the +ve tag is taken to the 16μF reservoir capacitor and through to the H.T. positive line.

Having completed the actual construction and wiring and carefully checked each part in turn against the diagrams the unit should be connected to the mains and switched on. If a testmeter is available it is a good idea to check at the various valve pins to make sure that there is H.T. on the screens and anodes (pins 5 and 7), and also a small positive on the cathodes (pin 2).

Setting Up

The output socket SK2 should now be connected to an amplifier input and the controls turned to near maximum to start with. If a signal generator is available then the adjustment is very simple and routine.

First of all set the signal generator to about 1440kc/s and feed the modulated signal into pin 1 of V2, then adjust the cores of T3 for maximum sound from the loudspeaker. Now transfer the generator to pin 1 of V1 and adjust both cores of T2 for maximum signal and then connect the signal generator to the aerial socket and finally adjust T1 cores for the best output.

This will bring the tuner fairly close to the Luxembourg programme and if desired a short aerial can be fitted and the final adjustment carried out on the actual transmission. A better way if

(Continued on page 749)

An AUDIO ABSORPTION WATTMETER

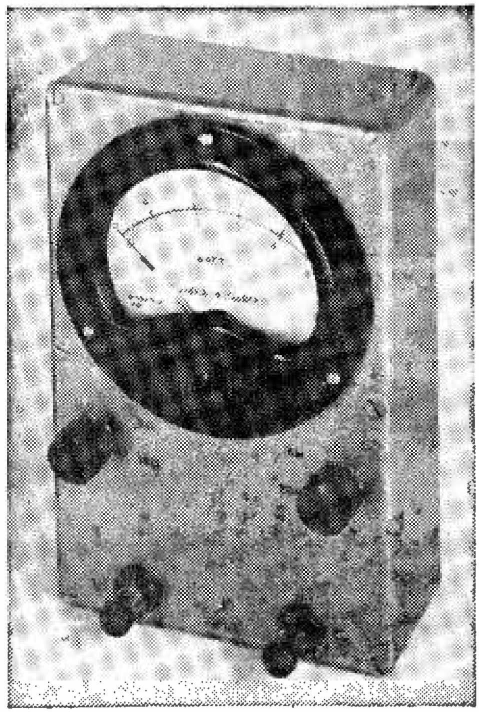
By K. BERRY

THIS wattmeter was developed to enable the power output of audio amplifiers to be measured. It is suitable for use with amplifiers having output impedances of 3 or 15Ω, and will measure powers of between 1 and 20 watts. A feature of this design is the fact that the meter has a near-linear scale as opposed to the more usual "square-law" scale associated with instruments of this type.

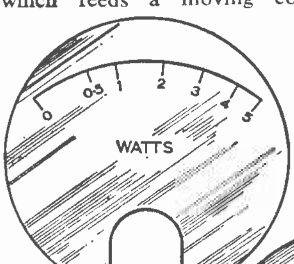
Theory

The power dissipated in a resistor is given by the expression $P=\frac{V^2}{R}$ watts, where R is the value of the resistor in ohms, and V is the voltage developed across it in volts. Thus if it is desired to measure the output power of an amplifier, a resistor, whose value is the same as the output impedance of the amplifier, should be connected to the output terminals of the amplifier and an A.C. voltmeter connected across it to measure the voltage developed. The power dissipated in the resistor can then be calculated. If, however, the meter was so calibrated, then the power developed could be read off directly thus obviating the need for calculations. This is the basis of the absorption wattmeter.

If the voltmeter used has a linear scale, the power calibration tends to be cramped at the "top" end of the scale as shown in Fig. 1. In this design, the voltage applied to the rectifier bridge which feeds a moving coil meter has been deliberately kept as small as possible. Consequently the diodes are being worked over the non-linear portion of their characteristics and since this approximates to a "square law" curve this largely cancels the cramping effect normally found at the top end of the scale as can be seen by comparing the scale in Fig. 2 with that in Fig. 1.



The finished instrument.



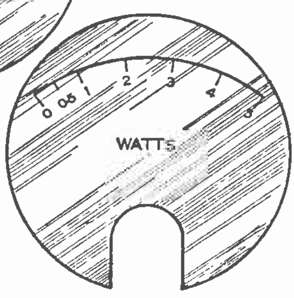


Fig. 1 (above)—The usual 'cramped' scale.

Fig. 2 (right)—A linearised scale.

Circuit Description

The circuit diagram of the wattmeter is given in Fig. 3. The appropriate load resistor, 3Ω or 15Ω, is chosen by SW1A. The voltage developed across the load resistor is applied to one of four potentiometer networks, the required network being selected when the impedance and power range switches are set. The output from the selected potentiometer network is fed to the bridge rectifier, Mr1-4, and thence to the meter M1. A 250Ω rheostat VR5 is connected in series with the meter. This has been included to enable an adjustment to be made to the linearity of the scale since this will vary slightly depending on the exact type of diodes used in the rectifier bridge.

Specification	
Impedance	3Ω or 15Ω
Power range	5 watts or 20 watts
Frequency response	± 0·5 dB 10 c/s = 100 kc/s

The use of four separate potentiometer net-

Table 1

Impedance							
3Ω				15Ω			
Voltage	Power	Voltage	Power	Voltage	Power	Voltage	Power
3·87	5	7·75	20	8·66	5	17·32	20
3·46	4	6·93	16	7·75	4	15·5	16
3	3	6	12	6·7	3	13·42	12
2·45	2	4·9	8	5·5	2	10·95	8
1·73	1	3·46	4	3·87	1	7·75	4
1·23	0·5	2·45	2	2·74	0·5	5·5	2

works instead of the more usual series (multiplier) resistors is explained by the necessity to keep the resistance in series with the bridge, low, and comparable. on all ranges. This results in a common calibration for all ranges.

Components and Construction

The choice of components is quite straightforward. The load resistors, R1 and R2, must, of course, have an ample power rating, but the use of 20W resistors is, perhaps, not essential. Provided the meter is not used to absorb a continuous 20W. there is no reason why. say, 10W resistors should not be used. The 3Ω board is made up of 3.3Ω and 47Ω resistors in parallel (=3.06Ω). The germanium diodes used in the prototype were Mullard type OA70, these are general purpose point-contact diodes and any similar diodes should prove suitable. The meter is a 3½in. 0-1mA movement with a D.C. resistance of 50Ω, but any 0-1mA meter should be equally satisfactory for this purpose.

The prototype wattmeter was housed in an "Eddystone" die-cast case of size 7⅜ x 4⅝ x 2 inches (approximately) with four small rubber feet fitted to the underside to prevent damage to the paint finish if placed on a rough surface.

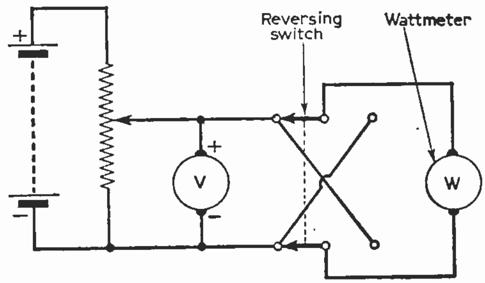


Fig. 4—The calibration arrangement.

Calibration

When the instrument has been assembled and wired, it is necessary to calibrate it by adjusting the potentiometers RV1-5 inclusive. This, fortunately, is quite a simple matter and requires only the use of an accurate D.C. voltmeter. This meter is used to measure the voltage applied to the terminals of the wattmeter. Before commencing calibration, the lead to SW1A should be unsoldered so that the load resistors R1 and R2 are disconnected. A variable D.C. voltage is then applied to the wattmeter as shown in Fig. 4. This can be obtained from a battery and poten-

(Continued on page 754)

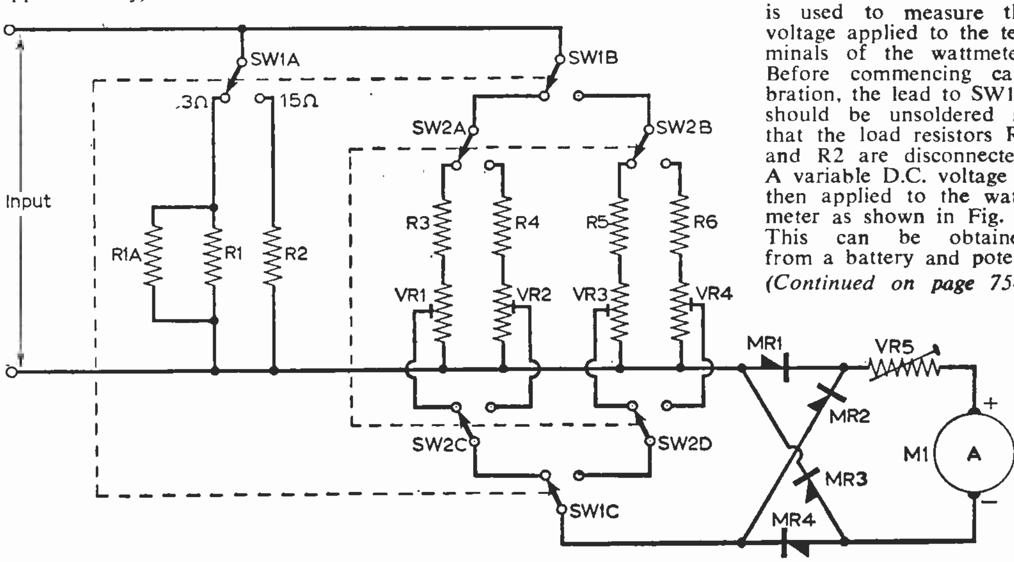


Fig. 3—The circuit of the instrument.

Radio Components and their Functions

(Continued from page 605 of the November issue)

By K. Royal

HAVING dealt with both TRF and superhet receivers, we now conclude this short series by analysing audio amplifiers in terms of component functions, voltages and currents. Basically, there are two essential types of audio amplifiers which are the concern of the service technician and experimenter, these being the single-ended output stage type and the push-pull arrangement.

Single-stage Amplifier

The simplest of audio amplifiers commercially available is shown in Fig. 6. This is designed for use in a record reproducer (Cossor, Model 559), and uses just a single amplifying stage, V1.

This is a high-slope pentode valve, which receives at its control grid the signal direct from the output of a crystal pick-up. The pick-up used has a relatively high output (hence the omission of an audio driver stage or voltage amplifier), and is a Collaro Studio-T type.

The pick-up signal is applied across the resistive element of a 2M volume control, which gives the correct matching. Instead of the slider of this control going straight to control grid, however, it goes to one side of the track of the tone control, R2, which is valued at 1M. As the other side of the resistive element goes via a capacitor to chassis, we get a tone-control, potential-divider arrangement.

Whatever level of pick-up signal is selected by the volume control. this is applied to R2 and C1 in series. Now, at high A.F., the impedance of C1 is relatively low, compared with its impedance at low A.F. At high audio frequencies. therefore, the capacitor end of R2 can be considered as connected to chassis through a low value resistance. Thus, when the slider of R2 is at the capacitor end of the resistive element, there is very little signal between the control grid of V1 and chassis. There is considerably more low-frequency signal, however, since to such signals C1 "looks" like a high impedance. At this setting of the control, then, we obtain an effective "bass lift".

At the other end of the control's range there is virtually no tone correction at all, because signals at all frequencies are applied direct from the slider of the volume control R1 to the control grid of V1, via the slider of R2. The fact that the high series impedance of R2 and C1 is in parallel with the signal at that setting is of little consequence. However, a progressive "top cut" or "bass lift" occurs as the slider of R2 is turned towards the capacitor end of the resistive element. This is a useful tone control circuit for the simple pick-up amplifier, and one for which the experimenter may well find applications.

The rest of V1 is wired in the usual manner. Grid bias for the valve is obtained from the voltage dropped across the cathode resistor R3, and this is of the order of 6V, as measured between cathode (positive) and chassis on a 1,000Ω/V meter. The anode is loaded by the loudspeaker transformer T1, whose turns ratio is selected to match the low impedance loudspeaker to the high anode impedance of the valve. C3 across the primary winding gives further tone correction and damps harmonic resonances which may otherwise be set up in the loudspeaker transformer.

The screen grid of the valve is fed through R4 and heavily decoupled (or smoothed) by C4. It is worth noting that the anode of the valve is fed straight from the output of the rectifier V2 without a smoothing choke or resistor. When this is done on a single-stage circuit the screen grid of the valve must have an almost ripple-free voltage, which is accomplished by the decoupling mentioned above. R4. then, can be considered as the smoothing resistor and C4 the smoothing capacitor. C5, at the cathode of the rectifier, is, of course, the ordinary reservoir capacitor. There is no negative feedback in this simple circuit, for even the cathode of the valve is heavily decoupled by C2.

A fully isolated power supply is employed, T2 being the mains transformer with H.T. and L.T. secondaries. The H.T. winding is centre tapped to facilitate full-wave rectification, while the heaters of the two valves are wired in parallel and energised from the 6·3V L.T. winding.

This kind of amplifier runs at about 260V H.T. (from the rectifier). This gives about 240V on the valve anode and 225V on the screen grid with currents of 41mA and 4·8mA respectively. The total H.T. current, therefore, is in the order of 46mA as measured in the cathode of V1. The A.C. voltages either side of the centre tap on the H.T. winding of the mains transformer are 235V.

Push-Pull Stereo Circuit

To illustrate the more complex push-pull circuit we show at Fig. 7 the circuit of the Decca SG188 stereo record reproducer. For any stereo system two identical amplifier sections are required which are given as Channels A and B on the circuit.

Each channel has a voltage amplifier tone control stage, followed by two more voltage amplifiers, a phase splitter, two pentodes in push-pull and a pair of parallel-connected rectifiers to provide the necessary current for the two channels. For the following discussion Channel A will be considered, bearing in mind that the rectifiers and power circuits only are common to both channels.

The stereo pick-up gives two outputs, one which is fed to Channel A and the other which is fed to Channel B. The pick-up signal is fed direct to triode V1A via the equalising circuit C50 and R50. This gives a rising response to the higher audio signals, since C50 is 100pF (having a high impedance to low A.F.) and R50 is 1M. R52 is simply the grid return for V1A.

The equalised signal is developed across the anode load R51 and fed through C52 to the tone control system. Thus from C52 we have a signal applied to the "treble" circuit (C53, VR1 and C54) and also a signal applied to the "bass" circuit (R56, VR2, C55, C56 and R57). Now when VR1 and VR2 are set to the centre of their ranges a signal of frequency characteristics almost equal to that at the output of C52 is fed to the volume control VR3 and there is no tone correction. There is attenuation, though, which is the reason why the circuit features three voltage amplifiers. At high A.F. C54 "looks" almost like a short-circuit, while C53 has a relatively low value of impedance. Thus, with VR1 slider at C53 end of the control, maximum treble is fed to the volume control and this value of treble diminishes as the control is turned in the opposite direction.

The network comprising R56, VR2, R57, C55 and C56 is, in effect, an adjustable low-pass filter. The signal goes in at the top of R56 and comes out at the slider of VR2. It thus passes only low-frequency signals to the volume control and the amount of low A.F. relative to high A.F. passed depends upon the setting of VR2.

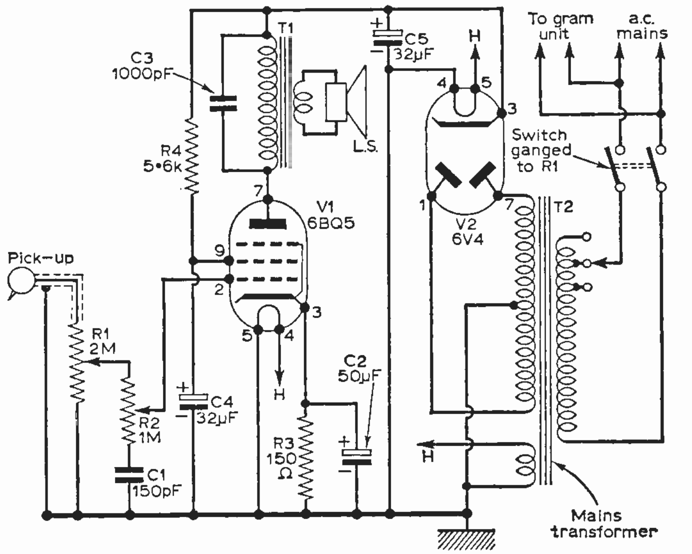


Fig. 6—The circuit diagram of a simple single-stage A.F. amplifier, used in the Cossor, Model 559 Record Reproducer.

Two Signals

In that way, then, the volume control receives two signals, one by way of the treble high-pass filter and the other by way of the bass low-pass filter, and as each of these filters are adjustable the required overall frequency response can be accurately established. This type of tone control circuit is also extensively used in hi-fi amplifiers and control units.

The equalised and tone-controlled signal is developed across the volume control and the required level is tapped off at the slider and fed to the control grid of V2A. This is a fairly conventional A.F. amplifier but has facilities in its cathode circuit for the application of negative feedback. The stage is biased by the voltage dropped across R62 and R64 as series in the cathode circuit. R66 is the anode load from whence the amplified signal is fed to the grid of V3A via the coupling capacitor C60.

R65 is the grid leak for V3A and reflects the voltage dropped across R69 in terms of grid bias at the grid. Current negative feedback is applied to this stage, since R69 does not have a bypass capacitor.

V4A is the phase splitter valve. This is direct coupled to the anode of V3A and the splitter is biased because the voltage at its cathode is V2 more positive than the voltage at its grid, thereby making the grid V2 negative with respect to its cathode.

Push-Pull Drive

The phase splitter produces two signals. one at the anode, across R71, and the other at the cathode, across R70. As these resistors are accurately balanced the two signals are of equal amplitude, but owing to the phase inversion effect of the valve the signal at the anode swings positive when the signal at the cathode swings negative and vice versa. These signals represent the drive for the push-pull valves and are fed through C64 to the control grid of V3A and through C63 to the control grid of V4B.

The output pair are biased for class A conditions, meaning that there is no flow of grid current, and the signals are re-established as one complete waveform across the centre-tapped primary of the output transformer T1. They are here coupled to the low-impedance secondary winding, which is tapped to suit a range of loudspeaker impedances.

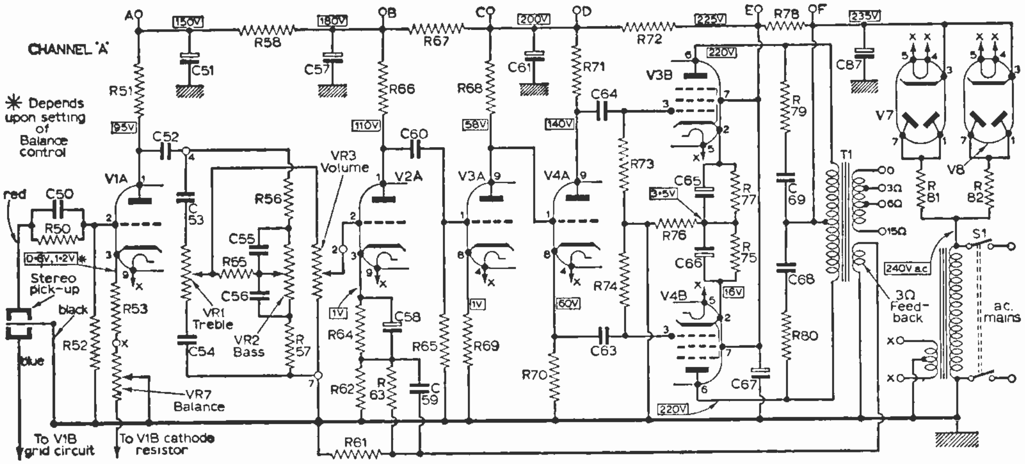


Fig. 7—The functions of all the components employed in this twin-channel, push-pull amplifier (Decca SG188) are given in the text.

Negative Feedback

A further secondary winding on T1 is employed for feeding back a fraction of the output signal to the cathode circuit of V2A as negative feedback. This is done through the frequency-selective network R63 and C59, with R61 as the other arm of a potential divider. In effect the feedback signals are reflected, via the cathode, to the control grid circuit of V2A in counteracting phase to the signals originally applied from V1A. This results in a reduction in total signal applied (hence another reason for the three voltage amplifiers), but its asset, of course, is that it cancels harmonic and other distortions, including hum.

The output valves are biased for class A by R75 and R77 in their cathodes, with the grid return circuit occurring through the balanced grid leaks R73 and R74. R76 is a low-value grid stopper arranged to prevent parasitic oscillations in the output stage. The cathodes of the output valves are decoupled by the electrolytics C65 and C66. This, along with the negative feedback, gives the stage a good damping factor, which is an essential requirement for high-quality reproduction.

Anti-resonant devices comprising R79/C69 and R80/C66 are connected across the primary of the output transformer and the screen grids of the output valves are connected in parallel and fed through R78, with C67 providing decoupling.

Each voltage amplifier stage is individually decoupled on the H.T. line, which is necessary in the interests of low-frequency stability, particularly when two amplifiers are sharing a common power supply. V1A is decoupled by R58/C51, V2A by R67/C57 and V3A by R72/C61.

Power Supply

The power supply used in this model is not isolated from the mains. It will be seen that an auto-transformer is used for feeding the anodes of the rectifiers V7 and V8 and this winding is connected to the mains supply via chassis. There is, however, a separate winding for the parallel-connected valve heaters and is centre tapped to chassis to reduce the pick-up of hum to the smallest possible level.

The valve anodes are connected by limiting resistors, necessary to avoid overloading of the rectifiers on surges, while the cathodes are connected in parallel, with C87 serving as the reservoir capacitor.

Stereo Balance Control

In twin-channel stereo systems a separate control labelled "balance" is often featured. This simply serves to balance the overall gain of the two channels. In Fig. 7 the balance control is VR7 and it is connected in the cathode circuits of the two first voltage amplifiers and, since the slider is connected to chassis, equal gains should occur with the control set to the centre of its range. When the control is adjusted so that the resistance in one cathode circuit is reduced then that valve increases slightly in gain, while its partner decreases slightly in gain and vice versa.

All the voltages to be expected in the various stages are marked on the circuit and, it will be obvious that the circuit of Channel B is identical to that of Channel A. ■

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THIS HEAD IS SPECIALLY DESIGNED FOR USE WITH THE DIGITAL COUNTER DESCRIBED IN THE FEBRUARY 1962 ISSUE, THE COMBINATION BEING SPECIALLY SUITED FOR MAKING MEASUREMENTS ON RADIOACTIVITY IN LIQUID SAMPLES (SUCH AS RAINWATER).

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IT SHOULD BE POSSIBLE TO BUILD THE UNIT DESCRIBED FOR LITTLE MORE THAN £10.

An Advanced GEIGER HEAD

By E. DEXTER

THE theoretical circuit shown in Fig. 1 is very similar to the simple Geiger Head published with the author's Digital Counter in the February issue. The main difference lies in the choice of a completely different type of Geiger-Tube, the Mullard MX124/01. The actual tube is enclosed in a thin-walled glass envelope coaxially within a sealed-on test-tube for containing the liquid to be tested. Thus the liquid intimately surrounds the Geiger-Tube proper, which accounts for the very high sensitivity.

H.T. Voltages

The MX124/01 has an unusually low operating voltage (400 to 500) compared to other tubes of this type. This is a distinct advantage for amateur circuitry. The arrangement of the H.T. feed in the circuit is somewhat unusual, a conventional 300V positive supply in conjunction with an additional 100V negative supply being used.

There are two good reasons why this arrangement has been adopted. Firstly, +300 and −100 are becoming standardised outputs for stabilised power supplies, and are thus also the main outputs of the "Experimenter's Power Pack" published recently in this magazine, which is admirably suited for operation of this unit.

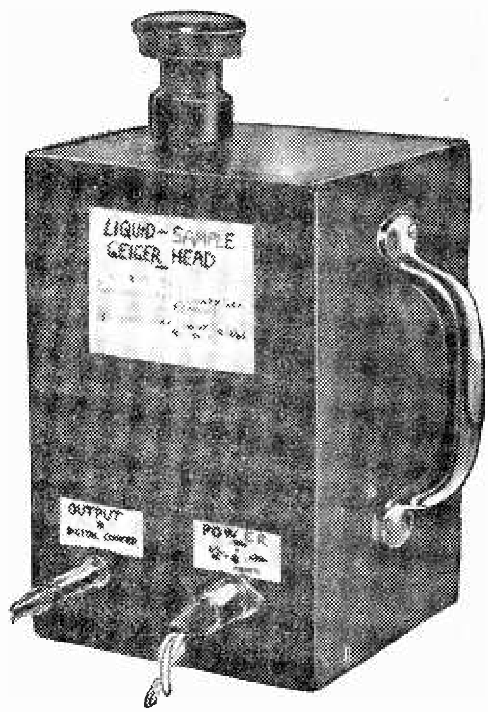
Secondly, the EC92 cathode-follower head-amplifier can be run off the same H.T. supply in this arrangement, as is evident from Fig. 1. The power supply requirements are seen to be identical to those of the Digital Counter, and the two units may be run simultaneously off the "Experimenter's Power Pack".

It is, for reliable and accurately reproducable results, highly desirable to run this equipment off a stabilised power supply, though other ordinary simple power supplies could be tried. It will then probably be necessary to use separate power supplies for this head and for the Digital Counter.

It is *absolutely essential* that the total voltage applied to the tube never exceeds 450V, as otherwise flashover and possible destruction of the tube can take place. Thus the positive H.T. must not exceed 350V.

Threshold Voltage

Mullard quotation for the Threshold Voltage for the MX124/01 is "maximum 400V". Individual samples vary and the tube in the author's prototype was found to have a threshold at 360V. It is desirable to operate the tube at approx. 50V above threshold which gives 410V for the author's prototype.



The finished instrument.

When the unit is initially put into operation, the output should be connected to an oscilloscope, and the pulses observed as the positive stabilised H.T. is varied on the power pack. As the H.T. voltage is gradually reduced, the pulse amplitude will also decrease, until it vanishes at the threshold voltage.

The voltmeter reading should then be noted, and the H.T. increased by about 40 to 50V. This assures the proper operating point having been set, and it should be checked in the same manner from time to time as the tube ages.

Pulse Amplitude

Fig. 2 is self-explanatory as far as the theoretical details of the generation of the pulses are concerned. The treatment is, of course, simplified, as no account has been taken of chemical effects within the tube also leading to rapid extinction of each discharge.

Nevertheless, the capacity-effects sketched in Fig. 2 generally dominate and are sufficient to give a measure of control over the output pulse amplitude, by means of adjustment of C1. The larger the capacitance of C1 and C*stray*, the greater is the charge-per-pulse passing through the tube, i.e. the greater the strain on the tube. It is thus desirable to keep both of these capacitances small.

Naturally, any capacitive loading of the tube increases the violence of the discharge on each pulse, and it may thus seem strange that a circuit is proposed which deliberately introduces such loading.

The advantage gained, however, is the production of a substantial pulse giving secure operation of simple counter circuits aimed to avoid all snags and critical effects in the input stages, and this advantage is considerable for amateur purposes.

Tube Life

The price paid for this advantage is a shortening of tube life, to the region of at least 100 million counts, instead of the almost infinite life achievable in more critical specialised circuits. While such a life would be too short for high counting-rate professional laboratory use, it is still more than ample for the amateur uses intended in this article.

One will be operating at counting rates around 100 per minute for the purposes envisaged, so that even with the minimum life of 100,000,000 counts, at least 15,000 operating hours are certain. Probably much more.

The prototype shows that, after completing more than 2,000 operating hours under these conditions, changes of tube characteristics are at the most a fraction of 1% of those of a brand new tube.

Slow Counting Rates

The adverse effects on dead-time and plateau-slope are of little importance at the slow counting rates intended, though probably seriously limiting the suitability of this circuit for work at normal laboratory counting rates of some hundred or more per second. The plateau-constancy over long periods of usage under the conditions specified has proved itself in practice, and the use of stabilised power supplies adequately removes errors of counting due to plateau-slope for the present purposes.

The actual values of C1 and C*stray* do not affect the output pulse amplitude as much as the *ratio* of their values. The *total* pulse-voltage generated is necessarily equal to the difference between operating point and threshold, which we deliberately set at about 40 to 50V.

This pulse voltage is seen in Fig. 2 to appear across C1 and C*stray* in series, the two capacitances thus forming a voltage-divider. Only the portion appearing across C*stray* is passed on to the cathode follower V2, and hence to the output. If a reasonably large part of the total pulse voltage is to appear at the output, therefore C1 must at

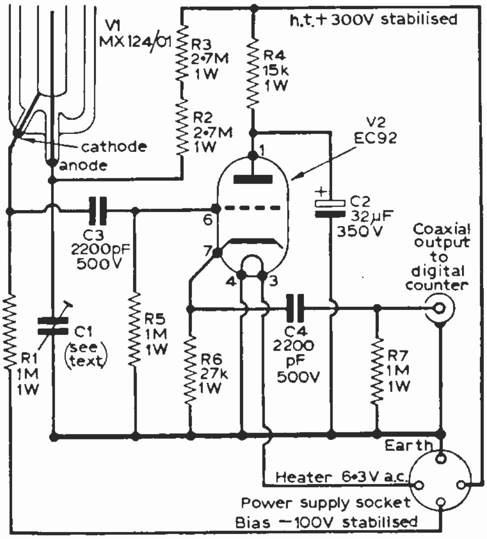


Fig. 1—The circuit of the head.

least be equal to, or somewhat larger than C*stray*.

This is the reason for including an actual physical component for C1, part of which is made up by the inherent stray anode capacitances of the tube and wiring, and the rest by a physical component in the form of a pair of twisted insulated wires.

It is desirable to set conditions such that, finally, C1 (total) and C*stray* are approximately equal. This condition is realised when the pulse output voltage from the unit is about half of the threshold-excess, i.e., some 20 to 25V peak. The output pulses should be observed on an oscilloscope in comparison with A.C. sinewave voltages of known amplitude, using the same Y-amplifier gain in all cases.

The length of twist of the insulated wires forming C1 is altered, until the output pulses are observed to have 20 to 25V amplitude. It need hardly be said that the operating point must *previously* have been set 40 to 50V above threshold, as described above.

The Cathode Follower

This stage is fully conventional. C3 blocks the negative 100V D.C., allowing only the positive pulses to pass, and be reproduced accurately at the same amplitude and form at the output. R4

(Continued on page 729)

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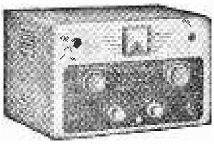
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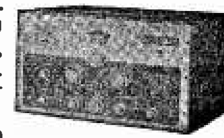
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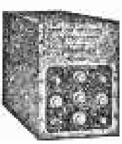
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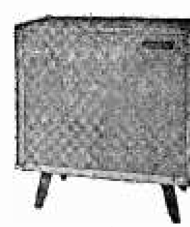
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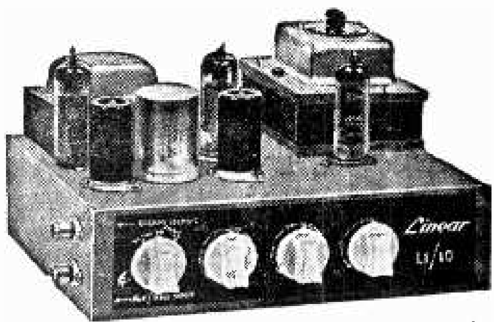

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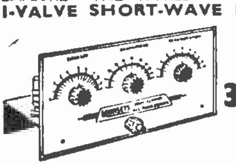

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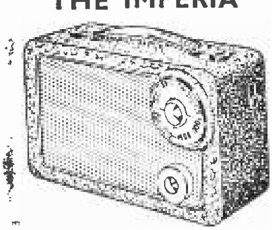

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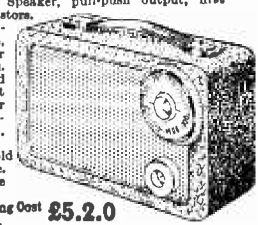

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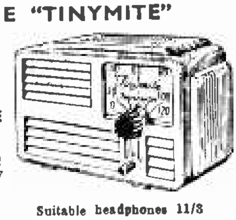

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MINISETS LTD. *Hatherley Mews, London E.17.*

(Continued from page 726)
and C2 give heavy decoupling for the stage. C4 and R7 remove any D.C. component from the output otherwise resulting from the cathode circuit of V2.

The purpose of V2 is *not* voltage amplification as the output voltage of the geiger tube is ample for the digital counter, etc. The purpose is, rather, to reduce the impedance, allowing transmission of the output signal on reasonably long lengths of coaxial cable without loss. This function certainly amounts to a form of power-amplification, however.

Gieger-Tube Screening

The manufacturers specify operation of the tube in a 2in. thick all round lead container, which can weigh anything up to half a hundredweight! Whilst this is certainly essential for efficient industrial use, it is by no means necessary for amateur use, provided the factors concerned are understood and taken into account. At any rate, it is clear why the bare tube alone must be removable in an industrial arrangement, and mercury-cup connectors used: the whole unit with lead casing would be far too heavy and cumbersome to move about!

The advantages of the heavy lead casing are principally twofold, neither of which is essential for the amateur. Firstly, and most important, the tube is thereby screened from ambient levels of X-rays or other radiation from other experiments and equipment operating on the premises nearby, which have nothing to do with, but would seriously interfere with, the experiment running with the tube in question. This danger of interference is not likely to arise under amateur conditions, provided such sources as luminous watches the clocks are kept away from a running experiment.

Secondly, the lead casing would absorb a large portion of the "Cosmic" background radiation coming from outer space, etc. This reduces the "background-count per minute" to be subtracted from a count made with a liquid sample, i.e. it improves the "signal-to-noise ratio", giving better resolution and shorter required counting times for a given desired accuracy.

This may be important for industrial concerns where time is money, but is unimportant for amateur usage. The saving in expense, and convenience in construction, achieved by omitting a lead screen outweighs all other considerations for the amateur.

Important Points

When operating the tube without a lead screen, the following two points must be watched carefully:—

(a) The unit is vulnerable to interference from external radioactive sources of sufficient intensity. Such sources must be removed to a distance of at least three yards, or kept fixed in position during an experiment, their effects being included in the subsequently subtracted "background count" made without the test-liquid in the tube. In particular, do not move the hands about near the unit during a count whilst wearing a wristwatch with luminous figures.

(b) The background count will be higher with the tube completely empty than when filled with pure non-active distilled water. This is due to the water acting as a weak screen, absorbing some of the low-energy components of the cosmic radiation.

Thus the "background-count" should always be made with the tube filled with pure distilled water, because the water-content of the subsequently counter test liquid will give the same reduction of cosmic background. Failure to observe this procedure can cause quite serious errors.

In the author's prototype, the background-count was found to be 40·4 per minute with the tube completely empty, but only 38·3 per minute with the tube full of distilled water. The count with a certain sample filled into the tube was 47·2 per minute, representing a correct signal of 8·9 per minute due to the sample.

Had the empty-tube background count been used in error, the sample-signal would apparently have been only 6·8 counts per minute, an error of well over 20%!

When using a lead screen the weaker cosmic-radiation components are absorbed anyway, so that then there will be no difference in background counts for an empty tube or one filled with distilled water.

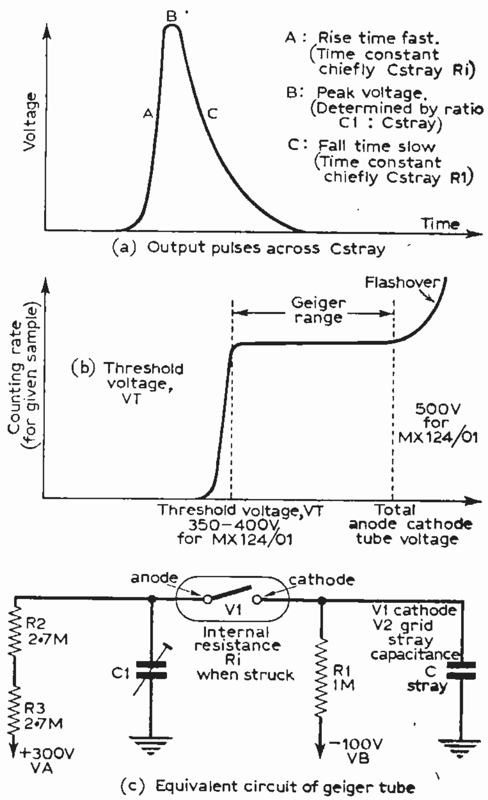

Fig. 2—Production of pulses and effect of C1: (a) output pulses; (b) threshold voltages; (c) equivalent circuit of the geiger tube.

Photoelectric Effect

Geiger-Tubes of the type here specified are often sensitive to light, giving an appreciable counting-rate in response to illumination. This effect was found to be immeasurably small for normal wave-lengths of light in the author's prototype. A back-ground-count of 40·4 per minute was obtained with the empty tube, whether completely dark or whether strongly illuminated with a couple of 25W bulbs 5in. away.

The accuracy limits of this experiment were about plus-or-minus one count per minute. Thus error due to normal room illumination, if present at all, is likely to be less than 2%. Nevertheless, it is desirable to keep the tube dark, for safety. The arrangement adopted satisfies this condition, in that most of the tube length is inside the body of the wooden case.

The rest is covered by the black P.V.C.-Tape, to within about ¼in. of the spout, which is covered by a cap, also desirable to reduce evaporation of the sample liquids. Any suitable opaque material of suitable shape and size can be used for the cap, preferably insulating and loosely fitting. *Do not* use a cork of any sort, as this could press down on and break the delicate inner construction of the tube.

Care of the Geiger-Tube

Counting times of more than three hours maximum should seldom if ever be required with the sensitivity achieved by this head. Samples prepared as already discussed in the "Digital Counter" article, and with the further remarks below, normally require counting times of only 30 to 60 minutes for sufficient accuracy. Thus samples need never be left very long in the tube.

Prolonged presence of samples in the tube can cause diffusion through the thin glass of the inner unit, raising the background count permanently.

Thus all samples should be poured out *immediately* after conclusion of a count, and the tube swilled out thoroughly at least three times with clean or distilled water.

Never use tarry, greasy or sticky liquids which could soil the tube permanently or render cleansing extremely difficult. Although dilute acids do no damage avoid using caustic alkalis and do not insert warm or hot liquids into the tube.

Preparation of Samples

Procedure outlined in the "Digital Counter" article should be observed. Whilst it is still necessary to concentrate rainfall and other water samples, lower concentration factors can be used than with the simple Geiger-Head described in the "Digital Counter" article.

The simple Geiger-Head, furthermore, gives really quick definite signals only with those rainfall samples representing the verge of real contamination. With present levels of radioactivity in rainfall, long careful overnight counts are required for reasonable quantitative measurements but with the unit described in this article, definite strong and reliable signals are very easily and very quickly produced even with rainfall of present levels of activity.

Components List

V1 Mullard Geiger Tube MX124/01
V2 EC92

Resistors (All resistors 1W carbon)

R1 1MΩ	*R5 1MΩ*
R2 2·7MΩ	*R6 27kΩ*
R3 2·7MΩ	*R7 1MΩ*
R4 15kΩ	

Capacitors

C1 See text	*C3 2200pF, 500V*
C2 32μF, 350V electrolytic	*C4 2200pF, 500V*

Miscellaneous
B7G valveholder and screening can
4-pole panel socket
Coaxial panel socket
Tagstrip. Material for cabinet

Quantitative Data

Serious experimenters, and particularly schools and clubs, will be interested in doing quantitative work with this apparatus, to determine not only relative values of radioactivity in liquid samples but also absolute values in terms of equivalent weight of radium per unit volume of the liquid.

The author has had available standard solutions of uranium and thorium, as well as possessing a high-voltage Geiger-Tube of similar type supplied with extensive calibration charts from the manufacturers. Using this apparatus as comparison standard, the prototype MX124/01 has been carefully calibrated. The results of this work, here given in full, may reasonably be supposed to be applicable to any sample of the MX124/01 tube used under the conditions specified in this article.

The Curie

The unit used for measuring absolute values of the radioactivity of substance is the Curie. A quantity of substance having the same effective activity as one gram of radium is said to have an activity of one Curie. This unit is extremely large, so that convenient practical units are the micro-Curie (μC) and the pico-Curie (pC) representing a millionth part, and a millionth of a millionth part, of a Curie, respectively.

One millogram or ordinary thorium has an activity of about 100pC. This was found to give, when effectively contained in the (exactly) 8 c.c. of liquid needed to fill the MX124/01, an increase of counting rate of about 10 per minute with the head described in this article.

Similarly, one milligram of ordinary uranium has an activity of about 350pC, and was found to give an increase of counting rate of about 35 per minute when present in the 8 c.c. contents of the MX124/01.

The sensitivity to this type of radioactive substance is thus about one count per minute per 10pc present in the contents. These substances, i.e. heavy elements, emit principally alpha-rays (helium nuclei) and gamma-rays (exceedingly short wavelength wireless waves), the tube responding principally to the latter.

(To be continued)

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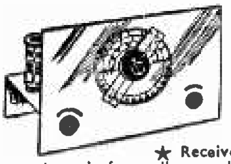

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Record your favourite programmes. Variable Medium wave tuning. Triple wound Super Hi-Q coil. Chassis and components colour coded. Easily constructed. Size 3 x 1½ x 1in. All parts, instructions and layout plans. **30/-** P. & P. 1/6

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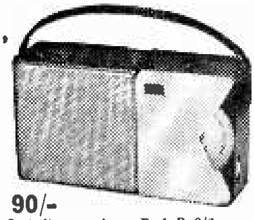

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In attractive two-tone contemporary case, with gold plated speaker grille and attractive dial. Size only 5¾ x 3½ x 1¾ins. No aerial or earth required—completely self contained. Genuine 3in. high flux PM speaker. Socket for personal listening. First grade transistors. Push-pull output—250 milliwatts. Volume control with on/off switch. Condenser tuning. Easy assembly on eyeletted circuit board.

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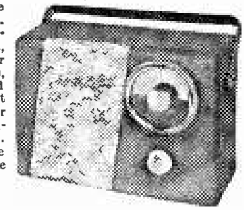

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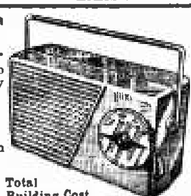

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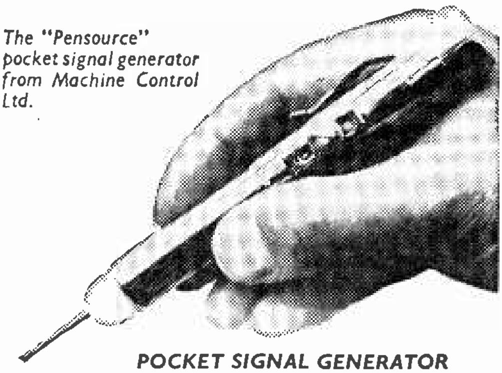
Trade News


The "Pensource" pocket signal generator from Machine Control Ltd.

POCKET SIGNAL GENERATOR

FOR engineers, radio and TV servicemen who require a small and convenient form of input for testing or fault finding, Electronic Machine Control Ltd., have produced the "Pensource" range of pocket signal sources.

These instruments are made available in several ranges and give an output of approximately ½V.

Basically each "Pensource" is a transistorised oscillator built into a robust chromium plated case. The supply to the oscillator is provided by a 1½V penlight cell and under normal conditions of use, should last approximately four to six months.

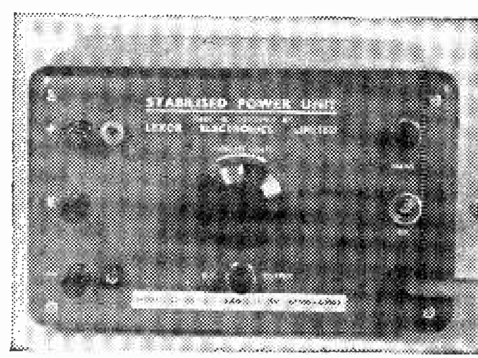
The "Pensource" costs £4 10s. and a leatherette case is also available at an extra cost of 10s. 6d. The makers are *Electronic Machine Control Ltd., Mayday Road, Thornton Heath, Surrey.*

STABILISED POWER UNITS

THE latest versions (Mk. III) of the Lexor stabilised power units models LT.12-05 and LT.24-05, are now available.

New features of the Mk. III include a much reduced longitudinal noise factor and an improved overload and short-circuit protection. The two models available have output voltage ranges of 5·5-14V or 18-28V. The output voltage of either instrument is continuously variable and may be adjusted either by a panel knob or a pre-set control. Both instruments will deliver output currents up to 0·5A continuously at all voltage settings.

The units are mounted in steel instruments cabinets 8in. x 5in. x 5¾in. finished in grey hammer stove enamel with contrasting blue panels. The price of the new Mk. III units is £25 7s. and they are made by *Lexor Electronics Limited, 25-31 Allesley Old Road, Coventry, Warwickshire.*

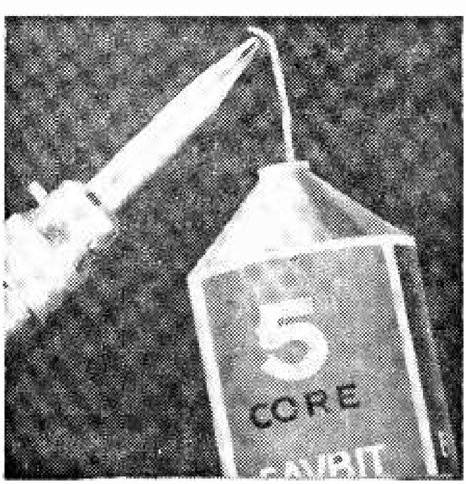


One of the new Lexor stabilised power units.

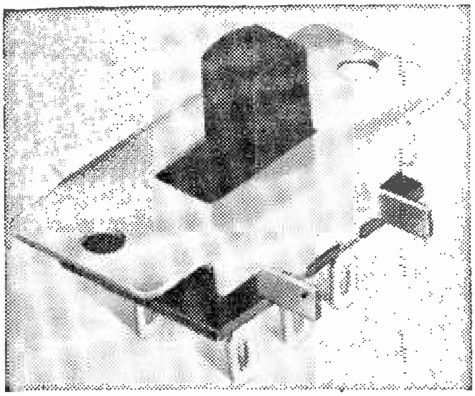
NEW SOLDER PACK

NEW from Multicore Solders Limited is a solder dispenser especially suitable for use by the amateur constructor. It is, in fact, an extruded aluminium tube, the top being tapered to a delivery hole through which the solder is drawn as required. This arrangement prevents the solder tangling and the flat base of the dispenser allows it to be stood firmly on the work bench, leaving the user complete freedom of both hands whilst working.

The contents of the new pack is a 16ft length of 18s.w.g. Ersin Multicore Savbit alloy and its price is 2s. 6d. complete. The manufacturers are *Multicore Solders Ltd., Maylands Avenue, Hemel Hempstead, Hertfordshire.*



The new Multicore solder dispenser.

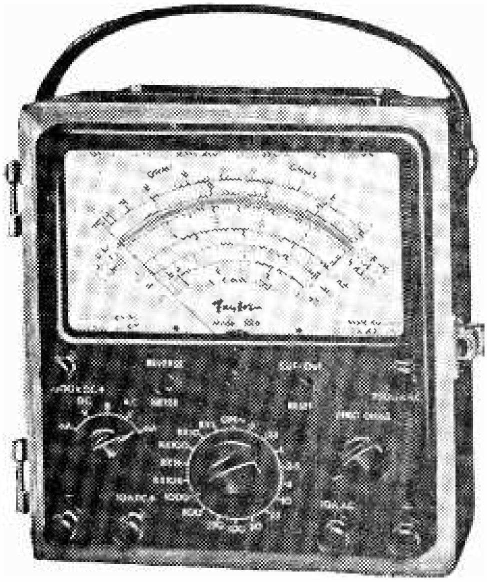


One of the new switches from Carr Fastener Co. Ltd.

NEW SLIDE SWITCHES

JUST incorporated with the range of components produced for the electronics industry by Carr Fastener Co. Ltd., are two new slide switches. These are identical in specification but differ slightly in their mounting facilities. Both switches are of the double-pole, double-throw type, and can be used for radio wavechange, instrument or any relatively low voltage switching application.

Constructionally, the switches differ only in their steel shell, one having vertical fixing lugs and the other having two 0·125in. diameter holes at 1.125in. centres and alternative side-fixing lugs. *Carr Fastener Co. Ltd., Stapleford, Nottingham.*



This new multimeter is manufactured by Taylor Electrical Instruments Ltd.

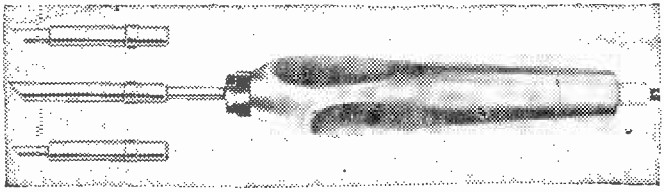
MINIATURE SOLDERING IRONS

RECENTLY A.N.T.E.X. Ltd. have added to their range of Precision soldering irons. Amongst the new additions is the model E240, a lightweight instrument operating from 230-240V mains and with a power consumption of 20W.

The novel design of these irons makes them easy to handle and attractive. Interchangeable bits are available to fit this model as well as a wire-stripper attachment. The price of the complete iron is 35s. and the makers are *A.N.T.E.X. Ltd., Grosvenor House, Croydon, Surrey.*

MULTIRANGE METER

THE model 88B multimeter from Taylor Electrical Instruments Ltd., is similar in operation to their popular model 88A, but is somewhat reduced in size. It is available in either a bakelite or wooden case.



The model E.240 soldering iron is made by A.N.T.E.X. Limited.

The sensitivity of the instrument is 20.000Ω/V, and other features include a mirror scale, an overload protection device and a reverse polarity facility.

Among the ranges included in the instrument are, resistance ranges up to 50MΩ and decibel ranges. The instrument will also measure capacitance and inductance but a model 388 adapter is required.

Another accessory which is available is a high voltage probe for measurements up to 25kV.

The two batteries used in the meter are located in a separate compartment. The types used are Ever-Ready U.2 and B.121.

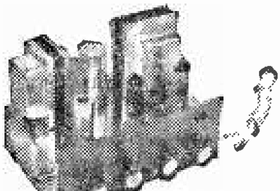
The makers of this new multimeter are *Taylor Electrical Instruments Ltd., Montrose Avenue, Slough, Buckinghamshire.*

THE TRANSISTOR CLOCK

ONE intriguing result of research in radio engineering—the transistor principle—has now been applied to clock-making. The Kundo (Crown Manufacturing Co. Ltd.) transistor clock, on display at the recent Watch and Jewellery Trade Fair, has an operating mechanism of unusual simplicity. A magnet attachment to its pendulum dips into a coil at each oscillation, producing, by induction, a voltage pulse which, fed into the transistor, triggers the flow of current from the battery to the drive coil. A driving impulse is thus imparted to the pendulum.

Needing no maintenance, this extraordinary timepiece runs continuously for no less a period than three years!

MULLARD 3-3 HI-FI AMPLIFIER



3 Valves, 3 watt, 3 ohm and 15 ohm Output. A really first-class Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line up: EF86, EL84, EZ81. Extra HT and LT available for Tuner Unit addition. This is the ideal companion Amplifier for FM tuner units.

TECHNICAL SPECIFICATION—Freq. Response: ± 1 db. 40 c/s.-25 Kc/s. Tone controls: Max. Treble Cut 12 db at 10 Kc/s. Max. Bass Boost 14 db. at 80 c/s. Sensitivity: 100 Mv. for 3 w. output. Output Power (at 400 c/s): 3 w. at 1% total harmonic distortion. Hum and Noise Level: At least 70 db below 3 w.

COMPLETE KIT (incl. Valves, all components, wiring diagram and special quality sectional Output Trans.). **ONLY £6.19.6.** Carr. 5/-. Complete wired and tested, 8 gns. **Bronze Escutcheon Panel, Printed Vol., Treble, Bass, On-off, supplied with each Kit.** Wired O/P socket power and additional smoothing for Tuner Unit. **10/6** extra.

Recommended Speakers—
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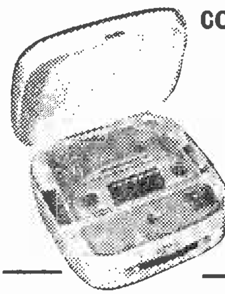

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Cabinet **£3.15.** P. & P. 6/6
Amplifier Kit **£8.19.6.** P. & P. 5/-.
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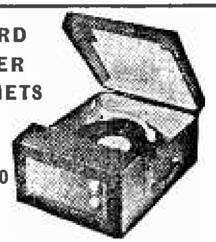
Volume Controls—5K-2 Meg-ohms, 3in. Spindles Morganite Midget Type 1⅛in. diam. Guar. 1 year. LOG or LIN ratios less Sw. 3/-. DP. Sw. 4/6. Twin Stereo less Sw. 6/6. DP Sw. 8/-.

RECORD PLAYER CABINETS



Cabinet Price **£3.3.0** Carr. & Ins. 5/-.

Contemporary style, rexine covered cabinet in two tone maroon and cream. Size 18¾ x 13¾ x ht. 8¼in., fitted with all accessories including baffle board and anodised metal fret. Space available for all modern amplifiers and autochangers, etc. Uncut record player mounting board 14 x 13in. supplied.

2-VALVE 2-WATT AMPLIFIER Twin stage ECL82 with vol. and neg. feedback Tone control. A.C. 200/250 v. with knobs, etc., ready wired to fit above cabinet. **£2.17.6.** P. & P. 1/6.
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JACK PLUGS. Standard 2½" Igranic Type, **2/6.** Screened Ditto, **3/3.** Miniature 1½", **2/3.** Screened Ditto, **2/6.**

ENAMELLED COPPER WIRE—¼lb. reels, 14g.-20g, **2/6**; 22g-28g, **3/-**; 30g-40g, **3/9.** Other gauges quoted for.

Ersin Multicore Solder 60/40 **3d.** per yard. ¼lb. **2/6**, etc.

Condensers—Silver Mica. All values, 2pF to 1,000pF, **6d.** each Ditto. Ceramics **9d.** Tub. 450V T.C.C., etc.. 0.001 mfd. to 0.01 and 0.1/350V., **9d.** 0.02-0.1/500V, **1/-.** 0.25 Hunts **1/6.** 0.5 T.C.C. **1/9**, etc., etc. **Close Tol. S/Micas**—10% 5pF-500pF **8d.** 600-5,000pF **1/-.** 1% 2pF-100pF **9d.** 100pF-500pF **11d.** 575pF-5,000pF **1/6.** **Resistors—Full Range** 10 ohms-10 megohms 20% ¼ and ½ W **3d.**, 1 W **5d.** (Midget type modern rating) 1W **6d.**, 2W **9d.** **Hi-Stab** 10% ¼W **5d.**, ½W **7d.** 5% ¼W **9d.**, 1% ¼W **1/6.**

JASON FM TUNER UNITS Designer-approved kits of parts:
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JTV MERCURY 10 gns.
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NEW JASON FM HANDBOOK, 2/6. 48 hr. Alignment Service **7/6.** P. & P. 2/6.

TYGAN FRET (contemp. pat.) 12 x 12in. **2/-.** 12 x 18in. **3/-.** 12 x 24in. **4/-.** 18 x 24in. **6/-** etc.

Speaker Fret — Expanded bronze anodised metal ⅛in. x ⅛in. diamond mesh, now **4/6** sq. ft., Multiples of 6in. cut max. width, 4 ft.

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100/25V	2/-	50+50/350V	6/6
8/450V	2/3	60+250/275V	12/6
16/450V	3/6	100+200/275V	12/6
16+16/45V	5/6		
32+32/450V	6/6		

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Kit consists of 3 sub assemblies already wired. Grub screw connections between Units only necessary—absolutely no soldering.
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7in.	1,200ft.	21/-	1,800ft.	28/6	2,400ft.	47/6

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Plastic Tape Reels .. 3in. **1/3**, 5in. **2/-**, 5¾in. **2/-**, 7in. **2/3**
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DAF96	9/-	EL84	8/6	PL82	9/6
DF96	9/-	EM81	9/6	PL83	10/6
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DL96	9/-	EY86	10/-	PY81	9/6
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A Simple 3-Valver

By T. M. Bush

THIS unpretentious little receiver can be built very cheaply. Considering the extreme simplicity of the circuit, it has a very good performance and with careful manipulation of the controls, the single tuned circuit will enable all the more powerful transmissions to be received clear of interference.

Circuit

The EF91 is a high slope miniature valve which is available ex-equipment very cheaply indeed. Three of them are used in this receiver. The first is arranged as a pentode R.F. amplifier but it will be noticed from Fig. 1 that there is no tuned circuit associated with it. The high slope of the valve, however, goes a long way towards repairing this omission and quite a worthwhile gain is achieved. Because the EF91 does not have variable-mu characteristics it was necessary to achieve some method of gain control other than by variation of bias, and the problem was solved very satisfactorily and simply by feeding the signal from the aerial to the slider of a 1M potentiometer in the grid circuit.

The second valve, connected as a triode, is used as a conventional leaky grid detector, regeneration being applied through the variable capacitor VC1 to sharpen the tuning and increase the sensitivity. Because the R.F. stage isolates the aerial from the tuned circuit the tuning is not affected by aerial loading and if by chance, as will sometimes happen, too much reaction is applied, the resultant oscillations will not be radiated to the annoyance of the neighbours. Resistor R5 and capacitors C2 and C3 remove the R.F. component from the output and the audio signal is passed via the capacitor C4 to V3, the output valve. This is another EF91, again triode connected. The optimum load could not be discovered but this is not of much importance with the triode connection and an output transformer having a ratio of 50:1 was found very satisfactory for a 3Ω loudspeaker.

Power Supply

A miniature double-wound mains transformer of the instrument type, having an output of 20mA at 250V and 1A at 6·3V supplies the power in conjunction with a contact-cooled metal rectifier. Smoothing is provided by the resistor R8, and the associated electrolytic capacitors C5 and C6. A

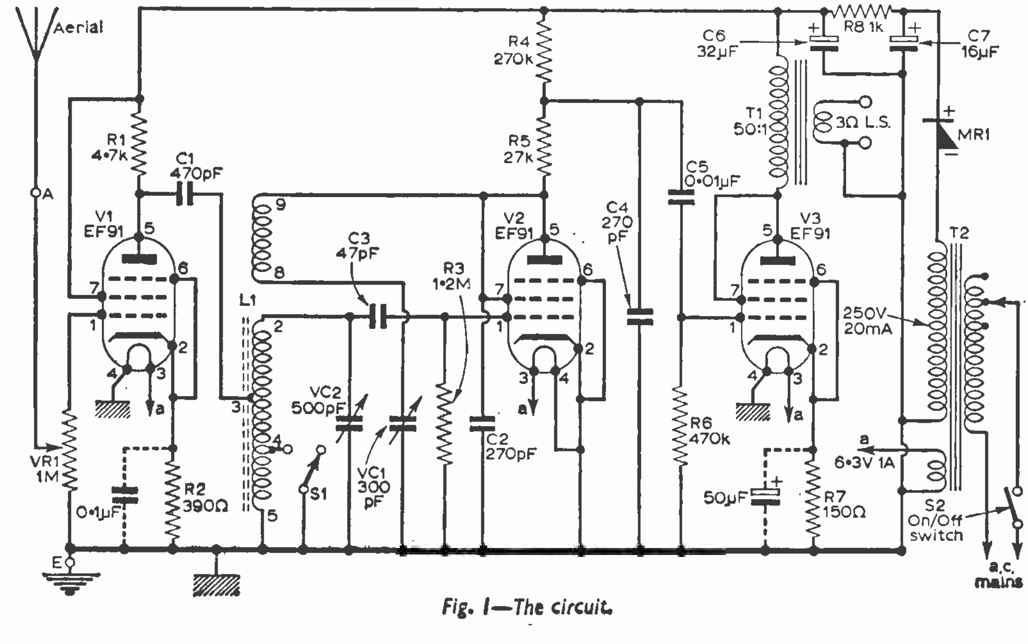


Fig. 1—The circuit.

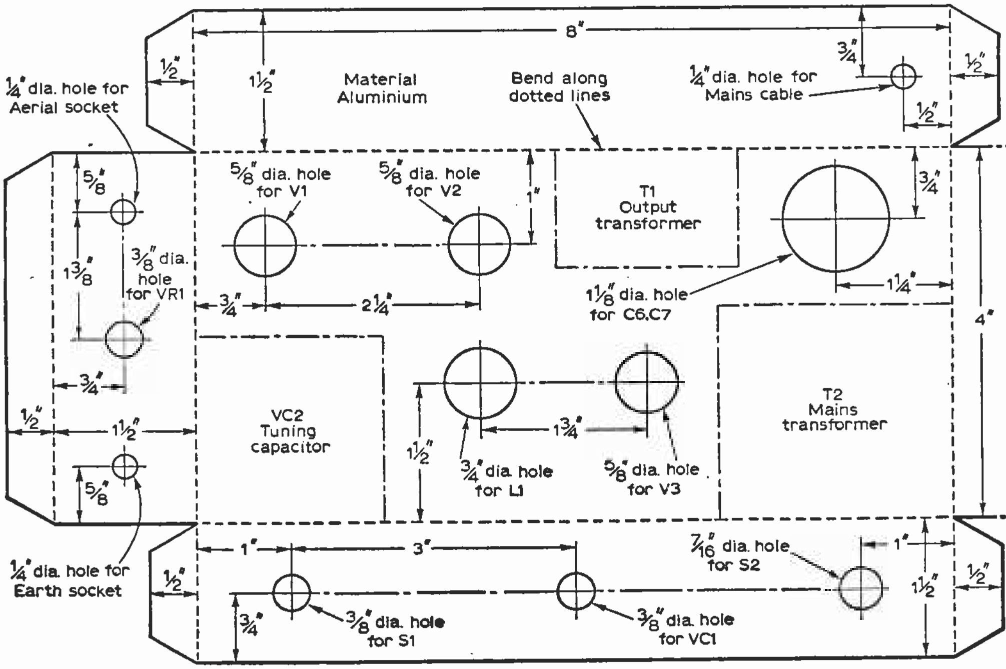


Fig. 2—The drilling dimensions of the chassis.

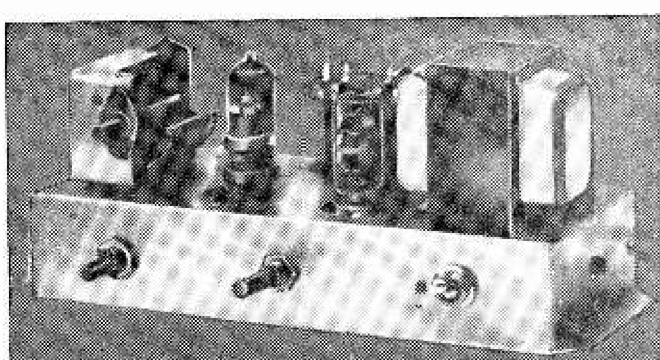
pilot or dial light, if fitted, should be 6·3V 0·04A, so as not to exceed the rating of the transformer winding. A separate on/off switch was fitted in the prototype but there is no reason why mains switching should not be incorporated with VR1. The power consumption from 240V A.C. mains is less than 20W.

Modifications

It will be noticed that the bias resistors of V1 and V3 are not bypassed. Consequently, if greater gain is required, capacitors may be fitted across them as shown in dotted outline in Fig. 1. A further increase in gain can be obtained by reducing the value of R2 to 150Ω but this will increase the current through the value and is permissible only if the mains transformer can accept the extra load. The total H.T. current in the prototype was exactly 20mA.

Construction

The prototype was constructed on a chassis of 18s.w.g. aluminium sheet measuring 8in. x 4in. x 1½in., details of which are given in Fig. 2. This gives plenty of room for standard size components with the exception of the reaction capacitor, VC1, where a miniature must be used in order that it may be accommodated within the depth of 1½in.; alternatively, the chassis could be made deeper. Construction may proceed in any convenient order. The layout and the arrangement of the wiring and components is not at all critical so long as the connections around V2 and the coil are kept to a reasonable length. Tinned copper wire of 22s.w.g. covered with sleeving is recommended for all the wiring, details of which are given in Fig. 3. The loudspeaker is connected direct to the secondary terminals of the output transformer on top of the chassis. It is good practice to connect one of these terminals to chassis and a solder tag should be fitted for the purpose on one of the transformer holding-down bolts.



The receiver nearing completion.

Components

Resistors may be ½W or ¼W, except R8 which should be 1W. The capacitors have to withstand

(Continued on page 741)

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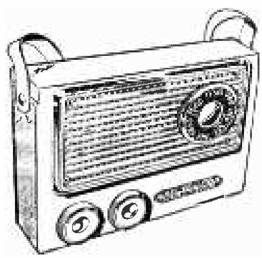

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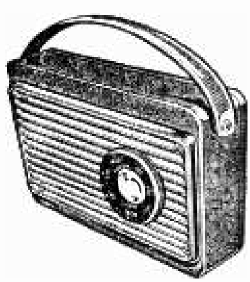

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"Agreeably surprised with Trawler Band reception. Luxembourg as loud as local. Your easy build diagram helped a lot . . . my first attempt."—H. S., Penzance, Cornwall (poor reception area).

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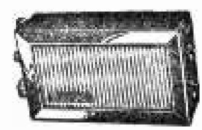

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- ★ 6 new type transistors and top quality components. Attractive case in blue and red and carrying strap with gold trim.
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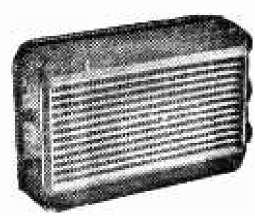

- ★ **2¾" Super-tone Loudspeaker.**
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- ★ Tuning condenser.
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Can be built for **59/6** P.P. 3/-, or with 3in. speaker 68/-

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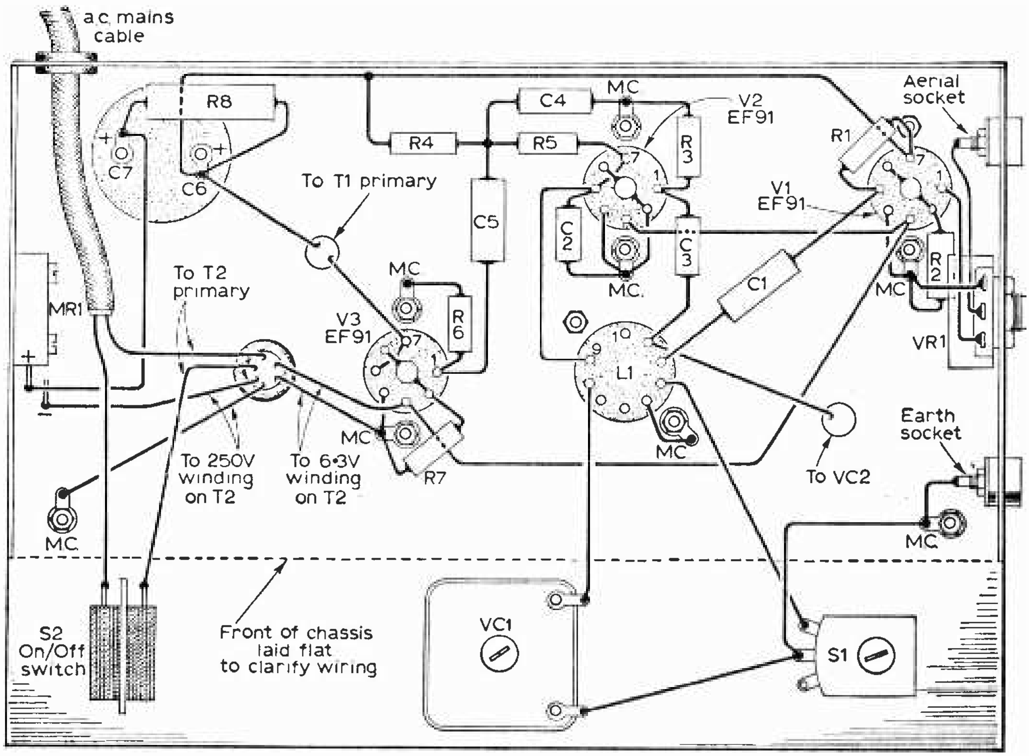

Fig. 3—The complete wiring diagram.

COMPONENTS LIST

Resistors (all ½W, carbon unless otherwise stated):

R1	*4·7k*	*R5*	*27k*
R2	*390Ω*	*R6*	*0·47M*
R3	*1·2M*	*R7*	*150Ω*
R4	*270k*	*R8*	*1k 1W*

VR1 1M carbon potentiometer

Valves:

V1, V2, V3 EF91, B7G base

Coil:

Iron dust core, dual range, medium and long wave bands, with reaction winding. (Repanco)

Capacitors:

C1 470pF ceramic or mica
C2 270pF ceramic or mica
C3 47pF ceramic or mica
C4 270pF ceramic or mica
C5 0·01μF paper 350V
C6 32μF electrolytic, 350V
C7 16μF electrolytic, 350V
VC1 300pF solid dielectric variable
VC2 500pF air dielectric variable

Transformers:

T1 Output—about 50 : 1
T2 Mains—Tapped primary. Secondaries: H.T.: 250V 20mA half wave. L.T. 6·3V 1A

Rectifier:

Contact-cooled 250V 20mA

(Continued from page 738)

the full H.T. voltage from the rectifier when first switching on and must therefore be 350V working. Any kind of tuning capacitor, air-spaced or otherwise can be used for VC2 or one-half of a two-gang component can be used as in the prototype. The coil L1, may be any iron-dust-cored dual wave type with a reaction winding but it is convenient if it is designed to plug into a B9A or B7G valve base. For tuning, a 3in. diameter engraved knob is fitted direct to the tuning capacitor but there is no reason why a slow motion drive should not be fitted if desired.

Testing and Operation

When the wiring has been completed, a test should be made with a meter between C6 and chassis to see that there are no short-circuits in the H.T. wiring. If all is well, power can be applied and transmissions should then be received. Two or three feet of wire as a throw-out aerial will usually be enough, though in poor reception conditions, some more efficient arrangement may be necessary. An earth is not essential, but will reduce mains-borne interference.

It will probably be found that with VR1 at maximum, some programmes will be receivable at adequate volume with VC1 set at minimum, but will suffer from interference from adjacent stations. In this case, the procedure is to reduce the volume by means of VR1 and bring it back to the desired level by the application of reaction, at the same time adjusting VC2 for the best results. ■

MIDGET MAINS PORTABLE

By V E HOLLEY

THIS handy little receiver was first built with one R.F. stage followed by a diode detector and in this form it gave good service in the north west London area. When later it was required for use in a less favourable location, a second R.F. stage was added to increase the sensitivity.

R.F. Amplifier

The signal is supplied by a ferrite rod aerial (L1, L2 in Fig. 1) and two R.F. pentodes, EF91, are used to amplify it to a suitable detection level.

The full gain of the two stages is not required and indeed, could not be used with stability, so the gain is reduced by resistance loading in both anode circuits and by omitting by-pass capacitors from the cathodes. If greater gain is required, one or both of these capacitors may be inserted in the manner of C4, which is shown dotted in Fig. 1. Decoupling is provided in both anode circuits.

The inductance of the rod aerial is adjustable within fairly wide limits and the second tuned circuit, which is ganged to it, may therefore incorporate any dual range iron dust cored coil designed to cover the long and medium-wave bands with a 500pF tuning capacitor.

It will be noted that there is no provision against overloading but as both valves operate with negative current feedback no trouble is likely to be encountered under normal conditions.

Selectivity

The selectivity provided by the two tuned circuits is quite good and with the assistance of the directional properties of the aerial, the BBC programmes and some of the continentals can be received clear of interference in daylight and darkness, in any reasonable reception area. Some further improvement might be obtained by applying reaction to L3 and L4; this was not tried.

Demodulation

The signal at the anode of V2 is rectified by a germanium diode D1 (GEX34). After passing through the R.F. filter C10, R8, C11, audio frequencies appear across the volume control, VR1 together with a D.C. voltage negative to chassis, which is used for alignment purposes, as will be described.

A.F. and Output Stages

A triode-pentode valve, ECL82, is used here in a conventional arrangement. Grid leak bias for the triode section avoids the need for a bias resistor and capacitor, but the pentode bias resistor must be bypassed in the normal manner in order to avoid negative current feedback which is, of course, undesirable in an output stage. The optimum load of the valve is 5,600Ω and to match this to a 3Ω loudspeaker, the output transformer must have a ratio of about 45:1.

If the D.C. resistance of the primary is more than about 200Ω, it is advisable to insert a resistor (R12) in the screen supply so that the voltage at the screen will not exceed that at the anode. The network R14, C15 serves to correct the response at the higher audio frequencies where valve and loudspeaker impedances rise considerably.

Power Supply

The receiver requires an H.T. supply of about 60mA at 210V and a heater supply of something

(Continued on page 745)

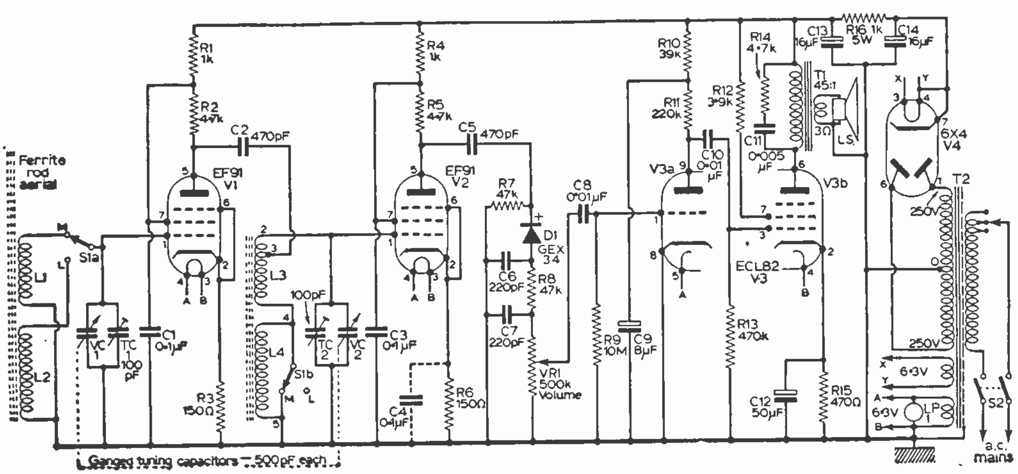

Fig. 1—The circuit.

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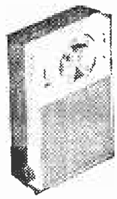

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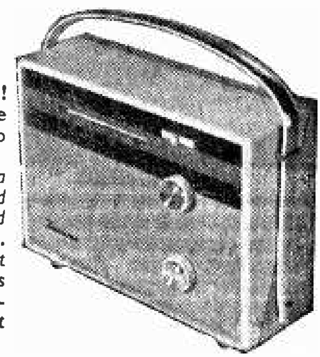

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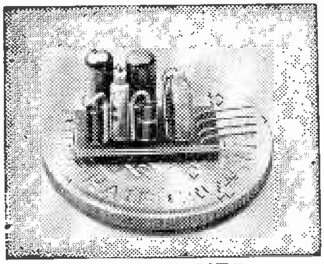

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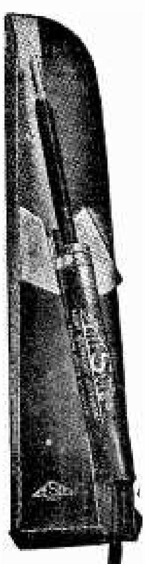
by LITESOLD



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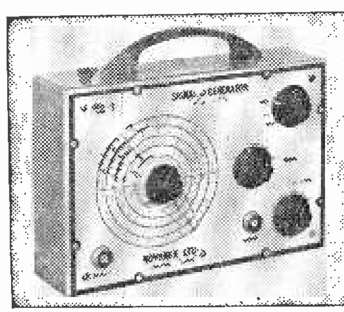

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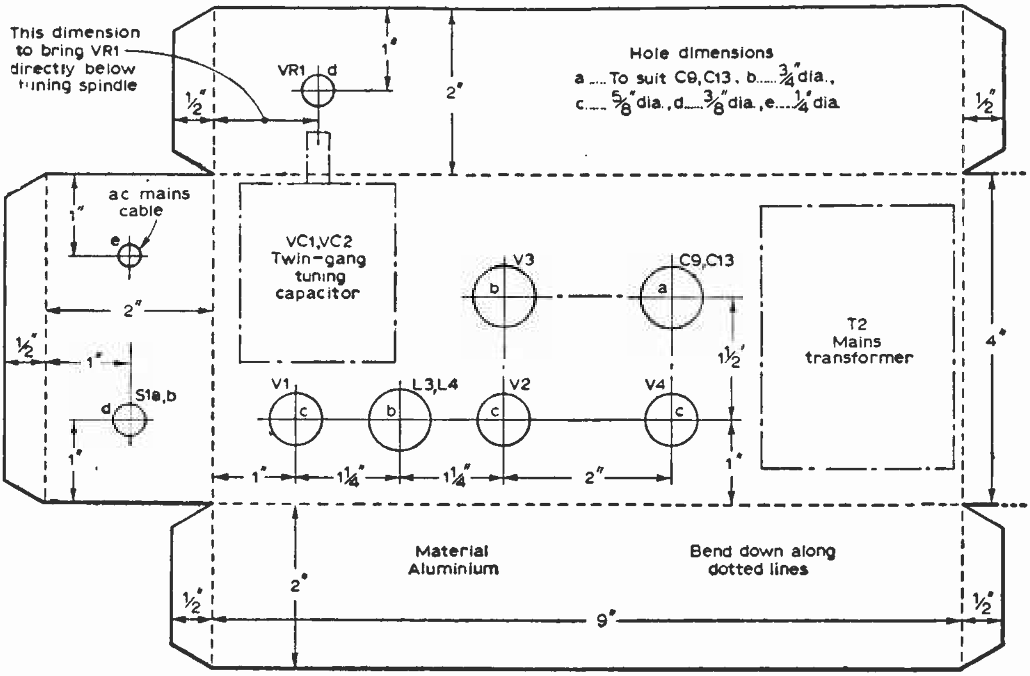


Fig. 2—The chassis drilling details.

(Continued from page 742)

under 2A at 6·3V. The use of a double wound mains transformer to supply this makes the chassis safe to handle at all times and considerably reduces mains-borne interference.

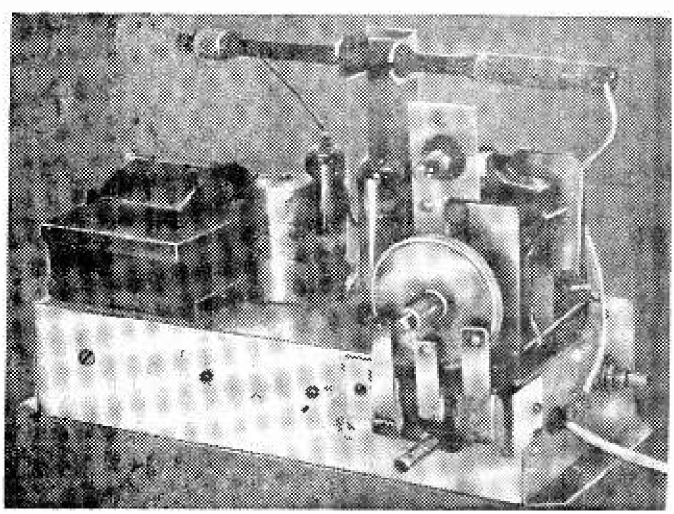
It is convenient to have a separate 6·3V winding to supply the heater of V4 so that there is not a large potential difference between its heater and cathode, but if only one winding is available, it is quite in order to include V4 heater with the others. If this is done, the winding should be rated at not less than 2·5A and *it is most important to omit the connection between pins 4 and 7 of the rectifier.* (See Fig. 1.)

Smoothing is provided by R16 in conjunction with the electrolytic capacitors C17 and C18, while R10 and C13 provide a little extra for the anode of V3a. The value of R16 may need adjustment in some cases to produce the correct H.T. line voltage. The mains switch is incorporated with VR1.

Construction

The receiver is constructed on a chassis of 18s.w.g. aluminium sheet, 9in. x 4in. x 2in., details of which are given in Fig. 2. The layout is not critical. The grid circuit of V1 which includes the aerial, is the point where instability is most easily introduced and care must be taken that it is not capacitively coupled to any of the later wiring. V1 and V2 must be screened.

The trimmers TC1 and TC2 are mounted on top of the tuning capacitor, and if in this position they can "see" each other, a small screen should be erected between them. The pilot light is also



The complete receiver, less its cabinet

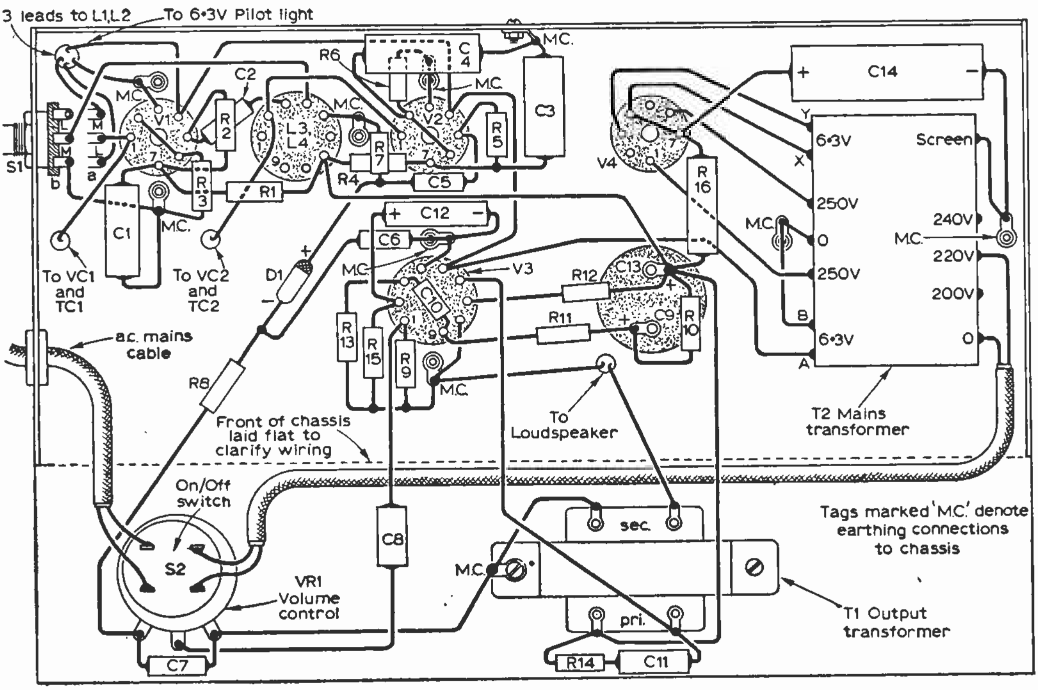


Fig. 3.—The underchassis wiring diagram.

mounted on top of the gang and to achieve a symmetrical appearance in the finished receiver, should be positioned so that its height above the tuning spindle is equal to the distance between that spindle and the spindle of VR1 below.

(To be continued)

LIST OF COMPONENTS

Resistors

(20%, $\frac{1}{2}$W carbon unless otherwise stated):

R1	1kΩ	R9	10MΩ
R2	4·7kΩ	R10	39kΩ
R3	150Ω	R11	220kΩ
R4	1kΩ	R12	3·9kΩ
R5	4·7kΩ	R13	470kΩ
R6	150Ω	R14	4·7kΩ
R7	47kΩ	R15	470Ω, 1W
R8	47kΩ	R16	1kΩ, 1W

VR1 500kΩ carbon potentiometer with switch (S2)

Capacitors:

- C1 0·1μF paper 350V
- C2 470pF ceramic or mica
- C3 0·1μF ceramic or mica
- C4 0·1μF ceramic or mica
- C5 470pF ceramic or mica
- C6 220pF ceramic or mica
- C7 220pF ceramic or mica
- C8 0·01μF paper 350V
- C9 8μF electrolytic 350V
- C10 0·01μF paper 350V
- C11 5,000pF paper 350V
- C12 50μF electrolytic 25V
- C13 16μF electrolytic 350V
- C14 16μF electrolytic 350V

VC1 500pF, VC2 500pF } twin-gang air variable tuner
TC1 100pF trimmer
TC2 100pF trimmer

Valves:

V1	EF91	V3	ECL82
V2	EF91	V4	6X4

Diode:

GEX34 or similar

Pilot lamp:

LP1 6·3V 0·3A

Transformers:

T1 Output 45 : 1
T2 Mains Tapped Primary. Secondaries: 250-0-250V 60-70mA; 6·3V 2A; 6·3V 1A

Loudspeaker:

LS 3Ω; 7 x 4in. elliptical

Switches:

S1 2-pole, 3-way
S2 D.P.S.T. (see VR1)

Coils:

L1, L2 Ferrite rod aerial, type FRA.2
L3, L4 Miniature dual range, iron dust cored

Miscellaneous:

Three B7G valveholders, one B9A valveholder. Screening cans for V1 and V2. Material for chassis.

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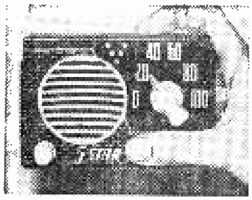

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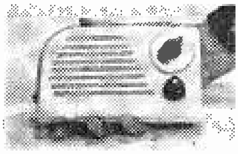
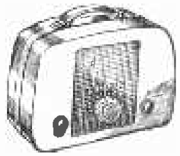
Build this newly-designed **"MINUETTE" 4-STAGE** transistor set in very strong ready drilled **ULTRA-MODERN CASE,** size only 6 x 3½ x 1in. Uses three transistors and diode and **SELF-CONTAINED LOUDSPEAKER.** Very sensitive, ideal for office, bedroom, holidays, etc. Months and months of listening off 1/2 battery. Can be built **FOR ONLY 39/6,** including **PROPER CASE,** miniature speaker, etc. **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS** etc., plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.





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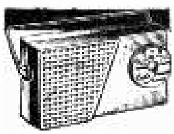

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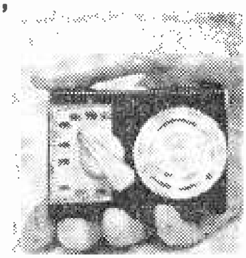
This is a pocket 2-stage transistor set not much larger than a matchbox. Excellent clear reception covering all medium waves, works for months off a tiny 1½ or 3 volt battery costing only 8d. Easy to build and an excellent introduction to transistor circuitry. Everything can be supplied down to the last nut and bolt incl. **SIMPLE PICTORIAL STEP-BY-STEP PLANS FOR ONLY 19/6,** plus post and packing 1/6. (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



BIG PROFITS FOR YOU IF YOU BUY NOW! Made to retail at 7 gns. you can now buy this famous Twin-gong Alarm for **only 37/6**—but only if you act now . . . **stocks are strictly limited. Easily installed** and operated. Switches on or off at any time. Fantastic **FINAL** reduction to clear (minimum order of 3) Carr. Free. **37/6** Free literature sent with each alarm.

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AUTOMATIC CIGARETTE LIGHTER instantly provides ready lit cigarette, without the driver taking his eyes from the road. Heavily chromium plated case holds 10. Easily and simply fitted to any car's dashboard. Works off 6 or 12 volts. Retail Price 44/9. **Special Clearance offer only 12/6** each. sold in minimum lots of 6. Carriage free.

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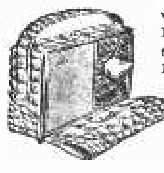

This **All Transistor Speaker Radio—The "San Remo" 6 Star** covers all medium waves including "Home," "Light," etc. Reliable and lightweight—Slips easily into the Pocket or Handbag—size only 4¼ x 2¾ x 1¼in.! **Works for Months on 1/2 Battery!** Ideal for holidays, Camping, Bedroom, etc. **Anyone can assemble** it in an hour or two with our simple-as-ABC PLAN! **Complete set of** parts including miniature speaker— everything—only 29/6, plus 2/6 P. & P. (C.O.D. 2/- extra.) Parts can be bought separately.

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CONCORD ELECTRONICS

(DEPT. 14/9) 210 CHURCH ROAD, HOVE, SUSSEX

THE BERKELEY

(Continued from page 695)

method is applicable when using "Croid" joinery glue which does enable a slight adjustment to be made before setting. Impact adhesives are extremely powerful, but a great deal of accuracy is then needed when placing the sections together.

Loudspeaker Apertures

Cut out the two loudspeaker apertures in the front panel and drill the holes for the fixing screws. For the main unit, drill four 5/16in. diameter holes equally spaced on a 13in. diameter. The positions of the H.F. tweeter fixing screws are indicated on the Blueprint and a No. 10 drill (2BA clearance) should be used here. All screw holes should be countersunk on the outer surface of the panel, and enlarged on the inner surface to accommodate a box spanner; the locking nut must be flush with the panel surface, or slightly recessed, when the screw is locked in position as indicated in the inset on Fig. 1.

The removable inspection panel on one side has a ¾in. rabbet all round. The top and bottom of the opening to take this panel will need a wood fillet glued and pinned on to make up a deficiency of ½in. The panel is held in place by a series of ¾in. x No. 8 csk. screws. Provided the edges of the cover fit the opening closely it should be necessary to insert a layer of felt only on the flat of the rabbet.

The base plinth is quite simply made from 1in. x 2in. batten, screwed and glued to the cabinet as shown (see section C/C on Blueprint), the corners being mitred and pinned. A few glue blocks on the inside can be applied.

Glue a thicknessing piece to the insides of the top and bottom front edges to give a ¾in. finish, which is afterwards veneering in conjunction with the top.

Clean up all the cabinet edges and fill in screw holes with plastic filler.

The top and bottom edges can now be veneered with the material selected. The edges should be carried right round the cabinet and form a slight projection to mask the edges of the "Vinyl" or "Fablon" covering on the sides. Should this method be adopted a slight adjustment is required to the inspection cover, which will be half an inch less in length.

Paint the whole of the interior and front, which will be covered by loudspeaker fabric, with flat black undercoating. Unless the front is treated in this way the loudspeaker apertures will be discernible through the fabric.

Fit the loudspeaker screws and secure with nuts as indicated in the inset on Fig. 1. The screws should be countersunk type and 1¼in. long. Use ¼in. diameter screws for the main unit, and 2BA screws for the tweeter.

Make up the beading as shown in section A/A and B/B on the Blueprint. The vertical lengths are rebated to cover the edges of the side members, but the horizontal length may be left solid.

Now stain and polish, if veneered, the top, edges and beads. The plinth looks well if ebonised.

All that remains now is to cover the sides with "Fablon" or similar material, wrapping this round the front edges, and then to apply the loudspeaker fabric. This material is glued around the edges only, to a depth of 3in. When it is set apply the beads and finish off the wooden surfaces with a final coat of polish.

A suitable loudspeaker covering is the synthetic material sold under the trade name of "Tygan", and is available in many patterns and shades. To obtain a taut surface, the "Tygan" should be shrunk by applying heat for a few seconds. This is most conveniently performed by holding an electric fire in front of the cabinet, about six inches away from the material. Watch carefully for signs of contraction, then immediately remove the fire.

Allow 24 hours for the glue to harden before carrying out this heat treatment. ■

THE LUXEMBOURG TUNER

(Continued from page 717)

another set is available (a transistor portable is ideal) is to tune the second set exactly to Luxembourg and then to beat the signal generator into it until it is precisely the same.

Without altering the signal generator setting go right through the alignment procedure detailed above and the tuner will then be spot on tune to the "Station of the Stars". It is suggested that during the alignment it is advisable to put a shorting link between the junction of C2 and C3 and chassis in order to cut out the AVC, otherwise this can make exact adjustments rather difficult. Do not forget to remove this link afterwards otherwise the AVC will be ineffective.

Alignment without Signal Generator

If you are having to tune up without a generator it will probably take a little longer as there must be a little trial and error adjustment to start with. If a really good aerial is available then this can be connected first to pin 1 of V2 and T3 adjusted until Luxembourg is heard, do not worry if it is not full strength or if other stations are butting in. Now transfer the aerial to pin 1 of V1 and adjust T2 and the station should emerge at full strength and with careful adjustment the unwanted stations can be eliminated.

Whichever method of alignment is used the final adjustment should always be made on the station itself with the tuner connected up to the actual aerial it is intended to use as this can have quite a marked effect on the tuning position of the two cores in T1.

Although the writer did not carry out experiments with other types of valve as more than enough signal was always available it is interesting to note that the EF91 valve which has considerably more gain has exactly the same base and connections and could possibly be substituted if desired although since this is not variable-μ the AVC circuit would not be effective. ■

Letters to the Editor

HI-FI FANATIC

SIR,—I recently visited a home of an acquaintance of mine who has a fine collection of classical L.P. records and an elaborate hi-fi system, consisting of a separate amplifier, pre-amplifier, record player and loudspeakers. I'm not a great fan of the classics myself, but as he was so enthusiastic in explaining his equipment, I thought it only polite to ask to hear one of his records. This I did and it was obvious that he was delighted. He then told me to choose a record from his collection.

Simple enough, I thought, but it was at this point that I made my big mistake. In my enthusiasm to get the ordeal over with, I had taken both the inner and outer covers of the record off and was turning it over in my hands to choose the side I wanted, before my friend could stop me. The first I knew of my mistake was when my friend grabbed the record from me and started to inspect it closely for any marks or scratches. After a moment or so, it began to dawn on me what I had done. In my innocence I had placed my fingers over the groove!

After many apologies from me and reprimands from my friend, he agreed to go on with the performance. Inside another 20 minutes he had finished making adjustments to the pick-up arm, the tone controls, the loudspeaker positions, cleaning the stylus etc, and then, and only then, could we hear the record.

I have heard about these record fanatics but I never before really believed that anyone could be so concerned about the welfare of something costing only 30s. to £2, and I count myself lucky to be able to listen to my cheap record player without worrying about how much dust is collecting under the stylus. — D. R. DAVENPORT (Doncaster).

ELECTRONIC GAMES

SIR,—You recently asked to hear from readers who have had experience of electronic games. I have designed such a game recently which is played to test a person's ability to recognise aircraft. The unit will be on show at the Schoolboy's Exhibition at Olympia on the Royal Air Force stand.

It consists of 18 transparencies of different aircraft and parts of aircraft which flash on individually for time periods varying from five to twenty seconds (this was achieved by using a modified P.W. circuit). On the control panel there are 18 buttons with 18 captions by the side of them, and a scoreboard registering the number of aircraft the player has recognised correctly.

The operator gets a visual warning to tell him how long he has before the sequence begins.

The master timing circuit operates a uniselector having 25 circuits, out of which 18 are used for the selection of the transparencies. The other seven are used to return the score to zero, to operate a warning as to the time left before the sequence starts and also to tell the player whether he is average, good or excellent at recognising aircraft.

In this unit, I used 59 relays, 58 of which were normal GPO type 3,000 and the other was a high-speed, dual coil type. Twenty-eight of the 58 ordinary relays were needed in order that the score could operate automatically. Eighteen were used for the transparencies, and the others used for a bell and several "anti-fiddle" circuits.—CPL. EDWARDS (R.A.F. Hendon).

RECEPTION ON THE CONTINENT

SIR,—Early next year I am taking my holiday in France and I was wondering what success I could expect of receiving British programmes on my car radio. This year, when I stayed at a hotel in France, I greatly missed hearing the Home and Light programmes, as the hotel's radio was always tuned to Continental stations. I wonder if any of your readers could tell me what the quality of reception would be.—A. A. CHILTON (Cardiff).

R.1481 RECEIVER

SIR,—I have recently been given an old R.1481 receiver and would very much like to receive any details on the power supply and circuit of this set, from any reader who owns one.—C. SHINGSLEY (Burgess Hill, Sussex).

CORRECTIONS

THE TUDOR BATTERY SUPERHET. The 2-gang tuning capacitor VC1, VC2, should be Jackson type 02, not "type L" as stated in the Components List on page 437 of the September issue.

THE STRAND AMPLIFIER. There is a wiring error on the Blueprint enclosed in the October issue. The heater wire of V2 (ECC83) as shown in Figs. 1a and 2 must be amended as follows: Connect together pins 4 and 5. Connect the 6·3V supply to pin 4 (or 5) and to pin 9.

Also note that in Fig. 2 pins 2 and 7 of V1 should be shown connected to the valveholder spigot, as described in the article on page 507.

THE TROUBADOUR. Transistor types should read: Tr1 OC44; Tr2 OC45; Tr3 OC45, and not as given in Fig. 1 and in the Components List of the Blueprint (June 1962 issue).

THE P.W. SIGNAL GENERATOR. The following amendment should be made to the Components List on the Blueprint (October 1962 issue): L4 QHF8, L5 QHF9.

Club News

REPORTS OF CURRENT ACTIVITIES

AMATEUR RADIO SOCIETY OF CHESHAM AND DISTRICT

Hon. Sec.: Capt. C. G. Stephenson, G3CLJ/T, 21 Lynton Road, Chesham, Buckinghamshire.

At the moment, many of the society's members are spending their time improving their headquarters. However, morse and practical classes continue to be held each Tuesday, and on Fridays, RAE lectures are given.

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec.: C. Godsmark, G3IWL, 211 Manwood Road, London, S.E.4.

At the society's recent AGM, W. Martin was elected chairman, C. Godsmark secretary and N. Moore treasurer.

On October 5th, G3HWG gave a lecture on "Oscilloscopes" and also demonstrated some of their uses.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.

A surplus sale was held on the first meeting in October and on 10th, "Technical Forum" was the topic for the evening.

On October 17th members enjoyed a film show and on November 3rd a number of members visited the R.S.G.B.'s exhibition in London.

DUDLEY AMATEUR RADIO CLUB

Hon. Sec.: D. H. W. Pratt, G3MHS, 23 Kent Street, Upper Gornal, Dudley, Worcestershire.

The Annual General Meeting of this Club was held on October 12th. On 26th of the same month members attended a demonstration and talk by the Wolverhampton Model Radio Control Society.

LOTHIANS RADIO SOCIETY

Hon. Sec.: G. Ritchie, c/o Cormie, 15 Rosslyn Terrace, Edinburgh 6.

"Monkey Glands for the HRO" was the title of the talk given on October 11th by GM3PQU, who also gave a demonstration of TVI proofing. Visitors from the South Lanark, Fife and Falkirk groups who attended the meeting on October 25th, were entertained with a film show.

Future Events:

November 8th—"Some Aspects of Transistors" by Dr. C. Davidson.

November 22nd—A surplus sale.

MITCHAM AND DISTRICT RADIO SOCIETY

Hon. Sec.: M. Pharaoh, G3LCH, 1 Madeira Road, Mitcham.

A talk on R.F. heating and its uses was given by B. Ayrlwood at the meeting on October 5th and at the following meeting on 19th, VQ4EV presented a film show.

Future Event:

November 16th—"Why be Afraid of Transistors?" by G8TB.

MELTON MOWBRAY AMATEUR RADIO SOCIETY

Hon. Soc.: D. W. Lilet, G3FDF, 23 Melton Road, Asfordby Hill, Melton Mowbray, Leicestershire.

At the meeting on October 18th members listened to a recorded lecture on transmitter design and TVI by N. Shires.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY

Hon. Sec.: A. Bobinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

Members operated a station during this year's Scout Jamboree on the Air, under the call-sign G3MVH. On October 23rd, members travelled to Bradford to attend the film show given at St. George's Hall.

For the first meeting in November, G3FQH gave a lecture on single side band.

SHEFFIELD AMATEUR RADIO CLUB

Hon. Sec.: D. R. A. Hill, 16 Tylney Road, Sheffield 2, Yorkshire.

The energy of many members at the moment is being expended on the task of furnishing the club's headquarters. The all-band transmitter and aerials also claim important places in the club's present programme.

In spite of all this work, many members are continuing to attend both the technical and general meetings and the novices classes are carrying on successfully with morse classes held on alternate Wednesdays.

SLADE RADIO SOCIETY

Hon. Sec.: C. N. Smart, 110 Woolmore Road, Erdington, Birmingham 23.

On October 19th, the club secretary gave a comprehensive lecture on a new transistorised D.F. receiver, and on 31st of that month members attended the Annual Dinner.

SPEN VALLEY AMATEUR RADIO SOCIETY

Hon. Sec.: L. A. Metcalfe, 1A Moorlands Road, Birkenshaw, Bradford, Yorkshire.

October proved to be a busy month for this society, starting with a talk called "Language of S.S.B." on 4th. A lecture called "Noise Problems" was given on 18th and later in the month members attended a film show.

The first meeting in November was devoted to "Tape Recorders".

STRATFORD-UPON-AVON AND DISTRICT AMATEUR RADIO CLUB

Hon. Sec.: P. Robinson, G3MGJ, 43 Loxley Road, Stratford-upon-Avon, Warwickshire.

To meet the May 1963 R.A.E., a series of lectures has been started dealing with radio theory.

The lectures for the two last meetings have been given by John Hewitt, G3MDU, and his subjects included alternating current and voltage, alternating current with inductance, etc.

Future Event:

November 9th—Coupled circuits, acceptors and rejector circuits, by M. Webb.

ABSORPTION WATTMETER

(Continued from page 719)

tiometer, but a reversing switch *must* be included and a reading obtained with the voltage applied to the wattmeter both "forward and reverse". The average of these is the "correct" meter reading. (This procedure takes account of differences in diode forward resistance.)

The voltage developed across 3 and 15Ω resistors for the 5 and 20W ranges have been calculated and are given in Table 1. The first step in the calibration process is to set the variable resistor controlling linearity (VR5). Having adjusted VR5 for zero resistance, set the D.C. voltage applied to the wattmeter to 8.66 volts. Switch the wattmeter to measure 5W at 15Ω and adjust VR3 until the meter reads full scale. Then reduce the D.C. voltage to 7.75 volts and note wattmeter reading, and so on down column 5 of Table 1. When the linearity control is correctly adjusted, the results obtained should be similar to those given in Table 2. If the readings obtained are lower than these, set RV5 (linearity) to its mid-position and re-adjust RV3. Repeat the comparison of meter readings and applied voltage.

If the readings are still low then RV5 must be further increased, whilst if the readings are high, RV5 must be reduced in value. This procedure may sound complex but in practice it takes but about 10 minutes.

When the linearity control has been set, the table of applied voltage against meter reading should be put to one side as this is required for absolute calibration of the meter. This may be done by drawing a calibration curve or alternatively, the scale can be removed from the meter and re-calibrated by hand. This latter method is preferable, but can result in a very "messy" looking job if great care is not taken.

Table 2

Voltage	Meter Reading
8·66	1
7·75	0·81
6·7	0·61
5·5	0·40
3·87	0·19
2·74	0·09
0	0

Table 3

7·5Ω			
Voltage	Power	Voltage	Power
6·12	5	12·25	20
5·5	4	10·95	16
4·74	3	9·5	12
3·87	2	7·75	8
2·74	1	5·48	4
1·94	0·5	3·87	2

COMPONENTS LIST

R1	3Ω	See text for power rating
R1A	47Ω	See text for power rating
R2	15Ω	See text for power rating
R3	150Ω	20%, ¼W carbon
R4	330Ω	20%, ¼W carbon
R5	330Ω	20%, ¼W carbon
R6	820Ω	20%, ¼W carbon
VR1—4	100Ω wire-wound potentiometers	
VR5	250Ω wire-wound potentiometer	
MR1—4	OA70 (Mullard)	
M1	Meter, moving coil, 0—1 mA f.s.d.	
SW1	Switch 3-pole, 2-way	
SW2	Switch 4-pole, 2-way	

The only job remaining now is to set the remaining range potentiometers as follows:

1 Set the meter to measure 5W at 3Ω, apply a voltage of 3.87 volts and adjust RV1 for full scale deflection.

2 Set the meter to measure 20W at 3Ω, apply a voltage of 7.75 volts and adjust RV2 for full scale deflection.

3 Set the meter to measure 20W at 15Ω, apply a voltage of 17.32 volts and adjust RV4 for full scale deflection.

The lead to SW1A should now be reconnected and the wattmeter is completed.

Additional Ranges

If additional or alternative ranges are required it is quite simple to add or substitute these. In Table 3 are given voltages appropriate to 5 and 20W ranges for 7·5Ω load. ■

FRIDAY, FEBRUARY 1st, 1963

A FILM SHOW

(In collaboration with Mullard Ltd.)

CAXTON HALL, WESTMINSTER

at 7-30 p.m.

Send for your free tickets now marking your envelope "Caxton Hall" in the top left-hand corner and enclosing a stamped addressed envelope (at least 3½in. x 6in.) for the tickets.

The films to be shown will include "Fuel for the Future" and "The Electroneers", and as in previous years, the programme has been arranged to appeal to all who are interested in radio.

The demand for tickets will be great; order yours NOW

Questions and answers for budding engineers

Q. What age should I be for this advertisement to concern me?

A. Around 16 to 19 if you want to join Electricity Supply from school. If you're an engineering graduate, or diploma-holder, you'll probably be in your early twenties. (Older, if you're a parent or teacher!)

Q. Where can I find an engineering career offering me plenty of scope?

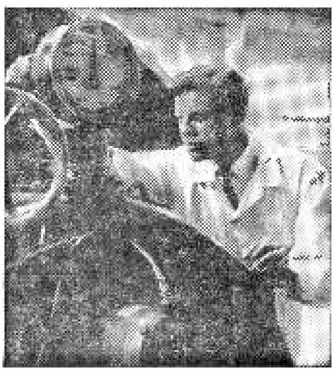
A. Electricity Supply offers *dozens* of good jobs. Few individual firms can hope to match the variety you'll find in the Electricity Supply industry.

Q. What is Electricity Supply?

A. It's the national industry responsible for generating electricity, transmitting it, distributing it throughout the country and advising how it can be used.

Q. What qualifications must I have?

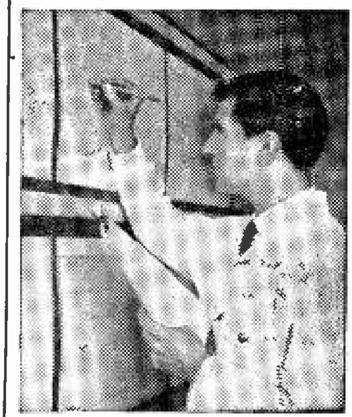
A. School-leavers need either a good Ordinary level G.C.E. including Maths, English, and a Science subject; or two Advanced level passes in Maths and Physics. Graduates need a British degree in electrical or mechanical engineering. Or you need an engineering diploma. You can apply in your last year at school or college — preferably in the January-March period before you take your final exams.



Q. What sort of training do I get?

A. For school-leavers, there's a 5-year apprenticeship. It consists of planned practical experience in the various departments, accompanied, for 'O' level entrants, by day release to a technical college and, for 'A' level recruits, by a 'sandwich' course, both leading to engineering qualifications.

Graduate trainees have a 2-year practical training in one of the main sections of the industry. The training of diploma-holders is planned to take into account past practical experience.



Q. Where do I go from here?

A. It's impossible to tell you here all about an industry that has to *double* its output every ten years. But jobs include everything from running a Power Station to bringing power to a new estate. For full details, write (giving age and exams you've passed) to: The Education and Training Officer, The Electricity Council, 155 Winsley Street, London, W.1.

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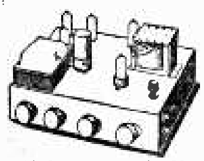

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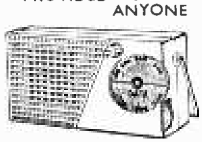

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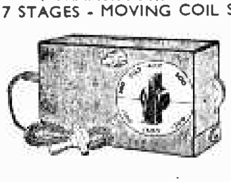

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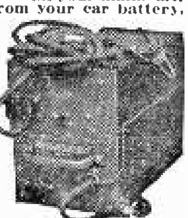

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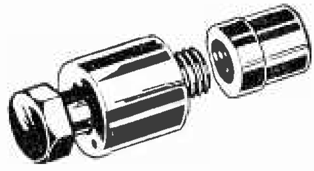

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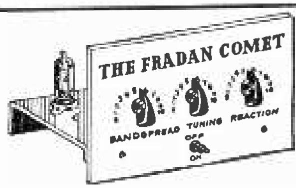

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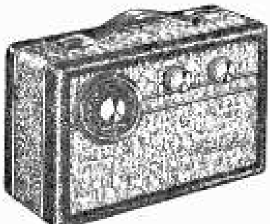

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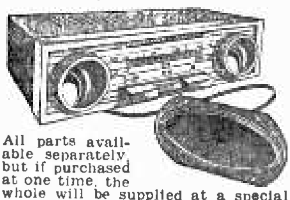

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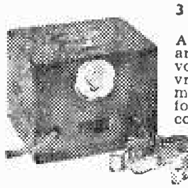

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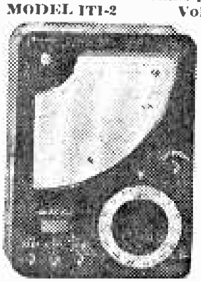

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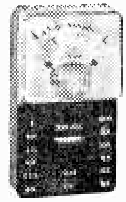

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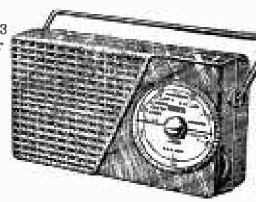

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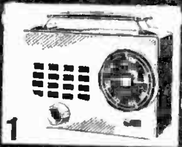
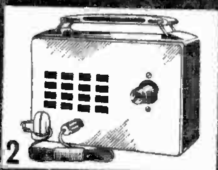
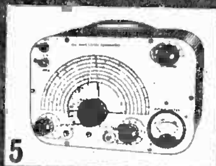
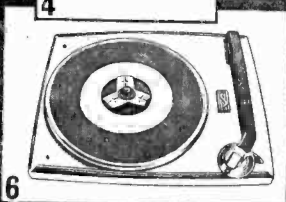
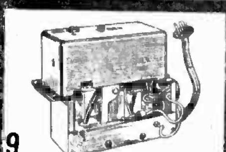
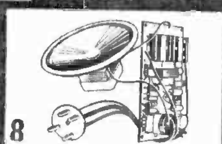


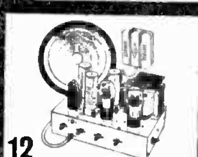


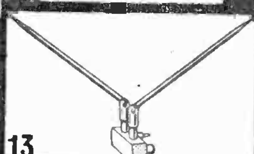


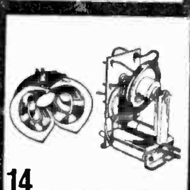












1. **SUPER 5 TRANSISTOR POCKET RADIO INCORPORATING PRINTED CIRCUIT & MINI-EARPIECE.** No Aerial or Earth required 4¾ x 3¼ x 1¼in. Output 200 M.W. 5 first quality transistors. High flux moving coil speaker. M/L Internal high gain ferrox aerial. £2.19.6. P. & P. 3/6. Circuit diagram 1/6, free with parts. All parts available separately.
2. **TRANSISTORISED POCKET RADIO** with printed circuit, mini-earpiece, high gain ferrox slab aerial. No aerial or earth required. To build yourself for completely personal listening. 4¾ x 3¼ x 1¼in. Luxembourg in favourable areas. Only 21/-. P. & P. 2/6. All parts available separately.
3. **A.C./D.C. POCKET MULTI-METER KIT.** 2in. moving coil meter, scale, calibrated in A.C./D.C. volts, ohms and milliamps. Voltage range A.C./D.C. 0-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms ranges 0-10,000, 0-100,000, 24/6. P. & P. 2/-. Wiring diagrams 1/-, free with parts.
4. **SIGNAL GENERATORS.** Cash £7.5.0, or 30/- deposit and 6 monthly payments of 21/6. P. & P. 5/6. Coverage 100 kc/s to 100 Mc/s on fundamentals and 100 Mc/s to 200 Mc/s on harmonics. Case 10 x 6½ x 5¼in. Three miniature valves and Metal Rectifier. A.C. mains 200/250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent. Modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output. Magic eye as output indicator. Accuracy ± 2 per cent.
5. **SIGNAL GENERATORS.** Cash £5.5.0. P. & P. 5/6. Coverage 120 kc/s to 84 Mc/s. Case 10 x 6½ x 4½in. Size of scale 6½ x 3½in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent, modulated or unmodulated R.F. output continuously variable 100 millivolts. C.W. and mod. switch variable A.F. output and moving coil output meter. Accuracy ± 2 per cent.
6. **STAAR 45. 9 v. BATTERY RECORD PLAYER complete with pick-up and deck.** A completely portable player. Head protected by plastic dome with a brush which cleans the stylus as it rises into playing position. 45 r.p.m. Auto on/off switch governed motor, attractive two tone grey finish, £2.14.6. P. & P. 2/-.
7. **CARRYING CASE for STAAR 45 or COMPLETE KIT** beautifully styled in two tone with record compartment. Specially designed to take player and amplifier. Just screw in and connect up. All parts available separately. Case only 22/6. P. & P. 4/-. **Complete kit £5.10.0.** P. & P. 5/-.
8. **TRANSISTORISED AMPLIFIER, suitable STAAR 45.** Output 1 watt. Size 4½ x 2¾in. Printed circuit, tone/volume controls plus 4 transistors. Push-pull output complete with 3in. moving coil speaker. Built and tested, 49/6. P. & P. 2/-.
9. **CHANNEL TUNER I.F.** 16-19 Mc/s. Continuously tunable from 174-216 Mc/s. Valves required—PCF80 and PCC84 (in series). Cover BBC and ITA ranges. Also Police, Fire and Taxis, etc. Brand new by famous maker, 10/-. P. & P. 3/-.
10. **B.S.R. MONARCH UAS WITH FUL-FI HEAD.** 4-speed, plays 10 records, 12in., 10in. or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in. and 12in. records of the same speed. Has manual play position: colour brown. Dimensions: 12½ x 10¾in. Space required above baseboard 4¾in. below baseboard 2¾in. Fitted with Ful-Fi turnover crystal head, £6.19.6. P. & P. 5/6.
11. **PUSH-PULL OUTPUT STAGE** inclusive of transistors with input and output transformers to match 3 ohms speech coil, suitable for use with the POCKET RADIO. Kit of parts, including transistors, 19/6. P. & P. 2/-. Wiring diagram 1/6, free with parts.
12. **8-watt PUSH-PULL 4 VALVE AMPLIFIER plus METAL RECTIFIER.** A.C. mains 200-250 v. Size 10½ x 6½ x 2¼in. 5 valves. For use with all makes and types of pick-up and mike. Negative feed back. Two input, mike and gram, and controls for same. Separate controls for Bass and Treble lift. Response flat from 40 cycles to 15 kc/s. 2 db down to 20 kc/s. Output 8 watts at 5 per cent total distortion. Noise level 40 db down all hum. Output transformer tapped for 3 and 15 ohms speech coils. For use with Std. or L.P. records, musical instruments such as guitars, etc. Suitable for small halls, £3.19.6. P. & P. 6/-. **Crystal mike to suit, 15/-.** P. & P. 2/-. **8in. P.M. Speaker to suit, 12/6.** P. & P. 2/-.
13. **INDOOR AERIAL for ITV/BBC/FM.** Complete with standard co-axial plug. Heavy chrome extending dipoles—7ft. fully extended. Plugs straight into T.V. or VHF Tuner. Fully directional, 10/6. P. & P. 1/6.
14. **LINE E.H.T. TRANSFORMERS.** Built-in line width control. 14 kv. Scan coil 90in. deflection on ferrite yokes. Frame O.P. transformer pl. 18 kv smoothing condenser, suitable for 14in., 17in. or 21in. tubes. With circuit diagram, 29/6. P. & P. 4/6. Suitable Focus Magnet (state tube). 10/-. P. & P. 3/-.

RADIO & T.V. COMPONENTS [ACTON] LIMITED

21b HIGH STREET ACTON, LONDON, W.3.

ALL ENQUIRIES S.A.E.
GOODS NOT DESPATCHED OUTSIDE U.K.

TRANSISTOR SET CASE. 11¼ x 8 x 3in. with carrying handle finished in two-tone grey with gold trim, price 22/6. Set of suitable knobs, 5/- extra. **LEATHERCLOTH COVERED RECORD PLAYER CASE,** suitable for single player unit, etc. Size 14¼ x 13 x 6⅝in., supplied with uncut motor-board, carrying handle, gold trim, available in red/grey and two-tone grey. Price 44/-.
LEATHER CLOTH CASE, as above but suitable for automatic record player, size 14¾ x 14¼ x 8¼in., available in blue/grey, red/grey, price 56/-. Uncut motorboard.

Case as above, base size 15¾ x 15 x 8¼in., tapered front motorboard cut out for UA14, available lemon/black, price 63/-.

Miniature Jack plug and socket 2/6 set.
Miniature Slide Switch 2 pole change over 2/6.
Transformers LT.44/700 Driver and Output 8/- pair.
Top Quality co-axial Cable semi airspaced 6d. yard.
All Co-Axial Accessories available from stock.

PERSONAL EARPHONE

A really sensitive dynamic earphone of exceptionally fine quality. Provides clear reproduction of music as well as speech. Fully guaranteed and complete with ear insert, 3 feet cord, sub miniature plug and socket. **Model CR5** Crystal Earpiece high amp. **Model MR-4.** Magnetic earpiece low amp., 6/- each.

"PRACTICAL WIRELESS" POCKET TRANSISTOR SUPERHET

The new version in a redesigned cabinet with carrying strap.

COMPONENTS PRICE LIST

Coil Set, (Osc. and 3 I.F.s)	22/-
Driver Transformer, Type PW/DT	8/3
Output Transformer, Type PW/OT	8/-
Ferrite Rod Aerial, Type PW/FR	8/6
Printed Circuit Board	7/6
2 Gang Capacitor, Type "OO"	12/6
Volume Control, Type V.C.1545	8/-
Switch	3/6
Hardware (Screws, nuts, washers, spacers, battery clips, cable cradles, cable studs, cable strapping)	4/-
Transistors, Type YC (Set of 6) **Xtal Diode,** Type GD9	43/-
Speaker	17/10
Case	12/6
Capacitors	15/-
Resistors	5/-
Trimmers, Type MT31/4A (3 required)	3/9

CONSTRUCTION LEAFLET AND "BLOW-UP" CIRCUIT DIAGRAM.
PRICE FOR THE COMPLETE KIT £7.19.6.

LOUDSPEAKER CABINETS

Baffle type, walnut finish:—

Type suitable for an 8" unit	Price 21/-
Type suitable for a 10" unit	Price 25/6
Type suitable for a 7" x 4" unit	Price 17/6

AUTOMATIC RECORD CHANGERS

BSR UA14	£6.19.6
COLLARO C60	£7.19.6
GARRARD AUTOSLIM	£7.19.6

SINGLE PLAYERS

EMT. 4 Speed with pick-up	£3.15.0
BSR EU6	£4.19.6
GARRARD TA MKII	£8.10.0
EMI BATTERY VERSION	£5.9.6

J.B. SD/2 GANG CONDENSER

Sub Min. Solid Dilectric Size ⅞" square x 7/16" deep. Cap 192pF Aerial 78pF osc. TRIMMERS FITTED 17/6 each.

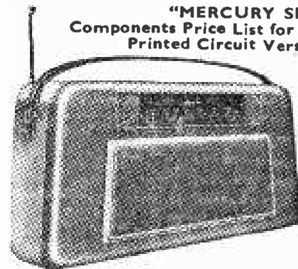
J.B. DILEMIN CONDENSER

Solid Dilectric available in 300pF or 500pF, 7/6 each.
Send for our Price Lists on Mini Amp Tutor, etc. etc.

Our new 1962/63 48-page catalogue, profusely illustrated, is now available. Please send 1/- in stamps for your copy. Trade Catalogue also available for which please attach your Business Letter Heading.

"MERCURY SIX"

Components Price List for the Printed Circuit Version



COIL SET (OSC. and 3 I.F.s)	22/-
DRIVER TRANSFORMER. Type PW/DT	8/3
OUTPUT TRANSFORMER. Type PW/OT.	8/-
FERRITE ROD AERIAL. Type PW/FR	8/6
2-GANG CAPACITOR. Type "OO"	12/6
VOLUME CONTROL, EGEN 10K. S/P/ SWITCH	6/6
SWITCH	3/6
TRANSISTOR Type Y.C. (set of six) XTAL DIODE Type GD9	43/-
SPEAKER	22/5
CASE complete with handle, front grille, studs	25/-
CAPACITORS	17/6
RESISTORS	5/-
TRIMMERS, Type MT.31/4A, 1/3 ea.	3/9
PRINTED CIRCUIT BOARD	14/6
COMPLETE DIAL ASSEMBLY (BOXED)	14/6
HARDWARE (Screws, Nuts, Washers, Spacers, Battery Clips, Aerial Cradle)	5/9
Postage and Packing	2/6
INSTRUCTION HANDBOOK	2/6

TRANSISTORS AND DIODES

Transistors	OC75 8/-	OCP71 25/-	OA73 3/-	GECS1
OC35 18/-	OC77 12/-	*Matched Prs.*	OA79 3/9	Audio 3/6
OC36 21/6	OC78 8/-	2xOC72 16/-	OA81 2/6	Red
OC44 6/-	OC81 8/-	2xOC78 16/-	OA85 3/-	Spot 3/6
OC45 6/-	OC84 8/6		OA91 3/-	White
OC70 6/6	OC170 9/6	*Diodes*	OA95 3/6	Spot 5/-
OC71 5/-	OC171 10/6	OA5 6/-		GEX34 3/-
OC72 8/-	OC201 31/-	OA10 8/-	*Sundry Types*	GEX35 3/-
OC73 16/-	OC202 26/-	OA70 3/-	PXA102 4/-	XD201 1/-

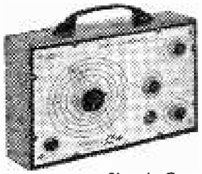
A set of Transistors comprising 1 OC44, 2 OC45, 1 OC81D, 2 OC81, 32/6 set.
Set of Audio Transistors, 1 x OC81, 2 x OC81, Driver Matched Pair, 15/6 set.

ALPHA RADIO SUPPLY CO.

103 LEEDS TERRACE
WINTOUN STREET
LEEDS 7

TERMS: Cash with Order or C.O.D. Postage and Packing Charges extra. Single valves 9d., Minimum Parcel Post charges 2/-. Please include sufficient postage with your order. Minimum C.O.D. fees and postage 3/6. These Postal Rates apply to U.K. only. For full terms of business see inside cover of catalogue. Personal shoppers 9 a.m. to 5 p.m. Mon. to Friday, Saturday 10 a.m. to 1 p.m.

TRANSISTOR PORTABLE SIGNAL GENERATOR



PRICE **£7.10.0** P.P. 2/6

A 1st class Signal Generator covering 200 Kc/s to 200 Mc/s in 8 ranges. Radio broadcasts and I.F., Amateur, VHF, Shipping, TV, etc. R.F., I.F., A.F., modulated R.F. outputs. Easy to read and use with full details. Within 2% accuracy. Size 6⅝ x 4⅝ x 2in.

12 MONTHS' GUARANTEE
Leaflet on request

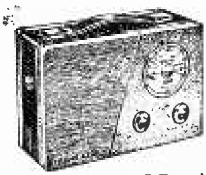
TAPE HEAD

Miniature ½ Track Record/Playback Head with Mounting Block. 850 ohm.
12/6, P.P. 9d.

TAPE RECORDER MOTOR

Miniature Motor designed for Battery Recorders, 4½ to 9 volts. Built in governor, 12/6. P.P. 1/-.

"TRANSFIVE" PORTABLE RADIO



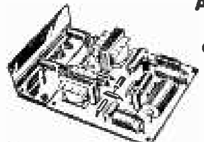
Medium and Long Wave Portable
8½ x 6½ x 3½in.
£5.19.6
P.P. 2/6

A simple to build 5-Transistor and Diode. Printed Circuit, Medium and Long Wave Portable. Features 5in. speaker, Car aerial socket. 1st grade transistors and carded components. Building plans free on request. THE IDEAL PORTABLE. **Full after sales service and guarantee.**
(See Back Cover for other types.)

VERNIER DIAL

New Miniature Slow Motion Vernier Dial, 8 to 1 reduction. Marked 0/100 Ideal for all test equipment, 14/-.

3/4 WATT 4 TRANSISTOR AMPLIFIER



- 1 watt peak output.
- ± 3db 70c/s to 12 kc/s.
- Output to 3 ohm speaker
- 9 volt operated.

Details on request.

Built and Tested	Kit of Parts
59/6 OR	**52/6**
P.P. 1/6	P.P. 1/6

A printed circuit high gain amplifier size 4 x 2¾ x ¾in. using Mullard OC71/OC81D and 2-OC81 Transistors. Ideal for Intercomm., Record Player, Tuner Amplifier or any application requiring a quality and reliable amplifier. Suitable large magnet 5-inch speaker, 15/-.

CATALOGUE
New Edition Now Ready. Three times the size, full of components and items. Send 1/- stamp for your copy.

GUITAR CONTACT MICROPHONE. High Impedance Guitar Contact Microphone with screened lead. Plugs into any valve amplifier. Very sensitive. 12/6. P.P. 9d.

TEST LEAD KIT

Complete set of test leads. Suitable for most instruments. Complete with pouch, 8/6. P.P. 1/-.

POCKET RADIO BOOSTER

Tubular unit, size 9½ x 3¼in. dia., which plugs into earphone socket of any transistor radio. Performance increase is fantastic. Ideal for home or car. 52/6. P.P. 1/6.

PERSONAL EARPHONES

★ 600 ohm. 10/6 ★ Crystal 9/6
★ 1,000 ohm. 12/6 ★ 8/10 ohm. 9/6
Fitted leads, Jack Plug and Socket.

SOLDERING IRON

Antex miniature 15 watt 220/250 volt Iron. Easily removed $\frac{3}{32}$in. bit. Ideal for all miniature work, 29/6. Spare bits, five sizes to ¼in., 3/- each.

CRYSTAL MIC. INSERTS		
	ACOS 2in.	10/6
	ACOS 1¼in.	7/6
	¾in. sq.	3/6

TYPE 38, TRANSMITTER RECEIVER

Complete with 5 valves. In new condition. These sets are sold without guarantee but are serviceable. 7.4 to 9 Mc/s. **22/6** P.P. 2/6
Headphones 7/6 pair. Junction Box 2/6. Throat Mike 4/6. Aerial Rod 2/6.

TELEPHONE ADAPTOR

★ Ideal for recording or amplifying telephone conversations. Supplied with screened cable. Fitted rubber sucker, 14/-.

MARCONI 19 SET CRYSTAL CONTROLLED CALIBRATOR

Crystal controlled oscillators giving either 10 kc/s, 100 kc/s or 1 Mc/s pips. Features neon modulator, supplied with spare valves and full handbook. **79/6** P.P. 2/-
Ideal standard frequency check.

TRANSISTOR PORTABLE TAPE RECORDER

★ **New 4-Transistor Version** ★

- Play/record up to 30 min.
- Built-in speaker, volume control, batteries and play/record/rewind.
- Quality reproduction.
- Sturdy case 6 x 8¼ x 2½in.

£9.19.6
P.P. 3/6

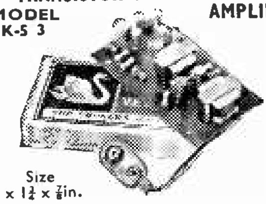
Fully Guaranteed

Supplied complete with microphone, tape, batteries and personal phone (for monitoring), and full instructions. New 4-transistor version with push-pull output, better quality, more attractive case, etc.

The Above are FULLY ASSEMBLED TESTED and GUARANTEED.

4 TRANSISTOR PUSH-PULL AUDIO AMPLIFIER

MODEL PK-5 3



Size 3 x 1½ x ⅞in.

A ready built miniature 250mW push-pull amplifier incorporating input and output transformers, 4 transistors, 9 volt battery snap cord, speaker and column connection leads. Ideal for use with record players, intercoms, hearing aids, tape recorders, etc. Complete with full instructions and circuit diagram.

PRICE **52/6** P.P. 1/6
SUITABLE 2½in. SPEAKER 16/6.

BATTERY RECORD PLAYER

- 6-7½ volt Garrard turntable with crystal pick-up. Plays 45 r.p.m. Ideal for above amplifier.

55/- P.P. 1/6.

- Suitable cabinet for amplifier and player, 17/6. P.P. 2/-.

LIGHTWEIGHT HEADPHONES

★ 2000 OHMS 12/6
★ 4000 OHMS 14/6
HIGH EFFICIENCY.

MINIATURE CLEAR FACED Brand New PANEL METERS

0–50 microamp	DC	39/6
0–500 ,,	DC	32/6
0–1 milliamp	DC	27/6
0–5 ,,	DC	27/6
0–300 volts	DC	27/6
"S" meter 1mA	... ...	35/-
"VU" meter ...	... ...	42/6

CRYSTAL MICROPHONES

ACOS 39-1. Stick Microphone with screened cable and stand (list 5 gns.), 32/6. P.P. 1/6.
ACOS 40. Desk Microphone with screened cable and built-in stand (list 50/-), 15/-. P.P. 1/6.
ACOS 45. Hand Microphone with screened lead, very sensitive, 25/-. P.P. 1/6.
100 C. Stick Microphone with muting switch and screened cable, detachable desk stand, cord and neck, 39/6. P.P. 1/6.
MC 24. Stick Microphone with muting switch and cable, 25/-. P.P. 1/6.
LAPEL. Miniature Mic. With clip. Ideal for recording, 15/-. P.P. 1/-.
BM 3. De Luxe Stick Mic., with muting switch cable, neckcord and detachable stand. Complete 52/6. P.P. 2/-.
(Illustrations of all types in our New Catalogue. 1/- post free).

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★ VALVES ★

by return of post

THE MOST COMPREHENSIVE COMPETITIVE VALVE LIST IN THE COUNTRY

10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozen). Post: 1 valve, 6d., 2-11, 1/-.

NEW LOW PRICES GUARANTEED 3 MONTHS

FREE TRANSIT INSURANCE. All valves are new or of fully guaranteed ex-Government or ex-equipment origin. Satisfaction or Money back Guarantee on Goods if returned unused within 14 days.

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1A7GT	11/-
1C5GT	9/-
1D5	8/-
1D6	9/9
1H5GT	9/9
1L4	8/3
1LD5	8/6
1LN5	4/9
1N5GT	9/9
1R5	5/6
1S4	8/-
1S5	4/6
1T4	3/6
2A3	6/6
2A7	9/6
3A4	4/9
3A5	9/-
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3Q4	7/-
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3V4	6/9
5R4GY	12/6
5T4	8/-
5U4G	4/9
5V4G	7/9
5Y3G	5/9
5Y3GT	5/9
5Y4G	11/-
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5Z4G	7/6
5Z4GT	11/-
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6AB8	7/-
6AC7	8/3
6AG5	3/-
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6AK5	5/-
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6AM6	3/-
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6AU6	7/6
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6B8G	3/-
6BA6	5/9
6BE6	5/9
6BG6G	15/-
6BH6	6/-
6BJ6	6/-
6BR7	9/6
6BW6	7/6
6BW7	5/6
6BX6	4/9
6C4	3/6
6C5	5/6
6C6	8/9
6C9	11/-
6CD6G	19/6
6CH6	7/6
6D2	3/-
6D3	9/6
6D6	4/3
6F1	4/9
6F6G	5/9
6F12	3/-
6F13	6/9
6F11	9/6
6F15	9/6
6F16	8/-
6F19	6/6
6F23	6/6
6F24	12/-
6F25	13/-
6F32	6/6
6F33	6/6
6J5	4/3
6J5G	3/-
6J5GT	4/-
6J6	4/-
6J7	8/6
6J7G	4/9
6J7GT	7/6
6J8	9/6
6K6GT	6/6
6K7	5/9
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6K8GT	8/9
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6L1	12/6
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6LD3	8/-
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6P1	7/6
6P25	8/6
6P28	12/6
6Q7G	6/-
6Q7GT	8/6
6R7G	8/6
6SA7	5/6
6SG7	4/9
6SH7	3/-
6SK7	5/-
6SL7GT	5/9
6SN7GT	4/6
6SQ7	5/9
6SS7	3/6
6U4GT	10/6
6V6G	5/-
6V6GT	6/-
6X2	7/9
6X4	5/-
6X5G	5/-
6X5GT	5/6
6Y6G	7/6
7A7	8/6
7B7	9/-
7B7	7/9
7C5	7/3
7C6	7/6
7H7	7/3
7K7	9/6
7Q7	8/6
7R7	10/6
7S7	9/-
7V7	7/9
7Y4	6/9
7Z4	7/-
8D3	3/-
10C1	11/6
10C2	14/6
10C14	8/-
10F1	5/9
10F9	10/6
10F18	10/-
10L14	7/-
10LD3	7/9
10LD11	14/6
10LD12	8/-
10P13	11/-
10P14	9/-
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12A6	1/9
12AH8	9/-
12AT6	7/6
12AT7	5/6
12AU6	9/6
12AU7	6/-
12AX7	6/6
12BA6	7/6
12BE6	7/6
12BH7	9/9
12C8	6/6
12E1	17/6
12J7GT	9/-
12K7GT	4/9
12K8	11/-
12K8GT	9/6
12Q7GT	5/-
12SA7	7/-
12SG7	5/-
12SH7	3/6
12SJ7	5/6
12SK7	4/9
12SN7GT	7/9
13D3	9/-
1487	14/9
19AQ5	7/6
19BG6	19/-
20D1	9/6
20F2	9/6
20L1	16/-
20P1	8/9
20P3	12/6
20P4	18/-
20P5	15/-
25A6G	8/-
25L6G	6/9
25L6GT	7/9
25Y5G	8/-
25Z4G	7/-
25Z5	8/-
25Z6G	8/-
30C1	7/-
30C15	11/6
30F5	6/-
30FL1	9/6
30L1	6/9
30L15	9/6
30P4	9/6
30P12	7/6
30P16	6/6
30P19	17/6
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30PL13	13/-
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35T	25/-
35W4	6/9
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35Z5GT	8/-
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50L6GT	8/6
52KU	10/6
53KU	10/6
61SPT	11/-
62BT	13/6
75	6/6
78	6/6
80	5/9
83	9/6
185BT	19/6
803	19/-
807(A)	5/6
808	7/6
813	55/-
832	14/-
866A	11/6
954	2/-
956	2/6
1265	5/9
9001	4/-
9002	4/9
ATP4	2/9
AZ31	8/-
AZ41	11/-
B36	7/9
C1C	9/6
CBL1	26/6
CBL31	21/-
CCH35	14/-
CL33	9/6
CY31	9/-
D77	3/6
D152	5/9
DA30	12/6
DAC32	9/9
DAF91	4/6
DAF96	7/3
DET19	2/9
DF33	9/9
DF91	3/6
DF96	7/3
DF97	8/6
DH63	6/-
DH76	5/-
DK32	11/-
DK91	5/6
DK92	7/-
DK96	7/3
DL33	8/-
DL35	9/-
DL63	6/-
DL75	6/-
DL82	9/-
DL91	8/-
DL92	6/-
DL94	6/9
DL96	7/3
EABC80	6/9
EAC91	8/6
EAF42	8/-
EB41	7/-
EB91	3/-
EBC33	4/9
EBC41	8/-
EBC81	7/9
EBF80	7/9
EBF83	9/6
EBF89	8/6
EBL21	12/6
EBL31	17/6
EC91	4/4
ECC31	7/6
ECC32	4/-
ECC33	4/6
ECC34	9/-
ECC35	6/-
ECC40	14/-
ECC81	5/6
ECC82	6/-
ECC83	6/6
ECC84	8/-
ECC85	7/9
ECC89	16/-
ECC91	4/-
ECF80	8/6
ECF82	8/6
ECH21	12/6
ECH35	7/6
ECH42	8/6
ECH81	7/9
ECH83	8/3
ECL80	7/-
ECL82	9/6
ECL83	11/7
ECL86	10/6
EF22	7/-
EF36	3/3
EF39	4/6
EF40	12/-
EF41	8/-
EF42	7/6
EF50-BR	2/-
USA	3/-
EF54	3/3
EF80	4/9
EF85	6/6
EF86	9/-
EF89	6/9
EF91	8/-
EF92	4/6
EF96	3/-
EF183	14/-
EF184	12/-
EL32	4/6
EL33	7/9
EL35	7/-
EL41	8/-
EL42	8/9
EL81	11/-
EL83	11/-
EL84	7/-
EL91	4/-
EM80	7/9
EM81	8/6
EM84	9/-
EM85	10/-
EN31	16/-
EY51	7/9
EY86	7/6
EZ35	5/6
EZ36	6/6
EZ40	6/6
EZ41	7/-
EZ80	6/-
EZ81	6/6
FW4/500	8/-
FW4/800	8/-
GT1C	7/-
GZ32	8/9
GZ34	12/6
HL41DD	8/3
HN309	19/-
HVR2	10/6
IW4/350	7/6
IW4/500	7/6
KLL32	8/6
KT32	6/9
KT33C	4/6
KT36	12/6
KT44	7/6
KT45	8/6
KT61	8/6
KT63	5/9
KT76	8/6
KTW61	5/9
KTW62	5/9
KTW63	5/9
KTZ63	5/6
L63	2/9
LN152	7/-
MU14	7/6
N37	11/-
N78	15/-
N108	16/-
N152	8/6
P41	4/6
P61	2/9
PABC80	11/6
PCC84	6/9
PCC85	8/9
PCC88	14/-
PCC89	9/-
PCC189	13/6
PCF80	7/-
PCF82	7/3
PCF84	16/-
PCF86	12/6
PCL82	7/3
PCL83	10/6
PCL84	7/6
PCL85	11/6
PCL86	12/6
PEN45	8/6
PEN46	5/-
PL33	8/3
PL36	9/6
PL38	16/6
PL81	8/6
PL82	6/6
PL83	6/6
PL84	8/-
PL820	8/6
PX4	12/6
PX25	9/6
PY31	9/-
PY32	10/-
PY80	6/9
PY81	6/6
PY82	6/-
PY83	7/-
PY88	9/9
PZ30	9/6
R18	11/-
R19	11/-
SP41	2/6
SP61	2/6
SU25	16/-
SU2150	4/6
T41	7/6
TDD4	7/6
U14	8/-
U18	8/-
U22	6/9
U24	16/-
U25	11/6
U26	9/9
U31	7/-
U33	14/-
U35	12/6
U37	26/-
U50	5/9
U52	4/9
U76	5/6
U78	5/-
U191	12/6
U281	9/6
U282	15/-
U301	15/-
U309	6/9
U329	6/9
U339	11/-
U801	19/-
UABC80	8/-
UAF42	7/9
UB41	7/9
UBC41	7/9
UBC81	9/6
UBF80	8/-
UBF89	7/6
UBL21	14/6
UCC84	14/6
UCC85	7/-
UCF80	15/-
UCH21	12/-
UCH42	7/3
UCH81	8/-
UCL82	9/9
UCL83	13/6
UF41	7/6
UF42	5/6
UF80	7/-
UF85	7/6
UF86	14/6
UF89	7/-
UL41	7/-
UL44	11/-
UL46	9/9
UL84	7/-
UM80	9/6
UR1C	8/-
UU6	12/6
UU7	9/6
UU8	17/-
UY1N	11/-
UY21	11/-
UY41	6/-
UY85	6/6
VP41	5/6
VR105	6/9
VR150	6/9
W61M	11/-
W76	4/9
W81	7/3
X61M	11/-
X63	8/6
X65	11/-
X66	11/-
X76M	11/-
X78	21/-
X79	16/6
X81M	9/-
Y63	6/3
Z63	4/9
Z66	9/6
Z152	4/9
Z719	4/9
ZD152	7/9

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HIGHEST QUALITY—COMPARE OUR PRICES

Carr. & Ins. 12/6

MOST MULLARD MAZDA, COSSOR. EMITRON, EMISCOPE, BRIMAR, FERRANTI TYPES. PROCESSED IN OUR OWN FACTORY	GUARANTEED	6 Months	12 Months	NEW TYPES
	12in.	£2. 0.0	£3. 5.0	MW 31/74 £4-0-0
	14in.	£2.10.0	£3.15.0	MW 36/24 £5-0-0
	15/17in.	£3. 5.0	£4.10.0	CRM 172 MW 43/64 £6-0-0
	21in.	£3.15.0	£5.15.0	

TUBE SNIPS

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

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4-SPEED RECORD PLAYERS. Latest Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Amazing value (pick-up only 19/-). £3.10.0. Carr. 3/-.

P.M. SPEAKERS, 3 ohm, top makes. Performance guaranteed. 6½in., 8in., 8/-, 5in. 7 x 4in., 11/-.

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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**

3 VALVE AMPLIFIERS. Kit of new parts, consisting chassis mains and output transformers, valves (P61, 6960G, 6X5G) and all components. With full instructions for making high gain amplifier with separate base and treble controls, negative feedback, etc, Truly unusual value at 29/-.

F.M. TUNER KITS. Well known make. Comprising F.M. Tuning Head, guaranteed none drift. Frequency coverage 88-100 Mc/s. OA81 balanced diode output, Magic Eye Tuning, Two I.F. Stages and discriminate, £6.9.6.

P.V.C. CONNECTING WIRE. 100 yds. 30 mil: Special Price 7/6. 200 yds. 30 mil: special price, 12/6. 25ft. Coil, 1/-, 5 Coils different colours, 4/-. Connecting flex. Prices as above.

TRANSISTORS. Red spot 3/6 ea. White Spot 4/6 ea. Yellow Spot 2/9 ea. Germanium diodes 9d. ea., 8/- doz.

TRADE SUPPLIED

CV and Industrial valves, receiver valves and components. Quantity quotations for all items advertised plus 100's more. Government departments and manufacturers supplied.

4 watt AMPLIFIERS

Further delivery of these excellent units to hand complete with amplifier 20P3 output and UU9 rectifier. Easily converted into high gain unit, complete with good quality, 8in. speaker in attractive two-tone bakelite case easily converted for guitars, record players, baby alarms, mic. amplifiers. Carr. Packing, etc. 7/6. **19/-**

As above but rebuilt into excellent amplifier with high gain preamp stage, tone control, negative feed-back, ready for immediate use, individually tested. Amazing volume and clarity easily worth £5. Our price whilst stocks last. Carr. Packing etc. 7/6. **45/-**

CONDENSERS. 25 Mixed, Electrolytic Many popular sizes. List Value £5, Our Price 10/-.

B.B.C./I.T.A. TUNERS

Famous makes complete with PCF80, PCC84 valves, 38 M/c I.F.

Fantastic value **19/-**

GET 15. G.E.C. High Power, Contact cooled, manufacture matched pr Transistor with Push-Pull Input & Output Transformers, with complete 1 watt ampl. circuit. Knock out price 29/-

NEW SPEAKER CABINETS, covered in attractive Rexine, Gold Metal front 11/-. Or complete with 7 x 4 Speaker, 19/-. P.P. 1/6.

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Miniature Ceramic and Silver Mica Condensers 3 pF to 5,000 pF. LIST VALUE OVER £5.

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All for ONLY **35/-** Post Free

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1. For PP3 or equivalent 9 volt Pocket Radio Battery. 18/6. P.P. 1/-.
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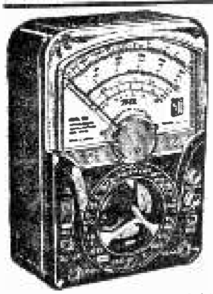
MODEL TH-L33

2,000 ohms per volt AC/DC. Size 5 x 3½ x 1½in.

75/- Fully Guaranteed with test leads, battery and instructions.

0/10/50/250/500/1000 volts D.C., 0/10/50/250/500/1000 volts A.C., 0/500µA/10/250mA, D.C.
3 ranges resistance 0/10K/100K/1 Meg. Capacity and dB ranges.



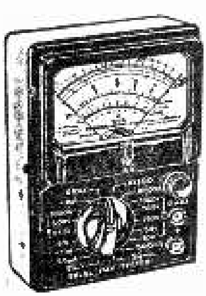
MODEL 500

30,000 ohms per volt multi-meter

£8.19.6

Fully Guaranteed

8 Ranges D.C. volts to 1 kV.
7 Ranges A.C. volts to 1 kV.
5 Ranges D.C. current to 12 amps.
3 Range resistance to 60 meg.
Short circuit, Buzz test. Output meter dB, etc., etc. Size 6½ x 4½ x 2¼in. With Leads, Batteries and Instructions.



MODEL TP5S

A.C./D.C. voltage up to 1,000 in 5 ranges. D.C. current 4 ranges up to 500mA. 4 range resistance to 10 megs. Capacity dB scales, etc. 20,000 ohms/volt Fully Guaranteed

£5.19.6

With Test Leads, Battery and Instructions. Size 5½ x 3½ x 1¾in.

AVO-8X PANCLIMATIC

Limited Quantity of these Superb Multi-testers, new conditions and fully guaranteed.

List £30 **£19.10.0** Regd. Post 5/-.

Inclusive of Batteries, Avo Test Leads and Leather Case. 20,000 ohms per V.

We stock the largest range in the Country of Transistors and Miniature Components for the home constructor. New Catalogue 1/-.

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1st GRADE FULLY GUARANTEED

XA101	5/-	XA702	17/6	XC101	6/-
XA102	6/-	XA703	25/-	XC121	6/-
XA103	4/-	*Power types*		XC131	10/-
XA104	4/-	XC141	10/-		
XB102	4/-	Pairs		(Pairs)	
XB112	4/-	12 w	22/6	XC171	10/-
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NPN types		Pairs			
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SPECIAL—Very Low Prices for Matched Sets from 29/6 to 32/6.

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MORE TYPES—LOWER PRICES

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Mullard Type MX115, 400 volts. Gamma sensitive type. 22/6. P.P. 1/6.

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COMPLETE INTERCOMM. SYSTEMS

★ 2-transistor transformer coupled, two speakers in moulded cabinets. Features 2-way Buzzer system and talking. Supplied complete with cable and batteries. **89/6** P.P. 1/6

★ 4-transistor de luxe version, with 2-way calling and talking. Moulded cabinets, long battery life—very sensitive. With cable and batteries. **£7.10.0** P.P. 2/-

STEREO PHONES

New stethoscope type stereo earphones with adjustable tubes. Fitted miniature jack plugs and leads. 2 x 8 ohms impedance, 27/6.

STEREO AMPLIFIER

4-Valve Amplifier with 2 watts output per channel to 30 ohms. Ready built, complete with Dials, Sockets and Knobs. Full tone, volume and balance controls. Crystal Input. 220/250 volt mains input. Fully Guaranteed **79/6** P.P. 2/-

PRACTICAL TRANSISTOR CIRCUITS 3/6 (Post Free)

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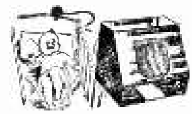

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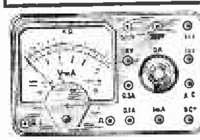
HOUSED IN ATTRACTIVE GOLD HAMMER FINISH PORTABLE CABINET. Battery operated, push-pull, 400MW output. Low impedance microphone enables unit to be used up to 200 yards. Output on quality speaker.

★ GUARANTEED for 12 MONTHS and 100% SAFE.
★ MICROPHONE is placed within 10ft. of baby; twin flex is taken to amplifier unit and placed in any room required. COMPLETELY BUILT & TESTED. P.P. 2/6. **£5.10.0**
★ Used All Night, Every Night. Battery Life 3 to 4 months.

Also Telephone Amplifier (as previously advertised). £5.10.0 P.P. 2/6



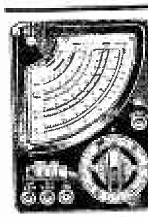
MODEL PT34

SIZE: 3⅝ x 2¾ x 1¼ in.

1,000 ohms per volt

49/6 Fully Guaranteed

0/10/50/250/500/1000 volts on A.C. and D.C.
0/1/100 mA. 0/500 mA D.C.
0/100k ohm resistance.
Complete with Leads, Battery and Instructions.



MODEL ITI-2 (200H)

20,000 ohms per volt.

£5.5.0

Size 4½ x 3¼ x 1⅛in. With Test Leads, Battery and Instructions.

6 Ranges D.C. voltage to 2½ kV.
5 Ranges A.C. voltage to 1 kV.
3 Ranges D.C. current to 250 mA.
Resistance to 6 meg.
Capacity and dB ranges.

AVO-7

Famous Multi-meter, reconditioned and fully guaranteed. Full A.C./D.C. voltage and current, resistance, dB, power, etc., etc.

Supplied with Batteries, Leads and Instructions. (Normal price £19.10.0)

£11.0.0 Regd. Post 5/-

LEATHER CASES FOR "AVO-7," 25/- extra.

ALL METERS FULLY GUARANTEED for 6 MONTHS

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 the PW Monophonic Electronic Organ and the PW Roadfarer.

The Index letters which precede the Blueprint Number indicate the periodical in which the description appeared. Thus PW refers to PRACTICAL WIRELESS; AW to *Amateur Wireless* and WM to *Wireless Magazine.*

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.

SPECIAL NOTE

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.*

Title	*Number*	*Price*
CRYSTAL SETS		
Junior Crystal Set	PW94	2/-
Dual-wave Crystal Diode	PW95	2/6
STRAIGHT SETS		
Battery Operated		
Modern One-valver	PW96	2/6
All-dry Three	PW97	3/6
Modern Two-valver	PW98	3/6
SUPERHETS		
A.C. Band-pass Three	PW99	4/-
A.C. Coronet-4	PW100	4/-
A.C. D.C. Coronet	PW101	4/-
The PW Pocket Superhet	—	5/-
MISCELLANEOUS		
The PW 3-speed Autogram	—	8/-
The PW Monophonic Electronic Organ *(No constructional details are available with this blueprint)*	—	8/-
The PW Roadfarer *(No constructional details are available with this blueprint)*	—	5/-
TELEVISION		
The PT Band III converter	—	1/6

Title	*Number*	*Price*
A.C. Fury Four	PW20	2/6
Experimenter's Short Wave	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Band-Spread Three (Battery)	PW68	2/6
Crystal Receiver	PW71	2/-
Signet Two (Battery)	PW76	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

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This coupon is available until 7th December, 1962, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, DECEMBER, 1962

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- FITTED HORIZONTAL TUNING SCALE
- WITH ALL STATIONS CLEARLY MARKED
- SUPPLIED WITH SIX MULLARD TRANSISTORS AND TWO DIODES
- FITTED RECORDING SOCKET AND CAR AERIAL SOCKET
- SUPPLIED WITH TWO-TONE BEIGE OR TWO-TONE BLUE CABINET WITH GOLD FITTINGS

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All parts sold separately

TOTAL COST £10.19.6 P.P. 3/6

The New "CONTESSA" 6-Transistor Portable Superhet Radio features simple printed circuit construction and fully illustrated building instructions, with all parts clearly marked and identified. Fitted with 8 inch Ferrite Aerial, double IFT's and the latest in components and design. Full tuning of both Medium and Long Wave Bands with unbeatable Selectivity and Sensitivity. Clearly marked station dial and room filling "MELLOWTONE" push-pull output are standard features. Performance is guaranteed to be better than any other design available to the home constructor whether used at home, out and about, or in a car.

OVERALL SIZE $10\frac{3}{4} \times 7\frac{3}{4} \times 3\frac{5}{8}$in.

FULL AFTER SALES SERVICE AND GUARANTEE

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6-TRANSISTOR SUPERHET

Size only $4\frac{1}{2} \times 2\frac{3}{4} \times 1\frac{1}{4}$in.

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The most compact 6-transistor and diode radio with speaker available to the home constructor. Features the latest in miniature components and circuitry. Supplied with Mullard transistors and two-tone moulded cabinets in red/white or blue/white with gold fittings. All components are supplied in packets and clearly identified. A printed circuit is used with fully illustrated building instructions. Push-pull output coupled with a sensitive and selective circuit make the "CAPRI" hard to beat. Fitted Earphone/Record socket. Full tuning on medium waves with long wave Light.

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★ Size only 1.9 x 1 x 1 inches!
Complete with circuit. Suitable $2\frac{1}{4}$in. Speaker, 15/-. **45/-** P.P. 1/-

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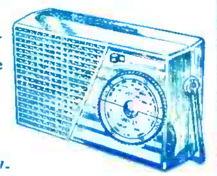
Send 1/- Stamp for new Triple Size Illustrated Catalogue

THREE PAGES of ITEMS

"QUINTET" MEDIUM AND LONG WAVE POCKET RADIO

PUSH-PULL SPEAKER OUTPUT



Size $5\frac{1}{4} \times 3 \times 1\frac{3}{4}$in.

Red or Blue with Gold trim.

Total Cost 99/6 P.P. 2/-

A Five-Transistor and Diode 7-stage medium and long wave printed circuit loudspeaker radio. Features 1st grade transistors and plainly marked printed circuit with carded components. Excellent results with full station separation guaranteed. Including Radio Luxembourg. Push-pull output up to 200 mW. Fitted 'Phone/Record socket and Car aerial socket. **Full after sales service and guarantee.**

PW-6

6-Transistor Superhet

Medium and Long Wave Radio

Size $5\frac{3}{4} \times 3\frac{3}{8} \times 2$in.

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Modified version of previously advertised "PW" Superhet. Now with new style Two-tone Cabinet. 1st grade components and transistors. Printed circuit. Features matched set of 6 Transistors. New $2\frac{1}{2}$ inch quality speaker and new illustrated building instructions.

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For "PW"-6, Mercury-6, Weyrad MW/LW and MW/SW, "PW" Regency, Alpha-3, etc.

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Three transistors
Two diodes

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Building Instructions Free

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A Three-Transistor Two-Diode Personal Radio for Medium Waves and Amateur top band and shipping. Quality output on personal phone. Fitted air spaced tuner, vol. control. No aerial or earth. Size $4\frac{3}{4} \times 3 \times 1\frac{1}{4}$in.

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