A BEGINNER'S CONSTRUCTIONAL COURSE

PRACTICAL WIRELESS

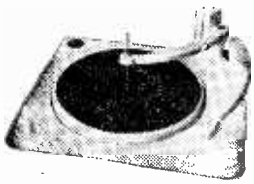
1/3

OCTOBER 1957

EDITOR: F. J. CAMM

Contents

Yours for £1.10.0 Down



Latest types by all famous makers are invariably in stock at competitive prices. BSR Monarch, Garrard, etc. Latest models from **£8.10.0**, or deposit **£1.10.0** and 8 payments of **£1** plus 5 - carriage and insurance.

Portable Cabinet 19/6

Product of a famous maker. Nicely covered with modern fabric size approx. 13¼ x 9 x 4. Complete with top board price **19/6**. carriage and ins. 3/6.

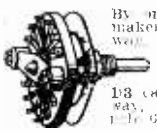
Crystal Microphone

Miniature crystal type has high gain and is suitable for all purposes—tape recorders — amplifiers. Price **4/9**, post and ins. 9d.

High Note Buzzer

A.C. operated, tone can be varied. Sale price **2/3**.

Ceramic Switches

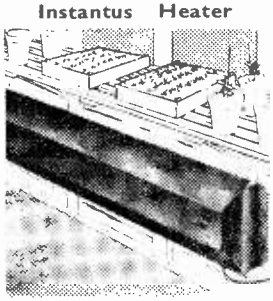


By one of our best makers. 3 pole, 3 way **2/6** each, also standard type switches 12 pole, 2 way, **1/3** each, 6 pole, 3 way, **1/3** each, 3 pole 6 way, **1/6** each.

Sapphire Needles

Unrepeatable bargain new and perfect—two types available miniature E.M.I. and standard transfers. Sale price **1** - each or **10**/- doz.

Instantus Heater



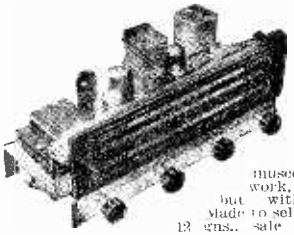
Convector heater, 1 kW. rating, 1ft. long, made from heavy gauge sheet steel (galvanised). Can be used for greenhouse, workshop, aviary, etc., etc. Price **£2.10.0** or with thermostat, **£4.5.0**, carriage 5/-.
2 KW MODEL. Free standing thermostatically controlled. **£5.17.6**. Both are guaranteed for 5 years.

Free this Month

To all "Practical Wireless" readers who send S.A.E. we will present free a copy of our booklet:

"MAKING AN ELECTRIC BLANKET"

Half Price Offer

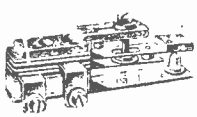


The famous Cleveland "Windsor 5" — 5 valve A.C. D.C. superhet with a particularly fine performance and appearance. New unused and ready to work, as illustrated but without knobs. Made to sell originally at 13 gns., sale price **6 gns.** (callers only). Or sent at your risk 5/- carriage.

Record Players

All fitted with 4 speed auto-changers of latest type and hi-fi pick-ups. Cabinets in latest fabrics. Special month the "Thusbury" **£17.17.0** cash or **£3** deposit and 8 monthly payments of **£2**. (Carriage and insurance 7/6.)

Thermostats

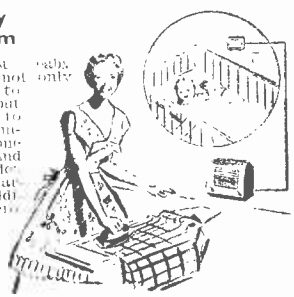


2¼in. x 1in. x 1¼in. high. Useful for the control of appliances such as convectors, thermopots, vulcanisers, hot plates, etc. Adjustable to operate over temperature range 50-550 deg. F., fitted with heavy silver contacts.
1 amp., **3/6**; 5 amp., **8/6**; 2 amp. QMB, **5/6**; 15 amp. QMB, **15** - 15 amp. wall mounting type, **19/6**.

This Month's Snip

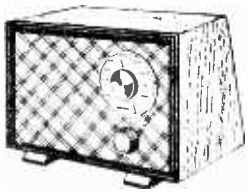
Heavy duty castors ideal for fitting to T.V. or instrument trolley. Current value 12/6 - special snip price **7/6** per set of four, plus 1 - post.

Baby Alarm



Unlike most baby alarms, this not only enables you to hear baby but also to talk to him. Price complete with one microphone and 100ft. twin flex **£6.19.6**. carriage 3/6, additional unit phone **19/6**. When Baby grows up can be used as office intercom.

OUR 19/6 COLUMN



The Skysearcher

This is a 2-valve plus-metal rectifier set useful as an educational set for beginners, also makes a fine second set for the bedroom, workshop, etc. All parts, less cabinet, chassis and speaker, **19/6**. Post & ins. 2/6. Data free with parts or available separately **1/6**. **3-valve battery version also available at the same price.**

All Mains Amplifier

Construct a powerful three-valve mains amplifier. Ideal for dances, parties, etc. Complete less chassis, cabinet and speaker (available if required). Data **1/6** (free with parts). Price **19/6** plus 2/6 post & ins.

'CHIMELITE' 19/6

It is a hall light, as well as a double chime and you can make it in a couple of evenings for the total cost of only **19/6** including instructions, post, 2/— data available separately price 1/6.

Simplex Transistor Set

Makes ideal bedroom radio, uses one transistor and and one crystal diode complete less case **19/6**. case 5/- extra, post & ins. 1/6.

A.C./D.C. Multi-Meter Kit

Measures A.C. D.C. volts, D.C. m.amps. and ohms. All the essential parts including 2½in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, and metal case, price **19/6** plus 1/9 post & ins.

Band III Converter

Suitable London Midlands—North—Scotland, etc. All the parts including 2 valves, coils, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra) **19/6**, plus 2/6 post and insurance. Data free with parts or available separately **1/6**.

GLASS PANELS

Size 10½ x 9½—parcel of five panels.

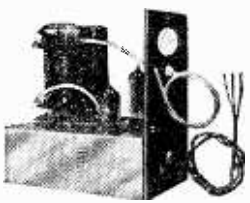
8/6

Post free.

BAND III PRE-AMP

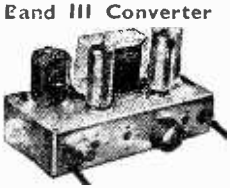
In difficult areas it will be necessary to increase the signal level and this is the ideal unit for this purpose. It is A.C. mains operated and is fitted with input and output coax. plugs. Price **£4**, post and packing 3/6.

THE ELPREQ E.H.T. GENERATOR



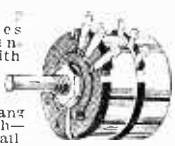
This unit contains three BVA valves. Output from 6 kV to 9 kV rectified with normal H.T. rail input but somewhat higher outputs can be obtained with higher H.T. supply. Dimensions are 6½x4½x7in. Price 69/6, post, packing, etc., 5/-.

The "ESTRONIC" Band III Converter



To-day's best value in Band III converters suitable for your TV, or money refunded. Complete ready to operate 49/6 non-mains, or 79/6 mains, post and insurance 3/6.

MORGANITE POTENTIOMETERS

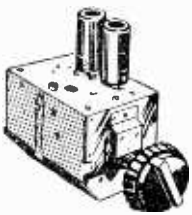


Single and gang types available, standard size with good length spindle, all new and boxed. Gang type 3/- each—values available: 5K + 5K, 100K + 100K, ½ meg. + ½ meg. Single types 1/- each, values available: 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg.

DO-IT-YOURSELF

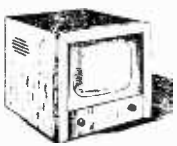
Hundreds of people have already fitted our T.V. converter and now enjoy BBC & ITA programmes—you can do the same. Our outfit contains: ITA Converter—ITA Aerial—36ft. Co-ax Down Lead—Interference Supressor—Illustrated detailed instructions - nothing else to buy, all for **£8/10 -**, carriage and insurance 4/6 or **10/- deposit and 9 monthly payments of £1.**

TURRET TUNER



Brand new stock, not surplus, with coils for Band I and III, complete with valves PCC84 and PCF80—I.F. Output 33/38 Mc/s with circuit diagram **79/6.** Knobs 3/6 extra, post and ins. 2/6.

14" T.V. CABINET



14in. T.V. cabinet of the latest styling made for one of our most famous firms—beautifully veneered and polished—limited quantity—**19/6** each. Carriage and packing 3/6 extra.

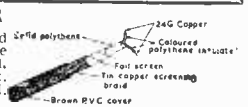
HI-FI SNIP

THE OCTAVIAN

HIGH FIDELITY AMPLIFIER

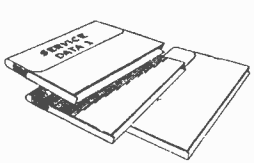
3 valve 4 watt with frequency response better than 40-15,000 C.P.S. Control panel size 8 x 2½in. comes fixed to chassis but is intended for independent mounting. Separate bass and treble controls giving fullest variation of cut and lift. Separate switch, absolutely no mains hum. Remarkable value at **£4/19/6,** plus 3/6 post & ins.

TWIN FEEDER



Ideal for FM down lead as a twin microphone lead, etc. Sale price **6d.** per yard. 80 ohm co-ax, low loss for Band III, 8d. per yard.

T.V. SERVICE SHEETS



100 sheets covering the most popular post-war Televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc., etc. Special 25% reduction to P.T. readers who order this month will receive the complete 100 sheets as printed. 15/- post free.

TELETRON COILS

Customers please note that all our branches carry good stocks of Teletron components.

BARGAINS TO CLEAR

A.C./D.C. Superhet Chassis. Long, Medium and Short wave, modern 5-valve circuit unused, but may be slightly storage soiled. Only **29/6** (coil pack worth more). Non-callers add 6/6 carriage and ins.

A.C. Superhet 5-Valve Chassis. Medium and two short, unused, but less valves and mains transformer. Uses standard Octal range. **27/6.** (Again, coil pack worth much more.) Non-callers add 6/6.

A.C. Superhet 7 v. 5-Waveband Chassis. H.F. stage. Unused. Less valves and power pack. Slightly soiled. Coil pack worth twice as much, circuit diagram supplied. **£2/15/-**, carriage and insurance 7/6.

A.C. 4-Valve Superhet, complete with valves, but less scale and pointer, unused. Circuit diagram supplied. **39/6** plus.

Note that the above four chassis, although unused, will need checking. On account of low price no guarantee is given. Nor, we regret, can technical assistance be given.

.1 mfd. 350 v. Small Tubular Metal cased Condensers. Made by Dubilier. 2/6 per dozen.

Germanium Diodes. B.T.H., with wire ends. **10d.** each or **9.-** dozen.

Midget I.F. Coils. Dust cored, size 1½ x 1in., 465 Kc/s. **4/6** pair.

Standard Size I.F. Coil. Dust cored, 465 Mc/s. **4/6** pair.

Coil Pack for Superhet. 465 Kc/s, I.F. Medium and 2 short waves. **9/6.**

Cathode-Ray Tube. VCR97. Instrument type. New **7/6** each, carriage 3/6.

Bakelite 5 Amp. Electric Wall Switch. "Hicraft," **9d.** each, or 8/- per dozen.

Series, parallel and off-electric wall switch made by Crabtree. Price **1/3** each, or **13/6** per doz.

NOTE: Additional Technical Data is not available on these bargain items.

Amplifier. ex-Government unit 1134 contains one double triode and one triode. **6/6,** post and ins. 2/6.

Connecting Wire. P.V.C. covered 24 s.w.g. copper. **2/6** per 100ft., or 5 coils, different colours, for **10.-.**

Scanning Coils by very good maker. New and unused. **4/6** complete.

Choke, 200 mA, first class. Made for Services. New **6/6,** post 1/6.

10 v. Superhet, 1½ metre. Ex-Govt., but unused. Complete with valves. Easily converted for Band III. **39/6,** carriage and packing 7/6.

Mains Transformer, 250-0-250, 60-80 mA, 6.3 v, standard mains input. Half shrouded. **12/6,** post and insurance 2/6.

R.F.25 Tuning Unit. New, unused and complete with valves. **9/6,** post 2/6.

Cathode-Ray Tube. VCR517. **8/6** each, carriage 2/6.

Mains Lead. Metal screened to stop interference. **9d.** yard.

Thermocouple mounted on valve base. Useful for experiments and schools. **6/6** each.

Midget Push-pull Input Transformer and push-pull output transformer to match. **8/-** the pair.

NOTE: Orders for small components over £2 are post free, otherwise please add sufficient.

ELECTRONIC PRECISION EQUIPMENT, LTD.

Post orders to E.P.E., LTD., Dept. 7, 66, Grove Road, Eastbourne.

Personal shoppers to one of these addresses, please.

266, London Road, Croydon.
Phone: CRO 6558
Half day, Wednesday.

42-46, Windmill Hill, Ruislip, Middx.
Phone: RUISLIP 5781
Half day, Wednesday.

152-3, Fleet Street, E.C.4.
Phone: FLEet 2833
Half day, Saturday.

29 Stroud Green Road, Finsbury Park, N.4.
Phone: ARChway 1049
Half day, Thursday.

R.S.C. BATTERY CHARGING EQUIPMENT

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

ASSEMBLED CHARGERS

6 v. 1 amp. 19/9
6 v. or 12 v. 1 amp. 27/9
6 v. 2 amps. 29/9
6 v. or 12 v. 2 amps. 38/9
6 v. or 12 v. 4 amps 59/9
Above ready for use. Carr. 3/6. With mains and output leads.

SELENIUM RECTIFIERS

6/12 v. 1 a, **4/11** | **L.T. Types H.W.**
6/12 v. 2 a, **8/9** | 6-12 v. 1 a, H.W., **2/9**
6/12 v. 3 a, **11/9** | **H.T. Types H.W.**
6/12 v. 4 a, **14/9** | 150 v. 40 mA, **3/9**
6/12 v. 6 a, **19/9** | 250 v. 50 mA, **5/9**
6/12 v. 10 a, **25/9** | 250 v. 80 mA, **7/9**
6/12 v. 15 a, **35/9** | 250 v. 150 mA, **9/9**
250 v. 250 mA, **11/9**

BATTERY CHARGER KITS

Consisting of Mains Transformer, F.W. Bridge Rectifier, well ventilated steel case. Fuses, Fuse-holders, Grommets, panels and circuit. Carr. 2/9 extra.

6 v. or 12 v. 1 amp. **22/9**
6 v. 2 amps. **25/9**
6 v. or 12 v. 2 amps. **31/6**
6 v. or 12 v. 4 amps. **53/9**

BATTERY CHARGER KIT

Consisting of F.W. Bridge Rectifier, 6/12 v. 5 a. Mains Trans., 0-9-15 v. 6 a. output and Ammeter, **49/9**. Post 3/-.

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case, finished attractive hammer blue. Ready for use. With mains and output leads. Double Fused.

Only **47/9**
Carr. 3/9.

Assembled 6 v. or 12 v. 4 amps. Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Double fused. Louvred steel case with stoved blue hammer finish. **75/-**

Ready for use with mains and output leads. Carr. 3/9.

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

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/cs. Screened. TOP SHROUDED DROP THROUGH

250-0-250 v. 70 mA 6.3 v. 2 a, 5 v. 2 a. **16/9**
350-0-350 v. 80 mA, 6.3 v. 2 a, 5 v. 2 a. ... **18/9**
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a. **22/9**
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a **22/9**
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a, **22/9**
350-0-350 v. 100 mA, 6.3 v. 4 v. 4 a, C.T. 0-4-5 v. 3 a **23/9**
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a. **29/9**

FULLY SHROUDED UPRIGHT

250-0-250 v. 60 mA, 6.3 v. 2 a, 5 v. 2 a. Midget type 2½-3-3in. **17/6**
350-0-350 v. 70 mA, 6.3 v. 2 a, 5 v. 2 a, **19/9**
250-0-250 v. 100 mA, 6.3 v. 4 v. 4 a, C.T. 0-4-5 v. 3 a **26/9**
250-0-250 v. 100 mA, 6.3 v. 6 a, 5 v. 3 a, for R1355 conversion **31/-**
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a, **23/9**
300-0-300 v. 100 mA, 6.3 v.-4 v. 4 a, C.T. 0-4-5 v. 3 a **26/9**
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a, **23/9**
350-0-350 v. 100 mA, 6.3 v.-4 v. 4 a, C.T. 0-4-5 v. 3 a **27/9**
300-0-300 v. 130 mA, 6.3 v. 4 a, 6.3 v. 1 a, for Mullard 510 Amplifier **35/9**
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a. **33/9**
350-0-350 v. 150 mA, 6.3 v. 2 a, 6.3 v. 2 a, 5 v. 3 a **35/9**
425-0-425 v. 200 mA, 6.3 v. 4 a. C.T. 6.3 v. 4 a, C.T., 5 v. 3 a. Suitable Williamson Amplifier, etc.... ... **49/9**
450-0-450 v. 250 mA, 6.3 v. 6 a, 6.3 v. 6 a, 5 v. 3 a **69/9**

FILAMENT TRANSFORMERS

All with 200-250 v. 50 c.s. primaries 6.3 v. 1.5 a, **5/9**: 6.3 v. 2 a, **7/6**: 0-4-6.3 v. 2 a, **7/9**: 12 v. 1 a, **7/11**: 6.3 v. 3 a, **8/11**: 6.3 v. 6 a, **17/6**: 12 v. 3 a, or 24 v. 1.5 a, **17/6**.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Input 200-250 v. A.C. Output 120 v. 40 mA. Fully smoothed and rectified supply to charge 2 v. accumulator. Price with louvred metal case and circuit, **29/6**, or ready for use, **8/9** extra.

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s

120 v. 40 mA, 5-0-5 v. 1 a **15/9**
90 v. 15 mA, 4-0-4 v. 500 mA **9/9**

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s Primaries:
0-9-15 v. 1½ a, **11/9**: 0-9-15 v. 3 a, **16/9**: 0-3-5-9-17 v. 3 a, **17/9**: 0-9-15 v. 5 a, **19/9**: 0-9-15 v. 6 a, **23/9**.

SMOOTHING CHOKES

250 mA, 5 H 100 ohms **12/9**
150 mA, 7-10 H 250 ohms **11/9**
100 mA, 100 H 200 ohms **8/9**
80 mA, 10 H 350 ohms **5/9**
60 mA, 10 H 400 ohms **4/11**

OUTPUT TRANSFORMERS

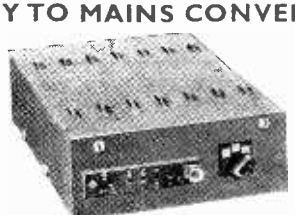
Midget Battery Pentode 66:1 for 3S4, etc. **3/9**
Small Pentode, 5,000 Ω to 3 Ω ... **3/9**
Small Pentode 7/8,000 Ω to 3 Ω ... **3/9**
Standard Pentode 5,000 Ω to 3 Ω ... **4/9**
Standard Pentode, 7/8,000 Ω to 3 Ω ... **4/9**
10,000 Ω to 3 Ω **4/9**
Push-Pull 10-12 watts 6V6 to 3 Ω or 15 Ω **15/9**
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15 Ω **16/9**
Push-Pull EL84 to 3 or 15 Ω **16/9**
Push-Pull 15-18 watts, 6L6, KT66 ... **22/9**
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 or 15 Ω **47/9**

SMALL MAINS TRANSFORMERS. 2½-3-2½in. approx. Primary 200-250 v. 50 cc s. 250-0-250 v. 70 mA. 6.3 v. 2.5 a. Store soiled but unused, guaranteed, **11/9**.

SPECIAL OFFERS: Electrolytics. 32-32-32 mfd. 250 v. Dubilier small can, **2/9** ea. 150 mfd. 450 v., **3/9**. Small .0005 mfd. 2-gang, **4/9** ea. Westinghouse Rectifiers 250 v. 250 mA. **7/9**. **CO-AXIAL CABLE.** 75 ohm, ¼in. **8d.** yd. Twin-Screened Feeder **11d.** yd.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2½in. approx. Completely replaces batteries 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 v. and 90 v.** This includes latest low consumption types.



Complete kit with diagrams, **39/9**, or ready to use, **46/9**.

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**.

JUNCTION TRANSISTORS. Red Spot Audio Type only **7/6** each. R.F. Type, **17/6**.

VOLUME CONTROLS with knob (1in. diam.) spindle, all values less switch, **2/9**; with S.P. switch, **3/9**; with D.P. switch, **4/6**.

T.V. CABINETS. Leading manufacturer's surplus. Attractive designs. Walnut veneered with doors for 15, 16 or 17in. Tube, **£3.19.6**. Carr. 7/6.

MINIATURE MOTORS. 24/28 v. D.C. or A.C. made by Hoover Ltd., Canada. Size only 2½ x 1¾in. Spindle 1¼in. long, ¼in. diam. Brand New, **9/9**.

EXTENSION SPEAKERS

Ready for use in walnut veneered cabinet.

8in. 2-3 ohms. **35/9**. Very limited number

EX-GOVT. METAL BLOCK (PAPER) CONDENSERS

4 mfd. 500 v., **2/9**: 4 mfd. 1,000 v., **4/9**: 8 mfd. 500 v., **4/9**: 10 mfd. 500 v., **3/9**.

EX-GOVT. SMOOTHING CHOKES

250 mA, 5 H 50 ohms **12/9**
150 mA, 10 H 100 ohms **11/9**
150 mA, 6-10 H 150 ohms Trop. ... **6/9**
120 mA, 12 H 100 ohms **9/9**
100 mA, 5 H 100 ohms **3/11**

EX-GOVT. E.H.T. SMOOTHING CONDENSERS. .02 mfd. 5,000 v. Cans, **2/9**; .1 mfd. 2,500 v. Bakelite Tubulars, **3/3**.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve Long and Medium wave 230-250 v. A.C. Mains receiver with selenium rectifier. It consists of a variable-Mu high-gain H.F. stage followed by a low distortion anode bend detector. Power pentode output is used. Valve line-up being 6K7, SP61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-point wiring diagrams, instructions and parts lists, **1/9**. This receiver can be built for a maximum of **£4/19/6**, including attractive Brown or Cream Bakelite or Walnut veneered wood cabinet 12 x 6½ x 5¼in.

EX-GOVT. DOUBLE WOUND STEP UP STEP DOWN TRANSFORMERS. 10-0-100-200-220-240 v. to 5-0-75-115-135 v. or REVERSE. 80-100 watts. Only **11/9**, plus 2/9 post. 10-0-100-200-220-240 v. to 9-0-110-122-136-148 v. or REVERSE. 200 watts. **35/9**, plus 7/6 carr. Both 50 c/s.

EX. GOV. MAINS TRANSFORMER. Primary 0-110-120-200-210-220-230-240-250 v. 50 c.p.s. Secs. 275-0-275 v. 100 mA, 6.3 v., 7a, 5 v. 3 a. Only **18/9**.

EX-GOVT. CASES. Size 14-10-8½in. high. Well ventilated, black crackle finished, undrilled cover. IDEAL FOR BATTERY, CHARGER OR INSTRUMENT CASE, OR COVER COULD BE USED FOR AMPLIFIER. Only **9/9**, plus 2/9 postage. Size 8½ x 13½ x 6½ ins. with undrilled well ventilated cover, finished in stoved grey enamel. Suitable for charger or instrument case, **7/9**, plus 2/9 post.

EX-GOVT. VALVES (NEW)

1T4	7/9	EF39	5/9	EF80	7/9
1S5	7/9	6V6G	7/9	EB91	8/9
3S4	8/9	6X4	8/9	EF36	4/9
5Y3G	8/9	6X5GT	7/9	EL32	3/9
5U4G	8/9	6L6G	11/9	EL91	5/9
5Z4G	8/9	807	7/9	KT44	8/9
6K7G	5/9	12A6	7/9	EZ90	8/9
6SJ7GT	6/9	15D2	4/9		
6SLGT	8/9	35Z4GT	9/9	EL84	10/6
6SN7GT	8/9	MH4	4/9	SP61	2/9
6AT6	7/9	ECC83	9/9	35Z4	8/9

ELECTROLYTICS (current production) NOT EX-GOVT.

Tubular Types		Can Types	
8µF 450 v. ...	1/9	16 mfd. 350 v.	1/11
8 mfd. 500 v.	2/6	16 mfd. 500 v.	2/9
16µF 350 v. ...	2/3	16µF 450 v. ...	2/9
16µF 450 v. ...	2/9	32µF 350 v. ...	2/11
16µF 500 v. ...	3/9	32 mfd. 450 v.	4/9
32µF 350 v. ...	3/9	100 mfd. 450 v.	4/9
25µF 25 v. ...	1/3	8-8µF 450 v. ...	2/9
50µF 12 v. ...	1/3	8-16µF 450 v.	3/11
50 mfd. 25 v. ...	1/6	16-16µF 450 v.	3/11
50µF 50 v. ...	1/9	32-32µF 350 v.	4/9
100 mfd. 12 v.	1/9	32-32µF 450 v.	5/9
100 mfd. 25 v.	2/3	100-100 mfd. 350 v.	4/9
1,500 mfd. 6 v.	1/6	64-120 mfd. 350 v.	7/9
3,000 mfd. 6 v.	3/9	100-200 mfd.	
6,000 mfd. 6 v.	3/9	275 v. ...	6/9

Many others in stock.

HEADPHONES. Brand new. Low resistance, **8/9** pr. High Resistance. **15/9** pr.

R.S.C. A8 ULTRA LINEAR 12 WATT AMPLIFIER

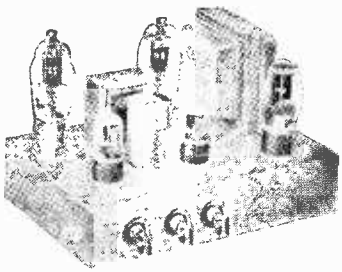
High-Fidelity Push Pull Amplifier with "Built-in" Tune Control. Pre-amp stages. High sensitivity. Includes 5 valves (807 outputs). High Quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut." Frequency response 3db., 30-30,000 c/cs. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all 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. 20 mA. and 6.3 v. 1.5 a. For supply of a RADIO FEEDER UNIT. Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/cs. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value at £7 15 -. or factory built 45 - extra. Carriage 10/-.

£7-15-0

If required louvred metal cover with 2 carrying handles can be supplied for 17 6. Additional input socket with associate Vol. control so that two different inputs such as Gram and "Mike" or Tape and Radio can be mixed, can be provided for 13 - extra. Guaranteed 12 months.

TERMS on assembled two input model: DEPOSIT 25 6 and nine monthly payments 23/4.

HIGH-FIDELITY MICROPHONES and SPEAKERS in stock. Keen cash prices or H.P. terms if supplied with amplifier.



COLLARO RC54 3-SPEED AUTO-CHANGERS with Studio Pick-up. Brand New. For 110 v. 50 c.p.s. A.C. mains. Price with 110 v. to 200-250 v. Auto Trans. only 7 Gns. Carr. 5/6.

COLLARO RC456 4-SPEED AUTO-CHANGERS with high fidelity Studio Pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c.p.s. A.C. mains. Our price £8/19/6, carr. 5/6.

LG3 MINIATURE 3-WATT GRAM AMPLIFIER. For use with above or any other single or auto-change units. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Size 6½ x 4½ x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 45 9.

PORTABLE CABINETS. Exceptionally attractive appearance. Size inside 17¾ x 12½ x 8½ in. Will take above amplifier and any modern 3 or 4 speed auto-changer or single player. 59/6. Carr. 3/6.

SPECIAL OFFER. Cabinet, Amplifier, 6½in. speaker, and RC/456. 14 Gns. Carr. 10 -.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. 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 of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-point wiring diagrams, instruction and priced parts list with illustration. 2/6. Total building cost £4 15 -. For descr. ptive leaflet send S.A.E.

LINEAR L45 MINIATURE 4.5 WATT QUALITY AMPLIFIER. Suitable for use with Collaro, B.S.R. or any other record-playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5½in. high. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only £5 19 6. Illustrated leaflet 3d.

LINEAR "DIATONIC" 10 WATT HIGH FIDELITY PUSH-PULL ULTRA LINEAR AMPLIFIER. For 200-230-250 v. 50 c.cs. A.C. mains. Valve line-up ECC33, ECC83, EL84, EL84, EZ81 miniature Mullard. The unit has self-contained Pre-amplifier Tone Control stages and separate Bass and Treble Controls. Independent "Mike" and Gram input sockets are provided. Size is only 10-8-6in. Output Matchings for 3 and 15 ohm speakers. Only 12 GNS.: or Deposit 26 9 plus 10 - carr. and 9 monthly payments of 26 9. Leaflet 3d.

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

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

LT45 HIGH QUALITY TAPE DECK AMPLIFIER. For All Tape Decks with High Impedance. Playback and Erase Heads, such as Lane, Truvox, etc. Or for Collaro, Brenell, etc. Type of Deck should be stated when ordering. Output is 4.5 watts. For 2-3 ohm speaker. For A.C. Mains 230-250 v. 50 c/cs. Positive compensated identification for recording level by Magic Eye. Recording facilities for 15, 7½ or 3¾in. per sec. Automatic equalisation at the turn of a knob. Linear frequency response of 3 db., 50-11,000 c/cs. Negative feed-back equalisation. Minimum hum. High output with completely effective erasure and distortionless reproduction. Sensitivity is 12 millivolts. Any kind of crystal microphone is suitable. Only 2 millivolts minimum output required from Recording head. Provision is made for feeding a P.A. amplifier. Illustrated leaflet 6d. Special price quoted for above with Deck.

12 GNS. Carr. 7 6

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/cs. 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, GZ33. 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/cs. A.C. Mains and has outputs for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for 17 6. The amplifier can be supplied, factory built with 12 months' guarantee for £12 19/6. TERMS: DEPOSIT 35 9 and 9 monthly payments of 28/11.

ONLY 10 GNS. Carr. 10/-

R.C.A. 20 WATT RE-ENTRANT SPEAKERS. 15 ohms or 600 ohms matching. For Outdoor work. Only 8 GNS.

P.M. SPEAKERS, All 2-3 ohms, 5in. Goodmans, 17 9. 6½in. Goodmans 16 9. 8in. Rola, 19 9. 10in. Elac. 26 9. 12in. Plessey, 29/11. 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier. £4 10/9. 12in. Plessey 3 ohms 10 watts. 59 6.

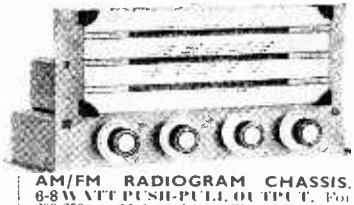
PLESSEY DUAL CONCENTRIC 12in. 15 ohm HIGH FIDELITY SPEAKER with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.), providing extraordinarily realistic reproduction when used with our A8 or similar amplifier. Rated 10 watts. Price complete, only £5 17 6.

M.E. SPEAKERS 2-3 ohms, 8in. R.A. Field, 600 ohms, 11 9.

P.M. SPEAKERS, 2-3 ohms. Suitable for use with 1.45, A5 or A7 amplifiers. Elac 7 x 4in. elliptical, 19 9. Celestion 6½in. with high flux density magnet, 19 9. 12in. Plessey, 29 11. 12in. Plessey with high flux density magnet, 47/9. The latter is especially recommended.

R.S.C. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

For 230-250 v. 50 c/cs. Mains input. Appearance and Specification, with exception of output wattage, as A5. Complete Kit with diagrams, £3/15 -. Assembled 22 6 extra. Carr. 3/6.



AM/FM RADIOGRAM CHASSIS. 6-8 WATT PUSH-PULL OUTPUT. For 200-250 v. Mains, Long Wave, Medium, F.M. and Gram. Complete with 8 B.V.A. valves. Guaranteed 12 months. Only 22 GNS. Or Deposit £2 12 - and 9 monthly payments of £2 12 -.

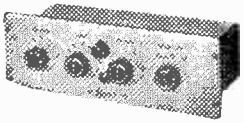
Terms: C.W.O. or C.O.D. NO C.O.D. under £1. Post 1 9 extra under £2: 2 9 extra under £5.
Open 9 to 5.30: Sats. until 1 p.m. Catalogue 6d. Trade List 5d. S.A.E. with all enquiries.

RADIO SUPPLY CO. (LEEDS) LTD.

32, THE CALLS, LEEDS, 2

COMPLETE KITS of PARTS for the "Hi-Fi" ENTHUSIAST

STERN'S REMOTE CONTROL UNIT



Designed in particular for use with the MULLARD 5-10 Main Amplifier

Ideally suited for simple domestic installation as an alternative to the more elaborate Pre-amplifier (shown and described opposite). Tone Control facilities are really excellent and in conjunction with the "5-10" Main Amplifier reproduction is of very high quality. Perfectly suitable for use with all the popular Record Players (B.S.R., Collaro, Garrard) and the modern Radio Tuner Units. Front Panel contains : (a) Coloured Indicator, (b) Separate BASS and TREBLE CONTROLS, (c) 3 position Selector Switch, (d) Volume control. Inputs on back for Radio and Gram. and Gram equalising is incorporated.

FULL DATA is contained in the 5-10 MAIN AMPLIFIER MANUAL at 1/6.

The MULLARD "5-10" MAIN AMPLIFIER

Probably the most popular and successful Amplifier yet designed and certainly needs no recommendation from us. Our kit is complete to MULLARDS specification including the latest ULTRA LINEAR OUTPUT TRANSFORMER and the recommended Mullard Valve line-up. All specified Components are supplied and Power Supply is available to drive a Radio Tuner Unit.

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & Ins.) **£9.10.0**

or alternatively we /supply— FULLY ASSEMBLED and TESTED for (Plus 5/- carr. & ins.) **£11.10.0**

The ASSEMBLY MANUAL containing FULL SPECIFICATION is available for 1/6. It also includes full data on the REMOTE CONTROL UNIT.

STERN'S "fidelity" PRE-AMPLIFIER TONE CONTROL UNIT

"A design for the Music Lover"

This unit can be used with any Main Amplifier. Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK-UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL. (b) STEEPCUT FILTER. (c) Continuously variable BASS and TREBLE CONTROLS, a variable OUTPUT CONTROL which enables its use with any type of Amplifier, and Jack Sockets on Front Panel for TAPE RECORD and TAPE PLAYBACK.

Used with the "5-10" the reproduction is comparable to that normally associated only with the very expensive commercially made High Fidelity Amplifiers. PRICE OF COMPLETE KIT OF PARTS **£6.6.0**

WE ALSO OFFER IT ASSEMBLED READY FOR USE, £8 (plus 5/- carr. & ins.).

The ASSEMBLY MANUAL contains full specification, and is available for 1/6.

BRITAIN'S FINEST "Hi-Fi" AMPLIFIER

THE GENUINE WILLIAMSON

STILL SETS THE STANDARD FOR ALL AMPLIFIERS

Many versions of the Williamson have been offered to the public at various low prices, but the "only Williamson" is the Amplifier built to the designer's specification and employing only the very high grade Components, i.e., PARTRIDGE TRANSFORMERS, CHOKES, etc., that he specifies. It is only in doing this that the exceptionally high standard that has made this Amplifier so famous, particularly in America, is obtained . . . WE HAVE DONE THIS ! . . . and we offer these KITS OF PARTS including Partridge and other high grade Components as follows :

(a) To build the MAIN AMPLIFIER ONLY (Illustrated above), **£14.10.0**

(b) To build the TWIN POWER SUPPLY UNIT ONLY (insufficient space to illustrate this). **£13.10.0**

(c) COMPLETE KIT to build both above, **£27.0.0**

We will also supply both **COMPLETELY ASSEMBLED** and will be pleased to quote. Credit and H.P. Terms are available. The complete SPECIFICATION and general ASSEMBLY INSTRUCTIONS are available for 3/6.

Our "fidelity" PREAMPLIFIER illustrated and described above (or alternatively the R.C.A. Pre-amplifier at **£16.5.0**) is recommended for use with the Williamson.

SPECIAL PRICE REDUCTIONS . . . WE WILL SUPPLY

(a) **The COMPLETE KIT of PARTS** to build both the **MULLARD 5-10** and the **REMOTE CONTROL UNIT** for..... **£11.11.0**

(b) **The COMPLETE KIT of PARTS** to build both the **MULLARD 5-10** and the "**Fidelity**" **PRE-AMPLIFIER TONE CONTROL UNIT** for..... **£15.15.0**

ALTERNATIVELY WE WILL SUPPLY ASSEMBLED and FULLY TESTED, as follows—

(a) **The MULLARD 5-10** and the **REMOTE CONTROL UNIT** for..... **£14.0.0**

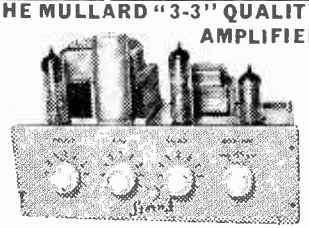
CREDIT SALE TERMS, £3.10.0 Deposit and 9 monthly payments of £1.5.8. H.P. TERMS, £7 Deposit and 9 monthly payments of 17/9.

(b) **The MULLARD 5-10** and the "**Fidelity**" **PRE-AMPLIFIER-TONE CONTROL UNIT** for..... **£18.18.0**

CREDIT SALE TERMS, £4.15.0 Deposit and 9 monthly payments of £1.14.7. H.P. TERMS, £9.9.0 Deposit and 12 monthly payments of 17/6.

WHEN ORDERING PLEASE INCLUDE 7/6 to cover cost of Carriage and Insurance.

THE MULLARD "3-3" QUALITY AMPLIFIER



A small compact Amplifier capable of HIGH QUALITY REPRODUCTION on both RADIO and GRAM.

PRICE FOR COMPLETE KIT OF PARTS. £6.19.6 (plus 6/6 carr. & ins.)

Alternatively supplied ASSEMBLED and READY FOR USE (plus 6/6 carr. & ins.). **£8.12.6**

The Complete SPECIFICATION and ASSEMBLY DIAGRAMS are available for 1/6.

Developed from the very popular 3 valve 3 watt Amplifier designed in the MULLARD LABORATORIES. We strictly adhere to the specification list ; in addition we have added switched equalising for L.P. and 78 Records and a position for Radio Inputs, plus additional power to feed a Radio Tuning Unit. Extremely simple to assemble and ideally suitable to incorporate with an F.M. Tuner or Record Player in a small installation.

STERN'S "HIGH QUALITY" 8-10 WATT AMPLIFIER

Has power supply for Radio Tuning Unit

PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) **£7.10.0**

SUPPLIED ASSEMBLED and READY FOR USE **£9.10.0**

Proved one of the most popular models yet offered to the HOME CONSTRUCTOR. Provides excellent reproduction up to 8 watts, employing 6V6's in push-pull, incorporating negative feedback. Provides for use of both 3 and 15 ohm speakers.

CALLERS ONLY

We have in stock various designs for HOME CONSTRUCTORS including F.M. Tuners, A.M. F.M. Tuners, Midget Battery Portable, Mains Units, etc., etc.

WE ALSO SUPPLY SEPARATELY—

(a) The 2-Stage (plus Rectifier) **AMPLIFIER** £4.2.6

(b) The **PORTABLE CARRYING CASE**..... £3.17.6

(c) 6½in. P.M SPEAKER... ... 16 9

Carriage and insurance, 1/- extra

We also have a smaller **PORTABLE CASE Ideal for Record Players**, PRICE ONLY **£3.3.0** (plus 3/- carr. & ins.).

SPECIAL CASH ONLY OFFER !!

This very attractive **PORTABLE AMPLIFIER CASE** together with a good quality **GRAM AMPLIFIER** and a matched 6½in. **P. M. SPEAKER**, ALL FOR ONLY **£8.7.6** (plus 7/6 carr & ins.).

The Amplifier consists of a 2 Stage design incorporating the modern B.V.A. valves types ECC81, EL84 plus EZ80 Rectifier and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger, and is attractively finished in Maroon and Grey colour Rexine.

(Dept. P.W.)

109 & 115 FLEET ST., LONDON, E.C.4.

Telephone : FLEet 5812 3, 4.

CASH OR TERMS

12 MONTHS GUARANTEE RECTANGULAR T.V. TUBES

As supplied to the trade for the last 7 years.

17" £7.10. **14" £5.10.**

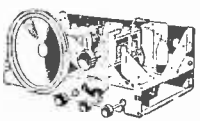
6 months full replacement. 6 months progressive. Made possible by the high quality of our tubes. 15/6 Ins., carr.

SPECIAL OFFER OF 14"–15"–16" T.V. TUBES. £5

CONVERT YOUR 9in.-10in.-12in. to above sizes. Information on how to "Do-it-Yourself" in our FREE catalogue.

12in. T.V. TUBES with guarantee, £6. Ins., carr., 15/6.

POPULAR RADIO or RADIO GRAM CHASSIS 39/9

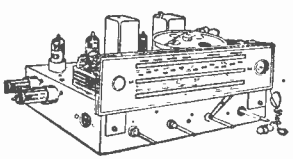


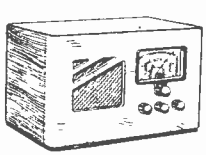
3 w/band and gram. S/het. 5 valve, International Octal. Ideal table gram, but still giving high quality output. 4 knob control. 8in. P.M. Speaker, 7/9 extra, set of knobs, 2/-. Chassis size 12in. x 6in. x 9in. Less valves. Ins., carr., 4/6.

ARGOSY PUSH PULL RADIO GRAM CHASSIS 139/6

Valves : 2 EBF80, 2 EL42, ECH81, EZ80, EBC41, EM31.

8 valve latest models. 3 w/band and gram. switched. Over 10 watts output. Full tone range. 4 knob control. Size 12in. x 7½in. x 7½in. Less valves. Ins., carr., 5/6.





HOME RADIO 79/6

5 valve (octal), superhet, 3 waveband receiver. A.C./D.C. Universal mains can be adapted for gram P.U. In wooden cabinet. 18½in. x 11½in. x 8½in. Ins., Carr., 7/6.

CAR RADIO AERIALS. 6/9. Whip antennae. 50in. long, collapsing to 11in. One hole fixing. Post 1/3.

BURGLAR ALARMS. 2 3. Made by Truvox. Can work from bell battery. New, including bell. P. & P. 1/9.

MAINS TRANSFORMERS

350-0-350 v. 80 mA. 4 v.-4 v. heaters. 200-250 v. Prim. ...	3/9
350-0-350 v. 80 mA. 12 v.-4 v. heaters. 200-250 v. Prim. ...	2/9
280-0-280 v. 80 mA. 6 v., 4 v., 4 v. 200-250 v. Prim.	5/9

Drop through type. Half shrouded. All above 2 3 post.

425-0-425 v., 5 v. 6 a., 6.3 v. 12 a., 6.3 v. 6 a., 200-250 v.. **17/6.** Screened primary. P. & P. 2 6.

O.P. TRANSFORMERS, 1/3. Standard size (2-5 ohms). Post 1/-, 1/3. 20 for **£1**. P. & P. on 20, 5/6.

Boxed VALVES *3 MONTHS GUARANTEE*

1A5	2/9	6N7GT	4/9	CV13	3/9	EF37	4/9
1S5	4/9	6SG7	3/9	EB34	1/9	EF41	8/9
3A8	3/9	77	3/9	EB91	6/9	EF50	2/9
4D1	2/9	8D2	3/9	ECC81	8/9	EL32	6/9
6B8	3/9	8D3	7/9	ECH42	8/9	EL91	3/9
6F12	7/9	12AU7	5/9	EF39	6/9	PEN45	6/9
6D2	6/9	12BE6	6/9	EF41	8/9	TT11	6/9
6H6M	1/9	12SG7	1/9	EF91	7/9	X66	3/9
6K7	3/9	12SJ7	1/9	DF66	5/9	Z77	7/9

American Types. UX. All at 3.9 each.

18	75	80	25RE
42	78	1D6	6A7
		6D6	6C6

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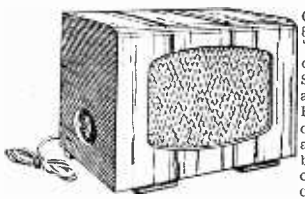

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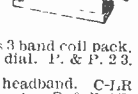

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PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXIII, No. 610, OCTOBER 1957

EDITOR : F. J. CAMM

25th YEAR OF ISSUE

COMMENTS OF THE MONTH

BY THE EDITOR

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CONTENTS :

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

OUR NEW COMPANION JOURNAL "PRACTICAL HOME MONEY MAKER"

IT is with great pleasure that we announce the introduction of our new companion monthly magazine, PRACTICAL HOME MONEY MAKER, the first issue of which will be published on Wednesday, September 18th, in exactly the same style, size and price as "The Practical Householder." Side by side with the great national Do-It-Yourself movement, of which "The Practical Householder" is the national representative, has developed another industry, which caters especially for those men and women who wish to occupy their spare time pleasurably and profitably, by making things for sale to produce those welcome extra pounds a week. Thus the object of the new magazine, which strikes an entirely new note in journalism, is to tell readers how to make for profit a wide variety of articles, and how to market them. It will explain how to make toys, ornaments, novelties in wood, glass and metal, articles of household equipment and pottery, glass-ware, mechanical toys, lampshades, jewellery, basket-work, knitwear, articles in plastic, leather handbags and wallets, rugs—to mention but a few of the subjects which will appear in early issues. Every possible avenue of profit earning at home will be dealt with. We shall include articles on rabbit breeding, aquaria, photography, poultry breeding and garden produce. Other articles will deal with marketing, obtaining orders, and the business side of home working. A large and expanding industry is now in existence to supply the materials and fittings which the reader may not be able to make for himself. There is thus a duality of purpose in this new journal, for it will cater for all those who are interested in the various home crafts for the pleasure of achievement and also for those who wish to combine profit with pleasure. Whilst our present group of journals tells readers how to *save* money, THE PRACTICAL HOME MONEY MAKER will tell them how to *make* it.

So many readers were disappointed in being unable to obtain the first issue of THE PRACTICAL HOUSEHOLDER that we thought they would welcome this early intimation of the newcomer, so that they can ensure obtaining a copy by placing a regular order with their newsagents now. *Only by doing this can you be quite certain of obtaining your copy.*

LORD BRABAZON PRESIDENT OF R.I.C.

LORD BRABAZON OF TARA has been elected president of the Radio Industry Council in succession to Sir Edward Appleton. In that capacity he opened this year's Radio Show. Lord Brabazon, the pioneer aviator, racing motorist, parliamentarian, ex-Air Minister and Minister of Transport, is a director of E.M.I., and before the war he was president of the Radio Manufacturers' Association, which the R.I.C. replaced. He holds the Royal Aero Club's Pilot's Licence No. 1.—F. J. C.

Our next issue, dated November, will be published on October 4th.

Round the World of Wireless

By "QUESTOR"

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of June, 1957, 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	
London Postal	1,149,405
Home Counties	1,158,686
Midland	882,713
North Eastern	1,158,790
North Western	852,783
South Western	731,538
Wales and Border Counties ...	460,526
Total England and Wales ...	6,394,441
Scotland	831,517
Northern Ireland	192,985
Grand Total	7,418,943

Radar Speedmeter

THE results of tests made by the chief engineer of the Automobile Association, Mr. J. R. Kinsey, M.I.Mech.E., A.M.Inst.T., F.I.Arb., into the operation of a radar speedmeter device of the type being introduced by the Lancashire police are announced by the A.A.

The A.A. first challenged the use of radar apparatus in Northern Ireland early this year, following tests conducted in December which showed that the machine is open to a number of influencing factors which are beyond the control of the operators.

Mr. Kinsey said to-day: "This delicate electronic instrument—it has 10 valves, 35 capacitors and 69 resistors—operates at a frequency of 2.455 Mc/s and within the very close limit of plus or minus one megacycle. In the event of a greater variation, the oscillator circuit of the transmitter needs to be readjusted—an exact operation requiring the use of a precision instrument in the form of a wavemeter.

"The range of the speedmeter is limited to a distance of about 170 feet, which means that a vehicle travelling at 40 m.p.h. may be in the effective part of the beam for only 0.7 seconds.

"The reading shown can be influenced by external factors such as the siting of the instrument, other vehicles passing in either direction, cyclists, or even by pedestrians who happen to enter the beam.

"Besides the risk of variation due to faulty or damaged components, ambient temperature can affect the accuracy of the reading. Variations in the voltage of the battery which powers the instrument can also result in error—as much as 6 m.p.h. in certain circumstances.

"The claims made by the manufacturers are limited to an accuracy of plus or minus 2 m.p.h. under the most favourable conditions."

Radio Industry Council Secretary

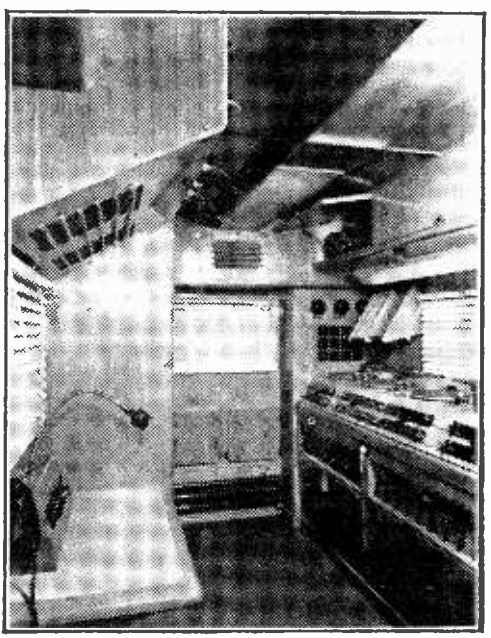
MR. GEORGE B. CAMPBELL has been appointed secretary of the Radio Industry Council in succession to Mr. Rupert P. Browne, who has retired through ill-health.

The Radio Industry Council, formed immediately after World War II, is the co-ordinating body for the four associations in the industry, representing respectively the domestic receiver manufacturers, the valve manufacturers, the component manufacturers and the manufacturers of communication equipment, navigation aids and electronic industrial equipment.

Mr. Campbell, who has been acting secretary for some months, is a native of Edinburgh and a Watsonian. He became assistant secretary in 1940 of the Radio Manufacturers' Association (an organisation which was succeeded by the Radio Industry Council), after a number of years in the industry, including two in the United States. His father was a well-known Scottish retailer.

Mr. Browne became the first secretary of the R.I.C. in 1945, after having been associated since their inception with the various organisations which the council replaced. He joined the first of these, the National Association of Radio Manufacturers, in 1924.

Mr. Browne was awarded the O.B.E. for his work in connection with the training of technical personnel during World War II.



The new BBC mobile studio and control room for O.B.s. This view shows the control cubicle from the studio door, showing the Producer's desk and disc reproduction turntables.

Performing Right Tribunal

THE Performing Right Tribunal, which was set up under Section 23 of the Copyright Act, 1956, have now taken occupation of the premises allotted to them at Someries House, Regents Park, London, N.W.1. The telephone number is Welbeck 1358-9.

The function of the tribunal is to determine disputes arising between licensing bodies and persons requiring licences to perform in public or to broadcast copyright works. It also has jurisdiction in the case of the public performance and broadcasting of records and the public performance of television broadcasts.

Communications for the tribunal should be addressed to the secretary.

New Radiotelephone Service

CABLE AND WIRELESS LTD. announce that a radiotelephone service has been opened between Saudi Arabia and Bahrein (Persian Gulf).

Connections are available in Saudi Arabia to Jeddah, Mecca, Taif, Reyadh, Damman, Khobar and Hofuf.

The service is available daily except Wednesday and Sunday between 06.30 and 07.30 hours G.M.T.

The rate is the equivalent of 10s. a minute.

Radio and TV Sales

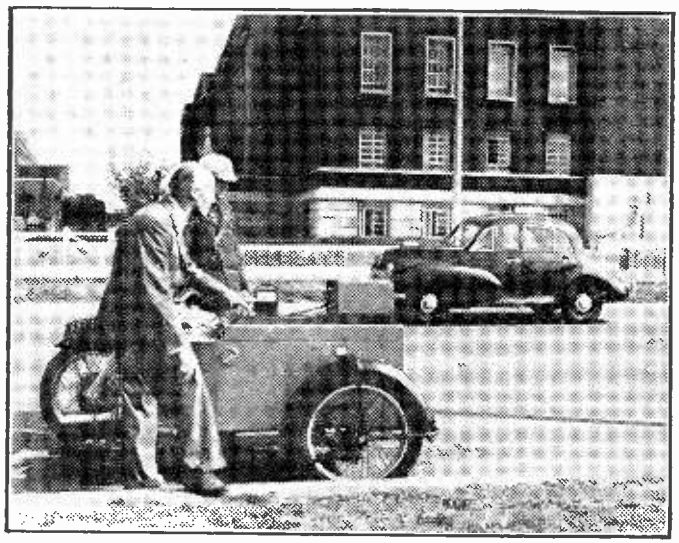
RETAIL sales of radio and television receivers and radiograms were higher during the first half of this year than during the corresponding period of 1956. Television receiver sales were greater by 16 per cent., radiogram sales by 35 per cent. and radio receiver sales by 19 per cent. The British Radio Equipment Manufacturers' Association, in making this comparison in their monthly retail survey, emphasise that it should be borne in mind that the level of sales during 1956 was depressed by the measures taken by the Government to limit public buying.

In June the retail sales of television receivers were 54,000, a decrease of 21 per cent. on the previous month and of 11 per cent. on June, 1956. Sales in the second quarter of the year were 7 per cent. above those in the second quarter of 1956.

The sales of radiograms in June (11,000) were the same as in June, 1956, and 27 per cent. lower than those of May. In the second quarter the sales were 11 per cent. above those in the second quarter of 1956.

For radio receivers the sales in June, 88,000, were 1 per cent. above those in the previous month and 10 per cent. above those of June, 1956.

The proportion of hire purchase and credit sales in June rose for radio receivers from 34 per cent. to 36 per cent. and for radiograms from 51 per cent. to 58 per cent.



Demonstrating the radar speedmeter on the Cromwell Road extension at Hammersmith. In this picture are the R.A.C.'s chief engineer Mr. Maurice Hudlass of Southport, Lancs., and Patrolman Arthur Isherwood of Tooting, London. They are seen checking a car passing the radar speedmeter.

Standard Musical Pitch

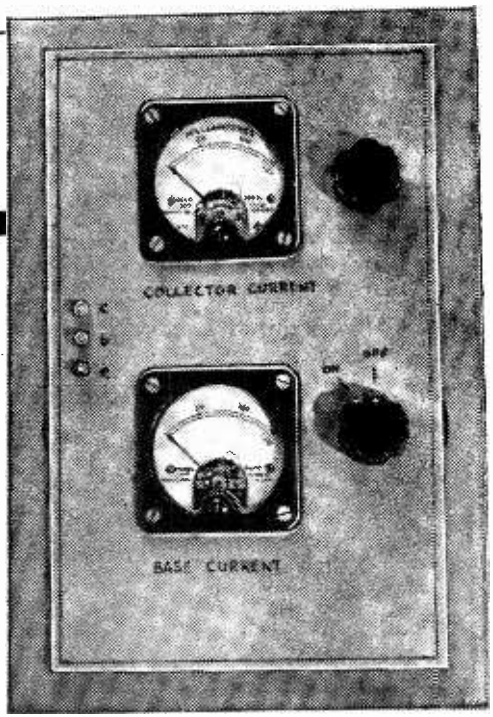
ONE of the lesser known services of the National Bureau of Standards is the broadcasting of a musical tone of standard pitch—middle "A" at 440 cycles per second—over its short-wave stations WWV (Beltsville, Maryland) and WWVH (Maui, Hawaii). These broadcasts make standard pitch available day and night throughout the United States and over much of the world. Since a short-wave receiver is all that is needed, easy access to standard pitch is thus provided for piano tuners and amateur and professional musicians.

A 600-c/s tone is also broadcast. This, together with the 440-c/s tone, is used by scientists, electronics engineers, and manufacturers in the measurement of short intervals of time and for calibrating instruments and devices that operate in the audio and ultrasonic frequency ranges.

The two frequencies are broadcast alternately, starting with 600 c/s on the hour for 3 minutes, interrupted 2 minutes, followed by 440 c/s for 3 minutes and interrupted 2 minutes. Each 10-minute period is the same except that WWV is off the air for 4 minutes beginning at 45 minutes after each hour; and WWVH is silent, in addition, for a 34-minute period each day beginning at 1900 Universal Time (9 a.m. in Hawaii or 2 p.m. E.S.T.).

To provide greater assurance of reliable reception, transmissions from the NBS stations are made simultaneous on several standard broadcast frequencies. WWV broadcasts on 2.5, 5, 10, 15, 20 and 25 Mc/s, and WWVH broadcasts on 5, 10 and 15 Mc/s.

A TRANSISTOR TEST SET



TEST YOUR TRANSISTORS BEFORE USE WITH THIS SIMPLE UNIT

By B. E. Wilkinson

OF the transistors available, probably the cheapest are the red spot type which replace the Mullard OC71. On buying these, one is not aware of their gain, since owing to production spread it may vary considerably. We may, however, be confident, that it lies between about 15 and 40. In building an audio-frequency amplifier, involving more than one stage, it is a good plan to use the higher gain stages first, so that if we were building a three-stage amplifier and had transistors of gain 35, 24, and 21, we would use them in that order. The reason for this is quite simple. Each transistor when working produces a certain amount of noise, which is passed on to the next stage, and amplified together with the signal Thus if the stages follow one another in descending order, the noise level is kept at a minimum. Apparatus for measuring the gain of junction transistors can be produced quite easily, and is well worth while making if one is to experiment with transistors to any extent.

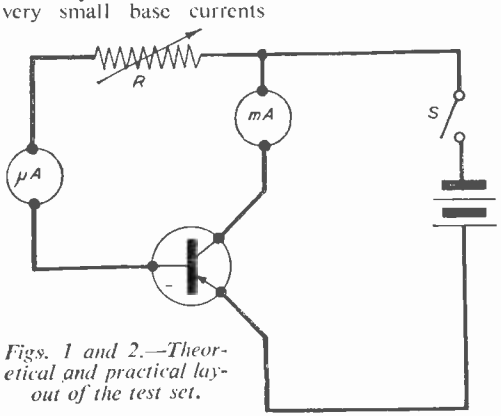
The gain of a transistor with grounded emitter is given by the relation

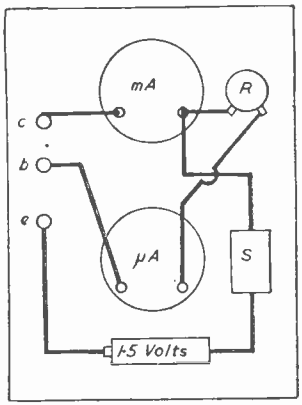
$$\frac{\text{change in collector current}}{\text{change in base current}} = \frac{Ic}{Ib}$$

From this it is clear that all we require is a device for measuring collector and base current changes. The circuit, which is very simple, is shown in Fig. 1. The microammeter is doubtless the most expensive item in the unit, but is necessary because of the very small base currents involved. The supply is a 1.5 volt dry battery, while the variable 10 K resistor is responsible for variation of the base current. A switch S is incorporated to prevent current drain from the battery when the unit is inoperative. The action of the test set is simple. The transistor having been connected into the circuit, the switch is closed. Immediately, the milliammeter, which should have a range of 1 to 10 milliamps, will show reading as will the microammeter, which should have a range of 0 to 50 microamps. Noting both readings, the 10 K resistor is varied until the collector current is made to increase by one milliamp. The new reading on the microammeter is then noted, so that the current gain of the transistor is given by dividing the difference in the readings of the collector by the difference in the readings of the base. A suggested layout is shown in Fig. 2.

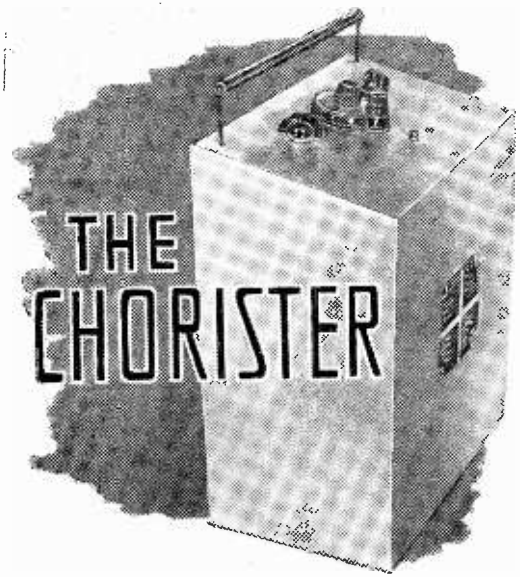
COMPONENTS FOR TRANSISTOR TEST SET

- 1 meter, 0-250 microamps.
- 1 meter, 0-10 milliamps.
- Variable resistor, 10 KΩ.
- On/off switch.
- Battery, 1.5 volts.
- 3 terminal nuts and bolts, 6 BA.
- Plastic covered wire for wiring.





Figs. 1 and 2.—Theoretical and practical layout of the test set.



A 4-VALVE BATTERY-OPERATED PORTABLE, COMPACT IN DESIGN AND LIGHT IN WEIGHT

By A. Sydenham

THIS receiver has been designed to give a wide range of stations, at the same time ensuring portability. It covers both medium and long wavebands.

Certain economies have been effected to enable it to be built as inexpensively as possible and also to save chassis space so that full-size H.T. and L.T. batteries can be used. The prototype uses an Elac 3½in. square speaker unit, but there is adequate accommodation for a larger unit if desired.

The circuit is shown theoretically in Fig. 1. An Osmor flat, spiral wound aerial is used for the medium waveband, and a tapping made half way down it enables an external aerial to be connected if required. This is optional as the receiver functions admirably on its own; additional transmissions can, however, be received by using a separate aerial. For the long waveband a loading coil (L2) is switched in series with the frame. A single oscillator coil (L3) is employed for both bands, C4 being switched across the primary in the "Long" position. As the Light Programme radiating on 200 kc/s is about the only one required this arrangement is perfectly satisfactory.

The intermediate frequency is 465 kc/s and is fed via T1 to V2, the I.F. amplifier. T1 is a miniature component made by the Teletron Co. It carries a tertiary winding but this is left unconnected.

Instead of using a second I.T.F., an Osmor coil, type QA12, is used. The primary of this coil is connected to the anode circuit of V2 and is tuned to 465 kc/s by means of C16, the secondary forming a tight inductive coupling to the diode demodulator. Maximum I.F. is thus presented to the diode.

A.F. is taken off at the usual point and fed to the grid of V3 via the conventional filter network. The diode D.C. load resistor is split into two separate resistors and A.V.C. is taken from their junction. A large A.V.C. bias is not necessary, neither is it desirable due to its being of the undelayed variety. The amount used is sufficient to prevent overloading from strong transmissions and as a further precaution the I.F. amplifier is not controlled.

A miniature I.F. transformer, ratio 1:3 provides

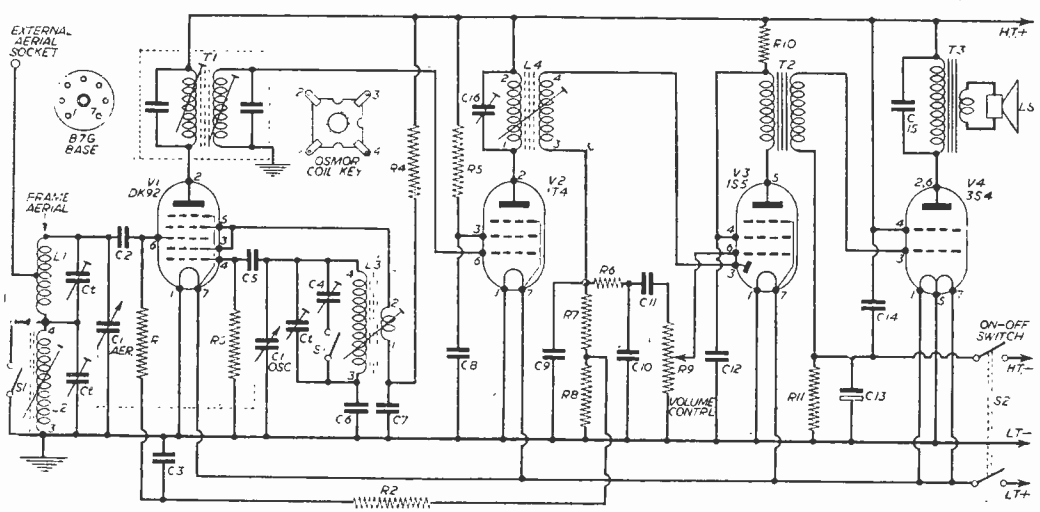


Fig. 1.—Theoretical circuit of the "Chorister."

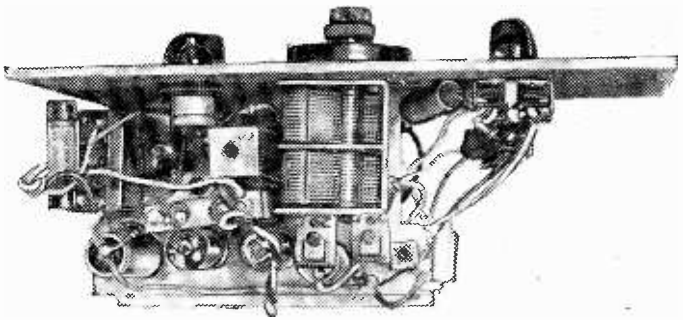
interstage coupling between V3 and V4 and a suitable component can be obtained from Messrs. Clydesdale Supply Co.

Automatic bias is included for V4, the bias resistor R11, being decoupled by C13. Note that if a metal can type is used the can must be isolated from chassis.

A 2μF block capacitor is connected across the H.T. battery and will be found worth its inclusion especially when the H.T. falls.

Regarding T3, the output transformer. This should have as large a core as possible. Some of the midget types are lacking in this respect and if used, distortion due to anode-bend rectification might occur in V4.

seen from the photographs. The dial and drive used in the prototype are not now available but an Eddystone type 843 should be found ideal. Alternatively a small dial may be drawn up on white card, covered with a piece of thin Perspex



A plan view of the upper side of chassis.

Construction

The arrangement and layout of main components is illustrated in Figs. 2 and 3, which also show partial point-to-point wiring. The chassis should first be drilled to conform with these diagrams and components mounted. Wiring up should commence with the filaments. Due to the shallowness of the chassis it is not possible to mount the on/off switch upright; it is, therefore, mounted sideways and the H.T. connection made to it prior to fixing. The front panel carries the wave-change switch and volume control and the chassis should be fixed $\frac{1}{2}$in. up from the bottom and $\frac{1}{4}$in. in from the edge so that it will not foul the cabinet when inserted. The panel and chassis must be rigidly fixed together as the receiver "hangs" when enclosed in its cabinet as can be and glued to the panel. For slow motion an epicyclic drive will suit excellently.

Leave the frame aerial until last. It can easily be fixed against the side of the cabinet by means of a piece of thick card, using the external aerial socket as a retainer.

The value of C4 is quoted at 500 pF. It is advisable to use a fixed capacitor of 450 pF in parallel with a 90 pF trimmer for this so that a range of adjustment is possible. The precise value depends on the core setting of L3 and also on the I.F., but by varying this trimmer in conjunction with the core of L2 the Light Programme can be brought in at full loudspeaker strength.

Lining up follows normal practice. If no signal generator is available the best that can be

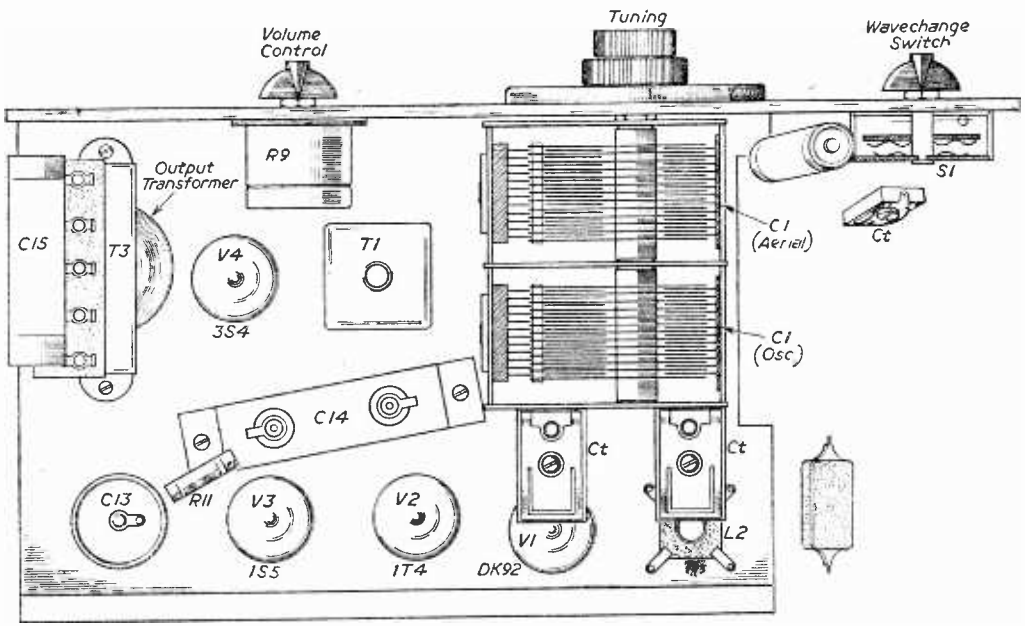
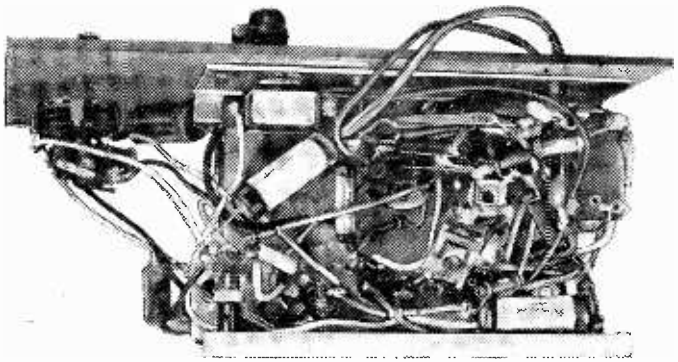


Fig. 3.—Top wiring details.

done is to get the circuits "in line" with each other and in this case the cores of T1 should be "in" as far as possible, otherwise the I.F. may be too high and cause whistles and interference from stations operating at the top end of the medium waveband. Trimming will be found extremely critical if maximum output is aimed at.



A view of the underside of the chassis.

"Hooting" was not experienced in the prototype but might result from the use of different types of L.F. transformer. If so a remedy can be effected by shunting the primary with a resistor. Too low a value will decrease amplification and this should be borne in mind. If the component values quoted are adhered to adequate audio output will result. H.T. current is 12mA at 90 volts, falling to 10mA at 80 volts, which is reasonable for a four valve circuit.

For the experimentally minded V3 may be used as a leaky-grid demodulator, the secondary winding of L4 being used for regeneration purposes.

Variable selectivity can also be incorporated if desired by utilising the tertiary winding of T1 in conjunction with a 5K potentiometer.

Cabinet Details

The author professes no skill in carpentry. However, the final result looks quite pleasing being made entirely from plywood and lacquered an attractive grey. Four rubber feet are also fitted. The carrying handle consists of a circular wooden rod secured to the back of the panel by two inverted L-shaped metal threaded rods. A suitable coathanger provides these items.

Five pieces of three-ply were used in the original and are illustrated in Fig. 4.

A further piece of five-ply, 10in. × 6in., is required for the base, and two strips 12in. × ¾in. × ¾in. for internal reinforcement, as may be seen from the sketch of the cabinet in Fig. 5.

LIST OF COMPONENTS

Capacitors

C1—500 pF twin-gang midget.
C2, 3, 7, 8, 11, 12 0.01 μF.
C4—500 pF (see text).
C5—100 pF.
C6—470 pF.
C9, 10—150 pF.
C13—50 μF, 25 v. elec.
C14—2 μF paper.
C15—0.001 μF.
C16—90 pF trimmer.
Ct—50 pF trimmers.

Resistors

R1, 2—500 K.
R3, 5—100 K.
R4, 6—4.7 K.
R7, 8—1 Meg.
R9—2 Meg. Pot.
R10 22 K. R11—1 K.

Valves

V1—DK92.
V2—1T4.
V3—1S5.
V4 3S4.

Coils

Osmor QFA1—L1. Osmor Q11—L2.
Osmor QO8—L3.
Osmor QA12—L4.
Four B7G bases.
I.F. Transformer—Teletron, type N.S.
L.F. Transformer—Midget, ratio 1:3.
Output transformer to match 3S4.
Speaker unit (see text).
Switch DPST, round dolly type.
Chassis—16 s.w.g., 6 x 4 x 1½ in.
Yaxley switch—2 pole, 2 way.
Three control knobs.
Batteries—H.T. 90 volt, L.T. 1.5 volt.

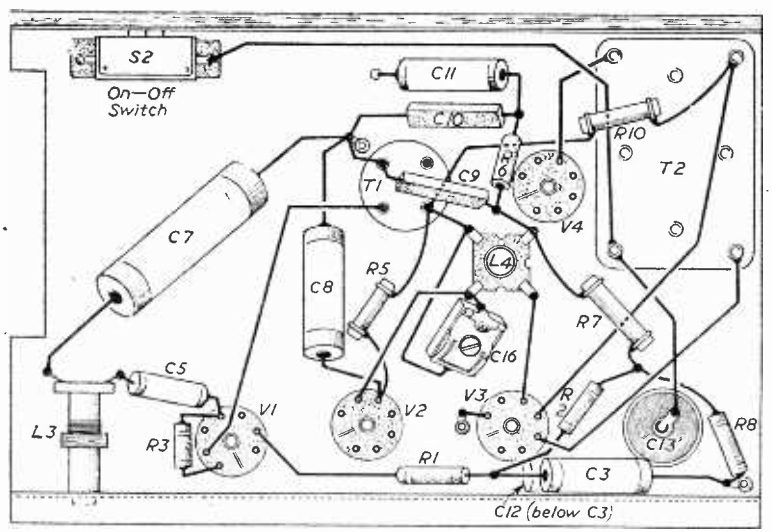


Fig. 2.—Wiring details of the view seen above.

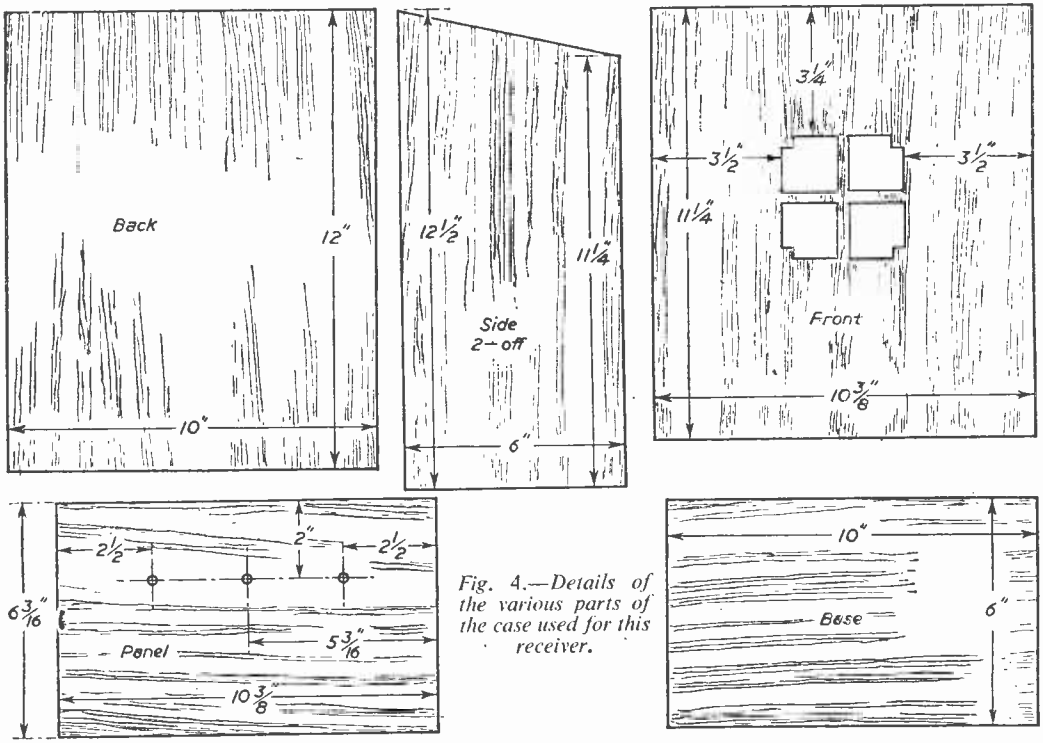


Fig. 4.—Details of the various parts of the case used for this receiver.

Results

Before the "Chorister" was brought into general use the small L.T. battery used in the initial test of the receiver was replaced by an AD32 (list price 4s. 3d.). The H. T. battery used was the Vidor equivalent of the Drydex H1146, used initially.

A most satisfactory performance resulted, the L.T. battery lasting some 126 days and the H.T. battery 154 days. These figures may be conservatively reckoned as hours as an average of 1 hour's listening per day would seem a fair estimate considering that on some days the receiver was only switched on for the News bulletin while on others several hours of listening were enjoyed.

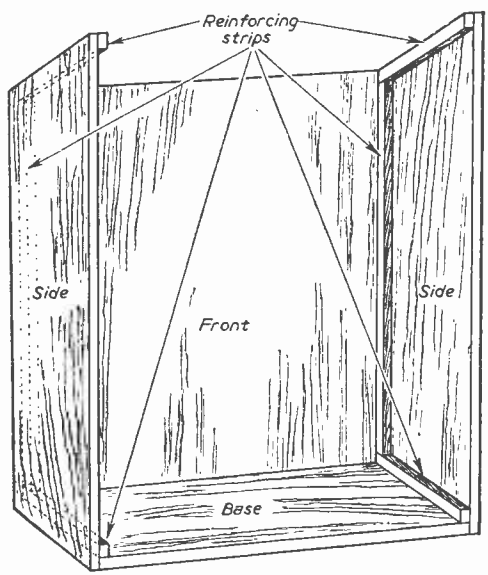


Fig. 5.—Assembly details of the case.

PRACTICAL TELEVISION SEPT. ISSUE NOW ON SALE PRICE 1s. 3d.

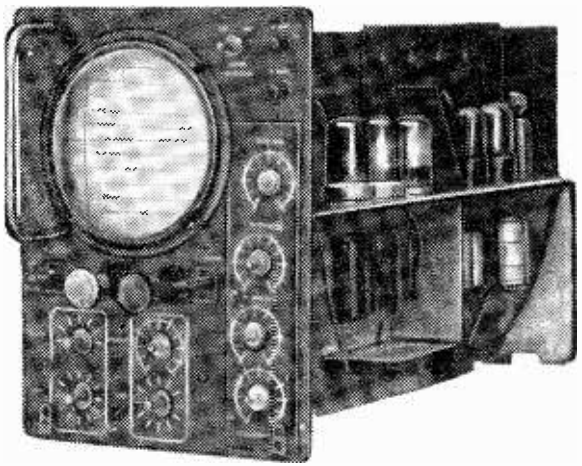
Our companion paper PRACTICAL TELEVISION, now on sale, contains a constructional article on an Improved Band III converter, utilising as the basis the popular ex-Government RF26 unit. It includes 2 R.F. stages, and is so designed that when switched to Band I the receiver with which it is used has the advantage of pre-amplification through the unit.

Amongst the other articles will be found two very important ones on the all-important picture tube. One of these deals with faults which are due to the tube itself, whilst the other deals with the problem of tube replacements.

There is a constructional article on a Low Loss Loft Aerial, TV I.F. transformers, Aerial Matching and Mismatching, and TV at Earls Court.

A new short series starts in this issue on Scanning and Synchronisation, whilst the usual features are also included.

A 'SCOPE FROM THE 62 UNIT



CONVERTING A POPULAR EX-GOVERNMENT UNIT INTO A USEFUL TEST SET

By D. Llanwyn Jones

(*Continued from page 466 September issue*)

Position B (Plate)

WHEN the switch is in this position (toggle straight out) the X input is connected directly to the X plate. The amplitude is still controlled by the X sensitivity potentiometer. The output of the timebase is still earthed.

Position C (Timebase)

In this position the timebase is connected to the plate. The amplitude of the timebase waveform is controlled by the X sensitivity. This is an advantage over normal practice since the output of the timebase varies with frequency.

The Switches

The diagrams on page 524 give the pin connections to the switches 1. 8 and 9. The numbers used in the case of 8 and 9 are the same as those in the preceding circuits. Remember that the X switch should have been inverted.

Timebase

The timebase employed in the oscilloscope is of the transitron type. This has a very linear sweep. All the capacitors used in the timebase *must* be perfect and hence ceramic or mica condensers are essential. The controls may be positioned as shown in Fig. 1. These are mounted in the metal box already mentioned which was originally in this position. Inside the box will be found two wafer switches (6-way) and two variable condensers. The latter are mounted at the end of two slow motion drives. The right-hand wafer is removed and the X sensitivity potentiometer mounted in its place. The variable capacitors are likewise dealt with. In the positions occupied by these the 2MΩ fine frequency control and the 2MΩ sync potentiometer may be fixed. The cogs from the condenser spindles may be fixed on to the spindles of these potentiometers and the controls worked through the slow motion drive. This gives a very fine control over the timebase frequency. The timebase range condensers may then be mounted in the space behind the remaining wafer switch.

As it stands the timebase will cover from about 5 c/s to 40 kc/s. If higher ranges are required the screen-supressor capacitor may be reduced in value.

Circuit of the Timebase

Note that the sync can either be taken off the Y plates, in which case the timebase can only be made to sync with the trace on the screen, or it can be taken to a socket and an external synchronising signal applied. In the author's case the sync is taken to the Y plate, the connection being conveniently made at the Y switch (pin f or c).

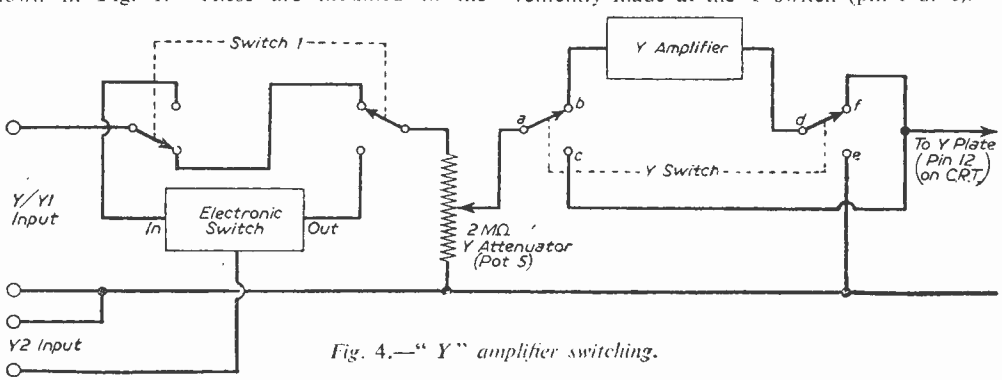


Fig. 4.—"Y" amplifier switching.

The output of the timebase is to pin 5 of the X switch.

In the prototype the timebase components were mounted on a tagstrip on the wall of the chassis in the position shown in Fig. 3 (b).

The wafer switch in the coarse frequency position is constructed in such a manner that, unless

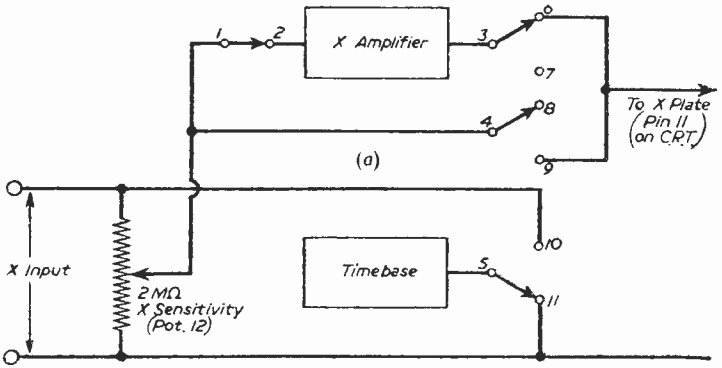
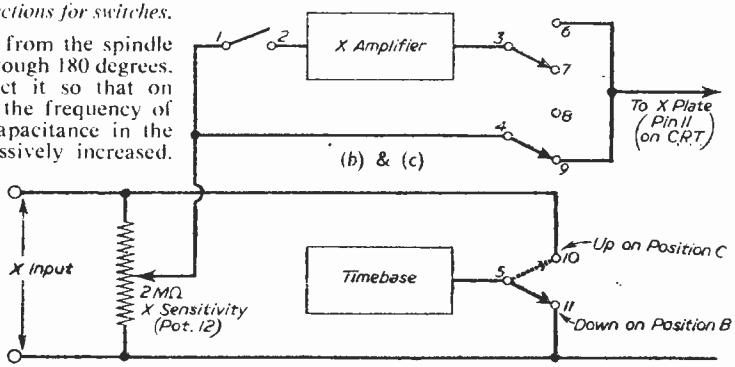


Fig. 5 (a), (b) and (c).—Pin connections for switches.

the moving wafer is removed from the spindle and replaced after turning through 180 degrees, it is only possible to connect it so that on turning the switch clockwise, the frequency of the timebase falls, i.e., the capacitance in the anode—grid circuit is progressively increased. The author carried out this procedure and in the circuit the switch is shown as thus modified. In this connection note that the grid of the valve must be connected to the contact of the switch, which is *always* in contact with the moving contact. A little study of the switch will make this point obvious. As the modified switch is turned clockwise capacities of 11,750, 1,750, 750, 250, 150 and 50 pF are introduced into the circuit. These values will give a continuous coverage over the specified frequency band.



The Y Amplifier

This is situated in the side compartment of the chassis. The reader may think the screen and cathode resistors a little unusual. This arrangement has been found, after a lot of experimenting, to give very little distortion. If the reader requires a more conventional amplifier the screen resistors should be about .5MΩ and the cathode resistors 150Ω. The input is from pin b of the Y switch and the output to pin d.

The X Amplifier

The author did not require an amplifier of high gain in this position and hence a single SP61 valve was employed in a conventional circuit. The gain of this stage will be found to be about 40 times. If a sensitive amplifier is required the circuit of the X amplifier may be used, making the cathode resistors 120Ω, the screen .5MΩ and using two SP61 valves. If desired this valve could be connected as a sync amplifier. The input is from pin 2 of the X switch and the output to pin 3. The position of the amplifier is shown in 3(b) and Fig. 2.

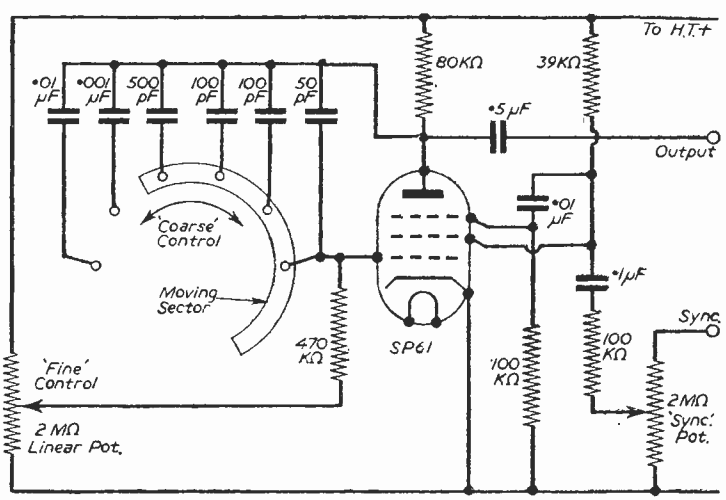


Fig. 7.—Details of the switch.

The Electronic Switch

The author originally attempted to construct a switch using EF50 valves throughout. The wave-form of the multivibrator was very poor, however, and the suppressor grid modulation

attempted introduced considerable distortion. It was therefore decided to adopt a proved design. The electronic switch used is that described by A. Haas and R. W. Hallows in their book "The Oscilloscope at Work." The signals to be displayed are connected to the Y2 input (which is wired direct to the Y2 potentiometer) and to the Y/Y1 socket. When the switch is in use the switch (1) is set to the "in" position, the Y attenuator (No. 5) is turned right up so that the maximum resistance is imposed between the Y plate and the chassis, and the Y switch (9) is set to plate. The Y switch should not be set to amplifier because of the transient nature of the output waveform from the electronic switch. The amplitude of the two traces is controlled separately by the Y1 and Y2 potentiometers and the separation of the two traces is varied by the operation of the "separation" control (4). When this is at mid track the two images should be coincident. Slight variations from this position are bound to occur, however, unless the two 6L7s and the 25kΩ resistors in the screen circuits are identical. To make full use of the components in the 62A the author has used 15kΩ resistors and a 25kΩ potentiometer in this circuit, i.e., in the screen grid circuit of the 6L7s. No snags have been found with this arrangement. The 2MΩ pot marked "frequency control" controls the switching frequency of the switch and may be pre-set as desired. The frequency is variable from about 300c/s to 10kc/s. The author finds that a fairly high frequency is best, the two traces then being made up of a number of dots. The internal screens of the 6N7s (pin 1) should be earthed. According to the valve manual, the 6L7s have no such screen, but if the metal type is procured it will be found that the metal case is connected to pin 1 of the base. Earthing this pin greatly improved the output waveform. The input circuit has already been described and the output is to switch 1. A study of Fig. 6 should clear up any difficulty here. Fig. 4 should also be consulted.

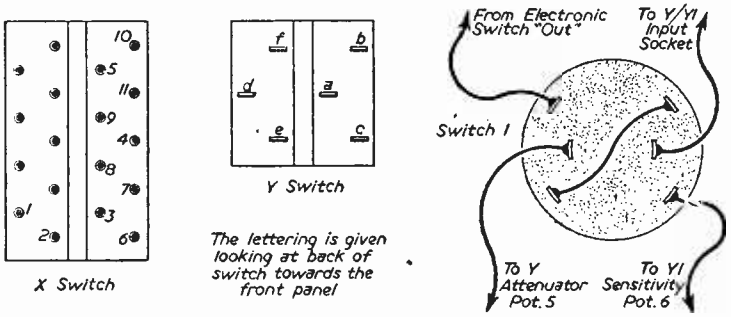


Fig. 6.—The electronic switch and other connecting data.

In making the output connection as short a length of screened cable as possible should be used or screened cable may even be dispensed with. This is because the higher frequency components of the output waveform are very liable to attenuation due to the capacitance of the lead. A capacity of only 50pF reduced the square wave to a triangular wave!

If all the precautions mentioned in this article are carried out no trouble should occur. If dis-

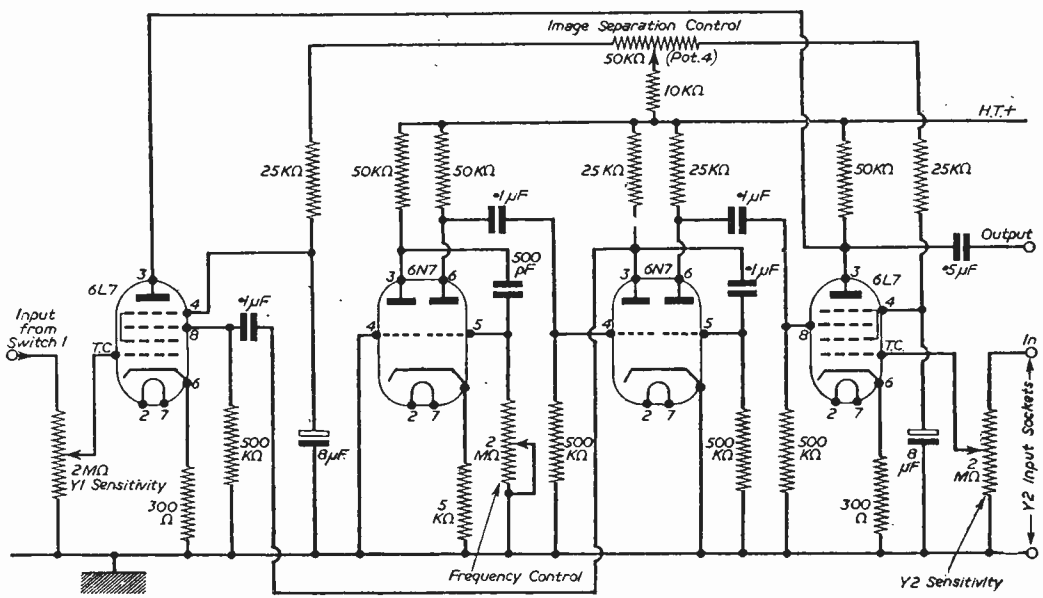


Fig. 10.—The "Y" amplifier.

tortion of the trace does occur this is almost certainly due to insufficient screening or careless routing of wires. If, as has been suggested, each section is tested after completion any hum which appears can be easily traced and the distortion nipped in the bud. If with the X and Y plates earthed the spot is still deflected then the distortion is magnetic. If the transformer is mounted as suggested and the Mu-metal screen is kept on the tube the constructor will not be troubled by this annoying fault.

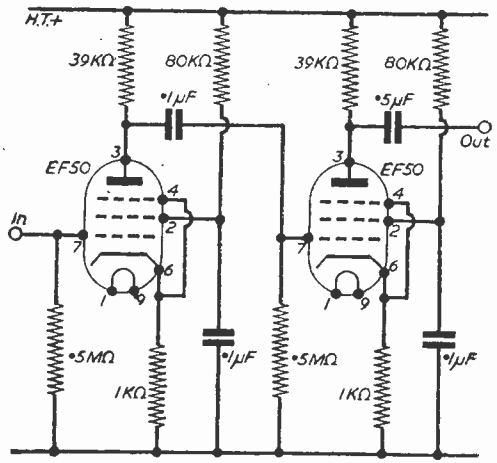


Fig. 8.—A two-valve switch.

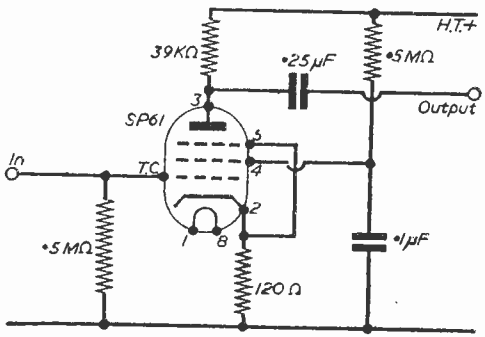


Fig. 9.—A one-valve switch.

News from the Clubs

THE SCIENCE MUSEUM RADIO SOCIETY

Hon. Sec. : Mr. G. C. Voller. The Science Museum, London, S.W.7. Telephone : KENsington 6371, Extension 237.

THE Science Museum Radio Society has arranged the first of its winter season of meetings for Tuesday, September 10th, 1957, commencing at 6 o'clock. An illustrated talk will be given by Major G. Watson (VP8BP) on : " Radio in Antarctica."

Membership is open to all Civil Servants, and full details can be obtained on application to the hon. secretary.

CLIFTON AMATEUR RADIO SOCIETY

Hon. Sec. : C. H. Bullivant, G3DIC, 25, St. Fillans Road, Catford, S.E.6.

FOUR teams took part in the Transmitting Field Day held on Sunday, July 28th, in the vicinity of Farnborough, Kent. The result was a win for C. Hatfull, G3HZI, and R. Poppi with C. Bullivant, G3DIC, and N. Moore runners-up. Other stations participating were G3FNZ and G3JKY.

During the summer months the weekly meetings have been devoted to constructional work, but commencing in September the fortnightly programme of talks, demonstrations, etc., is being reintroduced. September diary, 13th—11th Annual General Meeting ; 27th—Quiz.

Meetings are held every Friday at 7.30 p.m. at the clubrooms, 225, New Cross Road, London, S.E.14, when visitors and new members will receive a warm welcome. Details of membership can be obtained from the hon. secretary.

NORWICH & DISTRICT RADIO CLUB

Hon. Sec. : G4KO, Charles Avenue, Thorpe, Norwich.

THE club meets on Fridays at 7.30 p.m. at the Golden Lion, St. John's, Maddermarket. Recent evenings included " Electric Computers," by G3ASQ.

BRIGHTON AND DISTRICT RADIO CLUB (G3EVE)

Hon. Sec. : J. G. Trangmar, 33, Lennox Street, Brighton 7, Sussex.

MEETINGS are held every Tuesday evening at 7.30 p.m. at the Eagle Inn, Gloucester Road, Brighton, 1.

During the summer season there is no set programme, but informal discussions on all aspects of radio are held each week. The TX is also on the air quite frequently. New members and visitors are always welcome.

The A.G.M. will be held on Tuesday, September 24th, at 8 p.m.

EDINBURGH AMATEUR RADIO CLUB

Unity House, Hillside Crescent, Edinburgh.

THE Edinburgh Amateur Radio Club meets every Wednesday at 7.30 p.m. in Unity House, Hillside Crescent.

The September lecture will be given by Alex Dow on September 11th. Subject : " Wobbulators and Oscilloscopes."

October items are lectures on " Fault Finding in TV Receivers," " Sale of Goods," and " Magazine Review."

THE AMATEUR RADIO CLUB OF NOTTINGHAM (G3EKW)

Hon. Sec. : F. V. Farnsworth, 32, Harrow Road, West Bridgford, Nottingham.

THE Nottingham Amateur Radio Club continues to meet at Woodthorpe House, Mansfield Road, and due to increased membership the club will be open every Tuesday and Thursday at 7.15 p.m. An attractive programme is planned for the autumn including visits and lectures. Full details will be available later. Short sessions of Morse practice each club night. New members are very welcome.

BURY RADIO SOCIETY

Sec. : Mr. L. Robinson, 56, Avondale Avenue, Bury, Lancs.

THE Bury Radio Society holds its meetings on the second Tuesday of each month at the George Hotel, Kay Gardens, Bury.

On Tuesday, October 8th, Mr. R. H. Hammans, G2IG (the Immediate Past President of the R.S.G.B.), will talk on " Matching Matters."

WELLINGBOROUGH AND DISTRICT RADIO AND TELEVISION SOCIETY

Sec. : P. E. B. Butler, 84, Wellingborough Road, Rushden, Northants.

THE members have turned their hands to papering and painting the clubroom in preparation for the forthcoming winter season.

The society was once again in action at the local Charities Fete, where quite a considerable sum was raised by means of various electronic devices constructed by the members.

A winter programme is now in the process of being drawn up and a copy will be forwarded to you as soon as possible.

Copies of the winter programme may be obtained from the secretary at the above address.

A copy of the society's standing orders is available for anyone's inspection.

TORBAY AMATEUR RADIO SOCIETY

Hon. Sec. : Geo. Western, G3LFL, 118, Salisbury Avenue, Barton, Torquay.

MEETING at the Y.M.C.A. Torquay, the Torbay Amateur Radio Society spent an enjoyable evening under the chairmanship of Mr. W. H. Baker. The guest speaker was Don Willoughby, DL2YU, on leave from Rothenbach, Germany, whose informal talk was much appreciated. The next meeting will take place on Saturday, September 14th at 7.30 p.m. at the Y.M.C.A., Castle Road, Torquay, at which it is hoped to welcome further visitors to our district.

C.R.T. ISOLATION TRANSFORMER
Type A. Low leakage windings. Ratio 1 : 1.25 giving a 25% boost on secondary.
2 v., 10/6 ; 4 v., 10/6 ; 6.3 v., 10/6 ; 10.8 v., 10/6 ; 15.3 v., 10/6.
Ditto with mains primaries, 12/6 each.
Type B. Mains input 220/240 volts. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. Low capacity, suitable for most Cathode Ray Tubes. With Tag Panel, 21/- each.
Type C. Low capacity wound transformer for use with 2 volt Tubes with falling emission. Input 220/240 volts. Output 2-2½-2½-3 volts at 2 amps. With Tag Panel, 17/6 each.
NOTE.—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

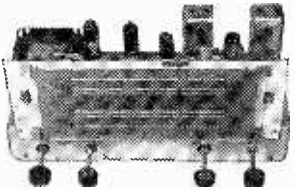
TRIMMERS Ceramic. 30, 50, 70 pf., 9d. ; 100 pf., 150 pf., 1/3 ; 250 pf., 1/6 ; 500 pf., 750 pf., 1/9.
RESISTORS. All values. 10 ohms to 10 meg., ½ w., 4d. ; 1 w., 6d. ; 2 w., 1/-.
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values 100 ohms to 10 meg.
5 watt, 10 watt, 15 watt } WIRE-WOUND RESISTORS 25 ohms—10,000 ohms..... { 1/3, 1/6, 2/-
15,000 ohms—50,000 ohms, 5 w., 1/9 ; 10 w., 2/3.

12/6 PURETONE RECORDING TAPE
1,200 ft. on standard 7" Plastic reels. Spools 5" metal, 1/6, 7" metal, 2/3.
FERROVOICE 1,200 ft. Plastic Tape 25/-
SCOTCH BOY, 1,200ft. Plastic Tape 27/-

O/P TRANSFORMERS. Heavy Duty 50 mA., 4/6. Multiratio, push-pull, 6/6. Miniature, 3/4, etc., 4/6.
L.F. CHOKES 15-10 H. 60/65 mA., 5/- ; 10 H. 80 mA., 8/6 ; 10 H. 150 mA., 12/6.
MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v., 4 a., 5 v. tapped 4 v., 2 a., ditto 250-0-250, 21/-. Bargain 300-0-300 65 mA., 6 v., 4 a., 4 v., 2 a., 15/-.
HEATER TRANS. Tapped prim., 200/250 v. 6.3 v. 1½ amps., 7/6 ; tapped sec. 2, 4, 6.3 v., 1½ amp., 8/6 ; prim. 230 v. Sec. 6.3 v. 3 amp., 10/6.
ALADDIN FORMERS and core, ½in., 8d. ; ¾in., 10d. 0.3in. **FORMERS 5037/8** and **Cans TVI/2.** ½in. sq. x 2in. and ¾in. sq. x 1¼in., 2/- ea., with cores.
TYANA.—Midget Soldering Iron 200/220 v. or 230/250 v., 16/9. **Solon Instrument Iron, 24/-.**
MAINS DROPPERS. 3in. x 1¼in. Adj. Sliders, .3 amp., 750 ohms, 4/3. 2 amp., 1,000 ohms, 4/3.
LINE CORD. .3 amp., 60 ohms per foot. .2 amp., 100 ohms per foot. 2-way, 6d. per foot. 3-way, 7d. per foot.
LOUDSPEAKER, P.M. 3 OHM, 2½in. square. 17/6. 5in. Goodmans, 17/6. 7in. x 4in. Goodmans, 21/-. 3½in. square, Elac, 21/-. 8in. Plessey, 19/6. 6½in. Goodmans, 18/6. 10in. R. & A., 30/-. T81, Tweeter, 18H75, 8/6. 12in. Plessey, 30/-. 8in. M.E. 2.5k field, tapped O.P. transf., 24/6.
CRYSTAL DIODE G.E.C., 2/-. **GEX34,** 4/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 16/6 pr.
MIKE TRANSF. Ratio 50 : 1, 3/9 ea. : 100 : 1, 10/6.
SWITCH CLEANER Fluid, squirt spout, 4/3 tin.
TWIN GANG TUNING CONDENSERS. .365 pf. miniature 1in. x 1½in. x 1½in., 10/-. .0005 Standard with trimmers, 9/- ; less trimmers, 8/- ; midget, 7/6 ; standard .0005 mfd. 3-gang, 7/3 ; 80 pf single, 2/6.
SPEAKER FRET, Expanded Metal Silver, 15½in. x 9½in., 2/- each ; 14½in. x 12½in., 3/- ea.
GOLD CLOTH. 18in. x 25in., 5/- ; 25in. x 36in., 10/-.
Tygan 4ft. 6in wide, 10/- ft. ; 2ft. 3in. wide, 5/- ft.

All Boxed VALVES New & Guaranteed

1R5	8/6	6K8	8/6	EB91	6/6
1S5	8/6	6L6	10/6	EBC33	8/6
1T4	8/6	6Q7	10/6	EBC41	10/6
2X2	3/6	6SA7	7/6	EBF80	8/6
3S4	8/6	6SN7	8/6	ECC84	12/6
3V4	8/6	6V6G	7/6	ECF80	10/6
5U4	8/6	6V6GT	8/6	ECF82	10/6
5Y3	8/6	6X4	7/6	ECH42	10/6
5Z4	10/6	6X5	7/6	ECL80	8/6
6AM6	8/6	7S7	8/6	ECL82	12/6
6B8	5/6	12A6	7/6	EF39	7/6
6B16	7/6	12AH8	10/6	EF41	10/6
6BH6	10/6	12AT7	10/6	EF50	5/6
6BW6	8/6	12AU7	10/6	Equiv.	
6BW7	8/6	12AX7	10/6	EF50	5/6
6CH6	10/-	12B6	10/6	Sylv.	
6D6	7/6	12BH7	10/6	EF80	10/8
6F6	7/6	12K7	8/6	EF92	5/8
6H6	3/-	12Q7	8/6	EL32	5/6
6J5	6/6	3524	10/6	EL84	10/8
6J6	7/-	80	8/6		
6J7	8/6	954	1/6	EY51	11/6
6K6	6/6	EA50	1/6	EZ40	10/6
6K7	5/6	EABC80	8/6	EZ81	11/6



1957 RADIOGRAM CHASSIS
THREE WAVEBANDS. FIVE VALVES S.W. 16 m.—50 m. LATEST MULLARD M.W. 200 m.—550 m. ECH42, EF41, ECB41. L.W. 800 m.—2,000 m. EL41, EZ40.
12 month guarantee.
A.C. 200/250 v. 4-way Switch ; Short-Medium-Long-Gram. A.V.C. and Negative feedback 4.2 watts. Chassis 13½ x 5½ x 2¼in. Glass Dial 10 x 4½in., horizontal or vertical available. 2 Pilot Lamps. Four Knobs, Walnut or Ivory. Aligned and calibrated. Chassis isolated from mains.
10 gns. Carr. & Ins., 4/6.
TERMS: Deposit £5.5.0 and six monthly payments of £1.
MATCHED SPEAKERS FOR ABOVE CHASSIS 8in., 17/6 ; 10in., 25/- ; 12in., 30/-.

RECOMMENDED FOR ABOVE CHASSIS
★ COLLARO ★
HIGH-FIDELITY AUTOCHANGER
1957 Model RC456
7in., 10in., 12in. Records
16, 33, 45, 78 r.p.m.
4 SPEEDS—10 RECORDS
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Listeners' Landslide

THE BBC recently disclosed that the average nightly audience listening to the sound broadcasts fell from 4,500,000 in the first quarter of this year to 3,500,000 in the second —a decline of 1,000,000. This is a matter for great concern to the BBC and to the future of sound broadcast, for eight years ago the average nightly audience was 8,000,000. No doubt, this vast drop can be partly accounted for by the competition of television. It is my view, however, that while TV must inevitably erode some of the interest in sound broadcasts, the decline in interest is due in some measure to the stereotyped and somewhat frowsy programmes which the BBC continues to radiate as it did before it had any competition. It considered that it was in an impregnable position, and if the listeners did not like the programmes they could lump them. I believe Lord Reith said, when he was D.G., "It is not what the public thinks regarding the programmes, but what we, who sit round this table, think." That attitude, even to-day, still permeates the BBC. It has concentrated far too much on childish parlour games and during the period of the day when the listening audience is small, insufficient care is taken in putting on good programmes. It is considered that anything will do during those hours. The effort is concentrated mainly on the evening programmes, but I fear that they are much of a muchness. They have become styled, no doubt due to the fact that these programmes have been produced for a number of years by the same producers. Dance music continues to occupy a large amount of programme time, as bands continue to split up, increase and multiply like germs. Even the plays chosen are outworn and badly selected in any case. Where the attempt is made to broadcast new plays by modern authors, they are usually of the problem type, written by young authors either anxious to rectify the world or to attack orthodoxy. It is not too late for the BBC to remedy this state of affairs, but drastic measures will have to be taken. Variety should be the spice of the broadcasting programmes. Too much Gilbert Harding, Anona Winn, and other radio characters, sates the public. To keep plugging Twenty Questions and similar Yankee inspired programmes is a great mistake, especially when the programme cast consists of the same few people. Variety in personnel as well as in programmes is absolutely essential. It will be said in reply to these criticisms that it is almost impossible to keep up a daily service of programmes for 365 days a year because programme material is simply not available. Then why attempt the impossible? Fewer programmes with gaps in the daytime would enable the BBC to pick the best of the material available and to reject the dross which is still allowed programme time. It must be faced that the sightless broadcasts must follow the same trend as took place when the talkies first competed with the silent films. Few people to-day would wish to see a silent film.

Music and Movement

I mentioned last month that I had had a letter from my old critic, Roy L. Williams. He disagrees entirely with my comments on the stupid Music and Movement programmes. It is true that he finds my paragraph amusing. He thinks that I am in favour of a return to the more formal methods of teaching used in my youth. He seems to doubt the existence of Eric Blom's Dictionary of Music. Well, I have a copy on my desk and I suggest that he goes to his local library and asks the junior assistant to lead him to a copy. He challenges my statement that illiteracy is on the increase which shows that he could never have read the public statistics relating to those called up for national service. However, I stick to my guns. Children go to school to be educated, not entertained, and if the BBC does want to intervene in a matter which is not their concern, namely education, I suggest that they should put out far more informative and useful programmes than Music and Movement. I have no doubt that the programmes are popular with children, but they should have no say in the matter. They would be in favour of a morning Punch and Judy show for example or an hour off to go to the pictures or of being handed a bag of lollipops. It is possible that a referendum would show that the majority of children really do not like it. Some of the schoolmasters I know do not. However, enough of Mr. Williams. I now turn to another letter I have received from a schoolmaster, Mr. Arthur Turner, of Gidea Park, who wrote to me relating to my comment on radio as a form of handicraft. His argument is: 1. I do not like radio construction myself; 2. Therefore no one else does; and 3. It is hence useless. He is in favour of teaching pupils to make things from old cotton reels, cigar boxes and cocoa tins. "The building of one small radio may be an exciting and interesting experience to a boy and may even lead him to a new interest in mathematics, but when it is completed, you have taught him to solder—no more that that. . . . I am doing more in the cultivation of hand and eye training than could ever be done by building radio sets." Well, others may have different opinions about that, and who said that radio classes were intended to supplant other forms of handicrafts? Nor did I state that such was intended to train the hand and the eye. I would welcome correspondence from other schoolmasters on this subject.

Principal Exhibits Reviewed

IT is not possible in this issue to review anything of oustanding interest, for the reason that nothing has been revealed at the time of going to press which comes within this category. If there are any remarkable developments they are being kept under a cloak of secrecy until the doors of Earls Court open on the eve of the show, and therefore it will be some weeks before even we know about them. However, a perusal of all the information which has so far been released by the manufacturers shows the usual parallel lines upon which most firms work, and in some models this is very marked. However, we will deal with the exhibits in groups so that we may more accurately present a picture for those who will not be able to visit the show.

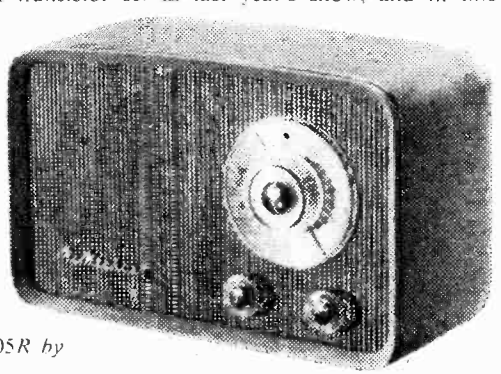
SPECIAL NOTE

This report has been compiled from information supplied by exhibitors, as we go to Press with this issue before the show opens.

In the next issue we shall complete our report of the show by giving details of the new models, components and other developments disclosed on the eve of the show.

As was to be expected, the transistor has found a much wider field this year, but it is still not a complete replacement for the valve. Its limitations have resulted in its being restricted to certain kinds of apparatus—certain sections of television receivers being one of the most popular. Next comes the portable. It is probably here that it finds its greatest application. This was only to be expected as its small size naturally leads the designer to think in terms of miniaturisation, and the portable and the deaf aid are probably the only pieces of complete equipment where this can be carried out to its logical conclusion.

The portable to-day has been reduced to most compact forms, and the general appearance has in many cases been styled on very modern lines with either plastic (transparent) control knobs or gilded or similar finishes. Some typical models may be seen on page 532, the upper being by Vidor and the other by Pam. The latter produced a transistor set at last year's show, and in this



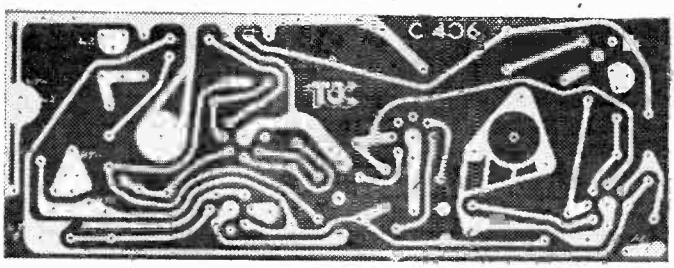
On the left is a playing desk by Collaro, and on the right Model M105R by McMichael.

particular model (No. 720) there are six transistors, and in addition it utilises a printed circuit. With the miniaturisation which this affords there is ample room for a good loudspeaker and this is a 6in. × 4in. elliptical. It thus gives very good quality reproduction and is, of course, very economical in use.

In the Vidor Vagabond which is seen above the Pam on page 532, the present-day Ferrite rod aerial is included and this type of aerial has now practically ousted the older form of pancake or slab aerial which has been in use for some time. A much higher Q is given with this type of aerial and, of course, apart from occupying much less space, it does not give so much trouble from its field, although it often proves desirable to experiment with its position. This particular set measures roughly 10in. × 3in. × 7in. and weighs only 4½lb. with batteries.

The Sky Casket by Ever Ready (page 533) is a valve portable and this is of the vanity-case type—no controls or other external components being visible as in other models. This is also fitted with an elliptical speaker but weighs 7¾lb. It employs a 4-valve superhet circuit.

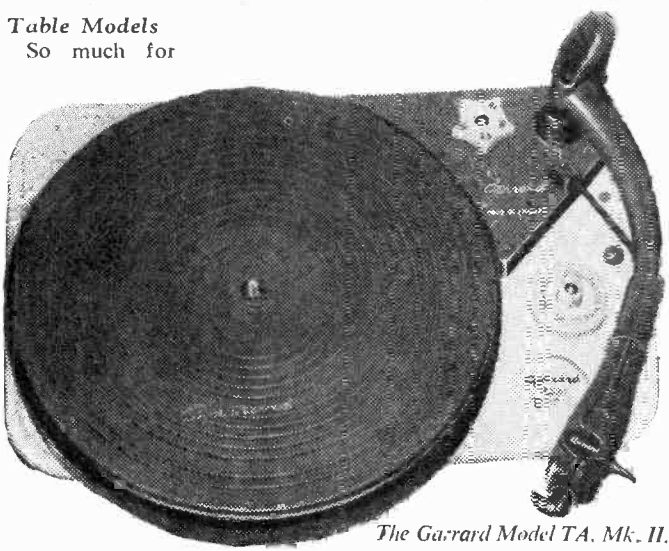
The Bush V.H.F radiogram-phone, with 2 matched speakers and tweeter.



One of the printed circuits by T.C.C.

Table Models

So much for the portable type of receiver, but it is worth while at this point to deal with the table models which in many cases are designed on very similar lines. In fact, the link between the portable and table model is so close that in the Pilot "Poppet" the makers have provided a removable panel so that if it is placed as a permanent home fixture the panel, which can be removed, leaves the cabinet in more or less the appearance of a standard table model. Out of doors the panel is used to hide the controls and scale. Here again the makers have gone in for attractive colouring, the set being in polka dot blue with biscuit, or blush rose and ivory, and the control knobs are in cream with gold engraved finger plates, and a gold escutcheon. This is a battery-mains model and utilises a 4-valve superhet circuit, again with the Ferrite aerial. It costs 17½ guineas. (See page 534.)



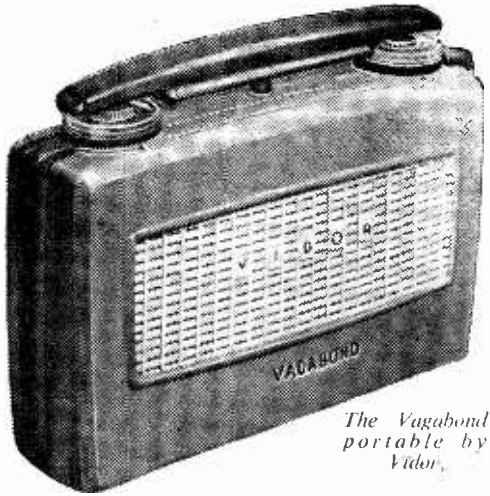
The Garrard Model TA, Mk. II.

In the direction of ordinary table models the McMichael

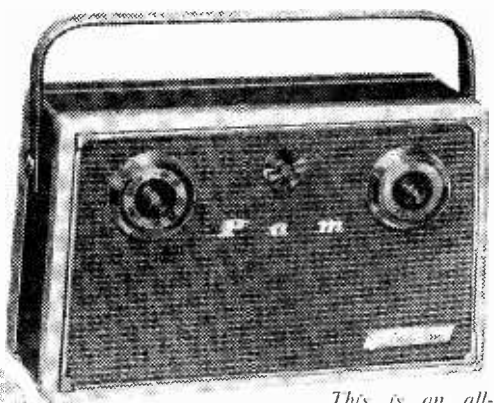
shown at the foot of page 530 is typical. This is their Model M105R, and is a 4-valve mains set, with the built-in Ferrite aerial, and is also in coloured finishes—the actual material being of a washable nature. For those who prefer the orthodox finish there is one model in selected walnut and contrasting veneers.

At the other extreme there are elaborate radiograms, some of which have been designed to give very high-quality reproduction from the record side, and in view of this the radio unit includes also an F.M. band. As we have before remarked, however, many receivers appear to be available labelled "A.M. and F.M.," but there has been no attempt to justify the F.M. section—in some cases small 8in. speakers are being used. After the BBC boost of the high-quality which is available on F.M. this is rather surprising, and we would have expected some of the firms to have made an effort to fit much better audio sections.

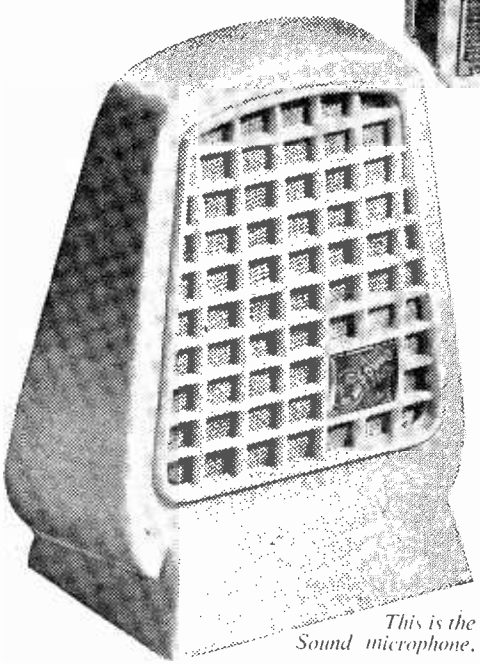
As a guide to the sort of equipment which is available, however, there is the Bush VHF radiogram, seen on page 531. In this the makers have taken great care with reproduction and have provided three loudspeakers. Two matched 10in. speakers plus a tweeter for the "top" should give very good results, not only from L.P. records but also from the radio side. As may be seen, there is also adequate record storage space, a shelf for books and a very reasonable sound chamber for the speakers. This model costs 98 guineas, and the bow-fronted cabinet is veneered in walnut with gilt trim.



The Vagabond portable by Vidor.



This is an all-transistor portable by Pam. It uses 6 transistors and costs 23 gns.



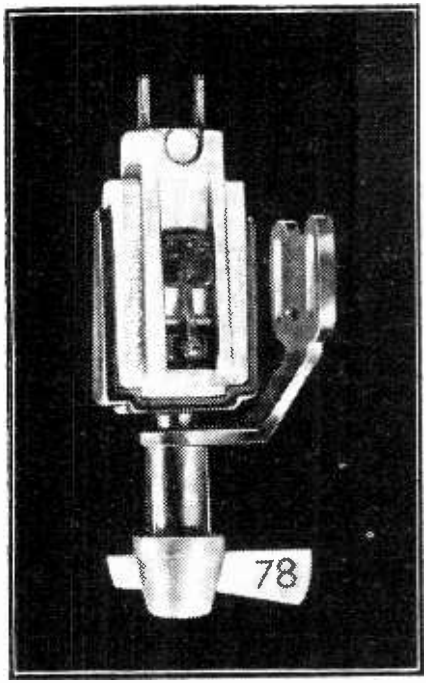
This is the Sound microphone.

Record Reproduction

The motor unit in the set just mentioned is of the 4-speed type, and although there are still only two main gramophone motor manufacturers their products offer a wide range of choice for the connoisseur. At the foot of page 530 is the Collaro 3F200 4-speed unit. These have the turn-over heads and provide speeds of 16, 33, 45 and 78. No provision appears to have been made for fine adjustment of speed, and this is a worth-while refinement for hi-fi fans, as if a disc is being used as accompaniment, etc., it is often found that it is out of tune and requires either slowing-up or speeding-up to bring it into pitch. All Collaro units, changers and transcription units are now fitted with the Studio Cartridge. Four types of crystal cartridge and one ceramic cartridge are available, depending on the requirements of the amplifier into which the pick-up output is fed. Tape transcriptors are also supplied by Collaro.

In the Garrard unit seen on page 531, again there are 4 speeds, and the makers have thoughtfully provided an adaptor for certain 45 r.p.m. discs. This may be seen in the centre on the right. This Garrard unit has a heavy turntable, plug-in pick-up head, and is mounted on a substantial rectangular plate to facilitate mounting in one's own cabinet.

Record-players are also to be found in plenty.



A turnover cartridge for pick-ups by Cosmocord, and below right, the Sky Casket by Ever Ready.

mains only, and costs 22 gns.

Alba are also showing a somwhat similar "Electronic Record Reproducer," which has a high quality printed circuit amplifier with 20 db negative feedback, a 4-speed changer unit, hi-fi head and three speakers—one elliptical bass unit and two square treble reproducers, which are mounted on the sides of the cabinet to give a 3D effect.

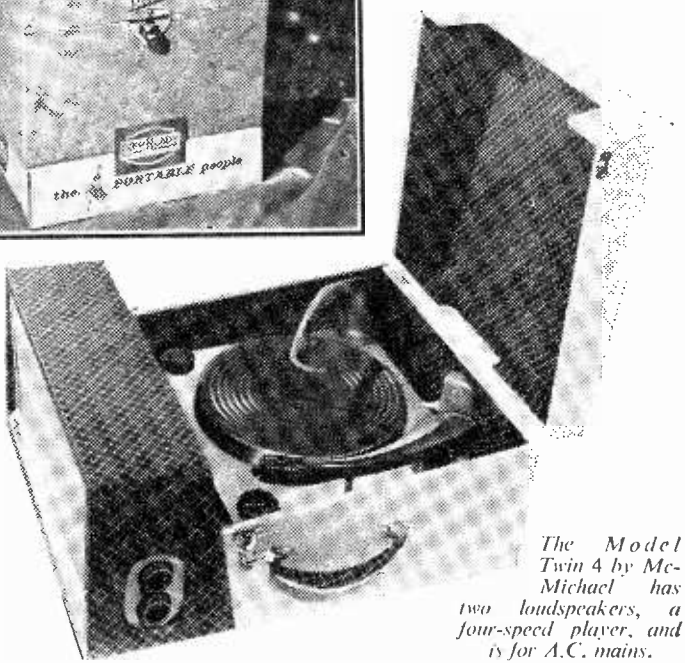
The cabinet is made from chip-wood to avoid resonance.

Used in many of the radiograms now on the market is the Cosmocord pick-up cartridge, seen in the illustration on the left. This is of the turn-over type and is designed to plug in, and it costs £1 10s. plus purchase tax.

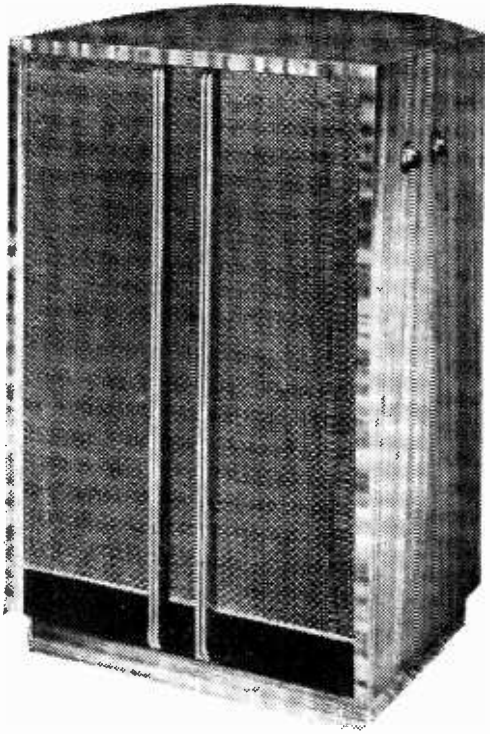
Sundries

In what might be termed the field of sundries we have microphones, loudspeakers, valves and similar incidentals. Goodman's Industries are one of the speaker firms, and most readers will remember last year's surprise of the "Acoustical Resistance Unit," to improve results from the speaker in its cabinet. Nothing has so far been announced for this year, but we may expect some further aid in high-fidelity. Their "315" reproducer may be seen on page 534, and this has three speakers fed by a double divider network made up of four half-section filters. The bass unit is a 12in. direct radiator speaker handling frequencies from 30 to 750 c/s. A pressure-driven horn loaded mid-range unit handles from 750 to 5,000 c/s, and a pressure driven horn loaded H.F. unit handles from 5,000 to 16,000 c/s. The mid-range and treble units are provided with externally operated variable attenuators of the constant impedance type, calibrated in 2 db steps between 0 and 12 db. The inside of the cabinet is divided into two parts, the upper portion containing two pressure units and their attenuators,

and here again there is ample scope for obtaining better reproduction. Unless the discs are to be played through a high-quality radiogram it seems almost a waste of time to have a long-playing record with a small speaker. The players in many cases are little larger than portable receivers, and whilst these may be satisfactory for use on certain occasions out of doors, there is room for better reproduction in the home—without having to go to the expense of a large radiogram. McMichael have tackled this question, and the result may be seen in the model on the right. This is known as the Twin 4, and it includes a 4-speed player, provision for extra speaker, and has two speakers built in. The section housing the speakers is designed to give very good overall response, and long players can certainly sound very good on this portable unit. It is, of course, for A.C.



The Model Twin 4 by McMichael has two loudspeakers, a four-speed player, and is for A.C. mains.



Goodmans "315" reproducer—a three-way Hi-Fi loudspeaker system.

and the lower portion, which is lagged, contains the bass unit and is loaded by the acoustical resistance unit already mentioned. The price of this cabinet speaker unit is £86 15s., and a 20-watt version is available at £92 5s.

Various types of microphone will be exhibited and one interesting model is shown on page 532. The makers (Tape Recorders Ltd.) claim that their engineers, engaged entirely on tape recorders, have designed this especially for use with tape apparatus. It is a crystal unit, housed in a contemporary polished plastic case of the desk or hand type. The base is lead loaded to prevent accidental knocking over and also to act as a stabilising device against unwanted vibration, etc., whilst the insert is mounted in a floating foamed plastic suspension device. It is claimed to be remarkably free from amplitude, phase and harmonic distortion, and gives crisp, clear quality. There is a two-year guarantee with each microphone, which costs 55s., inclusive of an 8ft. screened microphone lead and special screened jack plug of the standard G.P.O. pattern.

Cosmocord announce a new Terylene cable for their MIC 39-1 microphone and hope to be able to show a "Foldaway-Pack Microphone." The sensitivity of this instrument will be of the order of −50db. with a substantially flat response from approximately 40 c/s to 6,000 c/s and a virtually omni-directional characteristic. The makers emphasise that it will not be available for some time after the Show, although it is hoped to exhibit it.

A new midget

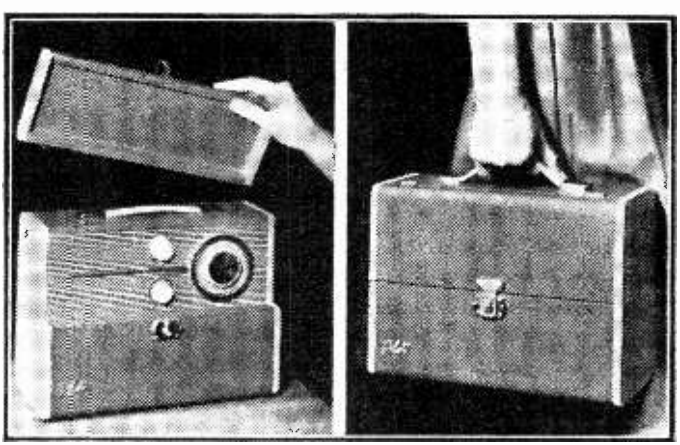
As we go to Press, Messrs. Cossor announce a neat printed circuit transistor pocket radio. This is one of the smallest we have yet seen, and its actual size is 6in. long, 3⅜in. wide and only 1½in. deep. It houses a 2¾in. loudspeaker and the circuit incorporates four entirely new transistors and two crystal diodes. It is covered in leatherette, which is available in red, grey, buff or lizard skin and fits into the pocket, whilst a flexible lead is available to which is attached a small earpiece. Plugging this in disconnects the loudspeaker. A Ferrodyne aerial is incorporated and the set operates on the Medium waveband only. No price has yet been announced.

Constructor sets

Most constructors will be interested in the test instrument series of home-constructor kits which are being marketed by Cossor. Amongst other items these include a valve voltmeter and a single-beam oscilloscope. An addition which will be seen in the demonstration room D.38 is a double-beam 'scope.

The kits are, in effect, factory-made instruments ready for home assembly, and contain everything, including nuts, bolts, washers, etc.

The instructional booklets for these instruments are very comprehensive, and they contain printed circuitry for certain parts. In a pocket at the rear of the instructional booklet will be found a complete circuit diagram and parts list, and the completed instruments are covered by a guarantee.



The Pilot "Poppet" portable which may also be used as a table model with the front removed.

TRANSISTORS in Practice

NOW that transistors in variety are appearing on the market more constructors will wish, no doubt, to turn their attention to these new and economical devices. The serious worker always desires to have some understanding of the devices that he constructs so, following the lines of the series of articles dealing with valve amplifiers, the basic theory, so far as it will help the practical man, will be dealt with before embarking on design work.

Many readers experience difficulty in understanding how the modern transistor operates, and therefore a short series of articles has been prepared to explain their action—in theory and practice. In this article the transistor is compared with an ordinary triode valve. Later articles will give practical circuits.

The characteristic of a contact between certain crystals and metals such as was used in earlier detector circuits is that of presenting a different resistance to an applied voltage of one polarity compared with that presented when the voltage is reversed. Any such non-linear device will act as a detector of modulated R.F. and is, in fact, very similar to the diode valve in this respect except that the reverse resistance (i.e., the resistance when the voltage is connected in the direction least favourable to the passage of current) is not so high as with a diode valve and therefore cannot be neglected even in a simple theoretical account, as is conveniently done in the case of the valve counterpart.

Point Contact Transistor

The multiplicity of substances used in early days as crystals has now disappeared and the transistors available for constructors use germanium. If instead of the single point of the diode device two such points bear on the germanium in close proximity to form a transistor each can be used as a separate diode but they are far from being independent of each other. Indeed, if one has a voltage applied in the forward direction (i.e., that to which the contact presents the lower resistance) a current will flow as expected, but if at the same time the second point contact has a voltage applied in the reverse direction the current flowing at that side is more than would be the case if the forward current of the first diode contact were to be switched off. In other words, the input current at the first point contact (called the emitter) subscribes some current to that passing through the second contact (the collector; the germanium forms the base) and as the impedance at the collector side is high (because the voltage is in the reverse direction) this current represents a higher power than that fed into the emitter. This arises from the basic formula for electrical power, i.e., $W=I^2R$. Thus a power gain is achieved. This is not something for nothing, of course. The additional power is drawn from the battery supplying the transistor.

The germanium used for semi-conductor devices is actually slightly impure. The impurity is in very small proportions and, in fact, the germanium to be used for this purpose has first to be purified to a very high degree before the wanted impurity is introduced in controlled quantities of about 1 part in 10^7. As a

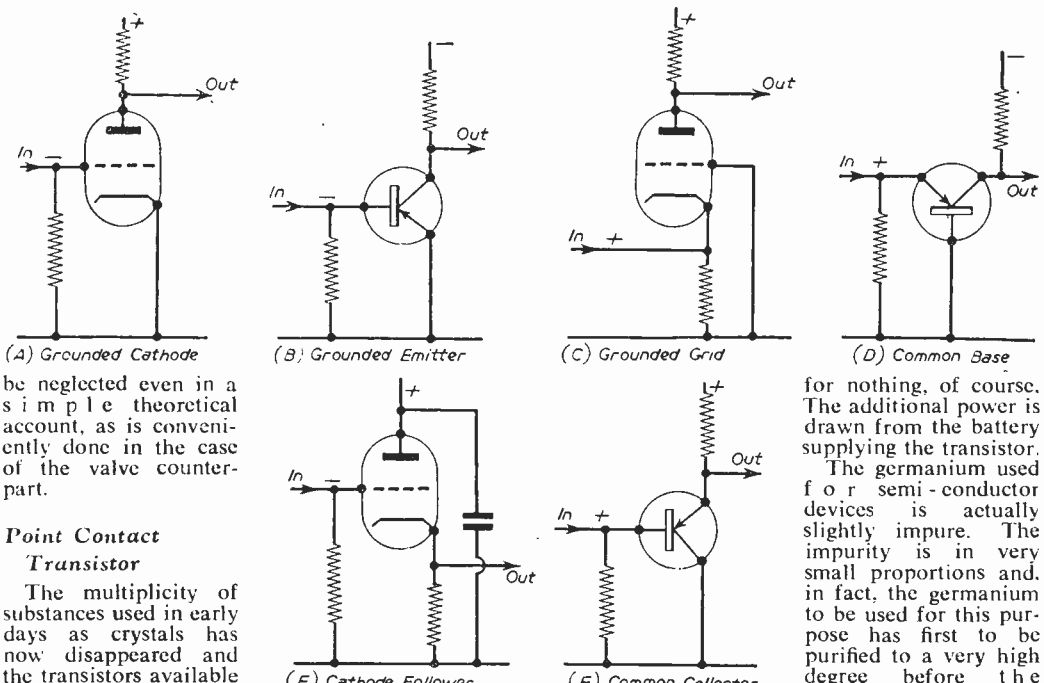


Fig. 1.—Diagrams showing comparison between the triode valve and the transistor. The signs indicate D.C. potentials with regard to earth.

result, depending on the type of impurity added, the material has either a surplus of electrons which are free to act as carriers of a current in which case the germanium is classed as "n" (for negative) or alternatively there are insufficient electrons to fill the positions where they are needed to provide continuous, pure germanium, in which case it is said that there are "holes" to act as carriers of a current and the germanium is classed as "p" (for positive).

Junction Transistors

The point contact transistor has now given way to the junction transistor for ordinary applications and this avoids the need for metallic points. As this is the type that the constructor is likely to use the rest of this article will deal only with them. The junction transistor is made up in the form of a sandwich using a very thin layer of one variety of germanium (p or n), which is called the base simply to agree with the terminology developed for the point contact variety, between two layers of the other variety. Those generally available have "n" germanium in the middle and so are classed as "p-n-p" transistors. So to provide current in the forward direction the "p" layer used as the emitter must have a positive voltage compared with the base and it follows that the other outer layer of "p" germanium, being the collector, must be biased with a negative voltage with regard to base.

MULLARD OC70

	Common Base	Common Emitter
r in with output shorted	70 ohms	2.2 K ohms
r in with output open	1 K ohm	1 K ohm
r out with input shorted	100 K ohms	100 K ohms
r out with input open	1.4 M ohms	45 K ohms

A comparison of the electrodes of a transistor with those of a triode valve leads to an understanding of the three ways of connecting a transistor. The emitter, being the source of the current (though in the case of the p-n-p transistor the current is of "holes" and not electrons), can be compared with the cathode of a valve, the base that in a sense controls the flow is similar to the grid and the collector that receives the current is comparable to the anode. Note, however, that voltages are reversed in the case of a transistor of the p-n-p variety compared with a valve. One is so accustomed to connecting the positive of the supply to the anode of a valve that, unless care is taken, the same will be done to a transistor with disastrous effects. Reversing the voltage on a valve simply stops it from working but a transistor may be destroyed with similar treatment.

The three possible methods of connecting a triode valve are given in Fig. 1 alongside the equivalent mode of connection with a transistor. It is quite reasonable for the constructor to think in terms of these parallels, because anything that assists by making use of this familiarity with valve circuitry to lead to an understanding of transistor techniques is worth while. The theoretical picture is really somewhat different and is best looked at in the first instance with the common base circuit in mind.

The emitter in a p-n-p transistor has "holes" as current carriers, which means that they have positive characteristics, and consequently by applying a positive voltage to the emitter the positive's "holes" are repelled across the barrier between two layers forming the emitter and the base. Here, in the base or middle layer, are negative carriers in the form of electrons and some "holes" combine with and are neutralised by some of the electrons. The majority of the "holes," however, are diffused through the base layer which, it will be remembered, is made very thin, and come under the influence of the negative charge applied to the collector, to which they are attracted. Quite commonly, 97 per cent. of the emitter current finds its way to the collector in this way and consequently the current gain (designated α) is less than unity, i.e., .97, showing in fact a slight loss rather than a gain. This does not seem so good as an amplifier until it is remembered that the output resistance of the transistor is much higher than its input resistance so that very nearly the same current out as in indicates a considerable power gain. Nevertheless, if the transistor is feeding a second transistor, which, of course, is also current driven rather than voltage or power driven, it can hardly be said to be fulfilling any purpose. The conclusion is reached, therefore, that it is impracticable to use one common-base connected transistor after another for successive amplification, as is done with valves (amplification in cascade as it is called) if coupling is by resistances and capacitances.

There is a device for converting power very familiar to the constructor though perhaps not all have thought of it in this way. A transformer accepts power and gives up the same amount of power (less a little taken up in transformer losses). If the secondary has fewer turns than the primary the transformer is "step down" and so gives up less voltage than it receives. As the power is substantially the same, however, the *current* is stepped up. So use can be made of the power gain of a common base connected transistor to feed into a similar transistor if a step-down coupling transformer is used.

It is a matter of considerable practical importance that the transistor output circuit is considerably influenced by conditions at its input and vice versa, so that it is not possible to think of the emitter and collector circuits in the detached manner that we are accustomed to in considering the grid and anode circuits of a valve. This is because current from the input circuit actually flows into the output circuit. For instance, the input resistance is quoted for the output shorted so far as the signal is concerned and again with the output open circuited. The working point is, in practice, somewhere between these two extremes. As an example, Table 1 gives figures for an OC70. It will be seen, however, that the output/input resistance ratio is of the

order of 1,000 : 1. The current gain of this transistor (α) is given as .968.

It is a common law of nature that to maintain a state of equilibrium what goes in must equal what goes out. This is stated somewhat more scientifically, perhaps, in Kirchhoff's first law with regard to a point in a circuit, and something of the sort applies to transistors. Here is a current flowing into the base from the emitter, represented by a flow of holes in the case of the p-n-p version, and a current flowing out of the base into the collector. The currents are of opposite sign, one in and one out, and are unequal in magnitude, the flow into the base exceeding the flow outward. There must be a third current to balance things and this is the base current (i.e., directly from the supply into the base), consisting of electrons flowing into the base in just sufficient quantity to

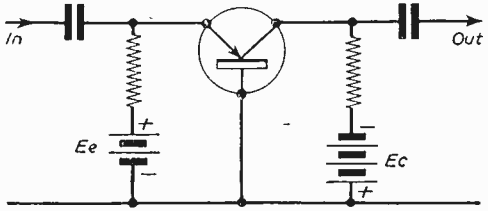


Fig. 2.—A common base amplifier.

neutralise the surplus holes that do not complete the path to the collector, or rather to replace the electrons that do the neutralising. Current gain being about .97 as between emitter and collector, the base current must therefore be .03 (i.e., 3 per cent.) of the emitter current.

Common Emitter Circuit

Now if the input signal were to be applied to the base in a common emitter circuit, as in Fig. 1 (b), which is comparable to the usual grid input valve circuit, this need be but 3 per cent. of the input needed at the emitter of the common base circuit for the same output (i.e., 97 per cent. of emitter current). The current gain is increased, therefore, by a factor $\frac{100}{3} = 33$, that is from .95 to about 30, a very useful gain figure that refers to current and not power. In the specific case of the OC70 previously quoted, the current gain was .968 for common base, giving a base current of $1 - .968 = .032$ times emitter current. The current gain for common emitter circuit (designated α^1) is, therefore, $\frac{1}{.032} \times .968 = 30$ as is specified by the makers. In general terms, $\alpha^1 = \frac{\alpha}{1 - \alpha}$

This change in circuit from common base to common emitter has its effect on the input and output resistances. It will be seen from Table 1 that the input resistance with open-circuited output, and output resistance with short-circuited input, remain the same, but the other two have changed to make the average working conditions (somewhere between the two extremes) present less diverse input and output resistances. This helps in the processes of practical design. In practice, the common emitter circuit is generally used for amplification.

The next step towards the practical use of transistors is to determine the effect of the transistor circuit on the phase of the signal. Fortunately the comparison with valve circuitry here holds good. There is a phase reversal across the common emitter circuit just as there is across the usual grounded cathode valve circuit. There is no reversal of phase in the case of the common base circuit, which is the same as the equivalent grounded grid valve circuit.

Common Collector Circuit

The common collector circuit compares with the cathode follower valve circuit and has similar qualities of relatively high input and low output

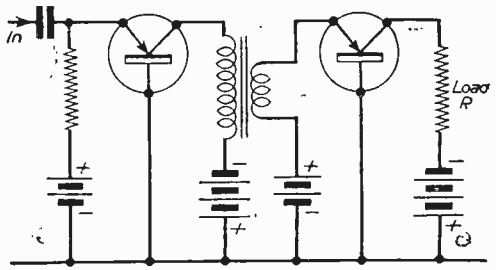


Fig. 3.—A transformer-coupled common base amplifier.

impedance. Its voltage gain is always under 1 and the current gain (this time designated α^{11}) is about the same as for common emitter. The input impedance is again affected by the output load resistance and is, in fact, around $\alpha^{11} \times$ load resistance. The output impedance is a function of the resistance of the source connected to the input, being of the order of α^{11} divided by the source resistance.

And now attention can be turned to circuitry.

Common Base Circuit

The basic circuit of the common base mode is given in Fig. 2. A p-n-p transistor is assumed. The emitter is therefore given a forward biasing voltage by battery Ee, with positive to emitter. Ec feeds the collector, but with negative towards the collector. It will be recollected that there is a current gain of less than unity with this circuit (that is, there is less signal current out of than was put into the circuit). As the transistor is current operated, however, it is no use "cascading" these circuits one after the other because there would be a slight loss rather than a gain at each stage. The circuit does give power gain, however, and so would help in driving a power-operated device such as a pair of phones or a loudspeaker. The normal rule for transfer of power applies in that the load impedance must be matched to the transistor output impedance. Reference has already been made to the use of a transformer to transform the power gain into a current gain and the use of a step-down transformer for this purpose is illustrated in Fig. 3.

(To be continued)

Servicing a Transistorised, Printed Circuit Receiver

HINTS FOR THE SERVICE ENGINEER HANDLING THE MODERN TYPE OF RECEIVER

IT is not to be thought that because transistors have a very long life, and that printed circuits eliminate most of dry-joint troubles, that this type of receiver will be practically free of need for service. On the contrary, printed circuits have to employ various components, as in the ordinary wired receiver, and faults that occur in these components can very quickly put transistors out of action. In other words, it will hardly be probable that a fault on a set of this type will be the fault of a transistor itself, but some component or incorrect voltages applied to the transistor.

Most transistor sets operate on a power supply that may go as low as four volts, and in first checking a receiver, this voltage should be measured. All components in the circuit should be carefully checked, but if continuity checks are taken the following precautions *must* be taken.

The meter to be used must have a resistance of at least 10K ohms in series with the leads. This is to prevent wrong value or polarity of voltage being applied to a transistor. If resistance measurements are required, it is preferable and safer to disconnect one end of the resistance to be measured. In some cases it may be necessary to disconnect base and collector leads of all transistors from the printed circuit panel. If this is done, then continuity tests may be made as is usual with a normal receiver. In general checking it should be noted that the base input impedance of transistors is low—between about 200 to 1,000 ohms, whereas the collector output impedance is from about 4,000 to 20,000 ohms. When connecting a signal generator into the circuit a condenser of 0.1μF should be in series with the input lead of generator to ensure that the transistor D.C. conditions are not altered. In a typical circuit given in Fig. 1, it will be noticed that separate transistors are used for mixer and oscillator, instead of a frequency changer as in a valve receiver. There are two stages of intermediate frequency amplification, a detector, an audio frequency amplifier and a push-pull output stage. In the typical circuit given there is no output transformer, but a centre tapped, high impedance speaker is used. In Fig. 2 is shown an output stage using an output transformer. Either of these methods may be met with.

Components

It will be found that the value of components in a transistorised receiver will vary considerably from those used in a conventional valve receiver. For instance, coupling and decoupling condensers will be of a higher value, owing to the low input impedance of transistors. This will mean that some of these condensers will be of the electrolytic type, although smaller than the electrolytics used in a valve receiver. Special miniature types have been specially designed for this purpose, as the working voltage is low.

Tuning capacitors, however, are much smaller than normal, due to the step down matching from R.F. coils to transistors.

The intermediate frequency transformers are generally single tuned only. This, although it means loss of selectivity, gives greater gain.

Output Stages

At present there are three types of output stage which are used. There is the ordinary transformer-coupled output, which has a low primary impedance if ordinary speakers are used. Then there is the transformerless circuit as in Fig. 1. The other type is that in which two transistors are connected in series across the supply voltage. This has an output impedance of approximately 30 ohms and does not require a centre tap.

Warnings on Servicing

To a service engineer who has had no previous experience of handling transistorised receivers, it is necessary to state that very careful attention must be given to the possible danger to transis-

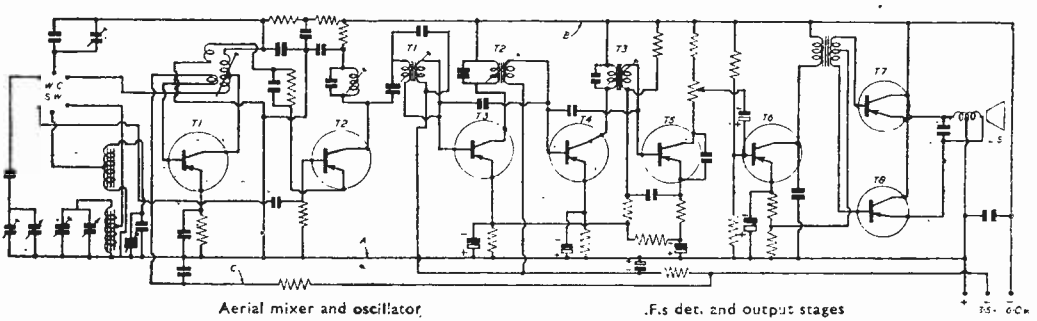


Fig. 1.—A typical circuit used as an example in this article.

tors by the methods that can safely be used with valve set servicing. A meter placed across the circuit, especially on a high ohm range, can place a voltage across one or more transistors which will destroy them. Correct polarity must be carefully observed. A point should be noted here. The transistor "Anode" or collector in a P-N-P transistor is negative, just the reverse to a valve. This mistake can easily occur to anyone new to this type of set. Replacing electrolytics requires care inasmuch as voltages may be allowed to develop accidently across to the various electrodes. The internal resistance of transistors, especially output (power) types, is very low, so that even small voltages can cause sufficient current to flow to burn out or damage them. Transistors should not be subject to excessive signal inputs during alignment. These may seriously overload transistors and cause damage. If any soldering is required see that the set is switched off and that there is no voltage between the soldering iron and earth.

Temperature

Transistors, as well as germanium diodes, are greatly affected by heat. When soldering them into or out of a set, the job must be done as quickly as possible. It is best to use a pair of pliers, grasping the wire connector between the soldering point and the body of the transistor.

		Type	Collector V	and M/a	Base V	Emitter V
T1	Oscillator	V6R3	−4.1	.70	−1.35	−1.6
T2	Mixer	V6R3M	−5.7	.35	—	—
T3	1st IF	V6R3	−6.0	.22	−1.45	−1.35
T4	2nd IF	V6R2	−6.0	.50	−1.45	−1.3
T5	Detector	V6R2	−5.2	.16	−1.55	−1.4
T6	A F Amp.	V10/30A	−5.4	6.0	−0.6	−0.4
T7	Output	V10/30A	−6.0	.6	−0.2	−0.1
T8	Output	V10/30A	−6.0	.6	−0.2	−0.1

The pliers will absorb most of the heat and prevent damage to the transistor. Another point to watch is not to bend the connectors of the transistor too near its body. The writer has even known transistors damaged by being placed close up to the bench lamp when the set was turned on its side.

When changing transistors in a receiver, be careful to maintain their original position as far as possible. If components are changed see that they are the correct value as laid down by the makers, otherwise the rated collector dissipation of the transistor may be exceeded and damage result. If you are in a service department and transistors have to be stored, see that they are in no danger of excessive temperature. Further,

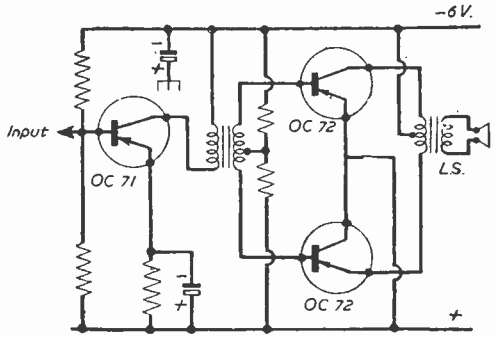


Fig. 2.—A transistorised output stage.

care should be taken to see that the opaque covering on transistors is not damaged, otherwise it is possible for them to pick up hum from an A.C. source of light.

Printed Circuit

There is quite a lot of care to be taken over substitutions, alterations and additions to printed circuits. Always use a soldering iron of not more than 60 watts and one with a small bit. Always clean and tin the connecting leads of the component to be replaced. Melt the circuit solder just before connecting new component. Use as little solder as possible to obviate shorting on to other parts of circuit. It is sometimes handy, in replacing a component, to cut out a faulty one leaving a small piece of wire on the panel to which the new component can be connected. In the case of a damaged printed circuit a small piece of wire can be soldered across the damaged part. Note that all printed circuits have a coating of insulating varnish over them, and this must be scraped away for repairs or when checking with meter. Circuit tracing, if no circuit diagram is available, is somewhat more difficult than with ordinary circuits. Typical readings of transistors in Fig. 1 are shown in the table above.

PROFESSOR BOFFIN

A BEGINNER'S CONSTRUCTION COURSE

AS DISTINCT FROM A THEORETICAL COURSE, T
STARTS WITH A SIMPLE CRYSTAL SET, WHICH IS G
MODIFIED IN STAGES, UNTIL IT BECOMES A CRY
TWO TRANSISTOR LOUDSPEAKER SET

By

THIS little radio has been designed with three things in mind:—

1. Simplicity for the absolute beginner.
2. Minimum cost (3s. 6d. for this stage).
3. The ease and cheapness with which it can be progressively improved month by month until it covers long and medium waves at loudspeaker strength (total cost about 45s.).

For those who are completely new to radio it is advisable to point out that a crystal set uses no batteries or mains and is thus cheap to run and is quite safe! Since it depends on "pick-up" in the aerial and earth for power these items must be really first class. If the following instructions are carefully followed the beginner will find the radio working the moment it is completed. He will be amazed that so simple and cheap a piece of apparatus can do so much.

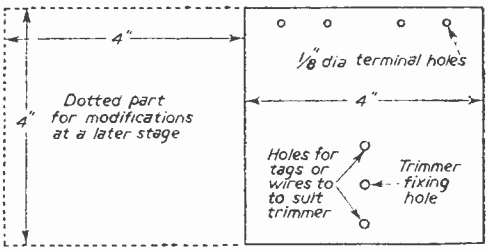


Fig. 1 (a).—Details of the front panel made from ¼in. plywood.

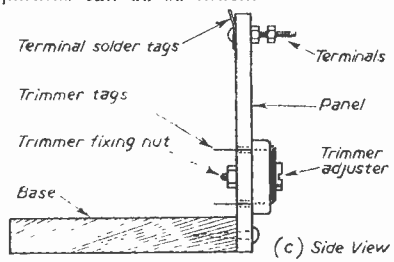


Fig. 1 (c).—Side view of panel and baseboard.

The Base and Panel

This set is made up on a wooden base about ¾in. thick, measuring 4in. × 4in., but if it is proposed to carry out later additions make it 8in. × 4in. (see Fig. 1b). The front panel should be of ⅛in. ply or hardboard (not metal) of the same size as the base (see Fig. 1a).

Mounting the Components

Drill the panel with holes for the terminals and the tuning condenser (trimmer) (Fig. 1a) and fix the panel to the base with panel pins or small screws (Fig. 1c). You need four small soldering tags which may be purchased or made from the details in Fig. 2. Note that the drilling is best done in a largish piece of metal prior to cutting out the tags. Bend each tag at its half way mark to make a right angle. If you have no terminals use some ⅛in. Whit. or similar nuts and bolts (from the ironmonger) about 1in. long. The terminals and tags are fixed to the panel as shown in Fig. 1c noting that the first nuts are screwed up dead tight, the extra nuts acting as the terminals proper. Now mount the trimmer (500 or 750 pF) on the *front* of the panel (Figs 7, 1c and 4) making sure that you do not use the adjusting screw or you may damage the trimmer.

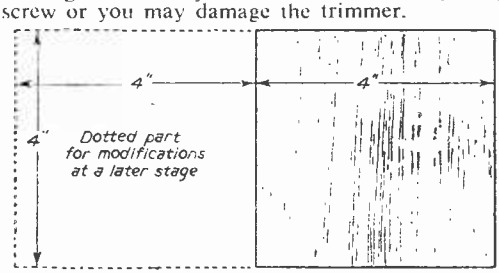


Fig. 1 (b).—Details of baseboard made from ¼in. or ⅜in. softwood.

Winding the Coil

The coil or inductance is now prepared. The former is a part of a domestic cleaner box or other

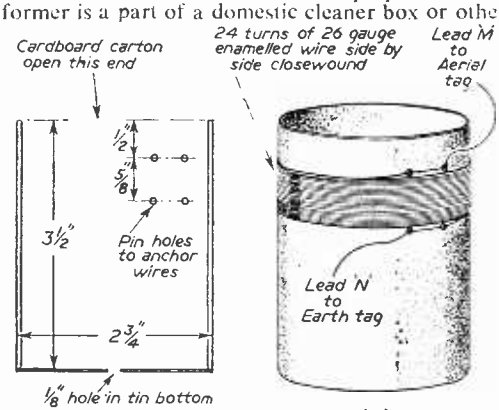
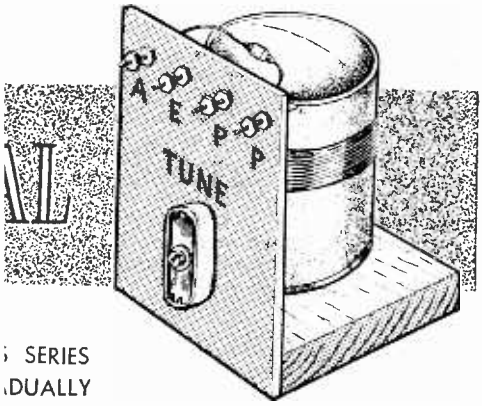


Fig. 3.—Details of the tuning coil.



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non-metal container of a similar diameter. Two small holes are made half an inch from the top and two more $\frac{1}{8}$in. lower down (see Fig. 3). You will note that only about half the box is needed. A hole is made in the base so that the coil may be fixed with a small screw. Now wind on 24

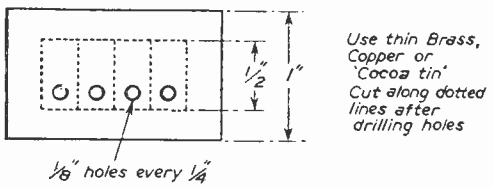


Fig. 2.—Home-made soldering tags.

turns of 25 or 26 gauge enamelled wire, the ends being anchored by taking them in and out of the small holes a few times. Some members of a youth club were recently building these radios and the author was baffled for some time by a percentage which would not work. The trouble was the use of boxes which are metal covered. If the silver coating is scraped off these boxes work, otherwise they will not.

Hints on Coil Winding

The beginner may find the following details about coil winding helpful. Stretch out the full amount of the wire in the hall or garden and fix one end firmly to the door, etc. Make sure there are no kinks in the wire then pull it gently until

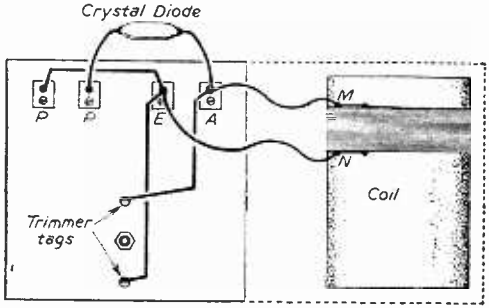


Fig. 6.—Coil and crystal wiring.

you feel it has stretched 6in. or so. It will now be perfectly straight. Fix one end of the wire to the former (use the holes), allow about 6in. for connections and with the wire *on top* of the former turn slowly. Keep the wire taut and push

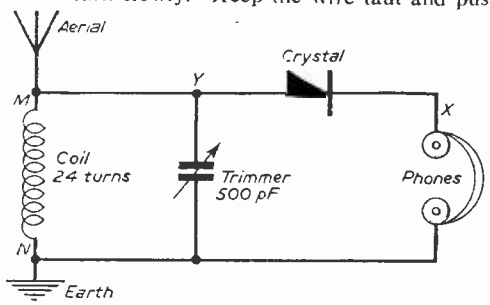


Fig. 5.—Theoretical circuit of the crystal set.

the wire up close as each turn is made. You will, of course, walk forward as necessary. Be careful to hold the winding tight while anchoring the end. (Refer to Fig. 8.)

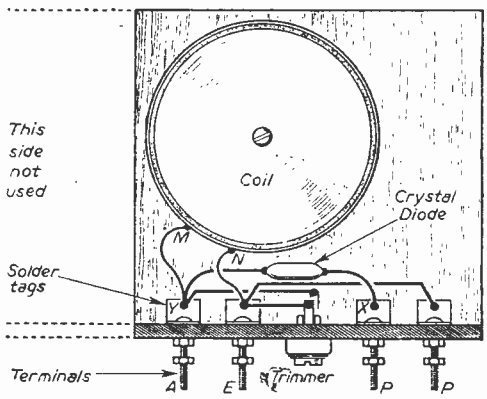


Fig. 4.—Plan of the first set, showing wiring.

Wiring Up the Receiver

Now fix the coil to the base (Fig. 4) and complete the wiring as shown in Figs. 5 and 6. If you are new to soldering the following hints will help you to get good clean joints. Beware of "dry" joints where solder is piled on but is not in good electrical contact. Switch on the iron or heat it in the gas; when a green flame shows, or it will just melt solder easily, clean it quickly with an old file or emery cloth and tin it in a tin lid containing some flux and odd bits of solder. Never start soldering unless the iron is well tinned. Do not use acid or acid-type soldering fluxes, or shorts may develop. It is easier, but not essential, to use cored solder for the rest of the work. A

good soldered joint has a neat rounded appearance, a bad one jagged and rough. The wires should withstand a good tug when fixed.

A Suggested Plan for the Beginner to Follow

1. Heat and tin iron.
2. Tin (coat with solder) all tags including those on the trimmer.
3. Scrape the enamel off the coil leads and tin them.
4. Cut the connecting wire (enamel wire will do) and scrape and tin the ends.
5. Join one phone tag to the earth tag (Figs. 5 and 6).
6. Take top of coil (M) to aerial tag and bottom (N) to earth tag.
7. Take each trimmer tag to the aerial and earth tags respectively.
8. Solder *quickly* the crystal diode between the spare phone terminal and the aerial.
9. Now check that the aerial tag has three wires on it, the earth three, but the phones one on each.

Some trimmers give the beginner trouble because the tags are made up of a bundle of shims. In this case great care must be exercised to see that all the shims of each tag are tinned and soldered together. When soldering diodes it is a good plan to hold the diode wire firmly in rather large pliers so that the diode is not heated by conduction up the wire.

A good but somewhat "technical" appearance may be given to the panel of home-made equipment by painting it with Indian ink and then writing on this any necessary wording with white Indian ink. When dry it is varnished with clear spirit lacquer.

APPARATUS REQUIRED

Base 8in. by 4in. by ½in. softwood.
Panel 8in. by 4in. by ¼in. plywood.
One domestic cleaner box.
4 ⅛in. Whit. by 1in. bolts. (Any ironmonger.)
8 ⅛in. Whit. nuts.
1 Crystal Diode.
1 500 or 750 pF trimmer.
20ft. 26 s.w.g. enamelled copper wire.
Flux, solder, screws.
Aerial earth and 'phones (see text).

Testing the Receiver

Connect the aerial terminal to a good long (preferably outdoor) aerial about 100ft. long. Ex-Army telephone wire is quite suitable but any insulated wire will do. Make quite sure the wire is in one piece (not knotted) and that it does not earth itself on a gutter, etc. Indoor aerials are not very much good in metal-framed buildings, but the author has quite good results with his metal bedframe as an aerial. Connect the earth terminal to a water pipe or one buried in the garden. Connect some phones to the appropriate terminals (Fig. 7). Any phones will do; some single ones are on sale now at 2s. 6d. and they work well on this receiver; however, the balanced armature type give best results and are obtainable at about 10s. 6d. Low resistance reed or balanced armature types are better than high resistance phones of a cheap make.

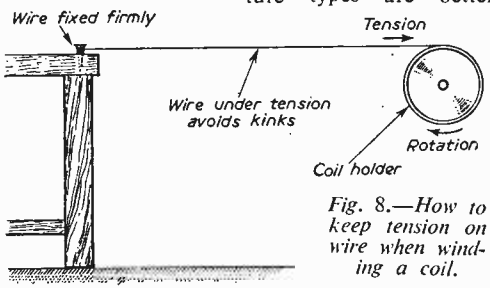


Fig. 8.—How to keep tension on wire when winding a coil.

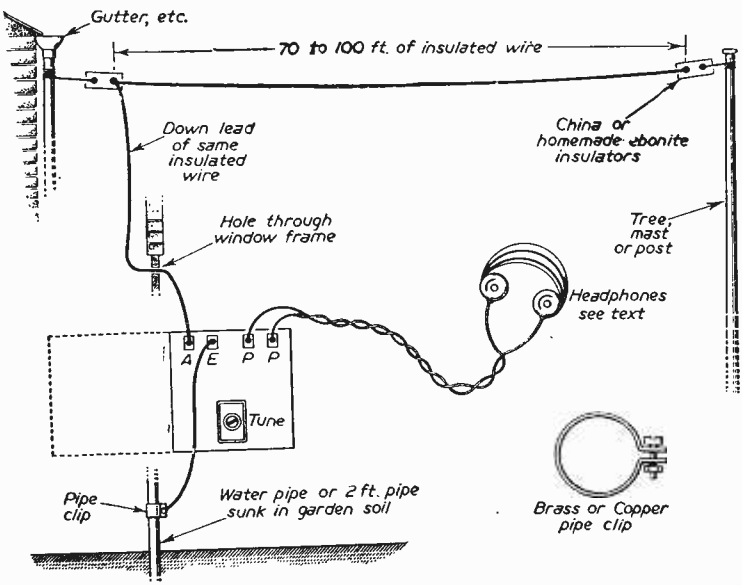
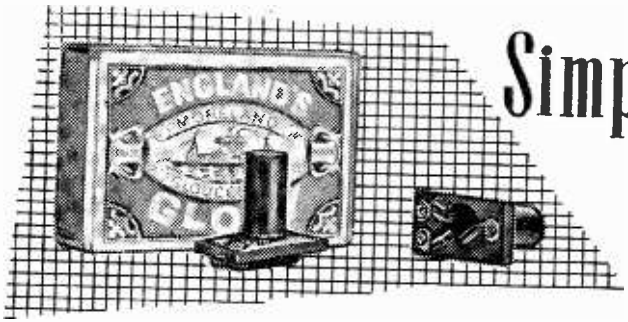


Fig. 7.—General layout for a crystal receiver.

If you have carefully followed the text your receiver will now be working, so tune the trimmer with a small insulated screwdriver until one station is heard at "optimum" strength (i.e., by turning the trimmer either way the station gets fainter). In Woking, Surrey, Home. Light and many European stations are easily received after dark, but with some interference (to be improved later!).

Since the aerial is connected directly to the coil its length and to some extent its position will have an effect on the number of turns required on the coil, and it may be necessary to *remove* a turn or two (up to about 5 for a very long aerial).

(To be continued.)



Simple Transistor Housing

A SIMPLE TRANSISTOR HOUSING FOR EXPERIMENTERS WITH ONLY A LIMITED NUMBER OF TRANSISTORS, USING OC70s, OC71s AND OC72s

By J. A. Ewens

ON account of the present high cost of transistors, it is often desirable to be able to change transistors from one piece of equipment to another. The difficulty is that the transistors can easily be damaged by being soldered too often, due to heat transfer up the wire to the junction, and hence a suitable housing is required which may be easily connected to any equipment. The different types of housings may be divided into two groups :

(a) *Semi-permanent housings* such as the type that plug into a B7G valve base or similar devices.

(b) *Permanent housings* which are screwed into the equipment.

The following is a very simple one of the latter type which can easily be made with bits from the spares box. The dimensions are not too critical, neither are the materials, but the transistor wires should be bent not less than 3 mm. from the seal.

A piece of bakelite tubing about 11/16in. long and 9/32in. inside diameter was cut. Two bakelite discs were then made, 9/32in. diameter and about 1/32in. thick. One of these was glued firmly into one end of the bakelite tubing (see A). The other had three small holes drilled in it (as shown in B), large enough to feed the transistor wires through.

Then the transistor wires were bent over at about 3mm. from the seal and the transistor was inserted into the bakelite tube with the seal end facing the closed end of the tube and the wires coming out through the open end (C).

The wires were arranged such that the middle one was the base with the emitter and collector at either side. noting which was which. Then a small quantity of candle grease was melted and poured into the bakelite tubing with the transistor in position. As soon as the wax became slightly stiff, the bottom cap was threaded on and glued firmly in position. The assembly was then put to one side while the wax hardened and the glue dried.

A piece of bakelite about 13/16in. × 7/16in. × 1/16in. was then cut, and a hole was drilled in the centre of this of diameter equal to the outside diameter of the bakelite tubing.

Next, three small tubular rivets were obtained (inside diameter just to take a 10 B.A. screw) and their outside diameter was measured, and three holes were drilled in the bakelite base of this diameter, as shown at D.

The bakelite tubing assembly was then fitted into the hole in the base and glued into position. When dry the three rivets were placed in the holes with the wires from the transistor just twisted under their top lips, and soldered after applying a short length of insulating flex, as shown at E.

The rivets were then tapped into position and burred over at the other side with an appropriate tool such as an old screwdriver with rounded shank.

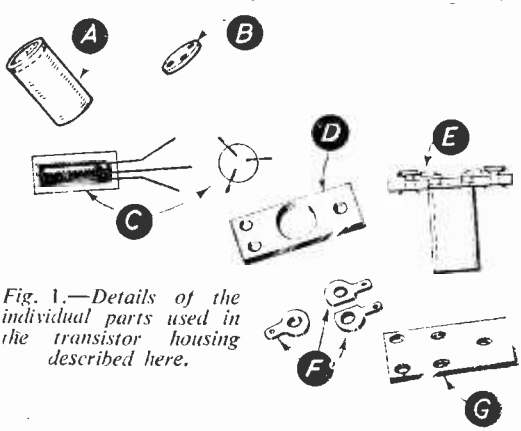


Fig. 1.—Details of the individual parts used in the transistor housing described here.

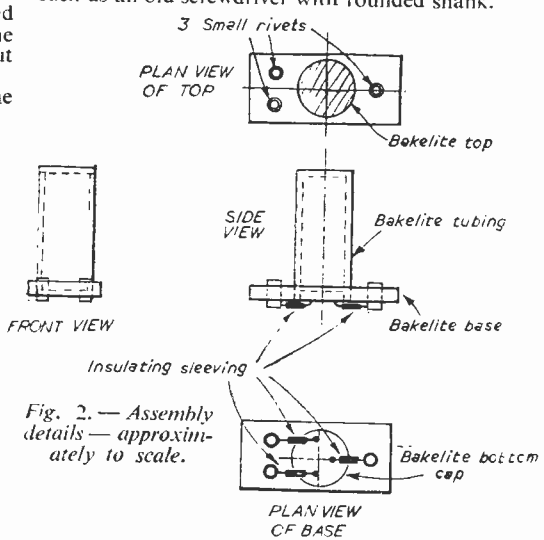


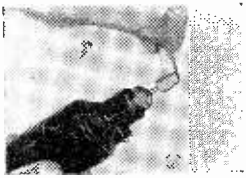
Fig. 2. — Assembly details — approximately to scale.

Soldering Wood, Glass, and Other Difficult Materials

DETAILS OF AN INTERESTING NEW PROCESS DEVELOPED IN THE U.S.A.

FOR many years it has been considered that only certain metals lent themselves to ordinary soft soldering, such materials as glass, aluminium, wood, etc., not being suitable for this type of connection or jointing. In radio, as well as in certain other industries, it would often be convenient to make connections electrically to these materials, but hitherto one has had to rely upon riveted contacts or eyeleting, with resultant use of labour and materials.

From the U.S.A. now comes news of a process which can be carried out by any handyman and which enables leads to be soldered to these new materials, and the group illustration at the foot of this page shows wires attached to a group of materials which, reading from left to right, includes glass, titanium, molybdenum, aluminium, tantalum, stainless steel, tungsten, ceramic and cobalt. At the bottom of the illustration are Wood's metal, a piece of tinned stainless steel and a "loaded" grinding wheel.



Loading the wheel.

Tinning the material.

The process, according to the Lead Development Association's "Lead News," involves the following process. A small grinding wheel is fitted to an electric drill or similar driving mechanism and this is pre-heated and then "loaded" by grinding a stick of 60/40 lead-tin solder or Wood's metal.

The material to be soldered is then in turn ground with this wheel, with a resultant "tinning" from the solder on it. Both surfaces to be joined are "tinned" by this method, heated, brought into close contact, and the soldering is then completed in the normal way using 50-50 lead-tin solder. Obviously, the material to be joined must be rendered heat-proof in some way over the area to be joined, although the majority of materials which may need joining will automatically fulfil this condition.

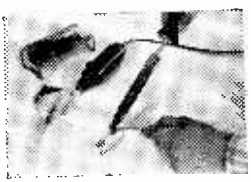
Small variations in technique may be necessary for different materials (the range of solders used includes 60-40 lead-tin, 50-50 lead-tin, 50-50 lead-indium and Wood's metal), but the method, in general, is the same for all materials.

It is claimed that this method will now be used to a large extent to replace the more expensive ultra-sonic method which has been in use for some time with some of the above-mentioned materials.

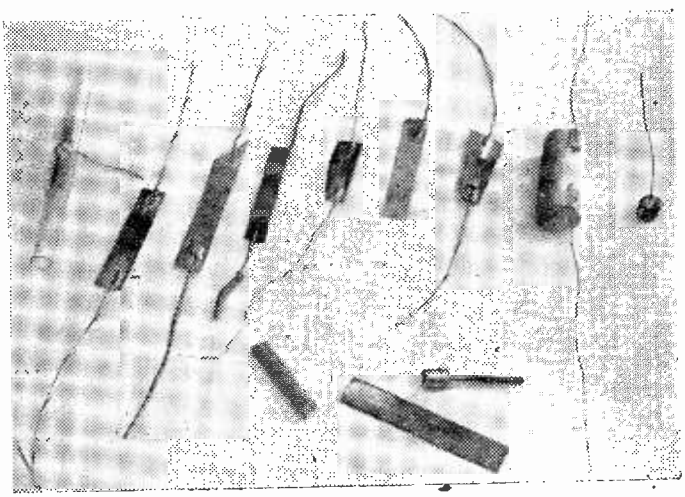
Practical Uses

The reader may wonder to what practical uses such a process could be put in connection with radio. One of the first which springs to mind is in connection with the printed circuit technique. By means of the scheme outlined above an amateur could make up his own printed circuit without having to employ any photographic process. Such a circuit, in conjunction with a transistor or two would form the basis of an experimental portable, whilst broken leads on certain components might also be replaced by similar means. The basic idea is obviously that the material to be soldered is made scrupulously clean by means of the high-speed rotating cutting wheel, and at the same time that heat generated by the friction causes the solder to run and attach itself to the material. No mention is made in the report of flux, but as this is normally used only to prevent oxidisation of the metal under heat, flux is unnecessary.

Material tinned.



Making the connection.



A group of materials treated by the new process.

TRANSISTORS

JUNCTION TYPE P-N-P

(British Manufacture)

RED-SPOT 800 kc/s Audio Frequency.....	10/-
BLUE-SPOT 1.6 Mc/s Mixer and Frequency Changer...	15/-
WHITE-SPOT 2.5 Mc/s R.F. and I.F. Amp.....	20/-

All Transistors are Tested and Guaranteed.
N.B. The Red-Spot is similar to Mullard OC71.

The New "TRANSISTOR—8"

Push-Pull Portable Superhet
Can be built for **£11/10/-.**

This Portable 8 Transistor Superhet is tunable for both Medium and Long Waves and is comparable in performance to any equivalent Commercial Transistor Set. Simplified construction enables this set to be built easily and quickly into an attractive lightweight cabinet supplied.

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- ★ Attractive lightweight contemporary case

N.B. Pair of Matched Mazda XC101's supplied at additional cost of 40/-.

We can supply all these items including Cabinet for **£11/10/-.** All parts sold separately.

Send for circuit diagrams, assembly data, illustrations and instructions, and full shopping list, **1/6.**

Call and hear demonstration model.

"EAVESDROPPER"

THREE TRANSISTOR POCKET RADIO

(No Aerial or Earth required)

Pre-selected to receive the Light and Home Stations. Total cost, as specified including Transistors, Transformers, Coils, Condensers and Battery, etc., with circuit and plastic case.

All items sold separately. **77/6** POST FREE
With single phone, 82/6. With Min. Hearing Aid, 92/6.

THE TELETRON "COMPANION"

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Tuned R.F. Circuit, Ardente Transformers, 3 Transistors, Drilled Plastic Chassis and Cabinet size 4½ x 3 x 1in., and all Components. Balanced Armature Output, Batteries, Knobs and Transistor Holders. Total cost

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ALL PARTS SOLD SEPARATELY

TRANSISTOR SIGNAL TRACER
Complete Kit with 2 Transistors, Components, Phones with Circuit and plastic case, 42/6.

"HOMELIGHT" TWO TRANSISTOR PERSONAL PORTABLE
No Aerial or Earth Required

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Size 3in. x 2in. x ¾in. No Aerial or Earth.
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Complete Kit with 2 Transistors, Components, Circuit and plastic case, 25/-.

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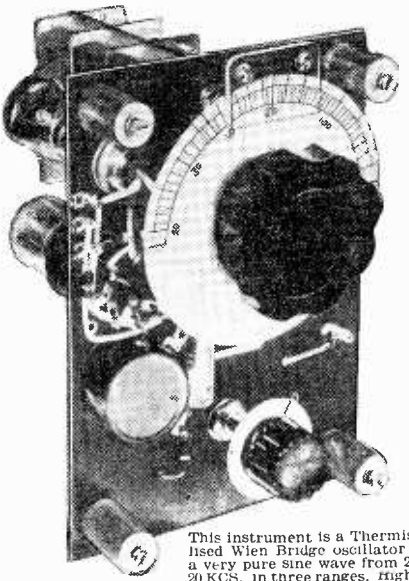
AUDIO OSCILLATOR UNIT TYPE 2



This instrument is a Thermistor stabilised Wien Bridge oscillator providing a very pure sine wave from 20 c.p.s. to 20 KCS., in three ranges. High accuracy of calibration and constancy of output voltage are features making this an exceptionally useful instrument for the testing of high-fidelity equipment. Send stamp for full details.

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MOTEK K9 complete with Pre-amplifier, **26 Gns.** Power Pack, **3 Gns.** extra.

The VIKING recorder, incorporating the K9 will be available shortly, **46 Gns.**

All above can be obtained on H.P. 50% down and 12 monthly payments, or Credit Sale—One-sixth down and 8 m.p.s.

OSCILLATOR COILS for the "P.W." Hi-Fi recorder (May issue). The Hatfield Osc. coil is the only one on the market sold with a guarantee of "less than 0.3 of 1% distortion," and having High and Low impedance outputs, is suitable for ALL heads, but particularly suitable for the Collaro Deck (or transcriptor). Price **10/6** Post Free.

Do you find that turning the Vol. control beyond a certain point, when recording, does not increase the recorded signal? This is due to Bias getting into an early part of the amplifier and "blocking" a later stage. A well-known recorder selling at over £800 uses 2 Rejector coils to avoid this, and it is possible YOUR recorder would benefit by a HATFIELD Rejector coil, which gives 40 dB rejection and in practice is far better than a "double-T" circuit. **5/6** Post Free, or **15/6** with Osc. coil. Full instructions given with all goods.

To those customers asking "How much is that K9 in the window," the answer is **"21 Gns."**

HATFIELD RADIO

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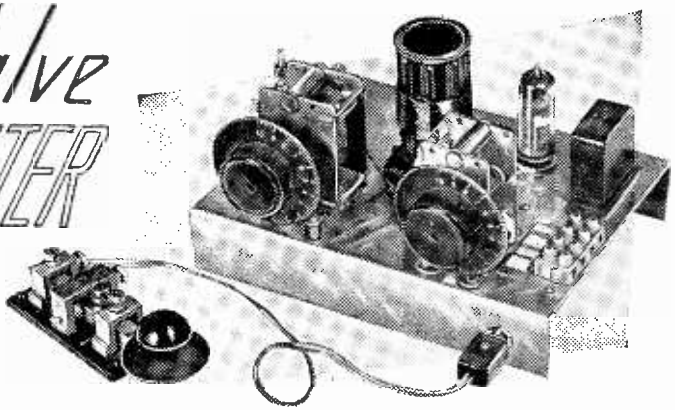
(Tape recorder specialists since 1952.)

A Single Valve TRANSMITTER

ADDING A P.A. STAGE TO THE TRANSMITTER DESCRIBED IN OUR SEPTEMBER ISSUE

By R. Wright



IF greater output is required from this transmitter it is a comparatively simple matter to fit a further power amplifier stage, using a 6V6 type valve, available for a few shillings on the surplus market. The pentode section of the ECL80 can then be used as an untuned buffer amplifier with the new power amplifier tuned to the fundamental or to the second harmonic of the crystal frequency. Alternatively, the ECL80 pentode may be operated as a doubler and the new P.A. stage as a straight amplifier or even as a second doubler giving a small output on the fourth harmonic of the crystal frequency.

If the first course is followed very little alteration to the original circuit (Fig. 1) will be required. The aerial circuit, including C4 and L1, should be disconnected from C3 and the output side of this capacitor taken to the grid of the new P.A. valve (V2). The new output stage should then appear as in Fig. 2, the output side of C6 being connected to the junction of L1 and C4 in the original aerial circuit. The power output of the transmitter will be considerably improved and, with an H.T. supply of 250 volts to V2, there will be a D.C. input to this valve of 10 watts—the maximum input power allowed by the G.P.O. on the top band (1.8 to 2.0 Mc/s). The cathode of the 6V6 should now be connected to the cathode of the ECL80 and both taken to earth through the key. In view of the additional current in the circuit, a resistor of about 300 ohms should be connected in series with C2 across the key in order to reduce key-click interference on neighbouring receivers. Fig. 2 shows the circuit of the new power amplifier stage.

If the alternative arrangement is adopted whereby the frequency doubling is effected in the ECL80 pentode section, it is only necessary to include a tuned circuit between the pentode section of the ECL80 and the 6V6 as shown in Fig. 3. Coils wound similarly to L1 may be used in the position for L2. However, the Denco range of "Maxi-Q" noval base coils may be used in this position with a very definite increase in efficiency and a saving of chassis space. These coils may be plugged in to a noval valve base and thus may quickly be changed if transmission is required on another frequency.

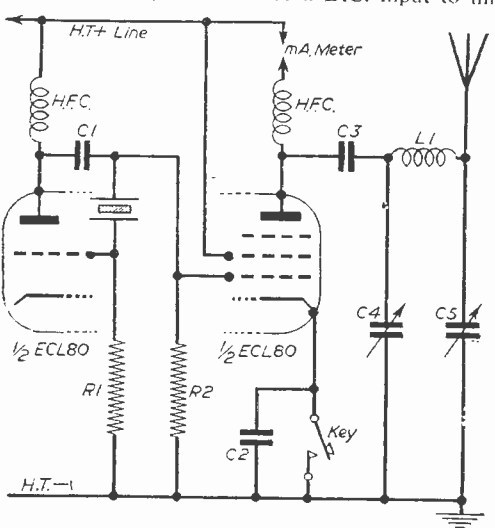


Fig. 1.—The original 1-valve circuit.

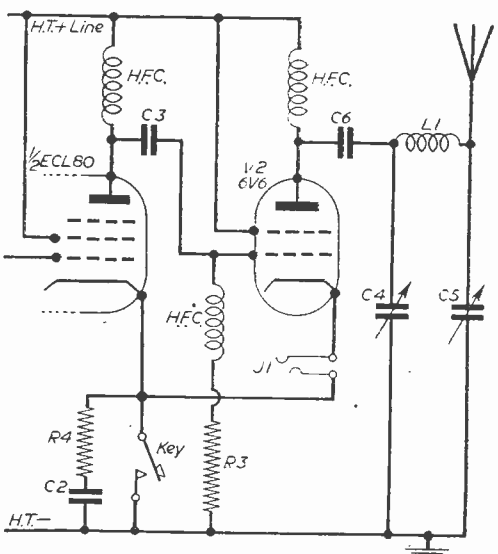


Fig. 2.—The new P.A. stage.

Tuning

With the appropriate crystal plugged in, it is only necessary to tune the aerial circuit as described in the original article, if the power amplifier is added and the ECL80 pentode used as an untuned amplifier. The milliammeter or low-current lamp used as a tuning indicator being connected in series with the 6V6 cathode either permanently or by means of a closed circuit jack. If the ECL80 output is to be tuned then it will be necessary to tune this circuit before attempting to tune the aerial circuit. To do this the meter should first be connected in the ECL80 cathode and with the key pressed, tune C8 with the correct coil in the L2 position, for a dip on the meter. The dip will be quite pronounced if L2, C8 tune to the fundamental but less if tuned to the second harmonic of the crystal frequency. Now plug the meter into the cathode circuit of the P.A. valve and tune the aerial circuit in the usual way. Coupling may be increased until the meter indicates a current of about 35 to 40 mA through the 6V6 at the dip. This reading applies to either power amplifier circuit.

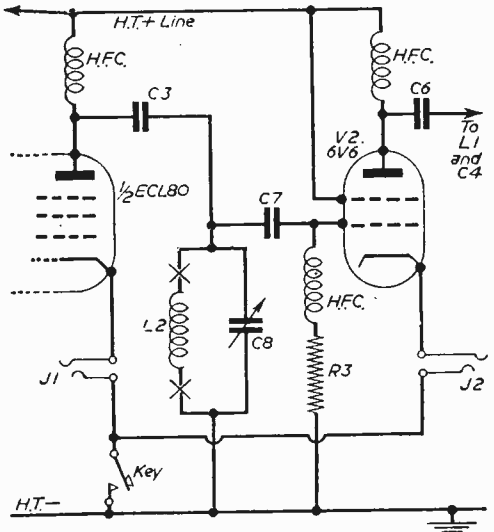


Fig. 3.—Modification to enable frequency doubling to be effected in the pentode section of the ECL80.

ADDITIONAL COMPONENTS

C6—0.01 μF (mica).
C7—0.001 μF (mica).
C8—300 pF variable. (A 500 pF variable may be used if a good quality 0.001 μF capacitor (mica) is connected in series.)
R3—47,000 ohms, half watt.
R4—300 ohms, half watt.
HFC—2.5 milli-henry chokes (Eddystone type 737).
L2—As L1, or alternatively, Denco Maxi-Q noval-base plug in coils (connections being made to pins 1 and 6 on the noval base holder). For 1.8 and 3.5 Mc/s, Denco Blue Range 3. For 7.0 and 14 Mc/s, Denco Blue Range 4.
J1, J2—Closed circuit jacks.
V2—6V6 type valve.

Courses of Instruction

Wembley Evening Institute

AS last year, this institution will again be holding classes at Copland School, High Road, Wembley, Middlesex, to prepare candidates for the City and Guilds Radio Amateurs' Examination. There will also be morse practice classes.

The classes will be held on Mondays and Thursdays, Morse, 7.0-8.0 p.m.; Radio Theory 8.0-10.0 p.m. Enrolment is at the school on Monday, September 16 to Thursday, September 19, between 7.0-9 p.m. and the classes start during the week beginning September 23.

Brentford Evening Institute

COURSES as below are to be held at Brentford Evening Institute, starting in the week commencing September 23. All classes are from 7-9 p.m. The fee is 30s. for one class for one session; each additional class taken costs 2s. 6d. only. Enrolment is during the evenings of the week September 16-20.

(i) Radio Servicing, 1st year (Monday evening). (ii) Morse for Radio Amateurs (Tuesday evenings). (iii) Radio Amateurs (Wednesday evenings). (iv) Radio Servicing, 2nd year (Thursday evenings).

Classes i, ii, and iii are suitable for students with no prior knowledge of the subjects.

Evening Institute, Potter Street, Northwood Hills

RADIO classes are again to be held, commencing on September 24. There are two courses, one assuming no knowledge of radio and covering the syllabus of the above examination, and a more advanced course for those with basic theory. Enrolments should be made on September 16, 17 and 18, between 6 and 8 p.m., at the Institute; the instructor will be Mr. G. P. Anderson, A.M.I.E.E. (G2QY).

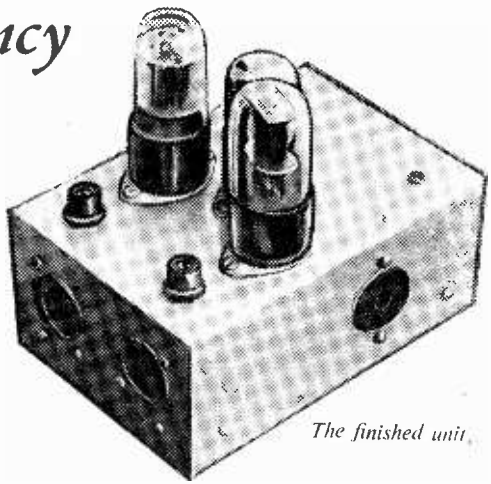
Grafton Radio Society

THE Society announce that they have again made arrangements with the Islington L.C.C. Men's Evening Institutes for official courses of instruction in the Radio Amateurs' Examination and Morse (both for beginners) to be held this winter at the Isledon School, Upper Hornsey Road, Holloway, London, N.7. The classes will meet on Mondays, commencing September 23, for the R.A.E., 7.0-9.0 p.m., followed by the Morse at 9.0-10.0 p.m., under the instruction of Messrs. S. H. Isles (G3BWQ) and L. Barber respectively. The fee is 20s. for one course, with an additional 2s. 6d. for the second. Application in the first instance should be made to the Hon. Secretary of the Grafton Radio Society, A. W. H. Wennell (G2CJN): 145, Uxendon Hill, Wembley Park, Middlesex, at once, so that a place may be assured.

A Musical Frequency Doubler

A USEFUL ADDITION TO MONOPHONIC TYPE ORGANS

By S. Brown



The finished unit.

THE following circuit was devised by the author to provide an increased range and variety of musical tones on a monophonic electronic organ, circuits of which have been published in this magazine, and a blueprint for which may be obtained from these offices, price 8s.

The obvious limitation of such an organ is that, as its name implies, it can produce only *one* note when any key is depressed. This circuit enables the note plus its octave above to sound simultaneously. Furthermore, the tones of the fundamental and its octave can be altered independently, thus increasing the range of the instrument still further.

The circuit to be described can be added to any existing monophonic instrument, with no alteration to the existing circuit, and may be switched in or out as desired.

Although three valves are shown in the figures, only two are required for the actual frequency-doubler, the third valve being an incorporated oscillator which provides the fundamental.

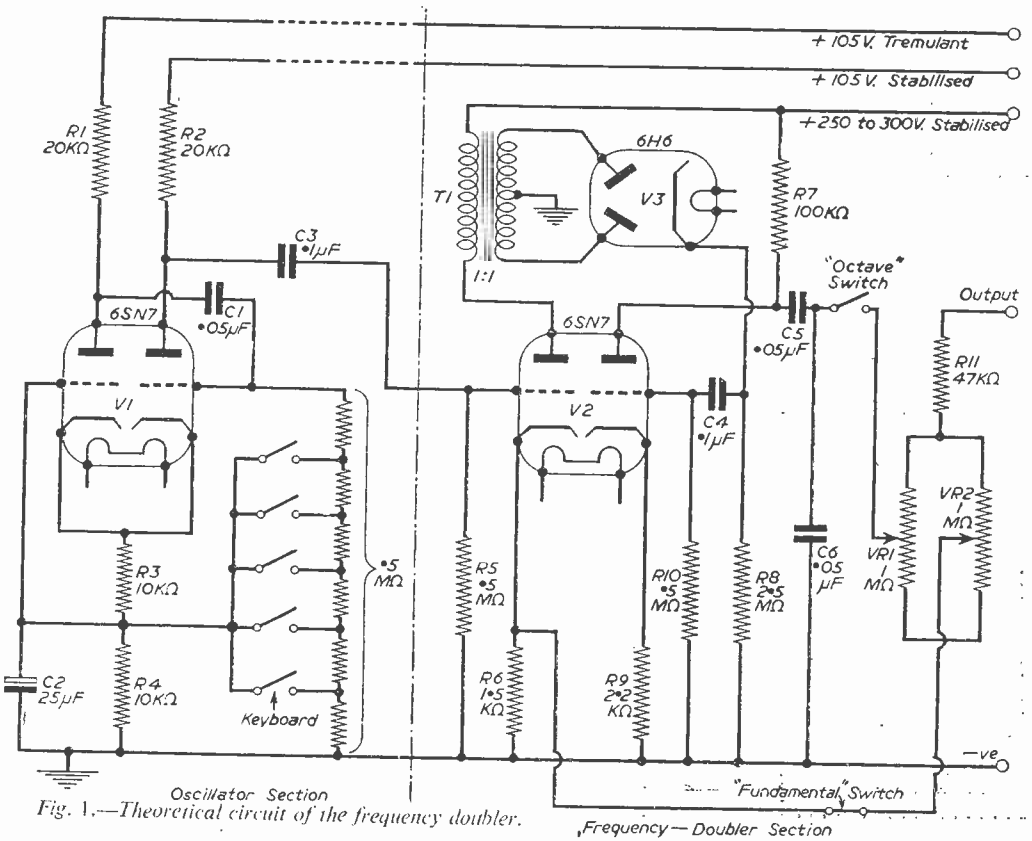


Fig. 1.—Theoretical circuit of the frequency doubler.

Circuit

This utilises a double diode 6H6 and the double triode 6SN7, both of which can be bought from government surplus stores quite cheaply. The only component which the constructor might not have to hand is the 1:1 centre-tapped transformer T.1. The component used by the author was a surplus component and has proved quite satisfactory.

V1 is the oscillator, using a conventional circuit which provides a waveform which can be modified easily. The output from V1 is fed via C3 to the first half of V2a. This half is necessary to prevent feedback and consequent frequency shift on V1. The signal developed across R6 provides the fundamental, the volume of which can be pre-set with VR2 to any desired level.

The centre-tapped transformer, being in the anode circuit of V2a, also develops the frequency

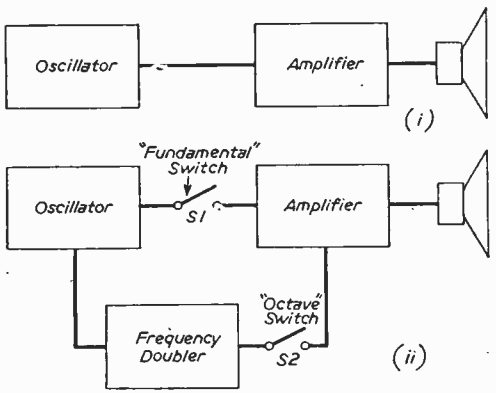


Fig. 4.—How the unit is incorporated in an organ.

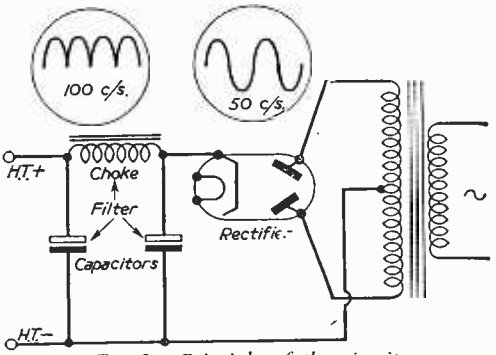


Fig. 3.—Principle of the circuit.

F1. and the secondary winding is taken to V3 (6H6) where the frequency is doubled.

This new signal 2F is now taken via V2b which acts as an amplifier. The final output is taken via C5 to the pre-set volume control VR1.

C6 modifies the tone of the doubled frequency and may be omitted or incorporated in a more

(Continued on page 557)

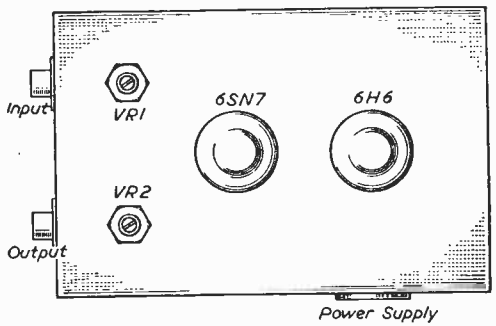


Fig. 5.—Suggested layout for frequency doubler circuit only.

LIST OF COMPONENTS

RESISTANCES

R1—20 K Ω
R2—20 K Ω
R3—10 K Ω
R4—10 K Ω
R5—500 K Ω
R6—1.5 K Ω
R7—100 K Ω
R8—2.5 M Ω
R9—2.2 K Ω
R10—500 K Ω
R11—47 K Ω
VR1—1 M Ω (Potr.)
VR2—1 M Ω (,,)

CAPACITANCES

C1—.05 μF
C2—25 μF (electrolytic)
C3—.1 μF
C4—.1 μF
C5—.05 μF
C6—.05 μF

VALVES

V1—6SN7
V2—6SN7
V3—6H6
Centre-tapped transformer, ratio 1 : 1.
2 toggle switches.
Nuts, bolts, etc.

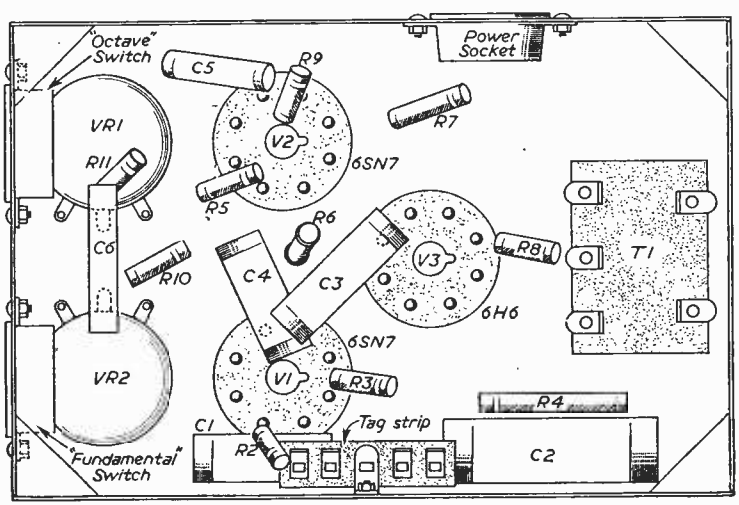


Fig. 2.—Underneath view of oscillator and "octave" chassis.

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The items listed below are from our range of components and accessories usually held in stock. Cash orders are normally dealt with on the day they are received. Orders for goods on Credit Sale are subject to slight delay, but this is kept to an absolute minimum.

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All components for the Amplifiers described in the Mullard Tape Recording Booklet are carried in stock. Two units are shown in the booklet.
AMPLIFIER TYPE A.—This is a complete Tape Recorder Amplifier with a single EL84 Output Valve.
AMPLIFIER TYPE B.—This is a combined record amplifier and playback pre-amplifier and is intended to feed into an existing main amplifier for Play-back.
Fully detailed parts lists are available on both amplifiers.

TAPE AMPLIFIER TYPE A

RESISTORS.—LAB Kit for all fixed resistors to correct tolerances with one potentiometer. **33 6.**
CONDENSERS. Complete kit, **31 6.** All condensers are available separately. Details in list.
VALVES.—EF86 Mullard, **24 4.** Alternative **15 -.** ECC83 Mullard **19 6.** Alternative **10 -.** EM81 Mullard **18 1.** EL84 Muliard **16 -.** Alternative **12 -.**
CRYSTAL DIODE.—Mullard OA71, **6/-.**
OSCILLATOR COILS.—Brenell, **8 -**; Truvox, **6 9**; Lane **10 -.**
PLUGS AND SOCKETS.—Set of Speaker, record and erase head, input and power plugs and sockets, **32 -.** All available separately. See list.
VALVE HOLDERS.—BM9 U, **10d.** XM9 UC1, **1 7.**
TAG BOARDS.—Bulgin C120, **1 3.** C125, **2 3.** Note : Four C125 are required, not two as stated in the booklet.
CERAMIC STAND OFF INSULATOR, 1/-.
KNOBS.—Bulgin K370. Black, **1 6.** White, **2 -.**
ESCUTCHEON FOR EM81.—2 6.
CHASSIS.—Denco. Fully drilled with cover plate. **31 6.**
OUTPUT TRANSFORMER.—Elstone OT 3, **21 -.** Gilson WO767, **25 -.** Partridge SVO 1. **60 -.**
SWITCHES.—Specialist switches. Set of three, **32 6.**
SUNDRIES KIT.—Contains all wire, nuts, bolts, sleeving, solder, etc. **8 -.**
COMPLETE KITS.—All above items as listed with alternative valves.
KIT A.—With Elstone Transformer. **£13.15.0.**
KIT B.—With Gilson Transformer. **£14.0.0.**
KIT C.—With Partridge Transformer. **£15.15.0.**
Mullard Valves. Any of the above kits can be supplied with Mullard Valves in place of the alternatives for an extra **£1.2.6.**

TAPE AMPLIFIER TYPE B

RESISTORS.—LAB Kit for all fixed resistors to correct tolerances with one potentiometer. **33.9.**
CONDENSERS.—Complete kit, **33.6.** All condensers available separately. See list for details.
OSCILLATOR COIL.—Brenell, **8/-.** Truvox, **6.9.** Lane, **10/-.**
VALVES.—EF86 Mullard, **24 4.** Alternative **15 -.** EM81 Mullard **18/1.** EL84 Mullard **16/-.** Alternative **12 -.**
CRYSTAL DIODE.—Mullard OA71, **6/-.**
VALVE HOLDERS.—BM9,U, **10d.** XM9 UC1, **1/7.** XM9/UG1, **2 3.**
SWITCH.—Specialist Switches SS567A, **16/6.**
PLUGS AND SOCKETS.—Set of Record and Erase Head, Input and Power plugs and sockets. **35 6.** All available separately. See Price List.
TAG BOARDS.—Bulgin C120, **1 3.** C125, **2 3.**
CERAMIC STAND OFF INSULATOR, 1 -.
KNOBS.—Bulgin K370. Black, **1 6.** White, **2 -.**
ESCUTCHEON FOR EM81.—2 6.
CHASSIS.—Denco. Fully drilled and complete with cover plate. **31 6.**
SUNDRIES KIT.—Contains all wire, solder, nuts, bolts, etc. **7 6.**
COMPLETE KIT.—All the above items with alternative valves, **£12.15.0.** Mullard Valves. Mullard Valves can be supplied in place of alternative types for **£1.12.0** extra.

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All transistors Post Free.

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Our kit is really complete, the Instruction Book, all components, valves and small items such as wire, nuts, bolts and solder being included. Definitely nothing else to buy.
COMPLETE KIT. £6.19.6. Post free. Credit Terms. Deposit **19 6** and seven monthly payments of **£1.0.0.**
All parts are available separately and our fully detailed list is available free upon request. Instruction Book can be supplied for **2.-** plus **3d.** postage.

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The Whiteley Hi-Fi Range of Speakers. HF1012 10in., **99 9.** HF912 9in., **88 6.** HF812, **83/6.** T816 Treble Speaker, **£6.10.0.** T10 Tweeter, **84 -.** Cross-over Units. CX3000 for T10, **30.-.** CX1500 for T816, **38 6.**

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All these cabinets are packed flat for home assembly.
The Junior Bass Reflex Corner Console, **£9.9.0.**
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Full construction data, point-to-point circuit and price list of components, 1/6.

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The ideal low cost transistor pocket radio for the beginner. The Two-Stage circuit utilises the new R.C.S. VARILOOPSTICK transistor coil. A specially designed miniature .0005 tuning condenser permits the receiver to be in a case which fits in the palm of your hand. Works for months off small battery costing 7d. Can be built in 30 minutes. PRICE **30/-**

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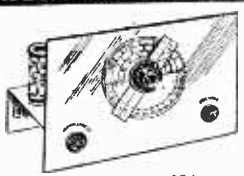
IV. WORLD WIDE SHORT-WAVE RADIO

EXPLORE THE WORLD ON SHORT WAVES!



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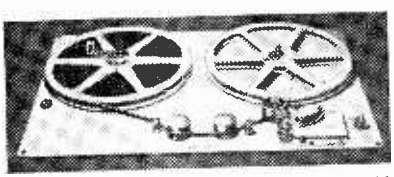
TAPE RECORDER KITS



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M.G. from Baghdad writes :—
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D. B., Malaya, writes :—
"The recorder is now working as well as a commercial model and I am very pleased with it."

This tape deck and amplifier is being used in the Antarctic by an Expedition member.

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Dual Range Crystal Set Coil, Type DRX1 ... **2/6**
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Range	Aerial	H.F.	Osc.	
800–2,000m.	RA1	RHF1	RO1	each 3/3
190– 550m.	RA2	RHF2	RO2	
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Ferrite Rod Aerial, Dual Range Type FR1 ... **12/6**
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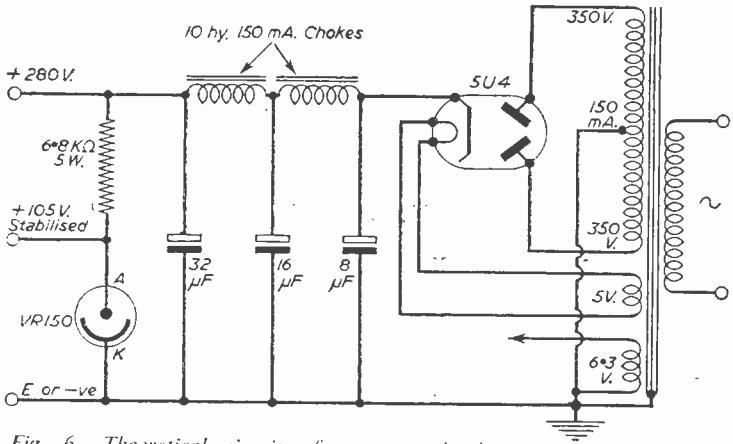


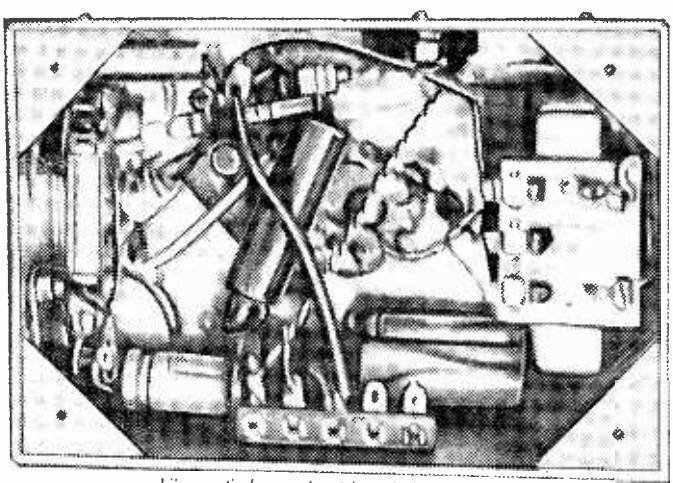
Fig. 6.—Theoretical circuit of power pack for organ and amplifier.

elaborate tone circuit as the constructor wishes. (See Fig. 1.)

The circuit has been modified from one which is familiar to every radio constructor; viz., the mains transformer and full-wave rectifier to provide the high-tension voltages in most A.C. radio receivers. (See Fig. 3.) The same principle is used in this circuit: the frequency of the mains input is 50 c.p.s. and the output "unsmoothed" H.T. has a 100 c.p.s. ripple, i.e., the frequency has been doubled.

The advantage of such a circuit over the conventional frequency-halver of the Eccles Jordan design can best be understood by comparison of the waveforms obtained in both circuits (see Fig. 8). In Fig. 8a it can be seen that half of the original wave is "cut-off," giving an "impulse" type of output, which is most undesirable in a musical instrument where low notes of the order 16 c.p.s. are to be faithfully reproduced.

By constructing an oscillator which will provide a good low-frequency curve, and using the frequency doubler, good waveforms are obtained over the whole range of the instrument.

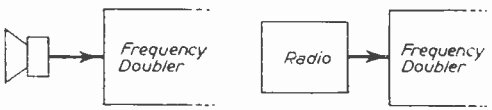


View of the underside of the unit.

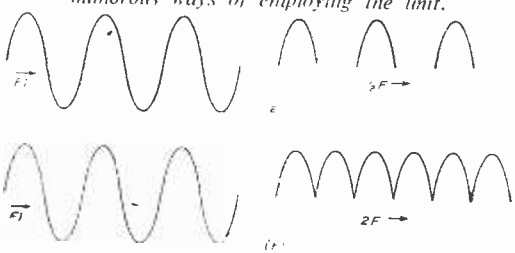
Construction

The instrument is constructed on a small chassis 6in. × 4in. × 2½in. The layout of the components is not critical, and in fact, if the constructor so wishes, V1 may be omitted so that different input signals can be easily substituted. (See Figs. 2 and 5.)

It is most important to ensure that the H.T. is well smoothed, particularly for the oscillator, otherwise unpleasant tones are easily produced. The power pack used in this instance by the author is shown in Fig. 6, and provides ample power to supply a 15-watt amplifier used with the above circuit, and has been found to be very effective.



Figs. 7 and 8.—Curves showing the action, and humorous ways of employing the unit.



Adjustments

After the construction is completed, the circuit is tested as follows:—

The output is connected to any suitable good quality amplifier, and VR1 is turned to a minimum. A single frequency F is fed into the G1 of the V2a and should be heard through the amplifier with VR2 in the maximum position.

Turn VR2 to half maximum volume and slowly advance VR1; the octave of F1 should now be heard as well, the volume of which can be pre-set by VR1. If no octave is heard, decrease the volume of F1 still further with VR2 and again advance the volume control VR1 as before.

By carefully moving VR1 and VR2 both notes can be adjusted to the same volume. Once set,

(Continued on page 574)

Programme Pointers

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

AMERICAN accents always seem suspect on the radio. I cannot think why, unless it be because English players frequently simulate them. But, apart from certain established American stars like Sam Wanamaker and Constance Cummings, there are others whose nationality it would be difficult to pinpoint. Whilst some, especially with a Southern drawl, sound so forced and exaggerated that we can only presume they emanate from English throats. Some imitations are so crude and elementary that we can only feel sorry they were elected to fulfil the task.

One felt this in the production of Tennessee Williams's beautiful play, "The Glass Menagerie," a symbolical play of the pre-second-war years, with their frustrations and illusions. Surely it would be better to play it in authentic English? After all, Molière and other French authors are not given in pidgeon cum Yvonne Arnaud English!

Having taken the adorable Yvonne's name in flippancy, we must treat it seriously in connection with her and Vic Oliver's weekly serial, "Spoken in Jest," a series based on some of the more famous quotations in the language. The episode I heard, "Rumour is a Lying Jade," proved very amusing, with both stars scoring points off each other with satisfactory frequency. Patricia Field, Gwen Lewis, Hugh Morton and Wilfred Babbage aided and abetted competently.

"Look Back to Lyttleton" was a novel by Caryl Brahms, which had been laid aside for touching up and taken out as suitable material for a radio play. The result, in Monday Night Theatre, was a bit of a hotch-potch, with specially composed music by Lennox Berkeley even more chaotic. The play was supposed to evoke the Edwardian era in a series of tiny vignettes interspersed with "instrumental effects." The music certainly failed to do this: the dialogue touched on it occasionally.

James McKechnie played "History," in other words, a narrator, who linked the episodes up and pin-pointed the pot-pourri. The cast of Beryl Calder, Gretchen Franklin, Betty Baskcomb, Barbara Couper, Helena Hughes, Simon Lack, Brewster Mason and Joan Sanderson wafted touches of wax vestas, crunching rolled roads, hansom cabs, and the odour and eau-de-colonge —only to name four of many memories. It seemed made as a comedy of manners, but it wasn't Wildean or Shavian.

"A Proper Charlie"

The current weekly Charlie Chester feature has a script written by Charles Hart and Bernard Botting. It is mildly amusing and, of course, as similar in pattern to all its predecessors, as a lamb chop is to all previous lamb chops. Mr. Chester is a versatile comedian and his part in the half hour is, of course, the best. Derick Guyler, Len Lowe, Pat Coombes and Marian Miller support. The last issue of it I heard contained "One Fine Day" execrably sung.

Repertory

Some of the repertory companies which have been filling the Monday evening theatre bill have been very good: a few of them could give, rather than take, points to the BBC stock casts. One of the best was the Edinburgh Gateway Co., who put on R. G. B. Sellar's dramatisation of Stevenson's unfinished novel, "Weir of Hermistoun." It was a pleasure to listen to acting so fresh and enthusiastic.

Tom Fleming as the "hanging judge," Michael Elder as his son Archie, Brian Mahoney as Archie's friend Frank Innes, Pamela Bain as Christine, Lennox Milne as the housekeeper, her aunt: all of them, with others, put in excellent work.

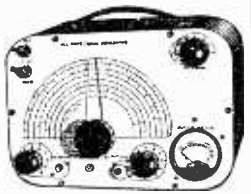
Mr. Sellar gave the story his own conclusion. As the *Radio Times* said, it was "feasible," but whether it was "Stevensonian" is another matter. I found the Scots accent and burr altogether charming.

Documentary

One of the most comprehensively documented enquiries I remember hearing was that on "smoking—its habit and its possible dangers," narrated by Robert Reid and produced by Nesta Pain. It even included a legal summing-up that, within reasonable doubt, the case against smoking versus lung cancer was proved. The body of evidence incorporated in the programme weighted heavily in this direction, upon which I have, naturally, no views. As a programme I thought it extremely well compiled, delivered and interesting.

Edgar Lustgarten, reading his own abridgement of "Murder at Elstree," performed something of a tour-de-force—it would have been complete had he acted it. Based, by Thomas Burke, on a nineteenth century melodrama, Mr. Lustgarten—who is well known to filmgoers as an accessory after Scotland Yard in the reconstruction and solution of crimes—read all the characters with much verisimilitude and imparted into the story considerable excitement and tension. It was ninety minutes in length, so Mr. Lustgarten had no let-up.

SIGNAL GENERATOR



Coverage 120 kc/s, 84 Mc/s. Metal case 10in. x 6¼in. x 4¼in. Size of scale, 6¼in. x 3¼in. 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 continuous variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finished case and white panel. Accuracy plus or minus 2%. £4/19/6 or 34/- deposit and 3 monthly payments 25/-. P. & P. 4/6 extra.

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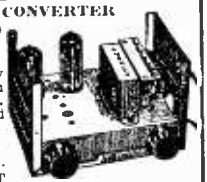
SUITABLE ANY TV (except Phillips)
ALL CHANNELS
NO ALTERATIONS TO SET



Complete with built-in power supply 230-250 v. A.C. mains. Crackle finish case 5¼in. long, 3¼in. wide, 4¼in. high, incorporating gain control and band switch. Illus. with cover removed.

£3.19.6 Plus P. & P. 2/3. Hire purchase available.

3 element folded dipole I.T.A. LOFT AERIAL 15/-. P. & P. 2/- Coax cable 8d. yd.

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Comprising 2in. moving coil meter, scale calibrated in A.C./D.C. volts, ohms and milli-amps. Voltage range AC/DC 0-10, 0-100 and 0-500, Milli-amps 0-10, 0-100. Ohms 0-1,000 and 0-10,000. Front panel, range switch, wire-wound pot (for ohms zero setting) two toggle switches, resistors and meter rectifier. In grey hammer-finish case.

19/6 Plus P. & P. 1/6.

Point to point wiring diagram 1/- free with kit.

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incorporating Ferrite rod aerial

Medium and long waves. In grey leatherette. Size 9in. x 7in. x 6in. Valve line-up: 1T4, 1R5, 1S5, 3V4. Complete kit of parts (less batteries).

£5.19.6 Plus Post & Packing 3/6

COMPLETELY BUILT PORTABLE AMPLIFIER

approx. size 6¼in. x 2¼in. incorporating 2 valves, contact-cooled metal rectifier, bass and treble lift controls and double wound mains transformer 230-250 v. **39/6** Plus P. & P. 3/6

5" P.M. SPEAKER & O.P. TRANSFORMER, if purchased with the above. 18/6. Plus P. & P. 1/6.

COLLARO 4-SPEED AUTOMATIC CHANGER

Model 456 (suitable for use with above amplifier). A.C. mains, 200-250 v., turnover crystal head. Brand new, fully guaranteed.

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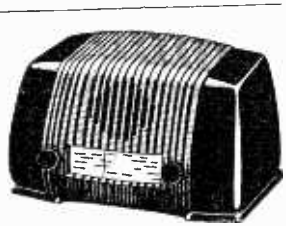

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TRANSMITTING TOPICS

NOTES ON MODULATORS

By O. J. Russell, B.Sc., A.Inst.P. (G3BHJ)

CORRESPONDENCE and "on the air" discussion has revealed that there is a very great deal of interest in the perennial subject of modulators. In many cases amateurs complain that information on operation of modulator valves at ratings other than the published ones is difficult to get. Also there is considerable confusion as to the load impedance, grid drive requirements and power pack current outputs needed when operating at voltages different from published values. This confusion is often accentuated by the stern warnings published about the critical operating conditions for modulator valves if full output with low distortion is required.

Load Impedance

To start upon these factors right away, let us consider the question of modulator load impedance. It must be stressed that the Class C P.A. stage is virtually an "ideal" load for a modulator, as it is virtually a pure resistance load. Hence, unlike a loudspeaker load, the full rated output may be achieved if the P.A. load is accurately matched into the modulator. To calculate the P.A. load, merely take the P.A. anode voltage and divide it by the P.A. current. In other words, calculate the P.A. resistance by Ohm's Law just as for any other resistance (Fig. 1). Having found the P.A. effective resistance, and knowing the required load impedance required by the modulator valves, the turns ratio required for the modulation transformer may be calculated by the usual method. The "usual method" is, of course, the calculation of the square root of the ratio of the impedances, which gives the required transformer ratio (Fig. 2). Thus if the Class C P.A. represents a resistance of 8,000 ohms, and the modulator valves require a load impedance of 4,000 ohms, then the required turns ratio is given by

$$Tr = \sqrt{\frac{8,000}{4,000}} = \sqrt{2} = 1.414$$

Thus a step-up ratio of 1.4, which is within about 1 per cent. of the "exact" figure, would be chosen. In most cases, of course, the square root of some odd ratio will have to be taken in practice, and with logarithmic tables handy, the square root may be determined rapidly. Many diaries, handbooks and mathematical tables include tables of square roots, while the standard mathematical procedure for calculating square roots may be employed. In default of any of these aids, the amateur may construct a table of square roots by straight-forward arithmetic. Take a series of numbers such as 0.7, 0.75, 0.80 . . . and so on in small steps, such as the steps of 0.05 in the above. Now square each number by multiplying by itself, and you have the squares of the numbers tabulated. Hence the original series is a table of the square roots of the numbers obtained by squaring them. This, of course, gives a series of odd decimals, as shown in the table constructed by this means on page 562. Closer values for required square roots may be obtained by estimating between two figures, constructing a table with closer differences (which involves considerable arithmetical labour) or by constructing a graph from values calculated by squaring a few simple numbers. A graph enables quite accurate values to be obtained if drawn on a reasonable scale.

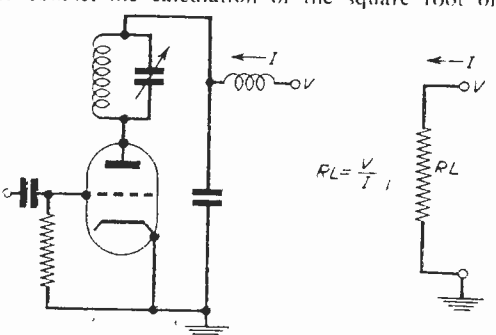

Fig. 1.—The "load impedance" of the P.A. stage for modulation purposes, is calculated as a purely ohmic resistance by Ohm's Law. In other words, the resistance corresponding to the P.A. plate current drawn at the applied plate voltage is calculated as for any other type of resistance.

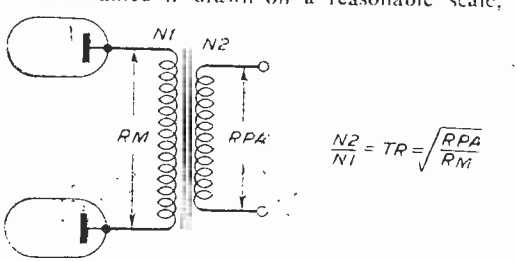

Fig. 2.—The turns ratio of the modulation transformer is calculated by the relationship shown above. RM is the required load value for the modulator valve or valves, while RPA is the effective resistance presented by the P.A. stage. N1 and N2 are the number of turns in the primary and secondary windings respectively. In practice the ratio of turns TR is all that need be known to effect a match.

and is to be recommended as the simplest way out when tables of logarithms or square root tables are not available, or if the procedure for calculating square roots is not known. Fig. 3 illustrates a graph of square roots made by the simple process of taking a few numbers and squaring them to set up a few values to enable a graph to be drawn (Fig. 4).

As the reader will have gathered, ratios accurate to a few per cent. are more than adequate for setting up the taps on the modulation transformer. In fact, ten per cent. accuracy of turns ratio is perfectly adequate, and no sleep should be lost over trying to get an "exact" match. In fact, if the P.A. tuning or loading alters from band to band, the current drawn by the P.A., and hence its value as a load impedance, will vary. However, those who have calculated an "exact" match ratio and set this up with loving care, display no qualms over loading up the P.A. on some bands to an input value markedly different, with no thought at all for altering the modulation transformer tap ratio. Why is this, and, in fact, what does happen if the modulator tubes *are* operated with incorrect values of load impedance? This requires some consideration as under amateur conditions a surplus modulation transformer obtained at a bargain price may be used, rather than an expensive "multi-match" type of commercial transformer. This, then, means that there may be a considerable mismatch between the modulators and the P.A. load values.

First, if the modulator valves *are* mismatched from the optimum load conditions, distortion *may* increase and output *may* suffer. However, under some conditions the output may be restored by increased grid drive, with Class AB2 and Class B modulators. Why this should be so requires some juggling with valve characteristic curves and load lines, so we will present the results of such jugglings rather than expand at length upon a theme which would require much space to develop it fully, and which may be left to a later article. Briefly, however, the effects of an altered load impedance depend critically upon whether the modulators are faced with a load which is greater or less than the rated load impedance (Fig. 4).

Consider first when the modulators are loaded by an impedance greater than their rated value. This means first a reduction in the peak current drawn by the modulators. Moreover, the total anode voltage swing remains approximately constant, as under Class AB2, or Class B conditions the anode voltage swing is fixed by the available H.T. voltage, and cannot be increased appreciably even by the most excessive overdrive. Thus the output available falls, and the most vicious overdriving will not give full output. This mode of operation, in fact, gives a clipping action in the modulator, which has been used to give a limiting action. Please note also that using a transformer ratio less than the optimum value is the condition that gives a higher load impedance to the modulator tubes. Thus, using a transformer ratio less than the correct one will inevitably prevent the modulator tubes from developing full output, and is to be avoided if severe limiting and consequent distortion in the modulators is to be avoided.

Lower Load

Things are different if the modulators are operated with a load value less than the optimum one. Here, for the same grid drive, the output voltage is lowered for the same peak current output. However if the audio grid drive is increased, it is possible to increase the anode voltage swing and the anode peak current, so that an output greater than with optimum load may be achieved. The qualifications are necessary, however, as the restored or even increased audio output is achieved at the cost of increased grid drive power, and of increased anode peak current. To obtain even the rated optimum output power possible with the correct load resistance, requires extra drive and a higher peak current if the load impedance is reduced below the correct value. This involves exceeding the maker's ratings as likely as not. Thus excessive drive results in excessive grid dissipation and heating, with possible shortening of valve life due to gas emission from the overheated grid. It should be noted that the 807 has thick copper supports to minimise grid heating, but which are of course not designed to dissipate more heat than that produced under the correct operating conditions! In addition the increased peak anode current drawn from the cathode may also shorten valve life, or cause increased anode heating with a good chance of releasing gas from the anode.

With 807s available cheaply on the surplus market, such considerations do not always appeal to the amateur, and a little tolerance in operating conditions is applied. However, due to the

MORE ON MODULATORS

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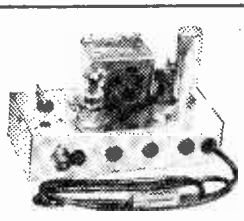
Numbers Squared	.64	.723	.81	.903	1.00	1.103	1.21	1.323

Number	.64	.723	.81	.903	1.00	1.103	1.21	1.323
Square Root	.80	.85	.90	.95	1.00	1.050	1.10	1.150

A table of square roots may be "manufactured" by taking a series of numbers and squaring them. The original series of numbers then becomes the "square root table" corresponding to the series of squares obtained by squaring the original series of numbers. This is quite adequate for modulation transformer ratio calculations (Figure Two), especially as intermediate values may be estimated closely. Thus the square root of .95 is clearly close to .975. (Accurate value .9746.)



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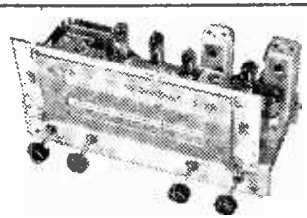

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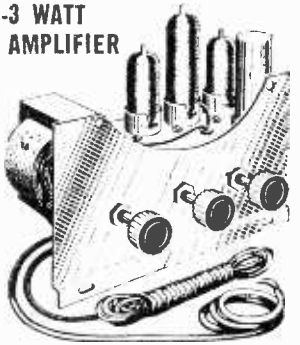

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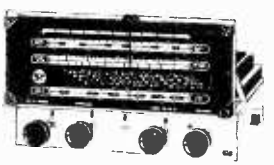

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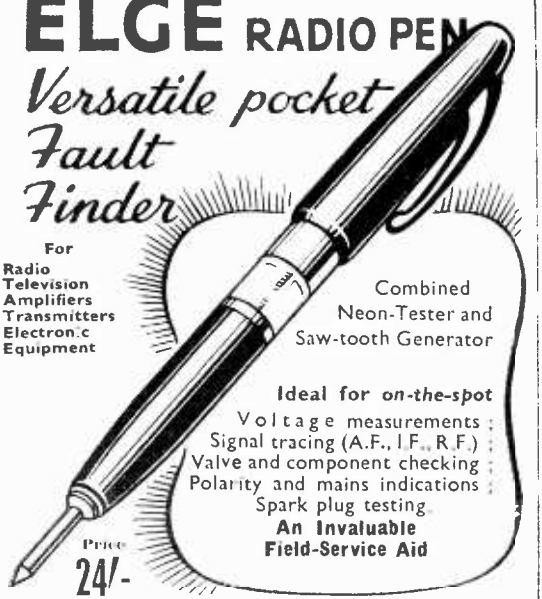

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5Y3GT	7 6	7H7	8 -	DM70	8 6	EL38	22 8	PZ30	18 -
5Z4G	9 -	7S7	9 -	FABC80	7 9	EL41	10 -	R19	13 6
6AB8	7 6	7Y4	8 -	FAC91	8 -	EL42	11 -	SP41	3 6
6AK5	4 6	12AH8	10 6	FAF42	10 6	EL81	9 6	SP61	3 6
6AL5	6 6	12AT7	8 -	FB91	6 6	EM34	10 -	U25	12 6
6AM5	5 -	12AU7	7 6	FBC33	7 6	EM80	10 -	U50	7 6
6AM6	6 -	12AX7	8 -	FBC41	10 -	EY51	10 6	U76	8 -
6AQ5	7 6	12J7GT	11 -	FBF80	9 6	EY86	10 -	U78	7 -
6AT6	8 6	12K7GT	7 6	FBF89	9 6	EZ40	8 -	UABC80	11 6
6BA6	7 6	12K8GT	14 -	FCC81	8 -	EZ41	9 6	UAF42	10 6
6BE6	7 6	12Q7GT	7 6	FCC82	7 6	EZ80	8 6	UBC41	8 9
6BJ6	7 -	12Z3	7 6	FCC83	8 -	EZ81	10 -	UBF80	9 6
6BR7	8 6	14S7	13 6	FCC84	10 6	PW4-500		UCH42	10 3
6BW6	7 6	25L6GT	9 -	FCC85	9 6		12 -	UF41	9 -
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6F1	15 -	35L6GT	9 6	FCH85	9 6	KT44	6 6	UL84	11 6
6F6G	6 6	35Z4GT	8 -	FCH42	10 -	KT63	6 6	UY21	15 6
6F12	6 -	35Z5GT	9 -	FCH81	8 -	KTW61	6 6	UY41	8 -
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6F15	14 9	80	8 6	FF96	4 6	N78	12 6	VP41	7 6
6J6	5 6	B36	20 -	FF97A	9 -	P61	3 6	W76	8 6
6K7G	4 6	CL33	16 9	FF99	6 -	PCC84	8 -	W77	5 6
6K7GT	6 -	D1	3 -	FF10	12 6	PCF80	8 9	X79	12 6
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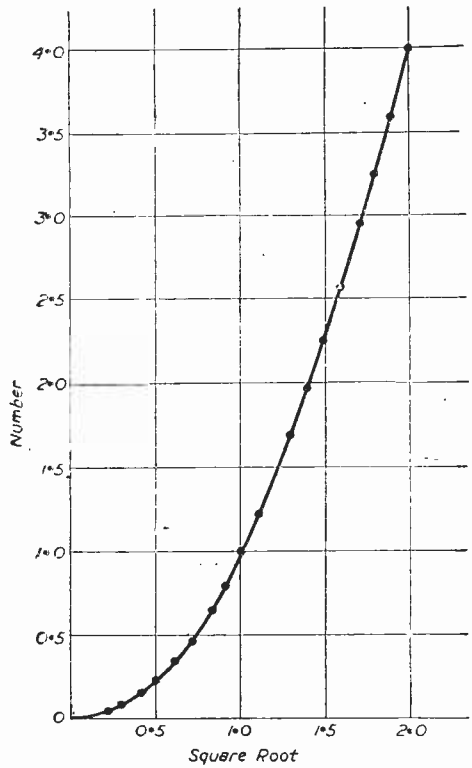


Fig. 3.—A graph of square roots produced by the "Inverse Method" of squaring a series of numbers, enables a useful square root graph, suitable for modulation ratio determination, to be drawn. The original series of numbers provides the square root values corresponding to numbers obtained by squaring the original series. As will be seen the graph was obtained by squaring a number sequence arranged in steps of 0.1.

present policy of the G.P.O. in restricting power inputs to a beggarly 150 watts, the British amateur is rather protected from the technical facts of life. Thus the rated maximum "anything goes" intermittent American limits for a pair of 807 modulators is a modest 120 watts of audio—sufficient to modulate a 240 watt P.A. With a 150 watt R.F. input limit, a pair of 807s are merely loafing along lazily when providing a comfortable 75 watts of audio for full modulation. Thus the "instinctive" choice of a higher than normal transformer ratio (which actually provides a lower than normal impedance for the modulator tubes) does enable the modulator tubes to develop their full rated power, or even slightly more at the cost of overdrive and excessive peak anode currents. However, should the power inputs permitted to the British amateur be increased to a more realistic level in due course, the operation of modulator tubes correctly would become important. Thus an increased licensed power input would not only enable certain interesting Geophysical Year work on back scatter, anomalous propagation, meteor scatter and many other valuable amateur activities to be expedited, but might serve to bring home a realisation of the niceties of electronic design. That this is not an unimportant point is brought home by a consideration of the more modern type tetrode the 6146. Here, even with low anode voltages, the high perveance and high peak anode current made it imperative to operate with not too low a value of anode load when used in modulator service. Unless this is observed, the high peak anode currents rapidly deteriorate the valve. However, the fact that a mere trifling choice of load values was responsible would be unlikely to occur to many familiar with the old reliable 807, which was a valve justly admired for its "hotted-up" characteristics when it first appeared over twenty years ago.

By all means of course use 807s, as indeed the writer does. In fact many amateurs are rolling up impressive DX scores with ancient triodes still in use over many many years. There is plenty of room in amateur radio for the QRP enthusiast, and the transistor king and valves that gave 25 watts output thirty years ago, will still give, and in fact in some cases are still giving, results, precisely equal results, to 25 watts produced by the most modern valves. In fact the writer produced R.F. in the V.H.F. region very many years ago with very ancient valves. However, it is no secret that the V.H.F. region and propagation questions were initially explored with valves of the earliest types, so that newness of equipment or valve types is not a requisite for efficient hamming. However, in certain spheres of amateur radio, it can be contested that the British amateur has been unduly restricted by power limitations. This has, in fact, prevented amateurs here from familiarising themselves with higher power equipment, and some of the interesting problems presented. It is to be hoped that the long awaited R.S.G.B. Handbook, will once more provide the British amateur with an up-to-date reference work in regard to transmitting techniques.

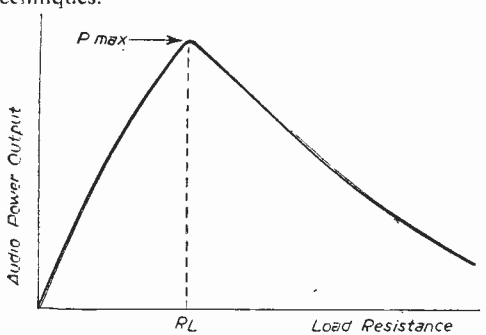


Fig. 4.—With constant audio grid drive, the power output from Class AB2 and Class B valves varies from the maximum output, and maximum audio output is obtained at one load value RL. Any other value of load impedance results in a loss of audio power. With values of R greater than RL, increased grid drive results in severe peak clipping. With load values less than RL, excessive drive may give increased output, at a cost of grid heating and excessive anode peak currents. (*See text.*)

The Alignment of F.M. Receivers

THE USE OF AN OSCILLOSCOPE IN ALIGNING F.M. RECEIVERS SIMPLIFIES THE WORK AND ENSURES ACCURACY IN ALIGNMENT. THE VARIOUS STAGES WILL BE DEALT WITH IN TURN

By F. E. Apps

Discriminator Stage

SET up as in Fig. 1. The frequency-modulated signal generator should be set up to the receiver intermediate frequency and its output applied to the grid of the last intermediate frequency amplifier. The generator sweep width should be adjusted to 300 kc/s. Connect the generator sync output terminal to the external sync terminal of the oscilloscope. The oscilloscope sweep frequency should now be set to the generator sweep frequency, or to twice that value if desired. (See Fig. 2, which shows the pattern given, A for the same frequency, B for twice the frequency.) Set the oscilloscope sync switch to external. Now adjust trimmers or slugs of discriminator transformer to obtain a symmetrical pattern. By this is meant (in Fig. 2A) B and D are equally spaced from the horizontal reference line, and also the distance A C equals C E. In the case of twice the frequency (Fig. 2B), the double pattern crosses on the horizontal reference line at point D, points A and C and F and G are evenly spaced from the horizontal line, and points B and E are equally spaced from point D. Care should be taken to get this pattern correct, otherwise the discriminator will not be efficient.

Ratio Detector

Many receivers use the ratio detector instead of the descriminator. The procedure of alignment is the same except for circuit differences (see Fig. 3).

Intermediate Frequency Alignment

The oscilloscope is connected to the receiver, through a 10,000 ohm resistor, to the top of the grid resistor of the limiter stage. The oscilloscope earth terminal should be connected to the receiver chassis. Short out the A.V.C. connect the frequency-modulated signal generator to the control grid of frequency changer. Set generator frequency to the intermediate frequency required (usually 10.7 Mc/s). The generator sweep frequency should be set to 150 kc/s. Set the oscilloscope sweep to correspond with the sweep frequency of generator. Set oscilloscope sync switch to external. Now adjust slugs or trimmers of I.F.s to obtain a pattern as in Fig. 4A. Use the lowest possible signal generator input which will give a good oscilloscope pattern, to prevent overloading, and increase the vertical gain of oscilloscope to increase height of pattern. The sync amplitude and coarse and fine frequency controls of the oscilloscope must be adjusted for a single, stationary pattern. To obtain a marker pip on the pattern, connect, by loose coupling, an unmodulated signal generator with adjustable output, to the frequency changer grid. The output from this must be kept low to prevent distortion of the pattern being observed.

Radio-frequency Amplifier

Connect the frequency-modulated signal generator to the aerial input terminals of the receiver. Set generator to the frequency required, and adjust sweep to 150 kc/s. Short out A.V.C. Connect oscilloscope vertical input through a crystal type demodulator probe to the grid of frequency changer (Fig. 5). Set oscilloscope sweep to the generator frequency and the sync switch to external. Connect generator sync output to the oscilloscope external sync terminal. Now adjust

(*Continued on page* 569)

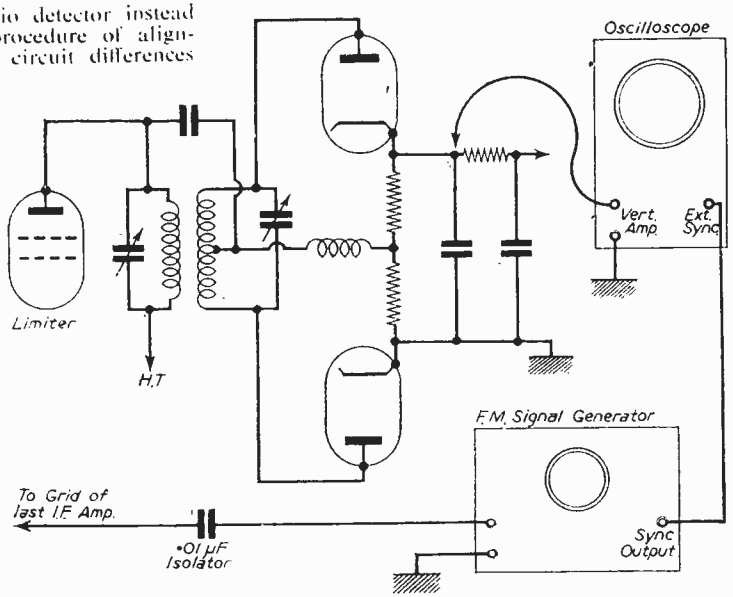
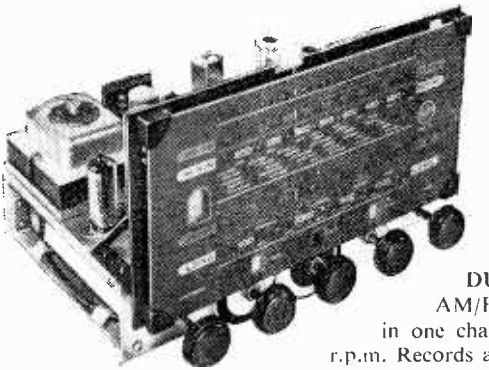


Fig. 1. The set-up of scope and discriminator stage.



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R.F. trimmers for a pattern as shown in Fig. 4B. The R.F. bandwidth can be measured from the pattern by means of a marker pip, supplied by an unmodulated signal generator as described in the section on I.F. alignment.

Other Methods

As the various makes of F.M. receivers vary slightly in their circuitry, it is as well to run through the different methods which manufac-

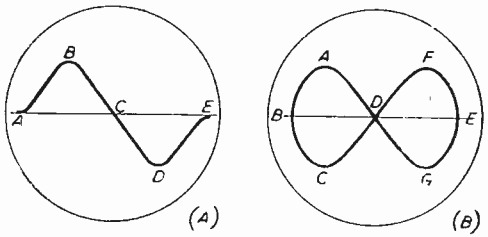

Fig. 2.—The scope pattern referred to on page 566.

turers advise for F.M. alignment. In the Cossor model 524 which is an A.M./F.M. receiver, the following procedure is suggested.

I.F. Alignment

Apply a 10.7 Mc/s signal, wobbulated 300 kc/s, to a test point which is at a point between two grid resistors of the second triode of a double triode V1. The oscilloscope is connected to the anode of V2 by means of a detector assembly as in Fig. 5. The cores of the I.F. transformers are then adjusted until a response similar to Fig. 4B

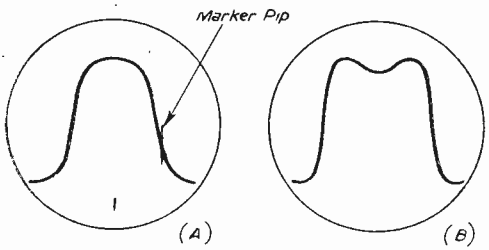

Fig. 4.—Curves obtained when the I.Fs are adjusted correctly.

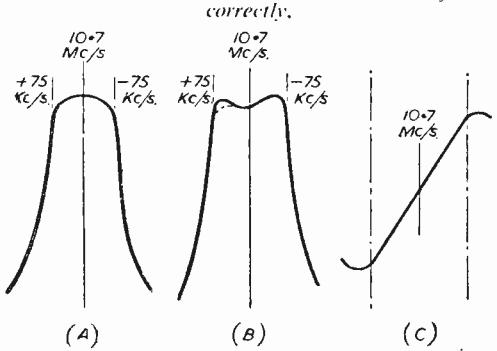

Fig. 8.—Final set of response curves.

is obtained. Then disconnect detector assembly and join oscilloscope leads across R29, which is the volume control. Put oscilloscope gain to maximum. Adjust third I.F. transformer until a pattern as Fig. 6 is obtained. The peaks of this response must be carefully balanced relative to the detuned datum line. Slight readjustment of the secondary of the second I.F. may be necessary to obtain optimum balance and linearity. Check linearity and balance of discriminator response by increasing input signal 40db, simultaneously reducing output.

R.F. Alignment

Apply signal of 90 Mc/s, modulated ±100 kc/s, to dipole aerial sockets. Connect oscilloscope across R29, volume control. Adjust oscillator trimmer for maximum undistorted response as Fig. 7A for a wobbulator locked to the oscillograph or Fig. 7B for an F.M. signal generator modulated by a sine wave. Then adjust R.F. core for maximum amplitude. Should the oscilloscope in use have low gain amplifiers it may be necessary to connect the oscilloscope across the output valve grid leak, in which case be careful to keep the volume control down slightly to prevent overloading.

Another Method With Ratio Detector

Connect the oscilloscope via probe given in Fig. 5 to anode of second I.F. amplifier. Use a signal generator with unmodulated output for marker pips, as previously mentioned. Connect output of wobbulator to grid of first I.F. amplifier. Adjust wobbulator to sweep from 10.4 to 11 Mc/s

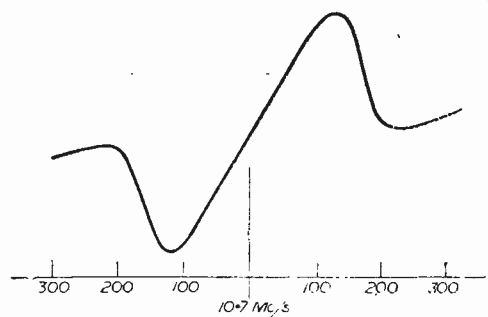

Fig. 6.—Result obtained after the third I.F. transformer is adjusted.

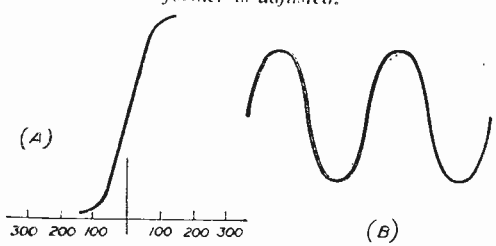

Fig. 7.—Curves with wobbular and sine wave modulation.

(centre frequency 10.7 Mc/s with 300 kc/s ± deviation). Then adjust cores of primary, second I.F. and secondary second I.F. until a curve as shown in Fig. 8A is obtained. Place a loop of wire around envelope of V1 and connect oscilloscope to the ends of loop. Adjust secondary of first I.F. and

primary of first I.F. (in that order) until a response curve similar to Fig. 8B. If necessary readjust second I.F. cores again.

Ratio Detector

Connect oscilloscope to volume control and with wobbulator set to 10.7 Mc/s ± kc/s, adjust primary and then secondary of ratio detector transformer. A curve as Fig. 8C should be obtained. Be careful that the centre portion

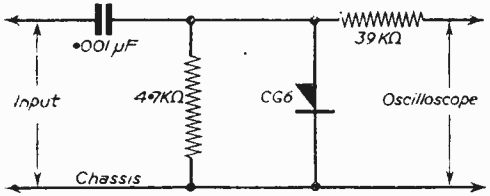

Fig. 5.—Detector assembly which should be used with the scope.

is straight and that the 10.7 Mc/s marker is in the centre of the straight portion.

Other Points to Notice

As remarked at the commencement of this article, alignment by oscilloscope affords a better method than other ways. Methods other than an oscilloscope can be used, such as an A.C. voltmeter across primary or secondary of the output transformer, or a valve voltmeter connected in the discriminator circuit, but as most manufacturers issue response curves it can be appreciated that a better result can be obtained by using an oscilloscope and get curves as laid down.

Procedure of Alignment

Practically all manufacturers advise the alignment of the A.M. portion of set first, in the case of an A.M./F.M. receiver. That having been done, then the adjustment of the F.M. intermediate transformers from the frequency changer or mixer, up to the discriminator transformer, should be carried out. Next, is the alignment of the discriminator transformer. After that the R.F. circuits and oscillator. Should there be any I.F. break-through traps, they should be done next. Before completion, a check should be made on the amount of radiation from the local oscillator.

Although various methods of alignment have been shown, it will always be advisable to follow the manufacturer's instructions. If not available, then either of the methods shown should suffice, observing the circuitry employed.

Distortion

Mis-alignment can cause serious distortion, but if it is experienced, do not immediately consider that realignment is necessary. It may be due to any of the following causes:—Faulty A.F. section; Instability of the I.F. stages. This can be checked by placing a voltmeter of high sensitivity across discriminator load resistor, with no signal input. If a meter reading shows, then there is instability. As the complete realignment of an A.M./F.M. receiver is a job that takes quite a time, if carried out conscientiously, it will be seen that jumping to the conclusion that a set requires realignment, is not too good, if it is another fault that is causing the trouble.

Further Notes

When realignment is found necessary, always allow time for the receiver to warm up thoroughly before attempting to make any adjustments. Non-metallic trimming tools should always be used, as you are dealing with much higher frequencies than in an amplitude modulated receiver.

Composite F.M. and TV Receivers

There are several manufacturers who are turning out a combined TV and F.M. receiver, and it will probably be found in some of these that the F.M. section affects the television section. In these cases, if re-alignment is necessary the F.M. section must be done first. As the variation of amplitude does not produce a corresponding variation of output with frequency modulation it is necessary to use a U.H.F. crystal detector, connected to the grid of the first I.F., and the rectified voltage, which is about 150mV, applied to an oscilloscope.

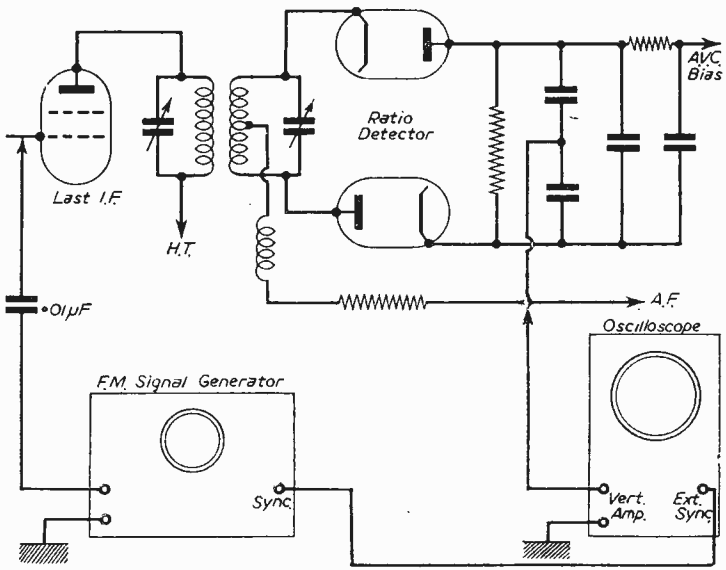

Fig. 3.—The set-up with ratio detector.

Open to Discussion

The Editor does not necessarily agree with opinions expressed by his correspondents

The Hi-Fi Tape Recorder

SIR.—I would like to make the following comments on the recently published design for the "P.W. Hi-Fi Tape Recorder."

1. The variable tone controls VR2 and VR3, and their associated network, have been placed between V2(A) anode and V2(B) grid, and since N.F.B. is taken from the output transformer and applied to V2(A) cathode, the controls are within the feedback loop Hence their effect in modifying the frequency response will be largely cancelled out by N.F.B. The obvious answer is to apply the feedback to V2(B) cathode.

2. While splitting the record / playback switching into two parts (S1 and S2) makes for avoidance of instability it does so at the expense of control simplicity. Surely mechanical coupling between the switches would be better ?

3. The idea of a "live-chassis" tape recorder is, I feel, a somewhat dangerous one. The writer states that the hum level is too high for recording with the mains plug reversed, but in spite of this it is not unknown for such things to happen. Neither is it unknown for some "neutral" mains lines to be sufficiently live with respect to earth to deliver a nasty shock. Live-chassis designs may be reasonably safe in radio sets where all metalwork can be covered, but with a tape recorder, which has connected to it metal cased microphones and earphones with a metal strap, the price of a mains transformer is a small one to pay for one's safety.

4. Finally, when the pre-amp and output stages make use of highly efficient miniature valves there appears to be little reason for using octal-based double-triodes in the intermediate stages. Double-triodes from the same range as the other miniatures are considerably better than the 6SN7 from the point of view of both noise and size. Incidentally, on "record" the idle output valve could well be used as L.S./phones monitor amplifier, leaving V3(B) to be used as a peak programme meter, which gives a much better indication for "hi-fi" equipment than a magic eye.—P. H. JURY (Loughboro').

[*The author makes the following comments.*]

IN reply to Mr. Jury's letter I have answered his questions in their numerical order:—

1. Placing the tone controls within the negative feedback loop does, in theory, tend to decrease their control over the frequency response, but in practice there is no audible difference including them in the loop or not. The more stages supplied with negative feedback the better ; it lowers the stage noise and stabilises the stage response to a level figure. In the writer's opinion, removing the feedback from V2(A) and connecting it to the cathode of V2(B) and thus placing the tone controls external to the feedback loop, is of purely academic interest. Experiment has proved that this modification only increases the noise level of the V2(A) stage slightly, without affecting the tone control operation at all.

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying commercial or surplus equipment. We cannot supply alternative details for receivers described in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of cover.

2. As the recorder was designed to be as economical as possible in construction, and to make the actual construction simple, the use of two separate "Yaxley" switches was specified. If these two switches were ganged mechanically, it would involve extra metal screening, and require drastic alterations to the amplifier chassis. As this modification would only reduce the number of controls to five, and the fact that a switch controlling the microphone input would still have to be fitted to enable the microphone to be switched into circuit with the amplifier in the "playback" position for P.A. working, this suggestion is regarded as somewhat irrelevant.

3. Although the incorrect connection of the mains will cause the chassis to be "live," if adequate precautions are taken, as mentioned in the article, the equipment is quite safe. Again, as mentioned in the text, an isolation transformer can be fitted if so desired. Regarding the "nasty shock" from a neutral mains lead, if this is so I suggest Mr. Jury informs the local electricity office, as all neutral mains leads should be to all intents and purposes at earth potential with respect to the live line. Most neutral leads measured between earth proper and "neutral" have registered between 5 and 25 volts R.M.S., voltages which cannot, under any stretch of the imagination, be called lethal.

4. The miniature valve type EF86 was chosen for its low noise and suitability for use as a pre-amplifier. The EL84s for their small physical size and approximate equivalent characteristics to the 6V6. There is insufficient room for the octal types. The 6SN7s were used because they are readily obtainable at modest cost, and the fact that they are reasonably small in size. Mr. Jury will find that the noise level of the miniature triodes as compared with the 6SN7 type is about the same. Incidentally, the octal-based valve is

more robust in construction, and contact resistance noises generated by the small pins of the B9A type so frequently do not appear with the octal types.

5. The remarks about the idle output valve, and peak programme level meter are interesting, but again this would involve drastic alterations to the circuit. The magic eye is extremely versatile as a level measuring device, and is adequate for the majority of uses. The suggestions put forward by Mr. Jury on these points would mean more controls for meter balancing, etc., a gross contradiction to his earlier statement of reducing the number of controls. In conclusion, I would like Mr. Jury to redesign the circuit, incorporating his suggestions: would the recorder then be really hi-fi? Surely the ear is the final test? I suggest Mr. Jury builds the recorder—as designed—he would be surprised at the quality available, octal based triodes and all.—B. I. PHILLIPS.

BBC Pronunciation

SIR,—More power to your campaign regarding English pronunciation, anglicised foreign names, and the BBC. There is far too much of this intellectual snobbery in evidence these days. Just for the record, to-day (July 14th), on "Two-way Family Favourites," a BBC announcer unblushingly announced " . . . from Mum and Dad at Bowl-ye(r) in Hampshire . . ."—surely we've had "Bewley" with us long enough for adoption even by such an august and important [sic] authority as the BBC?—E. F. W. JAMES (Greenford).

SIR,—Having just listened on the 6.0 p.m. News to-day to the BBC announcer's reference to "Cuvent" Garden, I feel that I must write to you to say how fully I agree with "Thermion's" strictures upon BBC pronunciation, and I now await with considerable interest the BBC's next rendering of the word "bomb" or "bombing."

I always enjoy reading your excellent paper, and as soon as I can find the time to do so, I intend to build the F.M. Receiver based upon the "373" I.F. strip as described by "Mark Time." I built my first F.M. receiver rather more than a year ago, using my own version of the modification of the RF26 unit described by a certain commercial undertaking, and am quite unable to understand how some of your correspondents seem to think that F.M. does not give any better results than those obtained on the medium waveband. To me, F.M. is incomparably superior in every way, and I experienced no particular difficulty in building the receiver. Alignment was perfectly simple: all I did was to look down the columns of my Baptismal Register till I found a parent whose occupation was "radio engineer," go round and ask how John Henry was getting on, and ask for the loan of a signal generator for a couple of hours. Possibly those enthusiasts who are disappointed at the results they are getting on F.M. do not realise how important it is to place the aerial in the position in which best results are obtained: I am using a simple half-wave dipole under the roof on the east side of the house, and I had to get 18 yards of co-axial cable to connect it to the receiver in the room in which I am using it; it is worth while, however, because with the aerial in any other position one gets distortion due to reflections from water pipes, gas pipes, etc.

The circuit that I am using includes a ratio discriminator without a limiter, and the only criticism that I have to make of the results that I am getting is that when aircraft pass through a certain position in the locality, one hears a dreadful noise which I can only compare with that made by a dog being sick, but we don't get all that number of aircraft over here to make this a serious nuisance. I shall be interested to see whether the limiter in the "373" circuit will have the effect of cutting out this form of annoyance. I will let you have a report on this matter when I have built the receiver.

In my opinion, the great advantage of F.M. is the absolutely silent background one gets under all normal conditions (one can even continue to listen during a thunderstorm) and the incomparably better rendering of orchestral music. One does want a decent loudspeaker, though, to bring out the full benefit of F.M. I am using a W.B. Stentorian ten inch, mounted on a hardboard baffle, and am very satisfied, but, as soon as "ERNIE" remembers my existence, I intend to build it into a bass-reflex cabinet to get even better results.—CHARLES H. ARNOLD (REV.) (S.E.).

Scouts Jubilee Jamboree

SIR,—I would refer to your short article on page 383 of the August issue, under the heading "Birmingham Jamboree." In this connection I wish to inform you that the text of the article is not wholly accurate and that you have apparently been misinformed.

The Radio Station at the Jamboree is the result of some twelve months' work by an organising committee, of which the writer was a member, formed from members of the Midland Amateur Radio Society, Slade Radio Society, and the British Amateur Television Club (Birmingham Group). The News Service to which the article refers and which the G.P.O. allowed us to broadcast, was organised by two members of this committee.—A. G. MACGREGOR, Assistant Hon. Sec. (Midland Amateur Radio Society).

A MUSICAL FREQUENCY DOUBLER

(*Concluded from page 557.*)

these should require no further attention.

One point worthy of note is that the *relative* volumes of F1 and F2 will depend on the tone control circuits, so that VR1 and VR2 may have to be re-adjusted to give the best *overall* results.

Incorporation of this circuit into an existing organ is explained in Fig. 4. The existing instrument is represented by Fig. 4 (i), and the modified one by Fig. 4 (ii). The switches can be either a simple toggle variety or arranged in the form of an octave "stop." Opening S1 will mute the fundamental and allow just the octave to sound.

Needless to say, some amusing results can be obtained by speaking into a microphone connected to the input, or by simply connecting the output of a radio receiver to the input! (See Fig. 8.)

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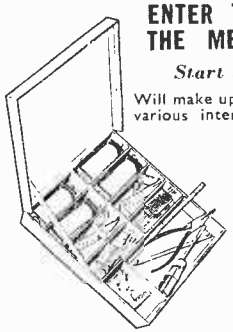

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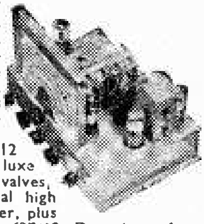

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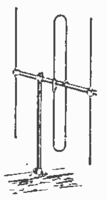

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AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

One-valve : 2/6

B.B.C. Special One-valver AW387*

Mains Operated

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SPECIAL NOTE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. 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, Strand, W.C.2.

No of Blueprint

SHORT-WAVE SETS

Battery Operated

One-valve : 2/6 each

S.W. One-valver for American AW429*

Two-valve : 2/6 each

Ultra-short Battery Two (SG, det Pen) WM402*

Four-valve : 3/6 each

A.W. Short Wave World-beater (HF Pen, D, RC, Trans) AW436*
Standard Four-valver Short-waver (SG, D, LF, P) WM383*

Mains Operated

Four-valve : 3/6

Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/6) WM387*
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