CONVERTING THE 'COMMAND' RECEIVER

PRACTICAL WIRELESS

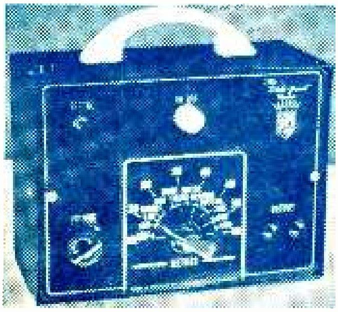
1/3

NOVEMBER 1957

EDITOR: F. J. CAMM

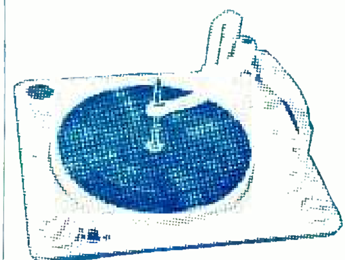
Contents

DO IT YOURSELF—IT'S SO EASY!



47/6 **Build this exceptionally sensitive double triode radio.** Uses unique assembly system and can be built by anyone **without any radio knowledge whatever** in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6½in. x 5in. x 3in. Covers all Medium and Long waves—uses only one all-dry battery. H.T. consumption only 1 to 1.5 mA. Uses personal phone. Ideal for Bedroom, Garden, Holiday, etc. **Many unsolicited testimonials. Mr. Norton of Oxted writes:** *Yesterday evening on the Medium waveband, I counted 32 separate stations: I am very pleased with the set, which is well worth the money.* **BUILD THE "SKYROMA" NOW! Total building cost—everything down to last nut and bolt—47/6** (Postage, etc., 2/-)—**with full set of clear, easy-to-follow plans.** (Parts sold separately. Priced Parts Lists, etc., 1/6.)

BRAND NEW CHANGERS £9-8-6!



LIMITED QUANTITY ONLY! In maker's sealed cartons. List price **£13.17.0.** The famous "Collaro" 4-speed autochange unit, Model 456. Incorporates Studio "O" high-fidelity turn-over crystal pick-up, the new manual and fully automatic control on all four speeds. Constant speed change cycle on all records. Designed so that there is a gentle lowering of the stack of the records on to the step of the spindle to avoid damage and wear to the centre holes of records. Size only 12in. x 13¼in., clearance required above base-board only 5in., clearance below only 2½in. **RUSH YOUR ORDER NOW! ONLY £9.8.6.** plus 4/6 Post and Packing.

LOOK! BUILD THIS POCKET RADIO FOR ONLY 37/6

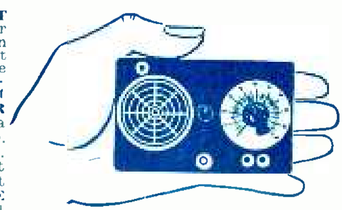
AT LAST! In response to many requests we now present the **DOUBLE TRIODE "SKYPOCKET,"** a beautifully designed precision **POCKET RADIO.** No radio knowledge needed!—EVERY SINGLE PART TESTED BEFORE DESPATCH; **Our simple, pictorial plans take you step-by-step.** This set has a remarkable sensitivity due to painstaking design. Covers all medium waves 200 to 550 Metres. Size only 5¼in. x 3in. x 2in. in Strong, Transparent case with panel, cover and ivorine dial. A really personal-phone, pocket-radio. **WITH DETACHABLE ROD AERIAL.** Self-contained all-dry battery operation. Average building time 1 hour. **Total Building Cost—including Case, Double Triode Valves, etc., in fact, everything down to the last nut and bolt—ONLY 37/6 with plans.** Postage, etc., 2/-. C.O.D. 1/6 extra. (Parts sold separately. Priced Parts List, etc., 1/6.) **Demand is certain to be heavy—SO SEND TO-DAY!**

Build This TRANSISTOR POCKET SET For Only 47/6!

ONLY £8-12-6

BRAND NEW—NOT SURPLUS! In maker's sealed cartons. Latest UA8 "Monarch" 4-speed record-player complete with High-fidelity "turnover" head. Type HGP 37—1. Capacity of 10 Records, plays 12in., 10in. and 7in. intermixed in any order. 78, 45, 33⅓ and 16 r.p.m. For A.C. mains 100 to 250 volts. Exclusive "magdisk" selector gives quickest and quietest change ever. With full instructions and fixing plans. **Limited Quantity at £8.12.6.** plus 4/6. Post, Packing, etc. **WHY PAY MORE! SEND NOW WHILE STOCKS LAST!**—modernise your radiogram and increase its value

WE'VE DONE IT AGAIN! . . . our design department in response to a great many requests have designed this **"SKY-PIXIE" Vest-Pocket TRANSISTOR RADIO** which gives a good performance. Size only 4¼in. x 3¼in. x ⅞in., the weight under 7 ozs.!—yet it is a **TWO-STAGE** receiver covering all medium waves, working entirely off a tiny "pen-light" battery, which costs 6d.—fits inside the case—and lasts many months. Uses personal phone and has push-button **LUMINOUS** On/Off Switch. Every part tested before despatch! **SPECIAL STEP-BY-STEP PLANS for ABSOLUTE BEGINNERS. Total building cost including case, transistors, etc.,—everything down to the last nut and bolt—ONLY 47/6 with plans.** Postage etc., 2/-. C.O.D., 1/6 extra. (Parts sold separately. Priced parts list, etc., 1/6.) As the building cost is absolutely "rockbottom" (it might increase later) **DEMAND WILL BE VERY HEAVY—RUSH YOUR ORDER TO-DAY!**



BUILD THIS TRANSISTOR SET FOR ONLY 35/-

VERY SPECIAL OFFER WHILE STOCK OF PARTS LASTS!—The "Sky-Scout" Pocket, two-stage transistor set, size only ⅞in. x 3¼in. x 4¼in. Covers all medium-waves and works entirely off tiny "pen-light" battery which costs 6d. and fits inside case. All parts tested before despatch. Can be built for 35/-, plus 2/- post and packing, including Case, Transistor, **STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS,** nuts, bolts, etc. (C.O.D. 1/6 extra.) Parts sold separately, priced parts list, etc., 1/6. **VERY SIMPLE TO BUILD.**

FEW ONLY AT 95/-!

NEW in maker's sealed cartons!—limited quantity of the famous 3-speed record player units, exceptionally easy to fix, with lightweight pick-up, incorporating "Acos" crystal turnover head and separate sapphire styli for Standard and Long-Playing. With full instructions and fixing plans. **Unbeatable price 95/-,** plus 3/6 Post, Packing, etc. C.O.D. 2/- extra. **RUSH YOUR ORDER NOW—BEFORE IT'S TOO LATE!**

CONCORD ELECTRONICS
69, PRESTON STREET, BRIGHTON. Dept. PWO

Orders receive prompt attention. Cheques accepted. Cash on delivery 1/6 extra. Please print name and address in block letters. Component suppliers to Schools, Universities, Government Research Establishments. **Complete range of components stocked.** *CALLERS WELCOME. Shop Hours: 9 a.m. to 6 p.m. (1 p.m. Thursday). Regret no Goods sent abroad.*

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
6/12 v.	2 a.	8/9
6/12 v.	3 a.	11/9
6/12 v.	4 a.	14/9
6/12 v.	6 a.	19/9
6/12 v.	10 a.	25/9
6/12 v.	15 a.	35/9

L.T. Types H.W. 6-12 v. ½ a. H.W., 2/9

H.T. Types H.W.

150 v.	40 mA.	3/9
250 v.	50 mA.	5/9
250 v.	80 mA.	7/9
250 v.	150 mA.	9/9
250 v.	250 mA.	11/9

BATTERY CHARGER KITS

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

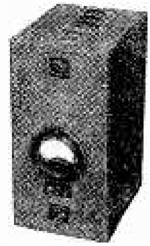
6 v. or 12 v. 1 amp.	22/9
6 v. 2 amps.	25/9
6 v. or 12 v. 2 amps.	31/6
6 v. or 12 v. 4 amps.	53/9

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 cc/s. Screened.

TOP SHROUDED DROP THROUGH

250-0-260 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, 5,000Ω to 3Ω	3/9
Small Pentode 7/8,000Ω to 3Ω	3/9
Standard Pentode 5,000Ω to 3Ω	4/9
Standard Pentode, 7/8,000Ω to 3Ω	4/9
10,000Ω to 3Ω	4/9
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω	15/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push-Pull EL84 to 3 or 15Ω	16/9
Push-Pull 15-18 watts, 6L6, KT66	22/9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 or 15Ω	47/9

SMALL MAINS TRANSFORMERS. 2½-3-2½in. approx. Primary 200-250 v. 50 c/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.

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 5½in.

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 0-0-110-122-136-148 v. or REVERSE. 200 watts, 35/9, plus 7/6 carr. Both for 50 c.p.s.

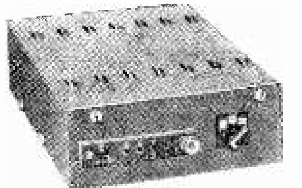
EX. GOV. MAINS TRANSFORMER. Primary 0-110-120-200-210-220-230-240-250 v. 50 c.p.s. Secs. 275-0-275 v. 100 mA. 6.3 v., 7a. 5 v. 3 a. Only 18/9.

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.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. 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.

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		
6SL7GT	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

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

VOLUME CONTROLS with long (¼in. diam.) spindle, all values less switch, 2/9; with S.P. switch, 3/9; with D.P. switch, 4/6.

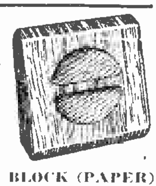
T.V. CABINETS. Leading manufacturer's surplus. Attractive designs. Walnut veneered with doors for 15, 16 or 17in. Tube. £3.19.6. Carr. 7/6.

MINIATURE MOTORS. 24/28 v. D.C. or A.C. made by Hoover Ltd., Canada. Size only 2½ x 1½in. Spindle 1½in. long, ⅛in. 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.

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. 275 v.	6/9
6,000 mfd. 6 v.	3/9		

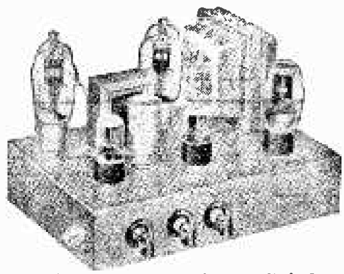
Many others in stock.

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 feed-back 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 Credit Sale terms if supplied with amplifier.

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/-

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 RC/457 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. Overall size 6½ x 4½ x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 49/9.

PORTABLE CABINETS. Exceptionally attractive appearance. Size inside 17½ 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/457. 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 descriptive 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 ECC83, 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 10-6-6in. 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.

R.S.C. TA1 HIGH QUALITY TAPE DECK AMPLIFIER. For Tape Decks with High or Low Impedance, Playback and Erase Heads, such as Lane, Truvox, Aspden, Collaro, Brenell, etc. For A.C. Mains 230-250 v. 50 c/cs. **Ready for Use. ONLY 11 GNS.**

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 microphony and hum. High output with completely effective erasure and distortionless reproduction. Sensitivity is 15 millivolts so that 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. Carriage 7/6. Illustrated leaflet 6d. Special price can be quoted for Amplifier and a Deck. When ordering please state make of Deck to be used.

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. 17/9. 8in. Rola. 19/9. 10in. Goodmans. 27/9. 10 x 6in. Elliptical Goodmans. 27/9. 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 (12,000 lines), 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 L45, A5 or A7 amplifiers. Elac 7 x 4in. elliptical, 19/9. Celestion 6½in. with high flux density magnet, 19/9. 12in. Plessey, 29/11.

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 HIGH QUALITY 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.

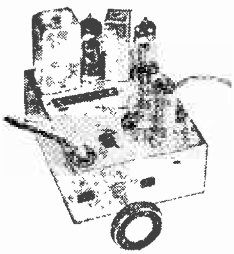
RADIO SUPPLY CO. (LEEDS) LTD. 32, THE CALLS, LEEDS, 2

HOME RADIO OF MITCHAM

187 LONDON ROAD, MITCHAM, SURREY MIT. 3282

HARDWARE KITS
Comprehensive kit of 2, 4, and 6 B.A. brass nuts, bolts and washers. USUALLY 6/9. OUR PRICE ONLY **4/6**, plus 9d. post.

NEW E.A.R. "TRIPLE FOUR" AMPLIFIER
Four-stage, 6 watt, ultra linear push-pull output. Independent bass, treble, and equalisation controls. **PRICE £11/11/-.**



NEW E.A.R. SWITCHED F.M. TUNER WITH A.F.C.
Automatic frequency control obviates all drift. Spot-on Home, Third, Light or Gram. **Ready built, 15 gns.** (Kit ready soon.)

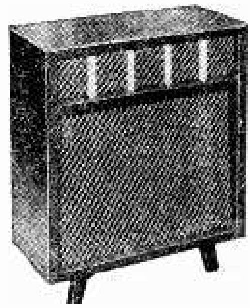
MAGNETIC RECORDING TAPES
A by-return service for all makes of recording tape. Standard and Long play in all sizes. C.O.D. or C.W.O. Lists on request.

THE HIWAYMAN
All-dry battery portable. 4 valves and high efficiency Ferrite rod aerial. Medium and Long Waves. Full constructional details and price list. PRICE **1/6.** Total building cost approx. **£7/10/-.**

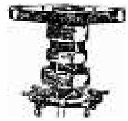
SPECIAL OFFERS
- ★ Low-loss semi-airspaced, 75/80 ohms, coaxial cable. ONLY **9d.** yard (plus 1/4 post).
- ★ High-grade single-screened microphone or audio cable. Black PVC covering. Brand new and perfect. ONLY **6d.** yard (plus 1/- post).
- ★ T.C.C. condensers, printed circuits, special valveholders, etc., for Commercial T.V. converter for VIEWMASTER. Listed at £2/3/-. OUR PRICE ONLY **27/6**, complete with data and price list.

NEWNES 7th Edition of "Short Wave Manual." PRICE **6/6** (post paid).

"Hi-Fi Year Book." PRICE **10/6** (6d. postage).



NEW E.A.R. "TRIO CONSOLE" SPEAKER
12in. Bass Unit and two Treble Units in handsome modern acoustic cabinet.
PRICE **£15/15/-.**

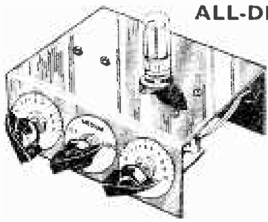


Appointed stockists for TELETRON and REPANCO coils, I.F. Transformers, Transistor Components, etc. Leaflets on request.

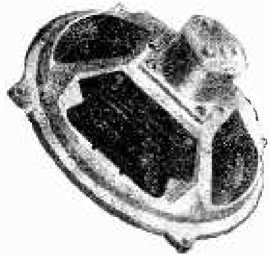
TRANSISTORS

Red Spot	**8/-**
OC71	**10/6**
White Spot	**17/6**
Yellow/Red R.F.	**21/-**

1 VALVE ALL-DRY BATTERY SET



Complete kit of parts including valve, **33/6.** H.T. and L.T. battery, **8/3.** Headphones **14/-** pair. Full constructional details and price list, price **9d.** post paid.



WB HF1012
High fidelity at realistic cost. 10in. die-cast unit, 12,000 gauss magnet. Response 30 c.p.s. to 14,000. 10 watts. Universal speech coil, 3, 7 and 15 ohms. **£4/19/9** (plus 2/- post).

JACKSON type "00" midget twin gang designed for use in transistor sets. From stock, **9/6.**

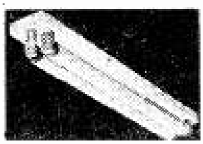
We are officially appointed agents for :—
EDDYSTONE COMMUNICATION RECEIVERS
PANDA TRANSMITTERS, ARMSTRONG CHASSIS
DULCI CHASSIS and AMPLIFIERS, etc.
Overseas enquiries for these items invited.

W.D. CIRCUIT DETAILS

Diagrams and other information extracted from official manuals. All 1/6 per copy. 12 for 15/-.

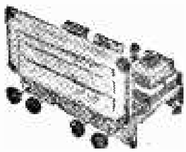
American Service Sheets	R.109
	78 receiver
A.1134	76 receiver
BC.348	R28 ARC5
BC.312	R1116 A
R.103A	RA-1B
B.C.342	AR88D
RA-1B	AN/APA-1
R-208	78
R-1155	76
R-1124A	R.T.18
R-1132A/R-1481	CAY-46-AAM-RADAR
R-1147	
R-1224A	A.S.B.-3
R-1082	Indicator 62A
R-1355	Indicator A.S.B.3
B.C.1206-A/B	Indicator 62
B-455-A (or -B)	Indicator 6K
B-454-A (or -B)	R.F. unit 24
B-453-A (or -B)	R.F. unit 26
Transmitter	R.F. unit 25
T1154/B.D.J.N.	R.F. unit 27
Fifty-eight walkie-talkie	Wireless set No. 19
Frequency meter B.C.221.	Demobbed valves

FLUORESCENT LIGHTS



These are complete fluorescent lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the work-bench and in similar locations. **Single 40.** 4ft. 3in. long, uses a 40t watt tube. **Twin 20.** Uses 2 20-watt standard tubes. Price for both of these is **39/6** complete with tubes. Carriage and insurance up to 150 miles **6/6**, up to 250 miles **8/6.**

THE CLEVELAND ORGANTONE

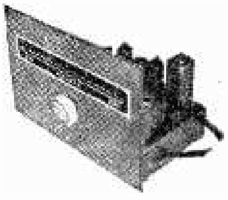


5 valve 3 waveband superhet covering Long, Medium and Short waves. Osram miniature valves—low loss iron coils — permeability — tuned I.F.S. — full A.V.C.—variable negative feed-back—gram. position—4 watts output—particularly fine tone. Chassis size 7in. x 7in. x 7in. approx. Tested in difficult areas, where exceptional results have been obtained. Price **£11/10/0** or **£2/0/0** deposit, plus 7 payments of **£1 10 0.** Carriage and ins. 10/-.

VARIABLE RHEOSTAT

This is a heavy duty slider resistor rated at 25 amps. but easily capable of twice this load. Basis resistance is .4 ohms but by the removal of one wire this becomes .8 ohms, alternatively it can be rewired to suit individual requirements. Adjustment is by rotating a Bakelite knob which couples to a heavy duty slider, ideal for dimmer circuit. Price **8/6**, post and ins. 3/6.

F.M. TUNER

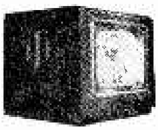


This is a high fidelity unit which although moderately priced has a performance equal to the highest priced. Its stability is very good and extremely good results have been received with the simplest of aerials as far away as Eastbourne. The unit is made up ready to work and has its own power supply for A.C. mains. Demonstration at all our branches. Price 12 gns. or **£1.12.0** down and 6 payments of **£2.** Post plus insurance 5/-.

THIS MONTH'S SNIP

6ft. UNBREAKABLE MAINS LEAD. This is the type of lead which is fitted to electric razors and similar appliances, makes fine lead for test-meters and any other devices where the flex is subject to continuous bending and kinking. Twin figure eight construction, soft cream P.V.C. covered. Normally costs 2/- per yard—we offer three leads for **3/-** post free; special quotes for large quantities.

12in. T.V. CABINET—15/-



We are offering these at not much more than the cost of the plywood they contain. If not wanted for T.V. many useful items can be made—record storage cabinet, H.F. loudspeaker case, bookcase, etc., etc. Price 15/-. Carriage 3/6.

MULLARD AMPLIFIER "510"

YOURS FOR 30/- DOWN

A Quality Amplifier designed by Mullard. Power output exceeds 10 watts. Frequency response almost flat from 10 to 20,000 C.P.S. For use with the Acos "Hi G" and other good pick-ups. Made up and ready to work is **£12/10/0** or **£1/10/0** down and 8 payments of **£1/10/0**, plus 10/- carriage and insurance.

MULLARD PRE-AMPLIFIER

For extra gain and fidelity this unit gives ideal results. It is arranged to plug into the amplifier and has two switches to provide compensation for radio, microphone, L.P. and 78 records. Complete with valve, made up ready to work. **£4.** Post and insurance 3/6, or **10/-** deposit and eight monthly payments of **10/-**.

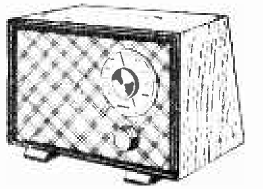
DO-IT-YOURSELF

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 Suppressor—Illustrated detailed instructions, nothing else to buy, all for **£8 10 0**, carriage and insurance 4/6 or **10/-** deposit and 9 monthly payments of **£1.**

Record Players

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

OUR 19/6 COLUMN



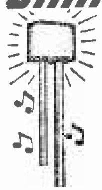
THE SKYSEARCHER

This is a 2-valve plus-metal receiver 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

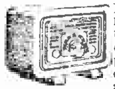
Powerful three-valve Mains amplifier ideal for dances, parties, etc. Complete less chassis cabinet and speaker (available if required)—data 1/6 (free with parts). Price **19/6**, plus 2/6 post and insurance.

"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 2/-.

Simplex Transistor Kit



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

A.C./D.C. Multimeter Kit

Measures A.C./D.C. volts and ohms. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price **19/6** plus 1/9 post and insurance.

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), plus 2/6 post and insurance. Data free with parts or available separately **1/6.**

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. **£2/15/0.** 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 Kc/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.

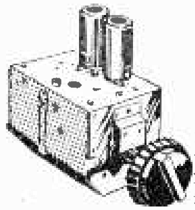
Cathode-Ray Tube, VCR517. **8/6** each, carriage 2/6.

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.



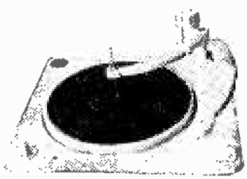
TURRET TUNER

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.

The "CRISPIAN" Portable Radio

A 4-valve truly portable battery set with very many good features as follows: Ferrite rod aerials, low consumption valves, superhet circuit with A.V.C. ready-built and aligned chassis if required, beautiful two tone cabinet covered with I.C.I. rexine and Tygan. Guaranteed results on long and medium waves anywhere. All parts, including speaker and cabinet are available separately or if all ordered together the price is **£7/15/0** complete, or 35/- down and 7 payments of **£1/0/0.** post and ins. 3/6, ready-built chassis 30/- extra. Instruction booklet free with parts or available separately, price **1/6.**

Yours for £1.10.0 Down



The latest most up-to-date Record Player made by the famous B.S.R. company. Using Hi-Fi Crystal Pick-Up and fitted with every modern device. Definitely a record changer which will give years of trouble-free music. Not surplus but the current model. Price **£8/10/0** or **£1/10/0** deposit and 8 monthly payments of **£1.** carriage and insurance 5/-.

DON'T BE CAUGHT LIKE THIS

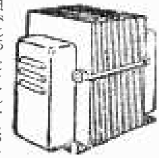
CAR STARTER CHARGER KIT

All parts to build 6- and 12-volt charger which can be connected to a "flat" battery and will enable the car to be started instantly. Kit comprising the following:

Mains transformer	22/6
5-amp. rectifier	17/6
Regulator Stud Switch	3/6
Resistance Wire	2/-
Resistance Former	2/6
Mains on off Switch	2/6
0-5 amp. Moving Coil Meter	12/6
Construction Data	1/6

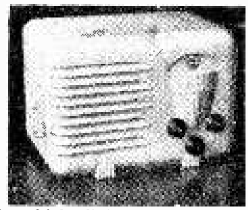
or if bought all together price is 52/6. plus 2/6 post and packing.

TRANSFORMERS SNIP

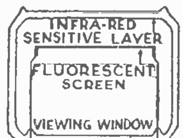


Standard tapped mains input. Output 6.3 at 3 amp. 5 v. at 2 amp. and 350-0-350 at 80 milliamps. Ex-equipment but guaranteed perfect. **9/6** plus 2/6 post and packing. (Note this transformer is a half shrouded drop-through type.) Similar voltage but 250 m.a. **27/6.** Post 3/6.

MAINS-MINI



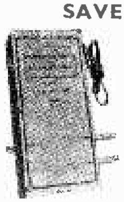
Uses high-efficiency coils, covers long and medium wavebands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, **£4/10/0.** plus 3/6 post. Constructional data free with the parts, or available separately 1/6.



"SNIPER-SCOPE"

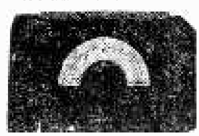
"Cats eye" used for seeing in the dark. Will work burglar alarms, counting circuits, smoke detectors and the hundred and one other devices as will the simpler type of photo cell. Price **5/-** each. Post and ins. 1/-. Data will be supplied with cells if required.

SAVE £2. 10s.



The Cleveland Band 3 converter is one of the best on the market and literally thousands are in use all over Britain. Original price £7/10/0. Sale price **£4/19/6.** carriage and ins. 5/-.

HUGE MINISTRY PURCHASE



R.1155—yours for £2 down

Frequency 75 Kc/s to 18 Mc/s—10 valve—metal case—robust receiver—cost over £60 to make—will give years of service, very little used. Price **£10** or 5 payments of £2. *Carr. & Insured case* 15/- *extra.*

ELECTRONIC PRECISION EQUIPMENT, LTD.

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1A3	3/-	6AT6	8/6	6L7M	8/-	12AH8	10/6	33A/158M		CV85	12/6	ECC33	8/6	EZ81	10/-	PCL82	12/6	UBF89	10/6
1A5	6/-	6B4G	6/-	6L18	13/-	12AT6	10/6		30/-	CV271	10/6	ECC35	8/6	GZ30	10/-	PCL83	12/6	UCC85	10/6
1A7	15/-	6B7	10/6	6N7	8/-	12AT7	8/6	35/51	12/6	CV428	30/-	ECC40	15/-	GZ32	12/6	PEN40DD		UCH42	10/-
1D6	10/6	6B8G	4/-	6Q7G	8/6	12AU7	7/6	35A5	11/-	D1	3/-	ECC81	8/6	GZ34	14/-		25/-	UCH81	11/6
1H5	11/-	6B8M	4/6	6Q7GT	9/-	12AX7	9/-	35L6GT	9/6	D42	10/6	ECC82	7/6	H30	5/-	PEN45	19/6	UCL82	13/6
1L4	6/6	6BA6	7/6	6R7G	8/6	12BA6	9/-	35W4	8/6	D63	5/-	ECC83	9/-	H63	12/6	PEN46	6/6	UF41	9/-
1LD5	5/-	6BE6	7/6	6SA7GT	8/6	12BE6	10/-	35Z3	10/6	D77	6/6	ECC84	10/-	HABC80		PL81	15/-	UF80	10/6
1LN5	5/-	6BJ6	8/-	6SG7GT	7/6	12E1	30/-	35Z4GT	8/-	DAC32	11/-	ECC85	9/6		13/6	PL82	9/-	UF85	10/6
1N5	11/-	6BR7	11/6	6SH7	6/-	12H6M	3/-	35Z5GT	9/-	DAF91	8/-	ECC91	5/6	HK90	10/-	PL83	11/6	UF89	10/6
1R5	8/6	6BW6	8/6	6SJ7	8/-	12J5GT	4/6	41MTL	7/6	DAF96	9/6	ECF80	12/6	HL23	10/6	PM2B	12/6	UL41	10/-
1S5	8/-	6BW7	9/-	6SK7GT	6/-	12J7GT	10/6	50C5	12/6	DCC90	7/-	ECF82	12/6	HL41	12/6	PM12	4/-	UL46	15/-
1T4	7/-	6BX6	8/6	6SL7GT	8/-	12K7GT		50L6GT	8/6	DF33	11/-	ECH35	9/6	HL133DD		PM12M	6/6	UL84	11/6
1U5	7/-	6C4	7/-	6SN7GT	7/6		8/6	61BT	12/6	DF91	7/-	ECH42	10/-		12/6	PY80	9/-	UY41	8/6
2A3	12/6	6C5	6/6	6SS7	7/6	12K8GT	14/-	61SPT	15/-	DF96	9/6	ECH81	8/-	HVR2	20/-	PY81	9/-	UY85	10/6
2A7	10/6	6C6	6/6	6U4GT	14/-	12Q7GT	8/6	72	4/6	DH63	8/6	ECL80	9/-	HVR2A	6/-	PY82	7/6	V1507	5/-
2C26	4/-	6C8	8/-	6U5G	7/6	12SA7	8/6	77	8/-	DH76	8/6	EF36	6/-	KL35	8/6	PY83	9/6	VLS492A	£3
2D13C	7/6	6C9	12/6	6U7	8/6	12SC7	7/6	78	8/6	DH77	8/6	EF37A	9/-	KT2	5/-	QP21	7/-	VMP4G	15/-
2X2	4/6	6C10	12/6	6V6G	7/-	12SG7	7/6	80	8/6	DK32	15/-	EF39	6/-	KT33C	10/-	QP25	15/-	VP2(7)	12/6
3A4	7/-	6CH6	7/6	6V6GT	7/-	12SH7	5/6	83	8/6	DK91	8/6	EF40	12/6	KT44	7/-	QS150/15		VP4(7)	15/-
3A5	7/-	6D6	6/6	6X4	7/-	12SJ7	8/-	85A2	15/-	DK92	10/-	EF41	9/6	KT63	6/6		10/6	VP13C	7/-
3B7	8/6	6E5	12/6	6X5GT	6/6	12SK7	6/-	150B2	15/-	DK96	9/6	EF42	12/6	KTW61	6/6	QVO4,7		VP23	6/6
3D6	5/-	6F1	15/-	6Z4/84	12/6	12SQ7	8/6	807	6/6	DL2	15/-	EF50(A)	7/-	KTW62	8/-		15/-	VP41	7/6
3Q4	9/-	6F6G	6/6	6Z5	12/6	12SR7	8/6	866A	12/6	DL33	9/6	EF50(E)	5/-	KTW63	8/-	R12	14/-	VR105/30	
3Q5GT	9/6	6F6GT	8/-	6/30L2	12/6	12U5G	7/6	956	3/-	DL92	8/-	EF54	5/-	KTZ41	6/-	SD6	12/7		9/-
3S4	8/-	6F8	10/6	7A7	12/6	12Y4	10/6	1203	7/-	DL94	9/-	EF73	10/6	KTZ63	10/6	SP4(7)	15/-	VR150/30	
3V4	9/-	6F12	9/-	7B7	8/-	14R7	10/6	4033L	12/6	DL96	9/6	EF80	8/6	L63	6/-	SP41	3/6		9/-
5U4	8/-	6F13	13/-	7C5	8/-	14S7	14/-	5763	12/6	DLS10	10/6	EF85	7/6	MH4	7/-	SP42	12/6	VT61A	5/-
5V4	12/6	6F16	9/6	7C6	8/-	19AQ5	11/-	7193	5/-	DM70	8/6	EF86	12/6	MHL4	7/6	SP61	3/6	VT501	5/-
5X4	10/-	6F17	12/6	7H7	8/-	19H1	10/-	7475	7/6	EA50	2/-	EF89	10/-	MHLD6	12/6	TP22	15/-	W76	8/6
5Y3	7/6	6F32	10/6	7Q7	9/-	20D1	16/-	9002	5/6	EA76	9/6	EF91	9/-	ML4	12/6	U16	12/-	X61	12/6
5Y4	10/-	6F33	7/6	7V7	8/6	20L1	13/6	9003	5/6	EABC80	7/6	EF92	6/6	ML6	6/6	U22	8/-	X65	12/6
5Z3	12/6	6G6	6/6	7Y4	8/-	25L6GT	9/-	9006	6/-	EAC91	7/6	EL32	5/6	MU14	8/6	U25	13/6	X66	12/6
5Z4G	10/-	6H6M	3/6	8D2	3/-	25Z4G	9/-	AC6PEN	6/6	EAF42	10/6	EL41	10/6	N78	12/6	U31	9/-	X79	12/6
6A8	10/-	6J5G	5/-	8D3	9/-	25Z5	10/6	AC/HL/		EB34	2/-	EL42	11/-	OA10	12/6	U50	7/6	XD(1.5)	4/-
6AB7	8/-	6J5GTG	5/6	9D2	3/6	25Z6G	9/6	DDD	15/-	EB41	8/6	EL81	15/-	OA70	5/-	U52	8/-	XFW10	6/6
6AB8	9/-	6J5GTM	6/-	10C1	15/-	28D7	7/-	AC/P4	8/-	EB91	6/6	EL84	10/6	OA71	5/-	U76	8/-	XFY12	6/6
6AC7	6/6	6J6	5/6	10C2	13/-	30	7/6	AP4	7/6	EBC33	7/6	EL91	5/-	OC72	30/-	U78	7/-	XH(1.5)	4/-
6AG5	6/6	6J7G	6/-	10F1	15/-	30C1	12/6	ATP4	3/6	EBC41	10/-	EM34	10/-	P61	3/6	U251	15/-	XSG(1.5)	4/-
6AG7	12/6	6J7GT	10/6	10F9	11/6	30F5	12/6	AZ31	12/6	EBF80	9/6	EM80	10/6	PABC80		U404	10/6	Y63	7/6
6AJ8	8/-	6K7G	5/-	10F18	12/6	30FL1	12/6	B329	10/6	EBF89	9/6	EY51	10/6		15/-	UABC80		Z63	10/6
6AK5	5/-	6K7GT	6/-	10LD3	8/6	30L1	12/6	BL63	7/6	EC52	5/6	EY86	10/6				10/6	Z66	20/-
6AK8	7/6	6K8G	8/-	10P13	17/6	30P4	15/-	CK505	6/6	EC54	6/-	EZ35	6/6	PCC84	8/-	UAF42	10/6	Z77	9/-
6AL5	6/6	6K8GT	11/-	11E3	15/-	30P12	13/6	CK506	6/6	EC70	12/6	EZ40	8/-	PCC85	12/6	UB41	12/7	Z719	12/6
6AM6	9/-	6LD3	10/-	12A6	6/6	30P16	10/6	CK523	6/6	ECC31	15/-	EZ41	10/6	PCF80	8/6	UBC41	8/6	Z729	12/6

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Every valve we despatch is first carefully tested in our laboratories, for maximum functioning characteristics, right in a radio or T.V. set—under actual operating conditions ! That's why we guarantee every Bentley valve in accordance with the Standard Guarantee. Full replacement within ninety days of purchase, excepting only burnouts and breakages.

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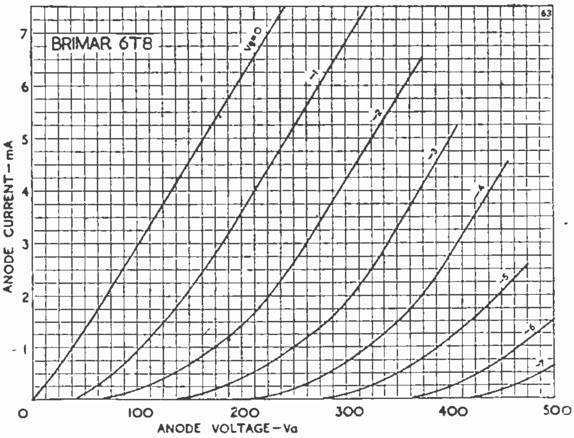
BRIMAR 6T8

The Brimar 6T8 is a triple-diode triode in which one diode has a separate cathode. The triode section has a high amplification factor making the valve suitable for use in AM/FM receivers in the demodulation and first stage audio circuits. The diodes may be used in series shunt limiter circuits, for example, in the audio sections of television and communications receivers, followed again by the triode, section for A.F. amplification.

Near Equivalents
EABC80 DH719 6AK8



Typical Triode Operating Characteristics as an R.C. coupled amplifier.

Anode Supply Voltage	250	250 volts
Anode Load Resistor	0.25	0.25 megohms
Grid Resistor	1.0	10 megohms
Cathode Bias Resistor	3	0 kilohms
Peak Output Voltage	43	40 volts
Stage Gain (for 24 V peak to peak output) ...	42	42
Distortion (for 24 V peak to peak output) ...	1	5%

Keep this for further reference or write to the Publicity Department for a data sheet.

Standard Telephones and Cables Limited FOOTSCRAY, SIDCUP, KENT Footscray 3333

WEYRAD

"H" TYPE COILS— FOR MANUFACTURERS, SERVICE ENGINEERS AND INDIVIDUAL CONSTRUCTORS

A low-priced, soundly-designed Range of Coils, providing continuous coverage from 12 to 2,000 metres in 6 Bands.

The coils are supplied in individual aerial, H.F. transformer and oscillator versions for each band. Iron dust cores are adjusted by means of a threaded brass stem with a screwdriver slot which permits fine adjustment of inductance without the danger of damage to cores. Circuit connections are made to 4 tags at the end of the former. Single 6 B.A. mounting.

" H " type coils are recommended for many popular circuits including the " Practical Wireless " AC/DC 3-valve Superhet and are widely used for servicing and conversion purposes.

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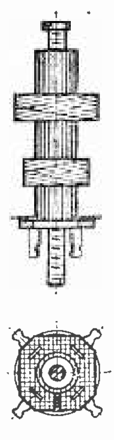

RANGES:

Band 1—800-2,000 mtrs.
Band 2—250-800 mtrs.
Band 3—190-550 mtrs.
Band 4— 90-250 mtrs.
Band 5— 33-100 mtrs.
Band 6— 16- 50 mtrs.
Band 7— 12- 37 mtrs.

Coils are coded according to type and range :
HA 1 = Band 1 aerial
HO 3 = Band 3 oscillator

ILLUSTRATED FOLDER..............**3d.** A.M./F.M. RECEIVER BOOKLET .... **2/6.**

WEYMOUTH RADIO MANUFACTURING CO., LTD.
CRESCENT STREET, WEYMOUTH, DORSET

PRACTICAL WIRELESS

EVERY MONTH
VOL. XXXIII, No. 611, NOVEMBER 1957

EDITOR : F. J. CAMM

25th YEAR OF ISSUE

COMMENTS OF THE MONTH

BY THE EDITOR

Editorial and Advertisement Offices :
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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.

SOUND v. TV IN FRANCE

VISITORS to this year's Radio Show will undoubtedly have formed the impression that the main emphasis was on TV, and the continuing increase in TV licences supports the view that the trade is now mainly TV minded. This is not the position, however, in France, for at the recent Radio Salon in Paris it was obvious that French manufacturers still consider radio their main market.

For the first time there was a separate gramophone record section, and it is significant that the 10,000,000th sound radio licence coincided with the opening of the exhibition. At present there are just over 10,000,000 licences in France. In this country the reverse is the case. During the past year the number of radio licences in France has increased by no less than 800,000 and the organisers of the exhibition stated that the output of sound sets this year will reach 1,500,000.

Yet in Great Britain, judging from the number of licences issued, the listening as distinct from the viewing public is on the wane.

Whereas British manufacturers tend to produce hideous futuristic designs of cabinets, garnished with ugly brass fittings, more reminiscent of the over-elaborate decoration of the Victorian era, as symbolised in the Albert Memorial, the French manufacturers are producing cabinet designs of more sober appearance. They are using lighter-coloured woods such as oak.

The decline in British sound broadcasting cannot entirely be ascribed, as we have commented before, to the competition of TV. The tendency to make programmes in this country parlour games interspersed with other inane programmes of the American style is no doubt a contributory factor. Our sound programmes have become stereotyped, which would indicate that producers are growing stale, and that a change in personnel is necessary. Of course, France is not so advanced in the sphere of TV as we are, and the relative high cost of a TV set in France may have engendered a reluctance on the part of the French public to buy TV sets. The position may, therefore, be merely a reflection of the French economic position rather than an indication of public taste. The position may change, however, during the next few years.

"PRACTICAL HOME MONEY MAKER"

OUR new companion journal the PRACTICAL HOME MONEY MAKER is now assured of a long and successful career, as indicated by the enormous demand for the first issue.

This new journal teaches you how profitably to employ your spare time in a very wide range of interesting hobbies. It tells you how to make and market and deals with Leather Work, Lampshades, Jewellery Making, Rugs, Pottery, Clock Repairing, Poultry Breeding, Small Scale Market Gardening, to mention only a few of the home-industry fields which it covers. It costs 1s. 3d. each month. It is bound to interest all members of the family. Have you ordered your copy?—F. J. C.

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

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 July, 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	*Total*
London Postal	1,143,188
Home Counties	1,152,273
Midland	877,607
North Eastern	1,149,055
North Western	847,295
South Western	726,152
Wales and Border Counties ...	458,743
Total England and Wales ...	6,354,313
Scotland	828,029
Northern Ireland	192,523
Grand Total	7,374,865

Radio-controlled Models

THE Post Office announced that 2,000 licences have now been issued in the United Kingdom for radio-controlled models such as aircraft, boats and cars, etc. These licences, which cost £1, remain in force for a period of 5 years.

This type of licence came into force on June 1, 1954, under The Wireless Telegraphy Act, 1949. One of the purposes of licensing is to prevent radio interference by controlling all uses of radio frequencies.

BBC Transmitters in the Isle of Man

THE BBC announces that a VHF transmitter to carry the Northern Home Service is to be installed on the same site as the permanent television station at Carnane in the Isle of Man. It is hoped that the transmitter will be ready for service early next year, thus giving many listeners in the Isle of Man, who provide themselves with VHF receivers and suitable aerials, the means of obtaining greatly improved reception free from interference from foreign stations. It is intended to add VHF transmitters for the Light and Third Programmes at a later stage and the building has been designed with this in mind.

Good progress is being made on the permanent BBC television station at Carnane, which is now being built to replace the existing temporary station. It is expected to be ready for service by the end of this year, and will provide a substantial improvement in reception for all viewers who now receive the temporary station.

The combined television and VHF sound broadcasting station will be known as the Douglas Transmitting Station.

GATAC and Sea Slug

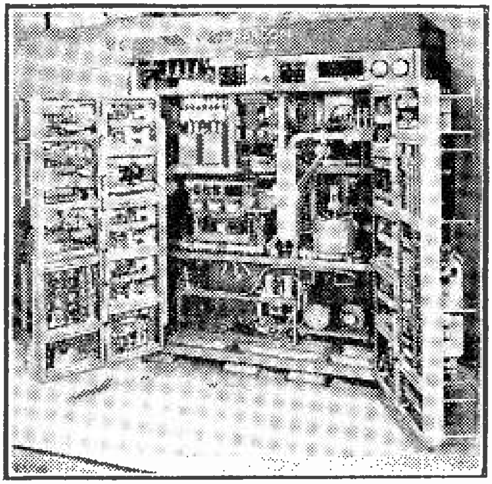
IT is now possible to reveal that GATAC—believed to be the largest analogue computer in Europe in the hands of a private firm—has been in use for many months for an intensive study of the performance of the naval guided weapon Sea Slug.

GATAC was designed and built by E.M.I. Electronics Ltd. to a Ministry of Supply order, primarily for the purpose of studying the complex non-linear three-dimensional control problems associated with guided weapons. It incorporates specially developed computing techniques which make it capable of simulating the control, guidance and propulsion systems of any existing British guided weapon together with its aerodynamic performance during its flight—using for the first time, it is believed, purely electronic techniques to achieve this end.

In connection with the Sea Slug project, GATAC can be used to provide complete electronic simulation of every feature governing the controllability of the weapon in flight, and it is thus possible to obtain data on its performance which would otherwise require many hundreds of costly actual firings.

Radio/TV Sales Recovery

THE monthly retail survey issued by the British Radio Equipment Manufacturers' Association from the National Radio and Television Exhibition, Earls Court, shows that sales for the first seven months were higher all round than in the first seven months of 1956 and are now



On public view for the first time at the 1957 S.B.A.C. Exhibition was the new Marconi Type SR1000 high-power transmitter/receiver. This is a 10 centimeter equipment with an actual output of 3 megawatts and incorporates many revolutionary features in its design. The single compact cabinet housing the equipment has built-in power supplies, cabling system, air and water cooling plant and a comprehensive waveform and performance monitoring system; the SR1000 is thus completely self-contained, requiring only connection to a three phase A.C. supply. The hinged gate frames which hold the small electronic units are shown in the open position, revealing the R.F. system situated at the rear of the cabinet.

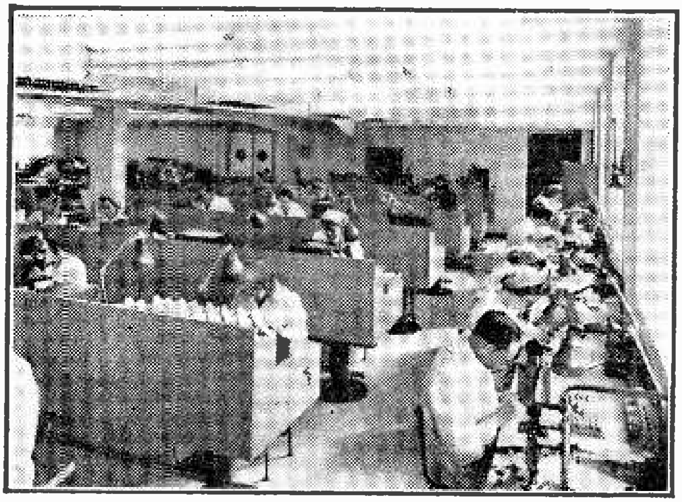
beginning to compare with those for 1955.

Sales of radio sets. 610.000. compare with 502.000 for the first seven months of last year. and 604.000 in 1955; sales of television sets. 555.000. compare with 492.000 last year and 537.000 for the first seven months of 1955; and of radiograms, 124.000, against 94.000 last year and 150.000 in 1955.

In July, retailers' sales of radio sets, 110.000, were 25 per cent. above those for June, 33 per cent. above those for July, 1956, and the highest since December last. Television sales, 75.000, were an increase of 39 per cent. on June, a decrease of 5 per cent. on July, 1956, but the highest since March last. Radiogram sales, 13.000, were 18 per cent. above those for June and 8 per cent. above those for July, 1956.

Miniature Vibrating Crystal Experiments

HUNGARY'S electronic measuring instruments factory is experimenting with the production of a miniature vibrating crystal for use in frequency modulation radios, states the newspaper *Népakarat.* It is now being tested under temperature conditions ranging from -40 to $+60$ degrees Centigrade, and it is expected that it will be possible to begin mass production next year.



To improve the reliability of their products even further, AVO Ltd. have introduced a dust-free, air-conditioned zone within which instruments are built, calibrated, and tested, under ideal working conditions. All personnel entering the zone must comply with exacting standards of cleanliness, and even visitors must observe the regulations. These superior manufacturing conditions, as good as can be found in any similar plant abroad, help to keep English-made "AVO" products well ahead in the race for world business.

Direct Radiotelephone Service

CABLE AND WIRELESS, LTD. announce that a direct radiotelephone service has been inaugurated between Jamaica and Puerto Rico.

The service is available between 14.30 and 19.30 G.M.T. daily and costs £2 3s. for three minutes.

New R.I.C. President

LORD BRABAZON OF TARA has been elected President of the Radio Industry Council in succession to Sir Edward Appleton.

His connections with the radio industry include a directorship of one of the leading manufacturing companies, the presidency for a time before the war of the now defunct Radio Manufacturers' Association and, of course, a close interest in aircraft in which radio and electronics become of increasing importance as speed, height and range increase.

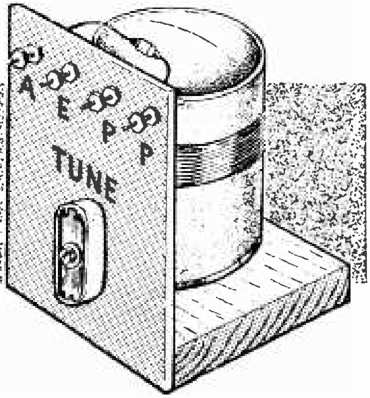
H-tests May Cut Radio

IT was recently suggested by a senior U.S. meteorologist, Professor H. R. Byers, that any increase in radiation resulting from H-tests might eventually prevent world-wide radio. At present the ionosphere is mainly responsible for conducting radio waves and permitting world-wide communications. Fall-outs from H-bomb explosions are electrifying the atmosphere above the earth and this electrification may extend into the air, which, says Professor Byers, due to movement may result in the prevention of long distance radio waves.

Radio in France

AT the recent Salon in Paris radio sets formed the majority of exhibits, and it appears from licence figures and sales that, contrary to the trend in this country, radio is on the increase.

A BEGINNER'S CONSTRUCTIONAL COURSE



AS DISTINCT FROM A THEORETICAL COURSE, THIS SERIES STARTED WITH A SIMPLE CRYSTAL SET, WHICH IS GRADUALLY MODIFIED IN STAGES, UNTIL IT BECOMES A CRYSTAL AND TWO TRANSISTOR LOUDSPEAKER SET

By E. V. King

(*Continued from page 544, October issue.*)

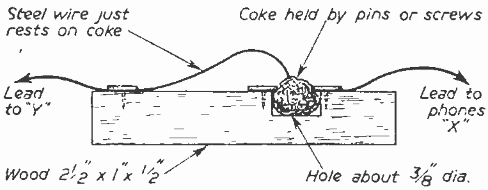
WHEN the trimmer is screwed up it is equivalent to putting turns on a coil and vice versa. Thus, if you are tuning in the Light Programme and you cannot undo the trimmer far enough to "peak" it, take off a turn of coil wire and try again. If you are careful you will get the Home with the trimmer screwed in and the Light with it out in the London area.

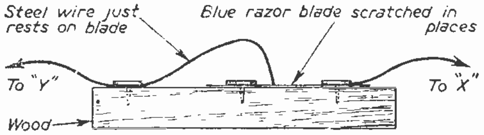
It is not suggested at this stage that this set is selective but for the beginner it is simple and is a certain successful start. Some interesting experiments using this receiver will now be given, together with modifications to improve the set's performance.

Crystal Experiments

By using the simple set just described the learner can perform some interesting and instructive experiments which will give him confidence and a better understanding of the working of the radio. Remember the remarks made about the fact that the aerial and earth must be first class.

When the set is working and has been tested, carry out the following experiments, remembering to make good soldered connections, and to scrape enamelled wire first. If any particular experiment is not successful revert to the original circuit to make sure the A., E., and phones are still all right.





Experiment 1

Try fitting the carton with coils with twice or half as many turns and retune the trimmer for the optimum position on one station. This experiment is best carried out in the evening when the medium-wave band is better received.

Experiment 2

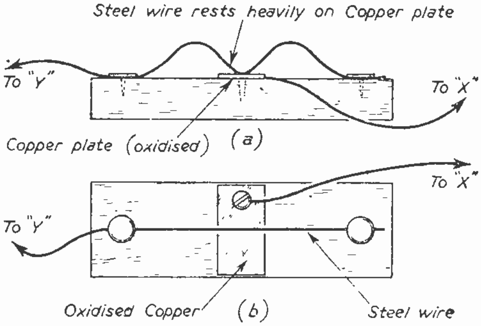
Try a similar experiment, but this time pile the coil wires on top of one another instead of having them side by side.

Experiment 3

Try introducing large iron and brass objects into the coil and retune the trimmer.

Experiment 4

Disconnect the diode (crystal) and in its place solder two leads about a foot long (X and Y, Figs. 4, 5 and 18). The diode crystal is not now used, and various "Prisoner of War" detectors are tried out. Take a piece of wood about 2½in. × 1in. and ½in. thick. Take a piece of *dry* coke as big as a pea and arrange it (Fig. 9) in a hole in the wood. Fix it with drawing pins or screws and attach a wire to one of these. Now a piece of steel wire from a wire brush or army "Don 5" telephone cable is arranged as shown, held by a



Figs. 9, 10 and 11.—Four experimental crystal detectors.

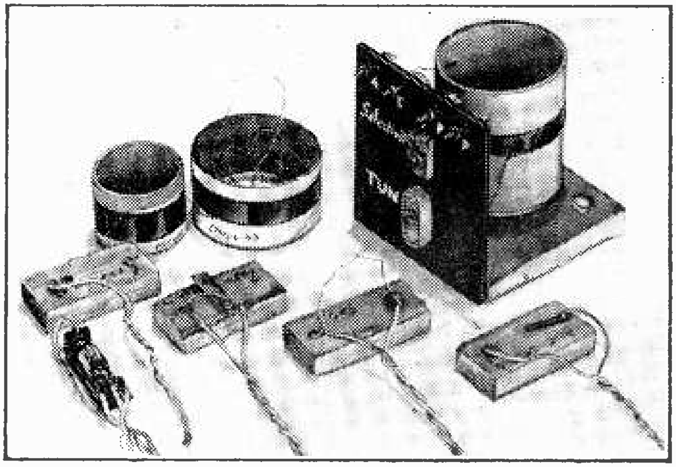
pin at one end and resting extremely lightly on the coke at the other. The two leads fixed to the radio are now connected to this detector. Careful adjustment will get quite good reception. Some pieces of coke work better than others. Other crystalline substances may be used, i.e., galena, hertzite, zincite, graphite, silicon, various pyrites and molybdenite. Some work better with a copper wire in place of the steel one.

Experiment 5

Fix up the "blue steel" detector shown in Fig. 10. The author found the best results were obtained with a piece of corset steel with the celluloid cover removed. Blue razor blades or clock springs also work quite well. The surface of the steel should be scratched with a gramophone needle or glass cutter. The steel wire which rests on the blue steel must be carefully adjusted by trial and error, only the lightest contact is required. This detector is, of course, wired in place of the "coke detector" of experiment 4.

Experiment 6

If you have patience you may like to make a copper oxide rectifier (detector). This is more difficult, but once working it is more permanent than the previous types. The author, after many experiments, found it best to take a small, clean piece of copper, heat it until it goes black, place it in weak ammonia solution for ten minutes, dry slowly and fix to the wood without fingering. The copper is thus coated with a reddish layer of oxide. Best results are obtained with the steel wire resting quite heavily on the oxide layer; the author found this pressure was best obtained by fixing the steel wire at each end, see Fig. 11.



The components used in this month's experiments.

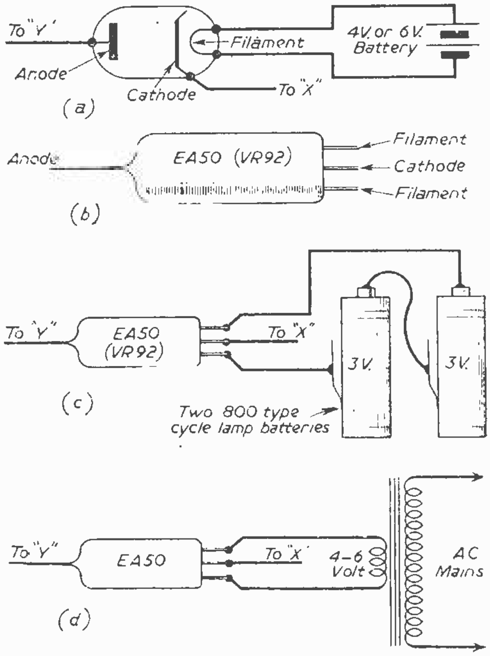


Fig. 12.—The thermionic diode detector.

Experiment 7

From a government surplus dealer obtain a thermionic diode such as a VR92 (EA50), this will cost about 1s. 6d. including the holder. Fix this up as a detector by reference to Fig. 12 (a), (b), (c) or (d).

The filament is connected directly to a 6v. battery but 4 volts will do, or you could use two cycle lamp batteries (Ever Ready 800) wired in series as shown in Fig. 12 (c). The filament will be seen to glow. Connect the anode and cathode to the leads X and Y as in experiments 4, 5 and 6. The results will be excellent and, of course, the detector will stand rough usage and vibration. In future if you suspect that your detector is faulty you can easily wire in this thermionic diode as a test.

LIST OF COMPONENTS

(For Variable Selectivity and Experiments.)
One 500 pF trimmer.
Wood, steel, screws, pins, etc.
VR92 (EA50) or similar diode.
Torch batteries.
Coke, Galena, Hertzite, Graphite, Silicon, etc.
26 s.w.g. enamelled copper wire.

Experiment 8

Put various small condensers or a trimmer (500 or 300pF) in the aerial lead as shown in Fig. 13. Always readjust the trimmer on the front panel. This aerial series condenser affects both volume and the ability to select stations (selectivity).

Experiment 9

Scrape off a little enamel in the middle of the coil and solder on a lead. The aerial is now disconnected from the terminal on the front panel and is connected to this centre tap. Try using an aerial series condenser as well. See Fig. 14.

Experiment 10

If you have some spare aerial wire around put

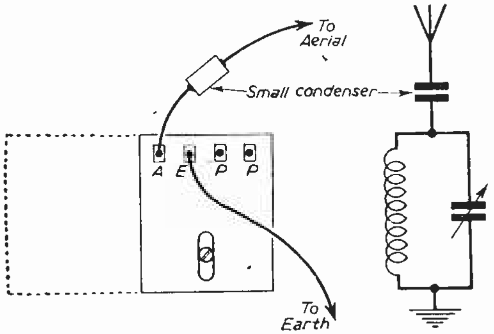


Fig. 13.—Experiment with aerial series condenser.

up another aerial parallel to and about a yard underneath the main one. It must be insulated from earth in the same way but is connected to the earth terminal in lieu of a proper earth. This can be used where the ground is very dry; it is known as a counterpoise system.

Experiment 11

If you have some spare enamelled or cotton covered copper wire between 26 and 40 s.w.g. try

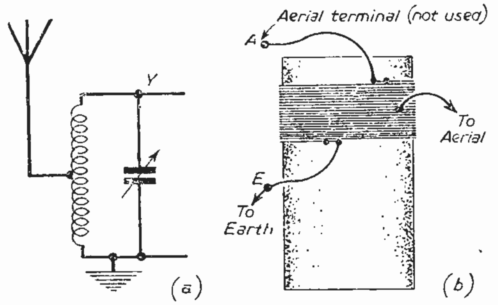


Fig. 14.—Experimental aerial input to centre tap.

to wind another coil to receive Droitwich on 1,500 metres (200 Kc/s). You will need between 100 and 150 turns. Even Moscow has been received on a crystal set in this country using the Long Waveband.

Experiment 12

Put the original coil back in and test the set. Now wind another carton with 24 turns of 26 s.w.g. enamelled wire. Refer to Fig. 15. Disconnect the aerial and connect it to the new coil, the other end of the coil going to earth. The coil is now placed directly over the top of the tuning coil and the trimmer readjusted. This is known as inductive coupling. You may also try sticking some matchsticks on the tuning coil with Durafix so that you can wind the aerial coil on top but spaced away from the tuning coil. Note that the new coil must be close up to the original.

Experiment 13

This is a somewhat more advanced experiment. Obtain another round non-metal box ¼in. smaller in diameter than the original coil. Wind on about 30 turns of 26 s.w.g. enamelled wire and connect

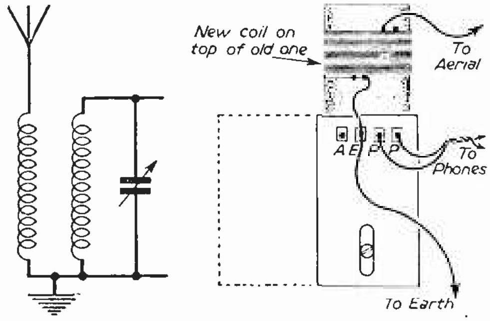


Fig. 15.—Inductive aeria coupling experiments.

up as shown in Fig. 16. Unscrew the trimmer and tune by moving one coil in and out of the other. Try turning one coil over so that the turns go in the opposite direction. This is known as variometer tuning.

Experiment 14

You may care to try to wind a coil to receive the Rugby G.P.O. transmitter on 16 Kc/s! Another Rugby transmitter works on 60 Kc/s (10.30 to 11.30 G.M.T.).

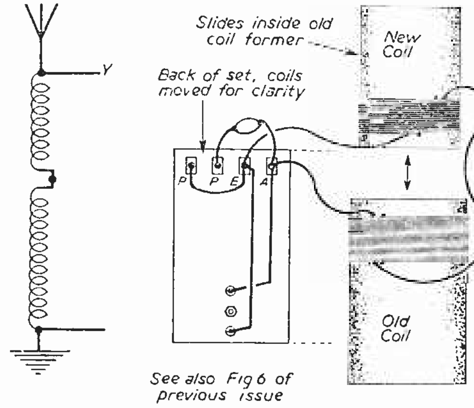


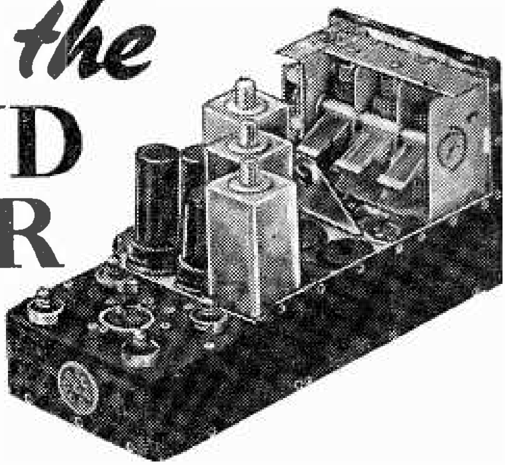
Fig. 16.—Experimental variometer tuning.

Modifications to the Basic Receiver

You may feel that after these experiments you can make some improvements on this set with your own ideas. Later some modifications will be given including the use of one transistor and widening the waveband coverage.

(To be continued)

Converting the COMMAND RECEIVER



MODIFICATIONS OF THE BC455 FOR DX USE

By R. E. S. Coulson

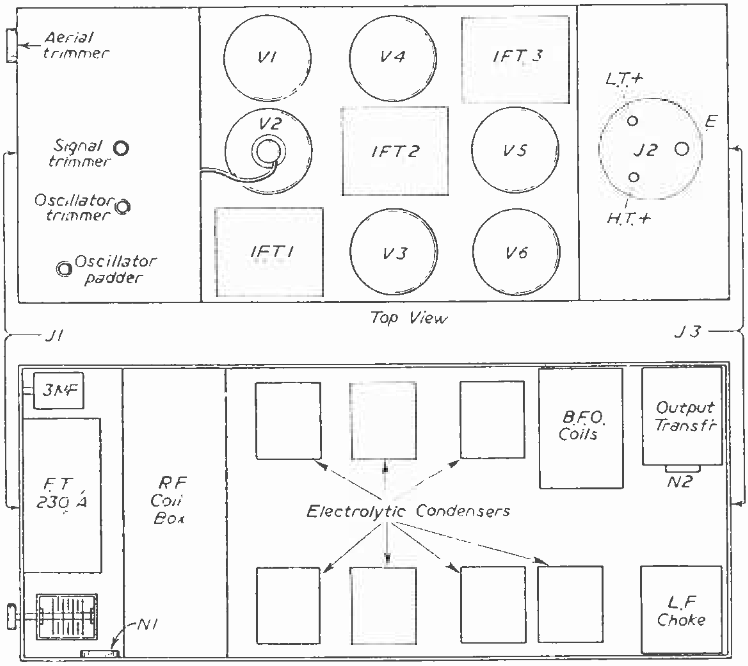
AS these receivers cover from 6 to 9 Mc/s, they may be used as they are on 40 metres, or the coils may be rewound to cover the 10-metre band, but the bandspread obtained is not great. A better plan is to modify the set by the addition of another piece of cheap surplus, the RF24 converter: the resulting double superhet may then be used on 10 and 15 metres as well as on 40 metres. With a set so modified and costing less than £2. I have heard amateur stations all over Europe, including Greece, Yugoslavia and Latvia, and in New Zealand, U.S.A., Canada, Brazil, Ecuador, Puerto Rico, Iceland, S. Africa, Mozambique, Morocco, Israel and Macao.

The BC455 is one of a series (SCR 274) of receivers intended for use in aircraft. The valve line-up is 12SK7(R.F.), 12K8(F.C.), 12SK7(IF$_1$), 12SK7(IF$_2$) 12SR7(B.F.O., Det.), 12A6(Output). In addition, there are two neons, one across the aerial coil, the other across the output transformer.

The BC455 was intended for rack mounting and remote control. Because of this it has no controls, and all inputs and outputs are taken through plugs and sockets.

BC455: Description

As may be seen from the circuit diagram (Fig. 2a, b, c, d), the BC455 is a six-valve superhet, covering 6 to 9 Mc/s, with an I.F. of 2.83 Mc/s. The first stage is an R.F. stage, using a 12SK7 pentode in a conventional circuit. For ease of alignment the aerial-coil trimmer is brought out to the front panel. A neon



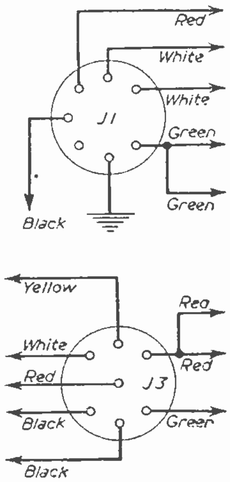


Fig. 1.—Top and bottom views of the receiver.

lamp (which strikes at about 80 volts) is connected across the aerial coil to prevent overloading of V1.

Coupling to the second stage, the frequency changer (12K8) is by dust-cored coil L2, L3. The frequency standard practice: the A.V.C. voltage for the set is not obtained from the D.D.T. stage, but from the diode action of the first grid and cathode of V4, the second I.F. amplifier valve. This is tapped via

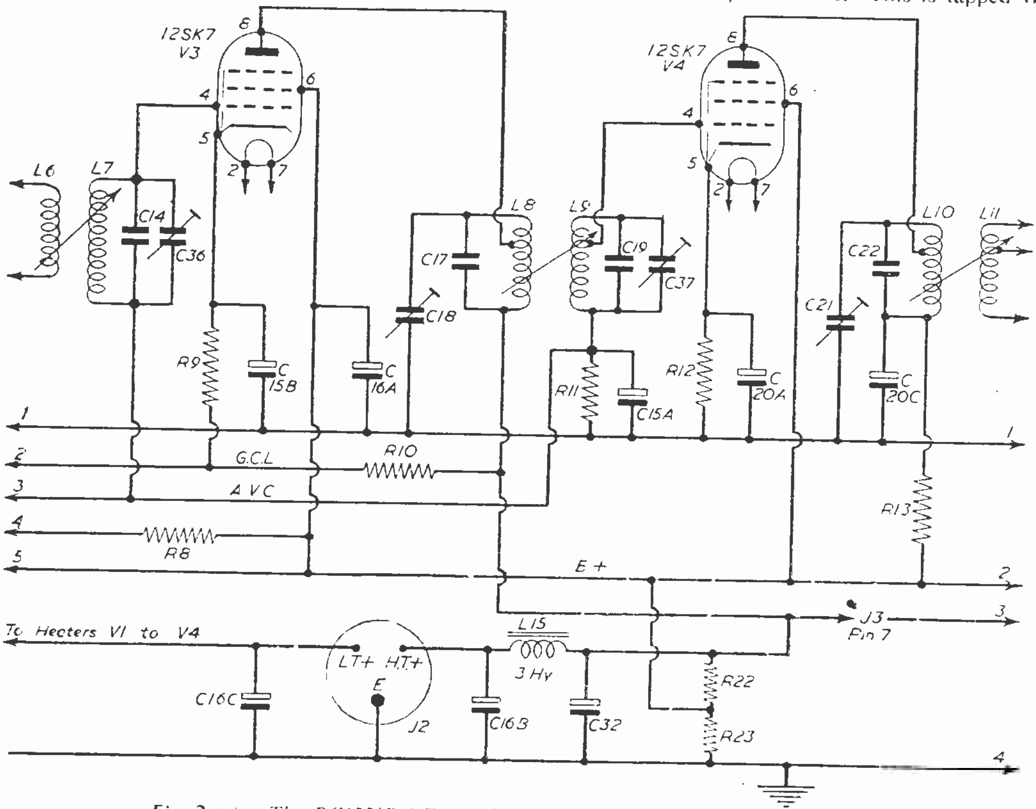


Fig. 2 (c).—The BC455/B I.F. amplifier. A list of parts appears on page 608.

changer is also standard, except that the oscillator triode is tuned in the anode circuit. The output from the F.C. is passed by L6, L7 (I.F.T.$_1$) to the I.F. amplifier. This is a two-stage job, having two 12SK7s coupled in the "middle" by L8, L9 (I.F.T.$_2$). The A.V.C. system departs from the R11 and C15 and applied via R5 and C7C to V1 via R2, and directly to V3. The cathode return to V1, V2, V3 is made through the gain control line and by way of that down to earth through a 50 K

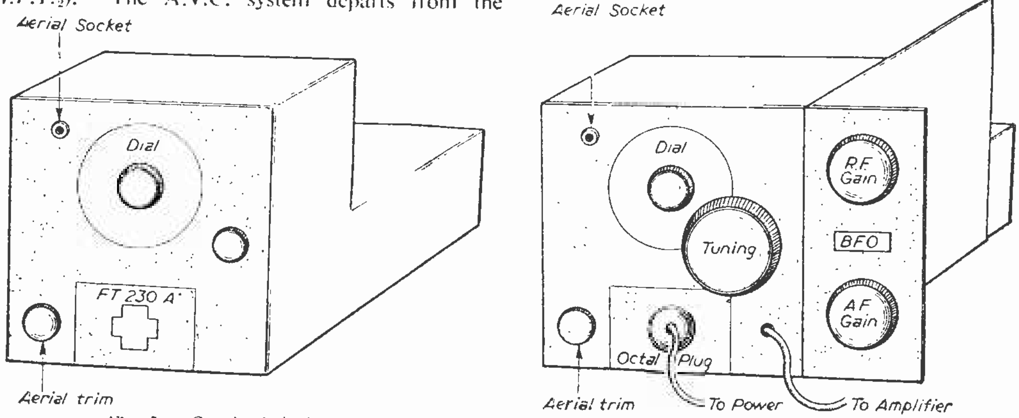


Fig. 5.—On the left the BC455/B before conversion, and on the right, after conversion.

potentiometer. This acts as a volume control.

Detection is by one of the diodes of the 12SR7. The triode section of this valve is used as a B.F.O., with L12 and L13. Tuning is adjusted by means of a hole in the side of the chassis, through which C28 may be reached. This varies the B.F.O. pitch. The cut-off of the B.F.O. is accomplished by shorting down to earth the junction of R15 and R17. The A.F. signal is tapped from the bottom of L11 and passed via R18, 19, to C28, and the grid of the 12A6. The anode circuit of this valve carries a 'phone transformer giving outputs for 300-ohm or 4,000-ohm 'phones. It is shown in the 4,000-ohm position.

RF24 : Description

The RF24 (Fig. 3) consists of an R.F. stage, VR65(SP61), feeding via a R.C. coupling to the grid coil of a mixer valve, VR65, which is cathode-coupled to a separate oscillator, VR65. The unit is switch-tuned and covers 20-30 Mc/s with an I.F. output in the region of 7-9 Mc/s. It has an output band-width of about 2 Mc/s, centred on 8 Mc/s.

Conversion

First, the heater circuit. Twenty-four-volt dynamotors are in very short supply, and it is therefore advisable to re-wire the valve heaters to 12-volt supply, so that they may be used either with a dynamotor or with a filament transformer.

The heater connections to all valves except the 12SR7 are to pins 2 and 7. On the 12SR7 pin 2 bears the grid, and the heater connections are to pins 7 and 8. The heaters are originally connected in series

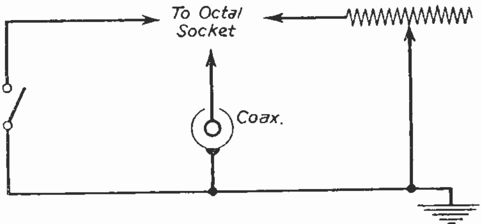


Fig. 6.—Connection to J1 or octal socket.

parallel, and must be converted to parallel in the manner shown in Fig. 4. The R.F.C. in the white lead, which goes from J1 to J3 is removed, the two white wires soldered together and wired to the H.T.+ connection on J2, so that a connection is made between J1 and J2. This carries H.T.+ input to the receiver.

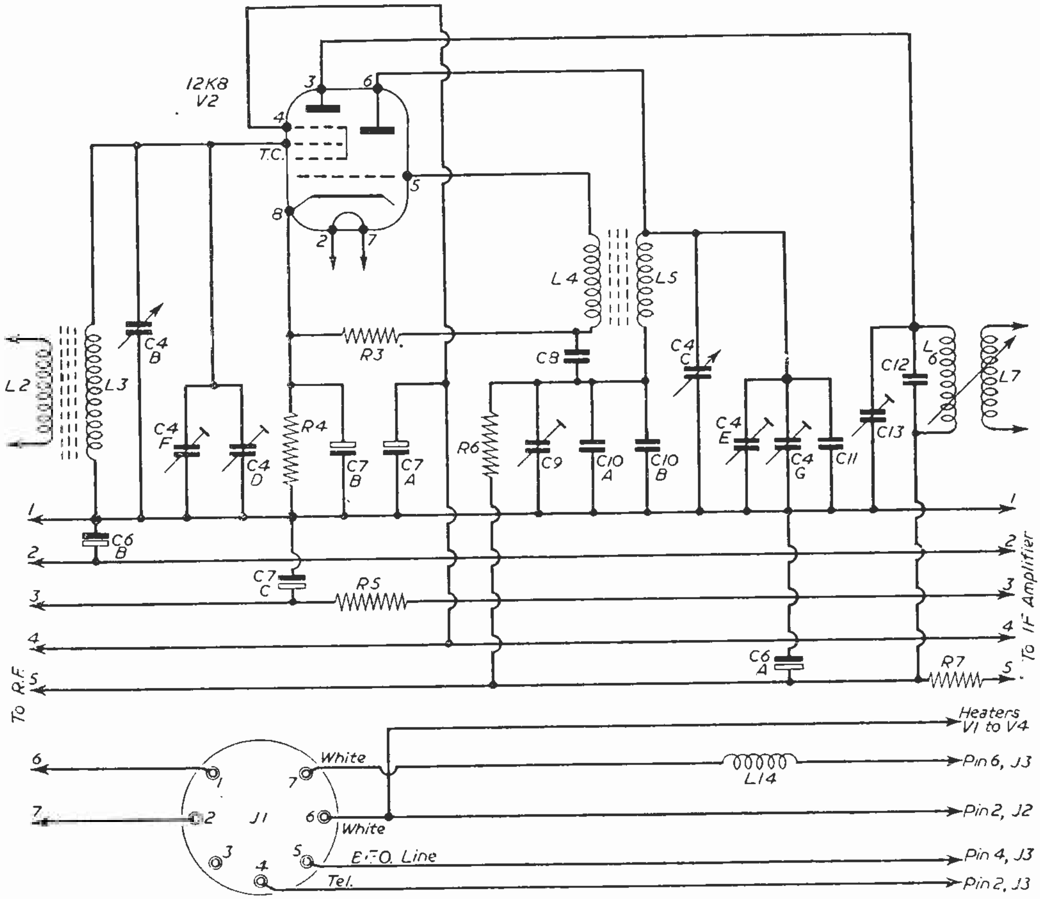


Fig. 2 (b).—The frequency-changer circuit. A list of parts appears on page 608.

Power Socket

Between the front panel and the coil-box will be found adaptor FT230A, which carries J1. It is entirely removed, complete with J1, and a piece of aluminium sheet is bolted in its place. This carries an octal socket, to which the connections of J1 are taken. An octal plug carrying the three input power leads is plugged into this socket.

Controls

These need some additional chassis space, which is obtained by bolting an L-shaped piece of aluminium sheeting to the right-hand side of the receiver (Fig. 5).

(a) *B.F.O.* This is a switch from the red wire of the octal socket down to chassis. When the switch is on, the B.F.O. is off, and vice versa. Mount in middle of side panel.

(b) *R.F. Gain Control.* This is a 50 K potentiometer connected as a variable resistance between the green octal plug wire and earth. Mount as top control on side panel.

(c) *A.F. Gain Control.* This is a .1 megohm potentiometer connected in place of R18 and R19.

(d) *Tuning Control.* Force a tube of ¼in. inside diameter over the spindle in the tuning aperture and into this tube force a ¼in. spindle. A knob may then be fixed on it: no slow-motion drive is needed.

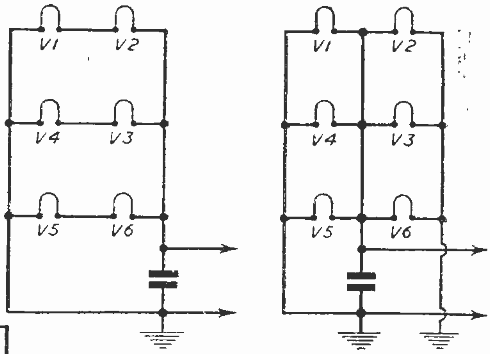


Fig. 4.—Heater circuit connections.

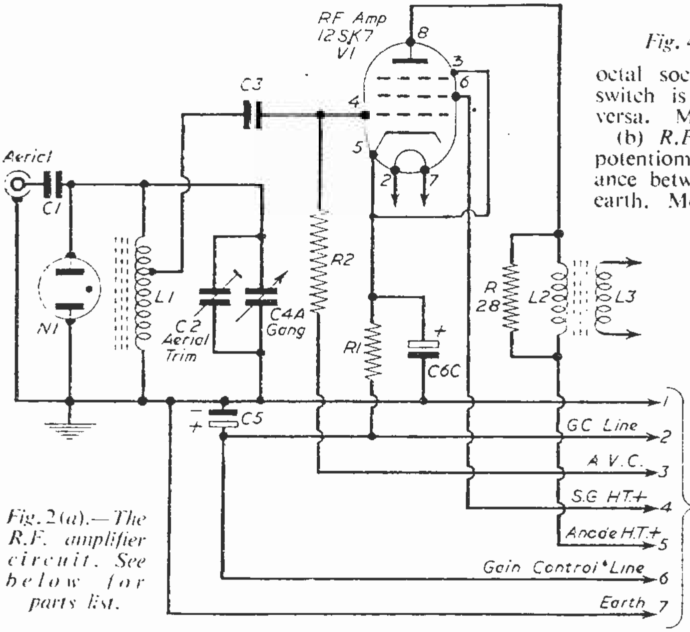


Fig. 2(a).—The R.F. amplifier circuit. See below for parts list.

A.F. Output

The black wire from the octal plug is fixed to the centre connection of coaxial cable, and the outer braiding is earthed. Take the cable to H.R. 'phones or to an amplifier.

(To be continued)

COMPONENTS LIST

PARTS FOR FIG. 2 (a)

R1—620 Ω
R2—2 MΩ
R28—51 KΩ
C1—11 pF
C2—15 pF trimmer
C3—100 pF
C4a—346 pF
C5—3 pF
C6C—.05 μF

PARTS FOR FIG. 2 (c)

C14—180 pF
C36—17 pF
C15B—.05 μF
C16A—.22 μF
C16C—.22 μF
C17—180 pF
C18—17 pF
R8—200 Ω
R9—620 Ω
R10—360 KΩ
C15A—.05 μF
C19—180 pF
C37—17 pF trimmer
C20A—.05 μF
C20C—.05 μF
C16B—.22 μF
C32—5 μF 300 v.w.
C21—17 pF trimmer
C22—180 pF
R11—100 KΩ
R12—510 Ω
R13—200 Ω
R12—7 KΩ
R23—7 KΩ
L15—L.F. choke 3 henrys

PARTS FOR FIG. 2 (d)

C23—180 pF
C38—17 pF
C24—200 pF
C15C—.05 μF
C26—100 pF
C27—335 pF
C28—34 pF
C29—.006 pF
C30—.15 μF
C20B—.01 μF
C35—750 pF
R14—100 KΩ
R15—20 KΩ
R16—100 KΩ
R17—100 KΩ
R18—510 KΩ
R19—100 KΩ
R20—2 MΩ
R21—1.5 KΩ

PARTS FOR FIG. 2 (b)

C4 B, C—gang 346 pF
C4 F, D, E, G—50 pF trimmer
C6B—.05 μF
C7C—.05 μF
C7B—.05 μF
C7A—.05 μF
C8—200 pF
C9—40 pF trimmer
R3—51 KΩ
R4—620 Ω
R5—150 KΩ
C6A—.05 μF
C10 A, B—670 pF total
C11—3 pF
C12—180 pF
C13—17 pF
R6—300 KΩ
R7—200 Ω
L14—RFC—112 μH

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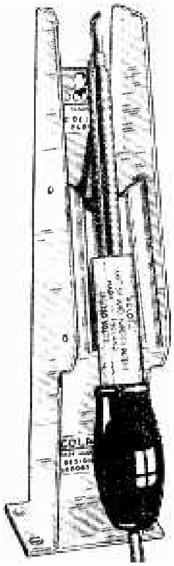

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CY31	12/11	PY82	8/3	5Y3GT	7/3	7S7	9/6
DM70	7/11	UBF80	9/6	6BA6	6/6	7Y4	7/11
EABC80	7/6	UCH42	9/11	6BJ6	7/11	10F9	11/6
EB91	6/11	UF41	8/11	6B8G	3/6	14S7	12/11
ECC84	10/11	UY41	7/11	6F1	13/6	25A6G	12/11
ECC85	9/-	1A7G	12/11	6F15	13/11	25Z4G	8/11
ECH35	10/6	1C5G	10/6	6K7G	2/11	25L6G	10/6
ECH42	9/6	1N5G	10/6	6Q7G	7/11	35L6GT	9/11
ECL80	8/6	1R5	7/11	6Q7GT	8/3	35A5	10/6
EF80	8/-	1S5	7/3	6U4GT	13/11	35W4	8/11
EF41	9/3	1T4	7/3	6V6GT	5/11	954	1/6
EF86	12/11	3Q4	8/11	7B7	8/6	955	3/11
EF89	9/6	3Q5	9/11	7C5	8/6	956	2/11
EL84	9/11	3S4	8/6	7C6	8/6	958	3/11
EY51	9/11	3V4	8/6				
EZ80	8/-						

On Your Wavelength

BY THERMION

I.P.R.E. Comes of Age

THE Incorporated Practical Radio Engineers was founded 21 years ago, and it celebrated its coming of age with a dinner and dance at the Café Royal in August. The chief guest was the Marquess of Donegall. This Institute during its 21 years of continued progress has played an important part in providing the pool from which the industry draws its technicians, and notwithstanding the difficulties of the war years its energetic secretary, Mr. W. Edwardes, has with the aid of his Council, carried on this important work.

Twenty-one years ago the industry was staffed by the early radio amateurs and transmitters who were the only technicians then available. They were quite unequal in numbers to the demand, and the I.P.R.E. realising the necessity for providing service engineers with the qualifications the Institute provides commenced its work of removing the deficiency.

The exchanging of technical information and the provision of lectures are two of the services contributing to this end. All of these points were dealt with by Mr. D. M. Hall when he proposed the toast of the Institute, and Mr. F. J. Camm, Hon. Member, in reply said that it was time that the work of the Institute, hitherto somewhat hidden under a bushel should have the limelight of publicity directed towards it, and as a birthday gift donated space in this journal so that the story can be properly told. As a further birthday gift he donated the sum of £25 to the funds of the Institute.

The President, that enthusiastic radio and television expert Mr. C. H. Gardner, announced that the Marquess of Donegall had accepted Hon. Membership of the I.P.R.E.

Particular tributes were paid to the work of Mr. Edwardes, the Gen. Sec., and to Mrs. Edwardes, and presentations were made to each. Donations had been received from members from almost every part of the world, as a result of which Mr. Edwardes was handed Premium Bonds to the value of £200 and Mrs. Edwardes a suitably engraved watch.

There must be many readers of this journal who ought to be members of this old-established Institute, and I suggest that they add impetus to its work by joining it.

Radio in Schools

I HAVE received many letters from schoolmasters on the subject of teaching radio in schools and criticising the master whose letter I quoted last month, and who thought that radio taught very little.

I will quote only one of these letters from a schoolmaster who for obvious reasons wishes to remain anonymous. He not only feels that radio should be taught in the schools since it is so much a part of our everyday life but that it should become, what it is not at present, a standard part of the school curriculum. He also very much agrees with my views on "Music and Movement." He thinks that like radio programmes, lessons have now become a matter of parlour games. He says that children do not want to *learn*, they want to *know*, but they want to do so without having to make the effort to learn. No doubt information can be picked up the play-way, but it is only superficial information.

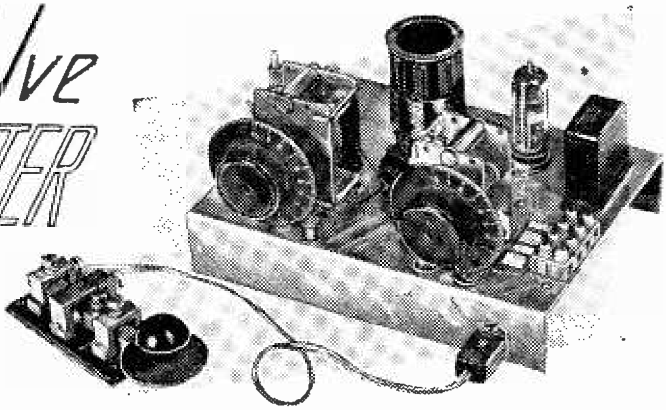
The cursory and somewhat casual education received by scholars to-day, even at universities, is well known to employers, some of whom did not have the advantage when they were young of the educational opportunities available to-day.

Applicants for posts cannot answer the most elementary questions regarding English, mathematics and geography. Some of them cannot construct a reasonably grammatical letter. Many of them, however, are experts on jazz and are accomplished dancers! Some of the teenagers now entering the labour force for the first time can rock their bodies in rhythm with a barrel organ, no doubt as a result of musical movement, but they cannot spell.

The influence of radio as a teacher and the new psychological approach to education, has produced a nation of juvenile half-witted prigs, who do not wish to work but want the highest possible pay for being there. The few critics who wish to eviscerate me because I want "Music and Movement" stopped should remember these incontrovertible facts. The BBC is performing a great disservice by allowing it to continue—apart from its continued interference with standard pronunciation. These are really matters which the Minister of Education should take up at once, for the BBC is doing great national harm in teaching education as if it were a joke. Educational standards are undoubtedly falling very seriously, and so is school discipline as a result. Give a boy the cane and the father is round the following morning threatening action.

This master started a radio club some years ago and it has 20 keen members. They run lectures by experts and by members. One afternoon a week the science labs are open for constructional work. The club runs exhibitions with prizes. If it is found that this absorbing hobby interferes with the lad's education in other directions he is threatened with expulsion from the club unless he improves and this usually has the desired effect. Many of the lads who have left have obtained important posts. Whilst I have not been able to reply to all the letters I have received individually, may I in closing this topic express my thanks to all those who have written to me.

A Single Valve TRANSMITTER



MODULATING THE ONE VALVE, TWO STAGE TRANSMITTER

By R. H. Wright

MODULATING this transmitter (originally described in the September issue) for R/T use involves slight alteration to the original circuit and little additional expense, while the few extra components can probably be accommodated on the transmitter chassis.

One advantage of using a pentode in the power amplifier stage of a low power transmitter such as this, is that modulation can be carried out quite efficiently by applying the modulating voltages to the suppressor grid. In this way it is possible to obtain up to 100 per cent. modulation with negligible distortion.

With such a system of modulation the D.C. screen current—and hence the screen grid losses—tend to be somewhat higher. This arises from the fact that since the total D.C. space current undergoes little change with suppressor grid modulation (this current being mainly controlled by the potentials applied to the control grid and screen grid) as the current to the anode is reduced the screen current must become correspondingly larger. This tendency to increase the screen losses usually limits the output power in suppressor grid modulators.

The Modulator Circuit

From Fig. 2, which shows the circuit of the modulator unit, it will be seen that a single valve is used. This is an EL91, triode connected.

The audio output from the microphone is passed through the microphone transformer to the grid of the modulator valve and the output from this valve is transformer coupled and applied between suppressor grid and cathode of the pentode section of the ECL80. A negative bias of about 6 volts is applied to the suppressor grid from a 9-volt grid bias battery to prevent suppressor grid current during positive half cycles of modulation. This bias, as well as the energising voltage for the microphone, can be taken from the same battery. The actual bias to the suppressor grid may need some final adjustment for good modulation.

In the original transmitter, the microphone transformer was from a scrap T1154. However, suitable microphone transformers are frequently advertised in these pages.

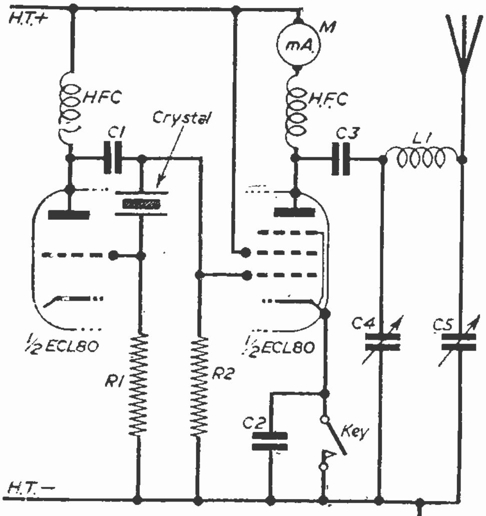


Fig. 1.—The original one-valve circuit.

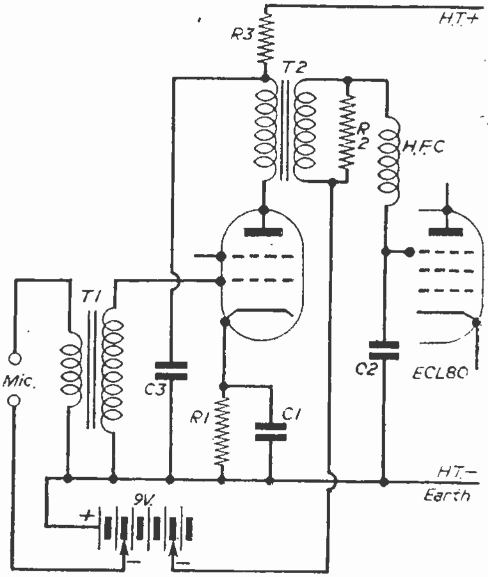


Fig. 2.—The modulating stage.

Circuit Changes

Comparison with the original circuit will show that it is only necessary to disconnect the suppressor grid-cathode link at the valveholder and connect the suppressor tag to the junction of the H.F. choke and C2 in the modulator unit. This unit can draw its supplies from the transmitter power unit, requiring 250 volts H.T. and 6.3 volts for the heater.

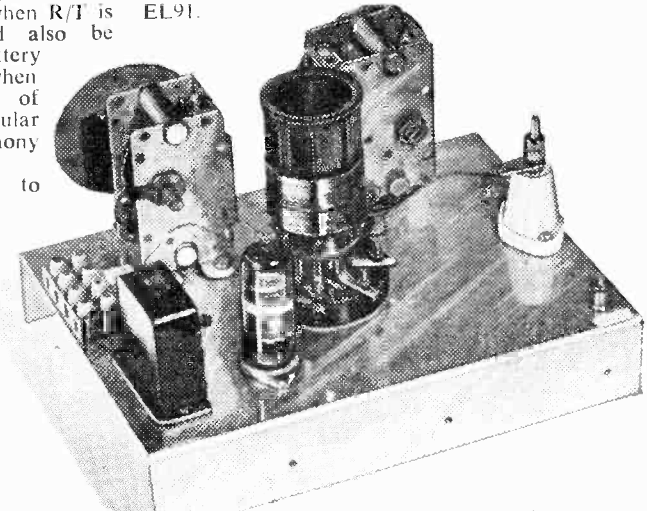
If the transmitter is to be used for both CW and R/T transmissions, a switch may be incorporated to earth the suppressor grid when R/T is not required. This switch should also be arranged to disconnect the bias battery and so prevent it from discharging when not actually required. One word of warning: if you wish to remain popular with other "hams" do not use telephony on the CW sections of the bands!

For use on the top band (1.8 to 2.0 Mc/s). L1 in the transmitter should have 45 turns, close wound, of 22 s.w.g. on a standard 1½in. diameter former.

If the 6V6 amplifier stage has been added (as described in the October issue), suppressor grid modulation of the P.A. is not possible. In this case, screen modulation may be employed. The circuit of the modulator remains almost the same except that the intervalve coupling transformer, T2, is now replaced by an audio choke and the screen of the 6V6 connected to the anode of the EL91.

ADDITIONAL COMPONENTS REQUIRED

R1—470 ohm 1 watt resistor.
R2—22,000 ohm ½ watt resistor.
R3—4,700 ohm 1 watt resistor.
C1—25 μF, 25 volt electrolytic capacitor.
C2—200 pF, mica capacitor.
C3—1 μF (350 v. D.C.) capacitor.
H.F.C. Eddystone H.F. choke, type 1010.
T1—Microphone transformer.
T2—Intervalve coupling transformer (5 : 1 step-up).
EL91 or equivalent.
B7G valveholder.
P.O. type carbon microphone.



View of the set from the rear.

TRANSISTORS in Practice

IN THIS ARTICLE FURTHER NOTES AND CIRCUITS ARE GIVEN

(*Continued from page 539, October issue*)

Common Emitter Circuit

THIS mode of operation is most generally used now that junction transistors have ousted the point contact variety for normal use. The current gain available from a common emitter circuit is an obvious advantage, permitting the cascading of circuits as successive amplifying stages coupled by resistances and capacitances only, so avoiding the need for interstage transformers. The input and output impedances being less diverse in the case of common emitter connection also eases the problem of interstage coupling.

The common emitter connection is inferior to the common base connection in one respect. Transistors are limited in the upper frequency at which they will work usefully and the current gain figures quoted in the data refer to audio signals. As frequency increases α decreases and manufacturers quote an α cut-off frequency. This indicates the order of frequency up to which the transistor is likely to work (actually it is the frequency at which gain drops by 3db. compared with its value at low frequency). Until recently transistors freely available in this country have had a comparatively low cut-off frequency, but now transistors with cut-off as high as 7 Mc/s have been made generally available. A higher operating frequency is practicable, however, with common base than with common emitter connection. The OC71, for instance, has a cut-off with grounded base connection at 500 Kc/s, whereas with grounded emitter it is falling off at 10 Kc/s.

The basic common emitter circuit is given in Fig. 4. The battery Eb is connected to bias the emitter positively with regard to base and Ec makes the collector negative with regard to base. The two batteries, so far as the collector/base circuit are concerned, are in series but in opposition, so that the effective collector voltage is the difference between those of the two batteries—Ec must obviously be the greater. It would be more convenient, in practice, to tap the base into the battery, as in Fig. 5, which will be seen to give exactly the same circuit slightly rearranged. Taps can be something of a nuisance, however, and a convenient and simple way to avoid them is to use a resistor between base and battery negative, as in Fig. 6. This resistor and the internal resistance of the transistor between base and emitter can be considered as providing a potentiometer across the battery providing the base with its proper voltage, much as though it was trapped into the battery as in Fig. 5. Cascading such stages to give successive amplification, still retaining the single battery technique, produces the circuit at Fig. 7. The load resistors R2 and R4 will have smaller values than in the case of valve circuits —actually of the order of 3.3 KΩ where the purpose is to drive a succeeding stage of a similar type. In view of the lower impedances involved the coupling capacitances for a given frequency range have to be much higher in value than in the case of the familiar valve circuitry.

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. Later articles will give practical circuits.

It will be remembered, perhaps, from the explanation given in the series of articles dealing with valve amplifiers that the criterion is the ratio of resistance to capacitive reactance. A value of .05μF to .1μF is generally specified for coupling valves—2μF is about the lowest value suitable for these transistor circuits. Clearly, one of the virtues of transistors is their small size, but little benefit would be derived from this if coupling capacitors of large physical size had to be used. Fortunately for this purpose miniature

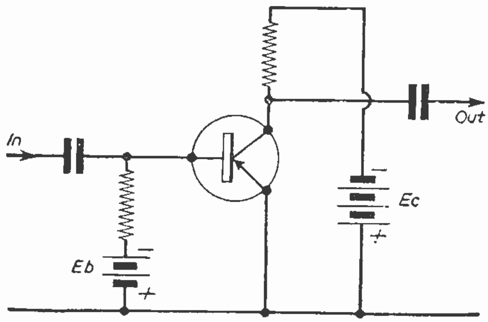
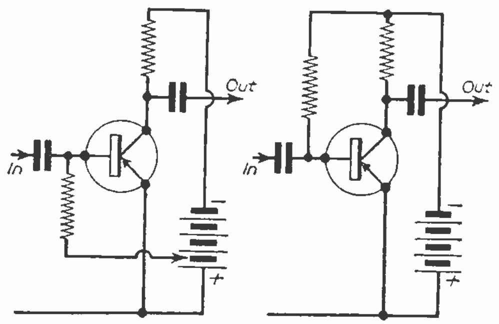


Fig. 4.—A common emitter amplifier.



Figs. 5 and 6.—Avoiding the use of two separate batteries by a tapping (left) and (right) by means of a base resistor.

electrolytics of low voltage working have been developed. As with all electrolytics, these must be connected in accordance with their polarity—the positive side generally going to base.

Input Conditions

It will be appreciated by now that the input conditions of a transistor circuit are vastly different from those of a valve. Its input impedance is finite, and its effect on the circuit feeding it cannot be ignored as with the common valve circuits at audio frequencies. This follows from the fact that the transistor is current driven. Now if the input were purely resistive it would not be necessary to stress this distinction because in a resistance the current waveform is identical with the voltage waveform. Just consider Ohm's Law if there is any doubt about this. Unfortunately,

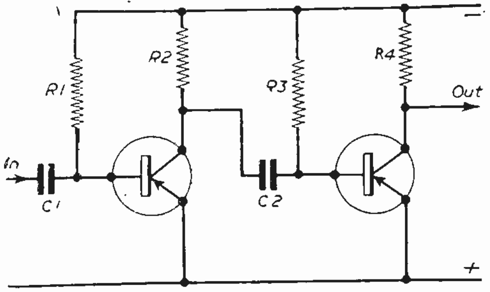


Fig. 7.—Common emitter amplifiers in cascade.

the input characteristic of a transistor does not exhibit a linear voltage/current characteristic, and it is the current waveform that is reproduced with a minimum of distortion at the output. Where the signal source is in the form of a voltage it is necessary to ensure that the source resistance is high compared with the input impedance of the transistor. When this is done the source resistance predominates in determining the current that will flow. The curvature of the transistor voltage/current curve is then swamped by the source resistance and distortion due to the transistor input characteristic is avoided. Often, therefore, there will be a resistor in series with the transistor input as in Fig. 8 which, at first glance, is doing nothing but waste valuable input signal but which, in fact, is supplementing the internal source resistance in order to ensure that the current flowing into the transistor is proportional to the voltage signal from the source. The well-equipped constructor who uses an oscilloscope to check his amplifiers will run into difficulties if he adopts the usual technique of feeding the transistor amplifier input signal to his oscilloscope amplifier, which is voltage operated. He must insert a resistor in series with the transistor input circuit, small enough not to affect the working of the input circuit, and take the voltage signal generated across this resistor into his oscilloscope.

D.C. Stabilisation

The collector and base of a transistor form a diode with reverse bias, and, as has been stated, the reverse resistance is far from being infinite. Consequently a current, called the leakage current, flows even when there is no current in the emitter/base circuit. The manufacturing spread allowed, even for transistors sold through the manufacturers' normal channels, is greater than with valves, and consequently the characteristics of transistors nominally similar in type are likely to be appreciably different. Those sold through the surplus market will have even wider spread. This will affect the leakage currents of various specimens. The leakage current is also a function of junction temperature, which is affected both by atmospheric temperature and by the working conditions of the transistor, and so is sensitive to any changes in operation. In the case of the common base connection this current is but a few microamps. It is not, therefore, an appreciable part of the total current and consequently variations due to this cause are not serious. This

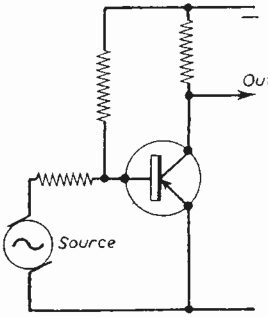


Fig. 8.—Series resistance to ensure current drive.

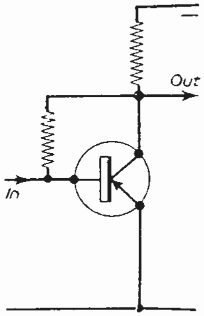


Fig. 9.—D.C. stabilisation by collector feedback.

method of connection is therefore relatively stable from the D.C. point of view.

Common emitter circuits are less satisfactory in this respect. Leakage current is subject to amplification by transistor action in this method of connection, and variations due to manufacturing spread and temperature variation are much more important. Indeed, leakage current in the output circuit can attain serious proportions, running the transistor into the extreme of its characteristic, causing clipping that prevents it from dealing with the signal applied or, in the case of power transistors, may even induce "thermal runaway" by cumulatively feeding back the effect of temperature increase until the transistor destroys itself.

Some measure of D.C. stabilisation has to be included in the common emitter circuit, therefore. The simplest method is to feed the base from the collector instead of from the battery negative terminal. This is shown in Fig. 9. This method is economical in that no additional components are needed but some signal feedback takes place along the D.C. feedback line, reducing the overall gain. The amount of signal feedback depends on the ratio of the feedback resistor to the base-emitter impedance and with normal values will not be very great. It can be avoided by decoupling the feedback so far as signal frequencies are concerned. This is just like decoupling used in valve circuits, using an additional resistor and capacitor, the two resistors having together the value of the single resistor used to feed back in the previous case so as to obtain the same D.C. conditions. This is given in Fig. 10.

The principle of this form of D.C. feedback is that a change in collector current, say, due to a change in temperature, causes a change in voltage drop across the load resistor. This change is communicated to the base and so the base current is changed. This changes the collector current in a direction to oppose the initiating change, so providing negative feedback and stabilising the circuit.

Unfortunately, the size of the feedback resistor in this arrangement is determined by the value of the bias current needed to operate the transistor at the chosen point, and it is unlikely that this would prove right from the feedback point of view. It is better than no stabilisation at all, but an alternative method is preferred. In this method the base is fed from a potentiometer across the supply voltage. A resistor is included in the emitter circuit which provides feedback as does a cathode resistor in a valve circuit. In order to avoid signal feedback, which would reduce gain, this resistor is bypassed so far as the signal is concerned by a capacitor. The circuit is given in Fig. 11. A change in collector current is accompanied by a change in emitter voltage and this is effectively in the base/emitter circuit, changing the voltage between these two electrodes in such a way that the resulting change in current flow in the base circuit tends to cause a change in collector current in opposition to the initiating change. Thus D.C. negative feedback is achieved without loss of gain by signal negative feedback, and the cathode resistor can be adjusted to the value needed for the degree of feedback required for D.C. stabilisation. The method of stabilisation just described is made even more effective than it seems at first glance by virtue of the input characteristic of the transistor. The effect of the feedback is to produce a voltage across the emitter resistor which is fed back. The transistor being current operated is stabilised by virtue of the current in the base circuit produced by this voltage. It has already been said that the input characteristic is not purely resistive and consequently the current fed back is not in proportion to the voltage. In fact, the curvature of the input characteristic has the effect of accentuating the feedback. Stages using this circuit can easily be cascaded to give cumulative amplification and the resultant circuit using three stages appears in Fig 12.

Practical designs will be given utilising the principles here explained and from which further practical points of design will arise, but before proceeding it would be as well to take stock and see what can be expected from transistors. They are not the answer to all electronic problems, as has often been represented, nor are they expected to replace the more conventional valve in all applications. Their great virtues are small size and modest power requirements. Wherever miniaturisation is looked for, therefore, they are likely to be applied. Frequency range, however,

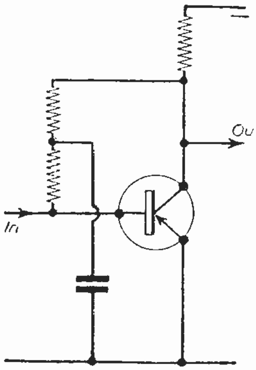


Fig. 10.—D.C. feedback without signal feedback.

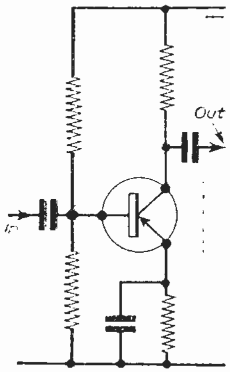


Fig. 11.—Preferred method of D.C. stabilisation.

is still severely limited compared with the valve, and power output transistors are still rare and expensive. For the ordinary domestic receiver undoubtedly valves are still more suitable, particularly if power is to be drawn from the mains. Miniature amplifiers of the kind used for deaf aids provide an obvious application. For battery receivers, of course, and particularly if they are needed to be portable, as most battery receivers are these days, they are very attractive because they need only a low voltage supply and they draw very little current. Here it is desirable to put the craze for high power output in perspective. It is quite likely that shortly transistors giving outputs up in the region of watts will be available and the thought is attractive. Nothing is free in this world, however, and all this power has to be supplied from the driving battery. Now if 6 volts supply is used and an output of 3 watts audio is needed, assuming rather optimistically that the output stage has a 100 per cent. conversion efficiency, half an amp. will be drawn from the battery on that account alone. Actually, conversion efficiency will be much less than 100 per cent. and so an amp. or so of power will be needed. What sort of battery is going to provide this kind of power? Of course, class B operation is likely to be used so that the average power drawn would be much less than peak. *(To be continued)*

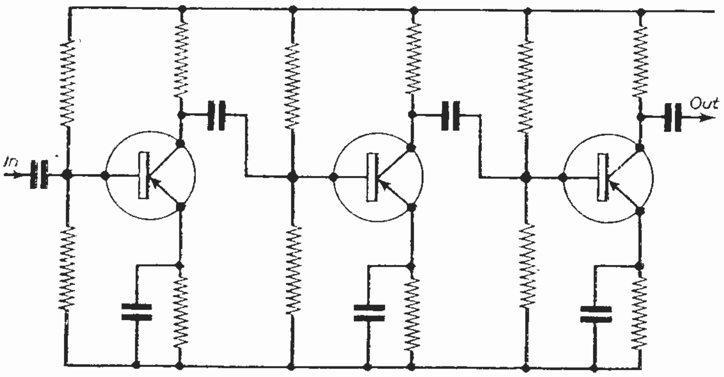


Fig. 12.—Three-stage stabilised common emitter amplifier.

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NOTE.—It is essential to use mains primary types with T.V. receivers having series-connected heaters.

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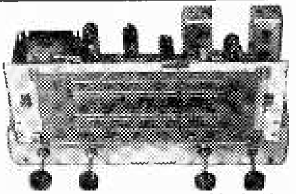
1S5	8/6	6L6	10/6	EBC33	8/6	HABC80	
1T4	8/6	6Q7	10/6	EBC41	10/6		12/3
2X2	3/6	6SA7	7/6	EBF80	8/6	HVR2A	7/6
3S4	8/6	6SN7	8/6	ECC84	12/6	MU14	10/3
3V4	8/6	6V6G	7/6	ECF80	10/6	PCC84	12/6
5U4	8/6	6V6GT	8/6	ECF82	10/6	PCF80	10/6
5Y3	8/6	6X4	7/6	ECH42	10/6	PCF82	10/6
5Z4	10/6	6X5	7/6	ECL80	8/6	PCL82	10/6
6AM6	8/6	12A6	7/6	ECL82	12/6	PEN25	6/6
6B8	5/6	12AH8	10/6	EF39	7/6	PL82	10/6
6BE6	7/6	12AT7	10/6	EF41	10/6	PY80	10/6
6BH6	10/6	12AU7	10/6	EF50	5/6	PY81	10/6
6BW6	8/6	12AX7	10/6	Equip.		PY82	10/6
6BW7	8/6	12BE6	10/6	EF50	5/6	SP61	5/6
6CH6	10/6	12BH7	10/6	Sylv.		UBC41	8/6
6D6	7/6	12K7	8/6	EF80	10/6	UCH42	8/6
6F6	7/6	12Q7	8/6	EF92	5/6	UF41	8/6
6H6	3/6	35Z4	10/6	EL32	5/6	UL41	8/6
6J5	6/6	80	8/6	EL84	10/6	UY41	8/6
6J6	7/6	954	1/6	EY51	11/6	U22	10/6
6J7	8/6						
6K6	6/6	EA50	1/6	EZ40	10/6	U25	11/6
6K7	5/6	EABC80	8/6	EZ81	11/6	X79	10/6



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M.W. 200 m.—550 m. ECH42, EF41, EBC41,
L.W. 800 m.—2,000 m. EL41, EZ40.
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1957 Model RC453
7in., 10in., 12in. Records
16, 33, 45, 78 r.p.m.
4 SPEEDS—10 RECORDS
With Studio "O" pick-up
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TERMS: Deposit £5.5.0 and six monthly payments of £1.
Space required 14in. x 12½in. 5in. above and 3in. below. Cut Out board, 6/-.

GARRARD 4-SPEED RECORD CHANGERS RC120/4H 1957 MODELS
Brand new and fully guaranteed 12 months.

AUDIO PERFECTION

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AMPLIFIER—RECORD PLAYER CABINETS. Cabinet size 18¼in. x 13½ x Ht. 8½in., with motor board 14 x 12½in., **£3.3.0.** post 3/-.

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TRANSISTORS. Audio, **10/-**. R.F. 2.6 Mc/s, **21/-**. Mullard OC71, **20/-**.

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Semi-air spaced Polythene insulated. ¼in. dia. Stranded core. Losses cut 50% **9d.** yd.
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Wearite M800 IF 565 Kc/s, 12/6 per pair.

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2/450 v.	2/3	8+8/500 v.	4/6	16+16/500 v.	6/-
4/450 v.	2/-	16+16/500 v.		25+20/450 v.	5/6
8/450 v.	2/3		6/-	32+32/350 v.	4/6
8/500 v.	2/9	**CAN TYPES**		32+32/450 v.	6/3
16/450 v.	3/3	Clips.	3d.	50+50/350 v.	7/-
16/500 v.	4/-	16/450 v.	3/6	60+100/350 v.	11/3
32/450 v.	5/6	32/350 v.	4/-	100+200/275 v.	
25/25 v.	1/9	64/350 v.	5/6		12/6
50/25 v.	1/9	500/12 v.	3/-	1,000+1,000/6 v.	
50/50 v.	2/-	8+16/450v.	5/-		6/3

Screw Base Type 512, 8/500 v., **3/-**; 16/500 v., **4/-**

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3 p. 4-way, 1 p. 12-way, long spindle 3/6
VALVEHOLDERS. Pax. Int. Oct., 4d. EF50, EA50, 6d. B12A, CRT, 1/3. Eng. and Amer. 4, 5, 6, 7, and 9 pin, 1/-. **MOULDED** Mazda and Int. Oct., 6d. B7G, B8A, B8G, B9A, 9d., B7G with can, 1/6. VCR97, 2/6, B8A with can, 2/6. **CERAMIC** EF50, B7G, B9A, Int. Oct., 1/-. B7G with can, 1/9.
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A NEON DELAY SWITCH

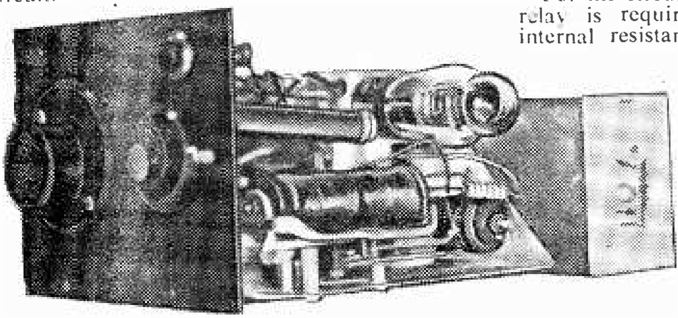
MAKING A TIME DELAY SWITCH, AND A PULSATOR OR REPEATER SWITCH

By P. Mansfield

THE author recently had need of a delay switch, which when switched on would remain on for a given time, and also a pulsator or interval repeater switch.

Of course, both of the above needs could be filled by a purely mechanical switch, involving cams, gears, etc.: but mechanical switches usually suffer the disadvantage of being non-variable. Thus it was decided to do both jobs electronically, utilising readily available surplus equipment.

Both the delay switch and the pulsator (which may be regarded as a very slow non-sinusoidal oscillator) rely on the time constant of a C.R. circuit.

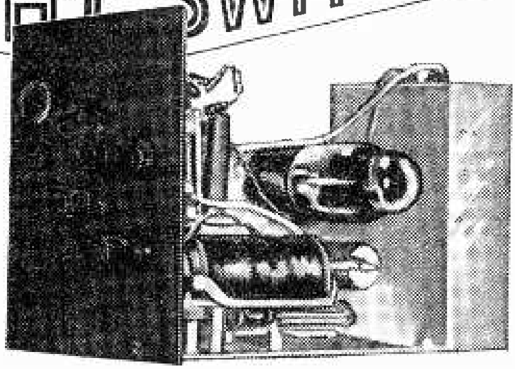


A view of the unit.

Two-thirds of the mains A.C. supply is tapped off and rectified through the half-wave metal rectifier The only smoothing found necessary was the 16μF electrolytic C1. The rectified direct current is then fed through suitable resistors to the charging condenser C2. In view of the long periods of charging (as much as 20 minutes) this condenser must have a very low leak. It was found that electrolytics could not fill this rôle, though for shorter intervals, in the order of 30 seconds, they could be employed.

During the charging process, up to the neon striking voltage, the neon (V1) remains non-conducting; at the striking voltage the neon tube discharges through the sensitive relay (RL1), and continues to discharge down to about 100 volts (due to residual ionisation); at this point the valve reaches the cut-off potential when the neon tube once more becomes non-conducting.

The charging process then repeats itself at regular intervals.



The contacts of the relay in the discharge circuit can thus be made to operate an external circuit intermittently.

For the circuit to function correctly, a sensitive relay is required: the one employed had an internal resistance of 6.5KΩ, and an operating current of 2mA.

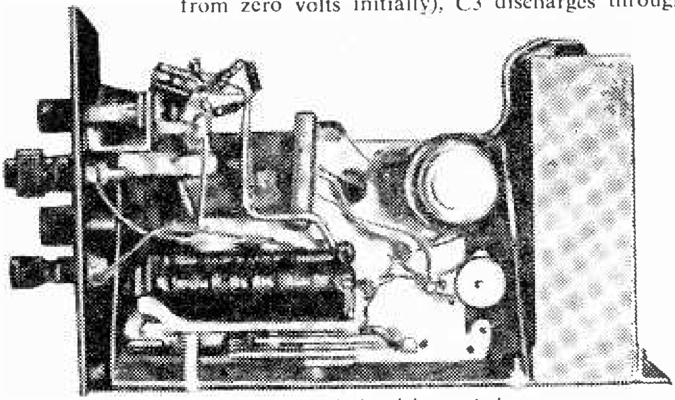
A reset switch S1 was provided, allowing the D.C. supply to be connected directly to the neon.

With the given values of charging resistance, the periods were:—

Position 1. — 4-25 seconds (using the variable 5 MΩ pot.).
Position 2.—3 minutes
Position 3.—4 minutes
Position 4.—6 minutes
Position 5.—9½ minutes
Position 6.—17 minutes
(The latter 5, potentiometer set at zero.)

Operation

Depressing Switch S1 causes the relay RL1 to be energised, the relay is arranged to hold itself in by shorting S1 through the contacts. A direct current is now applied through R3 to the oil-filled condenser C3. At the striking voltage (which in this case is reached after 10 minutes from zero volts initially), C3 discharges through



Another view of the delay switch.

the sensitive relay RL2, causing its closed contacts to open, thereby opening RL1 and thus switching off the whole circuit.

As the neon tube discharges only to 100 volts, C3 will still hold a charge when switched off. This will, of course, discharge slowly through R3, but if the switch is to be used again directly after, it is essential to start the charging process at zero volts on C3, if reproducible time periods are required. Hence a second press switch S2 is included as a reset switch, resetting the voltage on C3 to zero before the commencement of a timing.

The resistor R1 is included to allow the condensers C1 and C2 to discharge during the neon discharge interval, for it was found that they held enough charge to draw RL1 in again, after the neon had triggered, thereby switching the circuit on again.

The relay RL2 was arranged to hold in as long as possible, by including a series 2.2 KΩ resistor (R4). By experiment, R1 was found to be about 15 KΩ.

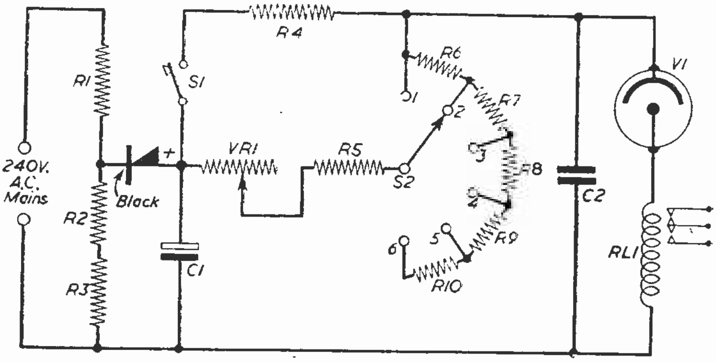


Fig. 1.—Circuit of the delay switch.

LIST OF COMPONENTS

RESISTORS

R1—, R2—, R3— 3.3 KΩ 10 watt ceramic
R4—10 KΩ ½ watt
R5—1 MΩ ½ watt
R6—43 MΩ ½ watt
R7—10 MΩ ½ watt
R8—22 MΩ ½ watt
R9—32 MΩ ½ watt
R10—66 MΩ ½ watt
VR1—5 MΩ variable

CONDENSERS

C1—16 μF 500 v.w. D.C. electrolytic
C2—8 μF 400 v.w. D.C. (oil filled)
Metal rectifier, 250 volt, 40-60 mA
V1—VR105 neon tube
RL1—Sensitive relay 6,500 Ω 2 mA working current (Obtainable on surplus market as U.S. Navy relay Model AN/APN-1 Cont. NXsa-22421.)

S1—Panel press switch (Bulgin)
S2—2-pole 6-way (180 deg. swing) (Yaxley)

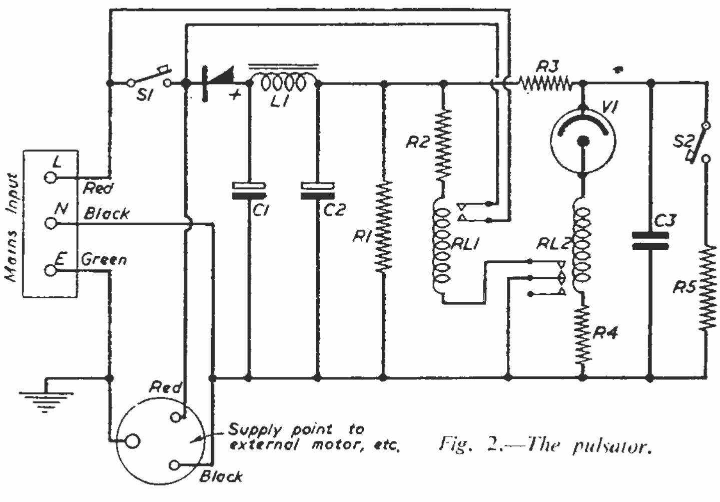


Fig. 2.—The pulsator.

It would, of course, be impossible to list the uses to which either of these pieces of apparatus could be put. Usually, after we publish an article of this nature, we are asked if it may be used in such and such a manner, and we should like to forestall such inquiries by stating that in the majority of cases it is not possible to give this information. Each case must be taken on its merits, and when it is remembered just what the unit is intended to do, it is usually possible to ascertain whether or not it should work, and then in all probability some experimental hook-ups are indicated. In other words, provided it does not seem likely that any risk is involved, a bench-test is the only way to say for certain whether a definite arrangement will work. Bearing in mind the features underlying the design, and after a study of the times of operation given on the preceding page, it should be possible to make modifications for a specific purpose.

LIST OF COMPONENTS

RESISTORS

R1—15 KΩ 10 watt (20%)
R2—2.5 KΩ 25 watt ceramic (5%)
R3—110 MΩ ½ watt (10%)
R4—2.2 KΩ ½ watt (20%)
R5—72 KΩ ½ watt (20%)

CONDENSERS

C1—16 μF 450 v.w. D.C. electrolytic
C2—16 μF 450 v.w. D.C. electrolytic
C3—6 μF 750 v.w. D.C. (oil filled)
L1—6 H 120 mA L.F. choke

Half-wave metal rectifier, 250 volts, 120 mA
RL1—6-volt relay 40 Ω internal resistance; 100 mA operating current; heavy external contacts to close when energised
RL2—6,500 Ω internal resistance, 2 mA operating current
V1—VR105 neon tube

The Marconi Doppler Navigator

In a recent issue we gave some details of the "Doppler Effect," and in response to a number of queries we give below some further details of the apparatus, which incorporates some most interesting circuits and devices.

THIS apparatus has hitherto been on the secret list, and has been in quantity production for the Royal Air Force for the past three years.

Briefly, the AD2000 is a completely self-contained airborne equipment which provides an automatic and continuous flow of navigational information such as immediate position in latitude and longtitude, track guidance, distance run or distance to go, estimated time of arrival and wind velocity. The equipment is virtually unaffected by weather conditions.

The overwhelming advantages of such an airborne navigational aid for military operations are obvious. It is the only system in full production to-day which does not depend upon the co-operation of ground-based stations and therefore the only one (apart from the use of astro-navigation) which is capable of independent global operation.

Aircraft using the Marconi AD2000 equipment are able to conform to their planned flight track much more closely than was possible hitherto; the aircraft can give its position and estimated time of arrival much more accurately, while, by virtue of the instantaneous and continuous information upon wind direction and speed, correlated with weather forecasts, the course of the aircraft can be altered immediately to avoid headwinds and take advantage of favourable ones, thus making a valuable contribution towards flying the shortest time track.

In the September issue on p. 473 we mentioned the Doppler Effect and navigation. Here are some further details of the apparatus.

The device measures the ground speed and drift angle of an aircraft in flight by making use of the well-known "Doppler Effect." Electromagnetic waves transmitted from the aircraft strike the ground and are deflected in various directions, a small portion of the energy returning to the aircraft. Due to the relative motion of the aircraft to the ground the frequency of the return signal differs slightly from the transmitted one. This difference in frequency bears a direct relationship to the ground speed of the aircraft.

In the AD2000 the aerial system radiates two beams, one forward and the other backward, both beams being depressed at an angle towards the ground. The ground speed is found by measuring the beat frequency produced when the return signals from the forward beam are mixed with those from the backward-looking beam. (This procedure avoids the necessity for the ultrastabilisation of the transmitter, which would be imperative if it was used as a comparison-source.)

Additionally, one beam is displaced to starboard and the other to port, the positions being switched twice a second. The drift angle is found by comparing the doppler frequency obtained when the forward beam is displaced to starboard and the backward beam to port with the frequency when the beam positions are reversed. The aerial is then automatically rotated until the two frequencies are equal. It is then aligned along the aircraft track.

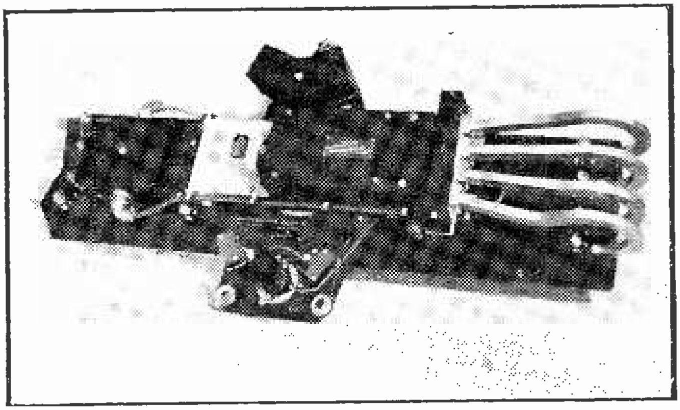
A pulsed system is used at a p.r.f. of 50 kc/s, with a pulse width of 0.45 micro-seconds. The pulses are generated by a magnetron which operates in bursts of 40 milli-seconds duration, twice a second. The peak power is 8kW (mean power, approximately 12 watts). The operating frequency is within the band 8,750-8,850 Mc/s.

Aerial System

The aerial, which is unpressurised, consists of four slotted linear arrays lying parallel to each other in a directional horn assembly, the axes of the arrays being horizontal. An arrangement of phased and anti-phased pairs, with a common feed at one end, provides the forward- and backward-looking beams. The beam width at the half-power points is 2½ degress.

The two pairs of aerials are energised alternately by a special Y-section of waveguide which oscillates about a vertical hinged joint to form a waveguide switch. The horn assembly deflects one pair of beams to a mean angle of 20 degrees to port and the other pair 20 degrees to starboard.

The waveguide switch is driven at a rate of one cycle/sec. from a small gearbox. Cam-operated



The unusual aerial system of the Doppler Navigator.

switches on the driving shaft provide sense and timing pulses to the remainder of the equipment.

To determine drift the aerials can be rotated 20 degrees either side of the fore-and-aft line of the aircraft. The azimuth gearbox carries a synchro transmitter which repeats the aerial position to the indicating unit.

Transmitter/Receiver

This consists of two pressurised containers. Housed in one of these are the magnetron, the modulator circuits, the receiver klystron and the first IF amplifier and AFC circuits.

The second container houses the main H.T. and EHT circuits, an associated delay circuit and relays. A pressurised duct connects the two units beneath the base castings so that EHT (8kV) leads are unbroken and remain within the pressurised containers.

The microwave circuits consist of a duplexer labyrinth connecting the magnetron and klystron to the aerial via a double-directional coupler which provides monitoring facilities for the forward- and backward-looking beams.

The modulator is controlled by a crystal oscillator which maintains the p.r.f. at 50 kc/s. As stated, the pulses are fed to the magnetron in bursts of 40 milli-seconds duration, repeated at half-second intervals in synchronism with the movement of the waveguide switch in the aerial system.

The I.F. amplifier, tuned to 45 Mc/s, is divided between the transmitter/receiver and the tracking unit. The first I.F. amplifier (contained in the transmitter/receiver) is rendered inoperative during the transmitted pulse by the application of a short blanking pulse from the modulator.

The integrator controls the speed of the motor driving the phonic wheels; this speed is a measurement of the aircraft ground speed.

The azimuth drive circuit controls the movement of the azimuth drive motor situated in the aerial system and rotates the aerial for drift angle measurement. The resultant ground speed and drift information is fed by synchros to an indicating unit.

Ground Position Indicator. The G.P.I. provides automatic and continuous information of the aircraft's position either in latitude and longitude, as a grid (nautical miles gone N or S and E or W) or as an A/A set track (along and across a set-in track). Choice of presentation is afforded by a switch.

The instrument is primarily a mechanical type of computer employing a conventional disc-ball-roller resolving gear set by the track drive to split incoming ground mileage into two components at right angles. The component outputs from the resolving gear drive the cyclometer-type counters at the front of the instrument; these show the ground position of the aircraft.

In order that information shall not be lost while setting the counters in flight, a fixing and storing device is incorporated. When obtaining a "fix" the two output drives from the resolving mechanism are switched from the counters to two sets of storage drums. After adjustment to the counters the switch is turned back to its normal position. The stored mileage is then automatically driven back into the counters, together with the normal incoming mileage.

News from the Clubs

THE AMATEUR RADIO CLUB OF NOTTINGHAM (G3EKW)

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

THE club continues to meet at 7.15 p.m. every Tuesday at Woodthorpe House, Mansfield Road and new members will be very welcome. The club's rebuilt transmitter is now operating on Top band and work is now in process for the rebuilding of transmitter to cover 40 and 80 metres.

Members recently visited Newark Club for a talk on D.F. by Mr. John Clayton.

BURY RADIO SOCIETY

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

THE society holds its monthly meetings on the second Tuesday of each month at 8 p.m. at the George Hotel, Kay Gardens, Bury.

October 8th. Mr. R. Hammans (G2IG) will talk on "Matching Matters."

November 12th. Mr. T. C. Platt (G2GA) reminisces under the title, "An Old-timer Looks Back."

LEEDS AMATEUR RADIO SOCIETY (G3BEW)

Hon. Sec.: J. R. Hey, 40, Richmond Ave., Headingley, Leeds, 6.

PROGRAMMES are now being printed and should be available shortly. Anyone wishing to become a member should either contact the Hon. Sec. or come along to any of the meetings, which will be almost every Friday at Swarthmore Educational Centre, 4, Woodhouse Square, Leeds, 3.

The club caters for all interests in radio, and many interesting visits have been arranged.

Programme for the first two months:

October 11th. Discussion to rebuild the club T.X.
October 18th. Talk, "Army communication equipment."
October 23rd. Visit to Skelton Grange Power Station.
November 1st. Simple gram amplifier.
November 8th. Transmitting evening.
November 15th. Talk, "War-time radar."
November 22nd. Visit to be arranged.

CRAY VALLEY

Hon. Sec.: S. W. Coursey, G3JJC, 49, Dulverton Road, London, S.E.9.

THE meeting of the Cray Valley Radio Club to be held on Tuesday, October 22nd, 1957, at 8 p.m. at the Station Hotel, Sidcup, Kent, will be devoted to an exhibition of members' home-constructed gear. A cordial welcome is extended to visitors.

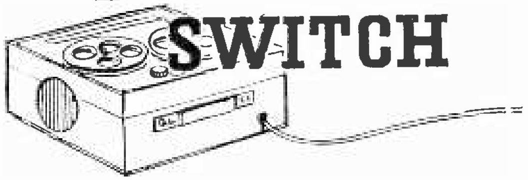
THE WEST LANCASHIRE RADIO SOCIETY

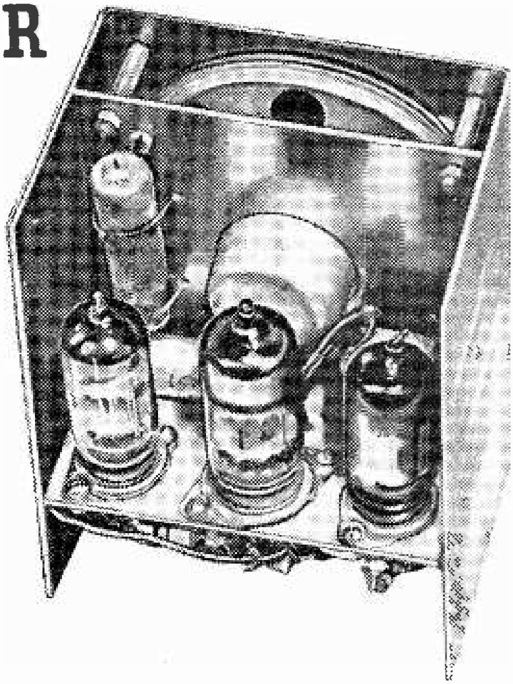
Hon. Sec.: K. Wright (G3KVE), 24, Stuart Road, Liverpool, 20.

MEETINGS continue to be held every Tuesday evening at 8 p.m. Morse classes are held every week at the club room under G3KKU. The club Tx is once again on the air on Top band and 80 metres.

Plans for N.F.D. 1958 are also under way, following the dummy run we had this year operating under N.F.D. conditions, but not actually taking part in the contest. Any information regarding the club and its activities will gladly be supplied by the Hon. Sec.

A TAPE RECORDER DICTATION SWITCH





A SPEECH-OPERATED MOTOR CONTROL TO CONSERVE TAPE

By Hugh Guy

A SIMPLE addition to a tape recorder whose prime function is recording dictation can produce a useful device for starting and stopping the deck driving motors in synchronism with the voice.

Not only does this achieve a considerable saving of tape but results in a much more coherent playback; all the embarrassing gaps between sentences while the speaker struggles for the next phrase are eliminated.

Such a device is not restricted to tape recorder applications alone but can be used in conjunction with R/T rigs for transmission only when speech modulated, and the same design can be applied equally well to both baby and burglar alarms.

In this article the layout which is detailed is one to which the reader is by no means restricted. There is no reason for example why the device should not be built into an existing tape recorder when used for motor switching, instead of constructing it as a separate unit round a small loudspeaker as described here.

Modifications of this kind are up to the individual as the circuit is quite adaptable.

Circuit Details

On page 626 it will be seen that the circuit comprises three stages. The first is a high gain pentode stage, V1, into which the output from a loudspeaker, used as a microphone, is coupled by a step-up transformer, T1. The amplified output is then fed to V2a, which serves as a low impedance cathode follower output stage for coupling into the appropriate tape recorder input

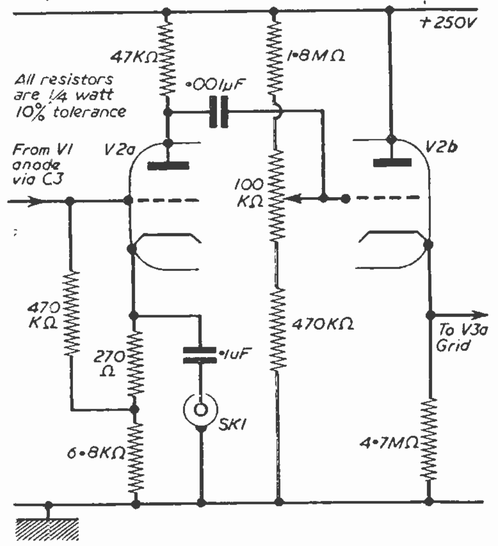


Fig. 1.—Modification to Fig. 3, for increased sensitivity.

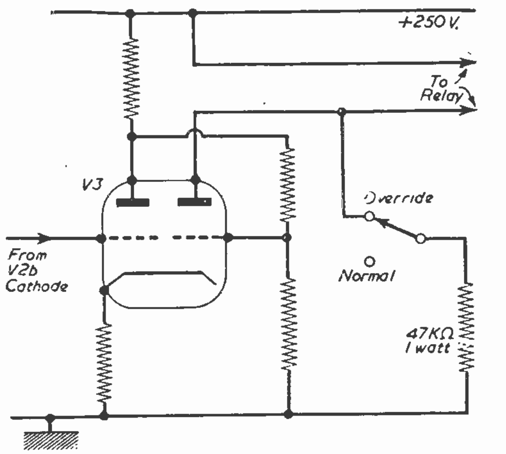


Fig. 2.—One of the positions in which an override switch may be connected.

socket. This part of the circuit constitutes the conventional microphone pre-amplifier. The output from the cathode follower is directly coupled to the grid of the V2b. This latter stage is a detector of the infinite impedance type, and the potential at its cathode rises when an audio signal is fed to its grid. Hence amplified speech signals increase the cathode potential at V2b cathode. The capacitor C6 smooths out the variations in these amplified signals and maintains this increase in potential for upwards of about a second after the signals have ceased. Being directly coupled to C6, V3a grid is also modulated

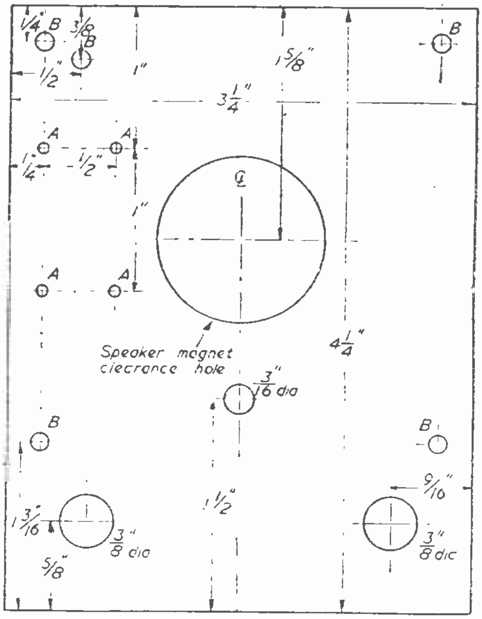


Fig. 6.—Drilling details for support panel.

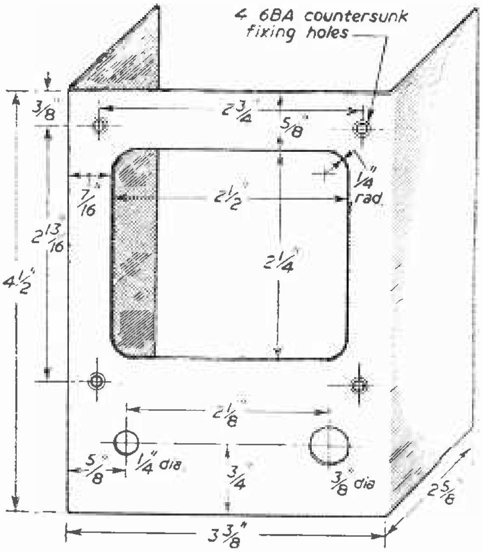


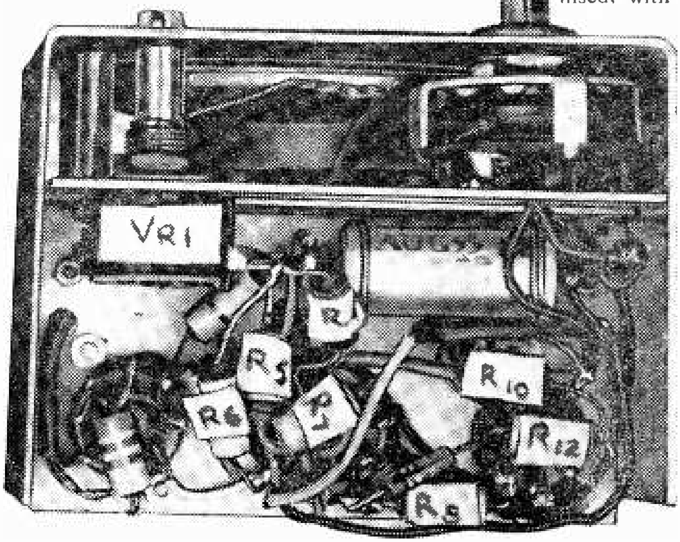
Fig. 7.—Cover for unit.

by this smooth voltage. Each time the loudspeaker receives the spoken word the voltage level at V3a grid smoothly rises to a mean value determined by the volume of the speech.

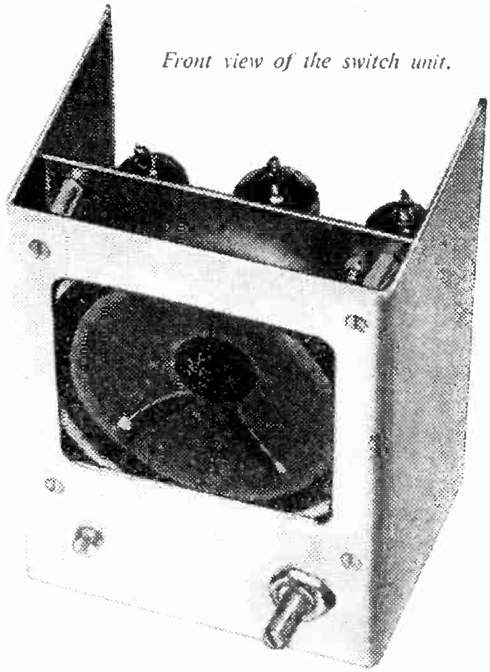
Now the double triode V3 is connected as a trigger stage, as many readers will have recognised, with the result that an increase in the potential of V3a grid will switch the valve current from V3b (which normally conducts about 5 milliamps) to V3a. The net change de-energises relay RL1, mounted in the tape recorder, by means of which the deck motors are switched on.

As soon as the mean level of V3a grid has fallen—that is, when the user of the device ceases his commentary—the valve current is once again diverted to the right-hand valve, and the relay is re-energised, opening the motor switching contacts and stopping the tape receiver.

Used intelligently the inevitable start and stop times of the recorder as the motor runs up to speed and slows to a stop when switched on and off by speech, will not mar any of the recorded dialogue. For example, a slight cough or the figure of speech



Underside view with components identified.



Front view of the switch unit.

"Er." is sufficient to start the machine, and none of the conversation will be lost at the beginning of each sequence.

General Arrangement

Chassis drawings, discussed in detail later in the text, give sufficient information for the constructor to build the unit either as a separate self-contained box housing the loudspeaker in addition to the circuitry, or as an extra chassis to be accommodated within the tape recorder itself and operated from the usual desk-type microphone.

A small 3in. loudspeaker was used in this design principally because the sensitivity of the unit is proportional to the size of the diaphragm of the device used as a microphone. By the same token a 5in. loudspeaker of the type sometimes used in office intercommunication equipment is even more sensitive. It may be, however, that the constructor wishes to use a less sensitive microphone, in which case it is suggested that the modification shown in Fig. 3 be incorporated in the circuit to increase the unit's sensitivity. Here it will be seen that the audio gain remains unchanged for the tape recorder input but that the gain is increased for operation of the trigger stage. The output to the infinite impedance detector V2b is taken from an anode load in V2a via a coupling condenser at an increased amplitude by virtue of the gain provided by the amplifier V2a. Such a circuit now renders the unit suitable for use with one of the small, comparatively insensitive crystal microphones available for about 5s. from several of the radio component suppliers.

Override Switch

Some conditions of use will obviously require that the tape recorder is not voiced-controlled: for example, when the speaker wishes to record intermittent dialogue of a conversational type. In these circumstances it is convenient to have a switch mounted on the unit to override the action of the voice controlled relay. Of the several ways in which this can be connected Fig. 2 shows one which will switch the relay into circuit regardless of the audio conditions associated with the device. Another equally simple way is to arrange that the relay contacts controlling the motor operate in parallel rather than in series with the existing deck on/off switch. With this arrangement, when the deck switch is in the "off" position, the device will be voice operated, and when in the "on" position the voice operated relay will not control the motors.

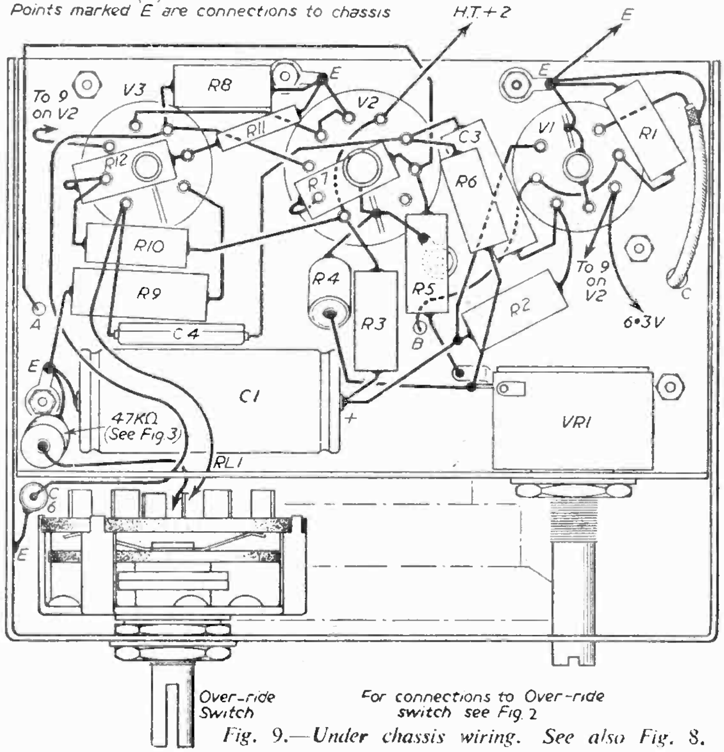


Fig. 9.—Under chassis wiring. See also Fig. 8.

Motor Relay Connections

Here again several arrangements may suggest themselves to the reader: one simple mode of connection is shown in Fig. 4. In any event, it is assumed that the relay, which is a 6,000 ohm Post Office type with at least one pair of normally closed contacts, will be mounted in the tape recorder itself. One very good reason for doing this, apart from the elimination of extra leads, is

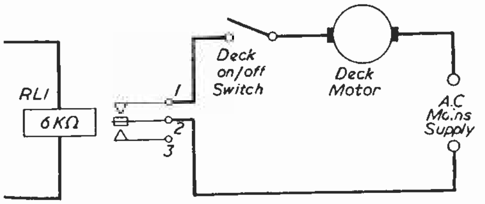


Fig. 4.—Relay connections for motor switching.

to prevent the noise made by the relay when it is actuated from operating the device itself. With a sensitive arrangement the click of the relay pulling in is amplified by the circuit which promptly causes the relay to fall out again. The nett effect is for a continual making and breaking of the relay at a rate determined by the timing combination C6 R8, about which more will be said later.

Constructional Details

The photographs show that the chassis consists of three main parts, the cover part of which (Fig. 7) is optional.

Figs. 5 and 6 show the chassis marking-out details. The material used is 18 s.w.g. aluminium. In Fig. 6 the details for fixing a loudspeaker are left to the constructor, since the design of these small speakers varies considerably one from another. The front cover, too, is made of 18 s.w.g. aluminium and has a large cut-out for the loudspeaker in the front. It is suggested that a

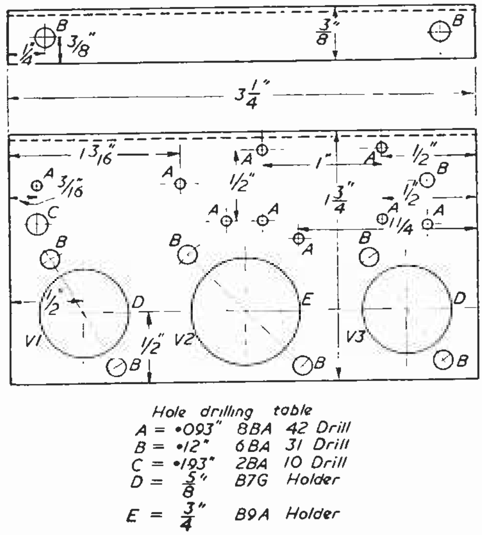


Fig. 5.—Drilling template for chassis.

suitable vent is provided for this by the use of a piece of expanded metal.

The method of assembly of the three basic parts is indicated in the photographs from which

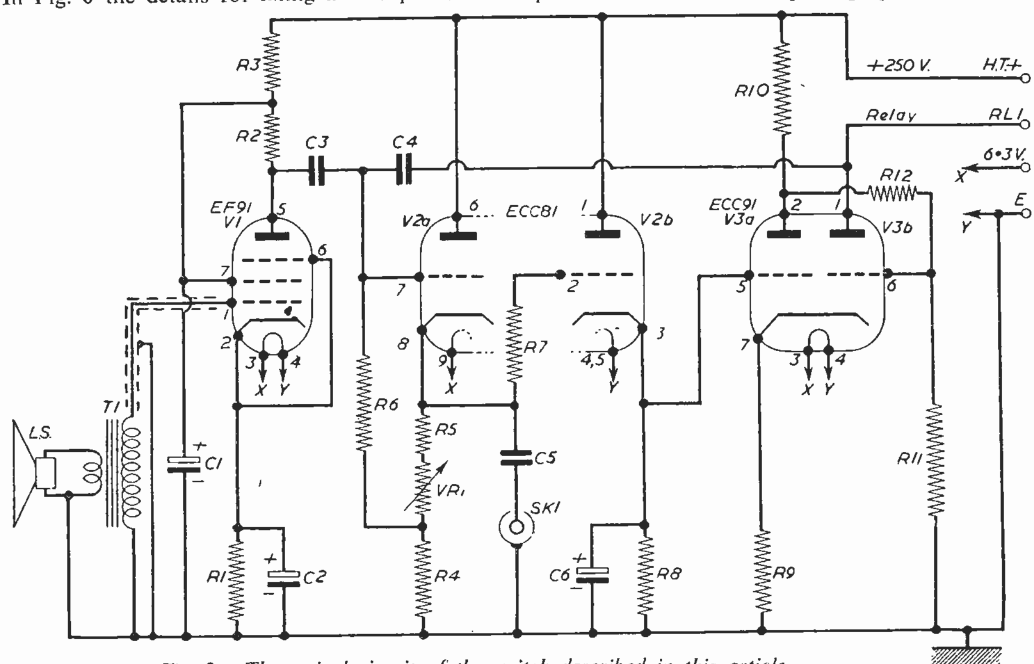


Fig. 3.—Theoretical circuit of the switch described in this article.

it will be seen that the small chassis (Fig. 5) is mounted at right angles to the support panel (Fig. 6) by means of two of four 1in. 6 BA countersunk screws. These four screws fit through four ¾in. long tubes—salvaged in the case of the unit described from an old rotary switch assembly—which separate the support panel and its chassis from the cover, at the same time allowing mounting space for the loudspeaker, which is fixed on the opposite side of the support face from the chassis. The ⅜in. hole on the cover is used to mount the override switch mentioned earlier, while the ¼in. diameter hole allows access to the pre-set control VR1, which is used in setting up the trigger circuit.

A simple U-shaped piece of metal with ventilation holes and a cable access hole drilled in it completes the assembly by providing a back cover to the unit. The drawing of this latter piece is not shown.

Painted white, the complete assembly needs no extra finish, and makes quite an attractive unit.

Wiring Details

In commencing wiring the heater leads should be the first to be attempted. A tightly twisted pair of wires connects the heater pins on the valve bases in parallel. The earth side of the heaters should be connected to an earthing tag screwed to the chassis at V1. Multiple earthing connections should be avoided as these can sometimes complicate the hum problem. Throughout this process and those immediately following, wiring is carried out easily prior to assembling the chassis to the support panel. Next, secure condensers C1 and C2 on adjacent sides of the chassis by means of two tightly looped copper wires, C1 being on the underside of the chassis. With a suitable midget transformer T1 in position wiring can now proceed.

Connections from C2 to the screen and cathode of V1 can now be made via the adjacent hole in the chassis and the screen connection made to C1. A screened lead should connect the secondary of the transformer T1 to the grid via its appropriate chassis hole. The screened braid of this lead should be soldered to the earth tag, to which the heater chain is returned.. Next connect the cathode of V2b to the grid of V3a. The lead from C6, which will be mounted on the loudspeaker side of the support panel by copper wire loops, can now be taken through the ⅜in. diameter hole in the support panel from V3a grid. On the opposite face of the support panel, secured by the same clamping wires as C6, condenser C5 is mounted. The one remaining wire connection to be made under the chassis prior to mounting intervalve resistors, is that connecting the anodes of V2a and V2b.

(To be concluded next month.)

LIST OF COMPONENTS

R1—10 k. ¼ w. 10%.	**C1—1 μF 350 vw. Electrolytic.**	**SK1—Pre-amp. outlet Jack socket.**
R2—470 k. ¼ w. 10%.	**C2—25 μF 25 vw. Electrolytic.**	**Cable A—4-way flexible lead attached to unit, terminated in 4-pin Carr-Fastener battery plug to mate with corresponding socket on Tape Recorder.**
R3—150 k. ¼ w. 10%.	**C3—1,000 pF 350 vw. Paper Tub.**	**LS—3in. Moving Coil Loudspeaker (see text).**
R4—18 k. ¼ w. 10%.	**C4—100 pF 350 vw. Mica.**	**RL1—6 k. Relay with at least one pair "normally-closed" contacts.**
R5—1 k. ¼ w. 10%.	**C5—0.1 μF 150 vw. Paper Tub.**	**2—B7G valveholders.**
R6—470 k. ¼w. 10%.	**C6—1 μF 200 vw. Electrolytic.**	**1—B9A valveholder.**
R7—470Ω. ¼ w. 10%.	**V1—Mullard EF91 or equiv. (e.g. Z77).**	**Sundry 6 BA x 3/16in. R.H. screws, nuts and solder tags. Flexible screened wire, connecting wire, etc.**
R8—4.7 m. ¼ w. 10%.	**V2—Mullard ECC81 or Brimar 12AT7.**	
R9—10 k. ¼ w. 10%.	**V3—Mullard ECC91 or Cossor 6J6.**	
R10—5.6 k. ¼ w. 10%.	**T1—Midget 60: 1 Speaker Transformer used as step-up mike transformer.**	
R11—330 k. ¼ w. 5%.		
R12—1.2 m. ¼ w. 5%.		
VR1—1k. pre-set pot'r.		

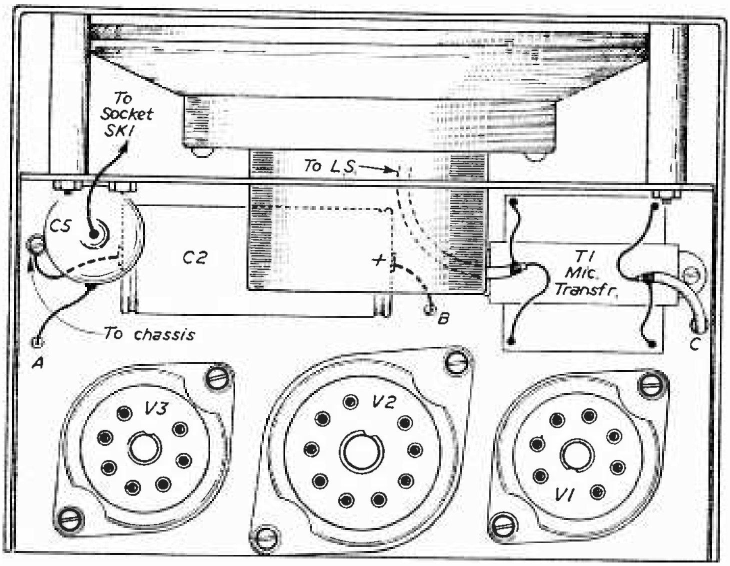


Fig. 8.—Above chassis view and wiring. See also Fig. 9.

AUTOMATIC FREQUENCY CORRECTION

OVERCOMING FREQUENCY DRIFT. SOME INTERESTING CIRCUITS

By Gordon J. King, Assoc.Brit.I.R.E.

THERE are two essential requirements for any system of automatic frequency correction (usually known as A.F.C.), and these are: (1) an electronic device whose magnitude of reactance can be altered by the application of a control voltage, and (2) a device for the production of a control voltage that will alter both in magnitude and polarity depending upon the extent and direction of the frequency drift in the system it is desired to correct.

In this article we are concerned with the application of A.F.C. to broadcast receivers (with special reference to V.H.F.-F.M. receivers, tuners and adaptors) so as to correct automatically any tuning error which may arise due to value drift of critical components or even due to mistuning of the receiver initially. It is interesting to note that during the early days of the superhet receiver, when push-button station selection and mechanical press-button systems (using electric motors) were popular, A.F.C. was often featured in the more expensive receiver as a means of combating the accurate-tuning limitations of these systems.

applied to it is zero or nearly so) contributes to one of the critical reactance elements in the oscillator circuit.

Thus, since this additional reactance in the oscillator circuit can be altered about its nominal value by the application of a control voltage, it clearly follows that alteration of the control voltage above and below an arbitrary zero reference point will result in a frequency swing of the oscillator above or below the frequency to which it is tuned. In other words, within a small limit, the oscillator frequency will come under the control of the voltage applied to the electronic reactance, and if one so desired it would be possible remotely to control accurately the tuning of a receiver, say, from an armchair by means of a potentiometer and a battery. There is little future in this, however; the idea is to get the control to work automatically so as to bring the receiver back into tune as the circuits drift. We will see later that a control voltage which is suitable for this purpose can be obtained from the receiver itself.

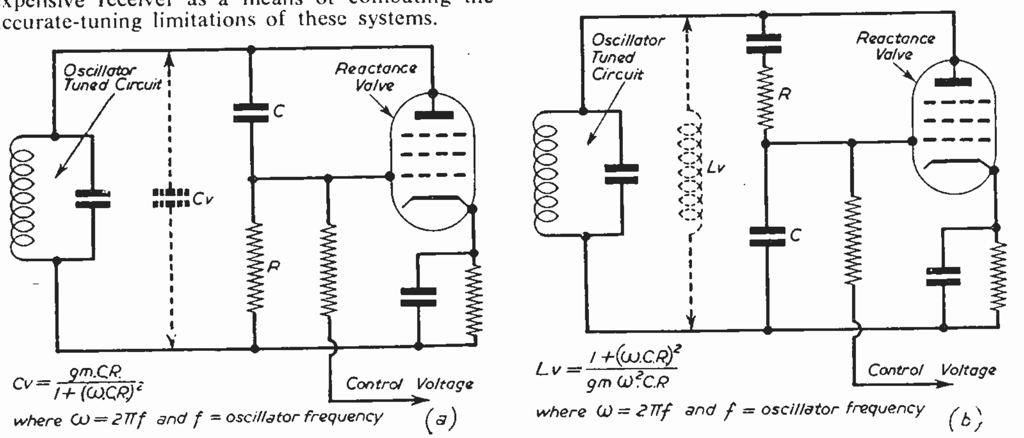


Fig. 1.—Two popular electronic reactance circuits. At (a) is shown a circuit which reflects across the oscillator tuning an effective capacitance, and at (b) a circuit which is effectively inductive in nature.

The idea progressively lost favour, however, but with the introduction of the V.H.F.-F.M. system of broadcasting and the need of very accurate tuning to avoid unnecessary A.F. distortion, coupled with the possibility of even greater frequency drift due to the very much higher operating frequency, A.F.C. as applied to tuners and adaptors is undergoing a revival.

The Electronic Reactance

Let us first examine the requirement as detailed at (1) above. The electronic reactance must be closely associated with the tuner's local oscillator and applied in such a way that its nominal reactance (i.e., that which it presents to the oscillator tuned circuit when the control potential

The Reactance Valve

The electronic reactance takes the form of a pentode valve in which the anode circuit is in parallel with the tuned circuit of the oscillator, basic circuits being shown in Figs. 1 (a) and (b). From Fig. 1 (a) it will be seen that also across the oscillator circuit is introduced a series-connected resistor capacitor combination whose junction is connected to the valve's control grid. The purpose of this is to supply the control grid with a portion of oscillator voltage that falls 90 deg. out

(Continued on page 631)

of phase with the oscillator voltage acting in the anode circuit—the phase shift being achieved by the function of capacitor C.

How this remarkable arrangement acts as a reactance can be realised when it is considered that the amplified grid voltage acting in the anode circuit draws from the oscillator a current which is almost 90 deg. out of phase with the voltage across the tuned circuit of the oscillator. This effect is, of course, precisely the same as that which would occur if an additional capacitor or

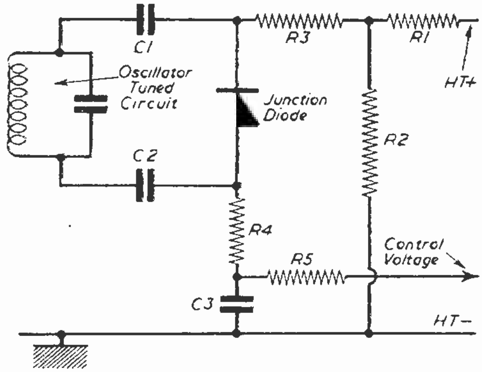


Fig. 2.—A junction diode A.F.C. circuit.

inductor were connected across the tuned circuit in place of the electronic reactance.

In the circuit at Fig. 1 (a) a capacitive reactance is presented to the oscillator circuit because the oscillator current in the reactance valve anode circuit leads the oscillator voltage by 90 deg. The actual magnitude of capacitance Cv so created depends upon the amplification of the valve and the values selected for C and R. Since the amplification of the valve depends on its mutual conductance, gm, it follows, therefore, that an alteration of grid bias, which effectively alters the value of gm, will modify the value of the capacitance reflected across the tuned circuit and also the tuned frequency of the oscillator. A method is thus available of altering the oscillator frequency by means of a control voltage.

There are several other ways of connecting a reactance valve so as to provide either a capacitive or inductive reactance across the oscillator circuit. Fig. 1 (b) shows an arrangement which gives an inductive reactance. Here the positions of C and R are reversed—the capacitor in series with the anode of the valve and R simply serves to block H.T. from the control grid circuit. There are also two other versions in which inductors are used instead of capacitors to give both inductive and capacitive reactance effects in relation to the oscillator circuit, but the circuits shown in Fig. 1 are the most commonly used in practical A.F.C. systems.

The Use of a Junction Diode

With the introduction of the junction diode, another method of altering the frequency of an oscillator by adjustment of a control voltage has been made available. The principle of operation relies upon the fact that the capacitance between the two elements of such diodes varies as an applied bias voltage is varied, provided the diode is biased into the non-conducting region.

Tests have shown that the G.E.C. SX641 and Mullard OA10 diodes exhibit this effect and are suitable for controlling frequency drift, even in V.H.F.-F.M. receivers where the frequency involved is in the region of 100 Mc/s.

The diode capacitance decreases with increase in bias voltage, and with the bias judiciously

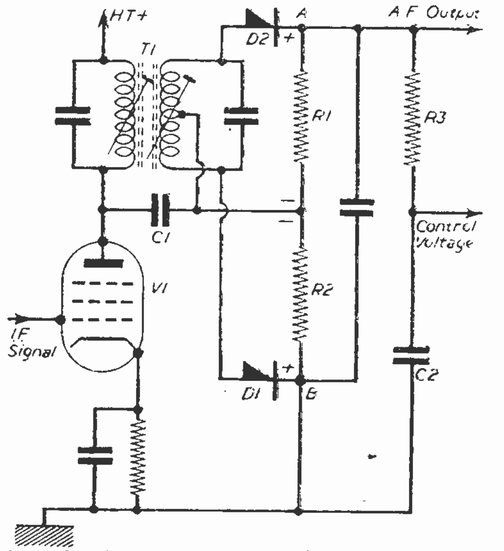


Fig. 3.—Basic circuit of phase discriminator.

arranged so that the diode is operated on the most linear portion of its characteristic curve a frequency deviation of approximately plus and minus 350 kc/s can be secured with a conventional capacitor-tuned oscillator working in the region of 100 Mc/s for a bias change of approximately plus and minus 5 volts. The frequency/bias characteristic so achieved is not wholly linear, and at low and high bias levels it tends to flatten out, but the tests reveal that a maximum slope of approximately 100 kc/s per volt can be obtained without undue difficulty over the workable portion of the curve.

A circuit illustrating the principles involved is shown in Fig. 2. From this it can be seen that the junction diode is effectively connected in parallel with the oscillator circuit: capacitors C1 and C2 serve to isolate the diode from the circuit from the D.C. point of view, but have little disturbance value from the aspect of the oscillator signal.

Resistor R3 holds the oscillator circuit away from the relatively low impedance of the bias source which is obtained by way of the potential-divider comprising R1 and R2 across the H.T. circuit. Resistors R4 and R5, along with capacitor C3, decouple the control voltage circuit and prevent the oscillator signal gaining admittance to other sections of the receiver.

As with reactance valve circuits, the presence of the diode across the oscillatory circuit tends to decrease the amplitude of the oscillator signal due to resistive damping, and this alters slightly as the control voltage is altered. Both this resistive factor and the factor concerning the additional nominal capacitance of the control circuits must be taken into account during the design of the oscillator section.

The Production of a Control Voltage

As intimated by requirement (2), at frequencies above and below the oscillator frequency required

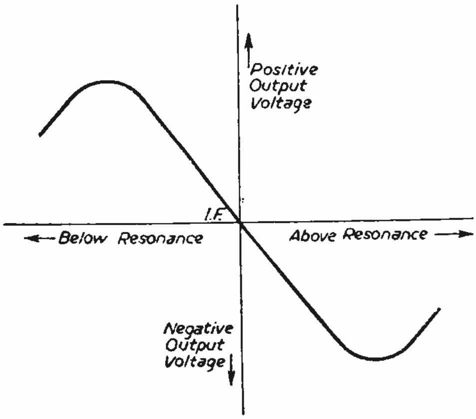


Fig. 4.—Discriminator characteristic. Illustrating how the output voltage will vary as the signal frequency alters below and above resonance of the discriminator transformer.

to give the correct intermediate-frequency the control voltage should be approximately positive or negative with respect to a reference voltage which may be present when the tuning is exact. Since this reference voltage is usually zero, the control voltage swings positive or negative depending upon the direction of the tuning error.

Provided the control voltage applied to the electronic reactance or junction diode is of a polarity which alters the reactance across the oscillator tuning in such a way that the oscillator frequency is altered to decrease the error of deviation of the intermediate frequency, the tuning error of the receiver or tuner will be automatically corrected. If the polarity is incorrect, however, the receiver will be permanently held off tune, and even by careful operation of the tuning control correct tuning will not be possible.

The Phase Discriminator

The control voltage is obtained from a phase discriminator, which is illustrated in basic form at Fig. 3. Valve V1 might well represent the final I.F. amplifier or limiter of a V.H.F.-F.M. receiver. It thus has applied to it an intermediate-frequency signal, which is re-developed in amplified form across the primary of the discriminator transformer T1 in the normal manner.

Because the secondary has a centre-tap, each diode (D1 and D2) will receive a signal of equal voltage from the secondary, but displaced in phase by 180 deg. Each diode will also receive a signal direct from the primary by way of capacitor C1, and as long as the incoming signal coincides in frequency with that to which T1 is tuned, there will exist a phase displacement of 90 deg. between the voltages across the primary and secondary. This is a normal characteristic of tuned and coupled circuits, and under this condition of exact tune the signal voltage arriving through C1 will add equally to the two diode circuits.

Since the two resistors R1 and R2 are of equal value, there will be equal current in the diodes and equal voltage across the resistors, with polarities as indicated on the circuit. The overall voltage between points marked A and B on the circuit will thus be equal to the sum of the voltages across R1 and R2, and under this condition will resolve to zero because the voltages have to be added in opposition.

Phase Change

When the frequency of the incoming signal differs from that to which the transformer is tuned, however, the phase between the voltages across the primary and secondary changes either below or above the 90 deg. reference depending on which way the coils are off tune in relation to the signal. When this happens the signal voltage arriving through C1 is no longer added equally to the two diode circuits. It adds to one and subtracts from the other due to the phase change. Thus, the current increases in one diode and decreases in the other and, similarly, the voltage increases across one resistor and decreases across the other. To illustrate this point: when the tuning is correct 10 volts may develop in opposition across each resistor, giving zero output between A and B, while in a mistuned condition the voltage across R1 may fall to 5 and rise to 15 volts across R2, giving an output of 10 volts positive at B with respect to A.

The magnitude of voltage so obtained due to tuning error will depend on the deviation of phase, with respect to the 90 deg. reference, between the voltages across the primary and secondary windings, remembering that the phase can change either above or below 90 deg. according to whether the intermediate-frequency is above or below resonance. The curve at Fig. 4 illustrates the manner in which the output voltage will vary as the frequency alters below and above resonance of the discriminator transformer.

The control voltage is taken from point A with respect to chassis, and passed through the filter comprising R3 and C2 for connection to the control grid of a reactance valve or to a junction diode.

Readers who are familiar with V.H.F.-F.M. receivers will recognise the circuit at Fig. 3 as the Foster-Seeley phase discriminator. It is interesting to note that this circuit was originally developed for A.F.C. applications before the war, before its use as an F.M. "detector" was fully realised. One should not get the idea that a separate discriminator is necessary for A.F.C. applications; the existing F.M. discriminator is perfectly capable of performing the dual function of demodulating the F.M. signal and supplying a control voltage for an A.F.C. system. The A.F. output is taken from the discriminator in the usual manner.

It should be mentioned that a suitable control voltage can also be obtained from a balanced ratio detector circuit, from the A.F. take-off point with respect to chassis, which is invariably connected to the junction of the matched load resistors.

FOR VALVES —GUARANTEED NEW AND BOXED

0Z4	5 6	6SN7	8	DAF96	10 6	PY82	8	VR65A	
1A3	3 6	6SQ7	9 3	DF96	10 6	PY83	12	(SP41)	3 -
1A5GT	6	6U4GT	14	DH76M	9	QP21	7 6	VR66 (P61)	
1A7	12 6	6U5G	8 6	DK96	10 6	R19	13 6		3 9
1C2	9 6	6L6	8 6	DL96	10 6	SP220	3 11	VR91	
1H5GT	10 6	6L7G	8 6	DM70	8 6	U10	10	(EF50)	4 -
1L4	6 6	6V6G	7	EABC80		U22	8	VR91	
1LD5	3 6	6V6GT	7 6		10	U25	13 6	(SYL)	7 -
1N5	10 6	6V6 M	8 6	EAC91	7 6	U45	15	VR92	
1R5	8	6X4	7 6	EAF42	12 6	U191	12 6	(EA50)	1 6
1S4	10 6	6X5G	7 6	EB41	9	UAF42	11 6	VR105/30	
1S5	7 6	6X5GT	7 6	EBC41	10	UB41	9 6		6 6
1T4	7 6	6-30L2	12 6	EBF80	11	UBC41	10	VR116	4 -
2X2	4 6	7B7	8 6	EC91	9 6	UBC42	11	VR136	6 -
3A4	7	7C5	8	ECC84	12 6	UBF80	12 6	VR137	5 6
3D6	5	7C6	8	ECC85	10	UCH42	12 6	VR150/30	
3Q4	9 6	7H7	9	ECC91	1 6	UCH81	12 6		8 -
3Q5	9 6	7Q7	9	ECF80	14 6	UF41	10	VP23	6 6
3S4	8 6	7S7	9 6	ECF82	15	UL41	11	VP41	7 6
3V4	9	7Y4	8 6	ECH35	11 6	UL84	12 6	VS70	3
4D1	3	75	11 6	ECH42	10 6	UY41	10	VT52	
42	8	77	8	ECH81	11	UY85	10 6	(EL32)	6 6
5R4GY	9 6	80	8 6	ECL80	11	VR21	2 9	VT501	5
5U4G	8	807	6 6	ECL82	13 6	VR53		VU39	
5Y3G	8	9D2	2 9	EF80	10	(EF39)	6 6	(MU12/14)	
5Y3GT	8	9D2	3 9	EF22	8 6	VR54			8 9
5Z4G	10 6	9001	5 6	EF40	12 6	(EB34)	2	VU64 (U12)	
6A7	13	9002	5 6	EF41	11	VR55			9
6A8G	10 6	9003	5 6	EF85	12 6	(EBC33)	7 6	VU111	2 6
6AC7	6 6	9004	5 6	EF86	12 6	VR56		W77	8 6
6AG5	5 6	9006	5 6	EF89	12 6	(EF36)	6 -	W729	13 6
6AK5	6 6	954	2	EF92	8 6	VR57		X65	10 -
6AK7, 6AG7	9	955	4 9	EL32	6 6	(EK32)	8	X79	11 6
6AL5	6 6	956	3 6	EL33	14 6	VR65		Z309	14
6AM6	9	10C1	12 6	EL41	10 6	(SP61)	3	Z319	14
6AQ5	7 6	10F1	12 6	EL42	11 6			Z759	11 6
6AT6	8 6	12A6	6 6	EL84	11				
6AU6	10 6	12AH8	11 6	EM34	10				

TRANSISTORS. RED SPOT, 10 - each. WHITE SPOT, 15 - each.

POSTAGE AND PACKING, 6d. per valve SAME DAY SERVICE.

6B4	5	12AT6	10 6	EM80	11
6B8G	4	12AT7	9	EY51	11 6
6BA6	7 6	12AU7	9 6	EY86	12
6BE6	8	12AX7	10	EY91	6 -
6BJ6	9	12BA6	9	EZ40	10
6BR7	11 6	12BE6	10	EZ80	10
6BS7	13	12H8	7	EZ90	9
6BW6	8 6	12H6	3	[illegible]	2 -
6BW7	10	12J5	4 6	GZ32	12 6
6C4	7	12J7	10	H30	5/
6C5GT	6 6	12K7	9/	HL23DD	
6C6	5	12K8	13		8 6
6CH6	7 6	12Q7	9 6	HL92	12 6
6D6	5	12SC7	2 6	HN309	13 6
6F1	13 6	12SG7	7 6	K40N	9/
6F6G	7 6	12SH7	5 6	KBC32	8/-
6F6M	7 6	12SJ7	8	KT24	4 6
6F13	14	12SK7	6	KT2	5/-
6F33	5 6	12SL7	8	KT33C	10/-
6F15	14	12SQ7	8 6	KT66	15/-
6G6G	4 6	12SR7	7 6	KTW63	8 6
6H6	2 6	14S7	13 6	KTZ41	6/-
6J5G	5	15D2	7 9	LP220	5/-
6J5GT	5 6	20D1	10 6	MH4	7 6
6J5M	6 6	20L1	13 6	MH41	7 9
6J6	6	20P3	13 6	N78	12/6
6J7G	6 -	20P5	11 6	P61	3/9
6K6GT	7/-	25L6GT	9 6	P215	3 11
6K7GT	7/-	25Y5G	9 9	PEN A4	15
6K7G	5 9	25Z4G	9	PEN25	5/
6K7M	6 9	25Z5	9	PEN46	7
6K8G	8 9	25Z6GT	9 6	PEN220A	
6K8GT	9 6	30F5	12 6		4 -
6L6G	9	30FL1	12 6	PCC84	10/-
6L7	7 6	30P4	15	PCF80	11/-
6L18	11 6	35L6GT	9 6	PCF82	12 6
6N7	7	35W4	9	PCL83	12 6
6P25	13 6	35Z4GT	8 6	PL81	13 6
6Q7GT	9	35Z5	9	PL82	10/-
6SA7GT	8	50L6GT	8 6	PL83	12
6SG7	7 6	[illegible]	3 6	PP225	3 11
6SH7	6	210DDT	5 6	PX25	12 6
6SJ7	8 6	210VPT	4 6	PY80	10/
6SK7	6/-	AC6/PEN	6 6	PY81	10/-
6SL7	8	ATP4	3 6		

ACOS MICROPHONES

MIC 36 SERIES

A good quality omni-directional microphone with flat response from 50 to 7,000 c.p.s.

MIC 36-2 Table Model without switch.
MIC 36-1 Table Model with switch.
MIC 36-5 Without switch, with adaptor for floor stand.
MIC 36-6 With switch and adaptor for a floor stand. The adaptor incorporates both a 5/8in. and 1/2in. 26 T.P.I. thread.

Without switch, **£3.3.0.**
With switch, **£3.8.0.**

MIC 33-1 WITHOUT SWITCH

A crystal hand or desk microphone designed for the high quality public address and tape-recording field, incorporating a specially designed acoustic filter giving a response flat from 50 to 7,000 c.p.s. The microphone is omni-directional and housed in an attractive plastic case.

Without switch, **£2.10.0**

MIC 33-2 WITH SWITCH

With switch, **£2.15.0.**

MIC 35-1

A general-purpose hand microphone of robust construction with substantially flat response from 50 to 5,000 c.p.s. Suitable for use in recording apparatus, public address equipment, etc. **£1.5.0.**

MIC 35-2

The same as MIC 35-1, but fitted with a small desk stand. **£1.6.6.**

APEX BAND III CONVERTER (Mark II)

★ B.B.C. or I.T.A. at the touch of a switch.
★ Built-in power supply for 200-250 v. A.C.
★ Variable fine tuner and gain control. Separate mains on off switch.
★ Robust construction for mounting on top or side of cabinet.
★ Size only 5¼in. x 4¼in. x 2½in.

Retail Price **£5.15.0** complete.

RECORD PLAYER UNITS

B.S.R. MONARCH

Four speed automatic record changer unit. Plays 7in., 10in. and 12in. records automatically with "BAKELITE DISK" Selector Turnover Pick-up. Unit Plate 14½in. x 10½in., **£8.15.0.**

COLLARO Model 3/544

Three speed single player. 4 separate steps, fitted with Studio pick-up. Cream finish, **£6.19.6.**

COLLARO

Four speed automatic record changer unit. 4 fully moving autochanger with many advanced features. Unit plate 12in. x 13in., **£9.15.0.**

Carriage on above units, 4/6.

8in. P.M. SPEAKER UNITS

With output transformer. Removed from units in perfect working order. Special Price **11/6** each. Postage 1/6.

WESTINGHOUSE RECTIFIERS

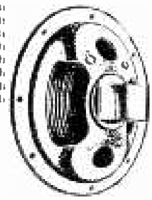
16RC-1-1-16-1	...	9/- each
18RA-1-1-16-1...	...	6/6 each
18RA-1-1-8-1 ...	...	4 each
14RA-1-2-8-3 ...	...	25. each
14A.86 ...	...	13/9 each
14A.97 ...	...	13/6 each
14A.100	...	15/- each
14A.124	...	27/6 each
14B.130	...	31/6 each
LW7 ...	...	23/9 each
WX6 ...	...	3/6 each

LOUDSPEAKER UNITS

Make	Type	Size	Price
Elac	Square	3½in.	19/6 each
Lectrona, Plessey	Round	5in.	17/6 each
Goodmans, Plessey	Round	6½in.	18/6 each
Goodmans, R. A. A.	Round	8in.	19/6 each
Plessey, R. A. A. Elac	Round	10in.	25/6 each
Plessey	Round	12in.	35/- each
Rola	Elliptical	7 x 4in.	19/6 each
Elac	Elliptical	10in. x 6in.	25/6 each

All the above are PM units with 2 to 3 ohm speech coils.

R.F.C. 12in. Heavy Duty 20 watts model, 15 ohms Speech Coil, **£5.5.0.**
8in. Mains Energised Speaker, **£1.**
6½in. Mains Energised Speaker, **17/6**
8in. Mains Energised Speaker, **£1.1.0.**
All have field coils of approx. 1000 ohms.



SPECIAL OFFER

Just a few 8in. units by Goodmans and Lectrona fitted with standard output transformer, **£1.1.6** each.

HEADPHONES-MICROPHONES

EX-GOVERNMENT HEADPHONES AND MICROPHONES

CLR Low resistance type 120 ohms, **7/6** pair.
Throat Microphones, American surplus, complete with strap, lead and plug type T30B, **3/-** set.
High Resistance Phones, 4,000 ohms, **13/6** pair.
High Resistance DLR Phones, **16/-** pair.
Ex-R.A.F. Microphone, Type 58 with Switch, **3/6** each.

OUR 1957-1958 CATALOGUE IS NOW AVAILABLE TO ALL READERS OF THIS MAGAZINE. 48 PAGES OF COMPONENTS AND EQUIPMENT OF INTEREST TO ALL RADIO ENTHUSIASTS. SEND 1/- IN STAMPS FOR YOUR COPY NOW.

ALPHA RADIO SUPPLY CO.

103 LEEDS TERRACE WINTOUN STREET LEEDS 7

TERMS: Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 1/-; 20/- add 1/6; 40/- add 2/-; £5 add 3/- unless otherwise stated. Minimum C.O.D. fee and postage 3/-. All single valves postage 6d. Personal Shoppers Monday-Friday 9 a.m. to 5 p.m. Saturday 10 a.m. to 1 p.m.

The Radio Show, 1957

OUR CORRESPONDENT REVIEWS SOME OF THIS YEAR'S EXHIBITS

By the Marquis of Donegall

THE television features of this year's Earls Court Show are dealt with in our companion paper "Practical Television," so we shall confine ourselves here to sound radio and other aspects of the exhibition.

Many of my remarks on the general trend of the show apply, however, as much to radio as to television. For instance, the general tendency towards Continental styling—gloss finish and "gold" metal trim and the growing of streamline legs on to console models. It was, in fact, obvious that the manufacturers had made an all-out effort to make the radio set fit in with the furnishings most likely to prevail in the modern home.

In the case of television, this year's show celebrated a definite 21st birthday. To fix anything quite as marked as that in the case of radio is more difficult. But if we look back 30 years—as I have done in my journalistic files—it would seem that radio as we know it was first put before the public on a big scale at the Olympia Exhibition of 1927. Previous exhibitions at the White City and at the Albert Hall had been chiefly devoted to the home-construction of sets—mostly crystal sets at that—the multi-valve set being decidedly the exception. Anyway, 1927 saw the end of Donegall's faithful cat's-whisker contraption and, as far as the show was concerned, it marked the end of knob-studded panels with trailing wires and unsightly batteries. The novelties introduced were the all-mains set, the superheterodyne and the gramophone pick-up. At one jump I plunged from the ridiculous to the sublime and bought myself a portable—at least it had a handle for those of Samsonic strength—that got Schenectady, Pittsburgh and most of South America quite regularly from my flat in Westminster. And that, youngsters, is more than any of your 1957 portable sets will do!

Apart from the improved styling of cabinets and the "leg" display, practically every manufacturer had concentrated on smaller, more efficient and more colourful portable sets. Starting with the giants, there were the larger TV/V.H.F. radiograms, with special loudspeakers and other features for improved sound. A good example was the model 1628 H.M.V. at 57 guineas. This stands on legs and includes storage space for records, but has no TV.

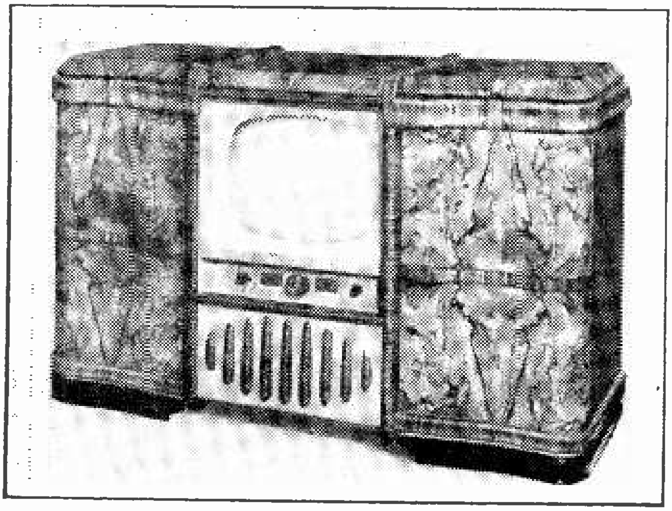
As no separate radio chassis is involved there were more TV radiograms than ever before. Nearly all the familiar makes had them but I noticed particularly attractive examples by Ultra, G.E.C., Decca, Ekco and Pye.

Continental ideas have certainly elongated the radiogram. Very compact models for flats were shown by Invicta and K.B., but the vertical design is becoming rare. The trend is for low models with lids and wide models with sliding doors. The "new look" is horizontal with metal trim.

Hi-Fi

Horizontality has the advantage of allowing ample space for record storage and gives room for several loudspeakers. R.G.D. and Regentone had no less than five, and arrangements up to four loudspeakers were quite frequent. By this means sound acquires a 3-D effect and the frequency response is smoothed and extended—a development necessitated by the V.H.F. radio and included in nearly all radiogram chassis, as well as for the purpose of doing justice to hi-fidelity records.

Acoustic chambers, cross-over filters (ensuring that each speaker receives only the frequencies it can handle) and high-grade pick-ups (including the variable-reluctance type), were other features to ensure the radiogram competing with unit hi-fi equipments. Prices ranged from £50 to 80 guineas for the de luxe designs.



A luxury TV-Radio, Tape Recorder and 4-speed Record Player, by Sobell.

Printed Circuits

Printed circuits and tremendously increased use of transistors have resulted in every manufacturer producing a mains-battery portable and/or a midget A.M. radio. H.M.V.'s model 1410 at 13 guineas is a battery receiver weighing only 2¼lb. Typically, a printed circuit is used throughout, three low-consumption valves and two transistors. Similarly, but with the tuner on top for L. and M. wavebands, the 12½ guinea Cossor is rather like a 10in. wide box-type lady's handbag. It comes in black and white or tweed green and dark green with a polythene protective wrapper and weighs 6lb. with batteries.

At 19 guineas Cossor have an all-transistor pocket radio about the same size as my American Zenith seven transistor job. Cossor's is a four transistor set for medium waveband reception finished in red, buff or grey artificial lizard skin (6in. × 3⅜in. × 1½in., weight 17oz.).

Actually, the smallest set in the show was the Perdio with dimensions of 5¾in. × 3¼in. × 1in., also a transistor pocket set.

Portables

Transistor battery sets are still too expensive to menace the little 4-valve portables retailing at about 11 guineas, of which good examples were shown by Murphy, Philips and Stella, the average being about half the price of transistor models. But several new transistor sets have been developed by, for instance, Cossor, G.E.C., K.B., Pam and Peto-Scott, with the advantage of very low running costs—perhaps a ¼d. a day or less. (I have been running my Zenith for nine months and have not yet had to buy a new midget Ever Ready battery for it!)

Development now continues in reducing the number of transistors in an average set from 8 to 6 while at the same time striving for improved sensitivity and increased volume.

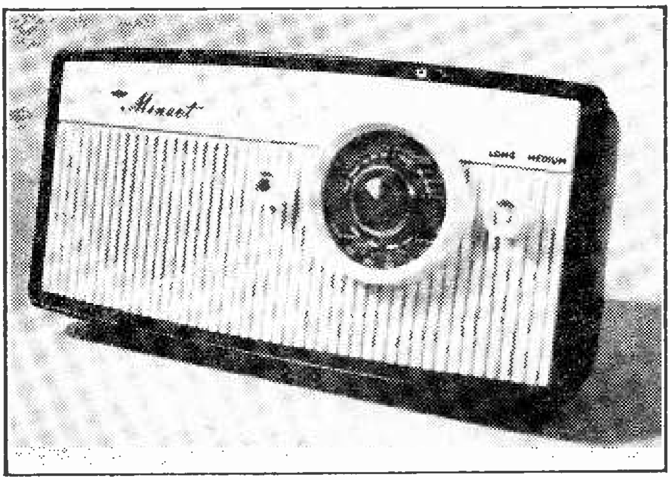
There were two items that do not seem to fit into any particular category. The first was a TV radiogram recorder by Pye, which, it should be mentioned, uses not tape but magnetic disc. It is called the Pye "Trio" and costs £167 5s. 6d. complete with the necessary accessories.

Having been asked by several American record companies whether my Donegall Sound Studios are prepared to supply stereophonic tapes—and having answered in the affirmative—I was naturally interested in G.E.C.'s demonstration of their latest stereophonic technique which incorporates what they call their Periphonic loudspeaker system. For the benefit of those who have not yet ventured into the labyrinth of stereophony, the object is, of course, to create the impression of depth and width in sound so that each ear receives sounds that are similar in nature to those that each ear receives at a live orchestral or other performance. (To put it at its simplest, it is the same idea as the old stereoscope of our childhood that you looked through and two photographs merged into 3-D.)

G.E.C.'s problem has been to find a method for correcting the destruction of balance so far inherent when the listener moved away from a central point between the strategically placed loudspeakers. Such correction has been found possible for time differences up to a maximum of about one-five-thousandth of a second by differences of sound intensity. After this, the position of the apparent sound source becomes less well defined.

Planned Furniture

To continue for a moment with displays that fitted into no particular category, I was impressed with Pamphonic's "Hi-Fi in G-Plan" furniture. The idea is to eliminate cluttering-up the living-room with a monstrous radiogram and an equally incongruous television set that completely wreck any pretensions that the room may have towards artistically planned furnishing. The way to avoid this terrible state of affairs, says my friend Pamphonic's Victor Weake, is to call in one of his experts who will proceed to incorporate any amount of Hi-Fi into your dwelling so that its outward and visible signs are hardly noticeable at all. Towards this end he showed me a piece of furniture which I would call a sideboard but he chooses to call a G-Plan Librenza. Be this as it may, the Thing goes along quite a bit of a sitting-room wall or can be used as a dividing unit between living-room and dining-cubicle. On the Thing (or should I say in it?) Mr. Weake will be delighted to put you an F.M. radio unit, a record-player, a pre-amplifier, an amplifier, record storage and a loudspeaker. Doubtless, if suitably remunerated, he would also find space on or in the Thing for a television, a tape-recorder, acetate disc-cutter and an infra-red cooker—with ample space on the shelves remaining for books, the collection of jade, a bit of Dresden china and that crystal with a snowstorm round the Eiffel Tower that you have been wondering what the devil to do with since you brought it back from Paris two years ago.



A new K.B. receiver—the Minuet, a five-valve mains transportable.

RETURN-OF-POST SERVICE

PLEASE NOTE NEW ADDRESS

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.

MULLARD TAPE AMPLIFIERS

All components for these Amplifiers as described in the Mullard Publications are always carried in stock.
AMPLIFIERS TYPES A & B.—See our Advert. in P.W. October issue for detailed prices or send for free price list.
AMPLIFIER TYPE C.—This is a new version of the Type B Amplifier. Send for free price list and details.

TELETRON COMPANION

We can supply complete kits for this popular Transistor set for **92 6** post free. All parts available separately. Send for list. Instruction Leaflet, **6d.**

JASON FM TUNERS

We can wholeheartedly recommend this tuner as being one of the most satisfactory of all FM Kits. Construction is easy and results first class.
Our kits are really complete, the Instruction Book, all components, valves and small items such as nuts, bolts, wire and solder all 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 available separately and our fully detailed list is available free upon request. Instruction Book **2 3** post free.

MULLARD 510 and GEC 912 PLUS AMPLIFIERS

We carry full stocks for all versions of these popular Amplifiers and our price lists are available free.

TEST INSTRUMENTS

AVO METER MODEL 8.—This finest of all Test Meters is always in stock. Cash Price, **£23.10.0.** Credit Terms, Deposit **£3.9.0** and seven monthly payments of **£3.3.0.**

RECORDING TAPE

All sizes of tape and empty spools by the following makes are stocked. BASF, Emitape, Ferrograph, MSS and Scotch Boy. We have a list of these available which includes details of many Tape Accessories which we also carry.

GRAMOPHONE STYLI

Full range of replacements always available. In every case we supply only Stylus by the actual Pick-up manufacturer concerned. Full list available. A range of Gramophone Accessories also available.

GRAMOPHONE EQUIPMENT

BSR MONARCH RECORD CHANGERS.—The latest four-speed model with turn-over crystal pick-up. **£8.2.6.** Credit Terms, Deposit **£1.5.0** and seven monthly payments of **£1.2.6.**
RECORD CHANGERS AND PLAYERS.—We have a selection of these by various makers with some at special prices. Write for our latest list of offers.

TRANSISTORS

SURPLUS TYPES
Special offer of the famous Red Spot. **7 6** each. Four for **27 6.**
RF Junction Type. Red Yellow Spot, **21/-.**
AF Junction Type. Red Green Spot. Pair in push-pull give 250 mW. **10 -** each.
MULLARD TYPES
OC70, **21/-**. OC71, **24 -**. OC72 Matched Pairs, **60 -**.
All transistors post free.

TRANSISTOR COMPONENTS

We have many types of miniature and sub-miniature condensers and other components. Fully detailed list available free.

GOODMANS SPEAKERS

AXIOM 150 Mk. II.—This most popular of all 12in. speakers is available for immediate delivery. Frequency range is 30 to 15,000 cycles. Handles 15 watts. 15 ohms Speech Coil. **£11.5.9.**
AUDIOM 60 BASS.—Ideal bass unit in multi speaker systems. Bass resonance 35 cycles. Handles 15 watts. 15 ohm Speech Coil. **£9.12.9.**
AXIETTE.—A fine speaker for use where size is important. 8in. diam. Frequency range 40-15,000 cycles. Handles 6 watts. Available with 3 or 15 ohm speech coil. **£6.18.6.**
TREBAX.—Pressure type tweeter. Frequency range is 2.5 to 16 K cs. Impedance 15 ohms. **£6.4.0.**
CROSS OVER UNIT X05000.—For use with Trebax. Cross over frequency is 5,000 cycles. **39 -.**

WHITELEY SPEAKERS

The famous WB range of quality speakers. HF1012, 10in., **99 9.** HF912, 9in., **88 6.** HF812, 8in., **83 6.** HF816, 8in., **£6.17.0.** T816 Treble Speaker, **£6.10.0.** T10 Tweeter, **£4.4.0.**
Crossover Units. X03000 for T10, **30 -.** X01500 for T816, **38/6.**

WHITELEY CABINETS

All these cabinets are packed flat for home assembly.
Junior Bass Reflex Corner Console, **£9.9.0.**
Bass Reflex Console, **£10.10.0.**
Bass Reflex Corner Console Cabinet, **£11.11.0.**
Other types available. Fully illustrated leaflet available free.

TSL LPH65 TWEETER SPEAKER

A very popular Tweeter which can be used in many installations to give much improved top response. Simply connect in parallel with main speaker via a 2 mfd. Paper Condenser. Price **39/6.** Suitable 2 mfd. Condenser, **2/6.**

CRYSTAL SET COMPONENTS

CHASSIS with tuning dial and Aerial, Earth and Phone sockets, **2 9.** Plugs to fit sockets, **4d.** each.
TUNING CONDENSER, 3 10. KNOB, 1/-.
COIL.—HAX Coil specially made for Crystal Diodes, **3/-.**
CRYSTAL DIODES, 1/-.

TRIPLE-TONE HI-FI AMPLIFIER

The latest Triple Tone Hi-Fi Amplifier is now available. Twelve watts output from a pair of 6V6 valves. **£15.18.9.** Credit Terms, **£2.8.3** and seven monthly payments of **£2.2.6.** Detailed literature available.

TRIPLE TONE MINOR AMPLIFIER

The Popular Minor Amplifier is always available. 4 watts output from a single 6V6 valve. Three tone controls. Full AC design. Not a live chassis. **£6.19.6.** Credit Terms, Deposit **19/6** and seven monthly payments of **£1.0.0.**

NEW MULLARD CIRCUITS

Details are just to hand at the time of writing this advertisement of three new Mullard Circuits. They are :—

1. AC DC Amplifier. 7 watt.
2. Two Valve Pre-Amplifier for 510 Amplifier.
3. Mixer Unit.

It is hoped by the time of publication to have details of these to send to those interested. Please write for details of the circuits which interest you.

CREDIT TERMS

Any of the above items can be supplied on Credit Terms. Details are as follows :—

SEVEN MONTHLY PAYMENTS. Deposit 3/- in the £ and balance plus a small service charge (10% of balance, but minimum charge £1) payable in seven monthly payments.

THREE MONTHLY PAYMENTS. Deposit 6/- in the £ and balance plus a small service charge (5% of balance, but minimum charge 10/-) payable in three monthly payments.

TERMS OF BUSINESS.—Cash with order or C.O.D. Postage extra under £3. We charge C.O.D. orders as follows. Up to £3 postage and C.O.D. fee, minimum 2/5. Over £3 and under £5, C.O.D. fee only 1/6. Over £5 no charge.

WATTS RADIO (MAIL ORDER) LTD.

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Telephone : Weybridge 4556

PLEASE NOTE. POSTAL BUSINESS ONLY FROM THIS ADDRESS.

Circuits for 2 Transistors

TWO-STAGE RECEIVERS ARE VERY POPULAR, AND IN THIS ARTICLE SUITABLE CIRCUITS ARE GIVEN

By F. G Rayer

MANY transistor circuits require special coupling transformers, or are rather difficult to set up initially. Both these difficulties may be overcome by using suitable arrangements which can be expected to work satisfactorily at once, without adjustment, and two transistors can be employed in this way in the circuits given here. Multi-transistor circuits tend to grow rather complex and costly, while a single transistor is insufficient for speaker reproduction, except in favourable circumstances. With two transistors, however, relatively few components are required, and adequate volume for loudspeaker reception can be anticipated.

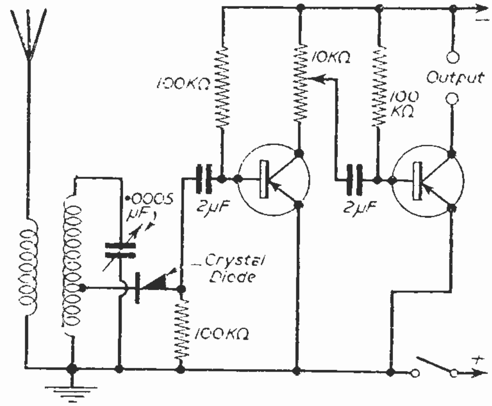


Fig. 2.—R.C. coupling.

The volume from two transistors does not approach that obtainable from two valves. Nor is sensitivity equal to that of a 2-valve receiver. A reasonably good indoor or outdoor aerial is thus required, and an earth is desirable. Two transistors can then give sufficient volume for comfortable speaker reception of the local stations. As running costs are extremely low, such an arrangement is very useful.

It is worth noting that a midget speaker is not recommended, unless small size is definitely required. For normal use, a 5in. to 6in. model, of good manufacture, is satisfactory. Some very good 3½in. speakers also exist, but smaller types, especially if of low cost, are best avoided, as volume will be reduced. However, any sensitive permanent-magnet speaker which has proved satisfactory with a small battery-operated receiver is likely to be suitable. A transistor output transformer is not essential, and this component may be of the type intended for triode output valves, and preferably of reasonably large proportions. With a multi-ratio transformer, the tags found to give best volume are used. A high ratio is not required.

Direct Coupling

A circuit of this kind is shown in Fig. 1, and requires two separate batteries, but no coupling components. It is best suited to low voltages, and only a small potential is applied to the first transistor- 1½ v. in this case. A double-pole switch is necessary. The output points are connected to phones or speaker transformer.

In Fig. 1, the first transistor acts as detector also, with base input, and this is quite effective. Transistors suitable for A.F. amplification only can be fed from a crystal diode detector, the circuit otherwise remaining unchanged.

As maximum volume from local stations is in view, a fairly tight aerial coupling is used, and is particularly satisfactory with fairly short aerials. With long aerials, a condenser of .0001μF to .0003μF may be included in the lead-in. Alternatively, the aerial may be taken to a tapping on the coil, or to a coupling winding. Any of these methods will increase selectivity.

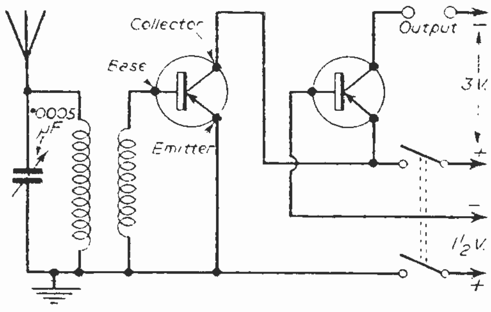


Fig. 1.—Direct coupled amplifier.

Resistance Capacity Coupling

R.C.C. is useful as the components are easily obtainable, and only one battery is required. Fig. 2 illus-

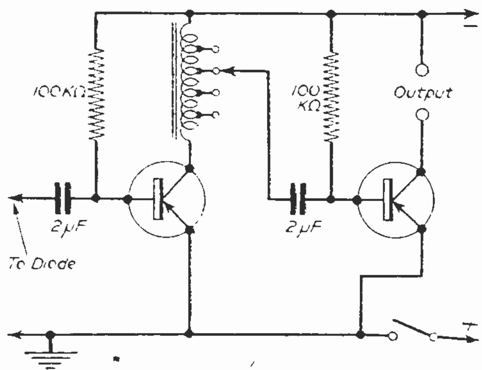


Fig. 3.—Auto-transformer coupling.

trates a circuit of this type consisting of a 2-stage transistor amplifier fed from a diode detector. The 10K potentiometer acts as A.F. volume control. The component values are not very critical, but the coupling condensers *must* be of large capacity, preferably not under 1μF.

Such a circuit may quite easily be overloaded. The simplest method of avoiding heavy currents, under such conditions, is to limit the battery voltage, and reasonable speaker reproduction is obtainable with a 3v. battery. If an increased voltage is desired, to obtain greater volume, then operating conditions should be checked with a meter.

Such a circuit can give a very useful degree of amplification. If instability develops with the volume control near maximum, the battery may need replacing, as back coupling can arise with a discharged battery having appreciable internal resistance. A large capacity condenser in parallel with the battery will help to avoid this.

It is not essential to use a tapping on the coil, for the diode. Any ordinary crystal set can thus be used to provide an input for the amplifier. But if maximum volume is to be achieved, the tapping (or a diode coupling winding) becomes necessary.

Transformer Coupling

A transformer with a step-down ratio of around 7:1 to 12:1 can be employed for inter-stage coupling. The primary is wired from first transistor collector to battery negative, and the secondary from battery positive to second transistor base. As a transistor is current operated, care is necessary that the transformer is not connected so that it provides a step-up ratio, or results will be extremely poor. Ex-service and other transformers of high inductance and moderate or low D.C. resistance will function satisfactorily in this way.

An auto-transformer can also be used, as shown in Fig. 3. This gives greater volume than R.C.C., and a multi-ratio output transformer is satisfactory. Most of the winding will require to be employed as collector circuit load, with only a small portion feeding the second transistor. The best tags to employ can be found by trial. The circuit otherwise remains the same as in Fig. 2. A fairly large transformer can give very good results, in this way.

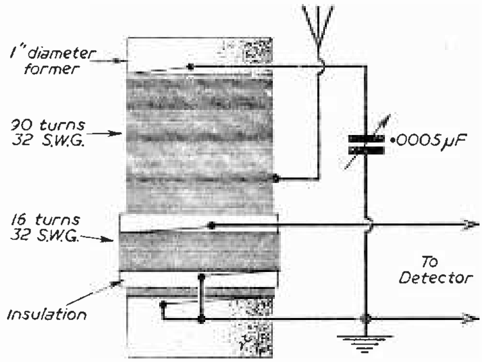


Fig. 6.—Transistor tuning coil.

A similar form of coupling can also be used with the first transistor acting as detector, as shown in Fig. 4. This requires fewer components, and will operate efficiently with most present-day transistors. Assuming that a multi-ratio transformer is fitted, the best tappings are found by trial, as explained. In all cases the transformer secondary is left wholly disconnected.

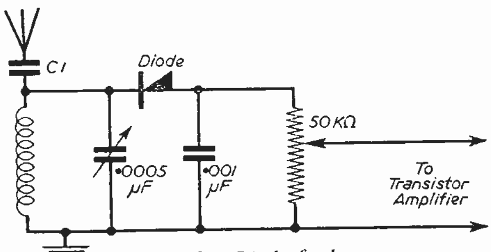


Fig. 5.—Diode feeder.

Diode Tuner

A diode tuner, with volume control, can be made employing the circuit in Fig. 5, and used to feed any transistor amplifier. When condenser coupling is employed between diode and first stage, the polarity of the diode is unimportant. But if forms of direct-coupling are employed here the negative end of the diode should be taken to the tuner output circuit. As with the other circuits, selectivity and input can be controlled by modification of the aerial condenser C1. With long, high, outdoor aerials, quite a small value is suitable. But with poor aerials, or short, indoor wires, the condenser must be fairly large (say up to .0005 μF), or it may be omitted. This circuit is suitable for use in conjunction with the amplifier in Fig. 3. In favourable circumstances sufficient volume will be obtainable with only one transistor stage. However, the use of two stages leaves a little in hand, but overloading of the output stage (causing distortion) should be avoided. This can be done by reducing the capacity of C1, or adjusting the volume control.

As already explained, volume may be improved

(*Concluded on page* 648)

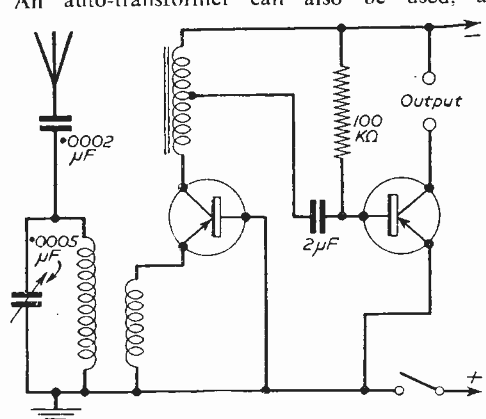


Fig. 4.—Emitter detection circuit.

TRANSMITTING TOPICS

GETTING STARTED—ADVICE TO THE WOULD-BE TRANSMITTER

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

AT regular intervals a fresh assignment of amateurs gets ready to take the air. Some of the new hands already have gear and aerial systems ready, while others are spending agonised thought on the construction of gear and the erection of aerial systems. Whatever stage the neophyte amateur is in at the instant of obtaining his licence, sooner or later he is ready to make his first essay on the air. He may, of course, be like a recent amateur who, the morning after receiving his ticket, was working American stations on Topband for his first QSOs! Whatever happens, there is usually a period in which much has to be learnt before the newcomer is a good operator or a good ham. We can examine some of these aspects, in the hope that they may be of help to some newcomers.

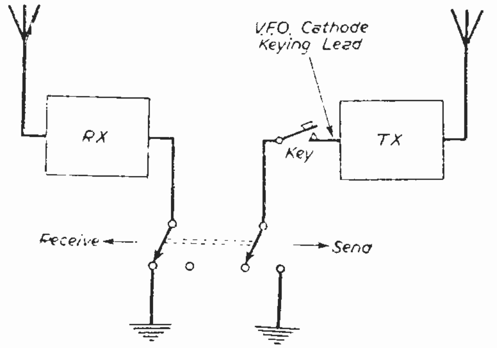


Fig. 1.—A simple two-pole double throw toggle switch can perform the function of a send-receive switch. The switch breaks the receiver H.T. transformer centre tap connection, and makes the transmitter VFO cathode connection for sending. Separate aerials or a manual changeover switch may be used for the transmitter and receiver aerial connections.

Assuming that gear capable of operation on some band is in existence, the usual first QSO or so is made with a local, usually on schedule. Topband, for example, is one of the favourite starting points, and the local ragchew net "stands by" for the new G3, and give him a report or two. Usually the new hand is so thrilled at the fact that he can be heard at all, that for a shorter or longer period he is quite happy to stick in with local ragchewing plus an occasional stab at Topband DX. Sooner or later, however, even if Topband has been the starting point, vaulting ambition lightly turns to thoughts of other bands and DX.

Here, of course, it is easy enough to lament the fact that the beginner is free to operate with 150 watts and telephony straight away. While the old restriction to a year on C.W. was perhaps too much of a good thing, a preliminary six months period on C.W. might be good. The writer, incidentally, has no personal axe to grind as he himself obtained a "full ticket" at the start. From observations on the air, however, it is felt that some mild persuasion to encourage C.W. operating is advisable.

Procedure

Whatever the gear, and whatever the situation, the amateur plunges into the rough and tumble of the competitive amateur bands sooner or later. Procedure, especially on C.W., may cause some uncertainty. The question of CQ calling, for example. Nothing is more irritating than a string of interminable CQs, especially when the signal fades right out just as the operator does decide to sign his call briefly. Moreover, when searching round the C.W. bands a station pumping out interminable CQs is passed over for more snappy operators. The too snappy CQ call is perhaps even worse. However, if no reply is received to a snappy CQ it can be repeated! Notice

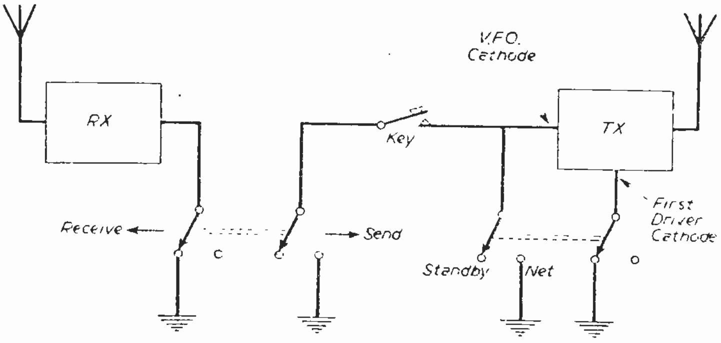


Fig. 3.—A "netting control switch" may be added to the simple control circuit of Fig. 1. In the "standby" position the transmitter is ready to operate when the other switch is thrown to "send." When the second switch is thrown to "net," the VFO only is turned on when the receiver is on, so that the VFO may be zero-beat with an incoming signal for netting purposes.

moreover that nowadays most calls are on the frequency on which a station has called CQ, at any rate on C.W. Generally five CQ signals signing once or twice plus five more CQs plus the callsign three times and signing is useful when conditions are slack. When things are busy the "three plus three" formula: three CQs and signing three times is sufficient. The sequence "CQ CQ CQ de G3 . . . G3 . . . G3 . . . AR K" is generally used, therefore, when the band is lively and activity is high. Not that the "de" sign (meaning roughly "from") is mandatory. It is poor practice to omit the "de." Even worse is the practice of sending "de" twice. This is the absolute hall-mark of the "lid," and is to be avoided at all costs. This is obvious on reflection. Suppose an operator picks up a DX CQ, which is fading in and out. He is—after VFOing to frequency—waiting alert and eager to register the callsign when it comes. The cue signal is the "de," which triggers him to register the callsign which should immediately follow.

directional or selective CQ call. Thus "CQ CQ CQ VK de G3BHJ G3BHJ G3BHJ KN" means (if one is foolhardy enough to do it) that one is looking for VK stations only, and that replies are wanted from VK stations only and that all others keep out. However, one so often hears stations putting out a "CQ ASIA" . . . and then promptly working a local European station, that (presumably) a station signing "KN" after a directional CQ really does mean business.

Generally, of course, a QSO starts with a CQ. However, on the DX bands it is true to say that a G station is unlikely to work much DX by calling CQ. In fact, by creating masses of QRM by prolonged CQ calling, G stations may create a barrage of interference when conditions are good. Generally, one is more likely to work DX by tuning around for DX stations that are calling CQ. When one locates a DX station calling CQ, it is necessary to put the VFO close to the DX frequency. It is essential to have a "netting" position, so that a weak beat from the VFO may be heard in the receiver. Depending on circumstances, it may also be necessary for the driver stages to be off as well, in order to get a comfortable intensity of beat note. With a well-screened TX it may be necessary to have the drivers on in order to hear the VFO, but with the drivers temporarily switched to another band. With the drivers on and tuned to the frequency band of operation, too much energy leaks out unless the receiver gains are turned down so as to lose the DX signal while netting. The ideal to aim at is a just comfortably audible beat from the VFO, so that one may "net" comfortably while still listening to the DX. The thing not to do is to swing the VFO with drivers and PA active across the band, thus radiating vicious squeals to all and sundry!

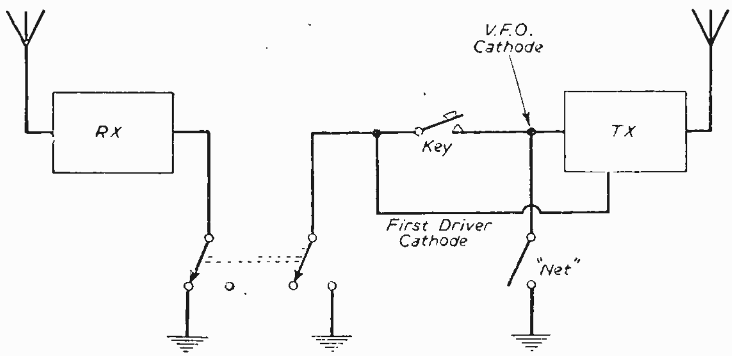
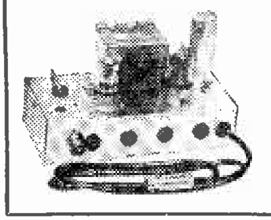


Fig. 2.—A simple "on-off" switch may be used for the "net" switch in the alternative circuit shown above. This enables a simple push button switch to be used for netting if desired.

When he fetches up with a mental jerk to find he is not writing the callsign but the second "de" the distant operator is blessed in no uncertain terms. Moreover, a station with a prefix such as 4X4 or 5A5 might be misread under QRM conditions as DE4XHT or DE5AH and thus lead to confusion, annoyance and much energy expenditure in calling a non-existent station. All double "ders" are requested to "de" once and no more before their callsigns. About the "AR" there is more freedom: while the "AR" indicates end of message it seems a little pointless to use it, particularly as the CQ and the repetition of callsigns lead to the inevitable result that the station is signing, and will be looking for calls. The "K" signal indicates, of course, an invitation for any station to call that wishes to do so. The signal "KN" on the other hand is used with the sense of "all others keep out." Thus usually "KN" is used when two stations are in QSO and do not want other stations to interrupt. When one is working rare DX with half Europe waiting on the side-lines, the injunction "KN" is certainly needed. Note, however, that the signal "KN" may also be used legitimately by a station making a

When "netting" to call DX, it is not a good idea to zerobeat with the DX. In a ragchewing local net, all stations should be zerobeat of course, but when calling DX if everybody else were to zerobeat, the mutual QRM would wipe out any sense in dreadful cacophony. In any case, when the calling stations are clustered within a kilocycle or so of the DX frequency, the resulting "pile-up" is again very difficult to decipher at the DX end. It then becomes a question of deciding just how far off frequency one should call the DX station. This must be done by both trial and error, and by estimating the spread of the pile-up. When and how long to call is also another point of importance. Listen carefully, in any case, to the DX station. Many DX stations wisely assume control of the pile-up by sending "10 U" or "10 D," for example, to indicate that they will be tuning for replies ten kilocycles up (U) or down

(Continued on page 647)



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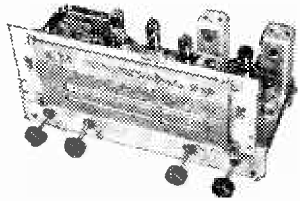

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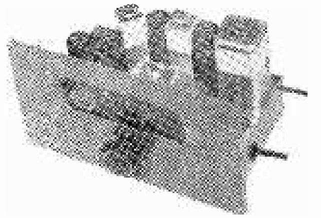

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(D) from their own frequency. Indications of this sort should be carefully watched, especially as a rare DX station working contacts at one a minute, streamlines procedure considerably. Thus, for example, an exchange of callsigns plus a single "QRZ" signal may be the only indication that the DX has finished one QSO, and is looking for other calls. On C.W., especially when there may be QRM and difficult conditions, failure to grasp exactly what is going on may lead to trouble.

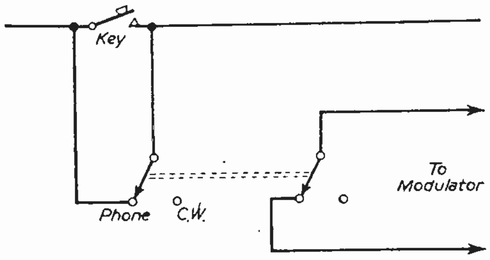

Fig. 4.—A switch shorting out the key provides for "phone-CW" switching. A second pole on the switch enables the modulator to be switched on and off at the same time.

Thus a DX station sending "QRM," and struggling to pull in signals from a station in QSO with him, may unwittingly cause a pile-up. This because the listening hordes awaiting a "QRZ" signal, under poor conditions, have convinced themselves that the final letter had two extra dots, or indeed that they missed the two dots due to conditions. Not to be backward in loosing off a call, they rapidly call the DX, and the other characters, figuring that as the DX is being called they had better not waste time either, also fire away. By this time the DX may have concluded that all the stations concerned are indulging in deliberate bad manners to break up his QSO. Usually such apparent bad manners may be due to misunderstandings at both ends. The type of "sharp practice" noted nowadays is the transparent trick of calling "CQ DX" on full power, just off the DX station's frequency. This is intended to create the impression that the calling station is unaware that a DX session is in progress, and has innocently put out a CQ. So far I cannot recollect any of such artful characters ever succeeding in getting the DX to call them!

Just what one is to do under all circumstances is a matter for personal decision. Thus in a well-conducted DX session, the procedure may consist of calling stations giving their own calls and nothing else when calling the DX. Thus when the DX has indicated—by a QRZ signal or otherwise—that he will now listen for calling stations, it is clear that all the DX needs to know is who is calling him! In other cases the technique of giving a call long enough to enable most of the pile-up to subside is used. From comments made by rare DX operators, it is clear that there is no clear cut preference for behaviour by the calling stations, so long as it is ethical. Moreover, apparently "unethical" behaviour may arise through misunderstanding. Thus one popular piece of rare DX used the simple procedure of concluding with "over" to indicate he was still in QSO, and of concluding with "tuning" to indicate he was now tuning for calls from other stations. Some observers not appreciating the subtle distinction between "over" and "tuning" were under the impression that half Europe was guilty of unethical behaviour. Confusion was increased by the fact that many stations having given a call to the DX, and hearing no reply after listening for a short period, proceeded to call further, thus being "on" while the DX station was transmitting in QSO. Such items, plus poor conditions, may easily complicate "rare DX" pile-up sessions.

Station Arrangements

Enough for the moment about operating procedure, and a little about station arrangements for operating. Clearly in the quick calling and listening sequences for DX operating, some facility is required in changeover. For local rag-chewing, the operation of a number of switches in sequence is awkward. Despite this, some operators gain an uncanny agility in flipping numbers of switches, twiddling receiver gain controls and so forth every time they make a changeover. A station has even been known to put the signal on and off the air by plugging the H.T. rectifier in and out of its socket! Relay and switching operations may be carried to a fine degree of complexity. However, remember that a relay is after all only a switch, and that a multiple

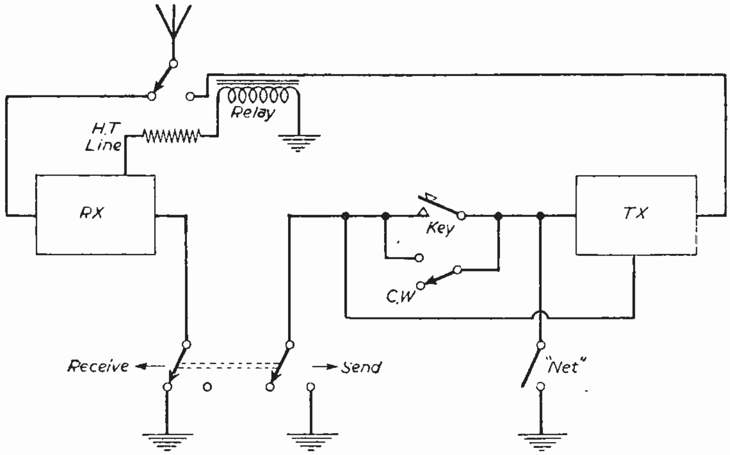

Fig. 5.—Where an H.T. line is switched, this may be used to provide for operating a relay. By this means, the aerial changeover relay may be operated. If necessary, additional relays to perform other switching functions may be employed as well. In this diagram switching the receiver H.T. line operates the aerial changeover relay.

contact key switch for example may have three positions for the operating lever. This can give "receive," "net" and "transmit" by suitable connection, and a low powered rig might be easily operated effectively by a keyswitch. Receiver muting, for example, could be handled by one position of the switch. If the PA is battery biased, a simple toggle switch can mute the receiver by breaking the centre-tap connection of the receiver power transformer, and put the transmitter on by making the VFO cathode connection, as in Fig. 1. For keying, the key may be in series with the VFO cathode keying lead. For "netting," an auxiliary switch is needed to shut off the driver stage when "netting," and this may be done by a cathode jack inserted in the first driver stage cathode, with the lead terminated in a switch (Fig. 2). If a two-pole toggle switch is used for the netting switch, operation of the net switch may cut off the driver stage and simultaneously turn on the VFO for netting (Fig. 3). This is simple enough, and at a pinch the aerial system may be manually switched, even using the good old-fashioned double-pole double-throw knife switches popular at one time as "earthing switches" for the domestic radio.

A further development of simple changeover systems incorporates relays. Where the transmitter H.T. supply is switched on and off, the H.T. line may be used—via a large dropping resistor—to operate the aerial changeover relay. A genuine aerial changeover relay suitable for such use is available from various suppliers. However, for switching the link side of the aerial tuner, an ordinary PO type of relay may be used if desired, while relays specifically designed for switching coaxial cable are available both as surplus and as new items. Generally, if an antenna tuner with link coupled output is used for the transmitter, the link connection may be switched to the receiver on reception. Using the main aerial and antenna tuner in this way gives a useful improvement in efficiency of transfer of energy to the receiver, the aerial tuner gives a little extra image frequency rejection, and the directive properties of the aerial will be exploited. Note that if a few milliamps can be "borrowed" from a switched H.T. line, this obviates the provision of a separate D.C. relay supply. However, high resistance relays are advised. The relay contacts may also be used to switch the VFO and driver stages on, with also an auxiliary "netting" switch for turning the VFO on only. With the H.T. line switched, therefore, a relay may perform the aerial changeover, receiver muting a transmitter switch or function with only the H.T. line switch manipulated. A switch breaking the H.T. transformer

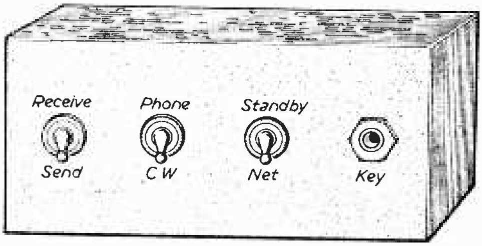

Fig. 6.—The transmitter control position after utilising the above ideas may be accommodated in a small box conveniently placed upon the operating table. A single switch serves for the changeover from sending to receiving, while "phone-CW" and "net" function switches are conveniently to hand. If a closed circuit keying jack is used, the phone CW switch might be omitted, and the withdrawal of the key will give the "Phone" position. Relays operated from receiver H.T. or the TX H.T. line will handle aerial change-over and other functions.

centre-tap thus performs the functions in a medium power pack. In higher power packs, a high voltage rating ceramic switch is advised, or alternatively in a high power pack, the filaments may be lit from separate transformers, and the H.T. transformer switched by a switch in the A.C. supply to the H.T. transformer. However you perform the functions, remember that careful listening is the important part of operating. Even when you are in QSO, you only transmit some 50 per cent. of the time, and the actual percentage of "shack time" spent in actual transmission is quite low. Careful listening will ensure that when you do transmit, you will make most effective use of your transmitter, and not expend effort in extended and fruitless calling!

CIRCUITS FOR 2 TRANSISTORS

(Concluded from page 640)

by using a tapped coil, or coupling winding, for the diode. If a tapping is employed it can be about one-fifth the total number of turns from the earthed end of the coil. Small, dust-cored coils are satisfactory, if of efficient design.

An air-cored coil, with diode coupling winding, can be made as shown in Fig. 6. The former is 1in. to 1⅛in. in diameter, and at least 2in. long. For tuning purposes, 90 turns of 32 s.w.g. enamelled wire are wound on, side by side, and tapped at about one-half the total number of turns to provide a point for the aerial connection. A layer of insulating tape is then wound over this coil, as indicated, and the coupling section added, leads from it passing to diode and earth.

Such a coil is suitable for the medium wave band and also for circuits of the type shown in Figs. 1 and 4. If the aerial is poor, so that volume is low, the tapping can be omitted. Or a condenser may be employed instead, as in Fig. 5. As aerial-coupling is loosened (smaller value for C1, or tapping nearer earth on the coil) selectivity will increase, but volume will fall. Optimum results thus depend upon individual adjustment, to suit the aerial and local conditions. The coupling employed is not critical, but if selectivity is inadequate with a good aerial, it should be remembered that this can be overcome by loosening aerial coupling. Selectivity is usually greater with a transistor detector than when a diode is employed.

The cheap junction-type of transistor, easily obtainable, will be found satisfactory in these circuits, though their performance naturally varies somewhat. Connections to emitter, base and collector must always be correct, and on no account must the battery be connected in the wrong polarity.

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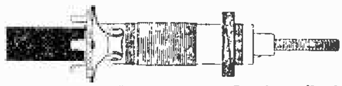

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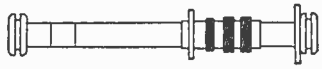

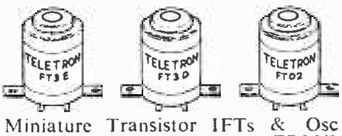

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TETRODES as TRIODES

IMPROVING THE OUTPUT STAGE BY MODIFYING THE VALVE CONNECTIONS

THE reduced harmonic distortion of the triode, compared with tetrode or pentode, is well known, but it is not always realised that output tetrodes and pentodes may readily be employed as triodes. When the circuit does not employ negative feedback, the improvement in quality will generally be at once audible. Triode operation results in reduced gain and power-handling capacity, so that the modification is best suited to equipment where the full output previously obtained with the tetrode working is not really required.

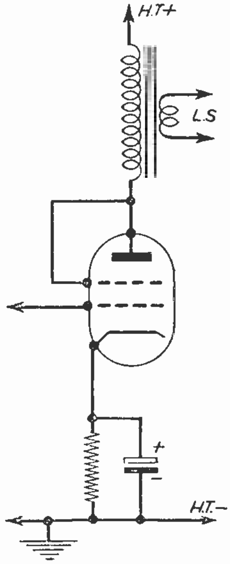

Fig. 1.—Single valve triode circuit.

When the output stage employs a single valve, the screen grid is wired directly to the anode, as in Fig. 1. Even with no other modification, an improvement should be noted. But for optimum results, the anode load should be reduced to approximately one-half its previous figure. For example, valves such as the 6V6 or 6BW6, with 250 volt H.T. supply, will normally require a load of 5,000 ohms for tetrode operation, but only about 2,000 ohms for triode working. With a 2/3 ohm speaker, the transformer ratio would thus need changing from about 45:1 to approximately 27:1. With a 15 ohm speaker the ratio would be reduced from 18:1 to 12:1. Fortunately triodes are less influenced by mismatching than are tetrodes, so that an improvement is possible even with the original output transformer.

Bias and other circuit details remain unchanged. However, if a top-cut condenser is present, either from anode to earth line, or in parallel with the speaker transformer primary, it should be removed or much reduced in value. Values of .01μF or even larger may be found with tetrodes and pentodes, and are fitted to reduce the harmonic emphasis with these valves, which is usually given as about 6 per cent. to 12 per cent., according to valve type. Such condensers are not required with triodes, and their removal will increase the realism of the upper register.

Push-pull

An improvement is also obtainable with a push-pull stage, though harmonic distortion is already much lower than with a single valve. Typical ratings for the 6V6 show over 3 per cent. harmonic distortion for tetrode working, falling to only 0.5 per cent. for triode operation.

If an output stage employing two such valves is to be built, the values shown in Fig. 2 will be found satisfactory. The 100 ohm resistors are oscillation stoppers, and will not always be required. They also tend to equalise performance. The optimum load is about 4,500 ohms, requiring a transformer of about 42:1, centre-tapped, for 2/3 ohm speaker.

If an existing circuit is to be modified, it is only necessary to change the screen grid connections and to reduce the anode load, if possible. With a multi-ratio output transformer, alternative tappings suitable for triodes will usually be present. Any top-cut or "tone correction" condensers should also be removed, or reduced in value.

No difficulty should arise in modifying any mains or battery receiver or amplifier output stage in this way. It is important to remember that the screen grids are not left disconnected, but must be wired to the anode. With some valves it is necessary to check that the maximum screen grid voltage will not be exceeded with the new form of connection.

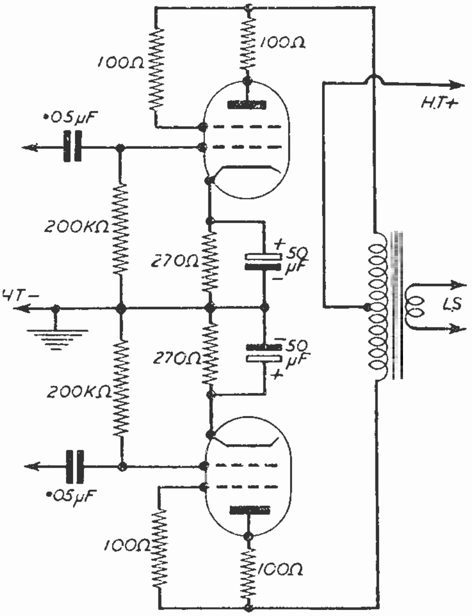

Fig. 2.—Push-pull with oscillation stoppers.

Programme Pointers

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

A SECOND hearing of "These Foolish Things" prompts one to wonder whether a synonym and an antonym can be found combined into one word. Conducted by Roy Plomley and based on an idea of Nancy Spain's, it is certainly foolish and inconsequential, yet leaving a feeling behind of a certain amount of brains and thought having gone to the devising and producing of it. It has reasonable entertainment value, and, within limits, is a likeable half hour. Kay Hammond, Charlotte Mitchell, René Cutforth, Monia Banishevsky, Geoffrey Grigson and Ivan Staff reminisced when I last heard it. What would Frank Muir and Dennis Norden do with it? (Producer, please note.)

A series of problems in detection by John P. Wynn, entitled "Inspector Scott Investigates," is now running. Reminding one of the competitions promoted by many commercial firms, in which the errors purposely put into a picture have to be spotted and the competitor detecting the most wins a four-figure cheque (providing his or her entry is accompanied by a stated number of wrappers off the article advertised), listeners are asked to guess how many mistakes have been interpolated into the unfolding of the story. A minute, filled with sweet music, is given for this purpose at the end of each episode. Inspector Scott is played by Deryck Guyler and the series produced by Vernon Harris.

Musical Quiz

The musical quiz, "Off the Cuff," run by Antony Hopkins, is as different from Joseph Cooper's "Call the Tune" as any two things presumably of the same genre can well be. "Off the Cuff" is very funny, light-hearted and irresponsible, most enjoyable, and excellent entertainment. The questions are set by Spike Hughes and the panel, on the evening I heard it, was made up of Carole Carr, Dick Bentley, Eric Sykes and Denis Matthews. To make sure that the proceedings didn't plumb too serious depths, "Flotsam" gave an amusing and clever sketch illustrating the evolution of one of his own tunes from Sullivan's "Lost Chord." May I bring to his notice the first notes of both "Delia" and "The Merry Widow" waltzes and that of the "Maid of the Mountains"? There are, of course, hundreds of tunes built on the same foundation. The series is admirably produced by Roy Speer.

Music

Music in the bulk occupies more radio time and programme space than any other "line." On the technicality of programme hours I stand open to correction: it seems that there is a vast corpus of sound at all times and in all seasons—symphony and promenade concerts, operas, recitals on every imaginable instrument and combination of instruments as well as light music in all its garishness and noisiness. Yet "The Critics" have never been known to tackle it. Would it not be a welcome change if they co-opted, from time to time, a musical colleague? A man of perception and objectivity should have wide, open spaces to wander in!

Plays

Young wife with good but stern, unromantic husband meets romance and flashy admiration at the hands of a young Frenchman and runs off with him to have her thrill while it lasts. This is more or less the theme of Caryl Brahms' "Away Went Polly," dramatised by herself from her own novel. But it has been done, of course, hundreds of times before. Here it was fashioned quite attractively and charmingly played by Yvonne Mitchell, Brewster Mason, Betty Hardy, Simon Lack, David Peel and Marianne Deeming.

Another rather corny piece based on an age-old theme—but not without entertainment value—was Bill Naughton's "My Flesh, My Blood." The ruthless stickler over dogma, caring only for the letter of the Law, ruins his family with his tyranny and religious megolomania, until his poor, wretched wife tries to end her miseries, albeit unsuccessfully, when the old man melts like an ice-cream in a child's possession; all is transformed and forgiven in the last few minutes of the piece, and Edward Chapman, Noel Dyson, Nan Marriott-Watson, Alan Rothwell, Valerie Miller, Brian Peck, Shirley King and Brian Trueman all live happily ever after.

The Third

A very good piece on the Third was Wyndham Lewis's "The Revenge for Love." Dealing with the comings and goings from the Spanish Civil War of various characters, including Communists, it was full of meaty lines and excellently acted. I remember one line of the narrator's in particular. Percy Hardcaster loses a leg in that war. Back in London he has been making love to Gillian on the sofa and having a rare old time generally, when suddenly we are told "he jumped to his feet. . . ." Wonderful things happen on the Third! But, joking apart, it was very good. Cast: Stephan Murray—narrator, J. Phillips, C. Leno, J. Richmond, Bettina Dickson, R. Napier, Isla Cameron, A. McClelland, O. Pooley and R. Snowdon. Producer, D. G. Bridson.

Open to Discussion

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

Music and Movement

SIR,—May I thank Thermion and say how whole-heartedly I agree with him in his criticism of "Music and Movement"? I am not yet a qualified teacher—I am still training at the City of Worcester Training College—but even in my short contact with education I must say that I am whole-heartedly of his opinion with regard to "Music and Movement."

It seems to me that the majority of the teaching profession are unwilling to voice their criticisms of it whereas the minority — probably teachers(?) of it—are in fear that their positions in the schools will not be justified.—T. MOORE (Yorks).

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.

High-cycle Transformers

SIR,—I was interested in the article on using high-cycle transformers printed in the June issue of PRACTICAL WIRELESS.

For the interest of readers who possess a "high-cycle" transformer or items of equipment containing one, I would like to point out that I have for some time now been running a small television from one of these transformers.

The only modification required turned out to be a 10μF condenser in series with the supply lead.

After testing the set-up it was found that all three heater windings, H.T. winding, and E.H.T. winding were at the required voltage and that there was negligible difference in voltage under different loads.

The condenser used was a large ex-W.D. 10μF with a 250KΩ resistor across it to discharge the condenser when the mains was disconnected.

In this way the unit used (a type P25 receiver) was almost unmodified, where changing the transformer would have been economically out of the question.—J. ROSS (Falkland).

Earliest Tape Recorder?

SIR,—In recent editions of PRACTICAL WIRELESS there have been articles on early tape recording. The earliest type of recording known is supposed, as mentioned by W. A. Steele, to be around 1913.

I have, however, an old book by Charles R. Gibson in which he describes "a telephone with a memory." The book was published in 1905. To quote the author:

"If one pictures for a moment a telephone transmitter sending out a varying current to the distant magnet, and if one recalls how the magnet acted upon a diaphragm, then we have only to replace the stationary disc by an iron wire passing in front of and slightly touching the magnet, the wire thus being magnetised by the influence of the electro-magnet which is varying under control of the speaker's voice."

He then goes on to explain how, if in turn the magnetised wire is passed again in front of the electro-magnet it will impart its magnetism to the electro-magnet which will in turn produce sound in a telephone receiver.

The purpose is that if "A" calls up "B" on his telephone and "B" is not at home the instrument described above will take the message and impart it to "B" when he comes home. Whether it works or not I do not know. Perhaps some reader would like to give it a try.—J. TAYLOR (Londonderry).

An Aerial Idea

SIR,—During some recent investigations into aerial design I discovered that a quarter wave aerial, the ends of which were placed in the aerial and earth sockets of an ordinary domestic receiver will greatly increase the sensitivity to such an extent as to enable amateur transmissions from most parts of the world to be received with good readability and signal strength. The aerial system has high directional properties but care should be taken in making sure that the spacing between the two major sides is not less than .025λ and the total length one quarter of the required wavelength. It is also advisable to give a word of caution with respect to the working conditions of this system. These may be classified as follows:

(a) Reception is limited to a narrow band of frequencies, i.e., a quarter wave aerial for 20 metres will not be responsive on fractions or multiples of this frequency and will therefore be useless for work on 40 and 80 metres, etc.

(b) The system is unresponsive when used in conjunction with receivers using regenerative principles in the form of reaction control.

(c) Since the aerial is highly directional, it is worth spending some time in arranging the position of the system.

Before the introduction of this aerial I was continually troubled by the high noise level on the 20 metre band, but since its introduction I have received some very remarkable transmissions which were unreceivable by local amateurs using their communications equipment. Amongst these were signals of QRK5/QSA7-9 from the following countries. North and South America, Alaska. Greenland. USSR, Greece. North and South Africa, and the Far East. All these transmissions were amateur, and not commercial stations.—J. C. BROGAN (Ayr).

Resonant Smoothing Circuit

SIR,—Mr. M. E. Kerwood's "Resonant Smoothing Circuit" (PRACTICAL WIRELESS, September, 1957), whilst well known, must be used with discretion and for practical purposes cannot be calculated with any accuracy from nominal component values. The latter have normally wide tolerances and to obtain resonance, experiment is usually necessary. Furthermore, having obtained some degree of resonance, undesirable oscillations can be induced into the H.T. line which may seriously affect the performance of the equipment. —Edward A. STOTT (Harlow).

Tape Recorder Maintenance

SIR,—Your contributor's reference to the cleaning method of erase and record/playback heads by use of carbon tetrachloride should be corrected. Where the head housing or case is made of thermo-plastic materials, this and any similar acetone fluids can cause damage. Pure alcohol (obtainable in small quantities from usual chemist shop) is a safer medium where heavy oxide deposit is noticed. Much of the deposit, however, can be cleared by use of an orange stick or alternative the free end of an ordinary match. —A. J. HOWARTH (Worcester).

The R1155

SIR,—I'm sure I am one of hundreds who own an R1155A, and curse the day when we bought it. The reason being that it leaves out the 1.8 Mc/s Ham Band.

We all need a low-cost high-performance converter which is in the reach of all of us. Therefore I would like to see an article on this. Can any reader help us?

I have followed all your modifications to the 1155.—ALAN BEAZLEY (Wilts).

Queer Faults

SIR,—I think it would be very interesting if readers—especially those who are engaged permanently on servicing—would give us some of their experiences in the way of queer faults. It is all very well being told that, for instance, if anode current is low, try the valve, etc., but there are times when everything tests O.K. according to the book. It is then that we have to search for something which is not in the book and that takes not only time, but all the patience which we possess. By listing some of the queer things which have been experienced one gets an idea of the lines which might have to be followed and, apart from the experience gained, much time is saved. As a matter of interest I would mention a fault which comes within this category, and although it occurred some years ago it is vouched for by one of the largest manufacturers in the country and was experienced by their service department. A customer reported that the set he had purchased was useless. When asked why he stated that it only picked up yesterday's programmes. A serviceman was sent round and the customer demonstrated with the aid of the published programme and the set that this was apparently a fact. He was ridiculed, but the set was asked for and on first testing in the service department it apparently was only picking up direct, the programme radiated the day before. There was a fairly simple solution, but for the time being everyone was completely mystified, as this was something which couldn't happen, yet apparently could be demonstrated. What do you think was wrong? I am sure mysterious faults like these will interest other readers.—H. G. TRAIL (Edgware).

Circuits and/or Wiring Diagrams?

SIR,—Your leading article in the September issue of PRACTICAL WIRELESS is very interesting to me, as I had been hoping for some time that the subject of circuit and wiring diagrams would be raised.

In July of last year I achieved a long-awaited ambition by attempting a small portable design contained in previous issues of PRACTICAL WIRELESS, and had a certain amount of success. The circuit diagram, however, at the time, was just "Greek"; the wiring diagram being the only understandable feature.

Other PRACTICAL WIRELESS designs followed, and were only completed by following the same procedure. However, in January of this year I tried (which was, for me) something a little more ambitious, a four valve portable battery superhet. Not a sound issued from the speaker! I tried for a week to trace my mistake, without success, and eventually realised that to be able to read a circuit diagram like a book was the only remedy, so I bought your "Beginners' Guide to Radio." What a revelation this publication proved to be! I learned how a valve was drawn, what the symbols meant and how components were connected.

Having gone through most of the early frustrations of someone new to the hobby I can now achieve reasonable success, but I find that the most useful forms of equipment dealt with in your columns are those (1) with a circuit diagram, (2) with comments by your contributor on alternative valves and components and (3) a chassis layout.

In conclusion, may I take the liberty of suggesting a new feature for PRACTICAL WIRELESS? Many beginners, such as myself, attempt to make up various pieces of equipment (invariably amplifiers) from valves and components that we have to hand. A recent attempt on my part provided me with ear-rending distortion—and only negative feed-back, stolen from an issue of PRACTICAL WIRELESS, helped to diminish the noise.

If you allowed readers to send these circuits to you for publication and you pulled them to pieces, explaining electrically why you suggest certain modifications. I am sure we would all benefit accordingly.—A. R. MARTIN (Sutton).

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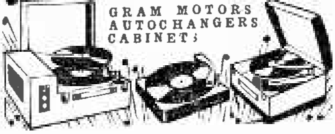

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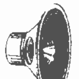

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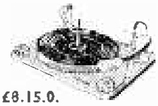

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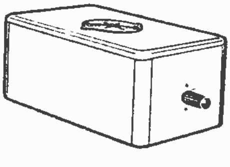

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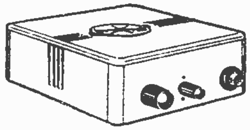

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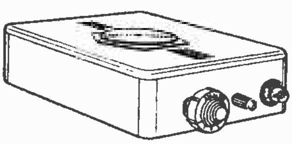

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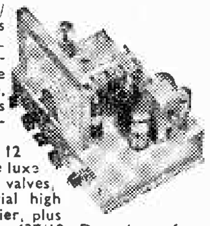

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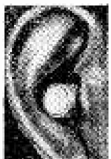

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