

MAKING A 'SCOPE FROM THE 62 UNIT

PRACTICAL 13

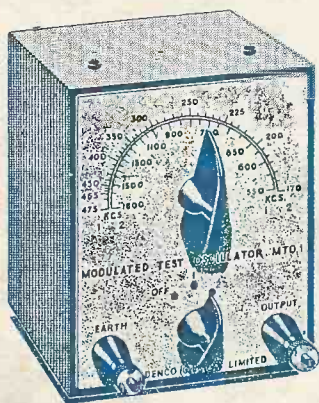
SEPTEMBER
1957

EDITOR: F.J. CAMM

WIRELESS



MAXI-Q
REGD.



WE PROUDLY PRESENT OUR LATEST HIGH STANDARD LOW PRICED INSTRUMENT WHICH WE KNOW WILL BECOME A PRIZED AND INDISPENSABLE POSSESSION IN EVERY CONSTRUCTOR'S SHACK

MODULATED TEST OSCILLATOR MTO.1

- ★ Provides a modulated signal suitable for I.F. alignment also trimming and tracking R.F. circuits.
- ★ Frequency is continuously variable from 170-475 kc/s and 550-1,600 kc/s.
- ★ Operates from a single 9 volt grid bias battery (not supplied) which is housed within the unit.
- ★ The case is manufactured from steel and is finished in matt black cellulose. The front panel is gloss black bearing white lettering. Dimensions are $5\frac{1}{16}'' \times 4\frac{1}{16}'' \times 3''$.
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Obtainable from all reputable stockists or from works. General Catalogue covering technical information on full range of components, 1/- post paid.

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STOP PRESS: MAXI-Q Pre-set F.M. Tuner Completely Assembled, £12. Variable F.M. Tuner, £11. MAXI-Q 60 kc/s. Tape Deck Oscillator Coils, TDO.1—for high impedance Erase heads (Truvox, etc.), 5/-. TDO.2—for low impedance Erase heads (Brenell and Collaro), 5/-.

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TAPE DECKS, 2-speed, twin track, easy to assemble kits with finest motor, Ferroxcube heads and full instructions.

MODEL 521 for 5in. spools, kit £7.10.0.

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AMPLIFIER kit, 2½ watt. record/replay, 2 recording positions, neon indicator, etc., £5.18.0. Power pack kit for above, £2.18.6 (both without valves). Carr. and packing extra.

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M.G. from Baghdad writes:—

“...really nice to have this amazing tape deck.”

D. B., Malaya, writes:—

“The recorder is now working as well as a commercial model and I am very pleased with it.”

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

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4 VALVES



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Complete kit of quality components (less valves),	Fringe-area version (less valves)
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1J4	6/6	6U5G	8/6	DH75M 9/-
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1J5	10/6	6V8G	7/-	DL86 10/6
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1R4	10/6	6X4	7/6	DM70 8/6
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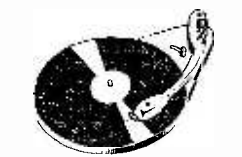
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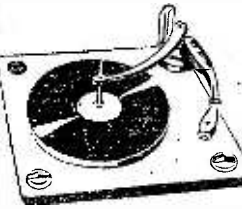
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4 speed automatic record changer unit plays 7in., 10in. and 12in. records automatically with "MACRODISK" selector. Unit plays 125 x 10 1/2in. £8 15s. 0d. each. Carriage 3/-.



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LOUDSPEAKER UNITS	each
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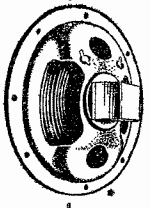
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TRANSISTORS. RED SPOT, 10/- each. BLUE SPOT, 15/- each. POSTAGE AND PACKING 6d. per valve. SAME DAY SERVICE.

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1A5	6-	6A47	12	6F82	10	6GX4	7-	12K7GT	8	6IMP	12	6V42S	30-	6C54	6-	6M34	10-	MHL012	6	6S47	15-	1Y41	8/6
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1D6	10	6A45	5-	6B46	6	6GX4	12	12A7GT	8	6S0C5	12	D42	10	6E32	10	6EY31	10	6M14	8	6S42	12	6V1507	5/-
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1J4	6	6A15	6/6	6H0M	3	6GX5	12	12A8T	7	6L1BT	12	D77	6	6E45	8	6EY85	8	6N78	3	6S41	25-	6VMP45	15/-
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1LN5	5-	6A03	7	6G3GT	5	6T87	8-	12A8T	7	6S6	7	DAF91	8-	6C81	8	6E241	10	6D13	9-	6U16	12-	6VAP47	15/-
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1R5	8/6	6A76	8	6G46	5	6T86	8-	12A8T	6	6T78	8	DC90	7-	6C83	9-	6E281	10-	PABCO8	1	6U25	13	6V23	6/6
1R5	8-	6B4G	6	6G74	6	6T87	8-	12A8T	7	6S0	8	DF93	11-	6C84	10-	6E280	10-		15-	6U31	8	6V41	8/6
1P4	7-	6B47	10	6G7GT	8	6T87	8-	12A8T	7	6S8	8	DF91	7-	6C85	9	6E282	12	6PCC84	8	6U30	7	6V1P33	12/6
1U5	7-	6B4G	4-	6K7G	6	6T77	8	12A5G	7	6S5A2	15-	DF06	9	6C91	9	6G234	14-	6PCC85	12	6U32	8	6V1P61	5/-
2A3	12/6	6B8M	4	6K7GT	6	6T74	8	12Y4	10	6L130B2	15-	DH63	8	6E980	12	6H30	5-	6PCC87	10	6U76	8	6V1T501	5/6
2C26	4-	6BA6	7	6K84	8	6S03	9-	1A4R7	10	6L807	6	DH76	8	6E982	12	6H63	12	6PCC82	11	6U78	7	6V1W6	8/6
2D13C	7/6	6B26	7	6K8GT	11-	9D2	3-	1A8T	14-	6G64	12	DH77	8	6E983	9	6HABC80	PCL82	12	6	6U251	15	6V1W7	6/6
2X2	4	6B4E	8	6L1D3	10	10C1	15-	1A4Q5	11-	6S6	3-	DK32	15-	6E42	10-		13	6PCC83	12	6U29	15	6X61	12/6
3A4	7	6B47	11	6L0G	9-	10C2	13-	1A4H	10-	12A93	7	DK61	8	6E41	8	6H90	10-	PEN4019	6	6U34	8	6X63	12/6
3A5	7	6B46	8	6L7M	8	10F1	15-	2011	12	74933L	12	DK92	10-	6E40	10-	6ECL50	12	6PCC85	12	6U32	10	6X66	11/6
3B7	8	6B47	10	6L18	13	10P9	11	2011	13	6S763	12	DK96	9	6E39	4	6H141	7	6PEN45	19	6	10	6X76M	12/-
3D6	5	6B46	10	6N7	8	10F18	12	2516GT	7	6T193	5-	DL2	15-	6E37A	9	6H133DD	6	PEN46	6	6U42	10	6X79	12/6
3Q4	9	6B47	8	6Q7G	8	10L1D3	8	2524G	9	6T475	7	DL33	9	6E39	6		12	6P81	13	6U44	12	6X1D13	4/6
3Q5GT	9	6C4	7	6Q7GT	9	10P13	17	2525	10	6R02	5	DL92	8	6E40	12		12	6HVR2	20	6U43	9	6XV10	6/6
384	8-	6C5	6	6R7G	8	11E3	15	2526GT	9	6R03	5	DL94	9	6E41	9		12	6HYR2A	6	6U43	11	6XV80	6/6
3Y4	9-	6C6	6	6R47	8	12A6	6	2847	7	6R06	6	DL96	6	6E42	12		12	6KLE3	8	6PMB2	12	6XPF89	10/6
5D4	8-	6C8	8-	6R47	6	12AHT	8	30	7	6ACCPEN	6	DL10	10	6E40A	7	6K72	5-	6FM12	4	6UC85	10	6XSG(L5)	4/-
5V4	12	6C10	12	6S47	7	12A8H	10	30C1	12	6AC/HL	7	DM70	8	6E40B	5-	6KT33C	10	6FM12M	6	6UC42	10	6X81	7/6
5X4	10	6C10	10	6S47	8	12A76	10	30F5	12	6ADD	15-	EA30	2-	6E44	7-	6PY80	9-	6UC81	11	6	6Y63	7/6	
5Y3	7	6C46	7	6S47	5	12A77	8	30F14	12	6AC/P4	8	EA76	9	6E43	10	6K763	6	6PY81	9	6UC82	13	6Y65	10/6
5Y4	10	6D4	6	6S7GT	8	12A77	7	30L1GT	12	6ALGO	10	EB380	7	6E40	10	6K763	6	6PY82	7	6UC41	9	6Z63	10/6
5Z3	12	6C1	15-	6S47	7	12A8T	9	30P12	13	6A74	7	EA91	9	6E43	7	6K762	5-	6PY83	9	6U880	10	6Z66	20/-
Z24G	10	6C6G	6	6S87	7	12B4G	9	31	7	6ATP4	6	EA42	10	6E46	12	6K763	8	6QP21	7	6U885	10	6Z77	9/-
6A8	10	6F8	10	6H4GT	14	12B6G	10	33A108M	AZ31	12	6EB4	2-	EF89	10	6K741	6	6QP25	6	6U889	10	6Z719	12/6	
6AB7	8-	6F12	9	6G5G	7	12B1	30-	30-	6B09	9	EB41	8	EF91	9	6K743	10	6Q8150	15	6U41	10	6Z729	12/6	
6AB8	10	6F13	13-	6U7	8	12H6M	3-	35/51	12	6B29	10	EB41	6	EF92	9	6L63	6	6U46	15-	6ZP2B	13/6		
								35A5	11-	1B63	7	EB43	15-	EL29	5								
								3610GT	9	CK523	6	EB43	7	EL41	10								
								35W4	8	CK523	6	EB41	10	EL42	11-								
								33Z3	10	6V63	10	EBF80	9	EL81	15-								

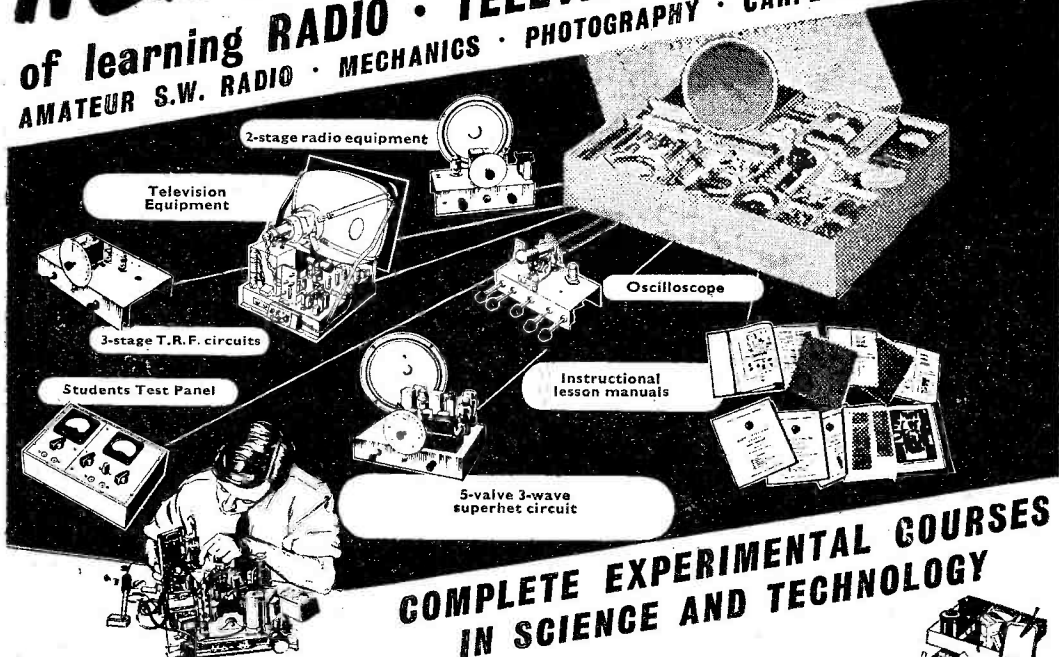
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All for A.C. Mains 200-250 v., 50 c/c.
Guaranteed 12 months.

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Above ready for use. Carr. 3/6. With mains and output leads.

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6/12 v. 3 a. 11/9 H.T. Types H.W.
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Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses, Fuse holders, Grommets, panels and circuit. Carr. 2/9 extra.

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



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/-**

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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. 23/9
C.T. 0-4-5 C.T. 5/3 v. 3 a. 23/9
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C.T. 0-4-5 v. 3 a. 26/9
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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/c 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 2 v. 1.5 a. 17/6.

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/c

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/c Primaries:

0-9-15 v. 1 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, 7-10-250 ohms.... 11/9
100 mA, 10 H 200 ohms.... 8/9
80 mA, 10 H 350 ohms.... 5/9
80 mA, 10 H 400 ohms.... 4/11

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 384, etc. 3/9
Small Pentode, 5,000 Ω to 3Ω. 3/9
Small Pentode 7/8,000 Ω to 3Ω 3/9
Standard Pentode, 5,000 Ω to 3Ω 4/9
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Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω 15/9
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EX-GOVT. TRANSE. 230/250 v. 50 c/c. HEAVY DUTY OIL FILLED suitable for electric welding or soil heating. Output 12 v. 80/100 amps. £6.19.6. Carr. 7/6.

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150 mA, 6-10 H 150 ohms Trop. 6/9
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JUNCTION TRANSISTORS. Red Spot Audio Type only 7/6 each.

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

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1S5	7/9	6V6G	7/9	EB91	8/9
35A	8/9	6X4	8/9	EF96	4/9
5Y3G	8/9	6X5GT	7/9	EL22	3/9
5U4G	8/9	6L6G	11/9	EL21	3/9
5Z4G	8/9	807	7/9	KT44	8/9
6K7G	5/9	12A6	7/9	EZ90	8/9
6S3VT	6/9	15D2	4/9	EL84	10/6
6S1GT	8/9	35Z4GFT	9/9	SP61	2/9
6SN7GT	8/9	MB4	4/9	100 mfd. 50 v.	4/9
6AT6	7/9	6CC83	9/9	35Z4	8/9

EX-GOVT. INSTRUMENT RDEL. Brand new, cartoned. Complete with 14 valves, including 5Z4, E.H.T. rectifier, Trans. former, Choke, etc. Only 29/9, carr. 7/6.

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Tubular Types	Can Types
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8 μf. 500 v. 2/6	18 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 μf. 450 v. 4/9
32μF 350 v. ... 3/9	100 mfd. 450 v. 4/9
25μF 25 v. ... 1/3	8-9μF 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 mfd. 350 v. 4/9
3,000 mfd. 6 v. 3/9	64-120 mfd. 350 v. 7/9
6,000 mfd. 6 v. 3/9	100-200 mfd. 6/9
	275 v. ... 6/9

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SMALL POTTED MAINS TRANS. Removed from New Ex-Govt. units. Primary 0-200-230-250 v. Secs. 250-0-250 v. 60 mA, 6.3 v. 2 a. 5 v. 2 a. Size 3 1/2 x 4 1/2 x 3 1/2 in. **11/9**

Type BM1. An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2 1/2 in. 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 for use, 46/9.

SPECIAL OFFERS: Electrolytics. 32-32 μf. 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. 1 in. 8d. yd. Twin Screened Feeder 1 1/2 yd.

Type BM2. Size 8 x 5 1/2 x 2 1/2 in. Supplies 120 mA, 90 v. and 60 v. 40 mA, and 2 v. 0.4 a to 1 amp. fully smoothed. Therefore completely replacing both H.T. batteries and L.T. 2 v. accumulators. When connected to A.C. mains supply 200-250 v. 50 c/c. **SUITABLE FOR ALL BATTERY RECEIVER NORMALLY USING 2 v. ACCUMULATOR.** Complete kit of parts with diagrams and instructions 49/9, or ready for use 59/6.

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

EXTENSION SPEAKERS Ready for use in walnut veneered cabinet. 8in. 2-3 ohms, 35/9. Very limited number



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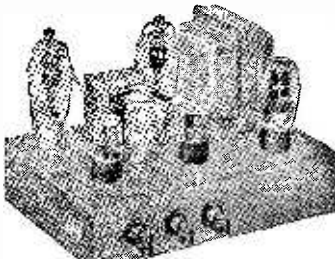
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VOLUME CONTROLS with long (1 in. diam.) spindle, all values less switch, 2/9; with S.P.A. switch, 3/9; with D.P. switch, 4/6.

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

High-Fidelity Push Pull Amplifier with "Built-in" Tone 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/c.s. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs. For STANDARD or LONG-PLAYING RECORDS. For MUSICAL INSTRUMENTS such as STRING BASS, GUITARS, etc. OUTPUT SOCKET with plug provides 300 v. 20 mA. and 6.3 v. 1.5 A. For supply of a RADIO FEEDER UNIT. Size approx. 12-9/16" high. For A.C. 200-250 v. 50 c/c.s. 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/-.

If required louvred metal cover with 2



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carrying handles can be supplied for 17/6. Additional input socket with associate Vol. control so that two different inputs such as Gram and 'Mike' or Tape and Radio can be mixed, can be provided for 13/- extra. Guaranteed 12 months. TERMS on assembled two input model: DEPOSIT 25/6 and nine monthly payments 23/4. HIGH FIDELITY MICROPHONES and SPEAKERS in stock. Keen cash prices or H.P. terms if supplied with amplifier.

COLLARO RC54 3-SPEED AUTO-CHANGERS with Studio Pick-up. Brand New. For 110 v. 50 c.p.s. A.C. mains. Price with 110 v. to 200-250 v. Auto Trans. only £7/15/-. Carr. 7/6.

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

LG3 3-WATT GRAM AMPLIFIER For use with above or any other single or auto-change units. A double wound mains transformer ensures that chassis and pick-up input are not "alive." Latest type B.V.A. valves used. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains sensitivity 250 m.v. Indiscernible hum. Size: 6-4 1/2" in. Control knobs, 501. and Tone with switch. Guaranteed 12 months. Only 69/9.

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. 200 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7 1/2" in. Simple alignment procedure. Point-to-point wiring diagrams, instruction and priced parts list with illustration. D.91. 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. Total negative feedback 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/c.s. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6-5-5 1/2" in. high. Chassis is fully isolated from mains. Output for 2-3 ohm speaker. Guaranteed for 12 months. Only £5/19/6; or assembled and nine monthly payments of 22/-. Illustrated leaflet 3d.

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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; Sat. until 10 p.m. Catalogue 6d. Trade List 5d. S.A.E. with all enquiries.

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 200-250-250 v. 50 c/c.s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with 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.



12 GNS.

LT45 HIGH QUALITY TAPE DECK AMPLIFIER. For All Tape Decks with High Impedance, Playback and Erase Heads, such as Lane, Truvox, Ready for etc. Or for Collaro, Brenell, Use. ONLY etc. Type of Deck should be stated when ordering. Output is 4.5 watts. For 2-3 ohm speaker. For A.C. Carr. 7/6

Mains 200-250 v. 50 c/c.s. Positive compensated identification for recording level by Magic Eye. Recording facilities for 15, 7 1/2 or 3 1/2 in. per sec. Automatic equalisation at the turn of a knob. Linear frequency response of ± 3 db., 50-11,000 c/c.s. Negative feedback equalisation. Minimum hum. High output with completely effective erasure and distortionless reproduction. -Sensitivity is 12 millivolts. Any kind of crystal microphone is suitable. Only 2 millivolts minimum output required from Recording head. Provision is made for feeding a P.A. amplifier. Illustrated leaflet 6d. Special price quoted for above with Deck.

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/c.s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used, EF86, EF86, ECC83, 807, 807, C233. 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/c.s. 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 Carr. 10/- 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.

10 GNS.

R.C.A. 20 WATT RE-ENTRANT SPEAKERS. 15 ohms or 600 ohms matching. For C.W.O. work. Only 3 C.N.S. P.M. SPEAKERS. All 2-3 ohms, 5 in. Goodmans, 17/9. 6 in. Goodmans water type, 16/9. 8 in. Rola, 19/9. 10 in. Elac, 26/9. 12 in. Plessey, 29/11. 10 in. W.B. Stentorian '3 or 15 ohms type HF1012 10 watts high fidelity type. Recommended for use with our A8 amplifier. £4/10/9. 12 in. Plessey 3 ohms 10 watts, 69/6.

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

M.F. SPEAKERS 2-3 ohms, 8 in. 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 4 in. elliptical, 19/9. Celestion 6 in. with high flux density magnet, 19/9. 12 in. Plessey, 29/11. 12 in. Plessey with high flux density magnet, 47/9. The latter is especially recommended.

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

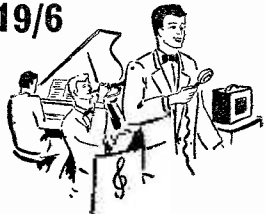
For 230-250 v. 50 c/c.s. Mains input. Appearance and Specification, with exception of output wattage, as A5. Complete wiring diagrams £3/15/-. Assembled 22/6 extra. Carr. 3/6.

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 beat detector. Power pentode output is used. Valve line up being 6KT, 6F6, 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 8 1/2 x 5 1/2 in.

RADIO SUPPLY CO. 32, THE CALLS, LEEDS, 2

Personal Shoppers (Not Postal) can also be supplied by Messrs. Vihers (Middlesex), Linthorpe Rd., Middlesbrough, (LEEDS) LTD.

ALL MAINS AMPLIFIER 19/6



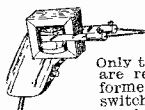
Construct a powerful three-valve mains amplifier. Ideal for dances, parties, etc. Complete less chassis, cabinet and speaker (available if required). Data 1/6 (free with parts).

W.D. CIRCUIT DETAILS

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

- | | |
|--------------------|---------------------|
| A.1134 | 78 receiver |
| BC.348 | 76 receiver |
| BC.312 | R28/ARC5 |
| R.103A | R1116A |
| BC.342 | RA-1B |
| RA-1B | AR88D |
| R-208 | AN APA-1 |
| R-1135 | 76 |
| R-124A | R.T.15 |
| R-1132A/R-1481 | CAY-16-AAM- |
| R-1147 | RADAR |
| R-1224A | A.S.E.-3 |
| R-1082 | Indicator 62A |
| R-1365 | Indicator A.S.B.3 |
| B.C.1206-A B | Indicator 62 |
| B-45-A (or-B) | Indicator 6K |
| B-45-A (or-B) | R.F. unit 24 |
| B-45-A (or-B) | R.F. unit 25 |
| Transmitter T1154 | R.F. unit 26 |
| Fifty-eight walkie | R.F. unit 27 |
| talkie | R.F. unit 27 |
| Frequency meter | Wireless set No. 19 |
| B.C.221 | Demobbed valves |

MAKING A SOLDER GUN



A 7-second solder gun of the type costing £3-14 was described in *Prac. Mech.*

Only two essential parts are required—(a) transformer and (b) push switch. These we can supply at 11/6, plus 2/- post. The rest of the

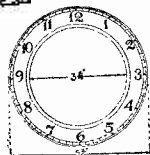
parts you will have in your own "junk" box. Copy of the article concerned given free with the kit.

CLOCK CASE

Also suitable for barometer or other instrument. Nicely polished. Price 4/6, post and packing 1/6.

Clock numerals to suit these cases etched on metal, 2/6.

Post 9d. 11 ordered separately.



TRANSFORMERS SNIP

Standard tapped mains input. Out put 6.3 at 3 amp, 5 v. at 2 amp, and 350-0-350 at 30 milliamps. Equipment guaranteed perfect, 8/6 plus 2/6 post & packing. (Note this transformer is a half shrouded drop-through type not stand up as illustrated.)



Complete T.V. Commercialising Outfit Sent for 14/6

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/.

MOTOR FOR MAINS-WORKING



Powerful electric motor, size 3in. long by 2 1/2in. diameter with speed variator suitable for operation on/off standard A.C. mains. Ideal for driving fan model, car heater, dryer, etc., etc. Don't miss this snip, 12/6, plus 2/- post and insurance. *Stand not included.*

THIS MONTH'S SNIP THE OCTAVIAN



HIGH FIDELITY AMPLIFIER

3 valve 4 watt with frequency response better than 40-15,000 C.P.S. Control panel size 8 x 2 1/2in. comes fixed to chassis but is intended for independent mounting. Separate bass and treble controls giving fullest variation of cut and lift. Separate switch, absolutely no mains hum. Remarkable value at £4 19/6.

The "CRISPIAN" Portable Radio



post and ins. 3/6, ready-built chassis 30/- extra. Instruction booklet free with parts or available separately, price 1/6.

TRANSISTORS

Red Spot replaces Mullard OC71, etc., 10/-.

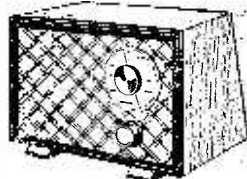
Blue spot suitable R.F. up to 1.6 Mc/s, 15/- each.

White spot up to 2.5 Mc/s, 20/-.

Mullard OC71, 20/-.
Mullard OC72, 30/-.



THE SKYSEARCHER An all mains set for 19/6



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

HUGE MINISTRY PURCHASE

R.1155—yours for £2 down

Frequency 75 kc/s to 18 Mc/s—10 valves—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. & transit case 15/- extra.

FLUORESCENT LIGHTS



These are a complete fluorescent lighting fitting. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the workbench and in similar locations.

Single 40. 4ft. 3in. long, uses a 40 watt tube. Price 39/6 complete with tube. Carriage and ins. up to 150 mill 6/8. Up to 250 miles 8/6.
Twin 20. Uses 2 20-watt standard tubes. Price 39/6 with tubes. Carriage and ins. up to 150 miles 6/6. Up to 250 miles 8/6.

YOURS FOR 30/- DOWN



MULLARD AMPLIFIER "510"

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 "HIG" 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-AMP, we are pleased to offer as a ready-made unit. It uses the low hum noise high gain pentode type EF86. It takes its power supply from the amplifier and incorporated 2 switches to provide immediate compensation, for radio, microphone I.P.S. and 78 records. The price of this unit is £4. Post and insurance 3/6 extra.

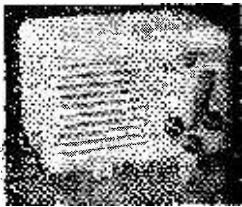
"CHIMELITE"



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, etc., 2/-; data available separately price 2/-.

19/6

MAINS-MINI



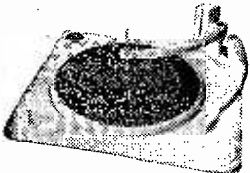
Uses high-efficiency coils, covers long and medium wavebands and fits into the neat white or brown bakelite cabinet—limited quantity only. All the parts, including cabinet, valves, in fact, everything, £4 10/0, plus 3/6 post. Constructional data free with the parts, or available separately, 1/6.

CONNECTING WIRE



P.V.C. covered in 100ft. coils—29 a coil or four coils different colours, 10/- post free.

SENT FOR £1.10.0 DOWN



4-SPEED GRAMPHONE AUTO-CHANGER

Latest types by all famous makers are invariably in stock at competitive prices. B.S.R. Monarch, Garrard, etc. Latest models from £8 10/- or deposit £1 10/- and 6 payments of £1, plus 5/- carriage and insurance.

FREE THIS MONTH

Our new booklet, "The Thermal Delayed Vacuum Relay," giving many interesting circuits. Given free with orders or send stamp for your copy.

DON'T BE CAUGHT LIKE THIS



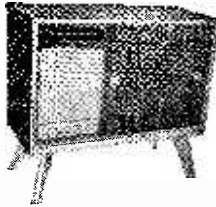
CAR STARTER CHARGER GEAR

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	2/6
Resistance Former	2/6
Mains on/off Switch	2/6
0-5 am. Moving Coil Meter	12/6
Constructional Data	1/6

or if bought all together price is 62/6, plus 2/6 post and packing.

CABINETS FOR ALL



The CONTINA

Another addition to our range of cabinets. This is of new revolutionary design, styled after the best of continental radios. Externally, it is finished in highly polished dark walnut veneer, with panelling picked out in gold. Interior is of same very high standard, its veneer being

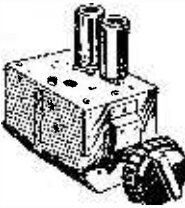
light mahogany which contrasts nicely with the dark walnut and generally gives a very pleasing appearance. The doors slide on metal runners and are fitted with gold insert finger plates. A really excellent cabinet for any home—size 3ft. 1 1/2 in. long, 1ft. 3 in. deep, 2ft. 1 1/2 in. high, including legs which are 10 in. from floor. Motor board 12 1/2 in. x 17 in., equipment aperture 17 1/2 x 9 1/2 in. gives ample space for 8 in. speaker. Ample storage space for recordings. Price £19 19/-, carriage and insurance 20/-.

5-VALVE SUPERHET

Yours for only £1 down



Chassis size approx. 9 1/2 x 7 1/2 x 8 1/2 in. First-class components. A.C. mains operation. Three waves (medium and two shorts). Complete with five valves, ready to work. New and unused. Cash price £5 19/6 or £1 down and 6 payments of £1 (carr. and ins. 7/7).



Turret Tuner

Brand new stock, not surplus, with coils for Band I and III complete with valves PCC84 and PCF90—I.F. Output 33/38 Mc/s with instructions and circuit diagram, 79/6. With knobs 3/6 extra, post and insurance 2/6.

BARGAINS TO CLEAR

Superhet 5v. AC/DC Chassis. Medium and two short. Unused. Less valves. Uses standard coil range. Coil pack worth more. 27/6. Carriage 6/6.

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

.1 mfd. 350v. small tubular metal cased type, made by Dubilier. 2/6 per doz.

Germanium Diodes, BTH. With wire ends. 10d. each or 9/- doz.

Superhet Coils. Long and medium. Aerial and oscillator circuit included. Per set 3/6.

Midget I.F. Coils, dust cored, size 1 1/2 in. x 1 in. 465 Kc/s. 5/6 per 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.

500 watt Isolation Transformer. Mains in, mains out. (Make servicing safe.) 69/6, post 6/6.

50 assorted resistors. Well mixed and useful values. 1 watt. Price 5/6 per 50. 1 and 1/2 watt 6/6 per 50.

Bakelite 5 amp. electric wall switch. "Heraft." 1d. each or 8/- per dozen.

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

Amplifier, ex-Government unit 1124 contains one double triode and one triode. 6/6, post and insurance 2/6.

Battery re-activator. If you use a battery portable this will save you pounds, operates from A.C. mains. 25/-, post and insurance 2/6.

5 core flexible cable 230v. cores. Price 10d. per yard.

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

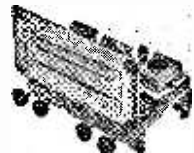
10 core flexible cable. 230v. cores. Price 1/6 per yard.

Mullard 510. Output transformer. 27/6, plus 2/6 post and packing.

Mullard 510. Mains transformer. 29/6, plus 2/6 post and packing.

Hand magnet generator, as used on telephones. 9/6.

ORGANTONE PARCEL 39/6



Here is an opportunity to build a fine set at a low figure, the parcel contains all the essential parts as follows: Punched and prepared chassis with scale pan—coloured glass dial with fixing cushions—drum drive and spindle—mains transformer—volume control—tone control—5-valve holders—circuit diagram and instructions. Limited quantity only for 39/6, plus 3/6 post and ins.

ELECTRONIC PRECISION EQUIPMENT, LTD.

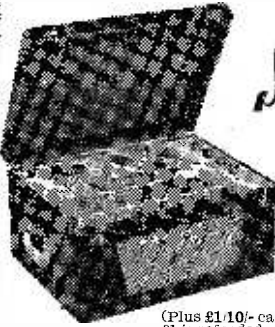
Post orders to E.P.E., LTD., Dept. 7, Sutton Road, Eastbourne

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

43-46, Windmill Hill, Ruship, Middx. Phone: RUISL 2 3780. Half day, Wednesday.

152-3, Fleet Street, E.C.4. Phone: FLEet 2633. Half day, Saturday.

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



Stern's introduce . . . A "fidelity" TAPE RECORDER

WITH EVERYTHING—EXCEPT A HIGH PRICE
TESTED AND APPROVED AT THE TRUVOX LABORATORIES
IT INCORPORATES: THE NEW TRUVOX Mk. IV TAPE DECK together
with the "fidelity" MODEL HF/TR2 TAPE AMPLIFIER (both illustrated on
this page), and a Rola 10in. x 6in. P.M. SPEAKER.

PRICE . . . Including CRYSTAL MIKE and 1,200ft. reel of PLASTIC TAPE.

£49.10.0.

(OR £3 EXTRA WITH REV. COUNTER.)

(Plus £1.10/- carriage and insurance, of which £1 is refunded on return of Packing case.)

BEFORE CHOOSING YOUR TAPE RECORDER YOU SHOULD HEAR THIS MODEL—TRULY "HI-FI" RECORDINGS ARE OBTAINABLE and it is comparable to much higher priced Recorders.
Alternatively send S.A.E. for ILLUSTRATED LEAFLET.

CREDIT SALE: Deposit £12.5/- and 9 monthly payments of £4.10 8.
HIRE PURCHASE: Deposit £24.15/- and 12 monthly payments of £2.5/11.

The "fidelity" TAPE AMPLIFIER Model HF/TR2 WITH POWER SUPPLY UNIT

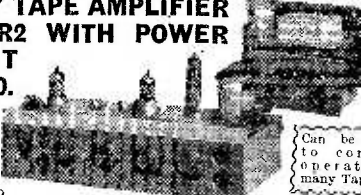
PRICE **£16.0.0.**

Carr. and ins. 6/-.

H.P. TERMS: Deposit £8 and 9 months of £1.

CREDIT TERMS:

Deposit £4 and 9 monthly payments of £1/9/4. When ordering, please advise make of deck in use. Send S.A.E. for full details.



Can be supplied to correctly operate with many Tape Decks.

The NEW TRUVOX MkIV TAPE DECK

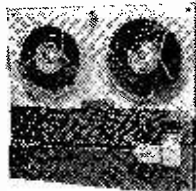
UNDOUBTEDLY ONE OF THE BEST DECKS ON THE MARKET.

PRICE **£27.6.0.** (Plus 10/- carr. and ins.)

CREDIT TERMS: Deposit £6.17/- and 9 monthly payments of £2.10/-.

H.P. TERMS: Deposit £13.13/- and 12 monthly payments of £1.5/-.

WE ALSO HAVE A FEW DECKS WITH REV. COUNTERS. Price £30/9/- Send S.A.E. for details.

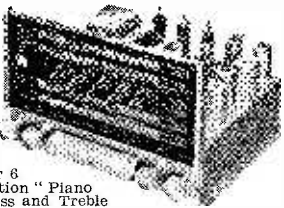


HOME CONSTRUCTORS
We can supply a COMPLETE KIT OF PARTS to build this TAPE AMPLIFIER for £12 (plus 5/- carr. and ins.). The Assembly Manual, Practical Diagrams, etc., are available for 2/6.
WE MAKE SPECIAL PRICES TO PURCHASERS OF TAPE EQUIPMENT (i.e. buyers of Deck and Amplifier together, etc., etc.). **SEND YOUR ENQUIRY TO US . . . H.P. and CREDIT SALE TERMS ARE AVAILABLE.**

MODERNIZE YOUR OLD RADIOGRAM

The NEW ARMSTRONG PB. 409 A.M./F.M. Radiogram Chassis

"A chassis for those who want the highest quality." ● A 9-valve line up employing the latest MULLARD preference-type valves. ● Provides complete coverage of the V.H.F./F.M. Transmissions plus the Short, Medium and Long Wavebands. ● Has Push-Pull Output with Negative Feedback for 8 watts Peak Output. ● Quick Action "Piano Key" Selectors and separate Bass and Treble Controls. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9 1/2in. x 8in. high.
PRICE **£29.8.0. TERMS:**

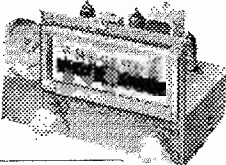


(Plus 6/- carr. & ins.) Credit £7.7.0 and 9 monthly payments of £2.14.0.
H.P. £14.14.0 and 12 monthly payments of £1.7.3.
SEND S.A.E. FOR ILLUSTRATED LEAFLET.

STERN'S "F.M." TUNING UNIT

A 5-valve Tuner incorporating the latest Mullard Permeability Tuning Heart and a "Magic Eye" Tuning Indicator.
PRICE ASSEMBLED **£14.10.0.**

READY FOR USE: (Plus 7/6 carriage and insurance.)
TERMS: (a) Hire Purchase: Deposit £7.5.0 and 9 monthly payments of 18.4.
(b) Credit: Deposit £3.12.6 and 9 monthly payments of £1.6.7.



RECORD PLAYERS

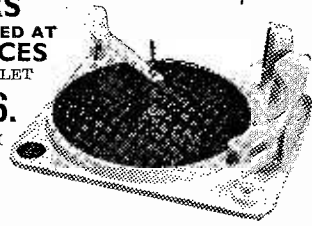
THE VERY LATEST MODELS OFFERED AT GREATLY REDUCED PRICES

Send S.A.E. for ILLUSTRATED LEAFLET

AN EXCEPTIONAL "CASH ONLY" OFFER **£8.7.6.**

THE NEW 4-SPEED B.S.R. MONARCH

- A "MIXER" Autochanger complete with High Fidelity Crystal "Turn-over" head.
- Incorporates the Manual Control position.



A TAPE PRE-AMPLIFIER and ERASE UNIT

STERN'S MODEL HF/TR1—A completely assembled Pre-amplifier with own Power Supply. Can be supplied correctly matched for use with Truvox or Collaro Decks and incorporates Recording Level Indicator and Monitoring facilities. Please send S.A.E. with any enquiry.
PRICE **£11.10.0.** (Plus 5/- carr. and ins.)
SPECIAL PRICE REDUCTION WHEN PURCHASED WITH TAPE DECK.

WE HAVE THE FULL RANGE OF DULGI CHASSIS IN STOCK

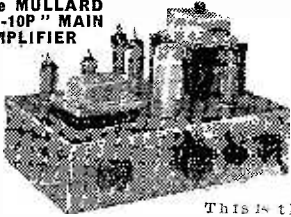
THE MODEL H.4. is illustrated but all Chassis and Tuners are similar—send S.A.E. for leaflets. H.P. and CREDIT SALE TERMS are available.
RADIOGRAM CHASSIS
These two Chassis are really well designed and reproduce most excellent quality on both Radio and Gram.

- MODEL H.3. A 3 Waveband AM/FM CHASSIS **£20.17.0.**
- MODEL H.4. A 4 Waveband AM/FM CHASSIS **£24.6.6.**
- TUNER UNIT CHASSIS
- THE F.M./H.F. TUNER CHASSIS with self-contained Power Supply **£17.10.3.**
- MODEL H4/T. A 4 Waveband AM/FM TUNER with self-contained POWER SUPPLY **£20.17.0.**
- MODEL H.11. A combined 4 Waveband AM/FM Tuner incorporating a "HI-FI" Control Unit—Audio Pre-amplifier, Gram equalising, Bass and Treble Controls, etc. **£29.3.10.**
- "HI-FI" AUDIO AMPLIFIERS
- MODEL G.A.4. A self-contained 4 watt Amplifier with adjustable Tone Control Box **£9.9.0.**
- MODEL D.P.A.10. A 10 watt Amplifier with separate "Tone Pre-amplifier Unit incorporating Bass and Treble Controls and Gram equalising" **£19.19.0.**

STERN RADIO LIMITED

COMPLETE KITS of PARTS for the "HI-FI" ENTHUSIAST

The MULLARD "5-10P" MAIN AMPLIFIER

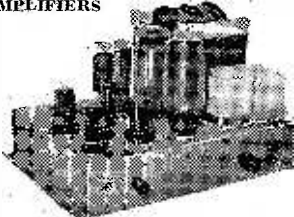


This is the very latest "Push Pull" design and needs no recommendation from us. Our Kit is complete to Mullard's specification, including the latest GILSON ULTRA LINEAR OUTPUT TRANSFORMER and the entire MULLARD Valve line up. ONLY HIGH GRADE SPECIFIED COMPONENTS are supplied. **PRICE OF COMPLETE KIT OF PARTS £11.11.0.** (Plus 5/- carr. & ins.)

The full SPECIFICATION and PRACTICAL BUILDING INSTRUCTIONS for these Units are available for 16 each. **SPECIAL PRICE REDUCTION.** We supply the two complete Kits—Mullard 5-10 and "fidelity" Preamplifier—for **£16.16.0.** We also supply both fully assembled and ready for use for **£19.19.0.** Terms are available.

BRITAIN'S FINEST "Hi-Fi" AMPLIFIER THE GENUINE WILLIAMSON

STILL SETS THE STANDARD FOR ALL AMPLIFIERS



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

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

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

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

We will also supply both COMPLETELY ASSEMBLED and will be pleased to quote. Credit and H.P. Terms are available. The complete SPECIFICATION and general ASSEMBLY INSTRUCTIONS are available for 8/6.

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CALLERS ONLY

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

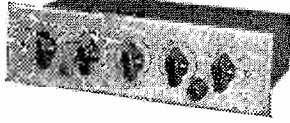
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109 & 115 FLEET ST., LONDON, E.C.4.

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STERN'S "fidelity" PREAMPLIFIER-TONE CONTROL UNIT

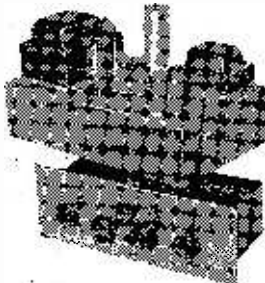
"A design for the music lover"



Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL. (b) STEEPCUT FILTER. (c) Continuously variable BASS and TREBLE CONTROLS, and a variable OUTPUT CONTROL which enables its use with any type of Amplifier. **PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) £6.6.0.** WE ALSO OFFER IT ASSEMBLED, READY FOR USE, **£8.0.0.**

The full SPECIFICATION and PRACTICAL BUILDING INSTRUCTIONS for these Units are available for 16 each. **SPECIAL PRICE REDUCTION.** We supply the two complete Kits—Mullard 5-10 and "fidelity" Preamplifier—for **£16.16.0.** We also supply both fully assembled and ready for use for **£19.19.0.** Terms are available.

THE MULLARD "5-10P" WITH REMOTE CONTROL UNIT



This is the original complete and very successful Mullard 5-10 Push Pull Amplifier but instead of the Controls being on the main Chassis we have incorporated them into a small REMOTE CONTROL BOX which facilitates mounting into existing Cabinets, etc. The Kit is strictly to specification and includes an ULTRA LINEAR OUTPUT TRANSFORMER made by ELECTROVOICE, in addition the Mains Transformer has extra power available for a RADIO TUNING UNIT.

The REMOTE CONTROL incorporates separate BASS and TREBLE CONTROLS, Mains ON-OFF SWITCH, VOLUME CONTROL, and a 3 position SELECTOR SWITCH for Radio Input, L.P. and 78 Records. A really high grade Amplifier capable of high fidelity reproduction and is very easily constructed from the point-to-point diagrams supplied.

PRICE OF COMPLETE KIT OF PARTS £11.0.0. (Plus 7/6 carr. & ins.)

Alternatively, we supply ASSEMBLED and READY for USE, for **£13.10.0.** (Plus carr. & ins., 7/6.)

H.P. TERMS.—£6.15.0 Deposit and 5 monthly payments of 17/3.

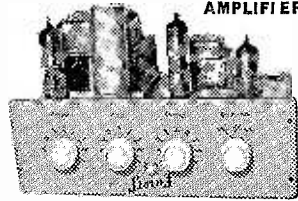
The full specification and PRACTICAL BUILDING INSTRUCTIONS are available for 1/6.

THIS IS HIGH QUALITY AT EXCEPTIONALLY LOW COST.

(a) The "COMPACT 5-2"

A Two-stage high sensitivity Amplifier having SEPARATE BASS AND TREBLE CONTROLS and designed to give up to approx. 5 watts with very pleasing quality. **PRICE £6.6.0.** (Plus 5/- carr. & ins.)

THE MULLARD "3-3" QUALITY AMPLIFIER



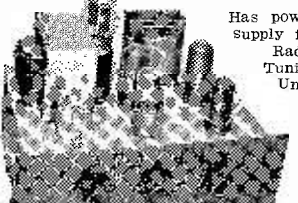
A small compact Amplifier capable of HIGH QUALITY REPRODUCTION on both RADIO and GRAM.

PRICE FOR COMPLETE KIT OF PARTS £6.19.6. (plus 6/6 carr. & ins.) Alternatively supplied ASSEMBLED and READY FOR USE, **£8.12.6.** (plus 6/6 carr. & ins.)

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

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

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



Has power supply for Radio Tuning Unit.

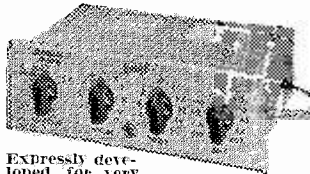
PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. & ins.) £7.10.0.

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

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

All ASSEMBLY MANUALS include "Point-to-Point" wiring diagrams and an individual Component Price List. Customers can, therefore, buy any part of a kit.

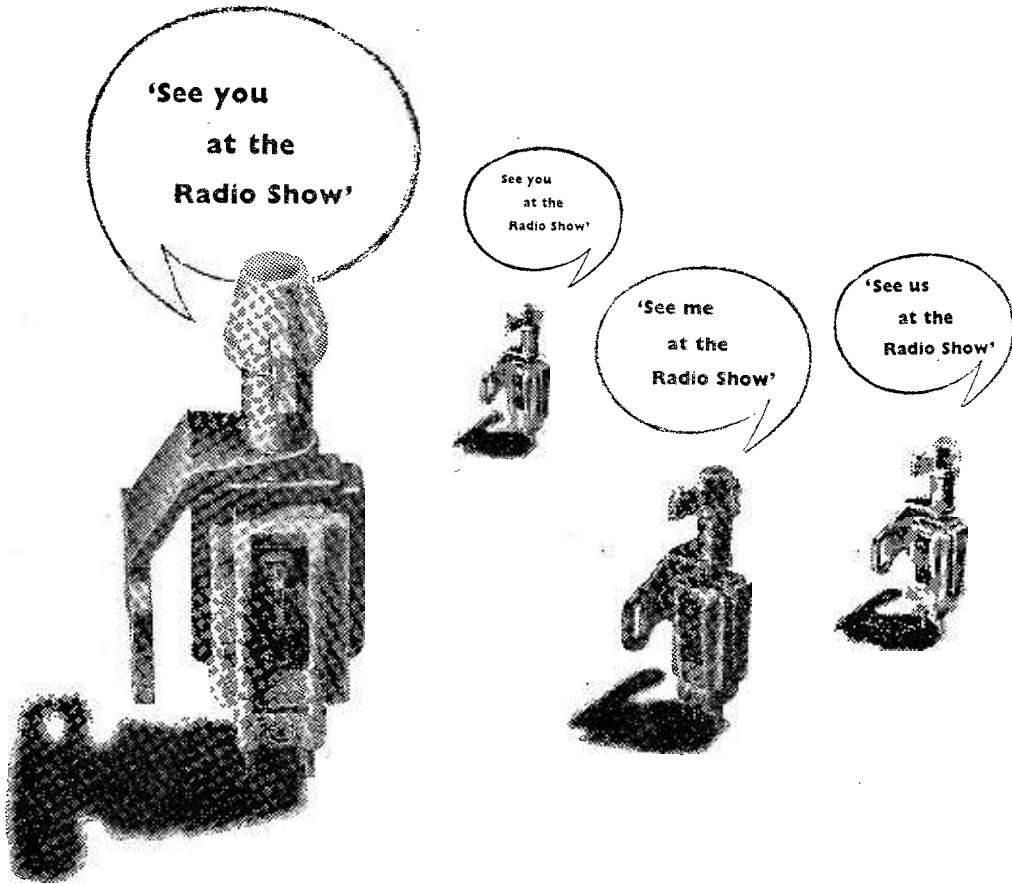
STERN'S "COMPACT 5" AMPLIFIER



Expressly developed for very high quality reproduction of Gram Records and particularly suitable for high quality reproductions of the F.M. transmissions. Two models are available:

(b) The "COMPACT 5-3" A three-stage version of the "5-2" model but in this case having an additional stage and incorporating Negative Feedback. **PRICE £6.16.0.** (Plus 5/- carr. & ins.)

A separate POWER SUPPLY UNIT to operate with these amplifiers is available for **£2.10.0.** £2.15.6 with additional Power available to Tuner.



Acos turnover cartridges Series 65 look forward

to meeting you at the Radio Show. Type 65-3 will demonstrate his high output* and good performance. Type 65-1 may, if he likes the look of you, play you a few bars to astound you with his wide range, linear characteristics, yet comparatively good output*.

If you are, incredibly, still a stranger to Acos cartridges, you may be formally introduced to them on Stand 213.

Outputs—Type 65-1: 0.15 V, Type 65-3: 1.0 V, at 1 cm/sec velocity, 1000 c/s.



ARE DOING THINGS IN STYL!

PRACTICAL WIRELESS

EVERY MONTH

VOL. XXXIII, No. 609, SEPTEMBER 1957

COMMENTS OF THE MONTH

EDITOR : F. J. GAMM

25th YEAR
OF ISSUE

BY THE EDITOR

CIRCUITS AND WIRING DIAGRAMS

SEVERAL readers have written to ask whether in our constructional details of receivers and instruments we could also include a complete wiring diagram and we should like to have the opinion of readers generally on the subject. The number of amateurs who are able to follow a circuit diagram has, of course, greatly increased during the past ten years, but the annual entry of new recruits to the pastime as a hobby must not be overlooked. Many of these have probably never seen a circuit diagram before, and to them, of course, a circuit diagram is indecipherable.

We do, as a fact, often give wiring diagrams of the more complicated apparatus, but the simpler circuits should easily be followed even by a beginner if he has a list of theoretical symbols by him, such as is given in our PRACTICAL WIRELESS Encyclopaedia, and in such cases we have omitted the complete wiring diagram. There are many who prefer to work from a circuit and if a beginner is to make any progress he should endeavour to work from them. In his early stages, a wiring diagram is of assistance. Wiring diagrams, however, occupy space, and we endeavour each month to include as many subjects as is possible. We have no objection, however, to including wiring diagrams if there is a general demand and we are always glad to assist readers who encounter any constructional difficulties. Will you please let us have your views?

B.S.R.A. EXHIBITION

THE British Sound Recording Association this year celebrates the 21st Anniversary of its foundation, and its 9th Annual Exhibition and Technical Convention will be held this year at the Waldorf Hotel, on September 20th to 22nd. Once again, we express the view that important though this association is, it should link up with the Radio Industry Council (not R.M.A. as referred to last month). It would gain in strength by doing so, and its products and activities would be brought to the attention of a far wider public if it was held as part of the exhibition at Earls Court. It is almost impossible to stage a national exhibition in the rooms of a hotel. Indeed, such an exhibition advertises its smallness and the daily press is hardly likely to take notice. As part of the National Radio Show, it would have the advantage of the very considerable and effective publicity arrangements of the R.I.C. We commend the suggestion to the B.S.R.A. for consideration.

THE RADIO SHOW

THE Radio Show this year takes place at Earls Court and opens on August 28th (not August 24th as stated)—a few weeks after publication of this issue. It is the 24th Exhibition of the series and the exhibition closes on September 7th. We extend a cordial welcome to all our readers to visit us on our Stand No. 117, where our staff will be in attendance to answer technical queries.—F. J. C.

Our next issue, dated October, will be published on Sept. 6th.

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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 Nownes, 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.

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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 May, 1957, in respect of 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	1,157,196
Home Counties	1,164,650
Midland	887,846
North Eastern	1,166,250
North Western	864,771
South Western	734,694
Wales and Border Counties	462,925
Total England and Wales ...	6,438,332
Scotland	832,810
Northern Ireland	193,416
Grand Total	7,464,558

New Marconi ADF for Hunting Clan Britannias

A GREAT deal of interest has been aroused in aviation radio circles by the new Marconi Type AD712 Automatic Direction Finder, which was demonstrated for the first time in public in January of this year. Now follows the announcement that Hunting Clan Air Transport Ltd. has ordered the AD712 for its new Bristol Britannias, which are due to begin flying on scheduled air routes in 1958.

The AD712 was chosen for these aircraft because of its simplicity of operation and control. The unique completely automatic crystal reference tuning with which it is provided makes it particularly suitable for pilot operation in modern high-speed transport planes.

Dial 9822 for Weather

WHEN the new telephone weather service in Belfast was inaugurated by the Postmaster-General, Rt. Hon. Ernest Marples, M.P., he recorded the first weather forecast to be available to any telephone subscriber in Belfast who dials 9822.

This has been made possible by the new type of equipment adopted for this service: simple and robust, and requiring the very minimum of time for recording and

putting into operation by non-technical staff.

The heart of the new installation is basically the well-known Emidicta dictating machine, and it was chosen by the Post Office for this service because of its established reliability and its flexibility in meeting the specialised P.O. requirements both technically and operationally.

Instead of an endless loop of tape (which is rather cumbersome in operation and requires both time and experience for editing, joining and setting up on the tape equipment), the Emidicta uses a circular 11in. flexible plastic disc coated with magnetic material and carried on a turntable. This provides for anything up to six or 12 minutes of recording if required. Forecasts are recorded directly on the disc and are ready for immediate playback merely by the adjustment of two switches to suit the length of the message.

Cloud Bouncing

YET another unusual scheme is reported from the U.S.A. where experiments have been carried out in bouncing signals off man-made clouds of ionised gas. The U.S. Air Force are conducting the experiments in conjunction with amateurs and the 14 and 148 Mc/s bands are being used. The experiments are being carried out as a result of reports that during the experimental tracking of an Aerobee rocket a cloud of gas was detected by radar and it is desired to prove whether or not this was a

coincidence. Distances of 700 miles will be possible for the "bounced" signals, and nitric oxide gas is to be released by rockets to form the "clouds."

BBC Service In Swahili

ON June 27 the BBC inaugurated a twice weekly service in Swahili directed to East Africa. This follows the introduction three months ago of a similar service in Hausa to West Africa which has proved to be highly successful.

The programmes (fifteen minutes in duration) are transmitted on Tuesdays and Thursdays at 09.45 GMT on 21,630 kc/s in 13 metre band, and 25,720 kc/s in 11 metre band. They will include reviews of the news, reports on events and developments of interest to East African listeners, and reports of the activities of East Africans in the United Kingdom.

VHF Network in Wales

A NEW VHF sound broadcasting station for north-east Wales will be built on a site

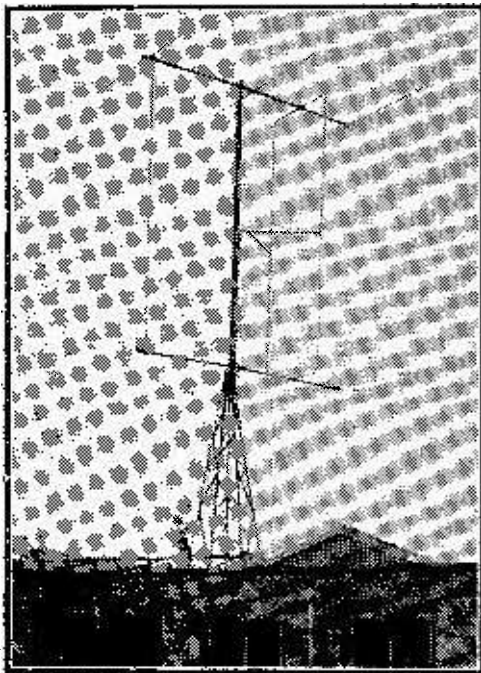


A novelty by Mullard. A coin rests on the plate, and if the hands are clapped the coin jumps and turns over.

1,800ft. above sea level at Cynrny-Brain, near Llangollen, and some eight miles west of Wrexham. The station will be known as Llangollen. Building work will start as soon as possible, and it is expected that the station will be completed by the autumn of next year. It will transmit the

15,000, an increase of 36 per cent. on May, 1956, and of seven per cent. on April this year. Radio receiver sales, at 87,000, showed an increase of 24 per cent. on May, 1956, and of 11 per cent. on April this year.

Retailers' sales in the first five months of the year have continued at a higher level than in the corresponding period of last year. Television and radio receiver sales were both up by 21 per cent. and radiogram sales by 41 per cent.



The 10-metre slot aerial on the roof of J.-Beam Aerials factory in Northants.

Home, Light and Third Programmes, and Network Three.

Llangollen will be the fourth BBC VHF sound broadcasting station to be built in Wales and will serve some 270,000 people in the Principality. This will bring the coverage of the VHF service in Wales up to 90 per cent. of the total population.

Radio and TV Sales

RETAILERS' sales of radio and television sets and radiograms in May were higher than in April, and higher also than in May, 1956, according to the monthly retail survey of the British Radio Equipment Manufacturers' Association.

Sales of television receivers were 68,000, an increase of 28 per cent. on May last year and of three per cent. on April, 1957. Sales of radiograms were

Slot Aerial Results

EXTRAORDINARY reports are often received of the performance of slot type aerials. The latest report comes from the well-known firm of J.-Beam Aerials who have installed on the roof of their factory in Northants a new slot arrangement designed for work on the 10 metre band. The accompanying illustration shows the installation, and it is reported that enthusiasts in the U.S.A. report that they have received the strongest signals ever from this country since the installation of this aerial.

High Temperature Rectifier

THE G.E.C. of America announce that they have successfully operated a silicon-carbide rectifier at temperatures from -100° to $+1,200^{\circ}$ F. Previously the highest temperature was 500° . It is reported that the high temperature is the result of using combinations of materials instead of a single material, generally silicon or germanium. It is emphasised that this high-temperature rectifier is still in the laboratory stage.

Micro-miniaturisation

DR. C. BRUNETTI at a recent Institute of Radio Engineers convention referred to

"insect-sized" electronic circuits. This will be achieved by stripping down miniature components. He pointed out that most components are merely insulation and air, and that even in the transistor the ratio of volume of active element to that of the case is extremely small. To the active part of the resistor is added first connecting leads, then an insulating cover many times the size of the active portion. He suggested that we might create circuits out of only the active materials then put the entire circuit in an insulating block.

New Semi-conductor

INVESTIGATION is being carried out in the U.S.A. on "chloroplasts." These are pieces of chlorophyll washed out of tobacco, spinach, beet and turnip leaves, and they are stated to act as semi-conductors. If this is eventually established then, the experts say, our ideas on the first step in photosynthesis may need some revision. Two similarities are: dried chloroplasts and suspensions of Chlorella algae glow like inorganic crystals when light shines on them and, when heated, their electrical resistance shows changes that might be due to freeing of electrons, as in semi-conductors.

Electronic Crevasse Detector

FOR the detection of crevasses a novel device has been produced by the U.S. Army Engineers. It consists of four electrodes, three placed at approximately 20ft. intervals and being in the form of sleds, and the fourth in the form of a power unit driving them. In use it is sent ahead of the investigator who sees on a meter indicating device any deviation caused by the variation of the air beneath the electrodes. Thus, over a crevasse the increased air under the electrode which happened to be over it would unbalance the system and cause a needle to move over a dial. It was driven over 100 miles of Greenland Ice Cap and located all the known crevasses and a number of new ones.

AMPLIFIERS: Design and Construction

17/6, or 18 3 by post from:
GEO. NEWNES LTD.
Tower House, Southampton Street,
Strand, London, W.C.2.

A RESONANT SMOOTHING CIRCUIT

AN INTERESTING CIRCUIT FOR REMOVING ALL TRACES OF RIPPLE

By M. E. Kerwood

HAVING built a piece of equipment with an external power supply, I found that even with additional smoothing provided in the equipment there was still a nasty ripple on the H.T. line. There was no room in the equipment or the power unit for an extra L.C. filter stage. This led me to consider improved methods of filtering of series and parallel tuned circuits.

After a few experiments, bearing in mind the space problem and the need to keep the H.T. source impedance low at all frequencies, the following simple addition proved very effective.

With the original smoothing circuit (Fig. 1) the

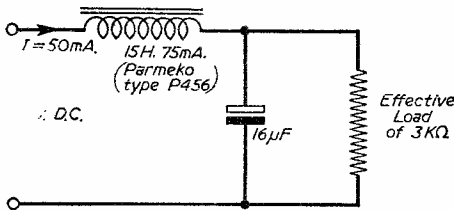


Fig. 1.—The original circuit.

input ripple was 5 v. p/p 100 c.p.s. on the top of the 150 v. D.C., ripple appearing across the load was 30 mV. p/p.

Taking the choke inductance to be nominal 15 H, the capacity required to tune it to 100 c/s is 0.3 µF. Connecting a 0.25 µF = 20 per cent. capacitor across the 15 H choke, thus producing a circuit near resonance at 100 c/s, the output ripple was reduced to 5 mV. p/p.

Thus the attenuation factor was increased by a factor of $\left(\frac{30 \text{ mV.}}{5 \text{ mV.}}\right) = 6$. Now compared with the attenuation factor of the original L.C. filter $\left(\frac{5 \cdot 1000}{30}\right) = 166$ this does not appear very good, but it has been obtained with practically no loss of space (the capacitor was mounted across the choke terminals) and at very little cost.

Treating the filter circuit as a potential divider and considering only the 100 c/s ripple, at which the reactance of the 16 µF condenser is approx. 100 ohms, then if the 3K load is ignored there are three combinations of the circuit worth investigating.

1. In the untuned state :

$$\frac{100 \text{ ohms}}{ZL + 100 \text{ ohms}} = \frac{30 \text{ mV.}}{5 \cdot 1000 \text{ mV.}}$$

(where ZL is the effective impedance of the choke at 100 c/s).

As ZL will be quite large it can be assumed that $ZL + 100 \text{ ohms} = ZL$ approx.

Thus $30 ZL = 5 \times 1000 \times 100 \text{ ohms.}$

So $ZL = 16.6 \text{ K.}$

2. In the tuned state :

$$\frac{100 \text{ ohms}}{Ze + 100 \text{ ohms}} = \frac{5 \text{ mV.}}{5 \cdot 1000 \text{ mV.}}$$

(where Ze is the effective impedance of the tuned circuit).

Taking, as previously, $Ze + 100 \text{ ohms} = Ze$ approx. Then $5 \cdot Ze = 500 \text{ K.}$

Therefore $Ze = 100 \text{ K.}$

3. We shall now see to what value this smoothing capacitor would have to be increased when used with the untuned choke to produce the same value of attenuation as when the tuned choke and 16 µF capacitor is used.

$$\frac{Xc}{ZL + Xc} = \frac{5 \text{ mV.}}{5 \cdot 1000 \text{ mV.}}$$

(where Xc is the reactance of the capacity replacing the 16 µF and ZL is the same as before).

Again, it will be in order to say that $ZL + Xc = ZL$ approx. and since $ZL = 16.6 \text{ K}$

$$\text{then } Xc = \frac{5 \cdot 16.6 \text{ K}}{5000} = 16.6 \text{ ohms.}$$

Therefore

$$\frac{1}{2\pi} 100 C = 16.6 \text{ ohms}$$

$$C = \frac{10^9}{2\pi 100 \times 16.6} \mu\text{F.}$$

$$C = 96 \mu\text{F.}$$

When the 16 µF was replaced by 100 µF the ripple was reduced to < 5 mV. with the choke untuned and was the same level as with the 16 µF and the choke tuned.

Thus Fig. 2 (a), (b) and (c) can be said to produce the same degree of smoothing. However, I think it can be seen that the circuit of Fig. 2 (a) requires less space, is cheaper and still has a low source impedance plus the fact that existing smoothing circuits can be improved with next to no trouble.

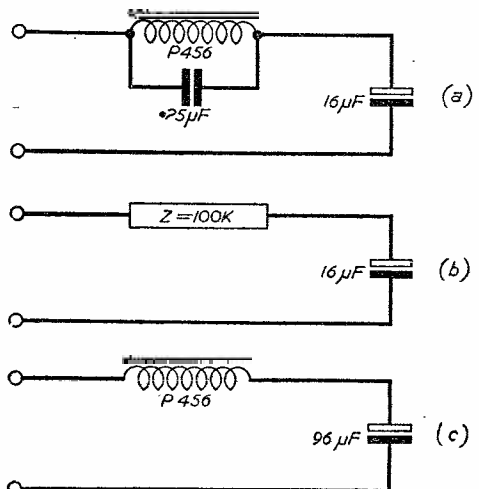


Fig. 2.—The modified circuit referred to by the author.

An FM Feeder Unit

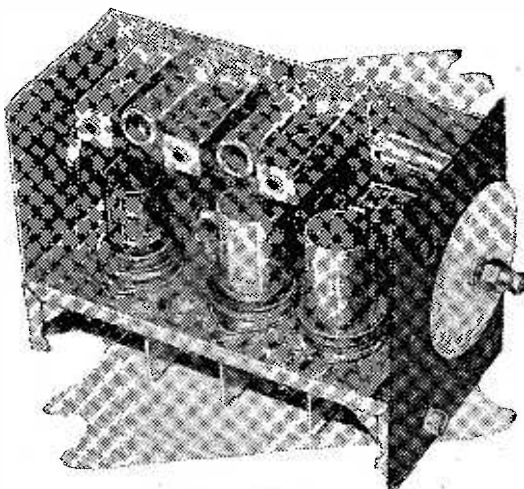
DETAILS FOR MODIFYING THE POPULAR R.F.27 UNIT FOR F.M. RECEPTION

By Allen Janes

(Continued from page 394, August issue)

COAXIAL cable screens the signal and at the same time acts as a capacitor across the primary of T1. Strip back the braid for about $\frac{1}{2}$ in. along the cable and cut it off, then connect centre conductor to pin 2 V2. Now strip off a $\frac{1}{2}$ in. length of outer sheath at a point about $1\frac{1}{2}$ in. from the anode, and lightly solder the exposed braid to the adjacent H.T. decoupling stand-off insulator. The cable is now pushed through the grommet and wired to the primary of T1. The method of fixing used was: Take a long solder tag and fix under a bolt on T1, wrap the end of the solder tag about the coax. to hold it, then press a grommet over the coaxial cable and hard against the solder tag to raise it clear of the chassis; the braid is then soldered direct to the adjacent wire on T1.

The wiring is now quite straightforward as shown in Fig. 5, the leads from the I.F.s being cut to length



The modified unit.

the valves. These should be between 100 and 250 volts, with the exception of V5, the anode and screen voltages here being approximately 50 volts. The cathode voltages can also be checked, the highest cathode voltage being 3.5-4 volts on V2. To check if oscillator is functioning place a voltmeter between anode and chassis and then short the grid, Pin 2, to chassis; a dip of about 10 volts should be shown on the meter if the stage is oscillating.

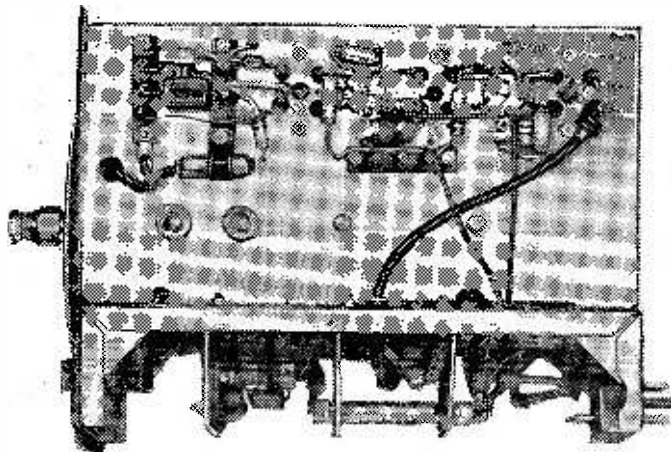
Alignment

Unscrew fully or take out altogether the dust iron core from T3 secondary, then set the remaining cores centrally in their individual coils. Place a voltmeter of fairly high resistance across C39 and inject a signal at 10.7 Mc/s between V5 grid and earth. Tune the cores of T3 primary and T2 secondary for maximum meter reading; transfer the signal generator to the grid of V4 and adjust the cores in the primary of T2 and the secondary of T1 for maximum output in the meter; now transfer the signal generator to the grid of V3 and tune the primary of T1 for maximum reading on the meter; the signal generator is left at this point and

and soldered in first, all leads being kept as short as possible.

Testing the Unit

Before aligning the unit it is advisable to carry out a few simple checks. First ensure that there is no short circuit between H.T. and chassis, and L.T. and chassis. Now plug in valves and dial light, if used, and connect to suitable supplies; the supplies required are 250 volt D.C. at 50-60 mA, and 6.3 volt A.C. at 1.6 A. Connect output to amplifier and switch on. Leave unit for a few minutes to warm up and then check voltages on the anodes and screens of



View of the underside of chassis. See also Fig. 5, page 445.

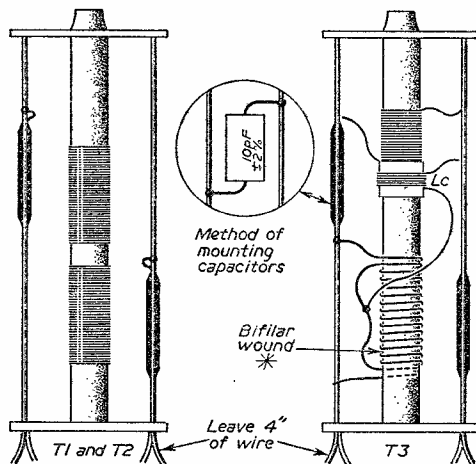
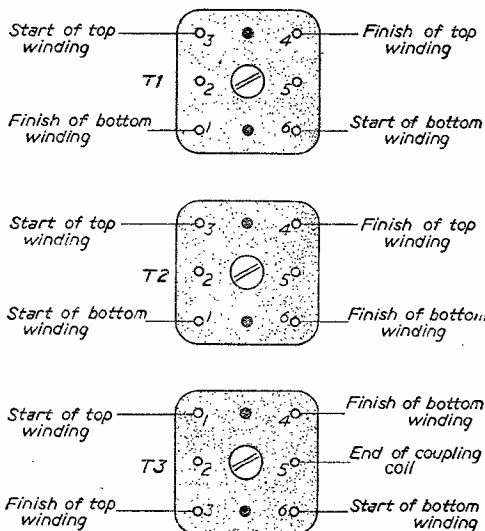
all coils, with the exception of L3 secondary, are readjusted for maximum output. The meter is now transferred to the junction of R20 and C37 and chassis, the dust iron core in T3 secondary is now screwed in and adjusted for minimum reading on the meter.

The signal generator is now set to 90 Mc/s or a

sub-harmonic and a signal injected into the aerial socket. Set the tuning capacitor at about two thirds in mesh and tune T6 for maximum meter reading ; if no meter reading is obtained then try tuning T6 at various tuning capacitor settings; align by closing up or moving apart the turns of wire on L2 and L3.

COIL WINDING TABLE

Circuit reference	No. of turns	Type of winding	Wire gauge s.w.g.	Spacing between coils	Tuned by	Trimmed by	Pin Nos.
L1	1	C.W.	Original coil 20 s.w.g. sleeved	Wound over centre of L2	—	—	—
L2	2	C.W.	16 enamel	—	VC1	—	—
L3	3	C.W.	16 enamel	—	VC2	—	—
L4	7in. of 75Ω coaxial cable. 3/8in. dia. Cathode tap 3in. from earthy end as shown in Fig. 2a.				VC3	T6	—
T1	39	C.W.	36 D.C.C.	3/16in.	coaxial cable	dust core	1 & 6
	39	C.W.	36 D.C.C.		C25	"	4 & 3
T2	39	C.W.	36 D.C.C.	3/16in.	C30	"	6 & 1
	39	C.W.	36 D.C.C.		C31	"	4 & 3
T3	30	C.W.	38 S.S.C.	1/4in.	C34	"	1 & 3
	15& 15	bifilar wound C.W.	36 D.C.C.		C35	"	6 & 4
LC	6	C.W.	38 S.S.C.	Wound over H.T. end of T3 primary	—	—	5

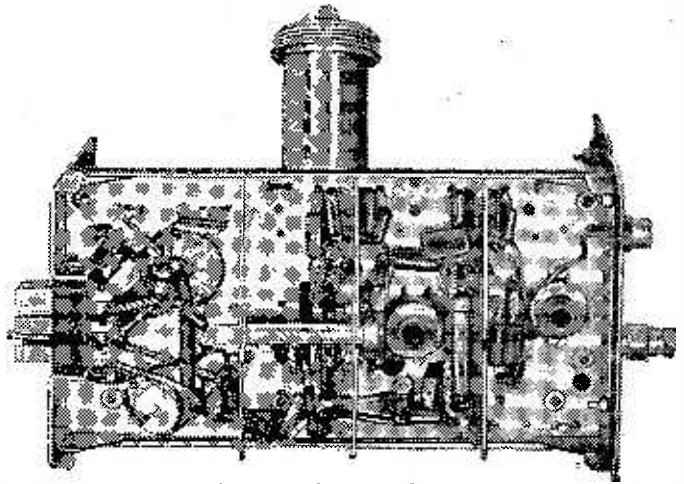


All coils are wound in the same direction.
 * Wind four wires side by side for 15 turns and secure with Durofix. Strip off wires 1 and 3 to leave spaced windings. Connect inner wires together for centre tap. Lc is wound over thin paper round top coil, the bottom of which is connected to the bifilar winding centre tap.

Fig. 4.—Base pin coil details, and coil winding details See table above for winding data.

When aligning the unit the output from the signal generator should be progressively reduced as each stage is brought into alignment; if the I.F.T.s will not tune up at 10.7 Mc/s or, if the cores project from their formers, the signal generator should be slightly off-tuned and the stages realigned.

Readers who have no high resistance voltmeter should switch the signal generator to audio modulation; the unit can then be tuned for maximum and minimum audio output instead of maximum and minimum meter readings. Those who have no signal generator could use an all-wave superhet broadcast receiver by connecting a wire from the oscillator tuning capacitor, via a small fixed capacitor, to the grid of V5. The broadcast receiver is then tuned over the range of 20-35 metres (15-8.6 Mc/s) till an indication is obtained on the meter or the carrier is heard on the amplifier. Now align I.F.T.s as with signal generator; the aerial is used when aligning R.F. stages and oscillator. Trim stages first for maximum background noise and then on a signal for maximum signal strength. When using this last method of alignment two things must be remembered, the first being that some short-wave local oscillators will cease working when long lengths of wire are connected to them, and secondly the reader may find the quality of reception poor; to obviate this the



Another view of the completed tuner,

I.F.s should be retuned for maximum quality and minimum background noise.

Readers who have used a different type of coaxial cable for L4 may have difficulty in aligning the oscillator stage. This can be overcome by using the following procedure: Oscillator frequency too high: check by placing an 100 pF air variable capacitor across T6. Now use the variable capacitor for trimming in place of T6. If the signal is now received

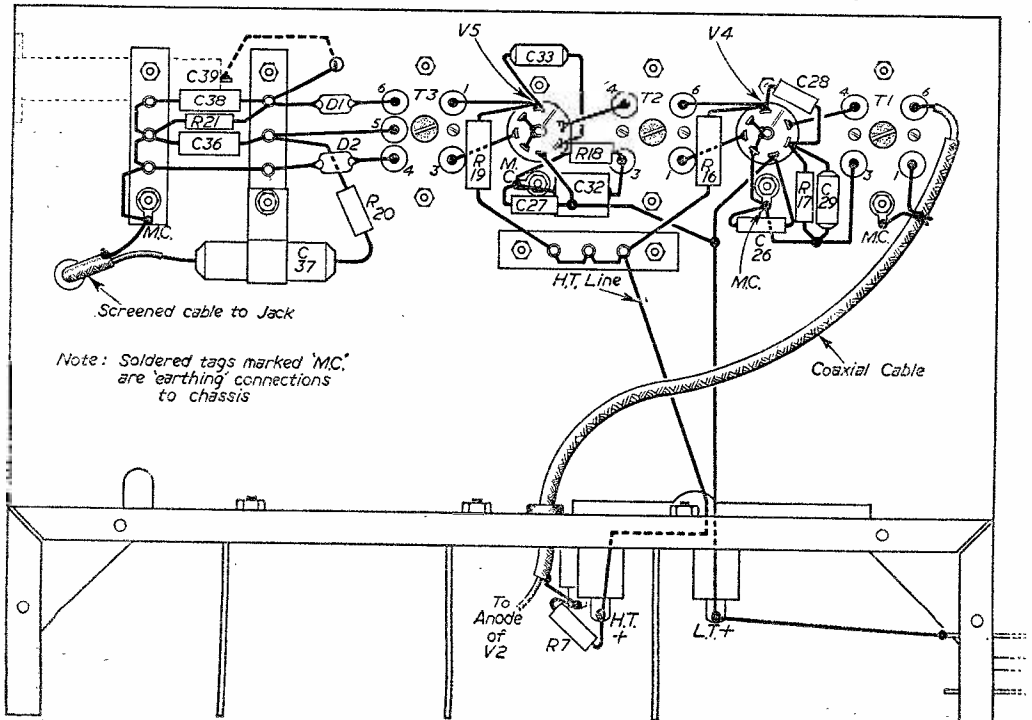


Fig. 5.--Wiring details of the unit.

then use a longer piece of coaxial cable for L4 or a larger trimmer in place of T6. Oscillator frequency too low? Check by shortening the grid end of the coaxial cable by $\frac{1}{8}$ in.; if still too low then again shorten coaxial cable.

Further Data and Improvements

The aerial should be mounted as high as possible to obtain good signal strength, and horizontally to reduce interference, which is usually vertically polarised. For those living in the reception area the aerial can consist of twin flex. Untwist one end and spread out the two wires horizontally to form a dipole of 5ft. overall length. Those who live in or outside the fringe reception area may have to use a dipole with reflector and perhaps also a director. The author, who lives on the outskirts of Coventry, has received good Home, Light and Third Programme signals with a couple of feet of thin wire hanging from the aerial socket.

If there is a large amount of distortion present in the output it will most likely be due to either misalignment or a pair of badly mismatched germanium diodes. The author used a fairly high voltage working capacitor for C39. If required, however, this can be lowered, 4 pF at 12 volts D.C. being adequate. If more gain is required the value of R19 may be reduced. It is, however, inadvisable to reduce R19 below 1 K Ω . When the value of this resistor is reduced the interference rejection properties of this stage are also reduced. Small metallised paper and miniature tubular ceramic capacitor are used for decoupling, as both types have negligible inductance and high capacity-to-size ratio. The ceramic trimmer C6 may be replaced by an air-spaced trimmer and the

following advantages obtained: easier to adjust, longer life stability and lower losses. There is one on the market which can be used here without re-drilling the chassis, its value being approximately 3-30 pF.

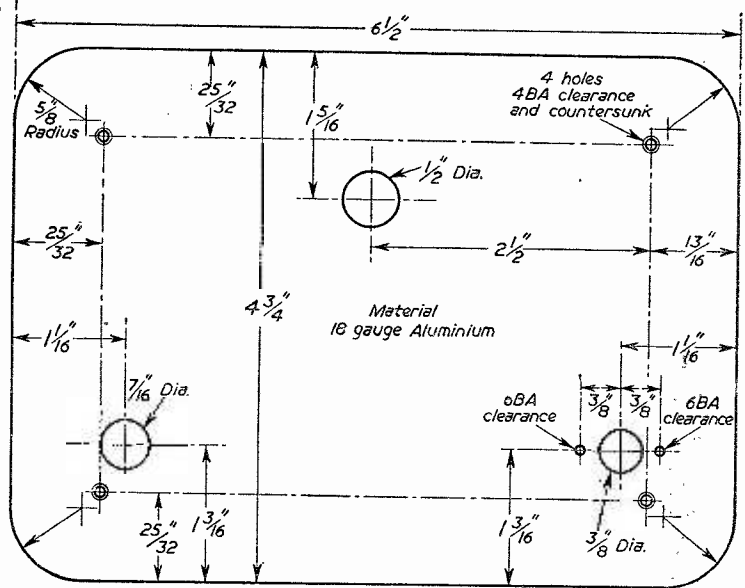


Fig. 4.—Details of the new front panel which is required.

Conclusion

When the unit is completed a large sheet of cardboard or some other suitable insulant should be cut to fit between the I.F. stages wiring and the outer case, this being to eliminate any risks of short circuits occurring here.

To finish off, the unit could be painted some suitable colour; the author chose black for the case and air-drying black crackle for the front panel. This left the unit with quite a pleasant appearance and bearing little resemblance to the original RF27 unit.

First Linear Accelerator

A FIVE MILLION electron-volt linear accelerator has recently been installed at a Ministry of Supply establishment. This machine is believed to be the first of its kind designed specifically for industrial radiography.

The outstanding advantage of linear accelerators is that they give more X-ray output and greater energy than machines previously used for radiography, including Van der Graaf machines, resonant transformers and cascade generators. The machine also compares favourably with multi-curie radio-isotope sources such as Cobalt 60. For example, a half-hour exposure using the linear accelerator will give a radiograph of the best obtainable definition of a steel specimen nine or ten inches thick, whereas the same exposure using a Cobalt 60

source of reasonable size would only give about five inches penetration.

The 5 MeV linear accelerator has been designed to give extremely good definition. Despite the high energy and the large output of over 500 roentgens per minute at 1 metre the electron beam which creates the X-rays has a diameter of only 2 mm. when it strikes the target. In addition, the polar diagram of the output tends to be flatter than is normally associated with such a high energy beam because of a special new magnetic focusing device associated with the X-ray head.

The main part of the machine has been kept small, the overall length being only 9 feet. This has made it possible to obtain a very high degree of mobility so that the accelerator can be moved into the best position for obtaining a radiograph instead of moving the specimen.



A SIMPLE A.C. TWO-STAGE AUDIO UNIT

By David A. Wilding

THE amplifier described here was built to provide reasonable quality without too much expenditure and most of the components necessary may be found in the amateur's workshop. It uses three valves and can be adapted to many applications, in the writer's case a gramophone amplifier.

The amplifier has treble and bass cut controls, a volume control and a separate on-off switch. It incorporates negative feedback and it is for this reason that no boost tone controls are used, since a considerable amount of gain is lost through the feedback loop which is taken from the secondary of the output transformer. It provides the suitable output of 5 watts (6 watts peak) and may be used for

all pick-ups having over 100 mv. output. The value of the volume control may be altered to suit individual pick-ups but, in the majority of cases, a 1 megohm control will suffice.

This amplifier is designed to be used with a 3 ohm loudspeaker, but may be used with a 15 ohm loudspeaker if the resistance of the output transformer is altered and the negative feedback resistor (R9) is given a higher value—this value may be found by using a 500 ohm pre-set resistor instead of R9.

The hum is virtually inaudible—this incredible absence of hum is obtained by using large values for the smoothing and decoupling condensers and this deficiency of hum can only be achieved by keeping to the specifications of the components and adequately screening *all* leads before the grid of the first valve.

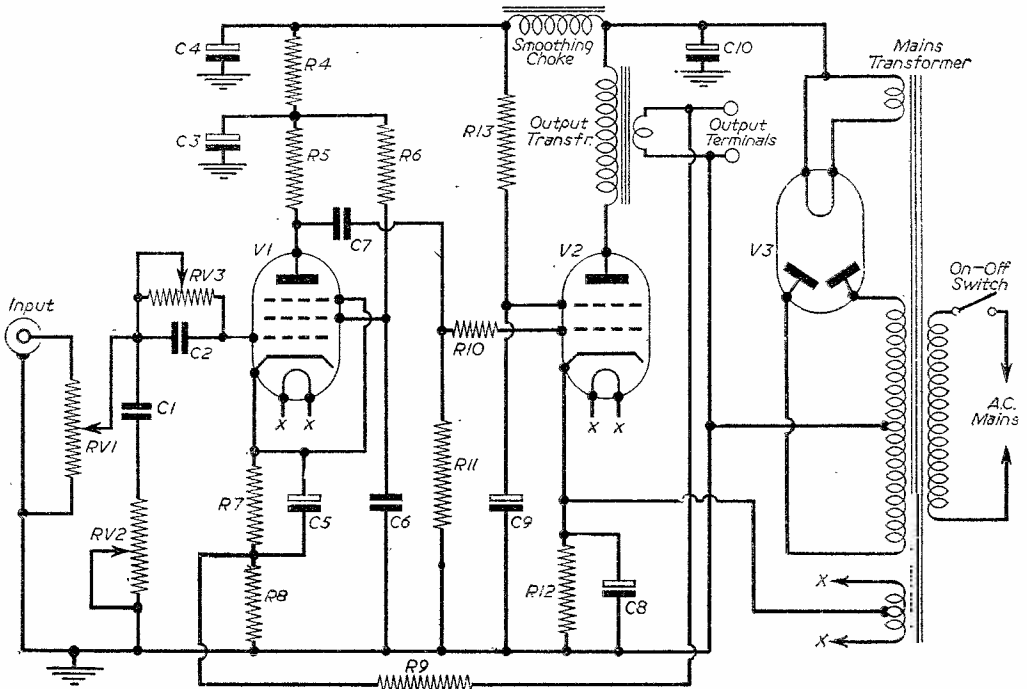
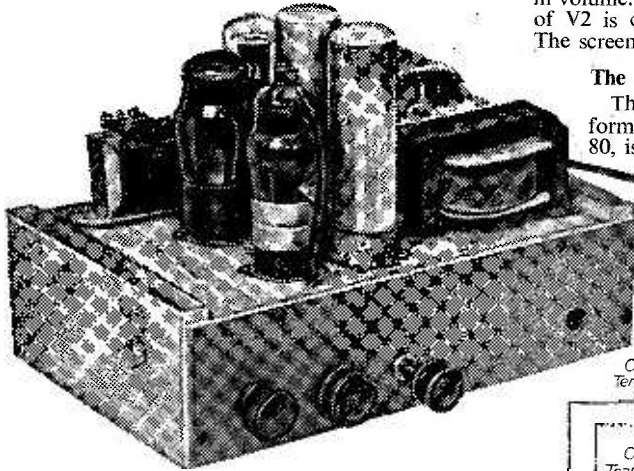


Fig. 1.—Theoretical circuit of the amplifier described here.

The Circuit

It will be seen from the circuit (Fig. 1) that the input is fed to the volume control and then through the tone controls, RV2 being the treble cut and RV3



Three-quarter front view of the amplifier.

being the bass cut; the two controls are based on the theory that as the capacitance varies the tone varies; actually the capacitors are fixed and the two variable resistors bring the condensers in and out of the circuit.

The signal is then fed to the grid of a pentode. The negative feedback is applied to the cathode of this valve from the output transformer. The anode and screen circuits are adequately decoupled by R4, R6, C3 and C6.

The output from V1 is taken through a condenser and resistor to V2, which is the output valve. From

the mains transformer a lead is connected to the cathode of V2; this lead is the centre tap of the heater winding for V1 and V2, taking this lead to the cathode instead of earth reduces the hum with no loss in volume. The output transformer in the anode lead of V2 is connected directly to the rectifier heater. The screen is decoupled by R13 and C9.

The Power Pack

The A.C. supply is taken to the mains transformer via the on-off switch. A rectifier, type 80, is the full-wave type and has 350 volts on each anode. The heater has a separate winding from V1 and V2, because it supplies the H.T., and it has a different heater voltage to the other valves.

A 40 μ F condenser is connected from the heater to earth and a lead is taken to the choke which smooths the H.T. A 24 μ F condenser finally smooths the

(Concluded on page 450)

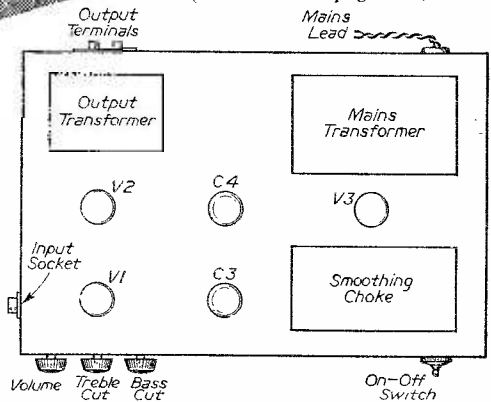


Fig. 2.—Suggested layout of the amplifier described.

LIST OF COMPONENTS

Resistors

- RV1 1 megohm variable.
 - RV2 2 megohm variable.
 - RV3 2 megohm variable.
 - R4 47 k $\frac{1}{2}$ watt, fixed carbon.
 - R5 220k $\frac{1}{2}$ watt, fixed carbon.
 - R6 1 megohm $\frac{1}{2}$ watt, fixed carbon.
 - R7 1.2k $\frac{1}{2}$ watt, fixed carbon.
 - R8 100 ohms $\frac{1}{2}$ watt, fixed carbon.
 - R9 150 ohms $\frac{1}{2}$ watt, fixed carbon.
 - R10 4.7k $\frac{1}{2}$ watt, fixed carbon.
 - R11 470k $\frac{1}{2}$ watt, fixed carbon.
 - R12 220 ohms $\frac{1}{2}$ watt, fixed carbon.
 - R13 10k 1 watt, fixed carbon.
- All resistors 10 per cent. tolerance.

Valves

- V1 6J7
- V2 6V6
- V3 80 or 5Z4

Condensers

- C1 0.1 μ F 250 vwg. Paper.
- C2 0.001 μ F 250 vwg. Paper.
- C3 8 μ F 450 vwg. Electrolytic. In can.
- C4 24 μ F 450 vwg. Electrolytic. In can.
- C5 25 μ F 25 vwg. Electrolytic.

- C6 0.1 μ F 350 vwg. Paper.

- C7 0.1 μ F 350 vwg. Paper.

- C8 25 μ F 25 vwg. Electrolytic.

- C9 8 μ F 350 vwg. Electrolytic.

- C10 40 μ F 450 vwg. Electrolytic. In can (mounted under the chassis directly beneath the choke).

Transformers

Mains : 350-0-350 volts at 70 mA.

6.3 volts at 1 amp.

5 volts at 2 amps.

Output : Primary, 5,000 ohms.

Secondary, 3 ohms.

Choke : 20 mA, 20 henrys.

Miscellaneous.

2 I.O. valveholders.

1 UX4 valveholder (unless a 5Z4 valve is used, in which case an extra I.O. valveholder will be required).

1 on-off switch.

1 chassis.

1 co-axial socket.

1 loud speaker socket.

Connecting wire, mains lead, solder, screws, nuts and bolts, etc.

THE NATIONAL

List of Principal Exhibitors
in Alphabetical Order,
with Stand Numbers

August 28th to
September 7th

RADIO SHOW

Name	Address	Stand No.	Name	Address	Stand No.
Aerialite, Ltd.	Castle Works, Stalybridge, Cheshire	7	Field & Co., Ltd. N. & S. B.	Brook Rd., London, N.22	207
Airmec, Ltd. ...	High Wycombe, Bucks.	228	Garrard Eng. & Mfg. Co., Ltd.	Newcastle St. Swindon, Wilts.	22
Ambassador Radio & T/V, Ltd.	Princess Works, Brighouse, Yorks.	51	General Electric Co., Ltd.	Magnet House, Kingsway, W.C.2	10
Antiference, Ltd.	Bicester Road, Aylesbury, Bucks.	24	Goodmans Industries, Ltd.	Axiom Works, Wembley, Middx.	116
Argosy Radio-vision, Ltd.	Abbey Road, Barking, Essex	2	Gramophone Co., Ltd.	21, Cavendish Place, Cavendish Square, W.1	12
AVO, Ltd. ...	Avocet House, 92-96, Vauxhall Bridge Road, S.W.1	62	Hunt (Capacitors), Ltd., A. H.	Bendon Valley, Wandsworth, S.W.18	48
Belling & Lee, Ltd.	Great Cambridge Road, Enfield, Middx.	55	Invicta Radio, Ltd.	100, Great Portland St., W.1	23
Bulgin & Co., Ltd., A. F.	By Pass Road, Barking, Essex	59	J. B. Mfg. Co. (Cabinets), Ltd.	Howard Way, Harlow, Essex	209
Burwell Products, Ltd.	116, Blackheath Road, S.E.10	205	J-Beam Aerials, Ltd.	Westonia, Weston Favell, Northampton	17
Bush Radio, Ltd.	Power Road, Chiswick, W.4	37 & 5	Koister-Brandes, Ltd.	Footscray, Sidecup, Kent	15
Colc, Ltd., E. K.	Ekco Works, Southend-on-Sea, Essex	44	Labgear (Cambridge), Ltd.	Willow Place, Cambridge	217
Collaro, Ltd. ...	Ripple Works, By Pass Road, Barking, Essex	26	McMichael Radio, Ltd.	Langley Park, Slough, Bucks.	45
Co-operative Wholesale Society, Ltd.	1, Balloon Street, Manchester 4	4	Marconiphone Co., Ltd.	21, Cavendish Place, Cavendish Square, W.1	50
Cosmocord, Ltd.	Eleanor Cross Road, Waltham Cross, Herts.	213	Masteradio, Ltd.	10-20, Fitzroy Place, N.W.1	35
Cossor Radio & T/V, Ltd.	Cossor House, Highbury, Grove, N.5	29	Meadow Dale Mfg. Co., Ltd.	The Dale, Willenhall, Staffs.	224
Decca Record Co., Ltd.	1-3, Brixton Road, S.W.9	28	Mullard, Ltd.	Mullard House, Torrington Place, W.C.1	39
Dubilier Condenser Co. (1925), Ltd.	Ducon Works, Victoria Rd., North Acton, W.3	57	Multicore Solders, Ltd.	Maylands Ave., Hemel Hempstead, Herts.	61
Dynatron Radio Ltd.	Castle Hill, Maidenhead, Berks.	33	Murphy Radio, Ltd.	Welwyn Garden City, Herts.	53
E. A. P. (Tape Recorders), Ltd.	9, Field Place, St. John St., E.C.1	9	NEWNES, GEO. LTD.	Tower House, Southampton Street, Strand, W.C.2	117
Edison Swan Elec., Ltd.	155, Charing Cross Rd., W.C.2	46	Pam Radio & T/V, Ltd.	295, Regent St., W.1	42
Electric Audio Reproducers, Ltd.	The Square, Isleworth, Middx.	41	Peradio, Ltd. ...	13, Bloomsbury Square, W.C.1	63
Ever Ready Co. (G.B.), Ltd.	Hercules Place, Holloway, N.7.	31	Period High Fidelity, Ltd.	28, South St., Mayfair, W.1	106
Expanded Metal Co., Ltd.	Burwood House, Caxton St., S.W.1	124	Peto Scott Elec. Insts., Ltd.	Addlestone Rd., Weybridge, Surrey	30
Ferguson Radio Corpn., Ltd.	105, Judd St., W.C.1	14	Philco (Gt. Brit.) Ltd.	30-32, Grays Inn Rd., W.C.1	43 & 305
Ferranti Radio & T/V, Ltd.	41-47, Old St., E.C.1	36			

Name	Address	Stand No.	Name	Address	Stand No.
Philips Elec., Ltd.	Century House, Shaftesbury Ave., W.C.2	20 & 21	Spencer - West, Ltd.	Quay Works, North Quay, Gt. Yarmouth, Norfolk	206
Pilot Radio, Ltd.	Park Royal Rd., N.W.10	54	Stella Radio & T/V Co., Ltd.	Oxford House, 9-15, Oxford St., W.1	34
Plessey Co., Ltd.	Vicarage Lane, Ilford, Essex	125	Tape Recorders (Electronics), Ltd.	784-788, High, Rd., Tottenham, N.17	111
Portogram Radio Elec. Ind., Ltd.	Preil Works, St. Rule St., S.W.8	1	Taylor Elec. Insts., Ltd.	419-424, Montrose Ave., Slough, Bucks	32
Power - Judd & Co., Ltd.	94, East Hill, S.W.18	208	Technical Suppliers, Ltd.	63, Goldhawk Rd., W.12	103
" PRACTICAL WIRELESS " AND " PRACTICAL TELEVISION " STAND NO. 117			Telefusi on (Engineering), Ltd.	Teleng Works, Church Rd., Harold Wood, Romford, Essex	227
Pye, Ltd. ...	Cambridge	13	Telegraph Condenser, Co., Ltd.	Wales Farm Rd., North Acton, W.3	58
R.C.A. Gt. Brit., Ltd.	Lincoln Way, Windmill Rd., Sunbury - on - Thames, Middx.	114	Telequipment, Ltd.	313, Chase Rd., N.14	226
R. M. Electric, Ltd.	21, Seaton Place, N.W.1	115	Telerection, Ltd.	Antenna Works, St. Pauls, Cheltenham, Glos.	38
Radio & Allied Industries, Ltd.	Langley Park, Slough, Bucks	19	Ultra Electric, Ltd.	Western Ave., Acton, W.3	11
Radio Gramophone Dev. Co. Ltd.	Eastern Ave. West, Mawneys, Romford, Essex	27	Valradio, Ltd. ...	Browells Lane, Feltham, Middx.	118
Rola Celestion, Ltd.	Ferry Works, Thames Ditton, Surrey	16	Vidor, Ltd. ...	West St., Erith, Kent	52
Regentone Radio & T/V, Ltd.	Eastern Ave. West, Mawneys, Romford, Essex	8	Walter Instruments, Ltd.	Garth Rd., Morden, Surrey	49
Roberts' Radio Co., Ltd.	Creek Rd., East Molesey, Surrey	25	Westinghouse Brake & Signal Co., Ltd.	82, York Way, Kings Cross, N.1	113
Standard Telephones & Cables, Ltd.	Brimar Valve Division, Footscray, Sidcup, Kent	6	Whiteley Elec. Radio Co., Ltd.	Radio Works, Victoria St., Mansfield, Notts.	65
Standard Telephones & Cables, Ltd.	Rectifier Division, Connaught House, Aldwych, W.C.2	63, 60	Wolsey Television, Ltd.	Cray Ave., St. Mary Cray, Orpington, Kent.	40

AN INEXPENSIVE HIGH QUALITY AMPLIFIER

(Concluded from page 448)

H.T. before it goes to V1 and V2. The 24μF condenser may be constructed by connecting 8μF and 16μF condensers in parallel. Power is also available for a feeder.

Layout and Construction

A suitable layout is illustrated in Fig. 2. The layout is not critical, but V1 should not be near the output transformer or the power pack. In constructing the amplifier a wooden chassis may be used without any increase of hum; this is cheaper than a metal chassis and not everyone has tools for metal chassis construction. Initially, the heater leads should be wired in; these must be twisted to minimise A.C. fields. The amplifier should then be built in stages starting at the input end. The metal covers of the controls, the output transformer, choke and mains transformer should all be earthed.

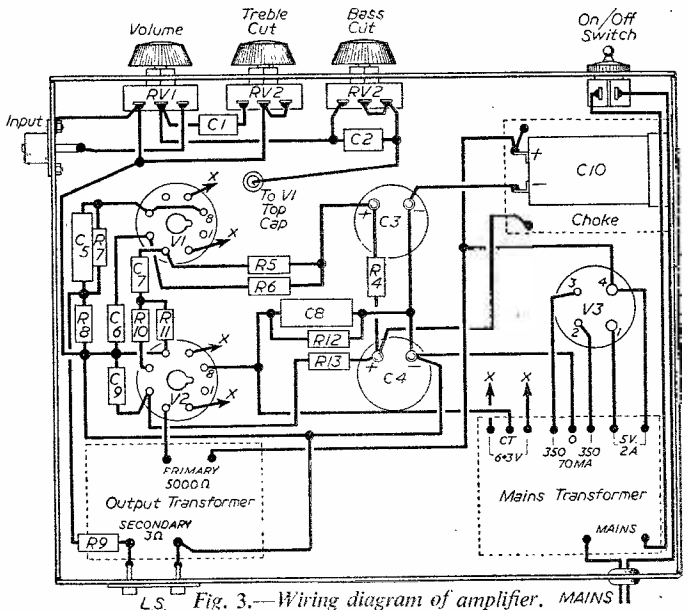
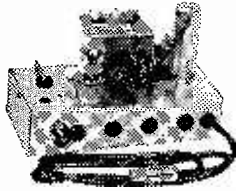


Fig. 3.—Wiring diagram of amplifier. MAINS II

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Mk. 2 Model as illustrated. Latest Cascade circuit using EC64 and EC780 valves giving improved sensitivity (8 dB) over standard circuits. Built-in Power supply AC 200 250v. Dimensions only 6 1/2 in. x 5 in. Hgt. 4 in. Simple and easy to fit - only external plug in connections. **Wired, aligned and tested ready for use.** State Channel required. **Offers Bargain Offer—good results or full refund, only £3.19.6s. Carr. & Pkg. 2/6.**

Mk. 1 Model using 2 8D9's or EF90's. Full constructor's Kit of Parts including drilled chassis 7 in. x 4 in. x 2 1/2 in.,

blueprint, valves and all components, etc., excluding Power Supplies to modified V.W. design. **Bargain Offer only 2 gns. P. & P. 3.6s. Power Supply Kit. Complete 20/-.** P. & P. 1/6. Band I-Band III Switch Kit, 6/6.

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Log. ratios, 10,000 ohms - 2 Megohms. Long spindles. 1 year guarantee. Midget Edison-wire type.
No Sw. S.P.Sw. D.P.Sw. 4/-
Linear Ratio, 10,000 ohms - 2 Megohms. Less switch, 4/- each.
Coax plugs, 1/2. Coax sockets, 1/-
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TWIN-FEEDER. 80 ohms, 6d. yd.; 300 ohms, 8d. yd.
TWIN SCREEN FEEDER. 80 ohms, 1 1/2 yd.; 300 ohms, 2 yd.
TRIMMERS, Ceramic, 4 pt. - 70 pt., 9d.; 100 pt., 150 pt., 1 1/3; 250 pt., 1/6; 600 pt., 1/9. **PHILIPS Beehive Type** - 2 to 8 pt. or 3 to 30 pt., 1/- each.
RESISTORS - Pref. values 10 ohms to 1 megohms.

CARBON WIRE-WOUND
20% Type, 1/2 w., 3d.; 1/2 w., 5d.; 1 w., 6d.; 2 w., 9d.
10% Type, 1/2 w., 9d.; 1 w., 1/6; 2 w., 1/9; 1/-
1% Hi-Stab, 1/2 w., 2/-

WIRE-WOUND POTS
Pre-Set Min. T.V. Type
Knurled Slotted Knob
All values 25 ohms to 30 K. 3 - ea. 50 K., 4/-
Ditto Carbon Track 50 K., 2 to 2 Meg., 3/-

CONDENSERS - Mica or S. Mica. All pref. values 2 pf. to 680 pf., 6d. ea. Ceramic types, 22 pf. 5,000 pf., 9d. each. Tubulars, 450 v., Hunt and T.C.C., .0005, .001, .005, .01 and 1/1000 v. 9d. 22, .05, 1,500 v. Hunt's T.C.C., 1/-; 25 Hunts, 1/6; 5 Hunts, 1/9. 1,150 v. T.C.C. (Simplex), 3/6; .001 6 kV, T.C.C., 5/6. .001 20 kV, T.C.C., 9/6.

STANDARD 3-WAVELENGTH COIL PACK. Size 2 1/2 in. x 2 1/2 in. x 1 1/2 in. depth, 4-pos. switching. Long. Med. Short. Gram. Dust-core coils pre-tuned for 465 Kc. I.F. Complete with trimmers and circuit, ready to use. A very sensitive and efficient coil pack. **Manufacturers' Surplus. Bargain Offer, 27/6.**

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5 w. 25 ohms 1 1/8
10 w. 10,000 1 1/8
15 w. ohms 2/-
3 w. 15,000 - 1 1/8
33,000
10 w. ohms 2 3/8

3w. LAB. COLVERN, Etc. Standard Size Pots, 2 1/2 in. Spindles. High Grade. All Values, 100 ohms to 50 K. 5/6; 100 K. 6/6
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Cut mounting board 5/-, carr. 1/-
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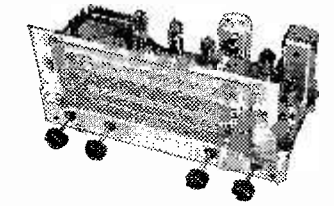
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5Z4	9/8	DI96	9/-	EF86	12/6	PL82	10/-	
6A7S	8/8	5L8	10/8	EP91	8/8	PL88	11/8	
6K7	6/6	EAC80	9/6	EM85	11/6	PS80	9/8	
6K8	8/8	EB91	8/6	EL41	10/6	PS81	9/8	
6Q7	8/8	EB8C	8/6	EL84	11/6	PY82	8/8	
6N7	8/8	EB8A1	10/6	EY81	10/6	U22	8/6	
6V6	7/6	ECC84	12/8	EZ44	8/8	UBC41	9/8	
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6X5	7/8	ECP82	12/8	EM14	9/8	UF41	10/-	
7C7	9/-	5CH42	10/8	PCF84	10/6	UY41	10/6	
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6K8. 8/8 EB91. 8/6 EL41. 10/6 PS81. 9/8
6Q7. 8/8 EB8C. 8/6 EL84. 11/6 PY82. 8/8
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DK96. DP96. DAP96. DL96 ... 35/-
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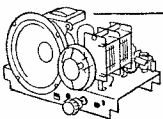
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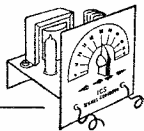
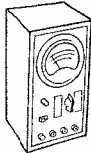
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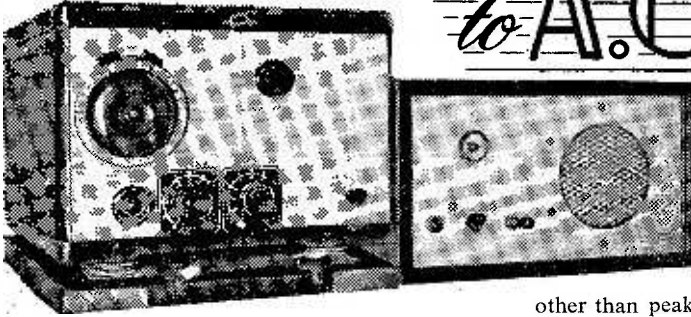
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Converting RA-10-DB to A.C. operation



By Alan Guy

Suitable valves are, for 6V6, 240 ohms, and for 6F6, 330 ohms. No alteration in base connections will be necessary. The whole conversion requires no interfering with the tuned stages

other than peaking the R.F. stages on final aerial testing, as the receiver is very robust; having been designed for use in an aircraft.

THE RA-10-DB as received is a 4 wave-band superhet made by the Bendix Radio Corporation of America, comprising R.F. mixer, oscillator, two I.F. stages, second detector (A.V.C. and first audio), output stage, B.F.O. and noise limiter and is powered by a 28-volt dynamotor. In its original form it was operated by a remote control unit which I understand is unobtainable. The circuit diagram and list of components is obtainable, however, and was of great use in the conversion. The set can be purchased complete with valves from the advertisers at £5 10s. and they can also supply the circuit diagram. It can also be picked up cheaper from time to time less valves.

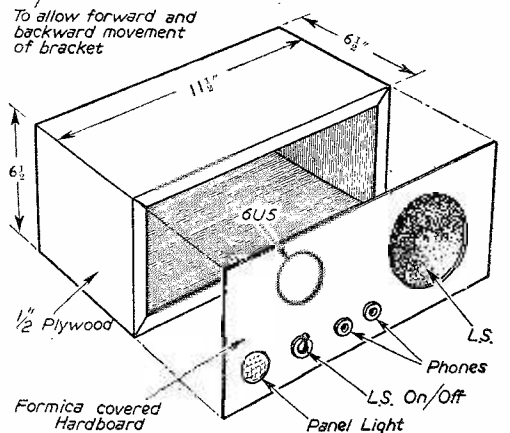
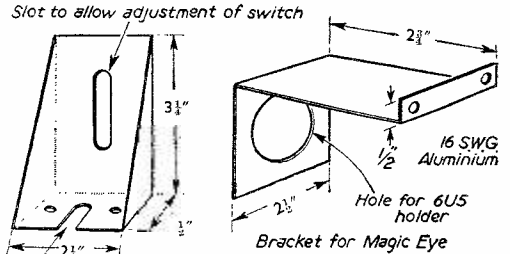
The waveband coverage is from 150 to 1100 kc/s and 2 to 10 Mc/s in four bands. Sensitivity is such that a 4 mV signal gives 50 mV audio at 4:1 signal-to-noise ratio. At 150 kc/s the bandwidth is only 25 kc/s and at 5 Mc/s it is 40 kc/s, so that selectivity is excellent. It is, therefore, the basis of a very fine communications receiver at very modest cost, and also lends itself to the use of converters on V.H.F. The writer has been using a 144 Mc/s converter using a 6J6 double triode with excellent results.

Valve Line-up

The line-up after conversion is as follows: 6SK7 R.F., 6K8 mixer and oscillator, 6SK7s I.F. stages, 6R7 det., A.V.C. and first audio, 6C5 B.F.O., 6K6 output, 6H6 noise limiter, 5Z4 rectifier and 6U5 tuning indicator. It was found, however, that a 6AC7 was a better R.F. valve to use, it being less noisy than the 6SK7. 6SG7s were used in the I.F. stages (merely because these were to hand). It was also found that a 6Q7 gave the same performance as the specified 6R7 without any modifications. Any 5-volt triode will do for the B.F.O. stage, and an L63 was used by the writer in this position. None of the above necessitates any alteration in either wiring or components. If any other valve than a 6K6 is used in the output stage, however, then the bias resistor R31 will have to be altered.

Stripping Down

Starting with the power unit, remove the cover on the dynamotor and cut the sealing wire on the pillars. Remove the terminals on R, B and Y, undo the pillar screws; the motor will then be loose and can be removed. A word of warning here—great care must be taken in the whole



Figs. 1, 2 and 3.—Details of the switch bracket, the holder for the Magic Eye, and the speaker cabinet.

stripping down process to avoid damage to components which will be used in the final receiver. Remove the red/white wires (three) from the choke L7, the red wire from the choke L5 and the black wire from the filter unit. This unit can now be removed by undoing four screws.

Aerial Section

Undo the loop box on the front of the set. Cut off all wires to the loop box at their source in the receiver and remove the box. Remove the aerial terminal from the front of the box and mount it in the hole for the purpose which is now exposed on the front panel of the receiver. Remove Xtal unit by cutting off all leads at the source. The relay and socket can now be easily removed.

Remove jumper wires from B to F, and C to D or ABCDEF panel. Remove resistor from pins 2 and 7 on V8. Remove R38 on tag panel. Next to the output valve is a covered-in valveholder, which is wired in parallel to the output valve. Remove all wires to the valveholder at their source except the screened wire, which will be used later. This socket will now be available for the rectifier.

23-way Socket

Pins 1, 2, 5 and 23 are not connected. Remove

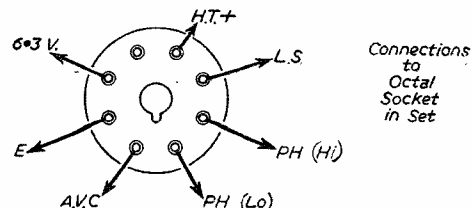
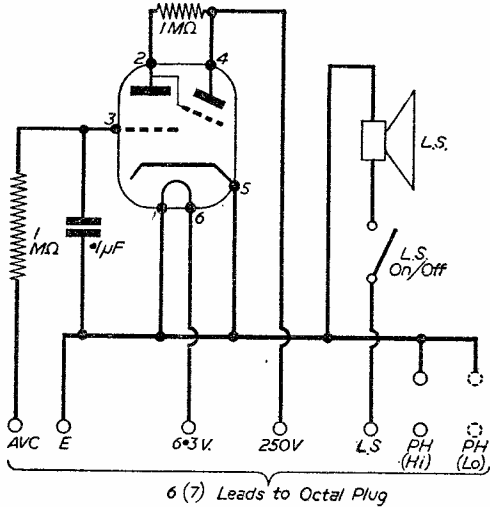
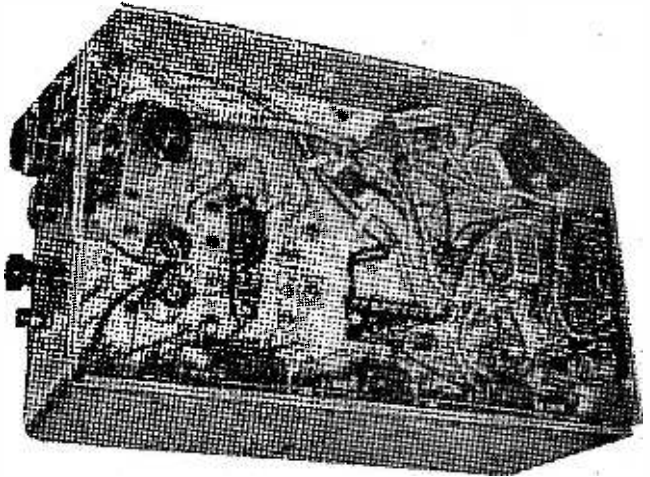


Fig. 4.—The Magic Eye circuit and plug connections.

wires at their source from pins 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 20, 21 and 22. The black/red wire from pin 14 is to be retained for use with the sensitivity control. The lead from



A view of the underside.

pin 17 is to be retained for the B.F.O. switch together with the black/green/white lead from pin 18. Yellow lead from pin 19 will be used for the headphone sockets.

Waveband Switch

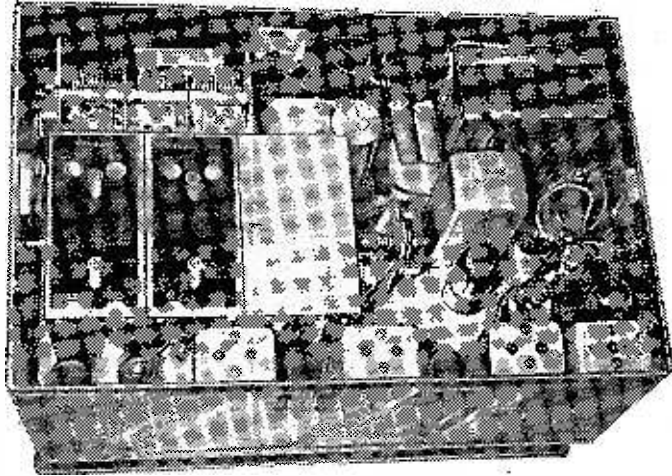
Remove cover from rear of selector box on switch unit located at the rear of the coil cans. This exposes a small 28-volt motor which operates the waveband switch. Draw out the switch spindle carefully, so as not to disturb the wafers and remove the selector box, having first cut off all leads at their source. Note carefully on which band the unit is set (Band I is the left-hand position when viewed from the front panel). Do not under any circumstances move the wafers as there is no clicker plate, the switch having been motor driven. Drill a 3/8 in. hole in the front panel, replace the spindle carefully, push through the front panel and affix a knob. The next job is to cover the hole left by the selector box and motor. Use a fairly strong piece of aluminium here, as a bracket is to be mounted on it. Cut and shape a bracket as shown in Fig. 1, and mount a single-pole 4-way switch. With a flexible coupler attach the rear of the main switch spindle to this switch and both will now work in step with each other using the clicker plate of the new switch. There is plenty of spindle length for this purpose and the wiring of the extra switch will be shown later on.

Other Modifications

Blank over the hole left by the 23-way socket and mount a 3-pole 3-way switch. This will be the B.F.O. switch. Remove the earth terminal from the front panel and mount at the rear of the set. Mount a 1/2 MΩ volume control with switch at the side of the B.F.O. switch. Mount

a 25 kΩ sensitivity control at the side of the volume control. Mount a fuseholder at the rear of the tuning capacitor inside the cabinet. Mount the power supply components as shown in the photograph with the smoothing choke underneath the chassis. Mount an output transformer near to the phone transformer (T16) underneath the chassis. Fit loudspeaker and phone sockets at the rear of the cabinet. Mount an octal socket

Remove dial assembly. Retain the coupler as it will be found that the spindle on the tuning capacitor is 1/16 in. diameter and couplers of this size are difficult to obtain. This coupler will require patience in removing, and it will be found that a length of 1/16 in. spindle is also available to attach to the new tuning dial. The writer used a Muirhead slow-motion dial removed from an R.F.26 unit. Mount the mains filter components next to the fuse-holder. This is an optional addition but was found to eliminate much mains-borne interference in the prototype. Remove the strip resistors from the main chassis as they will now be found to be completely disconnected.



Inside the cabinet—a neat layout.

The mechanical modifications are now complete and work can be commenced on the rewiring. It will be seen that all coils and transformers are brought out to numbered tags which greatly facilitates the rewiring and tracing of the circuit.

Rewiring
Join A, B, D and E together on the ABCDEF panel. This alters the valve heaters from series/parallel to all parallel connection. To complete the heater wiring connect pin 2 of V2 to pin 7 of V3. Connect pin 7 of V4 to "C" on panel, pin 2 of V7 to "C." Disconnect pin 2 of V9 from R39 and wire to pin 7 of V1. Keep this wiring to the side walls of the chassis.

near to the L.S. sockets at the rear of the set. Drill a 1/16 in. hole at the rear for the mains lead and insert a rubber grommet.

to "C." Disconnect pin 2 of V9 from R39 and wire to pin 7 of V1. Keep this wiring to the side walls of the chassis.

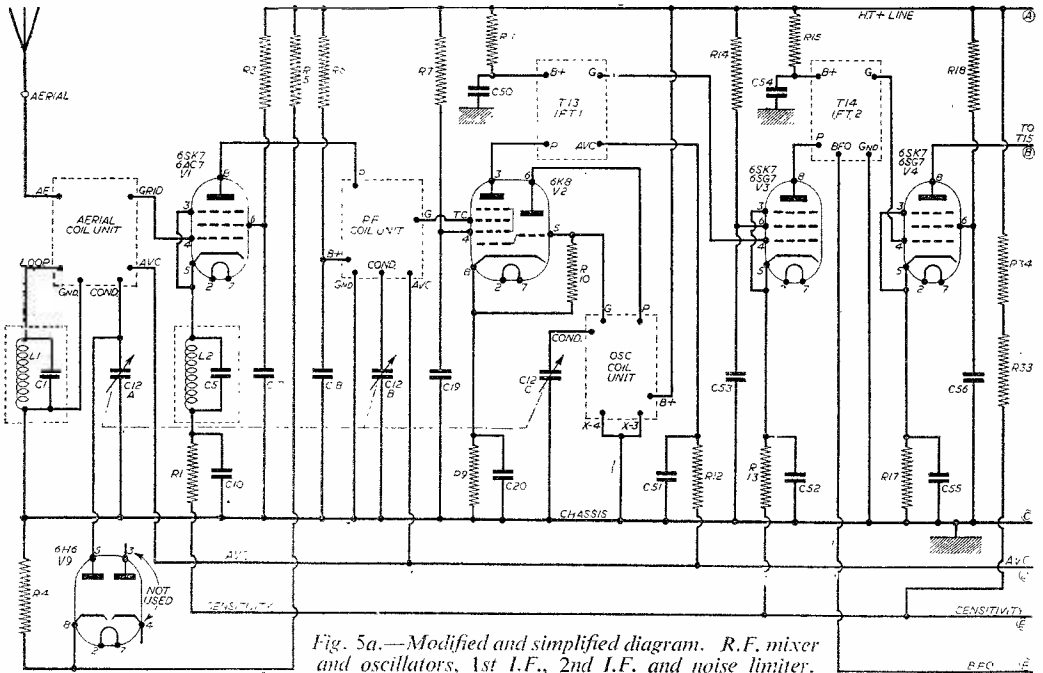


Fig. 5a.—Modified and simplified diagram. R.F. mixer and oscillators, 1st I.F., 2nd I.F. and noise limiter.

Wire in the power supply as shown in Fig 5 and connect H.T. lead to pin 6 on T16. Join the L.T. lead to "C" on ABCDEF panel and the negative lead to chassis. Output stage: connect top end of volume control to C72, other end to chassis. The slider is connected via a 0.02 μ F to the grid (pin 5). Disconnect pin 1 of T16 from the anode (pin 3). Connect one end of the loudspeaker transformer to the anode and the other end to pin 1 of T16. The two transformers are now in series. This results in some small mismatch, but was found to be unnoticeable. The transformer T16 can be disconnected entirely if desired, but, if so, should be retained on the chassis as it contains a smoothing choke which is left in circuit. The secondaries of these transformers are then taken to the phone and L.S. sockets at the rear of the receiver, leads from the sockets also being taken to the octal socket. It will be seen that T16 is available for use with either high or low resistance phones by using pin 4 for low, and pin 5 for high resistance phones. An extra socket can be placed at the rear if desired to accommodate both settings. Screened lead was used in all connections to the volume control.

B.F.O. Switch

Connect lead from "SW" on B.F.O. coil unit to pin 3 section A of the B.F.O. switch, as in Fig. 5b. Connect poles on sections A and B to chassis. Wire the pole on section C to pins 2, 3 and 4 on the additional wavechange switch. Connect pin 2, section A, to pin 3, section B, and also to pin 1 on the additional wavechange switch. This point is also connected to R41 via the retained black/green/white lead from pin 14 of the 23-way socket. All these connections can be clearly seen in Fig. 5b.

Mains

Wire in the A.C. side of the power supply, using screened leads to the switch on the volume control. A panel light was connected in the loudspeaker cabinet as will be seen later. If desired it is possible to short out section C of the B.F.O. switch and have the volume and sensitivity controls running together. This however requires some skill in operating and in the writer's case it was retained. Connect X3 and X4 to chassis. This completes the rewiring and the circuit must be carefully checked against Fig. 5a and 5b.

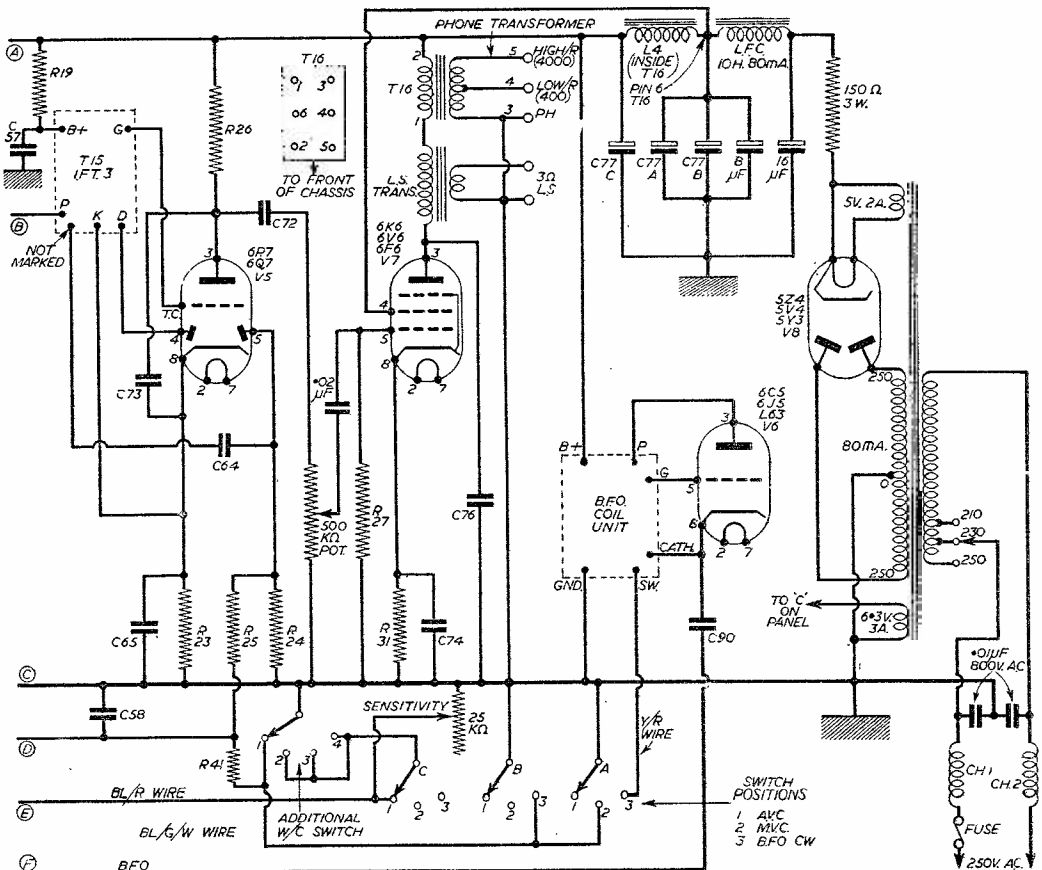


Fig. 5b.—Circuit of the detector, A.V.C., 1st A.F. stage, output stage, B.F.O. and rectifier.

Loudspeaker Cabinet and Magic Eye

After the wiring has been checked and found to be O.K., work can then proceed on the loudspeaker cabinet. A small 5in. loudspeaker was used and gave excellent results in the shack. However, if quality reception is desired a larger

EXTRA COMPONENTS REQUIRED

Valves 6U5 (Y63 or EM34). 5Z4 (5W4, 5Y3), 6.5-volt bulb.
Panel light holder.
6-pin UX base. Octal socket. Octal plug.
7 small sockets (Radiospares).
1 small toggle switch single pole.
3-pole, 3-way wafer switch. Single-pole 4-way wafer switch.
4 knobs. Muirhead slow motion dial.
Set of panel transfers
500 k. volume control with switch.
25 k. sensitivity control, less switch.
2 1 megohm resistors $\frac{1}{2}$ watt.
1 0.02 μ F 350 volt working.
1 0.1 μ F 350 volt working.
1 16-18 μ F 450 volt working Electrolytic.
150 ohms 3 watt stopper surge limiter.
Smoothing chole 10 H 80 mA 100 ohms.
Mains transformer 250-0-250 volt 80 mA. 6.3 volt 3 A, 5 volt 2 A.
5in. loudspeaker.
Output transformer to match 6K6 or 6V6.
Mains lead and plug. Connecting cable 6-way.
Wire, sleeving, etc.

speaker must be used, and a 0.001 to 0.02 μ F capacitor connected across the output transformer primary or a simple top cut tone control added. Fig. 2 gives the dimensions of the cabinet and panel. Formica covered hardboard being used for the latter which gives a pleasing finish. A piece of gold expanded aluminium fret was used in

front of the speaker. A bracket as shown in Fig. 2 was constructed to mount the Tuning Indicator which was a 6U5 with a UX Base. A Y63 or EM34 could be used in this position with equal results. The connections to the receiver were made via a 6-way cable as shown in Fig. 4. This fits into the octal socket which was fitted to the rear of the receiver.

Testing

When all construction work is finished, the units connected together and an aerial connected (a small throw-out will be sufficient for testing), the power can now be switched on. Switch to Band 1. Locate a weak signal and adjust C6 for maximum volume in the speaker. This should be the only adjustment necessary. If this is not successful, then a signal generator will be required and the set realigned. In the majority of cases, however, no more than slight alteration of the R.F. trimmers will be necessary and in the writer's case was only required on Band 3. Trimmers for Band 2 are C7. Band 3 C8 and Band 4 C9. The Muirhead dial is easy to handle and a chart can be made out for calibration and pasted on the side of the L.S. cabinet. Over a period of six months or more stations from over 30 countries have been logged and the set has now pride of place in the shack, being equal, in the writer's opinion, to the best communications receivers of its class.

Work is now proceeding on its conversion to a caravan receiver (it is rather large for a car).

Finally the cabinet is given a coat of grey (or to taste) paint and the controls finished off with "Panel Signs," the picture on p. 453 showing the finished assembly. Best results were obtained with an inverted "L" aerial of 30ft. length.

World's Largest Tape Factory

THE world's largest magnetic tape factory, which is estimated to be capable of meeting the recording demands of the entire world for the next ten years, went into production recently on a round-the-clock basis at Hutchinson, Minnesota, U.S.A.

Erected by the Minnesota Mining and Manufacturing Company, of St. Paul, U.S.A., which has a British associate of the same name, the factory is maintained like a hospital in order to achieve the near sterile conditions required to produce the essentially perfect magnetic recording tapes necessary for such fine applications as video tape recording, electronic computers and instrumentation recording.

General manager of the 3M company's Magnetic Products Division, Dr. W. W. Wetzel, said that the 78,000 square feet unit incorporated the ultimate in tape-making technology based on half a century's experience in applying precision coatings, and more than a decade of pioneering in the production of highly specialised tapes for magnetic recording.

He commented that the firm's new factory had more than tripled the American 3M company's magnetic tape production capacity and included facilities for a further 50 per cent. increase.

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

One of the most commonly used accessories in television transmission is the zoom lens, and this has now become so well-used that the majority of viewers take it for granted and hardly appreciate that it is being used. It is not a simple matter to construct a lens which will remain in focus no matter at what point it is set, and in the zoom lens British scientists produced an instrument which is now widely used not only in television, but also in cinematography. How it works is the subject of the main article in this month's issue of our companion paper PRACTICAL TELEVISION, now on sale.

Better conductivity is experienced on the short waves used for television when the wires or parts are silver plated, and the amateur can silver plate wires and parts for himself, as explained in "Silver Plating for the Experimenter" which forms the subject of another article in this issue.

Some Useful Aerial Devices are described, together with Fault Finding on A.G.C. systems, Servicing the Sobell TS17 and T346, Aerial Matching and Mismatching, Faults with Focus, Some Obscure Faults, Converting the 3807 to 12 channel reception, Beginners' Guide to Television and the usual features.



On Your Wavelength

BY THERMION

More About Musical Movement

MY paragraph in the August issue criticising the schools programme entitled "Music and Movement" has certainly caused some movement of the pens of school teachers. One such, John F. Whone, of Harrogate, bursts forth into a tirade in support of this stupid programme. Knowing far more about the teaching profession and the minds of children than he seems to suppose, I would emphasise my criticism of this programme, which in my view is asinine and should be withdrawn. Mr. Whone says: "We teachers know from constant experience that almost any person feels confident to know more about our job than we do." Judging from illiteracy figures, one would not think so. He asks me whether I have ever been in a school since I left, and I can inform him that I have been in regular touch with schools ever since. The onlooker often sees the best of the game, where the teacher often cannot see the tree for the wooden heads in front of him. I have a high regard for the teaching profession, but it cannot be denied that not all teachers are qualified to teach although they may have passed their examinations. He further asks me whether I understand the minds of six-year-old children. It may surprise him to know that I have often taught such classes. I credit even a six-year-old with a higher degree of intelligence than the BBC presume in their construction of their Music and Movement programmes. It is a great mistake to presume that children of six are imbeciles. Dancing and its offshoots should find no place in the school curriculum, and I do not doff my hat deferentially either to school teachers nor to the BBC in this respect.

Of course, the BBC is intended to cater for all types and all ages. I made no imputation to the contrary, but it could occupy programme time for children in a far more useful manner than radiating bilge of this sort. I find it impossible to believe that those who devised this programme and those who support it do understand the mind of a child of six. They imagine that they do. If one stretches a point and concedes that the programme might have some useful purpose in teaching it could be devised in a more realistic manner, with perhaps an improvement on the old method of making a child walk the length of a room with a book on its head, muttering "Prunes and prisms." Children go to school to be educated, not amused. Teachers should teach interestingly!

Pronunciation

SIMILARLY, I adhere to my point about BBC pronunciation. Where all dictionaries agree on the pronunciation of a particular word that should be accepted. The BBC should not set

itself up as an etymological authority, in view of the wide number of nationalities represented in its personnel. Some foreigners learning English do listen to the BBC and it must be confusing to them after a lesson from their English master teaching pronunciation of English words to listen to some gems such as "cundit" for conduit. Equally I think the BBC has a responsibility to see that people it engages in its programmes are rehearsed as to their pronunciation. Even the minds of teenagers can become affected by wrong pronunciation. If the teachers are teaching one pronunciation what will they have to say if the BBC gives another? One of the cryners the other day, in "sobbing" one of the latest out-pourings from tin-pan-alley into the microphone, came out with "Yaw perfection, without any fahlt . . . Skays are blew, dreams come trew, when I'm holding yew." The readily-absorbent minds of young children could be polluted with this uneducated pronunciation (as if perfection could have any fault, anyway!). In any case, with all this improvement in education, free education at that, and the improved opportunities for scholarships up to university standard, I am not so sanguine about illiteracy as Mr. Whone, who has to resort to sending me a cutting from a schoolteacher's periodical (beg pardon, they are schoolmasters now!).

The BBC should not be allowed to tamper with the school curriculum and, I repeat, Music and Movement should be dropped.

I have received a further convulsive paroxysmal effusion on this subject from our bombastic friend, Roy L. Williams, who hails from Yewstone Lodge, Wistantow, Craven Arms, Salop, but this I will reserve for special treatment next month.

The Radio Show

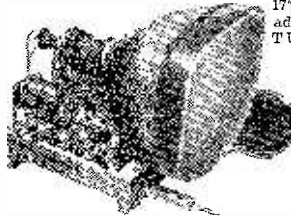
AS I write these notes, the Radio Show has not yet opened its portals to the thousands who will enter it to see what the show has provided for 1958. The accent, of course, will be on high-fi, tape recorders, but mainly with television. There is no indication at this stage of any surprised development.

It is unfortunate that the home industry does not evince the same interest in the constructor market as it did hitherto. It is still a large and lively market, and those firms who specialise in catering for amateurs' requirements continue to do excellent business on an improving sale. I suggest that the industry which is not doing too well as far as radio receivers are concerned might usefully turn its attention to the marketing of kit sets, as they did years ago. "The Melody Maker," "The Music Magnet" and similar kit sets sold in hundreds of thousands, and some of those receivers are still in existence. Unfortunately, the trade is not too well disposed to their older products and refuses to supply spares for them.

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T.V. TUBES 30/-

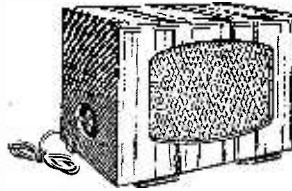
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ATTACHMENTS for "18" Transreceivers. ALL BRAND NEW. Headphones, 15/6; Hand Microphone, 12/6; Aerials, 5/-; Set of SIX VALVES, 30/-.

RESISTANCES. 100 Assorted useful values. New wire end. 12/6

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The National Radio Show—1957

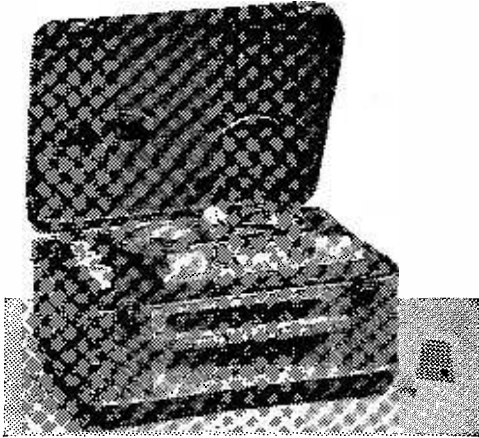
A PRELIMINARY REPORT OF THE EXHIBITS

ONCE again the National Radio Show is upon us and as usual it is shrouded in these early days by iron curtains dropped by various firms in the hope that they will be able to steal a march on their competitors. No doubt, as usual, when the opening day arrives there will be little to startle the visitor, and most firms will be more or less following each other except in so far as concerns manufacturing processes. For some years now there has been little which could be called "new." Even in television, stability has been attained and most

component. In fact it will not be necessary to try and trace a faulty part, as the mere location of a fault in a printed panel will be sufficient to warrant replacing the panel complete. Time will be saved and the part can be serviced at a later stage and then put back into stock ready for use again.

Transistors

Transistors appear to be very much more widely used in this year's apparatus, but so far as we can trace to date no firm which has yet produced in this country an N-P-N type, although there are a number of circuits in which this component can be used with advantage. The P-N-P is of course still limited by frequency and thus does not have such wide application as the valve. Its use in audio circuits has led, however, to more compact record players and tape recorders, as well as the personal type of portable. In the latter two categories manufacturers appear to be making quite a feature of the colour finishes and as a result the apparatus is quite attractive. Plastics help, both in the case and control knobs or scales, and many of the portables appear to be most attractive—a point which will, of course, appeal more to the opposite members of the sex than the mere male who is concerned with the "internals." Some of the cabinets are also claimed to be unbreakable. The Ferrite aerial is more or less standard. This gives much better results than the small internally-wound frame which was formerly used, and would appear to



A neat tape recorder by Baird.

new models really present the same internal arrangement in a new dress.

As we go to press so much in advance of our actual date of issue we naturally are in the dark concerning many items which will be on show, but a study of that information which has so far been released reveals that the only thing which may be said in a general way is that there will be a greater proportion of printed circuits and transistorised apparatus than at last year's show. Whilst it is expensive to tool up to produce a printed circuit for every design, it is found that certain parts of a receiver (and also of a television set) follow standard lines, and new designs merely consist of modifications to other parts of the complete set. Thus, these individual "set pieces" can be produced *en masse* and will as a result considerably reduce the overall cost of the complete set.

Thus it appears that we may see receivers in which some sections are on standard lines, whilst other parts are in the form of printed circuits. It would appear that there will be several advantages in this arrangement, not the least of which is that of servicing. If a fault arises in the printed part of the set, it will be a simple matter to take out the complete part and replace it rather than attempt to replace an individual

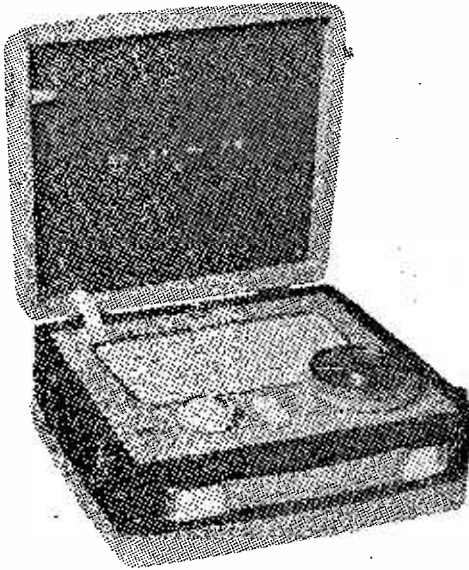


This record player, by Tape Recorders, has two matched speakers, four speeds and is for A.C. operation.

take two forms. In some cases the coils are wound on a length of Ferrite rod, whilst in others a slab of the material is used.

V.H.F.

There would appear to be more receivers designed to receive the BBC V.H.F. transmissions,



A neat portable by Bush typifies the trend in portables.

although from the details so far received no new technique appears to have been adopted. The circuits for these still, in the case of receivers designed also for medium- or long-wave reception, have the two circuits more or less in series—that is, on the I.F. side the normal 465 or 456 kc/s transformer is in series with the 10.7 Mc/s components, and two completely separate stages are used between the last I.F. and the first audio, with, of course, the difficulty of the necessary switching.

One thing which we are pleased to note, however, is that more manufacturers have decided to do justice to the V.H.F. transmissions. It has been pointed out, not only in this and other periodicals, but also by the BBC, that apart from the removal of man-made interference these transmissions afford the listener a very high quality of reproduction, and in past years many of the A.M./F.M. receivers still had a small 8in. speaker in a small cabinet which hardly did justice to the normal A.M. programmes.

At least one manufacturer has announced that this year a receiver is being introduced in which a complete dual loudspeaker network is being employed with cross-over etc., and yet is only rated at 4 watts. In the past it was usually found that such elaborate loudspeaker arrangements

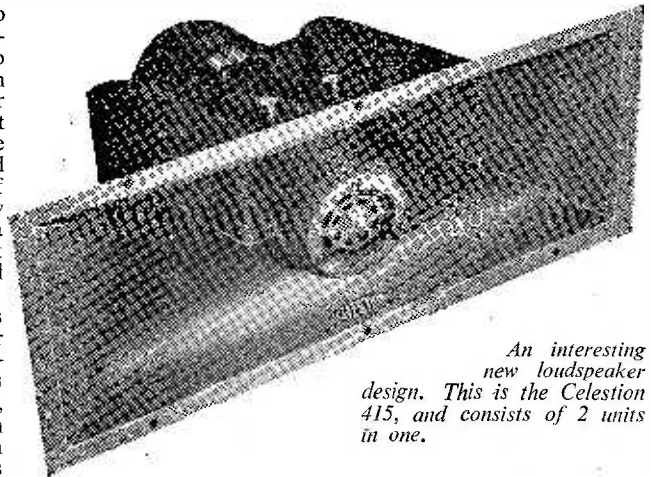
were only fitted to large installations rated at 10 watts or more. This is a welcome departure, and provided the cabinet size is adequate should provide the listener with worthwhile high-quality at reasonable expense. On the subject of quality, also, more amplifiers appear to be produced for those who wish to build up record players, recorders, etc., but so far we are unable to trace any cross-coupled amplifiers. Many manufacturers give the output rating, inter-modulation distortion, etc., but so far we have not seen a single one which gives a 'scope reproduction of the response to a square wave. Copies of 'scope response reveal far more, and more convincingly, the efficiency of a piece of equipment, and in fewer words. Perhaps in time manufacturers will supply such information.

Miniaturisation

The increasing employment of transistors and printed circuits has resulted in the manufacturer of components having to cut down the overall size of his products. This is particularly noticeable in the capacitor and audio transformer lines, where in some cases the dimensions have been reduced beyond what appears to be reasonable. However, it must be remembered that the transistor does not deal with currents of the order found in even the simplest valve stage, and as a result the current ratings may almost be ignored. One particular transformer which we have seen, with a ratio of over 4 to 1, is so small that you could pack nearly two dozen of them in an ordinary matchbox.

Fixed capacitors also have been reduced to remarkably small dimensions and these include electrolytics which again, in view of the very low voltage and current, are almost ridiculously tiny. But outside the transistor field, the very neat B7G type valves have resulted in smaller "standard" items and thus the portables and similar pieces of equipment are still smaller and more efficient, owing to the increase in the number of stages which may be employed.

Next month's issue will contain a stand-by-report of the exhibits, and will be on sale on September 6th.

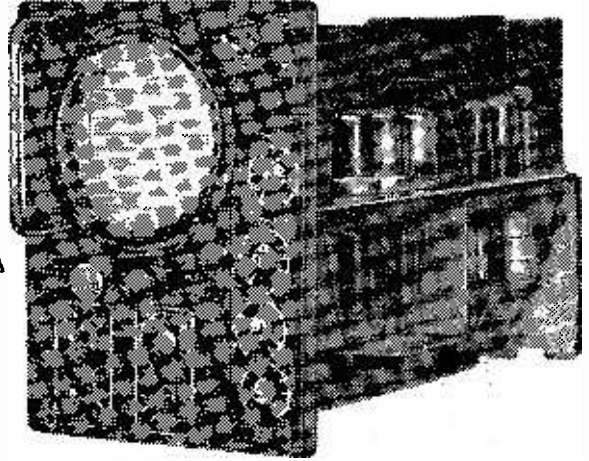


An interesting new loudspeaker design. This is the Celestion 415, and consists of 2 units in one.

A 'SCOPE FROM THE 62 UNIT

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

By D. Llanwyn Jones



THE original unit is the ex-W.D. Indicator Unit Type 62A. This is obtainable quite cheaply from most surplus stores. It contains a VCR97 tube with numerous EF50 (VR91), SP61 (CV118), VR54 and EA50 valves. The unit is constructed on a double-deck chassis. The original and final front panel layouts are shown in Fig. 1. The controls of the complete oscilloscope are detailed below. 1. Electronic switch in/out; 2. X shift; 3. Y shift; 4. separation; 5. Y attenuator; 6. Y1 sensitivity; 7. Y2 sensitivity; 8. X switch; 9. Y switch; 10 and 11, coarse and fine timebase frequency controls; 12. X sensitivity; 13. sync; 14. brilliance, and 15. focus. The numbers

given to controls in the following notes refer to those in the list above.

Before starting on the construction of the oscilloscope it is necessary to strip the unit completely with the exception of the valve heater connections, the original focus and brilliance potentiometers and the 2P2W switch at the top right of the front panel. The metal box which is at the front of the lower chassis should be removed carefully by undoing the four securing bolts from the front panel. This will be required later. Fig. 2 shows a view of the chassis from the top. The valveholders crossed out can be removed and the holes blanked out.

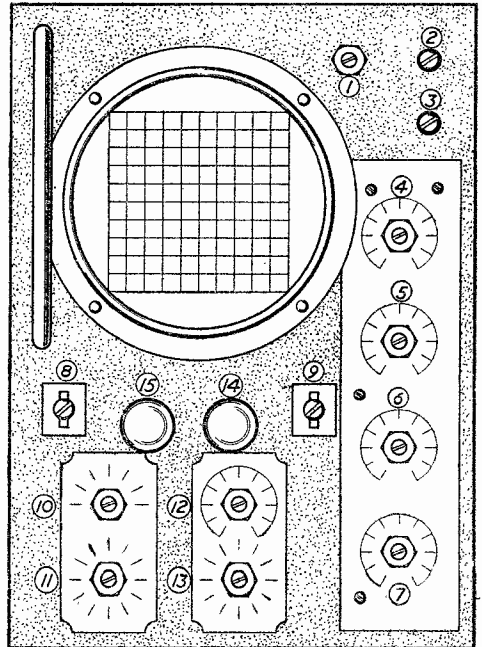
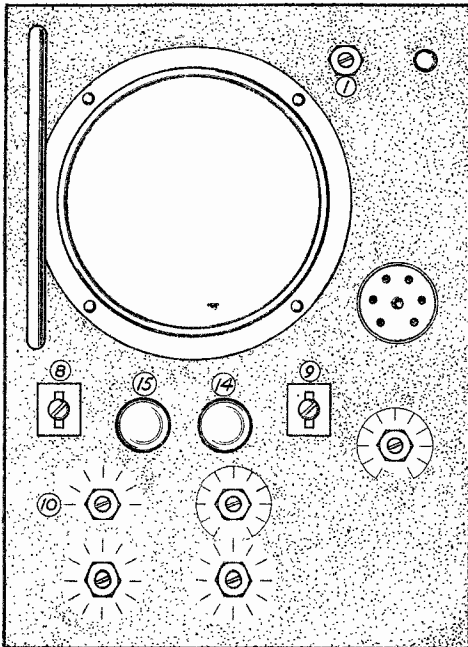


Fig. 1.—Details of the front panel before and after conversion.

The toggle switch 9 can be left in position, but the companion toggle switch 8 should be unscrewed, inverted, bringing the brass bar to the top, and then replaced. This is done so that

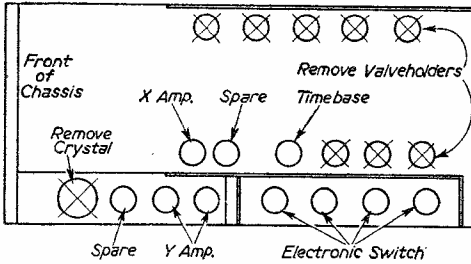


Fig. 2.—Position of the 'X' amplifier.

when the toggle is in the down position the switch is set to timebase.

Building the Oscilloscope

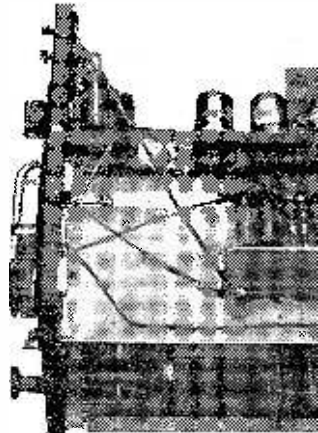
In the following notes the various sections of the oscilloscope are each described separately in the order in which they should be constructed. As each section is built, it is essential to test it for "hum." The screening does much to eliminate this and is therefore essential. All wires carrying current to the deflectors must be screened. Low loss screened cable should be used

in making such connections. Hum is shown on the screen in the form of elliptical or circular distortion of the trace. If the above precautions are taken, however, it will not prove troublesome.

The construction is detailed below under the following headings, EHT system, H.T. system, X and Y switches, Timebase, Y amplifier, X amplifier and the electronic switch.

The electronic switch probably needs some explanation. It is a Y deflecting device by means of which two traces can simultaneously be obtained on the screen from the two separate inputs.

The intending constructor can, of course, omit any section or sections that he does not think that he will require. In this case he will have to modify his front panel layout to take his controls.



Another view.

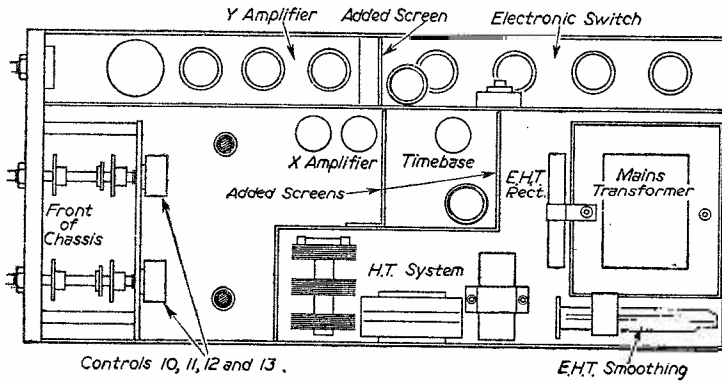
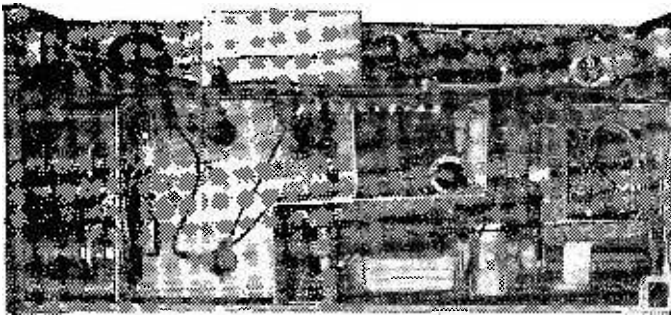


Fig. 3(b).—Details of the main layout.

Layout of the Chassis

Before starting to build the oscilloscope it is advisable to decide on the layout of the various sections. Figs. 3(a) and 3(b) show the layout adopted by the author. This layout has the advantage that the sections are screened from each other, as far as possible, by the chassis. Additional aluminium or tinplate screens should be positioned as shown. Dimensions of the screens are not given because of the large differences in the size of components, etc.

The constructor will find that he has not enough room on the front panel to mount the input sockets. In the prototype these were put on a paxolin strip which was screwed to the metal shield on the left-hand side of the C.R.T. as viewed from the front. The sockets were arranged to coincide with the ventilation holes on this side of the outer case. The sockets required are Y/Y1 input, Y2 input, X input, sync and 6.3v. output for experimental work on phase. A socket for time



An actual photograph of the view shown in the drawing above.

marking by grid modulation could be mounted, but this is rendered unnecessary by the electronic switch. Using this the standard frequency can be displayed by using Y2 input, the waveform under examination being applied to the Y1 input.

EHT System

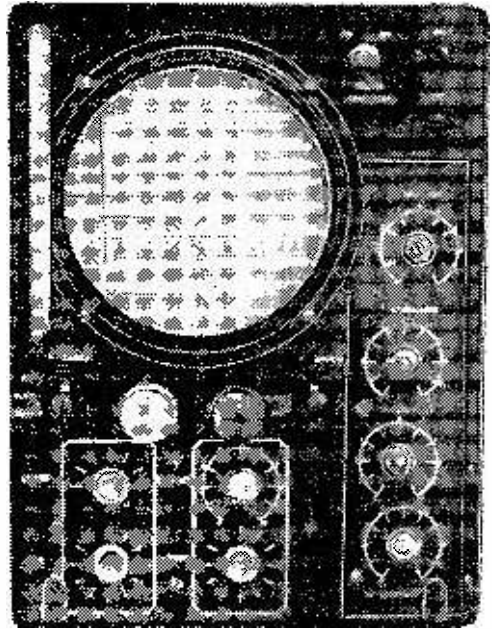
The circuit is conventional. The mains transformer required has primary to suit mains, secondaries 350—0—350v at 80 mA, 6.3v at 4A and 4v. at 1A. The rectifier is Sen—Ter—Cell type K3/25, but any rectifier rated above 1,000v. is suitable. The brilliance and focus potentiometers are already in position in the unit. Note that the heater of the C.R.T. is at EHT potential together with the heater winding on the transformer. If the cathode heater connection is



the chassis.

not made, odd snake-like contortions of the spot will occur.

The mains transformer must be bolted to the back of the lower chassis as shown on Fig. 3(b). If this is not done magnetic distortion will occur. In the circuit the ends of the shifts are shown



The main control layout.

connected to the chassis. This is only done for the purpose of testing the EHT, and after testing, the ends of the shifts connected to the chassis should be soldered together and the junction con-

The C.R.T. pins are numbered from the pin on the holder clockwise when viewed from back. Pin 7 is joined to the aquadag coating, and should be joined to pins 5 and 10

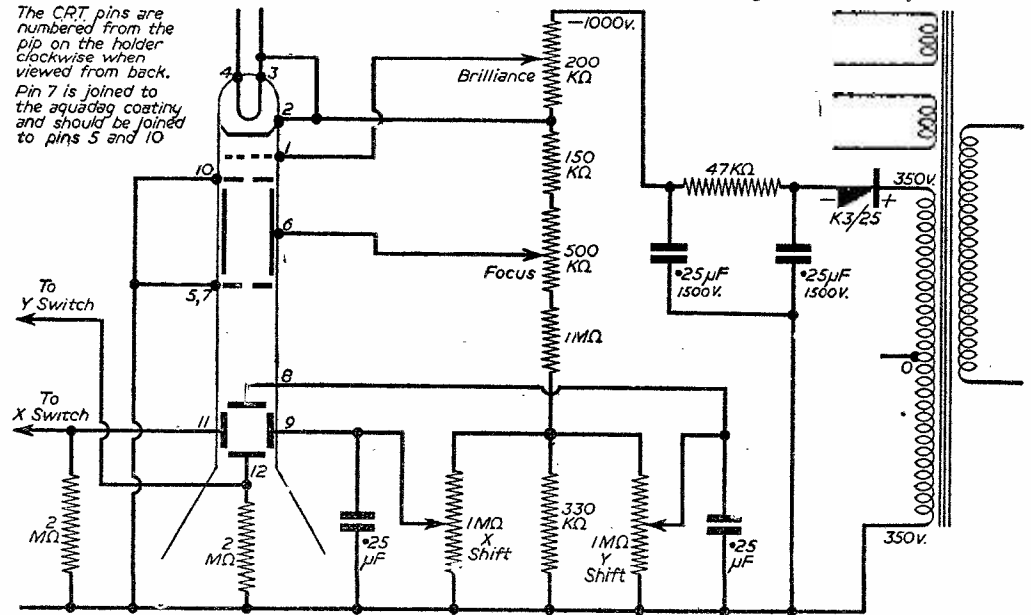


Fig. 3(c).—Pin connections for the C.R.T. and circuit of the tube power supply.

needed to the point in the H.T. power pack marked "shift." When the tube has been wired up the unit may be switched on.

the two rectifiers originally tried in this position ran very hot. At this point the valve heaters can be wired up.

H.T. System

This is located in the compartment shown in Fig. 3 (b). The H.T. is obtained from the same transformer as the EHT, the centre tap of the transformer being used. This is the point marked

X and Y Switches

These switching circuits may appear a little complicated at first glance, but if the constructor follows the numbering of the pin connections to be given later he cannot go wrong. The following arrangement allows the input from the Y/Y1 socket to be switched either to the electronic switch, or directly to the Y plate, or to the plate via the Y amplifier. The circuits utilise switches 1, 8 and 9. The diagrams will be given next month. Detailed connections to the various components will be found in the circuits of these items. Y switching.

The X switch will be

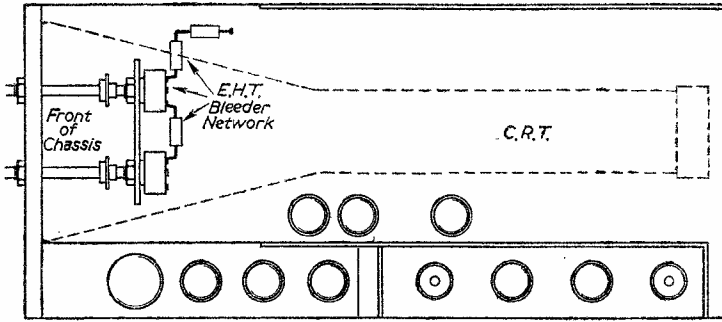


Fig. 3(a).—Further details of the layout.

On the transformer as shown in the circuit. The output is about 370 v. for the timebase and electronic switch and 270 v. for each of the amplifiers. The 100 μ F smoothing capacitor ensures that a good smooth H.T. is applied to the electronic switch and timebase. The amplifiers are further decoupled to prevent interaction by the 8 \pm 8 μ F capacitor. If hum is present it will be found that the electronic switch will sync with the mains frequency of switching always being a harmonic 50 c/s. 3 x R.M.2 are necessary since the peak inverse volts are of the order of 900 v. and

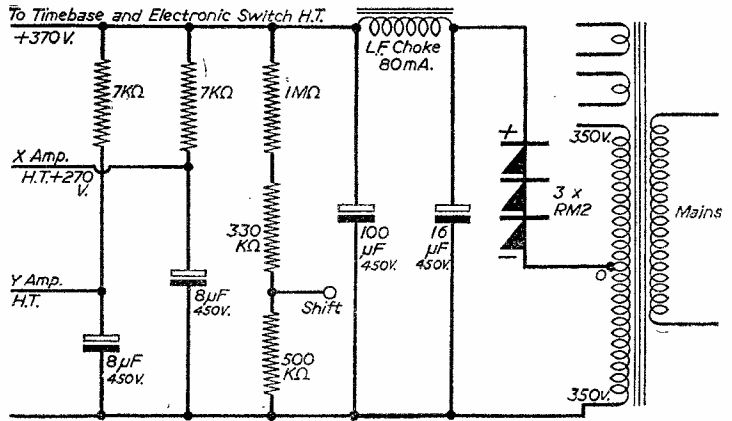


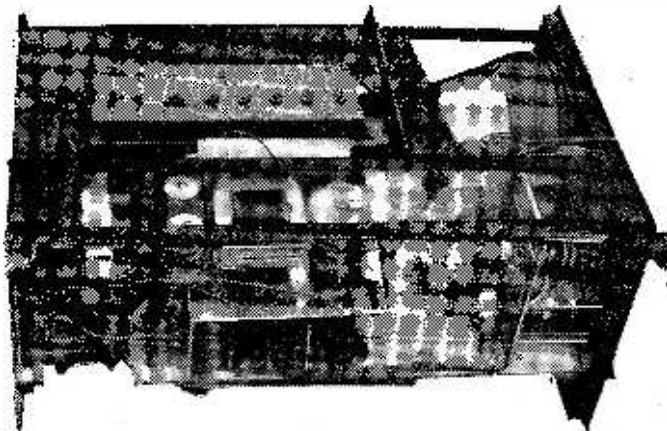
Fig. 3(d).—Circuit of the main power supply.

found to have three positions. In the following diagrams the positions of the moving contacts are shown in the three positions of the illustrations. The remainder of the illustrations will be given in next month's issue.

X Switching Position A (Amp)

In this position (with the toggle up) the X input is connected via the X amplifier to the X plate. The amplitude of the trace is controlled by the X sensitivity potentiometer. The output of the timebase is connected to the chassis. If it is left floating the amplifier will pick up the sawtooth.

(To be continued)



View from beneath chassis showing disposition of parts.

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1R5	8/6	6V8GT	7/-	7/6	EP41	9/6	PL36	12/6
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3Q4	9/-	6X5GT	6/8	6/6	EP48	8/6	PL82	9/6
3Q5GT	9/6	6T8	9/9	8/6	EP85	7/6	PL83	10/6
3S4	7/6	7B7	8/-	8/6	EP86	12/6	PY80	9/6
3V4	8/6	7C5	8/-	8/6	EP89	10/6	PY81	8/6
5U4G	9/-	7C8	8/-	8/6	EP91	9/6	PY82	7/6
5Y3GT	7/6	7HT	8/-	8/6	EP92	5/6	PY83	9/6
6A5	9/-	7K7	8/-	8/6	EL32	5/6	PZ30	18/-
6AB8	7/6	7Y4	8/-	8/6	EL38	23/6	SP41	3/6
6AK5	4/6	10C2	13/-	12/6	EL41	10/6	SP61	3/6
6AL5	6/6	10F1	15/-	14/6	EL42	11/6	U25	12/6
6AM5	5/-	12A18	10/6	10/6	EL84	9/6	U50	7/6
6AM6	6/-	12A17	8/6	8/6	EM34	10/6	U78	8/6
6AQ5	7/6	12A27	7/6	7/6	EM80	10/6	U78	8/6
6AT8	6/6	12AX7	9/-	9/6	EY61	10/6	UAB80	11/6
6BA6	7/6	12J7GT	11/-	11/6	EY86	10/6	UAF42	10/6
6BE6	7/6	12K7GT	8/6	8/6	EZ40	8/6	UBC41	8/6
6BJ6	7/6	12K8GT	14/-	14/6	EZ41	10/6	UBF80	9/6
6BR7	11/-	12Q7GT	8/6	8/6	EF89	9/6	UCH42	10/6
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6F12	6/-	35L9GT	9/6	9/6	ECF80	12/6	KT63	6/6
6F13	12/-	32Z3	10/6	10/6	ECF82	11/-	MU14	8/6
6F15	14/9	32Z4GT	8/6	8/6	ECF83	9/6	NU11	8/6
6J6	5/6	35Z5GT	9/-	9/6	EC85	9/6	NU16	7/6
6K7G	4/6	50L6GT	8/-	8/6	EC84	10/6	P81	12/6
6K7GT	6/-	8/-	8/6	8/6	EC81	8/-	PC84	8/-
6K8G	7/9	B33	19/6	19/6	EC83	9/6	PC89	8/9
6K8GT	9/6	19L6GT	19/6	19/6	EC83	9/6	PC89	8/9
6K9GT	9/6	19L6GT	19/6	19/6	EC83	9/6	PC89	8/9

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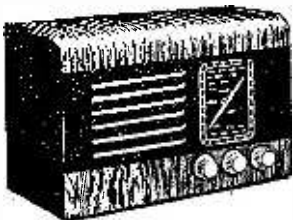
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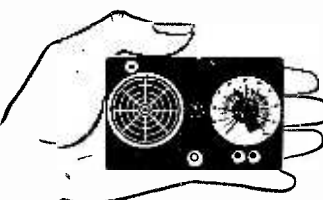
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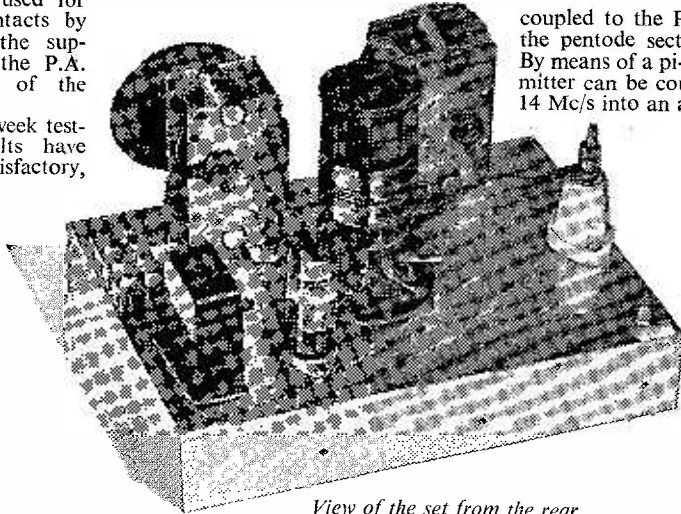
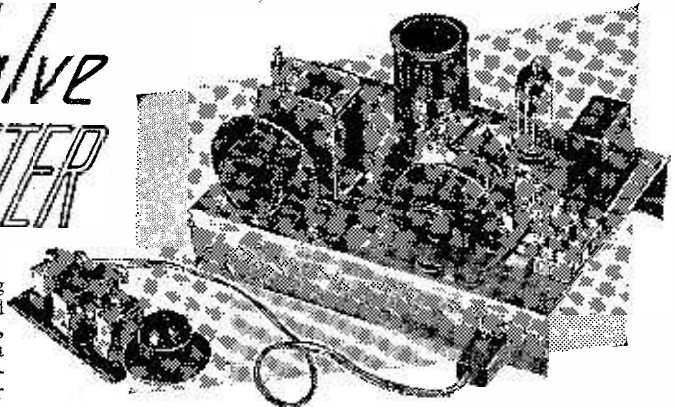
A Single Valve TRANSMITTER

By R. WRIGHT

THIS simple transmitter, using one ECL80 valve, can be used as a complete low power rig or, alternatively, as a driver unit for a power amplifier, and although primarily designed as a C.W. transmitter it may also be used for local 'phone contacts by modulating on the suppressor grid of the P.A. pentode section of the valve.

During a two-week testing period results have proved highly satisfactory, good reports being received on 3.5, 7 and 14 Mc/s with an input of 4 to 4.5 watts.

Reference to the circuit diagram will show that the transmitter comprises a Pierce oscillator built around the triode section of the valve and capacitively



View of the set from the rear.

coupled to the P.A. stage, which is the pentode section of the ECL80. By means of a pi-coupling, the transmitter can be coupled on 3.5, 7 and 14 Mc/s into an aerial of almost any

length. Radiation on the 3.5 Mc/s band can be obtained using a 3.5 Mc/s crystal, while the same crystal will also give transmission on the 7 Mc/s band, the output stage being used as a doubler with fair efficiency. A 7 Mc/s crystal may be used for transmission on the 7 Mc/s band and will give greater output

since the P.A. stage is now tuned to the fundamental instead of the second harmonic. If output is required on 14/Mc/s then a 7 Mc/s crystal must be used and the output stage tuned to the harmonic.

Tuning

Select suitable crystal and coil combination from

COMPONENT LIST

- C1—0.001 μ F (mica).
- C2—0.01 to 0.1 μ F (mica).
- C3—0.01 μ F (mica).
- C4—0.0003 μ F variable, or 0.0005 μ F variable in series with a good 0.001 μ F mica capacitor.
- C5—0.0065 μ F variable.
- R1—22,000 Ω , $\frac{1}{2}$ watt.
- R2—47,000 Ω , $\frac{1}{2}$ watt.
- HFC—2.5 mH chokes.
- L1 (a)—32 turns, No. 20 d.s.c., 1 $\frac{1}{2}$ in. diameter, close wound.
- L1 (b)—20 turns, No. 20 d.s.c., 1 $\frac{1}{2}$ in. diameter, 1 $\frac{1}{2}$ in. long.
- L1 (c)—10 turns, No. 18 enam., 1 $\frac{1}{2}$ in. diameter, 1in. long.
- M—0.30 mA. meter, or low current pilot lamp, in which case tune C4 for minimum brilliance.

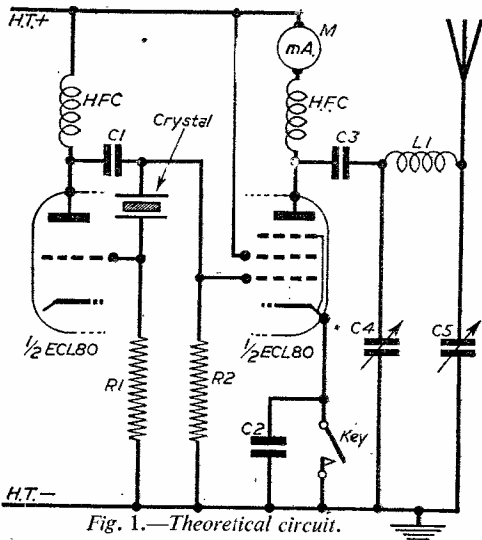


Fig. 1.—Theoretical circuit.

the table, put C5 to maximum capacitance and rotate C4 with the key pressed until a dip is observed in the meter reading. Now decrease C5 capacitance by about 10 per cent. and re-tune C4 for a dip. Continue this process until the meter reads 20 milliamps in the

Amateur Band (Mc/s)	Crystal Freq. (Mc/s)	Coil
3.5	3.5	L1 (a)
7.0	3.5 or 7.0	L1 (b)
14.0	7.0	L1 (c)

dip position. The transmitter is now coupled into the aerial.

Keying the Transmitter

The key may be placed in the cathode of the valve

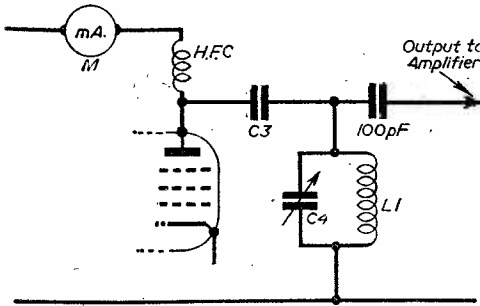


Fig. 2.—Rearrangement of the pentode section as a driver.

or in the H.T. negative line, but should be shunted in either position by a mica capacitor of 0.01 to 0.1 μ F in order to reduce interference in neighbouring receivers from key clicks. If the rig is being used as a driver for a higher power transmitter, then it would be preferable to key the following amplifier, and a toggle switch could replace the key in order that the oscillator may be switched off between QSO's. If the transmitter is to be used as a driver, Fig. 2 shows the rearrangement of the pentode section. An earth connection may be made to any point on the H.T. negative line.

The transmitter will require a power supply giving 200-220 volts H.T. at about 30 mA, and an L.T. supply of 6.3 volts at 0.3 amp. This may be obtained from an ordinary receiver-type power pack.

Careful reading of the advertisements in our pages will enable all the components for the transmitter to be bought for as little as 30s.

The transmitter as described has, of course, a limited range, and perhaps some readers would like something more powerful. In next month's issue we shall describe a Power Amplifier stage which may be added, and this may be made as a separate unit, or readers may desire to wait for next month's issue and build the complete set.

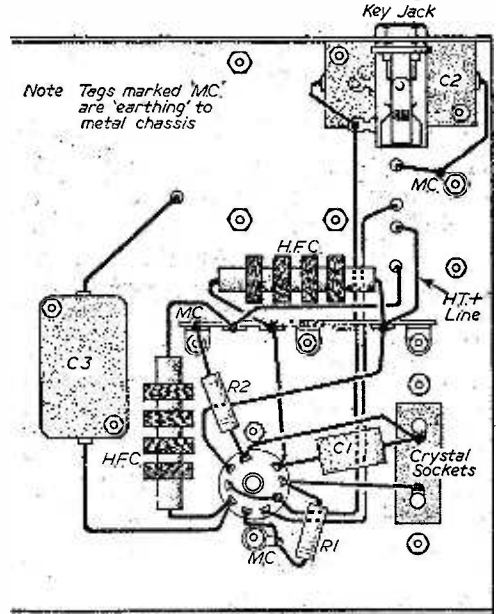


Fig. 4.—Wiring details below chassis.

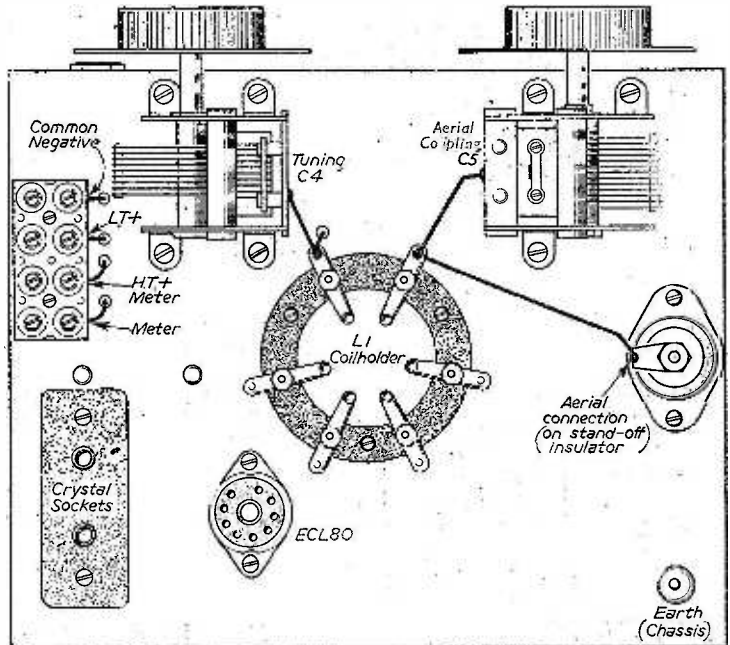


Fig. 3.—Top of chassis wiring and layout.

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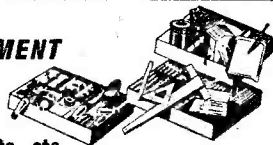
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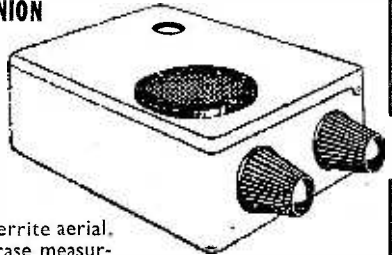
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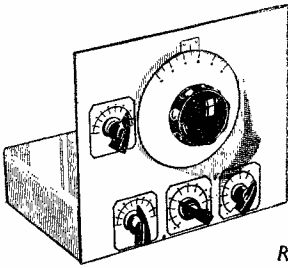
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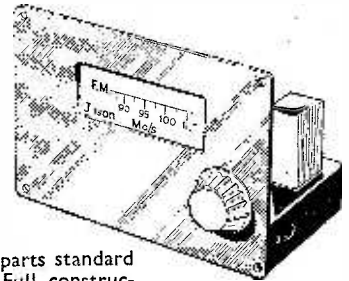
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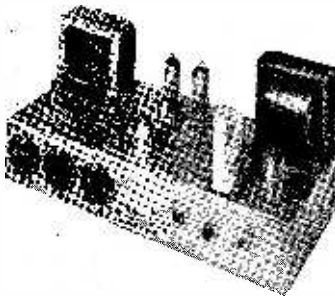
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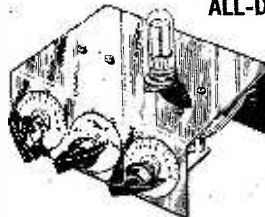
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The Radar Research Establishment

SOME INTERESTING DETAILS OF THE "HOME OF RADAR"

THE RADAR RESEARCH ESTABLISHMENT (R.R.E.), at Malvern, Worcestershire, is one of the largest of the Ministry of Supply's Research Establishments. It is responsible, in broad terms, for research in physics and electronics and for the development in collaboration with industry, of electronic equipment for the three Defence Services. Much of the work of the establishment has been of importance to the development of the civil electronic industry.

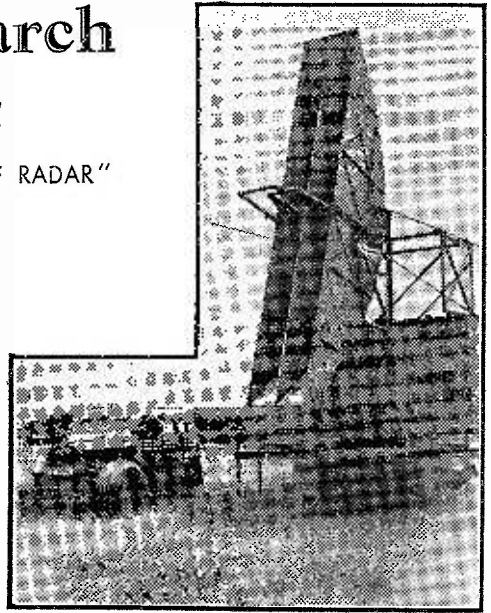
R.R.E. was formed in 1953 by the amalgamation of the Telecommunications Research Establishment (T.R.E.) and the Radar Research and Development Establishment (R.R.D.E.). T.R.E. grew out of the team formed by Sir Robert Watson Watt in 1935 to develop methods of locating enemy aircraft by radio. R.R.D.E. originated from an experimental section of the Royal Engineers which started work on the development of searchlights in 1917.

A.I., G.C.I and A.S.V.

T.R.E.'s first major contribution was to defence against air attack. By the outbreak of war in 1939, 20 early warning radar stations were in operational use and, guided by this radar chain, the "glorious few" won the Battle of Britain. Then came the battle against the night bomber, in which A.I. (Air Interception) and G.C.I. (Ground Controlled Interception) played a vital part. The climax of the Battle of the Atlantic came in June, 1943, when 100 U-boats were sighted and attacked by Coastal Command aircraft carrying centimetric radars (A.S.V.—Air-to-Surface Vessel). A whole range of navigation and bombing radars, including Gee, Oboe and H.S, carried the bombing offensive to the Ruhr and then to the heart of Germany. At the same time equipment was being devised for use in the invasion of Europe in 1944.

In the meantime, R.R.D.E. developed radars for directing anti-aircraft guns and searchlights. Later developments included coastal defence radars which virtually denied enemy shipping passage through the Channel, and the radio proximity fuse which was subsequently produced in large quantities in the U.S.A. and used with devastating success against the V1 flying bombs.

With the ending of the war these new techniques helped to solve some of the problems of peace. Studies were made of how electronics and radar could help industry, transport and civil aviation. Techniques developed for the location of enemy aircraft were applied to air traffic control and an airfield surface movement indicator was developed to give a picture of the movement of aircraft and vehicles on an airfield in all weather conditions.



A beam aerial for finding the height of aircraft.

War-time Gee, a navigational aid for bombers, was redesigned in a more compact form suitable for civil use. Gee-H designed for precision bombing was modified and used extensively in Africa to carry out rapid and accurate aerial surveys of hitherto unmapped territories.

The use of radar in meteorology was also explored. A study of the radar echoes obtained from rainstorms led to the design of a cloud and collision warning radar, now being extensively installed in civil aircraft, and the use of radar to study the upper atmosphere has given valuable information on the physics of rain formation.

Most of the post-war work of the establishment, concerned with the development of equipment, cannot be divulged for security reasons, but mention can be made of the design of a giant early warning radar, incorporating what is probably the largest radar aerial in the world, capable of detecting small aircraft at ranges of several hundred miles.

Doppler Effect

A revolutionary advance in aircraft navigation has also become possible by using the Doppler effect—the effect by which the pitch of a whistle or the frequency of a radio wave appears to change with the relative movement of the source and the observer. Research and design at R.R.E. and associated development in industry have produced these most efficient Doppler navigators.

The research programme at R.R.E. embraces a very wide field in physics and electronics and only a few selected items can be mentioned in this short note. A considerable effort in physics is devoted to the study of semiconductors, which

have become of great technological importance in recent years following the invention of the transistor. This, as readers know, is a crystal valve which is rapidly replacing the thermionic valve because of its much greater reliability, smaller size, and more efficient operation. Transistor action is possible only in semiconducting solids of the very highest crystalline perfection with accurately controlled "impurity" concentration. R.R.E. has developed special methods for growing such crystals in which the unwanted impurities are less than one part in a thousand million. Measurements at low temperatures play an important role in studying semiconductors because many effects are then greatly enhanced. The Physics Laboratory is therefore equipped with facilities for research at very low temperatures.

Semiconductors find a further important field of application as photosensitive elements, not only for visible light, but also for infra-red or heat rays. Infra-red photo cells of high sensitivity and rapid rate of response developed at R.R.E., are now used in infra-red spectroscopy, revealing fine structure which was previously unobservable, and in radiation pyrometers to control industrial furnaces.

A large new laboratory specially designed and equipped for research in solid state physics is now under construction at Malvern.

By the end of the war the advantages of very short wavelengths for radar—microwaves—were beginning to be apparent; the shorter the wavelength the higher the resolution or definition obtainable. Research sponsored largely by R.R.E. has resulted in a complete range of components now being available commercially for high resolution radar for marine use and for airfield surveillance. An interesting experiment in microwave techniques was carried out on the occasion of the solar eclipse in 1954 when a small team from Malvern used a microwave radio telescope to study the changes in solar emission from a site in Norway.

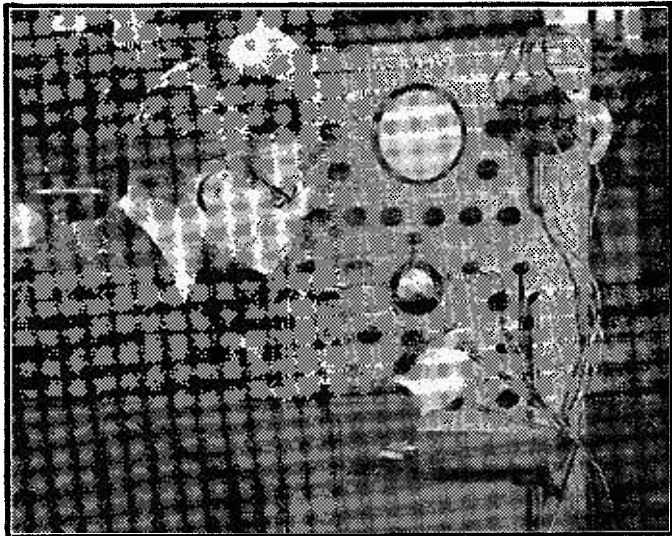
An important part of the establishment's work is that concerned with research on guided weapons and extensive use is made of computers, simulators and experimental test vehicles to obtain an understanding of the extremely complex problems of guidance. The first successful demonstration in the U.K. of a weapon under full automatic control was made by R.R.E. several years ago and the ideas and techniques now being investigated are believed to be as advanced as any in the world to-day.

Computers

Research is also directed to electronic techniques for data storage and high-speed computation. Experience gained by R.R.E. in the design and construction of TREAC, one of the first and

fastest digital computers in the country, is being used to great advantage in the development of advanced digital computing techniques using new solid state devices, such as transistors and ferrite rings. The application of these techniques to industrial automation may well lead to a minor revolution in the processes of industrial management as well as of production.

Service equipments must be reliable under very severe environmental conditions and R.R.E. is equipped with the most modern facilities for testing prototypes under extremes of temperature,



Ground control interception which is used to inform night fighters of the presence of enemy aircraft.

pressure, humidity, vibration and shock. The technical services division, which handles this work, has led the way in the development of reliable components and constructional techniques and the extent to which this work is appreciated by the radio industry is illustrated by the fact it receives an average of 500 visitors per year from the industry.

Recognising the nation-wide shortage of highly-trained electronic engineers, technicians and craftsmen, a college of electronics was opened at R.R.E. in 1947 and about 250 students are now serving a five-year apprenticeship in the college and in the laboratories and workshops of the establishment. It is believed that a college, closely associated in this way with modern research laboratories, is very well placed to play an increasingly important part in scientific and technical education.

The establishment has an important part to play in the defence of this country. Its contributions to the civil economy have been great, both in the development of new techniques in the radar and navigation field and also in the development of new components and new systems. There is no doubt that it will continue to play an important part in its contribution to the civil economy in research and development in the electronics field.

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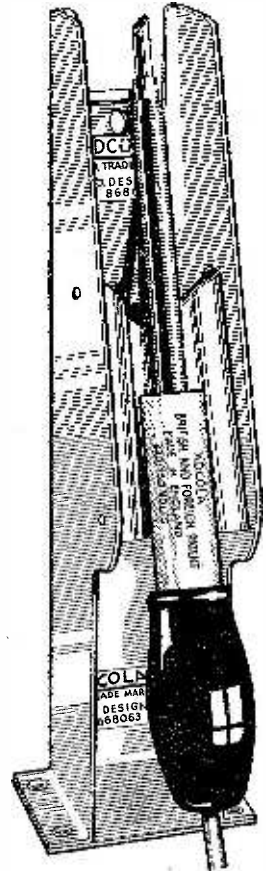
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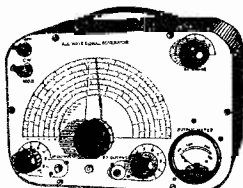
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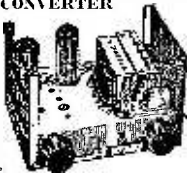
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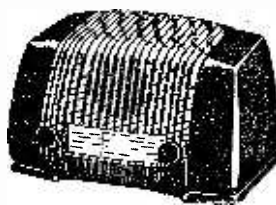
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Radio and Automation

RADIO APPARATUS IS FINDING INCREASING USE IN MODERN COMMERCIAL PRACTICE. SOME MODERN APPLICATIONS ARE GIVEN HERE By F. E. Sonn

(Continued from page 414, August issue)

IN Part II, a brief reference to "Servo-mechanisms" was given. It is thought that a further insight to this subject is necessary for the purposes of this article.

Servo-mechanisms, as applied to radio, first appeared, with the introduction of negative feedback.

This principle, as has been explained in many ways in this journal, is that whereby a lack of something in the output compared with the input, can be compensated by feeding back the portion of the output that is not linearly comparable with the input, and amplifying it so that the output is then nearly equal in all aspects to the input.

Servo-mechanisms, may be either electrical, hydraulic, or pneumatic in action. This article will only deal with the electrical method.

Methods of Control of Servo-mechanisms

If one wishes to control any physical quantity it is necessary to be able to measure it. Thus, if it is necessary to control the speed of rotation of a wheel, one must be able to measure its angular velocity. Should the case arise that the shaft of the wheel requires repositioning, then it is necessary to have the means to measure the angular shift. Before automation and servo-mechanism this was done by hand, using the eye as a measuring instrument.

In servo mechanics the human element is dispensed with and instead, the difference between the desired speed or positioning and the result obtained, is used as an action to eliminate the error.

For example, suppose a generator has to give 150 volts on load. With a voltmeter it would be possible to control the field so that the correct voltage was obtained. If, however, the output voltage could be compared with an accurate voltage of 150 volts, then it would be possible to compare the two voltages, and the difference between the two, if any, could be amplified and made to work a motor which in turn controls the positioning of the controlling rheostat of the generator field, until the error is reduced to zero. This principle is known as the "closed loop" control.

There are many types of controlling systems, but in the main they may be divided into two sections. The first is where the required control is varying and the second where it is a fixed value.

The first type, for instance, is in the control of a gun where the target is continually altering its position and it is necessary to move the gun to the required position quickly and accurately. On the other hand, the underlying principles of both types are the same.

Positioning

In electrical controlled servo-mechanisms, it becomes necessary to measure the input and output positions in electrical quantities. A potentiometer will convert angular positions to a voltage lineary.

For instance, if the total resistance of a potentiometer subtends an arc of 300 degrees or 5.24 radians and a battery of E volts is connected across it, then the voltage e on the moving arm at a position θ from the negative end is given by

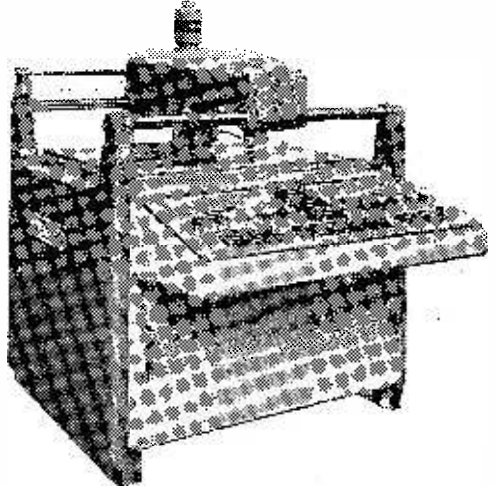
$$e = K_1 \theta$$

$$\text{where } K_1 = \frac{E}{5.24} \text{ volts/rad.}$$

If positive or negative signals are required, the potentiometer can be connected to earth, and so the applied battery potential is divided equally above and below earth.

Servo-mechanisms offer great advantages over machines operated by human operators. They have greater accuracy and speed of operation, and when correctly designed do not suffer from tiredness or monotony of operation.

One good instance of this is "George," of which most readers will have heard. This is the automatic pilot as used on aeroplanes. Large machines, such as the types used for transatlantic flights, could not be operated without



The Mullard "Autoplot" is an entirely new and electronically-controlled co-ordinate positioning machine for drilling, marking-out, plotting and other operations on sheet materials of any kind. Simply by setting-up the appropriate X- and Y-co-ordinates or rotary dials, the tool head can be moved automatically into any required position on the workpiece.

the aid of power-operated controls. This led to automatic control and "closing the loop." "George," once he has been put in action, will take complete charge of all necessary actions of the pilot needed for flying but will also provide for smoother flying because its actions and reactions are much faster and more accurate.

Methods of Converting Mechanical Error to Electrical

Continuous. Here the magnitude at any instance is the signal. Using R.C. networks a good approximation to the derivative and the integral of a signal is given.

Alternating. Here it is usual to employ an amplitude-modulated carrier. This carrier has a frequency much higher than any to which the servo-mechanism will respond, and its amplitude is proportional to the measured quantity. Either frequency modulation or phase modulation with fixed amplitude may be used.

Pulse operation. Here the variable may be the height of the pulse, the width or the pulse repetition rate.

Other Aspects of Radio and Automation

Automation in itself is a method by which processes are automatic, self acting, etc., self controlling. So far I have only dealt with true automation, but I propose to bring forward something that has been used for many years now, which although it is not automation in the real meaning of the word, has a close relationship.

Radio Control

One of the first instances of this occurred between the two wars. The Admiralty had a battleship, H.M.S. *Conqueror*, which was adapted for radio control. This was a ship of about 25,000 tons, which, being obsolete, was to be used as a target for battle practice. She was stripped as far as possible except for engines, etc., and

fitted with control gear under armour, which actuated her speed and steering in response to signals sent from a destroyer which followed her from a few miles astern. Nobody was aboard her, of course, as she had to be a target for the battle fleet. To obviate damage beyond repair, only practice ammunition was used (i.e., non-explosive shells). This ship by radio control could carry out the usual evasive methods of a battleship in action, increasing or decreasing speed, or turning to port or starboard as requisite. The method employed was that various signals, given out by the destroyer, closed or opened relays on the battleship, which in turn operated motors (an early form of servo motors) which in turn controlled her engines and steering gear.

Later, the R.A.F. used a similar idea with a plane called a "Queen Bee," which was directed by another plane and was used to train pilots in attack. I understand that in this case ammunition was not fired but camera-guns were used, which, on the films being developed, showed the accuracy of aim.

During the last war the Germans developed the V2 rocket. This was really a radio-controlled device except for its take off. It was only controlled after take off up to its desired height and then it was uncontrolled. They relied upon its velocity and height so that it would, in due course, when its fuel was expended, land within a given area.

Since then, however, we have progressed (or have we?) to the guided missile. Here one has an instrument which is under radio control immediately after take-off. Its direction may be altered at any moment and it is entirely controlled from the ground until it reaches its target. This, of course, only applies to the short range ones that are aimed at visual targets. Others, such as long-range missiles, have pre-set controls which take over after a brief period from take-off time, and guide the missile to its target.

News from the Clubs

THE CORNISH RADIO & TELEVISION CLUB

Hon. Sec.: J. Brown (G3LPB), The Waterworks, Penryn, Cornwall.

The club meets at the Y.M.C.A. Bar Road, Falmouth on the first Wednesday in every month, all visitors are welcomed. Lectures are arranged, also the club publication "The New Link" is being circulated to all the Cornish Hams and S.W.L. The meetings start at 7.30.

CLIFTON AMATEUR RADIO SOCIETY

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

MEETINGS are held every Friday at 7.30 p.m. at 225, New Cross Road, London, S.E.14. Details of membership may be obtained upon application to the Hon. Secretary.

THE SLADE RADIO SOCIETY

Hon. Sec.: Mr. C. N. Smart, 110, Woolmore Road, Erdington, Birmingham, 25.

PROGRAMME: THIRD QUARTER, 1957.

AUGUST 16th—"Coll Design": A discussion to be led by

Mr. N. B. Simmonds, (Member).

August 30th—Visit to the sound recording studios of Messrs. Hollick & Taylor. Details to be announced later.

Sept. 13th—Demonstration of the *Eddystone* "888" Communications Receiver by Messrs. Stratton & Co. Ltd.

Sept. 27th—"Microphony": A lecture by Mr. A. E. Robertson,

Assistant Head of B.B.C. Engineering Training Department.

DIRECTION-FINDING EVENTS

August 25th—Harcourt Trophy D.F. Test.

Sept. 8th—R.S.G.B. National D.F. Contest, Final.

Sept. 22nd—Harcourt Trophy D.F. Test.

CCUB STATION ACTIVITIES

The Club Station (G3JBN) at the Church House, is available every day of the week for the use of members. Instructional and constructional classes are held on every Tuesday and Wednesday evening. The "Slade Net" will be on the air on the following Friday evenings: August 9th; Sept. 6th.

Visitors to the Society's meetings, which commence at 7.45 p.m. prompt, and to the Club station, are cordially welcome.

TORBAY AMATEUR RADIO SOCIETY

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

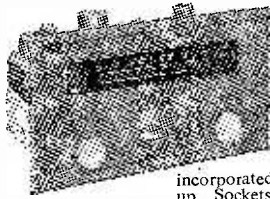
At the meeting on June 15th, held under the Chairman, G3JD, those members who co-operated in the recent R.S.G.B. National Field Day, spoke of their experiences during the competition. Those included G4RJ and G3GDW.

It has been decided that the Society shall acquire its own tent, which can be used in all future events in which members take part—whether in R.S.G.B. events, or in club contests. For this purpose, members are asked to bring radio gear of value, to be auctioned each month for this end. Half of the money to be handed to the vendor, and half to the Society.

At the next meeting, G3FUT will give his address on "Audio," and it is hoped that a full gathering will attend to welcome this address.

Please note that on and from the next meeting, these will be held on the second Saturday each month.

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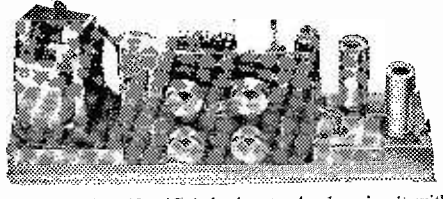
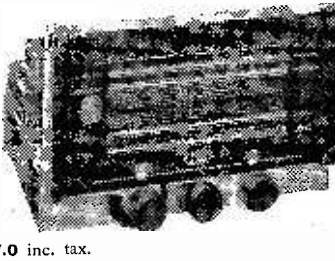


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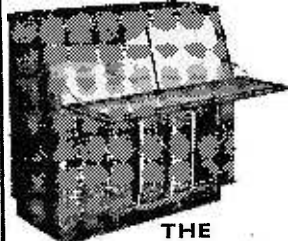
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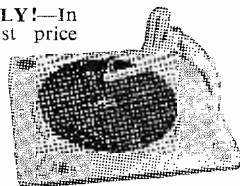
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Transistor Audio Amplifier Design

PRINCIPLES EXPLAINED, WITH A PRACTICAL CIRCUIT

By B. E. Wilkinson

WITH transistors now available at a reasonable price, many circuits are available for miniature radio receivers and audio frequency amplifiers. Little information is available, however, for those who would design their own equipment, so that the purpose of this article is to acquaint the reader with the processes involved in the design of an A.F. amplifier. Most of the design considerations are taken into account, so that the finished unit is stable and free from distortion. The complete circuit is given finally, with the values of all the components.

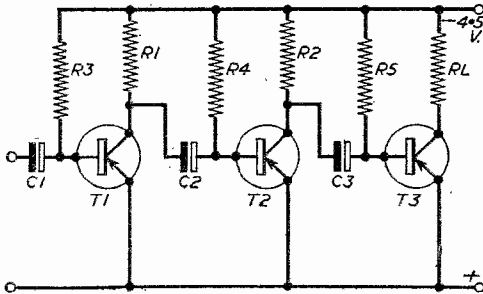


Fig. 1.—Basic design.

Initially, we decide the purpose of the amplifier. It is to be used, we shall suppose, in either a miniature tape recorder, or as the A.F. stage following a crystal set. It is required only to work a headset. The frequency range is to be from, say, 100 c.p.s. to, say 6,000 c.p.s. Finally, for convenience, we wish to work it from a 4.5 volt flashlight battery.

Of the transistors available, those at 10s. each, similar to the Mullard OC71, are suitable, and so we shall use these. Since the amplifier will need to have a high gain, we shall use three transistors with a high gain amplifier. Strong signals may overload it, so that a volume control must be incorporated. Although transformer coupling gives a higher gain, most transformers are expensive and bulky, so our amplifier will be of the resistance capacity coupled type.

Fig. 1 shows the amplifier in its simplest form, the stages being coupled by the condensers. R1, R2 and RL are the collector load resistors of T1, T2 and T3 respectively. R3, R4 and R5 are bias resistors, of which more will be mentioned later. The circuit as shown is in its simplest workable form. There is no D.C. stabilisation, and a later circuit incorporates this.

Calculation of Component Values

Our first decision, is the

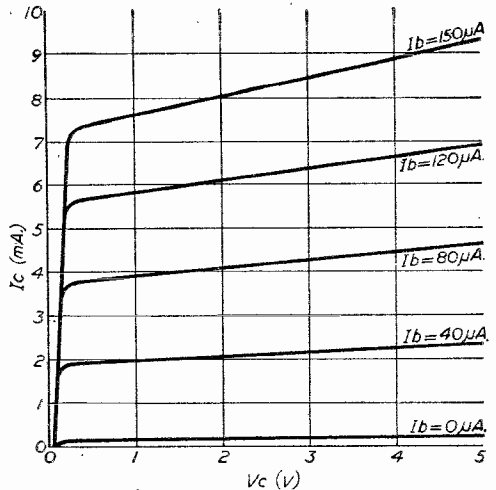


Fig. 2.— I_c - V_c characteristic of the OC71.

current to be passed by the collectors. In the first two stages a collector current of 0.5 mA is not unusual, so we shall assume this. We must expect to drop some voltage across R1 and R2. If we lose say 1.5 volts, so that we leave 3 volts on the collector, we require a 3K resistor as a load, thus:

$$R = \frac{E}{I} \quad R = \frac{1.5 \times 10^3}{.5} = 3K$$

We have thus established the D.C. working point of the first two stages namely .5 mA, 3 volts. We must now decide upon the values of R3 and R4, the bias resistors. Fig. 2 shows the I_c - V_c characteristics for an OC71. Finding the D.C. working point .5 mA, 3 volts, we see that this corresponds to a base current of approximately 10 μ A. The collector bias conditions fix the D.C. bias current of $I_b = 10 \mu$ A, of the input

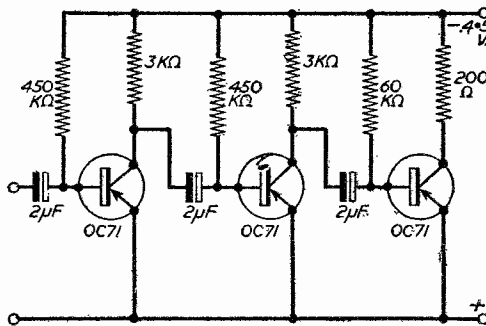


Fig. 3.—Partially developed circuit.

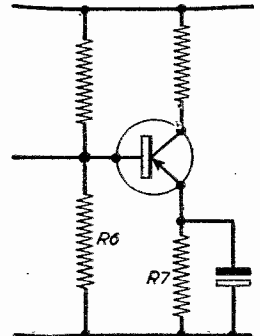


Fig. 4.—Stabilising resistors added.

base electrode. The value of the resistor necessary to pass a current of $10 \mu\text{A}$, is given by :

$$R = \frac{E}{I} \quad R = \frac{4.5}{10 \times 10^{-6}} = 450 \text{ K}$$

The value of R3 and R4 then will be 450 K. In Fig. 1, then, R1 and R2 are each 3K and R3 and R4 are each 450 K.

The final stage is slightly different, being a power or output stage. The final stage will be designed around a collector current of 3 mA. It is assumed that the resistance of the output load is 200Ω , so that the voltage dropped across it will be given by:

$$E = IR \quad E = 3 \times 10^{-3} \times 200 = 0.6 \text{ volts.}$$

Thus the collector voltage is 3.9 volts. The collector dissipation under no signal conditions is thus about 12 mW. so that the OC71 is being operated well below its maximum permissible dissipation. The D.C. working point, then, for the output stage is 3 mA. 4 volts. From Fig. 2 we see that the base current (Ib) required is approximately $75 \mu\text{A}$. The value of R5, then, will be given by:

$$R = \frac{E}{I} \quad R = \frac{4.5 \times 10^3}{75} = 60 \text{ K}$$

In order to complete the values of the components of the amplifiers as shown in Fig. 1 we must consider the coupling condensers C1, C2 and C3. These must

order of $2 \mu\text{F}$. Small condensers of this value are of the electrolytic type, so these must go to the base of the transistor. In fact, any value between $2 \mu\text{F}$ and $10 \mu\text{F}$ is satisfactory. Fig. 3 shows the circuit, with the values shown.

Transistors are very sensitive both to heat and light changes and for this reason stabilisation of the amplifier circuit is necessary. Calculation will not be dealt with, but standard values for the necessary resistors will be given. Fig. 4 shows a single stage

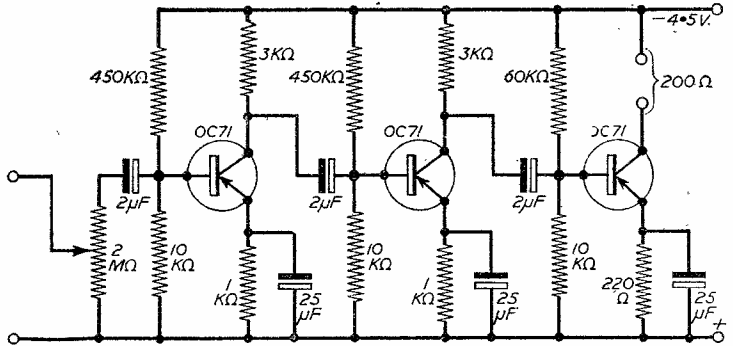
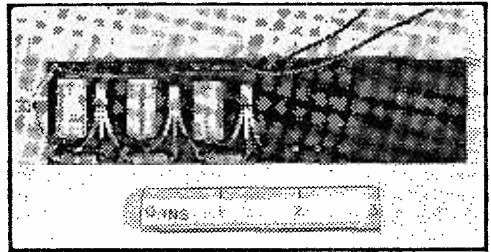
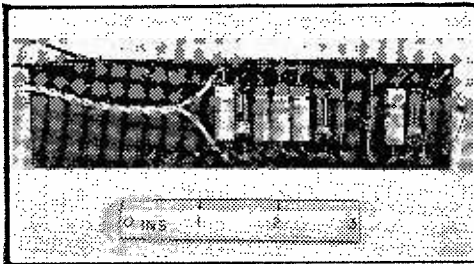


Fig. 5.—The final form of the circuit in Fig. 1.

D.C. stabilised, the system being known as Potential divider and emitter resistor stabilising. For the purposes of our amplifier, R6 and R7 should be, for the first two stages, of the order of 10K and 1K respectively. For the final stage the emitter resistor should be of the order of 10K.

The emitter resistors, of course, must be decoupled. The decoupling condensers should have a reactance



Top and underside views of an actual amplifier built to the circuit of Fig. 5. The piece of rule shows the actual size.

be large enough to pass the lowest frequency desired (100 c.p.s. in this case), and must have a reactance at this frequency, the same as the input resistance of the next stage. For an OC71, the input resistance is about 800, so we derive the value of C, from the

formula, $X_c = \frac{1}{2\pi fc}$ substituting.

$$800 = \frac{10^6}{2\pi \times 100 \times C} \quad \text{where } C \text{ is in } \mu\text{ farads,}$$

from which,

$$800 \times 2\pi \times 100 \times C = 10^6$$

$$\text{Hence } C = \frac{10^6}{800 \times 2\pi \times 100} = \frac{10^2}{8 \times 2\pi} = \frac{100}{16 \times 3.14} = 2 \mu\text{F.}$$

The value of C1, C2 and C3, then, should be of the

of not greater than one-tenth the value of the emitter resistance, at the lowest frequency to be passed

$$X_c = \frac{1}{2\pi fc} \quad \therefore 100 = \frac{10^6}{2\pi \times 100 \times 6} \quad \text{where } c \text{ is in } \mu\text{ farads.}$$

$$10^6 = 100 \times 2\pi \times 100 \times c.$$

$$c = \frac{10^6}{100 \times 100 \times 2\pi} = \frac{100}{6.28}$$

$c = 30 \mu\text{F}$ ($25 \mu\text{F}$ electrolytic condensers are available).

Owing to the high values these condensers should be electrolytic. The positive connections must go to earth. Fig. 5 shows the circuit in its final form, with values given. The added components are the $2\text{M}\Omega$ potentiometer and the $0.1 \mu\text{F}$ condenser.

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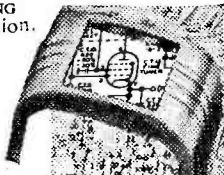
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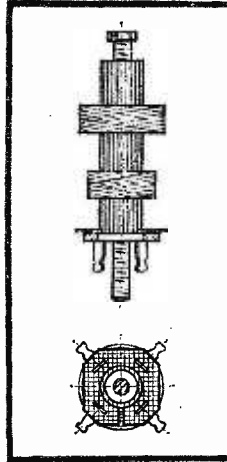
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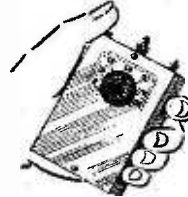
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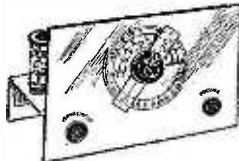


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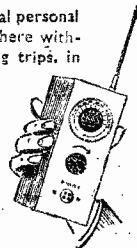


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Some More Obscure Faults

IN the May, 1955, issue of this journal I gave instances of obscure faults. These faults are of interest inasmuch as they often call for methods of tracing that are not the usual standards of checking. In tracing these faults one often has to disregard the laid down methods, and instead look for the cause or causes of the fault in components that appear to be beyond suspicion. It should be emphasised that when a fault is very elusive no component should go unchecked. To a service engineer, equipped with, say, a signal tracer, valve voltmeter and a complete set of test equipment, some of these faults would perhaps not be very obscure, but to a man with only a multi-range meter they can be difficult to find.

Fault No. 1

Set was a five-valve A.C./D.C. midget set. Trouble was instability. All decouplers were checked and found O.K. Valves also checked, O.K. I.F.s were realigned and also R.F., but instability still remained. Finally it was found that this was due to an open circuited negative feedback coil coupled to the primary of the second I.F., inside can.

Fault No. 2

Set was an A.C./D.C. five-valve model. Trouble was that it was noisy, especially whilst tuning. Normally one would expect this to be a noisy gang condenser but in this case the set had no tuning condenser, being permeability tuned. A check was made for dry joints, noisy valves, etc., but with no success. Eventually the fault was located, and it turned out to be loose and erratically moving cores in coils whilst tuning. The rubber grommets holding the coils steady whilst cores moved had perished, causing lateral movement of coils and thus extraneous noises.

Fault No. 3

Another five-valve A.C./D.C. midget. In this case hum was the complaint. The usual tests were carried out; valves, electrolytics, etc. Eventually the trouble was located and found to be due to disturbed components. The coupling condenser between volume control and grid of double diode triode had been pushed over until it was almost touching the earthing end of the 10 meg. grid leak. Just a slight movement away and the fault was cleared.

Fault No. 4

In this case an A.C. set with plate aerial. On outside aerial set worked O.K., but immediately plate aerial was used, instability occurred. This set was finally cured by earthing the loudspeaker casing and then putting a damping resistor of 20k ohms from plate aerial to ground.

Fault No. 5

Set a five-valve A.C. receiver. Trouble was noise when switched on for a few minutes, afterwards settling down and remaining O.K. This was eventually found to be due to arcing inside electrolytics when directly heated rectifier passed H.T. before other valves warmed up. Renewal of electrolytics cured this trouble.

Fault No. 6

This set was a G.E.C. 4855. Trouble was intermittency on medium and long. Valves, etc., were checked and found O.K. This intermittency was at prolonged periods and it was not for quite a while that it was found that both padder condensers (preset jobs) had developed intermittent shorts. As no value is given for these trimmers on service sheet, proper replacements had to be fitted.

Fault No. 7

Complaint was distortion, but actually it was R.F. in the A.F. portion of set. Usual checks were carried out without success and only when leads under chassis were rearranged, i.e., loud-speaker leads near I.F. valve, that set was finally made O.K.

Fault No. 8

The set was a Pilot "Little Maestro." The trouble was local stations appearing at two tuning points to each station. In other words "double humping." I.F.s were checked and found to be correctly aligned, and eventually the trouble was found to be the 10 meg. bias resistor on double diode triode having gone very high indeed. A new resistor cured this fault.

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Difficulties are often Encountered when Faults Arise which apparently do not Answer to normal Tests. A Service Engineer here discusses Some Such Faults.

Tried and Tested Transistor Circuits

TWO SIMPLE CIRCUITS FOR THE EXPERIMENTER

By A. Secker

BEFORE commencing any experiments with transistors it is best to have some suitable foundation upon which to build. A simple but adequate chassis may be made of pegboard which can be completed in a few minutes. A piece 18" by 12" will do nicely.

Having derived some entertainment and perhaps a little knowledge from the circuit in Fig. 1, the constructor may wish to construct something a little more intricate as in Fig. 2.

This circuit is of a transistor super-regenerative receiver. This set requires only a short aerial,

whereas that in Fig. 1 requires rather a long one. The layout is not critical, and if the experimenter wishes the components may be built into a small box. L1 is a transistor Ferrite rod aerial with L2, 7 to 10 turns of 22 s.w.g. enamelled wire wound closely next to the medium-wave winding. In areas of good reception an external aerial may not be necessary, and it may be possible with a long aerial to receive foreign broadcasts, although with the original set only Home, Light and Third programmes were received.

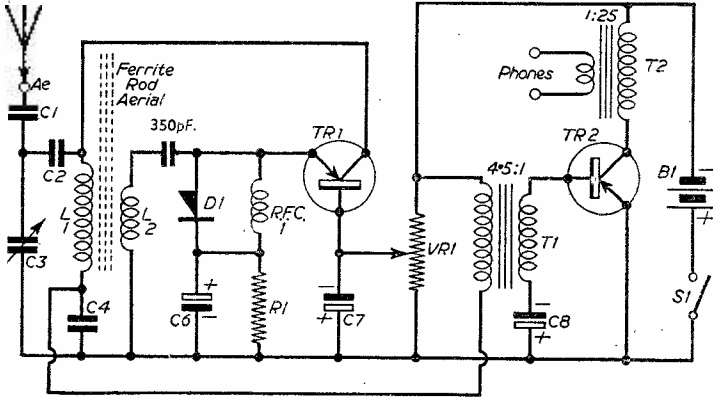


Fig. 2.—A more elaborate circuit.

The first circuit experimented upon was that shown in Fig. 1.

This is little more than a crystal set with a single amplification stage, yet the difference between a crystal set and this circuit is very noticeable.

L1 and L2 are medium wave and coupling coil respectively wound upon a cotton reel. L1 is 100 turns and L2 is 10 to 20 turns of 22 s.w.g. enamelled wire.

The tuning condenser is a .0005 μ F variable.

D1 is a Brimar GO3 diode.

TR1 is a red-spot surplus transistor.

The phones are 2,000 Ω resistance.

The drain on the battery is approximately 25 microamperes which allows it practically shelf life. When building this or any other transistor circuit, check all wiring carefully as any mistakes may result in the ruin of a transistor or some other costly component.

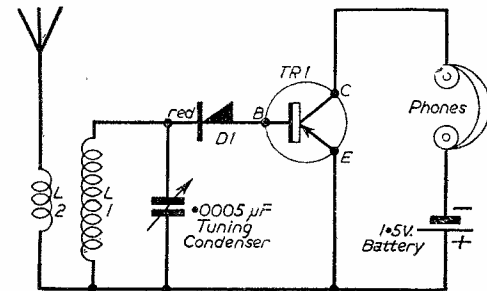








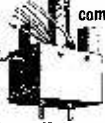
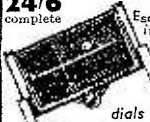
Fig. 1.—The first experimental circuit.

The Chassis

As mentioned in the opening paragraph, a piece of pegboard forms a very useful experimental "chassis." The chosen size should be stiffened and protected by runners on each side, using ordinary wooden batten, say, 1 1/2 in. or 2 in. by 1 in. These will serve not only to raise the surface from the table but also enable nuts and bolt-heads to be accommodated below without causing the chassis to tip or tilt when in use. It can, of course, afterwards be replaced by a standard chassis when the final circuit and layout has been decided upon.

LIST OF COMPONENTS

- C1—40 pF capacitor.
- C2—.02 μ F capacitor (T.C.C. Metallite).
- C3—.0005 μ F tuning condenser.
- C4—.002-.005 μ F capacitor. (Various values may be tried for best results.)
- C5—350 pF capacitor.
- C6, C7, C8—20 μ F 12-volt wkg. electrolytics (T.C.C. Picopack).
- D1—GO3 Brimar.
- RFC1—Radio frequency choke (Radio Clearance, Tottenham Court Road).
- R1—1 K Ω 1/4 watt resistor.
- T1—4.5 : 1 transistor transformer (multitone).
- T2—25 : 1 deaf-aid output transformer (G. Smith, Lisle Street).
- P1—Low-impedance earphones (Gee Radio, Lisle Street).
- B1—1.5-3-volt battery.
- VR1—100 K Ω potentiometer.
- S1—On/Off switch. Alternatively ganged with VR1.
- TR1, TR2—Red-spot surplus transistors (or OC71s Mullard).

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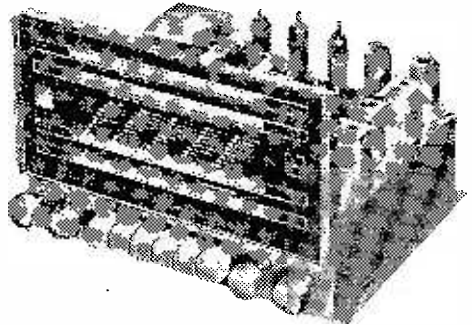
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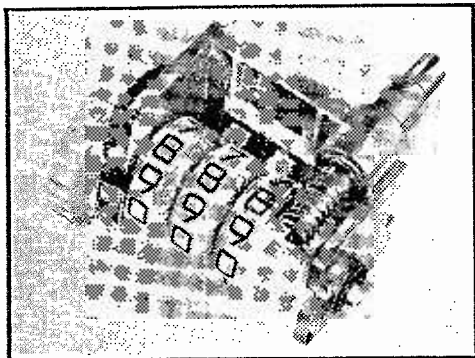
News from the Trade

OPEN FRAME TAPE RECORDER COUNTER

THE extended use of tape recorders has revealed the need for a compact high-speed resetting counter to replace the scale or pointer indicator.

English Numbering Machines Ltd. have developed a special unit for registering the position of the tape.

This is a 3-figure counter with an open "U"-shaped frame 1.7/16in. long \times 7/8in. wide, the



The open frame tape recorder counter.

depth from the reading face of the figure wheels to the base of the frame being 1in. A vertically mounted stainless steel driveshaft is used, located in an oilite bush, and this shaft mates with a nylon moulded worm wheel.

Either direction of rotation is available and the resetting wheel (for protruding through the tape deck if required) can be fitted on the left- or right-hand side.

The new counter is constructed to operate at high speeds, particularly applicable to re-winds, therefore all wheels and transfer gears are precision moulded in nylon. The use of this light high performance material ensures a constant low torque, durability of the counter unit, and noiseless operation.

The direct reading figure wheel counter is easier to read and registers the position of the tape more accurately than other forms of indicator.

An extremely low price for quantities is claimed by the manufacturers—English Numbering Machines Ltd.

TUNGSRAM VALVES

WITH the complete integration of Siemens Brothers & Co. Ltd. and The Edison Swan Electric Co. Ltd., as from July 1st, the company are no longer distributing Tungstram valves.

Orders will now be taken over by the British Tungstram Radio Works Co. Ltd., West Road, Tottenham, London, N.17, and customers are asked to send new orders to that company.

The British Tungstram Radio Works Co. Ltd. will accept responsibility for guarantee on all Tungstram valves which have been purchased from Siemens, and ask that all valve returns be sent to their Tottenham address.

Siemens Edison Swan Ltd. will, of course, be responsible for the manufacture and distribution of all Ediswan and Ediswan Mazda valves and cathode ray tubes.

CECO THERMOSTATIC SOLDERING IRON

THE Ceco iron is intended for production and repair work on radio, television, electronics and small work. Due to the thermostatic control of the temperature, the wattage has been increased considerably and is therefore able to do heavier work than would normally be expected of an iron of this size.

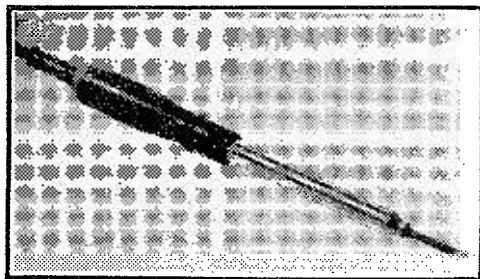
The temperature is usually set to 230-250 deg. C., which gives a comfortable working margin over the melting point of 60-40 solder without any risk of damaging insulation, spring contacts, etc. The user can, however, set the thermostat to any desired temperature to suit the particular job. The iron heats up in 1½ minutes, and the elements are rated at 70 watts and replace heat lost quickly. An important point is that the bit never needs filing. The iron, excluding flex, weighs 4½ozs. It is provided with a hook for hanging when not in use, which is easily removable if so desired.

Long Life

As the temperature is not allowed to rise beyond the setting of the thermostat, the elements in this iron operate at a lower temperature than normally and consequently have a much longer life. The bit also does not suffer from oxidation and alloying with solder and needs no more cleaning than a rub with a cloth.

The temperature does not fluctuate more than 15 deg. C. Due to the increased wattage of the elements, heat losses, while the job is in progress, are replaced rapidly and a consistent temperature is maintained under all circumstances.

The thermostat incorporates a micro-switch which gives negligible electrical interference. In normal use there are two switch operations per minute. As the iron may be left switched on



The Ceco thermostatically controlled soldering iron.

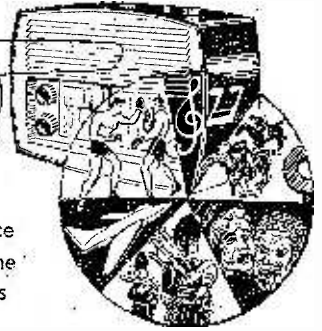
indefinitely without overheating it is at all times ready for immediate use.

All spare parts are interchangeable and may be obtained at short notice. The thermostat may be adjusted by a 3/32in. Allen key.

The irons are insulation tested at 1,000 volts, and the list price is 85s.

Cardross Engineering Co. Ltd., Levenford Works, Woodyard Road, Dumbarton.

Programme Pointers



"DEATH OF AN ADMIRAL." a radio adaptation by the authors, Gilbert and Margaret Hackforth-Jones, of their novel, was very successful. In the play Sir Hartney Duneton seeks revenge on a U-boat captain for the shooting of his wife and daughter on a torpedoed ship. However, the German, Captain Turton, was not guilty of the crime and he eventually rescues the Admiral from his yacht when it is sinking. The events which followed made it a very enjoyable Saturday evening theatre. The large cast was headed by Malcolm Graeme, John Westbrook, and Norman Shelley who, as the Admiral, bellowed and roared as Nelson could scarcely have imagined.

"The Day Lincoln was Shot," a radio dramatisation of the book by Jim Bishop, was repeated. It seemed very artificially contrived and lacking in drama. This was particularly noticeable at the moment the fatal shot was fired when, instead of the breathless, stunned silence and gasp of horror which would undoubtedly have occurred, there was a simultaneous shout and yell from the "supers," obviously "coming in" at the appointed moment.

The lengthy cast was headed by Chas. Richardson as Lincoln, Harold Ayer as John Wilkes Booth and Jon Farrell as Edwin McMasters Stanton. The play was written by Alexander McKee and narrated by Francis de Wolfe.

Scrapbook

"Scrapbook for 1928" was very much the mixture as before. These programmes remind me of an imaginary interview which I trust will never come to pass! It is as though someone, knowing our lives down to the smallest detail, were to immobilise us for an hour whilst they regaled us with all the stupidest and least important things we had ever done together with one or two of which we are heartily ashamed. Of course, they recall the odd achievement of which anyone would be proud. But for the most part they are a compilation of very insignificant events recalling memories both of the trivial and the unpleasant.

A Thriller

"Look to the Lady," adapted for radio by Felix Felton and Susan Ashman from Margery Allingham's novel, made a well-contrived and entertaining Saturday night theatre. All the ingredients were there for a real thriller. The mixture not quite as before, but sufficiently so to make it acceptable to all adepts in "whodunit" drama. The cast was headed by Richard Hurndall, Mary Wimbush and Brewster Mason. Production, Audrey Cameron.

Mammoth Production

Ben Jonson's "Volpone" is a mammoth creation, and in the first of the new "World Theatre" series, occupied an hour before the

Our Critic, Maurice Reeve, Reviews Some Recent Programmes

nine o'clock news as well as 70 minutes afterwards. What is it that makes a play like this so vastly less gripping and "holding" than one of Shakespeare's? I suggest it is the almost complete absence of what in music would be called melody and the memorable line. Whilst full of meat, lofty precepts and whimsy, it bores for long periods.

"The Trojans"

Berlioz's opera "The Trojans," too, was an even more mammoth affair. It is such a huge work and so costly to produce that it is hardly ever done anywhere. The present production came from Covent Garden.

Only the music is discernible over the radio, whereas in the theatre it was the production (his first in opera) of Sir John Gielgud that was arousing the greatest interest. It came over as a gorgeous tonal banquet given by the Covent Garden Orchestra and Opera Chorus under Raphael Kubelik. The cast was far too long to quote here.

Chief Musical Event

Perhaps the chief musical event of the summer has been the Elgar Centenary Festival in which all the Master's major and minor works have been given in various parts of the country.

I do not think he was responsible for the lyric "Land of Hope and Glory," which was set to his first "Pomp and Circumstance" march and, as a sort of second National Anthem, has stigmatised his work in the estimation of many.

A Great Composer

He was, nevertheless, probably the only native composer entitled to wear the tag "great". Many of his major works, for some reason or other which belongs to the alchemy of radio, make splendid broadcasts, and some memorable performances ensued.

The Third went all gay and completely discarded its rather sinister reputation with a four-year-old repetition of Anita Loos's classic "Gentlemen Prefer Blondes." Therein Yolande Donlan manages to acquire, from the more gullible of the sterner sex, anything from a cock-tail to a Cadillac. It was very funny, and to listen to Miss Donlan's victims take the count without a murmur or a quail, in fact loving every minute of it, was a major experience.

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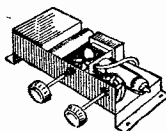
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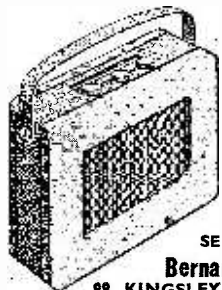
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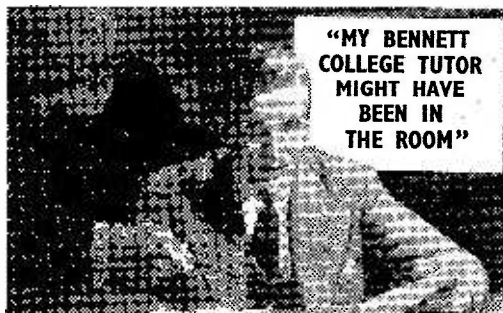
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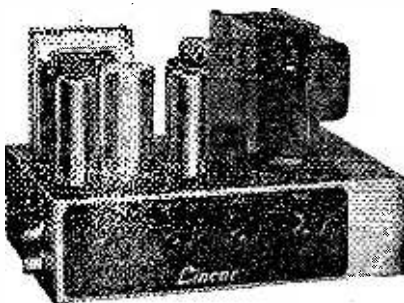
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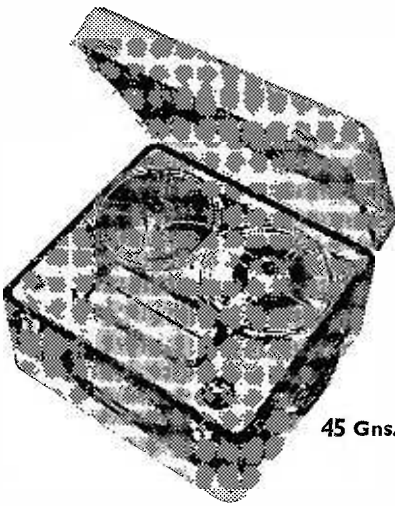
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Open to Discussion



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

Correspondents Wanted

SIR,—I am 17 years of age and would like to correspond with an enthusiast of my own age who is interested in tape recorders as a whole.—**JOHN R. ECCLES, 47, Scotch St., Whitehaven, Cumb.**

SIR,—I am 21 years of age and would like to correspond with amateurs of the same age.—**ERNEST AMARASINGHE, Overseas Telecommunication Service, Colombo, Ceylon.**

BBC Pronunciation

SIR,—I was interested in the remarks of Thermion regarding pronunciation. To me it sounds silly to hear the city of Budapest referred to as "Boodahpesth." By this rule, we should speak of "Barry" and "Bearleen," and if a reference was made to "Ahalooiin" or "Keyirkegg," no one would have any idea of what was referred to but perhaps a few of the inhabitants of Athlone and Cork. At the same time, how horrified some people would be if they heard the names "Glouse-ester" or "Hurtfordshire."

M. Reeve, in his "Programme Pointers" of the April issue, thinks it timely to "warn" against what he calls "Anti-American" sentiments, in the "Any Questions" programme, one of the best in a mixed lot, but surely these are just the free expression of opinion on the American attitude in recent months, and whatever our personal views, or his own beliefs may be, the recent tirade of Thermion against W. Graham was not particularly pro-American. Thank goodness, however, for the freedom of speech in Britain, which is not so marked in some other countries. "Programme Pointers" is, of course, just a series of statements of the opinions of the writer, and is not necessarily the opinions of readers.—**M. K. HUGGARDS (Co. Wicklow).**

[Of course! Every writer expresses his own opinions—ED.]

D-3Tr. Portable

SIR,—I have just read the article in the July issue, and much regret to have overlooked correcting an obvious error in Fig. 2, page 336. The jack for the large loudspeaker with its transformer is shown with the contact for the stem of a plug not connected; this loose end should be connected straight up to the lead from 3v negative to S2.

When this is in use, S2 must be left at OFF. These connections are not usual, but a more complicated jack with two switches is not easy to obtain.

Inserting a plug first opens B and then closes A.—**R. F. GRAHAM (Bedford).**

Sensitive Two-valver

SIR,—I expect many readers would be interested to learn that the "Sensitive Two-Valver," described in the August, 1955, edition, can quite simply be modified for amateur band reception.

At the moment I am using it on top band and 80 metres, though I dare say it would work equally well on other bands. I am using a 20 pF tuning condenser and home-made plug-in coils.

The top band coil is a PMF2 with one of the four banks shorted out and a trimmer across it. I have found that the best aerial for this band is an outside one of fair size connected to the grid coil through a 180 pF condenser.

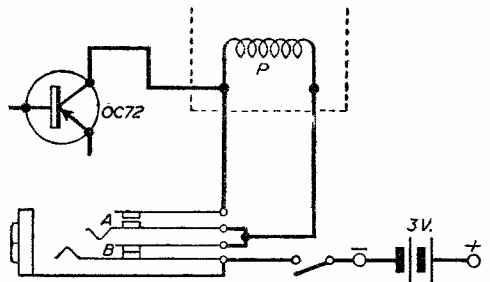
On 80 metres the coil is completely home made, though by careful adjustment of a trimmer across the coil the band is easily tuned in. Originally the aerial used for this band was a short length of wire joined straight to the grid coil. It was found, however, that any movement of this detuned the set badly, so now it has been replaced by a small whip aerial attached to the cabinet.

As the loudspeaker volume from the set is not very good 'phones can be fitted. The method I have adopted is to connect them to the speaker through an output transformer in reverse.

To end, I am very glad to see that it has been decided to devote more space to the short-wave section.—**DAVID R. DUCK (Addlestone).**

A Servicing Hint

SIR,—Many service engineers will be familiar with the type of fault which occurs when the performance of a receiver becomes unsatisfactory only after a lengthy working period. This type of fault is invariably associated with temperature rise within the receiver and its effect on certain critical or semi-



Mr. Graham's switch circuitry for the D-3Tr. portable.

faulty components. Much time can be spent endeavouring to locate the fault, and in some instances the cooling effect produced by removing the chassis from the cabinet is sufficient to restore the receiver performance to normal.

A speedy method of diagnosis has been evolved using a small portable hair dryer, which very quickly localises the fault by simulating the actual operating conditions over small areas of the chassis.

The hot air jet of the dryer is directed at the suspected component from a distance of approximately 2in., and its effect observed. Care should be taken to avoid excessive heating, particularly where wax-impregnated condensers are employed, since careful measurements show that this method can produce temperatures in excess of plus 80 deg. Centigrade in about two minutes.

The method outlined is particularly useful in observing the amount of drift on high-frequency oscillators where it is felt that there are certain design shortcomings, particularly in the correct matching of negative and positive temperature coefficient condensers.—H. LONGTON (Heywood).

Hi-Fi Tape Recorder

SIR.—We are very grateful for the fact that since the May issue of "Practical Wireless" specified our coil as oscillator in the Hi-Fi tape recorder, we have received many orders and inquiries.

Some difficulty has arisen, however, due to the fact that since your contributor purchased his coil we have made modifications to this coil, and we are now enclosing with every coil sold one of the old circuits explaining this.

Several coils were sent out, however, before this was realised, and possibly this will lead to queries and/or complaints, so we thought it advisable to put you in the picture, and enclose circuits of both the old and the new coil. We need hardly say that the claims we make for this coil are quite genuine, every coil should be up to the standard of the one submitted to the N.P.L.—G. E. HATFIELD (N.4).

Courses of Instruction

SIR.—The following classes organised by the East London R.S.G.B. group in conjunction with the Essex County Council are available for all those interested in amateur radio, irrespective of whether they are members of any society or of the general public.

1. RADIO AMATEURS' EXAMINATION COURSE.

Wednesday, 7.15 to 9.15 p.m. Eight-month course for those intending to take the examination.

2. MORSE AND CODES OF PRACTICE.

Monday, 7.30 to 9.30 p.m. Six-month course for those wishing to learn Morse, up to G.P.O. requirements for an amateur licence. Arrangements have been made with the G.P.O. for those who, in the opinion of the masters, have reached the required speed to be tested at the College in the evening by a representative of the Post Office.

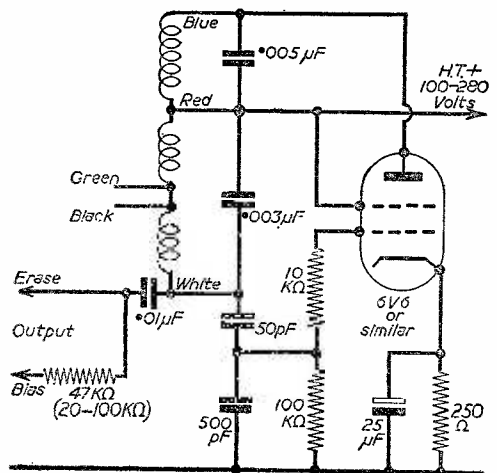
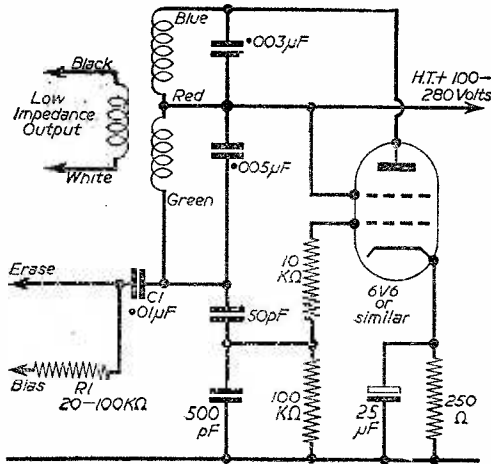
The venue for the above classes is The Ilford Literary Institute (High School for Girls), Cranbrook Road, Ilford, Essex.

It is adjacent to Gants Hill Station on the Central London Tube and buses past the door. The fee for the R.A.E. course will be £1 10s., and for Morse course £1 for those living in the Essex County Council area. Students from other parts of London will be admitted as out county students provided the local authority is notified.

Enrolment nights September 9th to 13th inclusive, 7 to 8.30 p.m.

Classes start the week commencing September 21st, 1957.

These classes have now been running for 10 years and over 150 students have passed the R.A.E. examinations. Those interested in the first instance should write to Mr. C. H. L. Edwards, G8TL, 28, Morgan Crescent, Theydon Bois, Epping, Essex, for reservations.



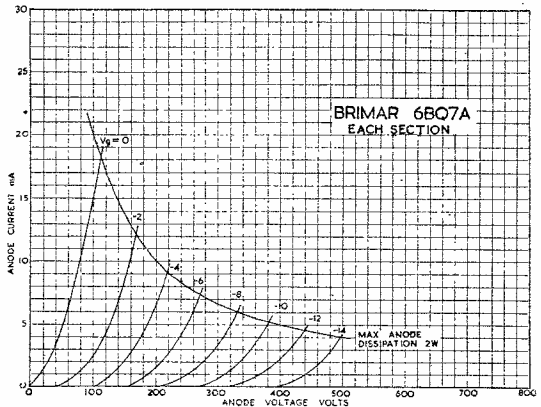
The Hatfield oscillator coil circuits. This coil was recommended for the Hi-Fi tape recorder, but has since been modified by the makers. See the letter above.

BRIMAR 6BQ7A

The Brimar 6BQ7A is a double triode consisting of two independent high slope sections with similar characteristics. The valve is particularly useful as a cascode R.F. amplifier for television receivers and also as a combined oscillator and mixer for frequency modulation receivers. It can, of course, be used wherever high slope triodes are required, and features low interaction between the sections as an internal screen is provided which is brought out to a separate base pin.



between the sections as an internal screen is provided which is brought out to a separate base pin.



TYPICAL CHARACTERISTICS

Heater voltage	6.3 volts
Heater current	0.4 amp
Anode voltage.....	150 volts
Cathode bias resistor.....	220 ohms
Anode current.....	9 mA
Mutual conductance.....	6.4 mA/V
Amplification factor.....	39
Anode resistance.....	6,100 ohms
Grid cut-off voltage ($I_a = 10\mu A$).....	—10 volts approx.

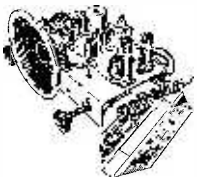
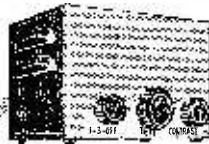
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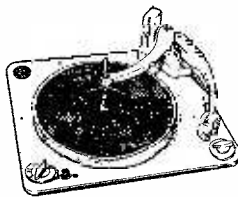
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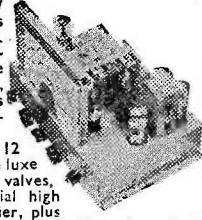
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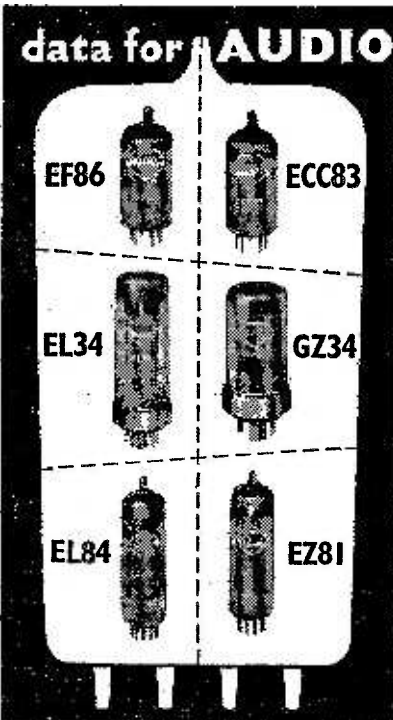
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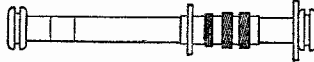
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- Three-valve : 4/- each
A.C. Band-Pass 3 ... PW99*

- Four-valve : 2/6 each
A.C. Fury Four (SG, SG, D, Pen) ... PW20*

- A.C. Hall-Mark (HF Pen, D, Push Full) ... PW45*

SUPERHETS

- Battery Sets : 2/6 each
F. J. Camm's 2-valve Superhet ... PW52*

- Mains Operated : 4/- each
"Coronet" A.C.4 ... PW100*
AC/DC "Coronet" Four ... PW101*

No. of
Blueprint

SHORT-WAVE SETS

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- One-valve : 2/6 each
Simple S.W. One-valver ... PW88*

- Two-valve : 2/6 each
Midget Short-wave Two (D, Pen) ... PW38A*

- Three-valve : 2/6 each
Experimenter's Short-wave Three (SG, D, Pow) ... PW30A*

- The Prefect 3 (D, 2 LF (RC and Trans)) ... PW63*

- The Band-spread S.W. Three (HF, Pen, D, (Pen), Pen) ... PW68*

PORTABLES

- 2/-
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MISCELLANEOUS

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S.W. Converter-Adapter (1 valve) ... PW48A*

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- The "Argus" (6in. C.R. Tube), 3/-*

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- The P.T. Band III Converter 1/6*

All the following blueprints, as well as the PRACTICAL WIRELESS numbers below 94 are pre-war designs, kept in circulation for those amateurs who wish to utilise old components which they may have in their spares box. The majority of the components for these receivers are no longer stocked by retailers.

AMATEUR WIRELESS AND WIRELESS MAGAZINE

STRAIGHT SETS

Battery Operated

- One-valve : 2/6
B.B.C. Special One-valver ... AW387*

Mains Operated

- Two-valve : 2/6 each
Consoelectric Two (D, Pen), A.C. ... AW403

SPECIAL NOTE

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

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

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No. of
Blueprint

SHORT-WAVE SETS

Battery Operated

- One-valve : 2/6 each
S.W. One-valver for American ... AW429*

- Two-valve : 2/6 each
Ultra-short Battery Two (SG, det Pen) ... WM402*

- Four-valve : 3/6 each
A.W. Short Wave World-beater (HF Pen, D, RC, Trans) ... AW436*

- Standard Four-valver Short-waver (SG, D, LF, P) ... WM383*

Mains Operated

- Four-valve : 3/6
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) ... WM391*

MISCELLANEOUS

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

- Listener's 5-watt A.C. Amplifier (3/6) ... WM392*

- De Luxe Concert A.C. Electrogram (2/6) ... WM403*

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