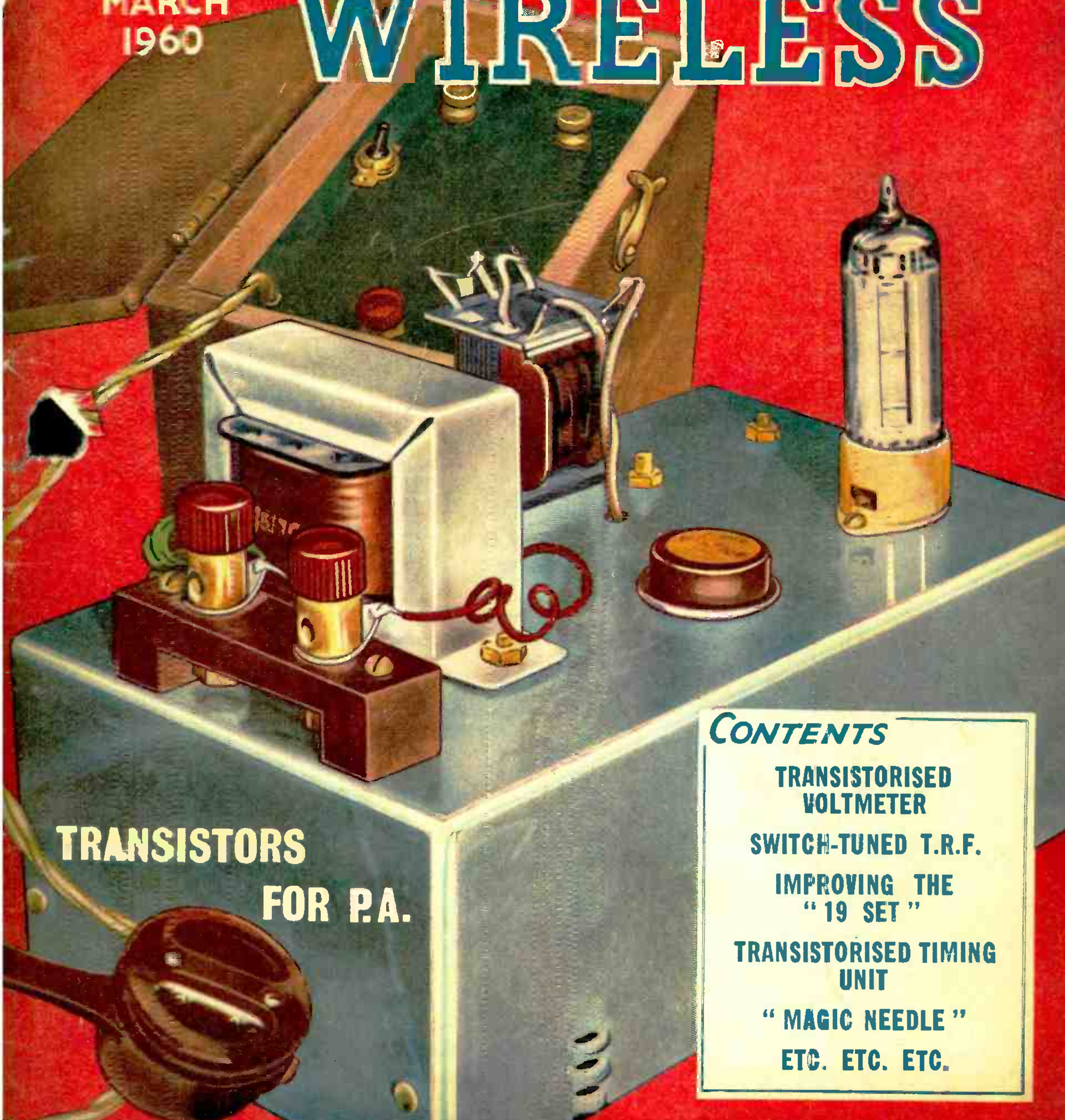
A COMPREHENSIVE PRE-AMP

PRACTICAL WIRELESS

1/6

MARCH 1960



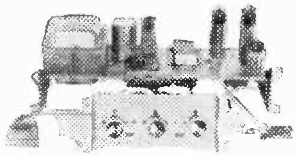
TRANSISTORS FOR P.A.

CONTENTS

HARVERSON SURPLUS CO. LTD.

48, Beddington Lane, Croydon, Surrey.

PHONE: THORNTON HEATH 2577.



MONAURAL AMPLIFIER

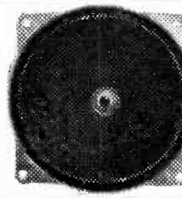
This amplifier as illustrated, made by a leading manufacturer. Mullard Valves—ECC83, EL84 x EL84, EZ80. Bass, Treble and Volume on remote panel. Elegant Knobs.

OUR PRICE **£6. 19. 6.** Plus P. & P. 3/6.

500 MICROAMETER

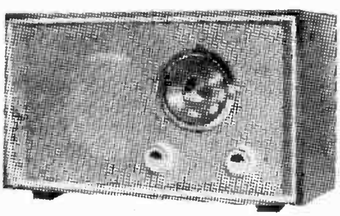
A 4½″ panel mounting 500 Microameter marked in ohms and ideal for building into a multi-range meter.

Price **£2.10.0.** Plus P. & P. 3/6.



PLESSEY TWEETER

This well-known Plessey 3-ohm Tweeter at our amazing price of **10/6.** Tax Paid. Plus P. & P. 1/6.



HARVERSON T.R.F. EASY FOUR KIT

All parts and point-to-point wiring diagram.

Our Price, **£4. 12. 6.**

Plus P. & P. 3/6.

TRANSISTOR by leading manufacturer. First Grade Equivalent OC44. **11/6** each—**6** for **60/-.**

THE WORLD FAMOUS
E.M.I. ANGEL TRANSCRIPTION P.U. (Model 17A)
A Pick-up for the connoisseur originally priced at £17.10.0. The last remaining few offered at **£5.10.0.** Plus P. & P. 5/-.

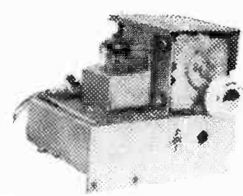
CHANNEL TUNER

12 Channel T.V. Turret Tuner by Clydon. 35 Mc/I.F. PCC84 x PCF80. Band 1=1–5
Band 3=8–11

BRAND NEW. **39/6.**
Plus P. & P. 1/6.

F.M. TUNER HEAD

As illustrated — uses ECC83. Less Valve at **14/6.** Plus P. &. P. 1/6. Regret no diagrams available.



THIS MONTH'S OFFER

Small generator or motor. 12 v. with reduction gear. Has dozens of applications, ideal for the model maker. Don't miss this. **12/6** each. Plus P. & P. 2/-.

Twin Padded, Grey, with Maroon Tracer Mains Lead. Usually 10d. per yard. Our Price **25/-** per 100-yard coil.

Printed circuit pots in banks of two or three:
400 K. x 2 Meg., **5/-** each. 2 Meg. x 200 K. x 2 Meg., **7/-** each.

60 Milliamp Chokes at per **6/-** each.

AMAZING SCOOP—Cossor 10″ Tubes. 108 K. New and Boxed. **21/-** each. Plus P. & P. 12/6.

Few Only—Taylor Windsor Circuit Analysers. Reconditioned. A Snip at **£12.0.0.** Plus P. & P. 5/6.

Woden P.P. O.P. Transformers. 20 watt. 4,500 ohm load. A bargain at **27/6.**

Taylor Windsor 240A Pattern Generator. Not new but perfect. **£8.10.0** each. Plus P. & P. and Insurance 10/-.

12 Assorted Pots. Wire wound and carbon. Switched and unswitched—all useful sizes at **21/-** the dozen. Plus P. & P. 1/-.

Taylor Signal Generators. Type 65A or B.
Not New—but Perfect. **£8.10.0** each. Plus P. & P. and Insurance 10/-.
Few only, **12″** 3 ohm R.A. 8120P Mk. 2 at **32/6.** Plus P. & P. 2/-. Midget 2 gang .0005 at **4/-** each. Plus P. & P. 10d.

IF YOU DO NOT SEE WHAT YOU WANT ON THIS PAGE–WE WILL GET IT FOR YOU
Write for our list of small parts and accessories for the Constructor. Trade willingly supplied.

R.S.C. HI-FI TAPE RECORDER KIT

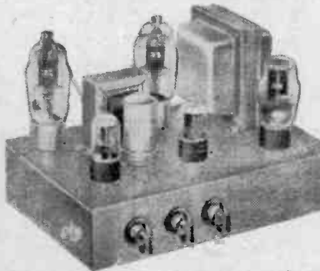
REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN 1 HOUR
The Recorder incorporates the Latest Collaro Mark IV Tape Transcriptor listed £25. The Linear LT45 High Quality Tape Amplifier listed £12.12.0. High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best Quality Tape listed 22/6, and a Handsome Portable carrying Cabinet finished in veneered walnut, size 18in. x 13in. x 9in. high, listed £4 10.0, and circuit. Total cost if purchased individually approx. £45. Performance equal to units in the £60-£80 class. Send S.A.E. for leaflet.

29 1/2 GNS. Carr. 17/6 **H.P. TERMS.** Deposit 3 gns. and 12 monthly payments 53/9. Cash price if settled in 3 mths.

HI-FI 10 WATT AMPLIFIERS

Slightly store soiled but guaranteed unused and in perfect order. Fitted **£5-19-9** Carr 7/6 Mullard valves. Dual inputs for "mike" and gram. etc. Bass and Treble Controls. High sensitivity and quality. For 200-250 v. A.C. mains.

R.S.C. A8 HIGH FIDELITY 12 WATT AMPLIFIER



Ultra Linear 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 ±3 db. 30-30,000 c/cs. Six negative feed-back loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs.

For STANDING or LONG - PLAYING RECORDS. For MUSICAL INSTRUMENTS such as **STRING BASS, GUITARS,** etc. **£7-15-0** **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5a. For supply of a **RADIO FEEDER UNIT**. Size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/cs. Outputs for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Unapproachable value, at £7/15/- or factory built 45/- extra. Carriage 10/-.
If required louvred metal cover with 2 carrying handles can be supplied for 18/9. Additional input sockets, 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 18/9** and 12 monthly payments. **18/9.**
HIGH FIDELITY MICROPHONES and **SPEAKERS** in stock. Keen cash prices or credit terms if supplied with amplifier.

STAAR GALAXY 4-SPEED MIXER AUTO-CHANGERS

Brand new, cartoned. Turnover sapphire styli. Many exclusive features. Unique design motor virtually free from rumble. For 200-250 v. A.C. mains. Only £5.19.6.

PORTABLE CABINETS
Full range of attractive designs from **15/9**

SPECIAL OFFER. Two tone Portable cabinet, Gram amplifier, Staar. Changer and 7in. x 4in. P.M. Speaker. 10 gns. Carr. 10/- or with B.S.R. UA8. 12 gns.

THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve Long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Power pentode output. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality are well up to standard, and simplicity of construction is a special feature. Point-to-Point wiring diagrams, instructions and parts list, 1/9. Maximum building costs £4.19.6, inc. attractive Walnut veneered wood cabinet 12in. x 6½in. x 5½in.

PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP54. Limited number brand new, perfect, at approx. half price. Only 29/11.

ACOS CRYSTAL MICROPHONES. Mic 40 hand or desk. Listed 45/-. **Only 29/9.** Type 33-1, hand or desk. List price 50/-. Brand new, cartoned. 35/9. 39-1 Stick type, list price 5 gns. Brand new. 39/6.

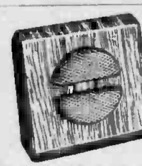
COSSOR VHF/FM RADIO RECEIVER KITS

Including 6 valves, Printed Circuit and Goodmans 10" x 6" Elliptical Speaker. Pre-aligned I.F.T.s Made to retail at 15 GNS. limited number at **£8-19-6**

R.S.C. PORTABLE TAPE RECORDER

A completely assembled unit in attractive two-tone rexine covered carrying case. Excellent frequency response. Auto-erase. Fast rewind. Takes up to 5¾in. tape spools. High Flux speaker, 3 watts output. Inputs for Radio/Gram and 'Mike.' For 230/250 v. 50 c.p.s. A.C. mains. Sensational value! Price, including 'Mike' Reel of best quality tape and empty spool. **19 GNS.** Carr. 10/6 Usual 12 months' guarantee. H.P. Terms: Deposit 44/- and 12 monthly payments of 33/4.

EXTENSION SPEAKERS



Ready for use in walnut veneered cabinet.
6½in. 2-3 ohms. 29/11.
8in. 2-3 ohms. 35/9.
10in. 2-3 ohms. 58/9.
Very limited number.

RECORDING TAPE AT BARGAIN PRICES. Leading makes. Brand New. P.V.C. based. 3in., 150ft., 5/11; 225ft., 7/9; 5in., 600ft., 15/11; 850ft., 22/6; 7in., 1,700ft., 35/-.

EMPTY SPOOLS. (Plastic.) 3in., 2/9; 5in., 2/11; 7in., 3/9.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

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

Type BM2. Size 8 x 5½ x 2½in. Supplies 120v. 90 v. and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed, thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators when connected to A.C. mains supply 200-250 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulator. Complete kit of parts with diagrams and instructions. 49/9, or ready for use, 59/6.

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

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

250-0-250 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a. ... 17/9
350-0-350 v. 80 mA. 6.3 v. 2 a. 5 v. 2 a. ... 18/9
250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 25/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 25/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 25/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 4 a. C.T. 0-4-5 v. 3 a. ... 25/9
350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. ... 29/9

FULLY SHROUDED UPRIGHT

250-0-250 v. 60 mA. 6.3 v. 2 a. 5 v. 2 a. Midget type 2½-3-3in. ... 17/9
250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 26/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 28/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a. ... 28/9
300-0-300 v. 130 mA. 6.3 v. 4 a. 6.3 v. 1 a. for Mullard 510 Amplifier ... 35/9
350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a. ... 35/9
425-0-425 v. 200 mA. 6.3 v. 4 a. C.T. 6.3 v. 4 a. C.T., 5 v. 3 a. Suitable Williamson Amplifier, etc. ... 49/9

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

OUTPUT TRANSFORMERS
Midget Battery Pentode 66:1 for 3S4. etc. ... 3/9
Small Pentode, 5000Ω to 3Ω ... 3/9
Small Pentode 7/8,000Ω to 3Ω ... 3/9
Standard Pentode 5,000Ω to 3Ω ... 5/6
Standard Pentode, 7/8,000Ω to 3Ω ... 5/6
10,000Ω to 3Ω ... 5/6
Push-Pull 10-12 watts 6V6 to 3Ω or 15Ω ... 18/9
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15Ω ... 19/9
Push-Pull EL84 to 3 or 15Ω ... 18/9
Push-Pull 15-18 watts, 6L6, KT66 ... 22/9
Push-Pull for Mullard 510 Ultra Linear ... 29/9
Push-Pull 20 watts, sectionally wound 6L6, KT66, etc., to 3 to 15Ω ... 47/9

ELIMINATOR TRANSFORMERS
Primaries 200-250 v. 50 c/s.
120 v. 40 mA. 5-0-5 v. 1 a. ... 15/9
90 v. 15 mA. 4-0-4 v. 500 mA. ... 9/9

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

CHARGER TRANSFORMERS
All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a. 12/9; 0-9-15 v. 3 a. 16/9; 0-9-15 v. 5 a. 19/9; 0-9-15 v. 6 a. 23/9.

AUTO TRANSFORMERS. 50 watt 0-110/115—230/250 v. 8/11 each.

COLLARO CONQUEST 4-SPEED AUTO-CHANGER with high fidelity Studio pick-up. Latest model. Brand new. Cartoned. For 200-250 v. 50 c.p.s. A.C. mains. Our price £7.19.6. Carr. 5/6.

COLLARO 4-SPEED SINGLE PLAYER UNITS. Type AC/4/564 with turnover crystal head. £6. .6. Carr. 4/6.

BENTLEY ACOUSTIC CORPORATION LTD.

THE VALVE SPECIALISTS. **38 CHALCOT ROAD, LONDON, N.W.1.** Telephone : PRIMROSE 9090

EXPRESS POSTAL SERVICE ! ALL ORDERS DESPATCHED SAME DAY AS RECEIVED. FOR ONLY 2/6 EXTRA TELEPHONE FOR THAT URGENT ORDER TO BE DESPATCHED IMMEDIATELY BY OUR SPECIAL C.O.D. SERVICE.

ANY ORDER INSURED AGAINST DAMAGE IN TRANSIT FOR ONLY 6d. EXTRA.

0A2	17/6	6C8	12/6	6X4	6/6	19BG6G		7475	7/6	EABC80	9/-	EL41	9/-	LN152	10/6	QS150/15		UCH81	9/6
0B2	17/6	6C9	12/6	6X5GT	6/-		23/3	9002	5/6	EAC91	7/6	EL42	13/11	LN309	11/6		10/6	UCL82	11/6
0Z4	6/-	6C10	10/6	6/30L2	10/-	19H1	10/-	AC/PEN		EAF42	9/6	EL81	12/6	MH4(C)	7/-	R12	9/6	UCL83	19/3
1A3	3/-	6CD6G	36/6	7A7	12/6	20D1	15/3	5-pin	23/3	EB34	2/6	EL84	8/6	MHL4	7/6	R18	14/-	UF41	9/-
1A5	6/-	6CH6	12/6	7B6	21/3	20F2	26/6	7-pin	15/-	EB41	8/6	EL85	13/11	MHLD6	12/6	R19	19/11	UF42	12/6
1A7	15/-	6D3	19/11	7B7	8/6	20L1	26/6	AC2PEN/		EB91	5/6	EL91	5/-	ML4	12/6	S130	15/-	UF80	10/6
1C5	12/6	6D6	6/6	7C5	8/-	20P1	26/6	DD	26/6	EBC3	23/3	EL95	10/6	MU14	9/-	SD6	12/-	UF85	10/6
1D5	9/-	6E5	12/6	7C6	8/-	20P3	23/3	AC5PEN		EBC33	7/-	EM34	10/-	MX40	15/-	SP4(7)	15/-	UF86	17/11
1D6	10/6	6F1	26/6	7D8	23/3	20P5	23/3		23/3	EBC41	8/6	EM71	23/3	N37	19/11	SP41	3/6	UF89	9/-
1H5GT	11/-	6F6G	7/-	7H7	8/-	25A6G	11/-	AC6PEN	7/6	EBC81	8/-	EM80	9/6	N78	19/11	SP42	12/6	UL41	9/-
1L4	6/-	6F6GTM	8/-	7R7	12/6	25L6GT	10/-	AC/5G	23/3	EBF80	10/-	EM81	9/6	N108	19/11	SP61	3/6	UL44	26/6
1LD5	5/-	6F8	12/6	7S7	10/6	25U4	16/7	AC/TP	33/2	EBF83	13/11	EM84	10/6	N308	20/7	SU25	26/6	UL46	14/6
1LN5	5/-	6F11	17/3	7V7	8/6	25Y5	10/6	AC/VP1	15/-	EBF89	9/6	EN31	37/-	N339	29/10	SU61	9/6	UL84	8/6
1N5GT	11/-	6F12	5/6	7Y4	8/-	25Y5G	10/-	AC/VP2	23/3	EBL21	23/3	EY51	9/6	P61	3/6	T41	23/3	UM4	17/3
1R5	7/6	6F13	11/6	7Z4	18/7	25Z4G	9/6	ATP4	5/-	EBL31	23/3	EY83	16/7	PABC80		TDD4	24/7	UM80	15/3
1S4	9/-	6F14	26/6	8D2	3/6	25Z5	10/6	AZ1	18/7	EC52	5/6	EY84	14/-		13/11	TH4B	15/-	URIC	9/-
1S5	7/6	6F15	15/3	8D3	5/6	25Z6G	10/-	AZ31	10/-	EC54	6/-	EY86	10/-	PCC84	8/-	TH41	26/6	UU6	19/11
1T4	6/-	6F16	9/6	9BW6	15/3	25Z6GT		AZ41	13/11	EC70	12/6	EZ35	6/-	PCC85	9/6	TH233	33/2	UU7	16/7
1U5	10/-	6F17	12/6	9D2	4/-		16/7	B36	24/7	EC92	13/3	EZ40	7/6	PCC88	23/11	TH2321	20/-	UU8	26/6
2A7	10/6	6F32	10/6	10C1	12/-	27SU	19/11	BL63	7/6	ECC32	10/6	EZ41	7/6	PCC89	14/-	TP22	15/-	UU9	7/6
2P	26/6	6F33	7/6	10C2	26/6	28D7	7/-	C1	12/6	ECC33	8/6	EZ80	7/-	PCF80	8/-	TP25	19/6	UY1N	18/7
2X2	4/6	6G6	6/6	10D2	12/-	30C1	8/-	C1C	12/6	ECC34	24/7	EZ81	7/-	PCF82	11/6	TP2620	33/2	UY21	16/6
3A4	7/-	6H6GTG	3/-	10F1	17/6	30F5	7/-	CBL1	26/6	ECC35	8/6	FC2A	24/7	PCL82	12/6	TY86F	13/3	UY41	7/6
3A5	10/6	6H6GTM	3/6	10F9	10/6	30FL1	10/-	CBL31	23/3	ECC40	23/3	FC4	15/-	PCL83	11/6	U12/14	12/-	UY85	7/-
3B7	12/6	6J5G	5/-	10LD3	8/6	30L1	8/-	CCH35	23/3	ECC81	8/-	FC13	26/6	PCL84	12/6	U16	12/-	VMS4B	23/3
3D6	5/-	6J5GTG	5/6	10LD11		30L15	14/-	CK506	6/6	ECC82	7/6	FC13C	26/6	PENA4	23/3	U18/20	9/-	VP2(7)	12/6
3Q4	7/6	6J5GTM	6/-		15/11	30P12	8/-	CL33	19/3	ECC83	8/-	FW4/500		PENB4	26/6	U22	8/-	VP4(7)	15/-
3Q5GT	9/6	6J6	5/6	10P13	15/6	30P16	8/-	CV63	10/6	ECC84	9/6		9/-	PEN4DD		U24	29/10	VP2B	14/6
3S4	7/6	6J7G	6/-	10P14	19/3	30PL1	11/6	CV271	10/6	ECC85	8/6	FW4/800			26/6	U25	17/11	VP4B	23/3
3V4	7/6	6J7GT	10/6	11D3	24/7	31	7/6	CV428	30/-	ECC88	23/11		9/-	PEN25	19/11	U26	10/-	VP13C	7/-
5R4GY	17/6	6K6GT	8/-	12A6	6/6	33A/158M		CY1	18/7	ECC91	5/6	GZ30	10/6	PEN36C		U31	9/6	VP23	6/6
5U4G	8/6	6K7G	5/-	12AC6	15/3		30/-	CY31	16/7	ECF80	11/6	GZ32	12/-		10/6	U33	26/6	VP41	6/6
5V4G	11/-	6K7GT	6/-	12AD6	17/3	35/51	12/6	D1	3/-	ECF82	10/6	GZ34	14/-	PEN40DD		U35	26/6	VR105/30	
5Y3G	8/-	6K8G	8/-	12AE6	13/11	35A5	21/3	D15	10/6	ECH3	26/6	H30	5/-		25/-	U37	26/6		9/-
5Y3GT	7/6	6K8GTG		12AH7	8/-	35L6GT	9/6	D63	5/-	ECH21	23/3	H63	12/6	PEN44	26/6	U43	9/6	VR150/30	
5Z3	12/6		12/6	12AH8	12/6	35W4	7/6	D77	5/6	ECH35	9/6	HABC80		PEN45	19/6	U45	9/6		9/-
5Z4G	10/6	6K25	19/11	12AT6	7/6	35Z3	10/6	DAC32	11/-	ECH42	10/6		13/6	PEN45DD		U50	8/-	VT61A	5/-
5Z4GT	12/6	6L1	23/3	12AT7	8/-	35Z4	6/6	DAF91	7/6	ECH81	9/-	HL23	10/6		26/6	U52	8/6	VT501	5/-
6A7	26/6	6L6G	9/6	12AU6	23/3	35Z5GT	9/-	DAF96	9/-	ECH83	13/11	HL23DD		PEN46	7/6	U54	19/11	W61M	26/6
6A8	10/-	6L6M	12/6	12AU7	7/6	41MTL	8/-	DD41	13/11	ECL80	10/6		17/3	PEN383	23/3	U76	6/6	W76	6/6
6AB7	8/-	6L7GT	12/6	12AV6	12/7	42	23/3	DF33	11/-	ECL82	10/6	HL41	12/6	PEN453DD		U78	6/6	W81M	6/-
6AB8	10/6	6L18	13/-	12AX7	8/-	43	12/6	DF66	15/-	ECL83	19/3	HL41DD			33/2	U107	16/7	W107	15/3
6AC7	6/6	6L19	23/3	12BA6	8/-	50C5	12/6	DF70	15/-	EF9	23/3		19/3	PEN/DD		U191	16/7	W729	18/7
6AG5	6/6	6LD3	8/6	12BE6	10/-	50CD6G		DF91	6/-	EF22	14/-	HL42DD		4020	33/2	U201	16/7	X24M	24/7
6AK5	8/-	6LD20	15/11	12BH7	21/3		36/6	DF96	9/-	EF36	6/-		19/3	PL33	19/3	U251	14/-	X31	26/6
6AL5	5/6	6N7	8/-	12E1	30/-	50L6GT	9/6	DF97	9/-	EF37A	8/-	HN309	24/7	PL36	14/-	U281	19/11	X41	15/-
6AM6	5/6	6P1	19/3	12J5GT	4/6	53KU	19/11	DH30	15/6	EF39	5/6	HVR2	20/-	PL38	26/6	U282	22/7	X61(C)	12/6
6AQ5	8/6	6P25	12/6	12J7GT	10/6	72	4/6	DH63	8/-	EF40	15/-	HVR2A	6/-	PL81	12/6	U301	23/3	X61M	26/6
6AT6	8/6	6P28	26/6	12K5	17/11	75	24/7	DH63(Met)		EF41	9/6	KF35	8/6	PL82	8/-	U329	14/-	X63	10/-
6AU6	10/6	6Q7G	8/-	12K7GT	6/6	77	8/-		17/6	EF42	11/6	KK32	21/11	PL83	9/-	U339	16/7	X65	12/6
6AV6	12/7	6Q7GT	11/-	12K8GT	14/-	78	8/6	DH76	6/6	EF50(A)	7/-	KL35	8/6	PL84	12/8	U403	16/7	X66	12/6
6B7	10/6	6R7G	10/-	12Q7GT	6/6	80	9/-	DH77	8/6	EF50(E)	5/-	KLL32	24/7	PL820	18/7	U404	8/6	X76M	14/-
6B8G	4/6	6SA7GT	8/6	12SA7	8/6	83	15/-	DH101	28/6	EF54	5/-	KT2	5/-	PM2B	12/6	U801	29/10	X78	21/3
6B8GT	5/-	6SC7	10/6	12SC7	8/6	83V	12/6	DH107	13/11	EF73	10/6	KT33C	10/-	PM12	6/6	U4020	16/7	X79	21/3
6BA6	7/6	6SG7GT	8/-	12SG7	8/6	85A2	15/-	DK32	15/-	EF80	7/-	KT36	29/10	PM12M	6/6	UABC80	9/-	X101	33/2
6BE6	7/6	6SH7GT	8/-	12SH7	8/6	150B2	15/-	DK40	21/3	EF85	7/-	KT41	26/6	PM24M	21/3	UAF42	9/6	X109	17/3
6BG6G	23/3	6SJ7GT	8/-	12SJ7	8/6	185BT	33/2	DK91	7/6	EF86	12/6	KT44	15/-	PX4	10/6	UB41	12/-	XD(1.5)	6/6
6BH6	9/-	6SK7GT	8/-	12SK7	8/6	185BTA	33/2	DK92	10/6	EF89	9/-	KT61	12/6	PX25	59/8	UBC41	8/6	XFG1	18/-
6BJ6	7/6	6SL7GT	8/-	12SQ7	12/6	304	10/6	DK96	9/-	EF91	5/6	KT63	7/-	PY31	16/7	UBC81	11/4	XFY12	9/6
6BQ7A	15/-	6SN7GT	6/6	12SR7	8/6	305	10/6	DL33	9/6	EF92	5/6	KT66	15/-	PY32	17/11	UBF80	9/-	XFY34	17/6
6BR7	23/3	6SQ7GT	9/-	12Y4	10/6	402Pen/A		DL66	15/-	EF97	13/3	KT88	22/6	PY80	7/6	UBF89	9/6	XH(1.5)	6/6
6BW6	10/6	6SS7GT	8/-	14B6	19/3		23/3	DL68	15/-	EF98	13/3	KTW61	8/-	PY81	9/-	UBL21	23/3	XSG(1.5)	
6BW7	7/-	6U4GT	12/6	14H7	23/3	307	7/6	DL92	7/6	EK32	8/6	KTW62	8/-	PY82	7/-	UCC84	14/7		6/6
6BX6	7/-	6U5G	7/6	14S7	27/10	956	3/-	DL94	7/6	EL32	5/6	KTW63	8/-	PY83	9/6	UCC85	9/-	Y63	7/6
6C4	7/-	6U7G	8/6	15D1	26/6	1821	16/7	DL96	9/-	EL33	12/6	KTZ41	8/-	PZ30	19/11	UCF80	16/7	Z63	10/6
6C5G	6/6	6V6G	7/-	18	23/3	5763	12/6	DM70	7/6	EL34	15/-	KTZ63	10/6	QP21	7/-	UCH21	23/3	Z66	20/-
6C6	6/6	6V6GTG	8/-	19AQ5	10/6	7193	5/-	EA50	2/-	EL38	26/6	L63	6/-	QP25	15/-	UCH42	9/6	Z77	5/6

FULL RANGE OF TRANSISTORS AND GERMANIUM DIODES IN STOCK. TECHNICAL DATA AND PRICES FREE ON RECEIPT OF SELF ADDRESSED ENVELOPE.

NEW METAL RECTIFIERS—FULLY GUARANTEED

Technical leaflet on Metal Rectifiers free on receipt of S.A.E.

DRM-1B	15/4	RM-1	7/-	WX3	3/6	14A100	27/-	14RA 1-2-8-2	17/6	16RE 2-1-8-1	8/6
DRM-2B	16/2	RM-2	9/-	WX4	3/6	14A124	28/-	14RA 1-2-8-3	21/-	18RA 1-1-8-1	4/6
DRM-3B	23/3	RM-3	9/6	WX6	3/6	14A163	38/-	14RA 2-1-16-1	21/-	18RA 1-1-16-1	6/6
LW7	21/-	RM-4	16/-	14A86	17/6	14B130	35/-	16RC 1-1-16-1	8/6	18RA 1-2-8-1	11/-
RM-0	7/11	RM-5	19/6	14A97	25/-	14B261	11/6	16RD 2-2-8-1	12/-	18RD 2-2-8-1	15/-

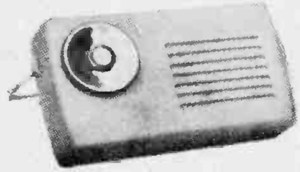
VOLUME CONTROLS · ELECTROLYTIC CONDENSERS

VOLUME CONTROLS	Standard Can				Wire-ended Tubular			
with long spindle and	8 x 8 x 8 mfd., 400 v.	3/6	100 x 400 mfd., 275 v.	12/6	32 mfd., 350 v.	2/6	8 x 8 mfd., 450 v.	3/-
ole switch, 4/6 each.	32 x 32 mfd., 275 v.	5/9	100 mfd., 275 v.	2/6	8 mfd., 450 v.	1/9	16 x 16 mfd., 450 v.	4/-
K 50K, 100K,	64 x 120 mfd., 350 v.	8/3	200 mfd., 275 v.	3/6	16 mfd., 450 v.	2/9	32 x 32 mfd., 350 v.	4/-
1 meg. 2 meg.	60 x 250 mfd., 275 v.	9/6	100 x 200 mfd., 275 v.	9/6	32 mfd., 450 v.	3/9	8 x 16 mfd., 450 v.	3/9

INESS: CASH WITH ORDER OR C.O.D. ONLY. POST/PACKING CHARGES 6d. PER ITEM; C.O.D. 2/6 VALUE £3 UPWARDS POST FREE. ALL VALVES BOXED, FULLY GUARANTEED, AND TED FROM THE WORLD'S FINEST MANUFACTURERS. PERSONAL SHOPPERS WELCOME FROM AYS 1 p.m. CATALOGUE OF OVER 1,000 DIFFERENT VALVES, WITH FULL TERMS OF EASE ENQUIRE FOR ANY ITEM NOT LISTED WITH S.A.E.

COMPLETE V.H.F./A.M. RADIO FOR £12.12.0

Brand new set, in superb walnut cabinet (size 19" x 8½" x 14½" high). Covering 80-100 Mc/s. 16-49 M., 200-500 M. and 1,200-2,000 M. Mains trans. 200-250 v. with 3 tappings. Ferrite rod aerial for A.M. Controls: volume on/off tone, tuning, w/change. Gram. and ext. speaker position provided. Fully guaranteed. Post and packing 5/- extra.

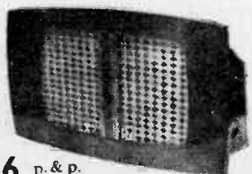


TRANSISTOR KIT

A six Transistor pocket radio, can be built for

£9.19.6

plus 3/6 post. Full medium and long wave superhet. Printed circuit construction, using latest miniature components, 2½" moving coil speaker, Ferrite Aerial. Choice of an attractive plastic cabinet in Cream, Blue or Red. Complete easy-to-build instruction book included. All Parts Sold Separately.



AMPLIFIER AND CABINET

3-watt Amplifier, using an ECL82 Valve and Metal Rectifier, housed in a modern attractive styled walnut cabinet with 5" P/M Speaker and on/off and tone controls. Can be sold for **£4.12.6** p. & p. 3/6.

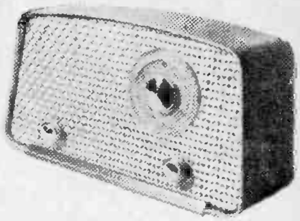
AUTO-CHANGERS
BRAND NEW OFFER

COLLARO 4-SPEED AUTO-CHANGERS

Incorporating auto and manual control. Complete with Studio crystal p.u. and sapphire stylus. Plus 3/6 p. & p.

OUR PRICE **£7.9.6**

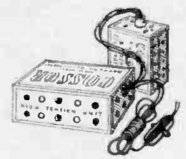
COSSOR MELODY MINOR MODEL 565



A transportable Model of Ultra Lightweight design for use on 200/250 v. Mains D.C. or A.C., 40/100 c/s. Using 4 valves UCH81, UBF89, UY85, UCL82 and Internal Ferrite Aerial.

LIST PRICE 14½ gns.

OUR PRICE **£8.17.6** p. & p. 2/6



Convert your Battery Set to Mains with a **COSSOR BATTERY ELIMINATOR** MU2. For operation on 200/250 v. 50 c/s A.C. mains. Output: L.T., 1.5 v. 125 mA.; H.T., 90 v. 10 mA.

LIST PRICE 3 gns.

OUR PRICE **37/6** p. & p. 2/6

SPEAKERS

3½ in. Speaker	17/6
5 in. ,,	15/-
6½ in. ,,	16/6
8 in. ,,	17/6
6 x 4 in. ,,	15/-
8 x 5 in. ,,	19/6
10 x 6 in. ,,	25/-
12 in. ,,	32/6

AMPLIFIER KIT

This is the famous Cossor 562K, 3-watt Audio Amplifier Kit, using 1 EF86, 6BQ5 and 5V4 valves, a 10" x 6" elliptical speaker and a 4" round speaker. This kit can be easily assembled to provide a compact and versatile printed circuit amplifier suitable for operation from radio microphone gramophone inputs. The circuit design includes negative feed-back and high performance loudspeakers, an easy-to-build instruction pamphlet. Original list price £9.15.0.

OUR PRICE £5.19.6 P. & P. 2/6.

B.S.R. 4-spd. mixer Autochanger type UA8, complete with latest B.S.R. "ful-fi." Carr. & Pkg. 3/6. **£6.19.6.**

SUB MINIATURE CONDENSERS

8 μF x 6 volt.
10 μF x 6 volt.
30 μF x 6 volt.
50 μF x 6 volt.
100 μF x 25 volt.

ALL AT 2/3 EACH

MAINS TRANSFORMERS

M.T.1 250/250 80 m/a, 19/6.
M.T.2 350/350 80 m/a, 19/6.
M.T.3 0/30 volts tapped, 19/6.
M.T.4 150 watt Auto Transformer, 19/6.
M.T.5 Battery Charger 4 amp., 19/6.
M.T.5a Battery Charger 1½ amp., 16/6.

STANDARD ELECTROLYTICS

8 μF x 450 volt, 1/8.
8 x 8 x 450 volt, 2/4.
16 mf. x 450 volt, 2/3.
16 x 16 x 450 volt, 3/6.
32 μF x 450 volt, 3/6.
32 x 32 x 450 volt, 5/6.

BARGAIN OFFER

17" Tube by well-known manufacturer Type CME/1702 (Sub-standard). Price (Callers only.) **£5.19.6.**

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ARROW ROAD, LONDON, W.9. TEL.: CUNNINGHAM 9530

Hours of business: 9 a.m.-6 p.m. Open all day Saturday.

Stern's "fidelity" TAPE EQUIPMENT

A SELECTION OF HIGH FIDELITY PORTABLE TAPE PREAMPLIFIERS

Adds "Hi-Fi" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION

IN ALL MODELS WE INCORPORATE THE TYPE "C" PREAMPLIFIER

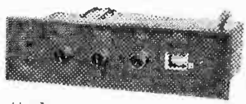
AND OFFER IT COMPLETE IN CASE WITH . . .

(a) The new COLLARO "STUDIO" 3 Speed Deck **£36.10.0**
H.P. Deposit. £7.6.0. 12 months £2.13.6.
(b) The COLLARO Mk. IV "Transcriptor" 3 Speed Deck **£41.10.0**
H.P. Deposit. £8.6.0. 12 months £3.0.11.
(c) The New TRUVOX Mk. VI. Tape Deck. **£43.10.0**
H.P. Deposit. £8.14.0. 12 months £3.3.10.
(d) The BRENELL Mk. V 3 Speed Deck **£51.10.0**
H.P. Deposit £10.6.0. 12 months £3.15.7.
(e) The WEARITE MODEL 4A. Tape Deck **£61.0.0**
Deposit. £12.4.0. 12 months £4.9.5.

STERN'S MULLARD TYPE "C" TAPE PREAMPLIFIER-ERASE UNIT

INCORPORATING THE NEW FERROXCUBE POT CORE PUSH-PULL OSCILLATOR and 3-SPEED TREBLE EQUALISATION by means of the latest FERROXCUBE POT CORE INDUCTOR.
PRICES......INCLUDING SEPARATE SMALL POWER SUPPLY

COMPLETE KIT OF PARTS.......... **£14.0.0**
ASSEMBLED AND TESTED **£17.0.0**



Dep. £3.8.0 and 12 of £1.4.11.

ALSO AVAILABLE EXCLUDING POWER SUPPLY UNIT FOR £11.15.0 and £14.10.0. respectively.
WHEN ORDERING PLEASE STATE MAKE OF TAPE DECK TO BE USED. We present this "Hi-Fi" Preamplifier strictly to Mullard's specification incorporating ONLY NEW HIGH-GRADE COMPONENTS and the SPECIFIED NEW MULLARD VALVES. It comprises a COMPLETELY SELF-CONTAINED UNIT. neatly finished in Hammered Gold with a very attractively engraved PERSPEX FRONT PANEL.

FOR PERMANENT HIGH QUALITY INSTALLATIONS WE ALSO OFFER (excluding case)

(a) The COLLARO "STUDIO" TAPE DECK and our Mullard Type "C" PREAMPLIFIER and Power Unit Assembled and Tested **£32.10.0**
H.P. Deposit £6.10.0. and 12 months £2.7.8.
(b) As above but TYPE "C" PREAMPLIFIER supplied as complete KIT OF PARTS **£29.0.0**
(c) The COLLARO Mk. IV TAPE DECK and the MULLARD TYPE "C" PREAMPLIFIER & Power Unit assembled, tested **£35.0.0**
H.P. Deposit £7 and 12 months £2.11.4.
(d) As (c) but Type "C" as COMPLETE KIT OF PARTS **£32.0.0**
(e) The TRUVOX Mk. VI DECK and the assembled Type "C" Preamplifier and Power Unit **£40.0.0**
H.P. Deposit £8.0.0. and 12 months £2.18.3.
(f) As above but Type "C" as complete KIT OF PARTS **£36.10.0**
(g) The BRENELL Mk. V DECK and the assembled Type "C" PREAMPLIFIER and POWER UNIT **£46.0.0**
H.P. Deposit £9.4.0. and 12 months £3.7.6.
(h) As (g) but Type "C" as complete KIT OF PARTS **£43.0.0**
(i) The WEARITE 4A DECK with TYPE "C" assembled and tested **£56.0.0**
H.P. Deposit. £11.4.0 and 12 months £4.2.1.
(Carriage and Insurance on above quotes 10/- extra.)
PLEASE ENCLOSE S.A.E. WITH ALL CORRESPONDENCE.

YOU CAN BUILD A COMPLETE TAPE RECORDER for £36.0.0

H.P. TERMS Deposit £7.4.0. 12 months £2.12.10.

FOR THIS WE SUPPLY:
★ COMPLETE KIT OF PARTS TO BUILD THE HF TR3 TAPE AMPLIFIER.
★ THE NEW COLLARO "STUDIO" TAPE DECK.
★ PORTABLE CARRYING CASE (as illustrated).
★ ROLA/CELESTION 10in. x 6in. P.M. LOUDSPEAKER.
★ ACOS CRYSTAL MICROPHONE. 1,200ft. SPOOL E.M.I. TAPE.

For those who prefer another type of TAPE DECK we will supply precisely as above—but IN PLACE of the COLLARO "STUDIO" DECK—WE INCLUDE :

(a) The Mk. VI COLLARO "TRANSCRIPTOR" DECK **£39.15.0**
H.P. Deposit £8.0.0 and 12 months £2.18.2.
(£1 extra to wire up the Transcriptor Switch Banks.)
(b) The New TRUVOX Mk. VI DECK **£45.0.0**
H.P. Deposit £9.0.0. and 12 months £3.6.0.
(Carriage and Insurance on all above is 12/6 extra.)

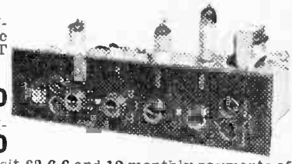
For Constructors with their own Cabinet WE OFFER
(a) COMPLETE KIT to build the HF/TR3 Amplifier together with the COLLARO "STUDIO" DECK **£28.0.0**
(b) As above but with HF TR3 supplied ASSEMBLED and TESTED **£31.10.0**
H.P. Deposit £6.6.0. and 12 months £2.6.0.
(c) COMPLETE KIT to build the HF/TR3, together with the Mk. IV COLLARO "TRANSCRIPTOR" TAPE DECK **£30.15.0**
(£1 extra if we are required to wire up Deck Switch Banks.)
(d) As above but HF/TR3 supplied ASSEMBLED and TESTED **£34.10.0**
(£1 extra if we are to wire up Deck Switch Banks.)
(e) COMPLETE KIT to build the HF/TR3, together with the NEW TRUVOX Mk. VI TAPE DECK **£36.0.0**
(f) As above but HF TR3 supplied ASSEMBLED and TESTED **£39.10.0**
H.P. Deposit £7.18.0. and 12 months £2.17.11.
(g) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENELL Mk. V TAPE DECK **£41.10.0**
(h) As above but HF/TR3 supplied ASSEMBLED and TESTED **£45.0.0**
H.P. Deposit £9.0.0. and 12 months £3.6.0.
Carriage and Insurance on each above is 10/- extra.

Attractive PORTABLE CASE is available to accommodate the TRUVOX or COLLARO TAPE DECKS and we offer it, together with ROLA/CELESTION 10in. x 6in. LOUDSPEAKER—ACOS CRYSTAL MICROPHONE—and 1,200 ft. SPOOL E.M.I. TAPE—ALL FOR £9.0.0. Carriage and Insurance 5/- extra.

WE HAVE THE NEW 2 SPEED TWIN TRACK TRUVOX Mk VI TAPE DECK IN STOCK £26.5.0
DEPOSIT : £5.5.0 and 12 MONTHS : £1.18.6

THE MODEL HF/TR3 TAPE AMPLIFIER

INCORPORATING
3-SPEED TREBLE EQUALISATION by means of the latest FERROXCUBE POT CORE INDUCTOR.



PRICE for COMPLETE KIT OF PARTS **£12.15.0**
PRICE FULLY ASSEMBLED & TESTED **£16.10.0**

HIRE PURCHASE. Deposit £3.6.6 and 12 monthly payments of £1.4.2. A very high-quality Amplifier based on the very successful TYPE "A" design completed in the MULLARD LABORATORIES. ONLY NEW HIGH-GRADE COMPONENTS are incorporated including MULLARD VALVES and a GILSON OUTPUT TRANSFORMER . . . other features are—Magic Eye Recording hand indicator—Effective Tone Control—Monitoring and Extension Speaker Sockets—Has own Power Supply and can be used as independent Amplifier for direct reproduction of Gram Records or from Radio Tuner. Overall size 11in. x 6in. x 6in. Can be supplied for use with Truvox—Collaro—Lane—Brenell or Motok Decks. Please spe[illegible] which. Send S.A.E. for leaflet or 2/6 for complete Assembl[illegible]

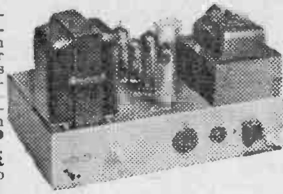
STERN RADIO LTD.
109 & 115 FLEET ST., LONDON, E.C.4
Telephone: FLEET STREET 5812/3/4

STERN S MULLARD DESIGNS

Des gned by MULLARD—presented by STERNS strictly to specification.

COMPLETE KIT OF PARTS—

MULLARD "5-10" MAIN AMPLIFIER

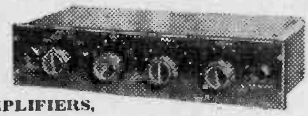


For use with the MULLARD 2-stage pre-amplifier (described below) with which an undistorted power output of up to 10 watts is obtained. This combination is thoroughly recommended to "Hi-Fi" enthusiasts who contemplate a versatile and very high quality home installation. We supply **SPECIFIED COMPONENTS AND NEW MULLARD VALVES**, including **PARMEKO MAINS TRANSFORMER** (which has extra Power available to drive Radio Tuner) and the choice of the latest Ultra-Linear **PARMEKO** or the **PARTRIDGE** Output Transformer.

PRICE COMPLETE KIT (PARMEKO Output Trans) **£10.0.0** Alternatively we supply **ASSEMBLED and TESTED, £11.10.0.**

ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA.

MULLARD'S PRE-AMPLIFIER TONE CONTROL UNIT



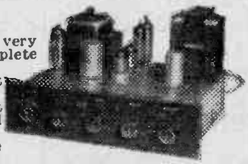
Employing two EF86 valves, and designed to operate with the MULLARD 3-3 and 5-10 **MAIN AMPLIFIERS**, but also perfectly suitable for other makes.

PRICE, COMPLETE KIT OF PARTS. **£6.6.0** Alternatively we supply ASSEMBLED AND TESTED **£8.0.0** (Carriage & Insurance, 5/- extra.)

Our kit is strictly to **MULLARD'S SPECIFICATION** and incorporates :

- Equalisation for the latest R.I.A.A. characteristics.
- Input for Crystal Pick-ups, and variable reluctance magnetic types.
- Input. (a) Direct from High Imp. Tape Head. (b) From a Tape Amplifier or Pre-amplifier.
- Sensitive Microphone Channel.
- Wide range **BASS** and **TREBLE** Controls.

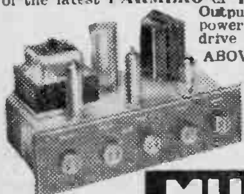
COMPLETE MULLARD 5-10



The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Input channels for high output pick-ups and all modern Radio Tuning Units only Specified Components and new **MULLARD VALVES** are supplied, including **PARMEKO MAINS TRANSFORMER** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers. Adequate power available to drive Radio Tuner. **£11.10.0** OR ASSEMBLED and TESTED **£13.10.0**

HIRE PURCHASE (Assembled Amp. only) DEP.: £2.14.0. 12 Months: 19/10.

ABOVE incorporating PARTRIDGE OUTPUT TRANS., £1.6.0 extra.



COMPLETE MULLARD 3-3

COMPLETE KIT OF PARTS **£7.10.0** OR ASSEMBLED and TESTED **£8.19.6**

(plus 6/6 coverage and insurance) H.P. Terms : Deposit £2.0.0 and 8 Months at £1.0.0. Developed from the very popular A3-valve 3-watt design Complete to MULLARD'S SPECIFICATION including Mullard valves and a **PARMEKO OUTPUT TRANSFORMER.**

THE IDEAL AMPLIFIER FOR SMALL HIGH QUALITY INSTALLATION

SPECIAL PRICE REDUCTIONS

(c) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-stage PRE-AMP CONTROL UNIT **£15.15.0**

(d) The "5-10" and the 2-stage PRE-AMP both ASSEMBLED and TESTED H.P. Dep. £3.16.0 and 12 months of £1.7.8 .... **£18.18.0**

(e) The KIT OF PARTS to build the DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT **£21.10.0**

(f) The DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED and TESTED **£25.0.0**
H.P. Terms : Deposit £5 and 12 months of £1.16.8.

(g) THE KIT OF PARTS to build one "5-10" MAIN CHANNEL and the DUAL-CHANNEL PRE-AMP CONTROL UNIT **£21.10.0**

(h) ONE "5-10" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER both ASSEMBLED and TESTED **£25.0.0**
H.P. Terms : Deposit £5. 12 months of £1.16.8.

(i) KIT OF PARTS to build Two "5-10" MAIN AMPLIFIERS (incorporating Parmeko Output Transformers) and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT **£31.0.0**

(j) TWO "5-10" AMPLIFIERS and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED & TESTED **£36.0.0**

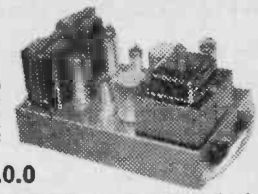
H.P. Terms : Deposit £7.4.0. 12 months £2.12.0.

Carriage and Insurance 7/6 extra.

Prices quoted are subject to £1.6.0 extra for Partridge Transformer.

MULLARD—STERN STEREO DESIGNS

DUAL "3-3" MAIN AMPLIFIER

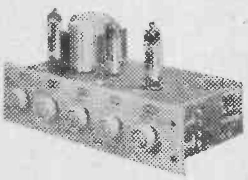


Comprises two "3-3" **MULLARD MAIN AMPLIFIERS** on one chassis and is designed to operate with our **DUAL CHANNEL PRE-AMPLIFIER** for both **STEREOPHONIC** or **MONAURAL** operation.

PRICE: COMPLETE KIT OF PARTS **£10.0.0**

Alternatively ASSEMBLED AND TESTED **£11.15.0** H.P. Terms: Deposit £2-7-0 & 12 months at 17/4. Its output power is 6 watts (3 watts per channel) and together with our **PRE-AMPLIFIER** provides a very acceptable **STEREO** installation.

COMPLETE STEREO AMPLIFIER



A thoroughly recommended design that very effectively meets the many requests for a low-priced but good quality **DUAL CHANNEL STEREOPHONIC AMPLIFIER.**
...: COMPLETE KIT ... **£8.10.0**
...IVELY ASS... TESTED **£10.10.0**
... ECL82 Triode Pentode Valves are incorporated in ...m a "CLASS A" single-ended output stage in each ... sensitivity is 300 m/volts, therefore when used ...ystal Pick-Ups, or Radio Tuning Units, an ...el is achieved, or similarly when switched ...ition a combined output of 4 watts is

DUAL CHANNEL PRE-AMPLIFIER

This model incorporates two 2-valve Pre-Amplifiers (described above) combined into a Single Unit enabling it to be used for both **STEREOPHONIC** or **MONAURAL** operation. It is designed primarily to operate with our range of **MULLARD MAIN AMPLIFIERS** but will also operate equally well with any make of Amplifiers requiring an input of 250 m/volts.

COMPLETE KIT OF PARTS **£12.10.0** ASSEMBLED AND TESTED **£15.0.0**

It will operate equally well for **MONAURAL** only operation with one "5/10" Main Amplifier to which the second Main Amplifier can at any time be added, thus very easily providing for both **STEREO** or **MONAURAL** reproduction. Recommended combinations for **STEREO** operation :

(a) The **DUAL CHANNEL PRE-AMPLIFIER** together with the Dual "3/3" **MAIN AMPLIFIER.**
(b) The **DUAL CHANNEL PRE-AMPLIFIER** together with two "5/10" **MAIN AMPLIFIERS.**

THE ASSEMBLY MANUAL is available for 3/-.

Please enclose S.A.E. if ILLUSTRATED and DESCRIPTIVE LEAFLETS are required . . . alternatively the COMPLETE ASSEMBLY MANUALS are available at 1/6 each.

STERN RADIO LTD.

Stern's "fidelity" TAPE RECORDERS

BEFORE YOU BUY—YOU SHOULD HEAR THESE RECORDERS. THEY ARE COMPARABLE TO THE MUCH HIGHER-PRICED MODELS

There are no better value for money Tape Recorders on the market—if you can't call and hear them, send S.A.E. for fully descriptive leaflets.

Each Model incorporates the highly successful HF/TR3 Amplifier (described opposite) thus ensuring truly "Hi-Fi" record and playback facilities.

All prices quoted provide for the COMPLETE RECORDER including CRYSTAL MICROPHONE and 1,200 ft. Spool of Tape.

MODEL CR3/S. Incorporates the New COLLARO "STUDIO" TWIN TRACK 3-Speed Deck **£41.0.0**
H.P. Terms: Deposit £8.4.0 and 12 months of £3.0.2.

MODEL CR3/T. Incorporates the very popular 3-Speed COLLARO Mk. IV "TRANSCRIPTOR" Deck which has both upper and lower tape tracks......... **£49.10.0**
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.

MODEL TR3/Mk. VI. Incorporates the New TRUVOX Mk. VI TWIN TRACK 2-Speed Tape Deck **£49.10.0**
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.

!! RADIOGRAM CHASSIS !!

ARMSTRONG MODEL AF/208..................... **£23.2.0**
7 valve AM/FM Chassis producing Max. 5 watts output.

ARMSTRONG "STEREO TWELVE"...... **£37.16.0**
The most complete AM/FM unit yet produced for Stereo, giving 6 watts high-fidelity push-pull output on each channel, 12 watts for monaural.

ARMSTRONG "JUBILEE"....................... **£29.8.0**
An AM/FM chassis with nine valves and with push-pull output stage providing 6 watts.

ARMSTRONG AM/FM "STEREO 44" **£28.7.0**
Provision is made for Stereo and monaural playback from pick-up or tape. Outputs provided for Stereo or Monaural tape recordings.

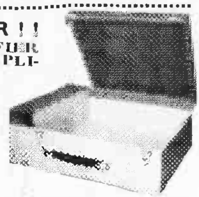
RADIO TUNING UNITS

DULCI MODEL FMT/2.......................... **£19.17.6**
A complete self-powered F.M. Tuner incorporating automatic frequency control.

ARMSTRONG "S.T.3" AM/FM UNITS...... **£27.6.0**
A self-powered high-fidelity Tuner covering full VHF, medium, and long wavebands with automatic frequency control on VHF.

DULCI "H4/T" AM/FM UNIT **£25.15.2**
A 4 waveband self-powered high-fidelity tuner covering the VHF/FM transmissions plus the long, medium and short wavebands.
NEW HIRE PURCHASE TERMS are available on all above. Illustrated leaflets available—send S.A.E. (Carr. and Ins. 5/- extra.)

A SPECIAL CASH ONLY OFFER !!



This very attractive **PORTABLE AMPLIFIER CASE** together with a good quality **GRAM AMPLIFIER** and a matched **P.M. SPEAKER.**

ALL for ONLY **£8.7.6** (Plus 7/6 Carr. & Ins.)

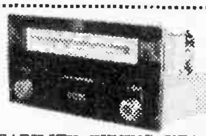
The Amplifier consists of a 2-stage design incorporating 3 modern B.V.A. valves and has separate BASS and TREBLE CONTROLS. The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine.

WE ALSO SUPPLY SEPARATELY—
(a) The 2-stage (plus Rectifier) **AMPLIFIER** **£4.2.6** (b) The **PORTABLE CARRYING CASE** **£3.17.6**
(c) **P.M. SPEAKER** **18/9** Carriage and Insurance 4/- extra.

— SPECIAL CASH ONLY BARGAIN —

A bulk purchase enables us to offer a very useful
INTERCOM SET OR BABY ALARM *for only* **£5.5.0**
(Plus 5/- carriage & Insurance).
Consists of MASTER UNIT and one EXTENSION, providing 2-way TALK-LISTEN facility. Complete in polished wood cases, size of each only 7¾ x 4¾ x 6in. high.

STERN'S MK. II "fidelity" F.M. TUNING UNIT

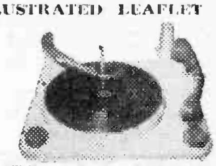


PRICE £14.5.0 (Plus 5/- Carr. and Ins.)

HIRE PURCHASE: Deposit £2.17.0 and 12 Monthly Payments of £1.0.11.
Incorporates the latest MULLARD PERMEABILITY TUNING HEART and the corresponding MULLARD VALVE LINE-UP. A really first-class Tuner, very attractively presented and comparable to many offered at much higher prices. Power consumption is only 1.5 amps. at 6.3 volts and 25 m/a at 250 volts.
HOME CONSTRUCTORS! YOU CAN BUILD THIS TUNING UNIT FOR ONLY £10.10.0 (Plus 5/- Carr. & Ins.) Please send S.A.E. for fully descriptive leaflet, or the Assembly Manual is available for 1/6.

!! RECORD PLAYERS !!

THE LATEST MODELS ARE IN STOCK MANY AT REDUCED PRICES !!!
SEND S.A.E. FOR ILLUSTRATED LEAFLET



B.S.R. MONARCH UA8 4-speed mixer Autochanger with Crystal Pick-up **£6.19.6**

The **NEW COLLARO MODEL RP594** 4-speed Single Record Player. Studio Cartridge **£9.18.9**

The **COLLARO "CONQUEST"** 4-speed Autochanger, Studio Pick-up **£7.10.0**

The latest **COLLARO "CONTINENTAL"** 4-speed MIXER Autochanger Studio "O" Pick-up **£8.10.0**

The **COLLARO** 4-speed Single Record Player, Studio Pick-up.. **£6.6.0**

THE NEW B.S.R. Model UA12 is in Stock. A 4 "SPEED" MIXER AUTOCHANGER **£8.7.6**

UA12 also available incorporating the **B.S.R. STEREO** Pick-up, plays L.P. and 78 Records **£10.10.0**

B.S.R. MODEL TU9 4-speed Single Record Player, complete with separate Crystal Pick-up **£4.4.0**

GARRARD MODEL TA/Mk. 11 4 Speed Player fitted high output Crystal Pick-Up **£8.10.0**

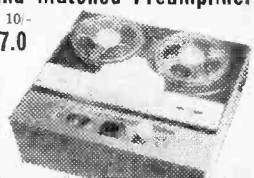
GARRARD MODEL RC/121/4. Autochanger 4 speeds. High Output. Crystal Pick-Up......................... **£10.0.0**

Carriage and Insurance on each above. 5/- extra.

"Hi-Fi" LOUDSPEAKERS

WE HAVE IN STOCK A COMPLETE RANGE BY GOODMANS—WHARFDALE—W.B.
Illustrated and Priced Leaflets on request.

THE "ADD-A-DECK" incorporating the NEW B.S.R. "MONARDECK" and Matched Preamplifier



Carriage and Insurance. 10/-
Deposit £3.12.0 12 mths. £1.6.2. **£17.17.0**

Designed to operate through the Pick-Up Sockets of the standard RADIO RECEIVER through which first-class results are obtained. It consists of a Twin Track Tape Deck, incorporating matched Pre-amplifier, and operates at 3¾in./sec. speed.
Supplied fully tested and completely assembled on an attractive wood plinth, and only requires connections to the mains supply and the Pick-Up Sockets, for which purposes "floating" leads are incorporated.

HOME CONSTRUCTOR

A RANGE OF "EASY TO ASSEMBLE" PREFABRICATED CABINETS. Designed by the W.B. "STENTORIAN" COMPANY for "Hi-Fi" Loudspeaker systems or to accommodate high-quality equipment. The acoustically designed Bass Reflex Cabinets containing the very successful "Stentorian" Speakers give really first-class reproduction and are well recommended. Models are also available to accommodate high-quality Amplifiers, Preamplifiers, Tuning Units, Record Players, etc. All models are very easily assembled, in fact, only a screwdriver is required. Fully illustrated leaflets are available, including specifications of the STENTORIAN LOUDSPEAKERS.

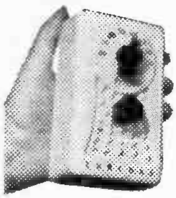
109 & 115 FLEET ST., LONDON, E.C.4
Telephone: FLEET STREET 5812/3/4

PLEASE ENCLOSE S.A.E. WITH ALL ENQUIRIES.

EASY AS A.B.C. TO BUILD

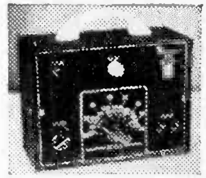
37/6

The new, exciting De Luxe "Gold Star" Pocket Radio in beautiful moulded plastic case—This model is a highly sensitive, self-contained set covering all medium waves. Uses modern miniature "button-base" valve and specially designed high efficiency coil. Exceptionally easy to build from our step-by-step plans—the case is supplied ready drilled! Size of radio only 4½in. x 2½in. x 1½in. !—and batteries fit inside. We can supply all parts including case, detachable aerial, instruction book, wire, screws, etc., for only 37/6, plus 2/6 Post and Packing. C.O.D. 2/- extra. (Parts sold separately, priced parts list 1/6.)



29/6

Our engineers have designed a novel Wrist-Watch Radio using latest Transistor Techniques. Size only 1½in. x 1in. x ½in. ! ! !—"Feather-weight"—yet gives clear, crisp, personal-phone reception over all medium waves. Tiny battery inside lasts months—costs 5d. No Snags, anyone can build it in an hour or two using our pictorial step-by-step simple plans. All parts supplied (including case and strap) for only 29/6 (add 2/6 Post, etc.). C.O.D. 2/- extra. (All parts sold separately, priced parts list 1/6.) Send Now !

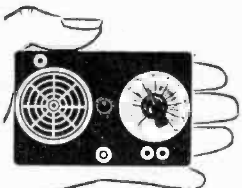


Can Be Built for 47/6. Build this exceptionally sensitive high efficiency personal phone radio. Uses unique assembly system and can be built by anyone without any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6½in. x 5in. x 3in. Covers all medium and long waves. H.T. consumption only 1 to 1.5 mA. Ideal for Bedroom, Garden, Holiday, etc. BUILD THE "SKY-ROMA" NOW ! Total building cost—everything down to the last nut and bolt, 47/6 (Postage, etc., 2/-)—with full set of clear, easy-to-follow plans. (Parts sold separately. Priced parts list and plans 1/6.) C.O.D. 2/- extra.

47/6

29/6

The sensational "Silvertone" model ! A highly compact self-contained miniature "button-base" valve pocket radio at absolute "rockbottom" building cost ! Covers all the medium waves with the very latest circuitry bringing in stations from all over Europe—without fuss. Easy as A.B.C. to assemble, using our step-by-step instruction manual. Size only 4½in. x 2½in. x 1½in.—a fascinating little pocket radio. We can supply all the parts including beautiful two-tone case, detachable aerial, instruction book, screws, wire, etc., for only 29/6 (plus 2/- post and packing). C.O.D. 2/- extra. (Parts sold separately, priced parts list 1/9.)



29/6

THIS TRANSISTOR SET Can Be Built For Only 29/6. The "Sky-Scout" Pocket two-stage transistor set, size only 1in. x 3½in. x 4½in. Covers all medium waves and works entirely off tiny "penlight" battery which costs 6d. and fits inside case. All parts tested before despatch. Can be built for 29/6, plus 2/- Post and Packing. INCLUDING CASE, TRANSISTOR, STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS, nuts, bolts, etc. (C.O.D. 2/- extra.) Parts sold separately, priced parts list and plans 1/6. VERY SIMPLE TO BUILD.

15/-

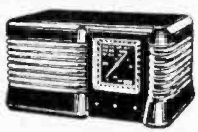
This amazing "Tiny-Tim" model—no larger than a matchbox—costs nothing to run—ever ! No batteries ! No Valves ! No electricity ! Will *never* run down or burn out. Uses the latest TRANSISTOR TYPE GERMANIUM DIODE, receives local stations anywhere—without extra aerial. Clear, Crisp Tone. No snags, anyone can build it within an hour using our step-by-step instruction book, etc., for only 15/-, plus 2/- Post and Packing (C.O.D. 2/- extra). (Parts sold separately, priced parts list 1/9.)

39/6

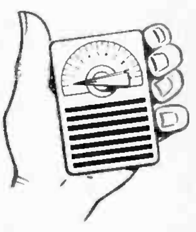
Anyone can build this beautiful precision Pocket Radio in an hour or two. No knowledge whatever needed. Our simple pictorial plans take you step-by-step ! Remarkably sensitive—covers all medium waves, inc. Luxembourg, Home, Light. Size only 2in. x 3in. x 5½in.—Not a Toy ! But a Real, Personal-phone, Valve Radio With Detachable Aerial ! IDEAL FOR BEDROOM, GARDEN, etc. We supply ALL parts necessary, together with plans, etc., for the special price of 39/6, plus 2/6 post and packing. (C.O.D. 2/- extra.) BUILD YOURS NOW ! (All parts sold separately, priced parts list 1/9.) Send Today ! Money refunded if parts returned intact within 7 days.

107/6

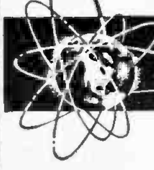
Choice of beautiful walnut veneered cabinet or ivory bakelite. This is the lowest possible price consistent with high quality. No radio knowledge whatever needed . . . can be built by anyone in 2-3 hours, using our very simple, easy-to-follow diagrams. The terrific new circuit of the "Ocean-Hopper" covers all medium and long waves, has razor-edge selectivity and exceptionally good tone. Price also includes ready drilled and punched chassis, set of simple-to-follow plans—in fact everything ! Parts tested before despatch ! Uses standard octal-base valves. (Low running costs—approximately 18 watts.) Size 12in. x 6in. x 5in. Build this long-range powerful midget NOW. TOTAL BUILDING COST INCLUDING PLANS, ETC., £5/7/6. (Post and Packing 3/6.) Parts sold separately. Priced parts list and plans 1/9. C.O.D. 2/- extra.



45/-



TWO - TRANSISTOR POCKET SET. Can Be Built for 45/-. BUILD THE "SKY-GNOME" VEST-POCKET TWO TRANSISTOR RADIO which gives a superb performance and is highly sensitive. Weight under 7 ozs.—yet it is a THREE-STAGE receiver covering all medium waves, working entirely off a "penlight" battery. Every part tested before despatch ! SPECIAL STEP-BY-STEP PLANS FOR ABSOLUTE BEGINNERS. Total building cost including case, transistors, etc.—everything down to the last nut and bolt—ONLY 45/- with plans. Postage, etc., 2/-. (C.O.D. 2/- extra.) (Parts sold separately. Priced parts list and plans 1/6.) RUSH YOUR ORDER TODAY !



CONCORD ELECTRONICS

210, Church Road, Hove, Sussex

Dept. PW16

Orders receive prompt attention. Cheques accepted. Cash on delivery 2/- extra. Please print name and address in block letters. Suppliers to Schools, Universities, Government and Research Establishments. **Complete range of components and valves stocked.** *Regret no C.O.D. abroad.*

NO DEPOSIT - INTEREST FREE - 20 or 36 WEEKS TO PAY!

4/1 DEPOSIT

R.P.2.

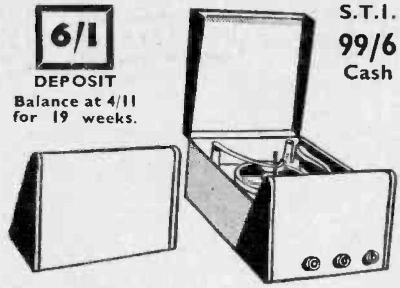
Balance at 2/11 per week for 19 weeks.

A beautifully styled cabinet. Made by a famous manufacturer. In polka dot cloth with clipped lid and carrying handle. Size 16 x 14½ x 8½in. deep. Will take B.S.R. Monarch 4-speed Autochanger and 7 x 4in. elliptical speaker and most of the modern portable amplifiers. Carr. & Ins. 4/6. Cash Price, 59/6.

STEREOPHONIC PLAYER CABINET

6/1 DEPOSIT Balance at 4/11 for 19 weeks.

S.T.I. 99/6 Cash



Continental style cabinet including extra clip-on speaker cabinet. 15⅜ x 10⅞ x 24⅞in. deep Takes B.S.R. 4-speed stereo Autochanger. Printed circuit amplifier. Two 8in. speakers. Carr. & Ins. 6/6.

4/7 DEPOSIT.

R.P.3.

Balance at 3/5 per week for 19 weeks.

A delightful looking cabinet 14⅞ x 17⅞ x 8⅞in. in 2-tone leatherette. Will take a B.S.R. Monarch 4-speed Autochanger and 6in. round speaker. Carr. & Ins. 4/6. Cash Price, 69/6.

AMPLIFIERS

12 Months Guarantee

ALL PORTABLE

AMPLIFIER Mk. D.1. 59/6
Brand new. Latest design with printed circuit. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated 2-3 watts output. Incorporating EL84 as high gain output valve. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

AMPLIFIER Mk. D.2 79/6
Printed circuit. Latest design. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated. 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve giving higher undistorted output. Volume and tone controls. Knobs 2/6 extra. P. & P. 3/6.

AMPLIFIER Mk. D.3 89/6
De-luxe model. Printed circuit. Latest design. Dimensions 7 x 2½ x 5in. A.C. only. Mains isolated. 3-4 watts output. Incorporating the latest ECL82 triode pentode output valve, giving higher undistorted output. Volume, treble and bass control. Knobs 3/6 extra. P. & P. 3/6.

AMPLIFIER Mk. D.5 39/6
Simple circuit employing ECL80 triode pentode output valve giving 2-3 watts output. A.C. only. Mains isolated. Single control for volume and on/off switch with knob. P. & P. 3/6

STEREOPHONIC AMPLIFIER

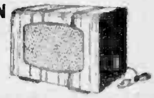
9/1 DEPOSIT. Balance at 7/11 for 19 weeks. **12 MONTHS GUARANTEE**

Beautifully made for portable stereophonic record players. Latest design with printed circuit. Dimensions 3 x 5½ x 9⅞in. A.C. only. Mains isolated. Twin amplifiers each side giving 3-4 watts output. Incorporating ECL82 triode pentode valve. Full tone, volume and balance controls. Complete and ready to fit. Knobs 3/6 per set extra. Carr. & Ins. 3/6.

Cash price £7.19.6.

EXTENSION SPEAKERS

19/9



Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms.) Switch and flex included. Ins. carr. 3/9.

8in. P.M. SPEAKER 8/9
Std; 2-5 ohms. With O.P. Trans., 10/-. P. & P. 2/6.

Elliptical SPEAKER 19/6
7" x 4".

Elliptical SPEAKER 22/6
9½" x 4½".

B.S.R. FUL-FI Crystal Turnover cartridges 19/6
Brand new, including sapphire needles for L.P. and Standard, giving fullest range and finest tone obtainable for any player. Can be fitted to all standard pick-up arms. P. & P. 9d.

B.S.R. MONARCH U.A.8 4-SPEED AUTOCHANGER

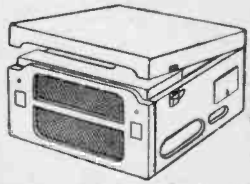
£6.19.6

4-speed Autochanger. Incorporating auto and manual control complete with turn-over crystal P.U. and Sapphire stylus. A.C. Post & Ins. 5/6, or Initial Payment 8/1, plus post and & Ins. and 19 weekly payments of 6/11.

T.U.9, B.S.R. 4-speed single player, £4.9.6.
Collaro Conquest 4-speed Autochanger, £6.19.6.
Collaro Conquest Stereo Autochanger, 11 gns.
P. & P. on all the above 5/6.

TAPE RECORDER CABINET

19/6



A MUST if you are building your own tape.

Suitable for the Truvox Tape Recording Desk. Less front cast speaker panel. Size 13¾ x 15 x 8½in. deep. Detachable lid with compartment for spare tape. Covered in green washable plastic material. P. & P. 4/6.

P.L.10 CABINET

Size 14⅞ x 12½ x 6in. Takes B.S.R. T.U.9 4-speed record player unit. 8 x 3in. elliptical speaker. Single control amplifier. Carr. & Ins. 4/6.

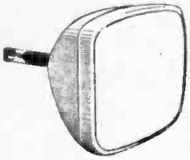
39/6

STURDY CASE, 12/6

8½ x 7½ x 3½in. deep. Covered in burgundy and grey washable rexine. Strong clasp, hinges and handle. Ideal for portable radio chassis or transistor set. Can be adapted as a record carrying case to hold 18 seven-inch long-playing records. P. & P. 2/6.

DUKE & CO. (Dept. DI), 621/3, Romford Road, Manor Park, E.12. Tel.: ILF. 6001/3.

Send for FREE catalogue.



REPLACEMENT RE-BUILT T/V TUBES

Yours for initial payment of **8/6**

Balance at 8/6 for 19 weeks.

12 months' Full Guarantee

All sizes except 10in. Completely rebuilt gun assembly, new cathode, heaters, etc., giving the high standard required for long picture life, quality and value. Carr. & ins. 15/6.

EXPRESS DESPATCH SERVICE

Please 'phone to confirm Tube in stock. Send Telegraph Money Order. Tube despatched Passenger Train same day. This service only available with remittance by a Telegraph Money Order and cash sales, not terms.

A CHASSIS FOR SPARES ALL THIS FOR ONLY 9/6

56 Resist ; incl. 7 variable. Controls. Condensers, incl. electrolytics. Coils, 7 I.F. and R.F. Trans. 14 valve holders. 9 B7G, 5 B5G, 3 octal, 4 Trans. Mains—O.PP.—Line—Frame. Chokes. 250 m.a. Metal rec. 300 volt 250 m.a. Fuse panel—scanning coils—focus magnet. Plugs—sockets—switch—chassis screws—tag strips, etc. I.F. strip in separate Power Pack can be used without dismantling. Chassis have been used, but were working when stored. 7 pages of circuits and instructions showing position of each component. Carriage. 10/6.

MODERN 17" T/V CHASSIS

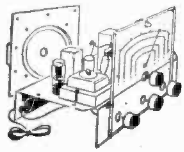
COMPLETE AND WORKING

24 GNS.

Latest chassis including 17in. tube, permanent magnet speaker, 13 channel Turret Tuner (any two selected channels fitted). Other channels supplied on request at 7/6 each. 13 valves. Chassis and valves guaranteed for three months. MW. 43-69 CRT. 2 months' full guarantee. Sound I.F. 19.5 Mc/s. Vision 16 Mc/s. A.C. only. Ready and working to fit into your own cabinet. Carr. & Ins., 25/-. As above, with 14in. tube, complete and working. £19.19.0.

SUPER CHASSIS

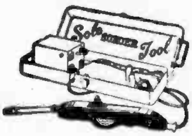
3/11 PER WEEK



On the initial payment of 5/1 plus carr. of 5/6, this chassis will be despatched. Balance at 3/11 for 19 weeks. Cash Price 79/6. 5-valve Superhet chassis including 8in. P.M. speaker and valves. Four control knobs (tone, volume, tuning, w/change switch). Four wavebands with position for gram p.u. and extension speaker. A.C. Ins., carr. 5/6.

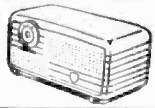
SOLO SOLDERING TOOL

12/6



110 v. 6 v. 12 v. (special adaptor for 200/250 v., 10/- extra). Automatic solder feed including a 20ft. reel of Ersin 60/40 solder and spare parts. It is a tool for electronic soldering or car wiring. Revolutionary in design. Instantly ready for use and cannot burn. In light metal case with full instructions for use. Post 3/6.

BAKELITE CABINETS 5/9



Brand new. Colour brown. Attractive design. Size 12 x 7 x 5¼in. Ideal for small receivers, converters, etc. P. & P. 3/9.

T.V. AERIALS 23/6
For all I.T.A channels. Outdoor or loft. 3 elements. P. & P. 2/6

AERIALS 15/6
B.B.C. indoor type. Folded dipole with 12ft. co-ax. cable fitted. Post 1/9.

T.V. AERIALS 35/-
COMBINED I.T.A. or B.B.C. New. L/SD. P. & P. 2/6.

CAR AERIAL 6/9
Plated. Whip antennae. 50in. long collapsing to 11in. One hole fixing. P. & P. 1/-. (Not telescopic.)

SOUND/VISION and I.F. STRIP 7/9
Plessey. I.F.s 10.5 Mc/s sound. 14 Mc/s vision. 8 valve holders. Less valves. Size 8½ x 5 x 4½in. Circuit incl. The tuner unit plugs directly into this chassis. P. & P. 2/6.

SOUND/VISION and I.F. STRIP 2/9
Salvaged. Complete sound and vision strip. 8 valve holders. Less valves. I.F.s 16-19.5 Mc/s. Size 8½ x 4½ x 4½in. Drawings free with order. P. & P. 2/6.

TIMEBASE 2/9
Containing scanning coils, line transformer, etc., less valves. Drawings free with order. P. & P. 2/6.

CO-AX. CABLE, 6d. YARD
Good quality. Cut to any length. 1/6 post on 20 yds.

INSULATING TAPE 1/6
75ft. x ½in. In sealed tins. Post 9d.

FOCUS MAGNETS 9/9
Brand new. 38 mm. incorporating picture shift control. P. & P. 1/3.

FOCUS MAGNETS 12/6
38 mm. Brand new. P. & P. 1/3.

SCANNING COILS 10/6
Low impedance. 38 mm. Brand new. P. & P. 1/3.

SCANNING COILS 15/9
Wide angle 90 deg. 38 mm. Low impedance. P. & P. 1/3.

T.V. MASKS 2/9
Gold plastic for 15in. tubes. Post 1/3.

CHASSIS 1/-
6 or 8 valve latest type midget valve design for A.M. or F.M. Brand new. Cadmium plated. Size 12¼ x 7¼ x 2¾. P. & P. 1/9

MAINS TRANSFORMERS 7/9
Primary 200-250. Secondary 300-0-300. 6 v. at 3.3 amps. P. & P. 2/9.

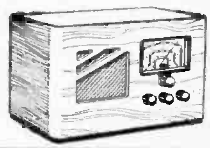
MAINS AUTO 0-205-225-245 VOLTS AT 300 m.a. 8/9
Isolated windings of 6.3 v. at 2-6 amp. 6.3 volt at 3-6 amp. 2 v. at 1-4 amp. P. & P. 3/9.

O.P. TRANSFORMERS 1/3
Standard size. 2-5 ohms. P. & P. 1/-. 20 for £1. P. & P. 5/6.

SUPER SUPERIOR RADIO 89/6

4 waveband. 5 valve superhet radio. 2-tone covered metal cabinet size 24¼ x 12 x 10in. 4 control knobs. Positions for gram., p.u. and extension speaker. A.C. only. Ins. carr. 8/6.

HOME RADIO A.C. or Universal 79/6



A.C./D.C. Universal mains 5-valve octal superhet. 3 waveband receiver can be adapted to gram p.u. In attractive wooden cabinet. 9¾ x 18½ x 11¾in. Ins., carr., 4/6. Terms available.

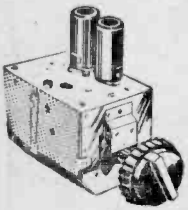
DUKE & CO. (Dept. D.1), 621, ROMFORD ROAD, MANOR PARK, E.12. ILF 6001-3

★ **CARRIAGE AND INSURANCE MUST BE SENT WITH INITIAL PAYMENT. WEEKLY EASY PAYMENTS.**
Details on Request.

For Your Lab.

Resistance substitution boxes are great time savers and you really cannot have too many of them; here then, is an opportunity to acquire these at a very low rate. Our R.S. kit available for only 8/6, plus 1/6 postage, comprises one 50 W. precision variable resistor 0-100 K., six 2-3 watt fixed resistors, one 6-position switch, one pointer knob and one ordinary knob and instructions. This unit when made up will give an infinite variability over the range 100 ohm to 2 meg.

12-CHANNEL TURRET TUNER



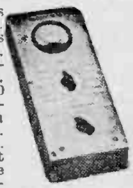
Ideal for converting an old or building into new T.V. These are brand new stock, not surplus, supplied complete with valves and coils for local Band I and Band III stations. **Model 1.** I.F. Output 33/38 Mc/s series heaters (parallel heaters, 5/- extra). **Model 2.** I.F. Output 16/19 Mc/s parallel heaters (series heaters, 5/- extra). With instructions and circuit diagram, 79/6, knobs 3/6 extra, postage and insurance 2/6.

Avo Prodclips

The advantage of these test prods is that by pressing the trigger at the side they become crocodile clips and can be left in circuit. This is a great time saver when servicing. Price 15/- Pair.

Our 68-page Hi-Fi Catalogue is now being sent out to customers —gives details of the latest and best Hi-Fi equipment with over 400 illustrations. Price 2/6 per copy which is refundable from purchases.

A.C./D.C. Multimeter Kit

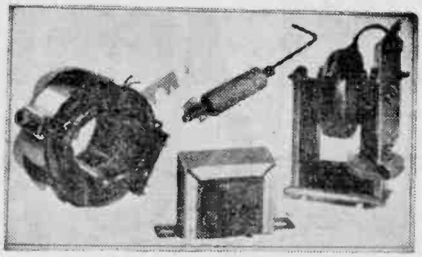


Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000. D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries, 0-500,000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions price 19/6, plus 2/6 post and insurance.

Miniature Microphone

American made. Dynamic type, real bargain at 2/6, plus 6d. postage.

FOUR ITEMS FOR PRICE OF ONE



Set of modern T.V. parts suitable for modernising old televisor or for a new one. For wide angle 14in. or 17in. tubes comprises: (1) Line output E.H.T. transformer. (2) 700 scanning coils on ferrite yokes. (3) Width control with ferrite core. (4) Frame output transformer. (5) Circuit diagram of a modern televisor. Offered at the price of the Line output transformer only, namely, 57/6, plus 2/6 post and insurance.

Unique Opportunity to build Fine Transistor Set

Constructor's parcel: to build Pocket 6 Transistor Set as currently being sold at £17.17.0. Parcel comprises Motiffed two-tone cabinet as illustrated, tuning dial, two gang tuning condenser, combined bakelite chassis / printed circuit and easy to follow circuit. Costing value 57/6—offered while supplies last at only 29/6, plus 2/6 post. Suitable for your own circuit or to build original circuit. All parts available at highly competitive prices. Do not miss the tremendous bargain.

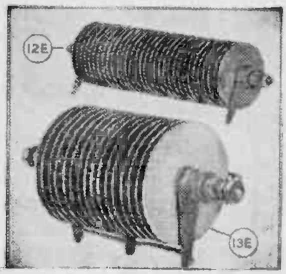
ASSURE YOUR FUTURE

The ownership of a good instrument has been the turning point in many a career, it could easily be yours, for you can own the latest Avo Test Instrument for the initial payment of only 10/-. This test instrument is ultra-modern, has a sensitivity of 10,000 Ohms per Volt, measures A.C. Volts 0-1,000 in 5 ranges, D.C. Volts 0-1,000 in 7 ranges, D.C. current at 1 Amp. in 5 ranges and resistance up to 2 Megs, in two ranges.

Free Gift. To extend the uses of this instrument, for instance, to measure capacity, inductance, E.H.T., etc., we have developed a range extender scale and operating notes, these will be sent free to purchasers of this instrument.

All sent immediately for 10/- deposit, balance by 21 payments of 10/-, which includes free insurance against accidental damage for 12 months. Non-callers add 3/6 post and insurance. Cash price, £9.10.0.

Rectifier Bargains

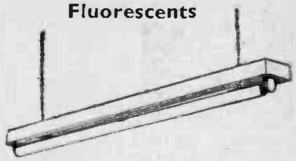


Selenium rectifier type 12, 500 v. 1A. half-wave, easily rebuilt into full wave or multiple type, contains 30 35 mm. discs. Price 8/6, plus 1/6 post. Type 13, 36 volt 9 amp. easily rebuilt into six full wave charger rectifiers suitable for 6 or 12 volt batteries at 3 amps, contains 24 84 mm. discs.

Real bargain at 19/6, plus 1/6 post.

FOR ADDRESS SEE OPPOSITE PAGE

Fluorescents



All complete with polyester filled choke and interference suppressors, starters and fluorescent tube—all ready, in fact, to switch on.

5ft. 80 watt, 54/9 plus 5/6 carriage and insurance.

4ft. 40 watt, 39/6 plus 5/6 carriage and insurance.

3ft. 40 watt, 39/6 plus 4/6 carriage and insurance.

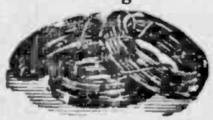
2ft. 20 watt, 39/6 plus 4/6 carriage and insurance.

Circular 40 watt, 87/- plus 5/6 carriage and insurance.

Circular 80 watt, 104/6 plus 5/6 carriage and insurance.

These fittings are suitable for hanging or direct fixing—carriage and insurance applies for distances up to 250 miles, over and above this carriage will be extra.

Connecting Wire



P.V.C. covered in 100ft. coils—2/9 a coil or four coils different colours, 10/-, post free.

Yaxley Switches

1 Pole 3 way	1/6
1 Pole 5 way	2/-
1 Pole 11 way	2/6
2 Pole 2 way ceramic	2/6
2 Pole 4 way	2/-
2 Pole 6 way	2/6
2 Pole 8 way	3/6
2 Pole 11 way	3/6
2 Pole 12 way	4/6
3 Pole 3 way	1/6
3 Pole 6 way	3/6
4 Pole 4 way	3/-
6 Position shorting	2/-
6 Pole 3 way	2/6
6 Pole 3 way ceramic	3/6
8 Pole 2 way	2/-
9 Pole 3 way	2/6
12 Pole 2 way	2/-

Building A Scope ?

3in. oscilloscope tube American made Type No. 3FP7. Octal base 6.3 v. .6 amp. heater, electrostatic deflection. Brand new and guaranteed, 15/- each, plus 1/6 post and insurance. Complete with circuit diagram.

Battery Charger Rectifier. Selenium 12-15 v., 5 amp., 12/6.

Metal Chassis. Punched for Mullard 510 Amplifier, complete with inner screening sections and stove enamelled, 12/6 set.

Geiger Counter Tubes. 20th Century type. Type No. G24, with circuit of geiger counter, 29/6.

Heavy Duty Test Prods. Red and black with plug-in lead attachments, 8/6.

Metal Rectifier

80 mA. 300 volt, 5/6 each, plus post 1/-.

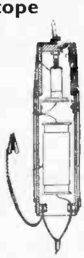
Band III Converters

Suitable Wales, London, Midlands, North, Scotland, etc. All the parts including 2 EF80 valves, coils, fine tuner, contrast control, condensers and resistors. (Metal case available as an extra.) Price only 19/6, plus 2/6 post and insurance. Data free with parts or available separately, 1/6.

Please send two more kits, the one you sent last week is performing magnificently. We receive this sort of letter every day of the week, so if you have hesitated because you thought our kits too cheap you need hesitate no longer.

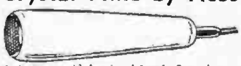
Luminous Switch, double pole designed for electric blankets, neon indicators glow when appliance is switched on. 10/-.

Radio Stethoscope



This can be slipped into the pocket rather like a fountain pen. With it in most districts a receiver can be checked from the grid of the first valve right through to the output without a signal generator, the stethoscope will operate in both L.F. and R.F. circuits without alteration. It is a complete fault-finder. All the necessary parts to make this tracer 8/6, post 1/-.

Crystal Mike by Acos



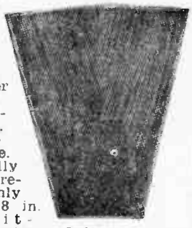
Model 39/1, this is ideal for tape or general amplifiers, complete with screened lead 39/6, plus 1/- post.

"Dim and Full" Switch

Particularly useful for controlling photoflood lamps which have only a short life at full brilliance. This toggle switch has three positions: the first position puts two lamps in series at half brilliance for setting up, the second position is off and the third position full brilliance for the operation shots. Also useful for controlling night lights, heaters, etc., etc. Price 3/9 each, post 9d. Circuit diagram included.

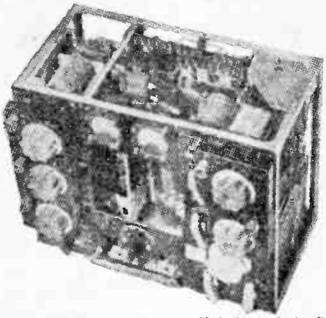
Hi-Fi Snip

Infinite Wall Baffle



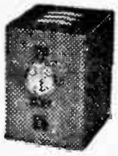
Nicely veneered and polished. Corner fitting (attaches to picture rail). Takes up no floor space. Gives really fantastic results with only low-priced 8 in. speaker. Fitting for tweeter. Only 45/- each, carriage and insurance 3/6.

£100 Worth of Equipment 19/6



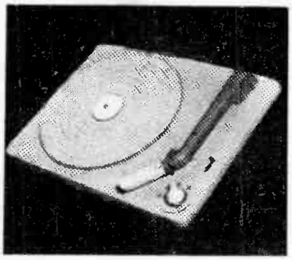
The famous R1154—unused but slightly soiled. Covers 200-500 kc/s, 3-5.5 Mc/s and 5.5-10 Mc/s. Has unique "click stop" mechanism. Wonderful breakdown value—meters, relays, switches. Complete with valves—real bargain at 19/6, plus 10/- carriage.

Car Battery Charger



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

Philips AG2009 Transcription Unit



Philips AG2009 Record Player, a modestly priced 4-speed unit with many outstanding features, is ideal for the enthusiast who is assembling his own equipment or modernising an older installation. The pick-up arm is wired for stereo and the Philips stereo head is available as an optional extra.

Eddy Current Brake gives ±2% fine adjustment on all four speeds. **Continuously variable pick-up** playing weight (2-12 gms.).

Supplied with Philips Hi-Fi crystal head, type AG3019 for microgroove and 78 r.p.m.

Frequency response 30-15,000 c/s.

Pick-up lifting and lowering device.

Individually balanced heavy turntable.

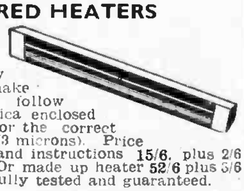
Muting switch fitted.

Can be used with any amplifier or radio set.

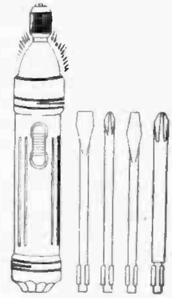
Complete with monaural pick-up, £10.10.0, or £1 deposit and 21 fortnightly payments of 10/-.

Available also with stereo head, diamond or sapphire stylus. Prices on request.

INFRA-RED HEATERS



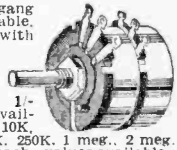
These latest type heaters are ideal for bathroom, kitchen, bedroom, etc. They are simple to make from our easy to follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and instructions 15/6, plus 2/6 post and insurance. Or made up heater 52/6 plus 5/6 post and insurance—fully tested and guaranteed.



For Your Service Department

An invaluable tool for working inside a dark cabinet or cupboard. This is a screwdriver with torch and has four interchangeable bits, two for the ordinary slotted screws and two for Philips heads. The torch section operates from 1½ v. batteries in the handle and will save its cost in frayed tempers alone. Why not treat yourself to one of these now? Only 10/6, plus 1/6 post and packing.

Morganite Potentiometers

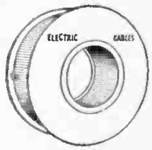


Single and 2-gang types available, standard size with good length spindle, all new and boxed. Single types, 1/- each, values available: 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg. Gang type 3/- each—values available: 5K+5K, 100K+100K, ½ meg.+½ meg., 2 meg.+2 meg.

This Month's Snip

8in. P.M. Speaker in fabric-covered cabinet—size 10in. x 8in. x 4in. Price 29/6, plus 2/6 post and insurance.

Versatile Wire



Single-strand 18-gauge with P.V.C. covering which makes it rustproof. Extra strong, will stand tremendous strain. Ideal for gardening, clothes lines, indoor aerials, etc. etc. Also being steel alloy and having a resistance of approximately ½ ohm per yard this can be used for electrical work, soil heating, wrapping round water pipes, etc. New on drum containing 3,000ft. Price 8/6, plus 3/6 carr.

T.V. Service Sheets

200 sheets covering most popular post-war televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc., £2, post free. PREVIOUS PURCHASERS OF THESE SHEETS PLEASE NOTE: WE CAN SUPPLY SHEETS Nos. 100-200, £1, or 150-200, 10/-.

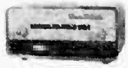
ELECTRONIC PRECISION EQUIPMENT LTD.

66, GROVE ROAD, EASTBOURNE, SUSSEX.

This is the correct address for post orders and for prompt attention please mark your envelope Dept. 7, also enough for postage.

Electronics (Manor Park) Ltd.	Electronics (Ruislip) Ltd.	Electronics (Croydon) Ltd.	Electronics (Finsbury Park) Ltd.
520, High St. North, Manor Park, E.12.	42-46, Windmill Hill, Ruislip, Middx. Phone: RUISLIP 5780. Half day Wednesday.	266, London Road, Croydon. Phone: CRO 6558. Half day Wednesday.	29, Stroud Green Rd., Finsbury Park, N.4. Phone: ARChway 1049. Half day Thursday.

Here are some new Heathkit models



F.M. TUNER. Tuning range 88-108 Mc/s. Three I.F. stages with pre-aligned transformers. Complete R.F. Unit is despatched wired, pre-aligned and tested. Built-in power supply. 7 valves. Sensitivity 2.5μV for 20 dB. noise quieting.

F.M. TUNER
£13.12.6

R.F. TUNING UNIT and I.F. AMPLIFIER AVAILABLE SEPARATELY

RP-1U
£12.10.0

TRANSCRIPTION RECORD PLAYER. Embodies new Collaro RP594 unit with the Ronette Stereo Pick-up. Gives excellent results on stereo or mono. (16, 33⅓, 45 L.P. or 78 r.p.m.) discs. Detachable head and supplied with wooden plinth.

THE 'COTSWOLD.' An acoustically designed 3-unit Speaker System capable of doing justice to finest programme sources. Range 30-20,000 c/s. All parts left "in the white" for finish to personal taste.

THE "GLOUCESTER" cabinet has been specially designed to meet the varying needs of different homes. Mk. I houses Record Player Stereo Amplifier, F.M. Tuner and records, etc. The Mk. II will house a Tape Deck in addition.

"PACKAGED DEALS"

The above models and others can be obtained as parts of "packaged deals" of **MATCHED STEREO HI-FI EQUIPMENT**, thereby saving you additional money.

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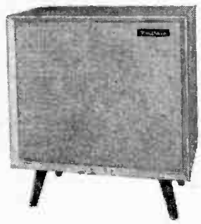

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Practical Wireless

VOL. XXXV, No. 637, MARCH 1960

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Contents

RADIO TELESCOPES

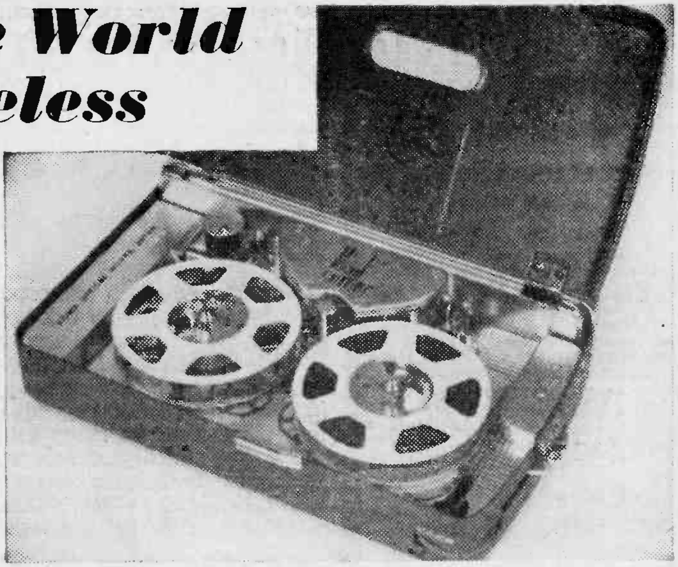
DURING the course of this year, wireless will play an important part when the first practical steps are taken to try to discover whether or not life exists elsewhere in the universe. The radio telescope at Green Bank, U.S.A., will be used by scientists who will listen for radio signals coming from other solar systems. Ever since scientists first made optical telescopes and probed the heavens, the great size of the universe has become more and more apparent, and now it is realised that its enormity cannot be comprehended. It has been supposed that there must be many other worlds similar to our own in which live intelligent beings similar to ourselves, and it is reasonable to assume that any signals transmitted from such worlds would aim at establishing contact with others and therefore would consist of definite sequences.

Naturally, it would be difficult to monitor more than one specific frequency and it is assumed that the wavelength used for the transmissions would be 1,420Mc/s. This frequency is known as the hydrogen line frequency and could be called the most popular frequency in creation since most of the matter in space is neutral hydrogen. Once the frequency of transmission has been assumed, the problem of monitoring becomes easier, although the difficulty now arises of detecting any deliberate modulation at that frequency. Owing to inter-galactic noise and other sources of signals, the detection of pulses may not prove easy. If, therefore, any of the other radio telescopes in the world were tuned to this frequency during their normal programme of work it is unlikely that signals would be detected, even if they were being transmitted. It is unlikely that the Jodrell Bank radio telescope will be used for monitoring space signals in the near future as it is heavily committed to its programme of research in radio astronomy and the tracking of earth satellites and moon probes. Jodrell Bank has a much larger range than the Green Bank telescope and will receive signals from at least 700 light years away and perhaps more and may be at present less suitable than Green Bank for the purpose in mind. The Green Bank telescope will be focused first on the nearest suitable stars. These are some 11 light years away—about 66 million million miles from us.

If there is intelligent life elsewhere in the universe it is reasonable to assume that radio will be the medium used for communication, although the speed of communication will not be as great as might at first be thought. Radio waves travel at 186,000 miles per second but even at this speed it might take 11 years for the signal to reach us and we might have to wait 22 years before we would receive a reply to any signals which we might transmit. In view of the delays involved, the transmission of signals at this juncture seems hardly worthwhile unless a very far-sighted policy is envisaged. The programme at the moment must be one of passive reception and the most that can be expected in the near future is the confirmation that some form of life exists elsewhere in the universe.

Our next issue, dated April, will be published on March 4th

Round the World of Wireless



This Kowa Microrecorder is claimed to be the smallest tape recorder in the world. Developed by the Kowa Optical Works of Japan, and produced by the Kowa Electric Laboratory in Nagoya, it can be used for 30 minutes uninterrupted recording on a double-track tape, which is reversed automatically when recording on one track has been completed. It is an all-transistor recorder with playback, and weighs 780 grams. Accessories include a telephone pick-up, "secret" wristwatch microphone, earphones and speaker.

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of November, 1959, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include licences issued to blind persons without payment.

Region	*Total*
London Postal...	846,739
Home Counties	817,455
Midland...	604,910
North Eastern ...	691,772
North Western...	558,805
South Western...	485,796
Wales and Border Counties ...	299,837
Total England and Wales	4,305,314
Scotland	507,208
Northern Ireland	148,266
Grand Total	4,960,788

British Equipment for Peru

THE Smethwick (Staffs) firm of Hadley Telephone and Sound Systems Ltd., is providing a staff location installation for a new hospital in Mollendo, Peru. The equipment, which consists of an amplifier, a moving coil microphone, 16 cabinet and 15 spherical type loudspeakers has been ordered from the British firm by Sociedad Relojera SA, of Lima, and will go into the Arequipa Hospital in Mollendo.

British Standard 448

THE B.S.I. announces the publication of another two Sections (B5G/F and B7E/F) to B.S. 448, "Electronic valve bases, caps and holders." The new sections specify the base and bulb outline dimensions of the B5G/F and B7E/F sub-miniature valves with flexible connecting leads. Gauges for checking the lead spacing and the bulb outline dimensions are also specified. Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, W.1. Price 2/- each. (Postage extra to non-subscribers.)

Electronic Computing for B.P.C.

AN order for one of the largest electronic computing systems in the United Kingdom has been placed with Ferranti Ltd. by the British Petroleum Company Limited. The system, costing over £¼ million, will also be one of the fastest in the United Kingdom for processing data as it is based on the Ferranti Mercury computer. at present the fastest machine manufactured in Western Europe. The extensive ancillary equipment includes a converter unit which transfers information from magnetic tape to punched cards and vice versa, and facilities for printing data from magnetic tape on very high speed printing units. The system will be used by the British Petroleum Co. for both scientific and commercial applications. It is anticipated that the system will be installed in one of the company's head office buildings in London around the turn of the year 1960/61.

U.H.F. Systems for S.A. Navy

A SUBSTANTIAL order for multi-channel medium and high power communication equipment has been placed with Plessey International Limited by the South African High Commissioner in London. The equipment will be installed on South African Navy fighting ships for ship-to-ship and ship-to-shore communication. The placing of this important order follows the success of similar Plessey U.H.F. sets on ships of the British and Commonwealth navies. The order was negotiated in South Africa by representatives of Plessey International Limited.

Radio Trades Examination Board

AT the annual general meeting of the board on December 30th last, Mr. Edwin Arthur William Spreadbury, M.Brit.I.R.E., was elected chairman in succession to Mr. E. M. Lee, B.Sc., M.I.E.E. (Belling and Lee Ltd.). Mr. Spreadbury has been associated with the R.T.E.B. since June, 1943, when he was appointed an examiner and a member of the examinations committee. Subsequently, he became a member of the committee which drafted the scheme of examination in television work, the first examination being held by the board in 1950. In recognition of this work Mr. Spreadbury was elected to the council of management of the board in 1947.

By reason of his technical articles and books, Mr. Spreadbury is well known to the industry and the trade for his interest in promoting higher standards of servicing efficiency. He has been connected with the radio industry since 1922. He joined the staff of the Wireless Trader in 1937 and is now the technical editor.

Radio-telephones for Mexico

AN initial contract has been signed with Pye Telecommunications Limited for 500 two-way units and fixed station equipments. Many of these radio-telephones will be used for the extension of the existing public correspondence scheme, whilst others will be used for new private radio-telephone systems. It is anticipated that 1,000 mobile units will be required by Mexico this year, to a total value of £100,000. Pye has already supplied over 3,000 mobile radio-telephone units to Mexico.

Electrical Engineers Exhibition

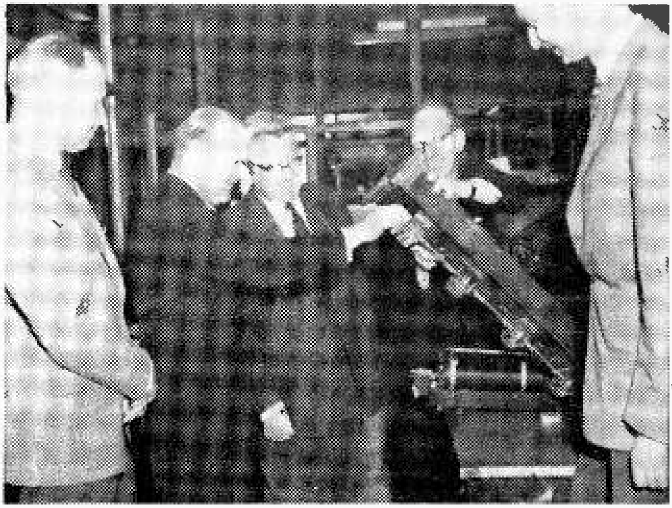
THE Ninth National Electrical Engineers Exhibition will be opened by the President of the Board of Trade, the Rt. Hon. Reginald Maudling, M.P., at 12 noon on April 5, 1960, at Earls Court. Part of the "Marine Electrics" feature will be devoted to electrical and electronic equipment from Britain's renowned aircraft carriers, H.M.S. Victorious and H.M.S. Hermes. Also featured will be equipment as used in the S.S. Canberra, the largest liner built in British shipyards since the war. Exhibits will include the latest navigational aids, radar and radio communications equipment. An electrolier, believed to be the world's largest, will be suspended from the 110ft. high roof of the Exhibition Hall. It is built by William McGeoch & Co. and measures 75ft. in circumference. Its total loadings will be around 18,500W. Visitors will walk on the world's largest electrically heated carpet. Made by Thermalay Ltd., it covers over 1,000 sq. ft. and will have a loading of more than 11,000W. For the first time there will be a feature of outdoor electrical equipment. An area of over 5,000 sq. ft. will be devoted to heavy transformers built by the English Electric Co. Ltd.

East Pakistan Contract

THE Commissioners of the Port of Chittagong, East Pakistan, have placed an order with Marconi's for the establishment of a V.H.F. radio-telephone network to improve ship-to-shore communications within the port area and the Kharnaphuli river. Besides the installation of duplicate V.H.F. transmitters and receivers in the shore stations at the port office and at the signal station at Juldia, the order also includes the supplying of mobile stations for use in two harbour tugs and a pilot launch. This installation will enable all visiting ships which are suitably equipped to enter or leave the port in full radio communication with the port authorities.

Change of Name

ON the 1st January, 1960, the British Thomson-Houston Company, Metropolitan-Vickers Electrical Company and Siemens Edison Swan Ltd. changed their names to Associated Electrical Industries (Rugby) Ltd., Associated Electrical Industries (Manchester) Ltd., and Associated Electrical Industries (Woolwich) Ltd., respectively. At the same time five new product divisions of Associated Electrical Industries were announced. They are as follows: (1) Cable Division; (2) Construction Division; (3) Telecommunications Division; (4) Radio and Electronic Components Division; (5) Instrumentation Division. From the 1st January the total of A.E.I. Product Divisions to be established became 12, and the famous companies whose names are to change will cease to trade, but will manage a number of A.E.I. Product Divisions.

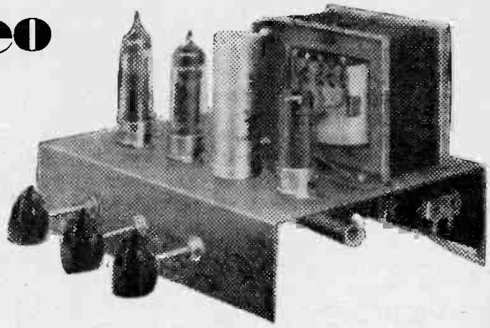


Marconi's Wireless Telegraph Co. Ltd., are designing and supplying the electronic equipment for a new air defence system for Sweden. Contracts worth approximately £1,500,000 have already been placed with the company. Recently a delegation of senior officials of the Royal Swedish Air Board visited the Marconi Works at Chelmsford and the Research and Development Laboratories at Great Baddow, in connection with the contract. Photograph shows (L. to R.) Colonel Hamilton and General Rapp of the Royal Swedish Air Board, Dr. E. Eastwood (Chief of Research, Marconi's), Mr. Keall (Marconi's) and Colonel H. Lindgren (Royal Swedish Air Board).

The D.C.2. Stereo Amplifier

A DIRECTLY COUPLED CIRCUIT

By J. S. Kendall



THE power required for listening in the average room is not great—in fact 2W is usually more than enough and even then this is only required on peaks. This stereo amplifier, the D.C.2, is directly coupled with negative feedback and an output of just over 3W per channel. The distortion and noise levels are low. Three controls are provided: volume, tone and stereo/mono. This latter allows one single input to be fed to both channels so that they act in parallel.

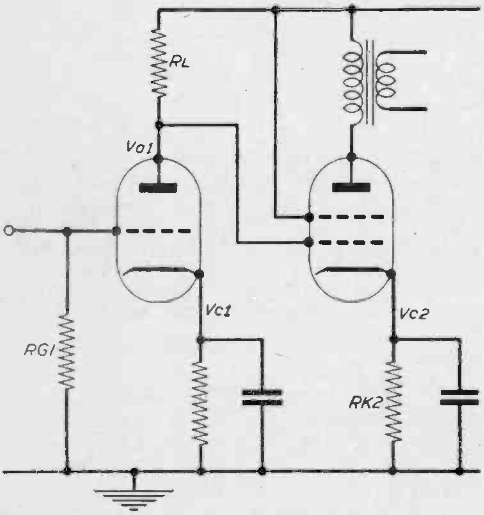


Fig. 1.—Theoretical circuit diagram.

Circuit

For this circuit twin direct-coupled amplifiers have been chosen. There are several reasons for this, one of the main being that from the grid of the input section to the anode of the output valve there is negligible phase shift from the lowest frequency to the highest. There is thus only one component in which phase shift can occur: the output transformer. Again, this phase shift has been reduced by the use of negative feedback. The total number of components is also low and construction for the beginner is simplified.

The basic circuit of each amplifier is shown in Fig. 1. It is drawn as a separate triode and pentode, which is correct although they are in the same glass envelope. The anode of the triode is strapped across to the control grid of the pentode section, and no stopper is used—the lead is only about $\frac{5}{8}$in., so none is required. Thus the anode voltage of the triode appears at the grid of the pentode.

If the reader is thinking of constructing his own directly-coupled amplifier, he should be warned not to attempt to work the drive valve at too low a voltage to allow it enough swing to drive the output valve correctly, and then attempt to clear up the matter with very heavy negative feedback. Allow an anode voltage of at least twice the r.m.s. drive voltage required by the output valve—within reason, the higher the better, but not so much that the output valve is starved of voltage. The average power supply unit with a 250-0-250V transformer will give about 300-320V smoothed. Remember that the anode voltage of the drive valve and the normal bias voltage of the output valve have to be substracted from this figure. A good figure for the anode voltage of the drive valve is 25 to 50V. The voltage at the cathode of the voltage output valve has to be the anode voltage of V1 plus the bias voltage of V2, i.e., $Vk2 = Va1 +$ (bias for V2). For example, H.T. line voltage is 300, the anode resistor for V1 is 220k and the anode current of V1 is 1.2mA. Thus, the voltage dropped across Rl would be 260. Thus, at the anode of V1 we would have $300-260=40$V. To this we have to add the value of the bias for the output valve—say, 6V which gives 46V. This, to the nearest 10 per cent., is 50V. Looking up the valve, we find, say, $Va=250$V., $Ia=36$mA, $Vg2=250$V, $Ig2=4$mA. We add the currents together: $36 + 4 = 40$mA and we can now, by a further simple calculation, calculate the value of the cathode resistor of V2 (Rk2). We have the voltage as 50V and the current at 40mA. Therefore, $Rk2=1.25$k. Now, 1,250 ohms is not a preferred value of resistor. Therefore, we must

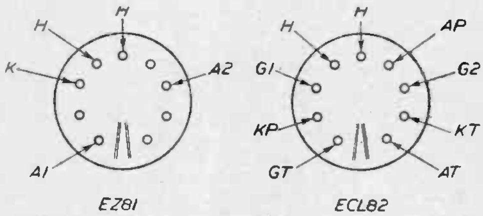


Fig. 2.—Valve base details.

find the nearest 5 per cent. preferred value, which is 1.2k. The wattage rating is next to be found. In this case W=EI is the formula to use. We have found E to be 50 and I as 0.04A (converting mA to amperes), so 50 × 0.04=2W. In this instance, as in all others where low drift is required, use a resistor that is well within its rating, say, 5W 5 per cent. wire wound. Next, having built the unit we have to test it. The critical reading is the one at the cathode of the output valve. The reading here is very rarely just as calculated even if we have made all our calculations correctly. The currents through the valves vary from valve to valve by quite a large amount, and also the conditions of the first valve circuit are reflected into the circuit of the second valve. It is the current through the output section of the valve that we have to watch, and bear in mind that we can expect a change in bias of 10V on the output valve for every 8mA change in Ia. Calculate the voltage drop across the valve and work out the power dissipated by it and check that this is not outside the ratings given by the manufacturers. If the errors are large, then corrections can best be made at the cathode resistor of the drive valve. To increase the resistance here will have the effect of increasing the cathode voltage of the output valve, a decrease will also cause a decrease in the output cathode voltage.

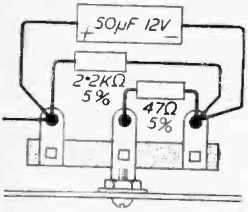


Fig. 3.—Wiring of the sub-assemblies for the triode stage.

Readings

When taking voltage readings on direct-coupled amplifiers, remember always to have the volume control set at the same point. All valves take a minute amount of grid current by what is known as secondary emission. This minute current, so small that it can usually be ignored, gives a voltage across the input resistor of the amplifier—usually the volume control, and is amplified by the first valve. Thus, say, the current is one-hundred-millionth of an ampere, and we use a 1M volume control, then the voltage is 1/100th and this amplified, say, 50 times by the valve gives ½V. With a modern output valve that can cause a definite change in current. However, with a new valve, it can be ignored, but with a valve that is older and softer, the figure will be ten times as high.

Construction

First the valveholders should be fitted to the chassis. Then as all the transformers are also associated with tag strips, next fit the mains transformer, and under the two nuts of the fixing bolts at the valveholder side, fix a three-way tag strip. The transformer should be fixed so that the H.T. and heater windings are at the valveholder side, and the mains tags to the rear of the chassis. Shake-proof washers should be used under the tag strips in order that a good connection to the chassis is made—simple, but important. The H.T. and heater wiring may now be made. Fig. 2 shows the base of the EZ81 rectifier valve. Run two wires (twisted for preference), one from each of the 300V secondary to one of the anodes of the EZ81—i.e., one 300V to A1 and the other to A2. Next, take a pair of wires from the 6.3V heater winding (top right-hand set of tags on the transformer) to the heater tags of the valveholder; ignore the tag marked 5V and use the common and the 6.3V tags.

Next, take a wire from pin 3 to pin 4 of the valveholder, and solder all the leads so far wired except the wire to pin 3. Next come the heaters of the other two valves—the ECL82s. The base wiring is shown in Fig. 2. Run a pair of twisted wires from the centre tapped 6.3V on the transformer to the heater tags of the valveholders—pins 4 and 5—then solder them. Next solder a wire on the mains transformer from the centre tag of the 300-0-300V winding to the centre-tap tag of the 6.3V winding and then on and solder to one of the fixing bolts of the mains transformer.

Sub-assemblies

Next make up two small sub-assemblies—these consist of a three-way tag strip, with an electrolytic and two resistors. They form the bias and negative feedback resistor for the triode sections of the ECL82 valves. 50μF, 12V electrolytics have been chosen and the resistors are of 5 per cent. tolerance. The reason for the use of 5 per cent. resistors has been explained earlier. The method of wiring the tag strips is shown in Fig. 3. A very neat job can be made of these if the wires are kept short—the view is as seen from the front edge of the chassis and the earthing tag is to the rear. At the right-hand end—the end with only the 2.2k and the electrolytic—solder a short length of wire—2in. is ample and it should be insulated. Next fix the four jacks in place, one in each of the four ⅜in. holes at the rear of the chassis.

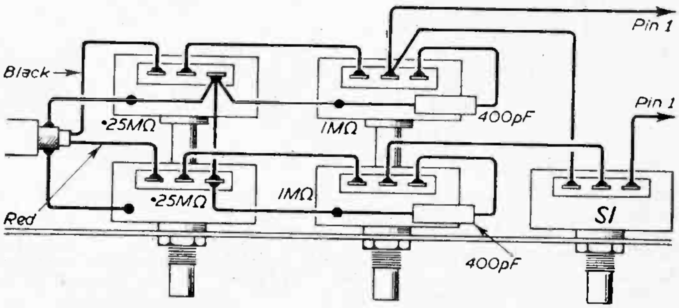


Fig. 4.—Tone and volume control stages.

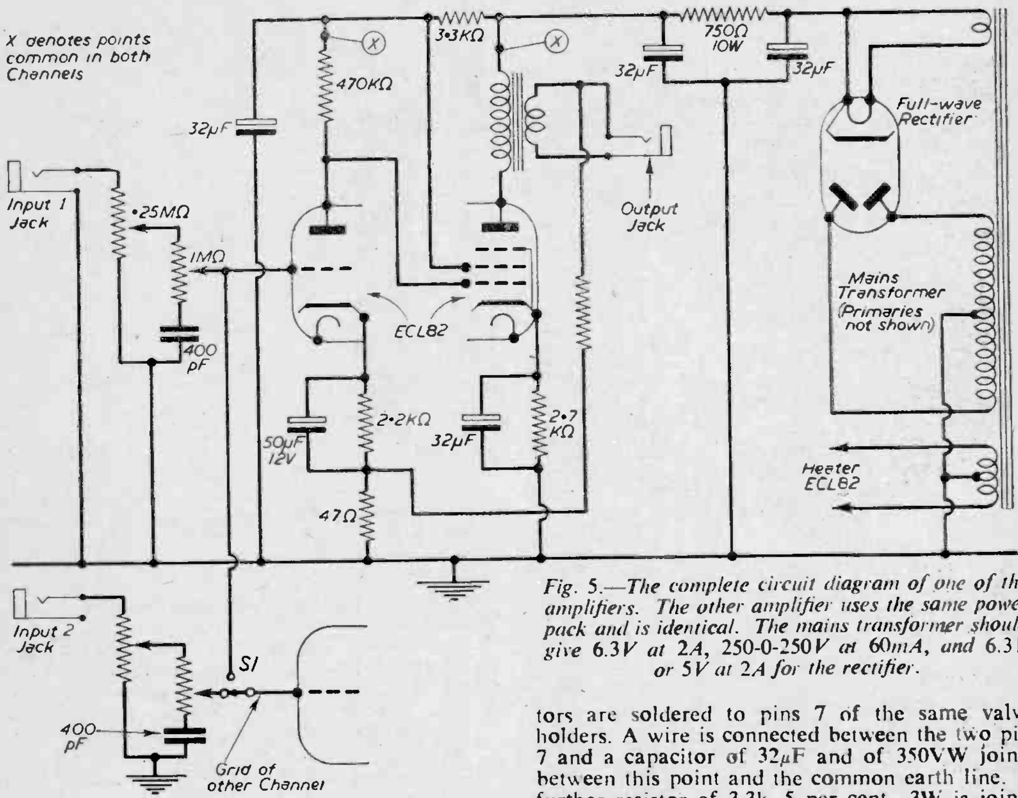


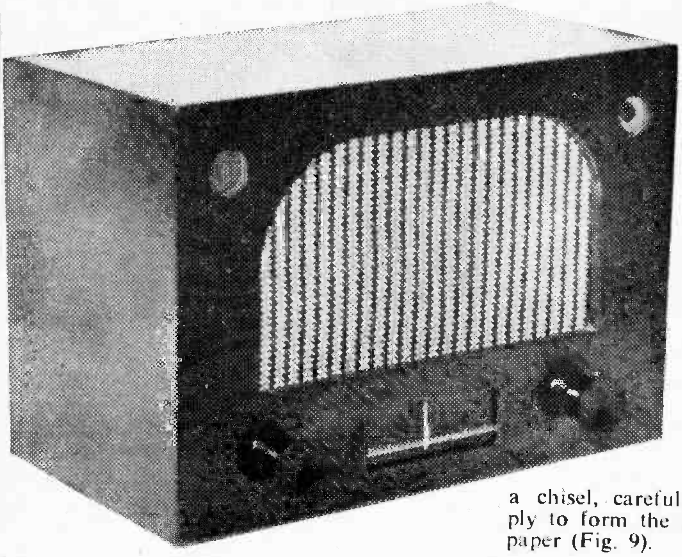
Fig. 5.—The complete circuit diagram of one of the amplifiers. The other amplifier uses the same power pack and is identical. The mains transformer should give 6.3V at 2A, 250-0-250V at 60mA, and 6.3V or 5V at 2A for the rectifier.

It is best to have the tags pointing in the same direction as the flange of the chassis. We can now fix the two output transformers in place. They are bolted in place with the tags pointing to the centre of the chassis. The small sub-assemblies are bolted one under each of the fixing bolts of the output transformers at the end nearest to the valveholders. We can now take the wiring a few steps further. Join the running wires from the sub-assemblies to pin 8 of the nearest ECL82. Join a wire from the inner tag of an output jack to the tag at the valve end of the nearest output transformer, and a 100Ω resistor from the same transformer tag to the junction on the sub-assembly of the capacitor, the 2.2k and the 47Ω resistor. Solder and repeat with the other transformer.

Final Wiring

Next, run a length of tinned copper wire through the four sleeve tags of the jacks (those are the tags at the fixing end of the jacks) and solder. Join the two nearest tags of the output transformers to this common earth line and solder. Take two 470k, 5 per cent. resistors and bend the wires sharply back about ¼in. from the body of the resistors and solder the bend to pin 9 of the two output valves—one on each—the free end of the wire is taken to pin 3 and soldered. This fixes the resistors in position and joins pins 3 and 9. The wires from the other ends of the resistors are soldered to pins 7 of the same valveholders. A wire is connected between the two pins 7 and a capacitor of 32μF and of 350VW joined between this point and the common earth line. A further resistor of 3.3k, 5 per cent., 3W is joined between the same point (+ve side of electrolytics, two 470k resistors and two tags 7 on the ECL82 valves) and one of the pins of the 32 + 32μF block electrolytic. Do not solder this last wire yet. At the inner side of the inner output transformer, the tag of a double 32μF capacitor is joined and soldered to the common earth line. It is simplest to follow if the two tags are placed in a horizontal plane so that one can be referred to as the left and the other as the right. To the left and nearly touching the capacitor is a three-way tag strip. From the right-hand tag of this, fix a wire to the left-hand tag of the 32 + 32μF, and between the same tag and the earth line fix a 2.7k wire-wound 5 per cent. resistor of 7W rating. Strap pin 2 of the nearest ECL82 to the junction of the resistor and capacitor and solder. Between the right-hand tag of the same capacitor and the centre (earthed tag) of the adjacent tag strip join a 2.7k, 5 per cent., 7W wire wound resistor, and from the junction of the 2.7k and the capacitor join a wire to pin 2 of the other ECL82 and solder. To complete the H.T. circuit wiring, take a 750Ω 10W wire wound resistor and join one end of it to the right-hand tag of the extreme left tag strip, run a wire to the cathode of the EZ81 and a further wire from the same cathode to the unoccupied tag of the 32 + 32μF 450VW electrolytic. Then solder these. The other end of the 750Ω 10W resistor should be against

(*Continued on page 944*)



A Quality F.M. Receiver

MAKING THE CABINET

(*Continued from page 848 of the February issue*)

By V. E. Holley

As stated in the previous article, a suitable cabinet for this receiver may be made from five-ply wood, ⅜in. thick, having an oak, walnut or similar facing.

Procedure

First mark out and cut the front, 13½in. × 9in. (Fig. 8) and cut the apertures for the speaker, tuning scale, etc. Those for the tuning indicator and panel light should first be cut from the faced side of the wood with a ⅞in. centre bit to a depth of about ⅛in. and completed from the other side with a 1⅛in. bit. The larger holes can be cut with a fret saw or hacksaw blade, working from the faced side. Sand the edges of all the holes smooth and flat, apply a coat of matt black paint and set aside to dry. Keep the paint off the faced surface.

Cut next two pieces for the sides, 9in. × 7½in. each. Check that they are exactly rectangular and of correct and identical measurement—the fit of the joints and consequently the strength of the cabinet depend on it. The top and bottom of each side must now be rebated to receive the top and bottom of the cabinet. On the unfaced side of the wood draw lines very slightly more than ⅜in. from the edges and with a tenon saw cut carefully along the lines to a depth of three layers of ply, keeping the saw at right angles to the surface. If the constructor is not too confident with a tenon saw, it is a good idea to tack a strip of wood with a straight edge along the line of cut to act as a guide for the saw. With a chisel, carefully remove the three layers of ply to form the rebate and finish off with glass-paper (Fig. 9).

Assembly

An exactly similar rebate must now be formed all round the four edges of the front of the cabinet, on the unfaced surface. Now assemble the front and two sides and measure the exact length of top and bottom required to fit into the rebates. Cut the top and bottom to this length and 7½in. wide; no rebating is required.

The top, bottom and sides should now be assembled temporarily on a flat surface, front downwards, using three 1in. panel pins, driven not more than half-way home at each corner. The rebated front should be a good push fit. Dismantle, apply a good resin glue to all mating surfaces and reassemble, driving the panel pins

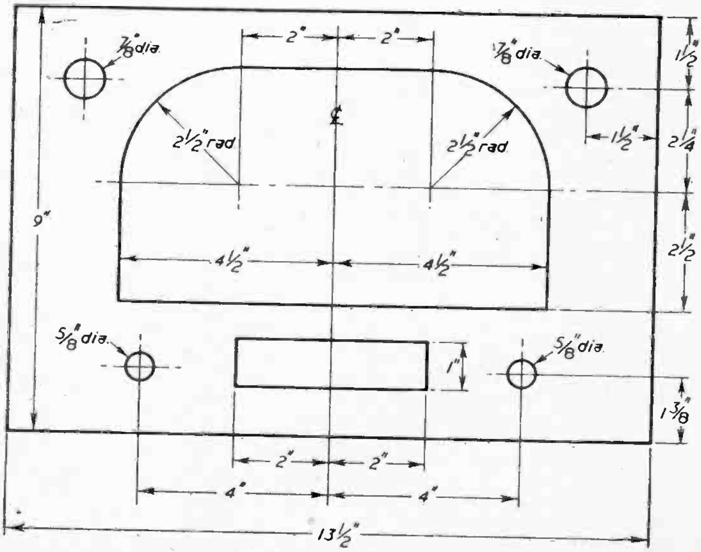


Fig. 8.—The front panel.

right home. Glue alone is sufficient to secure the front. Place the cabinet front up with a weight on top to keep the front firmly in position till the glue is hard.

Polishing

First punch in the panel pins till the heads are below the surface. A small wire nail with the point sawn off flat makes a good punch. Fill in the holes and any other blemishes with plastic wood of a suitable colour and when the filling is hard, give the whole cabinet a good rub down with No. 2 glass-paper, squaring off the corners and removing any old polish. Finish off with No. 0 glass-paper. The final result depends very largely on this preparation so make sure that no scratches or blemishes remain. Wood dye of the desired colour may now be rubbed in with a rag wad.

There are three methods of obtaining the final finish. The first and best is french polish, which is also the quickest. There is no need to view this with alarm as there are plenty of french polishes to be had which are specially compounded for amateur use and nothing more is required of the operator than that he should follow the comparatively simple instructions enclosed with the polish.

Another Method

The second method is to apply three or four coats of clear varnish, rubbing down with No. 0 glass-paper between each. A period of 24 to 48 hours must be allowed for the hardening of each coat. Varnish does not darken the wood. It should be applied and allowed to dry in a dust-free atmosphere.

Another alternative is shellac, which is an ingredient of most french polishes. Dissolve an ounce or so of gum shellac in methylated spirits to produce a liquid about the consistency of paraffin and apply rapidly with a brush. Do not attempt to spray it. About six coats will be required with a rub down between each. The mixture dries rapidly and has some darkening effect on the wood.

Finally, a back should be made for the cabinet. This may be of $\frac{1}{8}$in. plywood with suitable openings for connections and ventilation. To secure it, two $\frac{1}{2}$in. panel pins may be driven into the bottom edge so that they project $\frac{1}{8}$in. The heads

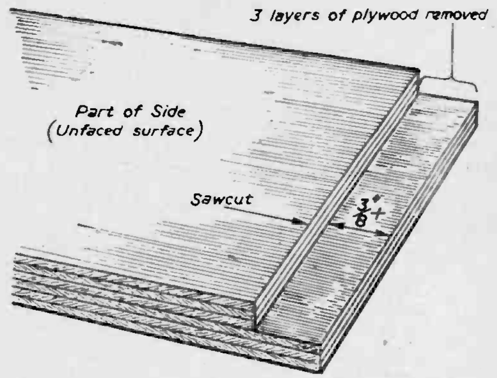


Fig. 9.—Forming the rebate.

can then be sharpened and pressed into the bottom of the cabinet. The top may be secured to small brackets or wood fillets fitted in the top corners of the cabinet.

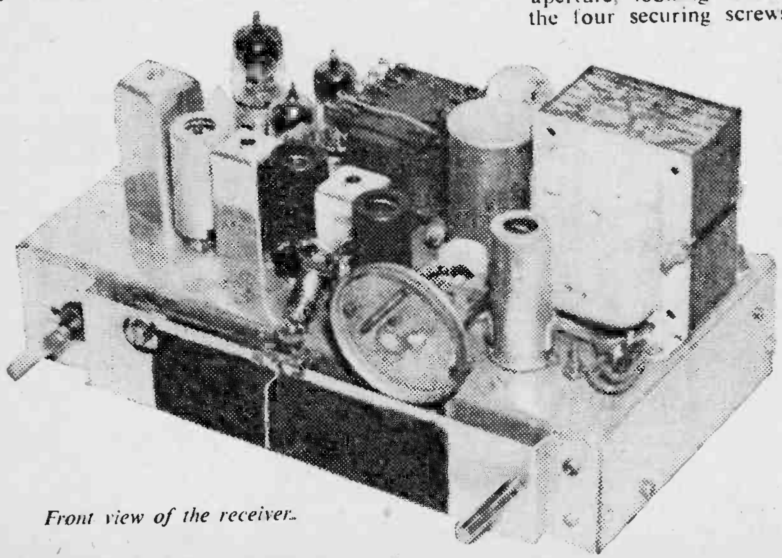
Fitting the Receiver

Glue a piece of Tygan or other suitable material over the speaker aperture and cut a piece of thin plywood to shape and size to cover the aperture with $\frac{1}{2}$in. to spare all round. In the plywood cut a 5in. diameter hole for the speaker in such a position that when fitted, the speaker will lie at the right-hand end of the aperture, looking from the rear, and three of the four securing screws will pass through the ply into the front of the cabinet. Attach the speaker to the ply at the fourth securing point, using a 4B.A. countersunk bolt, and fit the assembly into the cabinet with wood screws of suitable length.

The tuning indicator should be fitted to a bracket in the top left-hand corner, looking from the rear, and the panel light similarly in the opposite corner, a piece of coloured plastic being fitted into the hole through which the lamp is viewed.

The receiver may be secured in the cabinet by means of four self-tap-

(*Continued on page 970*)

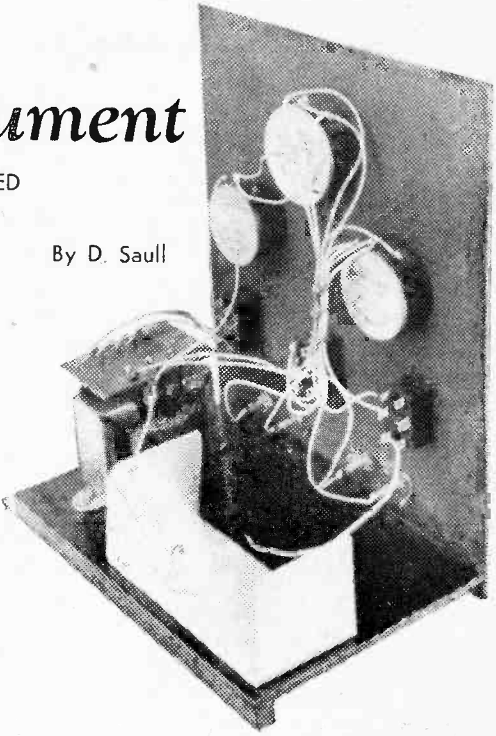


Front view of the receiver.

An Inductance Measuring Instrument

A D.C. BIAS SUPPLY IS INCLUDED

By D. Saull



INTERSTAGE, and output transformers for use in transistor circuits are not difficult to make. The A.C. voltage applied across their primary winding is very much smaller than those used in valve circuits, and consequently the number of turns on the core is very much fewer than for a similar transformer used in valve circuits. If an output stage transistor is, say, working Class B from a 6V battery supply, the maximum collector voltage swing will be from 0 to −6 (see Fig. 1),

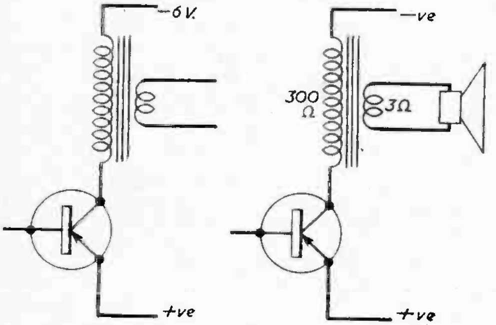


Fig. 1 (Left).—Amplifier circuit.
Fig. 2 (Right).—Transformer matching.

a total of 6V peak swing. This would correspond to a signal output of 6 × 0.707—a little over 4V r.m.s. In practice, an output stage would not work Class B single ended, but in push-pull, but this example does serve to show the low voltage swing in transistor applications compared with similar valve circuits where the anode voltage swing may be of the order of 200 or more.

There are two main considerations in the design of such an output transformer:—

(a) The correct matching of the transistor impedance to the, lower, loudspeaker impedance.

(b) The shunt impedance of the transformer windings must be sufficiently high in order not to shunt the lower frequency output signals past the speaker.

These two latter points require expanding.

(*a*) Impedance Matching (A.C. Conditions)

Consider an OC72 output transistor working, single ended, Class A, into a 3Ω speaker (Fig. 2).

The equivalent circuit as far as the transistor is concerned is as shown in Fig. 3.

So, looking into the primary from the transistor, 300Ω should be seen. However, looking into the secondary from the speaker 3Ω should be seen.

This condition is achieved by impedance matching with a transformer of the correct turns ratio, which is given by

$$\text{Turns ratio} = \sqrt{\frac{\text{Load impedance}}{\text{Speaker impedance}}} = \sqrt{\left(\frac{300}{3}\right)} = \sqrt{(100)} = 10$$

The primary must, therefore, have ten times more turns than the secondary, or, another way of putting it, the secondary winding requires ten times less turns than the primary. But, how many turns must the primary winding have in the first place? The answer to this question brings us to expansion (b).

(*b*) Shunt Inductance

An output transformer has a bandwidth, that is a range of frequencies which it will pass with

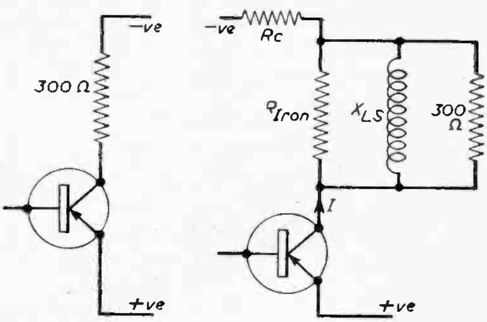


Fig. 3 (Left).—Equivalent circuit for transformer coupling. Fig. 4 (Right).—Simplified equivalent circuit for transformer loading.

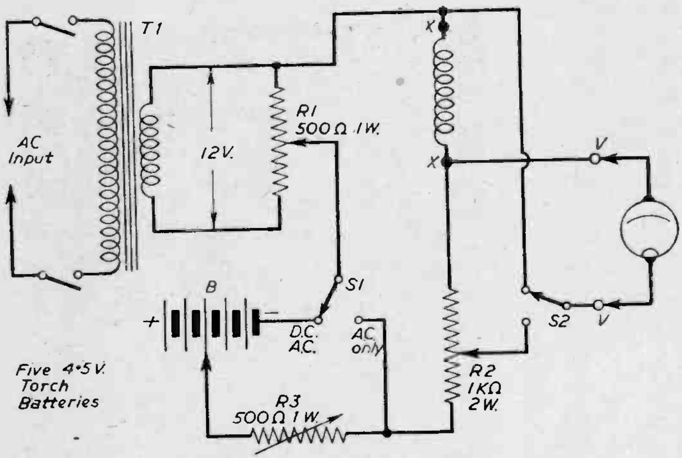


Fig. 5.—Complete circuit of the instrument.

equal attenuation. A moderate general purpose amplifier with single speaker will have a frequency range of approximately 100c/s-4kc/s.

The frequency response falls off at the higher end owing to leakage inductance and capacity between windings. At the lower frequency end this frequency fall off is due to shunt inductance.

The leakage inductance may be reduced by ensuring tight coupling between the windings and the core.

The shunt inductance effect may be reduced by ensuring that the primary inductance is high as possible.

Consider the simplified equivalent circuit for a transformer (Fig. 4) in the OC72 output stage being considered.

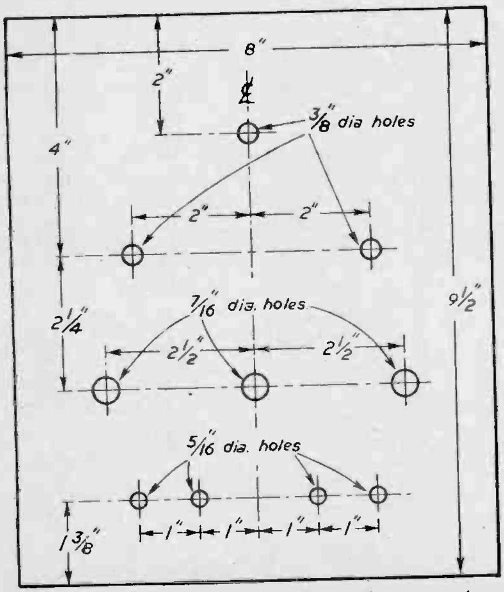


Fig. 6.—Drilling details of the front panel.

The copper losses (D.C. resistance of the transformer windings), Rc. waste the signal output power (I^2/Rc). The resistance R_{IRON} (the iron losses in the transformer laminations) waste power also.

The power delivered to the 300Ω resistance represents the useful power that is delivered to the speaker.

X_{LS} represents the shunt inductance, the current which by-passes the 300Ω resistance and is not available for transfer to the speaker. This value requires to be kept as high as possible, and it will be noticed that X_{LS} is lowest for the lower frequencies of the signal (i.e., $X_{LS}=2\pi fL$). In practice X_{LS} should not be less than twice the load impedance. For the transformer we have been considering about 250mH (this

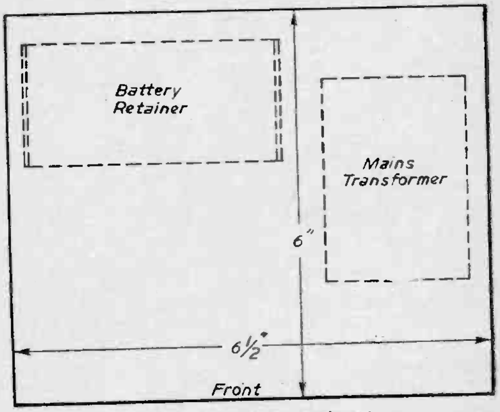


Fig. 7.—Chassis details.

gives about 6dB down at 100c/s).

It should be remembered that the inductance of an iron-cored winding may vary considerably with the A.C. applied voltage although it is nearly independent of frequency over the audio range.

Besides the A.C. component in the primary of a transformer, there may be a steady value of D.C. which will tend to lower the inductance of the winding.

Circuit of Inductance Measuring Instrument

Difficulties arise when measuring the impedance of iron cored windings on conventional inductance bridges, for the following reasons:—

(a) The A.C. applied voltage to the test component is usually unknown.

(b) There is usually no provision for any D.C. component.

The circuit of the instrument (shown in Fig. 5) does measure reasonably accurately the reactance of iron-cored windings with a D.C. component flowing in the windings, up to 1k (3H) at 50mA D.C.

The circuit values may be amended if desired to cover other ranges.

The mains transformer T1 is a 12V filament transformer. Resistor R1 regulates the required A.C. voltage appearing across terminals X to which the unknown winding is connected.

The battery "B" provides the D.C. component and is made up of five 4.5V torch batteries in series (22V). The 500Ω resistor R3 is the fine control of the D.C. component, and should be kept at a low value, the coarse control of current being achieved by altering the battery tapping.

Switch S1 throws the measuring conditions from A.C. only to A.C. plus D.C. component.

Resistor R2 is a 1k wire-wound potentiometer which is calibrated in ohms against an ohmmeter.

Switch S2 is used alternately in the measurement of the A.C. voltage drop across R2 and the test winding. The voltmeter connected to the terminals "V" ideally should be a value voltmeter (an ordinary voltmeter may be used if of high resistance).

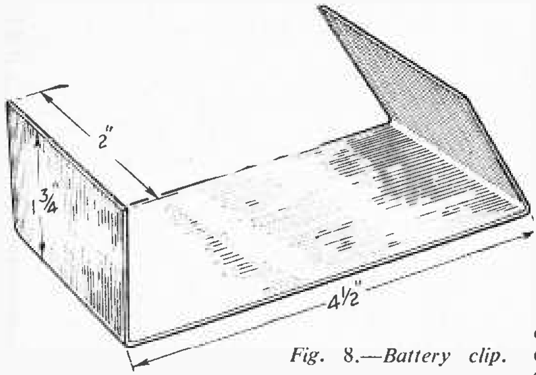


Fig. 8.—Battery clip.

The accuracy of the instrument is dependent upon the calibration of R2.

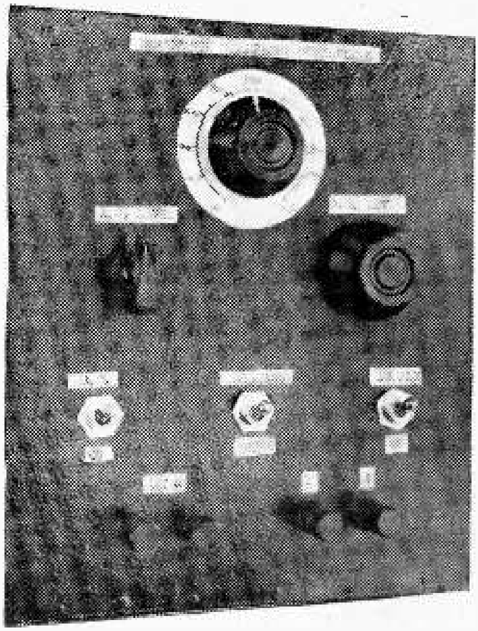
Use of the Instrument

The inductance required to be measured is connected to terminals "X"; S1 is switched to A.C. plus D.C. position and the required battery tap selected to give the appropriate D.C. current. This value is measured by a current meter inserted in one of the battery leads.

The main switch is closed and with a value voltmeter connected to terminals "V," switch S2 is thrown from one position to the other and R1 and R2 adjusted until the value voltmeter gives the same reading in both positions of switch S2, and the voltmeter reading is at the voltage at which the component under test will normally operate under circuit conditions. The reactance of the winding is then read off the calibrated scale on R2.

Practical Layout and Construction

The material used for the panel and base was hardboard, the marking out being shown in Fig. 6. The base was secured to the panel by means of a strip of ½in. × ½in. wood glued and pinned to the base.


The front panel.

The panel after cutting to size and drilling, etc., was painted black. A suitable hardboard case could be made to enclose the instrument and covered with an adhesive-backed plastic material.

Radio Trades Examination Board Fifteenth Annual Report

THE Council of Management has pleasure in presenting this report which covers the work of the board for the year ended 31st August, 1959.

The main object of the board, which is to promote technical courses in radio, television and electronic servicing, has met with considerable success—measured in terms of the number of candidates entering for the board's examinations. In 1959 a total of 2,310 candidates sat the radio and television servicing examinations and this represents an increase of 33 per cent. on the number of candidates sitting the same examinations in 1958.

Unfortunately, this larger number of candidates did not provide the same increase in the number of successes, and in fact, in the Radio Servicing Examination there was a drop in the number of candidates qualifying for a certificate.

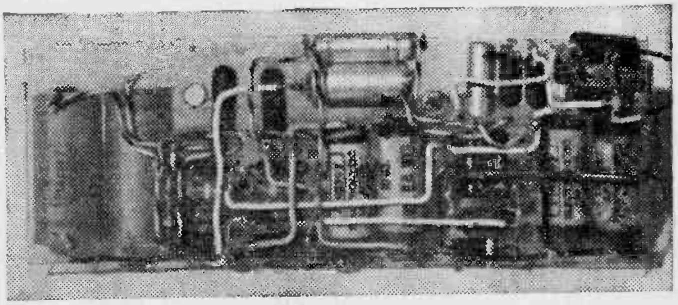
The relatively poor results in the Radio Servicing Examination have, however, been the cause of much discussion.

The written papers were very much below the normal standard and were the main cause of failure, and this inability to cope with theory undoubtedly resulted in many candidates failing the practical examination.

A Novel Circuit Technique

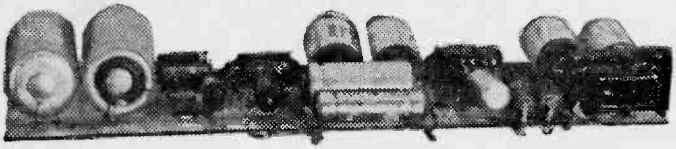
AN ALTERNATIVE TO PRINTED CIRCUITS

By J. D. Ingleby



A transistorised amplifier built using the technique described.

WITH the coming of "Hi-Fi" and the transistor, the home constructor is finding that the only stage at which he can exercise his skill and experience is in the assembly of a given circuit. Whether for better or worse, the art of improvising one's own circuit and components is rapidly becoming outdated, and the focus is increasingly on a neat and compact circuit. The printed circuit is the answer to this trend, and indeed most transistor superhet kits use this technique. However, making one's own printed circuit is an expensive and elaborate procedure. This article describes a technique which retains the advantages of printed circuits, their economy of size and weight, strength and neatness.



Another view of the transistorised amplifier.

Circuit Materials

This circuit technique uses, in place of a printed circuit board, ordinary celluloid or transparent plastic sheeting. This is obtainable at reasonable prices from model shops, hardware stores, radio dealers, or motor-cycle repair shops. It has the advantage that wiring can be done with the components in view, and furthermore that the components can be inserted simply by pushing the bent wire ends through the sheet with the tip of a hot soldering iron. This method of fixing is quite rigid, as the celluloid sets hard round the inserted end.

Method of Assembly

The transparent sheeting may be of any kind, with the following limitation: it must be rigid enough to hold the components firmly, but thin enough to allow them to pass through easily, 1/32in celluloid or "Corbex" sheeting is ideal. Most dealers have conveniently-sized offcuts, but large sheets are more economical in the long run.

The next step is to work out the layout of components from the circuit diagram. In doing this a compromise must be made between compactness and convenience, for the most symmetrical layout is seldom the easiest to wire. However, one advantage of transistorised equipment is that the components have all a more or less equal size, and thus a neat design is often practicable. The layout should be worked out on a piece of paper, which can be slipped under the board during construction.

When the celluloid has been cut to the required shape, using scissors, the components are shaped for insertion. This is done with a small pair of pliers, taking care not to damage the components. Transistor leads should not be bent too close to the seal, and resistors can crack if not handled carefully. Light pressure should be applied until the component sinks into the board: hold it in place until the celluloid sets firm. This may be done by using the plan as a guide underneath the board. It may be necessary to heat-shunt transistor leads with pliers or a crocodile clip, but with experience only a moment's heat need be applied. Transformers, coils, etc., may be either glued or bolted on. When all the components have been fixed on, turn the board over and trim all wire ends down to about 1/16in. long.

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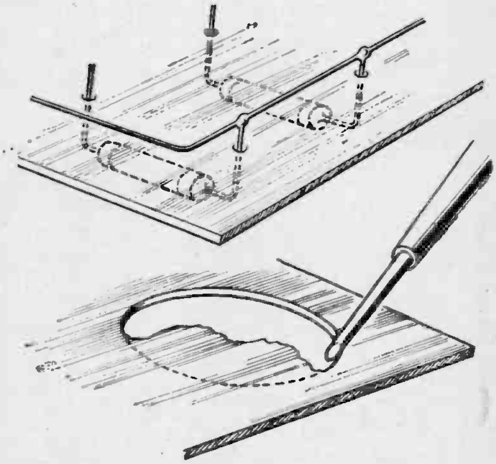
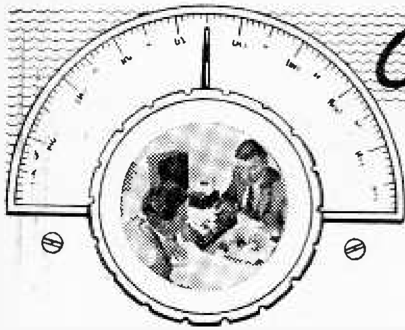


Fig. 1.—Method of fixing resistors and making holes in the plastic sheeting.



On Your Wavelength

BY THERMION

MANY of my friends who are radio amateurs construct items of radio gear in their spare time. The majority, to ensure domestic harmony, perform their operations in a shed outside the house, in a cellar or in a spare room. Most of the sheds and cellars used are damp and cold and although much of the apparatus built is for use on the domestic mains supply, few constructors appreciate the dangers encountered when working in such surroundings. Now the pundits among my readers will say that the remedy for this state of affairs is simple; all exposed metalwork including the chassis under construction should be earthed and 3-pin plugs should be used with all gear. This procedure is not easy to carry out, however, and if the earth wiring is not perfect, dangers may be created, as well as removed.

Some amateurs do not appreciate that there is a danger of shock when working in damp surroundings with apparatus connected to the domestic mains. One side of the mains (the neutral) is earthed at the source of supply and the other side is therefore at a potential of some 200-250V above earth. Thus, if it is possible during the constructional work to touch the live side of the mains and at the same time to make contact with the earth, either directly or indirectly, an electric shock will be experienced. The severity of the shock and its effects upon the recipient naturally depend upon the degree of electrical contact. Metal chassis can easily be connected by accident to the live side of the mains and would constitute a grave danger in workplaces such as sheds and cellars. However, if the chassis were earthed and inadvertently the live side of the mains made contact with it there would be, in effect, a short across the supply which would blow the fuses (always provided that the fuses had not been replaced with 18 gauge copper wire!).

If the constructor works in a room at, for instance, the top of the house where there are no earthed objects, it may not be necessary to earth the apparatus being used. In fact it may be an advantage to leave all chassis "floating"; when chassis are earthed the mains potential appears between the live mains lead and the chassis and it is all too easy to hold the chassis with one hand to steady it and touch live leads—H.T., mains, etc.—and receive a shock. My own practice as I do most of my constructional work in the topmost room of the house nowadays, is to leave all metalwork "floating." I have removed all earthed objects from the room; the floor is wooden and is covered in duck boards and I make a point of wearing rubber-soled shoes. There is no risk of shorting the H.T. when making wiring adjustments with a soldering iron while the apparatus is switched on: if the iron body and the chassis were earthed, contact between the iron and any part of the H.T. line would cause a partial or total short. No doubt this procedure of mine will be frowned upon by those who set themselves up as technical authorities, but as far as I can see there is less danger of shock with this system, if one can be quite sure that there are no earthed objects within reach of the test bench. Of course, the finished apparatus is fitted with a 3-wire mains lead and a 3-pin plug for safety.

The hazard of electric shock has come to be looked upon as something to ridicule. It is not. All electric shocks can be prevented if due attention is paid to the installation and the procedure employed. The commonest cause of workshop shocks is holding the chassis with one hand and touching a live point with the other, thus receiving a shock across the chest—one of the most dangerous paths for the current. The remedy is obvious.

A press notice from the Institution of Electrical Engineers was printed in the previous issue and I think it is worthwhile to reprint the most important parts of it which concern imported electrical apparatus and the dangers of mis-connection.

"The attention of vendors and users of imported domestic electrical apparatus, photographic and projection equipment, tape recorders, etc., is urgently directed to the risks which may ensue if the colour coding of the cores of the flexible cord with which such apparatus is furnished differs from the established British coding set out in The Institute's Regulations for the Electrical Equipment of Buildings, that is to say:

Green—earth connection.
Red—phase (live) connection.
Black—neutral connection.

"The risk is most acute if the flexible cord provided with the apparatus has a core coloured red which serves as its earth connection; because if the user, following established British practice, connects this core to the terminal of a British connecting plug which may itself be marked red, and then inserts the plug into a normal British socket, the result will be that any exposed metal parts of the imported apparatus connected to the red core will be charged at mains voltage, and represent a serious hazard."

Measurements with Multirange meters

ACCURACIES TO BE EXPECTED

By B. Sexton

THE most common voltmeter used for normal circuit measurements is undoubtedly the moving coil type. There are many manufactured and home-made instruments in daily use. Unfortunately the operation of this type of movement draws current from the circuit under test. This may alter the true circuit conditions and give misleading results. A study of the effects which are caused is both interesting and instructive and may save time normally wasted in trying to interpret a seemingly impossible result.

The errors caused by connecting the voltmeter to the circuit depend mainly upon two facts.

(a) the resistance of the meter or the "ohms per volt" figure.

(b) the source impedance of the voltage at the circuit test points.

"Ohms per Volt" (Ω/V)

This term is used for calculating the resistance that the connection of the meter effectively places in parallel across the test points. Normally, the lower this value of resistance, the more severe the effect of connecting the meter becomes. Basically the moving coil voltmeter is a milliammeter, or microammeter, with an externally added, high value series resistor. The Ω/V figure is proportional to the value of the added resistor which in turn depends upon the sensitivity or current required for f.s.d. (full scale deflection) of the meter. The more sensitive the meter, the less the current required for f.s.d. and the higher the value of the added series resistor. The higher the value of the series resistor the higher the Ω/V figure. Thus the Ω/V figure is indirectly related to the sensitivity of the meter.

Practical examples will make this clear. supposing the basic meter movement has an f.s.d. of 1mA and it is required to use the meter in conjunction with a series resistor to measure voltage up to 100, i.e., f.s.d. is to represent 100V. The value of series resistor is found to be 100V/1mA=100k. Or, in other words, when a 100k resistor is connected across 100V it will pass a current of 1mA and with the meter connected in series with the resistor it will indicate 1mA or if the scale is calibrated in volts, 100V. Now if the series resistor of value 100k is divided by the f.s.d. voltage of 100V we get 100k/100V=1,000. This is the ohms per volt figure for the particular meter in the example. As stated above. this figure is governed by the basic current required for f.s.d. and is not altered by the value of D.C. voltage chosen for f.s.d. For example, supposing a value of 250V was chosen for f.s.d. Then the added value of series resistor required to limit the current to 1mA is 250V/1mA=250k. Dividing this value by the f.s.d. voltage of 250 gives 250k/250V=1,000. Thus the Ω/V figure is the same as that for an f.s.d. of 100V.

Meter Movement

It should be noted that when obtaining the value of series resistor in previous examples the inherent resistance of the basic meter movement has not been taken into consideration. The resistance is usually so small in comparison with the large value of series resistor that it may safely be disregarded unless the meter is to be used with an f.s.d. of a very low voltage.

Now consider a more sensitive meter movement, one which requires, say, only $50\mu A$ for f.s.d. or is 20 times more sensitive than one requiring 1mA for f.s.d. To use this meter as a voltmeter with f.s.d. of 100V will require a series resistor of $100V/50\mu A$=2M. The Ω/V figure would then be 2M/100V=20,000. If the meter is used with an f.s.d. of 250V then calculations will give the

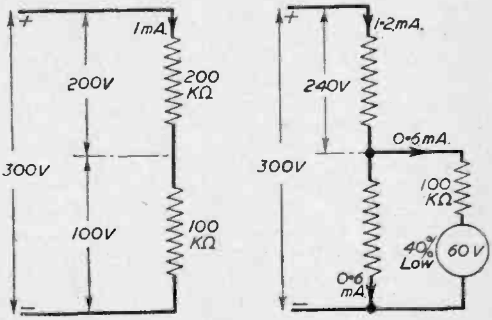


Fig. 1 (Left).—Simple circuit and calculated current and voltages. Fig. 2.—(Right).—The result of connecting a 1,000Ω/V meter on the 100V range.

value of series resistor as 5M and the O.P.V. figure as 20,000. Thus, using a meter which is 20 times more sensitive has increased the Ω/V figure by 20.

Thus the higher the sensitivity of the meter the higher the Ω/V figure. The Ω/V figure of any movement can quickly be found by dividing 1V by the f.s.d. current of the basic meter movement. A meter of f.s.d. 1mA has an Ω/V figure of 1V/1mA=1,000 and a meter of f.s.d. $50\mu A$ has a Ω/V figure of $1V/50\mu A$=20,000. These figures agree with those found by the longer method in the previous examples.

Normally the Ω/V figure is stated on the instrument, but if not then simply divide by the lowest direct current range. This assumes, of course, that the lowest direct current range is the basic, unshunted, meter movement.

Readings

Fig. 1 illustrates a simple circuit consisting of two resistors in series across a 300V supply. The true, calculated circuit conditions of current and voltage are shown. It is desired to measure the voltage of 100V across the junction of the two resistors and H.T. negative. The separate use of two meters with different Ω/V figures will be considered and illustrates the errors introduced by meter connection to the circuit. It should be noted that two resistors are shown for simplicity. The bottom resistor could represent the static D.C. resistance of a valve and the top resistor the anode load. The 100V would then represent the anode voltage.

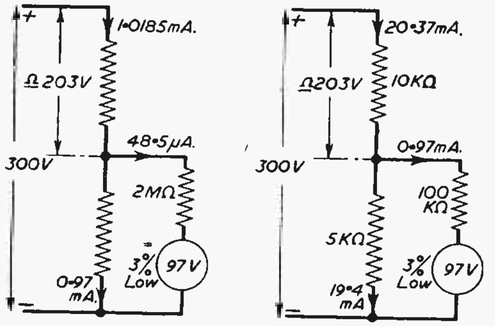


Fig. 3 (Left).—Result of using a meter of 20,000Ω/V.
Fig. 4 (Right).—Effect of 1,000Ω/V meter on accuracy when the source impedance is low.

The result of connecting a multi-range 1,000 Ω/V meter, switched to the 100V range, is shown in Fig. 2. The resistance of the voltmeter is represented by the series resistor and will be 100 × 1,000=100k. Note that the meter movement resistance is considered so comparatively small that it is neglected. The meter will appear as a 100k resistor in parallel with the 100k circuit resistor giving a resultant value of 50k. The 300V supply now "sees" a 200k resistor in series with an effective value of 50k. The circuit conditions, calculated from Ohm's Law, will adjust accordingly and are as shown. The original voltage of 100V will now be measured as 60V; the reading error is 40 per cent. low. The meter is drawing 0.6mA and the fixed 100k resistor is passing 0.6mA. This total current of 1.2mA is flowing through the 200k resistor causing a drop of 240V across it. It is interesting to note that although the meter is drawing 0.6mA, the original current has increased by only 0.2mA. It is this extra 0.2mA flowing through the 200k resistor which increased the volts drop by 40 thus subsequently decreasing the voltage across the bottom resistor.

Increased (Ω/V)

Fig. 3 shows the result of using a meter with a higher Ω/V figure of 20,000. On the 100V range the meter appears as a 2M resistor in parallel with the 100k circuit resistor giving a resultant value of 95.5k. Circuit conditions are as shown. The voltage can be calculated and now 97V will be measured, i.e., the reading is now only 3 per cent. low. The meter draws only 48.5μA, the 100k resistor passes 0.97mA and the total current is 1.0185mA or an increase of 18.5μA. This increase in current is much less than the increase caused by the 1,000Ω/V meter and consequently the voltage drop across the 200k resistor is increased by approximately 3. The calculated percentage errors show the superior accuracy obtainable with the higher Ω/V meter.

It must be emphasised that the errors obtained apply only to the circuit considered in Fig. 1. The impedance of the circuit at the test point also has an effect, as mentioned earlier; this effect will vary with different circuits.

Source Impedance

Consider the circuit shown in Fig. 4. Note that the resistors are now 10k and 5k. Before connecting the meter a calculation will show that the true voltage across the 5k resistor was 100V and the current 20mA. The meter connected is 1,000Ω/V and switched to the 100V range. As in Fig. 2 the meter appears as a 100k resistor, but is now in parallel with a 5k resistor giving a resultant value of 4.76k. The circuit conditions adjust as shown, the voltage is now measured as 97, i.e., the error is 3 per cent. The current drawn by the meter is 0.97mA and that passed by the 5k resistor is 19.4mA. The total current of 20.37mA flows through the 10k resistor. The extra 0.37mA causes the increased voltage to drop across the 10k resistor.

Thus comparing the circuits of Fig. 2 and Fig. 4 it will be seen that in both cases a 1,000Ω/V meter, switched to the 100V range, was used to measure a potential of 100V, but with widely differing results. This illustrates the importance of source impedance. When a voltage is being measured via a high resistance the current drawn by the meter can cause large errors owing to the voltage drop that this current produces. As the source impedance decreases, so does the voltage drop, and consequently the measurement becomes more accurate.

H.T. Battery

A practical example of this is the H.T. battery. A new battery, in perfect condition, has a low internal resistance and when measured with a low Ω/V meter will indicate correct voltage, but after use towards the end of its working life, the internal resistance will have increased and then there may be a marked difference between the measured voltage and the actual, no-load, voltage.

The higher the Ω/V figure of the meter the less important the effect of source impedance becomes. This point is illustrated by comparing Fig. 3 and Fig. 4. The voltage of Fig. 3 may be considered to have a high source impedance, but by using a meter of 20,000Ω/V, the accuracy is the same as that obtained in Fig. 4 where the voltage has a low source impedance, but is measured with a meter of only 1,000Ω/V. The accuracy could further be increased by using the 20,000Ω/V meter to measure the low source impedance voltage of Fig. 4.

Advantage

Thus the high Ω/V meter is far superior to the low Ω/V meter, but owing to the use of a more sensitive meter movement it is usually more expensive. By switching to a higher range, greater accuracy can be obtained with the low Ω/V meter although the reading of the scale becomes more difficult. Fig. 5 shows how the original circuit conditions of Fig. 2 would change if the meter is merely switched to a higher range. Assuming the meter has a 1,000V range it will then appear as a 1M resistor which, in parallel with the fixed 100k, gives a resultant of 91k. Note that the original current has increased by only 0.034mA. This increases the voltage drop across the 200k resistor to approximately 206. Thus the meter will indicate 94V. The reading error is then only 6 per cent. Compared to the original error of 40 per cent., this is a large increase in accuracy and illustrates the fact that it is always best to make a voltage reading on the highest convenient range. It must be realised, of course, that to read 94V accurately on a 1,000V scale may present difficulty. The number of divisions on the scale will be governed by the width of the scale and probably each division will represent 10V on the 1,000V range. Thus accurate interpolation is required. Whilst this becomes easier with experience it is obviously not so accurate as reading on the 100V scale where each division would then represent 1V.

This change in voltage reading when changing meter ranges of a low Ω/V meter can be used as an indication of the source impedance at the test point. If the reading changes drastically when the meter range is switched then a high source impedance is evident and obviously affecting the accuracy of the readings. If the meter reading changes only slightly with range switching, then the source impedance is low and readings are then much more reliable.

Measurement Methods

It is possible to read the voltage of Fig. 1 without causing any effect on the circuit conditions as no current is drawn from the circuit under test. Fig. 6 illustrates the method. Two meters and a potentiometer are required. The potentiometer is connected in parallel with the two original resistors. Note that connecting the potentiometer across the original 300V supply may cause the 300V supply to decrease slightly due to the extra load. This effect has, for simplicity, been ignored. If in practice it could not be ignored, then a separate power supply for the potentiometer would be required. The negative side of each supply would be joined. The voltage between the slider and H.T. negative is measured by the voltmeter VM2. Voltmeter VM1 is connected between the slider of the potentiometer and the junction of the two resistors. The position of the slider is varied until VM1 reads 0V. The voltage at the junction of the two resistors is then given by the reading of VM2, this will be the true voltage of 100. Although VM2 will be drawing current it will all pass through the added potentiometer circuit and not through the original circuit. It should be noted that VM2 is not reading the true voltage at the slider of the potentiometer, i.e., if VM2 was removed the true voltage at the slider would be higher than 100V. This is of no consequence as all we are interested in is obtaining a voltage which we can read easily that will be the same voltage as that at the junction of the two resistors. That it is the same is shown by the fact that the voltmeter VM1 indicates OV thus proving that the two points are at the same potential.

The accuracy of reading then depends only on the calibration accuracy of VM2. This method, of course, can be applied to the measurement of almost any high impedance point where meter current would give a false impression of the true reading.

Changes

Another difficulty sometimes encountered is the measurement of the change in a high potential. An example of this would be the change in output voltage of a power pack between no load and load conditions. With good regulation the change may be very small and consequently difficult to read on the high voltage range of the meter. Assume a practical example of a power pack which has a no load output voltage of 300. When a certain load is connected the ouput voltage may drop to say 299. If the output voltage was measured on the 1,000V meter range this change of 1V would be difficult to discern

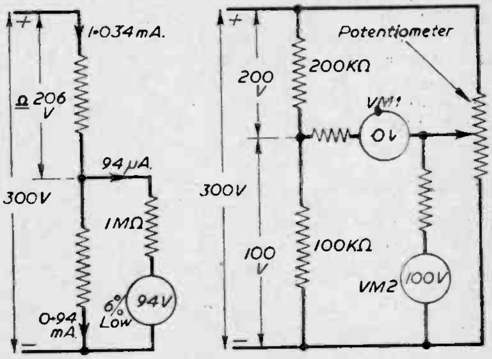


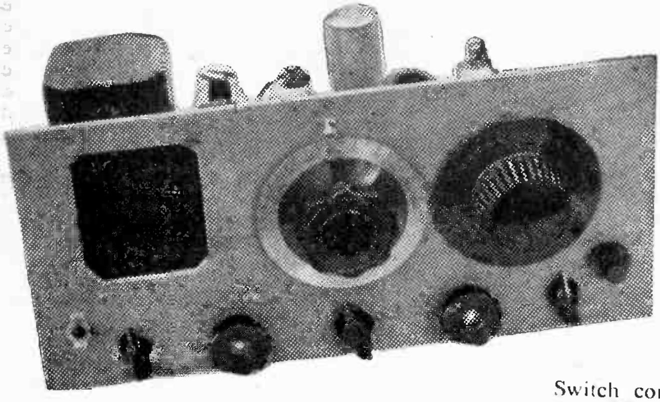
Fig. 5 (Left).—Effect on the circuit conditions of Fig. 2 when the meter is switched to a higher range. Fig. 6 (Right).—Making the measurement without drawing any current.

and practically impossible to read to any real degree of accuracy.

Fig. 7 (page 984) shows a simple but accurate method. The 300V no load output can be switched on load as shown. A second H.T. supply and resistor network are required. The voltage of this second H.T. supply must be within a volt or two of 300. The resistance of the potentiometer should be low, so that only a few volts are developed across it. Between the slider of this potentiometer and the original 300V supply is connected a voltmeter, the full scale reading of which is only a few volts. In the diagram 0-2.5V is shown. Note that the negative sides of the voltage supplies are common. Now by

(Continued on page 984)

An Experimental S.W. Three



OPERATING THE RECEIVER

By F. G. Rayer

(*Continued from page 858 of the February issue*)

THE number of turns in the coils used in this receiver were given in the previous article. The detector coils are shown in Fig. 4. In each case the primaries can be wound with 26 to 30s.w.g. wire, with turns side by side, about ¼in. space being left between this winding and the earthed end of the tuned section, as in Fig. 4.

In the diagrams "G" indicates the grid end of the tuning coil, "C" the cathode tap, and "E" the chassis or earth connection. "A" is the R.F. anode connection, and "H.T." the high tension line lead. The circuit will work well with no R.F. stage, "A" then being taken to the 50pF aerial condenser, and "H.T." to chassis.

Aerial Coils

These can be wound, or be ready-made S.W. coils. Using ½in. diameter formers, seven and a-half turns of 20s.w.g. wire, spaced to occupy 1in. winding length on the former, will do for 10 to 20m. For 18 to 30m 20 turns of 24s.w.g. will be satisfactory, with 30 turns of 26s.w.g. for 30 to 60m, and 50 turns of 30s.w.g. for 60 to 100m. The three larger coils are fitted with dust cores, and the tuning range can be adjusted with these to match the appropriate plug-in coils in the detector stage.

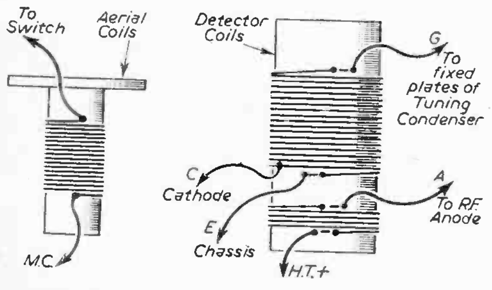


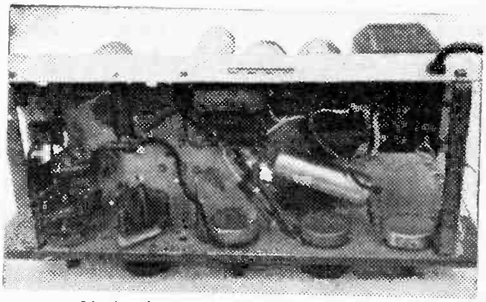
Fig. 4.—Construction of the aerial and detector coils.

For single band tuning, the aerial coil can be wound to match the detector coil. Leads should be short and direct in both tuned circuits.

Switch connections are shown in Fig. 5. In one position, the 470k resistor is in circuit from valve grid to chassis, and the 150pF tuning condenser is disconnected. The other four switch positions bring in the tuning condenser and one coil.

Operating the Set

Though distant reception is easily possible with a poor indoor aerial, an outdoor aerial will improve results. The aerial circuit switch is normally left at the untuned position. The detector regeneration control should be so operated that the valve is just on the point of oscillation. This position is easily found as increasing the screen grid voltage with this control will build up volume until the set oscillates when tuned through a station. The control knob should then be turned slightly back. With weak signals the correct setting of this control becomes very important.



Underchassis view of the receiver.

Tuning is normally carried out with the 15pF condenser. The 100pF condenser can be moved 10degrees at a time, this breaking up each waveband into many smaller bands, each of which is covered with the 15pF condenser, with some overlap. Provided the 100pF condenser is set accurately, as described, it will be quite easy to find any particular station logged against the 15pF condenser dial.

When necessary, an aerial coil can be switched in, and it is then quite easy to find the correct tuning position for the 150pF condenser. Selectivity in this circuit can be increased, when needed, by turning the 50pF aerial condenser to a low capacity. The R.F. gain control can best be set at about three-quarters full gain, but this can be adjusted as circumstances require.

Amateur stations will be heard on the 10, 15, 20, 40 and 80m bands, USA and other non-local stations coming in best on 10, 15 and 20m bands. Long distance reception of commercial broadcast stations will often be best on 19 and 25m bands, until evening, when 31 and 41m bands will often give very good reception of African, American, and Far East stations. Conditions vary according to the season and time of day, but very many transmissions are made in English, from localities all over the world, and it will generally be reasonably easy to log a number of these.

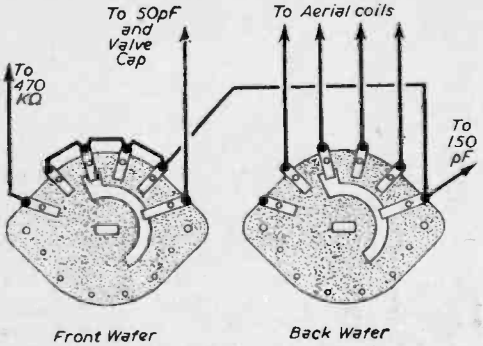
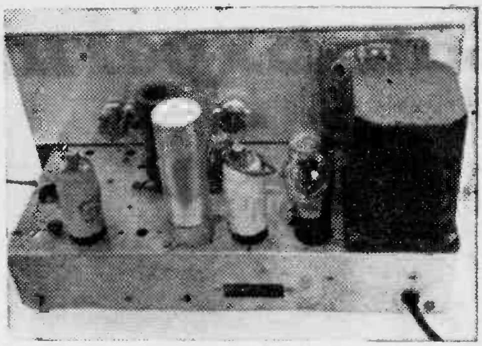


Fig. 5.—Switched wafer wiring.


Rear view of the receiver.

D.C.2. STEREO AMPLIFIER

(*Continued from page 930*)

the free tag of the next tag strip. Run two wires from this tag—securing the 10W resistor to it at the same time—one to the tag of the 32 + 32μF 450V with the 3.3k wire wound on it, and the other to the two tags on the output transformers that are situated second in from the rear of the chassis, then solder. We now have three of the four tags of the output transformers soldered. Between the remaining one and the last ones soldered, solder a 0.01μF 400VW paper capacitor, and join the same tag—free before the fixing of the 0.01μF—to pin 6 of the nearest ECL82. This should now leave both ECL82 valves with pin 1 free and a tag on each of the two left-hand (power unit end) jacks free.

We can now fix the volume control, tone control and the stereo/mono switch in position. With the chassis still inverted, the left-hand socket is for the volume control—a twin bank 250 + 250k log. The centre hole is for a similar type, but is 1M + 1M. The other control is the stereo/mono control, and is made by Kendall and Mousley Ltd. It is a single-pole two-position switch. The actual wiring of the tone and volume control circuit is shown in Fig. 4. Note that the wires from the input jacks are in screened twin cable and that the braiding is joined at one end to the common earth at the rear of the chassis, and at the other end to the various cases of the pots (four points) to two tags on the volume control, and also the two tone control capacitors are joined to the cases of the tone control pot. The colour of the wires in the screened twin is important, as if they are reversed the channels will be reversed in the amplifier.

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IT is essential that when soldering or making good any dry or loose connections, that the heat applied is carefully controlled, the reason being that excessive heat will result in the base material blistering, thus causing the metallic conductors to lift from it. Such base materials comprise phenolic impregnated papers, epoxy impregnated fabrics, or woven glass cloth treated with silicones or epoxy resins. The use of any particular base material depends mainly upon its final use, an important factor being the maximum working temperature.

As in the conventional type of radio circuit dry joints will result in poor electrical connections, not forgetting any break in the metallic conductor. Such breaks, however, in the printed circuit, may be only a very small crack, resulting in intermittent operation. Such faults can best be traced by continuity checks, but in doing so it is advisable to bend the printed circuit to assist in tracing the break or dry joint in the conductor.

It is as well to mention, however, that when soldering new connections, or making good any dry joints, it is necessary to ensure that no splashes of surplus solder short-circuit the metallic conductors or components, bearing in mind that with this type of circuit miniature components are used.

The insulation resistance between the conductors is usually fairly high, something in the order of 50,000M, but this value will be greatly reduced if the printed circuit is allowed to become damp, oily or dirty. Any dust collecting between the conductors will eventually result in tracking or electrical leakage.

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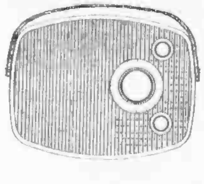

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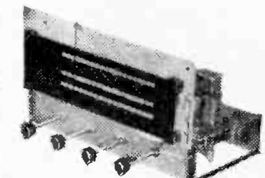

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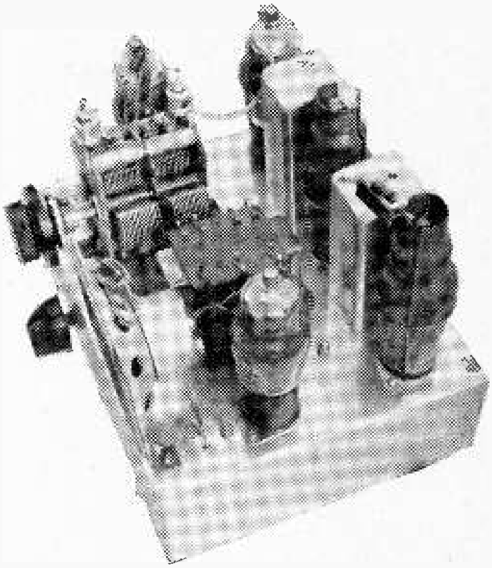


ALIGNMENT OF THE RECEIVER

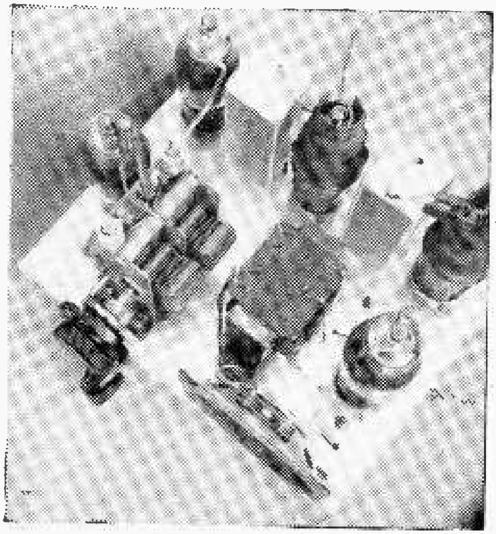
By J. Heath

(Continued from page 837 of the February issue)

WHEN wiring up the I.F. transformers, note that leads or tags are often marked according to the points to which they are normally connected. If so, then "anode" and "H.T. positive" leads will be the primary, with both transformers, and they are connected to anodes and H.T. positive line. With the first transformer, the bottom secondary lead or tag will often be marked "A.V.C." and this is taken to chassis, as in Fig. 3. With the second transformer, this lead is often marked "diode load" and it is also taken to chassis, as shown.

Coils

Aerial and oscillator coils are fitted to a small piece of aluminium, as with some types the core adjusting screws are otherwise inconveniently situated under the gang condenser. Coil tags are numbered in Figs. 1, 3 and 4. With the aerial coil, tag 3 is wired to the rear fixed plates of the gang condenser, marked "Y" in Fig. 2. A lead also passes down through the chassis from the front plates "X" to tag 7 of the oscillator coil.



Plan view of the receiver.

The tag connections shown in Fig. 4 are for the coils given in the components list (Astral Radio Products). The aerial and oscillator coils produced by other manufacturers will be equally satisfactory, but the maker's tag data must then be followed, as connections will not be the same as those in Fig. 4. The padder indicated in Fig. 1. must also be of the value specified by the coil maker. If long waves are also provided, a separate padder will be needed with the long wave oscillator coil, and will often be 150pF. Correct ganging of the tuned circuits will be impossible if the padder is omitted, or of the wrong capacity.

A tag board with two tags joined is used for H.T. positive connections, as in Fig. 3. A second small tag strip provides an aerial connection, the 500 pF condenser and 10k resistor forming a modulation hum filter. Trouble from modulation hum is unlikely, but in localities where this is severe, a 0.05μF 750V condenser can be wired in parallel with the primary of the mains transformer. The 500pF aerial condenser must also be of good make, and 500V or 750V rating, as it prevents mains voltages reaching the aerial.

Using and Adjusting the Set

If clear glass valves with no external or internal screening are fitted in the mixer and I.F. positions, instability is likely when the I.F. transformers are correctly aligned, and when the volume control is turned towards maximum. Valves of this kind should thus be provided with screening cans, of ready-made type, or bent up from aluminium. The cans are connected to the chassis.

Alignment is carried out as with a standard superhet. If a signal generator is available, set this to give a 465kc/s modulated output, and place the output lead near the anode connection of the mixer. The I.F. transformer cores are then adjusted for maximum response. The aerial and oscillator trimming condensers are then adjusted for best volume with a signal around 230m, and the cores are adjusted for best volume with a signal of about 500m.

Another Method

If no generator is available, it should be possible to tune in the local station. The I.F. transformers can then be adjusted for best volume, taking care that no core is at the limit of its travel. A station of fairly low wavelength is

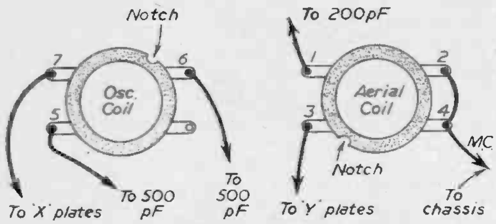
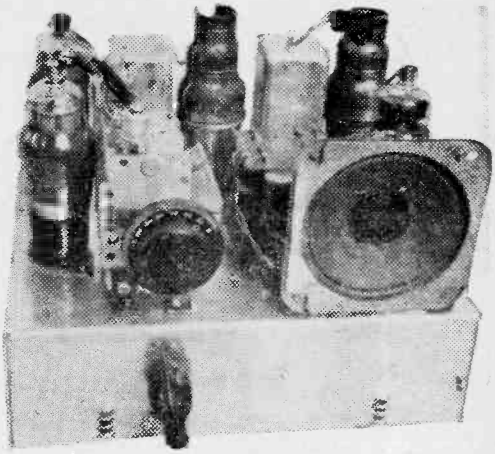


Fig. 4.—Aerial and oscillator coils.

then tuned in, and the gang condenser trimmers are adjusted for best results. The set is then tuned to a station of fairly high wavelength, and the coil cores are adjusted.

The procedure should be repeated two or three times, until no further improvement is possible. An insulated blade is most suitable, because the presence of a metal blade in the coil or transformer windings will upset adjustments.

A baffle board or cabinet is required if the loudspeaker is to give best reproduction. A cabinet is recommended, and can easily be made from ⅜in. thick or similar wood, with a 3-ply front. An aperture to match the speaker cone should be cut in the front, and covered with silk or speaker gauze. A clearance hole for the com-



Front view of the receiver.

bined switch and volume control, and an opening to suit the dial used, are also required. The completed receiver can then be placed in the cabinet from behind. If a back, with rows of holes for ventilation, is screwed on, this will protect the receiver and prevent chassis or other parts being touched, and thereby avoid the chance of mains shocks from this cause. For the same reason there should be no exposed metal, such as the volume control bush or spindle, or knob grub screws, which might be touched. This can be arranged by using a knob which covers the bush and nut, and having the grub screw well recessed, or filling the grub screw hole with an insulating compound such as sealing wax. Similar precautions should be taken with the tuning control.

A NOVEL CIRCUIT TECHNIQUE

(*Continued from page* 936)

Wiring

Do not use thick or multi-strand wire for wiring up the circuit. A diagram is often helpful, though most transistor circuits are relatively straightforward. A fixed order should be followed, starting, for example, with earth points, negative points, etc. Although transistor circuits are generally free from stray wire pick-up troubles, wires should be quite short.

Fig. 1 shows how to connect up the wire ends underneath the board. Time spent on good soldering pays dividends later on !

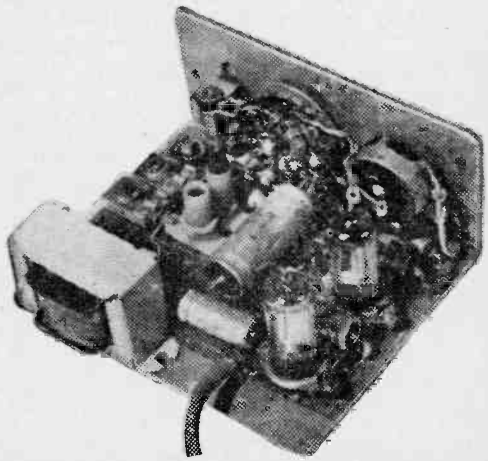
Installation

The completed circuit can be glued or bolted into place. Avoid looseness in equipment like car radios, which must be firmly constructed.

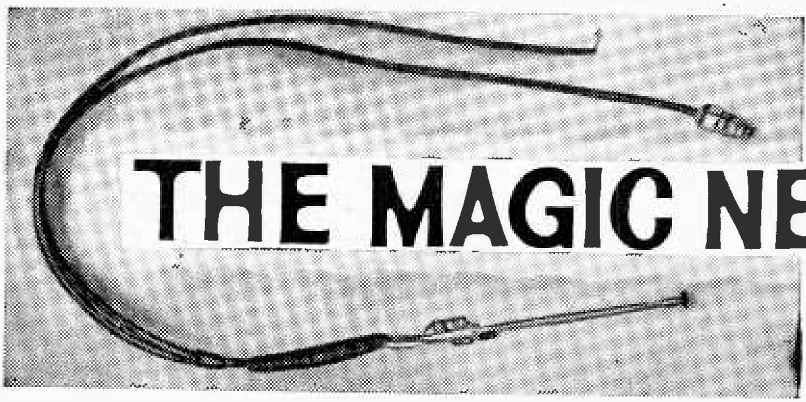
Removal of components for replacement is effected by melting the joint and levering out the loosened part.

Other Applications

Of course, transistor circuits are not the only application of this technique: many valve circuits can be constructed using celluloid sheeting, though large components often need to be more firmly secured. However, celluloid is an obvious replacement for tag boards, for components can be arranged as required, and the board bolted where it is most convenient. Fig. 1 shows how to cut out large holes for valveholders, which are then bolted on in the usual way.



A receiver built on plastic sheeting.



THE MAGIC NEEDLE

A DEVICE FOR CHECKING FREQUENCIES By G. Tomassett

THIS instrument, with its somewhat presumptuous name, is intended to facilitate frequency measurements. The accuracy obtainable, even at 200Mc/s, is of the order of $\pm$5c/s or so. These figures are relative. Explicitly, you can evaluate an unknown frequency with the mentioned accuracy relative to your R.F. signal generator.

Uses

The Magic Needle is operated in conjunction with a reliable R.F. generator. A sensitive A.F. amplifier may, sometimes, be dispensed with. Obviously, if you work on a tape recorder, you should not need a sensitive external audio amplifier. The same applies if you are dealing with a radio or TV set. The use of an external separate amplifier does, however, simplify things, particularly for the beginner.

The instrument has been successfully used for:—

(a) Radio sets, when, because of a defective component or because of a serious misalignment, the frequency has departed from its correct value. Its use has been of invaluable help with faulty transistor sets.

(b) TV sets, particularly in instances of channel changes. In these cases, the instrument is really indispensable. The line frequency can be measured utilising the harmonics produced in the output stage.

(c) Tape recorders to determine the erase frequency which can be of some significance. In this connection, owing to the relatively low frequency, the harmonics must be used. In one instance, where the frequency was 60kc/s, the 15th harmonic still gave an audible signal. (Zero beats were found in this succession: 600, 660, 720, 780, 840kc/s.)

(d) Experimental oscillators of any kind.

Operating the Test Gear

This is the sequence of the operations to be carried out in order to determine the value of an unknown frequency:

(a) Connect cable Y to input of A.F. amplifier and cable X to output of R.F. generator.

(b) Switch on all components. Allow five minutes or more for warming up.

(c) Set R.F. generator to maximum output and internal modulation to "off."

(d) Set A.F. amplifier to full volume.

(e) Pick up the needle, holding it where the cables are clamped together and, as a first attempt, put the tip of the needle as near as possible to the coil of the oscillator under test. Often, however, this proximity is not necessary; it can sometimes be detrimental, especially when high accuracy is required.

(f) Move the generator, operating both range and dial until the typical approximation of the zero beat is heard. If the sound produced is very loud, reduce the coupling by drawing the tip of the needle away from the circuit. When zero beat is obtained, the frequency sought will be within the region of $\pm$5c/s compared with the frequency recorded by the R.F. generator.

It must be realised that both the R.F. oscillator under test and the R.F. generator produce harmonics which might be misleading. As a rule, when more than one zero beat is heard, the loudest will be the right one (the one to be taken into account).

The Circuit

The R.F. current set up in Rg (internal resistance of generator) will flow through coil "C," diode D1 which rectifies it and, finally, return to

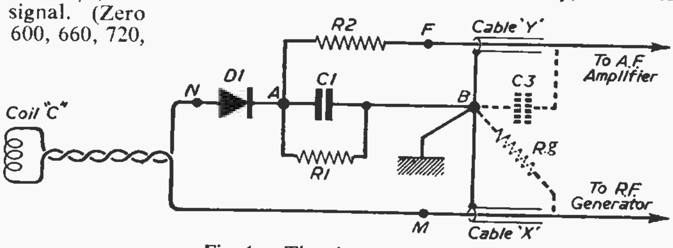


Fig. 1.—The circuit diagram.

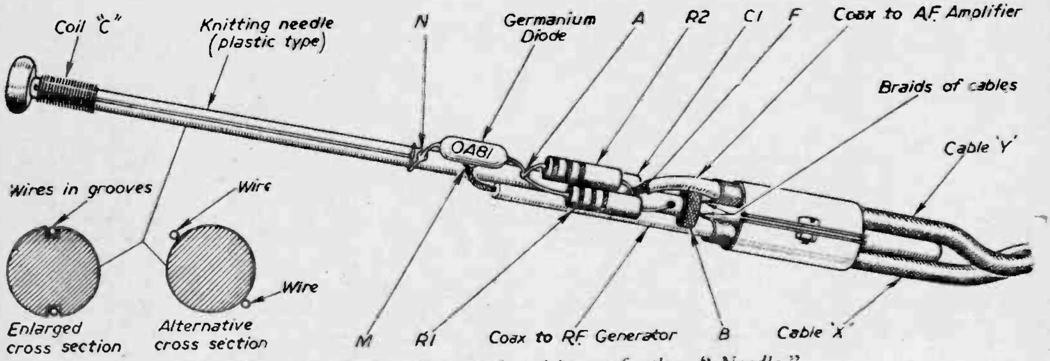


Fig. 2.—Construction and wiring of the "Needle."

Rg passing through the R1-C1 group. If any audible signal were superimposed on this current, the audible part would be taken from point A by R2, filtered by C3 (which is not physically present) and, finally, amplified by the A.F. amplifier. Obviously, if the R.F. generator is not internally modulated, nothing will be heard at the amplifying end. When, however, the tip coil "C" is

COMPONENTS LIST

D1 = Germanium diode (OA70 or similar).
R1 = 0.47M., 1/8W.
R2 = 0.1M., 1/8W.
C1 = 100pF, mica or ceramic.
Coil "C" = 10 turns 25-30 s.w.g. enamelled (the number of turns is not critical; neither is the diameter of the wire used).
Plastic needle = Any diameter in the region of 1/4in.
Coax cables = Two short lengths (about 2ft.).

immersed in an electromagnetic field, an induced current will circulate in it. Through the rectification process of D1, the two currents (the induced one and the one delivered by the generator) are mixed so that at point A there will appear as many as four currents of the following frequencies:

(1) (fg) = frequency of generator; (2) (fx) = value of unknown frequency; (3) (fg + fx); (4) (fg − fx).

As (fx) is likely to be a radio frequency (not audible) and as (fg) is definitely a radio frequency, it is clear that only the term (fg–fx) can give an audible frequency. Further, from (4), if (fx) equals (fg) the result of the subtraction will be zero or zero beat which is, in fact, the principle upon which this instrument works. The aim, then, is to find a frequency in the range of the R.F. generator which, because of its being equal to (fx), gives a zero beat through the Magic Needle.

The "difference" current of frequency (fg-fx) or (fx–fg), feeds the audio amplifier and is carried there by means of the low-pass filter R2-C3 (C3 is not physically present but represents stray capacitances). The low-pass filter will convey to earth the other three components, namely (fg), (fx), (fg + fx). The incoming R.F. signal and the outgoing audio signal are both carried by coax cables not longer than about 2ft.

Assembly of the Parts

All the components are attached to the needle through small holes (see Fig. 2). The distance in between the holes is not given because it is dependent upon and varies according to the length of the components used. Some five holes are needed and two extra ones are advisable to fix the ends of coil "C," thus preventing turns from slipping.

The wire used for the coil is also used for its connection to the rest of the circuit. In order to carry the two terminal wires of the coil to the components, it would be advisable to make two grooves along the needle (see cross section).

The coax cables are clamped together around the end of the needle by means of a bracket or simply by adhesive tape.

Transistorised Mixer Unit

IN the article by A. M. Shafford which appeared on page 765 of the January issue no definite details were given of the type of microphone for which the mixer is suited. The author assumed that it would normally be used with the crystal microphones supplied with popular tape recorders, that is, high impedance types. The method of gain control employed has given rise to a certain amount of criticism, but although it is not ideal, it is the simplest which can be achieved when only one transistor stage is employed and in practice gives very satisfactory results. The low amplification of the mixer makes it unnecessary to control gain after amplification; no significant improvement in signal-to-noise ratio would be achieved and a separate transistor amplifier would be needed in each channel before mixing. This procedure would complicate the design of the pre-amplifier which was aimed at simplicity and low power consumption.

The value of 10μF for the output coupling condenser may seem rather high, but it ensures that the unit is suitable for coupling into all valve amplifiers and as in the writer's case a fully transistorised amplifier. There is no point in choosing (say) a 0.01μF coupling condenser unless the unit is always to be used with amplifiers having high input impedances.

Versatile V.F.O.

FURTHER CONSTRUCTIONAL DETAILS

(Continued from page 844 of the February issue)

By R. H. Wright

Front view.

THE original V.F.O. unit was constructed on an 8in. × 8in. × 2½in. chassis, not because such a size was necessary, but rather because such a size was at hand. Actually, the whole unit, including the buffer valve, could be constructed easily on a 4in. × 8in. chassis. Eddystone have a chassis measuring 8½in. × 5¾in. × 2⅜in. and this is designed to fit inside their type No. 644 metal cabinet. Use of this cabinet would give a very profesional finish to the unit. Paxolin group panels can be used with definite advantage for the mounting of many of the individual capacitors and resistors and apart from making construction actually easier (since much inter-component wiring can be carried out on the panel itself) neaten the final unit and does away with the "spiders' web" of resistors and capacitors radiating out from each valveholder.

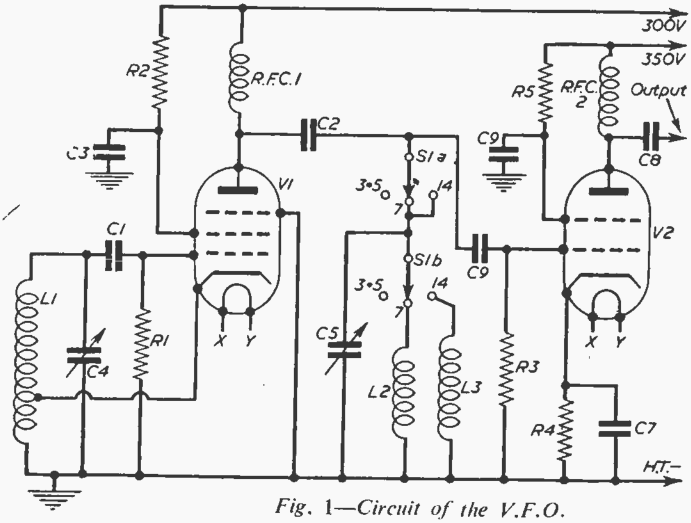


Fig. 1—Circuit of the V.F.O.

Operation of the V.F.O.

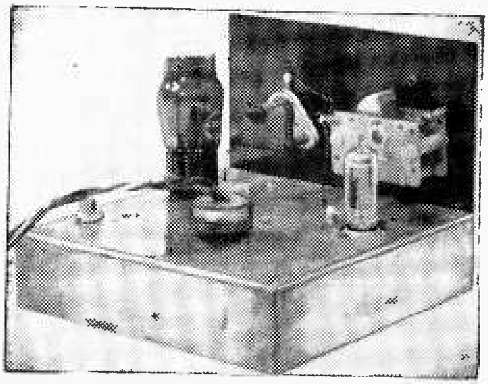
The writer has found that, generally speaking, it is bad policy to key the V.F.O. together with the main transmitter and such action makes a chirpy note very hard to eliminate. A better method is to fit a switch in the cathode line of the oscillator valve so that the oscillator can be switched on without operation of the full transmitter. This permits the oscillator to be adjusted to the required frequency without radiating a full signal and so causing interference. When the key is finally pressed it is only a moment's operation to make any final adjustment to the transmitter tuning before commencing a call.

If the full transmitter circuit suggested in the first section of the article has been built up, incorporating the V.F.O. and amplifier sections (Figs. 1 and 3) the following tuning procedure should be followed.

(i) Set the V.F.O. to the required frequency and tune the grid circuit of the buffer (C5/L2 or L3) to the second or fourth harmonic of 3.5Mc/s if final output is required on 7 or 14Mc/s. Correct tuning of this circuit would produce maximum grid current in the final amplifier circuit.

(ii) With the key pressed and the V.F.O. in operation, set C5 of the amplifier section to full capacitance value and, with the correct coil in the L1 (amplifier) position,

(Continued on page 957)

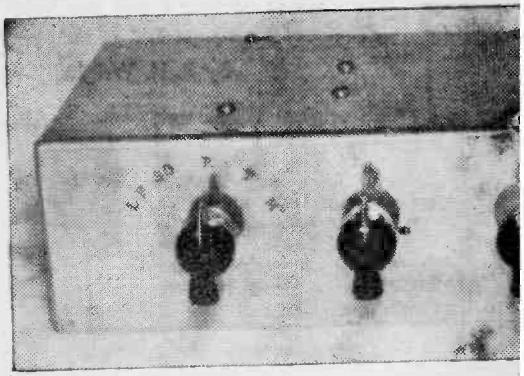


Rear view.

A Comprehensive

A THREE-VALVE CIRCUIT WITH TREBLE, BASS, VOLUME AND FILTER CONTROLS

By R. Taylor



The front panel.

AN ideal pre-amplifier may be stated to fulfil the following requirements : (a) to accept an electrical input from a gramophone pick-up, radio or other similar source ; (b) to correct this input for amplitude and frequency, and (c) to supply a suitably amplified voltage to the main amplifier.

The main audio amplifier usually supplies low impedance loudspeaker. Very few loudspeakers have an entirely satisfactory frequency response, and dimensions, shape and furnishing of a room may again influence and colour the sound issuing from the loudspeaker. It is thus often possible to improve the overall result by the judicious use of variable tone (or frequency) correcting networks which are most conveniently situated in the pre-amplifier.

The pre-amplifier about to be described is designed to fulfil as many of the essentials tabulated above as possible, while retaining the advantage of compactness and reliability.

Specification

Three coaxial inputs are shown in the theoretical diagram (Fig. 1) for gramophone pick-up, radio and tape, but constructors not possessing a tape recorder may choose to omit the third. It must be stressed that this pre-amplifier does not contain correction networks to enable direct replay from the tape deck playback head, and the input should be taken from a signal source after the frequency correction stage of the tape recorder pre-amp.

The inputs are taken via a selector switch to the grid of the first valve (6BR7) for voltage amplification. The load resistance RA of the pick-up input as shown in Fig. 1 will only be suitable for a magnetic type of pick-up, with an output of less than 50mV, such as the Goldring 500/600 cartridges, etc. For magnetic types of pickup with greater output, or crystal types, alternative input networks are recommended (Fig. 2).

Equalisation

A negative feedback resistance/capacity network in the anode/grid circuit of the first stage provides the necessary frequency correction for most L.P.

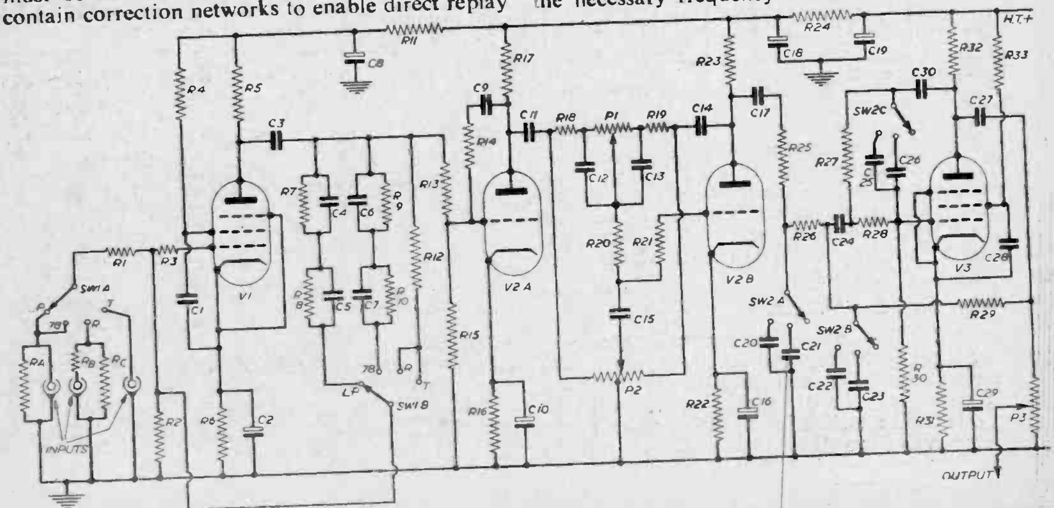
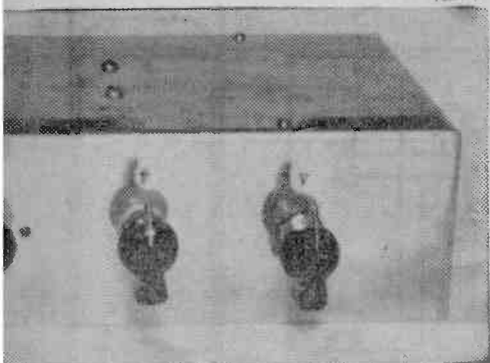


Fig. 1.—The complete circuit diagram.

Pre-amp



and 78rev/min recordings, while a resistance negative feedback circuit in combination with the potential divider Rb and Rc, attenuates the radio tuner signal sufficiently to avoid overloading the first valve stage.

The second stage (12AX7) incorporates a well known variable tone control circuit with independent cut and boost in both treble and bass frequencies, as referred to a frequency of 1kc/s.

This stage feeds into the final stage (6BR7) which includes both high- and low-pass filters. The high-pass, or "rumble," filter is useful for attenuating the irritating low frequency rumble associated with so many turntables, and has a cut-off frequency of about 35c/s with a slope greater than 12dB/octave, and is permanently in circuit. The low-pass filter can be switched from level response to frequency cuts at 7.5kc/s or 5kc/s with a slope approaching 18dB/octave.

Construction

The chassis is formed from a sheet of aluminium, preferably of 3/32in. thickness, to make a box 12in. × 5in. × 2½in. Apart from the input power supply junction box and coaxial sockets mounted on the rear of the chassis, the only projections are the controls on the front. As the valves run very cool, they are mounted with all the other components within the chassis, which makes a very neat, yet efficient unit.

To make construction easy, most of the resistors and capacitors are soldered on to group boards and tag strips, which can be assembled outside the chassis, with lengths of wire for connections

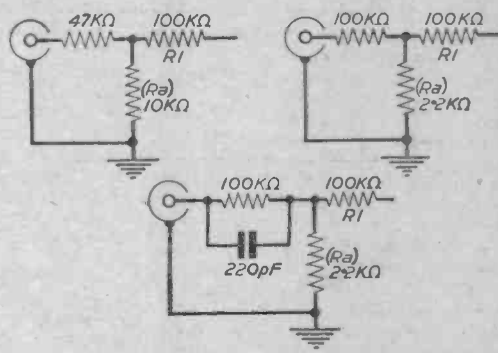
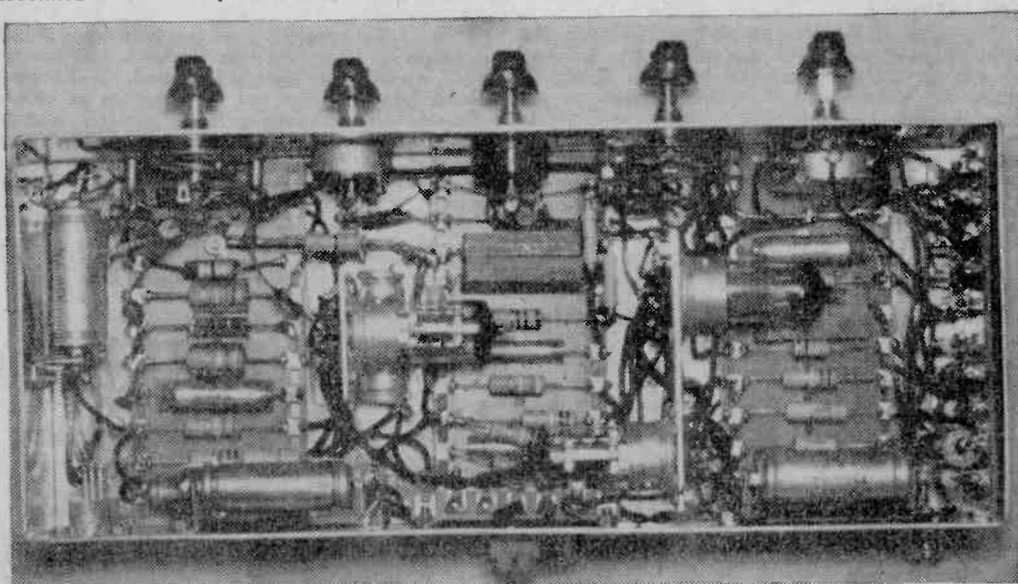


Fig. 2.—Alternative pick-up input circuits.



This view shows the compact layout employed

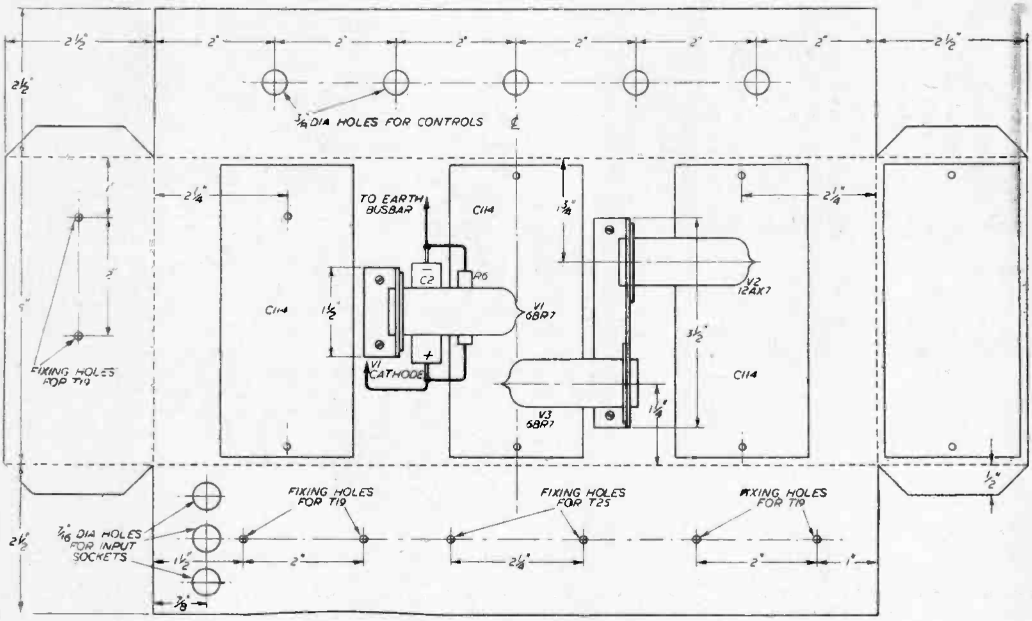


Fig. 3.—Chassis drilling details and layout.

to other units attached, before bolting into position.

Only *one* earthing point to chassis is used, and all connections to earth in the circuitry are made to this one point, via a heavy gauge copper busbar, the farthest end of which is insulated from chassis by connecting it to a spare terminal on a group board.

Chassis

The plan of the chassis, and approximate disposition of group boards, tag strips, etc., is shown in Fig. 3. The valveholder brackets should be made of aluminium of similar gauge to the chassis, with a ⅜in. to ½in. width right angle to bolt to the chassis. The valve sockets should be positioned to allow reasonable clearance between the valve and the components mounted on the group boards, and a distance of approximately 1⅝in. from the floor of the chassis to the valve centre line will be found suitable. The group boards are raised slightly from the chassis by a spacer nut, which enables the passage of insulated wiring between board and chassis, thus making a neater appearance.

It is suggested that the assembly and wiring of the pre-amplifier be undertaken very carefully to minimise the possibility of any mistake. If care is taken in following the diagrams and instructions, no difficulty should be found. It should be noted, however, that the construction of such a compact unit demands care and patience, and the use of a pencil bit soldering iron is almost an essential.

(To be continued)

COMPONENTS LIST

Resistors:

R1 100k	R13 100k	R25 68k
R2 2.2M	R14 270k	R26 68k
R3 3.3k	R15 470k	R27 3.3M
R4 1.5M	R16 2.7k	R28 100k
R5 220k	R17 100k	R29 390k
R6 1.5k	R18 100k	R30 470k
R7 470k	R19 470k	R31 560
R8 6.8M	R20 470k	R32 100k
R9 3.3M	R21 1k	R33 470k
R10 3.3M	R22 2.2k	Ra } see text
R11 22k	R23 100k	Rb } see text
R12 330k	R24 22k	Rc } see text

Capacitors:

C1 0.1 μF paper 350VW
C2 25 μF electrolytic 25VW
C3 0.05 μF paper 350VW
C4 220pF ceramic
C5 830pF ceramic
C6 50pF ceramic
C7 470pF ceramic
C8 8 μF electrolytic 350VW
C9 0 .01 μF 350VW
C10 25 μF electrolytic 25VW
C11 0.05 μF paper 350VW
C12 4,700pF ceramic
C13 4,730pF ceramic
C14 0.05 μF paper 350VW
C15 100pF ceramic
C16 25 μF electrolytic 25VW
C17 0.05 μF paper 350 VW
C18 8 μF electrolytic 350VW
C19 8 μF 350
C19 8 μF electrolytic 350VW
C20 680pF ceramic
C21 470pF ceramic
C22 1,500pF ceramic
C23 1,000pF ceramic
C24 4,700pF ceramic
C25 15pF ceramic
C26 10pF ceramic
C27 0.02 μF paper 350VW
C28 0.1 μF paper 350VW
C29 25 μF electrolytic 25VW

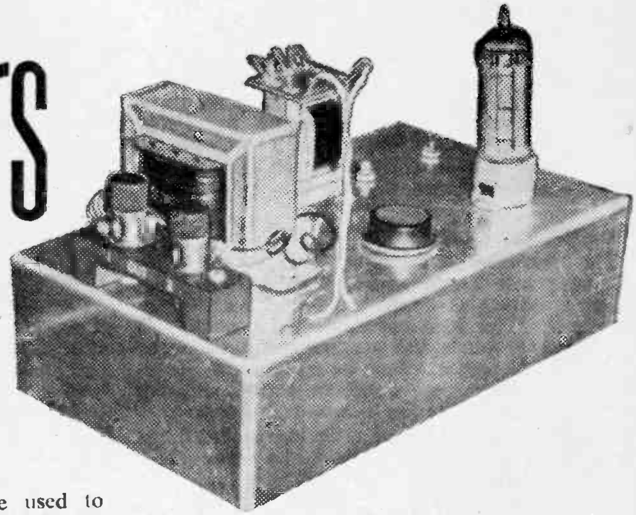
Sundries:

SW1 2-pole, 4-way switch
SW2 3-pole, 3-way switch
B9A valve bases
Coaxial sockets
P1 1M pot. (linear)
P2 500k pot. (linear) with tap at 50% rotation
P3 250k pot. (log.)
Group boards (Bulgin C114))
Tag strips (Bulgin T19 and T25)

Valves:

V1 6BR7
V2 12AX7
V3 6BR7

Transistors for P.A.



ADEQUATE OUTPUTS CAN BE OBTAINED FROM SIMPLE CIRCUITS

By J. Gray

A TRANSISTOR amplifier can be used to work a loudspeaker for sports, outdoor events, and similar functions, and this type of equipment can be independent of the need for mains or accumulator supplies. It is not practicable to obtain volume equalling that of a large mains-operated public address amplifier, which may deliver many watts, but a useful output can nevertheless be obtained.

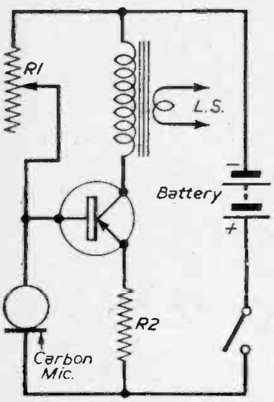


Fig. 1.—Directly coupled circuit.

In general, one of two purposes will be in view. First, it may be necessary to work a loudspeaker situated some distance from the microphone, so that the person using the latter can be at the best observation point. Or it may be necessary to obtain a good, easily audible signal without the person having to raise his voice. Transistor equipment will easily meet these needs, but ordinary transistor circuits will not give sufficient output for several loudspeakers, or very high volume coverage over a wide area.

Simple Circuit

A very simple circuit is shown in Fig. 1, using a microphone directly connected to a transistor. In this circuit, as in the others described later, a carbon microphone is essential to secure enough output. Various surplus microphone inserts and hand mikes may be used. Carbon microphones do not themselves produce any current, but present a varying resistance to a current obtained from a battery. When the switch is closed, current flows through the microphone and R1. R1 and the microphone act as a voltage divider supplying the transistor base. To secure a satisfactory base voltage, R1 is thus best of variable type. It should be set to a fairly high resistance at first, this being reduced until best results are obtained.

Best output will be obtained with a microphone of low resistance, preferably not over 50ohms. A wire-wound resistor of some 250ohms can then be used for R1. If the microphone is of high resistance then R1 must be increased in value to suit. The total resistance of R1 and the microphone then becomes rather high, so that the current through the mike is small, and the signal obtained from it is much reduced. Enough output will not be obtained with a high resistance carbon microphone unit.

R2 limits current, and can be about 2ohms for a power transistor such as the V30/20P. It is also wire-wound. A power transistor output transformer is essential, transformers intended for valve circuits being unsatisfactory. For the

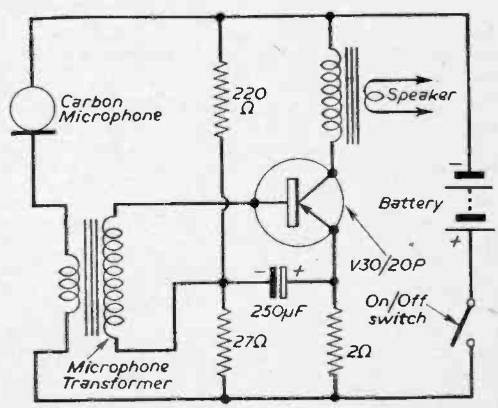


Fig. 2.—Adding a coupling transformer.

V30/20P and a 3ohm speaker, the transformer ratio should be about 3.2:1.

The battery voltage may be anything up to 12. Current is only drawn when the switch is closed. To save current, and let the transistor cool, a spring-loaded push switch may be used, and held down when announcements are being made. Dry batteries with large cells can be used, but for long periods of operation at best volume, an accumulator is recommended.

Transformer Coupling

The sensitivity of the circuit can be improved, especially with a microphone of fairly high resistance, by using an input transformer, as shown in Fig. 2. The base circuit of the transistor is completed through the secondary, and correct operating voltages can thus be maintained. Resistor values are for the transistor shown, but can be changed to suit other power transistors.

For maximum volume, the primary of the transformer should have about the same resistance as the microphone. If primary and mike are of rather dissimilar resistance, it will be found that no increase in volume is achieved. Best possible volume is obtained when both primary and microphone are of quite low resistance, so that a large microphone current passes through the primary. This is most easily assured by using one of the various " power " type microphone units. As with Fig. 1, any battery voltage may be used, but a 12V supply from accumulator or large dry cells will be best.

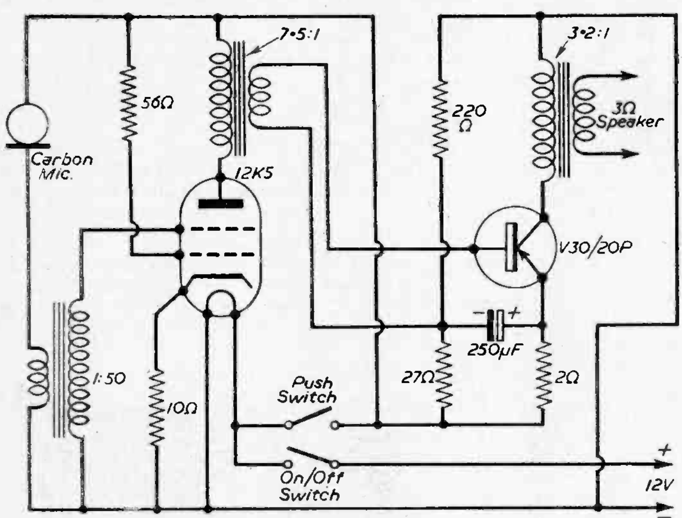


Fig. 3.—Circuit with valve pre-amplifier for 12V operation.

A Valve Pre-amplifier

A transistor requires power, in the form of current, to drive its base circuit. This means that a step-up transformer cannot be used from the microphone, because the transformer could only increase signal voltage at the expense of current. This difficulty does not arise with a valve, the grid of which requires an input voltage and negligible current. A valve pre-amplifier thus allows a high-ratio microphone step-up transformer to be used. This gives a very great increase in sensitivity, because the valve itself also provides more amplification.

A circuit of this kind is shown in Fig. 3, the valve being of a type intended for 12V heater and H.T. supply, so that only a 12V accumulator will be needed. Intermittent operation is, in fact, possible from a 12V dry battery made up of large cells.

Transformer Ratio

For best sensitivity, microphone transformer primary and mike should be of similar resistance, as explained. The ratio is not very important, 50:1 being average. A lower ratio may be needed with high resistance microphone units. Surplus microphone transformers of suitable type will do well, and will have a very high secondary resistance. Some speaker output transformers will function, with the low resistance winding used as primary.

The valve anode transformer is of the transistor coupling type, and this also applies to the output transformer. Both these transformers are wired so that the larger winding is primary, because a step-down ratio is necessary to match speaker to transistor, and transistor to valve. Wiring any of the transformers incorrectly will result in little or no output at all.

A switch completes the valve heater circuit, so that the cathode can be maintained at operating temperature. Talking is then possible immediately the push switch is closed. With only one switch it would be necessary either to leave the microphone and transistor drawing current, or to wait for the valve to heat up.

Underchassis wiring for the circuit in Fig. 3 is shown in Fig. 4. The secondary of the output transformer goes to speaker. The exact layout of parts is of little importance, provided the transformers are some distance apart, and preferably with their cores at right angles, to avoid howling.

The 220ohm resistor is best of 1W rating. It can be made up by wiring two 440ohm ½W resistors in parallel, or two 110ohm ½W resistors in series. The low value resistors are best wire-wound.

Transistor Mounting

When anything approaching maximum output is being obtained, the transistor will become hot. This heat must be conducted away. A metal plate, or the metal chassis, is thus used for this purpose. In Fig. 4, the transistor is bolted to the chassis, but is not in electrical contact with it. To obtain the required electrical insulation,

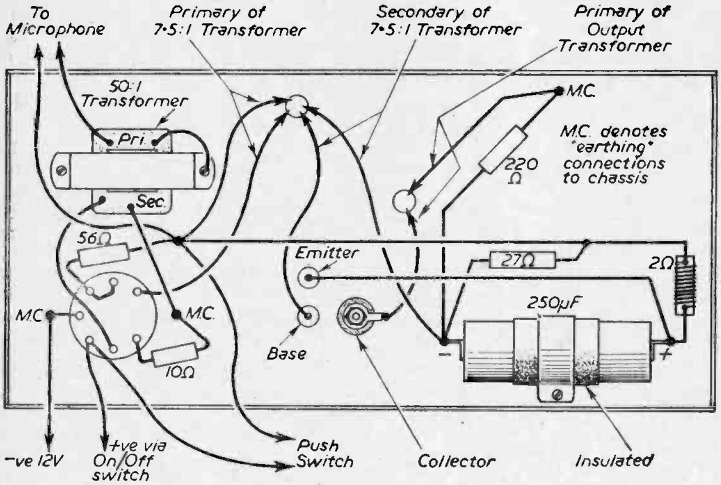


Fig. 4.—Wiring diagram for the circuit of Fig. 3.

while allowing heat to reach the chassis, the transistor makers provide a very thin mica washer. After drilling clearance holes for the transistor, burr or roughness must be carefully removed, so that the mica washer can lie flat on the chassis. The transistor is then bolted on, a paxolin or insulated washer being used to prevent contact between tag and chassis, on the underside. A "heat sink" can also be made by using a flat sheet of aluminium, of reasonably large size and stout gauge, if this is more convenient.

If an experimental circuit is made up, and a 12V supply used, an initial test with a meter is wise, to see that maximum ratings are not exceeded. This is not necessary when using specified values with the appropriate transistor. Some types of transistor are not intended for 12V, and this should be remembered.

The size of the loudspeaker is of no importance, except that a reasonably large unit is best, because small speakers will give less output, and may not be able to handle the signal without overloading. In some instances the speaker may be mounted in the same case as the amplifier, or it may be more convenient to have the speaker in a separate box, or fixed to a baffle board hung at some suitable point.

The layout of the various units (battery, microphone, amplifier, and speaker) is not of much importance, and depends on the purpose in view. With a small amplifier, as in Figs. 1 and 2, the mike, amplifier and speaker could be in a single case. Or batteries and amplifier may occupy the case, with leads to microphone and speaker.

With the larger type of amplifier, such as that in Figs. 3 and 4, it is convenient to house the amplifier separately, so that microphone, speaker and accumulator may be attached. Or the microphone may be permanently wired, and the amplifier can then have terminals or sockets for speaker, and a flexible cable for accumulator connecting purposes.

The simpler circuits shown require a relatively large input to the microphone. Howling owing to feedback from the loudspeaker is thus unlikely. However, with the circuit in Fig. 3 it will be found that vibrations or sounds from the loudspeaker must not be allowed to reach the microphone at all strongly, or howling will be set up.

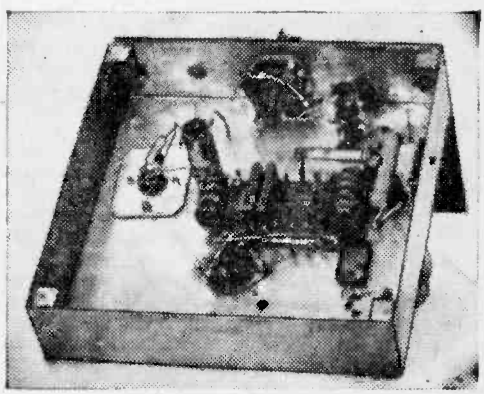
VERSATILE V.F.O.

(Continued from page 951)

rotate C4 and watch for a dip in the meter connected in the cathode of the amplifier valve. C4 should be adjusted to the lowest current reading when a dip is registered on the meter.

(iii) Now decrease the capacitance of C5 (and as this is done the meter reading will rise again) and retune for the dip by means of further adjustment of C4. Repeat this operation—decreasing C5 and retuning C4 to the dip—until the dip occurs at about 45 to 50 milliamps of cathode current. The transmitter is now tuned. The V.F.O. may now be adjusted to any frequency in the band without any further transmitter tuning actually being necessary though if the V.F.O. frequency changes by any appreciable amount it may be found that slight retuning increases output. The correct method of setting C6/L2 was described in the first section of the article. This, of course, can only be carried out in conjunction with a local TV receiver.

As mentioned previously, care must be taken to ensure that all sections of this transmitter, and, indeed, any transmitter, are correctly tuned to the required harmonic. For such a check, a wavemeter is very necessary and a suitable cheap, absorption type will be described in a future article.



Underchassis view.

A Transistorised Voltmeter

HIGH INPUT RESISTANCE IS A FEATURE

By G. Connor

THE meter described in this article is intended for the measurement of voltages in circuits where very small currents are to be found.

If a conventional moving coil or moving iron instrument is connected to a circuit in which only a few micro-amps current flow, then the high current drawn by the meter will result in extremely inaccurate readings. To overcome this effect, it is necessary to use a voltmeter with a very high impedance. The valve voltmeter is an example of such a device.

It was decided that as transistors are cheap and need only a low voltage battery supply we would use them. therefore making the meter portable in all ways. When transistors are used in the common emitter configuration. it shows a high impedance between the base and emitter and this fact has been made use of in the design of this apparatus.

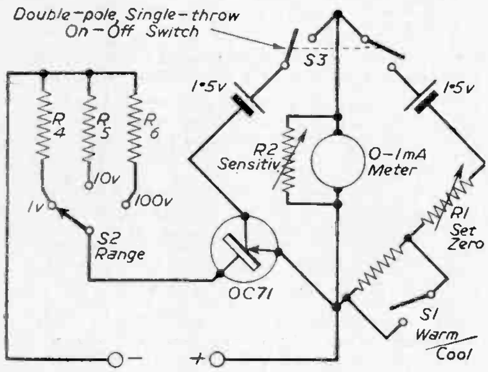


Fig. 1.—Circuit of the meter.

Circuit

The circuit shown in Fig. 1 may be considered as a bridge circuit with the meter in the centre arm. Once the circuit has been balanced by adjusting R1 and S1, any variation in the impedance between transistor collector and emitter will destroy the bridge balance and cause the meter to be deflected. The control R2 acts as a shunt to the meter and can be used as a sensitivity control.

The base of the transistor draws current from the supply to which the instrument is connected and since the emitter to collector impedance varies as the base current varies. then changes in the meter deflection occur. To increase the range of the instrument and to increase its impedance, series resistors are switched into the base circuit by S2. In the circuit a warm/cool switch has been provided. this is necessary owing to the dependence of the transistor operating conditions upon temperature. By the use of this switch, the instrument can be used over a wide temperature range.

The meter is adjusted initially as follows:

1. Switch on and after short circuiting the input adjust the set-zero R1 control for zero reading on the required range. If this proves difficult, it may be necessary to use the warm/cool switch.

2. Connect the instrument to source of known potential and set the pointer of the meter by means of the sensitivity control.

COMPONENTS

Transistor	OC71 or equivalent.
Meter	0-1mA.
R1	50k linear variable.
R2	25k ,, ,,
R3	47k fixed carbon.
R4	22k ,, ,,
R5	220k ,, ,,
R6	2.2M ,, ,,
S1	Two-way, single-pole, toggle switch.
S2	Three-way, single-pole, rotary switch.
S3	Two-way, two-pole, toggle switch.

Silicon Controlled Rectifiers

By E. G. Bulley

THESE devices can be said to be a development from both the silicon transistor and rectifier. They are in fact neither transistor nor rectifier but are analogous to the grid controlled rectifier or thyratron. and are p-n-p-n semi-conductors. They can. therefore, best be described as a controlled switching device. Such devices will. however. become more common and available to the constructor and experimenter as in the case of the transistor.

Silicon controlled rectifiers have a low forward voltage drop which permits high current ratings and high efficiency with low voltage requirements. Considering these devices, one will appreciate that they have three rectifying junctions. as can be seen from Fig. 1. The first "n" is known as the cathode. whereas the first "p" is known as the "gate." This termination acts as a grid as in thyratron practice and does not, therefore, need further explanation. The second "p" type is known as the anode and likewise, the reader will appreciate its use.

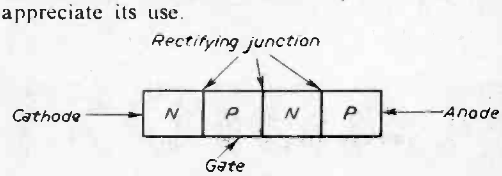


Fig. 1.—Diagram of the device.

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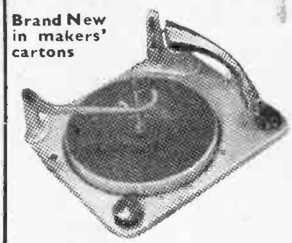

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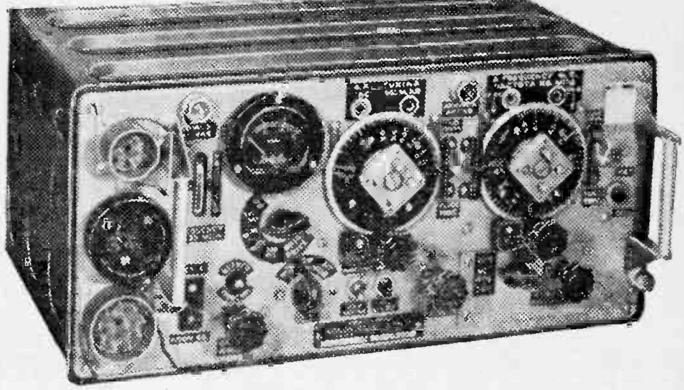

FURTHER IMPROVEMENTS

By D. W. Dillon

THE recent release of thousands of ex-army American-built W.S. No. 19 Mk.2's has resulted in almost every enthusiast's shack in the country containing one. While they are generally used in their original condition, several major defects soon become apparent. The first and most important of these is a great lack of selectivity—the subject of a recent PRACTICAL WIRELESS article. The second fault is that too much associated equipment is necessary for the operation of the set: power unit, accumulators, junction box, microphone, headphones and heavy connectors! The AVC action is too heavy and sluggish and the signal to noise ratio is very poor. It is very difficult to transmit good CW because of the lack of sidetone facilities. On telephony the output power is very low, the modulation invariably downward, and the speech quality poor. It is therefore fortunate that by the removal of the "B" set and "I.C." amplifier, much space is available for modifications. Although several amateurs have modified the "B" set for local two-metre use, in the majority of sets, this space simply goes to waste.

Modifications

The first part of this article should be of interest to all 19 set owners, and the carrying out of the simple modifications described results in transformation into a highly sensitive, selective and inexpensive mains-operated receiver. The second part of the article concerns the transmitter modifications and is of particular interest to licensed radio amateurs and those who hope to obtain a licence shortly. It should, however, be noted that, as with any radio transmitter, no matter how low the power, a Post Office licence is necessary before any attempt is made to transmit into an aerial.

The transmitter modifications will allow fully automatic sidetone monitoring on CW. The original circuit allowed only 12W input at about 30 per cent. efficiency on telephony, which does not usually result in flattering signal reports! This article will describe the addition of a 15W modulator stage requiring few extra components and which will allow 30W of good quality 100 per cent. modulated phone output to be run to the 807 P.A. Alternatively series-gate modulation is also described which gives carrier controlled output. The advantage of this method are the small space and few components required, but the disadvantages are lower efficiency and the necessity for 67½-90V negative bias on the modulator.

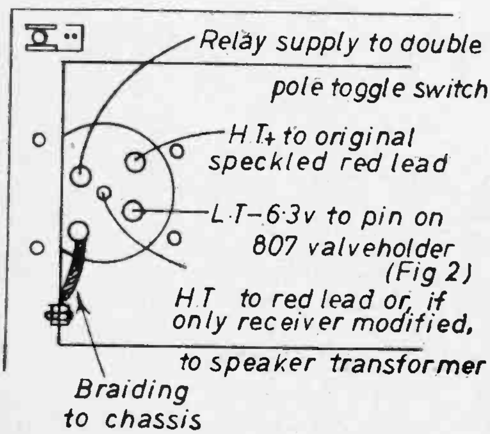

Fig. 1.—Wiring of the five-pin holder.

Testing

Having received the set, it is strongly recommended that it be tested in its original form, by obtaining the loan of the associated equipment. After it has been proved to be working satisfactorily, the B set and I.C. amplifier are stripped out. All the components to the left of the above-chassis screen (when looking at the front panel) should be removed, as should also those to the left of the below-chassis relays, with the exception of the key jack leads, the leads to pin 4 (green) on the 12-way plug and those to pins 4 (red) and 6 (speckled red) on the six-way plug. The B set gain control also remains. The six- and 12-way plugs are removed, the 12-way one being discarded and replaced by a British five-pin socket. The inside "plug" part of the five-way plug is discarded, the outside casing being once again bolted on to the panel, with a Mazda octal valve-holder bolted behind the panel to receive the speaker and remote control plug. The braided earth lead is connected to tag 3 on the holder.

while the original red (H.T.) leads are re-routed under the chassis, being connected to the five-pin socket as shown in Fig. 1. A closed circuit jack is substituted for the "quench control" grommet.

6V Operation

The 12V line is earthed at the 807 valveholder (Fig. 2), and a lead taken from the other heater tag to the five-way socket. This allows 6V operation of the heater chain. The green lead (ex-pin 4 is attached to the headphone jack socket. The

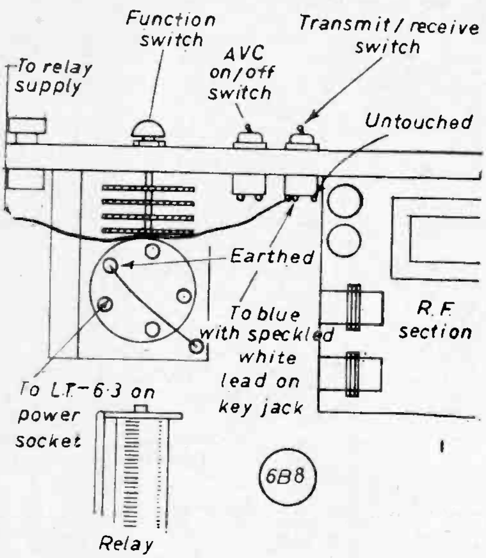

Fig. 2.—L.T. circuit rewiring.

leads to the single-pole toggle switch on the front panel are removed, as are also the left-hand section leads on the double-pole toggle switch.

The green and blue leads on the other section should not be disturbed. The large 0.1μF paper condenser fixed to the chassis beside the P.A. tuning condenser is replaced by a 750VW, 0.0005μF type. The 10Ω variable resistor (het tone) is removed and the leads insulated. In its place is mounted a 10k wire-wound potentiometer. The resistor between the cathode (pin 8) of V1A (6K7) and earth is disconnected from the chassis tag, and joined to the potentiometer slider. The left-hand tag of the potentiometer is earthed. This is the new R.F. gain control. The single-pole toggle switch on the front panel is used as the AVC on/off switch, being connected between chassis and the AVC line (white) on the tagboard near the 6B8 valveholder.

The bracket which originally supported the B set tuning condenser is modified to support a miniature air-spaced 0.0005μF variable condenser. This bracket is replaced in its original position, together with the calibrated knob. A 1½in. diameter 3in. coil former 3in. long is wound with 18 turns 22s.w.g. tinned-copper wire, evenly spaced over 2¼in., is mounted directly on the old E1148 valveholder. One end is joined to a soldering tag on the tuning condenser frame, and the other to the fixed vanes. The B set aerial socket is removed and replaced by a small ceramic feed-through insulation. This is joined to the fixed vanes. A four turn insulated link is fixed around the earthed end of the coil, and connected to a short piece of 80Ω coaxial cable, which passes directly under the condenser spindle and meter to the tank coil. The original screened box is replaced over the aerial tuning components.

Diode

A crystal diode is connected, with the black end to the fixed vanes and the red end to the small tagboard in the screened box. A wire is taken from this in the direction of the tank coil and marked for later described modifications. The lid of the box is fixed in position. The lead to the A set aerial socket is removed, together with the connection to C1A and the R.F. CL2B.

The tank coil L3A is removed, the connections being noted. The tapping point is ignored, and about three turns removed from the upper end. A four-turn insulated link is wound on the lower end and connected to the coaxial cable. The coil is replaced, the coaxial cable outer sheath being earthed to chassis at its base and all the original leads, with the exception of that to the tapped point, being reconnected to the coil. The set is now ready for testing.

(To be continued)

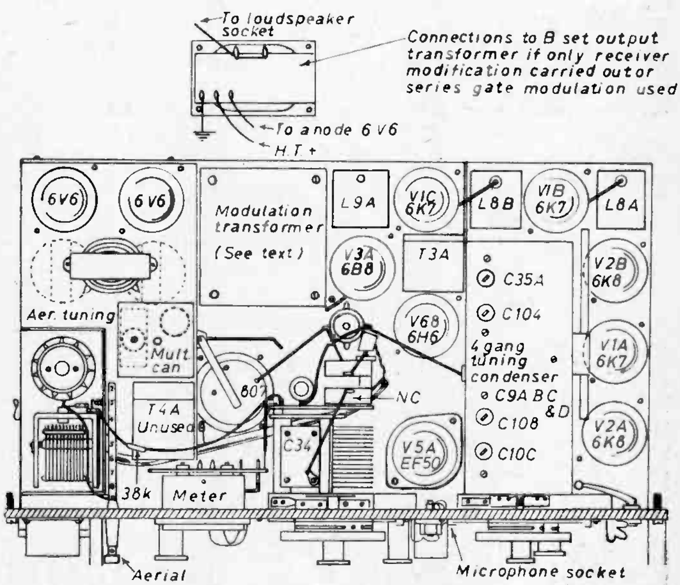

Fig. 3.—Top view of modified 19 set.

Transistorised Timing Unit

AN INEXPENSIVE CIRCUIT By L. Baker

THIS photographic process timer is simple to use, inexpensive to build, and small in size, making it a useful accessory in any amateur's darkroom. There are very few parts, and the average constructor will have many, if not all, of these already to hand. The circuit uses a single transistor of the red spot surplus type which makes possible the small size of the finished unit. The size of the case of the prototype is 3 × 5½ × 2in. This case was originally intended as a food box of the plastic type and is obtainable from all multiple stores. Other types of box or case can, of course, be used, but it is best to use insulating materials such as wood or plastic for the case of this unit so as to prevent any possibility of electrical shock.

Relay

Generally, the size of the relay used will govern the actual size of the finished unit. The relay must have a coil resistance of 2,000Ω. In the original model, a surplus type of relay was used, although the P.O. type 3000 works just as well, as indeed will any relay having the required coil resistance. The contacts of the relay must be capable of carrying a reasonably large current dependent on the lamp type in the enlarger. The condenser C1 in the diagram (500μF) is made up of two units of 250μF each. However, any number of condensers may be connected in parallel in order to obtain the required 500μF. The positive side of all the condensers used must be connected together as should the negative sides. The small transistor capacitors now on the market will suit admirably and any number of these connected in parallel to give the 500μF will suit.

The 2k potentiometer should preferably be a wire-wound type in the interests of accuracy and long service. In the prototype the on/off switch is ganged with this potentiometer, but a separate on/off switch could be fitted if it is considered desirable. The tag strip fitted inside the case serves the useful purpose of providing anchoring points for the wiring and transistor. The resistor R2 in the diagram is 100Ω and rated at ½W. A larger wattage component could be used here if ½W type is not to hand. The output socket mounted at the side of the plastic case in the prototype was taken from an old L.T. battery of the "dry" type. The writer used this socket as it was small and neat and easily mounted. Other two-pin sockets will suit just as well.

The relay should be mounted first and holes should be drilled in the case for the fixing bolts. Holes should be then drilled for the potentiometer, S2, the tagstrip, and the output socket. Having drilled the holes, all the parts should be removed from the case which should be covered with one of the thermoplastic materials now available. Alternatively, if a plywood case is used, this can be covered in rexine or similar material. Readers who are skilled in woodworking may care to sand and polish the case. All parts may now be mounted again and the wiring completed. It is best to wire in the transistor last and a heat shunt should be applied to the wires of this component while the iron is applied in order to avoid damage to this component. A pair of tags on the tagstrip are utilised to secure the mains flexible lead; one lead (neutral) from the mains is wired from the tagstrip directly to the output socket, the other lead being taken also to the output socket via the relay contacts.

Batteries

The batteries in the prototype unit were enclosed in the case of the unit. These batteries consisted of two transistor power supply batteries (each of 9V) wired in series to give 18V. One terminal of the on/off switch serves as the anchor point for the positive connection to the batteries. The negative connection to the batteries is taken from one terminal of the relay coil. The other parts are suspended in the wiring. Some of the tags on the strip are not used at all and some serve the purpose of anchoring the tagstrip to the plastic case by means of small nuts and bolts. Good quality plastic insulation wire should be used throughout. All wiring on completion should be double checked with batteries disconnected, for possible mistakes or short circuits. It is a good idea to include a 0-5mA meter in series with the positive lead to the batteries as a temporary check. On switching on a small current should flow: approximately 1 to 2mA, certainly no more.

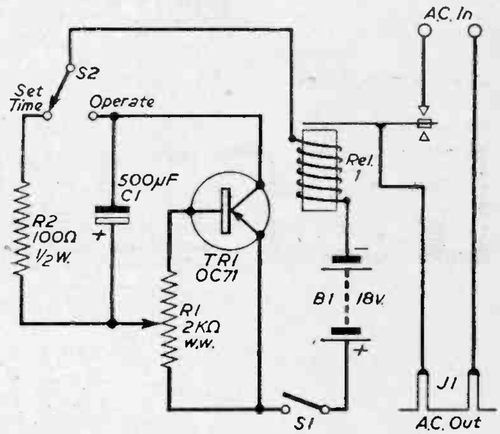

Fig. 1.—The circuit diagram.

To test and calibrate the instrument, the dial must be marked out and attached to the face of the instrument temporarily. It is not possible to mark in the seconds time on the dial accurately without at first experimenting with the completed unit.

(To be continued)

Switch-tuned T.R.F.

HIGH QUALITY RECEPTION OF LOCAL TRANSMISSIONS

By J. Lanspeary

THIS set was designed and built to provide a small, robust "kitchen" radio to receive the local M.W. transmissions, which in the author's area include the BBC Light Programme on 247 metres. The circuit is extremely simple, being a T.R.F. without reaction, using an infinite impedance detector to provide at least one circuit which tunes sharply. Miniature valves were used because these were to hand, but there is, of course, no reason why octal types should not be used; they have the advantage of cheapness. It is recommended, however, to use the specified valve as detector/A.F. amplifier, as the writer has found that the infinite impedance detector is subject to microphony, especially when mounted near the loudspeaker.

The 6AM6 used as R.F. amplifier is one of few valves which may be run with a screen voltage of 250, and a change here might call for a series screen resistor and associated decoupling condenser.

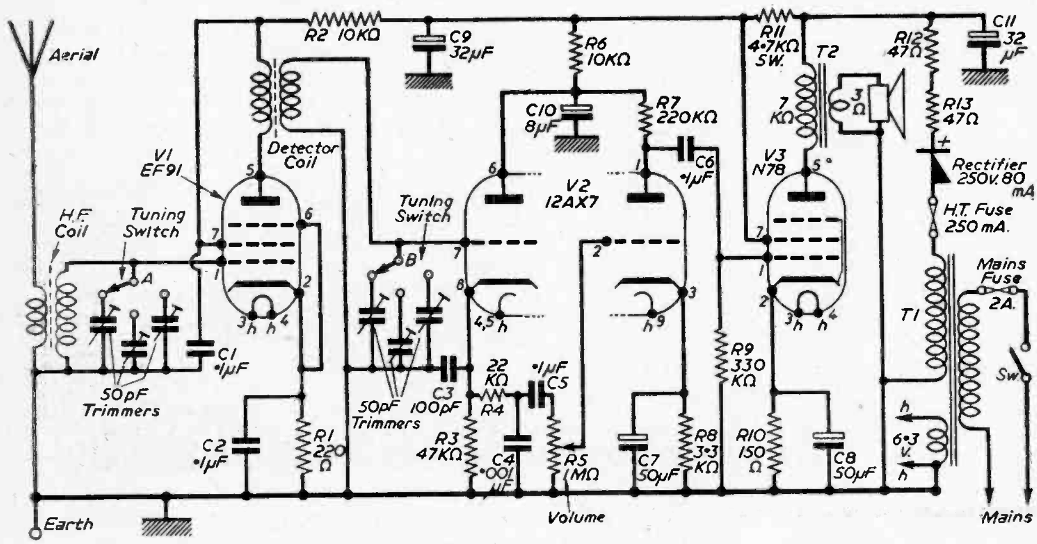

Fig. 1.—The circuit diagram.

Tuning

Switch-tuning was employed as it does away with the need for a dial and drive assembly, surely one of the most trying parts of a receiver. Also, it takes up less room.

Since the Light Programme was available on medium wave, this simplified matters considerably. The coils chosen were Osmor types QA11 and QHF11. These are aperiodic-type coils with dust-iron cores; they are very small and rather fragile, but the performance is very good. Tuning was carried out by a two-bank three-way Yaxley-type switch, and two banks of 3 × 50pF trimmers. All wiring to trimmers and switch was made in screened wire. Grid and anode leads may also be screened to advantage.

When wiring up around the 12AX7 base it will be found that a piece of tagboard is useful to mount the detector cathode components, and also the anode resistors. Wire up the power pack first, then the heaters, then the rest of the circuit backwards, beginning with the output stage and ending with the tuning switch.

The prototype used a 3in. deep chassis; this

(*Continued on page* 969)

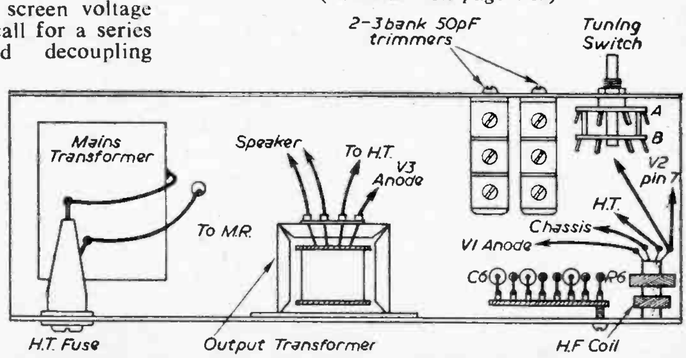

Fig. 2.—Underchassis layout.

WEYRAD

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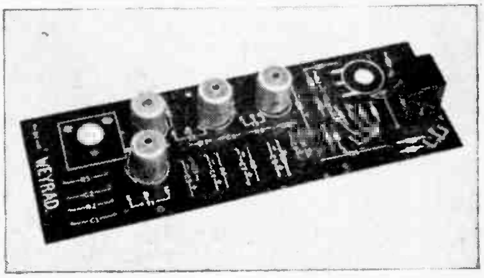
LONG AND MEDIUM WAVE AERIAL—RA2W
On 6in. rod, 7/16in. diameter, flying lead connections, 208 pF tuning **12/6**

OSCILLATOR COIL—P50/1AC
Medium wave in screening can. For 176 pF tuning condenser **5/4**

1st AND 2nd I.F. TRANSFORMERS—P50/2CC
470 Kc/s operation with 250 pF tuning in cans. 11/16in. diameter by 3/4in. high **5/7**

3rd I.F. TRANSFORMER—P50/3CC
Last stage transformer to feed diode detector. Size as P50/2 ... ... **6/-**

DRIVER TRANSFORMER—LFDT2
Upright mounting with six connecting tags— $1\frac{5}{16}$in. x $\frac{7}{8}$in. x $1\frac{3}{4}$in. **9/6**



PRINTED CIRCUIT—PCA1
Size $2\frac{3}{4}$in. x $8\frac{1}{4}$in. Ready drilled and printed with component positions **9/6**

THESE COMPONENTS ARE APPROVED BY TRANSISTOR MAKERS AND PERFORMANCE IS GUARANTEED.

Constructor's Booklet with full details, 2/-.

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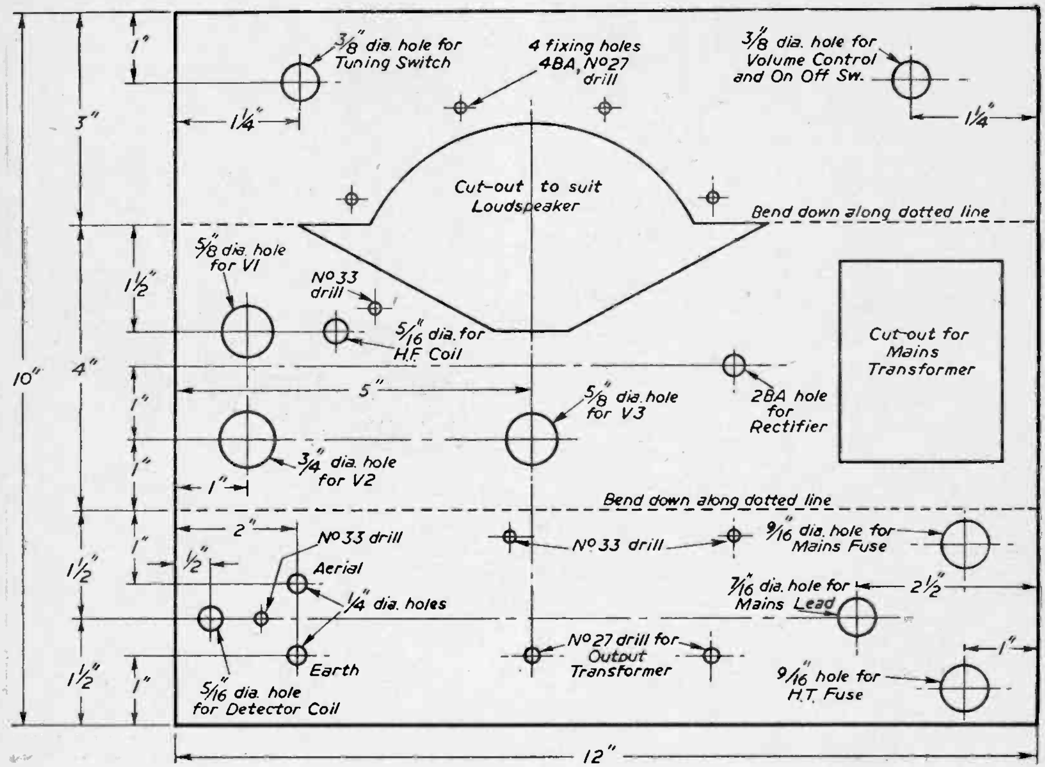

Fig. 3.—Chassis drilling details. (This diagram is not to scale.)

enabled the switch to be mounted underneath the valveholder wiring.

The Circuit

This is very simple. The first valve is connected as a tuned R.F. amplifier, feeding the first section of a 12AX7, which is connected as an infinite-impedance detector. The advantage of this type of detector is the very low loading which it imposes on the tuned circuit which feeds it. The result is that this tuned circuit tunes sharply, resulting in a great increase in selectivity.

The A.F. output is developed across the 47k detector cathode resistor. Residual R.F. is removed by the filter C3, R4, C4, and the D.C. component blocked by C5. Thereafter the signal passes to the second half of the 12AX7, which operates as a high gain A.F. amplifier, and to the output valve. This is an N78, rated to give 4W output into a 7k load, with 250V H.T.

The power supply circuit is also very simple, consisting of a half-wave metal rectifier, resistance-capacity smoothing, and mains transformer. Two 47Ω resistors are fitted in series with the rectifier; these can be of the ½W carbon type, and their function is to protect the rectifier from the initial surge which occurs when the electrolytic condensers charge up as the set is switched on. The main smoothing resistor is R11, and it is recommended that this be a vitreous wirewound type, as it becomes quite hot.

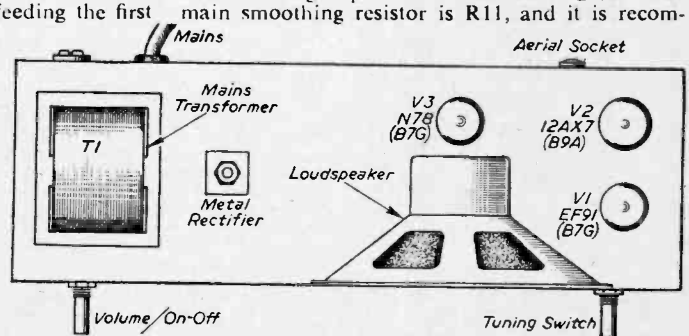

Fig. 4.—Above-chassis layout.

Performance

As can be expected, this receiver is not particularly sensitive, being a T.R.F. without reaction. However, it does give very good reproduction of the stronger signals put out by the BBC in the

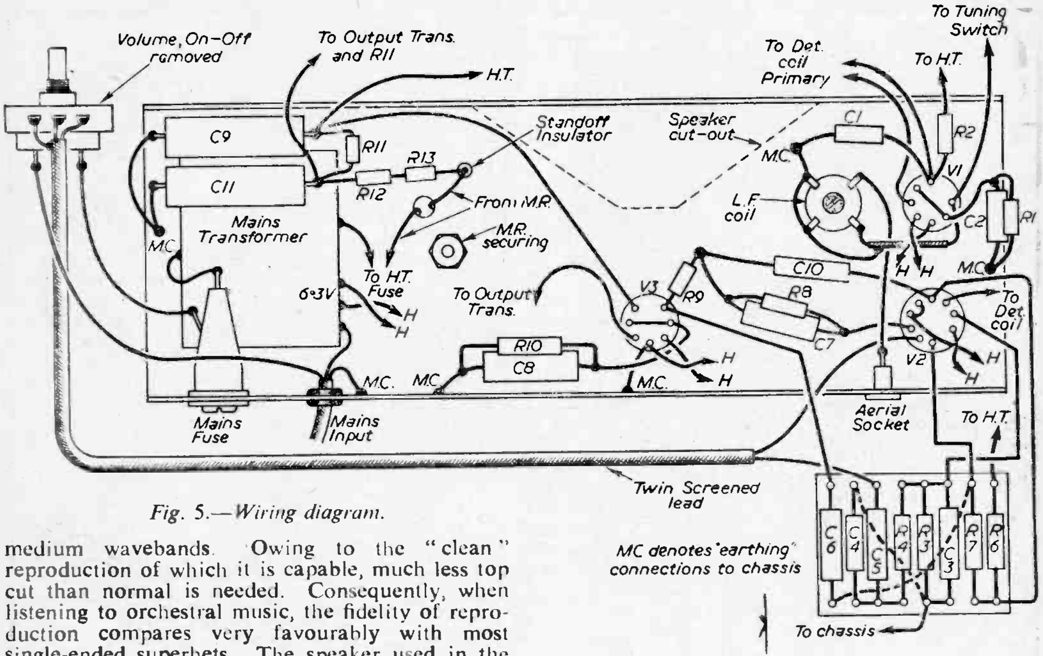

Fig. 5.—Wiring diagram.

medium wavebands. Owing to the "clean" reproduction of which it is capable, much less top cut than normal is needed. Consequently, when listening to orchestral music, the fidelity of reproduction compares very favourably with most single-ended superhets. The speaker used in the prototype was an 8in. wafer type, measuring less than 2in. back to front, and it was mounted on the chassis.

The results quoted were with 3ft. of 18s.w.g. copper wire used as an aerial and the chassis connected to mains earth (a very desirable feature when the set is housed in a cupboard, not a cabinet!). With a picture-rail aerial, some 15ft. long, volume is much increased, but selectivity becomes a problem, the longer aerial damping the first tuned circuit.

A QUALITY F.M. RECEIVER

(*Continued from page* 932)

ping screws passing through the bottom into the chassis flanges.

Although the values of the various components used in this receiver can be determined from the text and the circuit diagrams, some readers may find it easier to buy components from the list which is given below. When ordering, it may be found that some components are temporarily out of stock and if this is so the advice of the dealer should be taken concerning suitable equivalents.

COMPONENTS LIST

Resistors :
(All ¼W unless otherwise stated.)
R1—18k.
R2—4.7k ½W
R3—6.8k ½W
R4—150 Ω.
R5—100k.
R6—47k ½W
R7—4.7k ½W
R8—4.7k ½W
R9—47k.
R10—150 Ω.
R11—47 Ω.
R12—47k ½W
R13—47 Ω.
R14—6.8k.
R15—6.8k.
R16—1M.
R17—27k.
R18—1M.
R19—1M.
R20—47k.
R21—270k ½W
R22—2.7k.
R23—22 Ω.
R24—10k ½W
R25—47k.
R26—1M.
R27—2.2k.
R28—47k.
R29—470k.
R30—470k.
R31—600 Ω 1W
R32—See text (p. 848 February issue).
R33—100k.
VR1—2.2k pot. wire-wound.
VR2—1M log.

Capacitors :
C1—1,000pF ceramic.
C2—1,000pF ceramic.
C3—1,000pF ceramic.
C4—1,000pF ceramic.
C5—1,000pF ceramic.
C6—47pF ceramic.
C7—47pF ceramic.
C8—33pF ceramic.
C9, C10—25+25pF ganged.
C11—1,000pF ceramic.
C12—10,000pF ceramic.
C13—10,000pF ceramic.
C14—10,000pF ceramic.
C15—47pF ceramic.
C16—10,000pF ceramic.
C17—Not used.
C18—300pF mica or ceramic.
C19—300pF mica or ceramic.
C20—300pF mica or ceramic.
C21—50 μF electrolytic 25VW
C22—50 μF electrolytic 25VW
C23—2,000pF ceramic.
C24—0.01 μF paper 200VW
C25—8 μF electrolytic 350VW
C26—50 μF electrolytic 25VW
C27—0.01 μF 300VW
C28—8 μF electrolytic 350VW
C29—0.01 μF 300VW
C30—0.01 μF 300VW
C31—16 μF electrolytic 350VW
C32—16 μF electrolytic 350VW
C33—See text (p. 848 February issue).

Sundries :
IFT1, IFT2, 10.7Mc/s I.F. transformers.
RDT ratio detector transformer.
L1—See text and Fig. 3b.
L2—See text and Fig. 3a.
L3—See text and Fig. 3a.
L4—LF choke 10H 60mA.
T1—Output transformer Wharfdale GP8.
T2—Mains transformer 250-0-250V 60mA 6.3V 4A.

Valves :
V1, V2, V3, V4—EF91.
V5—ECC81 or ECC83.
V6, V7—EL91.
V8—6X5.
V9—EM34.

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Single 'phone, **4/6.**
Battery, **2/-.**
All components available separately. Stamped, addressed envelope for details.

PERSONAL PORTABLE

A wonderful little set that you can take anywhere. Ideal for camping, picnics, etc. Telescopic aerial rod supplied. Covers Medium Waveband 200-500 metres. Can be built in approx. 1 hour. All necessary components available at the following SPECIAL INCLUSIVE PRICES : 1-valve version ONLY **35/-.** 2-valve version ONLY **41/-.** Plus 2/- P. & P. Send for point-to-point wiring diagram and parts price list 2/-, post free.

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New E.M.I. t/up spools in polythene bag, 3/6 each, post free. 6 for 20/-.

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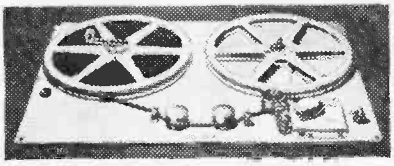
Tape Deck and Amplifier Kits



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Mr. R. White of Omagh, N. Ireland, writes : *"The performance of the recorder is very good, and I recommend it to all those who wish to get first class performance at approx. half the cost."*

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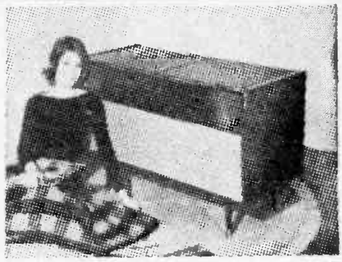

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RADIOSTRUCTOR

BRITAIN'S LEADING RADIO TRAINING ORGANISATION

Club News

REPORTS OF CURRENT ACTIVITIES

ALDERSHOT & DISTRICT AMATEUR RADIO SOCIETY
Signals Wing, No. 4 Training Regiment, Royal Engineers, Gibraltar Barracks.
Hon. Sec.: A. M. Laidler.

MEETINGS are held every Wednesday at the above address at 7.30 p.m. with the exception of the second Wednesday in each month when the meeting is held at "The Cannon," Victoria Road, Aldershot.

A technical course of training to R.A.E. standards was started in January in readiness for the May examination. It is also hoped to run Morse training periods for those persons requiring this type of training.

The society requires instructors and lecturers to give instruction to R.A.E. standards and licensed amateurs who are willing to devote a little time to instruct new members. All correspondence should be addressed to the hon. sec. at "Pondside," Sandy Lane, Churt, nr. Farnham, Surrey.

BRIGHTON AND DISTRICT RADIO CLUB
Home Guard Club, British Legion, 76, Marine Parade, Brighton.
Hon. Sec.: H. R. Henly (G3IHR).

ON January 6th Mr. D. Hemsley gave a talk on "A Home-built Oscilloscope for TV Servicing," and on January 20th a filmshow was held at the H.Q.

Future events:
February 10th.—Informal evening.
February 17th.—Filmshow.
February 24th.—"A Home-built Tape Recorder," by Mr. D. Hemsley.
March 2nd.—Informal evening.
March 9th.—"The Design of Communication Receivers," by H. R. Henly.
March 16th.—Filmshow.
March 23rd.—Informal evening.
March 30th.—Demonstration of the Geloso G209R Receiver, by R. Smith.

BRITISH INSTITUTION OF RADIO ENGINEERS
9, Bedford Square, London, W.C.1.
Meetings for February, 1960

LONDON Section.—Meetings are held at the London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1.

Tuesday, February 9th.—At 6.30. Computer group. "Drift Correction of D.C. Amplifiers," D. Leighton Davies.

Wednesday, February 24th.—At 6.30 p.m. Medical electronics group. "The Unification of Electronic Clinical Instruments," Dr. F. D. Stott.

Bristol, South-western Section.—Meetings are held at the School of Management Studies, Unity Street.

Wednesday, February 24th.—At 7 p.m. "Industrial Magnetic Recording and Playing Machine Design," J. Elliot.

Cardiff, South Wales Section.—Meetings are held at the Welsh College of Advanced Technology.

Wednesday, February 10th.—At 6.30 p.m. "Low Noise Low Drift D.C. Amplifiers," V. L. Devonald, B.Sc.

Newcastle-upon-Tyne, North-eastern Section.—Meetings are held at the Institution of Mining and Mechanical Engineers, Neville Hall, Westgate Rd.

Wednesday, February 10th.—At 6 p.m. "Instrumentation in Rocket Propulsion," Raymond E. Ross (Associate Member).

Wolverhampton, West Midlands Section.—Meetings are held at the College of Technology, Wulfruna Street.

Wednesday, February 10th.—At 7.15 p.m. "Electronic Reading," I. W. Merry.

BRITISH SOUND RECORDING ASSOCIATION

LONDON Meetings.—Meetings are held at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2.

Future events:
February 19th.—At 7.15 p.m. "The Sounds of Music," W. H. George, M.Sc., Ph.D., F.Inst.P.
March 18th.—At 7.15 p.m. Talk by R. S. Roberts, M.Brit.I.R.E. Sen.M.I.R.E.
April 22nd.—At 7.15 p.m. "Sound Radiation from Loudspeaker Cabinets," James Moir, M.I.E.E.
May 21st.—Amateur competition display—annual general meeting to be held in the evening at the Overseas League, St James's, S.W.1.

South-western Centre.
Centre Organizer: D. W. Aldous, "Alderbourne," Greenways Road, St. Marychurch, Torquay, Devon. Meetings are held at Callards Cafe at 7.45 p.m.

March 3rd.—"High Fidelity Sound Reproduction," N. Mordaunt (Tannoy).

CALCOT RADIO SOCIETY
Hon. Sec.: C. Aldous, 3, Oliver Drive, Calcot, Reading, Berkshire.
Future events:

FEBRUARY 18th.—Lecture and demonstration of Hi-Fi equipment by a representative of E.M.I. Sales.
March 17th.—Lecture on the suppression of electrical interference in TV and radio sets, by Mr. Richardson of the G.P.O.
April 21st.—A lecture and demonstrations by a representative of Truvox.
May 19th.—Lecture and demonstration on the Design of Hearing Aid Equipment, by Mr. Williams, of Belclere Ltd.

CHILTERN AMATEUR RADIO CLUB
Hon. Sec.: R. Barton, 25, Hillside Road, Marlow, Bucks.

MEETINGS are held at the British Legion Club, St. Mary's Street, High Wycombe, on the last Thursday of each month.

Future events:
February: "Some Aspects of Aerial Design"—G3LSK.
March: Mullard Film Show—G3INZ.
April: Junk sale and Quiz.
May: Mobile gear for the Amateur Band.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: F. C. Ward (G2CVV), 5, Uplands Avenue, Littleover, Derby.

MEETINGS are held in Room No. 4, 119, Green Lane, Derby.

Future events:
February 7th, at 7.30 p.m.: Proposed date for contest for G5YY.
March 18th, at 7.30 p.m.: Proposed date for annual dinner and dance.
August 14th, at 7.30 p.m.: Third annual mobile rally.

HALIFAX AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson (G3MDW), Candy Cabin, Ogden, Halifax.

ON December 8th members heard a lecture dealing with radio astronomy by Mr. Doihty, of Halifax, and on February 2nd H. Makin (G3FDC) gave a lecture on the S.W.R. Bridge.

Future events:
February 16th: Informal meeting.
March 1st: Film show.

NOTTINGHAM CO-OPERATIVE AMATEUR TAPE RECORDING SOCIETY

OWING to accommodation difficulties the meeting night has been altered to Thursday. A fairly detailed programme has been planned for the first few months of 1960 and, as several members have expressed the desire to know more about tape recorders, a series of informal discussions have been arranged to be given by experienced members. Alternate subjects deal with technical aspects and this means that the club will have meetings every other Thursday on February 18th, March 3rd, 17th, 31st, April 14th and 28th, etc.

THE RADAR AND ELECTRONICS ASSOCIATION
Hon. Sec.: C. W. Knight, 83, Portland Place, London, W.1.

MEETINGS are held at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2, at 7.30 p.m.

Future events:
February 9th: "Transistors—Today and Tomorrow," by E. Wolfendale, B.Sc.(Eng.), A.M.I.E.E.
March 28th: "Computers—Some Design Problems of Large-scale Computers," by Peter D. Hall, of Ferranti Ltd.

THE READING AMATEUR RADIO CLUB
Hon. Sec.: R. J. Nash (G3EJA), "Peacehaven," 9, Holybrook Road, Reading.

ON January 30th a meeting was held on morse instruction, following the discussion on field day activity for the new year. A junk sale was held afterwards.

Future events:
February 27th: Film on the manufacture and application of transistors.

March 26th : Talk on the application of transistors to ham gear, in particular receivers and transmitters.

Meetings are held at Palmer Hall, West Street, Reading, at 7.30 p.m.

REIGATE AMATEUR TRANSMITTING SOCIETY

Hon. Sec. : F. D. Thom (G3NKT), 12, Willow Road, Redhill, Surrey.

MEETINGS are held at The Tower, High Street, Redhill, usually on the third Saturday in the month at 7.30 p.m.

The club visited the BBC station at Tatsfield on January 9th and the first annual general meeting was held on January 16th.

Future events :

February 7th : Annual dinner to be held at Laker's Hotel, Redhill. Tickets 15s. each.

February 20th : "The Story of Paul Bates (G3MAC)," by G2DVD, assisted by G3HCU.

March 19th : "TVI" by G4ZU.

THE SLADE RADIO SOCIETY

Hon. Sec. : C. N. Smart, 110, Woolmore Road, Erdington, Birmingham, 23.

MEETINGS are held at the Church House, High Street, Erdington, at 7.45 p.m. The club station (G3JBN) at the Church House is available for the use of members for constructional purposes.

Future events :

February 12th : Sale of surplus equipment.

February 26th : "Electronics in the Search for Oil," by G. T. Peck, M.B.E.

March 4th : Mullard film meeting, to be held at the Bennett Hall, Y.M.C.A., Snow Hill, at 7.45 p.m.

March 11th : Modern broadcast reception.

March 25th : "Electronic Digital Computers," by M. D. Fowler (G3GKZ).

THE TEESIDE AMATEUR RADIO CLUB

Hon. Sec. : A. L. Taylor (G3JMO), 12, Endsleigh Drive, Acklam, Middlesbrough.

MEETINGS are held at Settlement House, 132, Newport Road, Middlesbrough, every alternate Friday from February 5th until the Easter break.

WELLINGBOROUGH AND DISTRICT RADIO AND TELEVISION SOCIETY

Hon. Sec. : D. J. Trusler, 87, Irchester Road, Rushden, Northants. Club room above W.I.C.S. fruit shop in Silver Street.

MEETINGS are held in the club room every Thursday at 7.45 p.m.

Future events :

February 18th : Film night in the club room.

March 3rd : Talk on "Electronics and Radiation," by R. Mitchell, B.Sc.

Third Conference on Medical Electronics

To be held at Olympia, London, 21st-27th July, 1960

THE human body is made up of a number of inter-related systems—brains and nerves, heart and blood vessels, stomach and intestines, lungs and windpipe—and different electronic techniques can be used for their measurement and control.

In the respiratory system, one of the things the physician may need to know is the velocity with which air flows through the windpipe, and the volume of air respired at each breath. This may be measured by a device called a pneumotachometer. In this, the airstream passes through a piece of metal gauze. This causes a change in pressure which is related to the rate of flow. The change in pressure is minute, but it can be measured by an electronic-pressure gauge. The electric signal obtained is passed through a "black box" which instantaneously computes the volume of air breathed in a given time, and records it as a line on moving paper.

The physician may need to know the amount of carbon dioxide which is being excreted as a waste product into the expired air. This information can be obtained by chemical analysis, but a single determination would take a skilled technician half an hour or more. The modern method uses infra-red rays which are passed through a sample of the breath. The carbon dioxide present abstracts some of the energy from the rays. The lost energy can be measured, and because of the terrific speed of electronic techniques the breath can be analysed in this way in a few hundredths of a second. Thus not only can the amount of carbon dioxide be measured, but also the concentration in each fraction of the expired air, and this can be very helpful in the diagnosis of respiratory disease.

In poliomyelitis, the breathing muscles may be partly paralysed, and the patient's respiration may then have to be assisted by a machine. Electronic devices can now measure the patient's disability, and control the degree of assistance provided by the machine. In this way the volume of breathing is automatically adjusted to suit the need of the individual patient.

During anæsthesia, drugs may be used which produce a temporary paralysis of the breathing muscles, and here again an electronically controlled machine may take over the patient's breathing and keep its volume at the right level.

Servo systems are common in electronics, and a "servo-anæsthetiser" has been devised at the Mayo Clinic. This is worked by the activity of the patient's brain. This activity is measured electronically. An increase in this measurement indicates that anæsthesia is becoming lighter. This increase sets off a relay which raises the rate at which the anæsthetic is being delivered. Conversely, deepening anæsthesia results in a decrease in the rate of delivery. In this way the depth of anæsthesia is automatically held at any desired level.

These are but a few examples of the impact of electronics on two aspects of medicine. New uses are continually being found, and so rapid is the progress, in a dozen different countries, that international conferences to exchange ideas and to tell of new techniques are needed every year.

The next such conference is being organised by the Electronics and Communications Section of The Institution of Electrical Engineers in London next July. Doctors, biologists and electronic engineers from all over the world are being invited to attend. The proceedings are designed to appeal not only to the medical and electronic experts but also to those who are not themselves specialists, but who wish to get a general background to the many new techniques. It is expected that from this meeting of British and foreign talent, new methods of measurement and control, of diagnosis and treatment, will emerge to heal the sick.

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300 MODELS (1958-1959)

Covering many of the newer models now in use all over the country, this volume fills an urgent need for technical data.

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RADIO, RECORD & TAPE SERVICING DATA FOR—

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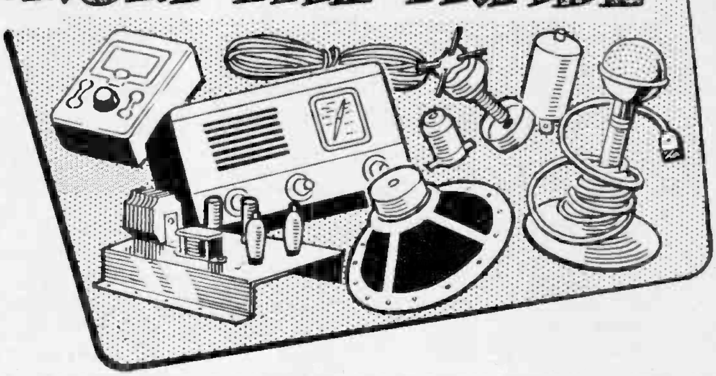
NEWS FROM THE TRADE

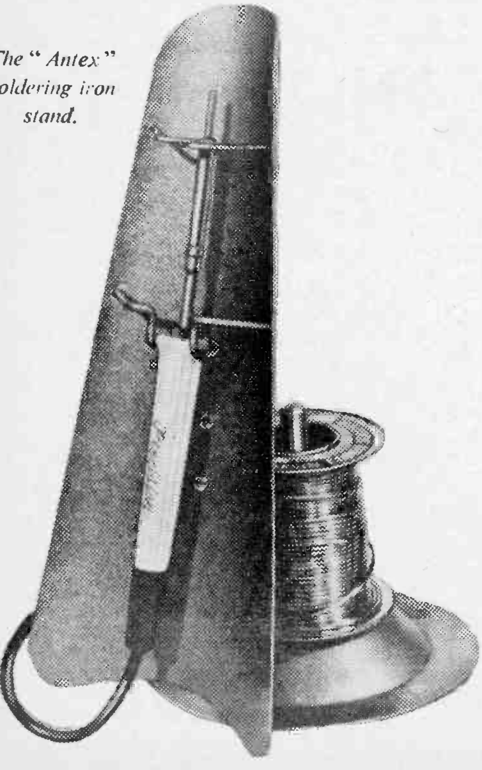


SOLDERING IRON STAND

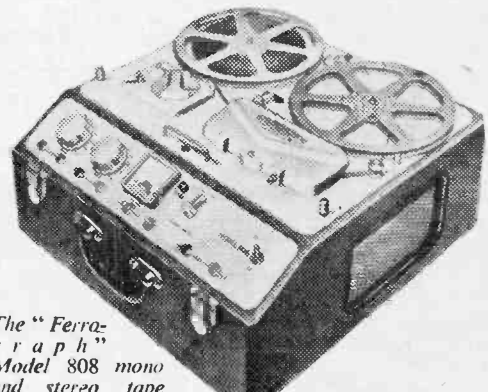
A NEW soldering iron stand is announced by Antex Ltd., and is suitable for bench mounting as well as for wall mounting. A reel of solder can be accommodated on the back. The iron shown in the illustration is of the mains type, and fitted with one of the five interchangeable bits. Soldering transistors without risk of damage is now possible by using the latest bit of only 0.040in. in diameter (1mm). It is necessary to touch the lead of a transistor for only a few seconds with this needle-type bit to solder or unsolder. The stand retails at 12s. 6d. *Antex Ltd., 7/8 Idol Lane, London, E.C.3.*

NEW TAPE RECORDER

A NEW tape recorder, Model 808, has been announced by Ferrograph. The purpose of the machine is to give both mono and stereo recording and reproduction on conventional tracks. There are complete recording amplifiers in both cases. Playback is at low level on all output channels: 1.5V across 5,000 ohms. The reason for this is twofold; in the first instance, it would not be possible to include two audio amplifiers in an already full portable case, and, secondly, the majority of serious users would be in possession of standard stereo amplifiers, and would have no need of further amplifiers of this type. In a two-tone, grey transportable cabinet, this model retails at 105 guineas. *British Ferrograph Recorder Co., Ltd., 131, Sloane Street, London, S.W.1.*



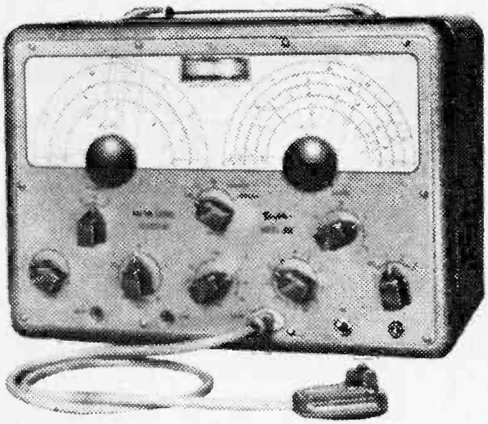
The "Antex" soldering iron stand.



The "Ferrograph" Model 808 mono and stereo tape recorder.

A.M./F.M. Signal Generator

A SIGNAL GENERATOR designed mainly for the servicing of A.M. and F.M. high frequency receivers and the intercarrier I.F. stages of television receivers was released in January by Taylor Instruments. This model (61A), provides in conjunction with an oscilloscope complete facilities for the sweep alignment of the R.F., I.F. and discriminator or ratio detector stages of A.M. and F.M. receivers. The A.M. generator covers the range 4-120Mc/s in five bands, all on fundamentals. The F.M. and sweep bands cover the frequencies 4-12Mc/s and 70-120Mc/s in three bands. Deviation on F.M. is variable up to 100kc/s from the mean carrier frequency at a modulation rate of 400c/s. All the facilities offered in the 61A model may be selected by internal switching. *Taylor Electrical Instruments Ltd., Montrose Avenue, Slough.*



The "Taylor" A.M./F.M. signal generator.

"THERMONIC OSCILLATORS"

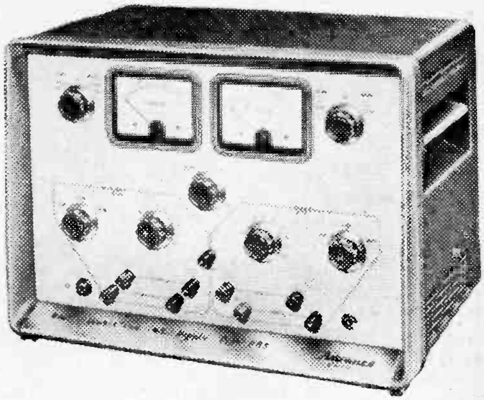
THE second of the new series of filmstrips introduced recently by the Mullard Educational Service to assist the teaching of electronic engineering in technical colleges and similar establishments has now been completed. The first strip in the series, parts 1 and 2, dealt with the basic principles of oscillation and the various forms of sinusoidal oscillators. "Thermonic Oscillators—parts 3 and 4" resumes the story with an exposition of non-sinusoidal oscillators. It explains the generation of pulses, square-waves, and sawtooth waveforms for television and oscilloscope timebases, and describes in detail the various forms of relaxation oscillator, blocking oscillator and multivibrator. The filmstrip comprises 22 frames in colour and may be obtained from the distributors. *Unicorn Head Visual Aids Ltd., 42, Westminster Palace Gardens, London, S.W.1.* price 25s.

"RADIO AMATEURS' HANDBOOK"

THE 27th edition of the *Radio Amateurs' Handbook* is to be published in 1960 and will remain the same price as the previous edition, which is 32s. 6d. For further information readers should contact *Arthur F. Bird, 66, Chandos Place, Strand, London, W.C.2.*

TRANSISTORISED STABLE D.C. SUPPLY

A TRANSISTORISED dual stabilised D.C. unit which provides two 0-30V, 1A stabilised supplies from a single instrument has been produced by "Advance." Both sections of the supply are floating and may be operated separately, or connected in series to provide a maximum output of 60V A.C. at 1 A. Similarly, both positive and negative voltage supplies may be drawn simultaneously up to a maximum of 30V each. The range of 0 to 30V in each section is covered in three 10V steps by means of a variable control directly calibrated in volts and the output is monitored by an ammeter and voltmeter which can be independently switched to either circuit as required. Four terminal output networks are incorporated which enables the effects of resistance of the connecting leads to the load to be virtually eliminated and overload protection is afforded by an electronic circuit which provides complete protection against both progressive overloads and short circuits. Protection against internal failure or excessive mains surges is provided by a panel-mounted fuse in the mains circuit. *Advance Components Ltd., Roebuck Road, Hainault, Ilford, Essex.*



The "Advance" stabilised D.C. unit.

TV SET FOR DESIGN CENTRE

A C.W.S. Defiant television set has been chosen by the Council of Industrial Design for exhibition in the Design Centre. Slimline model V101, it is a 17in. table model with 12 valves and a wide angle 110deg. tube.

CAREERS IN RADIO AND TELEVISION SERVICING

CAREERS for boys about to leave school, in the repair and maintenance of radio and television receivers, are described in *Radio and Television Servicing* (H.M. Stationery Office, No. 66, price 1s. 6d. net), a revised booklet in the "Choice of Careers" series published by the Central Youth Employment Executive.

A systematic approach is the basis of good servicing, and the booklet shows how the young trainee learns to identify the many different radio components, and to use hand tools and special test equipment, developing his knowledge of electrical theory at the same time.

The most common form of training in the industry is apprenticeship, and details are given of the national apprenticeship scheme drawn up by the trade and of the schemes operated by the Airways Corporations and the Service departments. Among the qualities needed for this occupation are dexterity, patience, perseverance and resourcefulness.

RETURN-OF-POST SERVICE

NEW ILLUSTRATED LISTS

New illustrated lists are available on all the following. Any will be sent free upon request.
GRAMOPHONE EQUIPMENT. Details of many types of Auto Changers, Single Record Players and Transcription Units including all the latest models. Many at special prices.
TEST GEAR. Test meters, Signal Generators, etc., by AVO, Jason, Pullin and Taylor.
LOUDSPEAKERS. Full details of Goodmans, Whiteley, Wharfdale and Elac types.
TAPE DECKS. All popular makes with a special offer.
RECORDING TAPES. A very wide range of all tapes and accessories.

RECORDING TAPE

DOUBLE PLAY

BASF. 300ft. (3in.), 14/- ; 600ft. (4in.), 25/- ; 1,200ft. (5in.), 42/- ; 1,600ft. (5¾in.), 52/6 ; 2,400ft. (7in.), 77/6.
SCOTCH BOY 200. 400ft. (3¼in.), 17/- ; 1,200ft. (5in.), 45/- ; 2,400ft. (7in.), 80/-.
TELEFUNKEN. 1,200ft. (5in.). In plastic container, 40/-. 1,800ft. (5¾in.) in plastic container, 50/-. 2,400 ft. (7in.) 75/-.
SPECIAL OFFER. 1,200ft. Standard Tape. Brand new. Famous maker. Fully guaranteed. 25/-. Four for 95/-.
Full range of standard and L.P. tape and accessories also stocked. Send for list. All tape post free.

MULLARD LUMENAR CATHODE RAY TUBES

• ATTRACTIVE PRICE. • 12 MONTHS' GUARANTEE. • AVAILABLE ON HIRE PURCHASE

12in. MW31/74. 14in. MW36/24. MW36/44. AW36/20. AW36/80. All £8.19.6. Hire Purchase Deposit £1.15.6 and 12 monthly payments of 13/8.

17in. MW43/69. MW43/80. AW43/80. All £10.7.6. Hire Purchase Deposit £2.1.6 and 12 monthly payments of 15/6.

ALL OTHER TUBES can be supplied at list prices. Many recently reduced. Send for free list or ask for quotation. H.P. available. ALL SENT CARRIAGE AND INSURANCE FREE.

GRAMOPHONE EQUIPMENT

ALL LATEST MODELS

	Cash Price	Hire Purchase Deposit	Mthly. Pmts.
RECORD CHANGERS			
COLLARO Conquest (Studio O PU)	£7.19. 6	£1.12. 0	6 of £1. 4.7
GARRARD RC121 (GC8 PU)	£9.19. 6	£1.19. 6	12 of 15/-
GARRARD RC88 (GC8 PU)	£16. 8. 0	£3. 6. 0	12 of £1. 4.0
GARRARD RC98 (GC8 PU)	£18.12. 8	£3.15. 8	12 of £1. 7.3
B.S.R. UA8 Monarch (TC8 PU)	£7. 5. 0	£1. 9. 0	6 of £1. 2.8
BSR UA12 Monarch (TC8 PU)	£9.19. 6	£1.19. 6	12 of 15/-
BSR UA12 Monarch (TC8S Stereo PU)	£10.17. 6	£2. 3. 6	12 of 16/2
SINGLE RECORD PLAYERS			
GARRARD TA (GC8 PU)	£8.10. 0	£1.14. 0	12 of 13/-
BSR TU9 (TC8 PU)	£4.10. 0	£1. 5. 0	3 of £1. 5.0
COLLARO RP584 (O. P or T PU)	£8.18.11	£1.15.11	12 of 13/7
COLLARO RP594 (O. P or T PU)	£9.18. 9	£1.18. 9	12 of 15/-
E.M.I. (Acos Stereo P.U.)	£6.15. 0	£1. 7. 0	12 of 10/8
TRANSCRIPTION UNITS			
COLLARO 4T/200 (TX88 PU)	£18.13. 0	£3.15. 0	12 of £1. 7.4
COLLARO 4TR/200 Motor only	£13.18. 3	£2.15. 3	12 of £1. 0.5
GARRARD 4HF (GC8 PU)	£18. 9. 9	£3.15. 9	12 of £1. 7.0

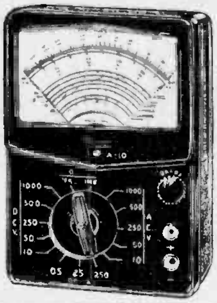
Many of the above can be supplied for stereo working. See our Gramophone Equipment List for details.

MULLARD TAPE PRE-AMPLIFIER

This unit is intended for use with an existing amplifier and provides all the circuits necessary for tape recording and playback. Instruction manual, giving full constructional information is available price, 2/10, post free.
COMPLETE KIT containing every item required down to the last nut and bolt. First-class items only included. £14.7.0. H.P. Deposit £2.17.0 and six monthly payments of £2.2.6. Kit less valves, £10.19.6. H.P. Deposit. £1.19.6 and six payments of £1.13.4. Power Unit kit, £3.19.6.

LATEST CABY TEST METERS

Now in stock. CABY SUPREME MULTI-RANGE METERS. Made abroad. We can confidently recommend these meters as being accurate, well made and very good value for money.



MODEL A-10. Sensitivity 2,000 ohms per volt A.C. and D.C. Five voltage ranges 10-1,000 volts A.C. and D.C. Three D.C. current ranges .5-250 ma. Two resistance ranges. Size 5¼in. x 3¾in. x 1¼in. Price. £4.17.6. H.P. Deposit £1.7.6 and three monthly payments of £1.6.8.

MODEL B-20. Sensitivity 4,000 ohms per volt A.C. and D.C. Voltage ranges—Five D.C. 10-1,000 volts. Four A.C. 10-1,000 volts. Four D.C. current ranges. .5-250 ma. Four resistance ranges. Price £6.10.0. H.P. Deposit £2 and three monthly payments of £1.13.4.

Illustrated leaflet giving full details of both models free upon request.

LATEST AVO TEST METERS

AVO METER MODEL 8. The finest multi-range meter available. 20,000 ohms per volt on D.C. ranges. Eight D.C. Voltage ranges 2.5 v. to 2,500 v. Seven D.C. current ranges 50 microamps. to 10 amps. Seven A.C. Voltage ranges 2.5 v. to 2,500 v. Four current ranges 100 mA. to 10 amps. Three resistance ranges. Fully detailed leaflet available. Price £23.10.0. H.P. Deposit £4.14.0 and 12 monthly payments of £1.14.6. Price with leather carrying case, £27.8.0. H.P. Deposit £5.8.0 and 12 payments of £2.0.4.
Other AVO Meters available include the Model 7. £19.10.0. H.P. Deposit £3.18.0 and 12 payments of £1.8.8 and the Multiminor price £9.10.0. H.P. Deposit £1.18.0 and 12 monthly payments of 14/4.

JASON FM TUNER

There are no less than four different Jason FM Tuner Kits now available to the Home Constructor. Brief details are given here and individual lists on any are available free.
MOST IMPORTANT. We take great pains to see that the kits we supply are *absolutely complete* in every detail and also that all components supplied are entirely suitable in every way. This accounts for differences in price you may notice between our prices and those of some of our competitors. THIS SHOULD BE BORNE IN MIND WHEN COMPARING PRICES.
Hire Purchase Terms available.

FMT2 & 3

STANDARD TUNERS

STANDARD TUNER. FMT1. The very popular tuner which is supplied with a chassis assembly fitted with a gold hammer finish front panel and glass dial. Employs four EF91 valves. External power supply is required. Complete kit £6.19.6 Power pack kit, 39/-.
STANDARD TUNER IN SHELF MOUNTING CASE. FMT2. This is a new version of the above tuner. The circuit has been brought up to date and is built into the very attractive shelf mounting case of the new Fringe Tuner mentioned below. The circuit uses four EF80 valves and the power supply can be built into the case if desired. Complete Kit £7.17.6 without power supply components. £9.16.0. with power supply.
MERCURY SWITCHED TUNER. This is a tuner in chassis form which has a three position switch for the three BBC programmes. Uses one ECF80 and four EF80 valves. External power supply is required. Complete Kit £9.19.0. Power Pack Kit 39/-.

FRINGE TUNERS

NEW FRINGE TUNER IN SHELF MOUNTING CASE. FMT3. This is an entirely new Fringe Tuner and is supplied complete with a very attractive green shelf mounting case with Perspex dial. The tuner is fitted with variable AFC. Internal power supply if desired. Valves used are one ECC81 and five EF80. Complete Kit £9.19.6 without power supply components. £11.18.0 with power supply.

INSTRUCTION MANUALS

All our kits include the appropriate instruction manual. All available separately as follows:—
Manual covering both Standard Tuners and the new Fringe Area model, 2/10 ; "Mercury," 2/3. All post free.

Hire Purchase Terms are available on any item. Repayments may be spread over 3, 6 or 12 months. Details as follows : Three months : Deposit 6/- in the £. Service charge 5% but minimum charge 10/-. Six and Twelve months : Deposit 4/- in the £. Service charge 10%. but minimum charge 20/-.
Terms of Business.—Cash with order or C.O.D. Postage extra under £3. We charge C.O.D. orders as follows. Up to £3, postage and C.O.D. fee minimum 2/8. Over £3 and under £5, C.O.D. fee only 1/6. Over £5 no charge.

WATTS RADIO
(MAIL ORDER) LTD.

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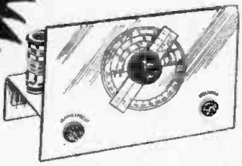
Telephone : Weybridge 4556
Please note : Postal business only from this address.

ENSURE SUCCESS WITH R.C.S.

CONSTRUCTORS CORNER

Explore the world on short-wave radio (10-100 m)

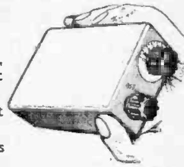
FOR ONLY **35/-**



Construction price includes valve and one coil covering 40-100 m.
- Can be converted to 2v. or 3v.
- Receives speech and music clearly from all over the world.

Send 2/- for diagram and price list.

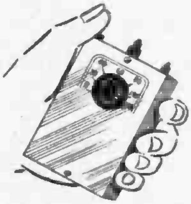
SENSATIONAL RESULTS WITH 2 TRANSISTORS



- ★ No aerial or earth.
- ★ Dial tuning with mini .0005.
- ★ Drilled chassis, colour coded, components, simple layout for beginners.
- ★ Special small case fits shirt pocket.
- ★ Soldering iron and pliers are only tools needed.

Finest results ever obtained with 2 transistors and diode layout. The ideal radio to carry with you everywhere. PARTS PRICE LIST & EASY LAYOUT PLANS, 2/-. Total building cost, including transistors, wire, etc., **62/6**

TRANSISTOR POCKET RADIO



Two-stage circuit using variloopstick coil.
- Ideal for the beginner.
- Can be built in 30 minutes.
- Works for months off 7d. battery.
- Fits into palm of your hand.

The ideal low-cost transistor pocket radio for the beginner. ONLY **30/-**
Send 2/- for data and list of components.

CRYSTAL RECEIVER

Covers M/W Band

All components including case for **10/6**

Ideal for the beginner

BUILD THIS AMAZING RADIO

POWERFUL ! PERSONAL ! PORTABLE !

- ★ Sturdy metal case.
- ★ No holes to drill.
- ★ Detachable rod aerial.
- ★ All batteries self contained.
- ★ Can be built in 1 hour.
- ★ Covers medium waves.
- ★ Loud clear tone.
- ★ Selective tuning.
- ★ All parts are sold separately.

FOR ONLY **35/-**

This delightful set is designed to give you a completely personal portable radio.
Bronze-finished case. Ideal for the beach, the bedroom, the office—in fact, anywhere.
Send 2/- for wiring diagram and component price list.

Post and packing: Under 10/- add 9d.: under 40/- add 1/6: over POST FREE

Trade Enquiries Welcomed **R.C.S. PRODUCTS (RADIO) LTD. 11, OLIVER RD., LONDON, E.17.** Mail Order Only

Premier RADIO

23, TOTTENHAM COURT ROAD, LONDON, W.1. TEL.: MUSEUM 3451/2

The "Petite" PORTABLE

MAY BE BUILT FOR **£7.7.0**

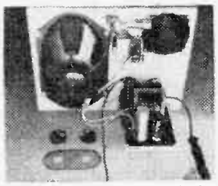
Plus p. & p. 3/-.

BATTERIES EXTRA. H.T. 10/- (Type B126) or equivalent L.T. 1/6 (Type AD35) or equivalent.

★Size only 8in. x 8in. x 4½in.

★Instruction book 1/6.

VISIT OUR NEW BRANCH AT 309 EDGWARE ROAD, W.2.
Telephone PAD 6963

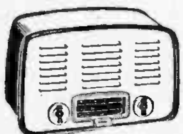


The Famous Cossor 3 watt AUDIO AMPLIFIER KIT 562K
Original Price £9.15.0.

OUR PRICE **£5.19.6,** p. & p. 2/6

This Kit assembled will provide a compact versatile Amplifier which incorporates the most up-to-date pre-assembled printed circuit and is suitable for operation from Radio, Microphone or Gramophone. The circuit design includes negative feedback, valve line-up 6V4, 6BQ5, EF86. Two Loudspeakers are used, i.e., 10in. x 6in. Elliptical and 4in. Treble, ensuring high quality output, suitable for use on 200/250 v. A.C. mains. All items are supplied, including Loudspeakers, Knobs and Escutcheon, with full assembly instructions and in maker's original cartons.

THE BEREC



The 'Berec' Battery Receiver for only £4.19.6 plus 5/- p. & p., or £1.0.0 dep. and 5 mthly pymts of 19/-. Suitable for use in the home or where normal electricity supply is not available, remarkable reception on med. and short wavebands, using DK92, DF92, DAF96, DL96, latest type min. Battery Valves: operates on an external B.103 Battery or equiv. Housed in an attractive, two-tone metal case. Size 11½ x 7½ x 5¼in. BATTERY EXTRA 13/6

Convert your Battery Portable to A.C. mains operation with the Cossor MU2 Battery Eliminator.

This unit is assembled and supplied with 4ft. of Mains Lead and unit Torpedo type of On/Off Switch. Housed in 2 metal containers approximately the same size as the AD.35 and B.126 batteries and suitable for Receivers using 1.4 volt L.T. and 90 volt H.T.
ORIGINAL PRICE 3 gns.
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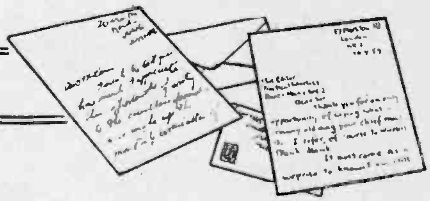
Open to Discussion



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

Interference

SIR,—I think you are right in your comment in the December, 1959, issue, by saying that interference on A.M. medium and long waves can only be stopped (or partly stopped) by closer control of frequencies and number of stations operating. All this deserves a conference of all countries concerned and must include the USSR (which has hundreds of stations). The chance of any agreement is very small, I think. What is needed is as follows: each country should be given three or four channels to broadcast high-powered transmissions. The main part of listening to home transmissions should be done on V.H.F. which at present is cheap. The medium wave perhaps could be made larger say 165-700m and each country should do its part to stop interference from morse, etc. We can only hope that something will be done sooner or later about the problem which grows worse each year.—M. REYNOLDS (Nailsea).

The "Old Days"

SIR,—It is obvious that amateur radio is not all that it used to be. This is because all "modern" components have to be soldered. In many cases there is very little of anything left, to solder on to! Many amateurs have no facilities for soldering. Many are not allowed to solder.

Again, modern components are dull and uninteresting in appearance. An article is described as a "capacitor" and has much wonderful scientific data tagged on. The latter no doubt is correct. But it will appear to be just a plain common roll, covered in paraffin wax, and with a wire sticking out of each end.

"Condensers" used to be well designed and interesting-looking pieces of apparatus. They had screwing-down holes, efficient terminals, *and* soldering tags. They were brand new in appearance, wrapped in tissue paper, and packed in attractive cartons. Therefore they sold well!

Resistances had metal cones at each end. To change a resistance, one had only to remove one from its clips and replace it with another. What magnificent iron-shrouded transformers there were. Variable condensers were veritable masterpieces. Coils were composite and shielded triumphs!

In those days there was also the sense of the marvellous to attract the amateur. I well remember the excitement which reigned when the "giant" 5XX station, with its 14kW, was about to take the air. I listened in with a crystal set, based on a 12 × 4in. cardboard former wound with 24 gauge D.C.C. wire. I think we half expected loud speaker results! I was gratified, however, to receive loud and clear telephone signals; much better than those previously received from the London station.

Valves were quite good in those days. Especially when the new "dull-emitters" were introduced.

The experimenter with battery and transistor sets, who does not wish to solder, should obtain some small oblong electrical connectors. These have a central hole, which enables them to be bolted to the chassis with small gauge bolts. They completely obviate the need to bend wires on condensers and resistances and can also be removed and replaced at will.

Use a larger chassis! One with components widely spaced gives a set a quite impressive appearance. Far more so than does a small chassis, containing all the wires and components, in more or less a jumbled heap.—A. TROWBRIDGE (Staines).

Capacitors

SIR,—I am a beginner to radio and I would like somebody of your readers to help me. Suppose that I need an 8μF. 600VW condenser and that nothing of the kind is available. Can I put two 16μF, 300VW condensers in series so that I will obtain an 8μF 600VW condenser from them? In my opinion I am right and I wonder of any of your readers will agree.—JOSEPH MIFSUD (Flat 1, Block XI, Hubbard Flats, Cospicua, Malta, G.C.).

Radio Sound

SIR,—There have been numerous letters about radio sound on A.F. amplifiers. The radio sound in most cases is due to the fact that anode bend rectification is taking place. This is most probably due to the fact that the bias resistor in one stage has deteriorated so that the valve is biased up to nearly cut off point and is hence acting as an anode bend detector. It could also be due to wrong choice of bias resistor value in the first case. The fact that different stations are received can only be due to the fact that the "mike" head is acting as a tuned circuit and with difference in the length of cable there will be a difference in frequency received.

If any other SWL of my own age (14) could take the trouble to correspond with me I should be pleased to hear from him.—W. J. WHITE (14, Pollard Close, Chigwell, Essex).

27Mc/s Transmitter

SIR,—I constructed the 27Mc/s pocket transmitter as published in the December edition of PRACTICAL WIRELESS, and found it to work quite satisfactory. I then converted the transmitter for mains use, using an R.F. pentode triode connected, cathode keying. I found that a 50c/s mains hum was being transmitted, so I included an A.F. choke in the anode circuit. This worked extremely well, but when I was working the transmitter I noticed that another signal was behind my own. I then sent out a continuous signal, and found that when my transmitter was in operation other stations transmitting speech and music came in behind, but when I switched my transmitter off they stopped. This did not only occur on 27Mc/s but on many frequencies. Can any reader give an explanation of this?—C. GODDARD (Wallington, Surrey).

Using the RF24

SIR,—Several queries have been received regarding the coil data of the RF24 unit. Several of the RF24 and RF25 units on the surplus market have been modified to cover the frequency ranges of the RF26 and RF27 units. The coil details required are as follows:

R.F. grid coil. 14½ turns 22s.w.g. tinned copper with three turn link interwound at earth end.

Mixer coil: 8½ turns 22s.w.g. tinned copper.—D. PRATT, G3KEP and D. NOBLE, G3MAW (Yorkshire).

Mains Polarity

SIR,—With reference to G. F. Watt's letter on mains polarity (December, 1959, issue), I should say that there would be no possibility of the Supply Authority changing the phases over at the Power Station or Sub-station, for that matter, as this would have disastrous effects, such as three-phase motors being reversed. Also on a single-phase supply the polarity of the switching of lights, also plugs, would be reversed; this also would result in the neutral being broken at the switch positions instead of the live side.

There is a possibilty of the mains round G. F. Watt's area being out of balance; this could be caused by too many consumers on the same phase, causing a leakage on the neutral, which could have a potential of several volts between neutral and earth, depending on this out of balance. This may be the explanation for the ripple of which Mr. G. F. Watts complains.

I was also interested in Mr. G. Y. Kingdon's letter in the November issue, and fully agree with him regarding earthing and more stress being placed on the correct connections of live and neutral and earth terminals of plugs, as all modern three-pin plugs and socket outlets are marked "L," "N" and "E." It is always advisable to test the socket outlet to find the polarity, as quite often these are connected the wrong way round, even when the job has been done by a so-called electrician.

I was also interested in Mr. W. Pascoe's comments on earth connections, and he makes a rather interesting point where miniature circuit breakers are employed on some modern installations. Where the radio set is an A.C. type with the three core lead connected to a mains earth system and also an independent outside earth, it does appear that this would create a parallel earth depending on the resistance of the two earths, therefore, affecting the working of the miniature circuit breaker. I intend taking this matter up with someone who is an authority on circuit breakers.—A. DEARDEN (Johannesburg, S. Africa).

Transistors v. Valves

SIR,—Being an ardent supporter of the valve, I would like to make a few points in its favour.

Transistor sets cannot beat F.M. mains valve sets as far as reproduction and good tone are concerned, because as yet transistors do not work so well at high frequencies, and it would be difficult for a transistor set to beat the tone and volume of an ordinary five-valve superhet.

Although mains sets do not work as soon as they are switched on, one should not compare transistor sets with mains superhets. Battery sets, on the other hand, work instantaneously like transistor sets.

Although transistors have many points in their favour, such as small size and low power consumption, valves are being made smaller, and are taking less current. Perhaps a power supply to heat the cathode could be completely eliminated by further research into "cold-cathode" valves. If there was no need for a filament battery, there would be few advantages for transistors.—D. C. HAIGH (Bradford, York).

SIR,—Recent letters from readers prompt me to offer a few remarks. On transistors. I would say that I have experimented with them for the past three years, having always tried to get a lot from the least, and like them.

I have achieved a certain success, being able to receive stations from all over Europe, plus Tangier, on all wavelengths down to 30m; this on a crystal and transistor circuit with a 75ft. aerial about 20ft. high, and a counterpoise type earth, as I find it very much better than a "grounded" earth. Tapped coil and switch are employed in both aerial and tuned circuits and output is boosted by a transformer.

I have tried many of the circuits which have been published in previous issues of PRACTICAL WIRELESS and have made many very good receivers—some without resistors.

The volume from the two circuits is terrific. But, like Capt. Graham and others remark, break-through persists from powerful stations, and in my area the local Third tries to swamp everything.

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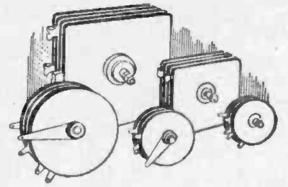

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For "Thermion's" information, until last week when I had a check and change, I was using as long wave coupling, a coil I wound by hand in 1923 and I have more components of that vintage. I also held one of the 15s. experimental licences of that time, and I listen to ships on a one valve circuit using a very old 2V valve and can log every ship, shore station including Scottish.—W. M. MACKENZIE (Gosport, Hants).

Correspondents Wanted

SIR,—I am 21 years of age and I am a qualified radio engineer. I am also working in the Police Radio Office as a radio engineer. I want to correspond with any boys of any age who are interested in radio subjects.—ASHAK KAPUR (Ph. Police Radio Office, Simla—2).

SIR,—I am 25 years of age and am very interested in radio and record changer repairs. I would like to correspond with radio technicians of any age anywhere. All letters received will be answered promptly.—DOLAT DESAI (P.O. Box 8333, Johannesburg, South Africa).

Information Required

SIR,—I am seeking information on converting RF26 unit to 10m. Would anyone who can help please contact me?—G. FOSTER (4, Thompson Avenue, Ormskirk, Lancs).

MEASUREMENTS WITH MULTI-RANGE METERS

(*Continued from page* 942)

adjusting the potentiometer the voltmeter should be set to read full scale, i.e., 2.5V. The potential between the slider and H.T. negative then has a reference value of 297.5V. The resistance value of the potentiometer is made low so that the adjustment is fine otherwise a slight movement of the slider would represent many volts and the voltmeter could not be accurately adjusted.

The load is now switched on and if the change in voltage is from 300V to 299V then the meter reading will decrease from 2.5V to 1.5V. This change can then easily be read to a high degree of accuracy.

A.C. Measurements

The basic moving-coil instrument may be modified to measure A.C. by first rectifying the A.C. before passing it through the meter movement.

Unfortunately the resistance of the rectifier varies with the amount of current flowing; at low values of current, low scale readings, the forward resistance of the rectifier is greater than at high scale readings. This effect is unimportant when using high voltage ranges as then the required high value of series resistor "swamps" the resistance variations of the rectifier. On low voltage ranges the rectifier resistance variation become proportionately greater when compared to the total circuit resistance and result in a non-linear shape of the low end of the scale.

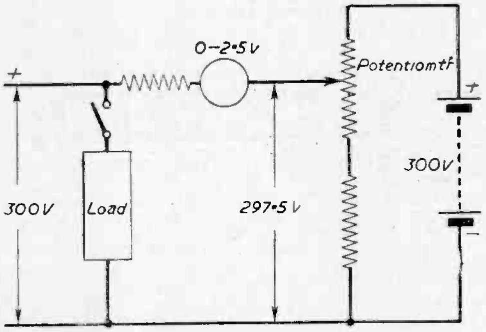

Fig. 7.—An accurate method for measuring small changes in voltage.

With the better, and subsequently more expensive, instrument the difficulty is overcome by using a voltage transformer on the low ranges. The low input voltage is stepped up and then the higher value of series resistor is large enough to swamp rectifier resistance variations.

Quoted Accuracies

In the cheaper instruments the inaccuracies are tolerated but are indicated by quoting the calibration accuracy of the meter as a percentage of *full scale* reading. Consider a meter, the accuracy of which is quoted as, say, 4 per cent. of full scale reading. On the 100V range this means a reading may vary by ±4V. At f.s.d., the percentage error is, of course, only 4 per cent. but the table above shows how the percentage error increases at voltages less than f.s.d.

Voltage	Accepted Variation	Error
80	76V to 84V	5%
40	36V to 44V	10%
20	16V to 24V	20%
8	4V to 12V	50%

This point should be borne in mind before wasting time trying to make a too accurate reading. The accuracy cannot be better than the accuracy of the instrument.

Another point to remember is that the moving coil instrument measures the mean value of the rectified A.C. The value normally required is the r.m.s. The average value when multiplied by the form factor gives the r.m.s. value. The form factor for a sine wave is 1.11 so during calibration all mean values are multiplied by 1.11 and scale readings are then read as r.m.s. values.

If the waveform of a measured voltage is not a pure sine wave, the form factor will not be 1.11 and the meter calibration will not be maintained. Two vastly different waveforms may have the same mean value but as the form factors would be different the r.m.s. values would be different although the meter deflection would be the same in each case. In practice the error is not very great but is mentioned mainly to emphasise the errors present when the waveform is not a pure sine wave.

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300-0-300 v. 100 m.a., 6.3 v. 2 a. 5 v. 2 a.	18/9
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F. W. BRIDGE

6/12 v. 1 a.	3/11
6/12 v. 2 a.	6/11
6/12 v. 3 a.	9/9
6/12 v. 4 a.	12/3
6/12 v. 6 a.	15/3
6/12 v. 10 a.	25/9
6/12 v. 15 a.	35/9
24 v. 2 a.	14/9

H.T. Types H.W.

150 v. 40 m.a.	3/9
250 v. 50 m.a.	3/11
250 v. 60 m.a.	4/11
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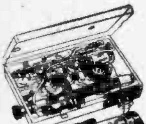

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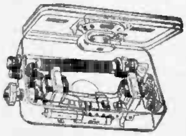

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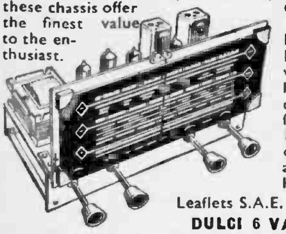

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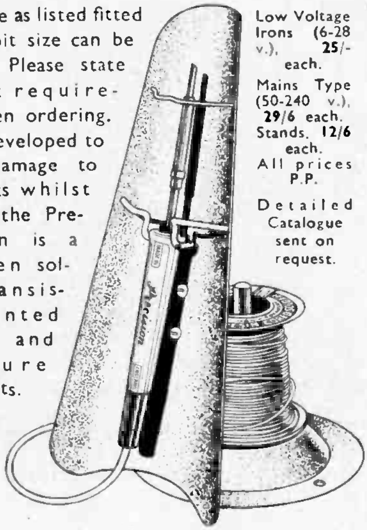

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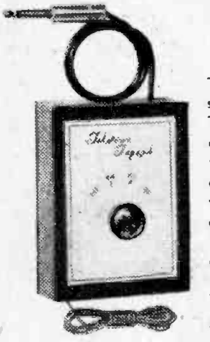

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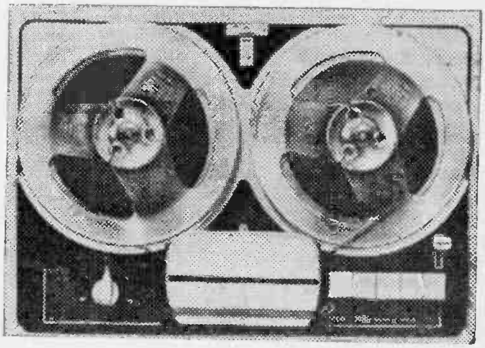

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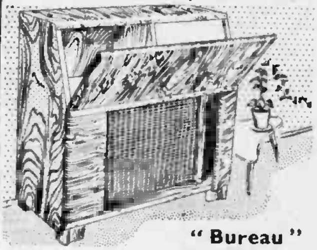

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Practical Wireless

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The index letters which precede the Blueprint Number indicate the periodical in which the description appeared. Thus PW refers to PRACTICAL WIRELESS; AW to *Amateur Wireless* and WM to *Wireless Magazine*.

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

SPECIAL NOTE

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