A TRANSISTORISED VOLTMETER

PRACTICAL WIRELESS

1/6

MAY
1960

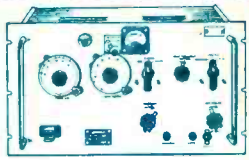
CONTENTS

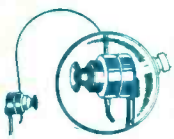
AN A.F. CALIBRATOR
SINGLE-ENDED AMPLIFIER
AVC FOR TAPE RECORDERS
100 kc/s CHECK OSCILLATOR
MAINS SHORT WAVE TWO
ETC. ETC. ETC.

POLICE - AIRCRAFT - HAM RECEIVER P.104

Frequency range 90-150 Mc/s. I.F. freq. 5 Mc/s. Complete with tuning meter, 14 valves: 2-R.F., 3-I.F., B.F.O., A.G.C., Audio. Crystal controlled with separate R.F. and oscillator tuning. R.F. and Audio controls. B.F.O. tone control. Oscillator and Audio signal fully metered. Power requirements 250 v. H.T., 6.3 v. L.T.

BRAND NEW
ONLY **£5** Carr. 15/-
MAINS POWER PACK
ONLY 60/-. Carr. 7/6





LIGHT-WEIGHT HEAD-SET. These H.S. 30 phones are the smallest used by the U.S. Air Force. 250Ω imp. using soft rubber miniature ear moulds for maximum music and voice reproduction of the finest quality. Supplied free is a small transformer unit with cord and plug which steps impedance up to 4,000Ω. ONLY 15/-. P. & P. 2/6.

CRYSTAL DIODES 6/- per doz. P. & P. 1/-.

MICROPHONES. BRAND NEW. Throat magnetic 4/6; Throat carbon 3/6; No. 8 carbon with switch 6/6; No. 7 moving coil 6/6. Tannoy power mikes only 5/-.

U.S.A. WHIP AERIALS. 12ft. 12/6. P. & P. 2/6.

MICROPHONE BARGAIN. Acos crystal stick mike. Complete with cable. List price 5 gns. Offered at only 49/6. P. & P. 1/6.

COSSOR DOUBLE BEAM OSCILLOSCOPE 339. 10-position time base, 6 c.p.s. to 250,000 c.p.s. Amplifier 10 c.p.s. to 2 mill. c.p.s. Used condition but in working order. £22.10.0. Carr. £1.

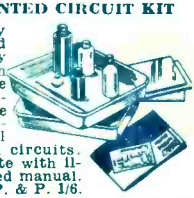
D.M.34. America's finest little dynamotor offering 12 v. in with 220 v. out at 80 mA. With suppression and smoothing mounting base. Size 4½ x 2½ x 2½in. Original packing. ONLY 35/-. P. & P. 3/6.

1 mA METER, 2in. round. 17/6. P. & P. 1/6.

R.C.3I2 RECEIVER, 1,500 kc. to 18 Mc/s. 6 Bands continuous tuning. Internal 12 volt supply unit. S.A.E. for details.

PRINTED CIRCUIT KIT

Easily and quickly you can make miniature professional printed circuits. Complete with illustrated manual. 19/6. P. & P. 1/6.



PORTABLE TRANS/RECEIVER No. 18

A self-contained Trans/Receiver for Telephone and C.W. Range approx. 10 miles. Freq.: 6-9 Mc/s. (50-33.3 metres). Valve line-up: 3 ARP-12, 2 AR-8, 1 ATP4. Complete with aerial, H.T. and L.T. meter and all accessories. Weight 20 lbs. Size 8 x 10 x 17in. BRAND NEW, ONLY 80/-. Carr. 10/-.

POCKET MULTIMETER BRAND NEW

2,500 o.p.v. Multi range 6/30/120/300/1,200 v. A.C., ditto D.C. 0-1 K., 0-1 megohm; 400 Micro-A., 12 mA., 300 mA. —00 to +64 db 5 ranges; 3in. x 4½in. x 1¼in. Large clear dial. Leads supplied.
Our Price 70/- P. & P. 2/6.

Mobile Radio Telephones Model HP11

Frequency range 75-100 Mc/s. Complete Trans. Receiver Assembly, and power supply, measuring only 8¼ x 8 x 4in. Weight 14½lb. Each set comprises one V.H.F. Trans/Receiver, one 12v. power supply and one hand microphone. Original cost over £100; supplied in used condition but in working order at ONLY **£18** Per Set Carr. 30/-

INSTANT VALVE FILAMENT TESTER, MODEL VT-41.

Pocket-size, battery operated. Gives Instant Check of: All radio valves;* All TV valves;* All TV and Radio fuses; Circuit continuity; All Pilot lamps. Has built-in miniature 7- and 9-pin valve straighteners and battery test.
* International Octal, B.8., B.9, B.7 Battery and Mains types.
Beautifully styled—precision made. Supplied complete. Fully guaranteed.
ONLY 30/-. P. & P. 2/6.

CONVERT TO V.H.F.

Within minutes you can extend the frequency of your receiver to cover V.H.F. by using our brand new V.H.F. Convertor. **R.F.26** covers 50-65 Mc/s. vernier calibrated tuning. 20/-. **R.F.25** covers 40-45 Mc/s. Switched tuning, 8/6. Circuits supplied. P. & P. 3/6 on each.

ACCUMULATORS. 2 volts 16 A.H. (unspillable). Ideal for 6 and 12 volts supply, etc. Brand new. Original cartons. Size 4in. x 7in. x 2in. 5/6 each. P. & P. 1/6. 3 for 15/-. P. & P. 3/6. 6 for 27/6. P. & P. 5/-.

HI-FI CO-AX SPEAKERS BRAND NEW—U.S.A. MADE. 12in. Co-axial Speaker. The woofer uses 6.8 oz. Alinco 5 magnet. Has 3in. tweeter and an electronic crossover network to separate the speaker functions. Frequency response: 40-17,000 cycles. Output 12 watts, impedance 8 ohms. ONLY 160/-. 8in. 2½in. tweeter, 10 watts, etc., 90/-. P. & P. 4/- on each.

COLLINS T.C.S. COMMUNICATION RECEIVER 1.5-12 Mc/s. Only £8.10.0. Carr. 15/-

TELEPHONE SETS. Brand new, fully portable—hand generator, bell, hand set, morse key, lamps, instructions. Only 60/- a pair. Carr. 10/-.

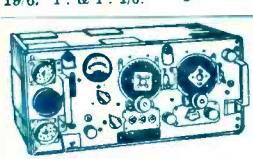
HIGH RESISTANCE HEADPHONES. Brand New. 16/-. P. & P. 1/6.

U.S.A. DYNAMOTORS manufactured by EICOR. Input 12 v., output 400 v. at 180 mA. Size 7in. x 4in. x 4½in. Brand new, 45/-. P. & P. 3/6.

BUILD AN F.M. TUNER with this miniature 9.72 Mc/s I.F. Strip. Has 6 modern miniature valves. I.F.T.'s, etc., supplied with full F.M. Tuner conversion details. Hailed by all our previous purchasers as a wonderful F.M. Tuner. Brand new, only 40/-. P. & P. 3/6.

VARIABLE TRANSFORMERS, MODEL B5

Input 230volts. Output 0 - 260 volts. 5 amps. Brand new: only £9. Carr. 12/6.



Special Offer—Order Now! Limited number only.

WIRELESS SET No. 19 MK. II

As described in "Practical Wireless," March page 961, April page 1027 and this issue.

This most famous Army Trans/Receiver covers 2-8 Mc/s. (150-37 metres) in two bands and 230-240 Mc/s. V.H.F. Has an intercom. amplifier. Designed for 12 and 24 volt operation. Uses a 6-valve superhet receiver, I.F. being 465 kc/s, and a 6-valve transmitter designed for voice and C.W. operation. Incorporates test and tuning meter for voltages, aerial loading and current tests. Panel Controls: Frequency tuning, P.A. tuning, Gain control, M.C.W., C.W., R.T. switch, Hettone, netting, off-on, Quench, aerial—A.V.C.—L.T.—H.T.—Drive tests. Supplied complete with 15 valves and instruction book.

SET ONLY 65/-
Carr. 10/-

Relda Radio Ltd.

Callers: 87 Tottenham Court Road, London W.1.
Mail Orders: (Dept. P), 32a Coptic Street, London W.C.1
Telephone: MUSeum 9607

FULLY ILLUS. CATALOGUE 1/3 Post Free.

ALL CHASSIS. 16 x 8 x 3 in. deep, heavy g'ge. 7/6.

PERSPEX FRONTS (as on 110° TVs). Heavy, ideal windscreens, etc., fraction of cost, 17in. 9/6, 21in., 15/-.

SYSTOFLEX. 1-3 mm. assorted colours. Twenty-four 1 yd. lengths, 3/6..

1000 YDS. ASSAULT CABLE. P.V.C. covered steel, ideal telephone lines, gardening. 9/- drum.

BATTERY ELIMINATORS (Cossor). 200-250 V.A.C. giving 1.5 v. 125 ma and 90 v. 10 ma, only 39/-.

465 kc I.F.T.'s. Miniature standard type, 7/6 pr.

TOGGLE SWITCHES. S.P. 1/9; D.P. 2/6.

MORSE KEYS. V.G. finish, 2/6.

INSULATING TAPE, Good quality, half price, 6 rolls, 2/6.

CERAMIC CONDENSERS. Top quality, rock-bottom prices. 3, 6, 8, 8.2, 9, 10, 12, 15, 16, 18, 20, 22, 26, 30, 33, 35, 47, 50, 70, 82, 100, 110, 120, 130, 150, 180, 200, 300, 350, 450, 470, 500, 600, 700, 750, 800, 1000, 1500, 1800, 2000, 3000, 4000, 5000. 6d. each. 5/- doz., 12/6 3 doz.

TUBULAR CONDENSERS. Top makes. 350/500 vw. 0.001, 0.002, 0.005, 0.01, 0.02, 0.03, 8d.; 0.05, 0.1, 0.2, 0.25, 0.5, 10d.

ELECTROLYTIC CONDENSERS. 4 mfd 500 vw, 1/6 5 mfd 50 vw, 1/3; 8 mfd 275 vw, 1/3; 8 mfd 450 vw, 1/9; 8-8 mfd 450 vw, 2/6; 16 mfd 350 vw, 1/9; 16-16 mfd 350 vw, 2/9; 25 mfd 25 vw, 1/-; 32 mfd 350 vw, 2/-; 32-32 mfd 350 vw, 2/9; 50 mfd 12 v, 1/-; 50-50 mfd 400 v, 4/6.

FERRITE RODS. 6 x ¼in. approx., 2/9 ea.; 6 x ½in., 2/9 ea.

REXINE. 54in. wide. Light grey or red, with white polka dots, 7/6 per yd. Your record player cabinet can be given a "New Look" at very low cost.

BATTERIES. All-Dry, ex-government, 60 plus, 1.5 v., 2/6 ea.; 6 for 12/6; 1 doz., 22/6.

INSTRUMENT KNOBS. By Painton. 2¼in. black, beautifully finished, 1/6 ea., 16/- doz.

RADIO AERIALS. Top quality, insulated, 25ft. 1/- ea., 10/6 doz.; 50ft. 1/10 ea., 19/- doz.

SPECIAL OFFERS

4-SPD. RECORD PLAYERS

Latest B.S.R. TU9 Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Truly amazing value at **£3/10/-** Carr. 3/-.

STEREO equipped 4-speed Single Player, famous make. Just released. Limited Quantity at **£6/19/-** Carr. 3/-.

VIBRATOR PACKS

6 volt, complete 220 volt, 60 mA output. Limited number..... **12/6**

CO-AXIAL CABLE

Semi-Air-Spaced low loss. 1-19 yds., 7d. per yd., p. & p. 1/3. 20-39 yds., 6d. per yd., p. & p. 1/9. 50 YARDS 22/6. P. & P. 2/-.

100 RESISTORS assortment ½-2 watt. **7/6**

VALVES ALL GUARANTEED 3 MONTHS.

PL81 SOILED, AMAZING VALUE AT ONLY **4/6**

EY51 SHORT ENDS **4/6** **U25** SHORT ENDS **8/-**

100 CONDENSERS 10/-

Due to huge purchase we can offer a wide, well balanced range of mainly the latest miniature Ceramic and Silver Mica Condensers from 3 pF to 10,000 pF. LIST VALUE OVER £5. A must for your spares.

PM SPEAKERS (SURPLUS 3 OHM)

Tested, top makes, performance guaranteed.
6½in. **7/-** 5in. 7X4 **11/-** 10in. 10X6 **13/-** 8in.

STEREO

Special Offer, matched pairs of speakers, 6½in. or 8in. 14/- pr. 10in., 22/- pr. Special quotations for quantities of the above speakers or any other goods listed.

AM/FM KIT. Gorla: Consisting of Tuning Heart, assembled, with 1st L.F. Transformers. Second FM, AM and Discriminator Transformers, complete kit. Comprehensive instruction booklet supplied. Booklet only, 2/-; Kit, with ECC85 valve, £3.13.6; Kit, less ECC85 valve, £3.5.0.

SWITCHES. Yaxley type. 4 pole, 3 way, 3/3; 3 pole, 4 way, 3/3; 2 pole, 6 way, 3/3; 2 pole, 2 way, 3/3. Toggle, small, 1/9; 5-10 amp rating, 2/3; Spring loaded off, 1/3.

CERAMIC TRIMMERS AND PADDERS. 50 pf. 8d.; 150-150, 250-250, 300-300 pf, 1/-.

CONCENTRIC TRIMMERS. Philips type, 9d.

COIL PACKS. 5 waveband, famous make, long, med., 3 short wavebands, superhet, ideal basis for communications set, 465 kcs. I.F. Beautifully made, 19/6.

COILS: Techtrad Midget Superhet coil sets, aerial and oscillator, long and medium wave, Polystrene formers, complete circuit, 8/6.

1000 ohm. 10 watt RESISTORS. Ideal Smoothing Droppers. 1/3 ea; 13/- doz.

CARBON RESISTORS. ½ watt, 3d. ea.; 1 watt and above, 4d. ea.: Close tolerance resistors, 6d. Unless stated on order, near values will be supplied.

MAINS DRIVEN BELLS. 200-250 A.C., incorporates step down transformer. 9/6 ea.

MULTI-RANGE TEST METER. Caby A.10 A.C. and D.C. volt (sensitivity 2,000 o.p.v.), 10 v., 50 v., 250 v., 500 v., 1000 v., Resistance 10 k ohms, 1 Megohm, D.C. current 0.5 mA, 25 mA. Decibels: accuracy D.C. ± 2%, 5½ x 3½ x 1¾ins. Weight 17 ozs. With test prods. and instr. book. £4.10.0.

SINGLE RECORD PLAYERS

COLLARO 4-speed 4/546	.. ..	£6 19 0
GARRARD 4-speed 4SP	.. ..	£7 7 6
GARRARD 4-speed TA MKII	.. ..	£8 19 0
GARRARD 4-speed 4HF	.. ..	£17 15 0

PORTABLE RECORD PLAYERS

Collaro 4-speed auto-changer, 2½ watt high gain amplifier. Super two-tone case. 13 gns.

Or case only 59/-. 2½-watt Amplifier complete on baffle with Speaker, £3.10.0.

VALVES BY RETURN OF POST

10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozens). Post: 1 valve, 6d.; 2-11, 1/-.

NEW LOW PRICES GUARANTEED 3 MONTHS

FREE TRANSIT INSURANCE. All valves are new or of fully guaranteed ex-Government or ex-equipment origin. Satisfaction or Money Back Guarantee on goods if returned unused within 14 days.

OZ4	5/6	6AT6	7/-	6J7GT	7/9	6X5G	5/6	12E1	12/6	42	7/6	DAF96	8/3	ECC81	6/-	EL91	4/9	N108	18/-	T41	7/6	UCH81	9/-
1A5GT	5/-	6AU6	8/6	6K6GT	6/6	6X5GT	6/6	12J5GT	3/6	43	7/6	DF33	9/9	ECC82	6/6	EM34	8/6	N152	10/6	TH30C	12/6	UCL82	11/3
1A7GT	12/6	6B7	8/6	6K7	5/9	6Z4	9/-	12K7GT	8/-	50C5	9/6	DF91	4/9	ECC83	7/6	EM80	9/3	P41	4/6	U13	8/-	UCL83	13/6
1C5GT	11/6	6B8G	3/6	6K7G	2/3	7A7	10/6	12K8GT	12/-	50L6GT	9/3	DF96	8/3	ECC84	8/9	EM81	9/3	P61	2/3	U18	8/6	UF41	8/6
1D5	9/6	6BA6	6/-	6K7GT	5/-	7B5	12/6	12Q7GT	6/-	53KU	10/6	DH63	6/9	ECC85	8/3	EM84	9/9	PABC80	11/-	U22	6/9	UF42	7/9
1D6	9/9	6BE6	6/6	6K8G	6/-	7B6	9/6	12SG7	6/-	54KU	8/9	DH76	6/-	ECF80	10/3	EM85	10/6	PCC84	7/9	U24	7/6	UF80	9/-
1H5GT	9/9	6BG6G	12/6	6K8GT	11/-	7B7	7/3	12SJ7	5/6	61SPT	11/-	DH77	7/-	ECF82	9/9	EN31	16/-	PCC85	9/3	U25	13/6	UF85	9/-
1L4	3/9	6BH6	6/9	6K25	7/6	7C5	7/6	12SK7	5/6	75	8/-	DK32	12/6	ECH21	14/-	EY51		PCC88	13/6	U26	12/-	UF86	14/6
1LD5	3/6	6BJ6	8/-	6L1	12/6	7C6	7/3	12SN7GT	8/6	77	6/6	DK91	6/9	ECH35	7/6	SMALL	9/-	PCF80	19/-	U31	8/3	UF89	7/3
1LN5	4/6	6BR7	10/6	6L6	9/9	7E7	9/6	12Y4	9/6	78	7/6	DK92	8/6	ECH42	8/9	EY86	9/-	PCF80	7/6	U33	13/-	UL41	7/6
1N5GT	9/9	6BW6	8/9	6L6G	7/6	7H7	7/6	14S7	14/9	80	6/6	DK96	8/3	ECH81	8/3	EZ35	6/6	PCF82	9/-	U35	8/9	UL44	12/6
1R5	6/9	6BW7	6/6	6L7	9/-	7K7	8/-	19AQ5	7/6	83	9/6	DL33	8/9	ECH83	11/-	EZ40	7/9	PCL82	9/3	U37	26/6	UL46	9/9
1S4	8/9	6BX6	5/9	6L18	9/-	7R7	10/6	19BG6G	15/-	90AV	4/6	DL35	11/6	ECL80	8/3	EZ41	7/6	PCL83	11/6	U43	9/-	UL84	8/-
1S5	6/-	6C4	3/6	6L19	11/6	7S7	9/6	20D1	9/6	117Z7	10/-	DL82	9/6	ECL82	10/-	EZ80	6/9	PCL84	9/9	U50	8/-	UM80	9/6
1T4	4/9	6C5	5/6	6LD3	8/6	7V7	7/9	20F2	8/6	185BT	16/-	DL91	8/9	ECL83	14/6	EZ81	7/3	PEN25	4/6	U52	5/6	UU6	12/6
2D21	4/6	6C6	4/3	6LD12	7/6	7Y4	7/6	20L1	9/6	723A	35/-	DL92	6/6	EF22	12/-	GT1C	7/-	PEN45	7/3	U76	6/-	UU7	9/6
3A4	5/6	6C9	9/6	6LD20	8/6	7Z4	7/6	20P1	11/6	807A	5/-	DL94	7/6	EF36	3/3	GZ32	8/9	PEN46	5/3	U78	6/-	UU8	16/6
3Q4	7/3	6CD6G	18/6	6N7	6/6	8D3	3/9	20P3	12/6	807E	3/9	DL96	8/3	EF39	4/3	GZ34	12/6	PL33	9/-	U107	11/-	UY1N	11/-
3Q5GT	8/9	6CH6	9/3	6P1	14/-	10C1	11/-	20P4	17/-	808	15/-	EA50	9d.	EF40	13/6	HABC80	9/6	PL36	12/-	U191	9/6	UY21	11/6
3S4	6/6	6D1	9d.	6P25	9/-	10C2	13/6	20P5	16/-	955	3/9	EABC80	7/6	EF41	8/9	HL41DD	9/6	PL38	14/6	U281	9/6	UY41	6/6
3V4	7/6	6D2	3/9	6P28	9/-	10C14	9/-	25A6G	8/-	956	2/9	EAC91	4/9	EF42	7/6	HVR2	7/6	PL81	10/6	U282	15/-	UY85	7/-
5R4G	11/-	6D3	11/6	6Q7G	6/9	10F1	6/9	25L6G	6.9	2050	3/6	EAF42	8/6	EF50-BR	2/-	KL35	7/9	PL82	7/9	U301	14/-	VR150/30	
5U4G	5/6	6D6	4/9	6Q7GT	9/3	10F9	10/3	25L6GT	9/-	5763	10/-	EB34	1/6	EF50-AM	2/6	KT32	6/9	PL83	8/-	U309	12/6		5/6
5V4G	9/9	6F1	6/9	6R7G	9/6	10L14	8/-	25Y5G	9/-	9001	4/-	EB41	7/-	EF54	3/3	KT33C	6/6	PL84	11/-	U329	12/6	W61M	11/-
5Y3G	6/-	6F6G	3/6	6SA7	5/9	10LD3	8/3	25Z4G	8/-	9003	4/-	EB91	3/9	EF80	9/6	KT36	9/-	PL500	16/-	U339	11/-	W76	6/-
5Y3GT	8/6	6F6M	7/-	6SC7	4/3	10LD12	8/9	25Z5	8/-	ATP4	2/9	EBC33	5/-	EF85	7/-	KT44	9/6	PY31	8/3	U403	9/6	W77	4/9
5Z4G	8/6	6F12	3/9	6SG7	4/9	10P13	9/6	25Z6	9/-	AZ31	9/-	EBC41	8/6	EF86	11/-	KT45	8/6	PY32	11/-	U404	6/6	W81	5/9
5Z4GT	11/-	6F13	6/9	6SH7	4/6	10P14	9/6	27SU	16/-	B36	8/6	EBC81	7/9	EF89	8/-	KT61	9/-	PY80	7/-	U801	17/-	X61M	12/6
6A7	11/-	6F14	9/6	6SJ7	6/-	10P18	8/-	30C1	7/6	B65	4/9	EBF80	8/6	EF91	3/9	KT63	6/6	PY81	7/-	UABC80	8/9	X63	9/6
6A8G	9/6	6F15	9/6	6SK7	5/3	12A6	5/3	30F5	7/-	CBL31	23/3	EBF89	8/6	EF92	4/9	KT66	12/6	PY82	7/-	UAF42	9/-	X65	11/-
6A8GT	13/6	6F16	8/9	6SL7GT	6/6	12AH7	6/9	30FL1	9/6	CCH35	7/6	EBL21	14/-	EF95	6/9	KT81	14/-	PY83	8/-	UB41	8/-	X66	11/-
6AB8	8/3	6F33	6/9	6SN7GT	4/9	12AH8	9/9	30L1	7/9	CL33	13/-	EBL31	16/-	EK32	7/9	KTW61	5/6	PZ30	12/-	UBC41	8/3	X76M	9/6
6AC7	4/6	6G6	6/-	6SQ7	6/3	12AT6	7/9	30P4	12/6	CY31	9/9	EC52	3/9	EL32	4/6	KTW63	4/9	R18	12/6	UBC81	10/-	X78	14/6
6AG5	4/3	6H6	2/-	6SS7	6/6	12AT7	6/-	30P12	8/-	D63	1/6	EC90	3/6	EL33	9/-	KTZ63	5/-	R19	12/6	UBF89	8/6	X79	16/6
6AG7	8/6	6J5	4/3	6U4GT	10/6	12AU7	6/6	30P16	7/9	D77	3/9	EC91	4/6	EL35	11/6	L63	2/9	SD6	9/-	UBL21	14/6	Y63	5/3
6AK5	6/9	6J5G	2/9	6U5G	6/3	12AX7	7/6	30PL1	10/6	D152	6/6	EC31	9/6	EL37	11/6	LN152	8/6	SP6	3/9	UCC84	14/6	Z63	5/3
6AL5	3/9	6J5GT	3/9	6V6G	5/9	12BA6	8/-	35L6GT	9/-	DA30	12/6	ECC32	4/-	EL38	12/6	LZ319	7/9	SP41	2/6	UCC85	8/-	Z66	9/6
6AM5	4/6	6J6	4/-	6V6GT	6/6	12BE6	8/9	35W4	6/9	DA90	2/6	ECC33	4/9	EL41	9/-	MU14	8/-	SP61	2/6	UCF80	16/-	Z77	3/9
6AM6	3/9	6J7	7/9	6X2	9/-	12BH7	10/8	35Z4GT	6/-	DAC32	9/9	ECC34	9/-	EL42	9/6	N37	11/-	SU25	15/-	UCH21	14/6	Z152	5/9
6AQ5	6/-	6J7G	5/3	6X4	6/-	12C8	6/8	35Z5GT	8/6	DAF91	6/-	ECC35	6/9	EL84	8/-	N78	15/-	SU2150A	4/6	UCH42	8/6	Z719	5/9

Post: 2 lbs. 1/6, 4 lbs. 2/-, 7 lbs. 2/9, 15 lbs. 3/6 etc. No C.O.D. ALL ITEMS LESS 5% & POST FREE IN DOZENS

TECHNICAL TRADING CO.

(Callers always welcome). LIST OF 1000 SNIPS 6d

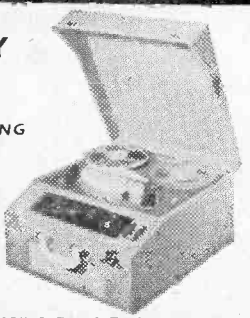
P.O. BOX 21 (W)

350-352 FRATTON ROAD, PORTSMOUTH.

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 UNIT
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 FIDELITY 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.

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

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. IV COLLARO "TRANSCRIPTOR" DECK **£39.15.0**
H.P. Deposit £8.0.0 and 12 months £2.18.2.

(b) The New TRUVOX Mk. VI DECK **£45.0.0**
(£1 extra to wire up the Transcriptor Switch Banks.)
H.P. Deposit £9.0.0. and 12 months £3.8.0.
(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.

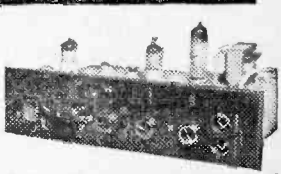
Carriage and Insurance on each above is 10/- extra.

Attractive PORTABLE CASE is available to accommodate the TRUVOX or COLLARO TAPE DECKS and we offer it, together with ROLA/CELESTION 10 x 6in. LOUDSPEAKER—ACOS CRYSTAL MICROPHONE—and 1,200ft. 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 £3.6.8 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 11 x 6 x 6in. Can be supplied for use with Truvox—Collaro—Lane—Brenell or Motok Decks. Please specify which. Send S.A.E. for leaflet or 2/6 for complete Assembly Manual.

STERN'S MULLARD DESIGNS

Designed by MULLARD—presented by STERNS strictly to specification

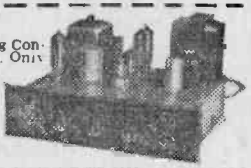
COMPLETE KIT OF PARTS— MULLARD "5-10" MAIN AMPLIFIER

For use with the MULLARD 2-stage pre-amplifier with which an undistorted power output of up to 10 watts is obtained. We supply **SPECIFIED COMPONENTS AND NEW MULLARD VALVES.** including **PARMEKO MAINS TRANSFORMER** and 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

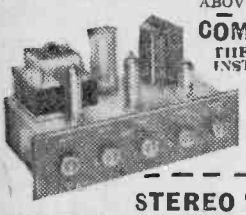
MULLARD'S PRE-AMPLIFIER TONE CONTROL UNIT

Employing two EF86 valves, and designed to operate with the MULLARD **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**
Supplied strictly to **MULLARD'S SPECIFICATION** and incorporating
- 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"



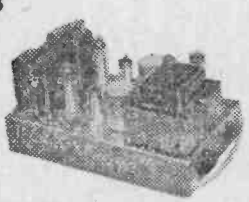
The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Only Specified Components and new **MULLARD VALVES** are supplied including **PARMEKO MAINS TRANSFORMERS** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers.
KIT OF PARTS **£11.10.0** OR ASSEMBLED and TESTED **£13.10.0**
HIRE PURCHASE (Assembled Amp. only) DEPOSIT £2.14.0. 12 months at: 19/10.
ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra



COMPLETE MULLARD "3-3"

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS OUTPUT
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. Complete to MULLARD'S SPECIFICATION including Mullard valves and a **PARMEKO OUTPUT TRANSFORMER**

STEREO "3-3" MAIN AMPLIFIER

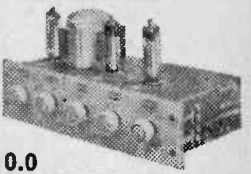


Comprises two "3-3" **MULLARD MAIN AMPLIFIERS** on one chassis and is designed to operate with our **DUAL CHANNEL PRE-AMPLIFIER** for both **STEREOPHONIC** or **MONAURAL** operation. Its output power is 6 watts (3 watts per channel).
PRICE: COMPLETE KIT OF PARTS **£10.0.0**
Alternatively ASSEMBLED AND TESTED **£11.15.0**
H.P. Terms: Deposit £2.7.6 and 12 months at 17/4.

STEREO DUAL CHANNEL PRE-AMPLIFIER

This model incorporates two Mullard 2-valve Pre-Amplifiers 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**
Operates 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.
THE ASSEMBLY MANUAL is available for 3/-.

COMPLETE STEREO AMPLIFIER

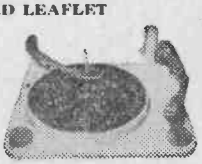


A thoroughly recommended Mullard design that very effectively meets the many requests for a low-priced but good quality **DUAL CHANNEL STEREOPHONIC AMPLIFIER.** Output power is 4 watts from **STEREO** or **MONAURAL** gram inputs.
PRICE: COMPLETE KIT OF PARTS **£8.10.0**
ALTERNATIVELY ASSEMBLED AND TESTED **£10.10.0**

!! RECORD PLAYERS !!

THE LASTEST MODELS ARE IN STOCK MANY AT REDUCED PRICES

SEND S.A.E. FOR ILLUSTRATED LEAFLET



B.S.R. MONARCH UA3 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 **COLLARO** 4-speed Single Record Player. Studio Pick-up. **£6.15.0**
THE NEW B.S.R. Model UA12 in Stock. A4 "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**
GARRARD MODEL TA MK.II 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.

SPECIAL PRICE REDUCTIONS

(c) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve 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.

! RADIOGRAM CHASSIS ! and V.H.F. RADIO TUNING UNITS

WE HAVE THE COMPLETE RANGE OF ARMSTRONG and DULCI high quality replacement Chassis in STOCK.
Descriptive leaflets are available—enclose S.A.E.

Please enclose S.A.E. for DESCRIPTIVE LEAFLETS COMPLETE ASSEMBLY MANUALS are available at 1/6 each.

STERN RADIO LTD.

Stern's "fidelity" TAPE RECORDERS

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.

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

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

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

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.

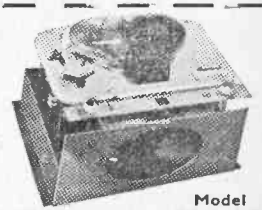
MODEL TR3/Mk. VI. Incorporates the New TRUVOX Mk. VI TWIN TRACK 2-speed Tape Deck **£49.10.0**
H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7.

Model HF/G2R

and NOW WE INTRODUCE

- **MODEL HF/G2P TAPE PREAMPLIFIER**
  The Ideal "Link" to add High Quality Tape Recording facilities to existing Audio Installations and the
- **MODEL HF/G2A TAPE AMPLIFIER**
  Designed to our usual High Technical Standard. Being based on the very successful Mullard Tape Designs. They incorporate MULLARD VALVES and only HIGH GRADE COMPONENTS

AS A RESULT WE PRESENT . . .
TWO UNITS METICULOUSLY MATCHED TO CORRECTLY OPERATE



Model HF/G2A-D

THE NEW GARRARD "MAGAZINE" TAPE DECK

Both Units form an entirely new "Easy to handle" presentation, each is completely self contained with Power Supply (Loudspeaker Amplifier HF/G2A only), and all INPUT and OUTPUT sockets incorporated on the chassis, which itself is constructed to allow for direct attachment to the tape deck. Thus the tape deck with the Amplifier (or Preamplifier fixed to it) form ONE COMPLETELY SELF-CONTAINED WORKING UNIT which requires only screwing into a Cabinet and Connecting to the Mains supply.

As is usual with GARRARD products this Tape Deck is a Precision Engineered Unit of Excellent Quality operating two tracks at 3¾ in./sec. speed. It is the "Easiest to Handle" Tape Deck, having only two controls and incorporates the new instantaneous Tape Loading Magazine which makes tape loading as simple as putting on a Record.

OVERALL PERFORMANCE IS REALLY EXCELLENT . . .

WE OFFER AS FOLLOWS:

(a) Model HF/G2R Portable TAPE RECORDER. Includes spool of L.P. Tape and Crystal Microp. **£33.0.0**
H.P. Terms: Deposit £6.12.0. 12 monthly payments £2.8.5

(b) Model HF/G2A-D, comp. AMPLIFIER and TAPE DECK. Inc. spool of L.P. Tape and L/S. **£27.10.0**
H.P. Terms: Deposit £5.10.0. 12 monthly payments £2.0.4

(c) ASSEMBLED AND TESTED AMPLIFIER Model HF/G2A **£15.0.0**
H.P. Terms: Deposit £3.0.0. 12 monthly payments £1.2.0

(d) Model HF/G2PP PORTABLE PREAMPLIFIER. Complete in Portable Case (like HF/G2R) **£30.0.0**
H.P. Terms: Deposit £6.0.0. 12 monthly payments £2.4.0

(e) Model HF/G2P-D, comp. PREAMPLIFIER and TAPE DECK. Includes spool of L.P. Tape. **£26.0.0**
H.P. Terms: Deposit £5.4.0. 12 monthly payments £1.18.2

(f) ASSEMBLED and TESTED PREAMPLIFIER Model HF/G2P **£14.0.0**
H.P. Terms: Deposit £2.16.0. 12 monthly payments £1.0.6

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.

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.

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

Telephone FLEET STREET 5812/3/4

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

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 Preamplifier, 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.

"Hi-Fi" LOUDSPEAKERS

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

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.

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

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN HALF AN HOUR

The Recorder incorporates the Latest Collaro Studio Tape Transcriptor. 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 22/8, and a Handsome Portable carrying Cabinet finished in Two-tone Rexine, size 18 x 13 x 9in. high, listed £4.10.0 and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. Send S.A.E. for leaflet.

25½ GNS. Carr. 17/6

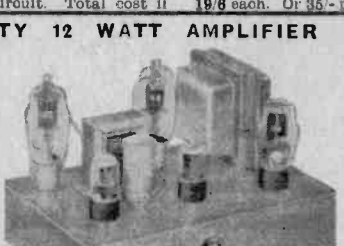
H.P. TERMS. Deposit 3 gns. and 12 monthly payments 45/9. Cash price if settled in 3 mths.

TELEVISION RECTIFIERS. 250v. 200mA, small size. Only 6/9 ea

RE-ENTRANT SPEAKERS. Tannoy, 8 watt, 7.5 ohms. Only 19/6 each. Or 35/- per pair.

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 feedback loops. Hum level 71 db. down. ONLY 70 Millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs.



For STANDING or LONG PLAYING RECORDS. For MUSICAL INSTRUMENTS such as **STRING BASS, GUITARS,** etc. **OUTPUT SOCKET** with plug provides 300 v. 30 mA and 6.3 v. 1.5a. 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 **£7.15.0** or factory built 45/- extra. Carriage 10/-.

£7-15-0

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.**

SPECIAL OFFER. Two tone Portable cabinet. Gram amplifier. Staar. Changer and 7 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 12 x 6½ x 5½ in.

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.**

EX. GOVT. MAINS TRANSFORMERS

Primaries 200-250 v. 50 c.p.s. A.C.

250 v. 60 m.a., 6.3 v. 2 a. **10/11**

270-0-275 v. 100 m.a. 6.3 v. 7 a. 5 v. 3 a. **21/9**

300-0-300 v. 60 m.a., 6.3 v. 2 a. **11/9**

300-0-300 v. 100 m.a., 6.3 v. 2 a. 5 v. 2 a. **18/9**

350-0-350 v. 160 m.a. 6.3 v. 5 a.. 5 v. 3 a. **27/9**

SELENIUM RECTIFIERS

F. W. BRIDGE		H.T. Types H.W.	
6/12 v. 1 a.....	3/11	150 v. 40 m.a...	3/9
6/12 v. 2 a.....	6/11	250 v. 50 m.a...	3/11
6/12 v. 3 a.....	9/9	250 v. 60 m.a...	4/11
6/12 v. 4 a.....	12/3	250 v. 80 m.a...	5/11
6/12 v. 6 a.....	15/3	250 v. 250 m.a.	12/9
6/12 v. 10 a.....	25/9	**CONTACT COOLED**	
6/12 v. 15 a.....	35/9	250 v. 30 m.a. H.W.	
2 v. 2 a.....	14/9	6/11, 250 v. 75 m.a. F.W. (Bridge)	8/11.

HI-FI 10 WATT AMPLIFIERS

Slightly store soiled but guaranteed unused and in perfect order. Fitted Mullard valves. Dual inputs for "mike" and gram, etc. Bass and Treble Controls. High sensitivity and quality. For 200-250 v. A.C.

£5-19-9 Carr. 7/6

R.S.C. BATTERY CHARGING EQUIPMENT

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

ASSEMBLED CHARGERS

6 v. 1 amp..... **19/9**
6 v. or 12 v. 1 amp..... **29/9**
6 v. 2 amps..... **29/9**
6 v. or 12 v. 2 amps..... **38/9**
6 v. or 12 v. 3 amps. with ammeter **59/9**

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

HEAVY DUTY CHARGER KIT.

6/12 v. 6 amps. variable output. Consisting of Mains Transformer 0-200-230-250 v. ; F.W. (Bridge) Selenium Rectifier ; Ammeter, Multi Position Switch with Knob ; Panels, Plugs, Fuses, Fuseholder, and circuit **59/9.** Carr. 4/6.

Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finish. Fused and ready for use with Carr 5-mains and output leads. Terms : Deposit 13/3 and 5 monthly payments 13/3.

69/9

ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.

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

49/9 Carr. 3/9.

BATTERY CHARGER KITS

Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuse-holders. Grommets, panels and circuit. Carr. 3/6 extra.

6 v. or 12 v. 1 amp..... **24/9**
As above, with Ammeter... **32/9**
6 v. 2 amps..... **25/9**
6 v. or 12 v. 2 amps..... **31/6**
6 v. or 12 v. 2 amps. inclusive of Ammeter..... **42/9**
6 v. or 12 v. 4 amps..... **53/9**
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector, **59/9.**

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

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.. **26/9**
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.. **26/9**
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, 5000 Ω to 3 Ω **3/9**
Small Pentode 7/8,000 Ω to 3 Ω **3/9**
Standard Pentode 5,000 Ω to 3 Ω **5/6**
Standard Pentode, 7/8,000 Ω to 3 Ω .. **5/6**
10,000 Ω to 3 Ω **5/6**
Push-Pull 10-12 watts 6V6 to 3 Ω or 15 Ω **18/9**
Push-Pull 10-12 watts to match 6V6 to 3-5-8 or 15 Ω **19/9**
Push-Pull EL84 to 3 or 15 Ω **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 15 Ω .. **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.

D.C. SUPPLY KIT. 12 v. 1 a. consisting of a partially drilled metal case, mains trans., F.W. Bridge Rectifier, 2 fuseholders and fuses. Chanke Direction switch, variable Speed regulator and circuit. For 200-250v. A.C. mains. Suitable for Electric Trains, etc. Limited number available at **33/9.**

R.S.C. A12 STEREOPHONIC AMPLIFIER KIT

A complete set of parts to construct a Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and point-to-point wiring diagrams supplied. Only good quality components and latest high grade valves used. Exceptionally realistic reproduction can be obtained at ample volume for the home, as can be demonstrated in typical surroundings at our County Arcade premises. A really sensational offer.

4 Gns. Carr. and pkg. 5/-

STEREO EQUIPMENT OFFER. Comprising A12 Kit, matched 8in. L/Speakers, and Acos T/O Stereo head with diamond stylus suitable most pick-ups. **£6-19-6** Carr. 7/6

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. 39-1 Stick types, list price 5 gns. Brand new. 39/6.

R.S.C. 30 WATT ULTRA LINEAR HIGH FIDELITY AMPLIFIER A10

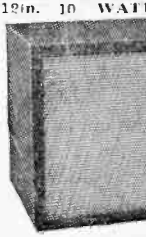
A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response -3 db. 30-30,000 c/cs. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used, EF86, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/cs. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for **18/9.** The amplifier can be supplied, factory built with 12 months' guarantee, for **£13.19.6. TERMS: DEPOSIT 24/9** and 12 monthly payments of 24/9.

11 GNS. Carr. 10/-

FULL RANGE OF LINEAR AMPLIFIERS ALWAYS IN STOCK.

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 7-5-5½in. high. Guaranteed for 12 months. Only £5/19/6. Send S.A.E. for illustrated leaflet. Terms. Deposit 22/6 and 5 monthly payments of 22/6.

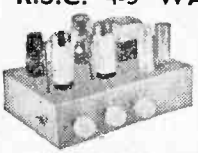
12in. 10 WATT HIGH QUALITY LOUDSPEAKER IN POLISHED WALNUT FINISHED CABINET



Gauss 12.000 lines. Speech coil 3 ohms or 15 ohms. Only £4.19.6 Carr. 5/-. Terms: Deposit 11/- and 9 monthly payments of 11/-.

12 in. 20 WATT HI-FI LOUDSPEAKERS IN CABINETS. Size 18 x 18 x 8 in. Finish as above. Terms: Deposit 13/10 and 12 monthly payments of 13/10. Only £7.19.6. Carr. 8/6.

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



A highly-sensitive 4-valve quality amplifier (or the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high fidelity pick-up heads. In addition to all other types of pick-ups and practically all 'mikes', separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71db. down, 15 db. of negative feedback is used. H.T. of 300 v. 25 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4/15/-, or assembled ready for use 25/- extra, plus 3/6 carr.: or Deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

R.S.C. PORTABLE GUITAR AMPLIFIERS

Junior 5 watts High Quality output. Separate Bass and Treble 'Cut' and 'Boost' controls. Sensitivity 15 m.v., Twin inputs. High Flux 8in. Loudspeaker 'built-in'. Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in satin walnut, and fitted carrying handle. H.P. Terms. Deposit £1 and 9 monthly payments of £1. **£8-19-6** Carr. 7/6

Senior 10 watts High Fidelity output. Separate Bass and Treble 'Cut' and 'Boost' controls. Two separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12 in. for Bass notes and a 7 x 4 m. elliptical for Treble. Cabinet is well made and finished satin walnut. Size approx. 18 x 18 x 8 in. H.P. Terms. Deposit 26/9 and 12 monthly payments of 26/9. Both models for 200-250 v. A.C. mains. **15 GNS.** Carr. 10/-

SPECIAL TRANSISTOR OFFER. TS1 Brimar. Brand new. Perfect. 3 for 10/9

PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER (12,000 lines) with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.), providing extraordinarily realistic reproduction when used with our A8 or similar amplifier. Rated 10 watts. Price only £5/17/6.

Hi-Fi CRYSTAL PICK-UP HEADS. (Turnover type with sapphire stylus). HCP59. Standard replacement for Garrard and B.S.R. B.S.R. Ful-fi, Garrard GC2, 19/9.

POWER PACK KIT. Output 250 v. 50 mA, fully smoothed and 6.3 v. 1.5 a. Consisting of Mains Trans., Selenium Rectifier, Smoothing Choke, Double Electrolytic Condenser, Chassis 6in. x 3½in. and Circuit. Only 18/9.

P.M. SPEAKERS. 2-3 ohm. 2½in. Perdio 21/9. 5in., 17/9. 6½in., 16/9. 8in., 19/9. 8 x 5in. 25/9. 10in. 26/9. 10 x 6in. 29/9. 12in. 29/11. 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A8 Amplifier, £4.10.9. 12in. Plessey 2 ohms 10 watts (12,000 lines). 59/6.

TWEETERS. Plessey 3Ω 19/9. 15 Ω 25/9

G13A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Over-all size 11½in. x 2½in. x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only 59/6.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). Delayed A.V.C. employed. The W.Ch. Sw. incorporates Gram position. Controls are Tuning, W.Ch. and Vol. only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustration, 2/6. Total building cost £4/15/-. For descriptive leaflet send S.A.E.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2½in. 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. 3-4 WATT A7 HIGH-GAIN AMPLIFIER

For 200/250 v. 50 c/cs. Mains input. Appearance and Specification, with exception of output wattage, as A5. amplifier. Complete kit with diagrams. £3.15.0. Carr. 3/6.

EX-GOVT. CASES. Size 14-10-8½in. high. Well ventilated, black crackle finished, undrilled cover. IDEAL FOR BATTERY CHARGER OR INSTRUMENT CASE, OR COVER COULD BE USED FOR AMPLIFIER. Only 9/9, plus 2/9 postage.

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.

TERMS: C.W.O. or C.O.D. No. C.O.D. under £1. Post 1/9 extra under £2; 2/9 extra under £5.
Open 9 to 6; Weds. until 1 p.m. Trade supplied. S.A.E. with all enquiries

R.S.C. (Leeds) Ltd. **BRADFORD, MANCHESTER and LEEDS**

Mail Orders to 29-31 Moorfield Rd., Leeds 12.
Callers to 5 and 7 County (Mecca) Arcade, Briggate, Leeds 1, and 8-10 Brown St. (Market St.). Manchester 2, or 56, Morley Street, (Next to Majestic Ballroom) Bradford.

RETURN-OF-POST SERVICE

JASON FM TUNERS

Three Jason F.M. Tuner kits with variable tuning are now available to the home constructor. Brief details are given here and our illustrated list is available free.

MOST IMPORTANT. We take great pains to see that every item needed is included in our kits and also that all items are entirely suitable in every way. This should be borne in mind when comparing prices.

Hire Purchase Terms are available on any kit.

INSTRUCTION MANUALS. All our kits include the instruction manual, but this can be supplied separately if required. Data Publications booklet describing FMT1, 2, and 3. 2/10, post free.

STANDARD TUNERS

FMT1. Supplied complete with a chassis-panel assembly fitted with a gold hammer finished panel and glass dial. Four EF91 valves are used and an external power supply is required. Complete kit **£6.19.6.** Power Pack Kit **£2.1.0.**

FMT2. This is a new version of the FMT1 and is supplied with a complete cabinet-chassis assembly which can be mounted in a cabinet or stood on a shelf. The circuit employs four EF80 valves and the power supply can be built into the cabinet if desired. Complete Kit less power supply **£7.17.6.** Kit with power supply **£9.16.0.**

FRINGE TUNER

FMT3. This is a fringe tuner using the same cabinet assembly as the FMT2 described above. The tuner is fitted with variable AFC and uses five EF80 and one ECC81 valves. Kit less power supply **£9.19.6.** Kit with power supply **£11.18.0.**

F.M./TV SWITCHED TUNERS

Kits for two new Jason F.M./TV Sound switched tuners are now available. Both incorporate the latest "Fireball" Turret Tuner which gives switch positions for the three BBC Programmes as well as BBC and ITA TV Sound. A.F.C. is fitted to ensure freedom from drift.

INSTRUCTION MANUALS. Our kits include these without extra charge, but the manual for either tuner can be supplied separately at 3/10, post free.

JTV2. This tuner is complete with power supply in a cabinet which can be used either for shelf or cabinet mounting. Complete kit **£14.14.0.**

MERCURY 2. This is similar to the JTV2 but has no provision for a power supply. It is mounted on a small chassis with printed front panel and is intended for cabinet fixing. Complete Kit **£10.10.0.**

IMPORTANT. When ordering these kits it is essential to give the TV channels and F.M. stations required on the tuner.

GRAMOPHONE EQUIPMENT

ALL LATEST MODELS	Cash Price	Deposit	Hire Purchase 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 PU) ..	£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.

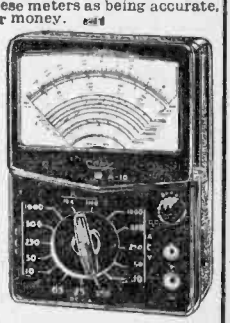
LATEST TEST METERS

AVOMETER 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 micro-amps. 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. 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.**

AVO MULTIMINOR A pocket size 10,000 ohms per volt meter (1,000 ohms per volt on A.C.). Six D.C. voltage ranges 2.5 to 1,000 volts. Five A.C. voltage ranges 10 to 1,000 volts. Five D.C. current ranges 100 micros. to 1 amp. Two resistance ranges. Price **£9.10.0.** H.P. deposit **£1.16.0** and 12 monthly payments of 14/4. With leather case **£11.9.0.** Deposit **£2.5.0** and 12 monthly payments of 17/-.

AVO METER MODEL 7. also available. Price **£19.10.0.** H.P. Deposit **£3.18.0** and 12 payments of **£1.8.8.** With leather case **£23.8.0.** H.P. deposit **£4.12.0** and 12 payments of **£1.14.6.**

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 0.5-250 mA. Two resistance ranges. Size 5¼ x 3¼ 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, 0.5-250 mA. Four resistance ranges. Price **£6.10.0.** H.P. Deposit **£2** and three monthly payments of **£1.13.4.**

Leaflets giving full details of any of the above meters are available free upon request.

CATHODE-RAY TUBES

BRAND NEW STOCK. NOT REBUILDS.
12 MONTHS' GUARANTEE

We can supply all BVA branded tubes at the new reduced prices. This includes Brimar, Cossor, Emiscope, Emitron, Ferranti, G.E.C., Mazda and Mullard. Full list of all available types sent on request.

NEW ILLUSTRATED LISTS

Illustrated lists are available on LOUDSPEAKERS, TAPE DECKS, TEST GEAR, RECORDING TAPES, GRAMOPHONE EQUIPMENT. Any will be sent free upon request.

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 per cent but minimum charge 10/-. Six and Twelve months: Deposit 4/- in the £. Service charge 10 per cent, but minimum charge 20/-.

Terms of Business.—Cash with order or C.O.D. We charge C.O.D. orders as follows. Up to £3, minimum 2/8. Over £3 and under £5, 1/6. Over £5 no charge. **Postage extra on CASH orders under £3.**

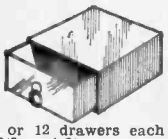
WATTS RADIO
(MAIL ORDER) LTD.

54 CHURCH STREET, WEYBRIDGE, SURREY
Telephone : Weybridge 4556
Please note : Postal business only from this address.

Beginner's Superhet

All the components including metal chassis, valves, metal rectifier, coils, tuning condenser, etc., etc., required to build the "Beginner's Superhet" as described in the January, 1958, issue, are available as a parcel. Price £3. plus 3/- post and insurance.

Component Storage Drawers



Stout board Construction these drawers are ideal for small parts. Supplied complete with simple erection instructions—1/6 each or 12 drawers each 6 × 2½ × 6¼in. 13/6, post 2/-

Variable Rheostat

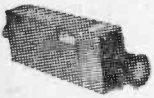
Heavy duty slider resistor rated at 25 amps. Basic resistance is 0.4 ohms. Can be rewired to suit individual requirements. Ideal for dimmer circuit, etc. Price 8/3, post 3/6.

Clock numerals etched on metal. 2/6. Post 1/-.

Suppressor Condenser

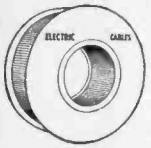
Stop your drill or other appliances interfering with your or your neighbours' radio or television. Simple instructions given. 1/6 each. 12/- dozen.

Cine Cameras



16 mm. motorised (24 VAC) for 16 frames per second, contains fine f/8.5 triple anastigmatic lens and spool to carry 25ft. of film—probable cost around £150, brand new and in sealed carton. £6.16.0 or 20/- deposit and 13 fortnightly payments of 10/-, post and insurance 3/6.

Versatile Wire

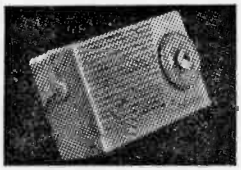


Single-strand 18-gauge with P.V.C. covering which makes it rustproof. Extra strong, will stand tremendous strain. Ideal for gardening, clothes lines, indoor aerials, etc. etc. Also being steel alloy and having a resistance of approximately ½ ohm per yard this can be used for electrical work, soil heating,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

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-toned 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.

Built a Transistor Set?



Or perhaps you intend building one—either way you may need a smart cabinet for it. We can supply similar to illustration, size approx. 5½ x 3 x 11in. with handle/rest, tuner, scale, control disc. Price 8/6 complete, post and ins. 1/6.

Another Battery Charger Bargain

Components Would Cost More

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

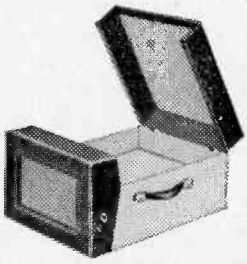
H.R.O. Power Unit

An extremely well made unit with input (switched) suitable for our Standard mains on 115 v. A.C. mains—output to fully smoothed 250 v 75 mA D.C. and 6.3 v. 3.5 amps. Made originally for the H.R.O. receiver but equally suitable for other set—unused and in perfect working order. Price £2.15.0, plus 3/6 post and insurance.

R1155 for Spares

These are less valves but otherwise reasonably complete—ideal for spares—prices £2 to £4 depending on condition—carriage 7/6.

CABINET SNIP



Extremely well-made portable amplifier case finished in two-tone and very modern in appearance. Large enough for stereo outfit with tape deck or auto-changer. Snip price 56/9, plus 3/6 carriage and insurance.

FOR ADDRESS SEE OPPOSITE PAGE

Special This Month

Moving Coil Meters:

0—500 microamp, 2in. flush	17/6
250-0-250 microamp, 2½in. surface	27/6
750 microamp, 2½in. surface	17/6
5-0-5 milliamp, 2½in. flush	17/6
0-30 milliamp, 2½in. flush	17/6
0-100 milliamp, 2½in. flush	15/-
0-300 milliamp, 2½in. flush	15/-
0-500 milliamp, 2½in. flush	15/-

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

Unbreakable Mains Lead. Type of lead fitted to electric razors makes fine lead for test meters and any other devices where subject to continuous bending. Twin figure eight construction, soft cream p.v.c. covered. Normally costs 2/- per yard. Three 6ft. leads for 2/-.

Metal Rectifier. Equivalent RM5. 12/6.

Metal Rectifier. 60/80 mA 250/300 v., 4/6.

Output Transformer. Standard Pentode. 4/6. Multi ratio. 6/6.

Bi-metal Strip. with heavy duty contact, ideal for thermostat, fire, lamp, etc., etc., 2/6.

Neon Lamp. Midget wire ended, ideal mains tester, etc., 2/-, ex. gov. 1/6.

Philips Trimmers, 0-30pF, 1/- each. 9/- doz.
Set of 8 Allen Keys, 3/6.

Install those extra Points. 3.029 twin flat T.R.S. cable. Big purchase enables us to sell this at 45/- per 100 yds., carriage 3/6.

Low Resistance Head Phones. Ideal crystal sets, etc., 7/6, plus 2/6.

Goodmans Multi Ratio Output Transformer, 6 watt, 8 ratios, from 12-1 to 72-1. Centre tapped for push/pull, 7/6, plus 1/-.
Ditto unbranded. 6/6, post 1/-.

Cold Cathode Valve CV413. Voltage regulator or trigger switch—unused but ex-equipment. 2/- each.

Tag Panels. Ideal for constructors, experimental circuits, etc., 3 of each of 12 different types, 5/-, post 1/6.

Slydlok Panel Mounting Fuses with carrier, 5 amp. 2/- each, 15 amp. 2/6 each.

Belling Lee 2BA fully insulated terminals for mounting through metal panels 2/- each.
Terminal Heads, insulated 4BA, 2/- doz.

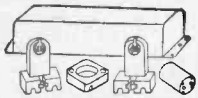
0.1 mFd 350 v. Small tubular metal cased condensers made by Dubilier. 2/6 doz.

50 Assorted Resistors. Well mixed and useful values ½ and ¼ watt. 5/- for 50.
Ditto, but 1 watt, 6/6 for 50.

Mains Transformer. Standard 230 v., input 250-0-250 at 80 mA, 6.3 v. at 5 A. 12/6.

Toggle Switch. Standard metal body type with round dolly, fixing ring and on/off indicating plate, 1/3 each or 12/- doz.

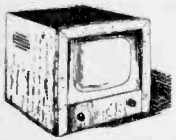
Screened Cable. Rubber covered, flexible with metal braiding, ideal for microphone or gramophone extensions, 4d. per yd., 30/- per 100 yds.



Fluorescent Light Bargain

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

Now Reduced to 9/6

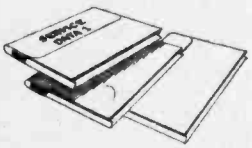


14in. TV cabinet of the latest styling—beautifully veneered and polished—limited quantity, sale price 9/6 each. Carriage and packing 3/6 extra. Masks 10/- extra.

"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.

TV Service Sheets



150 sheets covering the most popular post-war Televisors by leading makers—Cossor, Ekco, Ferguson, Pye, etc. Giving circuit diagram, component values, I.F. frequencies, etc. £1. post free.

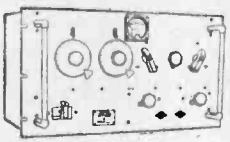
Building A Scope?

3in. oscilloscope tube American made Type No. 3FP7. Octal base 6.3 v. 0.6 amp heater, electrostatic deflection. Brand new and guaranteed, 15/- each, plus 1/6 post and insurance. Complete with circuit diagram.

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.

R1132—2 Metre Receiver



This is a 15 valve superhet covering 95-150 mc/s (2-3 metres). Switchable AGC and AVC—variable b.f.o. We have a few only of these very fine receivers—complete and good condition but may need some attention.

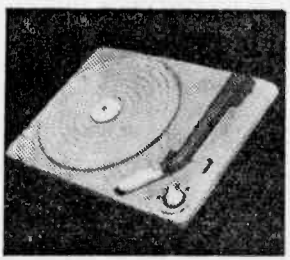
Price £6.19.6. plus 10/- carriage and insurance.

Power Unit 234A

Built to operate the 1132 but on extremely fine power pack for any job — standard mains input. h.t. output. 100 mA at 240 v. fully smoothed L.T. 6.3 v. at 5 amps.

Unused and in perfect order, £4.10.0. plus 7/6 carriage and insurance.

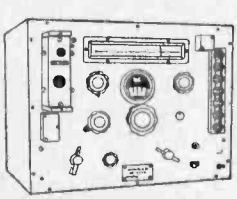
Philips AG2009 Transcription Unit



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 fortnightley payments of 10/-.
Available also with stereo head, diamond or sapphire stylus. Prices on request.

B.29 Receiver



A fine receiver made by the famous Marconi Company. Covers the shipping bands 15 k/c to 580 k/c in four switch stages. Has Vernier tuning and all refinements. Works off A.C. mains with internal power pack. A few only, in good working order £15 each. Also some needing servicing, £12.10.0 each.

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.

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
1 Pole 12 Way	3/-
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 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/-

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.

Transistor Snip

Equivalent of red spot—suitable all if circuits—tested before despatch. 4/6 each.

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, 6/6, post 1/-.

Miniature Microphone

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

ELECTRONIC PRECISION EQUIPMENT LTD.

Post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66 GROVE ROAD, EASTBOURNE, SUSSEX. marked Dept. 7,

Callers may use anyone of the Companies below:

Electronics (Manor Park) Ltd.,
520 High Street North, Manor Park, E.12
Phone: Ilford 1011
Half day Thursday

Electronics (Ruislip) Ltd.,
42-46 Windmill Hill, Ruislip, Middx.
Phone: RUISLIP 5780
Half day Wednesday

Electronics (Croydon) Ltd.,
266 London Road, Croydon.
Phone: CRO 6558
Half day Wednesday

Electronics (Finsbury Park) Ltd.,
29 Stroud Green Rd., Finsbury Park, N.4.
Phone: ARChway 1049
Half day Thursday

FOR VALVES - TUBES AND COMPONENTS - BY RETURN POST SERVICE

ACHLDDD	10/-	ECC85	9/6
AC/P	7/6	ECF80	12/-
AC5PENDDD	26/6	ECF82	13/-
AC6PEN	6/6	ECH3	26/6
ATP4	3/6	ECH21	23/3
AZ1	10/-	ECH35	23/3
AZ31	10/-	ECH42	9/6
AZ41	13/11	ECH81	9/-
B36	10/-	ECH83	13/11
CBL1	26/6	ECL80	10/-
CBL31	23/3	ECL82	12/6
CCH35	23/3	ECL83	19/3
CL4	12/6	EF9	23/3
CL33	19/3	EF22	8/6
CY31	16/7	EF36	5/-
CY1	18/7	EF37A	15/-
CV73	4/-	EF39	5/9
C36A	6/6	EF40	14/6
DAF96	8/9	EF41	9/9
DF96	8/9	EF42	11/-
DH63	7/6	EF50	4/-
DK96	8/9	EF50SYL	7/-
DL96	8/9	EF54	6/-
DM70	7/6	EF55	10/-
DN41	12/6	EF80	7/6
EA50	1/6	EF85	7/6
EABC80	9/-	EF86	13/-
EAF42	10/6	EF89	8/9
EB34	2/-	EF91	5/9
EB41	8/6	EF91 (BVA)	7/6
EB91	5/-	EF97	13/3
EBC33	6/9	EF98	13/3
EBC41	9/6	EL32	5/6
EBC81	11/4	EL33	14/-
EBC90	12/7	EL34	19/11
EBC91	12/7	EL36	19/11
EBF80	9/9	EL38	26/6
EBF89	9/6	EL41	10/6
EBL21	23/3	EL42	10/6
EBL31	23/3	EL81	16/7
ECC40	23/3	EL83	19/11
ECC81	8/-	EL84	9/-
ECC82	7/6	EL821	26/6
ECC83	9/-	EM34	9/6
ECC84	10/-	EM80	10/-
EM81	10/6	PCF80	9/6
EY51	10/-	PCF82	12/6
EY81	13/3	PCF84	16/7
EY86	10/-	PCL82	12/-
EZ35	16/7	PCL83	14/6
EZ40	7/6	PL38	26/6
EZ41	7/6	PCL84	16/7
EZ80	7/-	PL36	13/6
EZ81	7/-	PL81	12/6
EZ90	7/6	PL82	8/6
E1148	2/-	PL83	11/6
FC4	26/6	PL84	12/7
FC13	6/6	PL820	18/7
FW4/500	10/-	PX25	12/6
GT1C	27/6	PY31	16/7
GZ32	12/-	PY32	17/11
H30	5/-	PY80	7/6
H63	10/-	PY81	8/6
HL23DD	8/6	PY82	7/6
HL22	6/6	PY83	8/6
HN309	24/7	PZ30	19/11
K40N	9/-	PEN4DD	26/6
KF35	8/6	PEN4VA	12/6
KK32	21/11	PEN25	6/-
KLL32	24/7	PEN46	7/-
KT2	5/-	PEN383	23/3
KT24	5/-	PEN220A	4/-
KT32	14/-	PEN45DD	26/6
KT33C	8/6	PENA4	12/6
KT36	29/10	PM12M	8/-
KT61	13/6	QP21	5/-
KT63	7/6	R16	26/6
KT66	17/6	SP41	3/-
KT88	22/6	SP61	3/-
KT101	10/6	SP4/5	10/6
KTW61	6/6	SP4/7	10/6
KTW63	7/6	T41	23/3
KTZ41	3/6	TH233	18/6
MH41	7/9	TP25	10/-
ML4	8/6	U10	10/6
MSP4/5	7/6	U14	8/6
MSP4/7	7/6	U16	12/6
MX40	12/6	U22	8/-
N37	19/11	U25	14/-
N78	19/11	U26	12/6
N339	17/6	U37	26/6
OZ4	5/6	U45	15/-
P61	3/6	U50	8/-
PABC80	13/11	U76	8/-
PCC84	9/-	U191	11/6
PCC85	9/6	U339	12/-
PCC88	23/11	U403	16/7
PCC89	19/11	U404	11/4
		U801	29/10
		UABC80	10/-
		UAF42	9/6
		UBC41	9/-
		UBC81	11/4
		UBF80	9/6
		UBF89	13/11
		UBL21	23/3
		UC92	13/3
		UCC84	10/11
		UCC85	10/6
		UCF80	16/7
		UCH21	23/3
		UCH42	10/6
		UCH81	10/6
		UCL82	16/7
		UCL83	13/6
		UF41	9/-
		UF42	17/3
		UF80	13/11
		UF85	9/-
		UF86	17/11
		UF89	9/-
		UL41	10/-
		UL44	26/6
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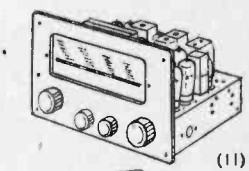
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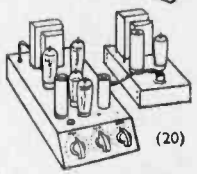
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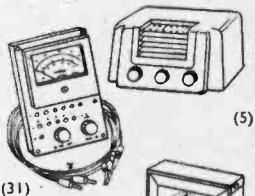
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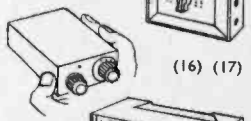
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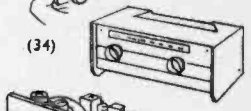
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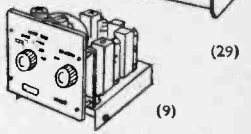
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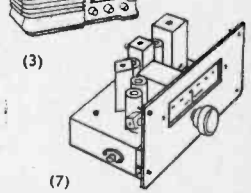
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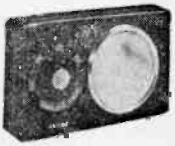

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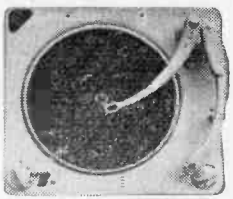

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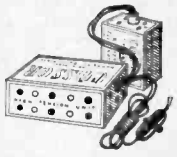

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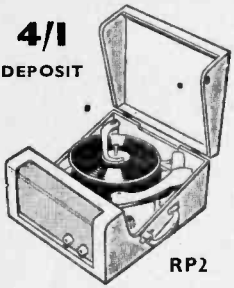


RP2

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**

STEREO RECORD PLAYER CABINET

with extension speaker cabinet

at the amazing offer of **99/6**

Portable 1960 Show Model in two-tone colours. Extension speaker cabinet secured in lid. Size 18 x 14 x 8½in. high. This stereophonic player retails at 35gns. in the shops today. A must for teenagers, and an essential for the enthusiast. Carr. & Ins. 5/6 with order. OR 6/1 initial payment and balance at 4/11 for 19 weeks.

NO DEPOSIT — *INTEREST FREE*
20 or 36 weeks to pay!
Send for a FREE catalogue.

RECORD PLAYER CABINET

5/4
DEPOSIT

RP3

Balance at 3/11 for 19 weeks. This contemporary cabinet in two-tone grey rexine is ideal for the modern home. Added attraction is the cream plastic speaker fret. Press button lid; lock. Fittings for screw-in legs. Internal measurements 14½ x 18 x 8¾in. deep. Takes a Garrard 121 mk. 2 or B.S.R. U.A.12; 9⅓ x 4½in. Elliptical speaker; any two control portable amplifiers. Carr. &Ins. 5/6. Cash Price **79/9**

DE-LUXE TAPE RECORDER CABINET

ONLY **29/9**

Beautifully made Tape Recording Cabinet. Size 14 x 11 x 8½in. Covered in two-tone rexine cloth. Stylish design. Carrying handle and detachable lid with lock and key. Easily adapted to Record Player Cabinet. Exceptional value at this very low price. P. & P. 4/6.

EXTENSION SPEAKERS 19/9

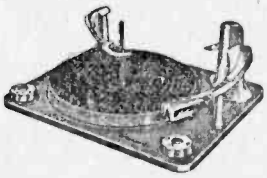
Polished oak cabinet of attractive appearance. Fitted with 8in. P.M. speaker W.B. or Goodmans of the highest quality. Standard matching to any receiver (2-5 ohms). Switch and flex included. Carr. & Ins. 3/9.

SOLO SOLDERING TOOL only 12/6

110v., 6v.; 12v. (special adaptor for 200/250v., 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. Post 3/6.

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

£6.19.6



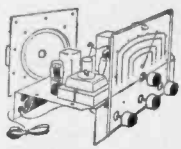
4-speed autochanger. Incorporating auto and manual control complete with turnover crystal P.U. and Sapphire stylus. A.C. Post & Ins. 5/6 or Initial Payment 8/1 plus Post & Ins. and 19 weekly payments of 6/11.

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	**11gns.**

P. & P. on all above 5/6.

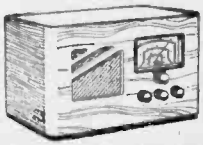
SUPER CHASSIS 3/11 per week

On the initial payment of 5/1 plus carriage 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.



HOME RADIO A.C. or UNIVERSAL 79/6

A.C./D.C. Universal mains 5-valve octal superhet. 3 w/band receiver can be adapted to gram p.u. in attractive wooden cabinet. Size 9⅜ x 18⅛ x 11¼in. Ins. and Carr. 4/6. Terms available.



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COMPLETE and WORKING

19 Gns.

Initial payment £1.0.7 and 19 weeks of 19/11 OR Initial payment £2.4.4 and 32 weeks of 11/1.
A 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. CRT full 12 months' guarantee. A.C. only. Ready and working to fit into your own cabinet. Carr. & Ins. 25/-. As above with 14in. tube, £15.15.0.

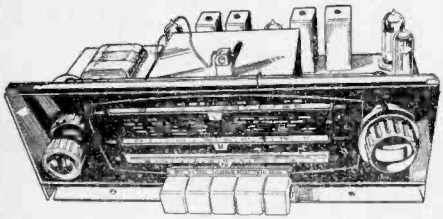
REPLACEMENT REBUILT TV TUBES

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

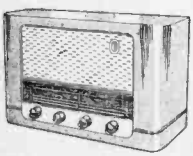
Balance at 8/6 for 19 weeks. 12 months' full guarantee. Cash price £9.10.0. All sizes except 10in. Carr. & Ins. 15/6.

DUKE & CO. 621/3 ROMFORD ROAD, MANOR PARK, E.12. ILF 6001/3

BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £13.6.8. (P. & P. 10/-)



Why buy a F.M. Tuner at the same price?
Tapped input 220-225 v. and 226-250 v. A.C. ONLY.
Chassis size 15 x 6½ x 5½in. high. New manufacture.
Dial 14½ x 4in. in gold and black.
Pick-up. Extension Speaker. Ae., E., and Dipole sockets. Five "piano" push buttons—OFF, L.W., M.W., F.M. and Gram. Aligned and tested. With all valves & O.P. Transformer. Tone Control Fitted.
Covers 1,000-1,900 M.; 200-500 M.; 88-98 Mc/s.
Valves EZ80 rect., ECH81, EF89, EABC80, EL84, ECC85.
Speaker & Cabinet to fit chassis (table model), 47/6.
10 x 6in. ELLIPTICAL SPEAKER, 20/-, to purchasers of this chassis.
TERMS:—(Chassis) £4.16.8 down + 10/- carr. and 6 Monthly Payments of 30/-, or with Cabinet & Speaker £5.9.2 down and 7 Monthly Payments of 32/-.



COMPLETE RADIO FOR ONLY £10.10.0. carr. pd.

Size 19 x 13 x 7½in. or Chassis and dial for £8 (carr. paid.). Chassis Size 15 x 6½ x 5½in.; 1,000-2,000 M.; 200-550 and 16-54 M. Mains (200-250 v A.C.) and O.P. Trans. (3 ohm); Gram. Aer., E., Ext. L.S. Sockets; New Mullard Valves ECH42, EF41, EBC41, EL41, EZ40 and Magic Eye EM81. Dial 15 x 3in. Fully aligned. Fantastic value for money.
6½in. or 6 x 4in. speaker fitted to cabinet. New Manufacture.

BATTERY ELIMINATOR. Converts your Battery Set to Mains. For 4 Low Consumption Valves (96 range). 90 v. 15 ma. and 1.4 v. 125 ma., 42/6 (2/6 post). 200-250 v. A.C. Size 5½ x 3½ x 2in. Also for 250 ma. 1.4 v. and 90 v. 15 ma. at same price. Specify which, or give Valve line-up.

TELERECTION AERIAL. "Twenty-20" adjustable set top or table for Bands 1, 2 and 3. "Gold" finished rods and mounting. List Price 42/-. Our price 30/- (carr. paid).

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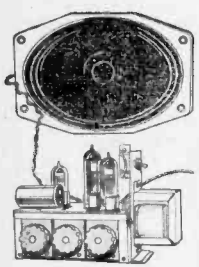
50 SILVERED MICA AND CERAMIC CONDENSERS, 10/-.
50 RESISTORS, 5/-. ALL DIFFERENT VALUES.
21 TUBULAR CONDENSERS (7 values 0.001 to 0.1mf) 4/6.

COMPLETE TAPE RECORDER FOR ONLY £19.19.0.

B.S.R. deck. Two-tone leatherette case. Acos crystal mike, 850ft. tape extra spool. On/Off Tone and Vol. 7 x 4in. Speaker. 1½ hrs. playing time. Single speed 3¾in./sec., fast forward and reverse, mike and radio inputs, ext. speaker socket; cannot be accidentally erased. 13½ x 12 x 8in. Weight 20 lbs. 12 months guarantee. Carr. 7/6 extra. **Terms:** £6 down and 6 monthly payments of 50/-.



3-VALVE AMPLIFIER (INC. RECT.). Capable of giving 6 watts. Mains and output transformers. Valves ECC81, EL84 and Rect. 3 Controls, volume, bass and treble. On/Off switch. Fully guaranteed. Chassis size 6½ x 3 x 2½in. 6½in. round or 7 x 4in. elliptical speaker, state which. Not suitable for microphone input.

67/- (3/- p. & p.).

LISTEN WITHOUT INTERFERENCE

Fully built V.H.F./F.M. Tuner for £5.10.0 (3/- post). Covers 88-98 Mc/sec. Wired, aligned and tested. 4 Mullard valves; for use up to 40 miles from transmitter. FRINGE MODEL for above this (5 valves), £6 (p. & p. 3/-). External H.T. and L.T. supplies reqd. for both of foregoing. BUT, a complete V.H.F. set, four valves, with mains transformer, amplifier, rectifier and speaker (with above frequency coverage) can be supplied for **ONLY £8.8.0** (4/- carr.). Cheap room dipole 10/-. 300 ohm twin feeder, 6d. yd. All with 12 months' guarantee.

GRAMOPHONE AMPLIFIER with 5in. SPEAKER. On Fabric-covered Baffle 12½ x 5in. Mains and Output Transformers. Metal Rectifier. ECL82 Valve. Tone and Volume Controls. On/Off switch. Plenty of Volume. Fully Guaranteed. Two Knobs supplied. Ready to play. Useful for Stereo.

ONLY 57/-, post 3/-

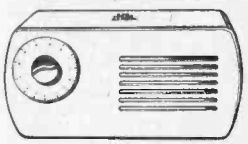
BEREC "PIONEER" RADIO IN MAKER'S CARTON. Valves DK96, DF96, DAF96, DL96. Requires Ever Ready battery B103 or battery elim. for converting to mains operation—see adjacent item. Two Short Wavebands 2.5 to 7 Mc/s and 6.5 to 17 Mc/s. Cabinet, 12 x 7½ x 6in. **ONLY £4.10.0** (2/6 p. & p.). (MW and SW £4.15.0 plus 2/6 p. & p.). In kit form with instructions and fully wired coil pack. Two Short Wavebands £4. One MW and SW £4.5.0. Plus 2/6 p. & p. Separate items supplied.
Send for List.

TAKE A CHANCE. We have surplus to present manufacturing requirements tens of thousands of resistors, silvered mica, tubulars, volume controls, electrolytics, valve holders, etc. **SEND US 20/-** for a bargain parcel of new goods. Our good name is your guarantee. Money back if not satisfied. State preference of types of goods.

SIX TRANSISTOR SUPERHET KIT

£8.19.6

Med. and L.W.; Printed Circuit; Instruction Book. Internal aerial. All items supplied separately. Write for price list. Battery, 9 v., PP4, 2/6.



ALL ITEMS GUARANTEED 12 MONTHS—R.V.A. VALVES 3 MONTHS.

Send 3d. (stamps will do) for our illustrated catalogue of the above items and others. All New Goods. Delivery by return. Terms:—One-third down and balance plus 7/6 in four equal monthly payments. Postage with down payment. (C.O.D. 2/- extra.)

SEE SPECIAL TERMS FOR A.M./F.M. CHASSIS AND TAPE RECORDER.
Posted Orders to Camberley Please.

See additional advertisement on page 64

GLADSTONE RADIO—58A HIGH STREET, CAMBERLEY, SURREY. Tel. 22791

Also at 3 Church Road, Lawrence Hill, Bristol 5.
Camberley, closed Saturdays. Bristol, closed Wed., afternoons.

Practical Wireless

VOL. No. XXXVI, 639 MAY 1960

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Contents

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

Obtaining Information

THE number of items of electronic equipment on the market is steadily increasing and every week sees additions to the range which is of interest to the home constructor. Naturally, the introduction of new equipment is preceded by comprehensive advertising which stimulates interest. However, when the item finally appears, it may be too expensive for the home constructor's pocket and he must perforce be content to wait until the price falls within his reach. The profits accrueing from the sale of a small number of expensive components may be worthwhile to the radio trade but in order to secure the goodwill of the larger part of the market, prices must be reduced as soon as possible. The methods adopted depend to a large extent on the type of equipment concerned, although if it is one which has not yet been placed on the general market, and is available only to, say, manufacturers or certain other specialised groups, then the matter becomes easier. For instance, a firm may approach the manufacturer of the equipment who find that the market is legitimately open to him and therefore a reasonable order cannot be refused. If the firm is reputable, the equipment purchased is used only in the goods manufactured by the firm, but, if, as sometimes happens, the firm lacks certain business scruples it may either be persuaded, or wish, to sell the goods "round the corner". At first sight this policy will result in lower prices for the constructor—all to the good—but there are certain aspects of the situation which complicate matters. When the item is bought and arrrives at the constructor's den, consideration has to be given to its housing and its use. It is usually the case that no definite information is included and the task therefore begins of tracing out the circuitry and the method of connection; if the equipment is complicated, the disadvantages inherent in the reduction in price become increasingly apparent and the lower price has to be weighed against the time spent in making the unit function.

The constructor may, by this time, be desperate for information and discuss the problem with the local dealer from whom he purchased the equipment. If the dealer cannot help him sufficiently, he may proceed, eventually, after asking the advice of his friends, the local radio club, etc., to the manufacturer whom he is sure will be able to resolve his difficulties. Generally, no doubt, this is so, but it may be that the letter he receives in reply may "regretfully" inform him that the equipment is not yet available on the open market, only to manufacturers, and therefore no information at all is available.

The situation is that the home constructor has paid a not inconsiderable price for an item of radio gear which, as it stands, is of little or no use to him. We deprecate this policy which is adopted by a few concerns; the home constructor should not have to pay for a mistake made by the manufacturers. The solution is surely for the manufacturers to prevent the purchasers of their equipment from selling the apparatus against their wishes. If equipment does reach the home constructor, full information should be made available to him; any refusal can only cause bitterness.

Our next issue, dated June, will be published on May 6th.

Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of January, 1960, 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	809,310
Home Counties	773,105
Midland	569,022
North Eastern	634,083
North Western	534,935
South Western	458,848
Wales and Border Counties ..	280,613
Total England Wales	4,059,916
Scotland	480,072
Northern Ireland	139,767
Grand Total	4,679,755

A new technique was used in the building of three new suites at a big London hotel—the Strand Palace—which cut building time by half, from seven months to 96 days, and reduced costs considerably. The job was carried out by using precise planning, close co-operation between hotel management, architect and builder, and by the use of radio to control operations. Every key-man on the job had his own miniature radio and was in constant touch with the control centre.

"Space Observatory"

A FULL-SCALE model of an Astronomical Space Observatory, designed by the Douglas Aircraft Company of America especially for the purpose, was shown at the "Daily Mail" Ideal Home Exhibition. The model, which was approximately 60ft high and 17ft in diameter, was made to show the sort of observatory that may possibly be used in the future. The electronics part of the Control Console display was provided by Mullard Ltd., and four cathode ray tubes each showed a trace to represent the sort of information which may be required by the spacemen of the future who may man such laboratories.

Transmitters

THE BBC has ordered a further two 100kW twin-channel high frequency sound broadcasting transmitters from Marconi's. These are for use at the Daventry station and will replace two existing transmitters on the BBC External Services.

The new equipments are a departure from conventional practice in that the penultimate R.F. and final R.F. amplifier and modulator valve stages are vapour-cooled: this is a system whereby the heat generated by the valve is transferred to water jackets surrounding them. The resultant steam is taken by convection to an air-cooled condenser which converts it once more to water for return by gravity feed to the water jackets.

New A.E.I. Division

THE important and ever-growing role that transistors and other semiconductor devices are playing in the electronics scene is recognised by the creation in A.E.I. Radio and Electronic Components Division of a new Product Department devoted to semiconductors.

The semiconductor department has its sales organisation at 155 Charing Cross Road, London, W.C.2. It produces a comprehensive range of types for industrial and commercial applications. Sales Manager is Mr. F. Szekely.

High-Power Radar

ITALY'S new intercontinental airport at Fiumicino, which is to be officially opened in the near future, is to be equipped with the most modern system of airways surveillance radar in the world.

The Ministry of the Italian Air Force, after intensive study of available equipments, has decided to install a Marconi 50cm, high power (500kW) radar, together with two display systems (comprising eleven display units), microwave radar link and ancillary equipment. The radar head will be generally similar to that at present being installed at London Airport, except that the Fiumicino installation is designed to provide additional high cover-age: this radar is the only type commercially available to have the advantage of a driven power klystron output stage, with its inherent stability.

In order to use the radar to cover separate functions, two display systems will be provided: one short range (maximum 40 miles) and the other long range (maximum 160 miles). These two display systems will be installed in different locations, to be connected with a microwave radar link.

1961 Computer Exhibition

A SECOND Electronic Computer Exhibition will be held in the National Hall, Olympia, London, from Wednesday, October 4, to Thursday, October 12,

1961, and a second Business Computer Symposium will be held concurrently.

This announcement is made by the Joint Committee of the Electronic Engineering Association (E.E.A.) and the Office Appliance and Business Equipment Trades Association (O.A.B.E.T.A.), which organised the very successful Exhibition in the same place at the end of 1958, when 40,000 people from 41 countries visited it.

As on the last occasion, the Exhibition and Symposium will be aimed to interest home and overseas users and potential users of computers and data processing systems and to demonstrate to them the recent considerable progress made in Great Britain in design, manufacture and use of computers.

Record 1959 Despatches

DESPATCHES of both television and radio receivers were at record levels in 1959, according to provisional estimates published by the British Radio Equipment Manufacturers' Association. For TV receivers, total despatches for the year amounted to 2,745,000, which was 36 per cent above those for 1958, the previous highest year. For radio receivers, the total, 1,551,000, was 19 per cent more than that for 1958, and 14 per cent more than in 1957, the previous highest year. Despatches of radiograms, 187,000, were 14 per cent lower than for 1958. (Despatches are net figures of deliveries by manufacturers to the home trade on firm and other accounts, including those to specialist rental and relay companies. Radio receivers include car radios).

Agreement

IT is announced that an agreement has been concluded between Marconi's Wireless Telegraph Company Ltd., of England, and Hermes Electronics Co., of the U.S.A. (formerly Hycon Eastern, Inc.). This agreement provides for general technical collaboration between the two companies in the field of point-to-point communications.

Hermes are well known as communications engineers and have planned and installed substantial communications systems. Among other activities Hermes are consultants to the Ace High project for S.H.A.P.E. and to the Ministry of Defence of the Royal Norwegian Government. It is expected that this new arrangement will greatly assist both companies to meet the current need for the engineering and supply of all types of point-to-point communications systems throughout the world.

New Cable Ship

A NEW cable-laying ship designed to lay and handle all known types of amplifiers and cables, including the kind to be used in the 28,000 mile Commonwealth round-the-world telephone cable, is to be built by Cable and Wireless Ltd. Full specifications for the ship will be completed later in the year. Its main features are to be: gross tonnage 7,000 tons; steaming range 8,000 miles, sea endurance, 60 days; maximum speed, 15 knots. Its carrying capacity will be 1,200 miles of light-weight telephone cable with repeaters or 1,500 miles of conventional telegraph cable.

A.E.I. Appointments

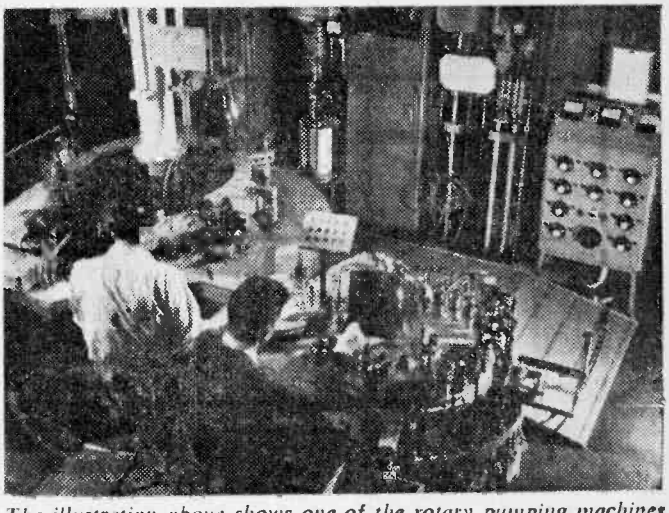
ASSOCIATED Electrical Industries Ltd., have appointed Sir Arthur Elton, Bart., to be the Controller of their Central Information Department. He will take up his duties on March 1st.

Sir Arthur Elton has for the last three years been in charge of films and television in the Public Relations Division of the Shell International Petroleum Company. For nine years before that, he was chairman of the Film Centre and in that capacity was adviser to Shell and other Companies.

J. E. A. Heale, formerly works manager of the Motherwell works of Metropolitan-Vickers (now A.E.I. (Manchester) Ltd.), has joined Associated Electrical Industries (Woolwich) Ltd., as general manager of works.

Weekly Electronics Newspaper

THE first ever weekly newspaper for the electronics industry is to be launched next September by Heywood and Company Limited. "Electronics Weekly" will give a wide news coverage to all aspects of the industry, including new developments in manufacture and application, components, materials, production techniques, commercial and financial news as well as a full coverage of overseas developments. A tabloid newspaper format has been chosen and initially, circulation will be available only to registered readers on payment of a nominal registration fee. However, plans are in hand to meet a demand through bookstalls at 4d. per copy

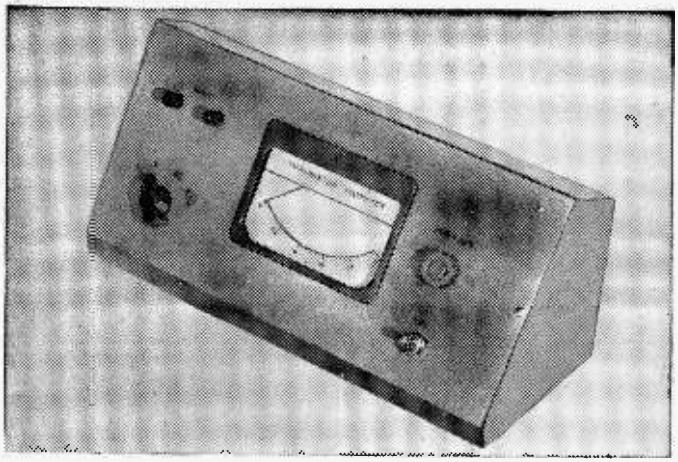


The illustration above shows one of the rotary pumping machines which remove the air from the valve envelopes to create the necessary vacuum in the manufacture of receiving valves at the Blackburn Plant of Mullard Ltd. Gas jets are used for sealing the base to the envelope and for "pinching-off" the pumping stem once the air has been removed.

Transistorised Voltmeter

HIGH INPUT IMPEDANCE FOR ACCURACY

By D. Saull



The completed voltmeter.

A VALVE voltmeter is a useful instrument to possess, but, unfortunately, such instruments are expensive to buy, or even to construct. In addition to the circuitry for the meter, a power pack is required to supply the D.C. for the valves, and the heater supply.

If transistors are used in the place of valves, a torch battery will replace the power pack, and no heater transformer is required. The aim of this article is to suggest the simplest possible type of "valve" voltmeter using the minimum number of components, and easy to construct. Whilst the input impedance is not so high as that of a valve voltmeter, it is sufficiently high for reasonable accuracy to be obtained.

Basic Circuit

In its simplest form, the valve voltmeter rectifies the A.C. test voltage, transforms the voltage to a current consideration, and amplifies the current to a degree sufficient to operate a current measuring meter. Such a circuit consists of a triode valve connected as an anode-bend detector, with an ammeter in the anode circuit. Fig. 2 illustrates the same principle but the valve is replaced with a transistor.

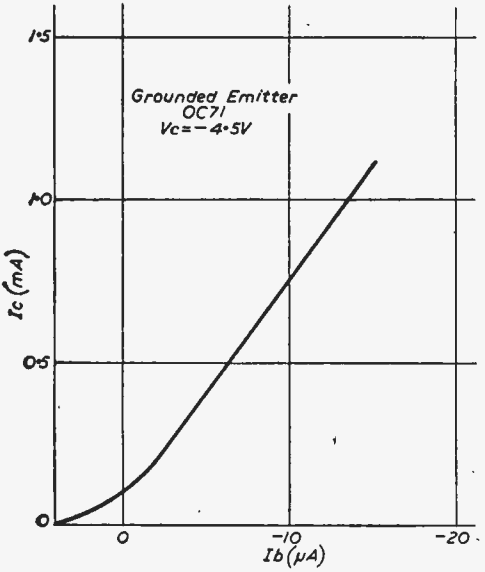


Fig. 1.—Ib/Ic characteristic for the OC71.

The characteristics of the grounded emitter OC71 transistor is shown in Fig. 1. It will be seen that for zero base-emitter current (i.e. no input condition) a small value of collector current will flow, hence in the circuit shown (Fig. 2) the meter will deflect slightly with no signal input. The circuit therefore requires to be modified to that shown in Fig. 3 to provide a 'set zero' provision for the meter. When the potentials at either side of the meter are equal the meter will remain at zero. A voltage being applied to the input will be rectified in the base-emitter circuit (which acts as a diode), amplified (current-wise) in the transistor and result in the potentials on either side of the meter being unequal. Consequently, the meter will deflect in relation to the applied voltage to the transistor input circuit. This is what we require for our "valve" voltmeter operation.

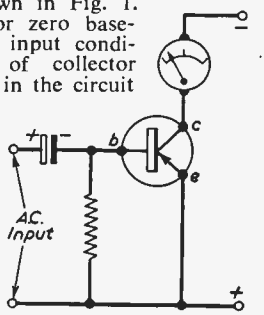


Fig. 2.—The basic circuit.

Practical Circuit

For ease of construction the design calls for a circuit requiring a convenient input voltage to give a full scale meter deflection. If for example a voltage input of 3.2V were required for a full scale meter deflection, then arriving at a convenient range of voltages becomes complicated; however, if 2.5V is chosen to give full scale deflection, then a useful range of voltages may easily be covered (i.e. 2.5V, multiply by two: 5V range; multiply by ten: 25V range; and multiply by a hundred: 250V range. which may be achieved with preferred value resistors and a four position switch).

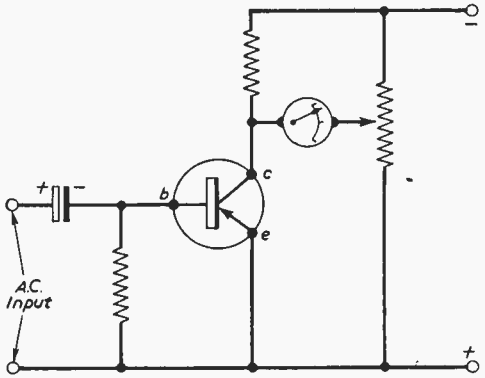


Fig. 3.—The circuit to enable the zero to be set.

The final circuit (Fig. 4) was therefore chosen, which gives a full scale meter deflection of 250μA for an A.C. input of approximately 2.5V.

The attenuator in the input circuit range selector, with the exception of the 1M value, are all 10k resistors. The 90k value is made up of nine 10k ¼W resistors connected in series. The remaining resistors in the complete circuit are nearly all of 1k value, which is a preferred value and should not be difficult to purchase.

Production Spreads

The 10k resistor in the emitter circuit compensates for production spreads in the characteristics of the transistor. It is also a safety device, inasmuch as it acts similarly to a resistor in the cathode circuit of a valve: the emitter potential follows the potential of the base, and tends to guard against overload conditions. In addition to these two factors, the resistor compensates against thermal conditions resulting from temperature rise in the transistor. The D.C. resistance of transistors decreases with increase of temperature. This is an accumulative effect, because, with decreasing D.C. resistance, a greater current flows, in turn resulting in a further temperature rise.

The emitter resistance has a large influence on the gain of the stage in the circuit shown (Fig. 4), variation of its value may be used as a method of adjusting the full scale deflection of the meter. Thus a 1mA full scale deflection meter may be used if so desired, although the writer found that a 250μA deflection gave a more linear overall calibration.

Choice of Meter

A variety of meter movements may be purchased on the surplus market in the price range between ten and thirty shillings. If one can be obtained calibrated from zero to 250μA so much the better, but it is not difficult to re-calibrate the scale. A 0-30μA or 0-100μA meter movement may be used in conjunction with a shunt. The writer used a 0-100μA movement in the prototype instrument,

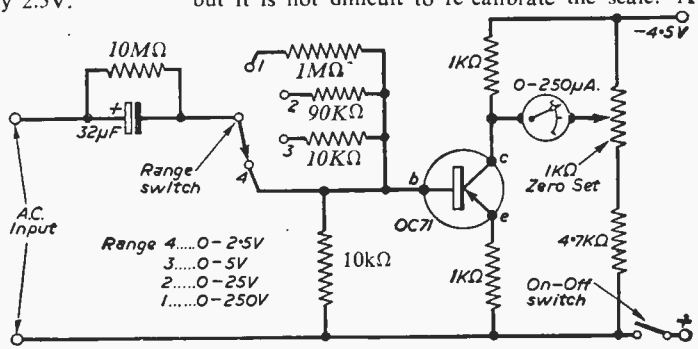


Fig. 4.—The complete circuit of the voltmeter.

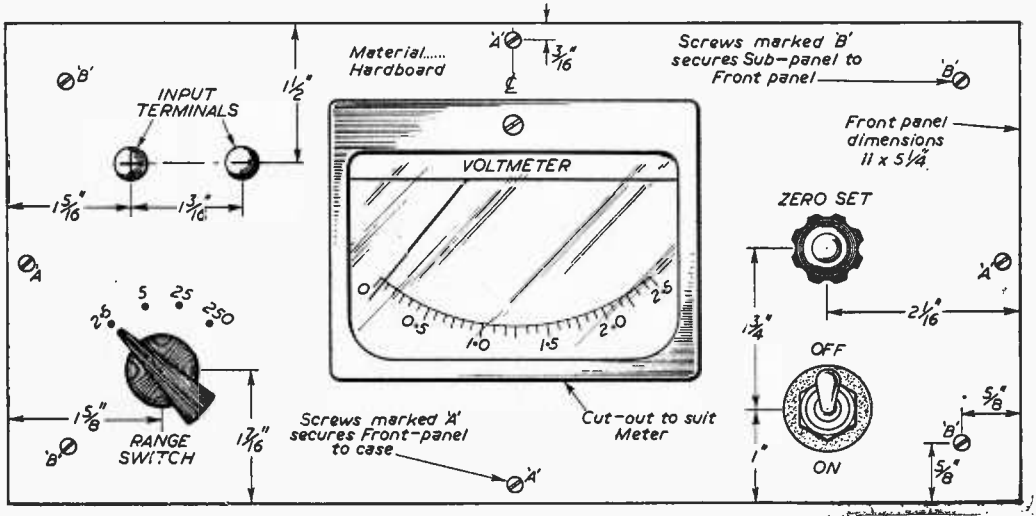


Fig. 5.—Layout and measurements of the front panel.

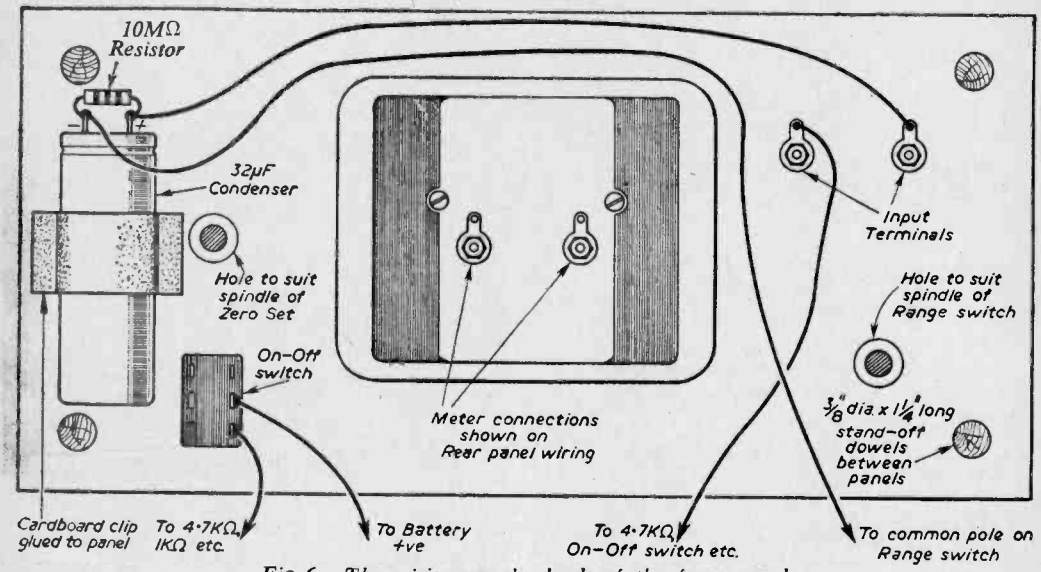


Fig 6.—The wiring on the back of the front panel.

using a 100Ω 10 per cent. resistor for the meter shunt. It should be remembered that it is not necessary for the meter to deflect fully at *exactly* 250μA, as final calibration may be carried out by adjusting the value of the 1k emitter resistor. Small adjustments may be made to this resistor by putting resistors in series (for increasing its value), or a resistor of very much larger value in parallel (for a small decrease in its value). Alternatively, a shunt resistance across the meter movement may prove most satisfactory.

Components

The range switch consists of a four position, single pole, break-before-make wafer switch.

The 32μF electrolytic capacitor in the input lead, provides a D.C. blocking condition when measuring an A.C. voltage with a superimposed D.C. component. For this reason the input terminals should be marked 'positive' and 'negative'. When measuring at such a test point in a circuit (i.e. the ripple voltage of a power pack) this should be borne in mind, and the meter connected with the correct polarity.

The 10M resistor across the capacitor provides a D.C. leakage path for safety reasons.

A Mullard OC71 transistor was used in the prototype; the cheaper red spot variety could most likely be used in its place with perhaps an alteration in the value of the emitter resistance. Other resistor values would remain unaltered.

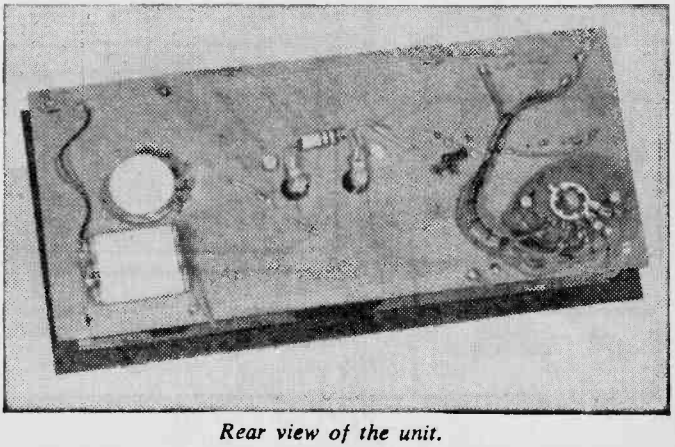
Practical Construction

Mark the panel out in pencil and saw to size using a tenon saw. Finish the edges with *fine* glass paper; using coarse glass paper tears the fibres of the hardboard and a neat appearance will not be obtained. Likewise, after drilling a hole in the hardboard, sand down both sides with fine glass paper and a neat, even hole will result.

The exact measurements for marking out the "chassis" are not shown, for the reason that the choice of meter movement will dictate to some extent the positioning of the components. A general layout only is given, and plenty of space left for rearrangement if desired.

The method of assembly is simple, components being on one side of the board, and connecting wiring on the reverse side, as in printed circuit wiring. No insulating covering on the connecting wires is necessary, except where two wires cross, which is seldom, and if this does occur, it may often be arranged to bring the crossing wire to the reverse side of the board over this junction. The complete wiring diagram will be given next month.

(To be continued)

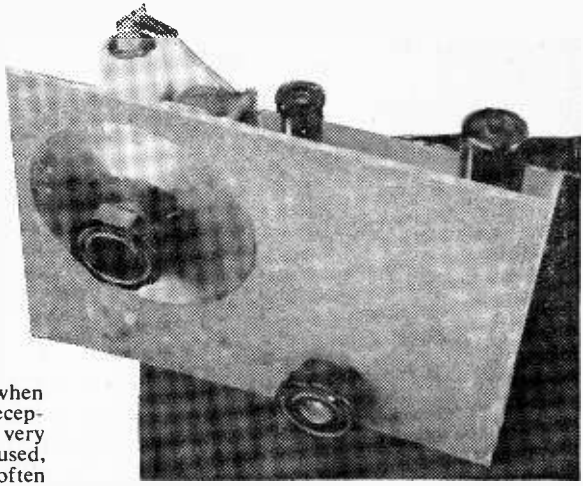


Rear view of the unit.

A MAINS SHORT WAVE TWO

A T.R.F. CIRCUIT FOR THE SWL

By J. Johnstone



Front view of the set.

A TWO-VALVE short wave receiver, when mains operated, will give loudspeaker reception of the more powerful stations. For very long distance reception, 'phones may be used, though reasonable speaker volume is often possible even for stations at a considerable distance. The circuit described here employs two pentodes, as regenerative detector and output. A separate power pack is indicated because this is quite often to hand or can be constructed.

Coils

Plug-in coils are used because these allow any bands between 10 and 200m to be covered while avoiding the need for wavechange switching and associated wiring. With plug-in coils, it is also easy to obtain or make additional coils at any time, to increase the tuning range, or to obtain only those coils needed for the bands which are of most interest. It is also possible to construct the receiver with a single fixed coil, choosing this to cover the most interesting frequencies.

The circuit is shown in Fig. 1. Coil connections are numbered for miniature Eddystone plug-in coils, but the same numbering will give identification of leads for home-wound coils. Regeneration is controlled by adjusting the screen grid voltage of the detector. For maximum possible efficiency with any individual specimen of detector valve, and with various coils and possible H.T. line voltages, it is best to use a 100pF *pre-set* condenser between point 4 and detector anode. This is then screwed down only just enough to obtain adequate reaction, with the particular coils, valve, and H.T. voltage actually used.

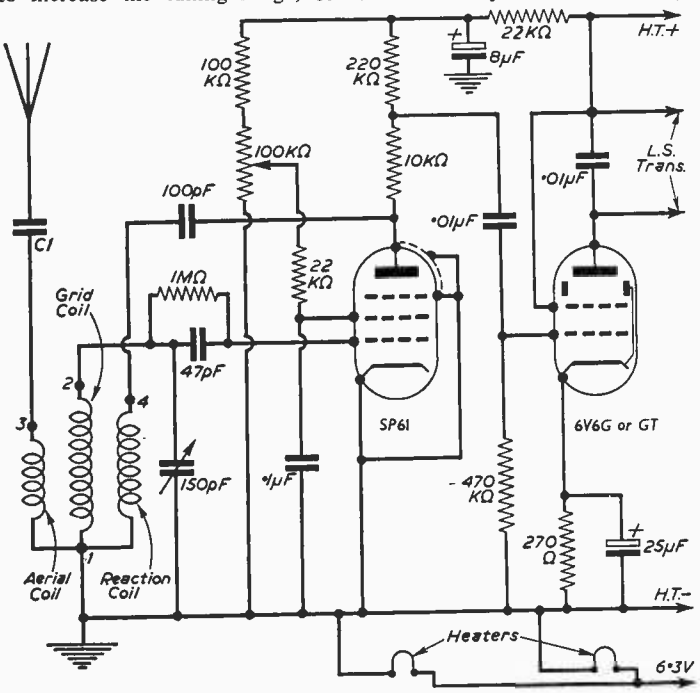


Fig. 1.—The circuit diagram.

Chassis layout

The tuning condenser, with reduction drive and scale, is fixed to a rigid bracket near the detector and coil, as shown in Fig. 2. The 47pF (or similar value) fixed condenser, with 1M leak in parallel, are soldered directly to the valve grid cap clip, with a short lead to the fixed plates of the condenser. The moving plates tag is wired directly to a tag, held by a bolt used as the chassis connection for the coil, underneath.

The regeneration control is situated to the right, as this is a convenient operating position. Underneath wiring is shown in Fig. 3. The SP61 valve requires a "Mazda" octal holder, with slightly wider pin spacing

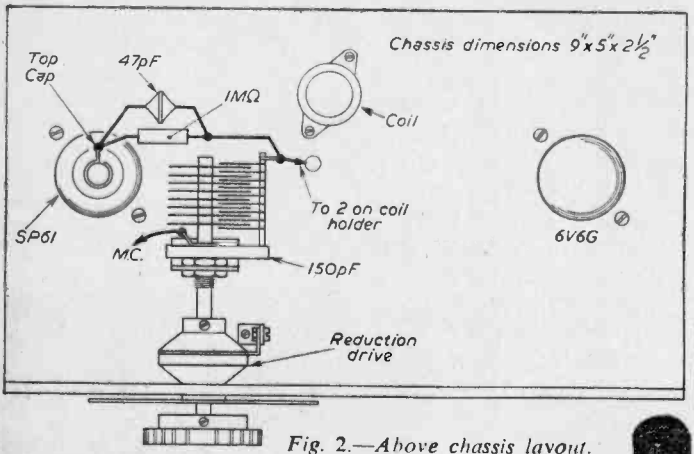


Fig. 2.—Above chassis layout.

between heater pins as this type of valve will not fit international octal holders. The various "M.C." connections go to tags bolted to the chassis.

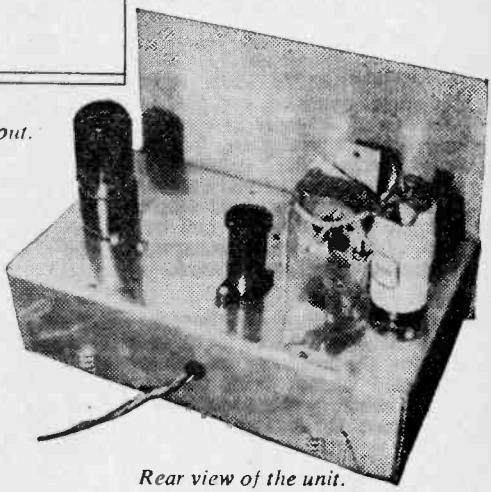
Coloured flex can be used to identify the various external connections. All leads in the set are shown in Figs. 2, and 3, and these layouts should be followed fairly closely.

Tuning coils

The holder in Fig. 3 is for the Eddystone coils mentioned, the large pin being earth. Four of these coils will give tuning ranges of about 10 to 20m, 19 to 45m, 40 to 95m and 90 to 200m. The largest coil has an adjustable dust core, and the actual band covered can be modified to some extent by changing its position.

If a number of faulty valves with similar bases are to hand, these may be used for coils by obtaining paxolin tube which is a push fit on the bases, and securing tube and base together with two small bolts. (Glass based valves cannot, of course, be used.) Plug-in coil formers to be wound as required can also be purchased.

Actual connections to the various windings of the coils are shown in Fig. 4. With a single coil



Rear view of the unit.

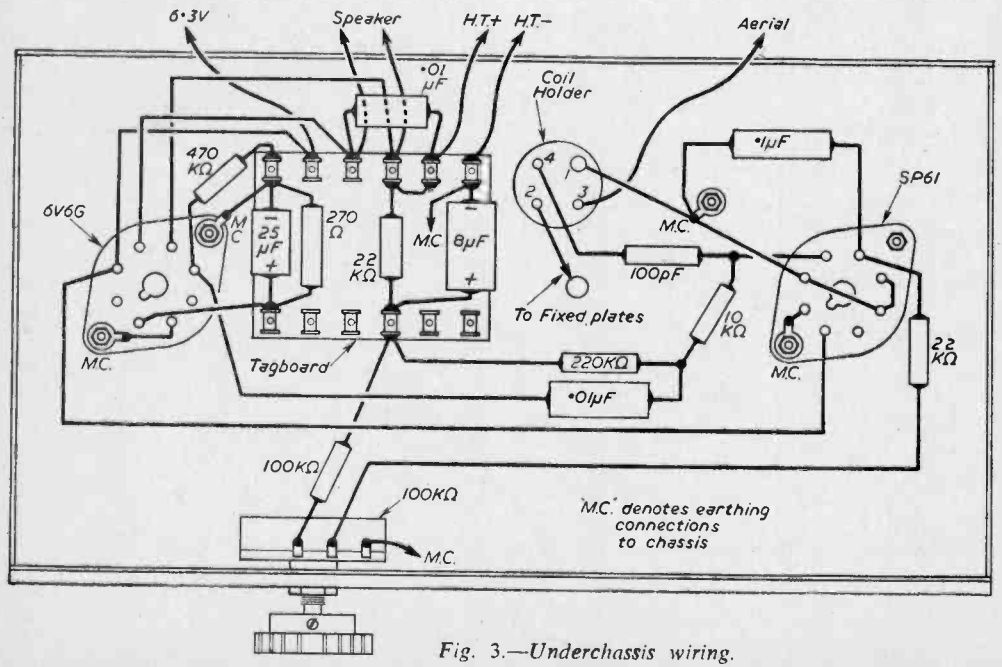


Fig. 3.—Underchassis wiring.

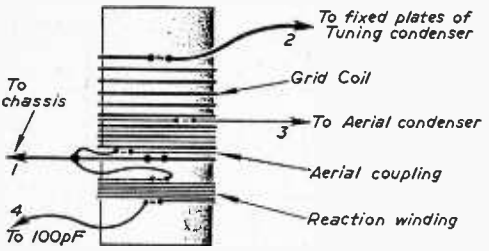


Fig. 4.—Coil details.

take the leads directly to the various components. With home wound plug-in coils, the leads are soldered to the various pins in the usual way.

The grid windings are best of fairly stout enamelled wire, the actual gauge not being critical. With the small coils, the aerial coupling winding can be placed between the spaced turns of the grid coil, as in Fig. 4. Turns of the reaction windings are side by side. Both aerial and reaction windings can be of thin enamelled or silk covered wire, 32 to 40s.w.g. being satisfactory.

Using formers about 1in. in diameter, the smallest coil can have 4½ turns for grid, three for aerial coupling, and five for reaction. The next coil can have 16 turns for grid, nine for aerial, and six for reaction. The next larger coil can have 30 turns, side by side, for grid, with ten turns for reaction. The aerial coupling winding can then be at the grid end of the 30 turn winding, about ¼in. from it, and have 15 turns. These three coils will tune from approximately 10 to 90m. For the higher band, a dust-cored coil is recommended, though not essential. A standard medium wave coil will allow the 160m band to be tuned, owing to the low stray capacity of the circuit.

If a single fixed coil is used, this can cover 19 to 45m, for general S.W. listening. Sizes of formers and numbers of turns other than those given can, of course, be employed, and will be satisfactory.

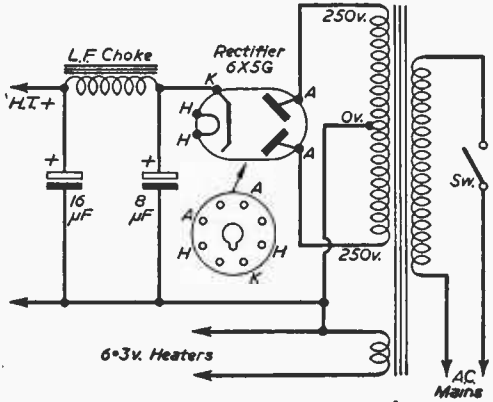
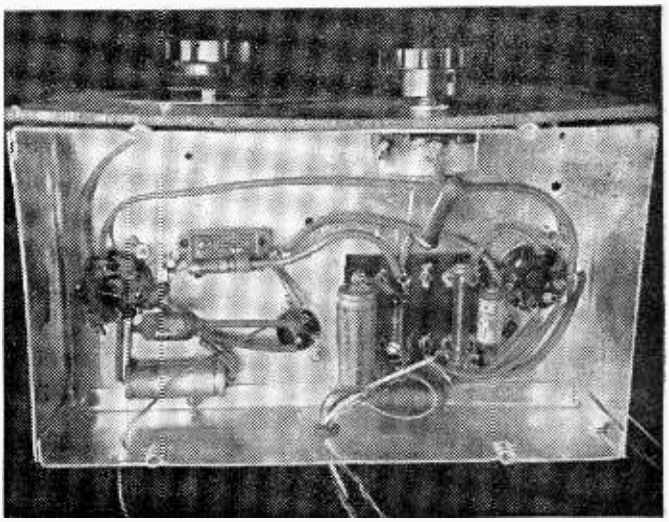


Fig. 5.—Circuit of the power pack.

Power supplies

Complete isolation from the mains should be assured by using a power pack with transformer, a suitable circuit being shown in Fig. 5. The 6X5G can be operated from the same 6·3V winding as supplies the other valves. Some rectifiers, such as the 5Z4, need a separate 5V rectifier heater winding. A transformer able to deliver 60mA will be of adequate size. The heater current is 1·65A for the three valves.



The underchassis wiring.

For 'phone reception, a triode such as the 6J5, with 3·3k bias resistor instead of the 270Ω component, will be satisfactory. This valve can be inserted without any wiring changes. A 6F6 would be equally satisfactory, for speaker use, with a 390Ω bias resistor.

COMPONENTS LIST

SP61 and 6V6 valves. Two holders (one "Mazda" and one "International" Octal).
Coils as described, with holder.
150pF or similar S.W. tuning condenser with drive, scale and knob.
Fixed condensers: 47pF, 100pF, two 0·01μF, 8μF 350VW, and 25μF 25VW.
Resistors: 270Ω 1W; 100k 1W; 10k, two 22k, 220k, 470k, 1M ½W.
100k potentiometer. Knob. Chassis.
For power pack:
6X5G. Octal valveholder. 250-0-250V 60mA, 6·3V 2A transformer.
60mA smoothing choke. 16μF and 8μF, or similar, 350VW condensers.

The speaker leads in Fig. 3 are taken to the primary of a 45:1 speaker transformer, the transformer secondary being connected to a 2/3 ohm speaker.

(Continued on page 47)

100 kc/s Check Oscillator

A ONE-VALVE CIRCUIT

By S. G. Wood

THE 100kc/s oscillator has much to commend it and is useful in the calibration of receivers, and in other directions. As a glance at the component list will show, few parts are required. The circuit is shown in Fig. 1 and a 6J5 triode valve is employed in a straightforward crystal oscillator circuit. However, a tetrode of the 6V6 or 6L6 class, triode-connected (i.e. with g2 and g3 strapped) could be used instead. Although 100kc/s crystals are not, perhaps, so easy to obtain, as say the ordinary type of crystal commonly used in the control of amateur transmitting equipment, they may be procured on the surplus market for around

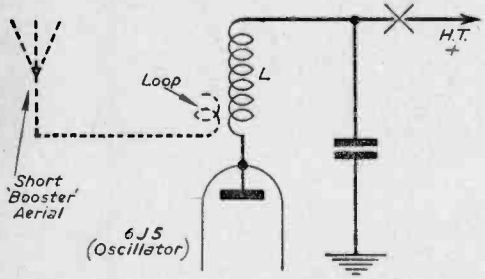


Fig. 2.—The additional aerial.

15s. The writer was lucky in this respect in obtaining a 100kc/s crystal (mounted) from a local ex-Government surplus shop for the small sum of sixpence.

Construction

The building of this unit should present little difficulty as all components (with the exception of the valve and crystal) are mounted beneath the small aluminium chassis. The size of this chassis is 3¼in. x 2¼in. x 1½in. and may conveniently be of 16s.w.g. The holes for the 6J5 valveholder, and rear connector socket were both made with a hole-cutter, whilst the smaller holes were made with the aid of an ordinary 3/16in. twist drill. No

COMPONENTS LIST

Aluminium chassis: size 3¼in. x 2¼in. x 1½in.
On/off toggle switch.
Octal base valveholders.
R.F. choke (see text).
100kc/s crystal and holder.
0·005μF (mica) fixed capacitor.
0·01μF (tubular) wire-ended capacitor.
220k resistor (½W)—(Erie).
2·2k resistor (½W)—(Erie).
Octal base connector plug.
Several 6BA brass nuts and bolts.
Wire, solder, etc.

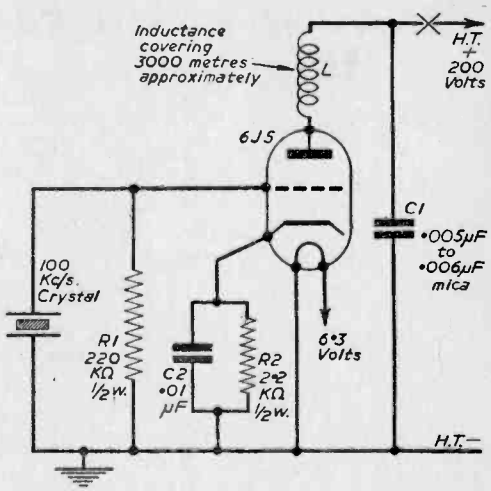


Fig. 1.—The circuit diagram.

variable tuning condenser is required, and therefore a front panel was not thought necessary, thus simplifying construction. The coil L may be any inductance covering approximately 3,000m, or an R.F. choke of similar electrical constants may be substituted. It might be mentioned that in the writer's case a canned R.F. choke removed from an old 1155 receiver proved ideal as a resonator coil, needing no external trimming. The under-chassis layout is shown in Fig. 3, and the extreme simplicity will be apparent. The valve base mounted to the rear of the chassis is used as a three-way connector socket for the power supply,

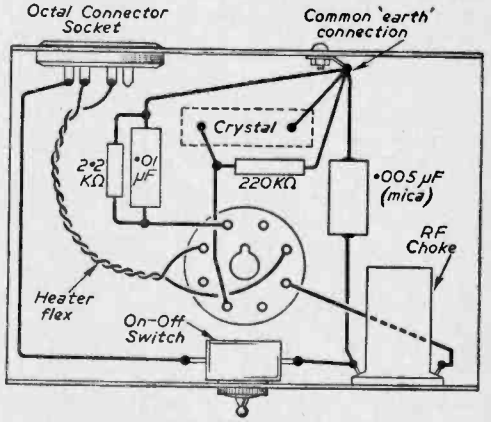


Fig. 3.—Underchassis wiring diagram (one heater lead should be earthed either in the power-pack or in the oscillator unit).

and a plug to fit is required. The resistors are of the ½W (wire-ended type), whilst the fixed capacitors are small, tubular mica dielectric types.

It will be noted that the pin connections to the rear octal base connector are not shown as this can be left to individual choice. In practice, the

(Continued on page 66)

Miniature Mains Model Tx

A CRYSTAL-CONTROLLED UNIT

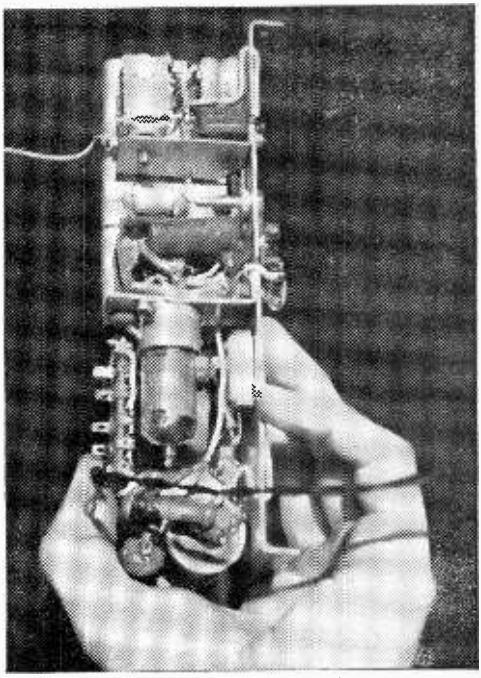
By G. F. Worcester

FOR testing and adjusting all kinds of model control receivers and equipment, or operating a model indoors, a crystal controlled transmitter operated from the mains is extremely handy. The unit described here, with its power pack, measures only 8in. x 3¼in. x 2½in., and uses two valves in a crystal controlled circuit which gives enough output for purposes of this kind.

The circuit is shown in Fig. 1, and employs two 6BA6 miniature valves, the first as a triode-connected regenerative crystal oscillator, and the second as multiplier and output. This type of circuit can work satisfactorily with almost any kind of valve. To keep size down, a small contact-cooled rectifier and mains transformer provide power, also isolating the equipment from the mains to avoid a live chassis.

Coil Windings

The crystal stage coil is tuned by means of an adjustable core and the stray circuit capacity. Using a 9Mc/s crystal, and smooth former ¼in. in diameter, 26 turns of 32s.w.g. wire, side by side, will serve for the tuned winding L1. Resonance is found by connecting a meter to the cathode circuit key leads, and adjusting the core setting until a dip in cathode current is encountered. It is necessary to set the core just off the position which gives maximum dip, to ensure that the oscillator will start reliably. If formers of different size are used, the number of turns should be modified, if necessary, until this dip is encountered. While these tests are made the crystal should be returned directly to the chassis, L2 being omitted.



The completed transmitter.

When the stage is found to operate as described, L2 is then included. It consists of two turns very close to the high tension end of L1. If the stage will not operate, or if oscillation is weakened, the leads from L2 should be reversed. Too much

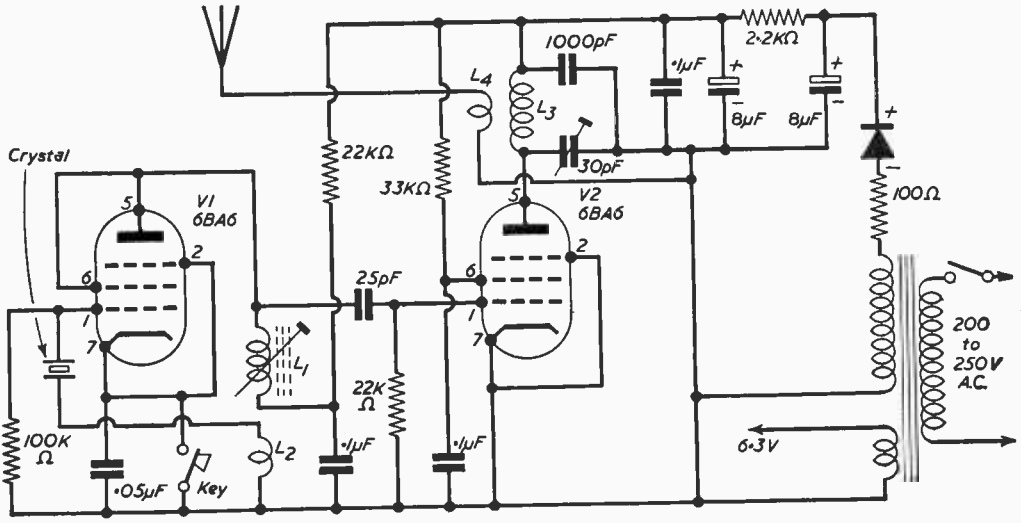
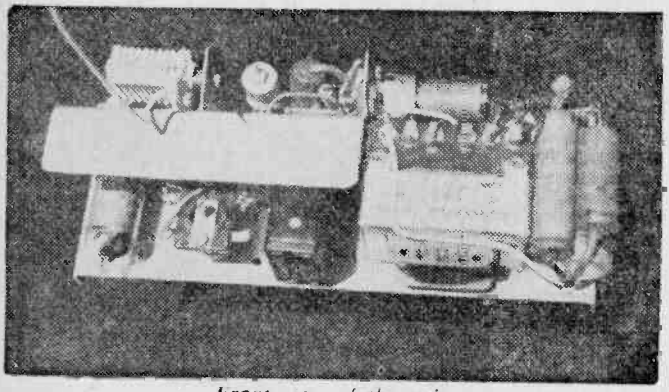


Fig. 1.—Circuit of the transmitter.

coupling between L1 and L2 can cause the stage to oscillate at any frequency to which it is tuned. It should therefore be checked that the valve ceases to oscillate when the anode circuit is tuned far off resonance.



Front view of the unit.

L3 consists of 10 turns of 20s.w.g. wire occupying 1in. winding space on a ribbed former ¼in. in diameter. For testing receiving equipment at short range, no aerial is needed. For somewhat longer range, a short vertical rod aerial is added. This is connected to L4, which consists of one turn of insulated wire at the H.T. end of L3, as also shown in Fig. 3 (on page 39).

Transmitter Layout

The wiring and the position of components is shown in Fig. 2. A vertical screen is bolted to the chassis, which is 8in. x 3¼in. with ¼in. runners. This screen is 2¼in. high, and has a 1in. flange bent over the crystal and core-tuned coil, as shown by the dotted line in Fig. 3. A 1in. flange at the end is bent at right angles and carries the crystal stage valveholder. A further small screen 2¼in. high and 1in. deep, is bolted in position to hold the output stage coil.

The crystal stage valveholder is bolted to the flange as mentioned, and the output stage holder is fitted near the end of the screen, as in Fig. 2. Underneath wiring for these holders is also shown. Leads should be short and direct, and grid and anode connections must be clear of the chassis, screens, and each other.

A small tag strip under the chassis serves as anchoring points for two flexible leads to the control key or push buttons. The mains switch is added in one mains lead from the transformer primary. The consumption of the two valves is about 20mA, plus 0·6A at 6·3V for heaters, and a large transformer is not needed. The rectifier should lie flat on the chassis, and be bolted firmly so that heat will be carried away.

A clip made from thin metal holds the 8 + 8μF condenser, the other condensers being held by their wire ends. The extra 1000pF condenser joined directly to L3 and chassis is required to obtain a short R.F. path.

The 30pF trimmer associated with L3 has its centre leg soldered to a bolt locked to the chassis. The second tag is wired to the anode end of L3. This trimmer should be air-spaced, and an ebonite tube should be shaped to engage with its end, so that it can be adjusted. The completed coil is held by means of a long bolt, with a spacing bush

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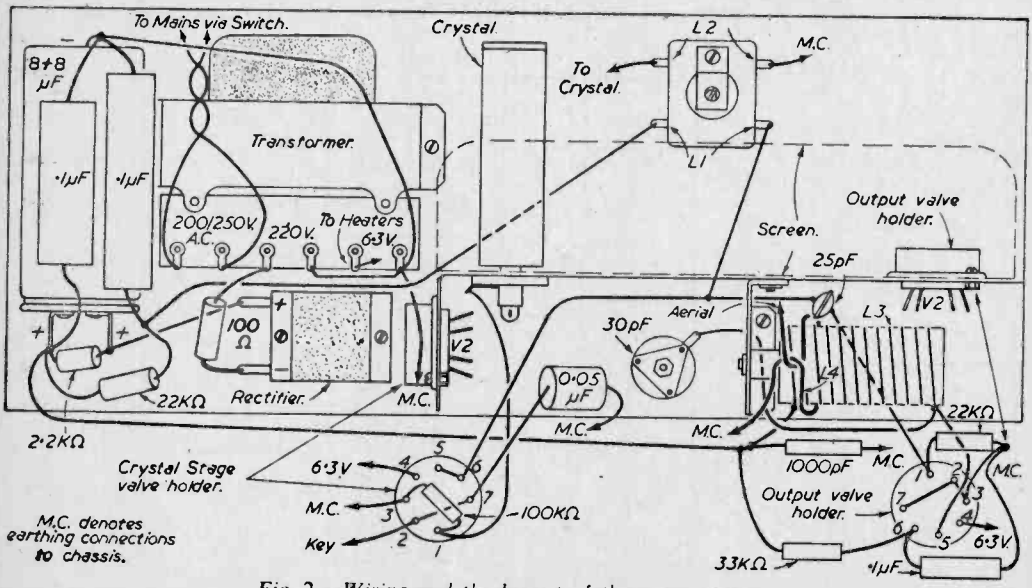
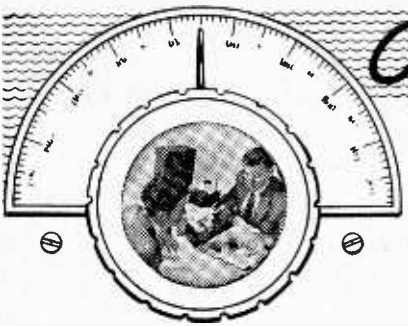


Fig. 2.—Wiring and the layout of the components.



On Your Wavelength

BY THERMION

Gramophone Records

TWENTY or thirty years ago, the gramophone ranked only as a novelty: its popularity could not be compared with that of radio. Eventually, I think it surpassed radio although, with the advent of television, it was, for the most part, neglected. As every dealer will agree, the gramophone record can now stand comparison with both television and radio. The sale of discs is now phenomenal—no doubt many of you who are reading this buy a new record every week or so. Personally, I buy only one record or two each month and I often have doubts whether the expenditure is worthwhile. I only buy "LP's"—I consider them to be more value for money and the surface noise is far less than that of 78rev/min pressings on account of the different materials used.

As far as I am concerned, there are two reasons why the purchase of records may give rise to concern: firstly, the novelty of the newly bought record tends to diminish rapidly. If a record is bought on a Friday, after five or six playings over the week-end it is probably added to the stockpile and not heard again for a week, a month or even longer. Secondly the quality, both technical and musical, of many records (classical only from my point of view) is not always as good as it ought to be. These are my two main, personal, criticisms —I must emphasise that they are purely personal although several of my musically and hi-fi minded friends have expressed agreement with me.

Lately, when buying and playing records, I have become increasingly more aware of a gnawing feeling of dissatisfaction largely on the first score which I mentioned above (no pun intended). I pay 30-40s. for a record which, in the day or two following its purchase, I play perhaps four times. Taking the round figure of 40s., each playing costs me about five shillings—less than the cost of a seat at an actual performance I know, but . . .

I have thought of several schemes for remedying the situation all of which would be difficult to employ. Soon after I first began to have doubt about the wisdom of buying inordinate quantities of gramophone records I reached the seemingly logical conclusion that the only safe thing to do would be to limit my purchases to a maximum figure to be decided in the light of further experience. However, the difficulties inherent in this practice are fairly obvious: how does one choose the records to be included in the select number and what is one to do if, having made a selection, a new record makes its appearance.

These are not the only problems: when I first started my collection of LP's, I had to contend with not only the purchase of records but also with the purchase and assembly of components into a high-fidelity installation. What started off as a modest excursion into sound reproduction soon became an obsession; long hours were spent on trying out various circuits—cross-overs, filters and other devices. In the end my judgment became so clouded after a multitude of different ideas had been tried that I was forced to rely on the opinions of my friends and relations. Eventually I left all my gear alone for a month and started afresh.

My final arrangement was a low power amplifier (10W) a versatile pre-amp unit and a 9cu ft corner reflex cabinet. I use a transcription record player as I am particularly sensitive to frequency modulated music (wow and flutter) and also to rumble which owing to the large reflex enclosure is made very evident.

I have now decided to leave the amplifier and loudspeaker system as it stands; even my younger acquaintances are satisfied with the quality. The good top response of which they speak is less important to me—my hearing is not what it used to be—although doubtless it contributes in some measure to my enjoyment. As for records, I suppose I shall continue to buy them although the more I buy, the more difficult it is to choose which to play and to find time to listen to them.

The Quest for Quality

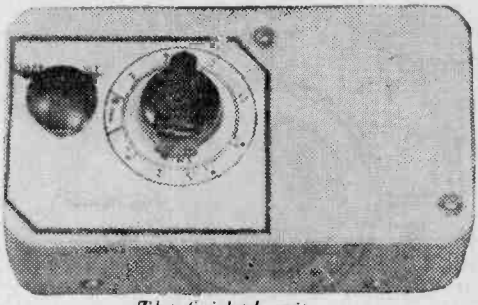
TALKING of amplifiers and suchlike reminds me of another perplexing question: is the search for "high fidelity" worthwhile? Most sound reproduction equipment sold for domestic use and which is claimed to be hi-fi savours more of the laboratory than of the home. I think that there is much to be said for the old fashioned "one-knob" type of installation which could be operated by even the female members of the household. My own apparatus has now developed to the stage where I permit no one else to use it; the controls are comprehensive and what with equalisers and the like, I can, "at a single touch, make Caruso sound like Hutch" as was once sung from a London stage. What a pity that all these complications are necessary for the enjoyment of records! The tragedy is that in many instances the hi-fi maniac becomes overwhelmed by the complications of his equipment that he ceases to listen to the music from his loudspeaker and concentrates on the hum and noise level (xdB down!) and kindred defects which are obvious only to the experienced ear. This outlook is easily developed and I was once conscious that I was listening more to the equipment than to the records. However, once I had recognised the malady and decided to keep my equipment at its present stage of development, it was possible, by a very determined effort, to regain my former standard of appreciation.

Transistorised Timing Unit

AN INEXPENSIVE CIRCUIT By L. Baker

(Continued from page 965 of the March issue)

WHEN the construction has been completed as described in the previous issue (see also Fig. 2. below), the calibration of the unit can be carried out and a stop-watch will be found convenient for this purpose. If this is not available, use can be made of a clock with an easily read seconds hand. To calibrate the dial, the output socket should be connected to an ordinary domestic electric lamp and the mains plug should be inserted in the mains socket. The switch S2 should be switched to "Set" and the dial should be rotated until S1 is heard to close. The dial should now be advanced approximately a quarter the length of its travel and the switch S2 thrown to operate. A check on the time of the stop-watch should be taken when S2 is put to operate. The lamp or enlarger will now light on throwing S2. Observation should now be made of the time the lamp remains alight. After a short time, the relay will operate and the lamp will be extinguished. Using this elapsed time as a basis, pencil marks can be made on the dial to suit individual requirements of various exposure times. These times can be anywhere between the limits of 2.5s (shortest exposure) and 2min. Once the marks are located on the dial, this may now be removed and permanent marks can be made on the dial using Indian ink. When not in use the unit should be switched to "Set Time" and the dial rotated to zero until S1 operates to conserve battery power.



The finished unit.

The enlarger switch may be removed altogether, or left in the "on" position while the timer is in use with the enlarger. The unit is small enough to be incorporated on the enlarger itself, say by mounting it on the enlarger column, or on the baseboard as a fixture.

Operation

In use, with a negative in the enlarger, having decided the exposure to be made, all that is required is that the operator turns the switch to "Set", rotates the dial to the predetermined time, turns the switch to operate and waits until the enlarger lamp is extinguished. The exposure is now complete.

The advantages of such a unit are many. For instance, in the case of many copies of one picture being required, once the correct time is set on the unit, all exposures are then automatically made and all are identical. Also it leaves the operator's hands free and this is useful for "burning in" or "shading" during the exposure. The unit can, of course, be made to operate a contact printer in the same way it does the enlarger.

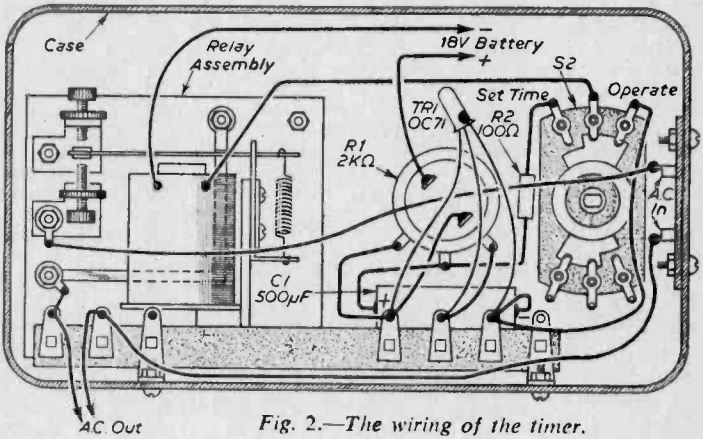
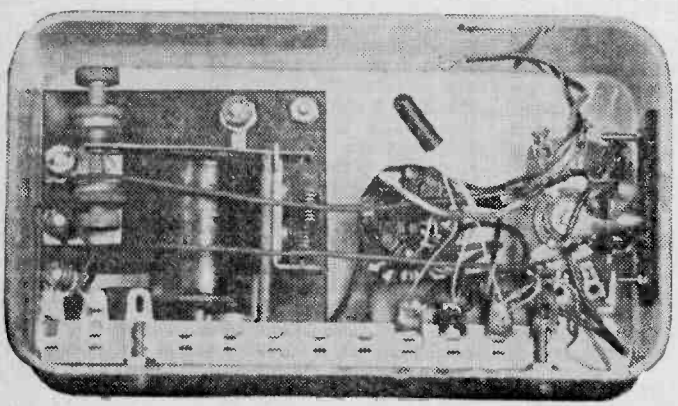


Fig. 2.—The wiring of the timer.



A view of the wiring.

An A.F. Calibrator

A CIRCUIT USING THE LINE REPETITION FREQUENCY OF TELEVISION AS A STANDARD

By G. K. Fairfield

THE repetition frequency of the synchronising pulses forming part of the transmitted television waveform is extremely accurate and can be relied upon to provide a frequency stability of 0·1 per cent. This fact may be used when attempting the calibration of an audio frequency signal generator since a higher degree of accuracy is rarely required. A series of precise spot frequencies can be derived from this basic standard which will have the accuracy of the transmitted television signal.

Whatever means is adopted to utilize this standard then a first requirement must be to achieve a minimum of interference with the working domestic television receiver.

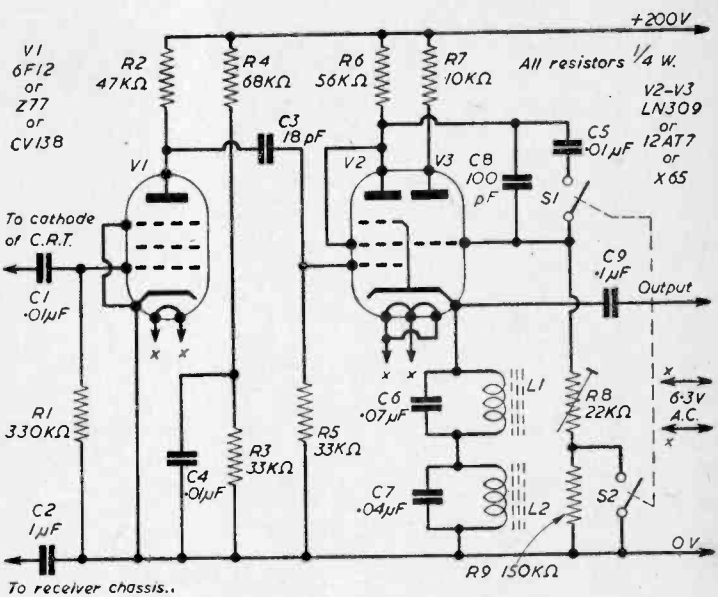


Fig. 1.—The circuit of the calibrator.

Frequency Calibrator

A simple circuit for achieving this calibration is shown in Fig. 1, which demands only access to base of the cathode-ray tube and the chassis of the receiver. No alterations to the circuit of the receiver are necessary.

An input signal is taken from between the cathode terminal of the cathode-ray tube and the chassis, as shown in Fig. 1, and applied to a limiting valve V1. This signal consists of two parts, the video signal which is variable in content and negative in polarity, and the synchronising signals which have a constant amplitude and are positive in direction. The valve has a low screen potential and behaves in exactly the same way as the sync separator in the television receiver. It thus conducts only on receipt of the positive synchronising signals and provides negative pulses at the anode terminal at a repetition frequency of 10,125c/s. These pulses are used to synchronise a cathode-coupled multivibrator V2 and 3. The repetition frequency of this is determined by the value of R8 and R9, C8 and C5 and is made extremely stable by the inclusion of a tuned circuit; L1/C6 and L2/C7 in the common cathode circuit. These tuned circuits have a high Q-factor and allow a near-sinusoidal waveform to be developed across them. This output voltage can be used for frequency comparison purposes as is described below.

Some slight distortion will be apparent in the lower frequency output and will take the form of the superimposition of small 10,125c/s ripples on the waveform owing to the resonance of L2/C7. These can be removed by short-circuiting this tuned circuit in this position, but are of value in practice since they indicated by their number that the circuit is dividing correctly by a factor of ten.

The multivibrator can be synchronised at an integral multiple or fraction of the television line scanning frequency up to a limit of about ten-to-one.

In the circuit shown two output frequencies are provided. A sinusoidal waveform of several volts in amplitude at a frequency of 10,125c/s with switch S1/2 open and a similar waveform at a frequency a decade lower, 1,012.5c/s with S1/2 closed.

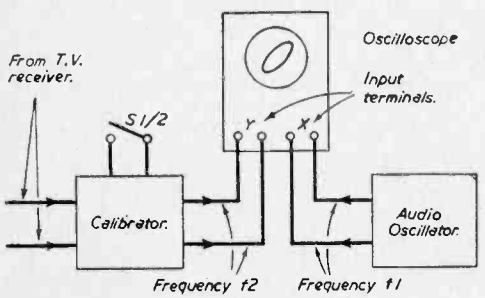


Fig. 2.—Calibration using a cathode ray oscilloscope.

The Tuned Circuit Inductances

These are wound on Mullard 'Ferroxcube' Pot Cores type LA 1. A bobbin is provided with these cores and should be wound as follows:—

Coil L1: 1,270 turns of 40s.w.g. enamelled copper wire which should completely fill the

bobbin. An inductance value of 600mH is required for this coil.

Coil L2: 150 turns of 30s.w.g. enamelled copper wire. An inductance value of 8mH is required in this case.

A gap is provided in the pot core assembly for the lead-out wires which should be well insulated at the point of exit, since the ferrite has sharp edges.

Frequency Comparison Using a C.R. Oscilloscope

The most convenient way of using the calibrator is to compare its output frequency with that of the audio oscillator undergoing calibration and adjust the frequency of the latter until it is an exact multiple of the calibration frequency. This can be achieved by using an oscilloscope to display the Lissajous figure resulting from the combination of the two signals.

The method is shown in Fig. 2 where the audio oscillator is connected to the X plates of an oscilloscope, via an amplifier if necessary, and the output of the calibrator to the Y-input amplifier of the oscilloscope.

With switch S1/2 in the appropriate position, the two spot frequencies 10,125c/s and 1,012.5c/s are easily recognisable, as the oscillator frequency becomes equal to these frequencies, by the appearance of a diagonal line or circle on the screen of the oscilloscope. Other frequencies can be determined by recognition of the Lissajous figures which are displayed as the oscillator frequency becomes an integral multiple of the calibrator frequency.

In this way the spot frequencies can be extended to cover every hundred or so cycles over the entire audio frequency range and extend into the lower radio frequency band of several hundred kilocycles.

There is the slight disadvantage of the frequencies being multiples or integral fractions of the line repetition frequency, 10,125c/s, but this is of little importance once the calibration chart for the oscillator or signal generator has been prepared.

Lissajous Figures

To those readers not familiar with the cathode-ray tube method of frequency comparison an explanation of this is included. A number of screen patterns (known as Lissajous figures), which are obtained when sinusoidal voltages having the frequency ratios and phase differences specified are applied to the two pairs of plates are shown in Fig. 3. When the two frequencies are equal and in phase, the trace is stationary and takes the form of a diagonal straight line.

Forms corresponding to a number of other phase relationships and different frequency ratios are also shown in Fig. 3. In these diagrams the two signals are sinusoidal and equal in amplitude. With signals of other waveforms, the traces are distorted but usually remain easily recognisable. Unequal amplitudes make the traces appear either flatter or narrower.

As the oscillator frequency is adjusted close to the calibrator frequency the phase difference between the two signals changes making the trace go through the various forms shown in Fig. 3 and the time to go through all of these forms is equal to the frequency period difference between the two signals.

The ratios of the two signals can be found by counting up the number of loops touching the horizontal axis and dividing this by the number of loops touching the vertical axis. When observing these figures then, one must not expect a stationary pattern on the screen but with a little

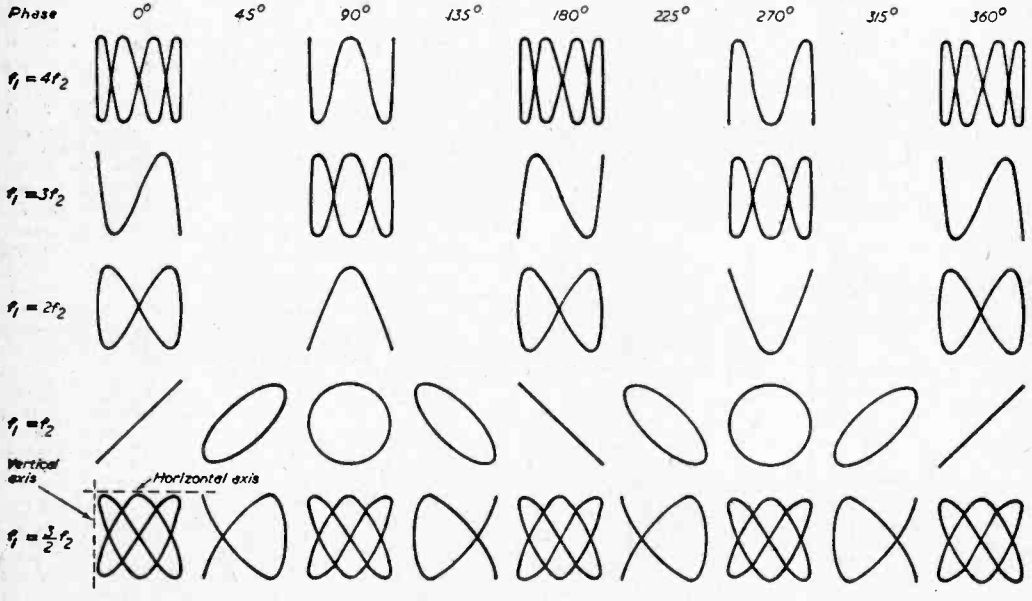


Fig. 3.—Lissajous figures obtained when two sinusoidal voltages having the frequency ratios given are applied to the X and Y plates of a cathode ray oscilloscope.

experience one can learn to recognise the changing pattern and determine the frequency ratio between the two signals—at least up to a ratio of about 5:1 or 1/5:1

"Magic Eye" Indicator

Should an oscilloscope not be available for comparison purposes between the calibrator output and the audio oscillator, then a similar order of accuracy can be obtained by the use of a cathode-ray tuning indicator or 'magic eye', providing rather more care is used in the initial setting up to find the spot frequencies. The circuit used for this purpose is shown in Fig. 4. The target grid of the indicator is modulated with the output of the audio oscillator whilst the comparator output is applied to the target anode via an amplifying and shaping valve circuit V3. When the two frequencies are equal and of opposite phase the target current is at a minimum and the 'eye' fully open, owing to the anode being negative whenever the grid is positive and the grid negative, beyond cut-off, when the anode is positive. Thus as the two frequencies approach each other the 'eye' begins to flicker and a zero beat is observed when the two frequencies are equal.

In order to sharpen the null indication, V3 provides a squaring of the input signal and V1 is included to prevent negative excursions of the input signal on the target grid. The clearest indication will be apparent when the two frequencies are equal, but can be observed when the frequencies differ by as much as 10:1. The extent of the target flicker will become less as the difference in frequencies increases, but a little

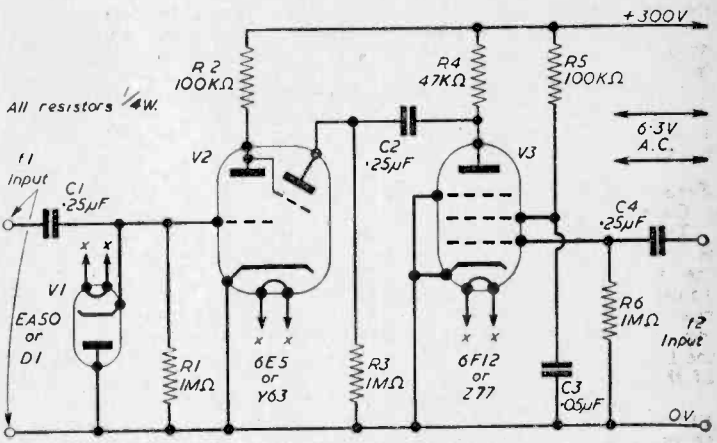


Fig. 4.—Frequency comparator circuit.

practice will enable this system to provide as useful an indication as that of Lissajous figures in the system previously described. It has one disadvantage, however, and that is that the frequency calibration must commence from the position of frequency equality. Then, as the frequency of the audio oscillator is advanced, the "eye" will be seen to go through a number of positions of flicker in turn, each one indicating that the frequency multiplication (or division) has increased by one. e.g. 1,012.5c/s, 2025c/s, 3,037.5c/s, etc. Unless frequency equality is found to begin with, as indicated by the most pronounced flicker, then the multiplication ratio can be in error throughout the process of calibration. This is not possible with the cathode-ray tube method since the number of loops in the Lissajous figures can be counted and the exact multiple determined no matter at which frequency the calibration commenced.

MAINS MODEL TX

(Continued from page 32)

or similar means to keep the coil a short distance from the metal screen.

Adjustments

Operation of the crystal controlled stage should be checked as explained, and the output valve may be removed for these tests. When correct oscillation is obtained, the second valve may be inserted, and the 30pF trimmer rotated to tune L3 to resonance at 27Mc/s. A bulb loop or loop with meter and crystal diode may be used to check for R.F., the loop being close to L3. The correct tuning for the trimmer will be that giving the best indication with the bulb loop or meter. The core of L2 may also be finally adjusted by this means, to secure maximum output, with reliable starting when the control key is closed. The total cathode current of the second 6BA6 should not exceed about 15mA. If it does, the 2·2k resistor should be increased slightly in value, this check being made with the crystal stage not oscillating.

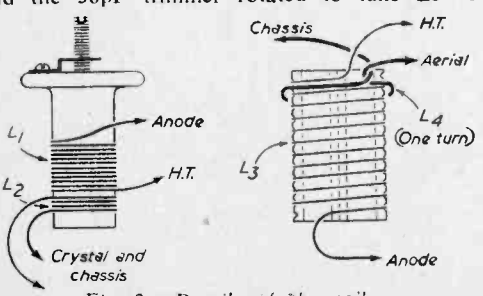


Fig. 3.—Details of the coils.

Once the core and trimmer have been correctly set, re-adjustment will not be necessary each time the transmitter is used. Nor is re-tuning essential when disconnecting or modifying the aerial, because the frequency of operation is not influenced by the length or position of the aerial used, as is the case with simple, tunable transmitters.

The containing case is best made from thin wood, because a metal box would lie too near L3. Holes drilled in the case will allow the trimmer and core of L2 to be reached with a trimming tool and insulated screwdriver, so that settings can be checked without taking the transmitter out of its case.

A Bridge for Low Resistance

ACCURATE MEASUREMENTS BELOW 100Ω

By "Constructor"

A BRIDGE which uses alternating current for measurements has many applications both for the direct measurement of resistance and of impedance at 50c/s. This latter facility can be of great use in receiver servicing, for, if the impedance of an output transformer is measured, shorted turns in the secondary will be reflected and a low impedance reading obtained. A single shorted turn will not be apparent from a D.C. resistance test as it may cause a variation of only perhaps 1 part in 5,000 but the impedance may drop to 1/10 of the original value.

Circuit

The circuit diagram is given in Fig. 1. The valves used are not critical and the 6J5 can be replaced by any 6·3V triode or almost any R.F. pentode strapped as a triode (SP61 for example). The bias resistor is also not critical and neither is the bypass capacitor; the values of 2·2k and 50μF 12VW are usually suitable. The indicator valve (Y63) may be replaced by a more modern type if desired. The power pack is easily constructed and the 6·3V heater winding is also used for supplying power to the bridge circuit. The value of the smoothing capacitor is not critical.

The 6·3V supplied to the bridge is fed by a limiting resistor which will prevent damage to the standard resistors if the test terminals are inadvertently shorted. The value is 5Ω and a wire-wound type or two carbon resistors in parallel may be used. The variable resistor for the balance should be a 12W pot (e.g. Colvern CLR7001).

Balance Indicator

The feed to the balance indicator is via a suitable pentode output transformer. The resistance standards used should be of 1 per cent tolerance and the circuit has been so designed that a rating of 1W is ample. The bridge can be calibrated directly by using various known resistors.

The calibration of the pot may be carried out mathematically. The total angle of rotation of the pot may be measured and is usually some 240deg. The arc traced out by the pointer of the potentiometer should be divided into five equal lengths. (It is as well to use a large pointer on the pot to ensure a long scale which is easier to calibrate). These five divisions can be divided into two, and each of these sub-divisions may be divided into ten parts. The outside of the scale can then be numbered from 0 to 10 clockwise and the inside of the scale from 0 to 10 anti-clockwise. It is then easy to calculate ratio values from the scale and to use these to ascertain the value of the unknown resistor. On the other hand, the scale could be calibrated directly in terms of resistance, e.g. on the scale already marked out, the second division clockwise would represent 0·25, 2·5 and 25Ω when standards of 1, 10 and 100Ω are used. The sixth division clockwise would represent 1·5, 15 and 150Ω. Calibration could of course be carried out using standard resistors, for instance a set of resistors of 1, 2, 3 and 4Ω could be used to give all values from 1 to 10Ω.

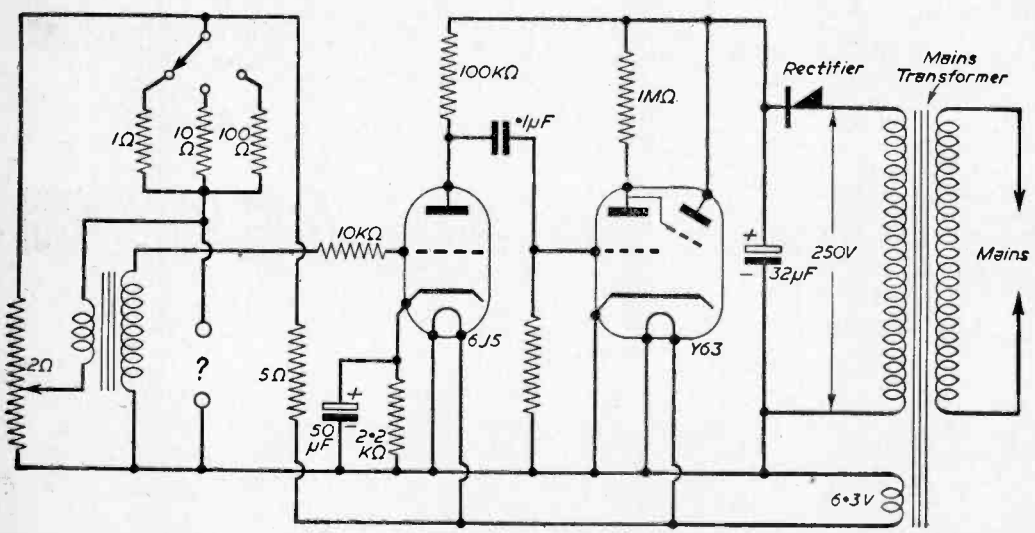


Fig. 1.—The complete circuit diagram.

A Quality Quartet

A FOUR-VALVE T.R.F.

By A. Sydenham

THIS receiver was built in order to obtain fidelity of output both from its radio section and from the subsequent A.F. amplifier. The A.F. amplifier was required for record reproduction.

Readers already possessing amplifiers but who require an efficient, inexpensive tuner will find the radio section an excellent choice whilst those who require an amplifier will find the A.F. section of interest. Either section can be built independently of the other if desired. The complete circuit is shown in Figs. 1 and 3.

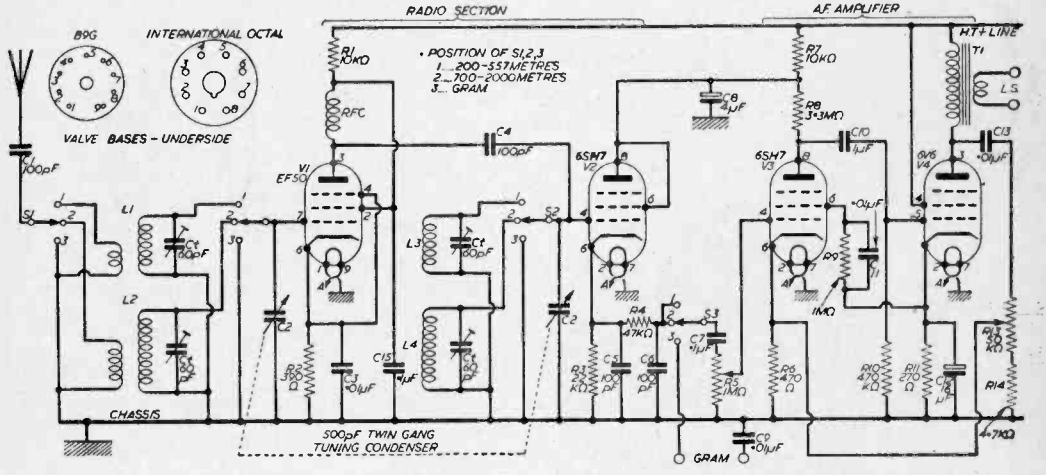


Fig. 1.—The circuit diagram.

Radio Section

To provide the detector with the gain necessary for its linear operation, a high-slope pentode is used as a R.F. amplifier. This feeds V2 via a tuned-grid coupling which further contributes to the gain. The detector imposes negligible damping on the second tuned circuit (unlike a diode) and tuning can therefore be made extremely sharp. Note that the coupling windings of L3 and L4 are not used. All trimmers are soldered directly across the coils.

Single-bank wavechange switches are not practical in this type of receiver if instability problems are to be avoided and therefore a two-bank type is used. The A.F. developed across R3 is filtered and fed to the A.F. amplifier which comprises V3 and V4.

The output from the A.F. section is more than that required for a normal size room. The output transformer is a critical part of any amplifier and the one used in the prototype is a bulky but

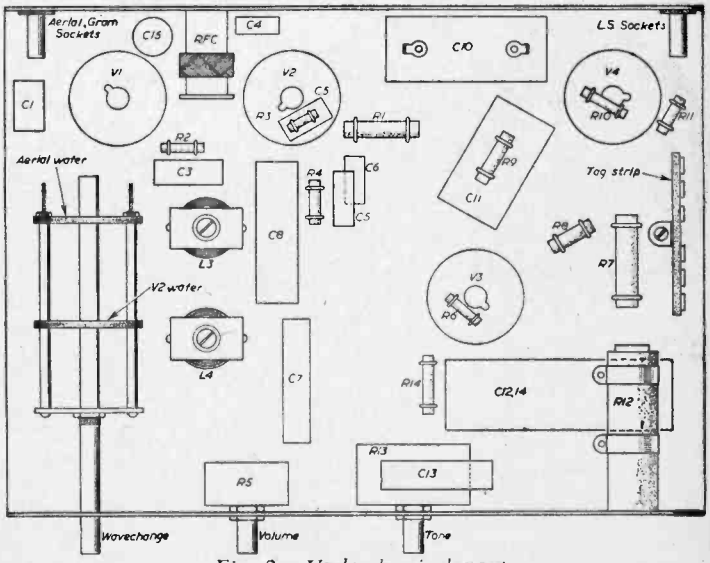


Fig. 2.—Underchassis layout.

extremely high grade component—a small type used here will prove disappointing.

The feedback tone control circuits permits a wide range of tone and is remarkably smooth in operation, the bass response being boosted when the slider of R13 is at the top end of its travel. A greater degree of boost can be obtained by increasing the value of C13.

LIST OF COMPONENTS

Capacitors:
C2—500pF twin gang.
(Other values of resistors and condensers are given in Fig. 1.)

Coils:
L1—M.W. aerial coil with coupling coil.
L2—L.W. aerial coil with coupling coil.
L3—M.W. H.F. coil.
L4—L.W. H.F. coil.
T1—Output transformer; ratio 45:1.
T2—Heater transformer, 230V input, 6·3V output at 2A.

Valves: V1—EF50. V2, 3 — 6SH7. V4—6V6.

Chassis — Minimum size 8½in. x 6¼in. x 2¼in.
Rectifiers—RM2—(2).
Miscellaneous—Aerial, Gram, L.S. Sockets, wire, solder, tags, etc.

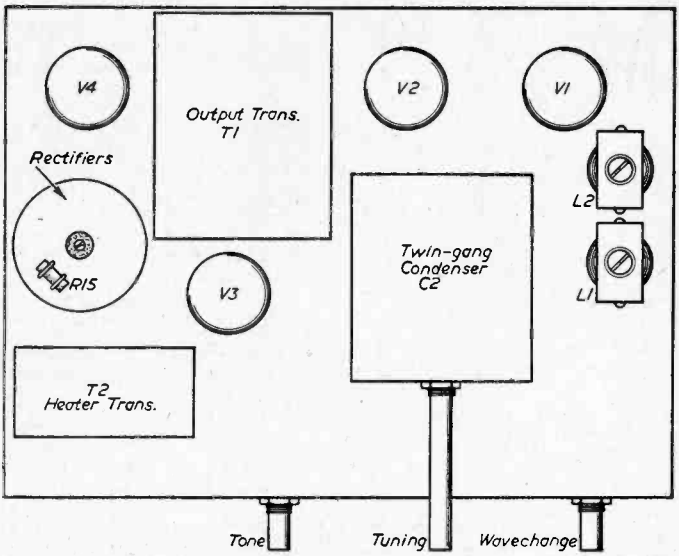


Fig 4.—Above chassis layout.

Important Note

It is essential to include both C1 and C9 if no isolating transformer is used between the mains and the receiver. Care should be taken, too, when handling the chassis which should on no account be earthed direct. Aerial, Gram and L.S. sockets should also be insulated from the chassis and there should be no exposed metalwork, grub screws, etc.

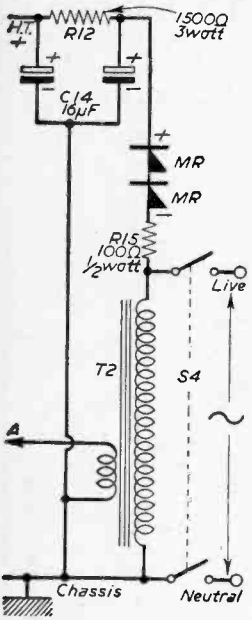


Fig. 3. — Power supply circuit (if added safety is desired, an isolating transformer can be used instead of the heater transformer indicated).

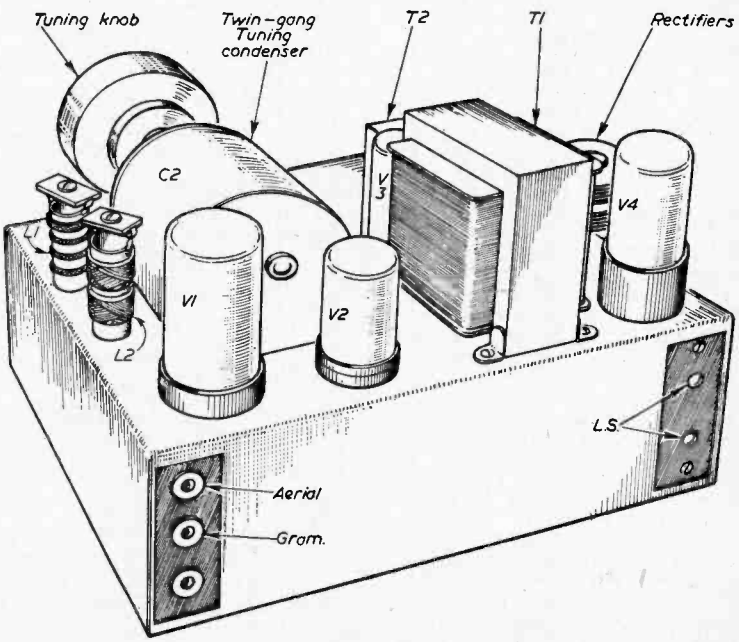


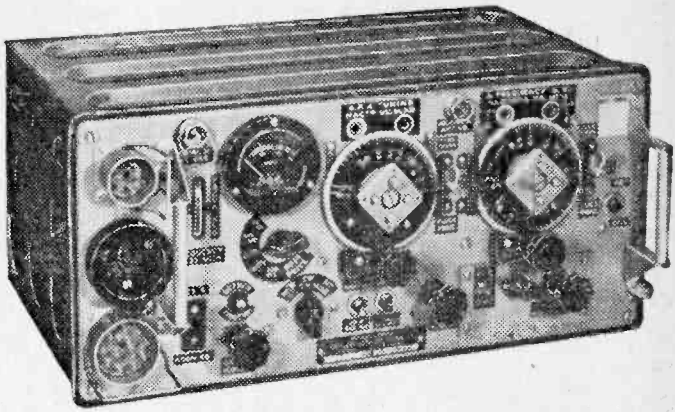
Fig. 5.—A perspective view.

The "No. 19" Set

FURTHER IMPROVEMENTS

By D. W. Dillon

(Continued from page 1028 of the April issue.)



IN the two previous articles, information has been given on modifications to the receiver section of the No. 19 Set and the intermediate testing was discussed. A circuit for a Q-multiplier to improve selectivity was also given. The valve used in this circuit was half of a 12AX7 double triode and in the circuit diagram (Fig. 6, page 1028 of the April issue) the unmarked coil is a high inductance R.F. choke. The remaining two coils are QA5/6·300 types, L1 being 7·5 to 3mH and L2 120-150μH.

In Fig. 4 on page 1027 of the previous issue, a draughtsman's error occurred and a revised diagram is given in Fig. 7 below. The bridge rectifier MR2/MR3/MR4 may consist of 4 half-wave types or a combination of half-wave and full-wave types provided they are of suitable rating.

Transmitter Modifications

The first necessity is to remove the original grid modulation components, and to short circuit the resistor, limiting the output power on 'phone. The 100k resistor between the grid pin of the 807 (R7G) and C22B is removed (care should be taken to select the correct resistor, since the grid leak R7D is also 100k). The brown lead going to the nearest section of the rear gang of the function switch is cut off and earthed. Full power will now be run on 'phone. It is recommended that the correct circuit diagram of the set be obtained for the remainder of the conversion, and some previous constructional experience is advantageous.

For the remainder of the conversion, as may be seen from Figs. 8 and 9, a number of sections of phone/CW switching, and transmit/receive switching are required. All the transmit/receive switching required can be carried out by the B set relay, which is connected in parallel with the other one. One end of the field coil is earthed to chassis, the other end being connected to the same tag as the blue-speckled white lead on the key jack. The connection from one of the tags on this jack to chassis is broken, being connected to the 24V+line on the power socket. Insertion of the key jack will not put the set on "transmit" as before. This should be tested to make sure that both relays function simultaneously. Transmit/receive switching is also carried out by the double-pole switch on the front panel.

To obtain phone/CW switching, some of the redundant sections of S7A are used. The one from which the brown lead has been removed may be used as it stands, the slider being already earthed to chassis by the yellow lead. Another section on the rear gang shunts the meter when switched to

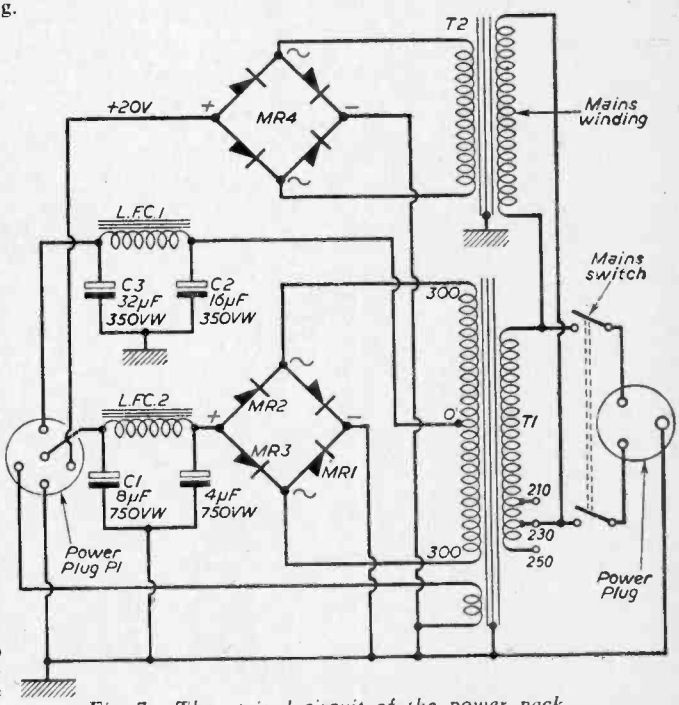


Fig. 7.—The revised circuit of the power pack.

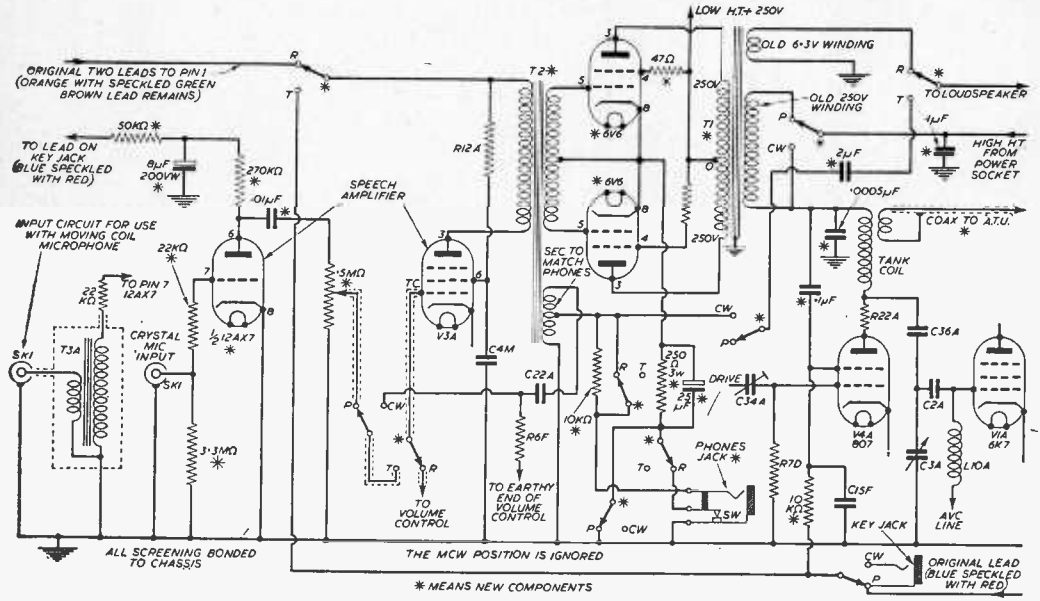


Fig. 8.—Circuit diagram of the transmitter modifications.

Ae on CW. This can also be used, the resistor being removed. All cut leads should, of course, be insulated. Another switching section is made available by the removal of the "Het Tone" leads. These are of thick, yellow insulated, tinned copper braiding.

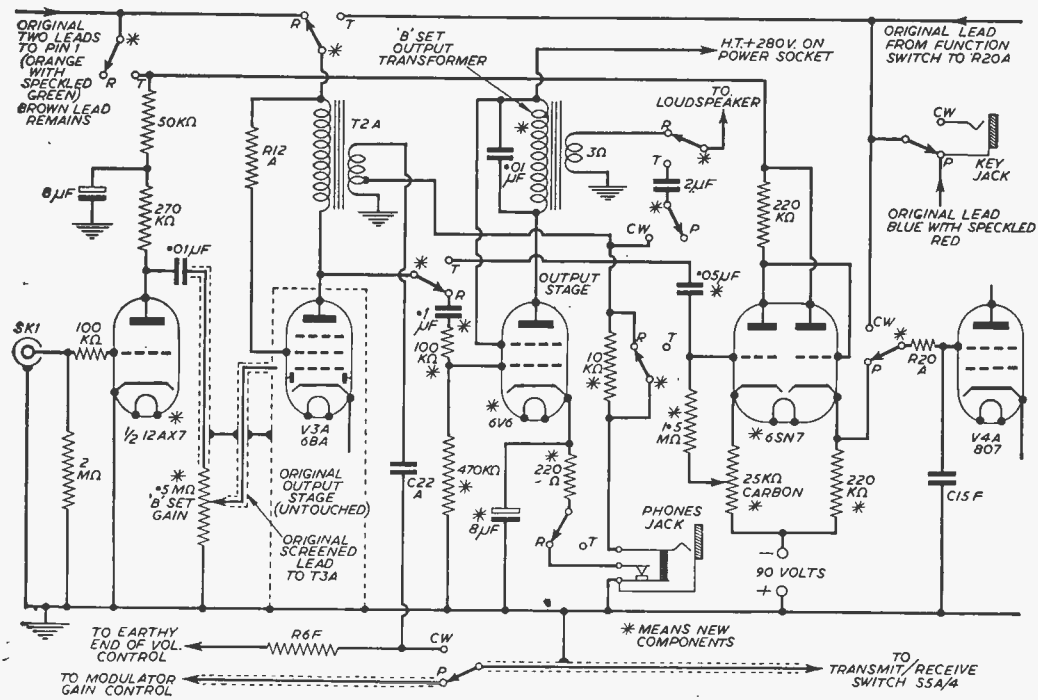


Fig 9.—Modifications to allow series-gate modulation and keying side-tone.

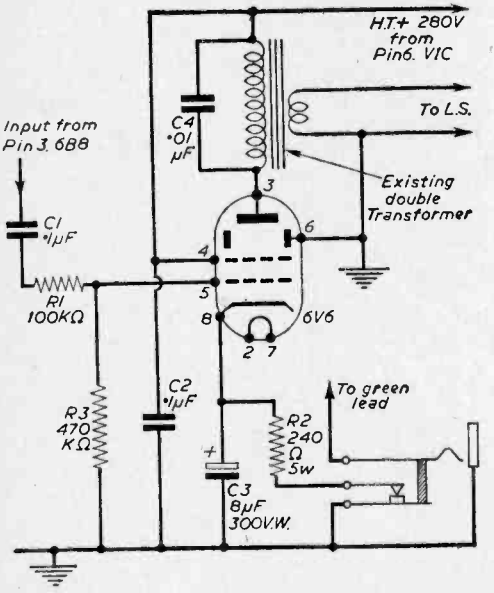


Fig. 10.—Circuit of the output stage.

Construction of Modulator

Two alternative methods are here available; either to use series-gate modulation with simple construction, lack of iron-cored components, and comparatively low efficiency, or to use anode and screen modulation which is slightly more difficult to construct and necessitates rewinding a transformer, but has high efficiency and slightly better output quality.

No attempt will be made to give a wiring diagram or description of the construction of the series-gate modulator. The layout is by no means critical, and all connections are given in the circuit diagram. The speech amplifier is the remaining half of the Q-multiplier 12AX7. A small 90V H.T. battery is mounted beside the 6V6 output stage, and provides modulator bias. Since current is only being drawn from this when the set is on transmit on phone, its life will be very long. The 25k carbon potentiometer is mounted in one of the original chassis feed-through holes. It is adjusted so that one-fifth to one-third of the peak carrier output is being indicated with no modulation input. When this modulation system is in use, the 6V6 output stage, as shown in Figs. 9 and 10, is required for speaker operation. In order to obtain a qualitative reading of the R.F. voltage on the aerial, a resistor (38k used in prototype) is connected from the tagboard in the A.T.U. to the tag. on the board mounted on C3A. which originally supported L2B (see Fig. 3 March issue).

The only portions of the anode and screen modulator (Fig. 8) worthy of mention are the modulation transformer T1 and the driver transformer T2. T1 is an old upright mounting 250-0-250V 60mA and 6·3V mains input transformer, connected according to Fig. 8. The 6·3V winding is used for the speaker output.

This must be one of the very few amateur band receivers which includes a 14W output stage! T2 is slightly more complicated. A small driver transformer of ratio 1:3+3 was obtained surplus, and had an extra (probably negative feedback) winding. This was removed, and the secondary winding from T2A wound in its place, care being taken to see that the winding direction is the same as that on T2A, or sidetone feedback will not be obtained on CW.

If moving coil microphone input is required, T3A is connected to the pre-amplifier; as shown in Fig. 8. Although this circuit diagram looks fairly complicated, many of the components are in place already and are only shown for clarity.

Final Testing

The best aerial for use with the set is a half wave type. This is about 134ft on 80m and 67ft on 40m. The set should be switched to CW transmit, and the P.A., and aerial tuning condenser alternately rotated to give the highest possible meter reading in the Ae position. All this time a medium frequency audio oscillation is heard in the loudspeaker when the key is depressed. It should be noted that the oscillation is not modulating the output; which is pure CW. The set should then be switched to phone; if series gate modulation is used, the power is lowered to about one-fifth by the carrier control. A suitable microphone is then plugged into the original A set aerial socket, and the modulation gain control increased until, on speaking, the carrier output increases. If series-gate modulation is used, the output should increase to the original CW valve, but if anode and screen modulation is used, the static carrier on phone and CW should be identical. Only a slight upward kick with modulation should be tolerated to prevent overmodulation.

A MAINS SHORT WAVE TWO

(Continued from page 29)

When using 'phones, these should be isolated from the H.T. circuit. This can be done by wiring a 0.1μF 500VW condenser from that side of the speaker transformer primary which is taken to the valve anode, and using this for one 'phone lead, taking the other to chassis and earth. The speaker itself may be disconnected.

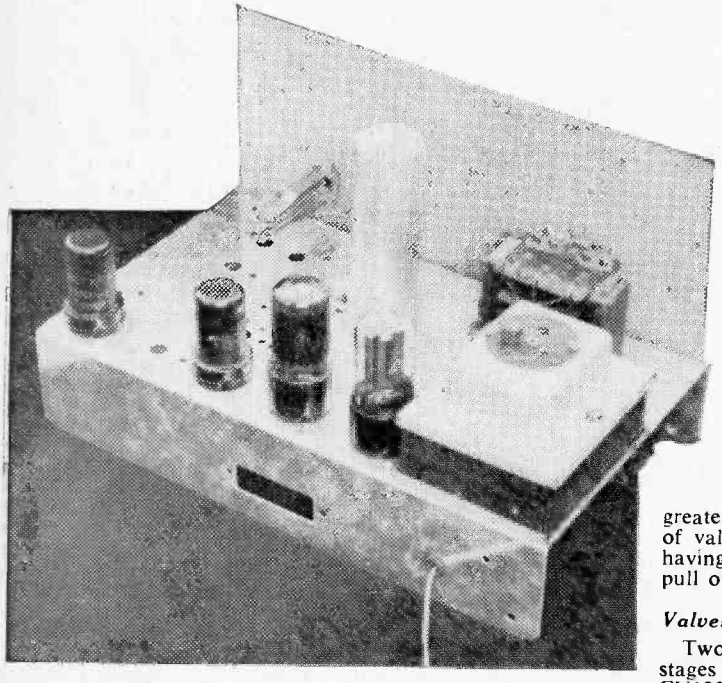
Using the receiver

The 100k potentiometer should be rotated only sufficiently to bring the detector to the point of oscillation, as shown by maximum sensitivity. Turning it too far will cause oscillation, and a drop in volume. This control is therefore operated in conjunction with the tuning control, in the normal way for reaction circuits.

The aerial condenser C1 is not shown in Fig. 3, and will not be needed with short aerials. For long aerials, or to reduce aerial damping, it is added in series with the aerial lead, at the receiver. It can be a fixed condenser, or a 50pF pre-set component.

A Singl

A STRAIGHTFORWARD AND HAS AMPL



Rear view of the unit.

FEATURES such as push-pull output and negative feedback appear so frequently in amplifiers that it is sometimes forgotten that good results can be obtained without such complications. A straightforward amplifier with a single output valve can give adequate volume for many purposes, and is easy to construct. The circuit of the amplifier described here is shown in Fig. 1, and has three stages. The overall gain is, of course, greater than if an equivalent number of valves were employed in a circuit having negative feedback or push-pull output.

Valves

Two 6J5 valves are used in the first stages but equivalents such as the L63, CV1932, and CV1934 are equally satisfactory. The 6J5G or 6J5GT type is also suitable. If only one screened valve such as a metal 6J5, is to hand, this is best placed in the first, or voltage amplifier, stage.

For general purposes, a 6V6, 6V6G, 6V6GT, or equivalent such as the CV509 or CV511 is used,

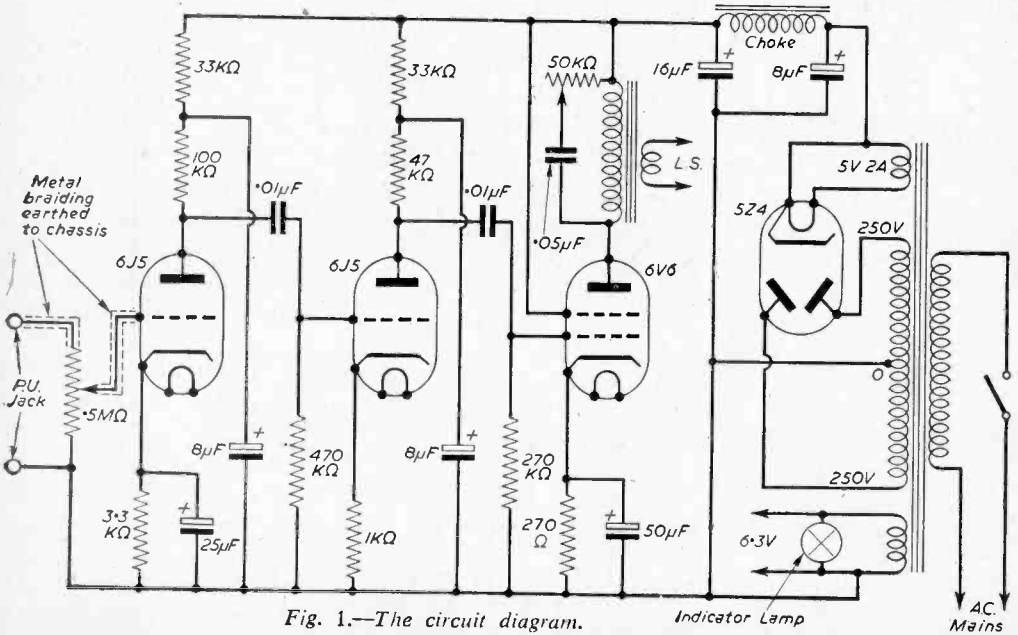
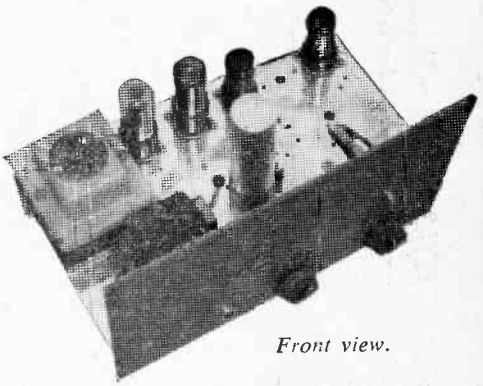


Fig. 1.—The circuit diagram.

?-ended Amplifier

RCUIT WHICH IS EASY TO CONSTRUCT OUTPUT FOR MANY PURPOSES

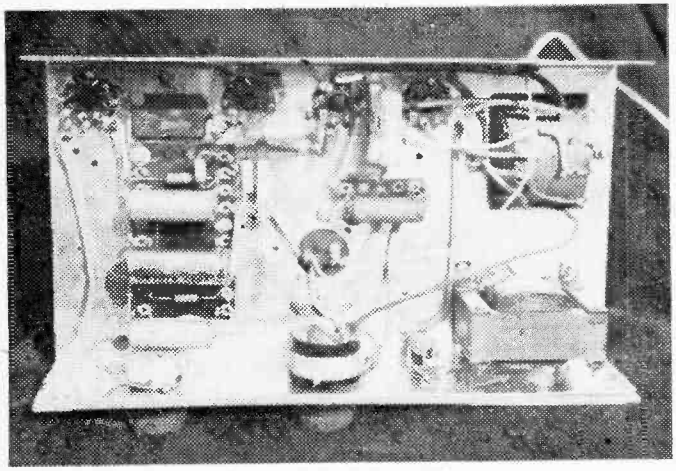
By F. G. Rayer



Front view.

and component values in the output stage are for this type. With a 250V H.T. supply, a little over 4W output can then be obtained. As rectifier, a 5Z4G, GZ30, U50, CV1863, or CV2748 may be fitted.

A simple top-cut tone control is wired across the output transformer primary, and this allows some adjustment of the "tone" of the reproduction. The main on/off switch is incorporated in this control. The other potentiometer is for volume control.



The underchassis wiring.

Notes on Components

As the amplifier is particularly suitable for beginners, in view of its ease of construction, a few notes about the actual parts to use may be helpful. Resistors are identified by colour coding, and the coding of the various resistors is shown in the component list. The colours are read as Body, Tip, and Dot, or in three bands from the end. Where a fourth colour appears, this will be gold to show 5 per cent. or silver for 10 per cent tolerance, but this can be disregarded for this amplifier. Slight changes in value are unimportant; for example, 50k instead of 47k. However, a large error, such as wrongly reading the number of noughts, can have a very severe result indeed.

The 0·01μF condensers are best of mica because slight leakage will upset the grid voltage. The large capacity electrolytic condensers will have polarity marked, and must be wired in correctly, as in the diagrams.

For a 6V6 output valve, or its equivalents a mains pentode output transformer with a ratio of 40:1 will be needed, for a 3Ω speaker. With a 15Ω speaker, the ratio should be 18:1. A *slight* departure from these figures will not matter. The secondary is the low resistance winding on the transformer.

The mains transformer needs to have a 5V, 2A winding for the rectifier heater, and 6·3V, 1½A winding for valves and bulb, which is the usual

COMPONENTS LIST

Four octal valveholders.
Two 6J5, 6V6, and 5Z4, or equivalents.
250-0-250V, 60-70mA, 5V, 2A, 6·3V, 1½A mains transformer.
Smoothing choke and output transformer: see text.
Two 8μF, 8 + 16μF 350VW or similar smoothing condensers.
25μF 25VW and 50μF 50VW bias condensers.
0·5M potentiometer. 50k potentiometer with switch.
6·3V, 0·3A bulb with holder fitting.
Chassis about 12in. x 7in. x 2½in.
Speaker sockets. Jack or P.U. sockets.
Resistors (with colour coding):
270Ω, 1W (red-purple-brown).
1k ½W (brown-black-red).
3·3k ½W (orange-orange-red).
Two 33k ½W (orange-orange-orange).
47k 1W (yellow-purple-orange).
100k 1W (brown-black-yellow).
270k ½W (red-purple-yellow).
470k ½W (yellow-purple-yellow).
Small condensers: two 0·01μF, preferably mica; 0·05μF paper.

6·3V, 0·3A type. For H.T., a 250-0-250V secondary, to provide 250V (with centre tap) at 70mA is required. Any upright, potted, drop-through or other mains transformer with such ratings will be suitable. The choke, used for smoothing, needs to carry 70mA also, and will usually have a resistance of about 250 to 300Ω. The inductance of the choke need not be known.

Chassis Preparation

A chassis 12in. x 7in., with 2½in. deep runners, will be convenient. Aluminium is easy to work. Large holes can be cut with one of the tools intended for this purpose, or can be made by drilling a series of small holes. All holes are best finished before mounting any parts.

The front runner is drilled for potentiometers and indicator bulb fitment, and the nuts securing these items also hold the panel in position. This is 7in. x 12in. and may be of metal or insulating material.

The layout of components on top of the chassis is shown in Fig. 2, and Fig. 3 shows wiring, etc., underneath. A number of points are marked "M.C." and these are soldered to tags bolted firmly to the chassis. Some of these bolts hold other items, such as valveholders, as well. The valveholder key-ways must be positioned as in Fig. 3.

A tagboard is bolted as in Fig. 3, being raised clear of the chassis by extra nuts. This board can be about 2in. x 3½in., unused tags being ignored.

Wiring

Insulated connecting wire, or 20s.w.g. wire with insulated sleeving, is most suitable for wiring. The heater circuit can be done first, keeping these connections right against the chassis. Leads run quite directly from point to point, as shown in Fig. 3.

The 0·05μF tone control condenser is mounted on a two way tag strip, both tags being insulated from the chassis. Leads pass from one tag, and from the 16μF condenser, up through a hole to the speaker transformer primary. The secondary goes to the speaker sockets, as in Fig. 2.

Good quality flex is used for the mains connections. The mains plug should be withdrawn before touching the switch or primary circuit joints. If power is taken from a 3-pin plug, use the green lead to earth the chassis to the large pin of the plug, and include the switch in the red lead. The chassis or amplifier is not "alive" to the mains, however, even when power is drawn from a 2-pin plug or adaptor.

Screened Leads

Screened leads are used for the first grid circuit. The metal braiding is drawn back for ¼in. or so, and wrapped with connecting wire, the joint being soldered. These leads are then taken to the chassis, to earth the braiding. The inner, insulated conductor goes from valveholder to volume control, and volume control to jack, as shown in the diagrams. When wiring up the jack, remember to use the tag connected to the tip for the inner conductor. It is quite in order to use a 2-socket Pick-Up strip, instead of the jack, provided the braiding of any external connection is taken to the socket which is connected to the amplifier chassis. If the plugs (or jack connections) are reversed—so that the braiding forms the grid connection—loud hum and instability will be caused.

One outer tag of the 50k tone control potentiometer is unused. The indicator bulb holder is returned to the chassis, by means of a lead, or the fixing bracket. The can of the 8 + 16μF condenser which forms the common negative connection, is secured to the chassis by means of a metal fixing clip.

Using the Amplifier

All connections should be well made, and no joints or parts should touch each other or the

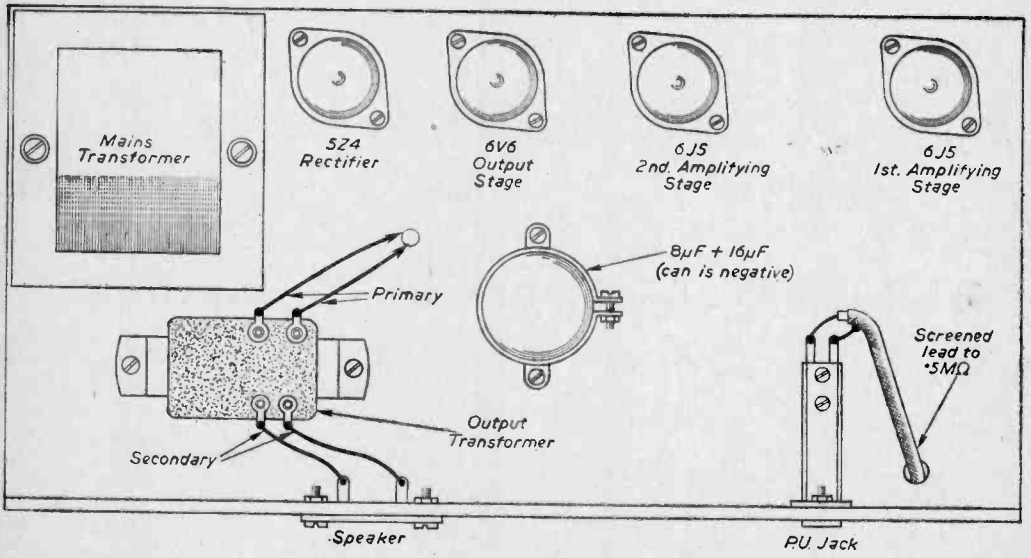


Fig. 2.—Layout of the chassis.

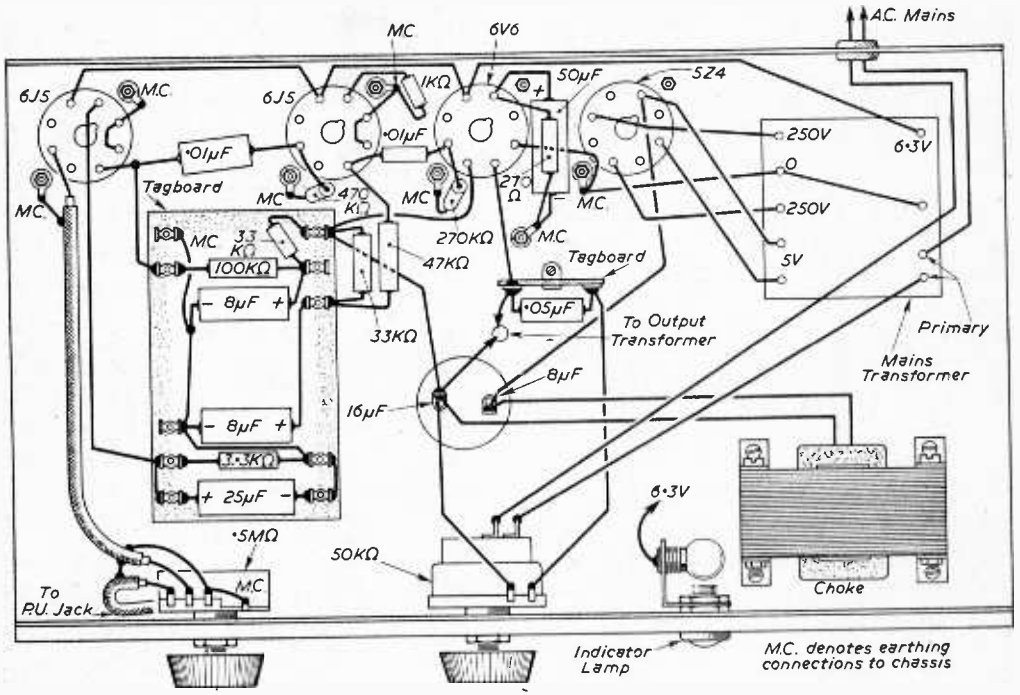


Fig. 3.—Wiring beneath the chassis.

chassis. Where mains and speaker transformer leads pass through the chassis, rubber grommets should be added so that the metal cannot cut the insulation.

The valves are inserted in the positions shown in Fig. 2. A reasonably large speaker is most satisfactory, say a 5in., 6in., or 8in. unit. It should be screwed to a baffle board, or mounted in a cabinet. Any permanent magnet speaker can be used except the small models intended for battery or transistor portables, which will be unable to handle the output available. Flexible leads from the speech coil tags terminate in plugs which are inserted in the sockets of the amplifier. If a microphone is used, sounds from the loudspeaker should not reach it direct, or howling will arise if the volume control is turned towards maximum.

Most mains transformers have tags or other means of selecting primary tappings to suit the mains voltage. If the exact tapping is not available, choose the next higher one on the transformer. In common with all transformer-operated equipment, the amplifier cannot be run from direct current mains.

With a radio tuner, and most pick-ups, the volume control will need to be turned only part way towards maximum, because the amplifier provides a good deal of gain. The input is for any high impedance source. That is, crystal and other high impedance pick-ups, or the usual radio tuner coupling circuit. With a low impedance pick-up or microphone, the usual matching transformer should be used, with its secondary wired to the amplifier jack plug or input sockets.

Reliability of Electronic Equipment

A SYMPOSIUM on electronic equipment reliability (Field Experience and Methods of assessing and Predicting Reliability) is to be held on Wednesday, 18th May, 1960, by the Institution of Electrical Engineers, Savoy Place, London, W.C.2. (Tel. Covent Garden 1871). All those who wish to attend must register, and registration forms may be obtained from the Secretary, at the above address.

The importance of reliability in electronic equipment for industrial or military use is now well recognised, and is of increasing interest to electronic equipment designers and engineers, parts designers and manufacturers, industrial and military users of electronic equipment and to inspectors and approving authorities.

The environmental conditions which equipments for Services use must now withstand and the massive complexity of electronic computers are two of the factors causing concern on the score of reliability.

The need clearly exists for some means of exchanging information on all aspects of electronic reliability and the symposium is arranged as an initial step in meeting this need.

AVC CIRCUIT FOR TAPE RECORDERS

A SIMPLE ADD-ON UNIT FOR VOLUME COMPRESSION

WHILE volume compression circuits have been widely used by communications engineers for many years, their advantages have not been accepted to any great degree by tape recording and amplifier enthusiasts. For the tape user recording dialogue—speeches for example—a volume compression unit can assist considerably in producing a recording of constant level thus lessening the task of the operator controlling the recording process.

How AVC Works

An AVC system functions by converting any input signal of greater amplitude than some predetermined level into a corresponding direct voltage. This direct voltage is used as a bias supply to an amplifier embodied in the AVC circuit, the amplifier being the type of which the gain varies with applied bias. Using this, a signal of relatively large amplitude will produce a bias large enough to decrease the gain of the amplifier proportionately. The bias produced by small signals, on the other hand, is not enough to reduce the amplifier gain significantly. As a result of this controlled gain variation, the ratio of maximum to minimum signal amplitudes is very much less at the output of the amplifier than at the input and the effect of volume "compression" is obtained. The block diagram of Fig. 1 illustrates the technique.

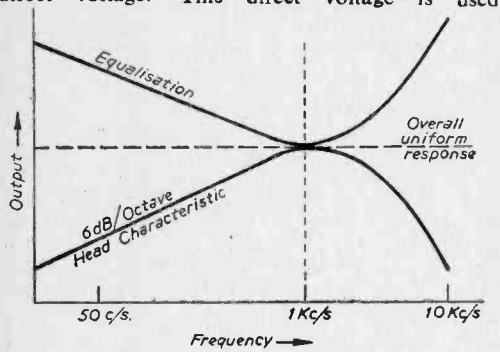


Fig. 2.—Tape playback response showing the effect of equalisation.

When a loud signal is suddenly fed into the AVC system it will often temporarily overload for a few milliseconds until the bias voltage has built up sufficiently to reduce the amplifier gain. The more

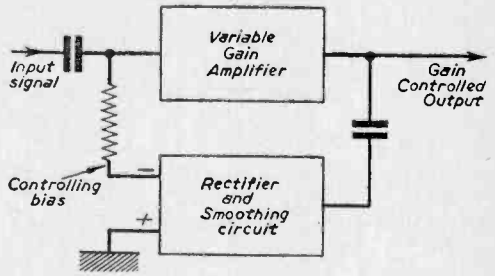


Fig. 1.—Block diagram of the AVC unit.

sophisticated AVC circuits therefore have surge limiting stages added to reduce this tendency. In addition, the transient caused by the sudden change in gain of the amplifier can cause a noticeable "thump" in the recording. Here, too, the professional users of AVC resort to a more complicated system known as "surgeless" volume control employing push-pull circuits or dummy tubes to eliminate the thump. These extra complications are not warranted here however, and it merely remains to decide where in the recording amplifier circuit an automatic volume control is most suitably located.

This can be best determined by considering typical tape recorder circuits.

Effect of AVC on Equalisation

Under practical recording conditions the signal being fed via the microphone into the amplifier will generally consist of a multitude of frequencies all occurring simultaneously. If, due to the effect of the equalising circuitry, any one of these component frequencies is amplified to a greater degree than the others then it will be this component which will be responsible for the development of an AVC biasing voltage. In turn the entire signal

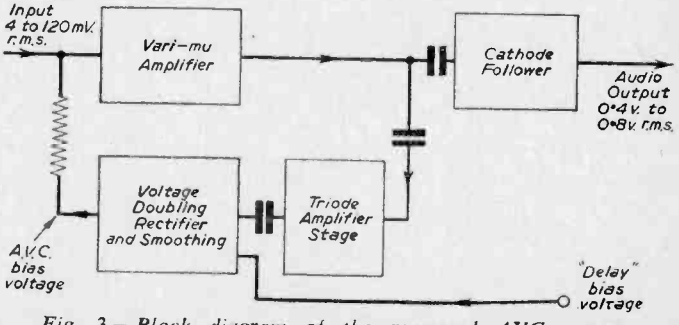


Fig. 3.—Block diagram of the proposed AVC system.

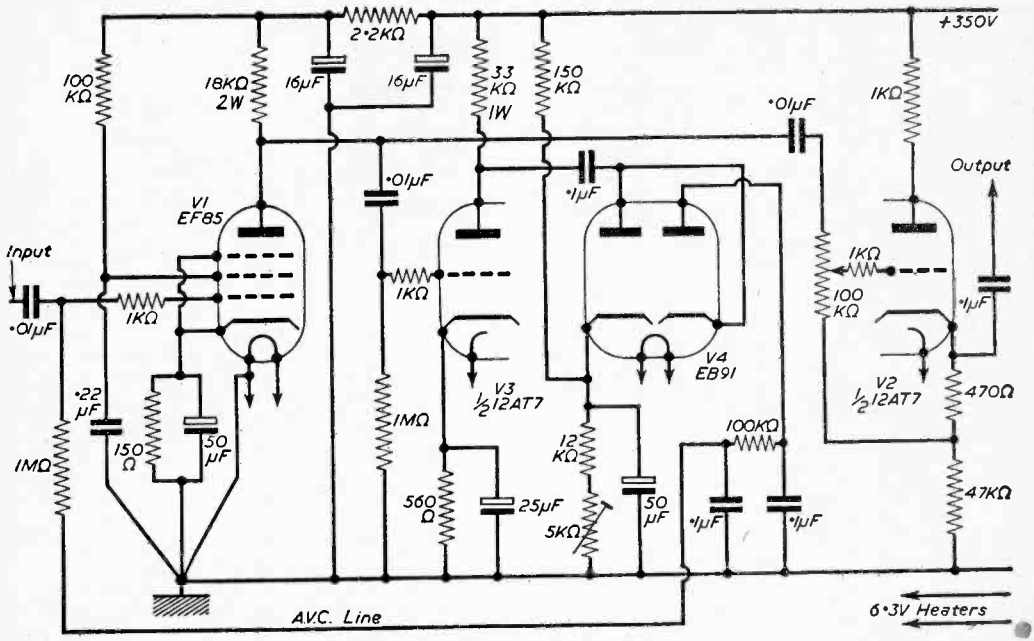


Fig. 4.—The practical circuit.

will be compressed when only the one component frequency is the offender.

The nett effect is that intentionally accentuated frequencies tend to become attenuated, and the action of AVC is to reduce the effect of equalisation accordingly. This result is in fact consistent with the action of any negative feedback circuit: the response of the circuit is made more uniform.

On recording, of course, this is not a disadvantage, provided that the appropriate pre-emphasis can be added on playback, a proviso which is met in the conventional recorder using a common record/playback amplifier.

It follows that the AVC system is best connected after the pre-amplifier stage in the recorder and after the equalisation circuitry. Additional advantages in placing the AVC system at this point rather than earlier in the amplifier chain are that no interference with circuitry carefully positioned to minimise hum problems is involved and a signal of reasonable amplitude is available to drive the AVC system.

Design Considerations

The AVC must be inoperative below some particular threshold level. This is achieved by feeding a pre-fixed biasing voltage into the rectifier which inhibits the controlling bias when signals are below this threshold. This pre-fixed bias is known as a delay bias and the sytem is then described as "delayed AVC". Readers will be familiar with this technique which is widely applied to superhet receivers.

Practical Circuit

The circuit is based on the EF85 vari-μ pentode and uses three stages. The arrangement is shown in Fig. 4. The vari-μ amplifier has a maximum gain of about 100, and the audio frequency output is coupled via a cathode follower to the remainder of the tape amplifier circuit. The cathode follower enables the entire circuit to be housed remotely from the recorder if required since its low output impedance will permit connection to the main amplifier via several yards of cable without undue attenuation of signal. A multicore cable should be used here, supplying H.T. and heaters and providing an output lead, preferably screened, as well.

The audio output available from the unit will be of the order of 0·4 to 0·8V and the preset gain control in the cathode follower grid circuit will permit the audio output to be set to a suitable level for feeding the main tape amplifier.

In addition to the audio output, a connection from the EF80 anode is also coupled to a triode stage acting as an AVC amplifier. This is necessary since the signal available at the pentode anode is not of sufficient amplitude in itself to develop the controlling bias. Accordingly, a triode amplifier is

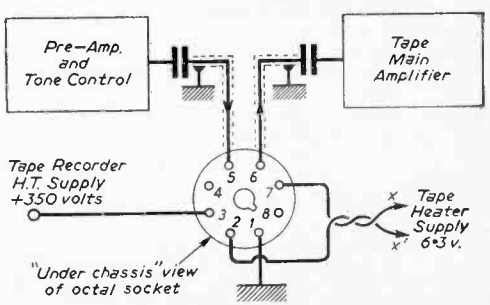


Fig. 5.—Outlet connections for socket on tape-recorder.

added, from the output of which the signal is connected to a voltage doubling rectifier circuit. The latter is used to obtain the controlling bias, which, after smoothing via two 0·1μF capacitors and a resistor of 100k, is applied to the grid resistor of V1.

The 'delay' voltage is made variable by means of VR1. This will permit alteration of the level of signal above which automatic gain control becomes effective, facilitating adjustment of the amplifier to suit prevailing conditions of use.

Wiring Details

Having decided the form of layout to be made, the heater wiring should be laid first, using a tightly twisted pair of insulated single conductor PVC wires. Of these two wires, the one connected to the pin 4 of V1 should be earthed to the valve base spigot and thence to a solder tag secured by one of the screws fixing the base to the chassis. The heaters should not be earthed elsewhere in the unit. By adopting this procedure, hum troubles should not occur.

Wiring of components follows normal practice, and the sensible disposition of tag strips should result in a tidy and accessible layout. Keep grid leads short, and where grid or anode stopper resistors are included in circuit (as for instance in V2) make sure that the body of the resistor is mounted as close as possible to the valve pin in question.

An H.T. line of 350V is shown in the circuit. This is not mandatory, and the loss in performance resulting from a lower H.T. is not serious.

Connecting the Unit in Circuit

In Fig. 5 (page 53) is indicated the conversion necessary to the existing tape recorder to which AVC is to be applied. It is assumed that the recorder is of the type previously discussed; that is, one employing a common record and playback amplifier. Those readers possessing separate amplifiers for record and playback should incorporate the connections in the recording amplifier only.

(Continued on page 77)

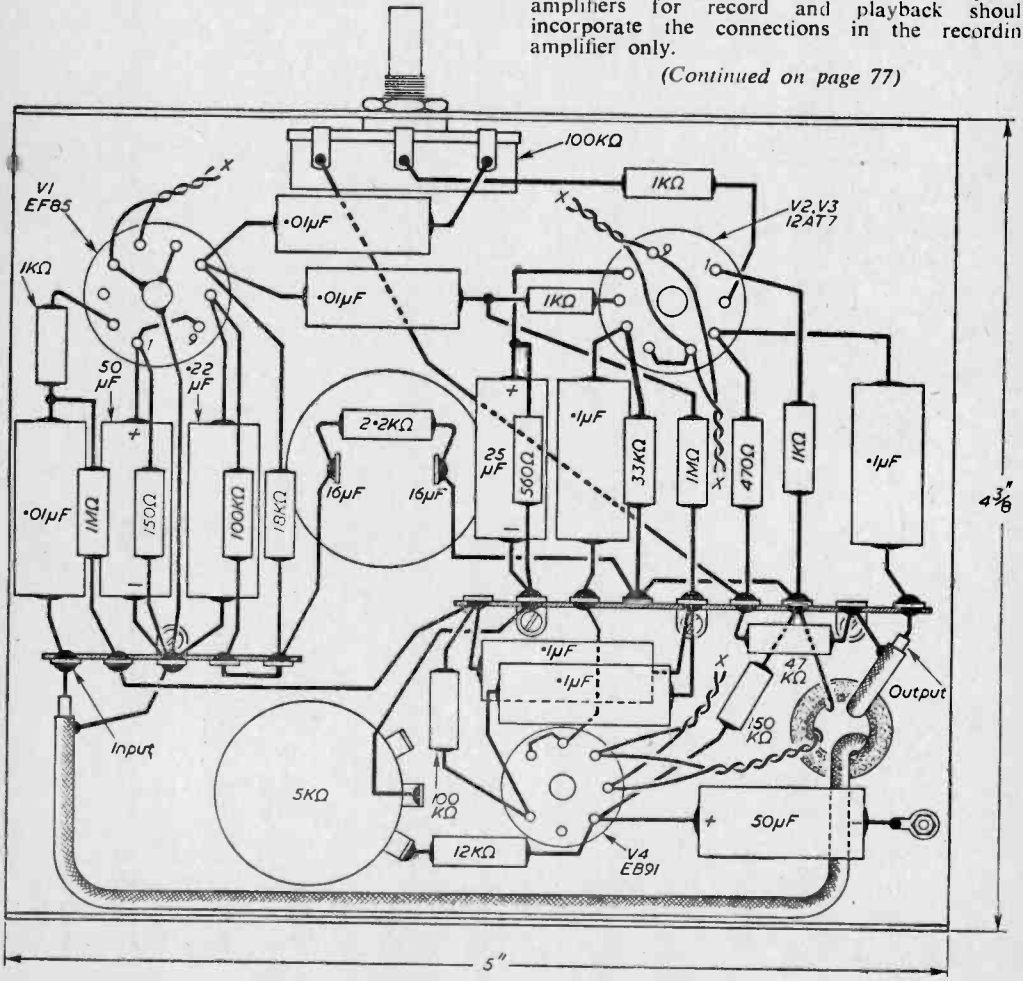


Fig. 6.—The underchassis wiring of the AVC unit.

Stereophonic Broadcasting

DETAILS OF THE MULLARD SYSTEM

DURING recent years experiments have been carried out by the BBC and certain commercial concerns on various systems for stereophonic broadcasting. A new system has recently been proposed and demonstrated by Mullard Ltd.—as mentioned in the Editorial of the previous issue—and the following description is taken from a report on the system by the Mullard Research Laboratories.

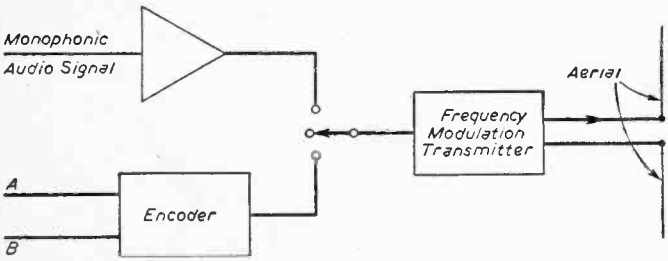


Fig. 1 (a).—The encoder unit for the new system replaces the input from the monophonic signal source.

Introduction

The assumed requirement is to provide a broadcast service for normal two-signal stereophony, i.e. stereophony in which two signals (A and B) are derived, the sum of which is an acceptable representation of the equivalent monophonic sound, whilst their difference is related to the lateral positions of the sound sources involved.

The system is a twin-channel application of the principles of pulse amplitude time multiplexing under conditions in which the bandwidth, after multiplexing but before modulation of the transmitter, is restricted to a logical minimum. The system is essentially symmetrical in character in its treatment of the signals A and B, and leads, in particular, to simplicity and therefore economy in receiver design and construction. Its implementation would also require only minor modifications to normal FM broadcast transmitting equipment. The radio frequency channel bandwidth may be identical with that used for normal monophonic FM systems.

Description of System

It is proposed to place the A and B stereophonic signals into an 'encoder', the output of which—called the complex signal—passes, in place of the normal monophonic signal to the transmitter frequency-modulation equipment. (See Fig. 1(a).) The remainder of the transmitter is of standard form.

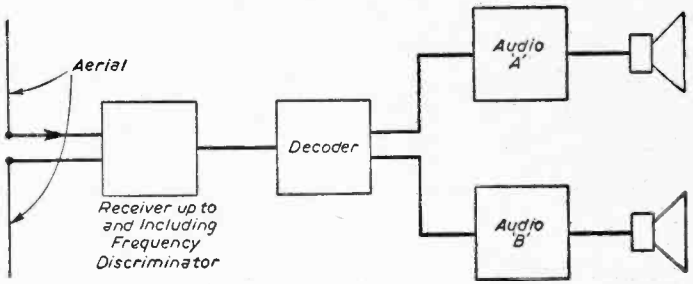


Fig. 1(b).—A decoder unit in the receiver separates the two signals.

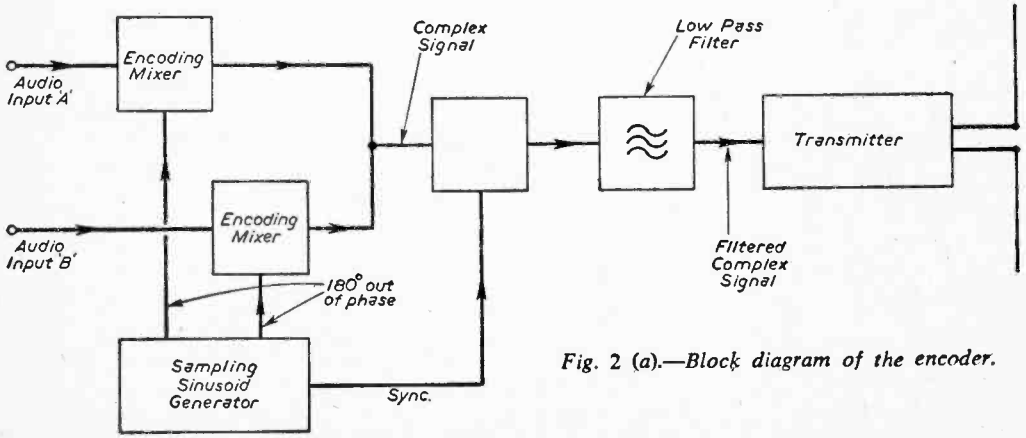


Fig. 2 (a).—Block diagram of the encoder.

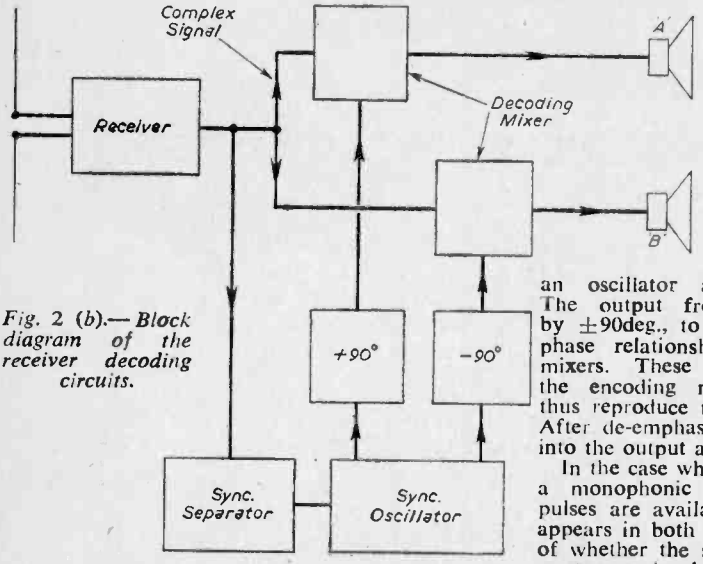


Fig. 2 (b).— Block diagram of the receiver decoding circuits.

At the receiver, standard components up to and including the frequency discriminator are used followed by a decoding apparatus and two conventional audio stages. (See Fig. 1(b).)

Transmitter (Figs. 2 and 3)

A sampling generator operating at the multiplexing frequency produces two sinusoids in anti-phase. These are fed into two mixing or multiplying devices to which are also applied respectively the two stereophonic signals A and B, suitably pre-emphasised. The sampling sinusoids are half-wave rectified by the circuits to produce two time interlaced pulse trains, one amplitude modulated by A, the other by B. The resultant output waveforms from the encoding mixers are shown in Figs. 4(a) and 4(b). Although, for clarity, pulses with an angle of flow of about 90deg. are shown, calculation and performance indicate that half-wave rectified pulses (i.e. an angle of flow of 180deg.) produce the best results from the point of view of obtaining optimum performance from the system.

Adding the outputs from the encoding mixers gives the complex signal shown in Fig. 4(c). This signal alone does not contain any information to resolve the A, B ambiguity in a subsequent receiver. In order to provide for correct synchronisation, a small amplitude component at the sampling or multiplexing frequency in phase quadrature with both sampling pulse trains is introduced, to give the asymmetry illustrated in Fig. 4(d). The rounded shape of the pulses is due to the bandwith limitation effect produced by passing the complex signal through a low pass filter (Fig. 2(a)) just before entry into the frequency modulator of the transmitter. Thereafter a normal transmitter is used.

The Receiver

A normal receiver is used up to the output circuit of the frequency discriminator, which is maintained at adequate bandwidth to recover the complex signal shown in Fig. 4(b). The negative synchronising pulses are separated in a synchronising separation circuit (see Fig. 2(b), and are used to phase-lock an oscillator at the multiplexing frequency. The output from this oscillator is rephased by ±90deg., to obtain the correct in-phase/anti-phase relationship for operating the decoding mixers. These are thereby synchronised with the encoding mixers in the transmitter, and thus reproduce the signals A and B respectively. After de-emphasis these signals are then directed into the output amplifiers A and B.

In the case where the stereo receiver is receiving a monophonic transmission, no synchronising pulses are available, and the monophonic signal appears in both audio output circuits, irrespective of whether the synchronising oscillator runs free or stops under these conditions. If the latter course is adopted an advantage in output signal/noise ratio is obtained.

Frequency Spectrum

In view of the bandwidth limitations owing to radio frequency channel allocations and to presently adopted techniques in typical

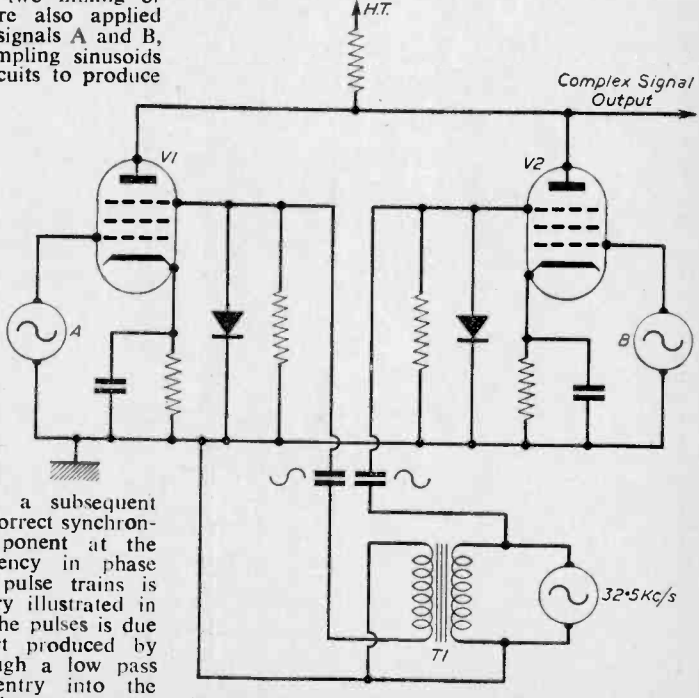


Fig. 3.—Basic encoding circuit.

monophonic receivers it has been necessary to confirm that the proposed system can be operated within these restrictions.

The filtered complex wave fed to the frequency modulator of the transmitter has a frequency spectrum consisting of (A + B) at audio frequency (A — B), DSB AM on a suppressed subcarrier at the sampling frequency, and (A + B), DSB AM on a subcarrier at the second harmonic of the sampling frequency (see Fig. 5), Audio bandwidth is usually 15kc/s and the sampling frequency 32·5kc/s. The bandwidth of the spectrum shown therefore is 80kc/s.

Such a modulating spectrum is acceptable in FM transmitters without exceeding the radio frequency signal bandwidths normally employed, for example, in Band II. By retaining a complex signal bandwidth of 80kc/s, ease of receiver synchronisation is achieved without either radiating a special high power synchronisation signal from the transmitter, or complicating the receiver by the inclusion of high quality synchronising filters.

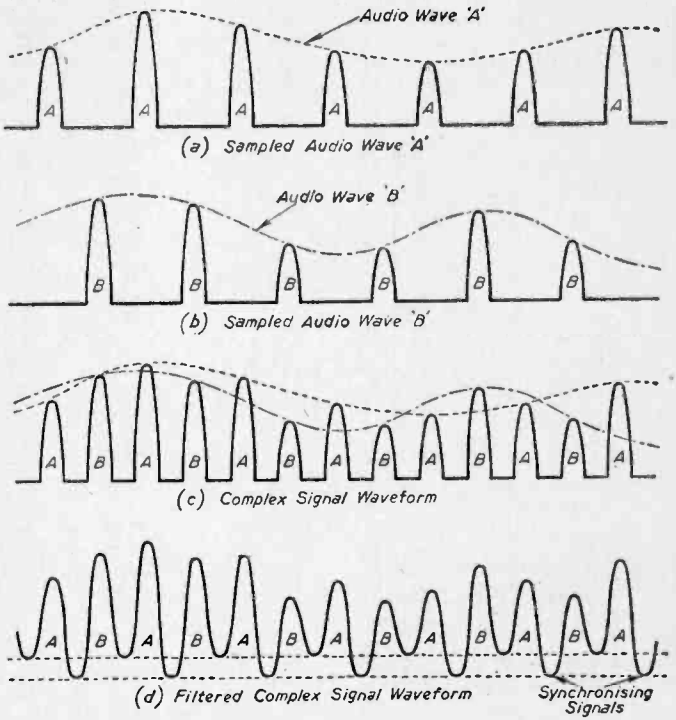


Fig. 4.—Various waveforms at the transmitter (a) and (b). Output waveforms from the encoding mixers. (c) The complex signal obtained by adding the outputs from the encoding mixers. (d) A symmetrical waveform obtained by adding a small amplitude component at the sampling or multiplexing frequency in phase quadrature with both sampling pulse trains.

Performance: Symmetry

The system basically provides two equal linear, symmetrical and independent signal paths and therefore is capable of transmitting two-signal stereophony, or bilingual or other two-signal broadcasts, with a performance of which the symmetry is limited only by any imperfections in the instrumentation employed.

Bandwidth of the Complex Signal

Most present FM receiver designs would provide adequate bandwidths for all the necessary components of the transmitted signal to be collected and recovered for decoding without distortion.

Fidelity

Audio frequencies in the normal range of 30c/s to 15kc/s will be transmitted by the system with a fidelity limited only by instrumental imperfections. The system also has good dynamic range possibilities.

Compatibility

The listener with a monophonic receiver will continue to hear an acceptable monophonic signal when receiving a stereophonic transmission. The level of sound at the receiver may change by a few decibels, when the transmitter is switched from mono to stereo operation, but this effect may be obviated, if desired, by suitably restricting the transmitter deviation on mono transmission.

Reverse Compatibility

The listener with a stereophonic receiver will hear a monophonic signal from both audio outputs when receiving a monophonic transmission. The level of sound at the receiver may change by a

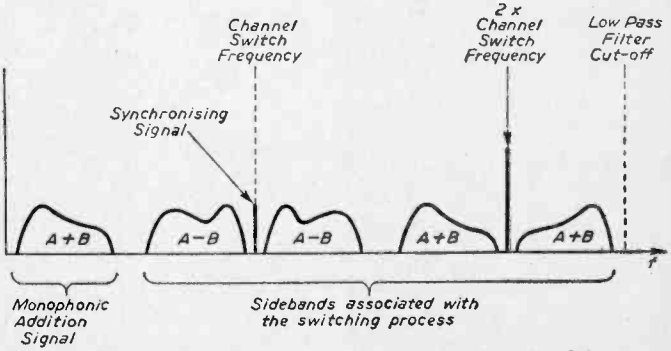


Fig. 5.—Spectral content in the complex signal.

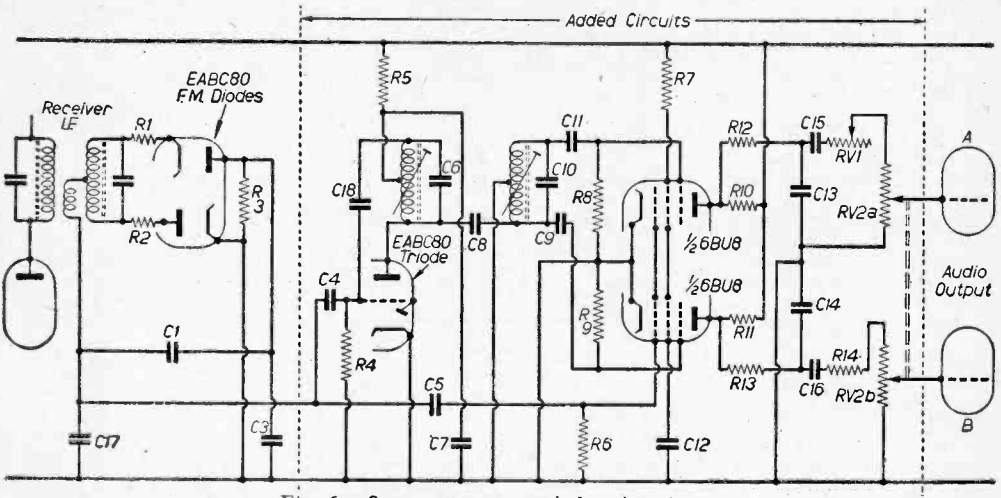


Fig. 6.—Sync separator and decoder circuit.

few decibels, as before, but this effect can also be avoided by similar means.

Cross-talk

The theoretical limit of cross-talk of the A input into the B output and vice-versa (for half-wave rectified encoding and decoding pulses) is −45dB. This is well below the maximum permissible for stereophonic broadcasting, and will also be acceptable for many bilingual and other two-signal transmissions.

The two encoding mixers at their simplest may each embody only one semiconductor diode, or one transistor. In a valve receiver a double triode or other double valve may be used.

Obviously, final steps in the engineering development of the simplest receiver have yet to be made. The circuit of a valve synchronising separator and decoder shown in Fig. 6, although uninvolved, does not represent the ultimate in simplicity which should finally be achieved.

Receiver	Monophonic		Stereophonic	
Type of Transmission	Mono	Stereo	Mono	Stereo
Change of output S/N	0†	-5dB	-15dB*†	-20dB
Change of receiver output level	0†	-5dB	0†	- 5dB

* This figure of -15dB will be improved to 0dB† if the synchronising oscillator in the receiver stops.

† These figures will be degraded by -5dB if the deviation on mono transmission is suitably restricted. Under these circumstances receiver output levels remain constant thoughout.

Signal-to-noise Ratio

The results of calculations and, in some cases, experiments show that the above performance is achieved (see panel).

Adjacent Channel Interference

Preliminary adjacent channel interference tests (at approximately 220kc/s separation) appear to yield extremely acceptable results.

Receiver Design

A normal FM receiver is required but fitted with a synchronising separator, decoder and two audio output circuits. The synchronising separator circuit requires the use of either a transistor or a triode in the oscillator. In some existing normal receiver designs such a triode is already available for use in this way.

Conclusions

1. The system provides adequate cross-talk performance for the achievement of good stereophonic transmission and of bilingual and most other twin-signal operations.
2. The system has near-optimum requirements in regard to transmitter and receiver simplicity and R.F. channel occupancy.
3. The system operates with fidelity, is fully compatible and reversely compatible.
4. Loss of output signal-to-noise ratio is low (5dB) on stereophonic transmission—monophonic reception and moderate (20dB) on stereo-stereo. Owing to the nature of the improvement threshold in frequency modulation reception the stereo to mono service area should be nearly the same and the stereo to stereo service area only slightly less than for a corresponding standard monophonic broadcasting system.

Curing Radio Interference

IMPROVING A.M. RECEPTION

By A. E. Irwin

MUCH of the interference in broadcast receivers can be reduced by putting up a good aerial. In the early days of radio, it was imperative to do this, but as sets became more and more sensitive, aerials became shorter and shorter, Some indoor aerials, only a few feet long, are nothing more than interference traps.

Long-wire Aerial

The old kind of aerial (Fig. 1), raised as high as possible and attached to the house with a lead-in wire and the other end attached to a garage roof or pole, will do much towards cutting down interference, especially when listening on the long-wave

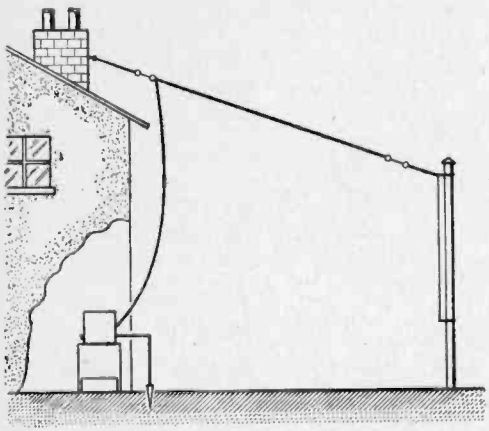


Fig. 1.—A good aerial/earth system is essential.

Light Programme where interference is worst. If you are lucky enough to have one of the new VHF receivers with a special aerial this, of course, does not apply and in any case you will not be having this sort of trouble.

Look at the earth connection—see that the wire is not broken and that it is making good contact to the metal pipe or plate in the garden.

Interference can be cut down by fitting a small condenser in the aerial lead, but, again, this is only effective if you have a good aerial. Remove the aerial lead from the aerial terminal and join it to one side of the condenser (see Fig. 2). Join the other side of the condenser to the aerial terminal.

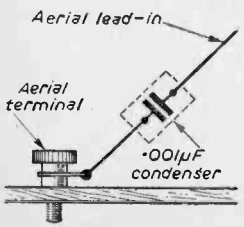
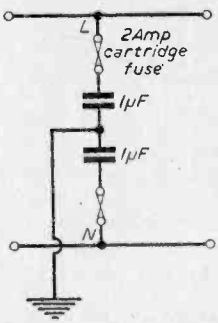


Fig. 2.—A 0·001μF condenser can be wired in series with the aerial lead.



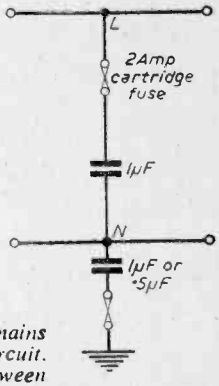


Fig. 3 (Left). — Basic mains interference suppression circuit. (Note: the condenser between the line and earth passes about 80mA to earth—250V 50/s A.C. circuit). Fig. 4 (Right).—Usual adaptation of the basic circuit. (Note: the condenser between neutral and earth passes a small current to earth.) This circuit is effective at frequencies from 150kc/s to 15Mc/s.

You may find a suitable condenser in your radio junk box—about 0·001μF capacity will serve.

Some sets are already fitted with a condenser, aerial terminal A1 being connected direct to the set and A2 through a suitable condenser to the set. Many anti-static devices, sold under various proprietry names in highly-coloured cases, when opened contain just this—an ordinary condenser.

Line Whistle

Another source of interference is the whistle of a neighbour's TV set when your set is tuned to the Light Programme on the long wave (200kc/s). The line frequency, which you hear as a continuous whistle when a TV set is on, is about 10kc/s in frequency. The 20th harmonic of the TV line frequency comes right on the Light programme frequency of 200kc/s. Therefore, this source of interference is difficult to combat. All you can do is to alter the tuning of your receiver up or down the dial to a point where speech just starts to distort. A lot of the whistle goes at this point.

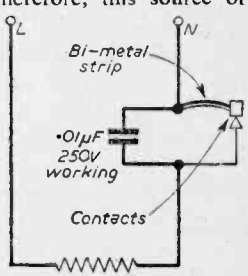


Fig. 5. — Suppressing a thermostat circuit.

Some manufacturers of TV sets have taken steps to prevent this type of spurious radiation. One firm paints the inside of the cabinet with metallised paint which stops it. However, if you are experiencing really serious interference of this sort, complain to the local G.P.O.

Mains-borne Interference

Another form of interference enters your set via the mains supply. This can usually be found by removing the aerial lead, checking if the interference still persists. Devices which can be purchased consist of two condensers, 1μF capacity, joined together and then earthed. Connections are

taken to each wire of the mains supply (see Fig. 3). This unit bypasses the interference so that it does not enter the set.

Most domestic appliances, vacuum cleaner, electric shavers and blankets, are not in use when someone wants to listen in, but if any of them do interfere badly with your reception, it is nearly always those with a thermostat. This device continually switches the current on and off through a pair of contacts. Each time the contacts make or break a spark may occur. A condenser of about 0·01μF capacity joined across the contacts will suppress the sparking and the interference (see Fig. 5).

Today, condensers are made small enough to fit inside the apparatus. Where this is not possible, a condenser type suppressor in a bakelite case can be connected in the mains supply lead to the offending equipment (Fig. 6).

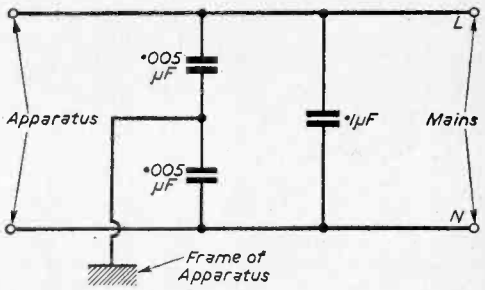


Fig. 6.—Suppressor circuit for connecting in the flex lead to the apparatus concerned. This must be wired as close to the offending apparatus as possible—within 6in.

100 kc/s CHECK OSCILLATOR

(Continued from page 30)

writer always adopts the following pin-connection sequence: pins 1 and 2 joined, and connected to earth (chassis), being one side of the heater circuit, whilst pin 5 carries the H.T. positive line with the remaining heater connection going to pin 7.

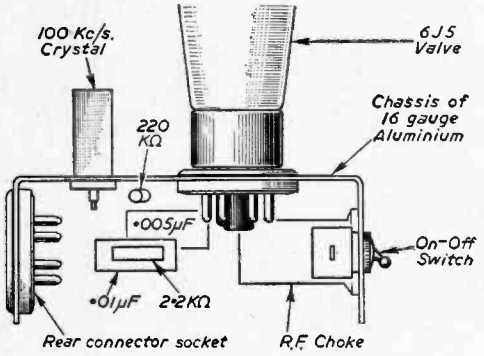


Fig. 4.—Side view of the unit.

The crystal holder is mounted on the chassis by drilling two 3/16in. holes to take two brass bolts, and two further, but larger, holes to give clearance for the crystal pins when it is positioned in its socket. A small toggle switch has been included in order to break H.T. to the oscillator. Making the oscillator work should present little difficulty, but care should be taken to see that excessive H.T. is not applied to the unit, or damage to the crystal may result (owing to the presence of too much R.F.). A safe voltage should be around 200 to 250, with the 6J5 triode, and in practice the existing power supply on the receiver may be employed, as with this unit the current drain is quite low (about 4 to 5 mA H.T.). Should the "radiation" prove insufficient on the higher frequencies, then a short length of insulated flex may be wound loosely round the anode connection to the R.F. choke (as in Fig. 2), thus giving "boost" to the signal. Though simple in design, this oscillator will prove of inestimable help in calculating—and signposting, as it were—any receiver, including some of the older BC types.

Conference on Components and Materials used in Electronic Engineering

THE Electronics and Communications Section of the Institute of Electrical Engineers announce that with the support of the Council they are organising a Conference on Components and Materials used in Electronic Engineering, at The Central Hall, Westminster, London, from 12th-17th June, 1961.

The scope of the Conference falls under three main headings:

(a) Materials

The preparation, and the physical and electrical properties of resistive dielectric, magnetic, piezo-electric, ferro-electric, magnetostrictive, photo-sensitive, etc., materials and their application to modern components.

Constructional materials such as boards for printed wiring, soldering and encapsulating materials.

(b) Components

Fixed and variable resistors, potentiometers, capacitors and inductors, transformers, transductors, and switches, relays, plugs, sockets and contacts.

Small motors and synchros.

Equipment wiring, R.F. connecting cables and fuses.

Potted and printed circuit components and modular structures.

It is intended to put special emphasis on new techniques of measurement, reliability and the effects of extreme operating conditions.

(c) Assembly Techniques

Miniaturisation and micro-miniaturisation.

Methods of automatic assembly.

Wrapped and crimped connections.

The conference will not cover thermionic devices, transistors and other semiconductor devices, neither will applications be included, except when a reference thereto is essential to a description of the nature of components or materials.

The Institution invites the submission of papers for consideration. Further information can be obtained from the Secretary, the Institution of Electrical Engineers, Savoy Place, London, W.C.2.

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RESISTORS.—FULL RANGE 10 ohms—10 megohms 20% ½ w. and ¼ w., 8d., ½ w., 6d., (Midget type modern rating), 1 w., 6d., 2 w., 9d., 10% Hi-Stab. ½ w., 6d. ¼ w., 7d., 5% ½ w., 9d., 1% HI-STAB. ¼ w., 1/6 (10-100 ohms 2/-).

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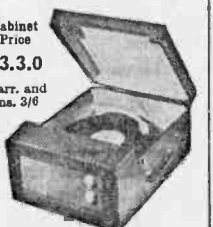

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Trade News

NEW PRODUCTS AND DEVELOPMENTS

D.C. CONVERSION UNIT

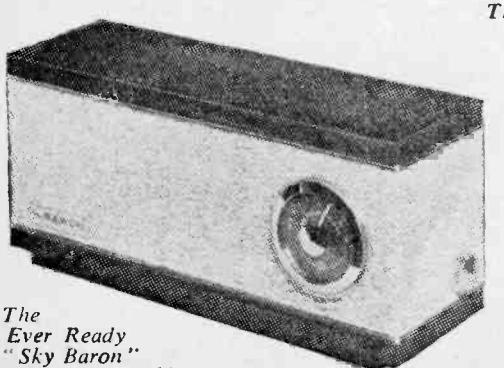
A TRANSISTORISED D.C. conversion unit claimed to give the same efficiency at 30W loading as at 150W, is marketed under the name "Dependapac". It is intended for use with mobile

The D.C. conversion unit.

transmitters and employs a system (for which a patent application has been made) of switching transformer taps and bias by relay to give economical operation. In a typical application, 530V at 228mA and 265V at 110mA are easily obtainable but other combinations may be used provided that the drain does not exceed 150W. The unit is robustly built and its total size is 8½in. x 2¼in. x 5in. The price is 21 guineas and the marketers are the *Dependable Relay Co. Ltd., 8a, Ainger Road, Camden Town, London, N.W.3.*

TRANSISTOR PORTABLE

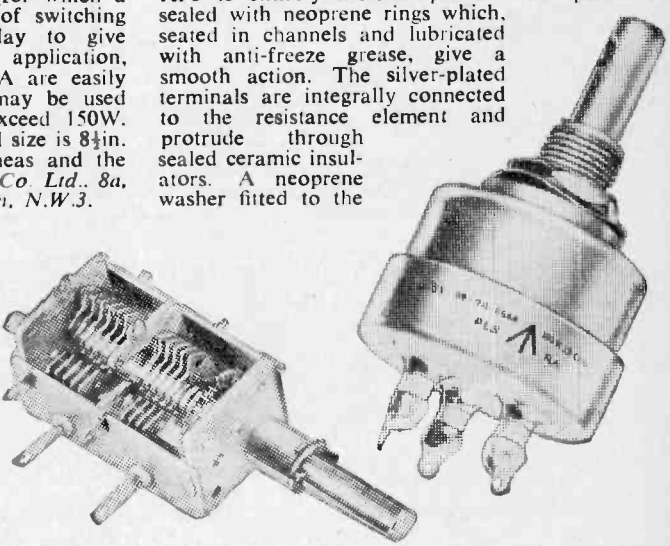
A SUPERHET transistor portable is announced by Ever Ready and uses a printed circuit with six transistors and a germanium diode. An internal ferrite aerial is used for normal reception although a socket can be fitted if required for an external aerial and earth. The receiver covers 190-540m and also receives the BBC Light programme on 1,500m as a pre-set station. It is claimed that in normal use the receiver costs 1/5 of a penny per hour and the maximum available output is some 500mW. The loudspeaker used is elliptical (8in. x 5in.) and the total weight of the set is about 8½lb. The overall size of the cabinet is 16½in. x 7½in. x 5½in. The price including purchase tax and the battery is £23 12s. 6d. *(The Ever Ready Company (Great Britain) Ltd., Hercules Place, Holloway, N.7).*



The Ever Ready "Sky Baron" transistor portable.

POTENTIOMETER and VARIABLE CAPACITOR

THE range of moulded track potentiometers produced by the Plessey Company Ltd. has been augmented by a new hermetically sealed type, the XP5. Designed to operate within the temperature range 40deg. C to 70deg. C, the new potentiometer conforms with the Inter-Service Standards for radio components. It will withstand severe bumping, vibration and tropical exposure. The XP5 is entirely moisture-proof. The spindle is sealed with neoprene rings which, seated in channels and lubricated with anti-freeze grease, give a smooth action. The silver-plated terminals are integrally connected to the resistance element and protrude through sealed ceramic insulators. A neoprene washer fitted to the mounting face provides the panel seal essential for use in sealed equipment. Resistance extends from 500 ohms to 2·5 megohms (linear or logarithmic). The maximum working voltage across resistance is 500 D.C. subject to limitations of power rating.



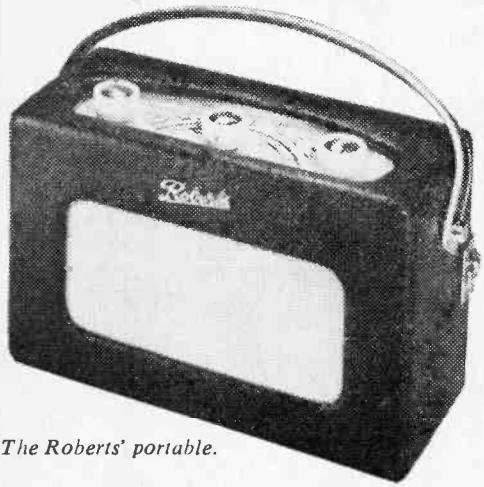
The Plessey variable capacitor and potentiometer (not to scale).

A new design of 2-gang FM variable capacitor to meet home and export requirements for FM receivers is also announced. The overall size is 1 11/16in. x 1¼in. x 1in. excluding spindle and tags. This type Y variable capacitor has been mechanically designed to give precise and consistent electrical performance for repetitive settings. The preferred version has a nominal straight line capacitance law with a capacitance swing per section of 14·75pF and a minimum of not greater

than 6pF. A screen is provided between the two sections and if required the capacitance of the front section can be increased to give a maximum of 25pF. It is of rigid construction and the rotor spindle is mounted between ball bearings—end play is eliminated by means of a flat tensioning spring. Spindle slackness and gear backlash are obviated in the design by spring loading the 3:1 reduction drive and incorporating a long bearing bush on the drive spindle. *(The Plessey Co. Ltd., Ilford, Essex.)*

ROBERTS' PORTABLE

A TRANSISTORISED receiver has been added to the Roberts' range of portables. The set covers both medium waves (188-555m) and long waves (1130-2,000m) and has a large, two-colour, tuning scale calibrated in metres on M.W. and marked with main BBC and European stations on M.W. and L.W. The 5in. loudspeaker has a high flux magnet for good sound reproduction. A ferrite rod aerial is used and the push-pull output stage will deliver some 300mW although the current



The Roberts' portable.

consumption from the 9V battery has an average value of only 20mA ensuring a long battery life. A carrying case is available as an optional extra. The price including purchase tax and battery is 18 guineas and the carrying cover is available for an extra £1 7s. 6d. Further details are available from *Roberts' Radio Co. Ltd., Creek Road, Molesey, Surrey.*

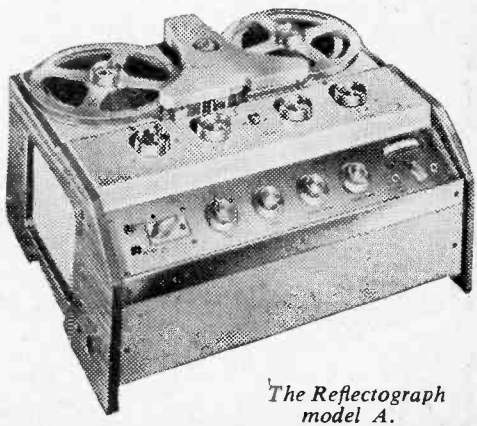
NEW REFLECTOGRAPH MODEL

THE first of the entirely new series of Reflectograph tape recorders incorporating the new Multimusic deck (described in the previous issue) is announced. The Model A is available for operation on standard voltages of 200-250 A.C. 50c/s and an alternative version may be supplied for use on 110V 60c/s. It is supplied with detachable wooden sides, the front and back of the actual deck and amplifier constituting the other two sides. When the recorder is built into furniture these sides may be removed completely. As the recorder is of standard rack width it may, for studio and industrial use, be mounted horizontally or at an angle in a rack.

The Eagle filament tester.

FILAMENT AND HEATER TESTER

A DEVICE for testing the filaments and heaters of valves has been marketed by Eagle Products. In use, the valve is placed into the appropriate socket and if the filament or heater is continuous, a pilot lamp beneath the panel of the tester will be seen to glow. Two contacts are provided for testing fuses and a receptacle in the centre of the panel enables pilot lamps to be checked. Two further contacts can be joined to test the internal battery. The unit is well finished and small in size. It will prove very useful to those who desire an instant check of continuity, whether of valves, heaters, pilot lamps, fuses or low resistance circuits. The tester is available from many dealers or direct from *Eagle Products, Eagle Works, Coptic Street, London, W.C.1,* price 30s. (2s. 6d. post and packing).



The Reflectograph model A.

Club News

REPORTS OF CURRENT ACTIVITIES

BLACKBURN AMATEUR RADIO CLUB
Hon. Sec.: K. Heap (G3NGZ), 138 New Bank Road, Blackburn.

The club meets every Friday evening at 8 p.m. in the clubroom at The Corporation Hotel, Revidge Road, Blackburn. The club is at present active on top band under the club call sign G3NTJ and hopes to be active on all bands in the near future. The club held its Annual General Meeting in the local fish and chip shop, probably the cheapest annual dinner on record at 1s. 9d. per head. A new committee was recently elected and consists of the following: Hon. Secretary, Mr. K. Heap (G3NGZ); Hon. Treasurer, Mr. E. Whittle (G3EHP); Chairman, Mr. J. Will.

BRADFORD AMATEUR RADIO SOCIETY
Cambridge House, 66 Little Horton Lane, Bradford 5.
Hon. Sec.: David M. Pratt, G3KEP. "Glenluce", Lyndale Road, Eldwick, Bingley, Yorkshire.

Future Events:
May 10th.—"Top Score".
May 24th.—Lecture on transistors by E. C. Bell, B.Sc.
June 14th.—Visit to "Holme Moss".
Meetings commence at 7.45 p.m.

THE BRITISH INSTITUTION OF RADIO ENGINEERS
9 Bedford Square. London, W.C.1.

Meetings for April, 1960.

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

April 7th at 6.30 p.m.—"The Work of the B.S.I. in relation to the Radio and Electronics Industry" by H. A. R. Binney, C.B.

April 13th at 6.30 p.m.—"Guided Weapon Control" by F. R. J. Spearman, Computer Group.

April 21st at 6.30 p.m.—"Nerve Impulses from Stretch Receptors in Muscle" by Dr. J. G. Nicholls, Medical Electronics Group.

April 27th at 6.30 p.m.—"Electronics in Oceanography" by M. J. Tucker, B.Sc.

April 28th at 6.30 p.m.—Discussion on the Education Committee's Report on "The Education and Training of the Professional Radio and Electronics Engineer".

Cheltenham—South Midlands Section.—Meetings are held at North Gloucestershire Technical College.

April 29th at 7 p.m.—"The Application of Semi-conductor Devices in Power Supplies" by D. D. Jones, B.Sc. This will be followed by the Annual General Meeting of the Section.

Glasgow—Scottish Section.—Meetings are held at the Institution of Engineers and Shipbuilders, 39 Elmbank Crescent.

April 28th at 6.30 p.m.—Annual General Meeting of the Section. Followed at 7.30 p.m. by a programme of Technical Films.

Manchester—North Western Section.—Meetings are held at the Reynolds Hall, College of Technology, Sackville Street.

April 14th at 6.30 p.m.—"The Measurement of Human Performance" by H. Woolf.

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

April 13th at 6 p.m.—Annual General Meeting of the Section. Followed at 6.30 p.m. by Chairman's Address. "The Development of Electronics in the North East" by J. Bilbrough (Associate Member).

BRITISH SOUND RECORDING ASSOCIATION

This year the "Amateur Competition" has been renamed "Home Constructors' Competition" and will include a section for work by non-members of the Association. The competition will be held on Saturday, May 21st, at the Royal Society of Arts, London, and there are two classes as follows—(*a*) Entries submitted by B.S.R.A. members. (*b*) Entries submitted by non-members.

Apparatus submitted for the competition should be associated with the recording and reproduction of sound, including appropriate test equipment. Exhibits will be judged on the score of technical originality, suitability for purpose, design and finish. Application forms may be obtained from the Association offices at "Greenways". 40 Fairfield Way, Ewell, Surrey. Entries should be submitted not later than May 14th.

CALCOT RADIO SOCIETY
Hon. Sec.: F. Mitchenall, 12 Glenwood Drive, Tilehurst, Reading, Berks.

At the Annual General Meeting the following officers were elected: Hon. Secretary, Mr. F. Mitchenall; Chairman, Mr. S. Woodward; Treasurer, Mr. E. Stears; Committee, Mr. H. Deadman, Mr. C. Stealey, Mr. C. Aldous, and Mr. J. Lansley.

Future events:

April 21st at 7.45 p.m.—Lecture and demonstration by Mr. K. C. Smith of Truvox Ltd. Mr. Smith will lecture on magnetic sound recording and reproduction. He will give a brief history of magnetic recording systems and demonstrate monophonic and stereophonic recording and reproduction.

May 19th at 7.45 p.m.—Lecture and demonstration by Mr. L. Williams of Belclere Transformers Co. Mr. Williams will display models and give a lecture on sub-miniature electronic techniques and their particular application to hearing aid design.

CROSBY AMATEUR RADIO SOCIETY
Hon. Sec.: K. R. Coates (G3IZT), 132 The Northern Road, Crosby, Liverpool 23.

At the Annual General Meeting of the club the following officers were elected: Chairman, J. Vaughan (G3JUA); Secretary, K. R. Coates (G2IZT); Treasurer, B. J. Read (G3JDT); Committee, L. Howlett (G3LIP), J. Garner (G3KEC), K. Hough (Junior Representative).

Future events:
April 12th.—Open night (Operation of club transmitter).
April 19th.—"Transistors" by B. J. Read (G3JDT).
April 26th.—Open night.

The club has recently purchased a new BC 342 and the whole station layout is being reorganised. Meetings are held at "Colonsay", Crosby Road South, Liverpool, at 8 p.m.

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

There was a record attendance on March 1st when a film show was held of amateur activities. A film was also shown by a local Ham G3KLZ on expedition in the Scottish Highlands.

Future Events:
April 12th.—Fire Precautions.
April 26th.—Informal Evening.
May 3rd.—Annual General Meeting.

NORTHERN MOBILE RADIO RALLY
Hon. Rally Sec.: J. Charlesworth (G3IJC), 23 Craven Lane, Gomersal, Nr. Leeds.

The Northern Mobile Radio Rally will be held at Harewood House on Sunday, May 22nd, 1960, by kind permission of H.R.H. The Princess Royal.

PETERBOROUGH AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: D. Byrne, G3KPO, "Jersey House", Eye, Peterborough.

At the Club meeting on March 4th seven new members were enrolled. It was decided to hold meetings on the first Friday in every month at Peterborough Technical College.

PRESTON AMATEUR RADIO SOCIETY
St. Paul's School. Pole Street, Preston, Lancs.
Hon. Sec.: G. Lancefield, 35 Briston Road, Frenchwood, Preston.

The club now meets at St. Paul's School on the second and fourth Tuesdays in each month and all meetings commence at 7.30 p.m. The Annual General Meeting was held on January 26th and was well attended. All the serving officers of the club were re-elected, and a new committee was formed. On February 9th a demonstration of a Tiger Transmitter was held and on February 23rd a talk on 2m operation and equipment by G3JAH.

Future Event:
April 12th.—Film Show.

SOUTH YORKSHIRE AMATEUR RADIO SOCIETY
Hon. Sec.: W. Farrar, G3ESP, 2A Highbury Avenue, Bessacarr, Doncaster.

A talk on "Transistors" was given on March 8th by Sgt. Vic Ludlow, G3JLZ, and on March 24th Jack Walker, G3CYS, gave a talk on "CW—for better or worse".

Future Events:
April 12th.—General discussion on aerial systems.
April 28th.—"How to succeed in R.A.E." Hints on examination technique for those about to take the licence exam., by Walter Farrar, G3ESP.

Meetings are held at the Stag Inn, Docklin Hill Road, Doncaster, on the second Tuesday and fourth Thursday of each calendar month at 8 p.m.

WELLINGBOROUGH RADIO CLUB
Hon. Sec.: P. Butler, 88 Wellingborough Road, Rushden, Northamptonshire.
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. At a special meeting on February 25th it was decided to change the name of the club from Wellingborough and District Radio and TV Society to Wellingborough Radio Club. Mr. G. A. Abrams again accepted the Presidency of the club.

Future Events:
April 7th.—Junk Sale.
June and July.—Participation in local Charity Fetes.
(Summer recess July 21st to September 1st, inclusive)

Letters to the Editor

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

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

Transistors v. Valves

SIR, — I have been reading with interest the various views put forward by the readers of PRACTICAL WIRELESS on the above subject. To these I should like to add my views. I would say, "Use valves where valves are applicable, and transistors where transistors are applicable." In the electronics industry many firms are spending large amounts of money in developing transistor circuits to replace valve circuits in existing equipment manufactured by them. I cannot see a firm spending money on such a project, unless there were considerable advantage in doing so. Overall, a transistor circuit is usually cheaper than a similar valve circuit. Where a large number of valves are used, say in a computer, a hundred valves with a heater dissipation of 1·9W per valve, total 190W, a lot of heat to dissipate in a small area! Transistors require no heater supply and consequently their overall efficiency is far greater than that of a valve, particularly at low power ratings. Transistors are now produced in production quantities for amplifiers working in excess of 600Mc/s. There is no difference between the frequency response of a valve amplifier and a properly designed transistor amplifier.

So much for industry, now for the home constructor. Transistor equipment may be so much more conveniently constructed on the kitchen table in the home, than valve circuitry, because it is less mechanical (i.e. no cutting chassis etc.) There are no mains power supplies, a torch battery suffices; and finally many of the transformers and coils may be home-made. The transistor requires a little investigation to understand its function and use—but any project is easy when you know how. Give me transistors any time for the home constructor. 25 per cent theory and 75 per cent practical—result—an interesting hobby for all ages—safe for the young—not too intricate for the old.—D. W. SAULL (Hatfield).

The "Old Days"

SIR,—My remarks in the March issue on the "Old Days" were inspired by "Thermion's" recent notes on the subject. Most modern stuff is excellent! I am only against repeated statements by many who never even used it, that all early apparatus was so much junk! The superior finish of much of it is thus overlooked: I wish they would stop plastering capacitors with wax. I prefer the plastic-covered ones; they do not collect dirt, and the data does not get rubbed off.

I agree that a set for permanent use must be soldered. Electrical connectors are for use when one keeps a set for about a month, then strips it down in order to construct another. Mr. Kirk's assumption, that modern components must be used in modern sets and soldered, to give full results, is of course correct. In my letter, I delved into the past with some old apparatus and blueprints I have. I had the idea that I might recapture some of the early inspiration mentioned by "Thermion." I know that I did, too!—A. TROWBRIDGE (Staines).

Capacitors

SIR,—Referring to Mr. Mifsud's query on capacitors in "Open to Discussion" PRACTICAL WIRELESS, March 1960, I venture to say that he is wrong about connecting two 16μF 300VW in series to obtain an 8μF 600VW. In theory this is correct but in practice a small amendment is necessary. If a capacitor has a leakage resistance of 200MΩ and is connected in series with one of a leakage resistance of 400MΩ then one will have a voltage across it which is twice the voltage on the other. So in practice it is found necessary to connect equal value resistors across them. This ensures that the voltage is divided equally across the capacitors. The resistors should be of a lower value than the anticipated leakage resistance of the capacitors—D. J. ELLIS (Wolverhampton).

SIR,—Regarding my query about capacitors in the March issue of PRACTICAL WIRELESS I received so many letters from your readers that it is impossible to thank each one by letter so may I through "Open to Discussion" thank all those who helped me in my problem. Their generous information was marvellous, and I much appreciate their help.—J. MIFSUD (Malta).

Interference

SIR,—May I suggest that your correspondent M. Reynolds ("Interference," March edition) does a little checking on International Frequency Allocations before making grandiose suggestions for the extension of the Medium Wave Broadcast Band? A quick glance at the frequency lists will show Mr. Reynolds that a fair-sized portion of the wavelengths he suggests could be used for Broadcasting (165 to 700m) are reserved for the Maritime Services—including the all-important International Distress Frequency of 500kc/s (600m)—surely an amendment such as this would only create more confusion—it certainly would not "do its part to stop interference from morse" as your correspondent suggests!—M. G. HUTCHINS (Dursley, Glos.).

(Continued on page 77)

C.R.T. ISOLATION TRANSFORMERS
TYPE A. OPTIONAL 25% and 50% BOOST. 2 V. *OR* 4 V. *OR* 6.3 V. *OR* 10.8 V. *OR* 13.3 V. MAINS INPUT. 12/6.

TYPE A2. HIGH QUALITY, LOW CAPACITY, 10/15 pF. OPTIONAL BOOST 25%, 50%, 75%. MAINS INPUT. 16/6.

TYPE B. MAINS INPUT, MULTI OUTPUT 2, 4, 6.3, 7.3, 10 and 13 VOLTS. BOOST 25% AND 50%. LOW CAPACITY 21/-.

TRIMMERS, Ceramic. 30, 50, 70 pF., 9d.; 100 pF., 150 pF., 1/3; 250 pF., 1/6; 500 pF. 750 pF., 1/9.
RESISTORS, Preferred values. 10 ohms to 10 meg., ¼ w., 4d., ½ w., 4d.; 1 w., 6d.; 1½ w., 8d.; 2 w., 1/-
HIGH STABILITY. ½ w., 1%, 2/-. Preferred values. 100 Ω to 10 meg. Ditto, 5%, 100 Ω to 5 meg. Ω, 9d.
¼ watt, ½ watt, 1 watt — **WIRE-WOUND RESISTORS** 25 ohms—10,000 ohms — 1/3, 1/6, 2/-
15,000 ohms—50,000 ohms, 5 w., 1/9; 10 w., 2/3

PLASTIC RECORDING TAPE

Long Play 7in. reel, 1,700ft	35/-
5½in. reel, 1,200ft	28/-
5in. reel, 850ft	21/-
3in. reel, 225ft	7/6
Standard 7in. Reel, 1,200ft	24/-
5in. reel, 600ft	15/-

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

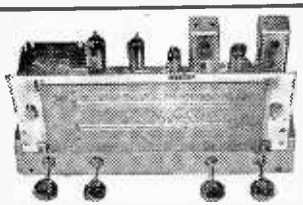
O.P. TRANSFORMERS. Heavy Duty 50 mA. 4/6. **Multiratio** push-pull, 7/6. Miniature, 384, etc., 4/6.
L.F. CHOKES 15/10 H. 60/65 mA, 5/-, 10 H. 85 mA, 10/6, 10 H. 150 mA, 14/-.

MAINS TRANSFORMERS. 200/250 v. A.C.	
STANDARD. 250-0-250, 80 mA. 6.3 v. 3.5 a. tapped 4 v. 4 a. Rectifier 6.3 v. 1 a. 5 v. 2 a. or 4 v. 2 a. ditto, 350-0-350 ..	22/6
MINIATURE. 200 v. 20 mA, 6.3 v. 1 a.	10/6
MIDGET. 220 v. 45 mA, 6.3 v. 2 a. ..	15/6
SMALL. 250-0-250, 100 mA, 6.3 v. 3.5 a.	19/6
STD. 250-0-250, 65 mA, 6.3 v. 3.5 a. ..	17/6
HEATER TRANS. 6.3 v. 1½ amp. ..	7/6
Ditto, tapped sec. 2, 4, 6.3 v., 1½ amp.	8/6
Ditto, sec. 6.3 v. 3 amp.	10/6

ALADDIN FORMERS and core. ½in., 8d.; ⅝in., 10d. 0.3in. **FORMERS** 5937/8 and Cans TV1/2. ⅝in. sq. x 2½in. and ¾in. sq. x 1¾in., 2/- ea., with cores.
TYANA. Midget Soldering Iron. 230 v. 40 w., 16/9.
REMPLOY Instrument Iron. 230 v. 25 w., 17/6.
MAINS DROPPERS. 3in. x 1¼in. Adj. Sliders. 0.3 amp., 750 ohms, 4/3. 0.2 amp., 1,000 ohms 4/3.
LINE CORD. 0.3 amp., 60 ohms per ft, 0.2 amp., 100 ohms per ft, 2-way, 6d. per ft, 3-way, 7d. per ft.
LOUDSPEAKER P.M. 3 OHM. 5in. Rola. 17/6. 8in. Pleasey, 19/6. 6in. x 4in. Rola, 18/-. 6½in. Rola, 18/6. 8 x 5in., 21/-. 10 x 6in., 27/6. 10in. Rola, 30/-. 4in. Tweeter, 25/-. 12in. R.A., 30/-. 14 x 8in., 45/-.
STENTORIAN HF1012. 10in. 3 to 15 ohm 10 w., 95/-. 12in. Baker 15 watt 3 ohms or 15 ohms, 105/-.
12in. BAKER FOAM SUSPENSION. 15 ohms, £8.
CRYSTAL DIODE. G.E.C., 2/-. **GEX34** 4/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 16/6 pr.
MIKE TRANSF. 50:1, 9/9 ea.; 100:1, Potted, 10/6.
SWITCH CLEANER. Fluid squirt spout. 4/3 tin.
TWIN GANG TUNING CONDENSERS. 365 pF. miniature 1in. x 1¼in. x 1¾in., 10/-. 0.0005 Standard with trimmers, 9/-; less trimmers, 8/-; midget, 7/6.
SINGLE. 50 pF, 2/6; 80 pF, 100 pF, 160 pF, 7/-. Spid dielectric 100, 300 500 pF, 3/6.
SPEAKER FRET. GOLD CLOTH. 17in. x 25in., 5/-. 25in. x 35in., 10/-. **Tyran** 4ft 6in. wide, 10/- ft; 2ft 3in. wide, 5/- ft. Samples S.A.E.

VALVES New and Boxed 90-day Guarantee.

1R5	7/6	6K8G	7/6	EABC80	8/6	EY86	10/-
1S5	7/6	6L6G	10/6	EB91	6/-	HABC80	
1T4	6/-	6N7M	6/6	EBC33	8/6		12/6
2X2	3/6	6Q7G	7/6	EBC41	8/6	HVR2A	6/6
3S4	7/6	6S4	6/-	EBF80	10/-	MU14	9/-
3V4	7/6	6S17M	6/6	ECC84	9/6	PCC84	9/6
3U4	7/6	6S7	6/6	ECF80	9/6	PCF80	9/6
3Y2	7/6	6V6G	6/6	ECH42	10/6	PCL82	11/6
5Z4	9/6	6X4	7/6	ECL82	10/6	PEN25	6/6
6AM6	5/-	6X5	6/6	EF39	5/6	PL82	10/6
6B8	5/6	12AT7	8/-	EF41	9/6	PY80	7/6
6BE6	7/6	12AU7	8/-	EF50	5/6	PY81	9/6
6BH6	9/6	12AX7	8/-	EF80	8/-	PY82	7/6
6BW6	9/6	12BE6	8/6	EF91	5/-	SP61	3/6
6D6	6/-	12K7	6/6	EH92	5/6	UBC41	9/6
6F6G	7/6	12Q7	6/6	EL32	5/-	UCH42	9/6
6H6	3/6	35L6	9/6	EL41	9/6	UF41	9/6
6J5	5/6	35Z4	7/-	EL84	8/6	UL41	9/6
6J6	5/6	80	9/6	EM81	9/6	UY41	8/-
6J7G	6/6	807	5/6	EZ40	7/6	U22	8/-
6K6GT	6/6	954	1/6	EZ80	7/6	VR105	8/6
6K7G	5/-	EA50	1/6	EY51	9/6	VR150	9/6



1960 RADIOGRAM CHASSIS

THREE WAVEBANDS FIVE VALVES
S.W. 16 m.—50 m. LATEST MULLARD
M.W. 200 m.—550 m. ECH81, EF89, EBC81,
L.W. 800 m.—2,000 m. EL84, EZ80.
12-month guarantee.
A.C. 200/250 v. 4-way Switch; Short-Medium-Long-Gram. A.V.C. and Negative feedback 5 watts. Chassis 13½ x 5½ x 2½in. Glass dial, horizontal or vertical, size 10 x 4¼in. Aligned and calibrated. Isolated Chassis.

£9.10.0 Carr. & Ins. 4/6.

TERMS: Dep. £5.5.0 and five monthly of £1.
MATCHED SPEAKERS FOR ABOVE CHASSIS. 8in., 17/6; 10in., 25/-; 12in., 30/-.

DULCI AM-FM MODEL H3
6 Valves. **£19.17.6** Leaflet. S.A.E.

£6.19.6

TERMS: Dep. £3.10.0 and four monthly of £1.
Stereo Model UA8 £7,19.6. UA12 £10.10.0.

BUILD THESE REPRODUCER BARGAINS SINGLE PLAYER KIT
Ready for immediate assembly

4-speed Collaro "Junior" Unit....	£4 12 6
Handsome case, 17½ x 13½ x 7in. with room to play 12in. records ..	£2 5 0
Ready-built 3-watt amplifier with two valves and loudspeaker	£3 12 6

or **£9.15.0** complete kit post free.

COLLARO AUTO-PLAYER KIT
HIGH-FIDELITY AUTOCHANGER
4-SPEEDS—10 RECORDS
Studio pick-up
OUR PRICE **£7.19.6** post free.
Or with cabinet, speaker, and amplifier.
£11.19.6 Carr. 5/6.

STEREO E.M.1. 4-SPEED SINGLE RECORD PLAYER. Acos 73 hi-fi stereo and normal Xtal pick-up. Silent motor, heavy turntable. Special Offer £6.19.6. Post 3/6.

ALUMINIUM CHASSIS. 18 s.w.g. undrilled. With 4 sides, riveted corners and lattice fixing holes, 2½in. sides, 7 x 4in., 4/6; 9 x 7in., 5/9; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.

TRANSISTORS. GENUINE EDISWAN R.F. 4 Mc/s. 18/-; 2 Mc/s, 15/-; Audio, 10/-. Red Spot 5/-. White Spot 7/6.

CRYSTAL MIKE INSERT by Acos, precision engineered. Size only 1in. x 3/16in.. 6/6.

HI-GAIN BAND 3 I.T.A. PRE-AMP KIT. Cascode circuit with valve ECC84. Price 29/6. With Power Pack, 49/6. Plans only 6d.
Band I BBC version same prices.

BBC TRANSISTOR RADIO. M. & L. wave. Complete kit 32/6, phones 7/6 extra. Deaf Aid Earpeice with Special Lead 15/-. Details 6d.

GARRARD SINGLE PLAYERS
AUDIO PERFECTION
Designed to play 16, 33, 45, 78 r.p.m. Records 7in., 10in., 12in. Lightweight Xtal pick-up. GC8 plug-in head. Stereo Wired.
MODEL TA MK II £8-10.
MODEL 4 HF £18.
(Stereo heads £2 extra.) Leaflets, S.A.E.

Volume Controls
Long spindles. Guaranteed 1 year. Midget 5K ohms to 2 Meg. No. Sw. D.P.Sw. 3/- 4/9
Lineal or Log Tracks.

80 ohm COAX CABLE
Postage 1d. per yard.
Semi-air spaced ¼in.
Stranded core. Losses cut 50% **6d. yd**
Fringe Quality Air Spaced. **1/- yd**

COAX PLUGS .. 1/- **LEAD SOCKET** .. 2/-
PANEL SOCKETS 1/- **OUTLET BOXES** .. 4/6
BALANCED TWIN FEEDER yd. 6d, 80 or 300 ohms.
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LETTERS TO THE EDITOR

(Continued from page 74)

SIR,—Re Mr. M. Reynolds' letter (March issue), surely he must know that it would be most impracticable, if not impossible, to extend the medium wave band beyond 550m, as the main marine communications frequencies would then be interefered with, and the 500kc/s (600m) International Calling Frequency could not be interfered with.

In my opinion, the only answer to the "interference problem" is to control rigidly the number of transmitters working on adjacent, or similar, frequencies, and to arrange them so that they are geographically far apart and times of transmission staggered.

There is, of course, the other alternative, costly and unlikely though it may seem, and that is the limitation of all broadcast transmissions to single-side-band only.—B. HALLAHAN (Sundays Well, Cork).

Resistance/Capacity Smoothing

SIR,— Why do makers of even the higher priced radios, tape recorders, etc., persist in using resistance/capacity smoothing in the power pack design? An example of this happened to me recently when I purchased a famous make of tape recorder of the £70 class. Upon connecting this to an external hi-fi amplifier, the residual mains hum with any bass boost was most distracting. On studying the circuit it was obvious that the smoothing left a lot to be desired. Upon inserting a choke and additional 16μF decoupler, this residual hum was entirely eliminated.

Is it not time that this bad habit of neglecting adequate smoothing in good quality equipment is brought home to manufacturers? True, it is often sufficient for the limited scope of bass frequencies handled by the internal speakers, but it is not good enough when feeding into modern amplifiers. There is no substitute for inductance smoothing; this applies even more so in high gain circuits.—A. M. WARRY (St. Lawrence, I.o.W.).

Morse Code

SIR,—I have been attempting to learn the morse code for some time with a view to taking the R.A.E. eventually. However, I am rather lacking in practical information about how the code is actually used by hams. For instance, does anyone use the "Ch" (of four dashes)? Is it reserved for words such as "character" or is it only used in foreign languages? Also, does anyone bother to use punctuations?

How much of the "Q" code is an amateur likely to use, and is it worth learning the "Z" code?

If any ham can give help, please do so, as I am sure that I am not the only one who would like to know.—R. C. WOODALL (Bradley House, 5 Barley Road, Rugby, Warwickshire).

AVC CIRCUIT FOR TAPE RECORDERS

(Continued from page 54)

Presuming that the AVC unit is to be housed remotely, then a neat outlet should be fitted to the tape recorder to accommodate input and output connections. An octal socket fitted to the cabinet should should prove satisfactory and a connector should be made up, terminating in an octal plug to fit the recorder socket.

In the recorder, the output from the pre-amplifier stage (after the equalising circuitry where this follows the pre-amplifier immediately) should be disconnected from the input of the following stage, and taken to one pin of the octal socket. Pin 5 is recommended as in Fig. 5. Pin 6 of the same socket should carry a screened lead to the input of the main tape amplifier. This arrangement leaves the AVC unit effectively bridging the gap between pre-amp and main amplifier.

All that remains is to connect up the power supply leads, tapping into the tape recorder supplies if they are of sufficient capacity, and to try the unit out. Some initial setting up, best determined by means of listening tests, will be necessary to obtain the best results from the unit, and this is accomplished by adjustment of the two variable controls within the unit.

R.C.A. MASTER OSCILLATOR

The Advertising Agents for Messrs. P. C. Radio Ltd., of 170 Goldhawk Road, London W12 have asked us to state that an error was made in the price of the R.C.A. Master Oscillator in their advertisement on page 1016 of the April issue. The price should be £27 10s. 0d. and not, as stated, £7 10s. 0d.

A COMPREHENSIVE PRE-AMP

SEVERAL queries have arisen following the publication of the article "A Comprehensive Pre-amp" in the March and April issues. In the radio input circuit, Rb and Rc constitute a potential divider and, as explained on page 953 of the March issue, their values are adjusted so that the signal reaching the grid of V1 is of such a magnitude as to ensure that the pre-amp is not under- or over-loaded. The value of (Rb + Rc) should be about 1M. They may be considered as equivalent to a conventional volume control, Rb being the part above the slider and Rc the part below the slider. Thus, values of, say, 100k for Rb and 1M for Rc, would give little attenuation while 1M for Rb and 100k for Rc would attenuate the signal considerably. The values of Rb and Rc therefore need to be adjusted experimentally to suit the radio unit in use. The test of their correct adjustment is that the volume control operates smoothly with adequate control of volume level—from zero to maximum—spread over the total length of the track.

Three pick-up input circuits were given in Fig. 2 (page 953 of the March issue): the top left pick-up input circuit is intended for use with magnetic types with a maximum output greater than 50mV, the top right circuit for the Collaro Studio P, and the lower circuit for the Collaro transcription pick-up. A few printing errors occurred in the list of components: R9 is 560k; R19 100k; R22 2·7k; C13 4700pF and C30 0·1μF. In Fig. 5, on page 1025 of the April issue, the left hand tag 8 of group board 2 should be joined to the left-hand side of the 22k smoothing resistor (tag strip 1). It should be noted that owing to the complicated nature of the wiring of the pre-amplifier, it was necessary to omit certain wires from the drawings and therefore construction and wiring should be checked with Fig. 1 (the circuit diagram) as it progresses.

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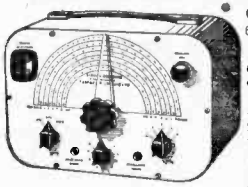

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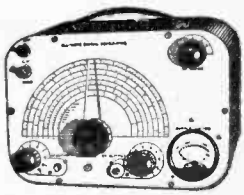

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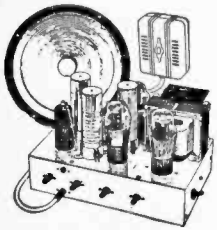

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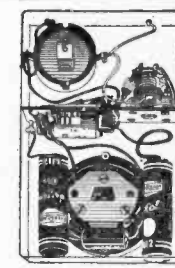

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Point to point wiring diagram **1/6**, free with kit.

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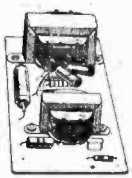

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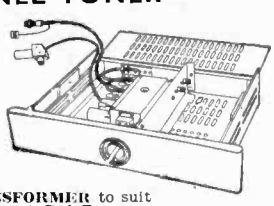

Will tune to all Band I and Band III stations. BRAND NEW by famous manufacturer. Complete with PCC84 and PCF80 valves (in series) **I.F. 16-19** or **33-38.** Also can be modified as an aerial convertor (instructions supplied).

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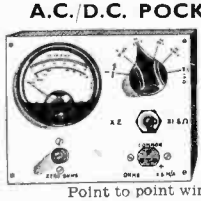

Comprising 2in. moving coil meter, scale calibrated in A.C./D.C. volts, ohms and milliamps. Voltage range A.C./D.C. p-50, 0-100, 0-250, 0-500. Milliamps 0-10, 0-100. Ohms range 0-10,000. Front panel, range switch, wire-wound pot (for ohms zero setting), toggle switch, resistor and rectifier. In grey hammer finish case.

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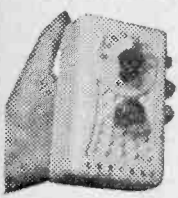

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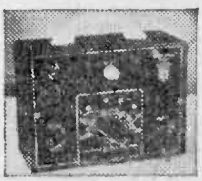

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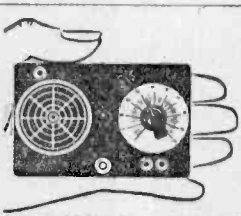

29/6

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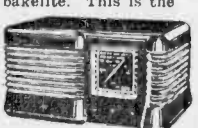

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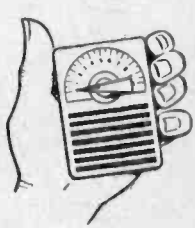

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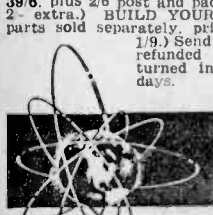

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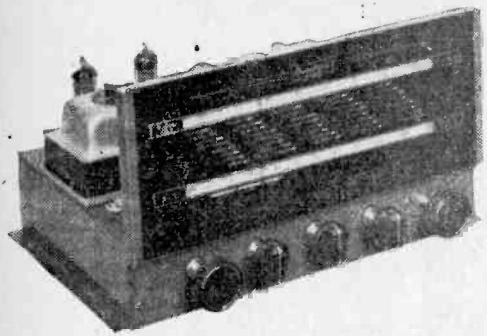

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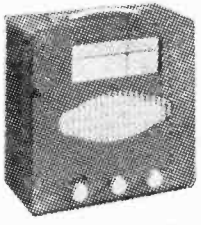

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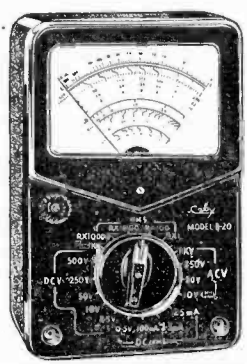

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Practical Wireless

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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*.

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The PT Band III Converter ...	—*	1/6

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Short-Wave Two	AW429*	2/6
Short-Wave World Beater ...	AW436*	3/6
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PRACTICAL WIRELESS, MAY, 1960

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