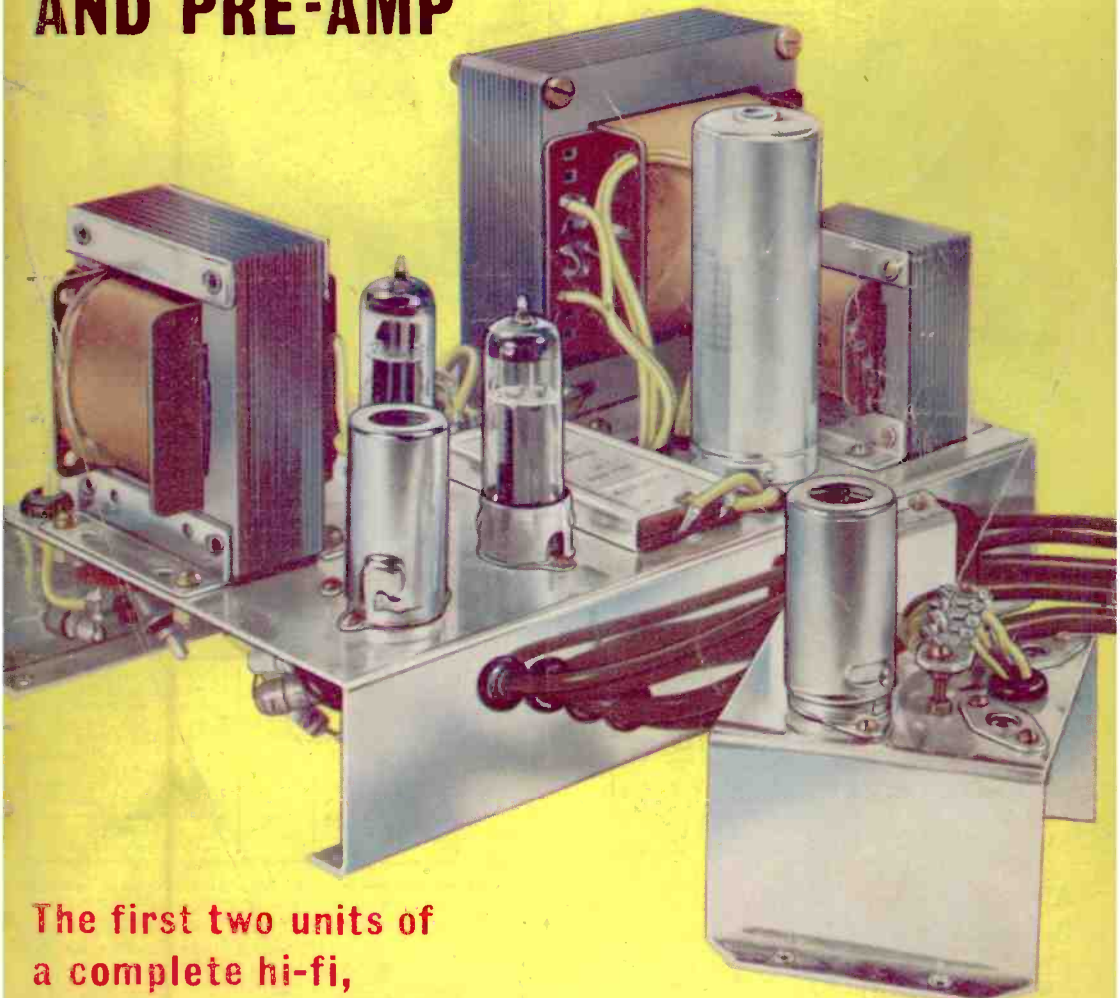
JANUARY
1963

Practical WIRELESS

2/-

QUALITY AMPLIFIER AND PRE-AMP



The first two units of
a complete hi-fi,
switch-tuned radiogram

Top Band Transmitter

Transistor Portable

★ VALVES ★

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THE MOST COMPREHENSIVE COMPETITIVE VALVE LIST IN THE COUNTRY

10% DISCOUNT SPECIAL OFFER TO PURCHASERS of any SIX VALVES marked in black type (15% in dozen). 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/-	6J5GT	4/-	12K8GT	9/6	DET19	2/9	EL91	4/-	R19	11/-
1A5GT	5/-	6J6	4/-	12Q7GT	5/-	DF33	9/9	EM80	7/9	SP41	2/6
1A7GT	11/-	6J7	8/6	12SA7	7/-	DF91	3/6	EM81	8/6	SP61	2/6
1C5GT	9/-	6J7G	4/9	12SG7	5/-	DF96	7/3	EM84	9/-	SU25	16/-
1D5	8/-	6J7GT	7/6	12SH7	3/6	DF97	8/6	EM85	10/-	SU2150	4/6
1D6	9/9	6J8	9/6	12SJ7	5/6	DH63	6/-	EN31	16/-	T41	7/6
1H5GT	9/9	6K6GT	6/6	12SK7	4/9	DH76	5/-	EY51	7/9	TDD4	7/6
1L4	3/3	6K7	5/9	12SN7GT	7/9	DK32	11/-	EY86	7/6	U14	8/-
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2A7	9/6	6LD3	8/-	20P3	12/6	DL91	8/-	GT1C	7/-	U37	26/-
3A4	4/9	6LD12	6/9	20P4	18/-	DL92	6/-	GZ32	8/9	U50	5/9
3A5	9/-	6LD20	7/9	20P5	15/-	DL94	6/9	GZ34	12/6	U52	4/9
3D6	4/6	6N7	7/6	25A6G	8/-	DL96	7/3	HL41DD		U76	5/6
3Q4	7/-	6P1	7/6	25L6G	6/9	EABC80	6/9		8/3	U78	5/-
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5Z4	11/-	6SN7GT	4/6	30L15	9/6	EBL21	12/6	KT61	8/6	UB41	7/9
5Z4G	7/6	6SQ7	5/9	30P4	9/6	EBL31	17/6	KT63	5/9	UBC41	7/9
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6A7	10/-	6V6GT	6/-	30PL1	9/6	ECC33	4/6	KTW63	5/9	UBL21	14/6
6A8G	8/6	6X2	7/9	30PL13	13/-	ECC34	9/-	KTZ63	5/6	UCC84	14/6
6A8GT	13/6	6X4	5/-	35L6GT	8/6	ECC35	6/-	L63	2/9	UCC85	7/-
6AB8	7/-	6X5G	5/-	35T	25/-	ECC40	14/-	LN152	7/-	UCF80	15/-
6AC7	3/3	6X5GT	5/6	35W4	6/9	ECC81	5/6	MU14	7/6	UCH21	12/-
6AG5	3/-	6Y6G	7/6	35Z4GT	5/6	ECC82	6/-	N37	11/-	UCH42	7/3
6AG7	7/6	7A7	8/6	35Z5GT	8/-	ECC83	6/6	N78	13/-	UCH81	8/-
6AK5	5/-	7B7	9/-	41	7/6	ECC84	8/-	N108	16/-	UCL82	9/9
6AL5	3/-	7B7	7/9	42	7/6	ECC85	7/9	N152	8/6	UCL83	13/6
6AM6	3/-	7C5	7/3	50C5	9/-	ECC89	16/-	P41	4/6	UF41	7/6
6AQ5	6/-	7C6	7/6	50CD6	19/-	ECC91	4/-	P61	2/9	UF42	5/6
6AT6	5/9	7H7	7/3	50L6GT	8/6	ECF80	8/6	PABC80		UF80	7/-
6AU6	7/6	7K7	9/6	52KU	10/6	ECF82	8/6		11/6	UF85	7/6
6B7	8/6	7Q7	8/6	53KU	10/6	ECH21	12/6	PCC84	6/9	UF86	14/6
6B8G	3/-	7R7	10/6	61SPT	11/-	ECH35	7/6	PCC85	8/9	UF89	7/-
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6BE6	5/9	7V7	7/9	75	6/6	ECH81	7/9	PCC89	9/-	UL44	11/-
6BG6G	15/-	7Y4	6/9	78	6/6	ECH83	8/3	PCC189	13/6	UL46	9/9
6BH6	6/-	7Z4	7/-	80	5/9	ECL80	7/-	PCF80	7/-	UL84	7/-
6BJ6	6/-	8D3	3/-	83	9/6	ECL82	9/6	PCF82	7/3	UM80	9/6
6BR7	9/6	10C1	11/6	185BT	19/6	ECL83	11/7	PCF84	16/-	UR1C	8/-
6BW6	7/6	10C2	14/6	803	19/-	ECL86	10/6	PCF86	12/6	UU6	12/6
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6BX6	4/9	10F1	5/9	808	7/6	EF36	3/3	PCL83	10/6	UU8	17/-
6C4	3/6	10F9	10/6	813	55/-	EF39	4/6	PCL84	7/6	UY1N	11/-
6C5	5/6	10F18	10/-	832	14/-	EF40	12/-	PCL85	11/6	UY21	11/-
6C6	3/9	10L14	7/-	866A	11/6	EF41	8/-	PCL86	12/6	UY41	6/-
6C9	11/-	10LD3	7/9	954	2/-	EF42	7/6	PEN45	8/6	UY85	6/6
6CD6G	19/6	10LD11	14/6	956	2/6	EF50-BR	2/-	PEN46	5/-	VP41	5/6
6CH6	7/6	10LD12	8/-	1265	5/9	USA	3/-	PL33	8/3	VR105	6/9
6D2	3/-	10P13	11/-	9001	4/-	EF54	3/3	PL36	9/6	VR150	6/9
6D3	9/6	10P14	9/-	9002	4/9	EF80	4/9	PL38	16/6	W61M	11/-
6D6	4/3	10P18	7/-	ATP4	2/9	EF85	6/6	PL81	8/6	W76	4/9
6F1	4/9	12A6	1/9	AZ31	8/-	EF86	9/-	PL82	6/6	W81	7/3
6F6G	5/9	12AH8	9/-	AZ41	11/-	EF89	6/9	PL83	6/6	X61M	11/-
6F12	3/-	12AT6	7/6	B36	7/9	EF91	3/-	PL84	8/-	X63	8/6
6F13	6/9	12AT7	5/6	C1C	9/6	EF92	4/6	PL820	8/6	X65	11/-
6F14	9/6	12AU6	9/6	CBL1	26/6	EF96	3/-	PX4	12/6	X66	11/-
6F15	9/6	12AU7	6/-	CBL31	21/-	EF183	14/-	PX25	9/6	X76M	11/-
6F16	8/-	12AX7	6/6	CCH35	14/-	EF184	12/-	PY31	9/-	X78	21/-
6F19	6/6	12BA6	7/6	CL33	9/6	EL32	4/6	PY32	10/-	X79	16/6
6F23	6/6	12BE6	7/6	CY31	9/-	EL33	7/9	PY80	6/9	X81M	9/-
6F24	12/-	12BH7	9/9	D77	3/6	EL35	7/-	PY81	6/6	Y63	6/3
6F25	13/-	12C8	6/6	D152	5/9	EL41	8/-	PY82	6/-	Z63	4/9
6F32	6/6	12E1	17/6	DA30	12/6	EL42	8/9	PY83	7/-	Z66	9/6
6F33	6/6	12J7GT	9/-	DAC32	9/9	EL81	11/-	PY88	9/9	Z152	4/9
6J5	4/3	12K7GT	4/9	DAF91	4/6	EL83	11/-	PZ30	9/6	Z719	4/9
6J5G	3/-	12K8	11/-	DAF96	7/3	EL84	7/-	R18	11/-	ZD152	7/9

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HIGHEST QUALITY— COMPARE OUR PRICES

Carr. & Ins. 12/6

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GUARANTEED	6 Months	12 Months
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Due to huge Bulk Special Purchase we are offering MW 31/74 Tubes at the unrepeatable price of 29/-. MW 36/24 ditto. 39/-, P.P. 12/6. The above are guaranteed for 6 months.

CO-AX, standard and low loss. 25 yds., 12/6, 50 yds., 22/6; 100 yds., 42/6. Co-ax Plugs 1/3. Wall outlet boxes 3/6

4-SPEED RECORD PLAYERS. Latest Turntable, together with lightweight Staar Galaxy dual sapphire crystal turnover pick-up head. Amazing value (pick-up only 19/-). £3.10.0. Carr. 3/-.

P.M. SPEAKERS. 3 ohm, top makes, Performance guaranteed. 6½in., 8in., 8/-. 5in. 7 x 4in., 11/-.

13 CHANNEL T.Vs.

Table Models, Famous Makes. Absolutely Complete. These sets are unequalled in value due to huge purchase direct from source. They are untested, and not guaranteed to be in working order. Carr. etc., 15/-.

12in. **£2.19.0** 14in. **£4.19.0**

3 VALVE AMPLIFIERS. Kit of new parts, consisting chassis mains and output transformers, valves (P61, 6V6G, 6X5G) and all components. With full instructions for making high gain amplifier with separate base and treble controls, negative feedback, etc. Truly unusual value at 29/-.

F.M. TUNER KITS. Well known make. Comprising F.M. Tuning Head, guaranteed none drift. Frequency coverage 88-100 Mc/s. OA81 balanced diode output. Magic Eye Tuning, Two I.F. Stages and discriminate, £6.9.6.

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TRANSISTORS. Red spot 3/6 ea. White Spot 4/6 ea. Yellow Spot 2/9 ea. Germanium diodes 9d. ea., 8/- doz.

TRADE SUPPLIED

CV and Industrial valves, receiver valves and components. Quantity quotations for all items advertised plus 100's more. Government departments and manufacturers supplied.

4 watt AMPLIFIERS

Further delivery of these excellent units to hand complete with amplifier 20P3 output and UU9 rectifier. Easily converted into high gain unit, complete with good quality, 8in. speaker in attractive two tone bakelite case easily converted for guitars, record players, baby alarms, mic. amplifiers. Carr. Packing, etc. 7/6. **19/-**

As above but rebuilt into excellent amplifier with high gain preamp stage, tone control, negative feed-back, ready for immediate use. Individually tested. Amazing volume and clarity easily worth £5. Our price whilst stocks last. Carr. Packing etc. 7/6. **45/-**

CONDENSERS. 25 Mixed, Electrolytic Many popular sizes. List Value £5. Our Price 10/-.

B.B.C./I.T.A. TUNERS

Famous makes complete with PCF80, PCC84 valves, 38 M/c I.F.

Fantastic value **19/-**

GET 15. G.E.C. High Power, Contact cooled, manufacture matched pr Transistor with Push-Pull Input & Output Transformers, with complete 1 watt ampl. circuit. Knock-out price 29/-

NEW SPEAKER CABINETS, covered in attractive Rexine, Gold Metal front 11/-. Or complete with 7 x 4 Speaker. 19/-. P.P. 1/6.

UA20 Autochangers. Latest B.S.R. 10 mixed records. Brand New. Unrepeatable, £6.19.0. Also UA14. A Proven Choice £6.19.0. P.P. 4/-.

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100 RESISTORS 6/6

100 CONDENSERS 10/-

Miniature Ceramic and Silver Mica Condensers 3 pF to 5,000 pF. LIST VALUE OVER £5.

IVORY/GOLD KNOBS 1" Diameter half price 1/2, 5 for 4/6; 1½" 1/3, 5 for 5/-.

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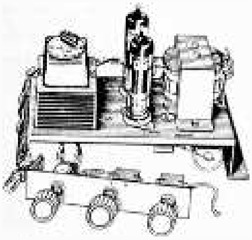
VALVES Amazing Value, Top Quality, Factory Fresh Standard Superhet, plus Magic Eye:—

ECH81 EBC81 EZ81 EF89 EL84 EM84 All for ONLY **35/-** Post Free

Satisfaction Guaranteed. This works out at only 5/10 per valve FM Valve Kits as above plus ECC85 42/- post free.

Post: 2 lbs. 2/-, 4 lbs. 2/6, 7 lbs. 3/6, 15 lbs. 4/-, etc No C.O.D. ALL ITEMS LESS 5% AND POST FREE IN DOZENS. LIST OF 1000 SNIPS, 6d.

MAIL ORDER ONLY **DEVONIAN COURT, PARK CRESCENT PLACE, BRIGHTON 7, SUSSEX**



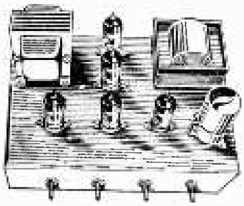
SPECIAL OFFER!

6 Watt Push-Pull Amplifier

2 ECL82 metal rec., separate bass and treble cont. on aux. panel. Made for one of the largest manufacturers of record players. Used in 30 gn. unit. Size 7 x 4in. panel, 6 x 1¼in. 3 ohm output, trans. included.

Our Price **£4.9.6** Post 4/-

10/14 WATT HI-FI AMPLIFIER



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded ultra output transformer (to match 3-15 speaker) and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier.
Simple instruction booklet 1/6. (Free with parts.)

All parts sold separately.

ONLY **£6.19.6** P. & P. 6/6.

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All 3 ohm impedance.

2½in.	12/6
5in.	12/6
6½in.	15/-
12in.	27/6
Goodmans 5in. tweeter	10/6
E.M.I. 2½in. tweeter	10/6
Goodmans 8in. x 5in. middle register speaker	10/6
E.M.I. 13½in. x 8½in. high flux	32/6
Rola Celestion, approx. 9in. x 6in., middle register speaker	10/6

P. & P. 1/6 per Speaker.

TAPE DECKS

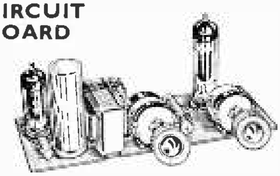
B.S.R. Monardeck

(Single speed) 3¾in. per sec., simple control, uses 5¾in. spools, **£6.15.0**, plus 5/6 carr. and ins. (Tapes extra.)

COLLARO STUDIO DECK

£10.10.0, plus 5/6 carr. and ins. (Tapes extra).

AMPLIFIER ON PRINTED CIRCUIT BOARD

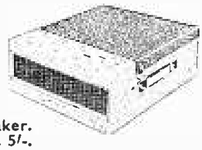


Two valve. UY85, UL84 with O.P. trans., use with 80 volt tap off motor. **39/6.**
P.P. 2/6 on above. Dropper res. for filaments if required, **2/6.**

B.S.R. AUTO UNITS

160 v. Suitable for use with above. (Slightly soiled.) **£5.5.0.** P. & P. 5/-.

LARGE CABINET



Suitable for above two items. Complete with 3 ohm speaker. **£3.9.6.** Carr. 5/-.

Superior Cabinet. Similar to above to take 8 x 5in. speaker, with motor board, will accommodate BSR UA14 or UA16. **£3.9.6.** Carr. 5/6. Speaker 15/- extra. P. & P. 1/6 extra.

WODEN TRANSFORMERS

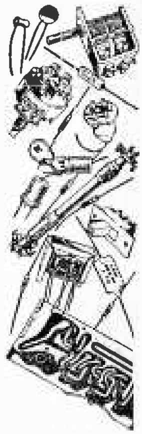
(Ex equip.). 200-240 v. input. Output 12 v. 1 amp., tapped 1, 8 and 10 v. Ideal for model railways and chargers. **8/6,** P.P. 2/-.

Colvern Wire Wound Potentiometers. 3in. 10 ohm 1 amp. Suitable for above. **5/-.** P. & P. 1/-.

LARGE WODEN MAINS TRANSFORMER

220/240 v. input. Output 40 v. at 3 amps. tapped 30 and 35 v. H.T. voltages 300 v. 100 mA. tapped 10 v. 150 v., 230 v., 260 v., also 90 v. 100 mA., 350 v., tapped at 200 v. 100 mA. Size 4½ x 5 x 5in. Weight approx. 12 lb. **20/-** each. P. & P. 5/-.

6 TRANSISTOR AND DIODE SUPERHET



A first class 2 waveband transistor superhet in kit form. ● Printed circuit panel (size 8⅛ x 2¾in.) ● 3 pre-aligned. I.F. transformers. ● High-gain Ferrite rod aerial. ● First-grade G.E.C. transistors. ● Car aerial winding. ● Push-pull output. ● All parts down to the minutest item with simple instructions.

All parts sold separately.

ONLY **£4.5.0** P. & P. 2/6

2½in. 35 ohm speaker, **10/6;** 3½in. 35 ohms speaker **16/6;** 35 ohm 5in. P.M. **18/6;** 7 x 4in. 35 ohms speaker **21/-.** P. & P. 1/6 per speaker.

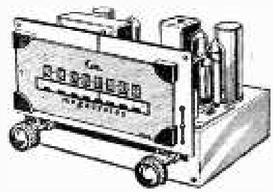
PORTABLE CABINET

Size approx. 9½ x 6¾ x 3½in. Suitable for above using 3½in. speaker. **25/-.** P. & P. 2/-.

COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 I.F. transformers, one oscillator coil, one driver transformer and wound Ferrite aerial (med., long and aerial coupling), **28/6** complete. post 1/-. 6 transistor printed circuit, board to match, **8/6,** post 9d. Circuit diagram 1/6 extra.

HARVERSON'S F.M. TUNER MARK I



● F.M. tuning head by famous maker. ● Guaranteed non-drift. ● Permeability tuning. ● Frequency coverage 88-100 mc/s. ● OA81 balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used ECC85, two EF80s, and EZ80 (rectifier). ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5½in. ● All parts sold separately. **£5.19.6,** plus 8/6 P.P. and ins. Circuit diagram and illustrations 1/6 P. free.

Mark II Version as above but complete with magic eye, front panel and brackets. **£6.12.6.** P. & P. 8/6.

Mark III Version as Mark I but with output stage (ECL82) and tone control. **£7.7.0.** P. & P. 8/6.

Handsome Metal Cabinets. Choice of Grey, Black or Green. To fit Mark I **25/-,** P. & P. 2/6. To fit Mark II **17/6,** P. & P. 2/6.

TRANSISTORS

All Post Free.

GET15 (Matched Pair), **15/-.**

OC72	6/-	OC71	5/-	XA103	6/6
OC76	6/-	PXA101	6/6	V15/10p	12/6

Set of Mullard 6 transistors **25/-.** Set of G.E.C. 1,874; 2,873; 3, S1 or GET114 **20/-.**

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

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

*** INDICATES VALVES WITH NEW TYPE CHEMICAL CATHODE FOR EXTRA LIFE AND RELIABILITY**

OA2	17/6
OB2	17/6
OZ4	5/-
1A3	3/-
1A5	6/-
1A7	12/-
1C1	6/-
1C2	10/6
1C3	8/6
1C5	12/6
1C6	10/6
1D5	18/2
1D6	10/6
1F1	7/6
1F2	3/-
1F3	3/-
1F7	15/-
1FD9	5/-
1G6	17/6
1H5	10/6
1L4	3/-
1LA6	16/10
1LD5	5/-
1LN5	5/-
1N5	10/6
1P1	7/6
1P10	6/-
1P11	7/6
1R5	6/-
1S4	9/-
1S5	5/-
1T2	25/11
1T4	3/-
1U4	12/6
1U5	5/6
2A7	10/6
2C26	4/-
2D13C	7/6
2D21*	15/-
2P	25/11
2X2	4/6
3A4	6/-
3A5	10/6
3B7	12/6
3D6	5/-
3Q4	7/6
3Q5	9/6
3S4	6/-
3V4	7/6
4D1	7/6
5R4GY	17/6
5U4G	4/6
5V4G	10/-
5Y3	5/6
5Y4	12/6
5Z3	19/5
5Z4	9/-
6/30L2*	10/-
6A7	10/6
6A8	9/-
6AB7	8/-
6AC7	4/-
6AG5	5/6
6AG7	7/6
6AJ5*	8/6
6AK5	8/-
6AK6*	12/6
6AK8*	9/-
6AL5	4/-
6AM5	5/-
6AM6	3/6
6AQ5	7/6
6AR6*	20/-
6AT6	6/-
6AU6	10/-
6AV6	12/4
6B7	10/6
6B8	3/-
6BA6	6/-
6BE6	6/-
6BG6G	22/8
6BH6*	8/-
6BJ6*	6/-

6BQ5	7/-
6BQ7A	15/-
6BR7*	9/-
6BR8*	18/2
6BS7	25/-
6BW6*	10/6
6BW7*	5/-
6BX6	5/-
6C4	5/-
6C5	6/6
6C6	6/6
6C8	12/6
6C9*	18/6
6C10	9/6
6C12*	13/7
6CD6G	35/8
6CH6	7/6
6CW4	24/-
6D1	2/-
6D3*	19/5
6D6	6/6
6D8	15/-
6E5	12/6
6F1*	25/11
6F5	12/6
6F6G	7/-
6F6GT	8/-
6F8	12/6
6F11*	17/9
6F12	3/6
6F13	10/-
6F14*	25/11
6F15*	14/11
6F16	8/-
6F17	12/6
6F18	14/11
6F19	6/-
6F23*	10/6
6F24*	9/6
6F32	10/6
6F33	7/6
6G6	6/6
6H6	3/-
6J5G	5/-
6J5GT	6/-
6J6	3/-
6J7G	4/6
6J7GT	10/6
6J8	12/6
6K6	8/-
6K7G	2/-
6K7GT	6/-
6K8G	5/-
6K8GT	10/6
6K25	19/5
6L1*	22/8
6L6G	7/6
6L6M	10/6
6L7GT	7/6
6L17	9/-
6L18*	13/-
6L19*	22/8
6LD3*	8/-
6LD13	11/8
6LD20*	15/7
6N7GT	8/-
6P1*	18/9
6P25*	12/6
6P26*	19/5
6P28*	25/11
6Q7G	6/-
6Q7GT	11/-
6R7G	10/-
6R7GT	11/-
6SA7	8/6
6SC7	7/6
6SG7	8/-
6SH7	8/-
6SJ7	8/-
6SK7	6/-
6SL7	6/-
6SN7	5/6
6SQ7	9/-

6SR7	12/6
6SS7	8/-
6U4GT	12/6
6U5G	7/6
6U7G	8/6
6V6G	4/6
6V6GT	8/6
6X4	4/6
6X5	5/-
7B6	20/9
7B7	8/6
7C5	8/-
7C6	8/-
7H7	8/-
7S7	9/6
7Y4	7/6
8D2	3/6
8D3	3/6
9BW6	14/11
9D2	4/-
9D7	13/7
10C1*	12/6
10C2*	25/11
10D1	7/6
10D2	11/8
10F1*	10/-
10F9*	11/6
10F18*	12/6
10LD3	8/6
10LD11	15/7
10P13*	15/-
10P14*	18/9
11E1	17/6
11E3	15/-
12A6	5/-
12A8	16/6
12AC6	14/11
12AD6	16/10
12AE6	13/7
12AH7	8/-
12AH8*	12/6
12AT6*	7/6
12AT7*	5/-
12AU6*	22/8
12AU7*	5/-
12AV6	12/4
12AX7*	7/-
12BA6*	8/-
12BE6*	9/-
12BH7*	20/9
12E1	30/-
12H6	3/-
12J5GT	4/-
12J7GT	8/6
12K5	17/6
12K7GT	5/-
12K8GT	14/-
12Q7GT	5/-
12SA7	8/6
12SC7	8/6
12SG7	7/-
12SH7	8/6
12SJ7	8/6
12SK7	6/-
12SQ7	11/6
12SR7	8/6
12U5G	7/6
12Y4	10/6
14B6	20/9
14H7	22/8
14S7	16/-
18	23/10
19	10/6
19AQ5	10/6
19BG6G	22/8
19H1	10/-
20D1*	14/11
20F2*	25/11
20L1*	25/11
20P1*	25/11
20P3*	22/8
20P4*	25/11
20P5*	22/8

25A6*	10/6
25L6GT	11/6
25U4GT	16/2
25Y5	10/6
25Y5G	19/5
25Z4G*	11/6
25Z5	10/6
25Z6GT	19/5
27SU	25/11
28D7	7/-
30C1*	7/6
30C15*	12/-
30F5*	6/-
30FL1*	9/6
30FL12	18/2
30L1*	7/6
30L15*	9/-
30P4*	15/-
30P12	7/6
30P16	7/6
30P19	19/5
30PL1	9/6
30PL13	10/6
35A5	20/9
35L6GT	9/6
35W4	7/6
35Z3	18/2
35Z4GT	6/-
35Z5GT	9/-
40SUA	18/2
41STH	25/11
42	22/8
43	10/-
50A5	21/10
50C5	10/-
50CD6G	35/7
50L6GT	10/-
52KU*	14/4
53KU*	19/5
72	4/6
77	8/-
78	6/6
80	9/-
83	15/-
83V	19/5
85A1	42/-
85A2	16/-
90AG	67/6
90AV	67/6
90CG	37/6
90CV	37/6
90C1	16/-
150B2	18/-
150C2	17/6
161	13/-
185BT	38/10
185BTA	38/10
301	20/-
304	15/-
305	13/-
306	13/-
807	6/-
4033	12/6
4378	2/-
5763	7/6
7193	5/-
7475	5/-
AC042	25/11
AC044	10/6
AC2PEN	22/8
AC2PEN/DD	12/6
AC4PEN	27/2
AC5PEN	22/8
AC5PEN/DD	25/11
AC6PEN	7/6
AC/PEN(5)	22/8

AC/PEN(7)	15/-
AC/SG	22/8
ACSGVM	15/-
AC/TH1	32/4
AC/TP	32/4
AC/VP1	15/-
AC/VP2	22/8
AP4	7/6
ATP4	5/-
AZ1	18/2
AZ31	10/-
AZ41*	13/7
B36	9/-
BL63	7/6
C1	12/6
C1C	12/6
CBL1	27/2
CBL31	22/8
CCH35	22/8
CK506	6/6
CL4	23/10
CL33	18/9
CV6	2/6
CV63	10/6
CV271	10/6
CY1	18/2
CY1C	18/2
CY31	11/-
D1	3/-
D15	10/6
D42	10/6
D63	5/-
D77	4/-
DAC32	10/6
DAF91	5/-
DAF96	7/6
DCC90	10/6
DD4	12/6
DD41	13/7
DDT4	12/6
DET25	7/6
DF33	10/6
DF66	15/-
DF72	30/-
DF91	3/-
DF96	7/6
DF97	9/-
DH30	15/6
DH63	6/-
DH76	5/-
DH77	6/-
DH81	25/11
DH101	27/11
DH107	18/9
DK32	12/-
DK40	21/10
DK91	6/-
DK92	10/6
DK96	8/6
DL33	9/6
DL35	12/6
DL63	10/-
DL66	17/6
DL68	15/-
DL72	15/-
DL75	30/-
DL92	6/-
DL94	7/6
DL95	7/6
DL96	7/6
DL810	10/6
DM70	7/6
DW4/350	13/6
DW4/500	13/6
DY86	13/-
E80F*	30/-
E83F*	30/-
E180F	34/8
E1148	2/6
EA50	2/-
EA76	9/6

EABC80	9/-
EAC91	4/-
EAF42*	9/-
EB34	2/6
EB41	8/6
EB91	4/-
EBC3	23/10
EBC33	5/-
EBC41*	8/-
EBC81*	8/-
EBC90	6/-
EBC91	12/4
EBF80*	8/-
EBF83	13/7
EBF89	9/6
EBL1	30/6
EBL21	22/8
EBL31	22/8
EC31	13/7
EC52	5/6
EC53	12/6
EC54	6/-
EC70	12/6
EC81	27/6
EC90	7/-
EC91	10/6
EC92*	13/-
ECC31	15/-
ECC32	5/6
ECC33	8/6
ECC34	23/11
ECC35	8/6
ECC40	17/6
ECC81*	5/-
ECC82*	5/-
ECC83*	7/-
ECC84*	9/-
ECC85	7/6
ECC88	23/4
ECC91	3/-
ECF80*	10/6
ECF82	10/6
ECF86	19/5
ECF804	20/-
ECH3	25/11
ECH21	22/8
ECH33	22/8
ECH35	6/6
ECH42*	9/6
ECH81*	7/6
ECH83	13/7
ECL80*	9/-
ECL82*	9/6
ECL83	18/9
ECL86	16/2
EF6	22/8
EF9	22/8
EF22	14/-
EF36	4/-
EF37A	8/-
EF39	4/6
EF40	15/-
EF41*	8/-
EF42	10/-
EF50 Brit.	5/-
Amer.	7/-
EF54	5/-
EF73	10/6
EF80*	5/-
EF83	13/6
EF85*	6/-
EF86*	9/-
EF89*	9/-
EF91	3/6
EF92	4/6
EF95	8/-
EF97*	13/-
EF98*	13/-
EF183*	18/2
EF184*	9/6
EF804	22/8
EK2	25/11

EK32	8/6
EL2	19/6
EL32	5/-
EL33	12/6
EL34*	15/-
EL35	19/6
EL37	23/11
EL38	18/6
EL41*	9/-
EL42*	10/-
EL81	16/2
EL83	19/5
EL84*	7/-
EL85	13/7
EL86	16/10
EL91	5/-
EL95*	10/6
EL360	27/-
EL820	18/2
EL821	25/11
EL822	19/6
EM4	17/9
EM34	9/6
EM35	12/-
EM71	23/10
EM80	9/-
EM81	9/6
EM84	10/6
EM85	16/10
EN31	53/-
EN91	15/-
EY51*	8/6
EY81	13/-
EY83	16/2
EY84	14/-
EY86*	7/6
EY91	7/6
EZ35	5/-
EZ40*	6/6
EZ41*	7/-
EZ80*	6/-
EZ81*	6/-
EZ90	4/6
FC4	25/11
FC13	25/11
FC13C	25/11
FW4/500	8/6
FW4/800	8/6
GT1C	25/-
GU50	41/6
GZ30	9/-
GZ32	10/-
GZ33*	19/5
GZ34	14/-
GZ37*	19/5
H30	5/-
H63	12/6
HABC80*	13/6
HL2	7/6
HL13C	7/6
HL23	14/11
HL23DD	7/8
HL41	12/6
HL133DD	12/6
HN309	29/1
HVR2A	6/-
HVR2	10/-
IW3	10/-
IW4/350	8/-
IW4/500	16/2
KBC32	20/5
KF35	8/6
KL35	8/6
KLL32	23/11
KT2	5/-
KT8	15/-
KT33C	8/-
KT36*	32/4
KT41	29/1
KT44	12/6

KT61	12/6
KT63	7/-
KT66	15/-
KT88	43/6
KT101	32/4
KTW61	6/6
KTW62	7/6
KTW63	6/6
KTZ41	8/-
L63	6/-
LP2	9/6
ME41	16/10
ME91	12/6
MH4	7/-
MHD4	12/6
MHL4	7/6
MHLD6	12/6
ML4	8/6
ML6	6/6
MS4B	22/8
MSP4	20/-
MU12/14	8/-
MX40	25/11
N37*	25/11
N78*	29/1
N108*	29/1
N118*	22/8
N151	10/-
N308*	20/1
N339*	15/-
N369*	16/10
P61	3/6
PABC80	13/7
PC95	13/-
PCC84*	7/6
PCC85	9/6
PCC88	18/-
PCC89*	8/6
PCF80*	7/6
PCF82	10/6
PCF84	16/2
PCF86*	9/6
PCL82*	9/-
PCL83*	9/6
PCL84*	7/6
PCL85*	10/-
PCL86	16/2
PEN4DD	25/11
PEN25	4/6
PEN40DD	34/-
PEN45	19/6
PEN45DD	25/11
PEN46	4/6
PEN383	22/8
PEN453DD	32/4
PENA4	22/8
PENB4	23/11
PENDD 4020	34/-
PL33	18/9
PL36*	15/-
PL38	25/11
PL81*	10/6
PL82	7/6
PL83	9/-
PL84*	12/4
PL820	18/2
PM84	16/10
PT15	10/6
PX4	10/6
PY31	16/2
PY32*	13/6
PY33*	13/6
PY80	7/6
PY81	7/6
PY82	7/-
PY83	7/6

PY88	13/-
PY800	13/-
PZ30	19/5
QP21	7/-
QP22B	12/6
QP25	14/6
QS150/15	10/6
R10	15/-
R12*	8/6
R16	25/11
R17	17/6
R18	14/-
R19	19/5
R52	12/6
RG1/240A	54/-
RK34	7/6
S130	22/6
SP4B	23/10
SP13C	12/6
SP41	3/6
SP42	12/6
SP61	3/6
SU25	27/2
SU61	8/6
SU2150A	7/-
T41	9/-
TDD2	12/6
TDD4	12/6
TH21C	20/-
TH41	25/11
TH233	34/-
TP22	15/-
TP25	15/-
TP2620	32/4
TY86F	13/-
UABC80	9/-
UAF42	9/6
UB41	12/-
UBC41*	8/6
UBC81*	11/-
UBF80*	9/-
UBF89*	9/6
UBL21	22/8
UCC84*	14/3
UCC85	7/6
UCF80*	13/-
UCH21	22/8
UCH42	9/6
UCH81*	9/6
UCL82	9/6
UCL83*	18/9
UF41*	9/-
UF42	12/6
UF80*	10/6
UF85*	9/-
UF86*	13/6
UF89*	8/-
UL41*	10/6
UL44	25/11
UL46	14/6
UL84*	8/6
UM4	17/9
UM34	16/10
UM80	14/11
UR1C	18/2
UU5	8/-
UU6	19/5
UU7	16/2
UU8	25/11
UU9	6/6
UU10	22/8
UU12	6/-
UY1N	18/2
UY21	18/2
UY41	6/6
UY85	6/-
U12/14	8/6
U16	10/-
U17	12/6
U18/20	8/6

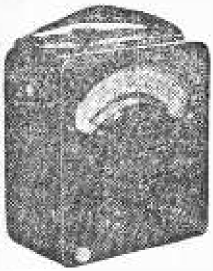
U19	48/6
U21	15/-
U22	8/-
U24	29/1
U25*	17/6
U26*	9/-
U31*	11/6
U33*	29/1
U35*	29/1
U37*	32/4
U41	19/6
U43	8/6
U45	13/6
U47	17/6
U50	5/6
U52	4/6
U54	19/5
U76	6/-
U78	4/6
U107*	19/5
U191*	16/2
U201	16/2
U251*	14/-
U281*	19/5
U282*	22/-
U291	11/6
U301*	22/3
U329*	14/-
U339*	16/2
U403	16/2
U404	6/6
U801*	29/1
U4020	18/2
VMP4G	15/-
VMS4B	15/-
VP2	12/6
VP2B	14/6
VP4	15/-
VP4A	17/6
VP4B	22/8
VP13C	7/-
VP23	6/6
VP41	6/-
VP133	22/8
VR75	17/6
VR105	7/-
VR150	7/-
VT61A	5/-
VT501	5/-
VU39	8/-
VU111	20/-
VU133	7/6
W21	12/6
W42	22/8
W61M	27/3
W63	10/6
W76	5/6
W77	4/6
W81M	6/-
W101*	29/1
W107*	22/8
W729	19/5
X14	12/-
X18	10/6
X41	25/11
X61	12/6
X63	9/-
X64	7/6
X65	12/6
X66	12/6
X76M	14/-
X78*	29/1
X79*	45/3
X109*	29/1
Y63	7/6
Y65	10/6
Z63	7/6
Z66	9/6
Z77	3/6
Z329*	18/2
Z719	5/-
Z729	9/-
Z759	36/-

Transistors and diodes	
GD3	5/6
GD4	5/6
GD5	5/6
GD6	5/6
GD8	4/-
GD9	4/-
GD10	4/-
GD12	4/-
GD15	8/-
GD16*	4/-
GET106	17/6
GET111	12/-
GET114	6/6
GET873	9/3
GET874	9/6
GEX13	3/6
GEX35	3/-
GEX36	10/-
GEX45/1	6/6
GEX55/1	15/-
GEX64	11/6
GEX66	15/-
AF102	27/6
AF114	11/-
AF115	10/6
AF116	10/-
AF117	9/6
AF127	12/-
OA5	6/-
OA10	8/-
OA70	3/-
OA73	3/-
OA79	3/-
OA81	3/-
OA85	3/-
OA86	4/-
OA91	3/-
OA95	3/6
OA210	9/6
OA211	13/6
OC16W	35/-
OC19	25/-
OC22	23/-
OC26	25/-
OC28	24/6
OC29	27/6
OC35	18/-
OC36	21/6
OC41	9/-
OC44	9/3
OC44PM	9/3
OC45	9/-
OC45PM	9/-
OC65	22/6
OC66	25/-
OC70	6/6
OC71	6/6
OC72	8/-
OC73	16/-
OC75	8/-
OC76	7/-
OC78	8/-
OC81	8/-
OC81M	8/-
OC82	10/-
OC83	6/-
OC84	8/6
OC140	29/-
OC170	9/6
OC171	10/6
OCP71	17/6
PXC101	6/6
PXC101A	6/6
XA104	18/-
V10/15A	12/-
V30/10P	28/6
V6/R2	9/3

METAL RECTIFIERS. DRM1B 13/-. DRM2B and DRM3B 15/6. LW7 21/-. LW15 26/-. RMO 7/11. RM1 5/3. RM2 7/6. RM3 7/9. RM4 14/-. RM5 19/6. 14A86 17/6. 14A97 25/-. 14A100 27/-. 14A124 28/-. 14A163 38/-. 14B130 35/-. 14B261 11/6. FC101 17/6. 16RC.1.1.16.1 8/6. FC31 21/-. 16RD.2.2.8.1 12/-. 16RE.2.1.8.1 8/6. 18RA.1.1.8.1 4/6. 18RA.1.2.8.1 11/-. FC116 6/6. FC124 15/-.
ELECTROLYTICS. Can types: 32 x 32/450v. 5/9. 50 x 50/350v. 7/-. 64 x 120/350v. 8/3. 60 x 250/275v. 9/6. 100 x 400/275v. 12/6. 100/275v. 3/-. 200/275v. 4/-. 100 x 200/275v. 9/6. Tubular types: 8/450v. 1/9. 16/450v. 2/9. 32/450v. 3/9. 8 x 8/450v. 3/-. 16 x 16/450v. 4/-. 32 x 32/350v. 4/-. 8 x 16/450v. 3/9.
P.M. SPEAKERS. 3 ohm types: 2½in. 17/-. 5in. 15/6. 6½in. 17/-. 7 x 4in. 15/-. 10in. 27/-. 12in. 29/6. 2½in., 80 ohms, 17/6. Post 2/- each.
MULLARD midget silicon rectifiers. Type BY100. Output 250 volts, ½ amp. No larger than a shirt button. 8/- each.
All goods brand new and actually in stock. We do not sell second-hand goods, manufacturers' rejects, or seconds, or items from dismantled equipment.

Terms of business:—Cash with order or C.O.D. only. Post 6d. per item except where stated. Orders over £3 post free. C.O.D. 2/6 extra. All orders cleared same day. Any parcel insured against damage in transit for 6d. extra. We are open for personal shoppers 8.30—5.30 p.m. Sats. 8—1 p.m. Complete list of modern and obsolete valves, resistors, condensers, transformers etc. with terms of business 6d. Please enquire for any item not listed with S.A.E.

UNIVERSAL AVOMETERS



Guaranteed perfect working order. Supplied complete with leads, batteries and instructions.
Model "D" 34 range £8.19.6
Model "7" 50 range £11.0.0
Registered Post 5/- extra.

COSSOR 1035 DOUBLE BEAM OSCILLOSCOPES

Guaranteed perfect working order. **£45** each. Carriage £1.

7.5 K.V.A. AUTO TRANSFORMERS

0-115-230 volts. Brand new boxed, **£15.** Carriage 10/-.

230/250 VOLT A.C. MOTORS

4¼ x 3in. dia., 90 watts, 5,000 r.p.m. ¼in. spindle. **22/6.** P.P. 1/6.

I K.V.A. ISOLATION TRANSFORMERS

230 v. PRI 230 v. Sec. Boxed, **£5** each. Carriage 10/-.

VARIAC TRANSFORMERS

24 amp., 230 volt primary, 185 to 250 volt output, **£12.10.0.** Carriage 10/-.

TELEPHONES TYPE "L"

Generator Bell Ringing, 2 line connection. With batteries, fully tested, **69/6** per pair. Carriage 5/-.

100 AMP A.C. METERS

Nalder Thompson 6in. scale. Brand new, boxed. **65/-.** P.P. 3/6.

3000 WATT AUTO TRANSFORMERS

0-115-230 volts, step-up or step-down. Brand new, boxed ex-U.S.A. **£7.10.0** each. Carr. 10/-.

FANTASTIC TAPE OFFER

Brand new American High Fidelity recording tape, 7in.—1800ft. **20/-.** 7in.—1200ft. **15/-.** P. & P. extra. S.A.E. for full bargain tape lists.

PANEL METERS

100µA	2½"	F.M.	D.C.	42/6
100µA	3½"	F.M.	D.C.	62/6
1mA	2½"	F.M.	D.C.	25/-
30/0/30mA	2½"	F.M.	D.C.	9/6
350mA	2½"	F.M.	D.C.	10/6
2 v.	2½"	F.M.	A.C.	17/6
10 v.	2"	Proj.	A.C.	15/6
300 v.	2½"	Proj.	A.C.	19/6
300 v.	2½"	F.M.	A.C.	25/-
500 v.	2½"	F.M.	A.C.	25/-
150 v.	3½"	F.M.	D.C.	32/6
1500 v.	3½"	Electrostatic		25/-

FIELD TELEPHONES TYPE "F"

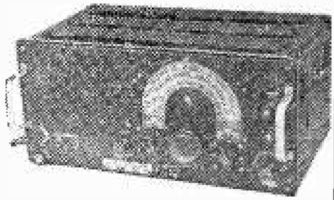
Suitable for many applications. Generator bell ringing, 2 line connection. With batteries and wooden carrying case, fully tested, **£4.19.6** per pair. Carr. 5/-.

P.C.R. COMMUNICATION RECEIVERS

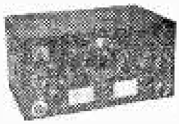
6 valves. Frequency coverage on 3 bands: 850-2,000 metres, 190-550 metres and 6-18 Mc/s. Super slow motion drive. AE trimmer, tone control, built in speaker. AS NEW **£6.19.6** each. Carr. 7/6.

P.C.R.2 RECEIVERS

850-2,000 metres, 190-550 metres 6-22 Mc/s. output for phones or 3 Ω speaker. As new **£5.19.6.** Carr. 7/6. Both above models can be supplied with internal power unit to operate on 200/250 v. A.C. at **39/6** extra or alternatively plug-in external power units are **35/-.**



NATIONAL H.R.O. RECEIVERS



BRAND NEW! Senior model, table mounting. Complete with a full set of 9 coils covering 50 kc/s to 30 Mc/s. Supplied complete in original transit cases, **£25.** Carr. 20/-. Power units to operate direct from 200/250 volt. A.C. **59/6** extra.

PRECISION COMBINATION VOLTMETER/AMMETER FOR A.C. AND D.C.

Two separate instruments housed in polished wood case, 6in. scales with knife edge pointers.
Ranges:
Volts A.C. and D.C. 160-300-600 v.
Amps. A.C. and D.C. 25-50-150-200 A.
Supplied complete with all current shunts, leads and leather carrying case. Manufactured by Elliott Bros. Supplied brand new, **£9.19.6** each. Carriage 7/6.

MINE DETECTOR No. 4A

Will detect all types of metal. Fully portable. Complete equipment supplied tested with instructions, **39/6.** Carriage, 10/6. Battery **8/6** extra.

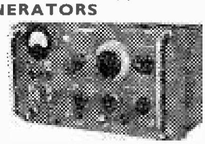
COLLARO STUDIO TAPE TRANSCRIPTOR

Brand new 1962 model, 3 speeds, 3 motors, digital counter, etc. Fitted with latest bradmatic heads and interlock button. Supplied with spare spool, instructions, fixings. **10 gns.** each. Carr. paid.

CLASS "D" WAVEMETERS MK. II

Heterodyne crystal controlled frequency meter covering 1.9 to 8 Mc/s. 6 volt D.C. operation. Supplied brand new. Complete with crystal, valves, spare vibrator, headset and instruction manual, **59/6** each. P.P. 3/6.

CT-53 SIGNAL GENERATORS

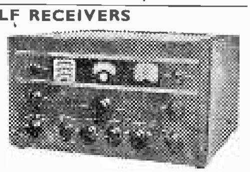


Precision instruments covering 8.9 to 15.5 Mc/s. and 20 to 300 Mc/s. on 6 bands. Variable attenuator from 1 microvolt to 100 millivolts. Operation 110/200/250 volts A.C. Supplied in perfect working order. Complete with calibration charts. **19 gns.** each. Carriage 10/6.

PRECISION A.C. AND D.C. VOLTMETERS

Two ranges, 160 and 320 volts, 8 inch mirror scale with knife edge pointer. Housed in polished wooden case. Ideal for schools, labs., etc. Supplied brand new, **£5.19.6** each. P.P. 3/6.

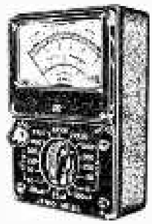
R.C.A. AR.88 LF RECEIVERS



These world-famous 14-valve receivers are offered in excellent condition. Fully tested and checked before dispatch. Frequency coverage on six bands is 75 to 550 Kc/s and 1.5 to 30 Mc/s. Completely self-contained except phones or speaker. Operation for 100-200-250 volt A.C. **£32.10.0** each, carriage 30/- ex.

JEMCO 4,000 OHM/VOLT TESTMETER

1% Precision Resistors throughout. Single control system for all ranges. Highly accurate. Sensitivity 4,000 Ω/volt A.C. and D.C.



Ranges:
D.C. volts: 0-10-50-250-500-1,000v.
A.C. volts: 0-10-50-250-500-1,000v.
D.C. current; 0-250vA 0-25-500mA
Resistance; 03-0kΩ 0-300kΩ 0-3MΩ
Decibels: —20 to +36 db (2 ranges).
Meter sensitivity: 100 microamp. **62/6** each P.P. 2/6.

JEMCO 20,000 OHM/VOLT TESTMETER

As above but with increased sensitivity and extended resistance range (0-5M Ω), **97/6** P.P. 2/6. Either type brand new. Guaranteed with leads, prods, batteries, instructions.

L.T. METAL RECTIFIERS

All full wave, bridge connected. Brand new, guaranteed.

12/18v. 1.5A.	3/9	24/36v. 4A.	15/6
12/18v. 2.5A.	6/3	24/36v. 15A.	45/-
12/18v. 4A.	8/6	36/48v. 2A.	19/6
12/18v. 6A.	12/3	36/48v. 4A.	29/6
12/18v. 10A.	22/6	36/48v. 6A.	32/6
12/18v. 15A.	37/6	48/60v. 2A.	21/-
24/36v. 1A.	7/3	48/60v. 10A.	82/6

Please add postage.

L.T. TRANSFORMERS

All primaries tapped 200/250 volts.
1 Battery Charging. 3.5, 9 or 17 volt, 1 amp., **9/9.** Ditto 2 amp, **14/3.** Ditto 4 amp., **16/6.** 9 or 17 volt, 6 amp., **26/-.**
2 Model Type 3, 4, 5, 6, 8, 10, 12, 15, 18, 20, 24 or 30 volt, 2 amp., **18/6.** Ditto 4 amp., **27/6.** Ditto 5 amp., **37/6.** Add Postage.

AUTO TRANSFORMERS

Step-up, step-down, tapped 0-115-200-230-250 volts. 15w., **9/-**; 60w., **12/6**; 150w., **18/6**; 200w., **27/6**; 300w., **42/6**; 500w., **67/6**; 1,000w. **99/6**; 1,500w., **£6.19.6.** P.P. extra.

R.C.A. PLATE TRANSFORMERS

Pri. 200/250 v. sec., 2,000-0-2,000 v. 500 mA, tapped 1,500 v. New, boxed, **£6.10.0.** Carriage 15/-.

DUMONT K1051P1 DOUBLE BEAM C.R.T.

Twin Gun. Brand new, boxed, **59/6.** P.P. 3/6.

1.2 Ohm 12 Amp RHEOSTAT

Geared slider type, new boxed-**15/6** each. P.P. 3/6.

PAINTON 100KΩ 3½ DIA. INSTRUMENT POTS

Fully screened, precision wire, wound, **10/6** each. P.P. 1/3.

CADMIUM SULPHIDE PHOTOCELLS

Very sensitive, full data supplied, **12/6** each. P.P. 6d.

MINIATURE PANEL METERS

For 1½in. dia. panel hole.

0-50µA	39/6	0-300 v. D.C.	27/6
0-500µA	32/6	"S" meter	35/-
0-1 mA	27/6	"VU" meter	42/6
0-5mA	27/6		

Hours of Business: **3 LISLE STREET, 9 a.m.—6 p.m. Half Day Saturday**
34 LISLE STREET. 9 a.m.—6 p.m. Half Day Thursday

Send S.A.E. For Bargain List

G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

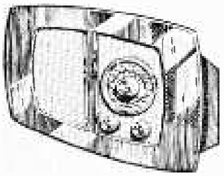
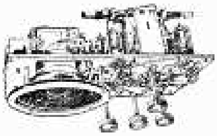


TABLE MODEL TRANSISTOR SET £9.10.0 (carr. paid)

6 transistors and diode, 5in. circular speaker, superhet circuit. Cabinet 13 x 7¾ x 4½in., battery included. Fully tunable LW and MW. Polished walnut front.

MAINS OPERATED RADIO CHASSIS AND AMPLIFIER OF FAMOUS MANUFACTURE



Chassis 10 x 5½ x 4in. front to back. Valves: UBC41, UCH41, UF89, UL84 with metal rectifier. 5in. speaker. Ferrite rod aerial. Tone, vol. and gram. position. Covers L. and M waves. Limited quantity at only £6 (5/- carr.) complete with small dial. Unused and in working order.

TELEFUNKEN

German made F.M. front end. 22/6 (post 2/6), with ECC85 valve. Permeability tuned, 88-99 Mc/s. 4 x 1¾ x 2in. high plus valve 2in. Circuit 2/-.

MULLARD

Permeability tuned F.M. front end 22/6 (post 2/6), with ECC85. 4 x 3 x 3½in. 88-95 Mc/s.

TRANSISTOR BABY ALARMS

Two attractive moulded units with connecting lead. Just plug the units together. FULLY BUILT, not a kit. Battery included, last months. Is excellent intercom. ONLY £5, carr. paid.

BRAYHEAD "TRANSTRONIC" TRANSISTOR CONSTRUCTION KIT

Two Mullard transistors and diode. Seven circuits can be built inc. transmitter and receiver. 15-page instruction book. Includes all necessary components. Just the gift for a beginner. Originally over £5. Our price 42/6 (post 2/6).

MINIATURE EARPHONES FOR TRANSISTOR RADIOS

3 foot cord. Miniature Jack and Socket. Crystal 8/-, magnetic 7/6.

4 TRANSISTOR MINIATURE PUSH-PULL AUDIO AMPLIFIER

For 3 ohm speaker. 200mW output suitable for intercoms. Portable radios, etc., with free instruction sheet and diagram. For mike or radio input 4 x 1½ x ¾. Printed circuit 47/6, post paid.

TRANSISTORS POST FREE

Set of 6 Mullard transistors OC44, 2-OC45, OC81D, 2-OC81 (matched) and OA70 diode 30/-; set of G.E.C. transistors 874, 2-873, 3-82 or 83. 17/6

TEST LEAD KIT

Leads, prods, terminals clips in case, 10/-, post paid.

PANEL OF 7 POTS.
10 x 1½in.—4 x 1M and 3 x 2M. 4/- (post 1/-).

THREE-VALVE AMPLIFIER AND RECTIFIER

4 watts. Valves ECC83, EL84 and EZ80. Controls, volume, bass and treble. On/off switch. (Chassis size 6½ x 3 x 2½in.) 6½in. round or 7 x 4in. elliptical speaker. Not suitable for microphone input. A.C. only. 67/-. P. & P. 3/-.

PERSPEX

12½ x 9¾ x ⅛in. clear, 5/-.
16 x 14 x 3/16in. clear, 7/6.
Postage on one sheet 2/-, on two or more 3/-.

TRANSISTOR COMPONENTS

M.W. and L.W. ferrite rod aerial, with car coupling coil. For 208pF condenser, 8/-; Osc. coil; 1st, 2nd and 3rd I.F's, all 5/6 ea.; Driver trans., 7/6 min. 64mF 10v; 10mF 16v; 30mF 6v, all 1/9 ea; Tuning cond. 208mF +1 176pF 8/6; post 9d. on all orders.

NEW 5 WATT AMPLIFIER

By famous manufacturers made to sell at £6.10. Our price ONLY 45/- (post 4/-); a few hundred only; valves EF91 and EL84 with metal rectifier; 6 x 4 x 1¾in. high (5in. over EL84). Mains trans. and o.p. with vol. and tone controls; on-off; co-ax input.

100 RESISTORS

100 resistors 6/-; 100 condensers inc. ceramic and silver mica, 9/6.

A FEW EX-RENTAL 4-WATT AMPLIFIERS

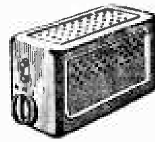
With 10P14, U404, and 10F3 valves; used but in fair condition. 8in. speaker; useful for record player, baby alarm, general amplifier, etc., 15 x 12½ x 6½ins. Mains operated, 18/6 (6/- carr.). Some wood and som moulded cabinets.

SPECIAL OFFER OF RECORDER CABINET

Plain boards, polished walnut finish, 38 x 15½ x 23in. high plus 8in. legs. Part delivery charge of £1, as offered elsewhere at over £22, brand new.
Fitted with 3 sliding doors.

PRICE **£13**

"READY TO USE" ITA CONVERTER



Direct switching ITA to BBC. metal rectifier, co-axial plug. Can be fitted in 5-10 mins., and needs no alteration to your set. ALL AREAS. ALL SETS. ALL CHANNELS. 12 months' guarantee (3 months on valves). Separate gain controls. Valves ECF80 and ECC84. Switch positions OFF—ITA—BBC. Bakelite moulded cabinet. 8½ x 4 x 6in. 70/- (3/- P. & P.).

AERIALS

Combined B.B.C. (Single Dipole) and Band 3 I.T.A. (5-Element) Aerial, with chimney lashings and Stand-off Arm. Carriage paid £3.15.0.

I.T.A. (Band 3) Aerials, for clipping to existing mast of diameter 1in. to 2in. Alternatively with wall-fixing plate at same price: 3 element £1.2.0, 5 element £1.10.0, 8 element £2.10.0, 11 element £3.2.6. Chimney lashings and Stand-off Arm 20/- extra for each of above.

Loft Mounting I.T.A. Aerials, 3 element 20/-, 5 element 26/-. All aerial prices carriage paid. Larger aerials for I.T.A. and B.B.C. can be supplied to special order.

Double 6 Element I.T.A. Plus B.B.C. "H" Aerial with 10ft. pole and double chimney lashings, £8.10.0.

An I.T.A. Table Top Aerial with amazing performance. The Wolsey Hi-Q at 19/6 (2/6 post). Good reception up to 20 miles. Cross-over unit in base with socket for B.B.C. aerial. Slightly tarnished at 12/6 (2/6 postage).

PERSPEX. 15 x 12 x ⅛in., tinted blue/grey, 6/6; 12½ x 9¾ x ⅛in., Clear, 5/-; 16 x 14 x 3/16ins., Clear, 7/6. Postage 2/- on 1; 3/- on 2 or more; 6 post paid.

A FANTASTIC OFFER OF EXTENSION SPEAKERS

Made by Goodman. Wooden Cabinet 12 x 7 x 10½in. Containing 8in. P.M. 3-ohm speaker; used but good condition. Vol. control fitted. Our price 12/6 (3/6 Post).

COMPONENTS FOR "P.W." AMPLIFIER, GENERATOR, ETC.

Tubular condensers 350v 0.01, 0.02, 0.05mFd, 6d. ea; 0.25 and 0.5mFd. 9d. ea; Resistors ½w 10% 6d. ea. 20% 3d. ea; Contact rectifier 250v, 50mA, 6/6; 16-16mFd Elect. 500v, 3/6; D.P.S.T. toggle switch, 3/-; High stab resistors 1/- ea; Valve holders B7G and B9a with skirt and screen, 1/- ea; Co-ax socket 1/-; 1M and 25k pots, with spindle 2/6 ea; SK2, SK4, and SK5 sockets 3/- ea; ditto plugs 3/- ea; add postage Also many other items specified. S.A.E. enquiries.

STERN'S MULLARD DESIGNS

Designed by MULLARD—presented by STERN'S strictly to specification

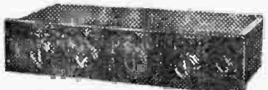
MULLARD "5-10" MAIN AMPLIFIER

For use with the MULLARD 2-valve pre-amplifier with which 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.

COMPLETE KIT OF PARTS (**PARMEKO** Output Trans.). **£10.0.0**

Alternatively we supply **ASSEMBLED and TESTED. £11.10.0** INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA.

MULLARD'S PREAMPLIFIER TONE CONTROL UNIT

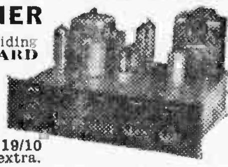


Employing two EF86 valves, and designed to operate with the MULLARD **MAIN AMPLIFIERS**, but also perfectly suitable for other makes.

KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£8.0.0**

★ 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.

THE MULLARD "510/RC" AMPLIFIER

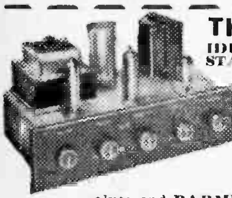


The popular complete "5-10" incorporating Control Unit providing up to 10 watts. Specified Components and new **MULLARD VALVES** are supplied including **PARMEKO MAINS TRANSFORMERS** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers.

KIT OF PARTS **£11.10.0** OR ASSEMBLED and TESTED **£13.10.0**

Dep. £2.6.0, 12 months at 17/0. Dep. £2.14.0, 12 months at 19/10
ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra.

THE MULLARD "33/RC"

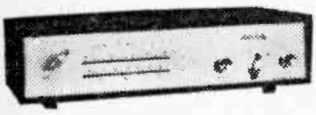


IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS

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

(plus 6/6 carr. and ins.) Deposit £2.0.0 and 8 months £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and **PARMEKO OUTPUT TRANSFORMER.**

"The TUDOR" AM/FM TUNING UNIT

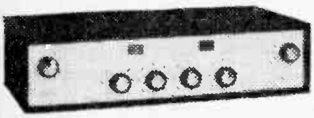


A SELF POWERED HIGH FIDELITY TUNER OF OUTSTANDING DESIGN

PRICE ONLY **£19.19.0** Deposit £4.0.0 and 12 months at £1.9.4.

Provides full coverage of the VHF/FM band (87-108 Mc/s) and also the LONG and MEDIUM wavebands. Incorporates Multiplex outlet socket for stereophonic purposes and separate controls for tuning the FM and AM bands. Operates perfectly with the STERN-MULLARD AMPLIFIERS and contains matching FRONT PANEL in Black/Gold or White/Black. Also operates equally well with any Amplifier requiring input of 100 to 350 m/Volts.

THE "TUDOR" STEREO AMPLIFIER



For Only
£18.18.0

Deposit £3.16.0. 12 months £1.7.8.

A self contained Amplifier designed to provide high quality stereophonic and monophonic reproduction. Each channel provides a rated output of 6 watts and for monophonic operation approx. 12 watts. Separate BASS and TREBLE CONTROLS. DESCRIPTIVE LEAFLET IS AVAILABLE.

PRICE REDUCTIONS

(a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CONTROL UNIT H.P. Dep. £3.7.0 and 12 months at £1.2.9 .... **£15.15.0**

(b) 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**

With Partridge O/put Transformer £1.6.0 extra.

RECORD PLAYERS

THE GARRARD "AUTO-SLIM" 4-speed Autochanger with Crystal Pick-up **£8.10.0**

GARRARD "AUTO-SLIM DE-LUXE" 4-speed Autochanger incorporates transcription Pick Up Arm **£12.14.6**

COLLARO "JUNIOR" 4 SPEED SINGLE RECORD PLAYER with separate Crystal Pick-up. Above Pick-up separately for £1.6.6. **£3.15.0**

The **COLLARO C60** 4-speed Autochanger unit with Studio "O" Pick-up **£7.19.6**

B.S.R. MODEL UA14. A 4-speed mixer Autochanger with Crystal Pick-up **£7.19.6**

GARRARD MODEL TA/Mk.II 4-speed Player fitted high output Crystal Pick-up.. **£8.10.0**

PHILIPS MODEL AG1016 . . . A 4-speed Player which can be operated both manually and automatically. Suitable for Mono or Stereo operation **£13.13.0**

Carr. and Ins. on each 5/- extra.

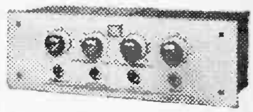
This attractive **PORTABLE AMPLIFIER CASE** with a good quality **GRAM AMPLIFIER** and **P.M. SPEAKER**

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

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

WE SUPPLY SEPARATELY—
(a) The 2-stage (plus Rectifier) **AMPLIFIER** £4.2.6
(b) The **PORTABLE CARRYING CASE** £3.17.6
(c) 6½in. **P.M. SPEAKER** 18/9. Carr. and Ins. 4/- extra.

MULLARD FOUR CHANNEL MIXER UNIT



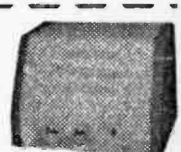
Self powered with Cathode follower output. Incorporates Two inputs for MICROPHONES One for CRYSTAL PICK UP and a fourth for RADIO or TAPE

Kit of Parts **£8.8.0**
Assembled and Tested **£10.0.0**

TERMS: Deposit £2 and 2 months at 15/-.

Alternatively **MODEL I.L.** provides for one microphone Input matched for moving coil or Ribbon Mike. £1.17.0 extra.

STERN'S INTER-COMM BABY ALARM



Employing the new MULLARD ECL86 valve to provide two (or three) way conversation up to extreme distances. A.C. 200 to 250 Volts.

PRICES . . . MASTER UNIT and ONE EXTENSION

KIT OF PARTS **£6.17.6** ASSEMBLED AND TESTED **£8.8.0**

Consists of a MASTER UNIT. size only 8½ x 5½ x 6in. and ONE EXTENSION (a second extension may be added to any time).

WE WELCOME ENQUIRIES and our TECHNICAL STAFF will with pleasure assist with choice of suitable equipment.

STERN RADIO 109, FLEET ST., LONDON, E.C.4. TELEPHONE FLEET ST., 5812-3 **PREMIER RADIO** 23, TOTTENHAM COURT RD., LONDON W.1 TELEPHONE MUSEUM 3451

MAIL ORDERS and all POSTAL ENQUIRIES to 7-9 TUDOR PLACE, TOTTENHAM COURT RD., LONDON, W.1. MUSEUM 6128/9

BUILD A HIGH QUALITY TAPE RECORDER LIKE THIS FOR £35.0.0

CARR. and INS. 10/- extra

FOR THIS WE SUPPLY......

Deposit £7.0.0 and 12 months of £2.11.4.

★ Complete Kit of Parts to Build the HF/TR3 Tape Amplifier. ★ The Latest Collaro "Studio" Tape Deck. ★ Portable Carrying Case (as illustrated).
★ Rola/Celestion 10 x 6in. p.m. Loudspeaker. ★ ACOS Crystal Microphone and 1,200 ft. Spool E.M.I. Tape.

ALTERNATIVELY WE SUPPLY THE COMPLETELY ASSEMBLED and GUARANTEED TAPE RECORDER FOR £39.10.0

H.P. Terms: Deposit £7.18.0 and 12 months of £2.17.11

HF/TR3MKII TAPE AMPLIFIER

(Mullard Type "A" design)

A very high quality Amplifier incorporating 3-speed treble equalisation, by the latest FEROXCUBE POT CORE INDUCTOR. FOR COLLARO-TRUVOX-BRENELL WEARITE Tape Decks. has GILSEN Output Transformer. Includes separate Power Supply Unit.

KIT OF PARTS **£13.13.0**
Deposit £2.15.0
12 months at £1.0.0.

ASSEMBLED and TESTED **£17.0.0**
Deposit £3.8.0.
12 months at £1.4.11.

ADD "HI-FI" TAPE RECORDING TO YOUR EXISTING AUDIO INSTALLATION WITH

MULLARD TYPE "C" TAPE PRE-AMPLIFIER—ERASE UNIT

The "Hi-Fi" link to add full tape recording facilities to High Fidelity home installations. Incorporates FEROXCUBE POT CORE PUSH-PULL OSCILLATOR and 3-speed treble equalisation by FEROXCUBE POT CORE INDUCTOR FOR WEARITE-COLLARO-TRUVOX OR BRENELL TAPE DECKS. Includes separate power Supply Unit.

KIT OF PARTS **£14.0.0** Deposit £2.16.0. 12 mths. at £1.0.6
OR ASSEMBLED **£17.0.0** Deposit £3.8.0. 12 months at £1.4.11
(Excluding power unit £11.15.0 and £14.10.0 respectively.)

SPECIAL "COMBINED ORDER" PRICES

For Constructors with their own cabinet—WE OFFER—

(a) KIT to build the HF/TR3 Amplifier together with the COLLARO "STUDIO" DECK **£26.0.0**
Deposit £5.4.0. 12 monthly payments of £1.18.2

(b) As above but with the HF/TR3 supplied ASSEMBLED and TESTED **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.4

(c) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENELL Mk. V TAPE DECK.... **£42.0.0**
Deposit £8.8.0. 12 monthly payments of £3.1.7

(d) As above but with HF/TR3 supplied ASSEMBLED and TESTED **£45.10.0**
Deposit £9.2.0. 12 monthly payments of £3.6.9

(e) THE ASSEMBLED AND TESTED HF/TR3 AMPLIFIER with the WEARITE MODEL 4A DECK, incorporates Wearite Head Lift Transformer etc. **£60.10.0**
Deposit £12.12.0. 12 monthly payments of £4.8.9

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

(a) The COLLARO "Studio" Deck with the Model "C" Preamplifier and POWER SUPPLY UNIT ASSEMBLED AND TESTED **£29.10.0**
Deposit £5.18.0. 12 monthly payments of £2.3.3

(b) As above but the TYPE "C" Unit and POWER UNIT supplied as COMPLETE KIT OF PARTS **£26.10.0**
Deposit £5.6.0. 12 monthly payments of £1.18.10

(c) The BRENELL Mk. V Deck with the Model "C" PREAMPLIFIER and POWER UNIT. ASSEMBLED and TESTED **£46.0.0**
Deposit £9.4.0 and 12 months at £3.7.6

(d) As above but the Model "C" PREAMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£43.0.0**
Deposit £8.12.0. 12 monthly payments of £3.3.1

(e) The WEARITE MODEL "4" DECK with ASSEMBLED and TESTED Model "C" PREAMPLIFIER and POWER UNIT incorporating WEARITE HEAD LIFT TRANSFORMER. Etc. **£60.10.0**
Deposit £12.2.0 and 12 months at £4.8.9

(Carriage and Insurance on above is 10/- extra.)

The MODEL HFG/2R PORTABLE TAPE RECORDER

(Original Price £33.0.0)

FOR ONLY 22 gns.

Deposit £4.14.0. 12 months £1.13.9 Crystal Microphone £1.0.0 extra. *(Carr. and Ins. 10/- extra).* Incorporates THE GARRARD "MAGAZINE" TAPE DECK and a HIGH QUALITY AMPLIFIER based on the very successful MULLARD TYPE "A" DESIGN and specifically developed to operate the GARRARD DECK. Price INCLUDES THE GARRARD TAPE MAGAZINE and 4in. SPOOL OF DOUBLE PLAY TAPE. Comprises a Twin Track Recorder operating at 3¾in/sec. speed and providing up to 1 hour 10 mins. playing time. Truly "Portable", weighs only 22 lbs.

THE 'ADD-A-DECK'

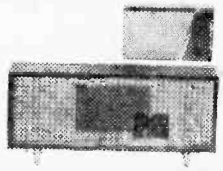
Incorporating GARRARD TAPE DECK and MODEL HF/G2P PRE-AMPLIFIER

Supplied on ONE CHASSIS(as illustrated)READY FOR USE **18 Gns.**
(Carr. & Ins. 10/- extra.)
Price includes Garrard Magazine and a 4 in. Spool Double Play Tape
H.P. Deposit £3.16.0. and 12 months of £1.7.8.
Provides complete tape recording facilities and designed to operate through the pick-up sockets of the standard type of RADIO RECEIVER, or an AMPLIFIER, from which really first class reproduction is obtained. It consists of a Twin Track Deck connected to the Pre-amplifier and operates at 3¾in/sec. speed providing up to 1 hr. 10 mins. playing time.

SENSATIONAL BARGAIN

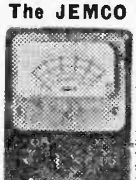
A BULK PURCHASE ENABLES US TO OFFER THE GRUNDIG "MINI-BOY" TRANSISTOR RADIO for only £10.10.0

USUAL PRICE **£26.5.0**



Small enough to fit in your pocket—or a big set performance at home by sliding the transistor set into the speaker enclosure Ferrite Rod Directional Aerial. Med. Wave Coverage 185-590M. Size 4 x 2¼ x 1 in. Speaker Enclosure size 9¼ x 3¾ x 1¼ in., fully guaranteed.

The JEMCO MODEL MT-955 MULTIMETER



50,000 ohms per volt—D.C.
5,000 ohms .. .. A.C.
A truly efficient Meter for the amateur or professional man, having features found normally in more expensive Meters. Ranges:
D.C. volts 2.5-10-50-250-1.K
A.C. .. 2.5-10-50-250-1.K
D.C. Current 100μA-10mA-100mA-500mA. 10 amps
Resistance 4 Ranges up to 20 meg.
Add D.B. 0-46 Size 7 x 5¼ x 3in.
PRICE, including Full Test Lead Kit .... **£12.19.6** 4/- p. & p.

109, FLEET ST., LONDON, E.C.4.
TELEPHONE FLEET ST., 5812-3
23, TOTTENHAM COURT RD., LONDON W.1.
TELEPHONE MUSEUM 3451
7-9 TUDOR PLACE, TOTTENHAM COURT RD., LONDON, W.1. TELEPHONE MUSEUM 1128/9

STEREO-MONO CRYSTAL CARTRIDGES AT GREATLY REDUCED PRICES

RONETTE Model "OV" Output 110m/Volts	29/6
RONETTE Model "105" Output 250m/Volts	35/-
RONETTE Model "105" with DIAMOND STYLUS..........	39/6
RONETTE Model "106" Output 500m/Volts	32/-
COLLARO "CERAMIC" Output 50m/Volts	25/6

All above are "TURNOVER" type Cartridges.

AUDIOTRON HI-FI TAPE RECORDER KIT 25½ GNS.

Carr. 17/6

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

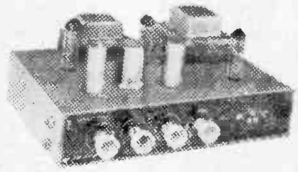
Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best quality Tape and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 14¼ x 15 x 8½in. high, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflets. **TERMS.** Deposit £2.13.9 and 12 monthly payments of 44/-. Cash price if settled in 3 months.

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

SPECIAL NOTE. The Tape Decks we supply are latest models. Where customers already have a Deck or wish to use one of those being offered cheaply we can supply Kit less Deck at 13 gns. carr. 10/-. Or deposit 2 gns. and 12 monthly payments 23/9. Also if required we can supply in lieu of portable cabinet and 7 x 4in. speaker, the Equipment Cabinet illustrated at foot of opp. page and a high flux 8¼ x 5¼in. speaker for 8 gns. extra.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram., as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, EZ81. 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 D.B. 30-30,000 c/s. Six negative feedback loops. Hum level 60 D.B. down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc.
OUTPUT SOCKET with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-
(Or factory built 51/- extra.)
If required louvred metal cover with 2 carrying handles can be supplied for 13/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9, and 9 monthly payments of 24/9.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets. Speaker. Microphones, etc., with cash and credit terms.

B.S.R. MONARDECK TAPEDECKS. Speed 3¾in. per sec. With high quality recording heads. **£6.19.6.** Carr. 5/-. Cabinets, to take Deck and amplifier **39/6.**
TWEETERS. Plessey 3Ω **19/9,** 15Ω **25/9. Jason FMT1** V.H.F./FM Radio Tuner design Total costs of parts including valves Tuning dial, Escutcheon, etc., **£6.19.9.** Other Jason equipment in stock.

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Collaro, **19/9.** Acos Stereo-Monaural **49/9.** Ronette Stereo-Monaural **59/6.**
BRADMATIC RECORDING HEADS. High Impedance Record/Playback 22/-. Low Impedance Erase. 12/6.
PICK-UP ARMS. Complete and with latest Acos/hi-fi Turnover Cartridge **29/11.**
CRYSTAL MICROPHONES. Hand type NP110 **14/9,** R.T.C. **19/9.** Acos Mic 40 **25/9** Acos Mic 45 **29/9.** Stick type Acos 39-1 **39/9.** BM3 with neck band and heavy table stand **59/9.** Lapel type **35/9.**
COLLARO JUNIOR 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only **£3.19.6.**
COLLARO CONQUEST 4-SPEED AUTO-CHANGER, with high fidelity Studio pick-up. Latest model. For 200-250 v. A.C. mains. **£6.19.6.** Carr. 5/6.
COLLARO RC 457 4-SPEED MIXER AUTO-CHANGERS. Turnover Studio head, for 200-250 v. A.C. **£7.19.6.** Carr. 4/6.
B.S.R. UA14 4-sp'd AUTO-CHANGERS with hi-fi turnover head. **£6.19.6.** Carr. 4/6.
GL3A 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. A.C. mains. Size 11¼ x 2¼ x 2½in. Controls: Vol. and Tone with switch. Only **59/6.**

R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts, suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3ohm speakers. Point-to-Point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. **8 Gns.** Full constructional details and price list 2/6. Carr. 10/-.
Kit can be assembled, ready to use 59/6 extra.

R.S.C. BATTERY CHARGING EQUIPMENT

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

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. Variable Charge Rate Selector Panels. Plugs, Fuses, Fuseholder and circuit. 59/9. Carr. 4/6.
CHARGER KIT. 12v. 14 AMP or 24v. 7 amp. Consisting of mains trans. 200-230-250 v. F.W. (Bridge) selenium Rectifier. F Ammeter. Fuses. Variable Resistor and Circuit. Only **6 gns.** Carr. 15/-. Please state if 12v. or 24v. kit required.

SOLDERING IRONS. 230-250 v. 30 watts. First quality. For Radio work. **19/9.** Spare elements and bits available.

Assembled 4-5 amps. 6/12v.
Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for use with mains and output leads. **69/9** Carr. 5/-. Terms: Deposit 13/3 and 5 monthly payments 13/3. 6/12 v. 3a., all facilities as above. Only 59/9, carr. 3/9.

ASSEMBLED 6/12 v. 2 amps.
Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Fused, ready for use with mains and putput leads **49/9** Carr. 3/9
6/12v. 1 amp. 27/9 Less meter.

ASSEMBLED 12V. 10 Amp. with variable charge rate adjustment, ammeter and strong louvred, stove enamelled case. Ready for use. Only **7 gns.** Carr. 10/- or in Kit Form 5 gns.

BATTERY CHARGER KITS Consisting of Mains Transformer. F.W. Bridge. Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders. Grommets, panels, Heavy Duty Clips, circuit. Carr. 3/6 extra.

6v. or 12v. 1 amp	22/9
As above, with Ammeter	28/9
6 v. 2 amps	21/9
6v. or 12v. 2 amps	27/9
6 v. or 12 v. 2 amps. inclusive of Ammeter	35/9
6 v. or 12 v. 4 amps	45/9
6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector	52/9

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

250-0-250v. 70mA. 6.3v. 2a. 0-5-6.3v. 2a	17/9
350-0-350v. 80mA. 6.3v. 2a. 5v. 2a	18/9
250-0-250v. 100mA. 6.3v. 2a. 6.3v. 1a	21/9
250-0-250v. 100mA. 6.3v. 3.5a. C.T.	19/9
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	25/9
300-0-300v. 130mA. 6.3v. 4a. 6.3v. 1a. for Mullard 510 Amplifier	29/9
300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	26/9
350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	26/9
350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a	29/9
425-0-425v. 200mA. 6.3v 4a. 5v. 3a	49/9

FULLY SHROUDED UPRIGHT

250-0-250v. 60mA. 6.3v. 2a. 0-5-6.3v. 2a. Midget type 2½-3-3in.	17/11
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	27/9
300-0-300v. 100mA. 6.3v. 4a. 5v. 3a	27/11
300-0-300v. 130mA. 6.3v. 4a. C.T. 6.3v. 1a. for Mullard Amplifier	33/9
350-0-350v. 100mA. 6.3v. 4a. 5v. 3a	27/11
350-0-350v. 150mA. 6.3v. 4a. 5v. 3a	35/9

FULLY SHROUDED (continued)—

425-0-425v. 200mA. 6.3v. 4a. C.T. 5v. 3a	55/-
425-0-425v. 200mA. 6.3v. 4a. C.T., 6.3v. 4a. C.T., 5v. 3a	59/9
450-0-450v. 250mA. 6.3v. 4a. C.T. 5v. 3a	69/9

OUTPUT TRANSFORMERS

Midget Battery Pentode 66 : 1 for 3S4, etc.	4/6
Small Pentode, 5000Ω to 3Ω	4/6
Small Pentode 7/8,000Ω to 3Ω	4/6
Standard Pentode 5,000Ω to 3Ω	5/9
Standard Pentode 7,000Ω to 3Ω	5/9
10,000Ω to 3Ω	5/9
Push-Pull 8 watts. EL84, or 6V6 to 3Ω or matched to 15Ω	9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 or 15Ω	19/9

Following types for 3 and 15Ω speakers:

Push-Pull 10-12 watts 6V6 or EL84	18/9
Push-Pull 15-18 watts, 6L6, KT66	22/9
Push-Pull Mullard 510 Ultra Linear	29/9
Push-Pull 20 watts, sectionally wound, 6L6, KT66, EL34, etc.	49/9

MIDGET MAINS Primaries 200-250 v. 50 c/s.

250 v. 60 mA. 6.3 v. 2a	11/9
250-0-250 v. 60 mA. 6.3 v. 2a	12/11

Both above size 2¼ x 2¼ x 2½ins.

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

SMOOTHING CHOKES

150 mA. 7-10 H 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

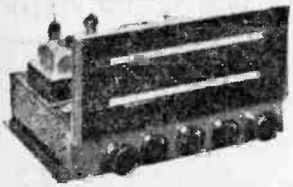
CHARGER TRANSFORMERS All with 200-230-250 v. 50 c/s Primaries; 0-9-15 v. 1½ a. **12/9;** 0-9-15 v. 2a. **14/9;** 0-9-15 v. 3 a., **16/9;** 0-9-15 v. 5 a., **19/9;** 0-9-15 v. 6 a., 23/9; 0-9-15 v. 8 a., **28/9.**

AUTO (Step up/Step down) TRANS. 0-110/120-230/250 v. 50-80 watts. **13/9.** 250 watts, **39/9;** 150 watts, **27/9.**

MICROPHONE TRANSFORMERS 120 : 1 high grade, clamped, **6/9;** 120 : 1 Potted, Mu-metal screened, **9/9.**

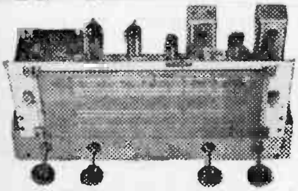
See opposite page for addresses

ARMSTRONG AF208AM/FM RADIOGRAM CHASSIS



★ Full VHF Band (87-108 Mc/s and Medium Band, 187-570M) ★ 7Valves ★ 5 Watts Output ★ 15db Negative Feedback ★ Separate wide range Bass and Treble Controls ★ 2 Compensated Pick-up Inputs ★ Frequency Response 30-22,000 c.p.s. ±2dB ★ Tape Record and Playback Facilities ★ Continental Reception of Good Programme Value ★ For 3, 7½ and 15 ohm speakers. Send S.A.E. for leaflet.

PRICE £22.18.0 Carr. Free



1962 RADIOGRAM CHASSIS

THREE WAVEBANDS — **FIVE VALVES**
S.W. 16 m.—50. 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. 3 ohm output, 5 watts. Chassis 13½ x 5½ x 2¼in. Glass dial. horizontal or vertical wording, size 10in. x 4½in. Aligned and calibrated. Isolated Chassis.

£9.10.0 Carr. & Ins. 4/6.

BARGAIN SALE PRICES

New Boxed VALVES 90-day Guarantee

0Z4	5/-	6K7G	5/-	EABC80	8/-	PCL82	10/-
1R5	6/-	6K8G	5/-	EB91	4/-	PCL84	10/-
1S5	6/-	6L6G	8/-	EBC41	8/-	PL81	10/-
1T4	3/-	6N7M	5/-	EBC81	8/-	PL83	8/-
2X2	2/-	6Q7G	6/-	EBF80	9/-	PY80	7/-
3S4	7/-	6SN7	5/-	ECH42	9/-	PY81	8/-
3V4	7/-	6V6G	5/-	ECH81	9/-	PY82	7/-
3Q5	7/-	6X4	5/-	EF85	6/-	PY83	8/-
5U4	6/-	6X5	6/-	EF89	8/-	QP25	7/-
5Y3	6/-	12AT7	6/-	EL32	5/-	SP41	3/-
5Z4	9/-	12AU7	6/-	EL84	7/-	SP61	3/-
6AC7	4/-	12AX7	7/-	EY51	9/-	U22	7/-
6AM6	4/-	12BH7	7/-	EY86	9/-	UBC41	8/-
6AT6	6/-	12K7	5/-	EZ40	7/-	UBC81	9/-
6BA6	7/-	12K8	14/-	EZ80	7/-	UBF89	9/-
6BE6	5/-	12Q7	5/-	EZ81	7/-	UCH81	9/-
6BW6	7/-	25Y5G	9/-	E1148	1/-	UCL82	10/-
6C4	5/-	35L6	9/-	HABC80	10/-	UCL83	12/-
6D6	5/-	35Z4	5/-	HVR2A	5/-	UF89	9/-
6G6	4/-	807	5/-	KT33C	8/-	UL41	9/-
6H6	3/-	954	2/-	KT76	8/-	UY41	7/-
6J5	5/-	DAF96	8/-	MU14	7/-	UY85	7/-
6J6	5/-	DF96	8/-	PCC84	8/-	UU9	7/-
6J7G	6/-	DK96	8/-	PCF80	8/-	VR150	7/-
6K6	5/-	DL96	8/-	PCF82	8/-	W81	6/-

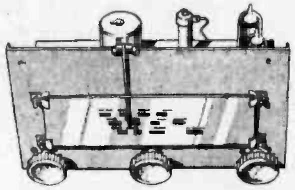
I.F. TRANSFORMERS 7/6 pair
465 K/s Slug Tuning Miniature Can, 2 x ¾ x ¾in. High Q and good bandwidth. Data sheets.

NEW ELECTROLYTICS — FAMOUS MAKES

TUBULAR		TUBULAR		CAN TYPES	
1/350V	2/-	50/350V	5/6	16/450V	5/-
2/350V	2/3	100/25V	3/-	32/350V	4/-
4/450V	2/3	250/25V	3/-	100/270V	5/6
8/450V	2/3	500/12V	3/-	2,000/6V	4/-
16/450V	3/-	8+8/450V	3/6	5 000/6V	5/-
32/450V	3/9	8+16/450V	3/9	32+32/350V	5/-
25/25V	1/9	16+16/450V	4/3	32+32/450V	6/-
50/25V	2/-	32+32/350V	4/6	32+32+32/350V	7/-
50/50V	2/-			50+50/350V	7/-
				64+120/350V	11/6
				100+200/275V	12/6

COMPLETE RADIO CHASSIS £5.19.6. post free

4 Mullard valves. 5in. speaker. Superhet Circuit. BRAND NEW. Size 9 x 6 x 5½in. high. Tested by us ready for use. 200/250 v. A.C.-D.C. Mains.



DE LUXE MODEL as illustrated with illuminated dial. Fully tunable over Medium and Long Wave. 12-month Guarantee. Only £5.19.6 post free

MAINS TRANSFORMERS 200/250 v. A.C.

Postage 2/- each transformer.

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. 22/6. ditto. 350-0-350 .. 29/6
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, 220-0-220, 50 mA. 6.3 v. 2 a. 17/6
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
GENERAL PURPOSE LOW VOLTAGE. 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v. 22/6
AUTO TRANSFORMER. 150 w. .. 22/6
0, 115, 200, 230, 250 v., 500 w. .. 32/6
MULLARD "510" Mains transformer .. 30/-
PARMEKO MAINS TRANSFORMER. Made for special contract, the ratings can safely be doubled. Guaranteed 2 years. Primary 0-110-210-230-250 v. H.T. 300-0-300 v. 50 mA. L.T 6.3 v. 1.8 amp. Size 4 × 3½ × 3½ in. Weight 6lb. Post 2/6 .. .. 17/6
MAINS POWER PACK. Size 3½ × 4½ × 4 in. with mains transformer, metal rectifier and condensers to provide smoothed H.T. output 220 v. 45 mA. D.C., L.T. 6.3 v. 2 a. Centre tapped. All ready built on a strong metal chassis. Brand New. Bargain. Post 2/6 .. .. 29/6

INTERVALVE TRANSFORMERS 3:1 or 5:1, 9/-. **O.P. TRANSFORMERS.** Heavy Duty 50 mA. 4/6. Multiratio, push-pull, 7/6. Ditto, 10 w., 15/6. Miniature, 384m etc., 5/9. **L.F. CHOKES** 15/10H. 60/65 mA, 5/-; 10 H., 85 mA, 10/6; 10 H., 150 mA, 14/-. **FULL WAVE BRIDGE SELENIUM RECTIFIER:** 2, 6 or 12 v. 1½ amp., 8/9; 2 a., 11/3; 4 a., 17/6. **CHARGER TRANSFORMERS.** Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1½ amps., 15/6. 2 amps., 17/6; 4 amps., 22/6. Circuit included. **4 AMP CAR BATTERY CHARGER** with amp. meter Leads, Fuse Case, etc., for 6 v. or 12 v., 69/9. **AMMETER.** 0 to 5 amp. 9/6

BOOKS list S.A.E.

40 Circuits for Germanium Diodes 3/-.
"W.W." Radio Valve Data, 6/-.
High Fidelity Speaker Enclosure, 5/-.
Valve and TV Tube Equivalents, 9/6
TV Fault Finding, 5/-.
Quality Amplifiers, 4/6.
Radio Valve Guide. Books 1, 2, 3 or 4, 5/- each.
Transistor Superhet Receivers, 7/6.
Practical Radio Inside Out, 3/6.
Master Colour Code Chart, 1/6.
Transistor Controlled Models, 7/6.

4 TRANSISTOR PUSH-PULL AUDIO AMPLIFIER

Size 3 × 1½ × ¾.

A ready built miniature push-pull amplifier with input and output transformers, 4 transistors. Ideal for use with record players, intercoms, baby alarms etc. Complete with full instructions and circuit.

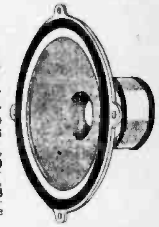
Price **52/6** 9v. Batt. 2/3. 2½in. Speaker 15/-

C.R.T. BOOSTER TRANSFORMERS for heater cathode short circuit, or tubes with failing emission. Full instructions supplied, mains input. **Type A optional 25% and 50% boost. 2v. or 4v. or 6.3v. or 10.8v. or 12.6v. State voltage required. PRICE 10/6.**

LOUDSPEAKERS P.M. 3 OHM. 2½, 3 4in., 19/6. 5in. Rola. 17/6; 8in. Plessey, 19/6; 7in. x 4in. Rola 18/-; 6½in. Rola. 18/6; 10 x 6in. 27/6; 10in. Rola, 30/-; 4in. Tweeter, 25/-; 12in. R.A. 30/-; 13½ x 8in., Double Cone E.M.I. 45/-.

STENTORIAN HF1012. 10in. 3 to 15 ohms, 10 w. 95/-. 35 ohm, 7 x 4in., 25/-; 5in., 22/6; 3½in., 19/6.

BAKER SELHURST LOUDSPEAKERS



Details S.A.E.

12in. Baker 15w. Stalwart 3 or 15 ohms, 45-13,000 c.p.s. 90/-

12in. Stereo, Foam Suspension, 12w., 35-16,000 c.p.s. .. £6.17.6

12in. Baker Ultra Twelve, 20 c.p.s. to 25 kc/s. £17.10

15in. Auditorium. 35 w., Bass, 20 c.p.s. to 12kc/s, £18

Details and Enclosure plans S.A.E.

TWIN GANG TUNING CONDENSERS. 365 pF, miniature 1in. x 1½in. x 1½in., 10/-. 500pF Standard with trimmers, 9/-; midget, 7/6; with trimmers, 9/-; 500pF slow motion tuning, standard or midget, 9/-.

SMALL 3 gang 500 pF, 17/-. **SINGLE** 365 pF 7/6.

SINGLE 25 pF, 50 pF, 75 pF, 100 pF, 160 pF, 5/6. Solid dielectric 100, 300, 500 pF, 3/6.

CONDENSERS. New stock. 0.001 mfd. 7 kV. T.C.C., 5/6; Ditto, 20 kV, 9/6; 0.1 mfd., 7 kV, 9/6. Tubular 500 v. 0.001 to 0.05 mfd., 9d., 0.1, 1/-; 0.25, 1/6; 0.5/500 v., 1/9; 0.1/350 v., 9d.; 0.1/2,000 v. 0.1/1,000 v., 1/9; 0.1 mfd., 2,000 volts, 3/6.

CERAMIC CONDS. 500 v. 0.3 pF to 0.01 mfd., 9d.

SILVER MICA CONDENSERS. 10% 5 pF to 500 pF 9d.; 600 pF to 3,000 pF, 1/-. Close tolerance (± 1 pF) 2.2 pF to 47 pF, 1/-. Ditto 1% 50 pF to 815 pF, 1/-; 1,000 pF to 5,000 pF, 1/9.

465 kc/s SIGNAL GENERATOR Price 15/-. Uses B.F.O. Unit, ZA 30038 ready made with valve IS5. **POCKET SIZE** 2½ x 4½ x 1in. One resistor to change, full instructions supplied. Battery 8/6 extra. 69V 1½V. Details S.A.E.

WAVECHANGE SWITCHES

8 p. 4-way 2 wafer long spindle 6/6
2 p. 2-way, or 2 p. 6-way long spindle .. 3/6
4 p. 2-way or 4 p. 3-way long spindle .. 3/6
3 p. 4-way, or 1 p. 12-way long spindle .. 3/6

Wavechange "MAKITS". Wafers available: 1 p. 12 way, 2 p. 6 way, 3 p. 4 way, 4 p. 3 way, 6 p. 2 way, 1 wafer switch, 8/6; 2 wafer switch, 12/6; 3 wafer switch, 16/-; additional wafers up to 12, 3/6 each extra. **Toggle Switches,** s.p., 2/-; d.p., 3/6; d.p.d.t., 4/-. **Rotary** s.p., 3/6; d.p., 4/6.

CRYSTAL MIKE INSERT, 6/6
Precision engineered. Midget size

ACOS 39-1 DE LUXE STICK MIKE 35/-
TSL QUALITY STICK MIKE.....25/-

Valveholders. Pax. int. oct., 4d. EA50, 6d. B12A, CRT. 1/3. Engl. and Amer. 4, 5 and 7 pin, 1/-. MOULDED Mazda and int. oct., 6d.; B7G, B8A, B8G, B9A, 9d. B7G with can, 1/6. B9A with can, 1/9. Ceramic EF50, B7G, B9A, int. oct., 1/-. B7G, B9A cans, 1/- each.

Quality 2-Stage HI-FI AMPLIFIER A.C. only, 200-250 v. Valves ECL86 and EZ80. 3 watt quality output. Mullard tone circuits, bass boost, treble and volume controls. Separate engraved front panel with de-luxe finish. Heavy duty output transformer 3 ohm. Quality mains transformer. Stove enamelled chassis size 6in. x5. in x 3in. Bargain Price £4.10.0. Circuit supplied.

Christmas Greetings

THE ORIGINAL
RADIO COMPONENT

Our written guarantee with every purchase. NEW COMPONENT LIST 1/-.

Bus 133 or 68 pass door S.R. Station Selhurst

Volume Controls

Linear of Log Tracks. Long spindles. Midget 5 K ohms to 2 Meg. L/S. 3/-; D.P., 4/6; Stereo L/S 10/6; D.P. 14/6

80 ohm CABLE COAX

Semi-air spaced ¼in. Stranded core. 40 yds. 17/6 60 yds. 25/- **6d. yd.**
Fringe Quality Air spaced **1/- yd.**

TELESCOPIC CHROME AERIALS. 13in. extending to 43in., 8/6 ea. **Coax. Adaptor Plug**, 1/6 extra.
TRIPLEXERS Bands I, II, III 12/6
COAX PLUG .. 1/- **LEAD SOCKET** .. 2/-
PANEL SOCKETS 1/- OUTLET BOXES 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms.
DITTO SCREENED per yd. 1/6. 80 ohms only.
Wirewound Ext. Speaker Control, 10Ω 3/-.
WIRE-WOUND POTS, 3 WATT. Pre-set Min. **TV Types.** All values 10 ohms to 25 K., 3/- ea. 30 K., 50 K., 4/-. (Carbon 30 K., to 2 meg., 3/-).
WIRE-WOUND 4 WATT Pots. Long spindle. Value, 50 ohms to 50 K., 6/6; 100 K., 7/6.
PHILIPS TRIMMERS, 0-10 pF, 3-30 pF, 1/-.
TRIMMERS, Ceramic. 30, 50, 70 pF, 9d.; 100 pF. 150 pF, 1/3; 250 pF, 1/6; 500 pF, 750 pF, 1/9.
TV etc. TRIMMER, 1000 pF, with knobs, 2/-.
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 10Ω to 10 meg. Ditto 5%, 10Ω to 22 meg., 9d.

WIRE-WOUND RESISTORS 10 ohms—10,000 ohms
5 watt .. 1/3
10 watt .. 2/-
15 watt .. 2/-
12.5K to 50K 10 w. 3/-

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

			Spare Plastic Reels
Double Play	7in. reel, 2,400ft.	60/-	
	5in. reel, 1,200ft.	37/6	
Long Play	7in. reel, 1,800ft.	35/-	3in. 1/6
	5¾in. reel, 1,200ft	23/6	4in. 2/-
	5 in. reel, 900ft.	18/6	5in. 2/-
Standard	7in. reel, 1,200ft	25/-	5¾in. 2/-
	5in. reel, 600ft.	16/-	7in. 2/6

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

CRYSTAL SET BOOKLET, 1/-.
CRYSTAL DIODE G.E.C., 2/-. **GEX34**, 4/-. **OA81**, 3/-.
HIGH RESISTANCE PHONES. 4,000 ohms, 15/- pr.
SWITCH CLEANER. Fluid squirt spout, 4/6 tin.

HIGH GAIN TV PRE-AMPLIFIERS BAND I B.B.C.

Tunable channels 1 to 5. Gain 18dB. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PCC84 valves if preferred.)
BAND III I.T.A.—Same prices. Tunable channels 8 to 13. Gain 17dB. Circuit and Coils only, 9/6.

1/16in. **Paxolin Panels**, 10 x 8in., 2/-.
Miniature Contact Cooled Rectifiers, 250V 50mA, 7/6; 250V 60mA, 8/6; 250V 85mA, 9/6; 200mA, 21/-; 300mA, 27/6.
TV etc., Silicon Sub-Min. Rectifier. 125V, 300mA, 6/6; 250V, 300mA, 14/6.
Selenium Rect., 300V 85mA, 5/-.
Coils Wearite "P" type, 3/- each.
Osmor Midget "Q" type, adj. dust core, from 4/- each. All ranges. List S.A.E.
Teletron D.W.R. L. and Med. T.R.F. with reaction, 4/-. Med. wave D.R., 3/6.
Ferrite Aerials, M., 8/9; M. and L., 12/6.
Osmor Ferrite Rod Aerials, L. and M. for transistor circuits, 10/- each.
Ferrite Rods, 8 x ⅜in., 3/-; 8 x 5/16in., 3/-.
H.F. Chokes, 2/6. **Osmor QC1**, 6/9.
T.R.F. Coils, A/HF, 7/- pair; HAX, 3/-. Repanco DRR2, 4/-. DRX1, 2/6.
Radio Screwdriver, 5in., 6d.
Neon Mains Tester Screwdriver, 5/-.
Solder Radiograde, 4d. yd., ½lb. 5/-.
Black Crackle Paint. Air drying, 3/- tin.

Aluminium Chassis, 18 s.w.g. Plain undrilled, 4 sides, riveted corners, 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; **Aluminium Panels**, 18 s.w.g., 12 x 12in. 4/6; 14 x 9in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/3; 8 x 6in., 2/-.

"6 + 1" TRANSISTOR RADIO MEDIUM AND LONG WAVE KIT

First class components to make a 6 transistor 2 wave band superhet chassis. Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, printed circuit, 8¼in. x 2¾in., but EXCLUDING speaker and cabinet. Simple instructions 1/6 (Free with kit).
Speakers, 35 ohm, 7 x 4in. 25/- 5in. 22/6, 3½in. 19/6. **£4.5.0**

BULGIN PLUGS AND SOCKETS. Non-reversible P74, 2-pin, 4/3; P73, 3-pin, 4/6; P194, 6-pin, 5/6
JACKS. English open circuit, 2/6. Closed circuit, 4/3. Grundig type, 3 pin. 1/3.
JACK PLUGS. English, 3/-; Screened, 4/-; Grundig, 3 pin. 3/6.
ALADDIN FORMERS and cores, ¼in., 8d.; ⅜in. 10d.
0.3in. FORMERS 5937 or 8 cans TV1 or 2, ⅜in. sq. x 2½in. or ⅞in. sq. x 1⅛in., 2/- with cores.
SLOW MOTION DRIVES. 6 : 1, 2/3.
SOLON IRON, 25W, 200V or 230V, 24/-.
ANTEX SUB-MIN IRON 15w. 200 or 240 v., 29/6.

JASON FM TUNER COIL SET

29/-. H.F. coil, aerial coil, oscillator coil, two i.f. transformers 10.7 Mc/s detector transformer and heater choke. Circuit and component book using four 6AM6, 2/6. **Complete Jason FMT1 Kit.** Jason chassis with calibrated dial, components and 4 valves, £6.5.0.

MAINS DROPPERS. Midget adjustable sliders, 0.3A, 1,000 ohms, 5/-; 0.2A, 1,200 ohms, 5/-; 0.15A, 1,500 ohms, 5/-; 0.1A, 2,000 ohms, 5/-.
MIKE TRANSFORMER. 50-1, 3/9.
P.V.C. Conn. Wire, single or stranded, 2d. yd.
Sleeving, 1 or 2 mm, 2d.; 4mm. 3d.; 6 mm. 5d. yd.
SPEAKER FRET. Gold cloth, 17 x 25in., 5/-; 25 x 35in., 10/-. **Tygan**, various colours, 52in. wide from 10/- ft.; 26in. wide, from 5/- ft. Samples, S.A.E. Expanded Metal, Gold, 12 x 12in., 6/-.

TELEVISION REPLACEMENTS

Line Output Transformers
from 45/- each, NEW Stock
and other timebase components. Most makes available. S.A.E. with all enquiries

WEYRAD

COILS AND TRANSFORMERS FOR 2-WAVE TRANSISTOR SUPERHETS WITH PRINTED CIRCUIT AND FERRITE ROD AERIAL

Long and Medium Wave Aerial—RA2W On 6in. rod, 208pF tuning.	12/6
Car Aerial Coil	1/-
Osc. Coil P50/1AC. 176pF tuning.	5/4
1st and 2nd I.F. Trans.—P50/2CC, 470kc/s 11/16in. dia. by ⅞in.	5/7 each.
3rd I.F. Trans.—P50/3CC.	6/-
Spare Cores	6d. each.
Driver Transformer—LFDT4.	9/6
Wavechange Slide Switch.	3/6
Printed Circuit—PCA1. Size 2⅞ x 8¼in. Ready drilled and printed.	9/6
Volume Control, 5KDP.	4/6
7 x 4in., 35 ohm Speaker.	25/-
3½in. round 35 ohm speaker.	19/6
24 Fixed Resistors.	10/6
16 Fixed Condensers.	21/-
Tuning Gang with trimmers.	10/6
6 Mullard Transistors and diode.	42/6
Constructor's Booklet.	2/-

Circuit and Details S.A.E.

NEW MULLARD TRANSISTORS OC71 6/-, OC72 7/6, OC81D 7/6, OC81 7/6, OC44 8/9, OC45 8/9, OC171 10/6, AF117 9/6

Sub Miniature Condensers. 0.1 mFd, 30 v, 1/3. 1, 2, 4, 5, 8, 16, 30, 50, 100 mFd. 15 volt 2/6 each. Transistor Holders 1/3.

B.B.C. Pocket 2 Transistor. M.W. and L.W. Radio Kit, 22/6. Miniature earpiece, 7/6. Batt. 2/3. Circuit details, etc. S.A.E.

MONARCH RECORD PLAYER

Kit with ready built amplifier, speaker and cabinet. carr. and ins. 5/- **£12.10.0**

Garrard deluxe auto-player kit

£12.19.6 Carr. and ins. 5/- details S.A.E.

GARRARD QUALITY AUTO-CHANGER, 4-speed, with plug-in xtal head. Ready built 2-valve amplifier, Loudspeaker and contemporary styled Portable Player Case.

All items guaranteed to fit together perfectly, can be assembled in thirty minutes, full instructions supplied.

4 Speed Autochanger, B.S.R., U.A.14	£7.10.0
B.S.R., U.A.12 Stereo/Mono.. ..	£8.5.0
Garrard Model Autoslim	£7.19.6
4 Speed Single Players, EMI with auto stop	£6.5.0
E.M.I. with separate pick-up ..	£3.9.6
Amplifier player cabinets	70/-
2-valve amplifier and 6½in. speaker ..	95/-
3-valve amplifier and 6½in. speaker ..	105/-

Wired and tested ready for use with above.
Replacement sapphire styli available from 6/-.
Replacement Xtals from 21/-; Stereo from 35/-.

SINGLE PLAYER KITS

£8.15.0 post 4/6.

With ready-built, 2 stage, 3 watts output amplifier. High flux 5in. speaker. Handsome portable case 13 x 10¼ x 7½in. Collaro 4-speed junior motor. LP/Std xtal pick-up for 7, 10, and 12in. records.
FEW ONLY KITS AS ABOVE but with 3-speed **B.S.R. Motor** **£7.15.0** complete (Post 4/6)

CABY MULTIMETER

Moving-coil Model M.1. 54/-

Measures D.C. or A.C. 6 v., 30 v., 120 v., 600 v., 1200 v. D.C. 30 mA. 300 mA. Ohms 0-001 k. Leaflet S.A.E.

ARDENTE Transistor Transformers

Type D3035, 7.3 CT; Push-Pull to 3 ohms for OC72, etc., 1 x ¾ x ⅝in. 9/6
Type D3034, 1.75 : 1CT. Push-Pull Driver for OC72, etc., 1 x ¾ x ⅝in. 9/6
Type D3058, 11.5 : 1 Output to 3 ohms for OC72, etc., 1 x ¾ x ⅝in. 9/6
Type D167, 18.2 : 1 Output to 3 ohms for OC72, etc., ¾ x ½ x ½in. 12/-
Type D239, 4.5 : 1 Driver Transformer, 10/-
Type D240, 8.5 : 1 Driver Transformer, 10/-

ARDENTE VOLUME CONTROLS

Type VC1545, 5K with switch, dia. 0.9in., 5/3.
Type VC1760, 5K with switch, dia. 0.7in., 10/6
Deaf aid earpiece xtal or magnetic, 7/6.

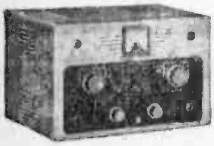
COMPONENT SHOP SPECIALISTS

Post 1/-, unless otherwise stated. *C.O.D. 2/-.*

337 WHITEHORSE ROAD WEST CROYDON

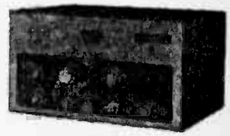
Telephone: **THO 1665**
(Export welcome. Send remittance and extra postage).

Easy-to-build kit-sets of **Heathkit** *highest quality at lowest cost*


DX-40U

AMATEUR TRANSMITTER. Model DX-40U. Self-contained. 80-10 m. Power Input 75 w. CW., 60 w. peak, C.C. phone. Output 40 w. to aerial. Provision for V.F.O. **£33.19.0**

AMATEUR TRANSMITTER. Model DX-100U Covers all amateur bands, 160-10 m. 150 w. D.C. input, self contained with power supply. Modulator, V.F.O. **£74.19.0**

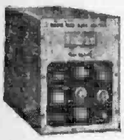

DX-100U

AUDIO SIGNAL GENERATOR. Model AG-9U. 10 c/s-100 kc/s, switch selected. Distortion less than 0.1%. 10 v. sine wave output metered in volts and dB's £21.9.6

VALVE VOLTMETER. Model V-7A. Measures volts to 1,500 (D.C. and R.M.S.) and 4,000 pk to pk. Res. 0.1 Ω-1,000 M Ω. D.C. input impeded. 11 MΩ. With test prods, leads and standardising battery £13.18.6

R.F. SIGNAL GENERATOR. Model RF-1U. Gives accurate source of R.F. up to 100 Mc/s on fundamentals and 200 Mc/s on harmonics. Up to 100 mV output on all bands. ... £12.15.6

SINGLE SIDEBAND ADAPTOR, Model SB-10U


SB-10U

May be used with most A.M. transmitters. Less than 3W R.F. input power required for 10W output. Operation on 80, 40, 20, 15 and 10m bands on USB, LSB or DSB **£39.5.0**

HI-FI 18W STEREO AMPLIFIER Model S-99. Ganged controls. Stereo/mono gram, radio and tape recorder inputs. Push-button selection. Printed circuit construction £27.19.6


S-99

HI-FI AM/FM TUNER. Tuning range: FM: 88-108 Mc/s. AM: 16-50, 200-550, 900-2,000 m. Tuning heart (£5.5.6 incl. P.T.) and I.F. amplifier (£20.13.0) sold separately. Printed circuit board ... ... Total £25.18.6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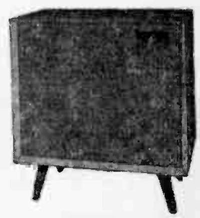
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Practical Wireless

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The Social Side

THE amateur radio enthusiast is singularly well served in the various outside activities arranged for his interest and entertainment. Perhaps this is often taken for granted but it is interesting to reflect that there are probably more public exhibitions relating to radio, audio and electronics than for any comparable subject.

There are exhibitions galore, from the brash, brassily commercial glitter of the National Radio Show to the more sedate specialist affairs such as the Physical Society's Exhibition. There is the Radio Communications Exhibition, the International Audio Fair and many others either directly associated or closely linked with the radio enthusiast's field of activity or of borderline interest.

The radio enthusiast is, by and large, a gregarious being, though he retains a sturdy individuality, so that apart from keeping him up-to-date on new developments these exhibitions provide an opportunity to relax with fellow enthusiasts and to discuss ideas, problems and to formulate new plans.

The big shows, however, are concentrated in the large cities (mainly London). But there is another source of entertainment and instruction of a more parochial nature and perhaps because it is purely altruistic gets closer to the heart of things—the local radio club.

There are dozens of them all over the country: big ones and small ones, ambitious ones and modest ones. But they all serve the same useful purpose—entertainment and instruction, social contact and practical activity.

Local radio clubs offer so many advantages that it is surprising they are not all overwhelmed with prospective members. Beginners and experts alike find many added hours of enjoyment to their hobby in the local club. Social, economic and educational barriers rarely exist, if at all, in such clubs. The beginners can obtain guidance and the advanced enthusiasts have the incentive of friendly competition.

And if you have no local radio club, remember that it only needs one or two keen sponsors to get one going; many of the established clubs began in very humble circumstances.

Seasonal Greetings

to all our readers

from the Editor and Staff of

Practical Wireless

Our next issue dated February will be published on January 4th.

ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of September, 1962, 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	634.290
Home Counties	589.869
Midland	425.631
North Eastern	450.548
North Western	385.556
South Western	346.938
Wales and Border Counties	196.242
Total England and Wales	3,029.074
Scotland	322.523
Northern Ireland	108.843
Grand Total	3.460.440

Commemoration for Morse

SAMUEL MORSE, the originator of the Morse code, is commemorated by an L.C.C. plaque at 141 Cleveland Street, St. Marylebone. It was unveiled recently in the presence of G.P.O. employees and representatives of the Royal Institute of Electrical Engineers.

When he was 20, Morse came to London to study art. His first contribution to the science of communication was discovering a method of making a permanent record of electro - magnetic impulses which were already being used to transmit messages by swinging a needle from letter to letter on a dial. He also made experiments in submarine telegraphy.

Radio in a Pair of Sunglasses

AN ingenious idea for housing a radio receiver has been produced recently by an American firm, the parts being built into the side pieces of a pair of sunglasses.

Burton Transistor Radio Sunglasses, as they are called, are complete with a tuning control and earphone, with an aerial which does not always have to be used.

Worn as ordinary sunglasses, the radio is tuned by a dial on the left earpiece. The glasses can be fitted with lens to any prescription.

This latest radio novelty comes from Precision Electronics, of California, U.S.A.

New Outside Broadcasts Base at Bristol

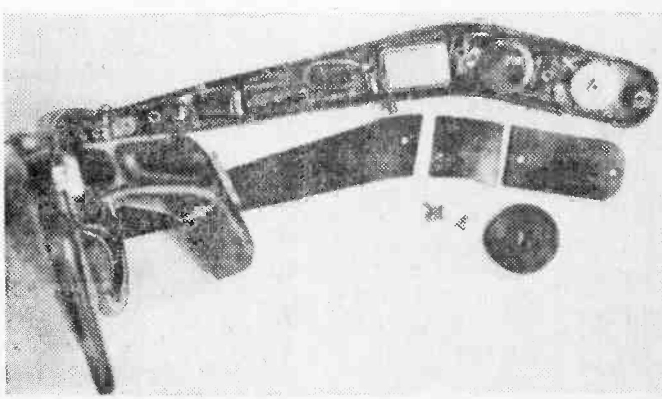
WORK has begun on the BBC's new West Region sound and television outside broadcasts base to be built on a site in Belgrave Road, Bristol. The new base will consist of a garage 200ft by 72ft for the outside broadcast vehicles, workshops and test rooms for the maintenance of the vehicles and their technical equipment and stores. Demolition work to clear the site of the existing buildings has begun and will be followed by the building, which is expected to take about 18 months.

The new base will replace the existing sound outside broadcast base at Whiteladies Road and the television base at Whitchurch Airport; it will be the headquarters of the BBC teams which cover the whole of the west and south west of England.

The vehicles used for sound broadcasts consist of recording cars for news and topicality programmes and a mobile control room for live contributions to the sound services.

Fifth Jamboree on the Air

FROM 00.01 hours G.M.T. on October 20th until 23.59



The latest radio novelty from America; a receiver in a pair of sunglasses.

hours G.M.T. on October 21st Scout radio enthusiasts all over the world were once again trying to contact each other during this year's two-day Jamboree-on-the-Air.

Stations were set up in many parts of the country with the help of local amateur radio clubs, one of the biggest being at Baden-Powell House in South Kensington, where, under the call sign GB3BPH, five separate transmitters were sending out the international call sign for the event, "CQ Jamboree".

For radio-minded visitors to Baden-Powell House during the event, communication receivers enabled them to "listen in". Other items of interest were on show, with licensed radio amateurs available to answer questions.

Change of Third Programme Frequency

ON November 1st the frequency of the Third Programme / Network Three transmitter at Les Platons (Channel Islands) was changed from 94·45Mc/s to 94·75Mc/s in accordance with international agreement (the revised Stockholm Plan of 1961). This means that the station appears at a slightly different position on the tuning dial, probably between ⅛in. and ¼in. from the old one.

Listeners who have v.h.f. receivers on which the three sound programmes are selected by a switch or push-button (such as some combined television and v.h.f. receivers) need to have the pre-set tuning adjusted inside the receiver for reception of the Third Programme and Network Three. This is a simple matter which a radio dealer can deal with in a few minutes.

Improving Acoustics of a Large Church

A SOUND reinforcement system has been supplied and installed in the Church of St. Peter, Rugby, by the Sound Equipment group of the AEI Electronic Apparatus Division to overcome the poor acoustics in the building.

Members of the congregation seated between the middle and back of the lofty nave have found it very difficult to hear clearly because of reverberation and echo. AEI engineers have now overcome the problem by siting six reinforcement loudspeakers at a number of points down the length of the church.

Microphones are mounted on both pulpit and lectern, ribbon types being selected for pick-up sensibility and sensitivity. Signals from the microphones are amplified by means of a two-way transistorised mixer unit and a conventional dual-channel power amplifier, each channel providing 10W of audio power to feed the loudspeaker units.

Dr. Kenzo Nagai and Dr. Shun-Ichi Iwasaki of Tokyo University, Japan, inspecting a tape recorder during their recent visit to an EMI factory.

Radio Telecommunications Project Nearing Completion in Angola

NOW nearing completion in Angola is an extensive multichannel network of trunk radio-telephone and telegraph channels connecting all the main centres of population in the territory.

The initial contract was awarded to the Marconi Co. and Automatic Telephone and Electric Co. Ltd. in late 1957 and subsequent contracts for the entire scheme were also placed with these companies.

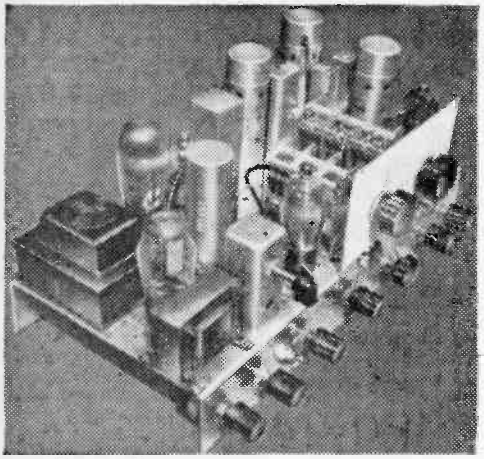
The main artery of the system connects Luanda, the capital, with Lobito, a main port, whilst other spur connections link Villa Marechal, Carmona, Malange, Benguela and Sa Da Bandeira.

All the links with one exception use Marconi v.h.f. terminal and repeater stations in duplicate, with automatic changeover to standby in the event of failure of an operational unit. The exception is the connection from Lobito to Benguela, for which a higher traffic capacity was demanded and which uses u.h.f. equipment.

Japanese Visitors

DR. KENZO NAGAI, professor at Tokyo University, where he is director of the Research Institute of Electrical Communication, was accompanied by Dr. Shun-Ichi Iwasaki, of the same institute, when he recently visited the Hayes plant of EMI Electronics Ltd.

Demonstrations were given of the company's range of professional tape recorders and the visitors were able to inspect experimental sound recording equipment in the EMI development laboratories.



General Purpose COMMUNICATIONS RECEIVER

by R. F. Graham

THIS is a 10-valve receiver (including rectifier) and covers approximately 19Mc/s to 550kc/s (16 to 550m) in four wavebands. A long-wave band may readily be added, if required. Bandspread tuning is included, and is very useful on the congested short wave frequencies. There are also noise-limiter, beat-frequency oscillator, and frequency marker stages as these features are often of aid in a communications type receiver.

It is recommended that the inexperienced constructor should test the receiver with coils installed for one band only. It is then easy to add the other coils, and this system avoids errors in band switch wiring.

The receiver uses octal valves, because of their low cost, easy availability, and general robustness. Building costs can be much reduced by using cheap, surplus components, and this is in order, for such items as capacitors, resistors, valveholders, mains transformer and choke, and similar parts. Doubtful components should, of course, be tested before use.

Complete Circuit

This is shown in Fig 2. V1 is an r.f. amplifier, and V2 the frequency changer. VC1A, VC2A and VC3A are the usual 3-gang tuning capacitor, which is operated by a ball drive. It is employed for general tuning, and also for band-setting. VC1B, VC2B and VC3B are a low-capacity 3-gang capacitor, used for band-spreading, and also operated by a ball drive. Accurate tuning over a narrow band of frequencies is possible with this capacitor. VC1C is a panel mounted aerial trimmer, and VC2 is a similar frequency changer trimmer, the oscillator circuit using the fixed trimmer TC1. This arrangement avoids the need for the twelve preset capacitors, which would otherwise be necessary, and also assures maximum efficiency on all parts of each band. In practice it is extremely difficult to obtain exact ganging throughout a band with fixed trimmers, so the use of panel trimmers avoids inefficiency from this reason and also allows the aerial circuit to be trimmed to suit any aerial which may be connected.

Separate oscillator and mixer stages were not found to be justified in this circuit. The r.f. stage helps to increase sensitivity and reduces 2nd channel interference.

Two i.f.t.'s are used as an i.f. filter between valves V2 and V3, and this circuit gives good selectivity. Two further i.f.t.'s are used in the following stages and a tuning meter can be plugged into the anode circuit of V4 if required. The screen grid of V4 is fed from the potential divider R14 and R15 in order to secure a greater change in anode current for a given a.v.c. voltage, to increase meter readings.

V5 provides a.v.c. and audio amplification, a small a.v.c. delay voltage being obtained across R22. V6 acts as detector and noise limiter. The noise limiter is very effective in reducing static type noise, but causes a slight deterioration in audio quality, so this stage can be cut out by means of the noise limiter switch S2. The limiter itself is of the type which automatically adjusts to carrier level.

V6 is the output stage, and V10 is the rectifier. A standby switch is provided. With the receiver in the standby position, all valve heaters are on, but h.t. is removed, R35 and R36 acting as a bleeder. This allows instant switching on and off (without waiting for heaters to warm up) and is also useful when working the receiver in conjunction with a transmitter.

V8 is the beat frequency oscillator, which is switched in when c.w. morse is to be received. It will be appreciated that if there is no interest whatever in c.w. morse, then this stage can be omitted. The b.f.o. is not required for ordinary reception of speech and music, so its h.t. supply is interrupted by the b.f.o. switch.

Crystal Marker

V7 is a crystal marker, using a similar circuit to those found in the more expensive communications receivers. When the marker is switched on, h.t. is applied to V7, and the marker signal is taken to the aerial circuit through C34. This allows exact calibration of the bandspreading and bandsetting capacitors, and also allows a narrow band of frequencies to be tuned with great accuracy, by adjusting the bandsetter knob to the marker signal.

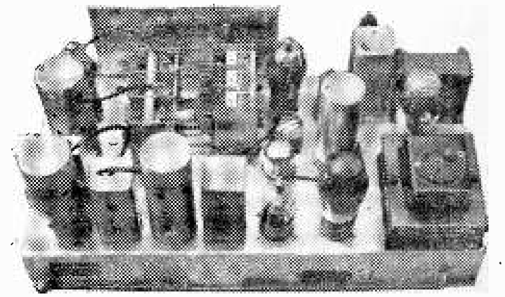
VR1 is a manual control of sensitivity, connected to the cathode circuits of V1, V3 and V4, and the a.v.c. switch S3 allows the a.v.c. system to be rendered inoperative, so that gain may be controlled manually by VR1. This is sometimes necessary for c.w. reception, or in other circumstances. VR2 is the usual audio gain control.

In addition to the a.v.c. switch and mains on/off switch S5, two combined function switches are provided. The switch for the marker and noise limiter (S2) has three positions: (1) marker on, (2) noise limiter in, (3) noise limiter out; the marker being off in positions (2) and (3). The remaining switch (S4) also has three positions: (1) receiver on and b.f.o. off, (2) standby, (3) receiver and b.f.o. on. Position (1) is for "Phone" (speech and music) reception, and position (3) is for "c.w.".

Chassis

This should be of stout gauge aluminium, and can be about 8½in. x 16in. x 2½in. The layout of the major components is shown in Fig. 1, and all large holes for valveholders and other parts should be drilled before mounting any components.

The two 3-gang variable capacitors are mounted so that their spindles are at the same height. An aluminium plate 7in. x 5in. is bolted to the front runner of the chassis, and has two holes to clear the ball drives. The lugs of these drives are bolted to this plate. The capacitor sections are wired in parallel, as in Fig. 1. These leads are taken to the



General view of the receiver top viewed from the back.

lower tags of the capacitors, but are clear of the chassis. The trimmer TC1 is soldered to a tag bolted to the capacitor frame. Leads from VC1A, VC2A and VC3A pass directly from the lower tags, through the chassis, to the band switch.

The 3-gang bandspreading capacitor is of about 20pF to 30pF maximum capacity. This can be made by removing plates from an ordinary 3-gang capacitor, as these are available cheaply. Low capacity 3-gang components are also sometimes available as surplus. Three small capacitors with extended spindles, ganged with couplers, could also be used. A 2-gang bandspreading capacitor, wired to VC2A and VC3A is also feasible, the panel trimmer VC1C then being used for adjustment of the aerial circuit, which does not tune sharply. A new gang capacitor of low value is relatively expensive.

Positions of the controls under the chassis will be seen from Fig. 3. A piece of aluminium about 2¾in. x 8½in. is bent to form the screen which also supports the frequency changer (V2) trimmer VC2C, and band switch S1. Both panel operated

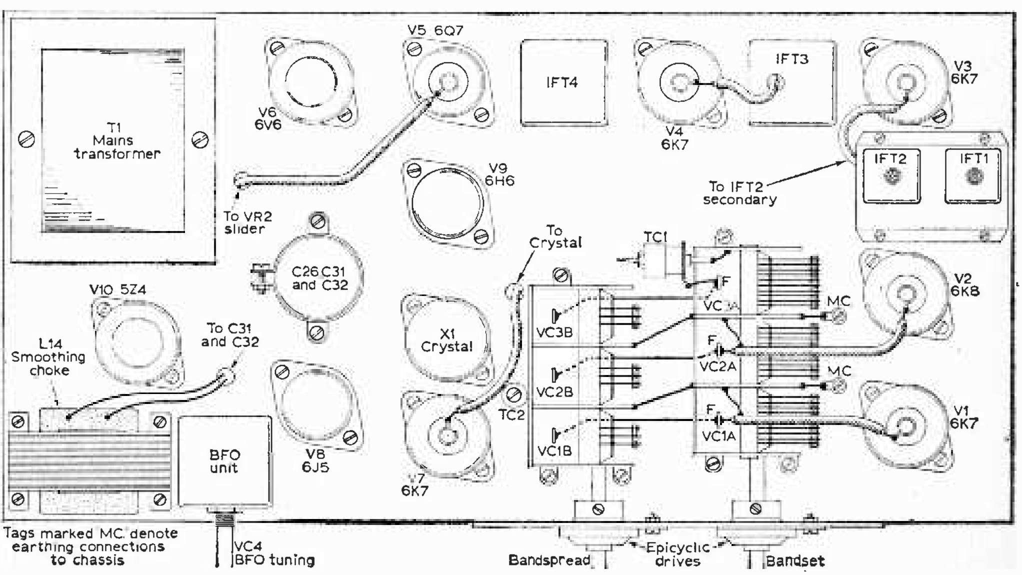


Fig. 1: Top of chassis layout showing location of components.

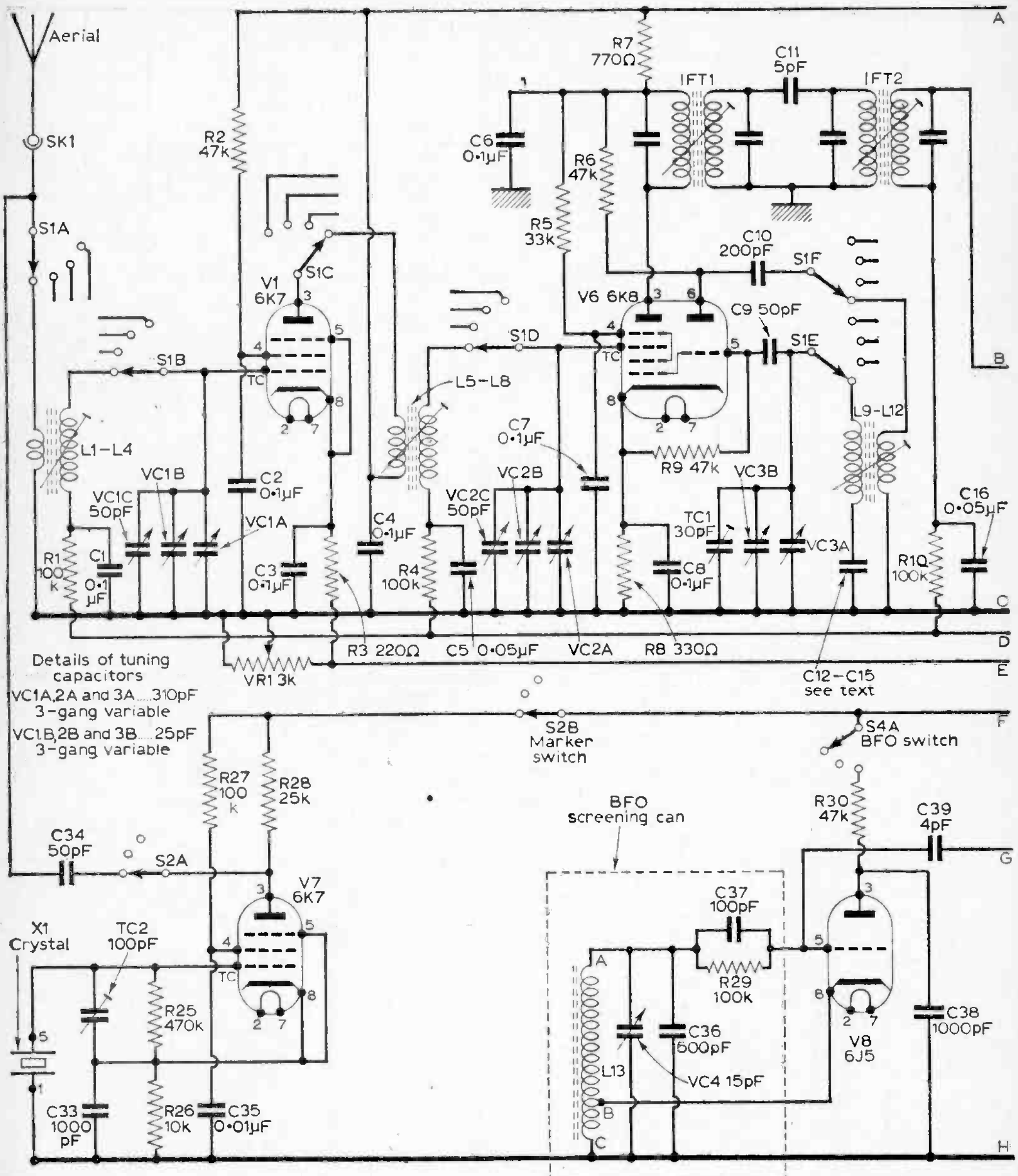


Fig.—2.

trimmers are miniature air-spaced variable capacitors, and about 40pF to 60pF will be suitable. The frequency changer stage trimmer requires an extension spindle, coupling, and bush.

Band Switch

The band switch S1 can best have an individual wafer for each circuit, that is, six wafers in all. These items will also be found from time to time in surplus lists, as a new switch of this kind is relatively expensive. Only 4-ways are required, for the four bands. If long waves are to be added, each wafer should be 5-way. Surplus 6-way and similar switches are suitable, unused contacts being ignored. The switch is dismantled so as to pass its spindle and rods through holes in the screen mentioned. This screen is bolted to the chassis, and makes the switch rigid.

In order that actual wiring can be as straight-

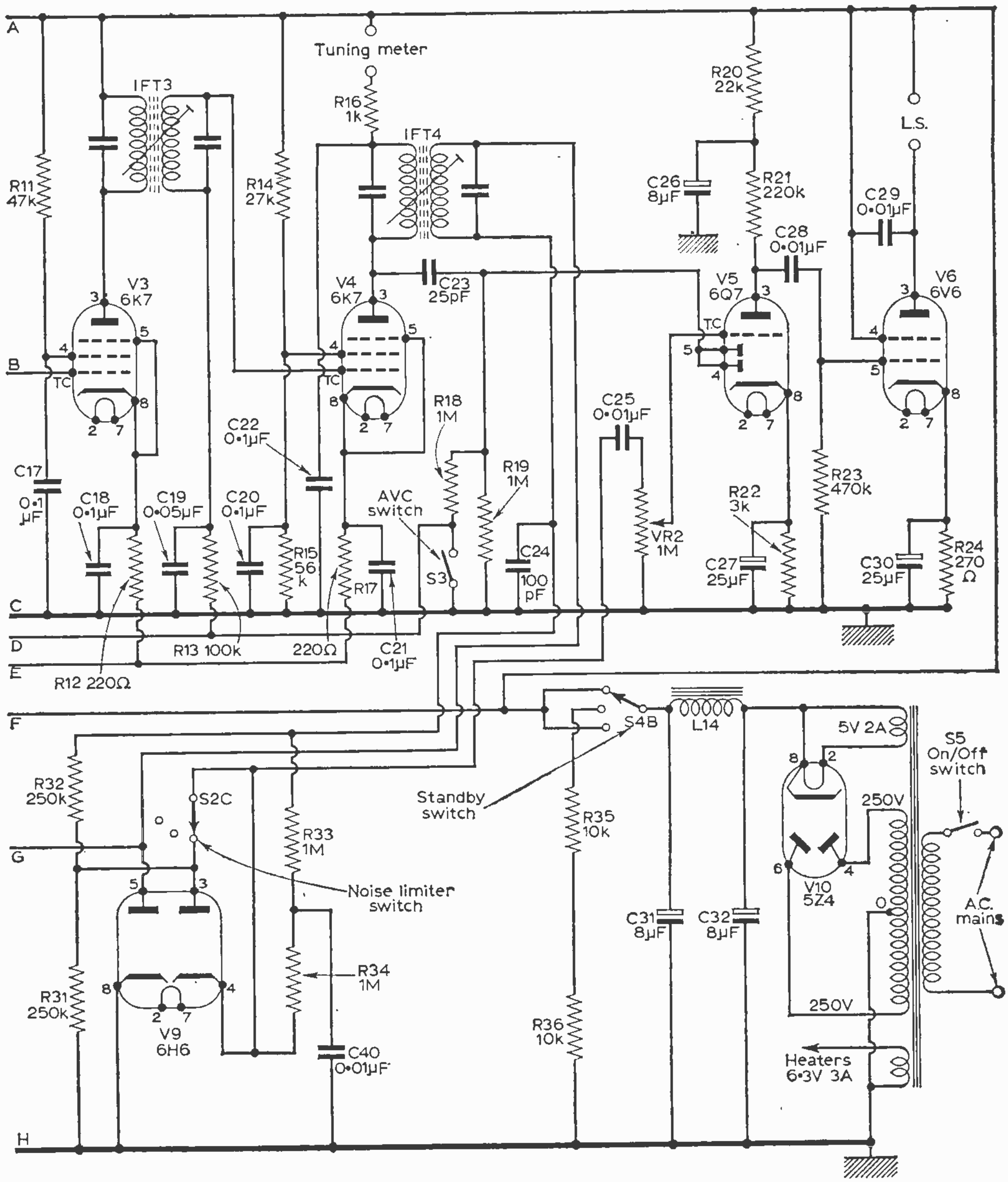


Fig. 2: The drawings on these two pages show the complete circuit diagram of the general purpose communications receiver. A complete parts list is given overleaf on page 800.

forward as possible, it will be found convenient to deal with one stage at a time. The more experienced constructor may, of course, prefer to wire the whole receiver, before testing it. If not, work may proceed in the order described.

Power Circuit

The mains transformer, rectifier (V10) and smoothing circuit (choke L1 and C31 and C32) may be wired first. At the same time, all the heater wiring can be completed, because these leads should be run close in contact with the chassis. Heater circuits are completed through the chassis. A tag should be secured under each nut, when mounting the valveholders, to form earthing points, marked MC. Keep heater wires clear of tags 3, 4 and 5 of V9, to avoid hum.

The h.t. section of the standby switch may be wired at this stage, if preferred. Connections to this switch are shown in Fig. 4. If a check is to be made, test that 6·3V a.c. is available at tags 2 and 7 of each valveholder, and that a d.c. h.t. voltage of roughly 250 is obtained across C31, with the switch in the standby position.

Frequency Changer

V2 is the frequency changer. Wafer 4 of S1 is used to select the coil primaries, and wafer 3 is wired to VC2A fixed plates, and to the frequency changer trimmer. The switch is turned to the appropiate position, and the M.W. coil L8 is connected. Wafers 5 and 6 are used for the oscillator coils, and L12 is the M.W. oscillator coil, with 470pF padder C15. A lead passes from wafer 5 to VC3A.

The description of the circuit will be continued in the next issue.

COMPONENTS LIST

Resistors

R1	100kΩ	R13	100kΩ	R25	470k
R2	47kΩ	R14	27k 1W	R26	10k
R3	220Ω	R15	56kΩ	R27	100k
R4	100kΩ	R16	1kΩ	R28	25k
R5	33kΩ	R17	220Ω	R29	100k
R6	47kΩ	R18	1MΩ	R30	47k
R7	770Ω	R19	1MΩ	R31	250k
R8	330Ω	R20	22kΩ	R32	250k
R9	47kΩ	R21	220kΩ	R33	1M
R10	100kΩ	R22	3kΩ	R34	1M
R11	47kΩ	R23	470kΩ	R35	10k 2W
R12	220Ω	R24	270Ω 1W	R36	10k 2W

All 10%, ½W except where otherwise stated.
VR1 3k wire-wound potentiometer.
VR2 1M potentiometer with switch (S5).

Capacitors:

C1	0·1μF 150V	C13	4500pF mica
C2	0·1μF 350V	C14	2500pF mica
C3	0·1μF 150V	C15	470pF mica
C4	0·1μF 350V	C16	0·05μF 150V
C5	0·05μF 150V	C17	0·1μF 350V
C6	0·1μF 350V	C18	0·1μF 150V
C7	0·1μF 350V	C19	0·05μF 150V
C8	0·1μF 150V	C20	0·1μF 350V
C9	50pF mica	C21	0·1μF 150V
C10	200pF mica	C22	0·1μF 350V
C11	5pF mica	C23	25pF mica
C12	4700pF mica	C24	100pF mica
C25	0·01μF tubular paper		
C26	8μF 350V		
C27	25μF 12V		
C28	0·01μF mica		
C29	0·01μF tubular paper		
C30	25μF 25V	C35	0·01μF 350V
C31	8μF 350V	C36	500pF mica
C32	8μF 350V	C37	100pF mica
C33	1000pF mica	C38	1000pF mica
C34	50pF mica		
C39	4pF ceramic (see text)		
C40	0·01μF tubular paper		

VC1A, VC2A and VC3A: 310pF or 500pF 3-gang variable
VC1B, VC2B and VC3B: 25pF or similar 3-gang variable
VC1C 50pF miniature variable
VC2C 50pF miniature variable
VC4 15pF miniature variable
TC1 30pF air-spaced beehive trimmer
TC2 100pF trimmer

Aerial Coils:

L1	Band 1	16 to 35m	QA2	(Osmor)
L2	Band 2	33 to 85m	QA3	
L3	Band 3	75 to 210m	QA4	
L4	Band 4	200 to 550m	QA8	

Mixer Coils:

L5	Band 1	QHF2	Osmor
L6	Band 2	QHF3	
L7	Band 3	QHF4	
L8	Band 4	QHF8	

Oscillator Coils:

L9	Band 1	Q04	Osmor
L10	Band 2	Q03	
L11	Band 3	Q04	
L12	Band 4	Q08	

L13 B.F.O. coil—see text
L14 L.F. smoothing choke 5H 100mA

I.F. Transformers:

IFT1, IFT2 Miniature I.F. transformers, 470 kc/s.
IFT3 Standard I.F. transformer, 470 kc/s.
IFT4 Standard I.F. transformer, 470 kc/s, for detector stage
T1 Mains transformer: Tapped Primary. Secondaries: 250-0-250V 100mA; 6·3V 3A; 5V 2A.

Switches:

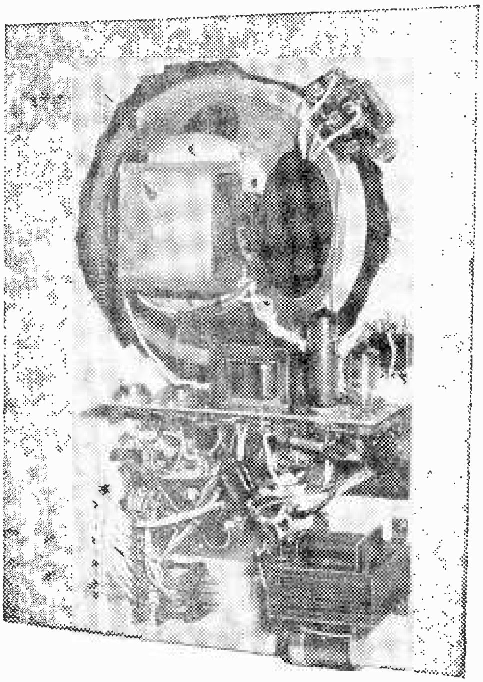
S1 6-wafer switch. Each wafer 1 pole, 4-way
S2 3-pole, 3-way miniature rotary switch
S3 On/off toggle switch
S4 2-pole, 3-way wafer switch
S5 On/off toggle switch (combined with VR1)
SK1 coaxial socket
X1 100 kc/s crystal (see text)

Valves:

V1	6K7	V6	6V6
V2	6K8	V7	6K7
V3	6K7	V8	6J5
V4	6K7	V9	6H6
V5	6Q7	V10	5Z4

Miscellaneous:

Eleven octal valveholders. Extension coupling. Knobs. Two ball-drives. Two 2-way socket strips. Loudspeaker with output transformer to match 5,000Ω. Valve screens, and cap clips. Chassis 8½ x 16 x 2½in. approx. Aluminium for screen, etc.



Central Control Amplifier

By E. McLoughlin

A MASTER CONTROL UNIT FOR AN AUDIO INSTALLATION

(Continued from page 705 of the December issue)

As already mentioned, this stage is not intended to give further voltage gain except for a very slight increase of final output voltage to compensate for line losses on the way to the distant loudspeakers in the other rooms. The output *voltage* is designed to be, apart from this last consideration, a true replica of the voltage at the speech-coil of the internal loudspeaker. But the line voltage is designed to be largely maintained, regardless of the exact number of loudspeakers switched on to the line. Thus, the transistor stage gives a *power-gain* of amount according to the number of loudspeakers operated on the line at any given time. Power gain without voltage change represents impedance step-down function, which is thus the ultimate function of this stage, in common with all circuits of the "cathode-follower" class, to which this circuit belongs.

Looking at the theoretical circuit of this stage in Fig. 2 it is apparently very simple indeed, needing few parts in all, and one might think that construction would be quite non-critical. But, upon experimenting in the course of designing this circuit in the author's workshop, a number of rather critical factors were discovered. These are basically threefold. Firstly, the setting of a suitable *operating point* for the transistors was very critical, and as the transistors are designed to run *very hot* (quite normal for this kind of transistor) during operation measures must be taken to counteract thermal-drift of the operating point as well as to ensure adequate cooling of the transistors. Secondly, the precise design of the transformers T4 and T5 was found to be highly critical and some considerable experimenting, involving repeated re-winds and comparative measurements, was needed until the factors involved were clearly understood and a fully satisfactory final design could be wound. Fig. 6 gives summarised details on this work on T4 and T5. The third critical point is connected with obtaining sufficient l.t. supply voltage at the required current and sufficient audio shunting of all internal impedances of the power supply and the biasing arrangements, even at the lowest frequency to be passed (nominally 35c/s). This involved the ultimate necessity for quite large capacities for C4, 5, 6, 7. Most particularly is C7 important and this has the largest capacity of all—5,000μF. This is because here the working impedance is lowest of all and insufficient capacity for C7 causes *considerable* loss of low-frequency power across R1 and the internal impedance of the power supply. For this reason, too, C6 and C7 have been returned to *chassis* and not placed directly in parallel with the operative bias resistors VR1 and R1, so that effective capacities are not reduced by virtue of C6 and C7 otherwise being in series with C5 of the power supply for audio purposes. This arrangement has the added advantage that a greater total *D.C.* voltage exists across C6 and C7, enabling the dielectric to form itself easily and properly.

It must be *stressed* that C7 *must* have at least the specified capacity. Use a greater capacity by all means if available—this is likely to give even better low-frequency performance when *many* loudspeakers are on the output line, but the specified value of 5,000μF was found to be the best compromise between satisfactory performance and tolerable price. It would, at a pinch, be possible to use 9V working capacitors to save expense, but these might under certain circumstances break down.

If C7 has insufficient capacity the internal source impedance of the output will rise so much that most of the constant-voltage benefits may be lost and performance then be little better than feeding the line direct from the EL84 output. The same great fall in performance results if T4 and T5 are not of optimum characteristics and therefore a discussion follows now on these items.

Reckoning a nominal output power of some 10W from a stage, and a nominal differential current gain of 50 for the particular type of transistors specified, some 200mW drive are required to be supplied through T4. If the presence or absence of T4 is, therefore, not to affect matching at the EL84 to any appreciable extent, then T4 must never demand more than about 10% of the total power delivered by the EL84.

The primary inductance of T4 must be just large enough not to consume too much current from the EL84 at the design low-cut-off frequency (35c/s). The 10% maximum condition would demand an effective load of about 40 to 50Ω, which may be halved at the low-cut-off frequency. Consequently the primary of T4 should have an impedance of some 20 to 30Ω at 35c/s, which is satisfied by an inductance of about a tenth of a Henry.

It is then necessary to find out how many turns will give this inductance on the core of an old loudspeaker transformer stripped of all original windings. As no nett d.c. now flows, the E/I stampings should be stacked on *alternate* sides in the new design, giving higher inductance per turn.

Wind on roughly some 200 turns of about 0·5mm diameter wire and insert the stampings. Then connect the windings to a 6·3V a.c. supply, measure the current drawn with an a.c. ammeter in series, and calculate the effective impedance at 50c/s through Ohm's Law. Neglecting the d.c. resistance, and dividing the impedance value thus obtained by 300, we get the inductance value in Henrys for the trial winding.

Divide value by the desired inductance value (one tenth of a Henry), and take the square-root of the result. Multiply this factor by the number of turns on the trial-winding to obtain the correct number of turns on the proposed core for the sible wire diameter should be primary of 74. The largest pos- used: 0·3 to 0·4mm diameter enamelled copper should be satisfactory.

The choice of turns-ratio is now governed by the requirement to make simultaneous maximum use of the full linear range of the characteristic of the EL84 and the transistors under the given operating conditions.

Linear Range

A steady 1V is dropped across R1 under the specified conditions. The minimum collector to emitter voltage for maintenance of "pentode" characteristics in the earthed-collector circuit for the 2N257 is stated at 1·5 to 2V (called "knee-voltage"). Thus, with 7·5V supply voltage, some 4·5V peak linear swing at the emitter-loads are realisable, representing some 3V r.m.s. requiring a drive of 3·25V r.m.s. at the bases.

The EL84 delivers some 3W into 4Ω, thus developing an r.m.s. voltage of 3·5V. Consequently T4 must have a step-down ratio of 3·5 to 3·25. Thus each half of the secondary must have 13/14 of the number of turns of the primary.

Use the same diameter wire throughout. The primary comes first on to the bobbin, in neat layers. Then the secondary, wound right through in the same direction, and accurately centre-tapped. If a mistake is made in the precise total number of turns, that does not matter much as long as the error is not more than one or two turns, but if the centre-tap is not at the exact numerical centre, consequences could be serious.

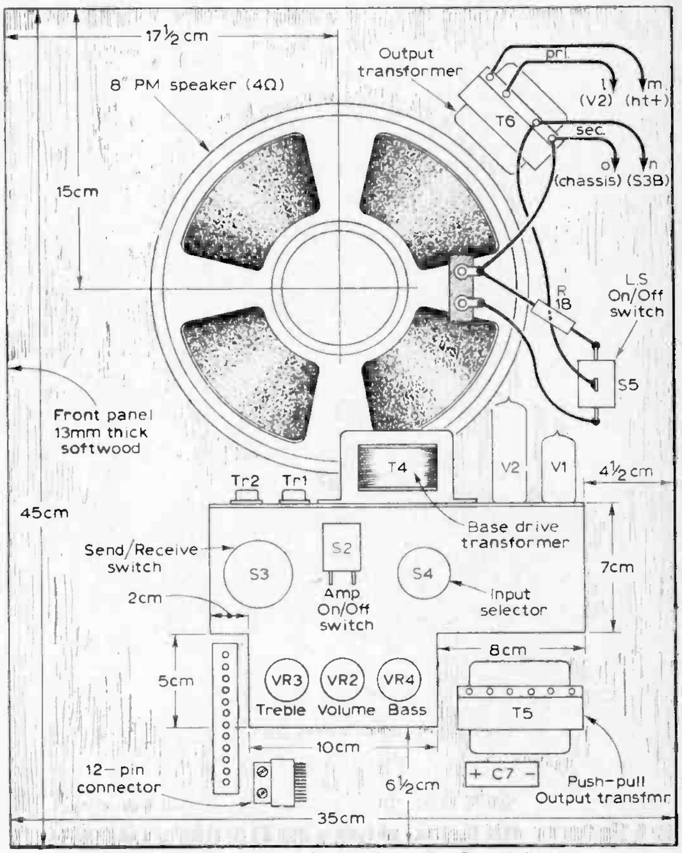


Fig. 4: The component layout diagram of the lid-unit.

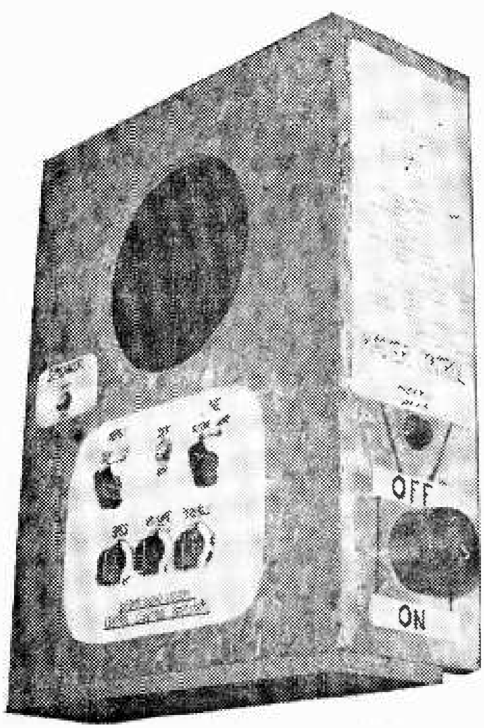
The performance would not be affected up to some 4W total output from the stage, for which the stage remains in class A (neither transistor cuts off on peaks), but at greater drive, when transition to Class AB takes place, with transistors cutting off on alternate peaks, severe distortion can start if the drive is asymmetric due to a falsely-positioned centre-tap on T4 (or T5, for that matter!). For the same reason, a *matched pair* of transistors should be purchased.

The present unit is designed for a reasonable compromise of 1A standing current per transistor, giving Class A operation up to quite considerable volume, going over to AB only for the final drive up to high volume, where "lower-bend distortion" plays less of a role in comparison to the already-present large undistorted signal level. The final tone quality of the unit is very fine indeed—though, of course, true high-fidelity in every respect would be got only with pure Class-A operation, requiring even higher standing transistor current.

The Output Transformer, T5

Design considerations are here as follows: On account of the, roughly, 1:1 ratios throughout the source impedance at T5 (neglecting the additional component from the bias and power supply circuits) will be roughly the EL84 output 4Ω divided by the differential current gain of the 2N257, representing roughly a tenth of an ohm.

This value is the correct one on which to base a design for T5 primary, even though almost the same impedance again adds in series from the other named sources to give the final source impedance seen by the line, which is then about a quarter of an ohm.

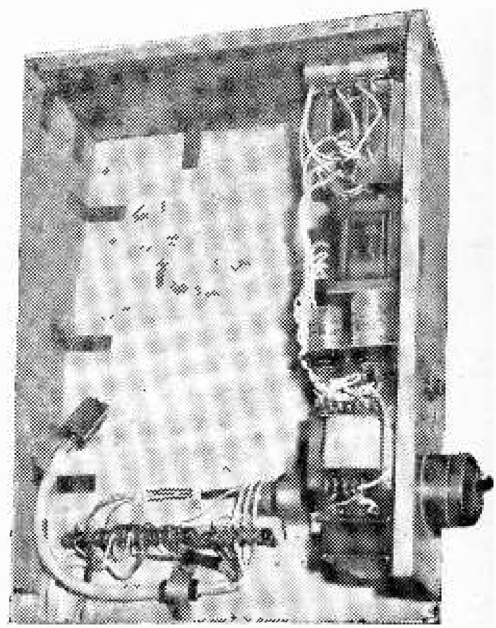


The finished amplifier.

We want the primary to have just sufficient inductance on each half so that it presents ten times the source impedance at least—i.e., at least an ohm. A very generous safety margin at the low-frequency cut-off of T4 is obtained by making the primary inductance of each half on T5 equal to about a hundredth of a Henry.

The exact number of turns needed are experimentally determinable as described for T4. A substantial core is needed on account of the higher power.

Regarding the turns ratio, this is fixed in the



The interior of the cabinet.

following manner: We see that we get a maximum swing of 3V r.m.s. from the emitter loads. We want, however, the same 3·5V back again which prevailed at the internal speaker direct from the EL84, plus about half a volt extra to compensate line losses.

Thus we want to step up the 3V to to 4V and the secondary of T5 must be given 4/3 as many turns as are found to be required for one half of the primary. Use very substantial enamelled copper wire as large as can be accommodated on the bobbin. As all windings taken together will require normally less than a total of 100 turns, wire of 1·5—2·0mm diameter should be able to be accommodated.

Really careful and thorough experimenters may like to go one stage of perfection further. They can wind an experimental version of T5 first, having taps on both primaries and secondary at 10% and 20% above and below the calculated number of turns. An experimental version of T4 can be wound similarly.

Feeding a pure sinewave into the Mullard amplifier from an audio signal generator and monitoring the EL84 output and the T5 output

COMPONENTS LIST

Resistors:

R1 ½Ω 5W w.w. (see text)

R2	25Ω	R10	2·2MΩ
R3	100KΩ	R11	560KΩ
R4	100KΩ	R12	10KΩ 2W
R5	25Ω	R13	1KΩ
R6	25Ω	R14	150Ω
R7	100KΩ	R15	1MΩ
R8	4·7MΩ	R16	680Ω 2W ±5%
R9	100Ω	R17	4·7KΩ ±5%

R18 4Ω 5W w.w. ±5%

Carbon ±20% 1W (unless individual details otherwise stated)

VR1 60Ω 5W w.w. Lin. Preset
VR2 500KΩ Log. Volume Control
VR3 500KΩ Lin. Potentiometer
VR4 50KΩ Log. Potentiometer

Transformers, Chokes:

T1 Mains Transformer 6·3V 1½A & 260V 60mA
T2 Mains Transformer 7½/0/7½V 2 x 2½A
T3 Mains Isolation Transformer 1 : 1 250 watt
T4 Base-Driver
T5 PP-Output
T6 EL84/4Ω Output Transformer
L1 Mains r.f. Choke
L2 H.T. Choke 10 Henry 60mA
L3 L.T. Choke 1/10 Henry 0·15Ω

Switches:

S1 Mains Lighting Toggle Switch
S2 1-pole On/Off QMB Toggle Switch
S3 Rotary Ceramic Switch, 4 pole 2 way
S4 Rotary Ceramic Switch, 1 pole 2 way
S5 Single-Pole Double-Throw QMB Toggle Switch

Capacitors:

C1 500pF 1000V.W. Super-Insulation
C2 Electrolytic 32μF 450V.W. (Can-type)
C3 Electrolytic 32μF 450V.W. (Can-type)
C4 Electrolytic 2500μF 12V.W. (Can-type)
C5 Electrolytic 2500μF 12V.W. (Can-type)
C6 Roll-Electrolytic 1000μF 12V.W.
C7 Electrolytic 5000μF 12V.W. (Large Roll and Clip)
C8 250pF 500V.W. Ceramic
C9 0·027μF 500V.W. Paper
C10 0·15μF 500V.W. Paper
C11 0·1μF 500V.W. Paper
C12 Roll-Electrolytic 50μF 80V.W.
C13 Roll-Electrolytic 8μF 450V.W.
C14 1000pF 500V.W. Ceramic
C15 0·1μF 500V.W. Paper

Valves, Diodes, Transistors:

V1 EF86 and Ceramic Noval Holder
V2 EL84 and Ceramic Noval Holder
TR1, TR2 } Matched Pair 2N257 Power Transistors
D1 Selenium Bridge Rectifier 260V a.c./60mA d.c.
D2 Fullwave Copper-Oxide Pair for 6V 3A d.c. output (approx.)

Sundries:

1 Panel Fuse Unit (insulated)
1 12-pole RAF-Connector Pair
1 8in. Speaker, 4Ω
Aluminium, Wood, Bolts, Screws, Tagstrips, etc.
½yd. 14-core Cable
Connecting Wire
Screened (Coaxial) Cable, low capacity, approx. 1 yd.
3-core Power Cable
4-core Power Cable to T3
Mains Plug
5 Pointer Knobs

with an oscilloscope (to show onset of distortion), as well as observing power with a d.c. voltmeter across known load resistors, a judicious selection of tappings can be found experimentally to give optimum performance consisting of:

(a) Onset of distortion *simultaneously* in the EL84 and the transistor output at the same drive maximum. This should be checked for load resistors simulating 1, 2, 3, 4 and 5 loudspeakers in parallel on the output line and at at least the following three frequencies: 50c/s, 1kc/s and 7·5kc/s.

(b) Line output voltage off-load some 10 to 20% higher than the voltage on the EL84 load, both equal when a line load equivalent to about three loudspeakers is connected.

Operating-Point Stabilisation

It is just in the emitter-follower arrangement of transistors that operating-point stabilisation can be particularly elegantly achieved, making use of the inherent total negative-feedback characteristic of any "cathode-follower" device. We choose R1 such that a suitable voltage drop appears across it at the desired standing current and set VR1 such that the voltage across its upper section is just above this design-voltage drop on R1.

Provided the resistance of VR1 is not too high this gives a very high measure of stabilisation of the total standing collector-emitter current through R1 regardless of whether the transistors are still cold or have warmed up. If R1 were omitted it would certainly be possible to set any desired operating point at a suitable different setting of VR1, but this would then be rather critical and unstable and subject to large drift. Adjust VR1 for 1V drop measured across R1.

Cooling

Finally a word about the measures to be adopted for adequate cooling of the transistors. The substantial cast-casings of the 2N257 form the collector connections and are ideally clamped hard against the chassis surface. To allow this in the present circuit and still maintain correct polarity it was necessary to earth the negative pole of the l.t. supply, having the positive insulated from chassis.

Also note in Fig. 4 that the transistors are mounted at the opposite end of the chassis from the EL84, with the transformer T4 as heat screen in between. This avoids unnecessary radiation heating of the transistors from the valves.

Note that the 2N257 are each rated at a total maximum dissipation of 12 watts when clamped to the chassis and will tolerate a temperature rise up to about 110deg F. to dissipate this heat power. ■

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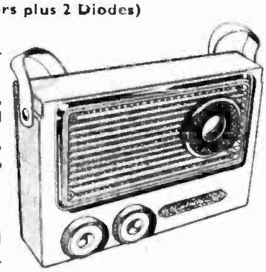

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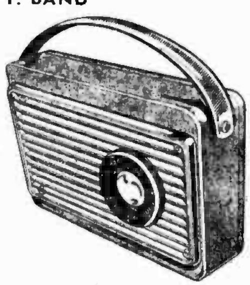

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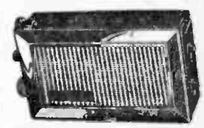

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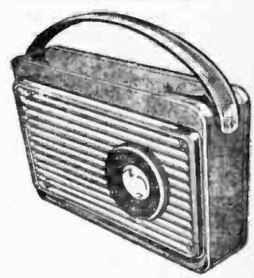

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- ★ Tuning condenser.
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- ★ Case with speaker grille in red.
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- ★ Simple assembly diagrams.
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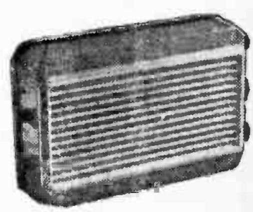

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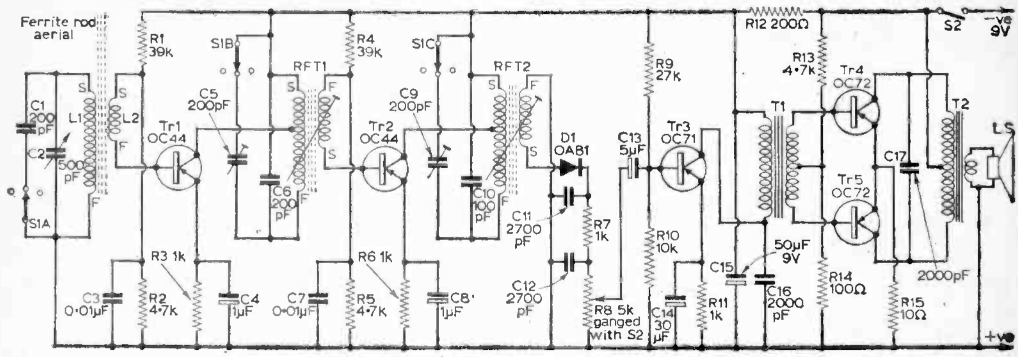


Fig. 1: The circuit.

T.R.F. TRANSISTOR PORTABLE

A FIVE TRANSISTOR RECEIVER

By G. G. TURTON

THE unit to be described is a five transistor portable radio receiver of high sensitivity which, compared with some other types of transistor portable, gives above-average quality of reproduction. Reaction is not employed, and two or three stations are pre-tuned and selected by means of a switch. Selectivity is good and there is a marked absence of background noise and interference.

The aerial coil is externally tuned and one section of the station selector switch merely shunts extra capacity across it, bringing it approximately to the frequency of the station selected. The external tuner is then used for final trimming, and is extremely useful for making adjustments under conditions of poor signal reception or when surrounding objects have a damping effect upon the aerial.

In the original receiver a 7in. by 4½in. elliptical speaker was used in order to take full advantage of the reproduction available. H.T. is derived from 9V battery and total current consumption of the unit from 5 to 6mA under "no signal" conditions.

The R.F. Amplifier and Detector

The R.F. section comprises two r.f. amplifiers and a diode detector. The diode used in the prototype was an OA81 but other types such as the OA71 are suitable. The transistors used were OC44s but here again equivalents are suitable.

In order to provide tuning of the entire medium-wave band, the value of the variable capacitor or trimmer C2 must be 500pF and is adjusted externally. The values of the fixed capacitors C6 and C10 are 100pF and with S1 position one make it possible to tune the r.f. transformers, by adjusting their dust-cores, to the frequency of any station between 200 and 270m. With S1 in position two the trimmers C5 and C9 will extend the range to about 350m. The switch in this position also shunts the aerial coil with a fixed

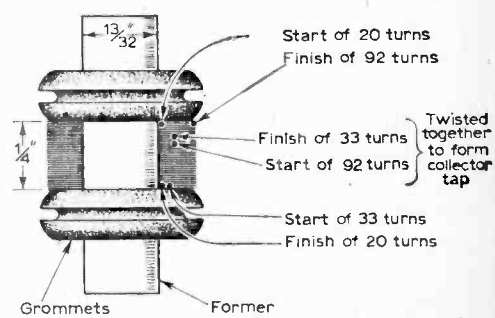


Fig. 2: Details of one of the r.f. transformers.

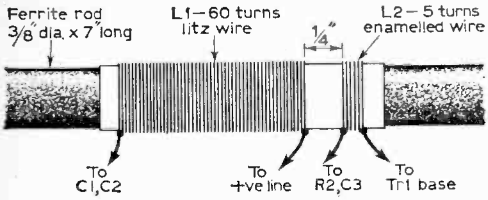


Fig. 3 (above): Details of the aerial.

capacitor C1. The values of these capacitors are 200pF.

With S1 in position three a further trimmer may be switched across each R.F. transformer primary and a fixed capacitor across the aerial coil in order to select a third station.

The A.F. Amplifier

The A.F. amplifier is a standard 200mW type using an OC71 as driver and a matched pair of OC72's in push-pull for output. The constructor may wish to use another amplifier more suitable to the components he has available or in order to obtain greater output.

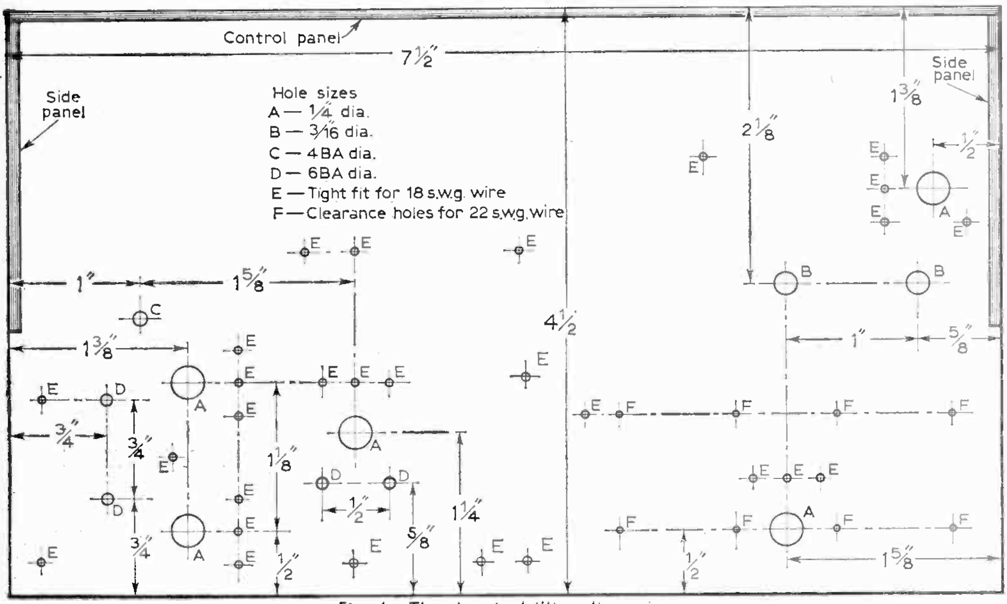
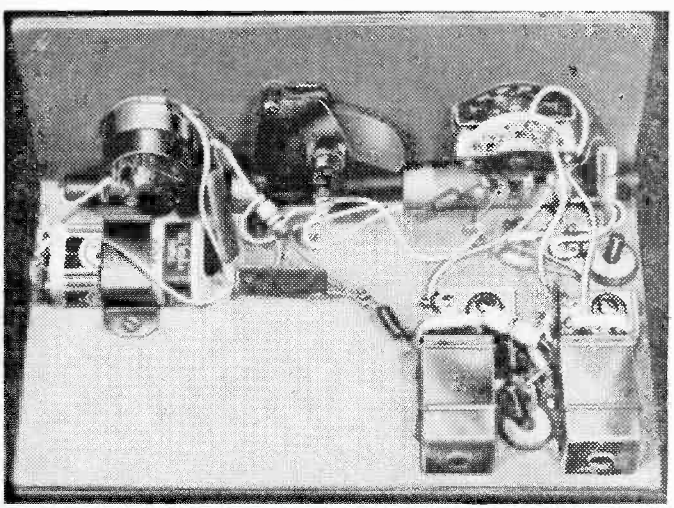


Fig. 4: The chassis drilling dimensions.



A rear view of the receiver.

There are several sets of matched driver and output transformers on the market, and supplied with some of these sets is a suggested circuit for their use. It is well to point out here that not all of the output transformers in these sets are suitable for matching to a standard 3Ω speaker and it is advisable to enquire on this matter when making any purchase.

If headphones or an ear-piece is used, the output stage may be omitted entirely, the three remaining transistors will provide more than adequate power. The r.f. stages alone make an admirable tuner unit for feeding into a high quality amplifier.

The values of coupling and decoupling capacitors in this section are not critical. The decoupling capacitor across the h.t., that is, from the primary of the driver transformer to earth must be at least 50μF. In general it is best to keep the value of all these capacitors as high as possible.

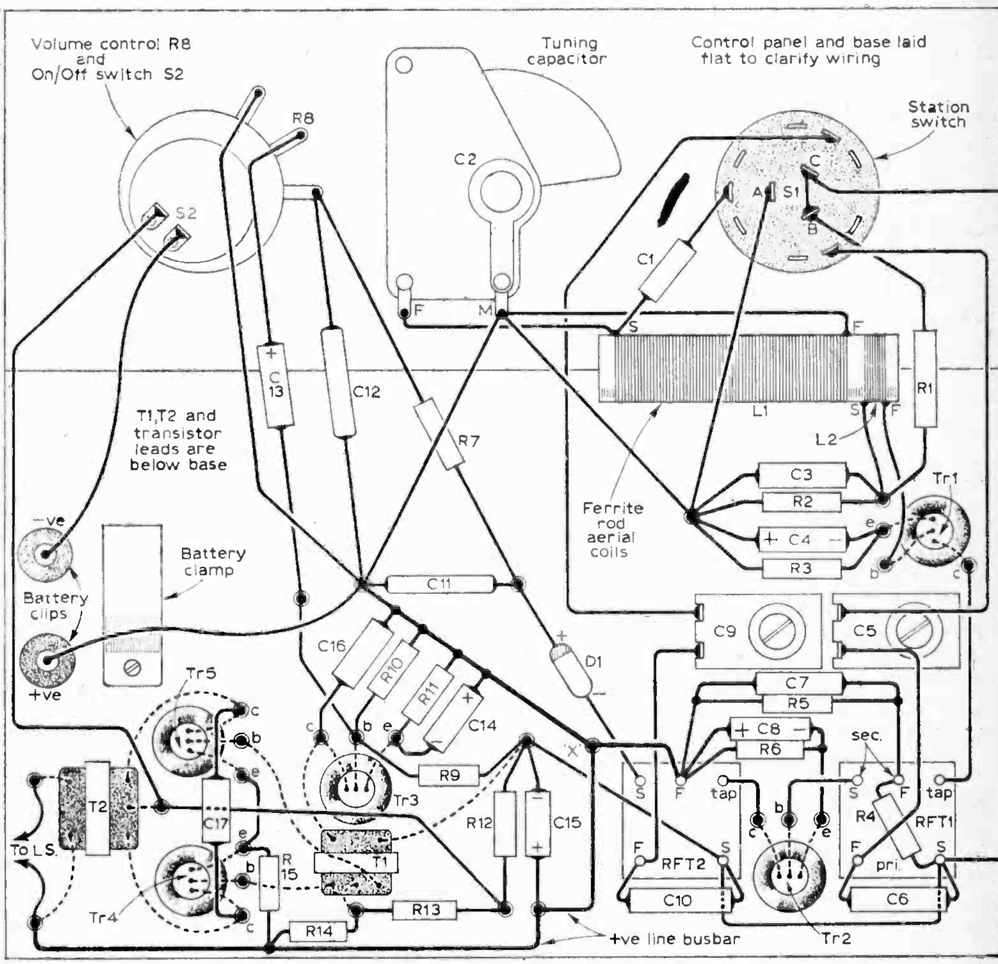
R.F. Transformers

The r.f. transformer coils are home-wound on $\frac{13}{32}$in. dia. formers using 7/45 Litz wire. They must be fitted with variable dust-cores and screening cans. Standard i.f. formers and cans are ideal.

First a single layer of 20 turns is wound on to the former. This should be about $\frac{1}{4}$in. in length and spaced by grommets or other suitable spacers. Mark the ends of all windings "start" and "finish". Now wind on top of this first layer a further 33 turns forming another layer and the commencement of a third. Finally 92 turns are added in single layers remembering to wind all coils in the same sense. The "finish" of the second coil of 33 turns and the "start" of the third coil of 92 turns must be twisted together to form the collector tap.

The entire operation requires less time than one may imagine and is quite simple to carry out, the only difficulty being the removal of the enamel insulation from the Litz wire. The following method, although not the speediest, is certain to ensure that all the strands are clean and undamaged.

The cotton or silk is removed from the wire and the strands played out fan shape. They are then drawn along fine flour paper until the copper appears through the enamel. The wire is then turned over and the treatment repeated until all the strands are clean. Finally the strands are counted to ensure all seven are intact, twisted together and tinned.



Transistors are secured through grommets mounted on base

Fig. 5: The wiring diagram.

All the coil ends are then soldered to the wire pillars fitted in the transformers, remembering to note pin connections before finally closing the screening can. The coils may be waxed or doped on completion to prevent damp entering.

Coils on Ferrite Rod

The aerial and coupling coils L1 and L2 are wound on to a ⅜in. by 7in. ferrite rod using 7/45 Litz wire for L1 and 40s.w.g. enamel covered wire for L2.

A paper tube is made to fit freely over the rod and on to this is wound 60 turns of Litz wire to form L1. The coupling coil L2 is five turns of 40s.w.g. spaced ¼in. from the aerial coil. Both windings are close-wound, and must slide easily on the paper tube along the ferrite rod in order to allow adjustment during alignment.

Before winding the coils it is advisable to insert two straight lengths of wire between the paper tube and the rod opposite each other. On completion of the coil these are removed and the coil will slide freely. For the wiring details of L1 and L2 see diagram.

Construction Suggestions

The chassis used in the prototype consisted of a paxolin base with an upright panel at one side for the mounting of controls. Holes are drilled where pins are required and small lengths of 16s.w.g. tinned copper wire are pushed through. Owing to the close proximity of the ferrite rod aerial to the upright panel, the material used for its construction must not be metal.

In order to reduce the overall thickness of the receiver case, the r.f.t. cans are laid on their sides and held secure to the chassis by lengths of 22s.w.g. wire which is passed through holes in the paxolin base and soldered. The thickness of the finished case is finally decided upon by the depth of the loudspeaker magnet and the size of battery decided upon.

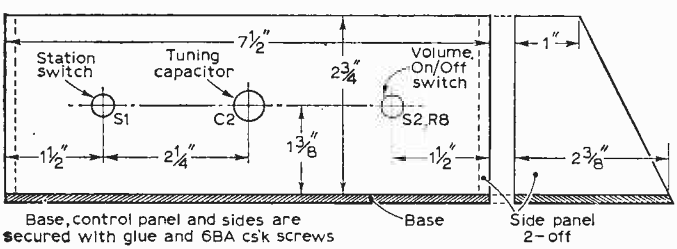


Fig. 6: The front and side panel dimensions.

C6 and C10 are mounted directly on to the pins of the r.f. transformers and S1 is located at the r.f. end of the chassis in order to prevent instability due to r.f. leads being too long.

With the receiver standing on its base the controls appear at the top panel of the case.

Alignment

Firstly the stations required to be selected by S1 must be decided upon by the constructor. Of the stations required, the one situated at the lowest end of the medium-wave band should be aligned first. In the case of the original receiver this station was the BBC Light Programme.

A length of wire to form a temporary aerial is connected via a capacitor to the top end of the aerial coil L1 and C2 is set to near its minimum capacitance, or to approximately 100pF. With S1 switched to position one and the r.f.t. dust-core at mid-position, it may be possible to receive the Light Programme.

The coils L1 and L2 must be situated near one end of the ferrite rod with the base coupling coil L2 on the inside. They may now require some adjustment by sliding them along the ferrite rod. If the station is not yet audible or the gain is low, slowly turn the core of RFT2 until results are achieved. RFT1 is then adjusted and C2 turned for maximum gain.

The whole process is repeated with the temporary aerial removed, until further improvement is not possible. Owing to the directional quality of ferrite rod aerials the receiver must be rotated for best results, on each station tuned.

S1 is then switched to position two and the trimmers C5 and C9 treated in a similar manner to that of the RFT cores in order to select the second station required. C2 is permanently variable and may need some adjustment but the cores of the r.f. transformers must not be moved after selection of the first station. Coils L1 and L2 are finally adjusted for best results on both stations and then permanently fixed. ■

COMPONENTS LIST

Resistors (All ⅛W, 10%):

R1	39kΩ	R3	1kΩ	R5	4·7kΩ
R2	4·7kΩ	R4	39kΩ	R6	1kΩ
R7	1kΩ	R8	5kΩ potentiometer with S2		
R9	27kΩ	R12	200Ω	R15	10Ω
R10	10kΩ	R13	4·7kΩ		
R11	1kΩ	R14	100Ω		

Capacitors:

C1	200pF		
C2	500pF tuning capacitor		
C3	0·01μF	C4	1μF
C5	200pF trimmer	C6	200pF
C7	0·01μF	C8	1μF
C9	200pF trimmer	C10	100pF
C11	2700pF	C15	50μF 9V
C12	2700pF	C16	0·002μF
C13	5μF	C17	0·002μF
C14	30μF		

Transistors:

Tr1	OC44	Tr4	OC72 } Matched
Tr2	OC44	Tr5	OC72 } pair
Tr3	OC71		

Coils and transformers: see text. **Diode,** D1, OA81 or equivalent. **Switch,** S1, 3-pole, 3-way. **Ferrite rod,** ⅜in. x 7in.

An Advanced GEIGER HEAD

By E. DEXTER

(Continued from page 730 of the December issue)

THE radioactivity of substances present in rainfall is principally of a completely different kind, because much lighter elements are involved. The emission again contains gamma-rays, the second component being mainly beta-rays, which are simply electrons hurled out of the atoms with an effective energy of several million volts.

The MX124/01 probably responds to both these components, so one would expect a much higher sensitivity in theory. But in practice this is not so, because of a number of other complicated factors, so that the effective sensitivity for this type of radioactive substance is much less.

Using a test-sample prepared from London snow, and making comparative measurements with this in the MX124/01 and in the author's calibrated standard Geiger-Head, it was found that one count per minute with the head described in this article corresponded to some 50 to 100pC of rainfall-type substances present in the 8 c.c. contents, representing a sensitivity some five to ten times poorer than for thorium and uranium types.

As a matter of interest, the test sample mentioned was prepared from ¾ of a pint of melted London snow from the fall in the winter of 1961/2, using the procedure described in the "Digital Counter" articles, and making the final volume 8 c.c. to suit the MX124/01.

The counting-rate increase observed was about nine per minute, representing an absolute activity in the region of 1,000pC per pint in the original snow, which is quite high! On the other hand, measurements on rainfall on the Continent some days later showed only about a quarter of this activity, whereas even higher values were observed in rainfall early in December 1961.

Conditions fluctuate greatly, therefore, and can be studied in detail with the head described here. If samples are prepared from a quart or two of original water, large signals are easily obtained, needing only some 30 to 60 minutes counting for an accuracy of 10%. Even tap water gives appreciable signals when treated in this way, values of 100 or 200pC per quart having been measured in some samples.

Rapid Counting

The head here described can be operated up to many hundreds of counts per second. For such cases the output may be connected direct to the "Direct - Reading Audio Frequency - Meter" (March, 1962) adjusting the preamplifier gain for maximum and stable reading on the meter (which will still fluctuate at the statistical distribution rate of the pulses).

A solution of thorium nitrate containing some 3 to 4 grams of the substance in 8 c.c. gave a reading of about 200c/s on the 0 to 500c/s range. Multiplication of the meter reading in c/s by about 80 will give the activity in pC contained in the fill of the Geiger-Tube. A solution of uranium nitrate containing 1 gram of the substance in the 8 c.c. fill gave a meter reading of about 300c/s.

Curiously enough, if these pulses are amplified and passed to a loudspeaker, no 300c/s note is distinguishable, the sound is merely a crackling hiss, because of the random sequence of the pulses in spite of a more or less definite average frequency.

If this unit is intended for anything but very occasional rapid counting, it would be advisable, in the interests of good tube life, to pay further attention still to keeping the stray tube capacities, and consequently C1, down to the smallest possible values.

Decontamination

After completing rapid-counting experiments with the prototype, and rinsing three times as usual, the count refused to return to the normal

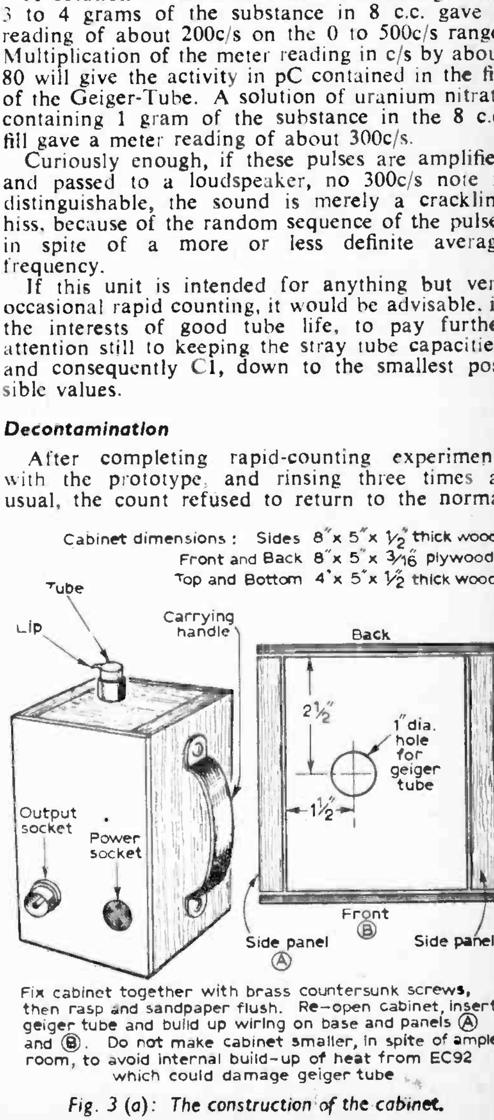


Fig. 3 (a): The construction of the cabinet.

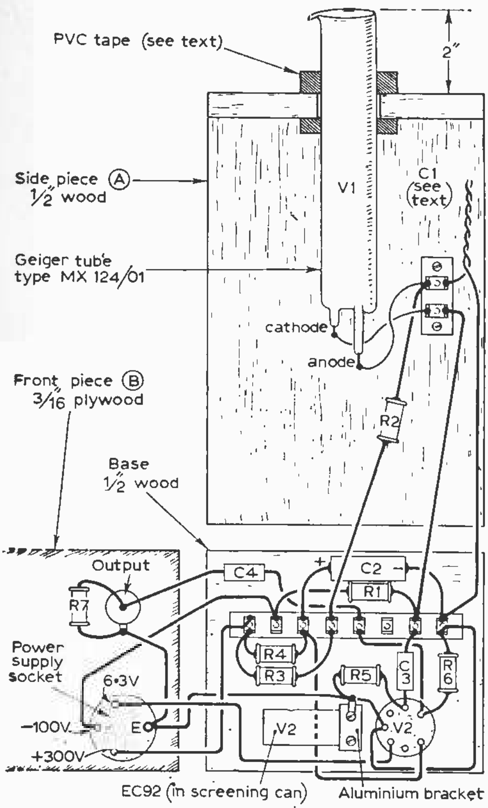


Fig. 3 (b): The component layout and wiring diagram.

(approx.) 40 per minute background, remaining at over 100 per minute, however much washing or soaking with pure water was undertaken.

A cure was effected by using dilute nitric acid as cleansing agent (one part acid to four of water). After three separate quarter-hour soaks with a fill of this acid, with threefold-rinsing in between each, the count returned to the normal background of about 40 per minute.

This form of contamination was clearly due to small precipitates of basic oxides, etc. forming a film on the inner tube, insoluble in water but soluble in nitric acid. To avoid such contamination right from the start, all liquids to be tested should be made strongly acid with at least 25% of the above-mentioned dilute nitric acid.

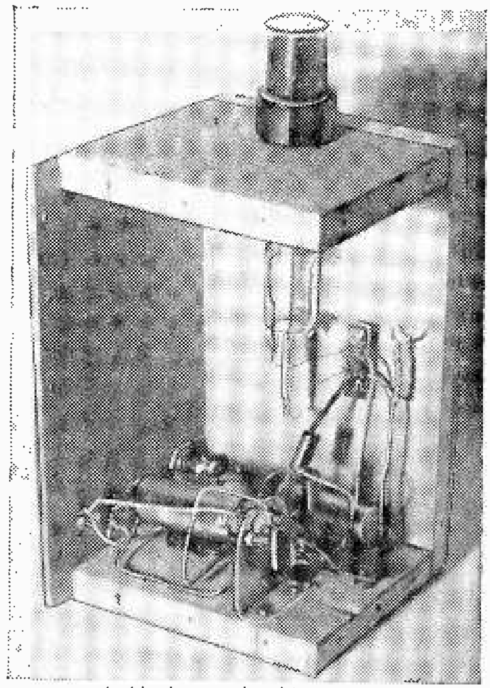
After completion of measurements, particularly if these involved rapid counting, a check should be made of the background count. If this is not normal, the above decontamination-procedure should be used. If this is not done immediately, and the contaminated tube is left standing even overnight, the deposits may harden and become impossible to remove even by the procedure outlined.

Whilst not rendering the tube fully useless, this will nevertheless reduce accuracy greatly, on account of the permanent worsening of the signal-to-noise ratio.

It is desirable to purchase the nitric acid ready-diluted with four parts of water, as this is then much less dangerous than the concentrated acid. Nevertheless, due respect and care is needed, as even the dilute acid is highly corrosive.

Prolonged experiments with this apparatus revealed the extreme importance of these considerations, which the author feels to be of far greater impact, for the purposes here intended, than the electronic error-sources connected with dead-time, plateau-slope, capacitive loading, etc. Whilst never having had any trouble from such electronic questions, over thousands of operating hours, the contamination question needed repeated attention, even for normal slow counting experiments, as progressing experiments soon revealed.

Some prolonged experiments were undertaken regarding the initial very high activity levels of fresh rain, lasting only a few hours or much less, so that no time was available for concentrating a sample or suitably acidifying it. The average



Inside the completed instrument.

count-increases thus measured from these effects, by filling the untreated rain direct into the head, amounted to some 10% or more increase of the background-count or more at the initial peak, and often remained unchanged present if the water was any appreciable length of time in the Geiger-Tube and then poured out.

This meant that virtually all the active material in the rain was absorbed out on to the glass of the tube. There it remained, and no amount of swilling with distilled water would remove it appreciably, yet a fill of dilute nitric acid removed it entirely within a few minutes in all cases.

Furthermore, samples acidified strongly with nitric acid in the manner described have never as

(Continued on page 815)

(Continued from page 812)

yet been observed to give rise to this contamination effect. The basic principle behind this demand for the generous use of nitric acid is that virtually all nitrates are highly soluble bodies in water, and thus nitric acid strongly hinders mineral deposits on glass.

Regarding the cource of these short-life peaks of activity, they are connected with natural radium and thorium emanation present in normal air, rain washing down portions of this or products thereof. The effect probably has nothing to do with atomic bombs or any other man-made devices, being a purely natural phenomenon.

Out of numerous experiments conducted by the author in past months, none failed to show an initial high activity peak in rains, snows, etc. This always seems to be present, whatever time of day rail fell, whatever the quantity of rain, etc. Peaks, some 20-100 times as powerful as the strongest atomic bomb fallout recorded at the author's station are always present in the initial half hour after rainfall, in the water.

Registration

The output of this Geiger-Head Unit is designed for use with author's Digital Counter described in February. This combination is suitable for counting rates up to at least 100 or 200 per minute, which is adequate for measurements with rainfall samples.

Much faster counting rates are achieved when solutions of thorium or uranium salts are filled into the Geiger-Tube, and in such cases the *Direct-Reading Audio-Frequency Meter* (PRACTICAL WIRELESS March 1962) forms an excellent registration-unit. The meter on this unit, reading cycles/second, gives pulses-per-second direct. It will be found that, for stable triggering, the pre-amplifier gain on the unit should be set about midway.

Amateur constructors will almost certainly be unable to obtain, or have difficulty in obtaining, uranium and thorium salts, and may indeed have difficulty in obtaining a Geiger-Tube of the specified type. But schools, clubs and institutions should normally have no difficulty, so that there is certain to be a sufficiently large circle of people actually able to put the subject of this article into practice.

The possibilities of educational work in radioactive tracer-chemistry analysis, using thorium and uranium salts in the apparatus described, are suggested to keen Sixth Forms and their teachers. Some quantitative details of the signals obtained in such experiments with the author's prototype are given below, as well as other relevant data on the sensitivity and use of the unit.

Construction and Layout

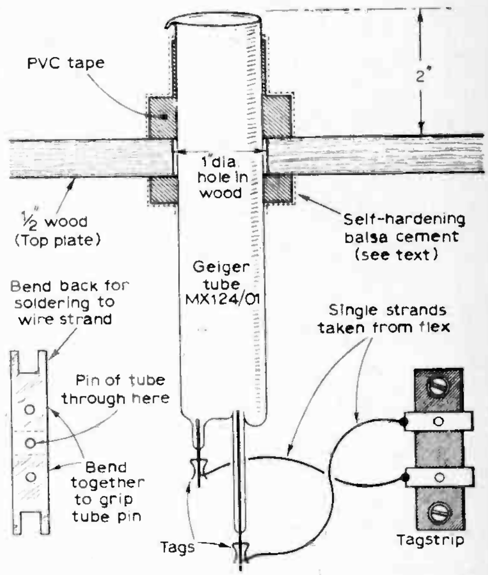
Fig. 3b shows the wiring and layout diagram. It is advisable to keep strictly to this arrangement which gives good results in the prototype. The whole unit is about the size and shape of a tall coffee-pot.

A handle is fixed at one side, and the protruding spout of the Geiger-Tube is arranged to be at the top front, so that pouring-operations are possible in the same way as with a coffee-pot. It is merely necessary to remove the power and output plugs from the side to free the unit for filling and emptying of test-liquids. Note particularly the arrangement of C1 in Fig. 3b.

Geiger-Tube Mounting

The Geiger-Tube is extremely fragile, and must have a resilient but firm mounting. The author found the arrangement sketched in Fig. 4 to be very satisfactory. A hole of 1in. diameter is drilled in the front of the top-piece of the case, as shown, and the Geiger-Tube then fixed in a position such that about 2in. protrude at the top, using a pile of P.V.C.-adhesive tape wound on to the tube each side of the hole through the case, to a greater diameter than the hole.

The P.V.C.-Tape is smooth plastic one side, and



Solder wires to tags before pushing on to geiger tube pins

Fig. 4: The Geiger-Tube mounting details and connections.

adhesive on the other, making a neat job with very high insulation. Ordinary insulating tape could be used, but is likely to be messy. The wound-on P.V.C.-Tape piles alone would creep with time and the Geiger Tube gradually falls into the case. To avoid this, and to make a really neat finish, the tape-windings are coated with a self-hardening transparent mass of the "*Uhu-Plus*" type. This is purchasable in packages containing two tubes, a binder and a hardener.

Equal quantities are mixed before use, and painted on with a nail or matchstick. The mass runs smoothly within a few minutes and dries hard in about 10 to 30 hours. The coating should run from the glass of the tube, over the P.V.C.-Tape, and on to the wood of the case.

Connections to Tube

The normal method of connection intended by the manufacturers for industrial use of the tube is to arrange for the two protruding pins to dip

(Continued on page 819)

Crystal controlled Top band 'phone Transmitter

By F. G. RAYER

In the 1·8-2Mc/s band, transmitter power is limited to 10W, so the equipment used is quite small, and no large or high voltage power pack is required. Many top band transmitters can, in fact, be run from a receiver type power pack.

If crystal control is employed, the circuits are even more simplified, and working with one or two crystals is feasible. Crystal control does, of course, provide excellent frequency stability, and avoids the difficulties associated with a variable frequency oscillator. The main disadvantage of crystal control lies in the fact that the transmitter can only be used on frequencies for which crystals are available. It is, however, possible to build a V.F.O., to replace the crystal, at a later date.

The circuits described here have been found to give good results, and are intended for speech transmission. They may be used for C.W. by keying the R.F. section in any usual way. The range obtained naturally depends upon conditions, type of aerial, etc., and is about usual for this type of equipment. That is, generally up to a range of several hundred miles, with 10W. Very much longer distances are sometimes covered.

Modulated Oscillator

A crystal controlled oscillator can be modulated

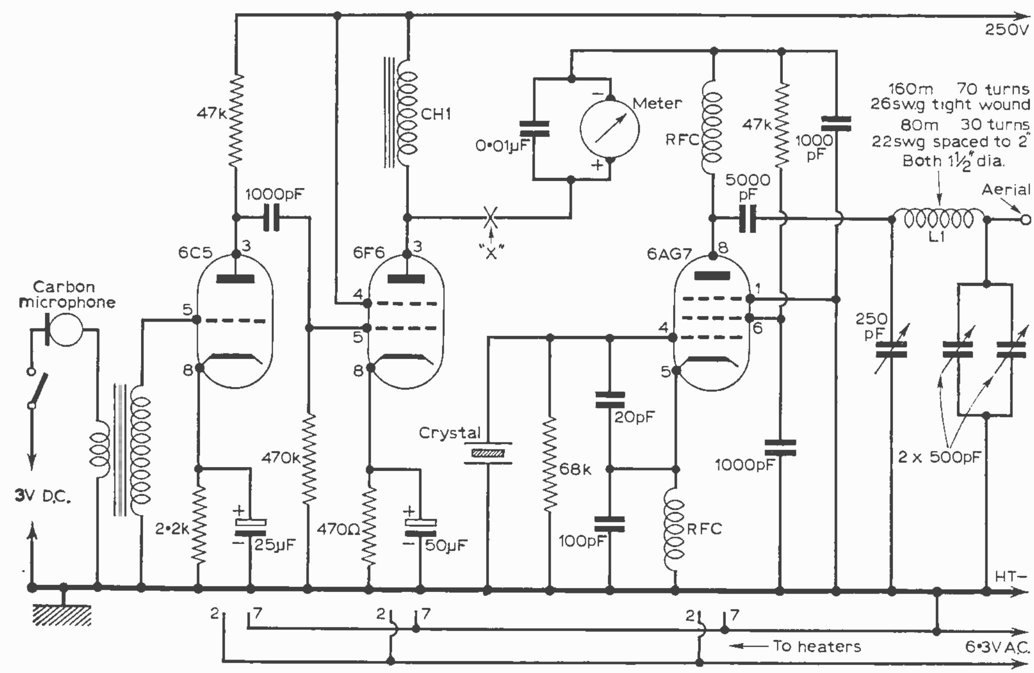


Fig. 1: Circuit diagram of the three-valve speech transmitter.

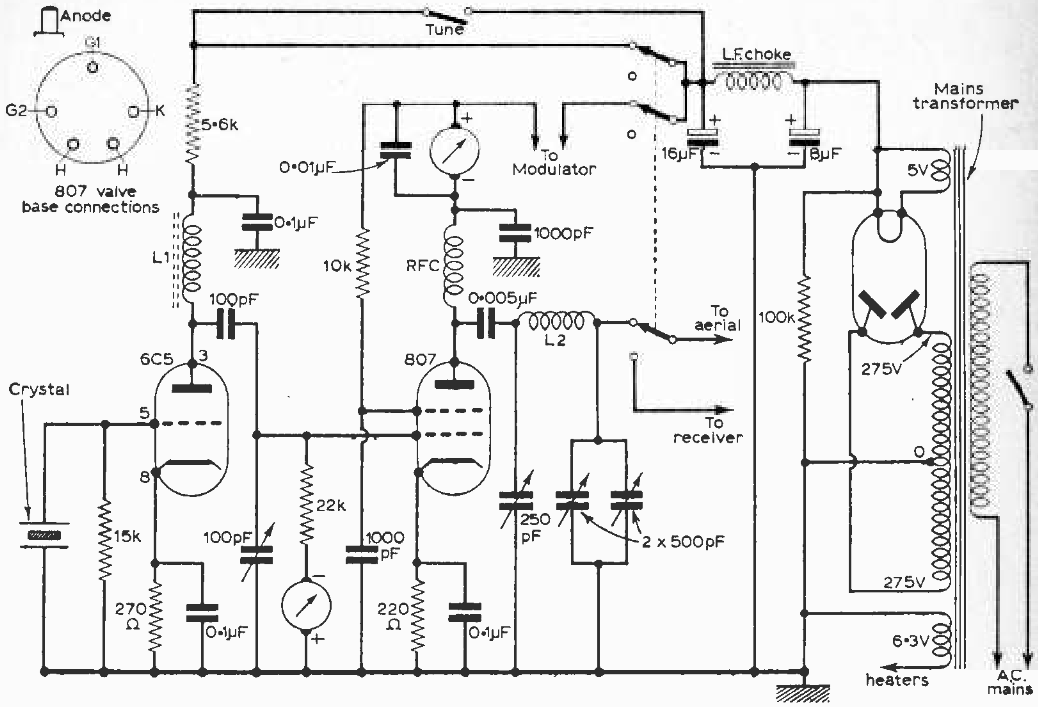


Fig. 2: Two-stage transmitter with switching and power pack.

quite deeply, and the circuit in Fig. 1 shows a complete speech transmitter using only three valves. The 6C5 and 6F6 form the speech amplifier, and many other valves of somewhat similar type may be used here. Surplus carbon microphones vary considerably in sensitivity and if this is too great the microphone battery voltage can be reduced. If a crystal type is preferred, the double-triode stage in Fig. 4 may replace the 6C5.

The 6AG7 is the crystal oscillator, with a pi output circuit to permit loading into almost any aerial. The anode tuning capacitor may be 150pF to 300pF, while the aerial loading capacitor is a two-gang or three-gang 500pF component, with sections in parallel.

The aerial loading capacitor is initially closed, and the anode tuning capacitor is adjusted until the meter shows a dip in current. If the current shown by the meter is too low, the aerial loading capacitor is opened, the anode tuning meanwhile being re-adjusted for minimum current.

This is continued until the meter shows the required current. The crystal oscillator should not be too heavily loaded. With a 250V anode voltage, 20mA will be 5W input, which is about the maximum recommended for this circuit.

The transmitter can be tested by wiring a lamp from the aerial terminal to chassis, and loading into this, as if into an aerial. Speech should sound clear and reasonably modulated. A carbon microphone and transformer of efficient type may easily overload the modulator, so the microphone should be kept at a reasonable distance. Gain can be reduced, if necessary, by removing the 25µF bias capacitor, or fitting a 500kΩ volume control.

Two-stage Transmitter

The two-stage transmitter in Fig. 2 will easily load up to the full 10W input, and can be fully modulated. The 6C5 is a simple crystal oscillator. A small medium wave coil with adjustable core can be arranged to cover 1·8-2Mc/s, the 100pF capacitor being used for tuning.

Tuning with this capacitor is adjusted until the grid meter shows between 2-4mA, corresponding to 40-80V bias developed across the 20kΩ grid resistor. Tuning should be slightly off resonance in the usual way, so that the crystal oscillator starts when switched on.

For aerial loading and tuning, the pi output circuit is the same as in Fig. 1. The actual anode voltage of the 807 will depend on voltage drop in the power pack smoothing choke, etc., but should be around 250V. At this voltage, loading the 807 until it draws 40mA will give an input of 10W.

In practice, signal strength reports are about the same if loading is to only 8W or 9W so exact adjustment is not needed. The input must not exceed 10W, unless the transmitter is used on the 3·5Mc/s or other bands, as mentioned later.

Cathode Bias

Some cathode bias is provided for each stage and this keeps the H.T. current to a safe level if the crystal stage does not oscillate, due to wrong tuning or any other fault. Initially, the "Tune" switch is closed, and the grid circuit tuned to produce 2mA to 4mA grid current, as described. This also allows the frequency to be found on a receiver before transmitting. The "Tune" switch is left open when operating.

Send/Receive switching is incorporated. With the switch in one position, both stages are on, and the transmitter output is taken to the aerial. With the switch in the receive position, the aerial is taken to the receiver, and the transmitter is switched off. No external relay or similar arrangement need be used.

The circuit will give reasonable results with the modulator in Fig. 1, but near 100% modulation cannot be obtained with this modulator. Quite good modulation will be achieved if the 807 is loaded to some 5W or 6W input.

The advantage of the Class A modulator, in Fig. 1, is its simplicity, and the fact that over-modulation is practically impossible when using it. Attempts to increase modulation too far will simply cause speech distortion.

To secure deep modulation with the simple Class A modulator, a capacitor and resistor may be wired in parallel, and included at the point "X" in Fig. 1. (This should not be done when modulating the crystal oscillator.) The capacitor can be 1μF to 4μF and the resistor may be about 1kΩ 2W or such a value as will permit nearly 100% modulation, with the 807 loaded to the required input.

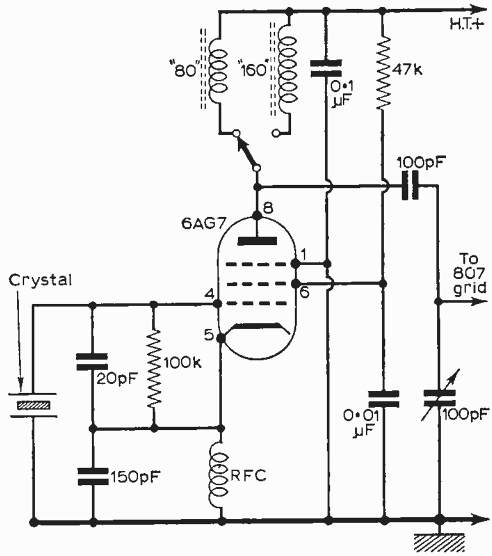


Fig. 3: Oscillator with output on fundamental and harmonics.

Harmonic Oscillator

If the 6C5 is replaced by a harmonic type oscillator, output may be obtained at multiples of the crystal frequency. The transmitter can then be used on other bands.

An oscillator of this type is shown in Fig. 3. The anode circuit can be tuned to the same frequency as the crystal, or to multiples of this frequency. In Fig. 3, a two-way switch allows working on 160 or 80m bands, with crystals having a fundamental frequency in the 160m band.

When doubling frequency, the crystals must be chosen to allow operation in the higher frequency band. For example, a 1850kc/s crystal would give operating frequencies of 1850kc/s and 3·7Mc/s. But a 1950kc/s crystal would do for top band only, as its harmonic would be 3·9Mc/s, which is outside the 3·5-3·8Mc/s band.

Small, dust cored coils may conveniently be used, as they can easily be adjusted to give coverage of the required bands, with the 100pF tuning capacitor. It is also possible to use a trimmer across one or both coils, setting this when first testing the equipment. The 807 grid current meter will show correct tuning, and indicate whether the 6AG7 anode coils are satisfactory for the bands required.

If preferred, the 20pF capacitor can be replaced by a 30pF trimmer. This allows adjustment of the oscillator, which may be helpful with doubtful surplus crystals, or crystals which have been ground by hand. The remainder of the circuit is the same as shown in Fig. 2.

When working in the 80m band, the 10W limit does not apply, so the anode current can be increased. An input of 20W or 30W can easily be achieved, with a higher H.T. voltage, but with the lower voltage supply the anode current is best kept down to about 70mA. or about 17W input. At this input, R.F. output should be sufficient to light a 15W domestic lamp well. Input may be increased slightly by omitting the 220Ω resistor and 0·1μF by-pass capacitor, taking the cathode of the 807 to chassis.

It is then essential to obtain some 2mA or so grid current, before switching on the 807 anode and screen grid circuit. The pi circuit should also be tuned quickly to resonance, as very heavy anode current will soon damage the valve.

Push-Pull Modulator

For 100% modulation, the modulator must deliver about one-half the power input of the 807. For example, if the 807 is loaded to 10W input, a 5W modulator will suffice. This means that many quite small amplifiers can be used successfully as modulators. A 10W amplifier, for example, would do well for P.A. inputs of up to 20W or so.

Fig. 4 shows a suitable modulator of straightforward design, and intended for top band use, or where the P.A. input is not much over 10W. If the crystal microphone does not give much output, and a little more gain is required, a 25μF bias capacitor may be shunted across the 1·5kΩ resistor.

There is no particular reason for choosing 12A6 valves for the output stage, except that these are available cheaply in some surplus equipment, with transformers to suit. They require a 12·6V heater supply. Other valves are perfectly satisfactory, such as the 6V6, 6BW6, etc.

Audio amplifiers intended for other purposes will generally have a phase-splitter valve, instead of the centre-tapped driver transformer. The use of such a stage, instead of the transformer, is perfectly satisfactory.

For maximum efficiency, the modulation transformer ratio is chosen to suit the push-pull output stage, and P.A. input. The ratio is chosen in exactly the same way as for a speaker matching

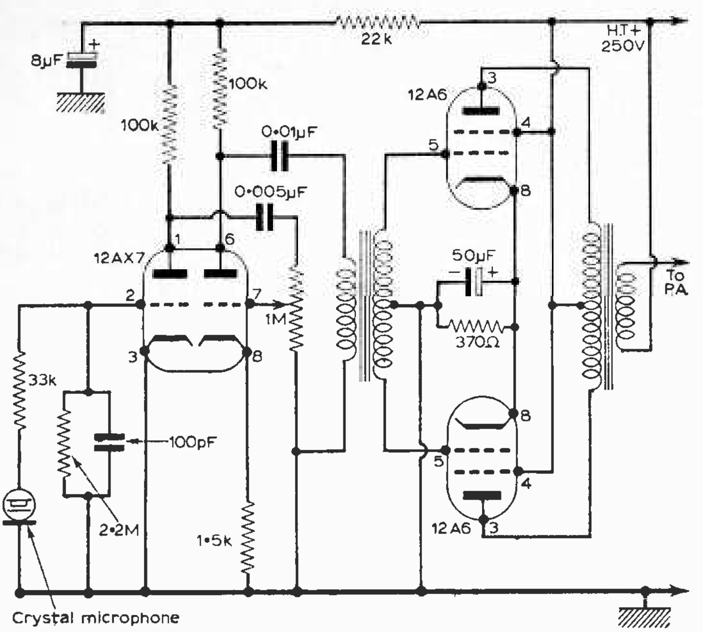


Fig. 4: Circuit of Class B modulator.

transformer, except that the P.A. will offer a much higher impedance load than does a speaker.

The modulating impedance of the P.A. can be found from:

$$Z = \frac{\text{P.A. H.T. voltage}}{\text{P.A. current (mA)}} \times 1000.$$

Assuming that the P.A. draws 40mA at 250V, the impedance will be approximately 6200Ω.

The optimum load of the output stage of the modulator depends on the valves and H.T. voltage. The figure is listed by valve makers. For example, it is 8,000Ω, for a pair of 6V6's, in Class AB1, with 285V. The transformer ratio is found in the usual way:

$$\text{Ratio: } \sqrt{\frac{\text{Optimum load}}{\text{Impedance of load}}}$$

The ratio is thus approximately 1·14:1, in the example. Multi-tap modulation transformers can be obtained, and will allow matching between modulator and P.A. to be easily adjusted. Good results can be obtained without the exact ratio, and results are usually satisfactory even if the P.A. is not loaded to exactly the input for which the modulation transformer ratio was intended. This allows surplus transformers be be used with success, if the matching is reasonably good.

Power Pack

If a receiver has a generously designed power pack, this can supply enough current for a top band transmitter and modulator. It would then be necessary to switch the power pack from receiver to transmitter by disconnecting the circuit at the smoothing choke. Heater current for the transmitter should be obtained from a small separate heater transformer, as the heaters are left on.

If a power pack is to be constructed, the circuit can be as shown in Fig. 2. A 5Z4 will provide up to 125mA. This valve has a 5V 2A heater. The 5V4 and 5U4 will supply 175mA and 225mA, if needed, and the latter has a 5V 3A heater. A bleeder resistor (100kΩ in Fig. 2) should be fitted, to discharge the capacitors.

The voltage obtained from the power pack is not very important for top band, and a 250V or 350V secondary can be used. But if a larger input is required, for other bands, a 350V or 450V h.t. supply may be used. ■

AN ADVANCED GEIGER HEAD

(Continued from page 815)

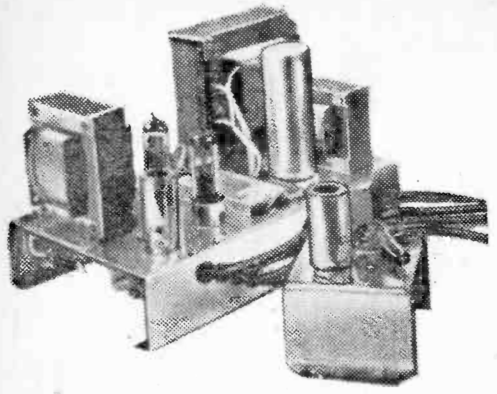
into suitably-placed mercury cups in the industrial holder. The author considers this arrangement to be unsuitable for general amateur and school use, for several reasons.

Firstly, it would mean removal of the bare tube alone each time for filling and emptying or cleaning, with consequent increased repeated danger of breakage each time. A permanent fixture arrangement, where the delicate parts of the tube are exposed only during initial construction of the unit, is considered to be more suitable for amateur use, and has been adopted here.

Secondly, mercury is far more dangerous than many people believe, and thus undesirable for amateur use. Small balls of spilled mercury lodged in crevices in floorboards of a badly ventilated room can cause mental defects, blindness, etc., over a period of many years to a constant occupier of such a room.

The method of making connections to the tube shown in Fig. 4, should be adopted. The author used solder-tag inserts from the type of tagstrip with removable inserts. These, when bent together, form very secure clips for pushing on to the tube wires, the central holes being of the correct diameter.

Prior to pushing these clips on to the tube wires, a single thin strand of bare wire from a piece of flex is soldered on to each clip, and wired to the nearby tagstrip, from which then ordinary connecting wires proceed to the rest of the circuitry. This arrangement very effectively removes all strain from the tube which would otherwise result from the connecting wires. ■



Quality A[…] and

THE FIRST TWO UNITS OF A COMPLETE HI-FI SWITCH-TUN[…]

This series of articles will describe a switch-tuned a.m.-f.m. sensitivity and stability, high-fidelity reproduction and large reserv[…] If required, the audio-amplifier can provide sufficient power to o[…] speakers distributed throughout a small dance-hall, at high volum[…]

THE equipment incorporates a power pack and audio-amplifier chassis together with its "flying-panel" containing all controls and connections. Apart from constituting a three-stage 15W push-pull amplifier (200mV r.m.s. sensitivity for full output) with all power supplies, this chassis also provides three independent and highly-smoothed h.t. outputs of 150 to 200V on 25mA loading each, and a heater output at 6·3V 4A. These outputs can feed tuner, tapedeck circuits and/or preamplifiers. The Radio/Gram switch on the flying-panel switches all these h.t. and l.t. supplies "on" in the "radio" position and "off" in the "gram" position. On the same switch another wafer switches a mains supply for a gramophone or tapedeck motor. The unit may thus certainly be used in conjunction with other apparatus than the particular tuner and record-reproducer to be described and can be built hy itself as a general-purpose amplifier and power pack.

The four-station switch-tuned M.W.-L.W. tuner is of very high sensitivity and also has a continuously-tunable v.h.f.-f.m. band with automatic frequency regulation. Emphasis on the a.m. section is on high gain, permitting powerful a.g.c. This tuner may if required be built alone for use in conjunction with other existing apparatus. While the gain of the amplifier alone is certainly ample for high-level pick-ups, such as crystal types, it is not quite sufficient for most high-class types which give a much lower output voltage under true high-fidelity conditions. Thus the final stage of the tuner chassis is also used as audio-preamplifier for the specified record reproducer chassis (Collaro Studio TX88). This pick-up gives an output of some 100 to 125mV, which would only load the amplifier to some 3 to 5W output without a preamplifier. While this would be ample for normal room listening it does not exploit the full capabilities of the amplifier. Thus, constructors building the amplifier and power pack chassis alone should provide a suitable preamplifier, or use a slightly lower quality pick-up unit of at least 250mV output.

Final Assembly of Radiogram

There are some excellent reasons for separating the equipment into two chassis, instead of using a single larger chassis. The least important (technically speaking), yet mechanically very useful, is the benefit of greater latitude in disposition of components, which gives a greater choice of cabinet type and shape.

A high power audio amplifier and a power pack both produce heavy surges of current at low frequency, contain large iron-cored components with stray magnetic fields, and components which

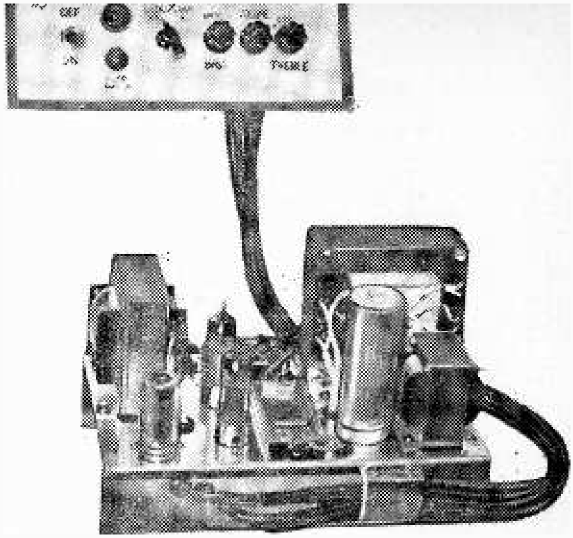
Load	Max. power	Corresponding to
2·5Ω	10·5 W	A pair of 5Ω speakers in parallel, receiving about 5 W each
5Ω	13·2 W	A single 5Ω speaker receiving about 13 W
7·5Ω	14·2 W	A pair of 15Ω speakers in parallel receiving about 7 W each (Optimum)
15Ω	10·1 W	A single 15Ω speaker receiving about 10 W

Measurements made at 50 c/s, 1 kc/s and 5 kc/s showed no significant differences.
Saturation current into a.c. ammeter across output transformer secondary, amplifier over-driven hard at 50 c/s mains frequency: 2 amps.

Table 1: Power output for 1·5% distortion, measured with an oscilloscope on the prototype, using load resistances of stated values on specified output transformer secondary.

ıplifier
ɔre-amp

RADIOGRAM



iogram of high
f output power.
.te several loud-

by A. Cole

get very hot indeed. Also, such equipment is very heavy.

The best position for such equipment is with the chassis standing horizontally on the floor of a much larger cabinet. The weight is then properly carried, and heat can be dissipated by strong upward convection currents. Valves can be mounted upright, which is always the best orientation of valves which get very hot during operation.

A tuner is concerned with low-current high-frequency signals, normally produces only moderate or little heat in its components, and is mechanically quite light. It is thus of advantage to mount a tuner chassis upright, with the valves horizontal and accessible through the rear of the cabinet, thus enabling controls to be situated inside the top of the cabinet, where they are more conveniently operated than at the front bottom of the cabinet.

The weight of a tuner chassis, once the power supply and audio-amplifier is removed, is small enough for hanging the chassis in this fashion, wheras this would give considerable mechanical complications if the heavy transformers were on the same chassis. For an audio-amplifier it is easy to mount all controls on a small "flying-panel" connected to the main amplifier chassis by almost any reasonable length of cables required.

It is thus ideal to build a high-quality radiogram in four portions. Firstly, the main amplifier and power pack chassis, standing well clear and secure on the floor of the large cabinet space. This can be immediately below the gramophone mechanism forming the second item. The third item is the flying control panel for the amplifier and power pack, which can be mounted at any convenient position on the horizontal inside-top panel of the cabinet. Finally, the tuner chassis, slung vertically with the controls projecting upwards through the inside-top panel of the cabinet.

Loudspeakers

Measurements made on the completed prototype amplifier chassis, given in Table 1, show that the output is reasonably tolerant of loudspeaker impedances, giving reasonable performance with virtually any speaker combination. The optimum load specified is 7·5Ω, yet available power losses are less than a third, even when using gross mismatches.

It is recommended that a pair of WB Stentorian HF1016 units be obtained, and connected to the two pairs of output terminals provided, which automatically place the two loudspeakers in parallel. The Stentorian has a universal speech coil, which should be wired for 15Ω on both units. Take care to phase both loudspeakers correctly relative to each other, so that the cones move in sympathy. This is achieved in identical speakers simply by wiring them in a precisely identical fashion.

Purpose of two loudspeakers

The purpose of designing for two loudspeakers is to obtain a greater "dimension and body" for the reproduction. One loudspeaker is mounted in the main cabinet, and the other in a separate housing placed a good distance away within the same room. The listener should have both loudspeakers in front of him, the relative positions being roughly those of a good stereo installation.

It is advantageous to make the acoustic characteristics of the main cabinet and the second loudspeaker cabinet rather different. The same cabinet air volumes should be used, but completely different dimensions: i.e., the second loudspeaker cabinet is of the bass reflex type, but the main radiogram cabinet is conventional.

Such a two-loudspeaker installation on a mono channel is able to run at much higher volume without discomfort to the listener, giving a great dimension to the sound, more in keeping with the

Continued over page

true characteristics of an orchestra. Furthermore, for a given power fed into such a system, the apparent subjective volume observed by the listener is considerably greater than for the same total power fed into a single loudspeaker—when properly dimensioned and adjusted.

Under good conditions, such an installation can give a performance on a mono channel closely approaching the performance of a cheap stereo outfit, as far as the "dimension" is concerned. The musical expert, of course, will not be fooled by this but it will certainly separate instruments which have different character, and many musical laymen will be unable to tell the difference between this and true stereo. Furthermore, the constructor can later duplicate the amplifier and run true stereo.

Power Pack and A.F. Chassis

Fig. 1 shows the complete theoretical circuit of this chassis and its flying control panel. The circuit is reasonably conventional apart from some unusual features in the power supply.

Amplifier Circuit

V1a, half an ECC83, is used as a simple straightforward voltage amplifier with a gain of some 50 to 60. The other half is used as anode loaded cathode-follower phase-splitter, probably the simplest of the "transformerless" types, and certainly extremely easy to balance, balance being quite automatic, regardless of valve condition, if the anode and cathode loads, R16, R18, are equal.

This circuit gives no gain of voltage, in common with all cathode-followers, but that is a reasonable price to pay for simplicity and reliability over long periods. The use of the normal bias resistor R17, to the bottom end of which the gridleak R13 is returned, ensures true class-A operation, so that both polarities of signal half-cycles are passed on without distortion.

Correct value of R17 is important to avoid distortion at high output power which can originate in this stage before the output stage itself starts overloading. The correct value of R8 is equally important. R16 and R18 should be a pair of equal resistors. C13 prevents unbalance at the cathode of the phase-splitter results, although such unbalance is not as serious in this design as in many similar amplifiers running the output stage in Class AB or Class B because here strict Class-A is employed throughout. This is unusual for this kind of amplifier, and places heavy demands on the power supply, as the no-signal standing current is well over 100mA in the output stage. Thus D2 is somewhat over-rated in voltage and

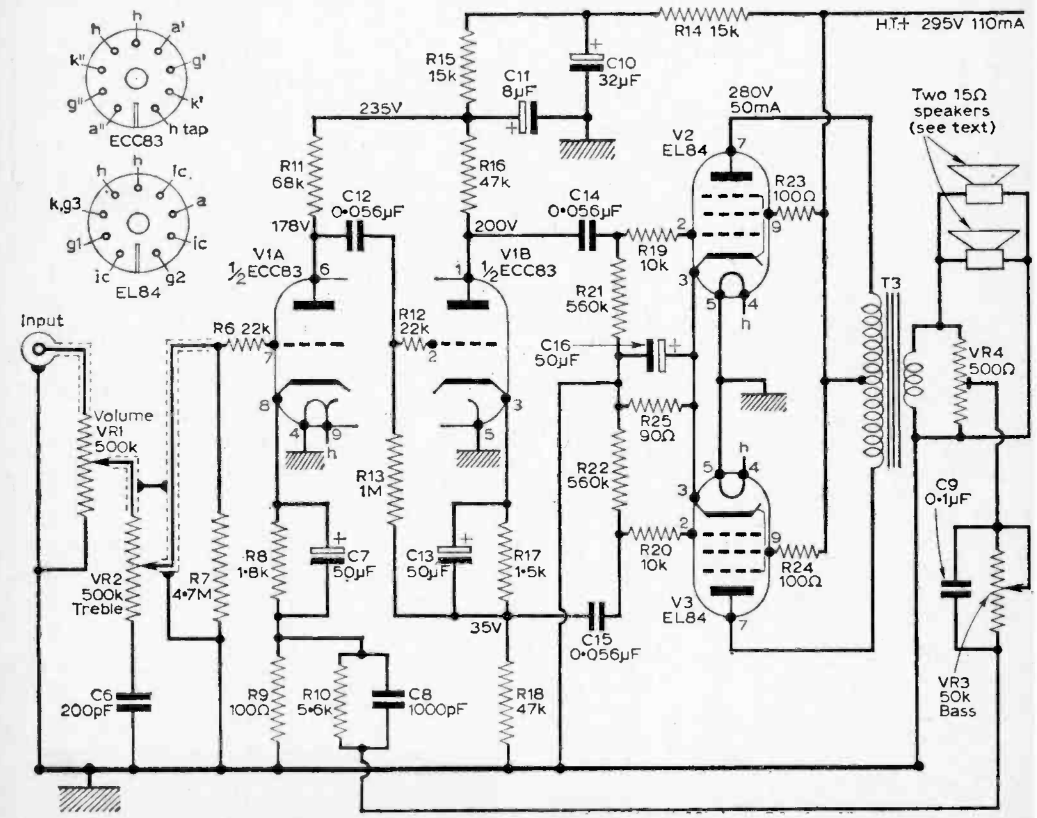


Fig. 1a.—The amplifier circuit.

current, to be certain of tolerating the high surges, and the smoothing electrolytics are in the form of a large chassis-mounting can of ample voltage-rating and surge-rating. It is undesirable to use small tubular electrolytics in this position, as these will probably sooner or later overheat and fail, on account of the surges.

A strict Class-A push-pull stage is very tolerant to mains ripple left on the h.t. However, V1 would most certainly not tolerate such ripple, hence the large amount of extra smoothing there obtained by means of R14, R15, C10, C11.

Grid-stoppers

It cannot be over-stressed how important grid-stoppers are with modern high-gain miniature valves, and it is probably true to say that the great majority of failures in amplifier designs nowadays are the result of insufficient attention having been paid to the direct or indirect effects of parasitic oscillations.

If some or all of the grid-stoppers R19, R20, R23, R24 are omitted, or incorrectly wired (grid-connection too long), the whole amplifier can go unstable, and V2 or V3, or both, can suddenly run bright red-hot and burn out. This could also lead to the destruction of components in the power supply. If an output stage goes into parasitic oscillation on account of improperly wired grid-circuits, the resulting grid-current often produces a monostable multivibrator action between the two valves as a by-product. This results in one of the EL84 valves being cut off, and the other running up to huge anode current, which rapidly destroys it.

Even with grid-stoppers it is possible that phase-shifts in a poor type of output transformer can give supersonic instability in the whole negative feedback loop with the same disastrous effects on the output valves. Such shifts in T3 are capable of being compensated by the arrangement of R10 and C8, which are adequate for a good quality transformer. If the anode-voltages on V2 and V3 show any tendency to unbalance as VR4 is adjusted, the effect of increasing or decreasing C8 could be tried, but if serious modifications are necessary, it is better to obtain a better output transformer. The "makeshift" practice of using a heater transformer for 110-220V mains as primary, and 6·3V as secondary, as a push-pull output transformer, is most strongly discouraged. Such heater transformers give very poor performance other than at mains frequency and may lead to incurable instability of the types discussed. The need for a really good item of reliable manufacture for T3 cannot be over-emphasised.

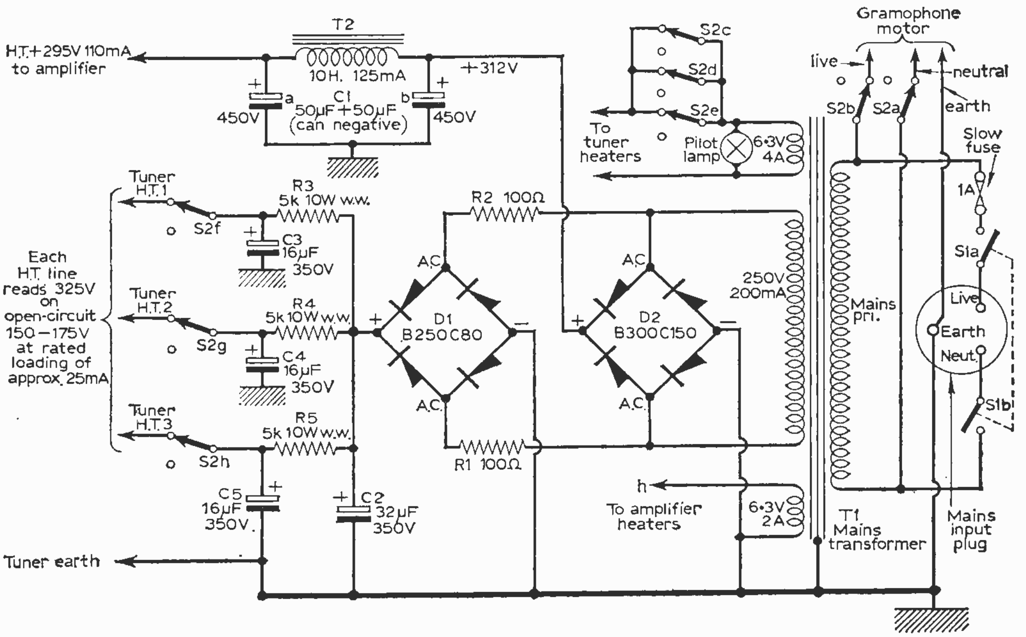


Fig. 1b—The power pack circuit.

Even V1, in spite of its low slope, is provided with very substantial grid-stoppers. All six grid-stoppers in this amplifier must be wired very close to the grid-pin they are to protect, and nothing else must then be connected direct to this grid-pin.

Tone Controls

This circuit uses a popular form of tone control which does not waste available power, nor give rise to dangers of overloading.

One of the poorest methods of tone control, from design points of view, is to connect a 10-50kΩ potentiometer and 0·1μF capacitor in series from the anode of the output valve to chassis.

(To be continued)

A Simple Filter Network

by
J. HASKELL

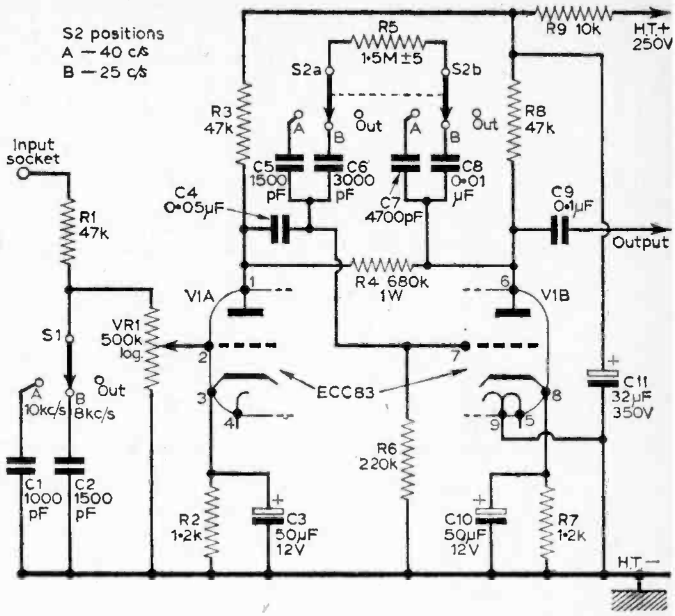


Fig. 1: Circuit of the filter network.

SAVE for treble, bass, volume and equalizer controls, scratch and rumble filters are rarely, if ever, found on average amplification equipment. These controls are necessary for the modern hi-fi amplifier, which has a good frequency response and is thus likely to reproduce record scratch and turntable rumble frequencies.

A scratch filter is also useful when playing records with a high transient content, and whose centre hole is essentric. With the former, tracin distortion would be more predominant and a hig frequency cut is necessary. The scratch filter i also useful for A.M. broadcasts where 10kc/ whistles and side-band interference are als present.

Rumble filters are useful for cutting out the lov frequency rumble present in record changers, an for eliminating the modulating tone of a medium wave broadcast.

For real high quality reproduc tion, filter "out" positions ar given; and a good frequenc response is maintained at lov distortion.

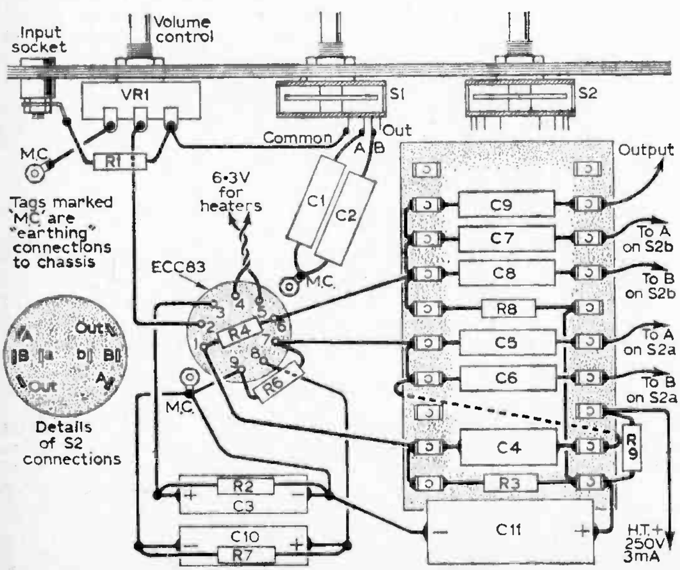


Fig. 3: General layout of the filter network.

Scratch Filter

The scratch filter shown i Fig. 1, is nothing but a simple treble-cut circuit comprising th resistors R1 and capacitors C1 an C2. Due to the attenuation arisin from a network of this type, som amplification is necessary, and thi is provided by the first section o the double-triode ECC83.

A low anode load and negativ feedback provided by R4 give good stability and adequate hig frequency response. The tw positions A and B (Fig. 1) of th switch SW1 give a 10dB cu beginning from 10kc/s and 8kc/ respectively. Although the ne work is simple, nevertheless it still very effective.

An alternative circuit for a scratch filter is given in Fig. 2. This is the cascade type, giving different degrees of cut at a fixed frequency. Both the networks have a filter "out" position when the signal is fed direct to the volume control VR1 through R1.

Rumble Filter

The rumble filter is based on the negative feedback principle. There are two advantages to this method—firstly it is very effective and secondly it improves the quality of the output of this stage.

Application of feedback from the anode of the second stage, back to the grid of the same stage, effectively lowers the input impedance, resulting in a low frequency cut. The values calculated are for cut at 40c/s and at 25c/s. There is also a filter "out" position.

If rumble still remains, even in the "A" position of the switch SW2, then C10 may be removed. This provides a gradual low frequency roll-off as well as current feedback to the second section of the valve. The high frequency response, however, will also suffer, so this should be tried only in extreme cases.

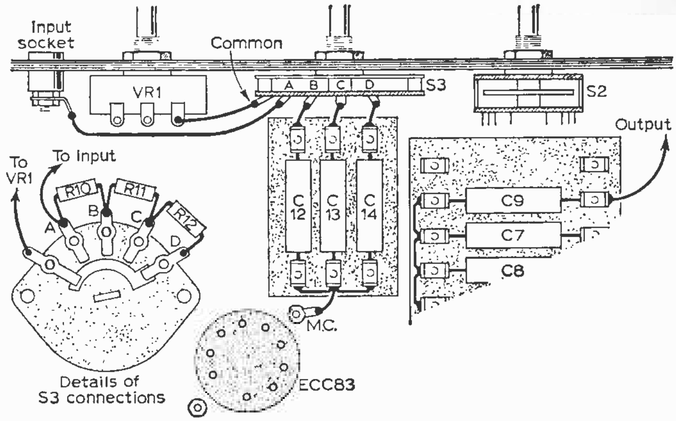


Fig. 4: Alternative arrangement when using the scratch filter of Fig. 2.

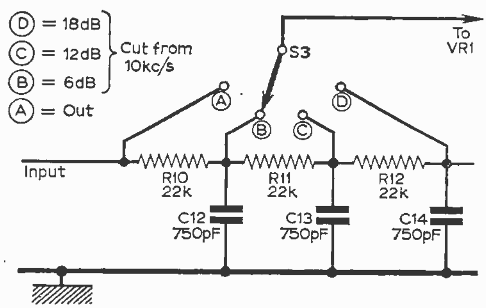


Fig. 2: Alternative circuit for scratch filter of the cascade type giving different degrees of cut at a fixed frequency.

Requirements

The circuit requires approximately 3mA of current at 250V, and is adequately decoupled by R9 and C1. An input voltage of 100mV results in an output of 600mV. The valve requires l.t. of 6·3V at 300mA.

Layout

The layout is by no means critical. Usual good wiring practice should be employed. Heater wiring should be tightly twisted and tucked close to the chassis. All signal leads should be kept away from a.c. wiring. Either a tag-board or separate tag-strips may be employed. The layout for tag-boards is given in Fig. 3. The circuit is very stable, and will give satisfaction to even the most critical of listeners. ■

COMPONENTS LIST

Resistors

(All fixed resistors 10%, $\frac{1}{2}$W, unless otherwise specified)

R1	47kΩ	R7	1·2kΩ
R2	1·2kΩ	R8	47kΩ
R3	47kΩ	R9	10kΩ
R4	680kΩ, 1W	R10†	22kΩ
R5	1·5MΩ, 5%	R11†	22kΩ
R6	220kΩ	R12†	22kΩ
VR1	500kΩ, log.		

Capacitors

C1* 1000pF ceramic or mica
C2* 1500pF ceramic or mica
C3 50μF, 12V electrolytic
C4 0·05μF 350V paper
C5 1500pF ceramic or mica
C6 3000pF ceramic or mica
C7 47000pF ceramic or mica
C8 0·01μF, 350V paper
C9 0·1μF, 350V paper
C10 50μF, 12V, electrolytic
C11 32μF, 350V, electrolytic
C12 750pF ceramic or mica
C13 750pF cermic or mica
C14 750pF ceramic or mica

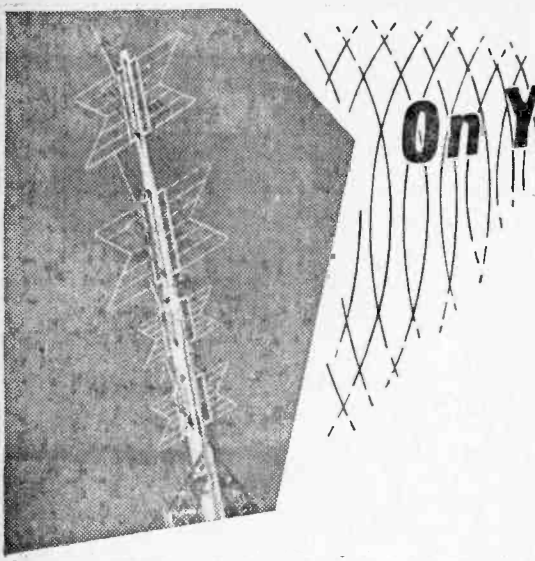
Switches

S1* 1 pole, 2 way
S2 2 pole, 3 way
S3† 1 pole, 4 way

Valve

V1 ECC83

**These components are used only in the circuit of Fig. 1.*
†These components are used only in the circuit of Fig. 2.



On Your Wavelength

By THERMION

AFTER all that has been said about the electronic games business in past issues, I have now received from a Mr. Massey of the Planet Instrument Co. of Leeds some most interesting data of a machine designed to play the game of Noughts and Crosses.

These details have been duplicated and apart from a very precise description of how the machine functions, there is a complete list of parts needed (with prices) and it would appear that here, at last, there is a really good electronic game available to those who are interested in this country.

Among the many details sent to me by readers were dozens of cuttings from American magazines showing that this hobby is apparently much more developed in the U.S.A. than over here, and I cannot imagine whether this is due to the Americans being more technically minded, or that commerce is more able to sell anything as long as it has a selling point or gimmick.

But this little noughts and crosses game appears to have most interesting possibilities and when I get time I must make one up. There are no complications so far as I can see, and no expensive relays—merely switches, bulbs and a little mechanical work for the casing or box. Thank you Mr. Massey for letting me see these details.

Short Cuts

I am often asked how such and such details can be calculated with only a single meter—the details required being those normally only found by using expensive or complicated bridges. There are, of course, well-known short cuts which are often employed by servicemen in their work, and which for all practical purposes are sufficiently accurate to enable a fault to be diagnosed, but not sufficiently accurate to enable one to say that a particular part is outside the normal working tolerance.

For instance, the impedance is often roughly calculated by doubling the d.c. resistance. I wonder if any readers have short-cuts of their own which might be of interest? One item, for instance, concerns the inductance, either of coils or iron-cored components. I have received one method of accurately calculating the inductance of an iron-cored choke, simply with an ordinary d.c. meter.

Now come on, you enthusiasts, how can you arrive at this? It seems quite an interesting idea, and I am sure there must be many such dodges in more or less common use in experimental labs. or workshops.

Ribbon Speakers

Some years ago the ribbon (or velocity) microphone was very popular, and quite a number of constructional articles appeared in many papers and magazines on how to make these. Usually the large magnets were obtained from ex-Government apparatus, and ordinary wrapping foil was crinkled for the essential element.

I have been experimenting with a similar idea for a ribbon loudspeaker, but I am afraid without much success. Either the instrument was too delicate and would only carry a very weak signal, or it was too robust and did not give much output above 12,000 or so cycles. I cannot remember seeing any articles in any magazines on the construction of this type of loudspeaker, and can only find a single one on the English market.

Of course, the efficiency is rather low, and there appears to be only one commercially made loudspeaker which incorporates one of these with a standard moving coil unit to give the complete frequency range. I have also been looking through complete receiver specifications and can only find one really high-quality radiogram which has this type of loudspeaker incorporated in its output, and this, I understand, is now being discontinued.

Why is this, I wonder? Modern tweeters are certainly very efficient, but one would have thought that the ribbon instrument, could have been developed to form a very strong competitor for these.

MIDGET MAINS PORTABLE

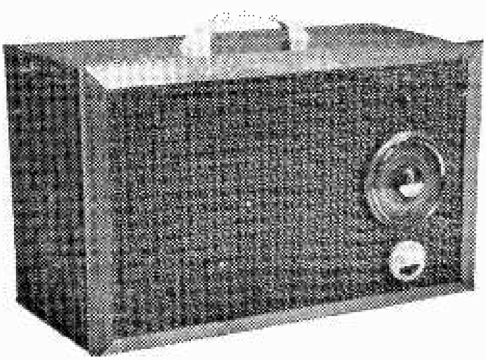
By V. E. HOLLEY

(Continued from page 746 of the December issue)

THE aerial is mounted in an aluminium bracket, details of which are given in Fig. 4. Rubber grommets should be inserted in the two ⅜in. holes and the ferrite rod passed through them. The metal can then be closed up to obtain a good tight grip. Take care in closing up that the edges of the metal do not meet or the equivalent of a shorted turn will be formed around the rod and its inductance will be reduced.

The second tuned circuit, L3, L4, is mounted above chassis in a screening can. Some manufacturers supply coils in aluminium containers which can be used for this purpose but any seamless container of suitable shape and size will do. Do not forget to remove any paint, paper labels, etc., from the lid before bolting it to the chassis.

The coil used in the prototype was designed to plug into a B9A valve base which was fitted below the chassis on the 6B.A. bolts used to secure the lid of the can above.



The author's completed receiver.

Components and Wiring

No special components are needed but it is advisable to use good quality mica capacitors for C2 and C5 because their insulation is important. Resistors can be mostly ½W or ¼W; where higher ratings are required they are specified in the list of components. Capacitors should be 350V working for C12 for which 25V will suffice.

A complete wiring diagram for the two-stage receiver is given in Fig. 3 (last month). In order to make the connections clear, the positions of the components are only approximate and the wiring has been opened out. In construction, components should be fitted in the most convenient positions and wiring should be no longer than necessary.

Tinned copper wire of 22s.w.g., covered with sleeving is suitable for all the wiring. The "earthy" end of L2 is taken to chassis on the aerial supporting bracket and is consequently not shown in Fig. 2.

Testing

When construction is complete, test with a meter between C14 and chassis to see that there are no shorts in the H.T. wiring. All being well, switch on and check that voltage is present at the anodes and screens of the valves. Measure the H.T. line voltage. It should be between 200 and 220V and if it is not, it must be brought within this range by altering the value of R16.

Alignment

Set the tuning capacitor near the fully open position, switch to Medium-wave and fix the aerial coil L1 temporarily in position about ¼in. from the end of the ferrite rod. Tune in a station at the high frequency end of the band and peak it with the trimmers TC1 and TC2.

If a high resistance voltmeter or a "magic eye" tuning indicator is available, connect it across VR1, positive to chassis; it will give a more accurate indication of optimum response than can be obtained by ear.

The next operation is to match the inductances of the two tuned circuits. Tune in a station at the low frequency end of the band and adjust the position of L1, at the same time moving the gang capacitor back and forth a little till the optimum combination of settings is found. Adjust the core of L3 for maximum signal. Repeat the adjustments at each end of the band, after which L1 can be fixed in position with a little beeswax. The final adjustment should be to the trimmers at the high frequency end of the band.

Now turn the switch to the long wave position and adjust the position of L2 and the setting of the tuning capacitor for optimum reception of the Light Programme on 200kc/s. Fix L2 in position. Do not make any alteration to the trimmers.

Tuning Arrangements

The conventional slow motion drive and tuning scale are dispensed with in favour of a direct drive on the tuning capacitor, using a 2½in. transparent "knob" with a rudimentary circular scale behind it, as fitted in some transistor sets. This gives adequate control but requires a little care to obtain accurate tuning. It is therefore supplemented by a simple selector assembly which enables the commonly used programmes to be found easily and accurately.

The spindle of the tuning capacitor carries a 2½in. drive drum, fitted back to front. Below it, bolted to the chassis, is a tinplate bracket carrying the desired number of phosphor bronze selector fingers, each carrying at the the upper end a $\frac{3}{16}$in. ball bearing which bears firmly on the surface of the drive drum.

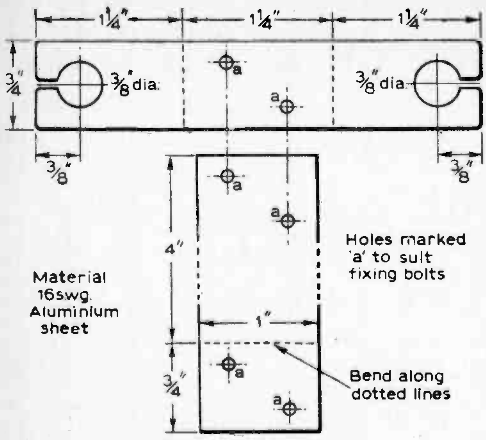
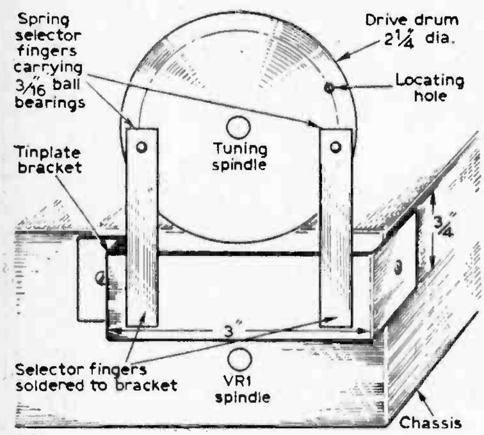


Fig. 4 (above): The ferrite aerial mount.

Fig. 5 (below): The selector turning assembly.



As the drum is rotated, the balls locate in holes drilled for the purpose in the drum and spaced radially so that each can be engaged by only one selector. Fig. 5 shows the arrangement in detail with two selectors in position; up to four could be accommodated. For a 3/16in. ball bearing, holes in the drum made with a 6B.A. clearance drill will be satisfactory; the holes in the selectors in which the balls are carried should be of a size just too small to allow the ball to pass through. It is important for accurate location that the holes should be round and sharp drills should be used.

To set up and align the assembly, place the drive drum on the capacitor spindle and fit the tinplate bracket to the chassis below it as in Fig. 5. Set the first selector in a convenient position on the bracket and mark and drill the locating hole in the drum. The selector with its ball located in the hole should then be held firmly in position on the bracket and soldered to it. With the drum stationary, rotate the tuning capacitor till the desired transmission is accurately tuned and then tighten the drum on the spindle.

For the second and subsequent selectors, tune in the desired transmission, mark and drill the locating hole and solder the selector to the bracket as before. This should be done with the set working and preferably with a meter connected across VR1 so that any inadvertent movement of the drum during the operation can be detected. This assembly gives very accurate location without requiring great precision in construction.

Cabinet

The cabinet is made very simply from four pieces of ⅜in. plywood having an oak, walnut or other suitable facing. To obtain a symmetrical appearance, the height must be adjusted to suit the spacing of the volume and tuning controls and the pilot light.

In the prototype, the tuning control was 3¼in. above the bottom of the chassis so the cabinet was made 6½in. high internally, which, with ⅜in. ply requires an overall height of 7¼in. Rebates, ¼in. deep and ⅜in. wide are required at the top and bottom of each side. The depth of the original cabinet is 5½in. but this may need some adjustment depending on the shape and size of the loudspeaker.

When the four pieces are ready, make a trial assembly, using two or three panel pins driven halfway home at each corner. Square it up and fit temporarily on the front a piece of ⅛in. ply or hardboard, cut to size.

A satisfactory fit having been obtained, mark all the joints for indentification, and dismantle; then coat the mating surfaces with glue and reassemble, driving the panel pins right home and punching the heads below the surface. Fill in the resulting indentations and any other blemishes with plastic wood of the colour in which the cabinet is to be finished. When the glue is hard, mark and cut apertures for the controls, pilot light and loudspeaker, not forgetting the wavechange switch in the right-hand side.

The loudspeaker should be sited at the top of the cabinet in any convenient position clear of the receiver. Half a dozen ½in. holes should be made in the bottom of the cabinet for ventilation.

Finishing

The top and sides of the cabinet should now be given a good rub down with glasspaper and french polished, painting or stained and varnished according to reference. Fit the loudspeaker with 4B.A. countersunk bolts, putting a little impact adhesive under the heads so that they will not rotate if it should be necessary to remove the speaker at a later date.

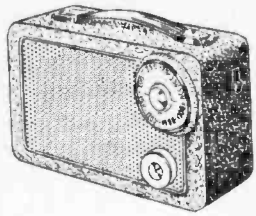
The front must then be completely covered with fabric secured with adhesive. It is not necessary to spread the adhesive over the whole surface but special attention should be paid to the edges and surrounds of the apertures. The front is finished off by fitting picture moulding round the edges, again using impact adhesive. The moulding can be of any desired shape so long as it is wide enough to hide the edge of the hardboard front. Appearance is improved if it is finished in a shade considerably lighter than that of the cabinet.

Four rubber buffers should be fitted to the bottom so as to raise the cabinet from the surface

(Continued on page 842)

MINISETS LTD Hatherley Mews London E17

THE IMPERIA



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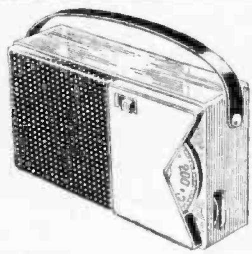

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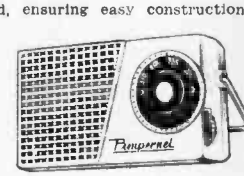

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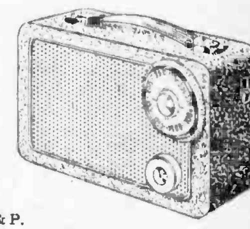

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A Transistorised Audio Oscillator

A SIMPLE MORSE PRACTICE OSCILLATOR

By K. Berry

THIS circuit was developed to meet a requirement for a simple low-level audio oscillator for the purpose of Morse practice. The design employs a balanced armature earpiece as a combined loudspeaker and inductance. It can also be used as a fixed frequency audio tone source for testing audio equipment.

Circuit Description

The circuit of the oscillator is shown in Fig. 1. It is a simple common-base oscillator. The tuned circuit comprises the inductance of the earpiece L1 and the capacitors C1 and C2. These capacitors form an impedance tap on the tuned circuit and

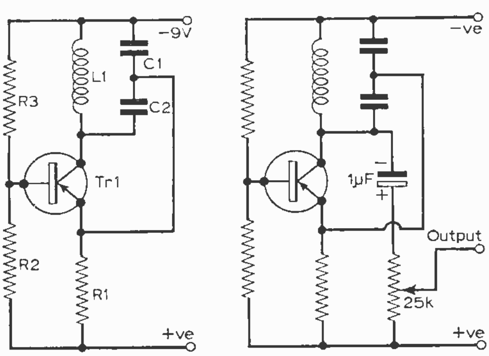


Fig. 1 (left): The circuit of the oscillator.
Fig. 2 (right): A circuit modification to use the oscillator as a tone source.

the voltage from this tap is fed back to the emitter of the transistor.

The base is supplied from the potentiometer formed by R2 and R3. It will be seen that the base supply is not decoupled by a capacitor as is usual. This was found to be unnecessary with the transistors which were tried in the circuit and was accordingly omitted.

If it is desired to use the oscillator as a tone source for testing audio equipment an output may be taken from the collector circuit as shown in Fig. 2. The maximum output voltage from this circuit is 1 volt R.M.S. into a load of 10kΩ.

If the oscillator is used as a Morse practice oscillator the output waveform is unimportant, but for other purposes where an electrical rather than acoustic output is wanted a pure sine-wave may be desired. A sine-wave of low distortion (though reduced in level) may be obtained by replacing R3 with a variable resistor (about 50kΩ) and reducing its resistance until oscillation just commences. The resultant output will then be completely undistorted.

Construction and Operation

No difficulties should be encountered in making this unit. The capacitors C1 and C2 should, as shown in the components list, be paper capacitors. Although a Mullard OC71 is specified for X1, most types of transistors, including "surplus" ones, should prove suitable.

The supply voltage is not critical—any voltage from 3 to 12 volts will operate the device, though a supply of 9 volts is recommended. The current consumption is 4mA at 9 volts. The oscillator frequency with the component values given is 1,250c/s.

The actual earpiece used was an Insert, Telephone, Balanced Armature No. 5, marked ITBA No. 5. These are low-resistance (30Ω D.C.) earpieces and are readily obtainable on the Government surplus market either singly or in pairs as headphones.

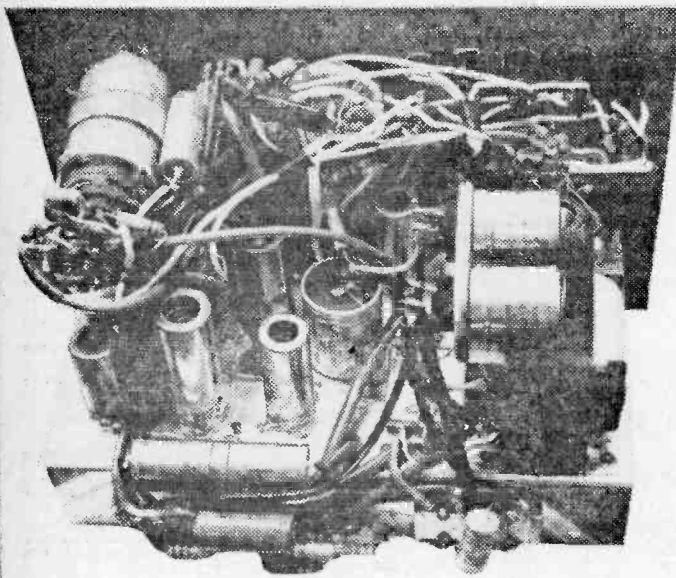
The original unit was mounted in a small Eddystone die-cast box of size $4\frac{1}{4}$ x $2\frac{3}{8}$ x $1\frac{1}{8}$ approximately, the battery being mounted externally. If a larger box is used the battery could be incorporated.

The oscillator should work as soon as the supply is connected. If it fails to oscillate the transistor may have a rather low gain. In this case a capacitor of 0·5μF connected across R2 should right matters. The original circuit operated with a transistor the gain of which was 35, so it is unlikely that any transistor, other than a defective one, should fail to oscillate. ■

COMPONENTS LIST

R1	1kΩ $\frac{1}{4}$ watt
R2, R3	5·6kΩ $\frac{1}{4}$ watt
C1, C2	1μF paper
X1	OC71
L1	Balanced Armature Earpiece

THE AUDITRON



By M. L. Michaelis, M.A.

(Continued from page 715 of the December issue)

THE use of normal germanium diodes of the r.f. or low-voltage types, is not permissible in the Auditron, and likewise, it is not permissible to use normal silicon rectifiers, even though these will stand the voltage, because their capacity is too high. The specified type of diode is rated for a cut-off frequency of 0·5Mc/s, and has about 10pF capacity. Current rating is not important and 5-10mA forward current is ample rating.

Flyback Tailing

Only at the last small portion of the highest speed range is a *part* of the flyback faintly visible. This is caused by the actually slightly exponential nature of the sharp downward-kick of the screen voltage at V6 at the end of the timebase-run, due to the very short time constant of stray capacities and the screen-impedance of V6.

This very short time constant means that the negative stroke of the blanking wave at the CRT-grid arrives about 5 microseconds late after the end of the timebase-run, and thus 5 microseconds of flyback are always visible.

However, if the effect is found to be excessive, the stray capacities in the region of V6 pin 1 are probably too high, which can most likely have resulted from an unsuitable switch S5. It should be observed that a *small* switch, with small spoon contacts and adequate spacing, be obtained for S5, i.e., a type well-established for successful use in timebase circuits, etc.

Function Switching

It is seen that the timebase circuits are completely dead in the position 1 of the function switch, giving "Signal Tracer" operation alone, i.e. allowing only the signal amplifier and valve-voltmeter to operate. S1d breaks h.t., and S1a the heaters to the timebase-circuit, in this setting. Postion 2 gives normal operation of the oscilloscope function and timebase. Postion 3 is the "Bridge" setting, where the phase-shifted 50c/s mains sinewave is used as timebase.

Here only h.t. is switched off for the proper timebase, and the heaters left operating, giving "standby" operation for the timebase. The reason for this is that normal use of the Auditron will often require repeated switching between "scope" and "bridge" functions, during experimental work.

The resulting repeated switching of the heaters of the timebase valves is neither good for the valves, nor good for working, as it would repeatedly waste time waiting for the valves to warm up, and would cause drifts in the timebase-calibrations, as the valves never then reach the proper stable operating conditions.

Calibrating the Timebase

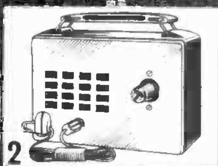
The Auditron should be switched on once everything is complete and working properly, and left running for at least 10 minutes on "scope" function before any attempt is made to calibrate the timebase. This allows the valves to reach the final operating state.

Now for the calibration procedure with normally available equipment. A preliminary is to be *certain* that the capacities of C25, C26, C27 are as closely as possible in the ratios 1 : 10 : 100. If necessary, trim with suitable parallel capacitors across those which are "low" in value. The *actual* capacities are far less important than the ratios, and the simple method for getting the ratios exact as required is described below.

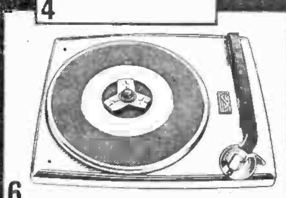
Having satisfied the above, switch to the fastest range, maximum sync., and feed in a signal at

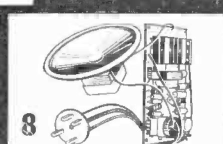
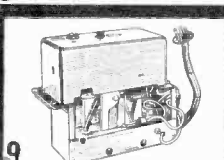
(Continued on page 837)

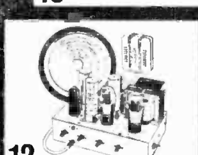
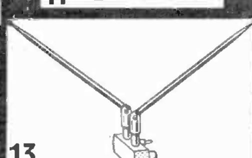
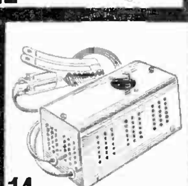
Just a few of our BARGAINS





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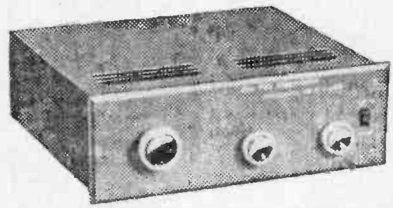

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TECHNICAL DATA—Power Output: 10 watts into 3 ohms. **Negative Feedback:** 60dB in main amp. **Output Impedance:** 0.23 ohms. **Harmonic Distortion:** less than 0.25% total at 10 watts output. **Frequency Response:** (—3dB, tone controls central) 30 c/s-20,000 c/s. **Bass Control:** ± 12dB at 30 c/s. **Treble Control:** +12dB, —16dB at 15,000 c/s. **Signal/Noise Ratio:** —70dB ref. max. output. **Input Selector:** (*i*) **Gram.,** high imp. crystal or mag. fully compensated, 100 mV; (*ii*) **Radio,** tape, etc., high imp. 150 mV. **Power Consumption:** 18 watts at 240 v. **Size:** 8¼ x 3 x 7in. **Weight:** 4 lb. **Finish:** grey wrinkle with gold front panel. **PRICE: 16 gns.**

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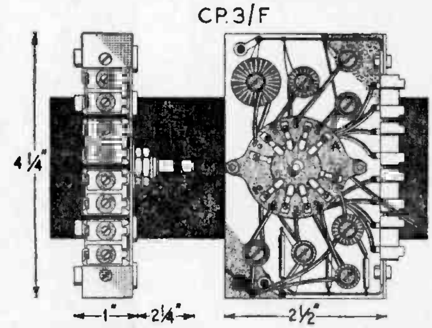
CP.3/F



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STOP PRESS: Stereo Broadcast Decoder Transformers, 26/- each.

(Continued from page 834)

100kc/s from an r.f. signal generator on the long wave range. One complete cycle of this frequency is 10 microseconds in duration. It should be possible to syncronise such that about one cycle appears stationary on the trace, and note its length against the centimetre lines engraved on the perspex-window to be placed in front of the c.r.t.-screen.

Thus calculate, in direct proportion, what time is represented by one centimetre of trace, and make the appropriate mark against the setting of the timebase fine-speed control.

Now slow-down the timebase speed by means of operating the fine control, until two waves appear stationary on the screen. Each cycle is 10 microseconds, thus the new time per centimetre can be read off in proportion. Carry on in this way, for increasing numbers of complete cycles stationary on the trace, until the slow-end of travel of the fine speed control is reached, when about 25 cycles should be visible.

From the 25 calibration marks prepare a properly-divided scaleplate, and affix to the fine-speed control. This will carry markings from about 12 to 25°, labelled "microseconds per centimetre", and should hold true, multiplied by 10 or 100 respectively, in the two slower settings of the coarse control S5, *provided* the ratios of C25 and C27 have been properly trimmed.

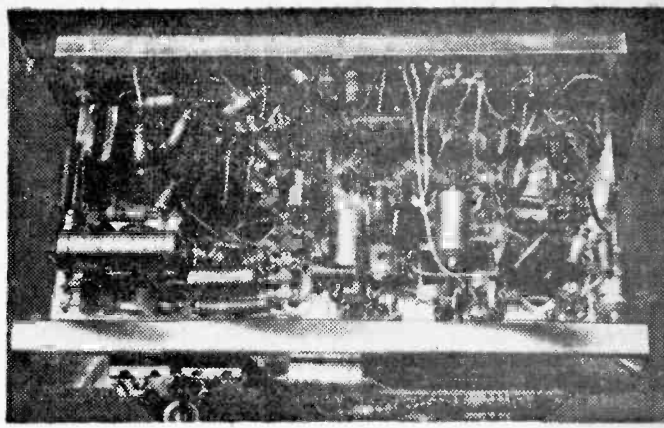
Check against the mains on the lowest speed range. One cycle of the mains frequency should occupy 20 milliseconds. If this is not observed, then something is wrong either with the accuracy of the 100k/c from the signal generator, or with the ratio-trimming of C25-C27.

The signal-generator should be checked initially by feeding the output into the aerial terminal of a radio receiver switched to long waves and tuned to the BBC Light Programme on 200kc/s. The generator should be tuned around the 100kc/s mark on its scale until zero-beat is heard between the second-harmonic and the Light-Programme carrier. This assures an accurate 100kc/s input to the Miniscope for the calibration.

Ratios of C25 to C27

The circuit of Fig. 2b should be connected up neatly in experimental form. Ra should be about 100Ω, and Rb about 1kΩ. Whatever the exact values, they should be exactly 1:10 ratio in nominal values, and ± 1% tolerance. Alternatively, lengths of resistance wire may be used, the one for Rb cut off exactly ten times as long as the one for Ra, from the same reel of wire. Using a thin resistance wire having at least 100Ω per yd. reasonable lengths suffice.

Various small capacitors are tried in parallel with either Ca or Cb until minimum sound is heard in the headphones, representing true 1:10 ratio of the final combinations for Ca and Cb. Use good-quality capacitors for C25 and C27 and any trimmers for these, of reputable make and stability.



A view of the underside showing the wiring.

It is well worth while to take some trouble to perform all steps of the timebase-calibration very carefully and methodically, as the final result will be a frequency-meter of surprising accuracy, for any frequency from about 25c/s to several hundred kc/s. Any waveform can be dealt with, but irregular sequences, such as a Geiger-Counter output, cannot have their frequencies measured in this way.

Power Supplies

A 6·3V heater supply at about 3A is required, and two h.t. lines, the one at about 240V 40mA and the other at about 600V 1mA (e.h.t. for the c.r.t.). A normal heater winding, and a 250V 50mA a.c. winding, feeding a conventional voltage-doubler circuit using the two contact-cooled metal rectifiers D1 and D2, supply these needs from an ordinary mains transformer.

In addition, a *fully isolated* 110V winding is required. The exact voltage is not critical, anything between 80 and 150V will do, though R1 will have to be altered in the same ratio as the available transformer voltage differs from 110. Also, R17 and R18 will have to be altered to give a trace of convenient length if the transformer voltage differs from 110. If it is not possible to obtain a transformer with such an extra isolated winding a small heater transformer giving 6·6V from a 110V supply should be run in reverse from the heater line of the Auditron. This heater transformer can be mounted at any convenient position within the instrument, but far enough from the c.r.t. so as not to influence it with any stray magnetic field it may have.

Although electrically suitable, the procedure of connecting the mains neutral to chassis and using the 110V tap on the mains primary for the 110V line is to be strongly discouraged for reasons of safety. If such an arrangement were used, and the mains plug connected the wrong way round, the chassis and all coaxial sockets would go live at full mains voltage. Apart from the dangers of shock, this could lead to *serious* short-circuits across equipment connected to such a universal instrument as the Auditron, and possible destruction of valuable equipment.

The H.T. and E.H.T. Supplies

Note the smoothing arrangements of R5, R6, R7 and C1-5 in Fig. 4. These are arranged to give maximum smoothing with the specified normal components, for simultaneous loading as required at the single and the doubled voltage. C6, being a good metallised-paper capacitor, gives an additional measure of stabilisation against small "flimmerings" of electrolytics on the e.h.t. line, thereby making the trace on the c.r.t. more steady. If the electrolytics used are very good, it can be omitted. Also, placing it in parallel with C11 instead of in the position shown could be tried. R8 serves as load for the e.h.t. line in the "tracer only" function, where the "scope" is off, thus preventing unnecessary peaking of the voltage. Most of the e.h.t. current consumed in the "scope" and "bridge" settings flows through the bleeder R14 down to VR1, which is operative immediately upon switching on, before the c.r.t. is warm. Thus initial switching-peaks are avoided.

Note the inclusion of C11, a high voltage electrolytic from final anode of the c.r.t. *to chassis*. This was found to be absolutely essential, connected in this way, to remove distribution hum between the e.h.t. line and the signal feeds from the Y-amplifier and the timebase. Such hum would give a widened or wiggly trace, depending whether the mains frequency is locked or not, if not removed.

Choice of Cathode Ray Tube

The tube used in the prototype is the Telefunken DG3-12A, a medium persistence miniature 1¼in. electrostatic tube for about 500V e.h.t. operation and 6·3V heater, for connection into a normal heater circuit. This is a fine precision tube, and should be readily obtainable in Britain from Telefunken representatives.

Any surplus tube, or tube of other origin, having similar electrical characteristics is directly usable in the Auditron.

The tube used must have a sensitivity such that 100 to 150V peak-to-peak is sufficient to deflect the spot right across the usable region of the screen, and if this condition is satisfied (see data for the tube it is proposed to use), the timebase and signal amplifier outputs for the here-published form are ample. If the sensitivity is greater, then outputs may be reduced by decreasing R65 suitably for the signal amplifier, and tapping the anode-load of the timebase by using a fixed resistor and potentiometer in series in place of VR10, but keeping to 100kΩ total resistance. One end of the potentiometer should still be connected to h.t., and the X-deflection fed from the other end.

Other E.H.T. Voltages

If the tube it is proposed to use satisfies these specifications in every way except that it needs a somewhat higher e.h.t. than 500V, then proceed

(*Continued on page 841*)

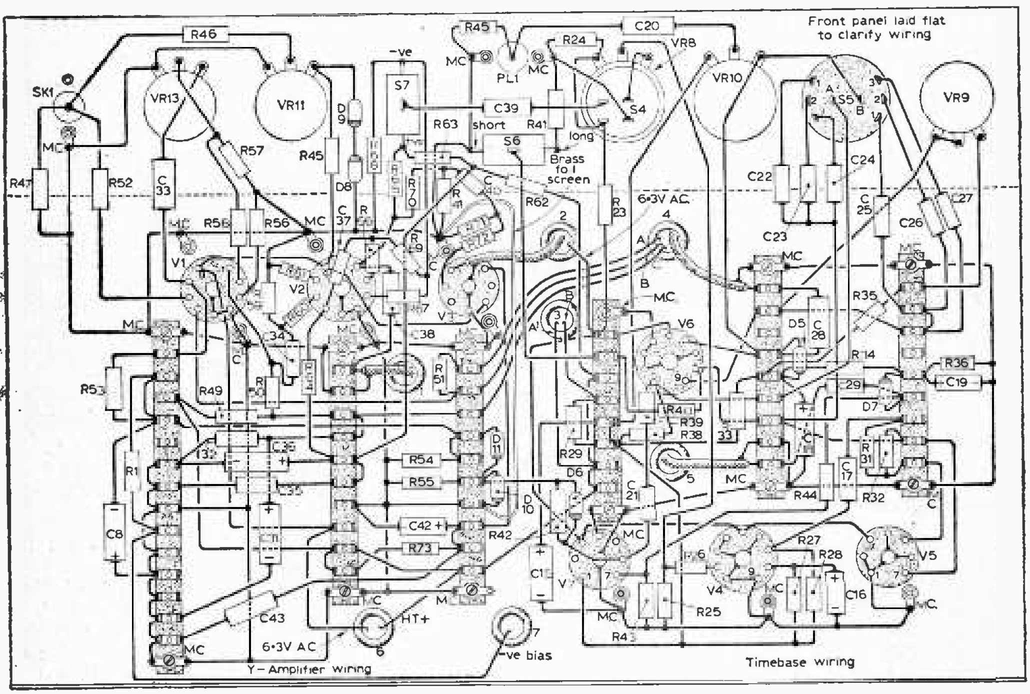


Fig. 11—The Y-amplifier and timebase wiring diagram.

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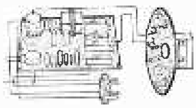

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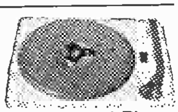

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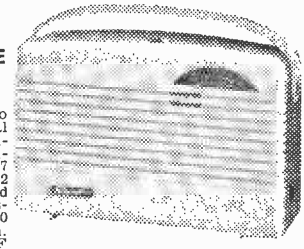

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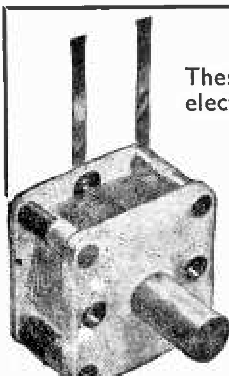

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(Continued from page 838)

as follows. Obtain a transformer with a 300, 350 or 400V a.c. winding, tapped at 250V. The end "0" still goes to C2, and D1 is unchanged, and fed from the 250V tap. Use a 1,000V a.c. input rating e.h.t. metal rectifier, of 2 to 5mA, in place of D2, and feed from the full voltage end of the transformer winding. The required full winding voltage will be about half the desired e.h.t. voltage, and is not critical. Remember that it is nearly always possible to run a c.r.t. at less than the rated e.h.t., at a slight sacrifice of focus and brilliance, but

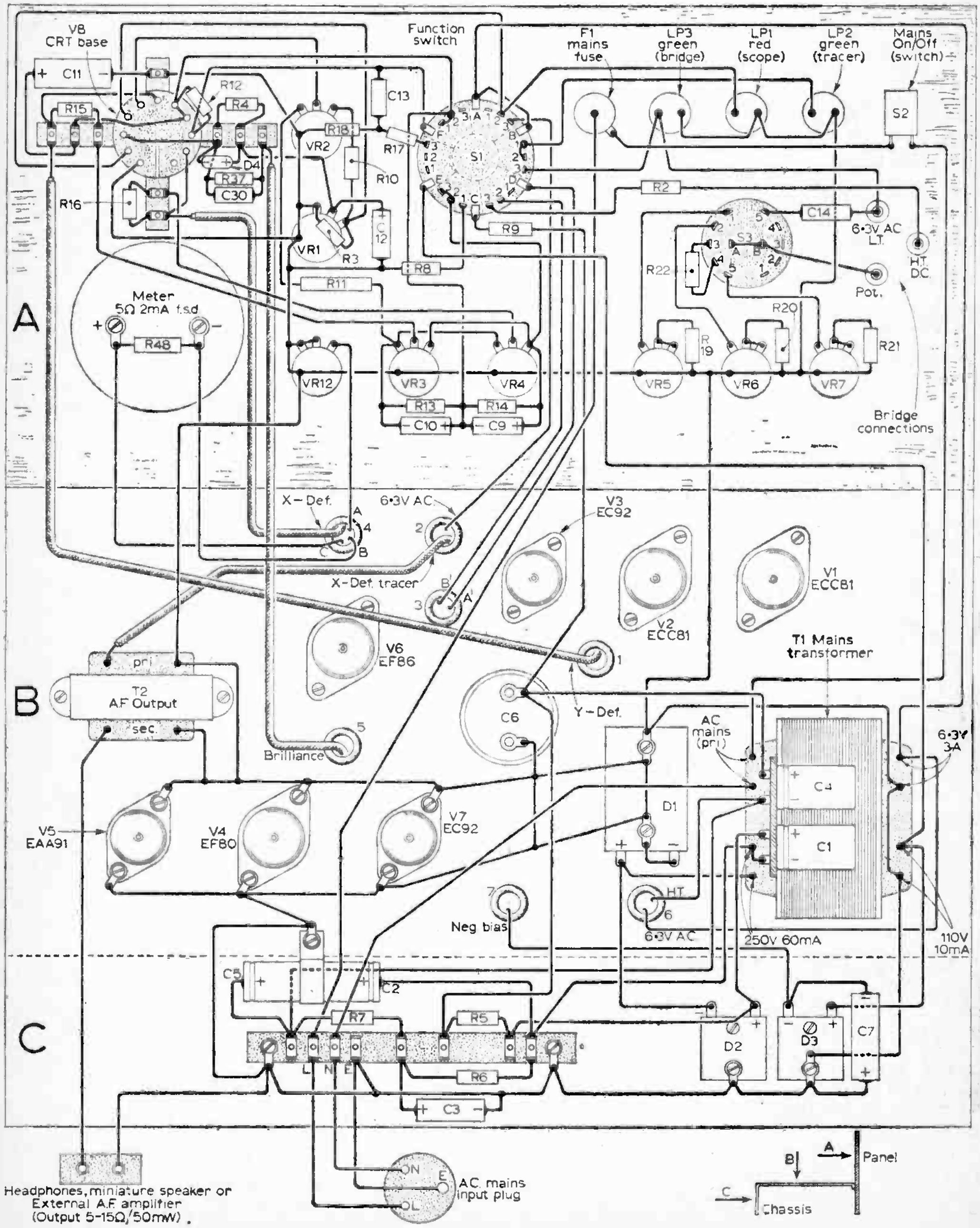

Fig. 12—Above-chassis and panel wiring.

increased deflection sensitivity, which latter may be very useful in adopting an available tube for use in the Auditron.

Remember to modify the voltage ratings of C1, C4, C6, C11 and possibly C12, C9, C10 if using other e.h.t. voltages. Use a pair of well insulated electrolytics in series, with a 1MΩ 2W resistor in parallel with each, in each position where a single electrolytic of the required rating is unobtainable. All resistances in the e.h.t. bleeder network, including potentiometers, will need modification if other voltages are used. The values of potentiometers should not be changed, but additional fixed resistors added, one on each side, for VR2, each equal to 125 times the e.h.t. increase ratio, in kΩ. If the resulting bleeder does not give the correct settings quite in the centres of the ranges of the controls, final adjustments should be made by trial and error, using common sense to determine the necessary direction of corrections from observation of the effects.

C.R.T. Mounting

If the proper mumetal screen and fixtures for the proposed tube are not to hand, and cannot be procured, then the following method of screening and fixture should be adopted. The tube should be enclosed by winding strips of sponge-rubber, or similar material, round all parts of it except the screen and base. This should be held in place by slipping a suitably shaped screen made of galvanised iron sheeting over it (a simple tube in the case of the Telefunken DG3-12A, a tube with conical end in the case of the VCR139A, etc.). A suitable angle-bracket is fixed to the panel on the inside, and the tube assembly clamped down on to this by means of a metal strap round the screen and fixed by means of two bolts to the bracket. Any other method of fixture giving rigidity and not straining the tube mechanically is equally suitable. The tube should be able to be rotated slightly, by slackening the strap bolts, to facilitate final mechanical alignment to get the timebase trace horizontal.

Deflection Connections

It is seen that asymmetric deflection is used on X and on Y plates. The slight astigmatism thereby produced is well tolerable, so that the trouble and expense of introducing push-pull amplifiers for symmetric deflection was not considered to be worth while. Thus one X plate and one Y plate is normally connected to the final anode (at earth potential for a.c.), and deflection voltages are applied to the other plates.

To avoid unnecessary capacitive loading of the timebase anode circuit due to switching, etc., the sinewave voltage for "bridge" X deflection is applied to the other X plate, normally "earthed" on "scope" function. This has the added advantage of enabling frequency comparison to be made against the mains frequency.

Elliptical Frequency Comparison

For this purpose, the function switch is turned to "bridge", and the Y calibration signal turned up on VR11, to obtain a suitably-sized oblique ellipse on the screen. Any external waveform to be examined may now be fed in at P2, the timebase output in "scope" use, and will "corrugate" the ellipse. The corrugations will rotate if the input waveform is no exact harmonic of the mains frequency, the number of rotations per second giving the number of c/s above or below the closest mains harmonic. For each exact harmonic relation the corrugated ellipse comes to rest, and the number of complete corrugations gives the number of times the input frequency is greater than the mains frequency.

This arrangement can be very useful for a quick check whether or not some circuit or other is locked to the mains or a harmonic thereof, which is required in some advanced experimental work. On the other hand, a very simple use of this arrangement is to check a fullwave h.t. rectifier. Feeding the ripple from the reservoir capacitor in, this should give two corrugations, stationary, and symmetrical in size and position. If asymmetry is noted, or only one corrugation, then one diode of the fullwave rectifier is not operating properly. Excessive ripple, caused by an open-circuited reservoir capacitor, can cause the ellipse to double-up into a distorted figure-of-eight. If this is symmetrical, it is proof that the fault is not in the rectifier valves, or not likely to be there.

(To be continued)

MIDGET MAINS PORTABLE

(Continued from page 830)

on which it stands sufficiently to allow the moulding to clear the surface. A plastic carrying handle on top is a useful addition.

Fitting the Receiver

Reduce the length of the wave change switch spindle to about ½in. and cut away the fabric from the front control apertures. Connect the loudspeaker and place the receiver in position, securing it with wood screws through the end flanges of the chassis. It is advisable to earth the metal frame of the loudspeaker or it may be found to affect the aerial inductance. This may be done by connecting it to the "earthy" side of the speech coil.

Fit a brass coupler to the wave change switch and use the sawn-off portion of the spindle to extend the control to the outside of the cabinet. The circular tuning scale can be secured direct to the fabric on the front of the cabinet but it is more convenient to operate if the scale and the "knob" which fits over it are made to stand out about ⅛in. This can be done by interposing a circular piece of hardboard or ply between the scale and the fabric.

Since the receiver is portable, it is desirable to fit a back to the cabinet. This may be of ⅛in. ply or hardboard with plently of ½in. holes for ventilation. Drive a couple of panel pins into the bottom edge till they project to about ⅛in. and file the heads to points which can be pressed into the bottom of the cabinet. The top can be secured to triangular wooden fillets glued into the top corners of the cabinet. ■

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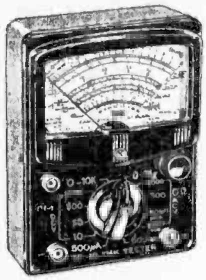

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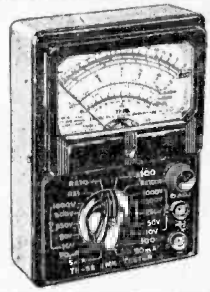

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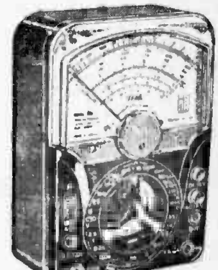

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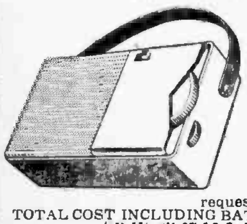

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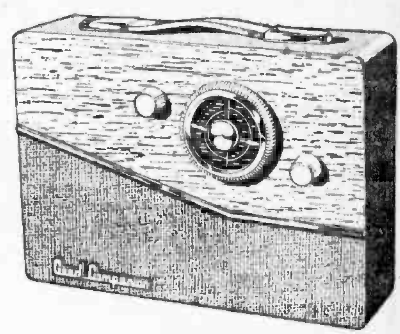

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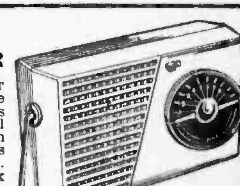

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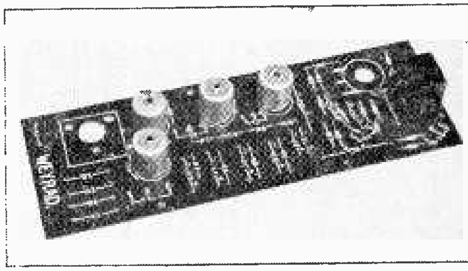

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3S4	5/9	6V6G	7/6	35W4	8/6	ECC84	7/6	N17	5/9	UL41	8/6
3V4	6/6	6X4	5/-	35Z4GT	8/-	ECF80	8/6	N18	8/-	UY41	7/6
5Y3GT	5/-	6X5G	5/9	5763	7/6	ECF82	8/-	N19	7/6	W17	7/6
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6AM6	4/-	12AD6	11/6	DCC90	12/6	ECL82	9/-	PCF82	7/6	X142	9/-
6AT6	6/-	12AH8	10/-	DF91	3/-	EF41	9/-	PCL82	8/-	X150	9/-
6BA6	5/-	12AT7	6/-	DF96	8/-	EF80	8/-	PCL84	9/-	Z77	4/-
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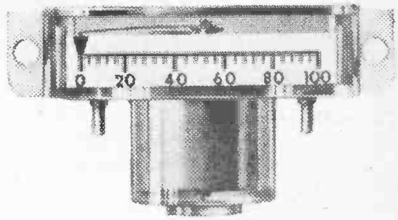
Trade News



A Taylor model II Edgewise meter.

MINIATURE TRANSISTOR AMPLIFIER

A NEW miniature transistor amplifier has recently come on to the market which has been designed for general use in intercom sets and portable record players and similar equipment. Its actual dimensions are 2in. x 1in. x 1in. and it uses for power a standard 9V battery in a three-transistor circuit.

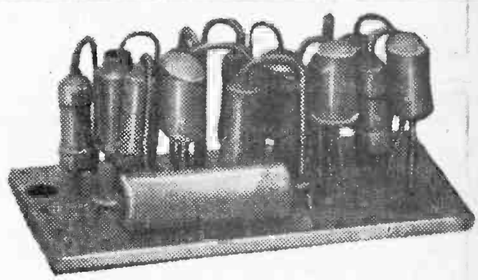
A feature of this amplifier is that it does not incorporate a transformer although one may be used if a high impedance input needs to be used.

The price of the amplifier (type 125) is 45s. and it is made by *Technical Suppliers Ltd., Hudson House, 63 Goldhawk Road, London W12.*

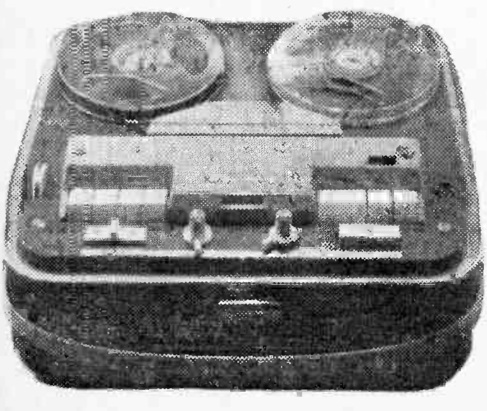
MINIATURE METER

THE model II Edgewise Meter is a Taylor instrument designed for special applications. Its very small dimensions give it obvious advantages over meters of more conventional size, the length of the scale being only 1¼in. The meter is built into a transparent case and a wide range of sensitivities is available, commencing at 50μA.

The model II is made by *Taylor Electrical Instruments Ltd., Montrose Avenue, Slough, Buckinghamshire.*



A miniature transistor amplifier from Technical Suppliers Ltd.



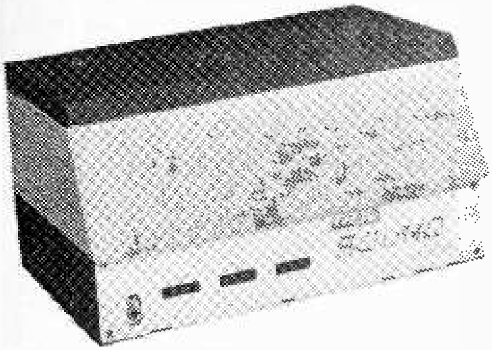
The new twin-track Grundig tape recorder.

NEW TWIN-TRACK TAPE RECORDER

ONE of the latest model tape recorders from Grundig (Great Britain) Limited, is the TK41. This is basically the twin-track version of their model TK40, but is equipped in addition, with a 7W output stage with separate bass and treble controls. The loudspeaker is fed with a reduced output power to prevent damage to the loudspeaker when the volume control is at maximum.

Inputs are provided for microphone, telephone adaptor, radio extension loudspeaker/gramophone pick-up and radio diode. There are also facilities for the connection of a remote control which can be fitted as an accessory.

The TK41 costs 75 guineas, including the microphone, and is made by *Grundig (Great Britain) Limited, 40 Newlands Park, Sydenham, S.E.26.*



The Sound Stereo Addon Unit.

STEREO UNIT

A USEFUL extra for owners of 1963 Sound tape recorders, models 42, 44, 38A and 40A, is the Sound Stereo Addon Unit. This unit is connected to any of these recorders by a special lead and enables pre-recorded stereo (four track) tapes to be reproduced.

The Addon unit is an amplifier matched to the tape recorder, and is capable of giving over 3W output. The printed circuit uses one ECC83 and one ECL86 valves. The cabinet has been designed to harmonise with the style of the tape recorders.

The cost of the unit is £14 14s. and it is made by *Sound Tape Recorders (Electronics) Ltd., 784-788 High Road, Tottenham, London N17.*

POCKET SIZED INSTRUMENTS

TWO radio servicing instruments made by Don Bosco, an American firm, can now be obtained in this country. They are both pocket sized and are carried as a pen, being less than 6in. long and only ½in. in diameter and being fitted with a pen clip.

The "Mosquito" signal injector, one of the instruments, provides a signal source (1kc/s with harmonics to 30Mc/s) for various applications. It generates a signal covering the audio i.f. and r.f. spectrum in any circuit under test.

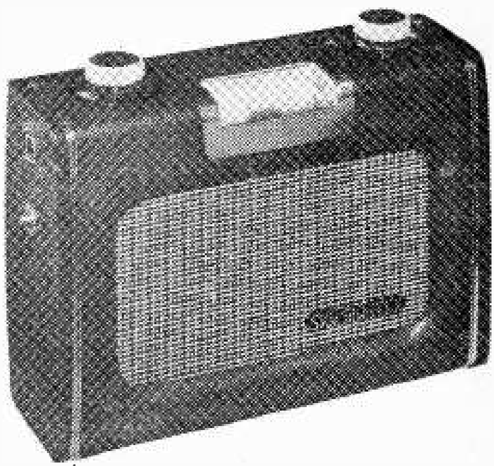
The "Stethotracer" is a multipurpose instrument to be used alone or with a range of accessories as a complete signal tracer.

Both these instruments use a self contained 1½V battery for power. The cost of the "Mosquito" is £5 15s. and the "Stethotracer" is £12 15s. The U.K. suppliers of all Don Bosco equipment are *Unitec, 57 Longfield Road, Harpenden, Hertfordshire.*

NEW PORTABLE RECEIVER

THE latest transistor receiver to come from the Ever Ready Co. Ltd., is the Sky Master. This is a six-transistor model covering Long and Medium wave bands. It is available in either blue or tan and it operates from a PP7 battery. The price is £17 17s. which includes purchase tax and battery.

Ever Ready Co. (G.B.) Ltd., Hercules Place, London N7.



Ever Ready's latest portable receiver.

International Conference on Satellite Communication

About 500 satellite communication experts, from several countries, gathered at the Institution of Electrical Engineers in London for the International Conference on Satellite Communication held in November, this year.

The Conference, organised by the Electronics Division of the I.E.E. was opened by Sir Ronald German, Director General of the Post Office. Others taking part were Captain C. F. Booth, Mr. F. J. D. Taylor and Mr. W. J. Bray (the British Post Office team responsible for engineering the Goonhilly project) and Mr. E. F. O'Neal, in charge of the Telstar project from the United States side, who was accompanied by other leading U.S. engineers from the Bell Telephone Laboratories and elsewhere.

More than 60 papers were presented and discussed, the object of the Conference being to bring together a representative cross-section of those actively concerned with furthering the science and technology of communications satellites and associated ground stations.

The Conference was divided into 11 sessions. Three dealt with aspects of complete satellite communications systems, and a further three with ground station aerials.

Projects Telstar and Relay, the first experimental systems involving active civil communications satellites, occupied two sessions devoted to the satellites themselves and the associated ground station equipments.

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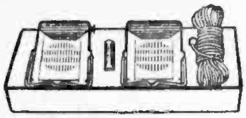

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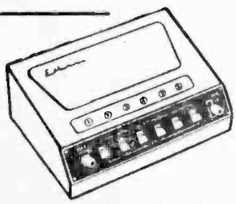

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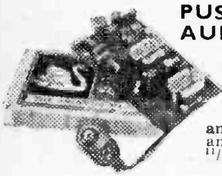

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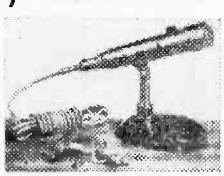

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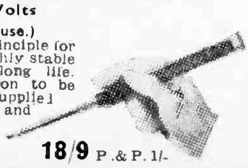

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some further notes on the *Regency*

SOME OBSERVATIONS AND RECOMMENDATIONS BY THE AUTHOR OF THIS POPULAR P.W. RECEIVER, FOR THOSE WISHING TO BUILD IT.

By D. B. Pitt

SINCE the publication of the *Regency* in the April 1962 issue of PRACTICAL WIRELESS, a fair amount of correspondence has taken place with readers, and it is the purpose of this article to summarise the main points raised.

Among readers who experienced difficulties with the receiver, there were three main complaints: (1) insensitivity (2) difficulty in following the "adjustment" procedure (p.1129) (3) instability. These three subjects will be dealt with in order, the last mentioned at some length.

Owing to the exigencies of printing, the writer did not have an opportunity of reviewing proofs prior to publication and a few small changes passed uncorrected.

Insensitivity

(1) The *Regency* was designed around two SB305 transistors (surface barrier type) and two OC72 transistors. Since SB type transistors are manufactured by only one company (Semiconductors Ltd.) and are not very widely retailed at present (though generally available by post) OC45 transistors were editorially substituted in the blueprint.

Ordinary junction type R.F. transistors such as the OC45 and OC44 are very widely retailed and the Editor felt that these would be likely to give reasonably satisfactory reception in most areas.

Correspondence since this date has revealed that many readers are *not* able to obtain sufficient volume in this way, and the writer therefore strongly recommends the use of the surface barrier types employed in the prototype. The SB078 transistor is, incidentally, a perfectly good substitute for the SB305 in this circuit.

This does not mean that *only* surface barrier transistors may be used for Tr1 and Tr2 to give good sensitivity. Any of the new diffused-base types (OC169, OC170, OC171 and equivalent type transistors) may be used *in principle*, especially for Tr1, but owing to the very high gain of these transistors, it may be found necessary to include a resistor in the *emitter* lead, especially of Tr2, in order to obtain stable performance. The value of such resistors can best be found by experiment, other component values not being affected.

Adjustment Difficulties

(2) The writer's semi-profile drawings of the volume controls appeared on the blueprint in "plan" view. Since the controls are symmetrical in form. the "plan" view is capable of two interpretations and some beginners to radio construction unfortunately chose the wrong sense. This error resulted in the reversal of the terms "clockwise" and "anti-clockwise" in the portion of text headed "Adjustments" and caused some confusion.

Looking at the front of the receiver, full *clockwise* rotation of the sensitivity control should be arranged, of course, to produce *maximum* resistance between points 26 and 27.

Instability

(3) During the two months following publication of the *Regency*, a number of readers reported instability in the receiver and these have been carefully analysed.

Instability often occurs in receivers through irregular coupling of the stages by reason of a shared battery resistance. This is most common at high supply voltages. Since the *Regency* uses 4½V instead of the more usual 9V, and the battery is by-passed by a 100μF capacitor, instability from this cause is hardly likely to occur and may safely be ignored.

Reflex receivers run the risk, however, of a special type of instability peculiar to their design. This arises from the presence of inductive elements in both collector and base circuits.

For efficient performance, the R.F. choke inductance must be kept high, especially if reception on the long wave band is required. The impedance presented by the choke at the higher frequencies (200-300m) may now be so great as to react with the inductance of the medium wave coupling coil so as to set up an audible oscillation. The inductance of this coupling coil must therefore be kept *as low as possible* consistent with reasonable transfer of signal.

The aerial rod assembly specified (Repanco FR2) has medium-wave coupling *within the required limit*. Likewise, the hand-wound coil and frame-aerial described (p.1129) are "tapped" at a point *well within the limit of safety.*

The Editor was kind enough to allow the writer to examine a *Regency* receiver submitted by a reader who complained of unstable performance.

Of the five inductors used, *none* were of the specified type, so that instability could have arisen in a number of ways. Nevertheless, the receiver functioned perfectly as soon as a suitable medium-wave coil was substituted.

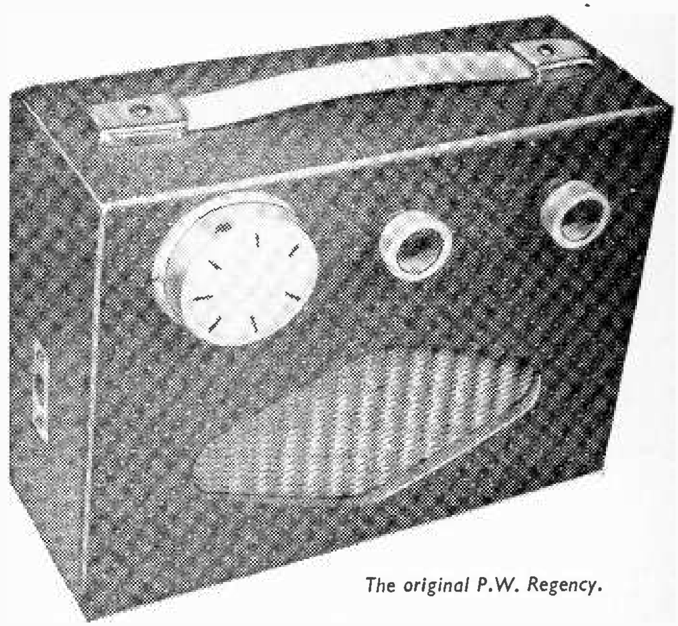
The aerial assembly employed by this reader, although a near enough substitute for use in a superhet receiver (for which most of such commercially supplied "aerials" are intended) was *not* a near enough substitute for use in a reflex receiver of high R.F. gain such as the *Regency*.

The inductance of the coupling coil rises with increased rod diameter, with increased number of turns, and with increased wire diameter. In the case of the receiver examined by the writer, the increase was due to *all three causes* together.

This defect can, of course, be readily cured *by simply removing a few turns from the medium-wave coupling-coil.*

To a few readers who had purchased an unsuitable aerial assembly and who did not care to tinker with an expensive component, the writer suggested placing a small resistor (typically 100Ω) across the medium-wave coupling-coil so as to shunt part of the signal. This has the desired effect at the cost of some slight loss in sensitivity.

A resistor (typically 1,000Ω) placed across the R.F. choke, gives a similar effect but, of course, needlessly reduces the efficiency of the long-wave band.


The original P.W. Regency.

Loudspeaker

Details of the loudspeaker were unfortunately omitted from the blueprint. The speaker used by the writer was an Elac 7in. x 4in. and this, or a similar type, is recommended. The *Regency* circuit will drive *any* large-diameter, high-flux speaker of from 2 to 5Ω impedance.

Short-wave Reception

The frame-aerial described on p.1129 is for the medium-wave band. If the Surface-Barrier transistors preferred by the writer are used, reception up to at least 5Mc/s may readily be obtained by simply reducing the number of turns on the frame aerial. The tapping, as before, should be after the first turn.

The hand-wound ferrite-rod aerial described does not offer quite such good possibilities owing to losses within the ferrite at high frequencies. Nevertheless, good "top band" and trawler band *at least* may be expected by reducing the number of turns.

Car Aerial

A number of readers have requested details of how to make the *Regency* work inside a car, using a standard "whip" type rod aerial.

For this, a length of co-axial cable is required. The outer braid is attached at one end to the frame of the car (preferably at the whip aerial's fixing screw). The other end of the outer braid goes to point "Y" in the receiver. The inner conductor of the cable is attached at one end to the metal of the "whip" itself and at the other end *either* directly to point 29 of the receiver *or* via a 47pF capacitor to the side-tag of the tuning condenser.

S.B. Transistors

The S.B. transistors used by the writer in the prototype receiver may be obtained from many advertisers in this magazine.

In case of difficulty they may be ordered directly from "Semiconductors Ltd.", Cheyney Manor, Swindon, Wilts. Types SB305 and SB078 are about equally suitable. ■

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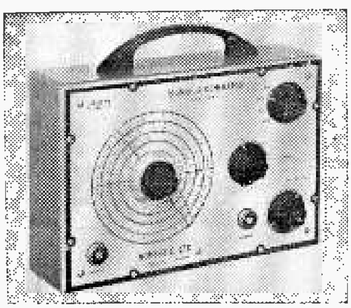

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Club News

REPORTS OF CURRENT ACTIVITIES

BARNSLEY AND DISTRICT AMATEUR RADIO CLUB
Hon. Sec.: P. Carbutt, G2AFV, 19 Warner Road, Barnsley, Yorkshire.

An illustrated tape-recorded lecture provided entertainment for members at the meeting on November 9th, the subject of the lecture being an expedition to St. Pierre. On November 23rd members had a chance to compare notes on their transmitting/receiving apparatus at a display of equipment organised by the Club.

Future Event:
December 14th—"Receiver Construction", by Mr. W. W. Williams.

CHILTERN AMATEUR RADIO LUB
Hon. Sec.: H. D. Coltman, G3PVJ, 301 Micklefield Road, High Wycombe, Buckinghamshire.

The only meeting of this Club in November was held on Thursday, 29th, and was devoted to a lecture on "Amateur Closed-circuit TV".

CLIFTON AMATEUR RADIO SOCIETY
Hon. Sec.: C. Godsmark, G3IWL, 211 Manwood Road, London, S.E.4.

The subject under discussion at the meeting on November 2nd' was the club contests held from time to time for members.

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

November proved to be a busy month for members of this Society, beginning with the annual trip to London for the R.S.G.B.'s exhibition, on Saturday, 3rd. On November 7th a surplus sale was held and on the 10th some members took part in the second R.S.G.B. 1·8Mc/s contest. R. Cullen gave a talk entitled "Radio Controlled Models" on November 14th and the last official meeting for that month was devoted to a film show.

The first meeting for December was taken up by another surplus sale.

Future Event:
December 12th—"The Club in Retrospect".

LEICESTER RADIO SOCIETY
Hon. Sec.: R. E. Hill, 28 Fayrhurst Road, Leicester.

At the recent A.G.M. of this Society the following officers were elected: Mr. M. Harrison, chairman; Mr. R. E. Hill, secretary; and Mr. H. A. Gray, treasurer.

Activity during the winter months will be confined to erecting the Society's operating room to be equipped with a 120W transmitter for the h.f. bands.

MELTON MOWBRAY AMATEUR RADIO SOCIETY
Hon. Sec.: D. W. Lilley, G3FDF, 23 Melton Road, Asfordby Hill, Melton Mowbray, Leicester.

The informative lecture on "Crystal Grinding" given by G3FDF at the November meeting, was enjoyed by all those members who attended.

Future Event:
December 20th—"Transistors", by J. L. Bowley.

MITCHAM AND DISTRICT RADIO SOCIETY
Hon. Sec.: B. Blandford, 1 Biggin Avenue, Mitcham, Surrey.

Planning and organisation for the Society's participation in N.F.D. were under discussion at the meeting on November 2nd. On November 16th, G8TB gave a talk entitled "Why be afraid of Transistors?"

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY
Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

This society ended November informally with a ragchew meeting on the 21st.

On December 5th members enjoyed a film show.

Future Event:
December 12th—The Annual Dinner.

PURLEY AND DISTRICT RADIO CLUB
Hon. Sec.: E. R. Honeywood, G3GKF, 105 Whytecliffe Road, Purley, Surrey.

Mr. J. Vaughan, G3DQY, gave an interesting talk and demonstration on November 2nd, dealing with "Pocket Paging Systems". At the second meeting of the month, Mr. R. Sykes, G3NFV, talked about the "Ham Hop Club".

READING AMATEUR RADIO CLUB
Hon. Sec.: R. G. Nash, G3EJA, Peacehaven, 9 Holybrook Road, Reading, Berkshire.

G3NNG gave an interesting lecture to members on November 24th; his lecture was called "Transistors v.h.f. and u.h.f.".

Future Event:
December 29th—"Transistor Tx and Rx".

SLADE RADIO SOCIETY
Hon. Sec.: D. D. S. Williams, 117 The Boulevard, Wylde Green, Sutton Coldfield, Warwickshire.

The lecture given on November 16th, entitled "Construction of Printed Circuits", was by member D. Wilson, who was followed by G. C. Simmonds, also a member of the society, and whose talk was called "An Analytical Review of D/F 1962".

The most important meeting for November was the Annual General Meeting, held on the 30th.

WIRRAL AMATEUR RADIO SOCIETY
Hon. Sec.: A. Seed, G3FOO, 31 Withert Avenue, Bebington, Wirral, Cheshire.

At the recent A.G.M., N. Kendrick was elected chairman, A. J. G. Keiller, treasurer, and A. Seed, secretary.

On November 7th, the second lecture on s.s.b. was given by G3FOS, and on the 16th members attended the local R.S.G.B. lecture given by Dr. Jennison.

Short-wave Listeners' Log

INTERFERENCE can often be troublesome on the short-wave bands, and any method of reducing it is generally well worth while, especially when receiving weak, distant stations. Interference can be of several kinds, and may reach the receiver in various ways, thus the appropriate cure must be chosen.

Interference is seldom troublesome when powerful transmissions are tuned in. The strong signals reduce receiver sensitivity due to the AVC circuit, and in any case help to over-ride interference. But with weak signals and maximum receiver sensitivity, trouble from static, electrical equipment, etc., may be severe.

A general background of clicks and similar noise, from electrical equipment, may be introduced through the mains, and in such a case, a mains suppressor will help considerably. Ready-made plug-in suppressors are available, but quite often a single by-pass capacitor, across the mains circuit at the receiver, will reduce such noise. Alternatively, one capacitor may be wired from each mains lead to earth, or receiver chassis. In A.C./D.C. circuits, a capacitor from rectifier anode to chassis may be needed. Capacitors of 0·05μF to 0·01μF, 500V rating are suitable suppressor components.

Suppressor Chokes

In severe cases, suppressor chokes may be used in series with the mains leads. For the average receiver, solenoid windings of about 200 turns of 28s.w.g. wire, on ⅜in. diameter or similar formers, will do.

The complete suppressor is best enclosed in an earthed metal case.

Aerial Filters

If modulation hum and similar noises are evident, an aerial filter consisting of two 100pF capacitors and an H.F. choke will probably be needed to clear this trouble. The capacitors are wired in series with the choke joined from their junction to chassis. One capacitor is then taken to the aerial, and the other to the receiver aerial socket. This filter is particularly successful with A.C./D.C. receivers, which should in any case be so connected to the mains plug that receiver chassis goes to mains neutral (black, or "N").

If interference ceases with the aerial disconnected, this indicates that it is not carried on the mains, and that the aerial, down-lead, earth and aerial coupling system may need modification.

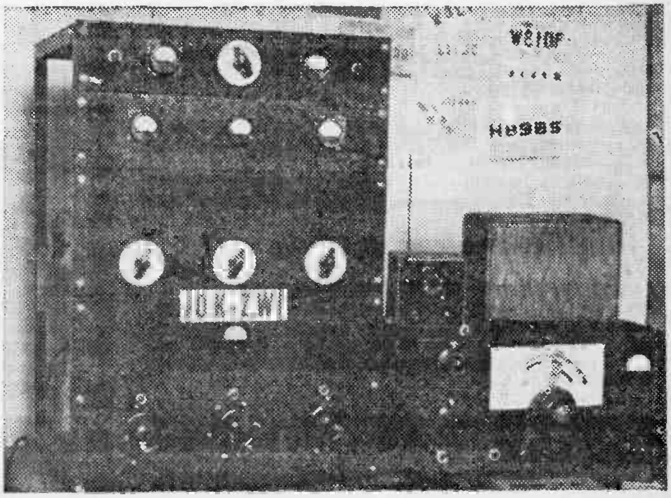
The aerial is best kept clear of sources of local interference—that is, away from roads, mains wiring, telephone wires, etc. Fitting an aerial up unnecessarily near to such interference sources is unwise. In some the aerial can be well clear, but any trouble taken to improve the aerial is always worth while.

With end-connected aerials, the down-lead may also pick up interference, so it must be clear of house wiring, etc. If this is impossible, a simple wire dipole, with coaxial or twin feeder, will greatly reduce interference.

Faraday Shield

A coupling transformer incorporating a Faraday shield may be used between aerial and receiver. This provides normal electromagnetic coupling, but due to the presence of the shield reduces electrostatic coupling. For general short-wave use, a 1½in. diameter former can be employed, with 28s.w.g. wire. The primary may be 14 turns spaced to occupy about 1½in.

For a balanced twin aerial feeder, take one lead to each end of the primary, and solder on a centre-tap, which is earthed. With a single aerial lead, take this to one end of the primary, and earth the other end. A layer of insulating material is placed over the primary. The shield is aluminium foil a little wider than the coil, and long enough to form a single turn. Insulation is placed so that the end of the shield is not electrically in contact with the beginning, and the shield is earthed. A layer of insulation is placed on the shield and the secondary, 14 turns, is wound on this. For a receiver with a single aerial terminal, wire the secondary to the aerial terminal and chassis (earth). For a receiver with balanced or dipole input, connect each end of the secondary winding to one input socket.



This photograph shows the 15W home-made station of a member of the Central Radio Club, Prague, Czechoslovakia.

For Your Bookshelf

REVIEWS OF RECENT PUBLICATIONS

THE TECHNIQUE OF THE SOUND STUDIO

By Alec Nisbett; published by Focal Press Ltd.
288 pages, 5½ x 8½ ins. Price 42s.

WRITING from his experience as a BBC studio manager and producer, the author has given us a comprehensive and informative account of the apparatus and techniques of recording sound based on methods employed at the BBC.

He covers a wide ground, taking in the basic design of a studio to the latest production techniques. Typical chapters are on microphone techniques for speech and music, checking quality, editing, fades and mixes, sound effects, echo techniques. One chapter deals specifically with *Radiophonics,* a study of the techniques used and the theoretical background to the building of tailor-made new sounds and the creative distortion of conventional sound. The relationship is shown between radiophonics and its parent fields of *musique concrete* and electronic music.

This authoritative book avoids unnecessary scientific and technological phraseology and is written in an easy style which keeps the reader interested—the facts are digested effortlessly. It will appeal to professionals and amateurs alike, for although the subject matter is initially based on the highest grade commercial equipment it also shows how the best results can be obtained with the simplest inexpensive microphone and tape recorder. For those interested in amateur recording, amateur dramatics, etc., this book contains a wealth of practical advice and will answer many of those hitherto difficult problems.—*W.N.S.*

RADIO SERVICING POCKET BOOK

Edited by J. P. Hawker; published by George Newnes Ltd.
198 pages, 4¾ x 7 ins. Price 12s.6d.

MANY readers will already be familiar with the original edition of this useful book, which now appears as a fully revised second edition.

A good deal of new material is now included and of particular interest is the section on the servicing of transistor receivers and the repair of printed wiring panels. The sections on servicing and alignment of v.h.f.-f.m. receivers has been expanded and the chapters dealing with car radio receivers. the suppression of car electrical interference, and record players (including stereo) are all enlarged.

Apart from basic details of modern radio circuitry, the book contains useful information on servicing instruments, fault finding and alignment, aerials, gram mechanisms and pick-ups. There is also a 35-page section of tabulated reference data including valve base connections, transistors and diodes, valve equivalents, BBC and European broadcasting stations, battery equivalents, wavelength-frequency conversion and so on.

To sum up, this useful pocket manual provides in a compact form much of the essential information needed in servicing both a.m. and f.m., valve and transistor, radios and should repay the initial outlay many times over. It forms a valuable companion volume to the Television Engineers' Pocket Book.—*D.C.*

HIGH FIDELITY POCKET BOOK

By W. E. Pannett, A.M.I.E.E.; published by George Newnes Ltd.
314 pages, 4¾ x 7¼ ins. Price 40s.

THIS new addition to the Newnes Pocket Book Series has been compiled to bring together information on all aspects of high quality sound reproduction in the home.

Introductory chapters on the nature of sound and its reproduction are followed by sections giving basic information, with circuits, on pre-amplifiers, tone control systems, power amplifiers, etc. This is followed by chapters on a.m. and f.m. radio tuners (again with full circuits), loudspeakers and loudspeaker enclosures.

Three chapters deal with disc and tape recording and reproduction. The book concludes with a section on power supply units, a collection of useful data and a glossary of terms used in sound reproduction.

This book is intended to appeal to the practising engineer, technician or to the home constructor enthusiast. The aim is to bring about a better understanding of the design and functioning of sound equipment. There is certainly a considerable amount of useful information packed into the 314 pages of this instructive book.—*J.S.*

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 the cover.

LOCAL COMMERCIAL RADIO

SIR,—I feel I cannot agree with the sympathies expressed by R. Robinson in the November issue of PRACTICAL WIRELESS. He, especially, as an amateur, should be aware of the seriousness of shortage of bandspace. That this should be cluttered up with multitudinous stations advertising each town seems to me to be against the ideas expressed by those who drew up the frequency allocations at Geneva.—N. J. H. DENT (Godalming).

TEST TRANSMISSIONS

SIR.—In answer to Mr. A. J. Richards in the August issue of PRACTICAL WIRELESS. The test transmissions he hears are, as he says, transmitted by many countries. They are transmitted by government stations solely for communications purposes. The reason for these, in my country anyway, is to provide a test signal for ships entering and leaving the country, to tune in on. These tapes are played for a considerable time until the transmitting station considers the ship is tuned in. It then calls the ship several times and waits for an answer—on another frequency. Meanwhile the test transmissions continue.—K. R. MOON (Te Awamut, New Zealand).

FREAK M.W. SIGNAL ON TV RECEIVER

SIR,—It may interest readers to note that I have a 13 channel Pye VT4 TV receiver, here in far-away Malaya (where, by the way, there are no TV transmissions, as yet) with which I am surprised to note that I am able to pick up the local radio broadcast from apparently the nearby M.W. radio broadcast relay station (operating around 800kc/s), or alternatively from the main transmission of the same programme on approximately 8Mc/s, S.W. I receive the signal on channel five only—at one end of the fine tuning adjustment.

The aerial used is an indoor telescopic "V" type and although the reception is distorted it is quite audible. I have checked that this is not a radiated signal from a neighbour's radio set.

After having read of other freak receptions on radio and tape recorders in these columns, I wonder whether any other reader has experienced similar receptions to mine and whether an explanation can be offered?—E. R. SUNDARAJ (Kaha, Bharu, Kelentan, Malaya).

BROADCAST BREAKTHROUGH

SIR.—With reference to those letters which have been appearing concerning "Broadcast Breakthrough"—I should like to say I have experience of a case up here in Ayrshire of reception of Luxembourg with no apparatus other than a pair of 50Ω headphones which are plugged into aerial and earth. Usually one requires a tuning circuit to select the carrier and some sort of a demodulation system before the modulation becomes audible; but *not* in this case. One simply connects the earphones to aerial and earth and listens. Readability is R4 and there is no sign of the usual Luxembourg fading experienced in these parts. What intrigues me, however, are the facts that no capacitors, resistors, coils, or any apparatus of any kind, other than a 54ft "Z" type aerial and earth connected to 'phones, are employed. That the local station, located at a distance of 35 miles is not heard; only Luxembourg some 600 miles away. Changing to a 2,000Ω set of 'phones only alters the volume: (We thought it was the coils in the head-set which were resonant at that frequency, leaving the inertia of the diaphram to iron out the modulation) and lastly the introduction of an aerial trimmer makes very little difference either in series or parallel.—J. M. J. HARRING (Altonhill, Kilmarnock).

CAN YOU HELP?

SIR,—I would be much obliged if any reader would lend or sell me certain copies of PRACTICAL WIRELESS, which I require for completing the information on certain circuits.

They are: November and December 1957, September 1958 and November 1960.—J. D. HILLS-HARROP (85 Hamlet Gardens, Hammersmith, London W6).

SIR,—I should like to know of any reader who would let me buy or borrow a copy of February 1961 PRACTICAL WIRELESS. I need this issue for the article on the Combined Radio and Table Lamp.—F. G. LAWRENCE (6 Essex Street, Forest Gate, E7).

SIR,—I wonder if any of your readers could supply me with an address from where I could obtain circuit diagrams and information for my 4660 receiver.—H. G. BROWN (4 Midcroft Avenue, Glasgow S4).

SIR,—I would be grateful if one of your readers would sell or loan me the circuit diagram of the R107 Communications Receiver, failing that, the valve line-up.—I. L. McCALLUM (Elderslie Hotel, Largs, Ayrshire).

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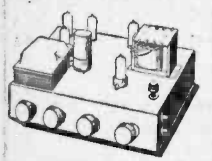

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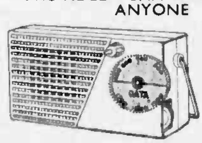

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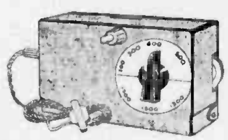

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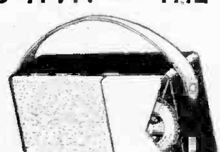

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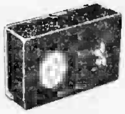

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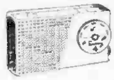

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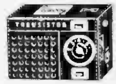

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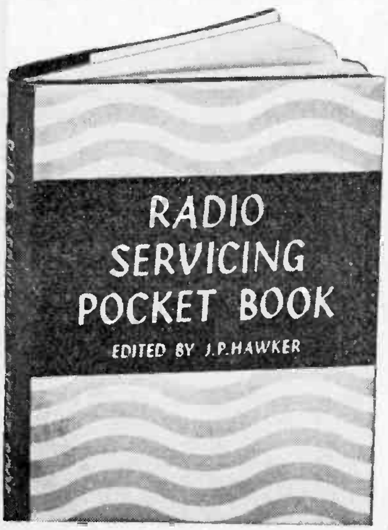

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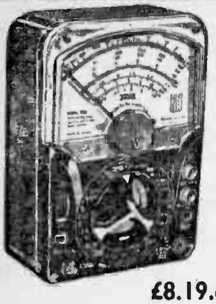

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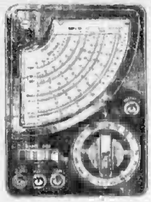

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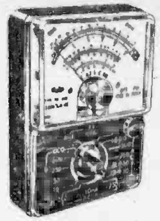

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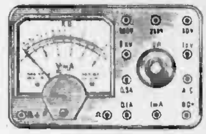

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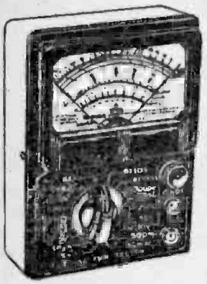

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