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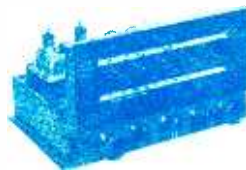
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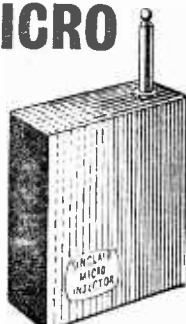
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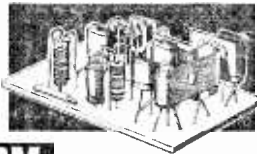
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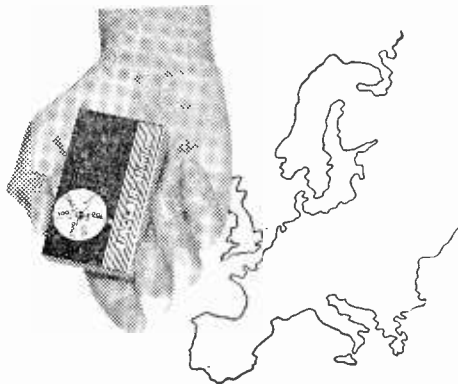
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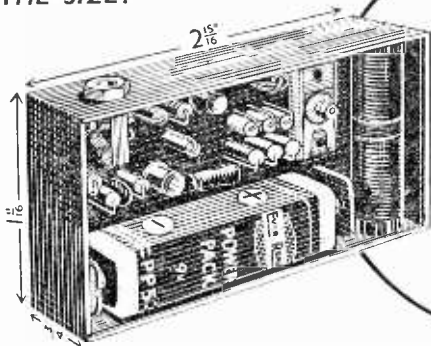
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Rogers Cadet Mk. 3 with pre-amplifier, 4 EF91 valves	£28.6.16
Deposit £2.13.8 and 12 monthly	£2.4.5
Leak Stereo 20, Main amplifier	£30.9.0
Deposit £8.4.6 and 12 monthly	£2.10.3
Leak Variotone III, stereo pre-amplifier	£25.0.0
Deposit £2.10.0 and 12 monthly	£2.1.6
Quad 22 Stereo Control Unit	£25.0.0
Deposit £2.10.0 and 12 monthly	£2.1.6
For Quad Main Amplifiers see Mono section above.	
Armstrong 222, integrated 10 watts per channel	£27.10.0
Deposit £2.18.0 and 12 monthly	£2.5.8

LOUDSPEAKERS

Goodmans Axielle S	£5.5.7
Goodmans Axiom 10	£6.5.11
Goodmans SK/20/XL	£7.0.0
Wharfedale Super 8/RS/DD	£6.14.2
W. B. HF1018 10in.	£4.7.6
R.T.C. 12in. 1mt. 15 watt	£5.5.0
R.T.C. Hi-Fi Master	£8.8.0
Goodmans XO 5000 cross-over	£1.19.0

QUARTER TRACK

Collaro Studio Deck Marriot "X" Series heads	£17.17.0
Deposit £1.7.8 and 12 monthly	£1.9.5
Tape Amplifier for Studio Deck, as over, but quarter track	£12.12.0
Deposit £1.17.0 and 12 monthly	£1.0.8
Case for above, with speaker, two tone grey	£5.5.0
Complete Kit with Tape and Microphone	£36.0.0
Deposit £3.10.0 and 12 monthly	£2.16.2
B.S.R. TDE Deck with Marriot "L" Series heads	£11.11.0
Deposit £1.4.0 and 12 monthly	19/0
Tape Amplifier for B.S.R. deck, as over, but quarter track	£9.9.0
Deposit £1.0.0 and 9 monthly	£1.1.0
Tape Pre-amplifier for Studio Deck, with power supplies, EUC81, E1.82, EZ260 and EM84. Mic. and Radio sockets, gives an equalised output of 400 mV. Volts.	Half Track £8.8.0
Deposit £1.0.0 and 8 monthly	Quarter Track £1.1.0
Deposit £1.0.0 and 9 monthly	£1.0.0

TAPE HEADS

MSS Quarter track, Record/Playback and Erase per set	£3.3.0
Erasmatic Half track Record Playback head only	£1.12.6
Erasmatic Half track Record Playback and Erase on plate	£1.19.6
Collan pressure pad for third head position	4/-
Brenell Mk. 5 Series 2 track, Half track 4 speed	£32.11.0
Deposit £3.0.0 and 12 monthly	£2.14.0
Brenell Mk. 3 Series 2 Track Amplifier with power pack	£26.0.0
Deposit £2.12.0 and 12 monthly	£2.3.2

NEW ARMSTRONG TUNER-AMPLIFIERS

Armstrong (Mono) AF208 A.M./F.M. Radio chassis, bass and treble controls, P.I. inputs, etc.	£21.4.0
Deposit £2.0.0 and 12 monthly	£1.14.10
Armstrong (Mono) 227 M A.M./F.M. Radio chassis, 10 watts	£33.18.0
Deposit £2.1.8 and 12 monthly	£2.16.1
Armstrong (Stereo) Stereo 55 A.M./F.M. Radio chassis, with Stereo gram	£29.18.0
Deposit £2.2.6 and 12 monthly	£2.9.5
Armstrong (Stereo) 227 A.M./F.M. Radio chassis, Stereo gram, 10 watts each channel	£48.15.0
Deposit £2.17.8 and 12 monthly	£4.1.1
Armstrong (Stereo) 228 A.M./F.M. Radio chassis, Stereo gram, 10 watts each channel, Filters etc.	£56.0.0
Deposit £5.12.0 and 12 monthly	£4.13.2
Rogers Switched F.M. Tuner, un-powered	£14.12.8
Deposit £1.11.8 and 12 monthly	£1.4.0
Tripletone F.M. Tuner, less power	£13.19.6
Deposit £1.8.0 and 12 monthly	£1.3.2
Tripletone F.M. Tuner, self-powered	£15.14.6
Deposit £1.11.8 and 12 monthly	£1.6.1
Armstrong 224 A.M./F.M. Tuner, self powered	£22.10.0
Deposit £2.2.0 and 12 monthly	£1.17.4
Armstrong 228 A.M./V.H.F. Tuner, self powered	£28.15.0
Deposit £2.17.6 and 12 monthly	£2.7.9

GRAMOPHONE UNITS

Garrard SRP10 with GCS cartridge, Mono, single player	£8.9.11
B.S.R. UA14 with GCS cartridge, Mono, 4 speed changer	£6.19.6
Deposit £1.0.0 and 6 monthly	£1.3.3
Garrard Autolite, Mono GCS cartridge, 4 speed changer	£7.17.0
Deposit £1.0.0 and 6 monthly	£1.2.6
Garrard AT8 Autolite de Luxe, GCS Mono cartridge	£11.9.0
Deposit £1.6.8 and 6 monthly	£1.4.9
Philips AG1018, stereo cartridge, will change 7in. records	£12.12.0
Deposit £1.7.0 and 12 monthly	£1.0.8
Decca Deram Arm and Plug-in Shell	£5.5.0
Decca Deram Transcription Cartridge	£4.14.6
Decca Deram Auto Cartridge	£3.18.6
Goldring GL58 with arm, less cartridge	£18.19.8
Deposit £1.12.0 and 12 monthly	£1.6.6
Goldring "88" Transcription, no arm	£17.14.0
Deposit £1.19.0 and 12 monthly	£1.9.0
Goldring GL55, 3 1/2 in. but less plug-up arm	£18.1.7
Deposit £1.7.7 and 12 monthly	£1.1.6
Garrard 4HF with Mono GCS cartridge	£17.0.0
Deposit £1.14.0 and 12 monthly	£1.8.2
Garrard Lab Type "A" Transcription auto-changer Mono GCS	£19.14.9
Deposit £1.19.6 and 12 monthly	£1.12.9
Garrard 301	£20.12.2
Deposit £2.3.2 and 12 monthly	£1.14.0
Garrard 301 Strobe	£22.0.0
Deposit £2.4.0 and 12 monthly	£1.16.8

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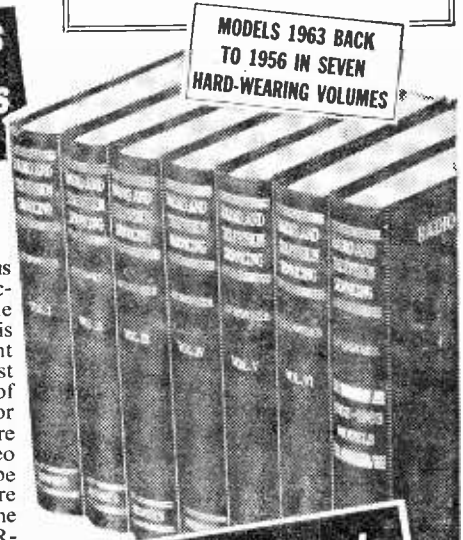
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0244T	4/3	BH87	28/6	5V6GT	5/6	20P4	13/9	DD	23/8	E142	7/8	K1242	5/8	R17	17/7	F24	1/6	AF127	9/8		
1A3	3/8	BHW7	6/9	6X4	3/9	20P5	13/6	AGPEN1/3	E142F	7/6	E151	8/3	LN152	6/7	R18	10/6	F27	3/9	BY213	11/6	
1A5	3/8	BH86	4/7	6X6	4/8	20P6	7/6	ACPN1/3	E143	1/7	E152	6/9	LN200	6/7	R19	7/4	G16	10/6	6/6	5/6	
1A7	3/8	BH85	4/7	6X8	4/8	20P7	7/6	ACPEN	E144	4/8	ELN4	4/8	LN319	6/7	R22	9/7	F101	10/6	G16	5/6	
1A7T	3/8	6C4	2/8	7B6	12/6	2514G	11/8	(5) 17/6	E145	2/3	E153	7/7	LP2	9/6	RG1240A	E107	17/6	G14	10/6	10/6	
1C2	6/9	6C5	4/7	7B7	7/6	25V3	7/8	ACPEN	E146	3/8	EL6	6/6	ME41	15/2	84/1	E191	10/6	GET102	8/6	8/6	
1C3	6/9	6C8	3/7	7D3	10/7	25V4	7/8	ACPEN	E147	6/6	E154	6/6	ME42	15/2	84/2	E191	10/6	GET103	8/6	8/6	
1C5	6/9	6C9	10/8	7D5	10/7	25Z4A	6/6	ACPEN	E148	6/6	E155	6/6	ME43	15/2	84/3	E191	10/6	GET104	8/6	8/6	
1D5	10/6	6C10	7/9	7D5	15/7	25Z6AT	8/1	12/1	E149	6/6	E156	10/4	MH14	7/6	8P13	12/6	F301	12/1	GT111	12/1	
1D6	10/6	6C12	6/7	7D6	15/7	2781	23/3	ACTH1	15/7	E157	6/6	EL822	10/6	MH14D12	6/6	8P14	12/6	F329	9/6	GT113	8/6
1D6	10/6	6C17	12/8	7D8	15/7	2847	6/9	A17P	18/7	E158	6/6	EL823	10/6	MH16	5/9	8P42	12/6	F330	10/7	GT114	6/6
1F1	5/9	6C18G	1/8	YH7	5/8	30074	5/8	A1112	5/8	E159	6/6	EM1	20/5	M148	20/5	8P91	2/7	F403	9/6	GT172	10/6
1F2	2/3	6C16	5/7	7R7	12/6	30015	5/9	A12P	20/5	E160	6/6	EM34	12/1	M149	12/1	8P92	2/7	F404	5/6	GT173	8/6
1F3	2/3	6C14	24/7	7Y7	20/1	300F5	5/9	ATP4	4/3	E161	6/6	EM35	12/1	M149	12/1	8P91	5/9	F501	17/8	GT174	8/6
1F01	5/9	6D1	1/8	7Y4	5/7	300F1	9/3	AZ1	5/9	E162	12/8	EM71	12/8	M149	8/9	T41	5/9	F4020	6/6	GEX36	3/8
1F09	6/7	6D3	9/8	8D2	2/6	300F112	11/8	AZ31	6/6	E163	6/6	EM80	6/3	N37	23/3	T192	12/6	VMF40	12/1	GEX36	10/6
1G6	6/7	6D6	3/7	8D3	3/7	300F1	5/6	AZ41	6/6	E164	6/6	EM81	7/7	N78	23/3	T194	12/6	VMF40	12/1	GEX36	10/6
1H5UT	8/1	6D8	1/8	9H8W	6/6	300L15	5/6	300L15	5/6	E165	6/6	EM84	6/6	N108	26/2	T210	6/6	VMF40	12/1	GEX36	10/6
1H4	2/8	6E5	9/8	9D2	5/7	300P4	12/3	300P4	12/3	E166	6/6	EM85	6/6	N389	15/7	T300	14/6	VMF40	12/1	GEX36	10/6
1L46	16/10	6E8	4/8	9D7	3/7	300P12	7/6	C1	12/6	E167	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1L45	4/8	6E8	5/8	10C1	3/7	300P16	6/7	C1C	12/6	E168	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1L45	4/8	6E8	5/8	10C2	12/6	300P19	12/3	C1H5	13/7	E169	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1N56T	8/1	6F6GT	7/8	10D1	4/7	300L1	6/6	CK506	6/6	E170	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1P1	5/9	6F8	5/7	10P2	10/6	300L13	9/6	C14	19/6	E171	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1P10	4/9	6F11	17/9	10P1	10/6	300L14	12/6	CK33	11/6	E172	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1P11	5/9	6F12	3/7	10P9	10/6	35A5	20/9	C8	2/6	E173	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1K5	4/7	6F3	4/9	10P16	10/6	35L40T	6/9	C8B3	10/6	E174	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1L6	5/7	6F14	23/8	10L13	9/3	35V1	12/6	C8C1	12/6	E175	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1R6	3/6	6F15	6/9	10L11	9/1	35Z3	16/4	C1A	16/4	E176	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1T2	34/11	6F16	6/9	10P13	10/6	35Z4GT	4/9	C1C	6/6	E177	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1T4	2/8	6F17	12/8	10P14	11/6	35Z6T	5/9	C151	5/9	E178	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1T4	5/9	6F18	13/8	10P15	11/6	3681 A	6/8	D1	1/3	E179	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
1T5	5/9	6F19	13/8	10P16	11/6	3681 B	6/8	D1	1/3	E180	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
2A7	10/6	6F23	9/7	11E1	15/7	42	5/7	D42	10/6	E181	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
2A8	3/9	6F24	9/8	11E3	17/7	43	10/7	D63	5/7	E182	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
2113C	7/7	6F26	5/7	12A6	6/7	50A5	21/10	D17	2/3	E183	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
2121	6/7	6F27	3/7	12A8	10/8	50B5	6/6	DAC32	3/7	E184	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
2B3	2/3	6F28	3/7	12A7	4/6	50C4	6/6	DAC32	3/7	E185	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
2X2	3/6	6G6	2/6	12A9	6/6	50D6G40	9/9	DAP96	5/9	E186	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
2A4	3/9	6H6	1/6	12A6	6/6	50L8P1	6/6	D6990	6/9	E187	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
3A5	6/9	6J6	3/7	12A17	6/7	52K1	14/8	D14	12/3	E188	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
3B7	5/7	6J6GT	3/7	12A18	9/7	53K1	14/8	D141	12/3	E189	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
3H6	4/7	6K6	4/7	12A19	4/6	53V4	6/6	D174	12/3	E190	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
3Q4	5/8	6J7G	4/6	12A17	3/6	55	9/6	D1723	7/6	E191	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
3Q5A	7/7	6J7GT	7/7	12A16	5/9	76	12/6	D173	8/6	E192	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
3B4	4/8	6J8	12/6	12A17	4/7	77	5/9	D166	15/7	E193	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
3Y4	3/8	6K6GT	7/6	12A16	6/6	78	4/6	D172	3/7	E194	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
4H1	3/9	6K7	1/8	12A17	4/6	80	6/3	D171	2/3	E195	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
5Y4GXY	9/7	6K7GT	1/8	12A16	5/9	83	13/6	D197	5/6	E196	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
5T4	7/7	6K6	3/3	12B6	4/9	88V	8/7	D196	10/6	E197	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
6C46	4/3	6K6GT	7/9	12B17	6/9	85A2	6/6	D1130	15/6	E198	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
5A46	7/6	6K25	12/7	12B1	16/9	90A3	6/7	D1H3	4/6	E199	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
5Y3AT	4/3	6K26	1/8	12B1GT	1/6	90A4	6/7	D1H2	5/6	E200	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
5Y4	9/6	6L6	6/6	12B2GT	1/6	90C1	4/6	D197	3/6	E201	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
5Z3	6/7	6L6M	9/7	12B2GT	3/7	90C2	4/6	D1H1	2/3	E202	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
5Z4	6/7	6L6M	9/7	12B2GT	3/7	90C3	4/6	D1H1	2/3	E203	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
5Z4	7/7	6L6GT	4/6	12K7	10/7	90C1	1/6	D1H10	25/7	E204	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
62012	8/1	6L17	12/6	12K7F	3/6	150R2	16/6	D1H107	15/11	E205	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
6A7	8/8	6L18	10/7	12K8	9/7	150R2	16/6	D1H108	15/11	E206	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
6A8	9/8	6L19	10/7	12K9	9/7	150R2	16/6	D1H109	15/11	E207	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
6A7	4/7	6L19	6/6	12K6	6/6	15M12T	34/11	D1K1	4/1	E208	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
6A7	3/7	6L19	7/7	12K7	4/7	15V6	6/6	D1K2	6/9	E209	6/6	EM87	15/2	P4	2/9	T41	13/6	VMF40	12/1	GEX36	10/6
6A15	2/9	6L120	5/6	12K17	3/7	220B	10/6	D1K3	6/3	E210	6/6	EM87	15/2	P4	2/9	T41	13/6				



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The SKYROVER

Controls: Waveband Selector, Volume Control with on/off Switch, Tuning Control. In plastic cabinet, size 10 x 6 1/2 x 3 1/2 in. with metal trim and carrying handle.

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and the SKYROVER De LUXE



The SKYROVER de luxe

Tone Control Circuit is incorporated, with separate Tone Control in addition to Volume Control, Tuning Control and Waveband Selector. In a wood cabinet, size 11 1/2 x 6 1/2 x 3 1/2 in. covered with a washable material, with plastic trim and carrying handle. Also car aerial socket fitted. Can be built for **£12.19.6** P. & P. 5/- extra.

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7 transistor plus 2 diode superhet, 6 waveband portable receiver. Operating from four 1.5 v. torch batteries. The SKYROVER and SKYROVER DE LUXE cover the full Medium Waveband and Short Waveband 31-94 M, and also 4 separate switched band-spread ranges, 13M, 16M, 19M and 25M. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow, stage by stage instructions.

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Superhet, 470 Kc/s. All Mullard Transistors and Diode. Uses 4-U2 batteries. 5in. Ceramic Magnet P.M. Speaker. Easy to read Dial Scale. Band Spread Tuning. 500 MW Output. Telescopic Aerial & Ferrite Rod Aerial.

WAVEBAND COVERAGE: 180-576M; 31-94M and Band Spread on 13, 16, 19 and 25 metre Bands.

2/6 extra. Refunded if you purchase the parcel. Four Leak-Proof batteries. 3/4 extra. All Components Available Separately.

THE "SPRITE"

Can be built for **79/6**

P. & P. 3/6 extra.



★ Six-Transistor Superhet Miniature Personal Pocket Radio. ★ Long and Medium wavebands. ★ Ferrite Rod aerial. ★ I.F. Frequency 470 Kc/s. ★ 3in. Speaker. ★ Printed circuit 21 x 2in. ★ Slow Motion Drive. ★ In Plastic Case. Size 4 x 2 1/2 x 1 1/2 in. In order to ensure perfect results, the SPRITE is supplied to you with R.F. and I.F. stages. Driver and Output stages ready built with all components mounted on the printed circuit. The SPRITE pre-assembled, plus cabinet, speaker and all components for final construction. Can be built for: **79/6** P. & P. 3/6 extra. Data and instructions separately 2/6. Refunded if parcel is purchased. *Real cut leather case/ wrist strap, personal earphone and case for earphone and battery 12/6 the lot extra. Make no mistake this is a SUPERBET receiver of genuine commercial quality. It is not a regenerative circuit.*

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6 TRANSISTOR POCKET RADIO fully built, 4 x 2 1/2 x 1 1/2 in. with 2in. speaker. Uses single PP3 type battery. Supplied complete with personal earpiece and leather case. Tunable over full medium waveband.

LASKY'S PRICE **79/6** P. & P. 2/6. Complete with all accessories.

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- ★ 7-transistor Superhet. ★ 350 milliwatt output into 4in. high flux speaker.
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- ★ Plastic cabinet with carrying handle, size 7 x 10 x 3 1/2 in. in Red, Grey, Blue/Grey or all Grey.
- ★ Easy to read Dial.
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An Outstanding Receiver. LASKY'S PRICE for the complete parcel including Transistors, Cabinet, Speaker, etc., and Full Construction Data. Can be built for: **£5.19.6** P. & P. 4/8.

PP9 Batt. 3/9. Data and instructions separately 2/6. Refunded if you purchase the parcel.

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By popular request a De Luxe version of the well-proven Realistic "Seven" now available. With the same electrical specification as standard model—PLUS A SUPERIOR WOOD CABINET IN CONTEMPORARY STYLING, covered in attractive washable material, with super-chrome trim and carrying handle. Also a full vision circular dial, externally mounted to further enhance the pleasant styling. ALL FOR ONLY **£1** EXTRA. P. & P. as for Std. model

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A "Privilege Parcel" allows you to purchase the Audio System of your choice at a worth while cash saving. Some examples are listed below, but we shall be pleased to quote our "Privilege Parcel" Prices for any selection of equipment of your own choice. Send us details of your requirements.

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Connoisseur Craftsman 2-speed transcription player..... £16. 5.6	Braun PC11 Stereo Transcription Unit £12. 9.6
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Total £50. 4.6

Total £47. 8.6

"PRIVILEGE PARCEL" Price: £47.10.0

"PRIVILEGE PARCEL" Price: £45.0.0

Collaro Studio Tape Deck, 1-track model £10.10.0

Lasky's Tape Amplifier £8.19.6
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7 x 4in. spkr. 15.6

Total £24. 0.0

"PRIVILEGE PARCEL" Price: £22.10.0

Collaro Studio Tape Deck, 1-track model £13.19.6
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Housed in beautifully styled cabinets offering terrific performance and very high quality reproduction. Built-in ferrite rod aerial for reception of all your favourite programmes. Fully guaranteed.

MODEL 55 (as illus.) Covers Medium, Long and Short waves. Size 5 1/2 in. w. x 9 1/2 in. d. x 4 1/2 in. h. **PRICE ONLY \$7.17.6.** P. & P. 5/6.

MODEL 56. Similar circuitry to above but covers Medium wave only. Size 7 1/2 in. w. x 5 1/2 in. d. x 4 1/2 in. h. **PRICE ONLY \$4.14.6.** P. & P. 5/6. *Either of the above can be easily adapted for use as A.M. Feeder unit.*

3-VALVE AUDIO AMPLIFIER. MODEL HA34



Designed for Hi-Fi reproduction of records A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7 1/2 in. w. x 4 in. d. x 4 1/2 in. h. Incorporates EUC88, EL84, EZ80 valves, heavy duty double wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume control. Negative feedback line. Output 4 1/2 watts. Front panel can be detached and leads extended for remote mounting of controls.

The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs **\$4.5.0** P. & P. 4/-

TWO VALVE AMPLIFIER similar to above but using ECL82 and EZ80 with tone and volume controls. Output 3 watts. **PRICE 7/5/-** P. & P. 4/-

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(Glass encapsulated, 2 wire lead out Size 1 1/2 in. high x 1/2 in. dia. Following frequencies (Kc/s) only available
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All Brand New in Makers' Original Packing

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B.S.R. UA14 \$6.2.6
Latest B.S.R. UA16 \$7.2.6
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with heavy-duty 4-pole motor.
FEW ONLY \$7.7.0 (Standard Auto-Slim \$6.17.6). Carr. 5/- on each.

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SET 15 (Matched Pair) 15/-
OC71 . . . 5/- PXA101 6/6
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Set of Mullard 6 transistors, OC44, 2-OC45, OC81D matched pair
OC81, 25/-

EDISWAN MAZDA

R.F.1 Pack: 1-PXA102 Mixer; 2-PXA101 I.F. Amp; (Equiv OC44 and OC45) 10/6
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ALL TRANSISTORS POST FREE

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ACCUS GP85/1 T/0 MONO CRYSTAL CARTRIDGE. Comp. with sapphire stylus and mounting bracket. Limited number only at 12/6. P. & P. 1/-.



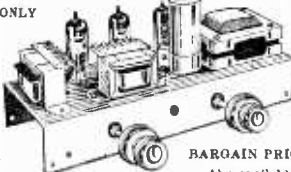
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This may be your last opportunity to secure one of these amazing amplifiers—when remaining few are sold no more will be available.

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Model 882 with BALANCE CONTROL, 110/250 v. A.C. input 6 watt undistorted output (10 watts nominal). Size 12 x 8 x 2 in. Weight 9 lb. Complete with spec. and instructions **STILL ONLY \$5.19.8.** Carr. 7/-.

FEW ONLY



STEREO AMPLIFIER

Incorporating 2 ECL82s and 1 EZ80, heavy duty, double wound mains transformer, Out at 4 watts per channel. Full tone and volume controls. Absolutely complete.

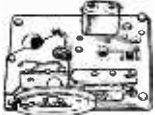
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Also available complete with two 8 x 5 in. Speakers for only \$5.10.6. P. & P. 6/6.

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A permeability tuned tuner head by a famous maker, supplied without valve (EC855) and drum and spindle, 18/6, plus 1/9 P. & P. Valve 8/6 extra. Drum and spindle 3/6 extra.

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E.M.I. 4-speed Player and P.U.

FURTHER HUGE PURCHASE enables us to offer these **67/6** P. & P. at 4/6.



Heavy 8 1/2 in. metal turntable. Low flutter performance 200/250 v. shaded motor with tap at 45v. for amplifier valve filament if required. Turnover LP/78 head.

RECORD PLAYER AMPLIFIER

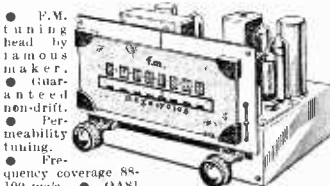
2 valve (EZ80 EC182) A.C. mains, 3 watts output, ready built, tested and complete with valves and output transformer. Size 7 1/2 in. w. x 2 1/2 in. d. x 5 1/2 in. h. 55/-. P. & P. 3/-. Suitable speakers: 6 1/2 in. 12/6 - P. & P. 1/6, 10 x 6 in. 28/-, P. & P. 1/6.

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Oatmeal, Red and Gold fabrics and various patterns in Vynair and Tycan for speaker and cabinet covering, also Red Rexine for cabinet covering only. All 5 1/2 in. wide and usually sold at 35/- yard.

OUR PRICE 13/6 length, plus P. & P. 1/6. (Minimum order 1 yard). Send S.A.E. for samples.

HARVERSON'S F.M. TUNER Mk. I



● F.M. tuning head by famous maker ● Tuning head is non-drift ● Permeability tuning ● Frequency coverage 88-100 Mc/s. ● OAS1 balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3 in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used EC83, two EF89's, and EZ80. (rectifier) ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5 1/2 in. ● All parts sold separately. Set of parts if purchased at one time **£15.6**, plus 8/6 P. & P. (Circuit diagram and instructions 1/6 post 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 (2V182) 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.

6 TRANSISTOR AND DIODE SUPERHET

A first-class 2 wavebands transistor superhet. ● Printed circuit panel (size 8 1/2 x 2 1/2 in.) ● 3 pre-attached I.F. transformers ● High-gain Ferrite rod aerial. ● All First-grade transistors. ● Car aerial winding. ● Push-pull output. ● All parts supplied with simple instructions. All parts sold separately. Set of parts if purchased at one time. **ONLY £4.5.0** P. & P. 2/6

35 OHM SPEAKERS

Suitable for use with above 2-in. Goodmans. Ideal replacement for most pocket portables 8/6; 2 1/2 in. 10/8; 3 1/2 in. 12/8; 5 in. 17/8; 7 x 4 in. 21/-. P. & P. 1/6 per speaker.

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Size approx. 9 1/2 x 6 1/2 x 3 1/2 in. Suitable for above using 3 1/2 in. speaker. 25/-. P. & P. 2/6.

COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

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

QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. This amplifier (which is used in a 29 gm. record player) employs EC83, EL84, EZ80 valves. Bass, treble and volume controls. Complete with output transformer matched for 3 ohm speaker.

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DITTO. Mounted on board with output transformer and 3 ohm speaker.
Complete at **89/6 P. & P. 4/6.**

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Uncut motor board. Will take above amplifier and B.S.R. or GARRARD Autochanger or Single Record Player Unit. Size 18 x 14 x 8 1/2 in.
PRICE £39.6 Carr. 5/-

HIGH GAIN 4-TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT
Type TAI

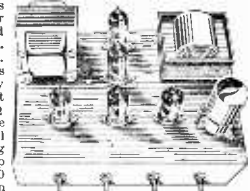
● Peak output in excess of 11 watts. ● All standard British components. ● Built on printed circuit panel, size 6 x 3 in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (GTT14 or 81 Multilink OC81D and matched pair of OC81 o/p). ● 9 volt operation. ● Everything supplied, wire, battery clips, solder, etc. ● Comprehensive easy to follow instructions and circuit diagram 1/6 (Free with Kit). All parts sold separately. Also ready built and tested. **52/6**. P. & P. 2/6. *A pair of T.A.I.'s are ideal for stereo.*



SPECIAL PRICE 45/-
P. & P. 2/6

10 1/4 WATT HI-FI AMPLIFIER KIT

A stylishly finished monoaural 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 section wound output transformer to match 3-15 ohm speaker and 2 independent volume controls and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, EC83, EF86 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts.) All parts sold separately. **ONLY £6.19.6** P. & P. 6/6. Also available ready built and tested complete with input jack plugs. **£8.15.0** P. & P. 6/6.



£6.19.6 P. & P. 6/6

BRAND NEW 3 OHM LOUDSPEAKERS

2 1/2 in. 12/8; 5 in. 12/8; 6 1/2 in. 15/-; 8 in. 21/-; 10 in. 25/-; 12 in. 27/6. E.M.I. 2 1/2 in. tweeter ... 10/6
8 in. x 5 in. By famous maker ... 10/6
Rola (selection approx. 9 in. x 6 in. middle register speaker) 10/6
10 in. x 6 in. 26/-
Also 15 ohm 12 inch, 30/-
P. & P. 2/6 to 6 in. 1/8; over 6 in. 2/6 per speaker.

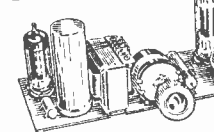
AMPLIFIER CARRYING CASES
BRAND NEW

Strongly made wooden construction, tough vinyl covered, complete with carrying handle. Overall size 13 1/2 in. wide x 9 in. deep x 9 in. high with sloping front panel. Weight only 4 1/2 lbs. Ideal for our 10 1/4 watt amplifier and many others.
BARAGAN PRICE 28/6
P. & P. 4/-

TAPE DECKS

COLLARO STUDIO DECK
£10.10.0 plus 5/6 carr. and ins.
B.S.R. MARSEDECK
(Single speed) 3 1/2 in. per sec., simple control, uses 5 1/2 in. spools. **£6.15.0** plus 5/6 carr. and ins. (Tapes extra on both).

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Superior CABINET To take a 3 in. speaker, with motor board will accommodate BSR UA14 or UA16. **£3.9.8**. Carr. 5/6. Speaker 10/6 extra. P. & P. 1/6 extra.
LARGE CABINET Similar to above with 3 ohm speaker. **£3.5.6**. Carr. 5/6.

ACOS CRYSTAL MIKES. High Imp. For desk or hand use. High sensitivity, 18/6. P. & P. 1/6.
THE GREAT STICK MIKE. Listed at 45/-. Our price 18/6. P. & P. 1/6.
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FEW ONLY 6 x 4 in. 3 ohm Speakers Similar to above. **Only 9/-**. P. & P. 1/6 per speaker.
8 x 5 in. 3 ohm SPEAKERS BY WELL KNOWN MAKER. Unrepeatable at only 10/8 each. P. & P. 1/6 per speaker.
A pair of these are ideal for Stereo.

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SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

Brand new individually checked and guaranteed VALVES

Table listing various vacuum tube types and their specifications, organized in columns. Includes types like AC/HL, E1266, EF92, etc., and their corresponding values.

MANY OTHERS IN STOCK include Cathode-Ray Tubes and Special Valves. U.K. orders below £1 P. & P. 1/-; over £1, 2/-; over £3, P. & P. free C.O.D. 3/6 extra. Overseas Postage extra at cost.

MARCONI COMMUNICATION RECEIVERS. CR.150. Frequency coverage 2-60 Mc/s in 5 bands. Two IFs. 1st 400 kc/s, 2nd 463 kc/s. Image signal rejecting cov 40 dB up to 30 Mc/s and 20-40 dB from 30-60 Mc/s. Self checking calibration (built in calibrator). Stabilisation of supply and temperature compensation. Electrical and mechanical bandspread. Metering and visual tuning indicator. Bandpass from 100c/s to 10 kc/s in 5 stages. Acoustic filter associated with 100 c/s. Bandpass position for CW reception. Facilities for diversity reception. In as new guaranteed condition with original mains power supply unit £70 or without power supply unit £60. Carriage 30/-.

Original mains power pack for H.R.O. 110/220 v. A.C. Brand new in original packaging, 45/-, P. & P. 4/-.

CONNECTORS FOR TCS RECEIVER, TRANSMITTER AND REMOTE CONTROL, with original plugs on both ends. New £1.17.6 each. P. & P. 2/6.

TRANSMITTER RECEIVER. TYPE 6BT. 3-5 Mc/s netting facilities. Low power consumption. Requires 150 v. h.t. and 3 v. 1.5 dry batteries. In good condition. 35/-. Carriage 8/.

COMMUNICATION RECEIVER. TYPE SR.40. 540 Kc/s-31 Mc/s in 4 bands. Built-in 5in. loudspeaker, telescopic aerial for SW reception. Calibrated "S" meter, automatic interference limiter. BFO circuit. 220v. A.C. Weight approx. 15 lb. £29, carriage free U.K.

R.209 RECEPTION SET. A 10-valve high-grade Superhet Receiver with facilities for receiving R/T (A.M. or F.M.) and CW frequency 1 Mc/s-20 Mc/s. Hermetically sealed. Built on miniature valves and incorporating its own vibrator power supply unit driven by a 6 v. battery (2 point connector included). The set provides for reception from rod, open-wire or dipole aerial with built-in loudspeaker

P. C. RADIO LTD
170 GOLDHAWK ROAD, W.12
Shepherd's Bush 4946
Open 9-5.30 p.m. Thursday 9-1 p.m.

or phone output. Dimensions: Length 12in., width 8in. depth 9in. Weight 23 lb. In as new, tested and guaranteed condition. £23.10.0, including special head-phone and supply leads. Carr. £1.

PRECISION WATT METERS made by Weston (USA) for D.C. and A.C. 25-1,000 c/s. Voltage coils 150 and 300 v., current max. 7.5 amps. Mirror dial calibrated up to 1,500 watts. Connecting instructions included. Overall measurements 6 1/2 x 5 1/2 x 3 1/2 in. Brand new £9.19.6.

CARBON INSET MICROPHONE. G.P.O. type, 2/6. P. & P. 1/6.

PANEL METERS (round)

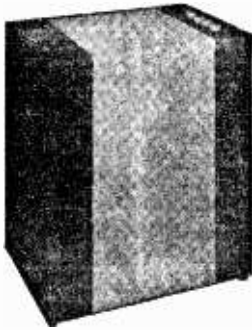
0-20 microamps	28/-	D.C.	79/-
0-50 microamps	3 1/2	D.C.	45/-
0-50 microamps	2 1/2	D.C. **	40/-
0-100 microamps	2 1/2	D.C.	35/-
0-100 microamps	2 1/2	D.C. **	35/-
0-200 microamps	2 1/2	D.C.	32/6
0-500 microamps	2 1/2	D.C.	30/-
0-500 microamps	2 1/2	D.C.	21/-
0-1mA*	2 1/2	D.C.	19/6
0-1mA	3 1/2	D.C.	31/-
0-1mA	3 1/2	D.C. **	35/-
0-5mA	3 1/2	D.C.	45/-
150-0-1,500mA	3 1/2	D.C.	29/6
0-15v	2 1/2	A.C.	17/6
0-50v	2 1/2	D.C.	28/-
0-150v	2 1/2	A.C.	24/-
0-500v (shunt)	2 1/2	D.C.	20/-
0-5kV	3 1/2	electrostatic	85/-
0-10kV	2 1/2	D.C.	63/-
Freq. 0-70 c/Sec/125v	3 1/2	** Weston", as usually used also in H.R.O. as "S" meter.	52/-

**Projection type.

THE R.S.C. BASS-MAJOR 30 WATT GUITAR AMPLIFIER

A MULTI-PURPOSE HIGH FIDELITY, HIGH OUTPUT UNIT FOR VOCAL AND INSTRUMENTALIST GROUPS

Eminently suitable for bass, lead or rhythm guitar and all other musical instruments



- * Incorporating two 12in. heavy duty 25-watt high flux (17,000 lines) loudspeakers with 2in. diameter speech coils. Designed for efficiently handling full output of amplifier at frequencies down to 25 c.p.s.
- * Dual Cone in second speaker reproduces frequencies up to 17,000 c.p.s.
- * Heavily made cabinet of convenient size 24 x 21 x 14in. has an exceptionally attractive covering in two contrasting tones of Vynair.
- * For 200-250 v. to 50 c.p.s. A.C. mains operation.
- * Four Jack socket inputs and two independent vol. controls for simultaneous connection of up to four instrument pick-ups or microphones.
- * Separate bass and treble controls providing more than adequate "Boost" or "Cut"
- * LEVEL frequency response throughout the audible range.
- * SUPERIOR TO UNITS AT TWICE THE COST.

39¹/₂ Gns.

Send S.A.E. for leaflet.
OR DEPOSIT of £4.3.0 and 12 monthly payments of £3.9.11. Carr. 17/6.

R.S.C. JUNIOR GUITAR AMPLIFIER
5-watt high quality output. Separate bass and treble "cut" and "boost" controls. Sensitivity 15 m.v. Two high impedance inputs. 10in. loudspeaker. Handsome, strongly made cabinet (size 14 x 14 x 7in. approx.) finished in attractive and durable polychrome. 200-250 A.C. mains operation. **£8.19.6** Or DEPOSIT £1 and 9 monthly payments of £1. Carr. 7/6.

LINEAR TREMOLO/PREAMP. UNIT
Designed for introducing the Tremolo effect to any amplifier which is fitted with a reserve power supply point for smoothed H.T. and 6.3 v. A.C. L.T. This applies to practically all amplifiers of our manufacture, and to those of several other manufacturers. The unit plugs into power supply point and any input socket or amplifier. Controls are Speed (frequency of interruptions), Depth (for heavy or light effect), Volume and Switch. Three sockets are for two inputs and Foot Switch. **4 Gns.** ONLY.

GLASGOW Opening late January at 236 Argyle St.

TRANSISTOR SALE. Mullard OC71 3/9, OC45 4/11, OC44 4/11, OC72 4/9, OC81 4/11, OC71 8/9, Ediswan XA101 3/9, XB102 3/9, XA112 3/9, XB113 3/9, XB104 3/9, XC101A 3/9. Postage 6d. for up to 3 Transistors.

D.C. SUPPLY KIT. 12 v. 1 a. consisting of a partially drilled metal case, mains trans., F.W. Bridge Rectifier, 2 fuseholders and fuses, Change Direction switch, variable Speed regulator and circuit. For 200-250 v. A.C. mains. Suitable for Electric Trains. Limited number available at 29/11.

SELENIUM RECTIFIERS
F.W. BRIDGE 24 v. 2 amp. .. 14/9
6/12 v. 1 a. .. 3/11 24 v. 20 amp. .. 89/9
6/12 v. 2 a. .. 6/11 H.T. TYPES H.W.
6/12 v. 3 a. .. 9/9 150 v. 40 mA .. 3/9
6/12 v. 4 a. .. 12/3 250 v. 50 mA .. 9/11
6/12 v. 6 a. .. 15/3 250 v. 60 mA .. 4/11
6/12 v. 10 a. .. 98/9 250 v. 80 mA .. 5/11
6/12 v. 15 a. .. 35/9 250 v. 250 mA .. 11/9
CONTACT COOLED. 250 v. 75 mA. F.W. (Bridge), 10/11. 250 v. 50 mA. F.W. (Bridge) 8/11. H.W. 250 v. 60 mA. 5/11.

HI-FI 10-WATT AMPLIFIERS. Brand New Complete **£7.19.9** Carr. 5/8. Manufacturers' discontinued Model. Push-pull output. Latest high efficiency valves. Dual separately controlled inputs for "Mike". Separate Bass and Treble Controls. High sensitivity. Output for 3 or 15 ohm speaker. Guaranteed tested and in perfect working order.

DERBY Now open at 26 Osmonston Road The Spot

R.S.C. (Manchester) MAIL ORDERS to 5 County Arcade, Leeds 1. Terms: C.W.O. or C.O.D. No C.O.D. under £1 Ltd. Postage 2/9 extra under £2. 4/6 extra under £5. Trade Supplied. S.A.E. with all enquiries please.

LEICESTER 32 High St.	BIRMINGHAM 6 Gt. Western Arcade (Opp Snow Hill Sta) No half-day	SHEFFIELD 13 Exchange St. Castle Market Bldgs. Sheffield Half-day	HULL 51 Savile St., Hull Thursday	LIVERPOOL 73 Dale St. Liverpool 2 Half-day	BRADFORD 56 Morley St. (above Alhambra Theatre) Bradford Wednesday	MANCHESTER 8-10 Brown St. (Market St.) Manchester 2 No half-day	LEEDS 5-7 County (Mecca) Arcade Briggate, Leeds No half-day
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R.S.C. SENIOR 15 watt GUITAR AMPLIFIER

For lead or rhythm guitar. High-fidelity push-pull output. Separate bass and treble "cut" and "boost" controls. Twin separately controlled inputs for two instruments or "mike" and pick-up can be used at the same time. Loudspeaker is a heavy duty high flux 12in. 2 watt model with cast chassis. Cabinet is well made and finished as Junior Model. Size approx. 18 x 18 x 8in.

Only **18 Gns.** Carr. 10/-

Send S.A.E. for leaflet. Or DEPOSIT 35/- and twelve monthly payments of 35/-.

HEAVY DUTY LOUDSPEAKERS IN SUBSTANTIAL REXINE COVERED CABINETS. Type B61. Suitable for Base Guitar Speaker Unit. High Flux. 15 ohms. 30 watts. Cabinet size approx. 24 x 21 x 13in. Only 191 gns. Or Deposit 37/6 and 12 monthly payments of 37/6. Type B62. Suitable for Bass Guitar. Super Sensitive. 15in. 15 ohms high flux speaker. Cabinet size approx. 30 x 21 x 14in. Attractive covering of two contrasting tones of Rexine and Vynair. Rating 50 watts. Only 29 gns. Or Deposit £3.7.8 and 12 monthly payments of 69/-.

LARGE REXINE COVERED SPEAKER CABINETS. Heavy blackboard construction. Very attractive two tone covering of Rexine and Vynair. Size 30 x 21 x 16in. cut for 15in. or 18in. speaker or for two 12in. 11 gns. Or Deposit 25/9 and 9 monthly payments of 25/9. Size 20 x 30 x 16in. cut for 15in. or 18in. speaker 13 gns. Or Deposit 30/4 and 9 monthly payments 30/4. Suitable speakers available

FANE EXTRA HEAVY DUTY LOUDSPEAKER 15in. TYPE 153. 40 watts. Total flux 375,000 lines. Extremely high sensitivity. 15 ohm voice coil. Only 18 gns. or Deposit 35/- and 12 monthly payments 35/-.

FANE EXTRA HEAVY L/SPEAKER 18in. 15 ohms. 60 watts. 9in. diam. Speech Coil. Total Flux 375,000 lines. High sensitivity. ONLY 25 gns. or Deposit 52/9 and 12 monthly payments of 43/- Send S.A.E. for leaflet on 153 and 183.

R.S.C. B20 BASS GUITAR AMPLIFIER

A highly efficient unit incorporating a massive 15in. high flux loudspeaker specially constructed to withstand heaviest load conditions. Rating 25 watts. Individual bass and treble controls give ample "boost" and "cut". Two high impedance Jack socket inputs are separately controlled. All controls are conveniently positioned in a recess on top of the cabinet. Cabinet is of substantial construction and attractively finished in two contrasting tones of Rexine and Vynair. Size approx. 24 x 21 x 13in. Operation from 200-250 v. 50 c.p.s. A.C. mains.

Send S.A.E. for leaflet. Or Deposit £3.2.0 and 12 monthly payments of 56/10. Carr. 17/6.

29¹/₂ Gns. Ex. GOVT. SMOOTHING CHOKES. 200 mA. 3-5 H. 50 ohms. Parmeko 8/9; 150 mA. 10 H. 50 ohms 9/9; 80 mA. 20 H. 90 ohms 5/9; 120 mA. 12 H. 100 ohms 8/9; 50 mA. 50 H. 1,000 ohms 6/9; 100 mA. 10 H. 100 ohms 6/9; 60 mA. 5-10 H. 250 ohms 2/11.

COMPLETE POWER PACK KIT, 19/11 Consisting of Mains Trans., Metal Rectifier. Double electrolytic, smoothing choke chassis and circuit. For 200-250 v. A.C. mains. Output 250 v., 60 mA. 6.3 v. 2 a.

R.S.C. POWER PACK, 39/9. Louvred metal case only 8 x 5 1/2 x 2 1/2in. Stove enamelled. For 200-250 v. A.C. mains. Output at 4 pin plug and socket 250 v. 60 mA. fully smoothed and 6.3 v. 2 a. Suitable for power requirements of almost any Pre-amp. or Radio Tuner.

R.S.C. BABY ALARM or INTER-COMM. KIT. Complete set of parts with diagrams, etc. Housed in two polished walnut finished cabinets of pleasing design. High sensitivity. For 200-250 v. A.C. mains. Fully isolated. Controllable at both units. An Intercomm. of this class would normally cost £20-£30. Only 89/6, carr. 5/- or assembled ready for use 6 gns.



EX. GOVT. SELENIUM RECTIFIERS 12v. 15 AMP (BRIDGE) F.W. ONLY 19/9

R.S.C. Manchester Ltd.

LIVERPOOL 32 High St.
BIRMINGHAM 6 Gt. Western Arcade (Opp Snow Hill Sta) No half-day
Half-day Thursday

SHEFFIELD 13 Exchange St. Castle Market Bldgs. Sheffield
Half-day Thursday

HULL 51 Savile St., Hull

LIVERPOOL 73 Dale St. Liverpool 2
Half-day Wednesday

BRADFORD 56 Morley St. (above Alhambra Theatre) Bradford
Half-day Wednesday

MANCHESTER 8-10 Brown St. (Market St.) Manchester 2
No half-day

LEEDS 5-7 County (Mecca) Arcade Briggate, Leeds
No Half-day

MAIL ORDERS to 5 County Arcade, Leeds 1. Terms: C.W.O. or C.O.D. No C.O.D. under £1. Postage 2/9 extra under £2. 4/6 extra under £5. Trade Supplied. S.A.E. with all enquiries please.

DERBY 26 Osmaston Road THE SPOT

FANE HEAVY DUTY HI-FI SPEAKERS

12in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies. 122/10 20w., 5 gns. 122/10A 20w., 6 gns. 122/12 20w., 6 gns. 122/12A 20w., 27.19.6 122/14 22w., 9 gns. 122/14A 22w., 10 gns. 122/17 25w., 11 gns. 122/17A 25w., 12 gns. 15in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies. 152/12 20w., 12 gns. 152/12A 20w., 13 gns. 152/14 27w., 14 gns. 152/14A 27w., 15 gns. 152/17 35w., 16 gns. 152/17A 35w., 17 gns. "A" indicates dual cone type. 30-17,000 c.p.s. Send S.A.E. for leaflets. Terms available.

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amplifier and Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 dB down. Frequency response -3 dB 30-30,000 c/s. 12 specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE. The unit is designed for CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUT-DOOR FUNCTIONS, etc. For use with Electronic ORGAN, GUITAR, STRING BASS, etc. For standard or long-playing amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required replacement cover with carrying handles can be supplied. factory built with EL34 output valves and 12 months' guarantee, for 14 gns. Send S.A.E. for leaflet. **TERMS: DEPOSIT 33/9** and 9 monthly payments of 33/9. Suitable microphones and speakers available at competitive prices.

11 Gns.

Carr. 10/- for 19/9. The amplifier can be supplied, factory built with EL34 output valves and 12 months' guarantee, for 14 gns. Send S.A.E. for leaflet. **TERMS: DEPOSIT 33/9** and 9 monthly payments of 33/9. Suitable microphones and speakers available at competitive prices.

ARMSTRONG, DULCI, LINEAR, ROGERS, LEAK and JASON EQUIPMENT, GOODMAN'S, W.B. and FANE SPEAKERS, GARRARD AND GOLDRING T/TABLES CASH or H.P.

SUPERHET FEEDER UNIT. Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers). Delayed A.V.C. Controls are Tuning, Wch and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. 250 v. from amplifier. Size approx 3 9/8 x 7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustrations. 2/6. Total building cost £4.15.0. S.A.E. for leaflet.

R.S.C. BATTERY TO MAINS CONVERSION UNITS

R.S.C. BATTERY TO MAINS Type BML. An all-dry battery eliminator. Size 5 1/4 x 4 1/2 in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. Suitable for all battery portable receivers requiring 1.4 and 90 v. This includes low consumption types. Complete kit with diagrams, 39/9, or ready to use, 46/6.



Type BM2. Size 8 x 5 1/2 x 2 1/2 in. Supplies 120 v. 90 v. and 60 v. 40 mA and 2 v. 0.4 a. to a lamp. fully smoothed. Thereby completely replacing both B.T. batteries and L.T. 2 v. accumulators when connected to A.C. mains supply 200/250 v. 50 c/s. SUITABLE FOR ALL BATTERY REPRODUCERS normally using 2 v. accumulators. Complete kit of parts with diagrams and instructions. 49/9, or ready for use, 59/6.

P.M. SPEAKERS, 10in. W.B. "Stentorian" 3 or 15 ohms type HF 1012 10 watts, hi-fidelity type. Recommended for use with our All Amplifier. £4.7.6. 12in R.A. 3 ohms 10 watts (12,000 lines), 59/9.

TWEETERS, R.A. 3 ohm. 25/9; 15 ohm 25/9
R.A. 12in. DUAL CONE 3 ohm 8 watt Speakers. Ideal for Stereo. Only 39/9 ea.

Jason FMTI V.H.F./F.M. Radio Tuner design. Total cost of parts including valves, Tuning dial, Eschutecon, etc., £7.19.6.

LINEAR 1.5 MINUTURE 4/5 WATT FULLY AMPLIFIER. Suitable for any record playing unit and most hi-fi telephones. Negative feed-back 12 dB. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves E280, ECC83, EL84. Size only 7 1/8 x 3 1/2 in. high. Guaranteed 12 months. Only £5.19.6. Send S.A.E. for leaflet. Terms: Deposit 22/6 and 5 monthly payments of 22/6.

12in. 10 WATT HIGH QUALITY LOUDSPEAKER



In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £4.19.6 Carr. 5/-. Terms: Deposit 11/3 and 9 monthly payments of 11/3. 12in. 20 WATT HI-FI LOUD-SPEAKERS IN CABINETS. Size 18 x 18 x 10in. Finish as above. Terms: Deposit 17/9 and 9 monthly payments of 17/9. Only £7.19.6. Carr. 8/6. For larger types see preceding page.

LINEAR L34 GRAM AMPLIFIER. High quality. Separate Bass and Treble controls. Handsome appearance. Completely enclosed. Black/Gold Frontplate 5 gns.

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



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 40 millivolts input is required for full output so that it is suitable for use with the latest hi-fidelity pick-up heads, in addition to all other types of pick-ups and practically all "mikes". Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 dB down, 15 dB of Negative feedback is used. L.T. of 300 v. 25 mA and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in a neat case and includes fully punched chassis (with baseplate) with Blue Hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4.15.0, or assembled ready for use 25/- extra. Plus 3/6 carr., or deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

GLASGOW Opening late January 326 Argyle St.

R.S.C. GRAM AMPLIFIER KIT. 3 watts output. Negative feedback. Controls Vol., Tone and Switch. Mains operation 200-250 v. A.C. Fully isolated chassis. Circuit, etc., supplied. Only 39/9. Carr. 3/9.

THE SKYFORD T.R.F. RECEIVER. A design for a 3 valve long and medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-point wiring diagrams, instructions and parts list 1/9. maximum building costs £4.19.6. inc. attractive walnut veneered wood cabinet 12 x 6 1/2 x 5 1/2 in.

MULTI-METERS, CABY MI. Sensitivity 2,000 ohms per volt. A.C. and D.C., 54/- A.10. Basic Meter sensitivity 155 microamps A.C. and D.C. ranges £4.17.6. B.20. Sensitivity up to 10,000 ohms per volt A.C. and D.C., £6.10.0. 30,000 ohms per volt, with overload buzzer, £8.19.6.

R.S.C. JUNIOR HI-FI REPRODUCER. The very latest Goodman Axiette 3 High Fidelity loudspeaker (retailing at approx. 5 gns.) fitted in a specially designed Bass Reflex cabinet size 12 x 18 x 10in. Acoustically lined and ported and finished in polished walnut veneer. Matching impedance 15 ohms. Frequency range 40-15,000 c.p.s. Power handling 6 watts nominal. Ideal for Stereo. Limited 8 Gns. Carr. 4/6.

R.S.C. BASS REFLEX CABINETS, JUNIOR MODEL. Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only £3.19.6.

STANDARD MODEL. As above but for 12in. speakers. Size 20 x 15 x 13in. For vertical or horizontal use. £5.19.6. Suitable legs with brass ferrules, 19/6 per set of 4.

R.S.C. CORNER CONSOLE CABINETS

Polished walnut veneer finish. Pleasing design. 4" X 10" MODEL. Size 20 x 11 x 8in. for 8 or 5in. or 10 x 6in. speakers, £2.9.9. **STANDARD MODEL.** Size 27 x 18 x 12in. for 8 or 10in. speakers, £4.11.9. **SENIOR MODEL.** Size 30 x 20 x 15in. for 12in. Speaker. Suitable Speaker systems below. Only 7 gns.



AUDIOTRINE HI-FI SPEAKER SYSTEMS. Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt ratings £4.19.9. Carr. 5/-. Or Senior 15 watt, £6.19.9. Carr. 7/6.

AUDIOTRINE EQUIPMENT CABINETS. Size 36 x 15 x 18in. Beautiful walnut veneered finish. Elegant contemporary design. Robust construction. Uncut, removable baseboard. Depth above baseboard 5 1/2". Only 12! gns. Carr. 15/- Terms: Dep. 29/9, and 9 mthly. pmts. 29/9



AUDIOTRON HI-FI TAPE RECORDER KIT 25¹/₂

GNS, Carr. 17/6.

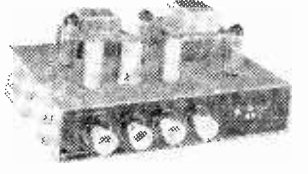


REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR
 Incorporating the latest Coliario Studio Tape Transcriber. The Audiotron High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Real Best Quality Tape and a Handsome Portable Carrying Cabinet with latest attractive two-tone polychrome finish size 14 1/2 x 5 3/4 in. 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.

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 dB 30-30,000 c/s. Six negative feedback loops. Hum level 90 dB 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, LEAD OR RHYTHM GUITARS**, etc.



OUTPUT SOCKET with plug provides 300 v., 30 mA., and 6.3 v., 1.5 a. For supply of a **RADIO FREQUENCY UNIT**. Size approx. 12 x 9 x 7 in. For A.C. mains 200-250 v., 50 c.p.s. Output for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. **Only 8 Gns.** Carr. 10/-. (Or factory built 51/- extra.)

If required louvered metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLY KIT.** 12/6. 12 monthly payments of 24/9. Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

LINEAR TAPE PRE-AMPLIFIER. Type 1P/1. Switched Negative feedback equalisation. Positions for Record (1in., 3in., 7in.) and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Coliario Tape Transcriber and a high fidelity amplifier, but suitable for almost any Tape Deck. **Only 9 gns.** S.A.E. for leaflet.

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



Kit can be supplied assembled and ready to use for 59/6 extra.

A complete set of parts for the construction of a stereo-ophonic 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 (monoaural) 10-watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm 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/-.

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Coliario 16/8. Acos Stereo-Monoaural, 20/9. Ronette Stereo-Monoaural 39/9. B.S.R. Stereo 39/9. **BRADAMATIC RECORDING HEADS.** High Impedance Record/Playback 22/- Low Impedance Erase, 12/6. **MARRIOTT RECORDING HEADS.** High Impedance, Record/Playback 15/- Low Impedance Erase, 10/-.

PICK-UP ARMS. Complete and with latest Acos/hi-f 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. BMG with neck band and heavy table stand 59/9. Label type 29/9. **COLIARIO JUNIOR** 4-speed Single Player Unit and Crystal Pick-up with hi-f Turnover head. Only £3.19.6. **B.S.R. CA14 4-sp/d AUTO-CHANGERS** with hi-f turnover head. 26.19.6. Carr. 4/6. **GARRARD AUTO-SLIM 4-SPEED AUTO-CHANGER** with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains. 27.19.6. Carr. 4/6. **GARRARD 48 AUTO-SLIM DELUXE 4-SPEED AUTO-CHANGERS.** Turnover GC8 head, for 200-250 v. A.C. mains. £11.9.0.

GLEA 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 11 1/2 x 2 1/2 in. Controls: Vol. and Tone with Switch. Only 59/6. **B.S.R. MONARDECK TAPEDECKS.** Speed 3 1/2 in. per sec. With high quality recording heads. £3.19.6. Carr. 5/-.

SENSATIONAL STEREO OFFER

A complete set of parts to construct a good quality Stereo amplifier with an undistorted output of 5 watts. For A.C. mains input of 200-250 v. Sensitivity 130 m.v. Canned Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head 18/9 extra with above only. **4 Gns.**

HEAVY DUTY CHARGER KIT. 6/12 v., 6 amps., variable output. Consisting of Mains Transformer 0-200-230-250 v.; P.W. (Bridge) Selenium Rectifier; Ammeter, Variable Charge Rate Selector Panels, Plugs, Fuses, Fuseholder and circuit. 59/9. Carr. 4/6.

R.S.C. BATTERY CHARGING EQUIPMENT Guaranteed 12 months.



plug for 6 v. or 12 v. charging. Louvered steel case with stoved grey hammer finish. Fused and ready for use with mains and output leads and battery clips. **59/9** Carr. 4/6.

All for A.C. Mains 200-250 v., 50 c/s.
ASSEMBLED 4 amps 6/12 v. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvered metal case with stoved grey hammer finish. Fused, ready for use with mains and output leads. **49/9** Carr. 3/9. 6/12v. lamp. 27/9 Less meter.

BATTERY CHARGER KITS. Consisting of Mains Transformer, P.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuseholders, Gauges, panels, Heavy Duty Clip, circuit. Carr. 3/6 extra
 6 v. or 12 v. 1 amp. 22/9
 As above, with Ammeter. 28/9
 6 v. or 12 v. 2 amps. 19/9
 6 v. or 12 v. 2 amps. inclusive of Ammeter. 35/9
 6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector. 52/9
CHARGER AMMETERS 0-1.5 a., 0-4 a., 0-7 a. 8/9 ea.
CHARGER KIT, 12, 10 Amp with variable charge rate adjustment and ammeter. £4.19.6. Carr. 10/-.

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

Interleaved and Impregnated. Primaries 200-250 v., 30 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. 0.5-6.3v. 2a. 18/9	
250-0-250v. 100mA. 6.3v. 2a. 6.3v. 1a. .. 21/9	
350-0-350v. 100mA. 6.3v. 2.5a. C.T. .. 21/9	
250-0-250v. 100mA. 6.3v. 4a. 0.5-6.3v. 3a. 15/9	
300-0-300v. 130mA. 6.3v. 1a. 6.3v. 1a. for Mullard 510 Amplifier .. 29/9	
300-0-300v. 100mA. 6.3v. 4a. 0.5-6.3v. 3a. 28/9	
350-0-350v. 100mA. 6.3v. 4a. 0.5-6.3v. 3a. 29/9	
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. 17/11	
Midget type 21 x 3 x 3in. .. 27/11	
250-0-250v. 100mA. 6.3v. 4a. 0.5-6.3v. 3a. 27/11	
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. 0.5-6.3v. 3a. 27/9	
350-0-350v. 150mA. 6.3v. 4a. 0.5-6.3v. 3a. 27/9	

CHARGER KIT, 12 v., 14 AMP or 24 v., 7 AMP
 Consisting of mains trans., 200-230-250 v. P.W. (Bridge) selenium Rectifier, Ammeter, Fuses, Variable Resistor, Heavy Steel Stove enamelled case and Circuit. Only £9.19.6. Carr. 15/-.. Please state if 12 v. or 24 v. kit required.

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 354. 4/6	
etc. 4/6	
Small Pentode 5,000 Ω to 3 Ω .. 4/6	
Small Pentode 7/8,000 Ω to 3 Ω .. 4/6	
Standard Pentode 5,000 Ω to 3 Ω .. 5/0	
Standard Pentode 7,000 Ω to 3 Ω .. 5/0	
10,000 Ω to 3 Ω .. 5/0	
Push-Pull 8 watts, EL84, or 6V6 to 3 Ω or matched to 15 Ω .. 9/9	
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-3-8 to 15 Ω .. 19/9	
Following types for 3 and 15 Ω 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, EL84, etc. 40/9	

MIDGET MAINS Primaries 200-250 v. 50 c/s. 250v. 60mA. 6.3v. 2a. 11/9	
250-0-250v. 60mA. 6.3v. 2a. 12/11	
Both above size 21 x 2 1/2 x 2 1/2 in.	
FILAMENT TRANSFORMERS	
All with 200-250v. 50 c/s primaries 6.3v. 1.5a. 5/9; 6.3v. 2a. 7/6; 0-4-6.3v. 2a. 7/9; 12v. 1a. 7/11; 6.3v. 3a. 8/11; 6.3v. 5a. 17/6; 12v. 1.5a. twice, 17/6.	
SMOOTHING CHOKES	
150mA. 7-10 H. 250 ohms. 11/9	
100mA. 10H. 200 ohms .. 8/9	
80mA. 10H. 350 ohms .. 5/9	
90mA. 10 H. 400 ohms .. 4/11	
CHARGER TRANSFORMERS	
All with 200-250v. 50 c/s Primaries:	
0-9-15v. 11a. 12/9; 0-9-15v. 2a. 14/9; 0-9-15v. 3a. 16/9; 0-9-15v. 5a. 19/9; 0-9-15v. 6a. 23/9; 0-9-15v. 8a. 28/9.	
4-11 (step up/Step down) TRANS.	
0-110/120-230/250v. 50-80 watts. 13/9; 250 watts. 39/9; 150 watts. 27/9.	
MICROPHONE TRANSFORMERS	
120:1 high grade, clamped. 8/9.	

PORTABLE TRANSISTOR RADIOS

BACKED BY SUPER AFTER SALES SERVICE

ROAMER SEVEN Mk III

● 9 stages—7 transistors and 2 diodes

Covers Medium and Long Waves, Trawler Band and two Short Waves to approx. 17 metres. Push-pull output for room filling volume from rich toned heavy duty 5in. speaker. Ferrite rod aerial for M & L waves and telescopic aerial for S Waves. Air spaced ganged tuning condenser ensures wonderful stations selection. Simulated hide case with gilt trim and shoulder and hand straps. Size 9 x 7 x 4in. approx. The perfect portable and the ideal car radio. (Uses PP9 battery available anywhere.)

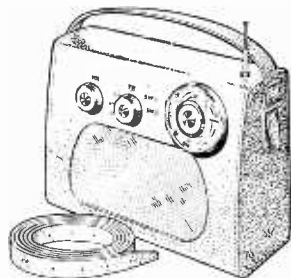
5 WAVEBAND PORTABLE OR CAR RADIO

Amazing performance and specification

Total cost of parts now only

£5.19.6 P. & P. 5/6

Parts Price List and easy build plans 3/-.



TRANSONA FIVE

"Home, Light A.F.N. Lux. all at good volume". G.P., Durham.

● 7 stages—5 transistors and 2 diodes.

Fully tunable over medium and Long Waves and Trawler Band. Incorporates Ferrite rod aerial, tuning condenser, volume control, new type line tone super dynamic speaker, etc. Attractive case. Size 6½ x 4½ x 1½in. with red speaker grille. (Uses 1289 battery available anywhere.)

Total cost of all parts now only **42/6**

P. & P. 3/6.

Parts Price List and easy build plans 2/-.



TRANSONA SIX

NEW!

● 8 stages—6 transistors and 2 diodes.

This is a top performance receiver covering full Medium and Long Waves and Trawler Band. High-grade powerful magnet 3in. speaker makes listening a pleasure. Push-pull transformers for ample power. Ferrite rod aerial. Many stations listed in one evening including Luxembourg loud and clear. Attractive case in grey with red grille. Size 6½ x 4½ x 1½in. (Uses PP4 battery available anywhere.) Carrying strap 2/- ex.

Total cost of all parts now only **59/6** P. & P. 3/6

Parts Price List and easy build plans 1/6



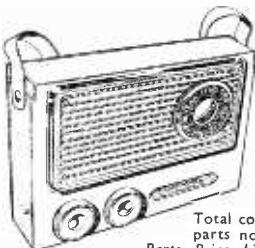
SUPER SEVEN

● 9 stages—7 transistors and 2 diodes

Covers Medium and Long Waves and Trawler band. The ideal radio, can be fitted with carrying strap for outdoor use. Completely portable—has built in aerial for wonderful reception. Push-pull output. 3in. speaker (will drive larger speaker). Size 7½ x 5½ x 1½in. (Uses PP6 battery available anywhere.)

Total cost of all parts now only **£3.19.6** P. & P. 3/6.

Parts Price List and easy build plans 2/-.



MELODY SIX

"... amazed at volume and performance... has really come up to my expectations". S.G., Stockton-on-Tees.

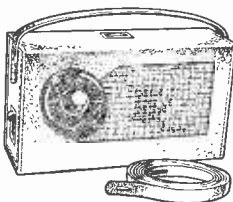
FREE! Miniature Earpiece, plug and socket (value 9/6) and details of conversion to private listening.

● 8 Stages—6 transistors and 2 diodes.

Our latest completely portable transistor radio covering medium and long waves. Incorporates pre-tagged circuit board, 3in. heavy duty speaker, top grade transistors, volume control, tuning condenser, wave change slide switch, sensitive 6in. ferrite rod aerial. Push-pull output. Wonderful reception of B.B.C. Home and Light, 208 and many Continental stations. Handsome leather-look pocket and supplied with hand and shoulder straps.

Total cost of all parts only **£4.9.6** P. & P. 3/-.

Parts Price List and easy build plans 4/-.



ROAMER SIX

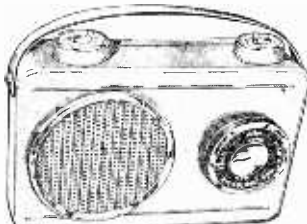
FREE! Miniature Earpiece, plug and socket (value 9/6) and details of conversion to private listening.

● 8 stages—6 transistors and 2 diodes.

Listen to stations half a world away with this 5 waveband portable. Tunable on Medium and Long waves, Trawler Band and two Short waves. Sensitive ferrite rod aerial and telescopic aerial for short waves. Top grade transistors, 3-inch speaker, handsome case with gilt fittings. Size 6½ x 4½ x 1½in.

Total cost of all parts now only **£4.19.6** P. & P. 3/6

Parts Price List and easy build plans 3/-.



POCKET FIVE

● 7 stages—5 transistors and 2 diodes.

Covers Medium and Long Waves and Trawler Band, a feature usually found in only the most expensive radios. On test Home, Light, Luxembourg and many Continental stations were received loud and clear. Designed round supersensitive Ferrite Rod Aerial and fine tone 2½in. moving coil speaker, built into attractive black case with red speaker grille. Size 5½ x 1½ x 3½in. (Uses 1289 battery available anywhere.)

Total cost of all parts now only **42/6** P. & P. 3/-.

Parts Price List and easy build plans 1/6

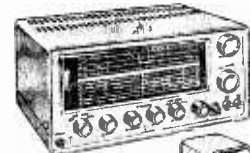


All components used in our receivers may be purchased separately if desired. Parts price lists and easy build plans supplied free with sets of parts or available separately at prices stated.

Radio Exchange Co.

27 HARPUR STREET, BEDFORD
Phone 2367 ● Opposite Co-op. ● 10-1 p.m. Sats

HE-30 SUPER AMATEUR COMMUNICATION RECEIVER



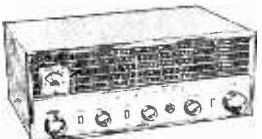
4 bands covering 550Kcs to 30Mc/s continuous. Operation 200/250 volt A.C. Special features include: Easy to read illuminated slide rule dial—Built in Q multiplier—Aerial trimmer—calibrated electrical bandspread on amateur bands—0-100 logging scale—noise limiter—AVC/MVC selector—stable coil windings—B.P.O. for clear CW and SSB reception—built in edgewise 'S' meter. Output for phones or STD speaker. Supplied brand new and guaranteed with manual. £42 carriage paid. S.A.E. for full details.

SPECIAL BONUS. With purchase of HE-30 receiver matching speaker for only 32/6 or separately for 62/6.



HE-40 DE LUXE 4-BAND COMMUNICATION RECEIVER

Frequency coverage 550Kcs to 30Mc/s continuous. Operation 220/240 volt A.C. The perfect receiver for short wave listening. Special features include: Slide rule tuning dial—electrical bandspread—0-100 logging scale—improved selectivity—built in 'S' meter—A.V.C.—Noise limiter—B.F.O.—Phone jack built in 5 in. speaker—tone control—standby switch—supplied with three aeriols, ferrite loop for broadcast band, adjustable 56in. whip for short wave and wire aerial. Smartly styled durable metal cabinet. Supplied brand new and guaranteed with manual. £24.15.0 carriage paid. S.A.E. for full details.



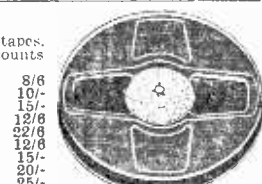
NATIONAL H.R.O. RECEIVER

SENIOR MODEL. Supplied complete with full set of nine coils covering 50Kcs to 30Mc/s. Each receiver thoroughly checked before despatch and available as follows:
Table Model. Good used cond... £19.19.0
Rack Model. As new cond... £22.10.0
Rack Model. Good used cond... £18.18.0
N.B.—Rack model is identical to table model with extended front panel to fit a 19in. rack. Carriage £1 extra.

200/250 volt A.C. power supplied for all above receivers, also sold separately 59/6, carr. 5/-. S.A.E. for details.

LAFAYETTE BRAND RECORDING TAPES

First grade quality American tapes. Brand new and guaranteed. Discounts for quantities.
5in. 600ft. std. plastic .. 8/6
5in. 500ft. L.P. acetate .. 10/-
5in. 1200ft. D.P. mylar .. 12/6
5in. 1200ft. L.P. acetate .. 12/6
5in. 1800ft. D.P. mylar .. 22/6
7in. 1200ft. std. mylar .. 12/6
7in. 1800ft. L.P. acetate .. 15/-
7in. 1800ft. L.P. mylar .. 22/6
7in. 2400ft. D.P. mylar .. 25/-

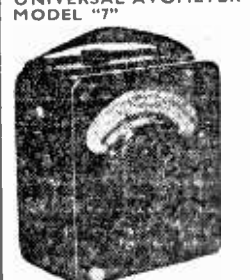


Postage 2/-, Over £3 post paid.

COSSOR DOUBLE BEAM OSCILLOSCOPE 1035

9in. tube. Calibrated Y1 amplifier from 50mV to 50V. Bandwidth 10Mc/s. Calibrated Y2 amplifier from 5V to 500V with bandwidth up to 100Kc/s. Directly calibrated X shift providing time measurements from 15 microseconds to 150 milliseconds. Supplied in guaranteed perfect condition. £40 each. Carr. 30/-.

UNIVERSAL AVOMETER MODEL "7"



MINE DETECTOR No. 4A

Will detect all types of metal. Fully portable. Complete with instructions. 39/6 each. Carr. 10/- Batteries 8/6 extra.

SILICON RECTIFIERS

SCR. 100V. P.I.V.	4.7 amp .. 7/6
200V. P.I.V.	9 amp .. 5/6
800V. P.I.V.	500mA .. 5/6
100V. P.I.V.	500mA .. 3/6
70V. P.I.V.	1 amp .. 3/6

0A292 miniature silicon rectifiers. 1/- each. Discounts for quantities. Please add postage.

50 ranges. Guaranteed perfect working order. Supplied complete with leads, batteries and instructions. £11 each. Registered post 5/- extra.

CLEAR PLASTIC PANEL METERS

D'Arsonval Movement. Jewelled Movements. 1 1/2 in. Square Fronts. 1 1/2 in. Overall Behind Panel. 1 in. Dia. Panel Hole. Accuracy 2% of Full Scale. Silver Dials. Black Numerals and Pointers. Front Zero Adjustment. All types moving coil. Individually boxed and guaranteed. Available as follows:

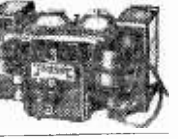
50uA .. 32/6	150mA .. 22/6
100uA .. 29/6	200mA .. 22/6
200uA .. 27/6	500mA .. 25/6
500uA .. 25/6	750mA .. 25/6
50-0-50uA .. 29/3	1A. DC .. 22/6
100-0-100uA .. 27/6	5A. DC .. 22/6
300mA .. 22/6	3V. DC .. 22/6
1mA .. 22/6	10V. DC .. 22/6
10mA .. 22/6	50V. DC .. 22/6
50mA .. 22/6	100V. DC .. 22/6
100mA .. 22/6	150V. DC .. 22/6



Calibrated 'S' meters 35/-. A full range of larger clear plastic and Bakelite panel meters are available. Send for illustrated leaflet. Trade terms available.

FIELD TELEPHONES

Type "L". Two line connection. generator bell ringings. Complete telephone system. Supplied in excellent condition. Fully tested and complete with batteries. Only 69/6 per pair. Carr. 5/-.
Type "P". As above but moulded bakelite case (as illustrated). Supplied complete with wooden transit case for field use. £4.19.6 per pair. Carr. 7/-.



MULTIMETERS BRAND NEW—FULLY GUARANTEED LOWEST EVER PRICES

Supplied with Leads, Batteries and Instructions.
1,000 ohm/VOLT .. 20,000 ohm/VOLT
0/15/150/1,000 v. A.C. and D.C. .. 0/10/50/250/500/1,000 v. A.C. and D.C.
0/150 mA D.C. .. 0/50/10/25/50 mA. D.C.
0/100 K ohm etc. .. 0/50K/100K/500K/1 meg. etc., 0/7/6. P. & P. 2/6.

30,000 ohm/VOLT .. 200,000 ohm/VOLT
0/1/10/50/250/500/1,000 v. D.C. .. 0/10/50/250/500 v. A.C.
0/50/10/25/50 mA. D.C. .. 0/10K/1 meg/10 meg., etc. £5.10.0. P.P. 2/6.
30,000 ohm/VOLT .. 200,000 ohm/VOLT
0/1/1/2/10/25/100/250/500/1,000 v. D.C. and A.C. .. 0/50/2A/15/50/300 mA/0/12 amp. D.C.
0/50K/1 meg./10 meg. etc. £6.17.6. Post paid
50,000 ohm/VOLT .. 200,000 ohm/VOLT
0/10/50/250/1,000/1,000 v. D.C. and A.C. .. 0/25/1A/2.5/25/250 mA. D.C.
0/10K/100K/1 meg./10 meg., etc., £7.10.0. P. & P. 3/6.
100,000 ohm/VOLT .. 200,000 ohm/VOLT
5/2.5/10/50/250/500/1,000 v. D.C. .. 2.5/10/50/250/1,000 v. A.C.
10/25/1A/2.5/25/250 mA/10 amp. D.C. .. 20K/200K/2 meg./20 meg. ohm etc. £6.19.6. Post Paid.



P.C.R.2 COMMUNICATION RECEIVERS

Excellent 6 valve receiver. Frequency coverage on 3 bands. 800-2,000 meters. 100-250 metres and 6-22Mc/s. Output for phone or speaker. Supplied in perfect condition. £5.19.6 each. Carr. 10/-.
The receiver can be supplied with an internal power supply to operate on 200/250 volt A.C. at 39/6 extra, or plug in external power supplies are 35/- extra. Full circuit supplied.

AVO WIDE RANGE SIGNAL GENERATORS

Frequency coverage 50Kcs to 80Mc/s in six turret operated cases. For use on standard A.C. mains. Packed in original transit cases with accessories. Supplied in as new condition, fully checked before despatch. £15. Carr. 10/-.

MINIFLUX TRACK TAPE HEADS

Set of three, record, playback, erase. Only 29/6 set. P. & P. 9d.

CR.100 COMMUNICATION RECEIVERS

60Kcs to 30Mc/s on 6 bands. 200/250 volt A.C. operation. Supplied in perfect working condition. £21 each. Carr. 30/-.

MICROAMMETERS

0-500 microamp 2 in. circular flush panel mounting. Dials engraved 0-15 1-6000 volt. Brand new boxed. 15/- P. & P. 1/6.

FIELD STRENGTH METERS

Frequency coverage 1-250Mc/s. Fitted with 200 microamp meter. Supplied with telescopic aerial earpiece and instructions 69/6 post paid.

HEAVY DUTY AUTO TRANSFORMERS

0/115/230 volt step up or step down. Brand new boxed, ex-U.S.A. 3,000 watt. £7.10.0. Carr. 10/- 7,500 watt. £15. Carr. 11/-.

LARGEST STOCK OF COMPONENTS IN THE COUNTRY OPEN 9 a.m.-6 p.m. EVERY DAY—MONDAY to SATURDAY.

C.W. SMITH & CO (RADIO) LIMITED
Phone: GERRARD 8704/9135
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

NEW YEAR CLEARANCE SALE — PRICES SLASHED

STOCKROOMS MUST BE CLEARED TO MAKE WAY FOR SPRING STOCK

Stock No. 101—Few Only MAINS BURG-LAR ALARMS. With complete set of door and window microswitches and Connecting Wire etc. Advertised at 7 gns. OUR PRICE to clear 39/6, plus 3/- P. & P.

Stock No. 102—BRASS RIGHT ANGLE BRACKETS, drilled with 2 holes. Approximately lin. square Only 9d. apair.

Stock No. 104—MINIATURE MEDIUM WAVE TUNING COILS with reaction winding. Clearance price 2/- each, plus 6d. P. & P.

Stock No. 105—39 ONLY PRECISION CAMERAS. Takes 127 film. To clear 8/6 each, plus 1/6 P. & P.

Stock No. 106—193 ONLY MINIATURE PLASTIC RADIO CABINETS, complete with Chrome carrying Handles, Dial and tuning knob. Size 5 1/2 x 3 1/4 x 1 1/4in. Clearance price only 5/6, plus 1/- P. & P.

Stock No. 107—PRINTED CIRCUITS of 3 Transistor Reflex Radio made to fit above radio, 2/6, plus 1/6 P. & P.

Stock No. 108—MINIATURE PRINTED RADIO CABINETS, 5 x 3 1/4 x 1 1/4in. 2/6 each to clear, plus 6d. P. & P.

Stock No. 109—BEAUTIFUL MINIATURE SIZE PLASTIC RADIO CABINETS. Size 5 x 3 x 1 1/4in. Printed and ready drilled. OUR PRICE 3/6, plus 1/- P. & P.

Stock No. 110—MINIATURE PLASTIC RADIO CABINETS unprinted. Size 3 x 2 1/4 x 1 1/4in. 2/6 each to clear, plus 6d. P. & P.

Stock No. 111—BEAUTIFULLY MOULDED MINIATURE PLASTIC RADIO CABINETS, complete with tiny carrying handle and tuning knob. Size 4 x 2 1/4 x 1 1/4in. Price to clear 3/6, plus 1/- P. & P.

Stock No. 111a—Specially Printed Circuits for above cabinet of two transistor reflex radio, 2/6, plus 6d. P. & P.

Stock No. 112—EXCEPTIONALLY GOOD LOOKING PLASTIC RADIO CABINETS "SLIM LINE". Size 6 x 3 1/4 x 1 1/4in. Clearance price 5/8, plus 9d. P. & P.

AMAZING CIGARETTE RADIO only 18/6

Complete set of parts. Amaze your friends! —(this highly sensitive TRANSISTOR "CIGARETTE" receives all medium wave stations clear and crisp—holds ten cigarettes—weighs less than 3 ozs. with cigarette! Tiny battery inside cost 3d. and last over three months. This brilliant little novelty personal phone radio is ideal for Beside, News, Sports, Office. Can be built by anyone from our simple pictorial diagrams in an hour or two. All parts supplied for 18/6 (add 1/6 P. & P.). C.O.D. 2/- extra. (Parts sold separately, priced parts lists 1/-.)

Stock No. 113a—BEAUTIFUL BLACK & GOLD READY DRILL FRONT RADIO PANELS TO GO WITH THESE, 5/-, plus 1/- P. & P.

Stock No. 114—MINIATURE RADIO CABINETS IN GOLD but undrilled. Size 4 1/2 x 3 x 1 1/4in. Give away price of 2/6, plus 6d. P. & P. Special carrying cases for above at 1/6, plus 6d. P. & P.

Stock No. 115—RADIO CABINETS same as specified as above, but upright design, 2/6 each, plus 6d. P. & P.

Stock No. 115a—Special carrying case for above at 1/6, plus 6d. P. & P.

Stock No. 116—ANOTHER TYPE RADIO CABINET, horizontal, 2/6 each, plus 6d. P. & P.

Stock No. 125—BRAND NEW MAGNETIC DEAF AID TYPE EARPIECES, complete with Plug and Socket. 300 ohms. OUR SPECIAL PRICE 5/-, plus 6d. P. & P.

Stock No. 126—BRAND NEW CRYSTAL DEAF AID TYPE EARPIECES. Our price 4/-, plus 6d. P. & P.

Stock No. 127—DEORATIVE SPEAKER GRILLS 2in. diameter, 3 for 1/-, plus 6d. P. & P.

Stock No. 128—4in. PLASTIC CARRYING HANDLES with fixing screws, 6d. each, plus 6d. P. & P.

Stock No. 135—93 ONLY STANDARD PLASTIC (EJECTING) SWITCHES, two way, cord operated Clearance price 2/6, plus 1/- P. & P.

AMAZING NEW INVENTION AUTOMATIC CAR LIGHTER ONLY 10/-

We have been lucky enough to purchase 1,500 only of these fully automatic Car Cigarette Dispenser/Lighters because of a frustrated export shipment. Originally made to sell at about 45/-! Robust and ingeniously designed in heavy chromium. Holds packet of cigarettes (any make and size) you reach out with one hand, press a button and a lighted cigarette is in your hand! Can be lit by anyone in 2/3 minutes. For 6 or 12 volts, full connecting details—only one wire to connect! Each one in own coloured box, brand new and untouched. Only 10/-, add 2/- P. & P. (C.O.D. 2/6 extra).

Stock No. 117—477 SUB-MINIATURE TRANSISTOR RADIO CASES (Plastic, undrilled). Size only 1 1/4 x 1 1/4 x 1/4in. To clear 1/- each, plus 6d. P. & P.

Stock No. 118—SPRING TIPS for holding Miniature Valves. Price for 3, 1/-, plus 6d. P. & P.

Stock No. 119—72 ONLY MINIATURE 6 TAG COILS covering Medium Wave and Long Wave with reaction winding. Price to clear 3/- each, plus 6d. P. & P.

Stock No. 120—SIMILAR TO ABOVE but Medium Wave only 2/- each plus 6d. P. & P.

Stock No. 169. "VOLKSRADIO" POCKET VALVE RADIO ONLY 15/-

Take a Over Bid makes this Fantastic Offer possible—the beautifully compact "5 Star Volkstradio" measuring 4 x 2 1/2 x 1 1/4in. receives perfectly—in the bedroom, office, garden—over all medium waves (incl. Luxembourg). Under 1d. hour running cost. Anyone can assemble in 1 or 2 hours, using our simple A B C plan. Complete set of parts. Only 15/-, plus 1/6 P. & P. C.O.D. ex. (Parts can be bought separately).

Stock No. 137—BRAND NEW TRIMMERS "VOLDON", 250 pF. To clear 1/- each, plus 6d. P. & P.

Stock No. 138—MINIATURE ACORN VALVES. Type 954, 9d. each, plus 6d. P. & P.

Stock No. 139—6K76 BRAND NEW VALVES, 2/9, plus 6d. P. & P.

Stock No. 140—6V6G VALVES, 4/6, plus 6d. P. & P.

Stock No. 141—114 BRAND NEW VALVES, 1/9, plus 6d. P. & P.

Stock No. 142—BRAND NEW B7G VALVE HOLDERS, 6d., plus 4d. P. & P.

THE MINUTE TRANSISTOR RADIO MIAMI ONLY 17/6

Unbelievably small—outrageously cheap. You will be amazed at the fine quality of tone and volume of this great little radio. Only a fantastic entertainment for months on an 8d. battery. Type 54, 9d. each, plus 6d. P. & P.

Stock No. 139—6K76 BRAND NEW VALVES, 2/9, plus 6d. P. & P.

Stock No. 140—6V6G VALVES, 4/6, plus 6d. P. & P.

Stock No. 141—114 BRAND NEW VALVES, 1/9, plus 6d. P. & P.

Stock No. 142—BRAND NEW B7G VALVE HOLDERS, 6d., plus 4d. P. & P.

TERMS OF BUSINESS
C.O.D. 2/6 extra, regret No C.O.D. under 1/-! Add extra postage for overseas. Special prices for quantity and the Trade. All orders guaranteed. Components, technical books, Hi-Fi by Leak, Jason, Lotz, Quail, etc. send S.A.E. for quotation or with any enquiry.

Stock No. 121—MEDIUM WAVE LOOPSTICK COILS with Variable Tuning Core, 75 only. To clear 2/9 each, plus 6d. P. & P.

Stock No. 122—FEW ONLY VARIABLE TUNING CONDENSER (Mica Dielectric)—0005 mfd., 3/6, plus 6d. P. & P.

Stock No. 123—173 RADIO DIALS. Printed Medium and Long Wave, Square Shape. Size 1 1/2 x 3/4in. with central hole. Price 1/6, plus 6d. P. & P.

Stock No. 124—SUB-MINIATURE DIODES, all brand new and tested. Clearance price 3 for 1/- plus 3d. P. & P.

OUR NEW 20-STAGE MINUETTE

Build this newly designed "MINUETTE" 4-STAGE transistor set in very strong ready drilled ULTRA-MODERN CASE, size only 6 x 3 1/4 x 1 1/4in.

Uses three transistors and diode and SELF-CONTAINED LOUDSPEAKER. Very sensitive, ideal for office, bedroom, holidays, etc. Months and months of listening off an 8d. battery. You can build FOR ONLY 20/- including PICTURE CASE, miniature speaker, etc. SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS etc., plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

Stock No. 163—BRAND NEW ASSORTED CONDENSERS 30pF to .01 mfd., 25 for 7/6, plus 1/- P. & P.

Stock No. 164—SPECIAL OFFER OF HOME CONSTRICTED RADIOS NEEDING ATTENTION. Filled with components in good condition.

Stock No. 164b—TYPE (B) 2/3 Transistor. Size 4 x 3 x 1 1/4in. Price 5/- each plus 1/6 P. & P.

Stock No. 164c—TYPE (E) 20 only. Valve Radios in small fibre attaché cases. Size 7 x 5 x 2 1/4in. Price 2/6, plus 2/6 P. & P.

Stock No. 164d—TYPE (D) Miniature Valve Radios in plastic case. Size approximately 3 x 3 x 1 1/4in. Price 5/- plus 1/6 P. & P.

Stock No. 164e—TYPE (E) 20 only. Valve Radios in small fibre attaché cases. Size 7 x 5 x 2 1/4in. Price 2/6, plus 2/6 P. & P.

Stock No. 165—SURPRISE PARCEL TYPE (a). Assorted components. Price 5/-, plus 1/6 P. & P.

Stock No. 167—SURPRISE PARCEL TYPE (c). Price 15/-, plus 2/- P. & P.

Stock No. 132—WANDER PLUGS. New and unused, 2/- doz., plus 6d. P. & P.

Stock No. 134—5in. MOVING COIL LOUD-SPEAKERS. Brand new, 3 ohms, 10/-, plus 2/6 P. & P.

Stock No. 168—SPECIAL CLEARANCE OF FULLY GUARANTEED BRAND NEW "GOLD FRONT" 6 TRANSISTOR SUPER-HET RADIOS. Complete with real leather carrying case. Personal earpiece, battery. All in beautiful presentation boxes. Only 75/- plus 2/6 P. & P. 74 only. Advertised at 45.6.0 recently. Last 74—no more available.

Stock No. 143—285 ONLY! MINIATURE PRECISION "MINETTA" 8 P.V. CAMERAS complete with 6 rolls of film and real leather carrying case. Size 2 1/4 x 1 1/4 x 1 1/4in. Price to clear 20/- each. Post Free.

Stock No. 144—BRAND NEW 2 1/2in. MOVING COIL LOUDSPEAKERS, SPECIAL PRICE 8/6 plus 1/6 P. & P. 30 ohms.

Stock No. 145—BRAND NEW ASSORTED RESISTORS in packets of 100, 6/-, plus 6d. P. & P.

Stock No. 151—BRAND NEW "PLESSEY" MOVING COIL SPEAKERS, 2 1/2in. 60 ohms. Matches Transistor Direct—No U.P.T. needed. Special prices 8/6, plus 1/6 P. & P.

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PERSONAL CALLERS WELCOME:— Open 8.30 a.m. until 1 p.m. and 2 p.m. until 5.30 p.m. Saturdays: 8.30 a.m. to 1 p.m. Demonstrations Daily.

STERN-CLYNE

Incorporating STERN RADIO LTD., PREMIER RADIO, CLYNE RADIO LTD.

Three well-known names with a reputation for quality and service.

Combined resources, technical knowledge and over 50 years' experience gives you an organisation offering a fully comprehensive specialist service in the rapidly expanding world of electronics.



MULLARD 3-VALVE PRE-AMPLIFIER TONE CONTROL UNIT

Designed mainly for Mullard Range of Amplifiers, also suitable for any Amplifiers requiring input up to 250mV. Incorporates 5 input Channels. Including for Tape and Magnetic Pick-ups. Separate Bass and Treble controls. High pass filter 20 to 160 c/s. low pass filter 5-9 Kc/s. Totally enclosed in case Size 11" x 4" x 4". **£10.00** (Carr. & ASSEMBLED **£13.10**)
KIT OF PARTS (Carr. & Ins. 5/-), AND TESTED



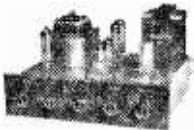
MULLARD "5-10" MAIN AMPLIFIER

For use with MULLARD 2 or 3 valve pre-amplifiers with which an undistorted power output of up to 10 watts is obtained. SPECIFIED COMPONENTS and MULLARD VALVES including PARTRIDGE MAINS TRANSFORMER and choice of PARMKO or PARTRIDGE Output Transformer. **£10.00**
COMPLETE KIT (Parmko Output Trans.) ASSEMBLED AND TESTED **£13.10**

ABOVE incorporating PARTRIDGE OUTPUT TRANS. **£1.6.0** extra. Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

THE MULLARD 5-10RC AMPLIFIER

The popular complete "5-10" incorporating Passive Control Unit providing up to 10 watts high quality reproduction with input of 500 mV. Specified components and new MULLARD VALVES. Includes PARTRIDGE MAINS TRANSFORMERS and choice of PARMKO or PARTRIDGE Output Transformers. Surplus Power available for Tuner. **£12.00**
COMPLETE KIT ASSEMBLED AND TESTED **£16.00** (Carr. & Ins. 7/6) With PARTRIDGE OUTPUT TRANS. **£1.6.0** ex.



Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

THE MULLARD 3-JRC HIGH QUALITY AMPLIFIER DEVELOPED FROM THE VERY POPULAR 3-WATT MULLARD "3-3" DESIGN.



KIT OF PARTS ASSEMBLED AND TESTED **£8.8.0**
£11.10.0

Complete to the MULLARD specification including PARMKO OUTPUT TRANSFORMER. Switched inputs for 78 and 500 mV. Extra power to drive a Radio Tuning Unit is also available. (Carr. & Ins. 0/6). Please state L.S. impedance. Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

THE "MONO-GRAM"

A small Amplifier of genuine high quality performance. Incorporates MULLARD ECL86 Valve, separate BASS and TREBLE controls. PARTRIDGE output Transformer producing up to 7 watts undistorted output. (Carr. & Ins. 3/6). Kit of Parts **£4.10.0** Assembled and Tested **£6.0.0**



Instruction book and detailed price list (free with kit) available separately at 2/6 Post Free.

THE NEW CHASSIS PUNCH SET

Five of the most used Hole Punches made of the best hardened steel will save hours of tedious hand labour, suitable for Aluminium, Sheet Metal, Plastic, etc. Punch Sizes 4", 6", 7", 1", 1", complete with Tommy Bar, Tapped Reamer, and Zip Fastening Case. PRICE **49/6** P.&P. **3/6**



SEND FOR CURRENT PRICE LIST OF ALL LEADING RECORDING TAPES AND ACCESSORIES

PRICE REDUCTIONS

- (a) THE KIT OF PARTS to build both the "5-10" Amplifier and the 2-Valve Pre-Amplifier..... **£15.15.0**
- (Carr. & Ins. 8/6) **£21.10.0**
- (a) Assembled and Tested **£21.10.0**
- (b) THE KIT OF PARTS to build both the "5-10" Amplifier and the 3-Valve Pre-Amplifier..... **£19.10.0**
- (Carr. & Ins. 10/-) **£25.10.0**
- (a) Assembled and Tested **£25.10.0**
- With PARTRIDGE OUTPUT TRANSFORMER **£1.6.0** extra.

MULLARD 2-VALVE PRE-AMPLIFIER TONE CONTROL UNIT

Employing two EF86 valves and designed to operate with the Mullard AMPLIFIERS but also perfectly suitable for other makes with input up to 250 mV. **£6.6.0** ASSEMBLED AND TESTED **£9.10.0** (Carr. & Ins. 5/-)
Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.



THE "TUDOR" STEREO AMPLIFIER

PRICE **£15.0.0** (Pkg. & Carr. 7/6)
A self-contained Shell-mounting 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 is produced. Separate BASS and TREBLE controls. The Cabinet is finished in Black Crackle. Size 14 x 8 x 4in. Send for full specification.



HI-FI STEREO HEADPHONES

For the connoisseur who requires perfection. Each Earphone consists of a 2" Dynamic Loudspeaker with a full frequency range, fitted with foam rubber Ear Pads for added comfort to keep out noise and to maintain an excellent bass response. The resistance Junction box with change-over switch provides simple transfer from Phones to Speaker. Specifications: Frequency Range - 20-15,000 c.p.s. Input Impedance - 16 ohms. Power rating - 1 watt. Weight - 13 ozs. PRICE **5 Gns.** P. & P. 2/6. (Junction box 15/- ex.)



STEREO STETHOSCOPE HEADSETS

Enjoy personal listening in absolute comfort with the new lightweight Stethoscope Headsets suitable for stereo or monaural. Magnetic low impedance. Complete with 6ft. of Cable and Stereo Jack Plug. PRICE **25/-** P.&P. **1/6**

MONAURAL STETHOSCOPE HEADSETS

Suitable for Radio, Tape Recorders, or monitoring tape recordings, magnetic low impedance or Crystal High Impedance. Complete with 4ft. of lead and miniature Jack Plug. PRICE **10/6** P.&P. **1/6**

AGOS MONAURAL STETHOSCOPE HEADSETS

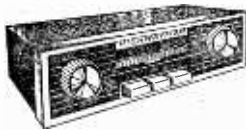
Suitable for Tape Recorders, or monitoring tape recordings, 100 ohm impedance magnetic. Complete with 4ft. of lead. (Originally 21/-) OUR PRICE **12/6** P.&P. **1/6**

SEE FOLLOWING PAGES FOR ADDRESSES AND DETAILS OF OTHER STERN-CLYNE PRODUCTS

Great Britain's Greatest Electronic Hobbies Organisation

STERN-CLYNE

NEW LOW PRICES - NOW YOU CAN AFFORD A CAR RADIO

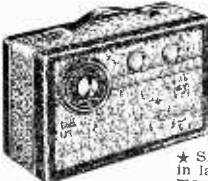


THE 'HIGHWAYMAN' OUR QUALITY CAR RADIO TO BUILD YOURSELF AT A NEW LOW PRICE

Look at these features:
 ★ Attractive styling. ★ Push-pull output ★ Three latest Mullard transistors plus valves types 6BH3 and 6CH33. ★ No Buzz, high output and sensitivity. ★ Printed circuit (latest type). 7 x 4 in. high flux p.m. speaker and battery. ★ Medium and Long Waves. ★ Push button for fingertip control. ★ Extremely low battery consumption (less than 1 amp). ★ Easy to fit any make car. (Positive earth only). ★ 12-volt operation. ★ Compact size, measures only 7 x 7 x 2 in. deep. ★ Easy assembly, supplied with dial and drive already mounted.

£7.19.6 Plus 5/- P. & P.

Special inclusive price of ONLY £7.19.6 Plus 5/- P. & P. All parts available separately. Individually priced parts list and comprehensive instruction booklet 2/6 post free. (Deducted from cost if complete parcel purchased later.)



THE "AIR KING"

Our highly successful six-transistor luxury portable with the "SLIM LINE" look. To build yourself, with printed circuit chassis for reliability and simplicity in construction. May be used as Car Radio, with full MEDIUM wave and LONG wave coverage.

Look at these features:

- ★ 500 milliwatt output to high flux 7 x 3 in. high fidelity loudspeaker.
- ★ Six selected MULLARD TRANSISTORS in latest super-sensitive circuit plus germanium diode.
- ★ Compact size only 9 1/2 x 3 1/2 x 6 in. high.
- ★ Attractive three-tone cabinet, black, dark grey and silver grey with gilt control knobs and all gilt fittings.
- ★ Coax. socket for car aerial.
- ★ Brand new guaranteed components.
- ★ Push-pull output.
- ★ Automatic volume control.
- ★ Long-life battery.
- ★ Super-sensitive internal Ferrite rod aerial.

£7.19.6 P. & P. 4/-

Special inclusive price for ONLY £7.19.6 P. & P. 4/-. Attention: special available. Full assembly details and individually priced parts list, all of which are available separately, price 1/6 post free.

ANOTHER NEW BRANCH!

OPENING SHORTLY AT

**20-22 WIThey GROVE
MANCHESTER 4**

The finest selection of Hi Fi equipment and a fully comprehensive range of components etc. for the Do-it-Yourself enthusiast

THE HE30 4-BAND COMMUNICATION RECEIVER



One of the finest general coverage bandspread Receivers available at this price. Covering 550Kc/s—1600Kc/s, 4.8Mc/s—14.5Mc/s, 1.6Mc/s—4.8Mc/s, 10.5Mc/s—20Mc/s. Illuminated slide rule dial, calibrated every 5Kc/s on 80 and 40 metres. Edgewise S-meter, 0.100 logging scale, coverage from 0.65—30Mc/s. 8 valve plus Receiver superhet circuit. RF Stage with an Aerial Trimmer, 2 IF Stages. B.F.O. control Q-multiplier. Controls: Function Switch, Audio Gain, Selectivity (Q-multiplier), Frequency (BFO), Band Selector, IF Gain, Trimmer, AVC-MVC Switch, ANL Switch, Main Tuning, Bandsread Tuning and Head-phone Jack. Selectivity—60dB at 10Kc/s, 0.8Kc/s at 6dB (with Q-Multiplier) IF-455Kc/s. External PM Speaker reqd., 4 or 8 ohms impedance, Output 1.5 watts. 8 modern Miniature BTG Base Valves and 5Y3 Rectifier. Size 15 x 10 x 7 in. Grey crackle finish. 220/240 volt A.C. mains, 50-60 cycle operation. Full instructions and circuit diagram supplied. Send S.A.E. **40 gns.** Carr. & for leaflet. PRICE Pkg. 15/-

SEND STAMP FOR COPY OF OUR INTERESTING LITTLE BOOKLET "What is High Fidelity?"

SEE PRECEDING PAGE FOR OTHER STERN-CLYNE PRODUCTS

THE "TRAVLER" MkII

Introducing our new ready-built transistorised car radio for ONLY **9 1/2 Gns.** P. & P. 5/- including 7 x 4 in. speaker fitted to baffle, fixing brackets, filter unit, all nuts and bolts with fitting instructions **£2.19.6** H.P. Terms: Dep. (Plus 5/- P. & P.)



★ Star Features ★ Handsomely Styled. ★ Mullard Valves and Transistors. ★ Push Buttons. ★ 1 1/2 watts Output. ★ Long and Medium Wavebands. ★ Quality Speaker (E.M.I.). ★ Easily Fitted. ★ Radio Luxembourg (and many other foreign stations) 12 volt Positive Earth Only (applies to 99.8% of the cars on the road). ★ Dimensions 7 x 2 x 7 in. depth. **Optional extras,** 3 section chromium plated weatherproof telescopic aerials type 1 17/44", 19/6; type 2, 2/743", 29/6, both plus P. & P. 2/6 if purchased separately.

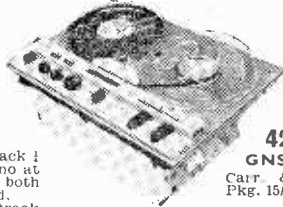
POCKETORDER TRANSDISORISED RECORDER

Why be bothered with a notepad? Take Pocketorder with you on those business trips, the mighty Midget is ideal. Simple to operate, a unique 4-way push-button Switch for record/playback, etc., and remote control switch built into microphone ensures complete ease of handling. Fully adjustable speed through the life of Batteries and the volume and tone from the 2 1/2" internal speaker is outstanding. All accessories included such as Leather Case, Accessory Case, Crystal Earpiece, Tape, Batteries and Microphone, no other extras required. Up to 34 mins. recording time, operates on 1.9 volt PP3 and 2-1/2 volt U12 Pen Batteries. Size 5 1/2 x 4 x 2 in. Weight **12 Gns.** P. & P. 2/6. Spare 2 1/2" empty spools, 1/-; Spare 2 1/2" 200FT. L.P. Tape, 5/-.



STEREO TAPE DECK WITH BUILT-IN PRE-AMPLIFIER

A professional addition to your Hi-Fi Stereo System consisting of two basic Units, the Tape Deck and Pre-amplifier, which employs 4 Transistors and 4 Valves. The Unit with record and playback 1 track stereo or 1 track mono at either 7 1/2 i.p.s. or 4 1/2 i.p.s. both speeds being fully equalised. Features: Track System: 1 track 2 channel stereo or monaural record and playback. Independent single channel recording on either channel while playback on other channel. Head Type: 1 track 2 channel inline stereo and associated erase heads. Low loss laminated pole pieces. Level indicators: 2 Meters, 1 per channel. Digital Counter: 3 digit tape position indicator. Automatic Stop: When tape runs out or breaks. Inputs: Microphone 1mV (50K, ohms impedance) Gram/Tuner 50mV (high impedance). Output: (cathode follower). Monitor Sockets: 2 x 5K, ohms impedance. Audio Output: 500mV. Oscillator: Push-pull 80 Kc/s. S/N Ratio: -45dB or better at 7 1/2" tape speed. Separation: 45dB or more between stereo channels. Frequency Response: 40 to 15,000 cycles per sec. at 7 1/2 i.p.s., 40 to 9,000 cycles per sec. at 4 1/2 i.p.s. Single Motor: 4 pole heavy duty induction type. Power Supply: 240V A.C. 50 cycles. Size 6 1/2 x 10 1/2" Tape Size: Up to 7". Line Up: 4-2SB175 Transistors, 2-12AT7, 1-1AU7, 1-12BH7 Valves.



42 GNS. Carr. & Pkg. 15/-

THE HE-40 4-BAND COMMUNICATION RECEIVER

Completely built and ready to go. High sensitivity Superhet receiver covering 550 Kc/s—1,500 Kc/s, 1.6 Mc/s—4.4 Mc/s, 4.4 Mc/s—11 Mc/s, 11 Mc/s—30 Mc/s. Electrical Bandsread tuning. Slide rule type tuning dial. Internal ferrite rod aerial for medium waveband reception and a 59n. 10 section chromium plated telescopic whip aerial for the short wave bands. Sockets for optional outdoor aerial. Internal high flux monitor loudspeaker. Latest modern miniature BTG base valves. Head-phone socket may also be used for external loudspeaker. ANL, B.F.O. built-in "S" meter. 220/240 volt A.C. mains, 50-60 cycle operation. Handsomely styled cabinet with grey crackle finish and handles from 5" panel with chrome and satin chrome fittings. Measurements 13 in. x 8 1/2 in. x 5 1/2 in. (high) and weighs only 1 1/2 lbs. A comprehensive instruction manual is supplied. An ideal receiver for the radio amateur and short wave listeners of all ages. Send S.A.E. for leaflet.



PRICE **£24.15.0** Carr. & Pkg. 12/6

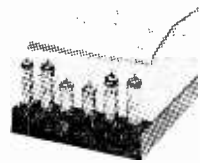
INTRODUCTION OFFER !! Available Shortly



FOR ONLY 48 gns

Pkgs. 15/- Pkgs. & Carr.

THE TUDOR STEREO HI-FI SYSTEM, comprising a Self Powered AM/FM Tuner, Stereo Pre-amplifier, 12 watt per channel Stereo Power Amplifier. The Tuner and Pre-amplifier are housed in matching black crackle finish metal cabinets for shelf mounting, with silver metal dials and matching knobs. Specifications: **Tuner**—Outstanding quality providing full VHF/FM long and medium waveband coverage. Frequency range FM 87.5-108.5 Mc/s, AM/MW 522-1630 Kc/s, LW 145-270 Kc/s 100mV output mains supply 105/240 A.C. Valve line-up: ECC85, ECH81, EBF89, EB91, EM64, ECC83. Multiplex outlet provided. **Pre-amplifier**—Designed for use with the Tudor Stereo Power Amplifier with inputs for most types of Pickups, direct play from Tape Heads and ample sensitivity for either Crystal or Moving Coil Microphone. Distortion 0.1%, tape outputs 100mV from 40K ohm



source, inputs—Microphone 5 mV, Tape 5.5 mV, R.I.A.A. 4.5mV hat 250 mV, Tuner 100mV. Valve line-up: 2—EF86, 1—ECC85. **Power Amplifier**—14 watts per Channel, sensitivity 1 volt r.m.s. for 14 watts output, frequency response $\pm 0.5dB$ 20 c/s.—20 Kc/s. Speaker Impedance 4, 8 or 16 ohms, surplus power available for Tape Pre-amp, mains supply 105/240 v. A.C. Valve line-up, 2—ECC83, 4—EL84, 1—GZ31.

DOUBLE FEATURE POWER AMPLIFIER AND JL10 POWER AMPLIFIER

A new conception in the field of audio engineering by Stern-Glyne development engineers. The most up-to-date circuitry is used in the Double Feature Pre-amplifier, it has matched inputs for microphone, crystal or magnetic pick-ups and radio tuner and in addition offers full facilities for tape recording and high fidelity replay. This unique feature means that should you wish to include tape in your hi-fi system at a later date all that is required is a suitable tape deck. Offers superb reproduction from all sources at low cost. Available shortly.

Brief Specifications:

★ **J.L.10 POWER AMPLIFIER**

Incorporates the latest triode-pentode ECL86 valves in push-pull, PARTRIDGE ultra linear output transformer, PARTRIDGE mains transformer and smoothing choke, 10 watts power output, surplus power available for tuner. Output impedance 3—7.5—15 ohms.

KIT OF PARTS **11 Gns.** C. & L. 7/6.
READY BUILT **14 Gns.**

DOUBLE FEATURE PRE-AMPLIFIER

Inputs for microphone, crystal or magnetic pick-ups, tuner unit, Push-button switching for 3 tape speeds equalised. Tape erase Bias Oscillator circuit incorporating ferro-cube transformer. Function switch, separate base, treble and volume controls, level control and latest EMBI magic eye level indicator. The pre-amplifier is totally enclosed in a silver hammer finish steel case, and an attractive perspex front panel completes the presentation.

KIT OF PARTS **£17.00** READY BUILT **£21.00** C. & L. 5/-

PRICES: If both above units purchased together:

KIT OF PARTS **£27.10.0** READY BUILT **32 Gns.** C. & L. 10/-.

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MODEL CR3/S TAPE RECORDER



MODEL CR3/S incorporates the HF/TR3 Mk. II Tape Amplifier (described below) and the Collaro "Studio" Twin Track 3-speed Deck operating at 1 1/2 in., 3 in., and 7 1/2 in. speeds. Complete with microphone and 1,200ft. tape.

KIT OF PARTS **£33.8.0**
ASSEMBLED AND TESTED **£43.0.0**
(Carr. & Ins. 15/- extra.)

STEREO TAPE PRE-AMPLIFIER

MODEL STP-1. For use with current TRUVOX, BRENELL or COLLARO "STUDIO" 1 and 1 track Stereo Decks. Incorporates Ferroxcube Oscillator, 4-speed Equalisation Signal Level Meter and separate Gain Control. Includes separate Power Unit. KIT OF PARTS (Carr. & Ins. 8/6.) **ASSEMBLED £28.0.0**

Instruction book and detailed price list (free with kit) available separately at 5/- Post Free.

TAPE PRE-AMPLIFIER MULLARD Type "C"

Suitable for most 1 track, Mono Tape Decks. Incorporates Ferroxcube Push-Pull Oscillator, Treble Inductor and 3-sp. Equalisation. Includes separate Power Unit.

KIT OF PARTS **£14.0.0** (Carr. & Ins. 7/6.) **ASSEMBLED £19.10.0**
Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

MULLARD TAPE AMPLIFIER MODEL HF/TR3/MK.II

Based on Mullard's Type "A" design and suitable for most 1 track Mono Tape Decks. Incorporates Ferroxcube Treble Inductor, Gilson Output Transformer, and 3-speed Equalisation. Includes separate Power Unit, using PARTRIDGE Mains Transformer.

KIT OF PARTS **£13.13.0** (Carr. & Ins. 7/6.) **ASSEMBLED £19.0.0**
Instruction book and detailed price list (free with kit) available separately at 3/- Post Free.

COMBINATION TAPE UNITS

All our Tape Units can be supplied specially matched to any Tape Deck such as Collaro, Brenell Mk.5 Series II, also the Wearite. Specimen prices as below.

	Kit	Assembled
STP-1 Pre-amp with Collaro Studio Tape Deck.....	£36. 0.0	£42. 0.0
Assembled with track switch fitted, £44.2.0.		
STP-1 with Brenell Mk.5 Series II with Track Switch fitted.....	£64. 0.0	
STP-1 with Brenell Mk.5 Series II, 1 Track Deck.....	£74.15.0	
Type "C" Pre-amp with Collaro Studio Tape Deck.....	£24.10.0	£30. 0.0
Assembled with deck wired and matched, £32.2.0.		
Type "C" Pre-amp with Brenell Mk.5 Series II Deck.....	£46.11.0	£53. 1.0
Assembled with deck wired and matched, £55.3.0.		
HFTR3 with Collaro Studio Tape Deck.....	£24. 3.0	£29.10.0
Assembled with deck wired and matched, £31.12.0.		
HFTR3 with Brenell Mk.5 Series II Deck.....	£46. 4.0	£51.11.0
Assembled with deck wired and matched, £55.13.0.		

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● AMPLIFIER KITS

We have full stocks of all components for the Mullard 510, Mullard 3-3, Mullard 2 and 3 Valve Pre-amp, Mullard Stereo, Mullard Mixer. GEC912 Plus. Fully detailed list on any of these sent upon request. Instruction Manuals; All Mullard Audio Circuits in "Circuits for Audio Amplifiers". 9/5. GEC912, 4/6. All post free.

● MARTIN AUDIO KITS

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Model 227 Mono	£33.18.0	£6.18.0	12 of £2. 9.6
Model 226 De Luxe Stereo	£52. 0.0	£11. 0.0	12 of £4. 2. 6
Stereo 55 Stereo	£29.18.0	£5.18.0	12 of £2. 4. 0

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	Cash Price	Deposit	Hire Purchase Mthly/Pmts.
Model AF208 AM/FM	£21. 4. 0	£4. 4. 0	12 of £1.11.2
Model T48 FM	£20. 8. 0	£4. 2. 0	12 of £1. 9.11
Model ST3 Mk 2 AM/FM	£25.12.0	£5. 2. 0	12 of £1.17.11

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● TAPE RECORDING EQUIPMENT

	Cash Price	Deposit	Hire Purchase Mthly/Pmts.
ALL CARRIAGE FREE			
COLLARO STUDIO, latest model. Two track. Bradmatic Heads	£10.19.6	£2. 3.6	12 of 16/4
Four Track, Marriott Heads	£17.17.0	£3.12.0	12 of 26/2

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MULLARD TAPE PRE-AMPLIFIER KIT We stock complete kits and all separate components for the Mullard Tape Pre-Amplifier. Fully detailed list available.

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- FMT3 (with power), £11.7.6; Mercury 2, £10.14.6.

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● P.W. STRAND, MAYFAIR & SAVOY UNITS

We stock parts for the P.W. Strand Amplifier, Mayfair Pre-Amplifier and Savoy FM Tuner. Detailed price lists are available.

● LATEST TEST METERS

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AVO Model 11 Mark II	£21. 0.0	£4. 4.0	12 of £1.10.10
AVO Multimeter Mark 4	£29.10.0	£15.0.0	12 of £1.14.4
T.M.K. TP10	£3.19.6	£1. 3.6	3 of £1.2.0
T.M.K. TP28	£5.19.6	£1.15.6	3 of £1.11.4
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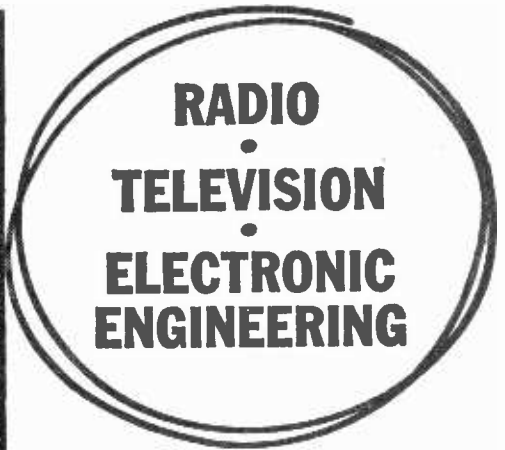
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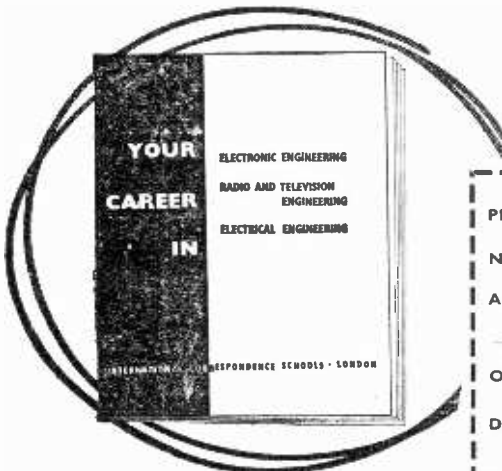
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16/450V	3/3 1,000/12V	5/8 50/450V
22/450V	3/3 5,000/6V	5/8 82-32/350V
26/25V	1/3 8+8/450V	3/8 32+32+32/350V
26/50V	2/3 8+16/450V	3/8 50+50/350V
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ENAMEL COPPER WIRE. 16 to 22 awg., 24-30, 3/6; 32-40, 4/6; D.C.C. 28, 34, 38 amp. 2oz. 3/6.

I.F. TRANSFORMERS 7/6 pair

465 K/s Sing Tuning Miniature Can, 2 x 1 1/2 in. High Q and good bandwidth. Data sheets. Standard size Weyrad, 10/6 pair.

PULL WAVE BRIDGE SELENIUM RECTIFIER: 2, 6 or 12 v. 1 1/2 amp. 8/9; 2 a., 11/3; 4 a., 17/6.

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4 AMP CAR BATTERY CHARGER with ammeter Leads, Fuse Case, etc., for 6 v. of 12 v., 60/9.

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TV Radio Handbook. ... 5/-

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Size 3 x 1 1/2 x 1.

A ready built miniature push-pull amplifier with Driver and output transformers, 4 transistors. Ideal for use with record players, intercoms, BABY ALARMS, etc. Complete with full I/O instruction and circuit.

Price 47/6 ov. Batt. 2.3. 2 1/2in. Speaker 15/-.

1964 RADIOGRAM CHASSIS



THREE WAVEBANDS FIVE VALVES

S.W. 16 m.—50 m. LATEST MULLARD M.W. 200 m.—550 m. ECH81, EF89, EB081, L.W. 800 m.—2,000 m. RL84, EZ80

12-month Guarantee.

A.C. 200/250 v. 4-way Switch; Short-Medium, Long/Form. Ferrite Aerial A.V.C. and Negative feedback. 3 ohm output, 5 watts. Glass dial, horizontal winding, size 13in. x 4in. Aligned and calibrated. Isolated Chassis, size 13 1/2in. x 9in. high x 5 1/2in. deep.

£9.15.6 Carr. & Ins. 4/6.

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12in. Baker 15w. Stalwart 3 or 15 ohms, 44-15,000 c.p.s. ... 90/-

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15in. Auditorium, 35w., Bass, 20 c.p.s. to 12 kc/s Ideal Bass Guitar, 218.

Portable enclosures for 12in. "Stalwart", 88 each.

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STENTORIAN HF1012. 10in. 3 to 15 ohms, 10w. 87/6; 12in. HF102, 72/-; Tweeter T359, 80/-; Cross-over CX3000, 30/-.

EXTENSION SPEAKER CABINETS. 5in., 15/6; 6 1/2in., 18/6; 8in., 19/6; 10in., 29/6.

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500 pF slow motion tuning, standard or midjet, 9/-.

Transformer gang 208 + 178 pF with trimmers, 10/6.

SMALL 3 gang 500 pF 17/-.

SINGLE 10 365 pF, 7/6.

SINGLE 10 365 pF, 50 pF, 7/6 or 100 pF, 150 pF, 5/6.

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CONDENSERS. New stock. 0.001 mfd. 7 kV, 9 v. T.C.C. 5/6; Ditto, 20 kv, 9/6; 0.1 mfd., 7 kv, 9 v. Tubular 500 v. 0.001 to 0.05 mfd., 9d., 0.1, 1/-; 0.25, 1/6; 0.5/350 v., 1/8; 0.1/850 v., 9d.; 0.1/2,000 v. 0.1/1,000 v., 1/8; 0.1 mfd. 2,000 volta, 3/6.

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

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Close tolerance (+1 pF) 2.2 pF to 47 pF, 1/-.

Ditto 1% to 50 pF to 815 pF, 1/-; 1,000 pF to 5,000 pF, 1/8.

465 kc/s SIGNAL GENERATOR

Price 10/6. Uses B.F.O. Unit, ZA 30038 ready made with valve 18S. POCKET SIZE 2 1/2 x 4 1/2 in. One resistor to change, full instructions supplied. Battery 8/6 extra. 69V 11V. Details Free.

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8 p. 4-way 2 water long spindle ... 6/6

2 p. 2-way or 2 p. 6-way long spindle ... 3/6

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Wavechange "MAKITS". Wafers available: 1 p. 12 way, 2 p. 6 way, 3 p. 4 way, 4 p. 3 way, 8 p. 2 way, 1 w. water switch, 8/6.

2 wafer switch, 12/6; 3 wafer switch, 18/-; additional wafers up to 12, 3/6 each extra; Torgie Switches, s.d., 2/-; d.p., 3/6.

D.B.D.t., 4/-. Min. Side d.p.d.t., 3/6.

CRYSTAL MIKE INSERTS, 6/6

High output. Size 1 1/2in. dia. x 1in.

ACOS MIC. 14, insert 1 1/2in. dia. x 1in. 8/6

ACOS 39-1 DE LUXE STICK MIKE 35/-

TSL QUALITY STICK MIKE ... 25/-

TELEPHONE TAPE MIKE ... 10/8

GUITAR CONTACT MIKE ... 15/6

Valveholders. EA50, 6d. B12A, CRT, 1/3. Ensl., and Amer. 4, 5 and 7 pin. 1/-.

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BTG, B8A cans, 1/- each. Valve plugs BTG, B8A, 2/3.

HIGH GAIN TV PRE-AMPLIFIERS

B.C.C. Bands 1 to 5. Gain 18dB. EC084 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (EC084 valves if preferred). Collie only 9/6.

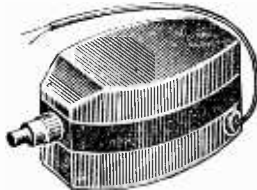
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Tunable channels 8 to 13. Gain 17dB. Circuit and cotis only, 9/6.

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

THE "INSTANT" BULK TAPE ERASER AND RECORDING HEAD DEMAGNETIZER



200/250 v. A.C. **35/-** Leaflet S.A.E.

PLASTIC RECORDING TAPE

Double Play	7in. reel, 2,400ft. 42/-	Spare Plastic Reels
	5in. reel, 1,200ft. 25/-	
Long Play	7in. reel, 1,800ft. 22/6	3in. 1/8
	5in. reel, 1,200ft. 17/6	4in. 2/-
	5in. reel, 900ft. 15/6	5in. 2/-
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	5in. reel, 600ft. 11/6	7in. 2/6

"EASISPLICE" Tape Splicer 5/-.

CRYSTAL SET BOOKLET, 1/-.
CRYSTAL DIODE (E.E.C. 2/-). GEX34, 4/-, OA81, 3/-.
HIGH RESISTANCE PHONES, 4,000 ohms, 15/-.
MOVING COIL PHONES, 100 ohms, 10/-.
SWITCH CLEANER. Fluid squirt spout, 4/6 tin.

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

First class components to make a 6 transistor 2 waveband superhet chassis. Ideal for portable or table radio. All parts including BVA transistors, ferrite aerial, with ear aerial coil, printed circuit, 8in. x 2 1/2in., but EXCLUDING Speaker and cabinet.
 Speakers, 35 ohms, 7 x 4in. 21/- **£4.50**
 5in., 17/6, 3in., 15/6.

BULGIN PLUGS AND SOCKETS. Non-reversible P74, 2-pin, 4/3; P73, 3-pin, 4/6; P194, 6-pin, 6/6. "DOMINA" plugs, 2/6; sockets, 2/6.

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JACK PLUGS. English, 3/-; Screwed, 4/-; Grounding, 3-pin, 3/6; Phono Plugs, 1/-; Sockets, 6d.

ALADDIN FORMERS and cores, 3in., 8d.; 7in., 10d. 0.3in. FORMERS 5937 of 8 cans TV1 of 2, 2in. sq. x 2 1/2in., or 3in. sq. x 2 1/2in., 2/- with cores.

FLOW MOTION DEVICES. etc., 4/3.

SOLOIN IRON. 25W, 200V or 230V, 24/-.

ANTEX SUB-MIN. IRON. 15w, 200 or 240v., 20/6.

BENCH STAND for above, 12/6. Spares in Stock.

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Ferrite Aerials, M., 8/9; M. and L., 12/6.

Osmor Ferrite Rod Aerials, L. and M. for transistor circuits, 10/- each.

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H.F. Chokes, 2/6; Osmor CCL, 6/6.

T.R.F. Coils, A/HF, 7/- pair; HAX, 3/6.

Repanco DRR2, 4/6. DRX1, 3/-.

Screwdriver, 5in., 6d., Test Prods, 2/9.

Neoside Trimming Tool, 1/9.

Neon Mains Test, 80v. screw driver, 5/-.

Multicore Solder, 4d. yd. Dispenser, 2/6.

Aluminium Chassis, 18 s.w.g. Plain, undrilled, 4 sides, riveted corners, lattice fixing holes, 2 1/2in. sides, 7 x 4in., 4/6; 9 x 7in., 5/9; 12 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/-.

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B.S.R. 2 TRACK	TD 2 DECK
£8.8.0	£6.15.0
COLLARO TRACK	STUDIO 14 K
£8.8.0	£10.10.0

COMPLETE RECORDING & PLAY-BACK AMPLIFIERS

2 TRACK B.S.R.	COLLARO
£8.8.0	£11.11.0

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 TRANSFORMERS, 50-1, 3/9.

P.V.C. Covered Wire, single or stranded, 2d. yd. Sleeving, 1 or 2 min., 2d.; 4 mm., 3d.; 6 mm., 5d. yd.

SPEAKER-FRET, Gold, Maroon or Green Cloth, 17 x 25in., 5/-; 25 x 35in., 10/-.

Tygan, various colours 32in. wide from 10/-; 26in. wide from 5/-; it. Samples 1/-.

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All leading makes, volume controls, etc., line output transformers, etc., B. V. A. valves (current and obsolete types). Send S.A.E. for quotation.

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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, with ear aerial coupling coil, 12/6

Osc. Coil P501/AC, 176 pF tuning, 5/4

1st and 2nd I.F. Trans.—P502/CC, 470k/25 11/16in. dia. by 4in. 5/7 each

3rd I.F. Trans.—P503/CC, 6/-

Spare Cores 6/- each

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Wavechange Slide Switch d.p.d.t. 2/6

Printed Circuit—PCAL, Size 2 1/2 x 8 1/2in. Ready drilled and printed 9/6

Volume Control, 5K-DP 4/6

35 ohm Speakers, 3in., 15/6; 5in., 17/6; 7 x 4in., 21/6

Tuning Gang with trimmers 10/6

6 Mullard Transistors and diode 42/6

Constructor's Booklet 2/-

3 ohm O.P. Trans. O.P.T.1 10/6

NEW MULLARD TRANSISTORS

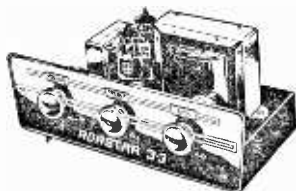
OC71 8/-, OC72 7/6, OC81D 7/6, OC81 7/6, OC4 8/9, OC45 8/6, OC110 6/6, AF117 6/6.

Sub Miniature Condensers, 0.1 mfd., 30v., 1/3, 1.2, 4, 5, 8, 16, 25, 30, 50, 100 mfd., 15 volt 2/6 each. Transistor Holders 1/3.

SINCLAIR "SILIMINE"

Med. wave, 2 transistors, 2 diodes, min. earphone, ferrite aerial. Micro receiver 3 x 1 1/4 x 1 1/2in. 49/6, batt. 3/6.

ADASTRA 3-3 AMPLIFIER 3 WATTS HIGH FIDELITY AT LOW COST



READY BUILT WIRED AND TESTED A.C. only, 300-350 V. 5Vces EC128 and EC25, 3 ohms quality output. Mullard tone controls. Controls: bass boost, treble and volume. Separate engraved front panel with de luxe finish. Quality mains transformer. Stove enamelled chassis—size 6in. x 5in. x 2in. Bargain Price £4.19.6

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"Performs agreeably well" (The Gramophone)

BUILD YOUR OWN RECORD PLAYER

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4 Speed Autochange or Single Player units supplied with brand new 2-tone Portable Cabinets 17x15x5 1/2in. de luxe Strong carrying handle, gilt finish clips and hinges. As used by Famous Make for 20Gns. models. Ready cut-out motor board 14x13in. Front baffle with 7 x 4in. high flux loudspeaker and 3 watt 2 valve UY85, UCL82 2-stage amplifier ready built on metal chassis 12 x 3 x 2 1/2in. Quality 3 ohm output transformer, low hum level circuit. Volume and Tone controls. 3-core safety mains lead. All items fit together perfectly. Special instructions enable assembly in 30 minutes, only 5 wires to join! 12-month written guarantee. Available separately or package deals as below.

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 B.S.R. Monarch ... £11.10.0 P.P. 5/6
 Garrard Autolism ... £12.18.0 P.P. 5/6

SINGLE PLAYER KITS COMPLETE (as above)
 E.M.I. Junior ... £9.19.6 P.P. 5/6
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OR SEPARATELY
 Cabinet with board 14 x 13in. cut out to your choice **£3.8.6** P.P. 3/6
 Amplifier with 7 x 4in. speaker **£3.17.6** P.P. 2/6

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 Garrard AT6 ... £11.0.0 P.P. 5/-

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Replacement sapphire stylus available from 6/3. Replacement Xtals from 15/-; Stereo from 31/6.

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£5.15.0 Post 5/-.

With 2-stage Amplifier; 3-watt; 2 valves, UCL82, UY85; High-flux 5in. speaker; 4-speed E.M.I. Turntable, 16, 33, 45, 78 r.p.m.; Crystal Pick-up for LP/SD. Records, 7in., 10in., 12in.; Cut out Mounting board 12 1/2 x 9 1/2 in.

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 D3035, 7.3 CT-1 Push-Pull to 3 ohms for OC72, 11/-
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DEAF AID EARPIECE, Xtal or magnetic, 7/6

SUB-MIN. JACK AND PLUG 3/6 pair

MINIATURE PANEL METERS

Size 1in. sq. Precision jewelled bearings, 2% accuracy, silvered dials, black numerals and fine pointers. Zero adjustment screw on front of meter.

0-1 mA	27/6	0-50 mA	39/6
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0-300 V	27/6	"S" Meter	35/-

CARY MULTIMETER M.1
 0-1200 v. A.C./D.C., ohms 0-100k, etc. 54/-

COMPONENT SHOP 337 WHITEHORSE ROAD WEST CROYDON

P.P. charge 1/-. C.O.D. 2/- extra. Telephone: THO 1665 (Export welcome. Send remittance, and extra postage, no C.O.D.)

**RADIO-AMATEUR GEAR
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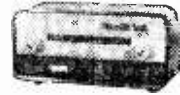
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*With the clearly-written instruction manuals,
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Have the world's best equipment—and save money*



AMATEUR BANDS RECEIVER. Model RA-1. Covers all Amateur Bands from 160 to 10m. Special features incl. half lattice crystal filter, 8 valves, signal strength "S" meter, tuned R.F. amplifier stage ... Kit £39.6.6
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5W HI-FI MONO AMPLIFIER. Model MA-5. A low-priced amplifier based on the S-33. Printed circuit construction makes it easy to build. Kit £10.19.6. Assembled £15.10.0

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"MOHICAN" GENERAL COVERAGE RECEIVER. Model GC-1U. Fully Transistorised. Excellent portable or general purpose receiver for amateur or short wave listening. See full spec. leaflet. Kit £39.17.6
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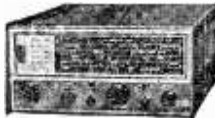


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PA AMPLIFIER. Model PA1. 50 W. (rms.) 100 W. pk. output. For vocal and instrument groups, guitars, etc. 4 inputs, 2 loudspeakers. Send for full details. Kit £54.15.0
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COMMUNICATIONS TYPE RECEIVER Mod. RG-1. An excellent low cost receiver. Freq. cov.: 600 kc/s-1.5 Mc/s. 1.7 Mc/s-32 Mc/s. Send for details. Kit £39.16.0.
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5in. OSCILLOSCOPE. Model O-12U. Wide band amplifiers essential for TV servicing, F.M. alignment, etc. T/B covers 10 c/s-500 kc/s in 5 ranges. Kit £35.10.0. Assembled £43.10.0

VALVE VOLTMETER. Model V7A. Measures up to 1,500 volts (D.C. and R.M.S.) and 4,000 pk. to pk. Res. 0.1 Ω - 1,000MΩ Kit £13.18.6 Assembled £19.18.6

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MULTIMETER. Model MM-1U. Ranges: 0-1.5 v. to 1,500 v. A.C. and D.C. 150ΩG—15A D.C. 0.2Ω to 20ΩM 4 1/2in. 50μA meter. Kit £12.18.0 Assembled £18.11.6

R.F. SIGNAL GENERATOR. Model RF-1U. Up to 100 Mc/s fundamental, 200 Mc/s on harmonics. Up to 100 mV output all bands. Kit £13.8.0. Assembled £19.18.0



DX-40U

40 w. to aerial. Prov. for VFO Kit £33.19.0 Assembled £45.8.0

250

AMERICAN HEATHKIT MODELS
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AMATEUR TRANSMITTER. Model DX-40U. Self-contained. 80-10 m. Power input 75 w. CW., 60 w. peak C.C. phone. Output ... Kit £33.19.0 Assembled £45.8.0

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DX-100U

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A member of the Daystrom Group, manufacturers of the
WORLD'S LARGEST-SELLING ELECTRONIC KITS

Send me **FREE BRITISH CATALOGUE** (Yes/No)

Full details of model(s) _____

NAME _____

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PW2.

Practical Wireless

Vol. XXXIX No. 684 FEBRUARY, 1964

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Offices:

PRACTICAL WIRELESS

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

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In Search of a Leader!

ONCE every month, it behoves your editor to write the several hundred words which comprise the leader column. It is, of course, an old cynical precept that nobody bothers to read leader articles (except in *The Times*!) and that if sufficiently emboldened an editor could fill his column with all manner of libellous, scurrilous and defamatory matter and no one would be the wiser.

Anyone who has sat at an editor's desk will be able to refute this most emphatically! This hoary old gag is only a gag and was most likely first thought up by a frustrated assistant editor!

Thus, in framing the month's leading article, an editor is aware that a large percentage of his readers is going to read the results of his literary efforts, be they modest, be they profound. However, there is more truth in the assertion that the leader is the toughest part to write and there can be very few editors who at some time in their career have not sat temporarily baffled, awaiting an idea to burgeon.

For, especially in a magazine such as PRACTICAL WIRELESS, the subject matter must relate to something with which the average reader can associate himself. That is why, though often tempted, we seldom stray into the realms of trade and broadcasting politics, ethics and practices; these subjects receive sufficient airing via more appropriate mouthpieces.

The aim is to deal with topics of direct interest to readers. To comment. To provide talking points. To stimulate activities. To offer guidance. It is an opportunity for your editor to forge a personal link with readers once a month.

Before becoming a professional journalist, your editor would willingly have volunteered to write a supply of leaders for the contemporary radio magazines on what were (at the time) burning issues or pet theories. And now, hundreds of leaders later, it might be interesting and enlightening to reverse the procedure. In short, we invite you to write a leader!

Here is a glorious opportunity to air your comments on a chosen subject, to address fellow readers. The rules are simple: just write approximately 250-300 words (about half the length of this article) on a suitable theme—anything providing it deals with the hobby of radio construction—and give it a title. Send it to PRACTICAL WIRELESS, marked "Leader Competition". Entries need not be typed, though this is preferable.

Two guineas will be awarded to the entry considered the best by a panel of judges from the staff of PRACTICAL WIRELESS, and one guinea for the runner-up. The judges' decision will be final and we regret that it will not be possible to acknowledge individual entries.

The winning leaders will be published within the pages of the April issue. The closing date is *January 31st*.

Let's have a good response to this invitation. At least it will prove that you *do* read the leader page!

Our next issue dated March will be published on February 7th



NEWS AT HOME AND ABROAD

Retailers Association Adopts New Symbol

AS a result of a large number of requests from domestic and electrical retailers, the Radio and Television Retailers Association recently formed a separate association for the benefit of these retailers. Known as the Electrical Appliance Association, this new body has recently adopted a symbol which will be displayed in shops so that the consumers may benefit by identifying firms belonging to the E.A.A.

The new symbol has been designed along the same lines of the already well known R.T.R.A. trade mark.

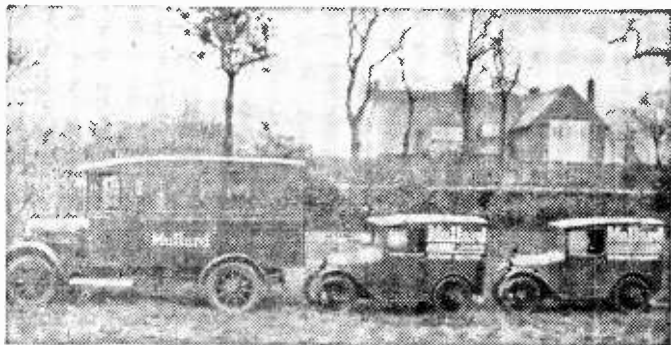


IN ASSOCIATION WITH THE RADIO & TELEVISION RETAILERS' ASSOCIATION
The symbol of the Electrical Appliance Association

25 Years of Valve Manufacturing

DESPITE the transistor, the Blackburn plant of Mullards Limited—25 years old in November last year—still manages to produce approximately 50 million valves a year. This recent anniversary was also marked by the 80th birthday of Mr. S. R. Mullard who founded the first Mullard Radio Valve Company in 1920. During the two decades which followed, the demand for radio valves increased enormously so that new premises were always being sought and larger factories being built to supply this demand, with the eventual establishing of the plant at Blackburn in 1938.

By 1944 the output from this plant, which had a labour force of 200, was 6.5 million valves a year. This had risen to 33 million by 1955 and to 50 million by 1958, when 5,000 were employed in this one factory. Now the Blackburn plant is only one of 18 Mullard factories throughout England, producing a variety of sophisticated components for the electronics industry, bearing only a technical similarity to the early transmitting and receiving valves, with which S. R. Mullard began his manufacturing company 43 years ago.



Even in 1924 the growing importance of valves was indicated by the number of Mullard vans such as these, which were then familiar sights on the roads.

RADIO EQUIPMENT FOR TSR-2

THE R.A.F.'s new tactical-strike-reconnaissance and strategic nuclear bomber, the TSR-2, will be fitted with instrument landing system and h.f. communication equipments manufactured by the Marconi Company Limited.

The H.S. is that of the Marconi Sixty Series equipment. The communication equipment will provide both single and double side-band transmission and reception at high power.

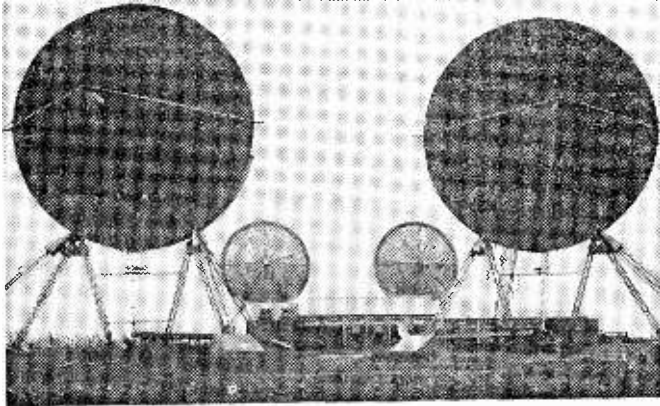
NATO COMMUNICATIONS NETWORK COMPLETE

THE Supreme Headquarters Allied Powers Europe has recently accepted, on behalf of the North Atlantic Treaty Organisation, the final station in NATO's ACE HIGH communi-

cations network. This vast system of radio stations stretches from Norway to Turkey; an 8,300 mile link, incorporating 82 stations, located in nine of the NATO countries.

The design, manufacture and installation of the complete project has been the task of International Telephone and Telegraph Corporation and its affiliated companies, and included in each of the stations is multiplex equipment made by Standard Telephones and Cables Limited.

The purpose of the ACE HIGH system is to provide a reliable method of communication between the nations of the European-wide command area of NATO, and to accomplish this, both tropospheric forward scatter (over-the-horizon) and line-of-sight types of transmissions are used throughout the network. The stations have all been built on high ground, each with two pairs of 65ft. circular dish-aerials positioned to pick up and re-transmit any of the 250 telephone and 180 telegraph circuits which can be accommodated by the system.



One of the 82 stations of NATO's ACE HIGH network.

NEW TITLE FOR I.E.E. JOURNAL

THE official organ of the I.E.E., in which papers originally presented to meetings of the Institution are published, has for years been known as the Journal of the Institution of Electrical Engineers. Now the Council of the Institution has changed the name to "Electronics and Power", with the previous title remaining as a sub-title.

The Council decided on this change as a means of emphasising the scope of the Institution and to dispel the idea that the I.E.E. is mainly concerned with power engineering when, in fact, for several years electronic subjects have been more in evidence in papers and at meetings than power engineering.

Aircraft Equipment Tours West Germany

A DEMONSTRATION aircraft belonging to the Marconi Company Limited, recently completed a sales tour of West Germany. Aboard the aircraft was a variety of equipment, manufactured by the company, which was shown to aircraft operators and constructors throughout the Federal Republic during the ten days of the tour.

Included in the demonstration equipment was standard airline Doppler Navigator and the new helicopter Doppler systems.

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R.T. for Desert Patrols

IN its fight against the menace of locusts, the Desert Locust Control Organisation of East Africa keeps a constant surveillance on the breeding grounds and movements of this pest. Much of this work involves patrols over barren and underdeveloped areas, extending sometimes hundreds of miles from centres of communication. To provide their patrols and static stations with a reliable means of communication, the D.L.C.O. recently selected and ordered Marconi h.f., s.s.b. transmitter/receiver equipment.

This equipment can provide adequate daytime communications over many hundreds of miles, using only a simple dipole aerial and a transmitter power of only 100W.

STC ACQUIRES HUDSON ELECTRONICS

THE firm of Hudson Electronic Devices Limited, manufacturers of mobile radio communication equipment, was formed and built up by Mr. A. D. Hudson, at one time an apprentice of Standard Telephones and Cables Limited. Now STC Limited has acquired the issued capital of Hudson Electronic Devices, so that it becomes part of STC's radio division.

Mr. Hudson will remain as a director, however, as plans for the firm's expansion go on under new management.

Electronics Symposium in Birmingham

A ONE day symposium on "Electronics in the Automobile Industry", has been arranged by the Electronics Section of the South Midland Centre of the I.E.E. and the West Midland Section of the British I.R.E. The symposium is to be held during April, this year, and will take place in the Electrical Engineering Department of the University of Birmingham.

Circuit Description

The circuit (see Fig. 1) is designed around the new Denco transistor coils—based on their well-tried range of Miniature Dual Purpose Coils. Ranges 3, 4 and 5 are used, covering respectively 1.67 to 5.3Mc/s, 5 to 15Mc/s, and 10.5 to 31-Mc/s. The coil connections are switched by a 3-way 9-pole Yaxley switch (S1), using three wafers with interposed screens.

The r.f. stage uses an OC170 transistor (Tr1) with blue coils in the aerial stage and yellow coils as coupling to the second stage. An r.f. gain control VR1 varies the base voltage of Tr1. An external

fore, tuned to this frequency, corresponding to 187.5m on the medium wave band. In practice, since the medium wave band of many receivers only goes down to just below 200m, the lowest clear wavelength on the band is selected (this may fall anywhere between 190 and 200m) and the output of the converter adjusted to it.

The three-gang tuning capacitor (VC1, 3, 5) is fitted with a calibrated dial incorporating a slow motion tuning device. The bandspread capacitor (VC4, 6) is coupled to the mixer and oscillator sections only; this two-gang capacitor is also fitted with a calibrated dial. The aerial section is trimmed separately by VC2, this being necessary to accommodate different types and lengths of aerial.

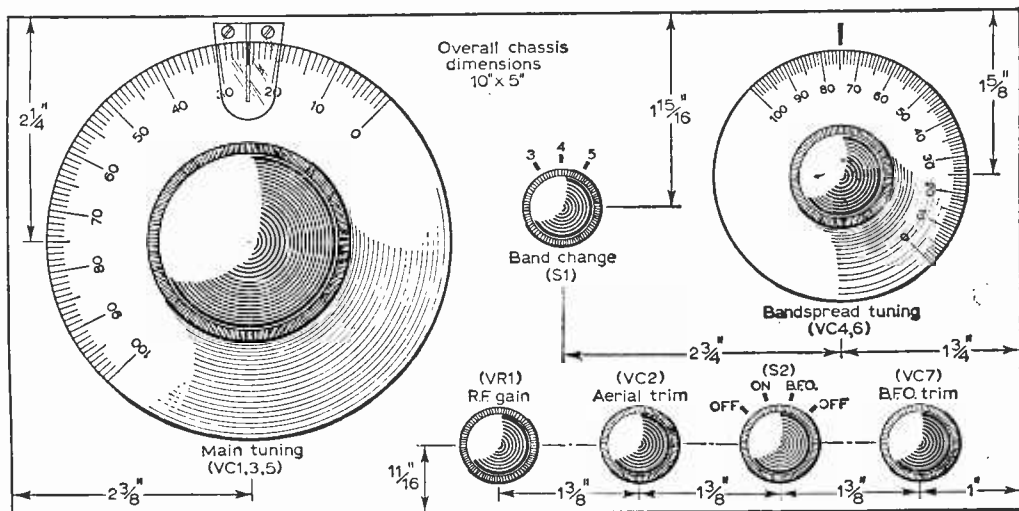


Fig. 2: Drilling details and control layout of the front panel.

aerial can be fed to the primary of the aerial coils, or a built-in telescopic aerial can be used, this being connected permanently to the aerial tuned circuit via a small capacitor.

The second stage is the mixer oscillator and the transistor (Tr2) is also an OC170. The white coils are used here and an output of nominally 1.6Mc/s is obtained at T1. The broadcast receiver is, there-

TABLE I
Frequency and Wavelength Coverage

Range	DIAL SETTING	
	100	0
3	1.67Mc/s 180m	5.3Mc/s 57m
4	5.0Mc/s 60m	15Mc/s 20m
5	10.5Mc/s 28m	31.5Mc/s 9.5m

Beat Frequency Oscillator

The b.f.o. unit uses an OC45 transistor (Tr3), with the appropriate b.f.o. transformer (T2). The swing of the trimming capacitor (VC7) is adequate to permit reception of all s.s.b. transmissions. The b.f.o. may be coupled by means of a 1pF capacitor from pin 2 of T2 to pin 2 of T1, but this should not be necessary, since the b.f.o. coil and the i.f. transformer are physically adjacent.

The b.f.o. is switched on and off by S2, which also serves as the on/off switch for the unit as a whole. A large capacitor, C8, is fitted to smooth out any fluctuations in the power supply, this latter item consisting of four pen-torch batteries in series, giving a 6V supply.

Mechanical Construction

The front panel, of 1/16 in. aluminium, size 10 in. x 5 in. is drilled as per Fig. 2, countersinking most of the 6B.A. holes as indicated.

The chassis, of 1/4 in. bakelite or perspex, size 9 in. x 4 1/2 in., is drilled as per Fig. 3.

The exact dimensions for the two transformers (T1 and T2) are not given, only the centres being indicated. This is because the drilling figures are

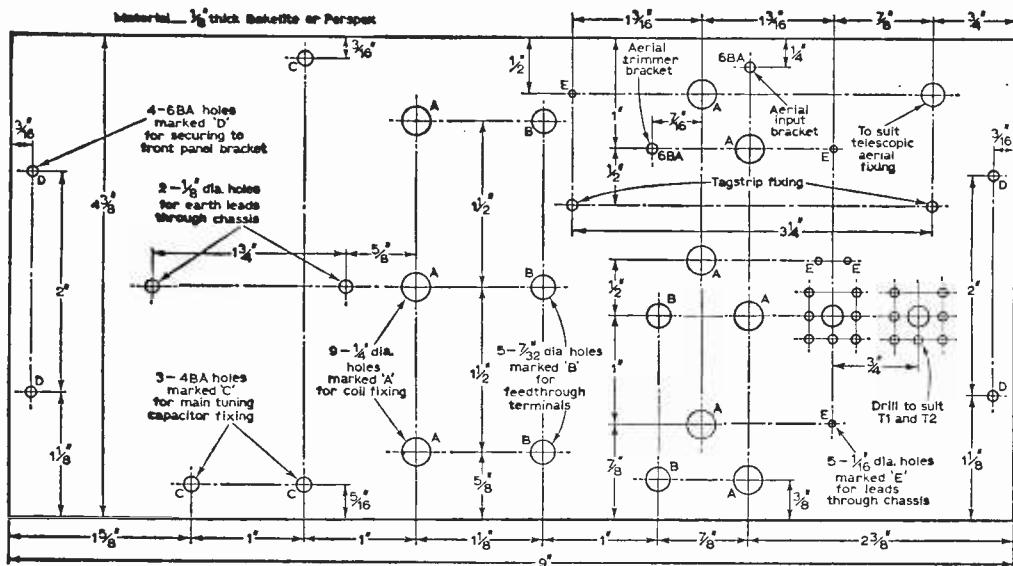


Fig. 3: Chassis dimensions diagram

rather awkward and the constructor would perhaps prefer to consult the information leaflet supplied with the components. All the transformer drillings, except the core adjusting hole, should be heavily countersunk from the underside of the chassis, as the component pins are rather short, being originally designed for use on rather thinner printed circuit boards.

The two supporting brackets are constructed from 20s.w.g. tin sheet as shown in Fig. 4, taking

care to make the bends in the two brackets in the reverse mode, so that the whole job is symmetrical when fastened together.

Finally, at this stage, the two small brackets for the aerial input and trimmer can be formed as per Fig. 5.

The Case

The converter may be housed in a metal case, size 10in. wide x 5in. high x 4 1/4in. deep (internal

COMPONENTS LIST

Resistors:

- | | |
|----------|----------|
| R1 8.2kΩ | R6 2.7kΩ |
| R2 1.2kΩ | R7 1kΩ |
| R3 1kΩ | R8 22kΩ |
| R4 1.2kΩ | R9 4.7kΩ |
| R5 10kΩ | R10 1kΩ |

All 10%, 1/4W carbon
VR1 2kΩ potentiometer

Capacitors:

- C1 0.01μF paper
- C2 0.05μF paper
- C3 0.01μF paper
- C4 2,000pF ceramic or mica
- C5 0.01μF paper
- C6 0.01μF paper
- C7 0.01μF paper
- C8 50μF electrolytic 12V
- C9 340pF silver mica
- C10 960pF silver mica
- C11 2,000pF silver mica
- C12 0.01μF paper
- C13 0.01μF paper
- VC1, 3, 5 3-gang variable 310pF each section (Jackson type E 3)
- VC2 25pF variable (Jackson type C801)
- VC4, 6 25pF split stator (Jackson type C808)
- VC7 15pF variable (Jackson type C801)
- TC1-9 30pF concentric trimmer (Philips)

Inductors:

- | | | |
|------------------------------|--|--------------------|
| L1 Blue, range 3 | } Denco transistor dual purpose coils | |
| L2 Blue, range 4 | | |
| L3 Blue, range 5 | | |
| L4 Yellow, range 3 | | } Blue=aerial coil |
| L5 Yellow, range 4 | | |
| L6 Yellow, range 5 | } White=oscillator coil (for 1.6Mc/s i.f.) | |
| L7 White, range 3 | | |
| L8 White, range 4 | } (for coverage of ranges see Table 1) | |
| L9 White, range 5 | | |
| T1 I.F. transformer 16/1.6 | | } Denco |
| T2 B.F.O. transformer 17/1.6 | | |

Switches:

- S1 Rotary type, 9-pole, 3-way; three wafers with screens (Denco)
- S2 Rotary type, 2-pole, 4-way (Minibank 'C')

Transistors:

- | | |
|-----------|----------|
| Tr1 OC170 | Tr3 OC45 |
| Tr2 OC170 | |

Miscellaneous:

Main tuning drive unit (Jackson Ball Drive 4489). Bandspread dial, 2in. dial calibrated 0-100 (Bulgin) with knob to suit. Five feedthrough connectors (Radiospares). Four 1.5V cells (Ever Ready U12).

dimensions), this giving a slightly recessed front panel. Drillings will be needed for the telescopic aerial, the external aerial and the output lead.

The best method of fixing the converter into this case is by two bolts through the back of the case screwing into two tapped brackets fitted to the back of the chassis. The constructor may have his own ideas on this subject, however, and the above ideas are offered only as a suggestion. It is, however, advisable to use a metal case if at all possible, so as to provide full screening of the converter circuits.

Mounting and Wiring-up

If not purchased complete, switch S1 should be made up with wafer layout as indicated in Fig. 6, and with screens (Fig. 7a) and spacings as indicated (Fig. 7b).

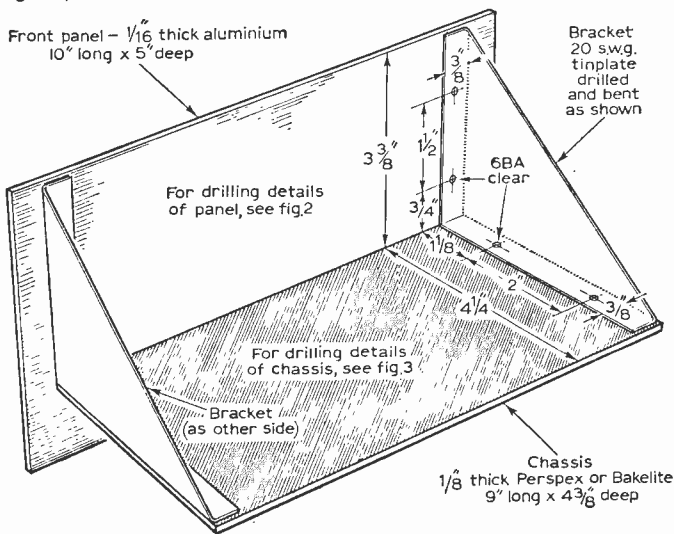


Fig. 4: The assembly of the front panel and chassis.

The first components to be mounted on the chassis are the two transformers T1 and T2, these being held in position by bending the can tags. Next, a 12-way tag-strip is mounted on the underside of the chassis using holes marked G (see Fig. 3). Finally, mount five feed-through terminals into the holes marked E1 to E5 (Fig. 8).

The assembled switch should now be mounted, but before doing so, it is advisable to fit earth tags on to either side of the corner holes in the screens and also to solder flying leads on to the 7, 8 and 9 o'clock contacts of the front and middle wafers (these are the pin 5 connections, Fig. 6), since these points may be difficult to get at later.

When the switch is mounted, refer to Fig. 6, and first connect the lower wipers to the appropriate feed-through terminals. Then mount all coils with pins uppermost (see layout diagram, Fig. 9), and complete all switch wiring, with the exception of the leads from the top wipers (tuning capacitor leads), and the aerial wiper on the rear wafer.

Next complete all the coil wiring, by commencing up appropriate pins (e.g. white coils, all pins 8 commoned, all pins 7 commoned, etc.).

Certain of the other components can now be mounted inside the coil compartments. These are:

- R1 from pin 8 of L4 through hole in screen 2 to pin 7 of L1.
- R6 and C6 from pin 7 of L4 to earth tag adjacent.
- R7 and C7 from pin 7 of L7 to earth tag adjacent.
- C3 from pin 8 of L4 to earth tag adjacent.
- C1 from pin 7 of L1 to earth tag adjacent.
- C9 from pin 3 of L7 } solder direct to screen 1 at nearest
- C10 from pin 4 of L8 } point.
- C11 from pin 6 of L9 }

Next, certain leads can be taken from the coil pins to points below the chassis and also on the screens (refer to Fig. 8 for tagstrip numbering).

These are:

- Pin 1 of L1 to earth tag adjacent.
- Pin 1 of L4 to earth tag adjacent.
- Pin 7 of L2 through hole F1 to tag 6 on tagstrip.
- Pin 7 of L5 through hole F3 to tag 8 on tagstrip.
- Pin 8 of L5 through hole F2 to tag 9 on tagstrip.
- Pin 8 of L8 through hole F4 to pin 2 of T1.

The main tuning capacitor and the bandspread capacitor can now be mounted. The top wipers on each switch wafer are wired to the appropriate tags on the main tuning capacitor and, in the case of the front and middle wafers, to the appropriate tags on the bandspread capacitor as well.

VR1, S2 and VC7 are mounted next, making sure that the spindle of VC7 does not touch the front panel.

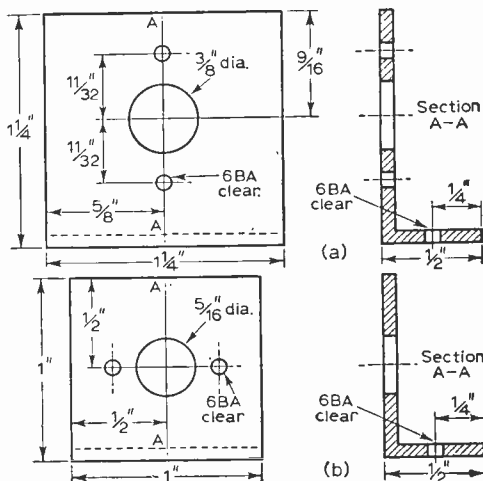


Fig. 5 (a) aerial trimmer bracket; (b) aerial input bracket.

The earth wiring is then fitted, using 20s.w.g. tinned copper wire. The earth tags on the bandspread capacitor are connected to screen 1 adjacent, soldering direct to the screen. The earth tags on screens 1 and 2 are wired together and the wiring continued to all earth tags on the main tuning capacitor, making use of holes C to run underneath the capacitor. The earth wiring is continued underneath the chassis to the appropriate tags on VR1, then on to the tagstrip, joining up tags 2, 3 and 12, and finally to the can tags of T1 and L10.

The underchassis components are now wired up as follows:

- Pin 3 of T1 to tag 10 on tagstrip.
- C4 and R5 across tags 8 and 10 on tagstrip.

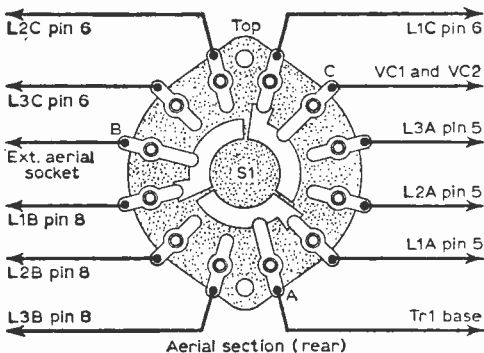
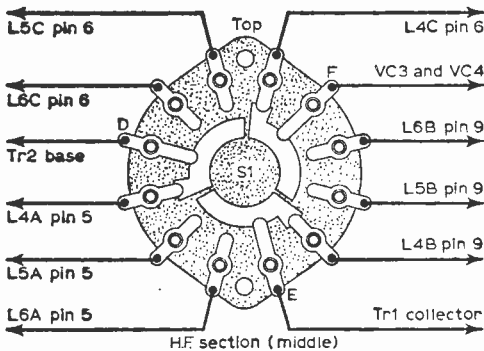
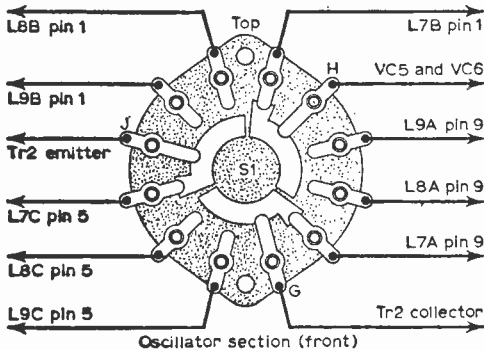


Fig. 6: Wiring of S1. Note: wafers viewed from rear.

- C5 across tags 10 and 12 on tagstrip.
- R4 across tags 7 and 10 on tagstrip.
- R2 across tags 7 and 9 on tagstrip.
- C2 and R3 across tags 1 and 3 on tagstrip.
- C8 across tags 7 and 12 on tagstrip.
- R10 and C13 across tags 11 and 12 on tagstrip.
- Wire lead from top of VR1 to tag 6 on tagstrip;
- Wire lead from contacts 2 and 3 on S2a to tag 7 on tagstrip.
- Wire lead from contact 3 on S2b to one contact of VC7 and continue on to pin 1 of T2.
- Wire lead from other contact of VC7 to pin 3 of T2.
- Wire R8 from pin 4 of T2 to pin 1 of T2.
- Wire R9 and C12 from pin 4 of T2 to tag 12 on tagstrip.

The transistors can now be wired in (see Fig. 1 for connections). All wires except the OC170 screens should be sleeved and the full length of lead wire should be retained.

Wiring points are:

- Tr1 Collector - feedthrough terminal E2.
- Screen - tag 2 tagstrip.
- Base - feedthrough terminal F1.
- Emitter - tag 1 tagstrip.
- Tr2 Collector - feedthrough terminal E3.
- Screen - use earth terminal on VR1.
- Base - feedthrough terminal F4.
- Emitter - feedthrough terminal E5.
- Tr3 Collector - pin 3 T2.
- Base - pin 5 T2.
- Emitter - tag 11 tagstrip.

TABLE 2
Tracking Points

Range	BAND END		TRACKING POINTS	
	L.F. (Dial 100)	H.F. (Dial 0)	L.F. (Dial 89)	H.F. (Dial 8½)
3	1.67Mc/s	5.3Mc/s	1.83Mc/s	4.5Mc/s
4	5.0Mc/s	15.0Mc/s	5.5Mc/s	13.5Mc/s
5	10.5Mc/s	31.5Mc/s	11.5Mc/s	28.5Mc/s

The coaxial aerial socket and the aerial trimmer VC2 are mounted on their brackets and fitted to the chassis with an extension spindle on VC2 coming out through a bush on the front panel.

The body of the coaxial socket is wired to pin 1 of L3 and the centre connection to the appropriate wiper on the rear wafer. The earth connection of VC2 is taken to tag 3 on the tagstrip and the other connection through hole F5 to the top wiper on the rear switch wafer.

The coaxial output lead is soldered across pins 4 and 5 of T1, pin 5 also being connected to tag 12 on the tagstrip. This output lead should preferably be clamped to the chassis to prevent jerking.

The nine concentric trimming capacitors may now be fitted into position. The "live" connection (outer connection) should be soldered either on to the appropriate switch contact or coil pin, whilst the earth connection (centre spindle) should be soldered directly on to the screen. Care must be taken to keep the top of the trimmers below the level of the top of the front panel, otherwise they will foul the case.

Finally, the batteries can be mounted (clamped to chassis underneath the main tuning capacitor) and the linking wires soldered. The positive battery terminal is taken to tag 3 on the tagstrip and the negative terminal to the wipers of S2A and S2B.

Knobs and dials are then fitted and the converter is ready for lining-up.

Telescopic Aerial

It will be noted that no exact details have been given for fitting the telescopic aerial. This is because there is a wide variety of suitable devices on sale, ranging from the truly telescopic (and rather expensive) type, to the cheaper semi-telescopic car aerial.

The general idea is that the aerial selected should have a tapped hole in its bottom section A corresponding bolt of some 1/4 in. length is fed up through hole M (Fig. 3) and tightened down with a nut, leaving enough thread to screw into the aerial. A solder tag is placed under the head of the bolt (i.e. underneath the chassis) and C14 is wired from this tag to the "live" tag of VC2.

A suitable hole is cut in the top of the can and fitted with a rubber grommet, making a good push fit for the aerial, which is screwed in when the converter has been fastened in its case.

Once this has been done the converter output lead is plugged in and the unit switched on. Range 3 is selected, with the main tuning capacitor fully meshed and the oscillator temporarily stopped by shorting across L7(b). The signal generator is fed into the aerial input socket via a 400Ω resistor (link generator chassis to converter earth) and adjusted between 1.5 and 1.6Mc/s (modulated) until a note is heard in the speaker. T1 is peaked and is now tuned to the input frequency of the basic receiver.

The generator is now fed in unmodulated and the b.f.o. switched on. With VC7 set in mid-position, T2 core is adjusted until a beat note is

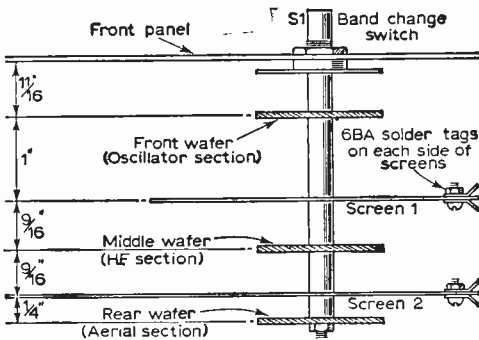
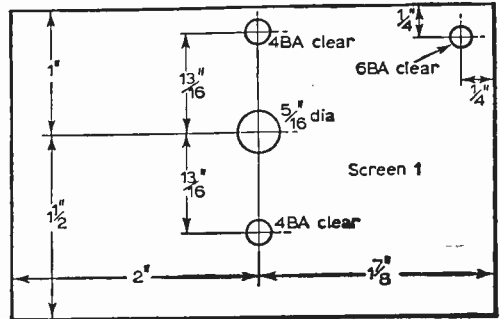
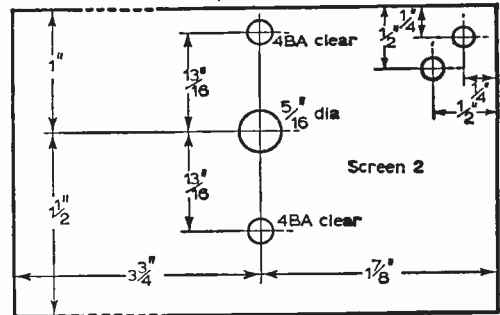


Fig. 7a (above): Showing the build-up of the switch.

Fig. 7b (right): Drilling details of S1 screens (viewed from rear).



Material for both screens—20 swg. tinplate



Lining Up

Lining-up should preferably be done with the use of a signal generator although, as will be shown, it is possible to manage without such an instrument.

The output lead should be fitted with a terminal appropriate to the input socket of the main receiver and should be kept as short as is practicable.

The main receiver should be tuned to the selected frequency at the bottom end of the medium wave band. In the case of a mains-operated receiver or car radio this can certainly be the very end of the scale, since with the normal aerial removed there will be no pick-up. The case of a transistor portable is rather different, since the internal ferrite aerial cannot be disconnected. However, the lowest clear wavelength should be selected and any residual pick-up can be minimised by suitable orientation of the receiver.

heard and the centre position found where the note disappears.

Standard procedure is now used for the main lining-up. The b.f.o. is switched off, the shorting link on L7 removed, VC4-6 set to minimum capacity, VC2 set at half capacity and the generator used modulated.

Referring to Table 2, each band is lined up in turn, first setting the band-end limits by adjusting the oscillator core with the generator set to the low-frequency end of the band and then adjusting the oscillator trimmer as the top-end frequency is fed in.

When this has been done the generator is set to the lower tracking frequency and the main dial set to a reading of 89. The cores of all coils of the appropriate range are now adjusted for maximum signal. The generator is then set to the higher tracking frequency and the main tuning dial set to a reading of 8 1/2. The trimmers of all coils are adjusted for maximum signal. This process

is repeated until no further adjustment of cores or trimmers is required.

Lining Up Without a Signal Generator

After adjusting the main receiver to the frequency chosen, short out L7(b) coil as before and switch converter on with the b.f.o. also on. Set VC7 to mid-position and adjust the core of T2 until a loud rushing noise is heard in the speaker. This denotes that the b.f.o. is oscillating at the selected input frequency and the core of T1 can now be peaked, using this "noise" source.

The b.f.o. is then switched off and the shorting link removed. The band edges cannot be set accurately (although they can be altered at a later date when known stations are identified), so it is suggested that the oscillator cores and trimmers are set to mid-position. Some measure of lining-up can now be achieved by selecting reasonably strong transmissions near the 8½ and 89 dial settings and peaking cores of the aerial and h.f. coils at the higher setting and peaking trimmers associated with these coils at the lower setting, repeating the process until further adjustment makes no improvement.

Operating the Converter

The converter performance has been found to be very good when fed into a standard six-

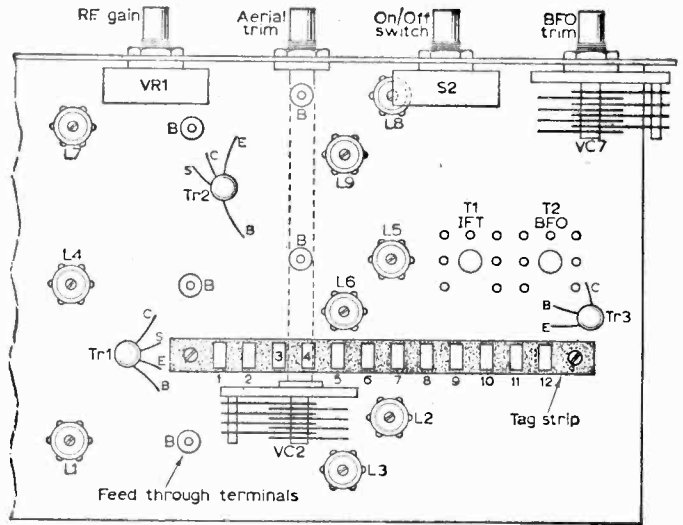


Fig. 8: Underchassis layout diagram.

transistor portable and exceptional when backed by a more sophisticated strip.

The r.f. gain control should be kept well down on the stronger stations to avoid overloading the main receiver. The bandspread tuning gives good results and the aerial trimmer is hardly needed but should be peaked when any change of aerial is made.

When an s.s.b. transmission is received the b.f.o. should be switched on and b.f.o. trimmer adjusted until the speech becomes intelligible. The r.f. gain control should be turned well down when doing this, otherwise distortion may occur.

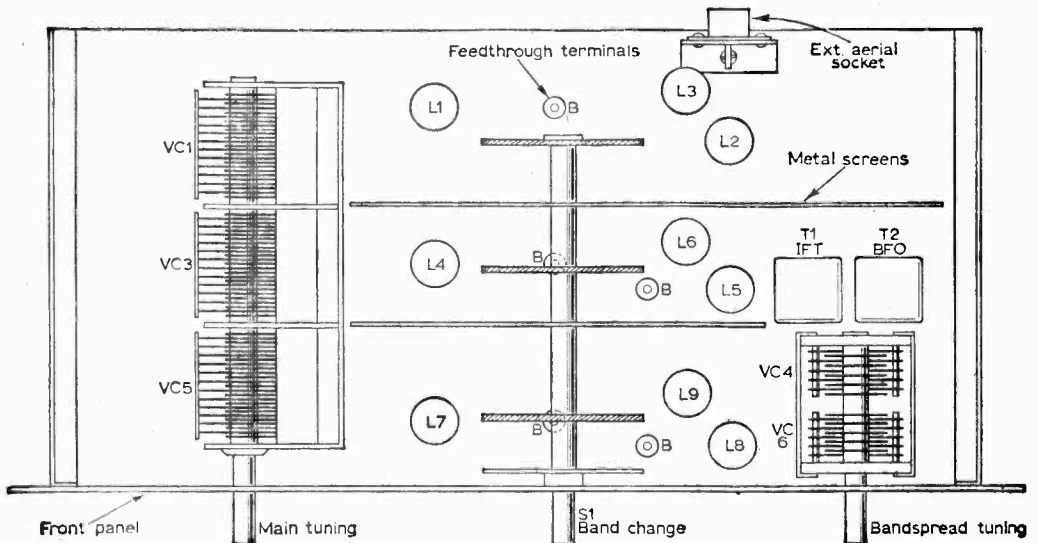
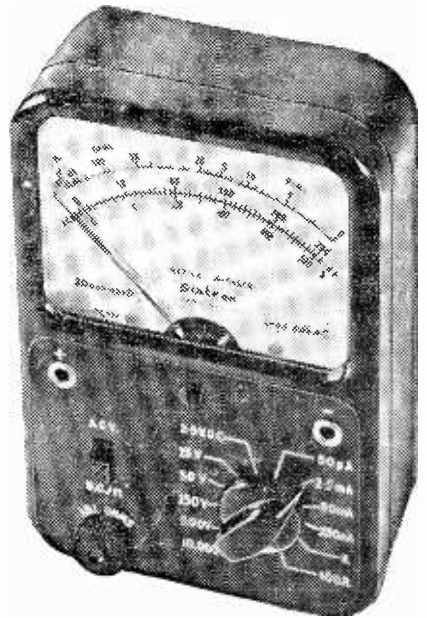


Fig. 9: Above-chassis layout of components.

Further Applications of the PRACTICAL WIRELESS "Sixteen" Multirange METER



ON the reverse side of the blueprint issued last month, featuring the P.W. "Sixteen" multirange test meter, details were given of typical tests and applications of such an instrument. This month, we follow up with a few more notes on applications to further illustrate the versatility of a basic multirange meter.

Capacitor Testing

The reactance of capacitors can be calculated from voltage and current tests when a suitable a.c. is applied. A circuit such as Fig. 1, making use of a double-wound transformer with tapped secondary for high-voltage capacitors and a low-voltage secondary for testing electrolytics, can be used for obtaining readings.

First measure the voltage across the capacitor, then place the meter, switched to the 25V a.c. range, across the variable resistor R1 to measure the current taken by the capacitor. If R1 is 500Ω, full-scale deflection represents 50mA.

In the low-voltage position R2 should be 100Ω, giving a 5V deflection on the 25V a.c. range, which represents 650mA.

To calculate reactance in ohms first consider the formula $X_c = \frac{10^6}{2\pi fC}$, where X_c is the reactance in ohms, f is in this case 50 cycles (mains supply), and C the capacitance in microfarads. X_c is also equal to E/I , the a.c. voltage across the capacitor divided by the current through it.

Combining the two formulae,

$$X_c = \frac{10^6 E}{2\pi f C I}$$

Transposing, we obtain

$$C = \frac{10^6 I}{2\pi f E}$$

With an applied frequency of

50c/s the factor $\frac{10^6}{2\pi f}$ becomes

3.18 if the conversion is to milli-

amperes, volts and microfarads. Thus $C = K \times I/E$.

The double-wound transformer affords isolation from mains supply, but direct connection to the mains can be used for this test if sufficient care is taken. If R1 (and R2) is made variable, compensation can be made for small differences in circuit capacitance, meter impedance, etc., by checking a good capacitor of known value. It is further advisable to check several, taking an average, to allow for normal tolerances.

The low-voltage winding of the transformer can be used to apply 3 to 7V to electrolytic capacitors of high working voltage, but is not suitable for low working voltage capacitors, which should be tested by bridge methods. In this test the readings will all be at the lower end of the scale.

Inductance Testing

Similar measurements can be taken for inductances of high value, such as transformer windings and loudspeaker fields, but accuracy is not so great

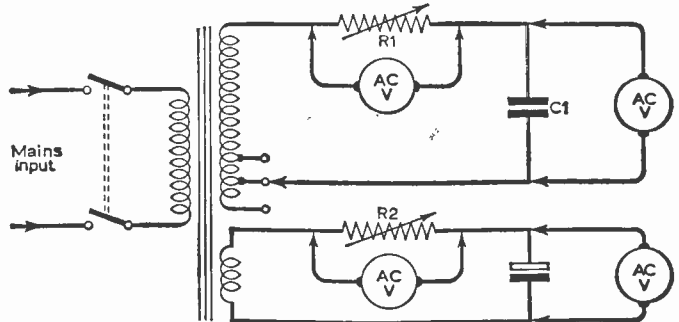


Fig. 1: A suitable circuit for calculating capacitor reactance.

as the current is limited not only by the inductance but also by the self-capacitance and resistance of the windings. In this case the inductance in henrys = $K \times E/I$.

It should be remembered that the inductance of an iron-cored coil or transformer winding decreases when d.c. flows through it, as in the case of a smoothing choke.

Alignment Procedures

The multimeter can be used in various ways to indicate output voltages, current and power for alignment and response checking.

Most obvious method is to measure the a.c. voltage across the secondary winding of an audio output transformer for sound level, as in Fig. 2. The loudspeaker is disconnected and its place taken by a resistor of equivalent impedance. (Note that this resistor must be of sufficient wattage to dissipate the expected power output.) Power output is

equal to $\frac{V^2}{R}$ where V is the indicated voltage and R the equivalent resistance.

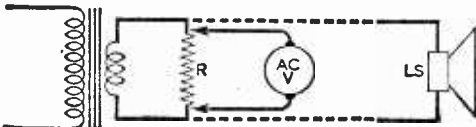


Fig. 2: Output voltage measurements.

Alternative methods include the measurement of detected signal voltage across the detector load, using a low d.c. milliamp or microamp range in series with a suitable resistor. The resistor acts as multiplier to the meter and as an isolating component in conjunction with the decoupling capacitor which should be fitted. (See also Fig. 4.) Another method is the measurement of a.g.c. voltage.

Indication of sensitivity on f.m. receivers is also taken at the detector stage in the manner illustrated in Figs. 3 and 4 on last month's blueprint.

Output measurement on transistorised portable radios presents a different problem as the output is in the region of a few milliwatts. Across a 50Ω loudspeaker an indication of perhaps half-scale on the 25V a.c. range may be obtained at full output, but where a 3Ω loudspeaker is used there may only be two or three volts available and readings will be too closely spaced at the lower end of the scale.

A better alternative method is to insert the multimeter in the battery supply lead to the receiver, switched to the 50mA range (250mA range for larger sets). As the current consumption is dependent on output power this gives a suitable indication for alignment purposes and a current of about 10mA would be expected under quiescent conditions, increasing to perhaps 35mA or more when fully loaded with the signal generator input. This gives an easily visible variation over the central portion of the scale.

For vision alignment either a.c. or d.c. conditions can be used, as in Fig. 3. The varying d.c. voltage across the video amplifier anode load resistor can be measured, with the disadvantage that both meter leads are then at high potential and that the signal being measured is unmodulated.

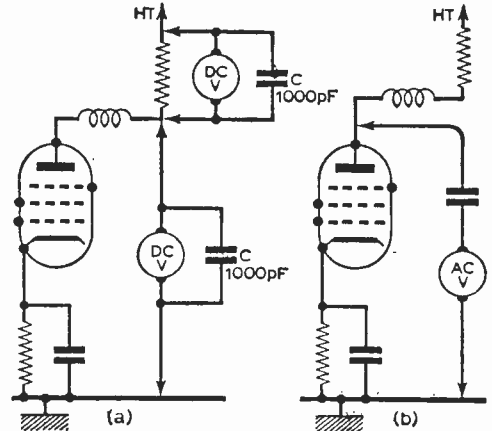


Fig. 3: Output measurements for vision alignment purposes.

With a negative-going video signal the reading is from minimum to maximum. If measured from chassis to anode the readings will commence at the "black-level" anode voltage and dip as resonance is approached during tuning. Adjust for maximum dip.

A modulated input can be measured as in Fig. 3(b). With a capacitor of about 0.25μF in series with the meter, switched to a.c. volts, the signal gives an indication from zero to maximum.

If signal levels are such that accurate indication cannot be obtained other methods may be used as, for example, inserting the meter, switched to a suitable mA range, in the anode lead of the video amplifier, or applying it, switched to microamps, with a series resistor (as r.f. stopper) across the vision detector load.

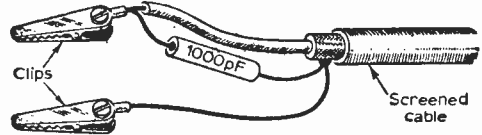


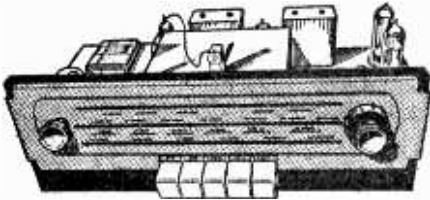
Fig. 4: A method of decoupling the meter which may be used with low currents and voltages.

A convenient measuring point is the modulating electrode of the cathode ray tube, where a d.c. varying in sympathy with the signal is to be found.

As a final stricture remember to decouple the meter, as near the point of application as possible, where the self-capacitance and inductance of the leads could cause instability in the circuit being tested. Fig. 4 shows the method employed for television testing, which lends itself to other applications where both current and voltage are low.

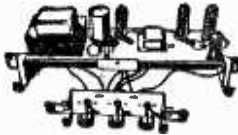
Coaxial cable is used to connect the prods or clips to the meter and a decoupling capacitor, 0.001μF, is fitted directly to the "live" prod and the other end soldered to the braided outer of the coaxial cable. This method is not suitable for high voltage or current measurements where normal, separate leads should be used.

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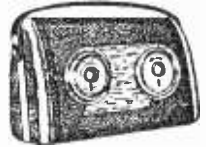
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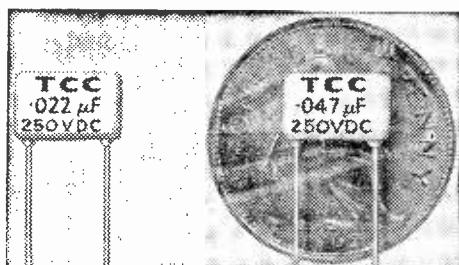
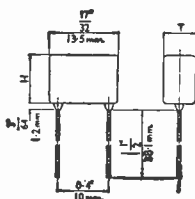


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GETTING THE BEST FROM AUDIO EQUIPMENT

BY R. HINDLE

HOW can one get the best out of one's sound reproducing equipment? Ideally, one room in the house should be earmarked as the "music room", and equipment should be carefully built therein to give the very best results when sitting in normal listening position, the room treated with curtains and soft furnishings to give acceptable acoustic conditions.

Descriptions of such music rooms have been seen and occasionally one can visit a demonstration room lavishly provided for by some knowledgeable architect. These as often as not just make us realise that hi-fi in that sense is not for us. We have to fit in with more normal budgets, not to mention the aesthetic but less technical aspirations of one's wife and family.

Typically, the average household has two rooms in which listening is concentrated. In the author's case these are the lounge, providing the best surroundings for listening, and the family living room, a utility room in constant use.

Speaker Extensions

The simplest and perhaps the most satisfactory solution from a technical point of view is for both radio and gramophone equipment to be in one of the rooms. Generally speaking the lounge would be chosen because the piece of furniture needed to house this equipment to today's standard must be large, long and low—not a piece for the family room. Besides, though the lounge is less often used, when it is occupied the best possible reproduction is needed there.

Under these circumstances an extension speaker will probably be provided in the family room—the best quality that can be afforded, of course, in order to do justice to the amplifier. At this stage it is not proposed to deal with the provision of a mono speaker output from a stereo record—would anyone really be happy to do this anyway?—and it is assumed that the amplifier provides a mono output.

The connection between amplifier and extension speaker is not just a simple matter of using any old piece of flex or bell wire. Almost invariably the extension speaker will have a low impedance input, the speaker transformer in the main amplifier serving both local and extension speaker. This is advisable because an extension at low impedance is less likely to pick up interference and mains hum than would an extension at the high impedance (primary) side of the speaker transformer.

The low impedance connection has the disadvantage, however, that unless the cable used to

connect the extension speaker is carefully chosen, or else the cable run is very short, the impedance of the cable can be comparable to the speaker impedance itself (perhaps only 3Ω) and consequently there will be a loss of audio power in the cable. A cable impedance equal to the speaker impedance will attenuate available speaker power to a half the total available. Also it should be noted that the speaker impedance varies with frequency and therefore if the cable impedance is low it is likely to introduce amplitude distortion.

Modern amplifiers generally have a high degree of negative feedback taken from the secondary of the output transformer and such amplifiers are sensitive to reactive load. It is difficult to design an amplifier which will be stable with an appreciable capacitive load but inevitably an extension lead introduces a capacitive component. Unless care is taken, therefore, an extension speaker might well result in amplifier instability.

The answer to all these problems, attenuation, amplitude distortion and instability, is a low loss cable of low capacitance. Fortunately, electronics workers dealing with the other end of the frequency spectrum—the television engineers—have developed just the cable for the job. Television coaxial lead-in cable is ideal for speaker connections.

It is an odd thought that knowledgeable workers will take every precaution at the v.h.f. end of the scale but will fail to appreciate the equivalent precautions necessary when working at audio frequency. In practice, coaxial cable has many useful applications in audio work. It can be unsightly for long extension speaker leads unless care is taken and ideally it should be run under the floorboards. Avoid joining pieces of cable if possible, because, sooner or later, a joint is likely to introduce noise; if a joint must be made use a proper connector.

Switching Circuits

Assuming that the main speaker system (adjacent to the amplifier) when used alone is properly matched to the amplifier, connecting an extension speaker, whether in series or in parallel, will cause a mismatch. The popular types of amplifier using a normal degree of feedback are not very sensitive to changes in load and a reduction in effective load caused by wiring an extension speaker across the main speaker is unlikely to cause trouble.

However, it is desirable that the volume at both speaker positions should be similar. The extension speaker should have an impedance similar to the main speaker or else the available power will not be evenly divided between the two.

Some kind of built-in switching is highly desirable. It should be possible to mute the speaker at both ends and also the circuit should be so arranged that if both speakers are muted (or the local speaker muted and the remote speaker disconnected) the amplifier is not running without load.

This being so, one might just as well arrange matters so that there is less likelihood of mismatch. An additional advantage is that by wiring in this way there will be no change in power in one speaker when the other is switched on or off. Figure 1(a) gives the wiring. It will be seen that when a speaker is muted, a resistance is brought into use to dissipate the power that would otherwise drive that speaker. The resistance in each case must equal the nominal impedance of the speaker (i.e. a 15Ω resistor for a 15Ω speaker etc).

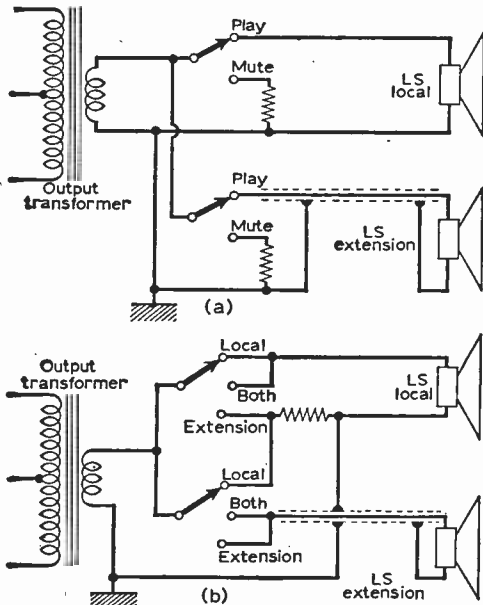


Fig. 1: Switching circuits for extension speakers.

Assuming that the two speakers have similar impedances as recommended above, this circuit results in a permanent division of available audio power into two equal parts, one part fed to each room. In practice a reduction of audio power by a factor 2 is not very noticeable to the ear.

However, if the equipment is being designed or bought with such a distribution system in mind the fact that only half audio power is available at each location should be borne in mind.

It will be seen that two separate switches are provided, one for each speaker. Consequently the switch for the extension speaker could conveniently be moved to the extension speaker end of the cable, fitting it on to the speaker cabinet itself for local control. If the switch control is to be entirely at the amplifier end a single three position switch might be preferable, providing main speaker only, extension speaker only or both speakers.

This should be wired as in Fig. 1(b). It will be noted that only one resistor is used, brought into circuit when either one speaker is connected. This connection prevents the muting of both speakers or open circuits in case the extension speaker is disconnected.

It will be realised that either of these methods of wiring results in halving the impedance presented to the amplifier and this should be borne in mind if various output impedances are provided for. However, the usual type of amplifier will be quite happy under these circumstances.

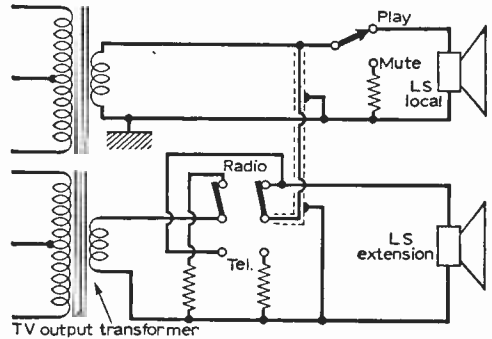


Fig. 2: Utilising a television loudspeaker as an extension speaker.

The extension speaker could, perhaps, be the television speaker if impedances are compatible. In this case care must be taken to see that the television output stage cannot be switched on without a load. A modification of Fig. 1(b) given in Fig. 2 is suggested. The switch disconnects the TV output transformer from the speaker when this is in use as an extension but at the same time inserts a resistive load to prevent the TV output being open circuited.

Two separate resistors are shown but if the load needs of the amplifier and the TV are similar (the latter will probably be of the order of 3Ω) a single one will suffice, the two points of the switch to which the separate resistors are connected being thus connected together and the single resistor being from this connection to the earthy lead.

Volume Control

The amplifier will be adequately provided with volume control but there may be a need for a local control at the extension speaker end. A resistive potentiometer type of control can be fitted as at Fig. 3, but not without introducing new

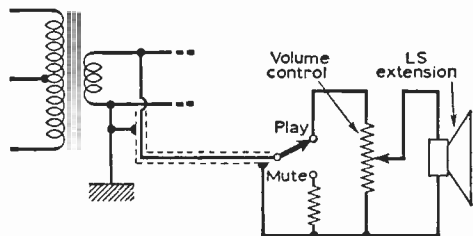


Fig. 3: Volume control for the extension speaker.

problems. When the volume control is set for full volume the potentiometer resistance is in parallel with the speaker and therefore to avoid power loss (and also possible amplitude distortion) the resistance must be appreciably higher than the speaker impedance.

On the other hand, at low volume levels the potentiometer resistance becomes the amplifier extension load and if this is appreciably higher than the speaker impedance the amplifier will be presented with a mismatch! One must compromise. A potentiometer total resistance of not less than four times the speaker nominal impedance is suggested and, in round figures, 50Ω for a 3Ω speaker and

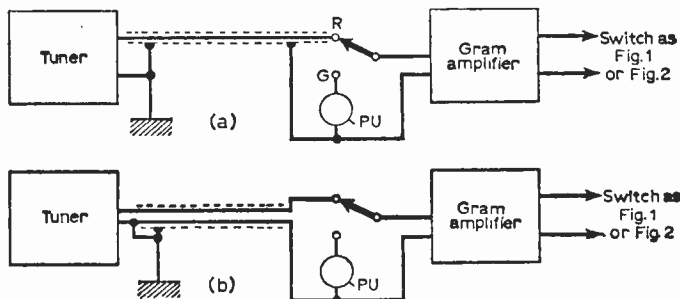


Fig. 4: Inter-wiring between separate tuner and amplifier.

100Ω for a 15Ω speaker are sizes likely to be available.

More elaborate circuits can be developed to minimise variation in load but are probably not worth the trouble except as nice little technical problems to solve.

A Personal Problem

The problem actually facing the author, when the line of thought that resulted in this article was generated, was somewhat different to those already dealt with. The habits of the family were such that in the living room the normal form of entertainment called for was television and radio, with only very occasional call for gramophone reproduction, whereas in the lounge the gramophone is most frequently used and only occasionally is radio used.

This being so it seemed wrong to install the radio in the lounge, requiring a visit to that room whenever a change of programme was required in the living room, or alternatively the provision of a complex remote control system.

The problem thus became as follows: radio equipment was to be installed in the living room and gramophone equipment was to be in the lounge. How should these be interconnected so that the occasional facility should be provided in each room to use the equipment fitted in the other, and would such a scheme be an acceptable and cheaper alternative to any duplication of equipment?

Using the Main Amplifier

The first temptation was to provide only a tuner and speaker in the living room and to bring into use for radio the main and comparatively expensive amplifier in the lounge equipment. The tuner output would then be permanently wired by means of a coaxial cable into the lounge equipment where there would be the usual radio-gram switch, and

on the output side of the amplifier would be one of the switch versions given in Fig. 1.

This arrangement is given schematically in Fig. 4(a). There would be complications to the radio-gram switching if stereo gramophone reproduction was provided, but that is another story.

Using this arrangement some precautions have to be taken. It is desirable that the tuner audio output should be reasonably high so that the risk of appreciable pick-up of interference is minimised: a cathode follower output would be preferred. The outer screen of the coaxial should be connected to the tuner chassis at one end and the amplifier chassis at the other; it should connect to an earthed point only at one end—presumably at the tuner end.

A better scheme to avoid hum pick-up would be to use a twin core screened cable in place of the single core of the usual coaxial cable. The outer sheath in this case is connected to a good earth at only one point, the earth return signal lead being carried by one of the cores as in Fig. 4(b).

However this lead from tuner to gramophone is arranged, there will be the need for an additional and separate coaxial lead back from the gramophone amplifier to the extension speaker.

Self Contained Radio

The main objection to the above scheme is the need to go to the lounge to switch on when radio is needed in the living room. The disadvantage of such action in reverse was not considered to be serious because the need for radio in the lounge was less frequent.

Of course, the system could be elaborated. It would not be difficult to arrange for mains to be switched on a both equipment positions by operating one switch at either end, using the well-known changeover switch technique found in practically every house to switch on or off a light, say, from the top of bottom of the stairs. The tuner could be switch tuned and the switch could be relay-operated so that remote control of tuning would be practicable.

At this stage one begins to wonder if it would not be better to duplicate the radio equipment at the gramophone end.

Finally, it was decided to provide a separate amplifier for the radio in the living room so that the radio there was self-contained and could be completely operated from that room. Provision was to be made to feed signals between rooms only to allow the radio output to be heard in the lounge and to allow gramophone reproduction to be heard in the living room.

The Method Adopted

The method of connection finally decided upon is given in Fig. 5. A radio/gramophone switch is wired between output transformer and speaker at each end. If the living room equipment is switched to radio and the lounge equipment is switched to

—continued on page 931

TEST GEAR accessories

Part 1

BY C. MACKAY

MANY of the cheaper type of test instruments are sold today without any form of accessories such as test leads, dummy aerials for signal generators, diode detector probes for use with oscilloscopes, signal tracers, etc., or cathode follower probes. Often they are not even available as an extra, although they may be absolutely essential for the correct operation of the instrument.

The constructor, too, is often faced with a similar problem after having built an expensive piece of apparatus and then not being able to complete it properly.

TEST LEADS

A large number of the problems associated with test leads are matters of individual requirements and, accordingly, the experimenter must use his own ingenuity.

However, it should be said that there must be available a large number of test leads of all types. Good, well-insulated components and flex (preferably not solid core wire) should be used throughout. Remember that it is definitely a mistake to make leads too long, since they invariably manage to form the most unbelievably complex knots as

well as acting as most efficient aerials for picking up mains hum and other forms of interference.

THE DUMMY AERIAL

When the front end of a receiver is being aligned with the aid of a signal generator the impedance of the source must be the same as that of the aerial. To make this so a matching network called a dummy aerial unit is placed between the signal generator and the receiver.

The circuit of such a dummy aerial unit constructed by the author is shown in Fig. 1.

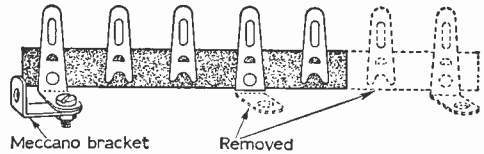


Fig. 2: The dummy aerial tagstrip.

The unit was constructed in a small coil-screening can made by Denco (Clacton) Ltd. It is normally supplied with their Maxi-Q range of coils but is also available separately.

The can is cylindrical, 1 7/16 in. in diameter, 2 3/8 in. high, with a screw-on lid. The size of the can is unimportant and a different type can be used equally well.

CONSTRUCTIONAL DETAILS

It is advisable to construct the coil first. The original was made out of a short length of insulated spindle extension rod about 1 1/2 in. long and 1/4 in. in diameter. On it are wound 40 turns of 28s.w.g. wire so as to occupy 1 in. of the former. The coil is then made tight and the whole component covered in polystyrene cement or some similar substance.

Now we start in the screening can. A tagstrip on which the components will be mounted is to be bolted vertically to the underside of the lid of the can as follows:

First drill a hole about 1/4 in. in diameter in the centre of the lid, then drill two 6B.A. holes to suit the coaxial socket used.

The tagstrip is a seven-way type, three contacts having "earth" bolt holes. At one end only a two-tag section is sawn off, leaving a five-way tagstrip. The central earth tag has the bolt hole section either bent up double or removed (see Fig. 2).

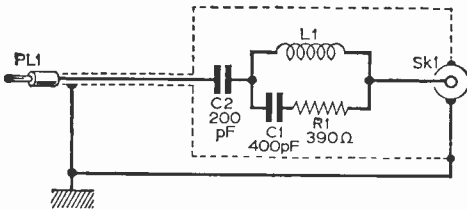


Fig. 1: The circuit of the dummy aerial unit.

COMPONENTS LIST FOR DUMMY AERIAL UNIT

- R1 390Ω carbon composition 1W
- C1 400pF midget ceramic
- C2 200pF midget ceramic
- SK1 coaxial socket
- PL1 coaxial plug
- L1 40 turns 28s.w.g. on 1/4 in. former (see text)

Miscellaneous:

- One 7-way tagstrip, 2 yards coaxial cable.
- Screening can (Denco (Clacton) Ltd.). Nuts and bolts, etc.

To the third and now only remaining earth bolt hole is attached a right-angled bracket of the Meccano type (may be bought in any good toy shop).

The tagstrip bracket assembly is then bolted under one coaxial socket bolt and wired up as follows (see Fig. 3):

The tags are numbered as in Fig. 3, tag 1 being earthed.

First take a short length of wire and join tag 2 to the central connector of the coaxial socket. Wire R1 between tags 2 and 3, C1 between tags 3 and 5, C2 between tags 4 and 5 and L1 between tags 2 and 5.

CONNECTIONS FOR OPERATING

A hole is now drilled in the main part of the can in the centre of the base to take the connecting cable to the signal generator. This cable, with a coaxial plug attached, is passed through the hole in the can. The inner of the cable is soldered to tag 4 and the outer of the cable to earth (tag 1). The two halves are now carefully screwed together, taking care that no components touch the side of the can.

The unit is now ready for use.

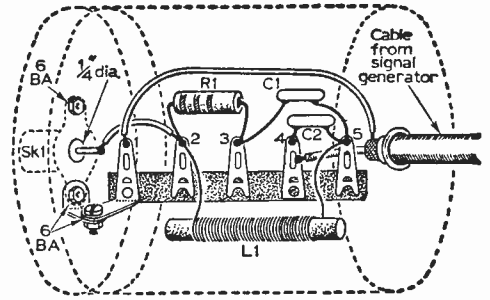


Fig. 3: Wiring and mounting the tagstrip bracket.

WARNING

If the above unit is to be used with "live" chassis equipment the signal generator should be isolated from the mains and the chassis of the generator must not be earthed. Care should also be taken to ensure that the "live" chassis to be tested has the neutral side of the mains connected to the chassis.

Part 2 appears next month

Wiring for Sound

—continued from page 929

gram (the usual state of affairs) the signals at each end pass to the local speaker without involving the coaxial leads.

However, the radiogram switch at each end has a second bank of connections whose purpose is seen to be to switch in a resistance dummy load into the circuit of the equipment not being called upon to deliver a signal. In the case of the switch positions referred to above these resistive loads are applied at the remote end of each coaxial cable.

Thus the switching is comparable to that in Fig. 1 in that in all permutations of switching a half of the output power of each equipment—radio and gramophone—is fed to each room whether it is used there or not. At each end the signal not in use at any time is dissipated in the resistance at that end.

Thus it follows also that the load is a half of what it would be if the switching had not been introduced. This and the halving of power should be remembered when connecting up the other equipment.

Looking again at Fig. 5 it will be seen that both

ends can take radio simultaneously, in which case the resistors are in parallel and across the gramophone output. The gramophone equipment need not be switched on, of course. Similarly, both ends can take gramophone.

The final permutation permits each end to take the signal from the remote end, thus feeding the the gramophone output to the living room and radio output to the lounge, in which case the resistors are applied as load to the local ends.

The important point to realise is that all these permutations apply comparable loads at each end (it is assumed and it should be so arranged that the nominal speaker impedances at both ends are the same) and consequently there will be no apparent change in reproduction at either end when the switch is operated at the other.

Little need be said about the methods of construction. The switch can be mounted at each end at a suitable position and the wiring could be supported by the switch. It would be preferable, however, to make up a unit on a little aluminium chassis containing the switch sockets to take the two coaxial terminations and connections for the speaker and output transformer connections. ■

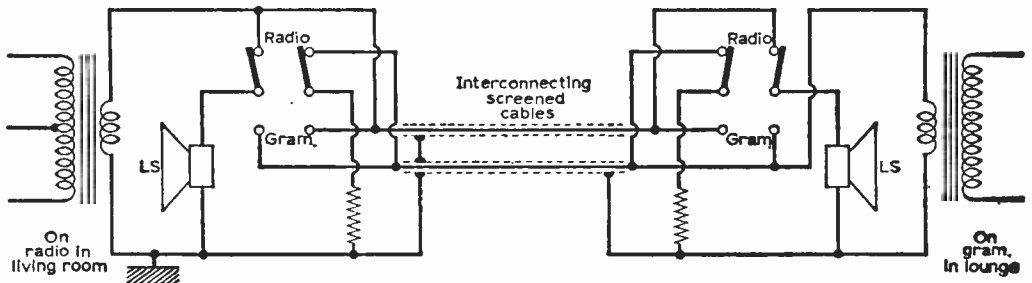
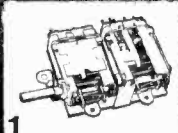


Fig. 5: The radio/gramophone interconnections.

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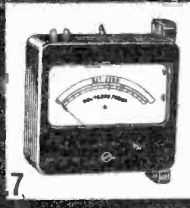
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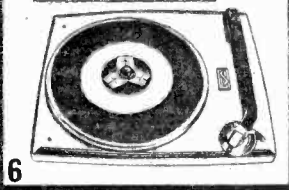
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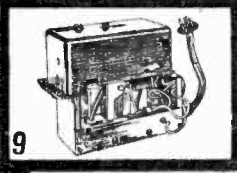
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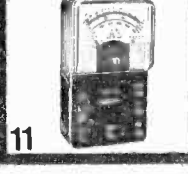
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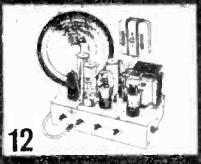
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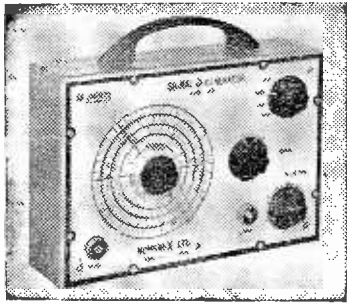
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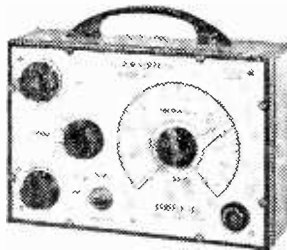
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3V4	6/-6X4	5/-80	6/-ECP82	7/8-N709	7/-W17	3/6
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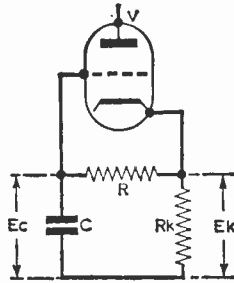
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 Postage and packing 6d. Over £1 post free. C.O.D. 4/-

Circuit Operation

To understand the operation of the circuit, a simplified diagram is shown in Fig. 2. Here the valve *V* is effectively a cathode-follower, where, for sharp cut-off valves, the voltage E_k developed across the cathode resistor R_k is nearly equal to the voltage E_c developed across the capacitor C . The small difference existing between grid and cathode, $E_k - E_c$, depends on the actual valve characteristic, but it has a finite value and capacitor C is consequently charged very slowly from this small potential difference.

Fig. 2: A much simplified version of the circuit shown in Fig. 1 to illustrate the basic method of operation of the timer.



The important thing is that this voltage across R is substantially independent of other potentials and so the current through R has a constant value $(E_k - E_c)/R$. The capacitor is therefore charged at a constant rate and the voltage rises across it linearly with time. This arrangement overcomes the difficulties experienced with the simple C and R circuit which has an exponential charge curve and requires bulky components for a long delay.

The actual operation of the whole circuit of Fig. 1 is rather more involved than the simple explanation given above, but the basic theory obtains. The valve acts as a rectifier to the a.c. mains supply, developing a d.c. voltage across the variable control $VR1$ and the relay coil RLA , smoothed by the electrolytic $C2$. The grid "follows" the cathode potential so that, when the switch $S1C$ moves to the "Time" position and removes the $10k\Omega$ shorting resistor from capacitor $C1$, this latter begins to charge by virtue of the small grid-cathode potential existing across $R3-R4$.

As the charge proceeds, the grid moves progressively away from the cathode potential, and after a certain interval, determined by the setting of $VR1$, sufficient valve current flows to operate the relay. Contacts $RLA-1$ then open, extinguishing

the lamp, while contacts $RLA-2$ close, shorting out the resistors $R3, R4$ and clamping the relay fully.

To reset the operation, the switch $S1$ (which has three poles) is moved to the centre position, discharging $C1$ through $R1$, and breaking the anode supply to the valve. The relay then drops out, in readiness for the next charging cycle.

Construction

There is nothing critical about the layout of this circuit, and no details need be given therefore of the actual mechanical arrangements. The timer is easily assembled in a small case and builders will suit themselves on the details of appearance. *It must be noticed, however, that the "earth" line is NOT chassis, and that the case, if metal, must be isolated from this negative line, being earthed back through the mains supply third pin. Particular care should be taken to ensure that the case of capacitor $C2$ is insulated from the chassis, especially if it is of the type where the case and negative terminal are commoned.*

The Function Switch

The three-pole, three-way switch $S1$ is a standard wafer type, not a midget variety however, and if a ceramic wafer can be obtained so much the better. This switch gives three positions as indicated in the diagram, namely FOCUS, RESET and TIME. In the FOCUS position, the lamp is connected directly across the mains, and is used in this position when setting up and focusing of the enlarger is necessary.

In the RESET position, the lamp is extinguished, the charging capacitor shunted by the $10k\Omega$ resistor $R1$, and the valve anode supply is broken.

When switched to TIME, the lamp will light, and remain lighted for the duration of the charging cycle after which it will extinguish and remain so until the following exposure is prepared. Provided that about one second is allowed to elapse while the switch is at the RESET position, the following timing will be unaffected by the period at which the reset is actually switched.

The Post Office type 3000 relay has a 2000Ω coil and two pairs of contacts, one pair normally open ($RLA-2$) and one pair normally closed ($RLA-1$). The pair $RLA-2$ should close just before the pair $RLA-1$ open. The lamp contacts $RLA-1$ should preferably be of the "heavy duty" type, although two "light duty" pairs have been used by the writer for many months without adverse effect.

COMPONENTS LIST

Resistors:

$R1$	$10k\Omega$	$R4$	see text
$R2$	$100k\Omega$	$R5$	22Ω
$R3$	see text		
	All 10%, $\frac{1}{4}W$ carbon		
$VR1$	$15k\Omega$ wire-wound potentiometer (Colvern CLR 3001)		

Capacitors:

$C1$	$1\mu F$ paper 350V
$C2$	$8\mu F$ electrolytic 450V

Switches:

$S1$	3-pole, 3-way wafer switch (Oak-NSF)
$S2$	S.P.S.T. toggle switch
$S3$	D.P.S.T. toggle switch

Miscellaneous:

RLA	P.O. type 3000 relay, 2000Ω coil. Two sets of contacts; one normally open, one normally closed
$T1$	Heater transformer, Primary 200-250V. Secondary 6.3V 0.3A
VI	12AU7 or ECC82

Setting Up

The timing ranges are determined by the values of R4 and R3, the latter being shorted out by switch S2 for the lower range.

With the unit connected to the mains supply and S2 closed, set the control VR1 to a maximum, that is, all resistance in circuit. Try a resistor of value between 2.2M Ω and 3.3M Ω for R4 and on switching to TIME, check for a period of about 10 seconds, using a stop watch or the second hand of a

watch. When a value has been found that will give a maximum of about 10 to 12 seconds, the rest of the scale can be calibrated down to a lower limit of about 0.5 second. Note that the extreme lower part of the scale will be indeterminate, the lowest consistent timing being obtained with about one-eighth travel of the control in circuit.

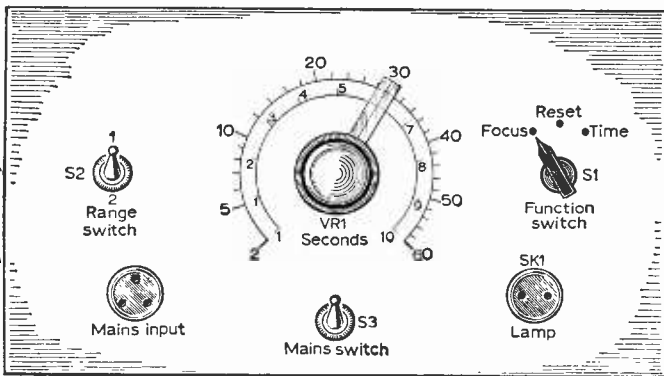
Now connect a further resistor of about 6.8 to 10M Ω in series with the value for R4 already used, and with the control again at maximum, check the timing to get a value of about 60 seconds. When this has been done, the rest of the scale can be calibrated as before; this time a lower limit of about 3 to 5 seconds will be obtained, so that there

Extending the Range

For longer timings, C1 may be increased to 2 μ F or higher, but an electrolytic should not be used here, only paper of 350V working or higher, and of best quality. Similarly R3 and R4 may be increased to give higher ranges.

All resistors may be $\frac{1}{2}$ W rating, though higher ratings may be used if readily to hand. The valve should be of a type such as the 12AU7 (ECC82) using a B9A base, or the 6SN7 or equivalent in the octal series. The two triode sections in these valves are strapped across to make a single triode. ■

Fig. 3: A suggested layout of controls for the front panel of the instrument.



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A MEDIUM WAVE RECEIVER

An inexpensive
two-valve circuit

By D. G. HARDING

THIS receiver was designed to give enough power to operate a loudspeaker and yet use few inexpensive and readily available components. It is therefore ideal for beginners to construct.

Fig. 1 shows the front view of the receiver, but the front panel can be omitted if desired. In the prototype it was found that a slow-motion drive was not required as there was good separation between the stations. This set is quite sensitive and

it will pick up Radio Luxembourg and many other Continental stations as well as local stations.

Circuit Detail

The circuit (Fig. 2) is very simple and uses only two valves. V1 (Z63) is the r.f. amplifier and detector. V2 (6J5) is used as the a.f. output valve.

To increase sensitivity, regeneration has been used. By this system some of the r.f. signal at the anode of V1 is inductively coupled back to the grid circuit by L2. The amount of regeneration is determined by the position of VR1, which controls the gain of this stage. No volume control has been used as the regeneration control can be used to decrease or increase the volume.

Power Requirements

The power requirements of this receiver are 6.3V at 1A and 250V at 40mA. This means that a small transformer can be used.

Chassis Layout and Wiring

Fig. 3 shows the chassis layout of the main components. All transformers and other major components should be bolted down before wiring commences.

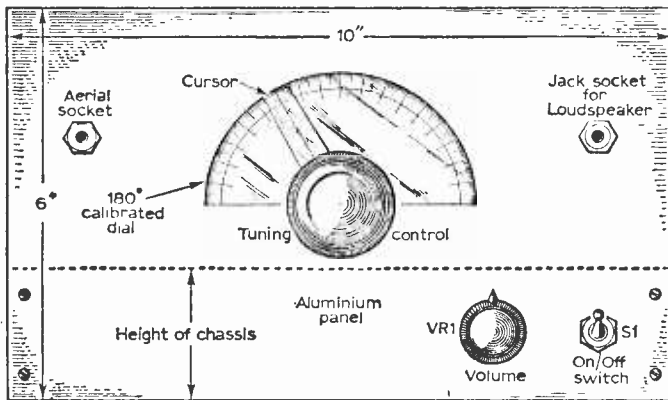


Fig. 1: A view of the front of the receiver.

Resistors: COMPONENTS LIST

- | | |
|-----------------|-----------------|
| R1 1M Ω | R5 47k Ω |
| R2 15k Ω | R6 47k Ω |
| R3 47k Ω | R7 15k Ω |
| R4 33k Ω | R8 150 Ω |
- All 10%, $\frac{1}{2}$ W
VR1 0.5M Ω potentiometer

Capacitors:

- | |
|---------------------------------|
| C1 0.001 μ F paper |
| C2 100pF mica or ceramic |
| C3 100pF mica or ceramic |
| C4 0.01 μ F paper |
| C5 0.01 μ F paper |
| C6 25 μ F electrolytic 25V |
| C7 16 μ F electrolytic 350V |
| C8 16 μ F electrolytic 350V |
| VC1 500pF air-spaced variable |
| TC1 5-40pF trimmer |

Inductors:

- | | |
|-------|----------------------------------|
| L1, 2 | See text and Fig. 4 |
| L3 | L.F. smoothing choke 10-15H 60mA |

Transformers:

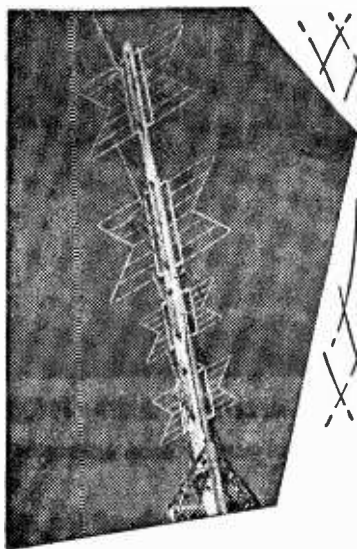
- | | |
|----|--|
| T1 | Small pentode output transformer:
7-8,000 Ω to 3 Ω |
| T2 | Mains transformer. Tapped primary.
Secondaries 0-250V 60mA; 6.3V 1A |

Valves:

- | | | | |
|----|-------------|----|------------|
| V1 | Z63 or EF36 | V2 | L63 or 6J5 |
|----|-------------|----|------------|

Miscellaneous:

- | | |
|--|--|
| MRI | Selenium rectifier DRM1B or DSM1
(Brimar) |
| S1 | S.P.S.T. toggle switch |
| Chassis 10in. x 6in. Two octal valveholders. | |
| Terminal strip. Jack socket. | |



On Your Wavelength

By THERMION

how flexible this method of recording is help to promote confidence in the minds of these members of the public when it appears a question of conviction or acquittal may depend upon a tape replayed in court? It would seem not.

This psychological aspect is, I submit, extremely important. Before such a system is adopted in courts of law it is essential that it be demonstrated to the public at large that it is, beyond all reasonable shadow of doubt, proof against interference.

Mains Connections

The need for rationalisation of colour coding for mains leads has been accepted by many countries, but the implementation of international agreements takes time. In the meanwhile a great variety of electrical appliances have been imported into this country and quite often the mains connections are at variance with our method of coding, i.e. red-live, black-neutral and green-earth.

Dangerous situations can arise particularly in the case of equipment of German origin since in that country it was common practice until recently to use the red lead for earthing purposes.

Before putting any imported equipment into service the obvious course is to examine the mains lead connections at the appliance itself, and to change these over if necessary in order to conform with British practice. If this cannot be easily performed, a suitable label bearing the identification of the three conductors should be tied to the plug end of the cable; this will be a future reminder, to other users, if not to you.

To Earth, or Not to Earth!

The use of double insulation for portable appliances is becoming increasingly common. For those not familiar with this term, it describes a method of construction where any exposed metal work is completely insulated from the remainder of the assembly—this protective insulation being quite separate from and additional to the functional insulation associated with the current carrying parts.

Such appliances require only a two-core cable, no earthing connection being needed. Vacuum cleaners, shavers and clocks are typical examples. The 1963 Amendments to the Regulations for Electrical Equipment of Buildings issued in December last year by the Institution of Electrical Engineers extend further the list of domestic appliances that now may use the double-insulation method of construction.

Familiarity with double-insulated appliances must not, of course, blind us to the vital importance of properly earthing the outer metalwork of all apparatus having only single insulation.

I SEE that an eminent Q.C. has proposed that statements made to the police by accused persons should be tape recorded, and that this recording should be played back in court and used as evidence, in place of the normal written and signed statement.

While I can appreciate that this suggestion is put forward as being in the interest of the individual concerned in a charge, I admit being a little worried about the implied immunity from interference which one supposes is the chief reason that has prompted this recommendation. It has been stated that special recorders without erase or rewind facilities would be employed and that the tape itself would be enclosed in a plug-in cassette; in this way the recorded tape would be completely inaccessible and so could not be cut and edited or otherwise tampered with. Nevertheless there would still remain the possibility of complete erasure if the cassette was brought near a strong magnetic field, although such a possibility is not, maybe, a serious objection since the presentation in court of a blank tape would prove highly embarrassing to the police.

As a further guard against electronic tampering it has been suggested that the original recording could embody a coded signal possibly at supersonic frequency, but this would complicate the equipment somewhat.

What is Your Verdict?

Assuming all these technical problems can be solved so that the security of the recording is no longer in doubt, will it be easy to convince the public that this is so? Remember that tape recorders are widely used by all kinds of people nowadays, and the creation of unusual sound effects by tape trickery is now a common pastime for many amateurs. Will this "inside" knowledge of recording techniques and the appreciation of

PRACTICAL CIRCUITS FOR ELECTRIC GUITARS

GUITAR AMPLIFIER, PRE-AMPLIFIER AND PICK-UP

ELECTRIC plectrum guitars employ magnetic pick-ups which are usually situated just beneath the steel strings. Acoustic instruments, i.e. those with a normally shaped hollow body, can easily be converted for electric operation by fitting suitable "pick-ups". The more modern version of the plectrum guitar may have a solid body and therefore the sound must be produced entirely by means of a magnetic pick-up and amplifier. These observations apply also to Hawaiian guitars constructed from solid wood.

Magnetic Pick-ups

However, the principle of electrical operation for both plectrum and Hawaiian guitars is the same: the steel strings are made to interrupt a magnetic field, thus creating small electric currents which can be amplified in the same way as those from a gramophone pick-up or a tape recording head. The construction of sensitive magnetic pick-ups is somewhat tedious and it is cheaper in the long run to purchase these ready made. Excellent pick-ups with a high degree of sensitivity can be obtained from most large musical instrument dealers.

Control

As with any device which transforms mechanised vibration to alternating electric currents, subsequent amplification is usually required. The signals produced by such devices can also be modified electrically: this means that various forms of tone control can be applied and other effects introduced before or during amplification.

The position of the pick-up(s) relative to the strings and the bridge, for instance, has considerable effect on the harmonic content of the output and therefore the overall tone. To make the most of this two, and sometimes three, pick-ups are employed, as shown in Fig. 1. The pick-up nearest the bridge produces a thin, hard tone, the one nearest the fret board a deeper and more mellow effect. In addition to this variable electrical tone control may be applied as well as

suitable volume control and/or fixed attenuation for "solo to rhythm" playing.

Control Circuits

Electrical circuits may be employed for the modification of an acoustic plectrum guitar or

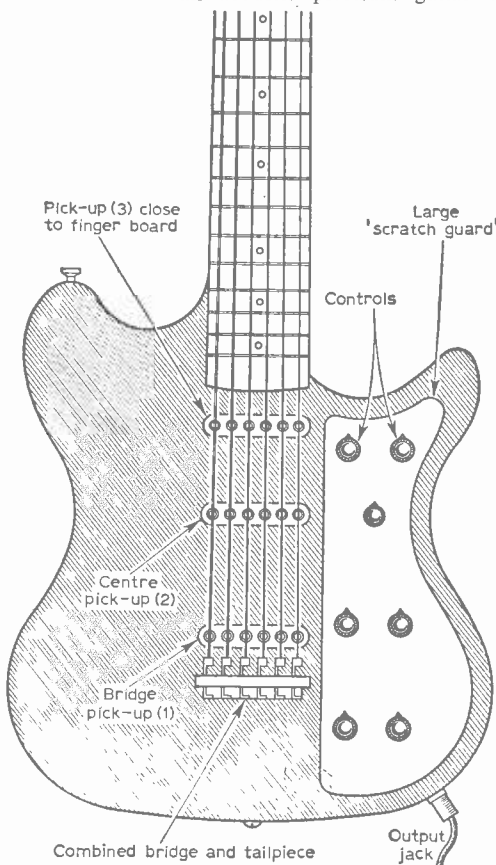


Fig. 1: The layout of controls and pick-ups on a modern guitar.

REFERENCES 1 AND 2

- Electronic Music and Musique Concrète*, by F. C. Judd, A.Inst.E. (Neville Spearman Limited).
Radio and Electronic Hobbies, by F. C. Judd, A.Inst.E. (Muscum Press).



CONTROL CIRCUITS DESCRIBED BY F. C. JUDD

incorporated in home-constructed Hawaiian guitars (Refs. 1 and 2).

The control system of Fig. 2 is for tone and volume control with a single pick-up and the few components can be mounted on the "scratch guard" or an extension of it. A rhythm switch has also been included (S1).

Component details are given in the circuit and so long as screened interconnecting leads are used where indicated there should be no problems with induced hum. As an extra precaution against this the underside of the scratch guard or an extension of it may be lined with thin aluminium or tinplate which must be earthed to the common earth of the output lead. (Note: The output lead to the amplifier must, of course, be screened.)

Control for Three Pick-ups

The circuit of Fig. 3 is for three pick-ups, although this could be modified for two if required. It provides for independent volume and tone control over each pick-up, either of which may be selected by the ganged switch S1, S2 and S3.

A "rhythm switch" S4 and S5 has also been included. This brings a fixed attenuator into

circuit, thereby reducing the output automatically for "rhythm" or chord playing. This control system does, of course, require more space but with careful layout can be built into a large "scratch guard" as in Fig. 1.

Tremolo Control

In *Practical Wireless*, February, 1961, the author described an electronic tremolo unit which could also serve as a guitar preamplifier.

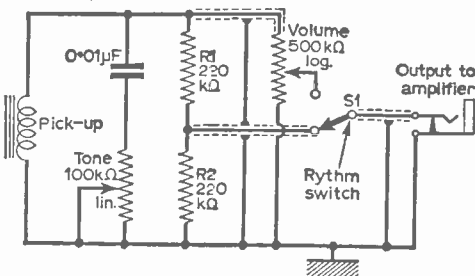


Fig. 2: A tone and volume control circuit. (Note: reducing the value of R2 will reduce the output.)

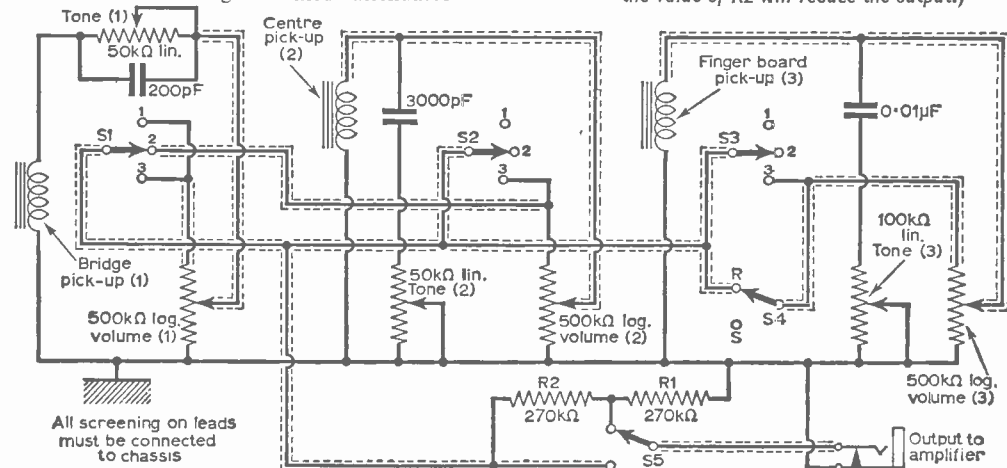


Fig. 3: The control circuit for three guitar pick-ups.

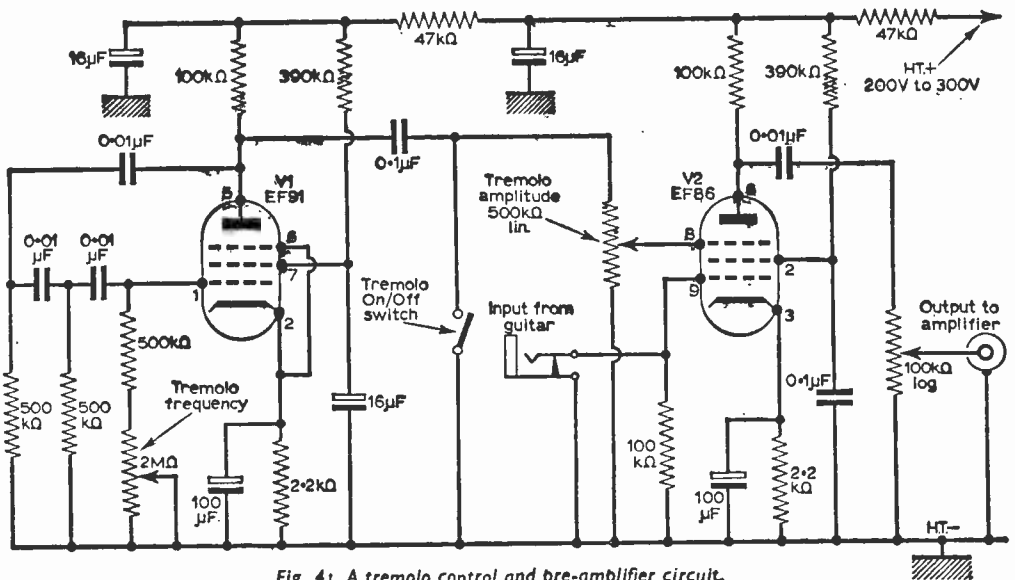


Fig. 4: A tremolo control and pre-amplifier circuit.

One of the greatest problems with electronic tremolo is the familiar "thump" caused by harmonics from the tremolo oscillator, which operates on a fundamental frequency of 6 to 10c/s. The circuit shown in Fig. 4 is a much modified version of the one which appeared in the *Practical Wireless* article mentioned above. (Those who have already built this unit could modify it quite easily to the new circuit.)

The tremolo oscillator V1 employs the familiar phase shift circuit and almost any modern h.f. pentode will operate—viz.: EF91, EF80, etc. The

pre-amplifier V2 must be an EF86 because the tremolo signal is applied to the suppressor grid (G3).

The tremolo amplitude is controlled by VR2, but remember that beyond a certain point "thump" might be apparent due to excessive level. Tremolo frequency is controlled by VR1 and the output from the pre-amplifier by VR3. Because of the high gain of V2 the output voltage from the pre-amplifier is quite considerable. The gain

—continued on page 961

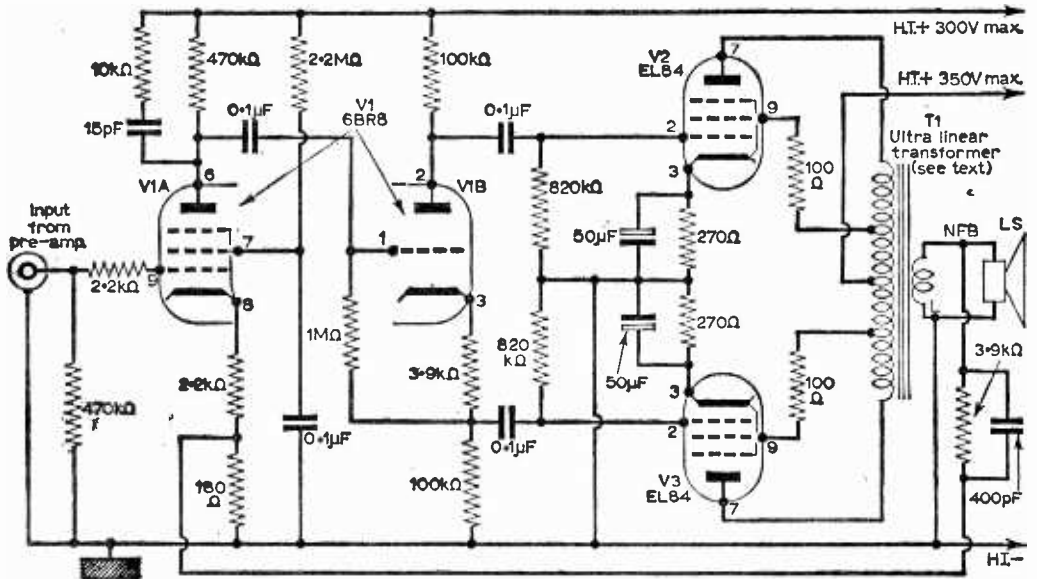


Fig. 5: A power amplifier circuit for electric guitars.

A DOOR INTERCOM

A simple yet versatile piece of equipment

By P. HENDERSON

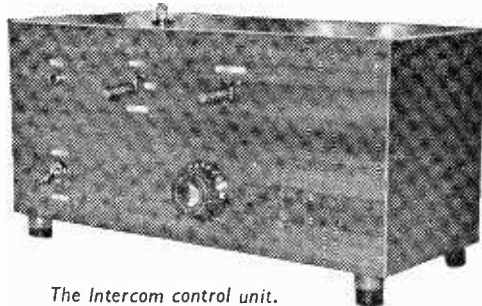
THIS unit was designed for an upstairs flat to avoid tiring journeys up and down stairs in order to answer the door to callers. It allows for two-way conversations between the living room of the flat and callers at the front door, by way of an amplifier unit and an extension loudspeaker unit, the latter being installed outside the front door. An additional facility is provided, namely that the door can be unlocked from upstairs when required.

The Amplifier Unit

The basic unit is a two-stage high-gain amplifier, using a 6SH7 resistance coupled to a 6V6 in a simple manner as shown in Fig. 1. The switch S1 connects the unit to any number of separate extensions as well as to the front door. In the prototype for example, there is an extension to the garage-

workshop. A relay RLA with a high impedance coil that is actuated from the h.t. line of the amplifier through a suitable ballast resistor when the "press-to-talk" switch S3 is closed, controls the changeover from "Listen" to "Talk". This relay is equipped with two sets of changeover contacts.

Resistors R6 and R7 act as "ballast" for the relays RLA and RLB respectively; their values must be determined by experiment. The connections to and from the relay contacts should be carried out using screened cable to minimise hum pick-up. No feedback is incorporated in the ampli-



The Intercom control unit.

fier, and the unit is quite stable after the addition of the 0.002μF mica capacitor C9 across the primary of T2. The design of the amplifier cabinet is not critical. As very little heat is liberated during the quiescent period, only a fair degree of ventilation is required. The power unit is shown in Fig. 2.

Extension Leads

For the door extension, three-core wire is used, two cores feeding the speaker, and the remaining core, together with one of the speaker leads as

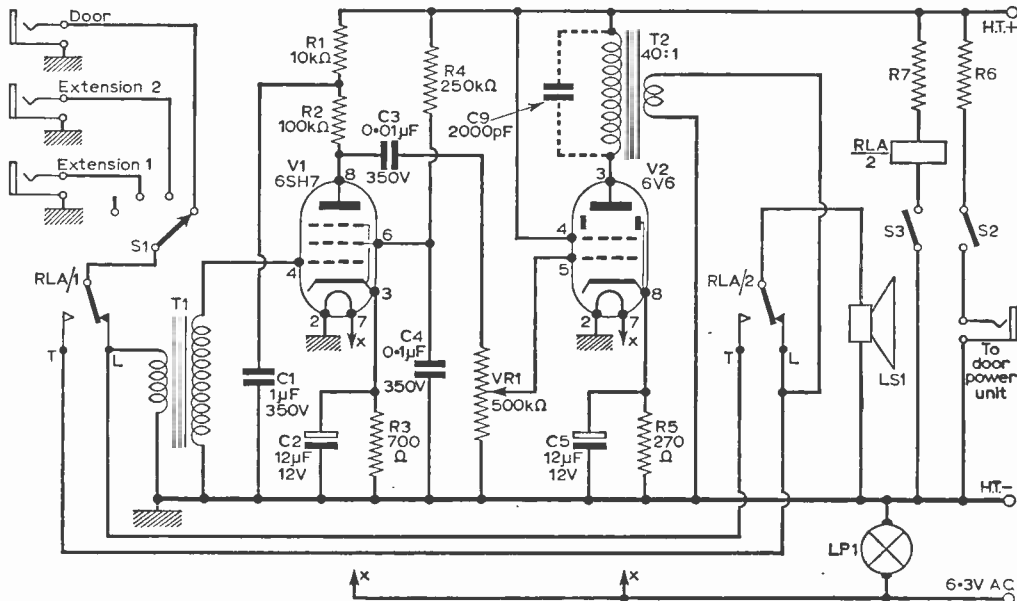


Fig. 1: The two-stage amplifier circuit.

common, supplies the feed from S2 to the relay RLB in the l.t. power unit. See Fig. 3 and Fig. 4. All other extensions require only twin feeds.

Door Loudspeaker

In the author's installation, a surplus Tannoy speaker unit was pressed into service. This speaker is mounted outside the front door in a suitable position in its original case. However the terminals on the outside are ignored as they feed a transformer and a capacitor, both of which are *not* used in this unit now.

The supply to the speaker is connected directly to the speaker leads, and the speaker itself is

When the door bell rings, one closes the switch S5, and the current is fed to the heaters of the 5Y3 rectifier. This being a directly heated valve, h.t. is applied to the amplifier after a delay of only five seconds or so. A neon indicator V5 connected to the h.t. line indicates when the h.t. is applied, and one can then speak.

A similar neon (V4) is used to indicate that the mains is switched on to the unit; alternatively, a 6.3V dial lamp can be wired into the heater circuit.

Remotely Controlled Door Lock

Although knowing who is at the door is a great help, it is still often necessary to go downstairs to open the door to allow the caller to enter. This unit allows a modified Yale type lock unit to be unlocked from upstairs (or any other distant position) as well. A Yale type lock is installed in the usual way, if not already fitted, but the lock case is altered as shown in Fig. 5.

A small hole is cut in the case, and a short length of screwed rod is connected to one of the "legs" of the lock mechanism, and the other end is connected to the solenoid plunger.

The solenoid itself is made from a car indicator arm solenoid. The original windings are removed, and 8oz. of 20s.w.g. enamelled copper wire wound on to the original former. Two cardboard or formica "cheeks" will be needed to contain all the new wire within the length of the

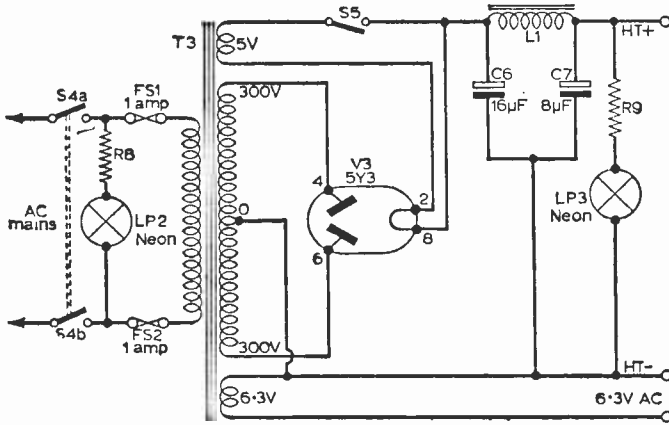


Fig. 2: The power pack circuit.

enveloped in a polythene bag to make it more weatherproof. Although the Tannoy's impedance is actually 7Ω, the mismatch does not appear to cause trouble, as callers are clearly heard even at considerable distances from the speaker.

Method of Operation

In the "Listen" position, the loudspeaker outside the front door acts as a microphone and feeds its signal to the primary of T1 through contacts RLA/1 in the "L" position. The signal is amplified, the gain being controlled by VR1, in the usual manner. The output transformer T2 conveys the audio signal to the amplifier loudspeaker LS1 by way of contacts RLB/2 in the "L" position.

An elliptical loudspeaker is used in the author's main control unit. This loudspeaker is mounted facing upwards, and one speaks down to it, with very satisfactory results.

When one wishes to know who a caller is, the press-to-talk switch S3 is closed, and so relay R1A is energised and the contacts "1" and "2" are set to the "T" position. The loudspeaker LS1 in the amplifier now acts as a microphone, and its output is fed to the primary of T1, and the signal from the amplifier is fed to the door loudspeaker LS2 through the output transformer and S1.

Each morning the mains switch S4 is switched on and the heaters of the 6SH7 and the 6V6 are thus supplied with current. The unit is left in this state ready for use, all day, as consumption is quite small, and the unit is then always ready for immediate use.

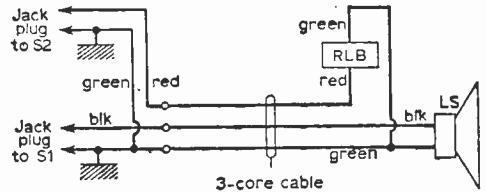


Fig. 3: Interconnecting wiring for the door extension.

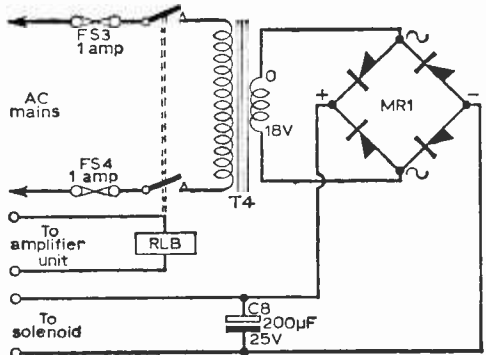


Fig. 4: Wiring between S2 and the l.t. power unit.

former. The ends of the windings are taken to a small connecting block. The remote end of the solenoid is screwed to the inside of the door, using washers to space the solenoid off the door so that the solenoid plunger and lock mechanism is free to move and does not bind.

The solenoid is energised by a l.t. supply unit, as shown in Fig. 4. This unit supplies sufficient d.c. to energise the solenoid, ensuring a certain and small withdrawal of the lock tongue.

The supply from the l.t. unit to the solenoid is carried out in mains type twin 3/029 in order to minimise volt drop due to the heavy current drawn by the solenoid. The lead is carried up the inside

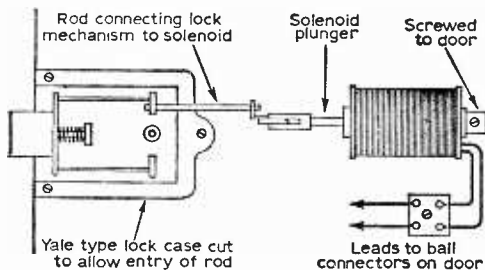


Fig. 5: Modifications to the Yale lock.

edge of the door frame (see Fig. 6(b)) and each core supplies its own brass contact strip, as shown.

The supply is picked up from these two strips by a pair of small spring-loaded balls in brass cases used as ball and socket door catches. These are fitted as near to the outside face of the front door as shown in Fig. 6(a). The holes to accommodate the catches are drilled well into the door frame, so that small holes may be drilled from the inside of the door to meet them.

Wires are soldered to the rear of the ball holders as in Fig. 6(c) and the leads are lead through the communicating holes, and the leads connected to the connecting block to complete the supply circuit.

COMPONENTS LIST

Resistors:

- R1 10kΩ
- R2 100kΩ
- R3 700Ω
- R4 250kΩ
- R5 270Ω
- VR1 0.5MΩ carbon potentiometer
- R6 (ballast for RLB)
- R7 (ballast for RLA)
- R8 (see LP3)
- R9 (see LP3)

Capacitors:

- C1 1μF paper 350V
- C2 12μF electrolytic 12V
- C3 0.01μF paper 350V
- C4 0.1μF paper 350V
- C5 12μF electrolytic 12V
- C6 16μF electrolytic 450V
- C7 8μF electrolytic 450V
- C8 200μF electrolytic 25V
- C9 2,000pF mica

Transformers:

- T1 Microphone or miniature output transformer, 60 : 1
- T2 Pentode output transformer with 3Ω secondary
- T3 Mains transformer. Secondaries: 350-0-350V 80mA; 6.3V 3A; 5V 2A.
- T4 Mains transformer. Secondary: 15 to 18V 10A

Switches:

- S1 Rotary switch, single pole, number of ways to suit extensions required
- S2 Toggle switch, single pole on/off
- S3 Push button switch, single pole
- S4 Toggle switch, 2 pole on/off
- S5 Toggle switch, single pole on/off

- FS1-4 1A fuse
- L1 Smoothing choke 10-20H 80mA
- MR1 Bridge rectifier 20V 10A
- RLA P.O. type relay, with high impedance coil. Two sets of changeover contacts.
- RLB P.O. type relay, with high impedance coil. Double pole make-break contacts

Valves:

- V1 6SN7
- V2 6V6
- V3 5Y3

Lamps:

- LPI 6.3V lamp
- LP2, 3 Neon indicator, mains type with resistors (R8, R9) included
- LS1 Loudspeaker unit 3Ω
- LS2 "Tannoy" or similar loudspeaker unit 3Ω

Miscellaneous:

Jack sockets. Three I.O. valveholders. Sufficient p.v.c. insulated twin 3/029 for solenoid supply. Two 4 oz. reels of 20 s.w.g. enamelled copper wire. Connector block. Other sundry items for solenoid unit and door contacts as detailed in text.

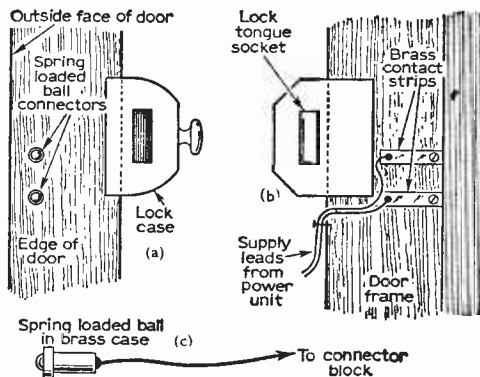


Fig. 6(a): The spring-loaded ball contacts.

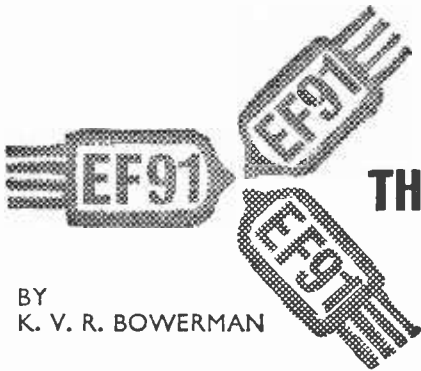
Fig. 6(b): Fitting the solenoid supply lead.

Fig. 6(c): Wiring to the ball contact holders.

It will be appreciated that the supply to the solenoid will cease when the door has been pushed so far open, and the balls lose contact with the brass strips, but this is of no consequence, as by then the tongue of the lock will be well clear of its socket on the door frame.

When S2 on the amplifier is closed h.t. current energises RLB in the l.t. supply unit, switching on the mains supply to the transformer T4. This transformer supplies about 10A and 15-18V to a 10A bridge rectifier. (The 200μF capacitor is not essential, but does eliminate the a.c. hum from the solenoid.)

The complete l.t. unit is situated as near to the door as possible so as to keep the supply lead short.



THE VERSATILE EF91



BY
K. V. R. BOWERMAN

ONE of the cheapest and most efficient pentode valves obtainable is the EF91. This valve has a large number of "aliases", among them 6AM6, 8D3, 6F12, Z77 and CV138, and it can be obtained for as little as 1s. 9d. from advertisers in this magazine.

Designed as a high-slope r.f. pentode, the EF91 is, in fact, far more versatile than this might suggest. It operates well at any frequency and appears to be quite tolerant about operating conditions, and consequently, lends itself well to every kind of circuit. E.M.I. even used it in early television receivers as a sound output valve.

The purpose of this article is to give two examples of simply constructed equipment, quite suitable for beginners, which work extraordinarily well and cost very little to make. If you have a well-stocked "junk box", so much the better.

EF91 Switched Superhet

The first piece of equipment to be described is a switched superhet receiver for a.m. Three stations can be selected and, in the prototype, these were the Light Programme on 247m., the Home Service on 330m., and the Third Programme on 464m. Of course, any three stations in the medium waveband can be brought in as required. A modification described later enables one long wave station to be substituted for one of the medium wave stations, if necessary.

The Superhet Circuit

Five EF91 valves are used in the receiver shown in Fig. 1(a).

The r.f. signal appears across the ferrite rod winding and is tuned by TC1 alone, or TC1 plus TC2, or TC1 plus TC2, plus TC3, depending on which station is required. The tuned signal is fed to the control grid of V1.

V2, strapped as a triode, acts as the local oscillator. The oscillator coil L2 is tuned by TC4, or TC4 plus TC5, or TC4 plus TC5 plus TC6, depending on which station is required. The oscillator signal is fed via the very small capacitor C2 to the control grid of V1, this latter valve thus acts as a mixer. This system, unconventional though it may be, nevertheless works extremely well.

A number of complex signals now appear at the anode of V1, including the i.f. The i.f. transformer,

T1, selects the required signal and feeds it to the grid of V3. This valve operates as a straightforward, conventional, i.f. amplifier. The amplified i.f. signal now finds its way via C8 and R7 to the grid of V4.

Strapped as a triode, V4 is wired as a "leaky grid" detector, mainly because this is simple to set up and is very sensitive.

The detected audio signal now appears across the volume control VR1, the slider of which is connected to the control grid of V5. This valve operates as an output pentode and drives the loud-speaker via T3.

The power pack is very simple (Fig. 1b). One secondary on T4 supplies the heater current, and another supplies the half-wave rectifier MR1. Choke L3 and the two electrolytic capacitors, C13 and C14, provide adequate smoothing and regulation.

C9 serves to remove any residual i.f. signal from the audio circuits. R12 and R13 may not be required, but can be fitted if there is a tendency to i.f. instability; their function is to broaden the tuning of the i.f. transformers so that they do not give too "peaky" a response which can lead to oscillation in the very high gain EF91 valves.

Construction

The chassis illustrated (Fig. 2) is considerably larger than necessary but was used merely because it happened to be on hand. Obviously a smaller chassis can be employed, so long as the components fit fairly well without overcrowding.

Layout is not critical, provided grid and anode leads are kept well away from each other and as short as practicable.

First, mark out the chassis and drill as necessary. Next, mount the valveholders (with a solder tag under one bolt on each), then the i.f. transformers, mains transformer, choke (if used), smoothing capacitors, rectifier and output transformer (Figs. 2 and 3).

Now fit the volume control, station selector switch and on/off switch.

The wiring can now be started. Solder the heater wiring first, tucking the "hot" lead well into the corners of the chassis. Next, wire the bias resistors and by-pass capacitors, together with the chassis returns for the heater and any other earth wiring on the valveholders. Don't forget to earth

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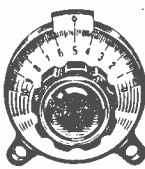
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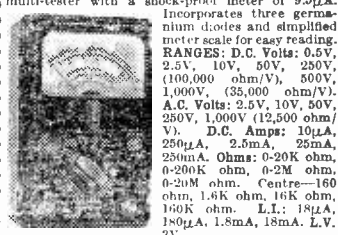
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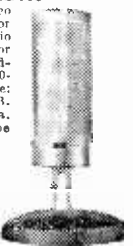
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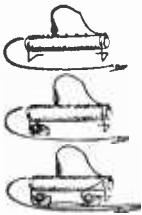
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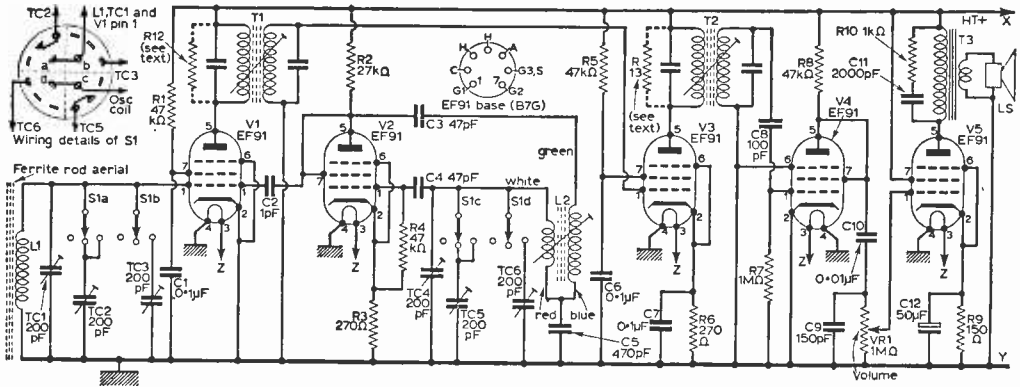


Fig. 1a (above): The superhet circuit.

Fig. 1b (right): The power supply circuit for the superhet receiver.

COMPONENTS LIST
SWITCH-TUNED SUPERHET (Fig. 1)

Resistors:

R1	47kΩ	R8	47kΩ
R2	27kΩ	R9	150Ω ½W
R3	270Ω	R10	1kΩ
R4	47k	R11	100Ω 2W
R5	47k	R12	47kΩ
R6	270Ω	R13	47kΩ
R7	1MΩ		

All 10%, ½W unless otherwise stated
VR1 1MΩ potentiometer

Capacitors:

C1	0.1μF paper
C2	1pF silver mica
C3	47pF ceramic
C4	47pF ceramic
C5	470pF silver mica
C6	0.1μF paper
C7	0.1μF paper
C8	100pF silver mica
C9	150pF silver mica
C10	0.01μF paper
C11	2,000pF paper
C12	50μF electrolytic 50V
C13	32μF
C14	32μF

} electrolytic 300V

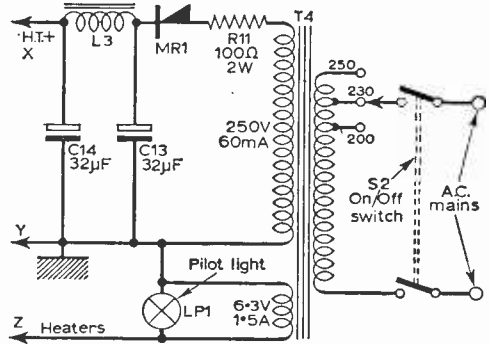
TC1, 4 200 + 200pF double trimmer
TC2, 5 200 + 200pF double trimmer
TC3, 6 200 + 200pF double trimmer

Inductors:

L1	Ferrite rod aerial, with m.w. winding (Teletron)
L2	Oscillator coil, m.w. (Weymouth HO3)
L3	Smoothing choke 10-20H 80mA

Transformers:

T1, 2	I.F. transformer, 465 kc/s
T3	Pentode output transformer, 3Ω secondary
T4	Mains transformer. Secondaries: 0-250V 60mA; 6-3V 1.5A
S1	4-pole, 3-way wafer switch
S2	Toggle switch, d.p.s.t.
LP1	6-3V 0.5A pilot lamp
MR1	Metal rectifier 250V 75mA
VI-5	EF91



the centre spigot of each valveholder. For earthing large components, the writer found it convenient to run a "busbar" of 18s.w.g. tinned copper wire between two tags along the length of the chassis. The by-pass capacitors can then be lined up quite neatly, as can be seen. The screen and anode resistors should be soldered next, as close as possible to the tags on the valveholders.

Now mount the oscillator coil as close to the tags of V1 valveholder as it will go. Carefully solder the components associated with the oscillator circuit. Don't overheat the solder tags on the oscillator coil otherwise the polystyrene former will melt. Finally, run the h.t.+ line.

The next problem is to mount the ferrite rod and the three double trimmers. All these components are on top of the chassis and must be immediately above the station switch and oscillator coil. On the chassis illustrated, the trimmers are along one end. It may be considered more convenient to have them along the back of the chassis so that they can be adjusted while the set is in its cabinet.

The ferrite rod is secured to a strip of insulating material (such as Perspex or Paxolin), and this, in turn, is mounted on a simple bracket made from a strip of aluminium. Wiring of the rod, trimmers and switch, should now be carried out as shown.

Finally, connect the pilot light, speaker lead, speaker and mains lead—but do not plug in yet (see Testing and Alignment). The speaker frame, one side of the speech coil and the speaker transformer clamp should all be connected to chassis.

Testing and Alignment

Before plugging in, test between the positive terminal of C14 and chassis with an ohmmeter set to a high resistance range. The needle should give a kick as the capacitor charges and then sink back to infinity (or at least 2mΩ). If the needle swings over to zero and stops there, there is a short on the h.t.+ line and the wiring should be carefully checked to find the fault. If all is well, however, plug in the mains lead and switch on. The pilot light and valveheaters should light up.

Set meter to 300V d.c. range and again apply it between the positive tag of C14 and chassis. The h.t. line voltage should be between 220 and 250V.

This is not critical but if much above 250V, increase the value of R11. If all is well, proceed with the alignment, which is given below in numbered steps:

- 1 Switch on and allow set to warm up. Unscrew all trimmers. Set volume control three-quarters towards full volume. Set S1 to position 1.
- 2 Temporarily attach about a yard of wire to act as a "throw-out" aerial to the "hot" tag of TC1.
- 3 Using a screwdriver of insulating material (a piece of ebonite or Tufnol rod filed to a screwdriver point is ideal), slowly screw in TC4 until the Light Programme is heard faintly.

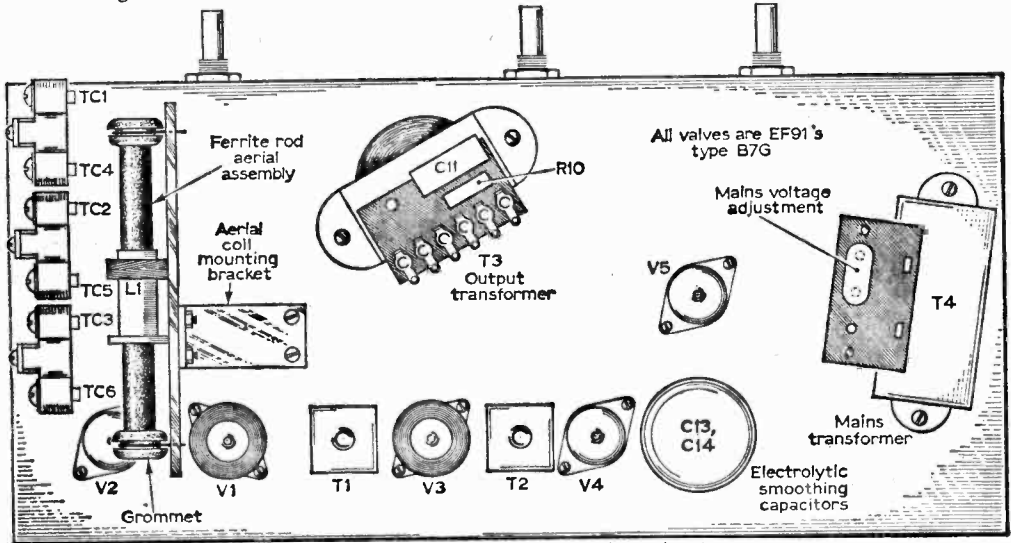


Fig. 2: The layout of components above-chassis.

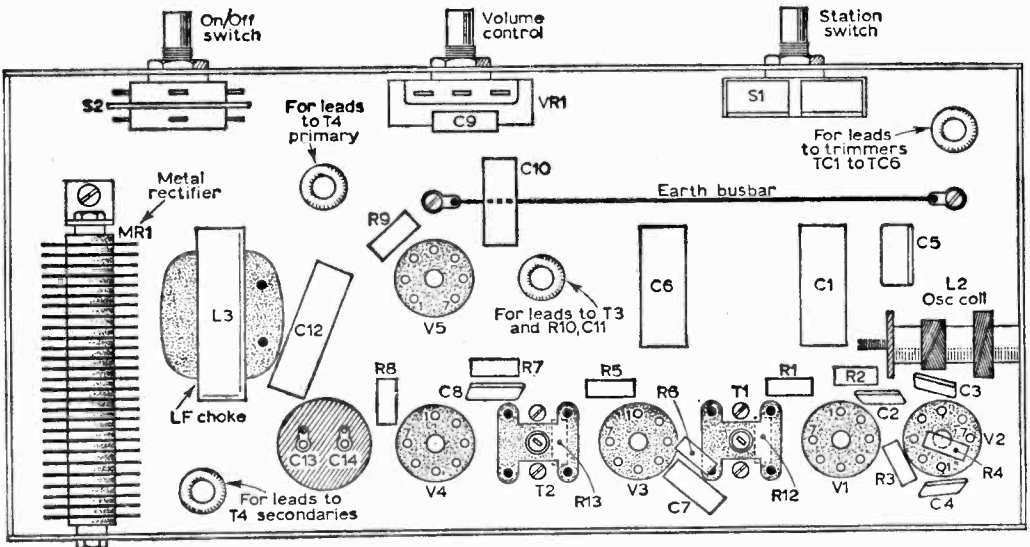


Fig. 3: An underchassis view of the receiver.

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25/25v. 50/12v. 1/9; 8+8/450v. 4/6; 50/50v. 100/125v. 2/-; 32+32/275v. 4/6 8/450v. 4/350v. 2/3; 50/50/350v. 6/6 18+16/450v. 5/6; 60/250/275v. 12/6 32+32/450v. 6/6; 100+200/275v. 12/6

SPECIAL BARGAIN

1/2 Meg. VOL. Controls DP. Sw. 4" flatted spindle. Famous Mfrs. 4 for 10/-, post free.

RECORD PLAYER CABINETS 59/6 Carr. & Ins. 5/-

Contemporary style, rexine covered cabinet in two-tone maroon and cream. Size 13 1/2" x 8 1/2" x 8 1/2", fitted with all accessories including baffle board and Vnair fret. Space available for all modern amplifiers and auto-changers etc. (Ncut record player mounting board 11 1/2" x 12 1/2" supplied).

2-VALVE 2 WATT AMPLIFIER. EZ80 and Twin stage ECL82 with vol. and neg. feedback tone control. A.C. 200/250V with knobs, etc., ready wired to fit above cabinet. £2.17.6. P. & P. 1/6, 7" x 4" Speaker and trans. 22/-, P. & P. 2/-.

COMPLETE R/PLAYER KIT. As illus. BSR UA14 Unit. New Bargain Price Now Only £11.10.0. 7/6 carr. Double wound mains Tr. no live chassis!

YGAN FRET (Contemp. pat.), 12 x 3in. 2/-; 12 x 18in. 3/-; 12 x 24in. 4/-, etc.

XPANDED ANODISED METAL. Reactive gilt finish 1/2 in. x 1/2 in. anodized brass 4/8 sq.ft. Multiple of 5 n. cut. Max. size 4ft. x 3ft., 47/6, ins carr.

NAMBELED COPPER WIRE—h. reels 14g-20g. 2/6; 22g-28g. 3/-; 1g-34g 3/9; 36g-38g. 4/3; 39g-40g. 6. 3/6.



MULLARD "3-3" HI-FI AMPLIFIER. 3 VALVES 3 WATT

3 ohm and 15 ohm Output. A really first-class Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line up: EF86, EL84, EZ81, Extra HT and LI available for Tuner Unit addition. This is the ideal companion Amplifier for FM tuner units.

TECHNICAL SPECIFICATION—
 Pres. Response: + or - 1 dB 40 c/s-25 Kc/s. Tone controls: Max. Treble Cut 12 dB at 10 Kc/s. Max. Bass Boost 14 dB at 80 c/s. Sensitivity: 100 Mv for 3 w. output. Output Power (at 400 c/s): 3 w. at 1% total harmonic distortion. Hum and Noise Level: At least 70 dB below 3 w.

Bronze Escutechon, Printed Vol. Treble. Bass. On-Off, supplied with each Kit.
 Recommended Speakers—WB. HF 1012. £4.7.6. Goodmans AXIOM 10. £6.5.0. 8in. AXIETTE £5.5.0 or AUDIOM 51 £8.10.0.

DE-LUXE RECORD PLAYER KIT

Incorporating 4 Sp. Garrard Auto-Slim unit and Mullard latest 3 w. amplifier (ECL 86 and EZ 80), vol. bass and treble controls, with 8" x 5" 10,000 line speaker. Contemporary styled 2-tone cabinet, charcoal-grey and off-white with matching blue relief. Size 17 1/2" x 16" x 6"

COMPLETE KIT £13.19.6
 Carr. and ins. 10s.
 Cat. & Const. details 2/6 (free with kit).

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 Single Players carr. 3/6
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TRANSISTOR COMPONENTS

Midget I.P.'s.—465 Kc/s 7^{1/2}in. diam. 5/3
 Osc. Coil M. & L.W. 5/9
 Midget Driver Trans. 3.5-1/2
 Midget Output Trans. Push-Button 3 ohms 6/9
 Elect. Condensers—Midget Type 1 mfd.-50 mfd. ea. 1/9, 100 mfd. 2/-, 12V.
 Condensers 150 v. working: .01 mfd. .02 mfd. .03 mfd. .04 mfd. .05 mfd. .1 mfd. 1/- .25 mfd. 1/3; .5 mfd. 1/6, etc. Midget Tuning Condensers. 3/6. "OO" 208 pF and 176 pF. 8/6. ditto with trimmers, 9/6. JTB. 220pF and 105pF conc. auto motion 19/8. 365pF single 7/8. sub. Min jin. Dalemin 100 pF. 300pF. 500pF. 7/- each.
FERRITE AERIALS. M. & L.W.
 car aerial coil 9/3.
 Midget Vol. Control with edge control knob, 5 K/ohms, with switch 4/9; Ditto less switch 3/9.
 Speakers: P.M.; 3in. Plessey 7/6 6ohms 15/8. 2 1/2in. Continental 8 ohms 13/6. 7 x 4in. Plessey 35 ohms 23/6.
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 Brand New. Mfrs. 1st grade. 1 OC44 & 2 OC45. 16/6. 1 OC81D & 2 OC81. 15/6. All above and OAS1. 32/6, Post Free.

7 VALVE AM/FM RADIOGRAM CHASSIS

Valve line-up ECC85, ECH81, EF89, EABC80, EL84, EM81, EZ80. Three Waveband and Switched Gram positions. Med. 200-550 m. Long 1,000-2,000 m. VHF/EM 88-95 Mc/s. Philips Continental Tuning Insert with permeability tuning on FM and combination AM/FM (F. transformers, 480 Kc/s. and 10.7 Mc/s. Dust core tuning all coils. Latest circuitry including AVC and Neg. Feedback. Three watt output. Sensitivity and reproduction of a very high standard. Chassis size 13 1/2 x 6 1/2 in. Height 7 1/2 in. Edge illuminated glass dial 11 1/2 x 3 1/2 in.

Vertical pointer. Horizontal station names. Gold on brown background. A.C. 200/250v. operation. Magic-eye tuning. Cct. diagram now available.

Aligned and tested ready for use £13.10.0 Carr. & ins. 7/6.

Complete with 4 Knobs—walnut or ivory to choice. Indoor FM aerial 3/6 extra. 3 ohm P.M. Speaker only required. Recommended Quality Speakers 10in. Elac H/1D. 30/-; 13 1/2 x 5in. E.M.L. "Fidelity", 35/-; 12in. B.A. with cone. Treeter. 42/6. Carr. 2/6.

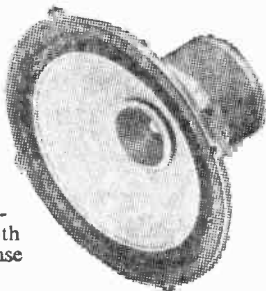
BONDACOUST Speaker Cabinet Acoustic Wadding (lin. thick approx.) 12in. wide, any length—1/6 ft., 4/-, yd. **TINNED COPPER WIRE**. 16-22g. 2/6 3lb. **FRSN MULTICORE SOLDER**. 50/10 4d per carr. Cartons 2/6 etc.

We manufacture all types Radio Mains Transf., Chokes, Quality O/P Trans., etc. Enquiries invited for Specials. Prototypes for small production runs. Quotations by return. Send for detailed bargain lists. 3d. stamp.

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Praise for the
**WHARFEDALE
 SUPER 10/RS/DD**

The following letter is typical of many received praising the performance of the new Wharfedale Super 10/RS/DD and the Golden 10/RS/DD both of which have a remarkably wide and smooth response as the response curve indicates.



16 Grant House,
 Albion Avenue,
 LONDON, S.W.8.

Dear Mr. Briggs,

I feel I must write to you to say how pleased I am with my converted W10 Speaker (now a Super 10/RS/DD) which I received safely on Saturday.

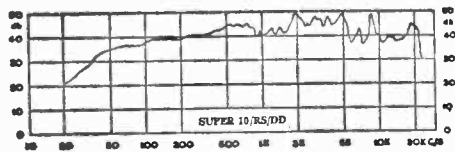
The treble response is a delight to hear and even my poor quality records sound better, no doubt due to the absence of peaks in the middle and upper register. My pressure unit tweeter has now been dispensed with as it certainly cannot compete with the treble in your unit.

Being lucky enough to live within good range of Wrotham, I was able to put it through tests with various transmissions including the Proms, and we all have been most impressed—the bass improvement is also exceptionally good.

Yours sincerely,

Geo. H. Hunter.

Impedance 10/15 ohms only. 1in. dia. centre pole. Flux density 16,000 oersteds. Max. input 10 watts rms or 20 watts peak. Frequency range 30-20,000 c/s. Aluminium voice coil. Roll surround and double diaphragm. Axial response curve. Mic. distance 12in. Input 4v. at 1,000 c/s.



PRICES: SUPER 10/RS/DD £10.18.8 including P.T.
 GOLDEN 10/RS/DD £7.17.5 including P.T.
 Descriptive Leaflet on request



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 Phone: Idle 1235/6

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 by LITESOLD



These new ADAMIN micro soldering instruments supplement the well-known LITESOLD models for special applications and still further extend our very comprehensive range of specialised soldering equipment.
 Bit sizes now 1/16in. to 1/32in.

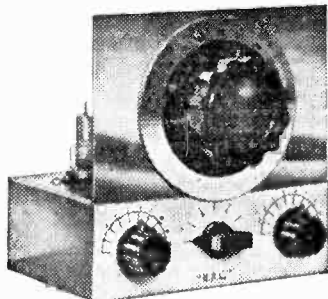
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The C10L (shown on bench stand) is probably the smallest mains voltage model in the world. Bit dia. 3/32in., length 7in., weight 1/2oz. (less flex). Heats in 30 secs.

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**NEW 1964 RANGE NOW READY
 ONE-VALVE MODEL "CX"—
 COMPLETE KIT PRICE 34/6**

Customers say: "Definitely the best one valve S.W. kit available at any price." This kit contains all genuine Short-Wave components, a drilled chassis, accessories and full instructions. Ready to assemble and of course as all our products, fully guaranteed. FULL RANGE of other kits still available including the famous model 'K'. Price 77/-.

Before ordering call and inspect a demonstration receiver or send for a descriptive catalogue and order form to:—

"H.A.C." SHORT-WAVE PRODUCTS
 (Dept. T.H.), 44 Old Bond St., London W.1.

- 4 If nothing is heard even when TC4 is screwed all the way from "fully out" to "fully in", give TC1 one turn clockwise and repeat 3.
- 5 As soon as the Light Programme is heard, remove the temporary wire aerial and adjust TC4, then TC1 for maximum signal, if necessary swinging the set round to orientate the ferrite rod towards the transmitter.
- 6 Switch S1 to position 2. Slowly screw in trimmer TC5 until the Home Service is heard.
- 7 Adjust TC5 then TC2 for maximum signal.
- 8 Switch S1 to position 3. Slowly screw in trimmer TC6 until the Third Programme is heard.
- 9 Adjust TC6 then TC3 for maximum signal.

Note that the Light Programme on 247 metres is not receivable in some localities. In these areas the long wave (1,500 metres) station must be brought in. This can be done by using a dual wave ferrite rod and an extra oscillator coil. The wiring modifications are shown in Fig. 4. the same principles in setting up apply.

Cabinet

The cabinet will, of course, depend largely on the shape and size of the chassis. The writer converted an old table receiver cabinet in somewhat crude fashion, see picture.

If the set is to do service in the kitchen it is usually possible to find a small space in a cupboard and build the set into that. Or a simply constructed cabinet made from 5-ply, carefully painted or covered with plastic material, often gives a surprisingly professional-like finish.

EF91 Push-pull Gramophone Amplifier

The circuit shown in Fig. 5 uses four EF91 valves and gives good volume and quality from a crystal pick-up. It is, of course, not in the hi-fi class, but it is ideal for "pop" records and gives reproduction well up to the standard of most "pop boxes". A simple top-cut tone control helps to get rid of surface noise on old records.

The Circuit Stage by Stage

The signal from the pick-up is fed through screened cable to the input terminals (these can conveniently be incorporated in a coaxial socket). The signal appears across VR1, which is the volume control. The slider of the volume control is connected directly to the grid of V1 which acts as a voltage amplifier. VR2 and C1 together form a simple tone control.

R2 and C4 provide automatic bias for V1, and R1 is the screen feed resistor. C5 forms the coupling between V1 and V2.

V2, strapped as a triode, is the phase-splitter. The anode load is split between R7 and R6, R6 being in the cathode line, and two equal signals but 180° out of phase appear, one at the "bottom" end of R7, the other at the "top" end of R6. These out-of-phase signals are fed via the coupling capacitors C7 and C8 to the control grids of V3 and V4.

The anodes of V3 and V4 are fed via the centre-tapped primary of T1, which is a push-pull output transformer.

The power pack shown for the switched superhet is quite suitable for this amplifier.

COMPONENTS LIST	
Additional Parts for L.W. Operation	
(Fig. 4)	
C5a	47pF silver mica
TC3a	100pF ceramic
TC6a	100pF ceramic
L1a	Ferrite rod aerial, with l.w. and m.w. windings
L2a	Oscillator coil, l.w. (Weymouth HO1)
S3	3-pole, 2-way wafer switch

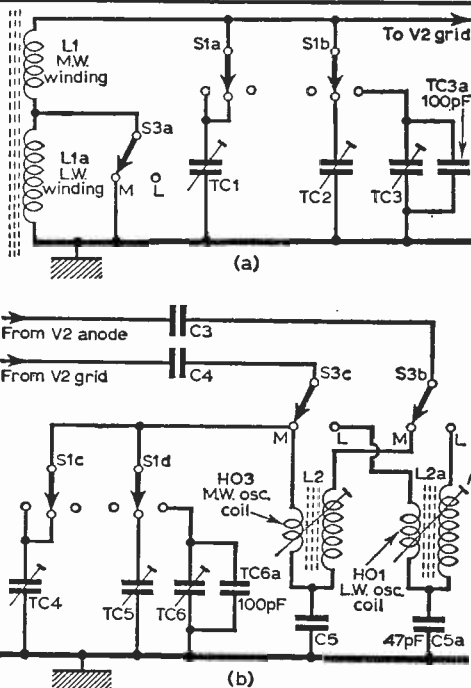


Fig. 4: The circuit modifications necessary to incorporate long waves.

Amplifier Construction

A chassis as small as 8in. x 10in. x 2in. should comfortably accommodate all components. Note that if the mains transformer is mounted on the same chassis as the choke and/or the output transformer, then the cores should be orientated at right angles to one another or separated by a metal screen (or screened by mounting one item under the chassis and another on top).

All earth connections should be made to an earth bus bar of thick copper wire (not less than 18s.w.g.) and this should be connected to chassis at one point only (the coaxial input socket). Heater wiring should be by closely twisted flex tucked well into corners of the chassis. All signal wiring up to the input to V1 must be in screened cable.

Testing

Test the power supply as for the superhet receiver then, after allowing the valves to warm up, turn the volume control up to full volume and

**COMPONENTS LIST
PUSH-PULL AMPLIFIER (Fig. 5)**

Resistors:

- | | |
|----------|-------------|
| R1 470kΩ | R7 27kΩ 5% |
| R2 160Ω | R8 27k 5% |
| R3 47kΩ | R9 470kΩ 5% |
| R4 47kΩ | R10 470k 5% |
| R5 1MΩ | R11 100Ω ½W |
| R6 160Ω | |
- All ±10%, ½W except where otherwise stated
- VR1 1MΩ carbon potentiometer, log
VR2 0.5MΩ carbon potentiometer, linear

Capacitors:

- | |
|---|
| C1 2000pF paper |
| C2 8μF electrolytic 300V |
| C3 8μF electrolytic 300V |
| C4 25μF electrolytic 25V |
| C5 0.1μF paper |
| C6 25μF electrolytic 25V |
| C7 0.1μF paper |
| C8 0.1μF paper |
| C9 50μF electrolytic 50V |
| T1 Push-pull output transformer. 7000Ω primary, 3Ω secondary (Radiospares multi-tapped) |
| VI-4 EF91 |

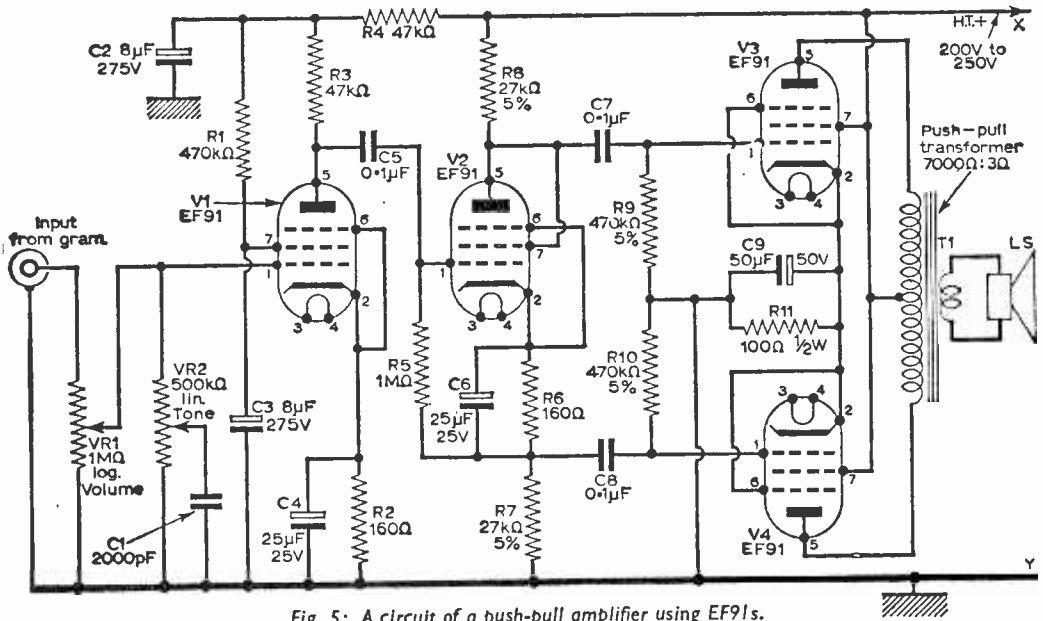


Fig. 5: A circuit of a push-pull amplifier using EF91s.

briefly touch the centre pin of the coaxial socket with a finger. A loud hum should issue from the loudspeaker. If this is reduced nearly to zero as the volume control is operated, and if the character of the hum is altered by the setting of the tone control, then all is well and the pick-up can be connected to the input.

Other Applications

It will be seen from the foregoing what a splendid little valve the EF91 is. One would be

hard put to it to find an application for which it could *not* be used!

The author has made a morse practice oscillator and a "valve voltmeter" type of alignment aid using these valves.

Other uses could be in photo-electric relay circuits as an amplifier, as a microphone pre-amplifier, or in a pre-amplifying mixer circuit for tape recorders.

The valve has also been used very successfully in v.h.f. f.m. applications described in this magazine.

THE "PRACTICAL WIRELESS" FILM SHOW

The "Practical Wireless" Film Show which is held annually and to which readers of P.W. are invited, is to be held, as before, at Caxton Hall, Westminster. The date and time of the Show, which is arranged in collaboration with Mullard Limited, is the 31st January, 1964, at 7.30 p.m.

The programme will appeal to all readers of "Practical Wireless" and of especial interest will be the illustrated talk on colour, 625-line and u.h.f. television, which will form the first part of the programme. After a break for refreshments, the programme will continue with a film entitled "Ultrasonics".

Tickets may be obtained free on request from these offices. A stamped addressed envelope must be enclosed with all applications for tickets.

HOME CONSTRUCTORS LOOK!

AT THIS OUTSTANDING 1964 RANGE OF TRANSISTOR RADIOS



THE SKYROVER
7 TRANSISTOR
PORTABLE
RECEIVER

THE SKYROVER
De Luxe
7 TRANSISTOR PORTABLE



GENERAL SPECIFICATION FOR BOTH MODELS

7 transistor and 2 diode superhet—6 waveband portable receiver, covering the full Medium Waveband (180-576 M) and Short Waveband (3.1-94 M) and in addition 4 separate switched Band Spread Ranges on 13M, 16M, 19M, and 25M bands—with manual Band Spread Tuning for accurate Station selection. I.F. frequency 470 Kc/s. Output 500 MW. 5in. Ceramic Magnet P.M. Speaker. Telescopic and internal Ferrite Rod Aerial. All Mullard Transistors and Diodes. The coil pack and tuning knob is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our detailed and easy to follow instructions. Operates on four 1.5V torch batts. (U2 or equivalent).

THE SKYROVER. Individual Details—controls: Waveband Selector, Volume Control with on/off switch, Tuning Control with easy to read Dial Scale. In attractive plastic cabinet, size: 10 x 6½ x 3½in., with metal trim and carrying handle.

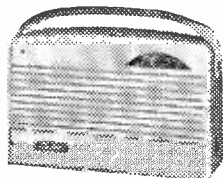
THE SKYROVER De Luxe. Tone Control Circuit is incorporated with separate Tone Control in addition to Volume and Tuning Controls and Waveband Selector. In sturdy wood cabinet, size: 11½ x 6½ x 3in., covered in washable material with plastic trim and carrying handle. Also Car Aerial socket.

MAY BE BUILT FOR **£10.19.6**
All Parts Sold Separately.

MAY BE BUILT FOR **£12.19.6**
All Parts Sold Separately.

Circuit diagram and data for each set 2/6 extra, free if all parts bought. Four U2 batteries 2/8 extra. Four Leak-Proof Batteries 8/4 extra. Add 5/- P. & P. on each set.

THE 'REALISTIC 7'



A fully transistorised Portable Receiver made to the highest professional standards—is now available to the home constructor. Comprises 7 Mullard Trans. OC44, 2 OC45's, OC71, OC81D, and 2 OC81's plus OA70 Crystal Diode. Delivers 350 milliwatt output to 4in. high flux speaker—I.F. frequency 470 Kc/s.—fully tunable over medium and long wavebands. All components mounted on single printed circuit board, size 5½ x 5½in. Attractive two-tone plastic cabinet with carrying handle—size 7 x 10 x 3½in., with easy to read dial and socket for car and aerial, choice of Red/Grey, Blue/Grey or all Grey, complete with full instructions.

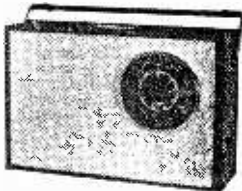
MAY BE BUILT FOR **£5.19.6**
All parts sold separately Battery 3/9 extra.
P. & P. 4/6 extra. (Circuit diagram 2/6, free if all parts bought.)

AND REALISTIC 7 De Luxe

A "De Luxe" version of the well proven "Realistic 7" is now available, with the same specification as the standard model PLUS a restyled superior wood cabinet covered in attractive washable materials, with chrome trim and carrying handle, AND ALSO a full vision circular tuning dial (externally mounted) to further improve this wonderful set.

Only **£1.0.0** extra

P. & P. etc. as Standard Model.



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2 TRANSISTOR POCKET RADIO COMPLETELY BUILT

Ready made as illustrated—complete with personal earpiece, telescopic aerial, battery and carrying case! Wonderful value and performance—full medium waveband coverage—built in 2½in. speaker gives full tone reproduction. Works on single PP3 9 v. battery. In attractive plastic case—size only 4 x 2½ x 1in. All accessories included in the price.

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MAY BE BUILT FOR **79/6** All parts sold separately Real Calf Leather Case, wrist strap and Personal Earphone with case and battery, 12/6 extra.
P. & P. 3/6 extra. (Data and instructions 2/6 free if all parts bought.)

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Simpler Electronic MUSIC

A Guide for the Creative Tape Enthusiast
By Lloyd Brunt

At one time or another most of us have felt the desire to be creative and, with an interest in sound, music is often the most satisfying outlet. Our mind perhaps first turns to a musical instrument, but most instruments are expensive and require many years of study for complete mastery.

The only other course, then, seems to be electronic music. Again the big problem is money, and electronic computers, and the other complex circuits connected with this form of composition are not the easiest things to obtain and understand!

Frustrated in this way, the author looked around for something within the reach of anyone with a limited budget and a small amount of talent. The only equipment necessary would be that which the ordinary tape recording amateur would possess, and the method that which even the least experienced person could easily master.

The idea devised is simple, yet can give pleasing results, even at the first attempt. A signal varying in frequency within the audio range is recorded in a continuous stream on to ordinary magnetic recording tape. The tape is then cut into lengths varying from about 1 to 5 in., and the pieces thoroughly mixed. A blank tape is also cut into varying lengths and kept separate from the recorded tape.

The pieces are then joined together on an editing block with, say, two recorded pieces and a blank, five recorded pieces and a blank, the length and the number of recorded insertions being left entirely to the whim of the individual.

On the author's first attempt, when a reasonable length was composed, it was found to give an amusingly jig-like tune, and after some substitution, a pleasant melody was compiled.

A problem that must be solved before any "composing" can begin is from where to obtain the varying signal. A signal generator, covering the whole audio range is the obvious and probably the most convenient answer, but it is not essential. The author found that by recording the tuning-in signal transmitted before the beginning of the day's programme on Network Three, several different frequencies were obtained. But this method limited the notes to the number of tape speeds, and was therefore unsatisfactory.

An alternative, using the same transmission was found. The tape recorder is set to "record" but left in the "pause" position. The take spool is then turned by hand at varying speeds. As any speed can be obtained by this method it is found that when the tape is played back at a constant speed many varying notes are obtained, and with care and a little practice any frequency is attainable.

The more musically minded may wish to be more precise and not compose "by accident". If a few basic rules of composition are adhered to, and the notes sorted into groups by the length and pitch, a passable piece of music can be easily compiled. It may even be possible to put together existing musical works by careful following of the score, but the author found that even to set out "Ba Ba Black Sheep" took a great deal of time and patience.

It was found that the quickest way to join the tape was by using "jointing tape" and that the weld joint took much too long to dry for this sort of editing. Leader-tape was first used between the notes but was later discarded in preference of blank tape because of the unnatural pause the former gave.

It must also be noted that the tape must remain the same way up unless used on a single track or twin channel tape recorder as inversion will cause the note to appear on the lower track and therefore disappear upon playback. This inversion was found to give a pleasing stereophonic effect on the author's twin channel recorder but it may be guarded against by using a tape with the manufacturer's name printed along its length, the inversion of the name indicating that the note is inverted.

If you are fortunate enough to have two tape recorders, the edited tape should be re-recorded on to a continuous length as a tape that is so edited will not play very smoothly. Two tape recorders may be used to obtain a rhythm by loading one with a continuous loop arrangement while adding the other notes to the arrangement.

This by no means exhausts the possibilities of this type of recording and these notes are only intended as a guide; echo, superimposition, addition of everyday sounds, are just a few of the numerous extensions which will suggest themselves to the operator. A person with imagination and patience could produce some really worthwhile results even with the simplest of equipment. ■

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NEON RELAXATION OSCILLATORS

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BY M. J. BUNCE

ONE of the simplest types of oscillator available is the neon relaxation oscillator. Operation of this circuit depends upon the charging of a capacitor via a resistor and its subsequent discharge via a neon tube which is caused to "strike" when the voltage across the capacitor reaches a certain value.

The Simplest Circuit

In Fig. 1 we have a neon which will fire at 200V. Across it is a capacitor Cx. The neon and capacitor are connected to 200V d.c. through resistor Rx. On switching the apparatus on, Cx is slowly charged through Rx until the p.d. across the capacitor reaches 200V, whereupon the neon will fire and discharge Cx. Immediately afterwards the capacitor charges up again and the process is repeated.

Component Values

The frequency of the pulses is entirely dependent upon the component values used in the circuit. If, for example, Rx is increased, the charging time of the capacitor would be delayed somewhat, and the frequency would be lower. By using a variable resistor, the frequency may be varied continuously. A word of warning may not be out of place here. If Rx is reduced to a minimum of 5kΩ, the neon may arc across and be damaged. It is usual, therefore, when using a variable resistor as Rx, to include a fixed resistor of not less than 5kΩ in series with the variable component.

Type of Waveform

The waveform produced can be seen from Fig. 2. The sloping part of the waveform represents the capacitor charging and the vertical stroke is where the neon fires. For obvious reasons this is called a sawtooth wave. The ideal shape is indicated in Fig. 2(a), but as a capacitor charges exponentially the slope has a distinct curve in it. This can be seen if the oscillator is used in conjunction with an oscilloscope.

Power Requirements

The consumption of such an oscillator is small indeed. 200-250V d.c. at 15-30mA is ample for such a device. Smoothing is a relatively simple matter (Fig. 3). Two 2μF electrolytic capacitors are all that is required, in conjunction with a resistor of 5.6kΩ or possibly two 4μF electrolytics with a 4.7kΩ resistor. A full-wave rectification system is not essential and if an isolating transformer is used

Fig. 1 (right): The simplest circuit for the oscillator.

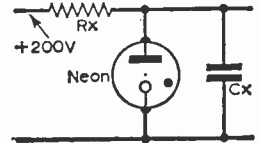


Fig. 2 (below): The ideal and actual waveforms produced.

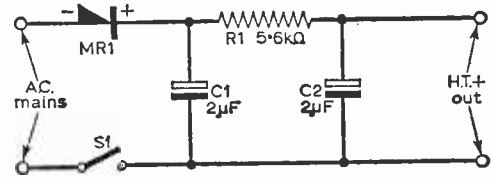
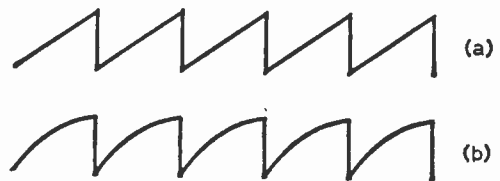
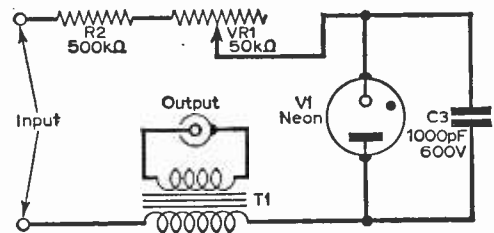


Fig. 3 (above): The h.t. supply circuit.

Fig. 4 (below): A practical circuit for the oscillator.



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2 1/2	7000	50	8/8	4	7000	3	8/8	5	6000	5	8/-	5	9500	5	10/8
2 1/2	7000	80	8/8	4	7000	25	11/8	5	7000	3	8/8	5 1/2	10000	3	11/8
2 1/2	8500 (E.M.I.)	3	8/8	4	6000	35	10/8	5	7000	5	8/8	5 1/2	7000	3	11/-
2 1/2	7000	35	8/8	4	7000	35	11/-	5	7000	3	9/-	5 1/2	8500	3	11/8

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5 x 3	6000	3	7/8	5 x 3	8000	25	11/-	7 x 3 1/2	9500	3	10/8	8 x 2 1/2	8500	5	9/8
5 x 3	7000	3	8/-	6 x 4	6000	3	8/8	7 x 4	7000	3	10/-	8 x 2 1/2	9500	3	10/-
5 x 3	8000	3	8/8	6 x 4	7000	3	9/-	7 x 4	8500	3	10/8	8 x 2 1/2	9500	4	10/-
5 x 3	6000	25	9/8	6 x 4	8500	3	9/8	8 x 2 1/2	6000	3	8/8	8 x 2 1/2	9500	5	10/-
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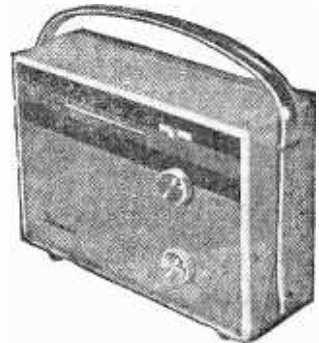
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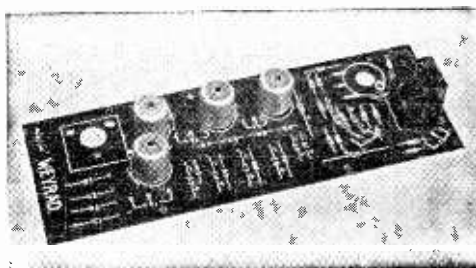
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MR1	Rectifier 250V 50mA
V1	Neon tube 200V

in series with the negative lead as shown in Fig. 4, no mains transformer is necessary.

Uses of Neon Oscillators

Neon oscillators may be found in old television sets, operating the timebases. Under these circumstances the lower portion of the waveform only is used to avoid distortion due to its exponential nature. In recent models gas-filled or "thyatron" triodes have been used instead. They are ideal as

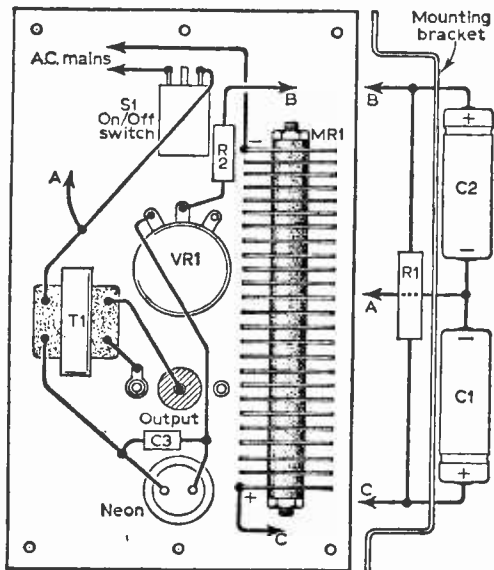


Fig. 5: Constructional details of the unit.

general purpose oscillators for testing radio receivers, amplifiers etc. They are of particular interest to readers possessing oscilloscopes.

A Practical Design

A practical general purpose oscillator which was built for less than £1, using surplus components and spares from the "junk box" will now be described. This oscillator was designed to operate at audio frequency in the range 500-2,000c/s.

The whole unit was made on a panel of 18s.w.g aluminium measuring 6in. x 4in. In the centre of

the panel a hole is drilled for a variable resistor (50k Ω). Above this a s.p.s.t. toggle switch is mounted, and below the 50k Ω variable, a coaxial socket (used for TV aerial sockets), is mounted. Below the coaxial socket, the neon is placed. This serves also as an indicator as to whether or not the unit is operating. The toggle switch (S1) controls the mains input and the 50k Ω variable (VR1) is a frequency control.

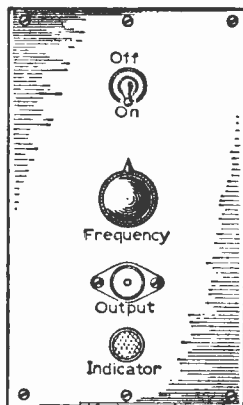


Fig. 6: The front panel layout of the unit.

The coaxial socket is for the output and the wiring is shown in Fig. 5. The underside view of front panel and mounting brackets are shown in Fig. 5. To avoid "live" output sockets an interstage transformer with a ratio of 1:1 was used as shown.

The output can be checked by connecting a loud-speaker with output transformer across the coaxial output socket. When using the oscillator into a high impedance input (i.e. mike socket on a tape recorder) always use screened coaxial cable to avoid hum pick-up. It is advisable to include a 60mA fuse in the negative lead in case the neon or the capacitor C1 should break down. Note that C3 must be a 600V working component to avoid leakage losses.

Practical Circuits for Electric Guitars

—continued from page 942

control VR3 must therefore be adjusted with discretion if an existing guitar amplifier is being used.

A Guitar Amplifier

Since all the tone controlling can be best effected at the guitar pick-ups, further tone controls are superfluous.

A combination of the control circuits given in this article, the tremolo/preamplifier of Fig. 4 and the power amplifier of Fig. 5, will provide a complete electric guitar amplification system.

The power amplifier employs a Brimar 6BR8 triode-pentode which functions as a first amplifier and phase splitter. The output stage uses two EL84's in ultra-linear push-pull, providing a maximum undistorted output of 10-12W. For guitar work this output can be taken up to peaks of 15W or so without appreciable distortion. The amplifier has negative feedback between the output and the cathode of V1A and it is most important that this is included and, of course, in the correct phase.

The output transformer in the original design was a Radiospares EL84 type which is supplied with wiring instructions for correct phasing of the negative feedback.

BOOKS REVIEWED

ELECTRONICS EXPERIMENTS AND PROJECTS

By Len Buckwalter; 128 pages, 5½ ins × 8½ ins. Price 25s.

ELECTRONICS FOR THE BEGINNER

By J. A. Stanley; 190 pages, 5½ ins × 8½ ins. Price 25s.

Both published by W. Foulshaw & Co. Ltd.

THESE two interesting American books have now been published in the U.K. and each contains an introductory chapter specially written for the English reader. This is a very sensible idea, since a novice is likely to be mislead or confused by certain Americanisms, while it is also most important to draw attention to the difference in the legal position with regard to the use of transmitting apparatus in this country as opposed to the U.S.A. Thus the English reader is advised not to build the oscillator and simple transmitter described in these books, but to treat these particular articles purely as a theoretical study. However such qualifications hardly diminish the value of these books to beginners on this side of the Atlantic. Both authors have adopted a friendly conversational style, and this helps to create the right atmosphere between teacher and pupil.

With the absolute beginner in mind, it is very difficult to decide which volume should take precedence, for each provides in its own particular way a valuable initiation into the field of Electronics.

Whereas **Electronic Experiments and Projects** sets out to give an understanding of the elementary principles by means of simple experiments that can be performed on the table at home, **Electronics for the Beginner** deals with the building of equipment—not so much for finding out how things work, but rather more for the enjoyment the completed equipment will provide. Actually, to be more correct, this latter book should be entitled "Radio and Audio for the Beginner" because the equipment described is limited to radio receivers and audio amplifiers.

Electronic Experiments and Projects conducts the reader through a series of experiments, most being performed using a piece of perforated hardboard as a "breadboard". Only a small number of commonly available parts are needed and as all electrical connections are made by clips the only tool required is a small screwdriver.

The earlier experiments involve the use of simple home-made circuit elements of R, C and L. Simple tests with a crystal diode and a transistor demonstrate the action of these semiconductor devices. Then follow a variety of experiments (or perhaps the term "projects" is here more applicable) which put into operation the basic ideas. These devices range from a simple telephone and a radio receiver to electronic devices for detecting such quantities as light, moisture and heat. The book concludes with details of how to make a simple computer for multiplication and division.

The arrangement of each article follows a standard pattern with sub sections entitled Preparation,

Setup, Operation, Conclusion and Parts List. Each experiment is illustrated with a photograph of the complete breadboard set-up, a layout diagram and a circuit diagram.

The essentially practical character of **Electronics for the Beginner** is indicated by the first Chapter; this is devoted to tools and soldering. The second Chapter "Building a Trap for Radio waves" is not as one might suppose concerned with a high Q rejector circuit but deals with the construction of an aerial system. Next, a simple crystal receiver is fully described so that the reader is very soon equipped for "listening in".

But having whetted his appetite, the beginner is not allowed to proceed too far on the constructional side before being given some essential basic information regarding components and symbols and the art of circuit reading. Then he is better equipped to continue the exploration of the remainder of the book, and as his mood and fancy takes him, may direct his attention to the realms of world-wide radio or to hi-fi and stereo. The instructions for building the various equipments are clearly written, well illustrated and are well-nigh foolproof. For example, the wiring-up is in every case detailed wire by wire.—D.D.R.

TRANSISTOR INVERTERS AND CONVERTERS

By Thomas Roddam; published by Iliffe Books Ltd. 240 pages, 201 diagrams. Price 42s.

DOUBTS that have existed in this reviewer's mind concerning the desirability or logic of giving a fine distinction to the terms "inverter" and "converter" have not been entirely dispelled by Mr. Roddam in his excellent work dealing with transistor circuits for a.c. to d.c. or d.c. to a.c. conversion.

Why not simply use the term "converter" and qualify it by the adjectival use of "a.c. to d.c." or "d.c. to a.c." as the case may be?

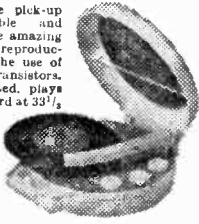
This is not, of course, a criticism that one can level at the author personally, since he is using words already generally established in electronic engineering, but I feel this opportunity of drawing attention to another unfortunate choice of terms must not be neglected.

The opening chapter of **Transistor Inverters and Converters** surveys all the present sources of electrical power and suggests that the omnipresence of a.c. is perhaps only transient, since in the future the distribution of power may be performed more effectively by d.c. mains circuits. This prospect, in addition to the existing quite considerable requirements for operating various types of apparatus from low-voltage d.c. supplies, gives a further emphasis to the relevance of this book. Having assured us of the indispensability of these devices the author commences his detailed discussion.

—continued on page 966

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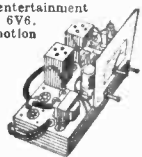
Any three transistors (not Mat Alloy). Any six Hightab resistors (state value req.). Any four valve holders and one surplus item. Plus one portable mains soldering iron. All for **30/-** P. & P. 1/3



This month's bargain

SUPERHET RADIO CHASSIS

These well-made chassis were made for the Government for Forces entertainment with 6K8 6K7, 6Q7, 6V6. Choke smoothing slow-motion tuning printed scale. 200-550 metres. BRAND NEW. ONLY **5/76**



Cabinet with 8in. speaker **27/6** P. & P. 3/- to fit.

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Omnidirectional response 60-10,000 c/s. Output level 52 dB. Built-in on/off switch Provision for conversion to hand held, cord suspended or stand mike. Attractive satin chrome finish.

Microphone **35/-** P. & P. 1/6
Desk Stands **7/6** P. & P. 1/6
Floor Stands Available

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- Mullard OC 44 3/11 P. & P. 3d.
- Mullard OC 45 3/11 P. & P. 3d.
- Mullard OC 71 2/11 P. & P. 3d.
- Mullard OA 81 1/11 P. & P. 3d.
- Eidswan X20 Germanium diodes 1/11 P. & P. 3d.
- Transistor Holder 3 Pin, 11d, each P. & P. 3d.

MICRO ALLOY TRANSISTORS

- Mat 100 7/9
- Mat 101 8/8
- Mat 120 7/9
- Mat 121 5/8

Above MAT's Postage Paid.
Ferrite Siab Aerials, suitable for Transistor Sets. **3/-** P. & P. 6d.

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Balance armature type **15/11** P. & P. 2/6

HIGH IMPEDANCE PERSONAL LISTENING EARPIECES

Suitable for all types of crystal sets and transistor sets. **5/11** P. & P. 6d.
Complete with plug.

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(Unspillable)

2 volts 16 A.H. Brand new. Size 4 x 7 x 2in. 4/11 each, 3 for 12/6. P. & P. 3/-.



CRYSTAL SET

With ear-piece and headphones.

9/11 P. & P. 1/9



TEST SET 252

Range 20-88 mc/s in 4 bands. Vernier tuning. Optional pulse-output with the tuning 50 c/s mains operation. Noise generator. Strongly made, with metal carrying case. Contains many valuable components: 9 valves, full wave rectifier unit, 3 crystal. Meter. Mains transformer, numerous switches, 42/6 P. & P. chokes, condensers, etc.



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Suitable for transmitting circuits. **4/11**

MOWING COIL HEADPHONES AND MICROPHONES ATTACHED. Suitable for 19 set. Not new. **5/11** P. & P. 2/3

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22 Tested Circuits using Micro Alloy Transistors, 5/6.
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Complete with wooden carrying case. Battery operation. Few only. Price 35/- plus 5/- P. & P.

COMPONENTS

MINIATURE WIRE WOUND RESISTORS. 6C, 60 Ω and 100 Ω . Ideal for use in test meters. **2/11** P. & P. 8/11 each

FULL WAVE HEAVY DUTY METAL RECTIFIERS. 250v.-100mA. **6/11** each
SMOOTHING CHOKES. 100mA, 10-20H resistance 450 ohms. Sturdy metal case. **4/11** P. & P. 2/6

SMOOTHING CONDENSERS. TCC metal enclosed block condenser, 4d, 24, 12in. with terminals. 8inFd. 360v working. Suitable for cross-over units. **3/11** P. & P. 1/6

MAIN TRANSFORMER. Mains standard primary 250, 0.250v, 80mA, 6.3v. volts at 4amps, 5 volts at 2 amps. Both tapped at 4v. **18/11** each P. & P. 2/6

As above 350, 0.350v. sec. **19/11** P. & P. 2/6
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PAXOLIN TAG STRIPS (14 tags). Double way. **1/3** each P. & P. 6d.

7 WAY TAG STRIP. 9d, each P. & P. 3d.
PANEL MOUNTING FUSE HOLDERS. Beautifully made, plastic, sturdy construction. **2/11** each P. & P. 6d.

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OCTAL MOULDED VALVE HOLDERS. 6d., 3 for 1/3. 8U7 valve holders, 9d., 3 for 2/-.
B7G valve holders, ceramic moulded with screening skirt, 9d., 3 for 2/- P. & P. on each 3d.

CONDENSERS. Variable Condenser solid dielectric. 0.005mFd. **3/3** P. & P. 9d.

TRIMMERS. 0.750pF max. 9d. P. & P. 3d.
CONDENSERS. 60 mFd electrolytic reversible 12v. working. **1/3** P. & P. 3d.

1mFd CONDENSERS. 130v. working. Suitable as suppressors. **1/11** P. & P. 9d.

470PF 10% tolerance, 750 working. **7d.** P. & P. 3d.

MORSE KEYS

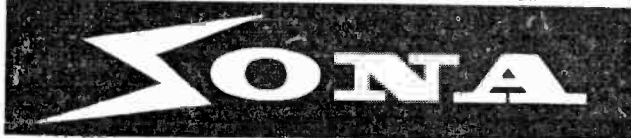
Morse Key assembly No. 3. Key with base cover and terminals. Complete with lead, jack plug, and connector. BRAND NEW **6/11** P. & P. 2/3



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A host of valuable components (block condenser, jack plug sock et, etc.). ONLY **1/11** EACH P. & P. 1/8

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TSL Mk. II "STUDIO SPECIAL" MOVING-COIL

Designed for professional quality reproduction



Grey plastic with plated metal

79/6

With improved diaphragm and coil assembly. Complete with fit. cable and non-slip base. In elegant "sound-flow" contoured case. Sensitivity—1mV per micro-bar at 1,000 c/s. Completely smooth response from 40 to 15,000 c/s. Output impedance—50K Ω. Pattern—spherical lobe.

TSL Mk. 2 THREE CHANNEL MIXER

The most popular low-priced mixer ever made! Can be used with any tape recorder. Complete with colour-coded plugs, modern controls. Gold hammer finished steel case.

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For frequency base and treble speaker systems. Essential to perfect hi-fi reproduction.

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BERNARDS BOOKS FOR TRANSISTOR CONSTRUCTORS

184 Tested Transistor Circuits using Modules. **2/6** Post free

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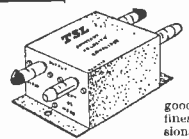
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This remarkable new TSL development enables quality almost as good as the finest professional magnetic pick-ups to be obtained from crystal or ceramic types. With it, even cheap record players become first-class instruments. With good equipment results are astonishing. Ideal for H.S.R. Collaro, Garrard and Acos. With plugs for mono or stereo. 3 years' guarantee. Ready for use. **30/-** Thousands sold. **POST FREE**

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B.H. "HI-FI 14" with integrated tone controls and mix facilities



A real break-through in hi-fi value! This superb amplifier designed by Dr. W. J. May incorporates valuable features including two high gain inputs, each with its own volume control to permit mixing. Multiple neg. feedback loops can be varied. Robust design using quality components means dependability at all times. Frequency response—23-25,000 c/s ±2dB. Separate bass and treble cut and lift controls. Output—3 or 15 ohms. With punched chassis, valves and instructions.

FANTASTIC VALUE AT THE PRICE!
 Complete kit of parts as described **£7.19.6** Built and tested 29.19.6

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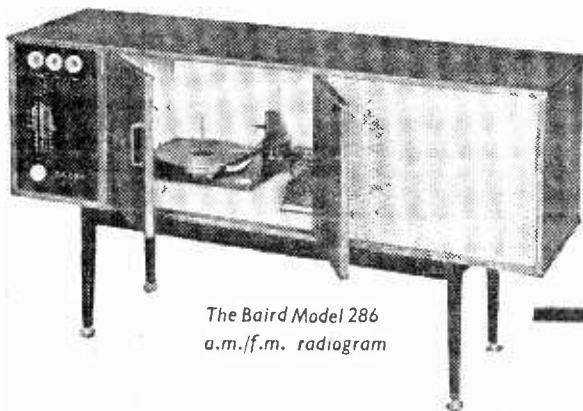
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HOME RADIO LTD., Dept. PW, 187 London Rd., Mitcham, Surrey

T rade N ews



The Baird Model 286
a.m./f.m. radiogram

Seven Watt Record Player

THE new Encore record player from Pam has been designed to give better-than-normal reproduction from a portable record reproducer. Its features include a new Monarch BSR-UA.15 four speed autochanger (taking all sizes of records) and a crystal pick-up.

The circuit of the Encore (Model 5206) delivers an output of 7W through a 6½ in. diameter speaker. Three controls atop the attractive cabinet give separate bass, treble and volume control of the output.

The price of the Encore record player, which is made by Pam (Radio and Television) Limited, 295 Regent Street, London, W.1., is 25 guineas.

Pam's new 7W record player

Tape Deck

A NEW tape deck made by Lorlin Electronic Co. Ltd., has recently become available in two or four track models. The deck employs three motors and can be operated at three different speeds. It can accommodate spools up to 7 in. in diameter and when running a tape-controlled brake tensions the tape evenly from beginning to end of the reel.

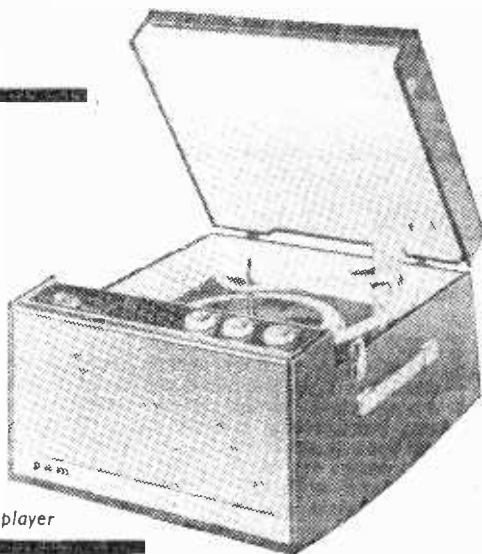
Two models of the tape deck (type SB.26) are available, costing 31 and 39 guineas. The manufacturers are Lorlin Electronic Co. Ltd., 23 Wardour Street, London, W.1.

A.M./F.M. Radiogram

BAIRD Television Limited have recently introduced a new radiogram, the model 286. The receiver on this model tunes over the whole of the medium waveband and to the Light Programme on long waves. F.M. transmissions are received from 88 to 100Mc/s.

The gram unit incorporates a four-speed autochange record deck which provides good quality reproduction through the 8 in. round loudspeaker, which is housed in a sound chamber at the right-hand side of the cabinet.

The price of the model 286 is 57 guineas and the makers are Baird Television Limited, Seymour Mews House, Wigmore Street, London, W.1.

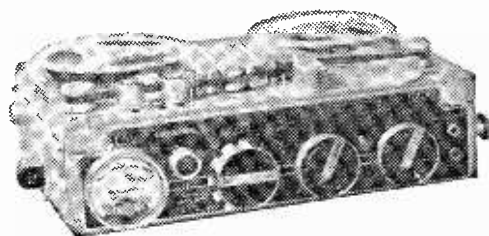


Professional Tape Recorder

THE Nagra IINP is a Swiss-made portable tape recorder of professional standards and capable of studio quality performance.

The transistorised circuit operates from self-contained batteries or from a mains unit. The tape deck provides for a choice of three speeds, 3½ in.p.s., 7½ in.p.s. and 15 in.p.s., and at the highest tape speed the frequency response is 30c/s to 18kc/s.

The Nagra IINP tape recorder is manufactured by Kudelski of Switzerland and the U.K. agents are Livingston Laboratories Limited, 31 Camden Road, London, N.W.1. Its price?—£340.



This is the Nagra IINP portable tape recorder



The latest communications receiver from Hammarlund

General Coverage Receiver

THE latest general coverage receiver to come from the Hammarlund Manufacturing Company, is the type HQ-180AX, an improved version of the HQ-180A. This receiver features 11 fixed frequency crystals in addition to the v.f.o., six of which are plugged in on the face of the instrument, the remainder being reached through a hinged compartment in the cabinet. An unusual feature of the HQ-180AX is the facility for compensating for minor frequency variations of the crystals by means of a ± 3 kc/s vernier tuner control.

Complete technical data of this new communications receiver may be obtained from the U.K. agents for Hammarlund equipment, K. W. Electronics Limited, Vanguard Works, 1 Heath Street, Dartford, Kent.

BOOKS REVIEWED

—continued from page 962

First, the two principal circuit elements, the transistor and the transformer, are in turn closely examined and their characteristics analysed; they are then brought together in subsequent chapters where various forms of single-ended, push-pull, bridge, sine-wave and driven inverter (or converter) circuits all receive thorough attention.

Without doubt a valuable reference source for design engineers, this book will also be of great interest to many others who seek more than a mere surface knowledge of the subject.—F.E.B.

AUDIO AND ACOUSTICS

By G. A. Briggs, with James Moir; published by Wharfedale Wireless Works Limited, Idle, Bradford, Yorkshire. 168 pages, 8½ in. x 5½ in. Price 10s. 6d. (11s. 6d. post free).

MANY readers have seen, or have on their bookshelves, a book called **Sound Reproduction**. This, published originally in 1949, was an enlarged version of a booklet **Loudspeakers**, but covering a larger field. It was, in fact, the forerunner of the now well known series of audio books by G. A. Briggs. The author's unconventional style and his method of presenting facts and data in a most readable form caught the imagination of audiophiles and **Sound Reproduction** eventually went into three editions.

In 1962, when **Sound Reproduction** ran out of print, it was decided not to reprint again, or to bring out a revised edition, but (in the words of the author) "to divide and conquer and have two or three modest volumes instead of one huge tome running to several hundred pages."

Audio and Acoustics is the first in this programme of revision and, as the name suggests, concentrates mainly on the problems of acoustics. Although some of the material is taken from **Sound Reproduction** much of it is completely new and those who found the original book of value will certainly not be wasting their money in purchasing this new publication.

A very informative historical section deals with audio and acoustical developments, ranging from Edison's phonograph of 1877 to modern demonstration rooms and transistorised videotape recorders. This leads into chapters on the Ear, Resonance, Echo and Reverberation and Room Acoustics, all of which provide hard facts and food for thought. Other sections cover Free-field Sound Rooms, Transient Response, Stereo, Concert Halls and Studios and Live/Recorded Tests.

As the author points out, there is a growing interest in the acoustic aspect of sound, and in any audio set-up the real final link in an audio chain is **not** the loudspeaker system but the acoustics of the listening room. Therefore, this aspect requires more attention than that to which it is generally given.—W.N.S.

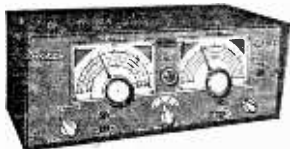
TOP QUALITY—LOW COST **CRC** AMATEUR RADIO EQUIPMENT

BUILD YOUR SHORT WAVE LISTENING STATION WITH CODAR-KITS.
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THE FINEST SUPERHET KIT EVER OFFERED



Frequency Range 540 Kc/s to 30-Mc/s in four Band-switched ranges.



Electrical Bandsread. Coil Unit wired ready and I.F. Transformers factory aligned, no test equipment required. Temperature compensated trimmers. Regenerative I.F. stage for maximum gain and B.F.O. Panel aerial trimmer, separate speaker switch, 3 watts output for external 2-3 ohm speaker. Separate cathode follower for tape recording etc. Valve line-up—ECH81, EBF89, ECC81, EL84, EZ80, EM84 (Optional extra). For 200-250 volt A.C. Cabinet size 16 x 6½ x 8½ in.

Complete Kit with 17-page Instruction Manual Carriage 6/-. **£18.50**

Tuning indicator parts with EM84, 17/6.

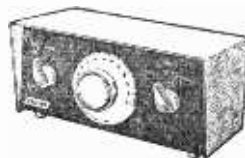
H.P. TERMS AVAILABLE

CAN BE SUPPLIED READY BUILT, PRICE ON REQUEST. "S" Meter conversion kit available

★ **P.R. 30 R.F. PRESELECTOR** ★

Frequency range 1.5-30 Mc/s. Substantially improves the performance of any superhet receiver.

G4HZ writes . . . I am delighted with it, it improves my Eddystone 640 in all respects. The difference with the Pre-selector is fantastic, a weak signal on 15 metres about 52 changed to 58. On the L.F. Bands, unwanted noise and mush is cut out.



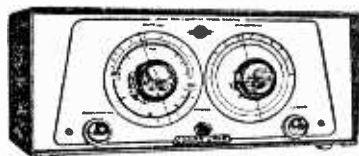
G3RIA writes . . . The results in conjunction with my Eddystone 888 are amazing. Signals are twice as strong with much higher signal/noise ratio. A First-class product well worth the money. The P.R.30 uses EF183 Frame Grid R.F. Amplifier and provides up to 20 dB gain. Features include vernier tuning, gain control, selector switch for either dipole or end fed antenna. External power supplies (obtainable from Rx). Smart styling in grey and black. Complete, ready for use, with all plugs, cables. Now available in two models.

P.R.30 for external power supplies 180-250 volts H.T., 6.3 volts 3 amp. L.T. (obtainable from receiver). **£4.17.6** Carr. 3/6.

P.R.30X self powered with internal power supply for 200-250 volt A.C. Will provide 200 volts up to 25 M/a. and 6.3 volts 1 amp. for other accessories. **£7.2.0** Carr. 3/6.

THE NEW CR 45 MAINS T.R.F. SHORT WAVE RECEIVER

World-wide short wave reception, North-South America, India, Russia, Far East, Australia, amateurs, shipping, etc.



- ★ Separate electrical bandsread.
- ★ Three slow motion vernier drives.
- ★ Low loss polystyrene plug-in coils, factory aligned.
- ★ Dials calibrated in frequencies and degrees.
- ★ Power output 3 watts for 2/3 ohm speaker.
- ★ Valve line-up: ECC81/EL84/EZ80.
- ★ Front Panel Silver and Black, control knobs Grey.
- ★ Provision for panel phone jack.

Superb modern styling and Top quality components throughout. Complete CR 45 CODAR-KIT, with valves and 3 Coils, 10-28, 25-75, 60-176 metres. Instruction Manual 11 pages, less Cabinet **£7.5.0** Carr. 4/6.

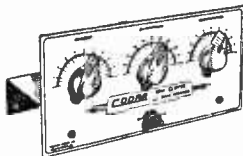
CR 45 Cabinet Silver Grey 12 x 5½ x 7 in. with sliding door for easy coil changing and detachable louvred rear panel **28/6**

Instruction Manual only 4/- post free. Extra coils 4/9 each. CAN BE SUPPLIED READY BUILT. PRICE ON REQUEST.

★ **THE MINI-CLIPPER**

- ★ Miniature 1 valve short wave receiver.
- ★ Low loss polystyrene plug-in coils, factory aligned.
- ★ Air spaced ball bearing condensers.
- ★ Provision to add two-transistor amplifier.
- ★ Battery lasts months.

36/6



Can be built in one evening, ready to switch on, to bring the fascination of Short Wave listening at very low cost. Complete MINI-CLIPPER CODAR-KIT, valve, and one coil 25-75 metres, Instruction Manual 4 pages. 37/6, carr. 2/6. Extra Coils 4/9 each. Electrical Bandsread available. Instruction Manual only 2/-, post free.

★ **THE SUPER CLIPPER** ★

- ★ Peak Performance short wave battery receiver.
- ★ Large precision dial, dual slow motion drives.
- ★ Bandsread on all Bands.
- ★ High gain valve/transistor hybrid circuit.
- ★ 2 Mullard transistor amplifiers, pre-assembled and tested.
- ★ Low loss polystyrene plug-in coils, factory aligned.
- ★ Batteries last months.

88/6



Easy to assemble, this famous Short Wave Receiver brings a new world of listening pleasure to your finger tips. Complete SUPER-CLIPPER CODAR-KIT, valve, transistors, 2 Coils 20-60, 55-180 metres. Instruction Manual 7 pages. 88/6, carr. 2/6. Front Panel Silver Grey, 10 x 7½ in. 6/9 extra if required. Extra Coils 4/9 each.

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Model	Coone	Frequency response c.p.s.	Impedance ohms	Main resonance c.p.s.	Power handling watts R.M.S.	Flux density gauss	Total flux Maxwells	Voice coil winding	Diam. of Chassis	Baffle Hole	Nett weight lbs	Retail Price
122/10	Single	25-5000	15	32 or 75	20	10,000	100,000	Copper	12in.	11in.	6lbs.	5 gns.
122/10A	Dual	10-15000	15	32 or 75	20	10,000	100,000	Aluminium	12in.	11in.	6lbs.	6 gns.
122/12	Single	25-5000	15	32 or 75	20	12,000	160,000	Copper	12in.	11in.	6lbs.	26.15.0
122/12A	Dual	30-15000	15	32 or 75	20	12,000	160,000	Aluminium	12in.	11in.	6lbs.	27.19.6
122/14	Single	25-5000	15	32 or 75	22	14,000	186,000	Copper	12in.	11in.	7lbs.	9 gns.
122/14A	Dual	30-15000	15	32 or 75	22	14,000	186,000	Aluminium	12in.	11in.	7lbs.	10 gns.
122/17	Single	25-8000	15	32 or 75	25	17,000	226,000	Copper	12in.	11in.	10½lbs.	£11.17.6
122/17A	Dual	30-17000	15	32 or 75	25	17,000	226,000	Aluminium	12in.	11in.	10½lbs.	£12.17.6
152/12	Single	25-3500	15	30 or 75	20	12,000	160,000	Copper	15in.	13½in.	8lbs.	12 gns.
152/12A	Dual	30-15000	15	30 or 75	20	12,000	160,000	Aluminium	15in.	13½in.	8lbs.	13 gns.
152/14	Single	25-3500	15	30 or 75	22	14,000	186,000	Copper	15in.	13½in.	9lbs.	14 gns.
152/14A	Dual	30-15000	15	30 or 75	22	14,000	186,000	Aluminium	15in.	13½in.	9lbs.	15 gns.
152/17	Single	25-4000	15	30 or 75	25	17,000	226,000	Copper	15in.	13½in.	12½lbs.	16 gns.
152/17A	Dual	30-17000	15	30 or 75	25	17,000	226,000	Aluminium	15in.	13½in.	12½lbs.	17 gns.

EXTRA HEAVY DUTY TYPES WITH 3in. DIAMETER POLE PIECES

153	Single	30-3500	15	40 or 75	40	14,000	375,000	Copper	15in.	13½in.	20lbs.	18 gns.
153	Single	20-3000	15	30 or 75	80	14,000	375,000	Copper	18in.	16½in.	22lbs.	25 gns.

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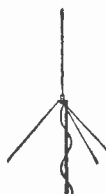
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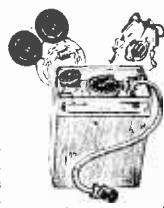
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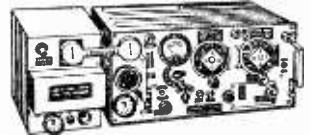
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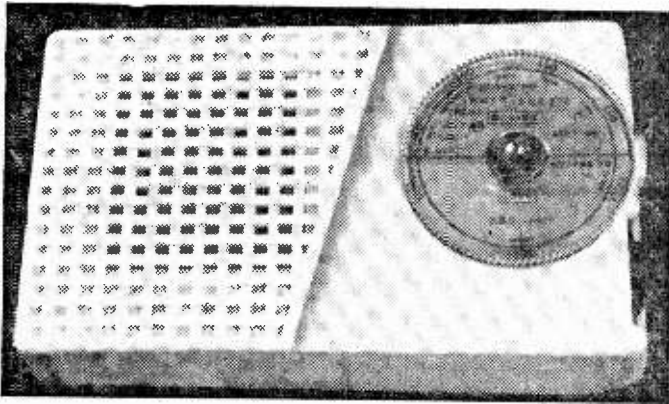


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Long Waves for the M.W.



The receiver as it appeared originally.

Pocket Superbet

By J. G. Thompson

MODIFYING THIS P.W. TRANSISTOR DESIGN FOR L.W. RECEPTION

THE receiver described in the September, 1962, issue of *Practical Wireless* tunes medium waves only. However, it can quite easily be modified to include long waves if this is required. Two methods will be found satisfactory and either may be adopted.

The simplest arrangement is to add sufficient capacity to give preset tuning of the Light Programme on 1,500m, the original medium wave ferrite rod winding being used on both bands. Reception on the long wave band is then confined to 1,500m only. The second method is to provide a long wave loading coil and coverage is then about 1,100m to 1,750m, allowing reception of other stations in this band. In both cases the oscillator coil remains unchanged, the necessary extra capacity being switched in.

Preset Tuning

The circuit for this arrangement is shown in Fig. 1. When the switch is in the medium wave position medium wave reception is obtained as before. With the switch in the long wave position TC3 and C16 are in parallel with the medium wave aerial winding and the 180pF capacitor is across the oscillator coil. The usual tuning control acts as a fine tuning or manual trimmer.

The receiver is sufficiently sensitive for this arrangement to give adequate volume in very many localities. The set is, of course, intended for reception of the Light Programme only on this band as mentioned.

C16 and TC3 need to total about 1,750pF and

this can conveniently be obtained with a 1,600pF fixed disc capacitor and a 300pF or 500pF trimmer. VC1 provides 208pF and this allows further adjustment, since it is not very important where the Light Programme is found on the dial. It should, however, be possible to obtain 1,500m with the gang capacitor roughly half closed, this depending on the exact capacity of the 180pF oscillator capacitor and the coil core. On the long wave

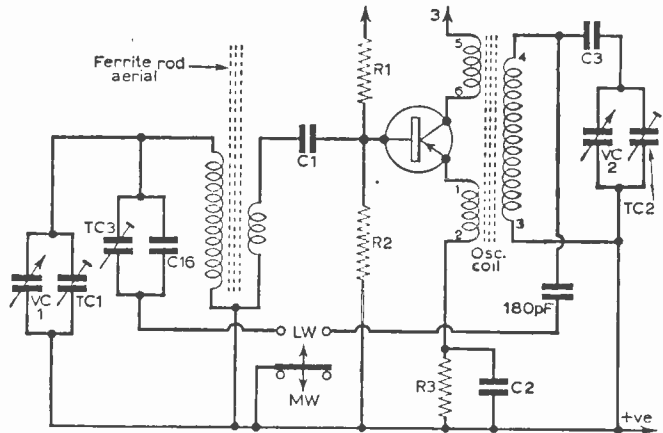
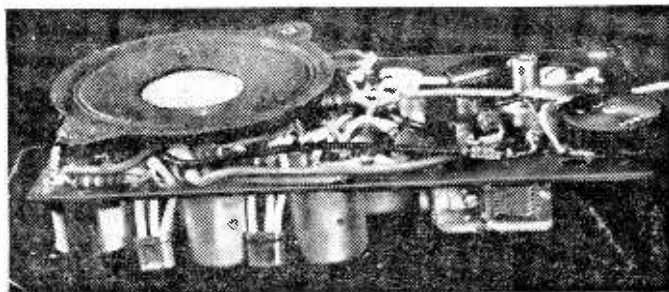


Fig. 1: Circuit modifications to receive the Light Programme on long waves.

band the position of the oscillator coil core has a great effect on frequency. If necessary slight readjustment may be made, followed by realignment on the medium wave band.

It is feasible to obtain 1,500m at a marked point on the dial by adjusting TC3 and C16 and by including a further trimmer in parallel with the 180pF capacitor. But tuning will still be restricted to the Light Programme only.

If a few small fixed capacitors are to hand values



The chassis of the prototype receiver.

may be selected to bring 1,500m within the swing of the gang capacitor. Capacitors can be tried experimentally by wiring them across VC1 and from pin 4 of the oscillator coil to the positive line.

Long Wave Tuning

This method gives normal tuning and allows reception of one or two other stations in addition to the Light Programme on 1,500m. The circuit is shown in Fig. 2.

The long wave loading coil, with TC3 in parallel, is in series with the existing medium wave coil. The base coupling winding is returned to a tapping on the long wave coil. The long wave coil is shorted out when the switch is in the medium wave position. With the switch in the long wave position the loading coil is in circuit and the 180pF capacitor and TC4 are in parallel with the oscillator coil.

It is important that the tapping is near the "earth" end of the long wave coil and that both medium wave and long wave coil turns are in the same direction when they are in series. The long wave section is slid on the free end of the ferrite rod.

Frequency coverage may be modified by adjusting TC4. TC3 is adjusted for best volume around

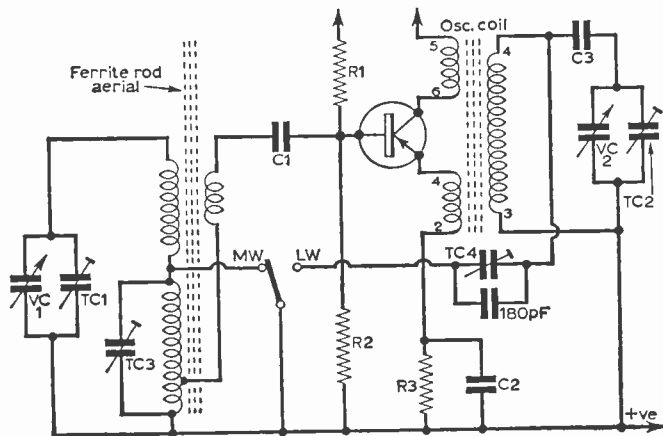


Fig. 2: The circuit for complete l.w. coverage.

1,200m. The receiver is then tuned to about 1,650m and the long wave winding is moved along the rod for best results.

Switch Mounting

A miniature slide switch can be positioned in the free space left near the oscillator coil, taking care that it clears the tuning control, as in Fig. 3.

The circuit in Fig. 1 requires two poles closed for long wave reception. A two-pole, two-way

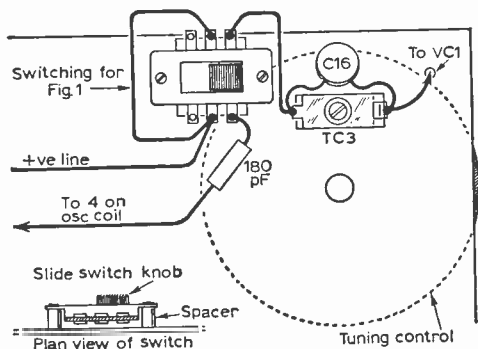


Fig. 3: Mounting details of the wavechange switch.

switch, as actually shown in Fig. 3, will thus be needed. The outer tags will have to be bent over to clear the case.

For the circuit in Fig. 2 a single pole two-way switch is sufficient. The switch shown in Fig. 3 may, of course, be used, but a single pole two-way switch will require less space as one set of contacts will be omitted. The centre tag goes to the positive line, exactly as in Fig. 3. One outer tag is wired to the junction of medium wave and long wave aerial coils. The remaining outer tag is connected to TC4 and the 180pF capacitor, which are returned to pin 4 of the oscillator coil.

The switch is held by 8B.A. or smaller bolts with countersunk heads, spacers (or extra nuts) being used so that it is just clear of the paxolin panel. Carefully measure the switch position, drill a small pilot hole through the case and enlarge this with a small file to match the switch slot.

After either of the modifications shown, slight retrimming and realignment will be necessary on the medium wave band because of the stray capacity of switch wiring, etc. ■

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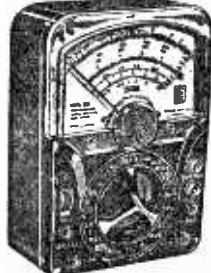
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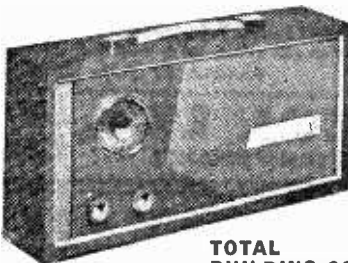
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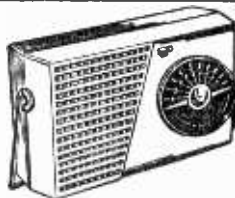


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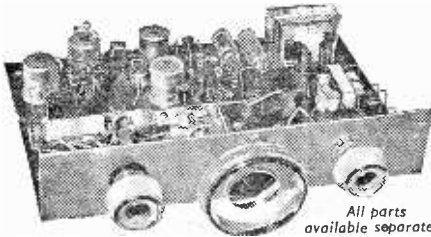
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6K8GT	7/9	30P13	9/6	EB91	2/-	EM87	8/9	PL84	5/9	UCH81	7/6
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6P28	9/6	AZ31	6/11	EB91	2/-	EM87	8/9	PL84	5/9	UCH81	7/6
6Q7G	4/9	B36	4/9	EB91	2/-	EM87	8/9	PL84	5/9	UCH81	7/6
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BY V. E. HOLLEY

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This device consists essentially of an auto transformer arranged so that both the input and output windings can be varied at will as shown in Fig. 1 and a meter to indicate the output voltage.

Choice of Transformer

It will be seen at once that although the transformer is an indispensable part of the device, it does very little work, so that quite a large output is obtainable from a component of modest size.

An ordinary mains transformer as used in radio receivers is quite suitable and it does not matter if one or more of the secondaries is defective, so long as there are no shorted turns. The transformer must have a tapped primary and needs, of course, to be chosen with some regard to the output required. The following figures refer to the transformer used in the prototype and show how the maximum output current may be calculated.

Secondary ratings:

350-0-350V 120mA (700 x 0.12)	= 84 volt-amps
6.3V 2A	= 12 volt-amps
6.3V 4A	= 24 volt-amps

Total 120

Assuming a transformer efficiency of 80 per cent, this total may be increased to 150 when referred to the primary and it is deduced that the primary will be capable of 150 volt-amperes at the lowest input tapping of 200V; and that the maximum current which can safely be permitted to flow through it is $\frac{150}{200} = 0.75A$.

This figure however, relates to service in a radio receiver, where the poor form factor of the h.t. secondary current, caused by the presence of the rectifier and reservoir capacitor, contributes appreciably to the heating effect.

A further consideration is that the currents in the two sections of an auto-transformer winding are in exactly opposite phase, so that the current in the section which is common to both input and output circuits is limited to the difference between the input and output currents. Thus the full output current will flow only in that small portion of the

winding which is used to step the voltage up (or down) and its heating effect will be correspondingly small.

The result of all this is that the figure arrived at by calculation may be increased by about a third, and in fact, the transformer in the prototype unit becomes only faintly warm when a current of 1A is drawn continuously.

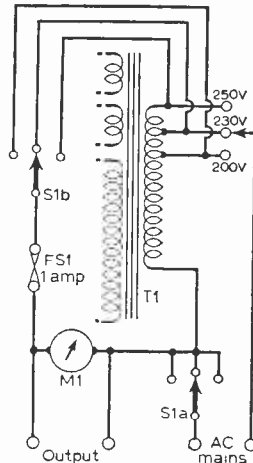


Fig. 1: The circuit of the unit.

Other Components

The 2-pole, 4-way rotary switch, S1, should be of the "make before break" variety. One pole (a) is used as a mains on/off switch in the input circuit and the other (b) to select the required output windings.

An a.c. voltmeter, reading to 300V, is needed to indicate the output voltage. High accuracy is not necessary and a cheap moving iron meter will be quite satisfactory.

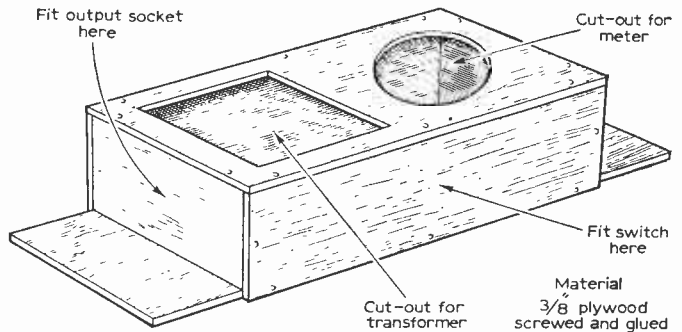


Fig. 2: Construction details of the case.

The cartridge fuse, FS1, in the output circuit should be of the anti-surge type, and its value should be chosen according to the maximum permissible output current.

Construction

The form of construction is unimportant. The prototype was built in a 3/4 in. plywood box 9 in. x 4 1/2 in. x 2 1/2 in. the bottom being extended at each

—continued on page 974

Testing Dry Batteries

By G. A. W. Partridge

DRY cells are used extensively as a portable power supply for valve and transistor radios. The cells which give approximately 1.5V each are made into batteries in order to produce the necessary electrical power.

After a certain length of time the cells cease to produce electricity and therefore have to be discarded and fresh batteries installed.

The usual idea, when a dry battery is under suspicion, is to simply test it with a voltmeter (Fig. 1). This is, however, not always satisfactory.

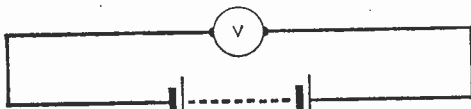


Fig. 1: The straightforward test for dry batteries.

For example, a radio battery was tested in this manner and gave a reading of 9V which was correct, but the radio barely functioned. The answer was that the battery had sufficient power to pass the tiny current necessary to operate the voltmeter but when it was called upon to pass about 25mA for the radio it could not do it.

In other words the e.m.f. (electromotive force) of the battery was still 9V but its p.d. (potential difference) was much less. The answer therefore, is to measure the p.d. and also the e.m.f.

What is the difference?

The e.m.f. can be taken as the battery's open-circuit voltage, and the p.d. is the voltage across the battery when a normal current is being drawn from it. The p.d. varies with this current so the battery should be tested while operating at normal load conditions. The p.d. and e.m.f. readings will

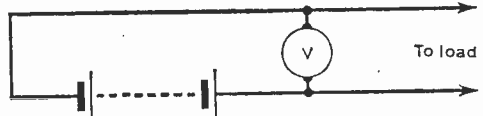


Fig. 2: Testing a battery's p.d.

therefore show up the condition of the battery (Fig. 2).

Another point that is overlooked is that a battery has an internal resistance. Actually the difference between e.m.f. and p.d. is the voltage necessary to overcome this resistance which can be calculated from:

$$r = \frac{E - V}{I}$$

r = internal resistance.

E = e.m.f. (open circuit) in volts.

V = p.d. (closed circuit) in volts.

I = current in amperes.

Here is an example taken from an actual test. A torch cell was found to have an e.m.f. of 1.4V. It was connected through a milliammeter to a small resistance and the current drawn was 240mA. The p.d. was found to be 1.1V. The internal resistance is:

$$r = \frac{E - V}{I} = \frac{1.4 - 1.1}{240/1000} = \frac{1.4 - 1.1}{0.24} = 1.3\Omega.$$

This cell is starting to deteriorate. The e.m.f. is low and the internal resistance rather high. A test on a good cell indicated an e.m.f. of 1.5 and an internal resistance of 0.37Ω.

A battery of cells will have a higher internal resistance if they are connected in series. For example a 6V dry battery will have four 1.5V cells connected in series. If each cell has an internal resistance of 0.4Ω then the total resistance will be 0.4 × 4 = 1.6Ω.

Large capacity batteries for low voltages and higher currents have their cells connected in parallel. The total internal resistance will then be:

$$\frac{1}{R} = \frac{1}{r} \times \text{The number of cells.}$$

A battery of ten cells, each with a resistance of 0.4Ω will give a battery internal resistance of:

$$\frac{1}{R} = \frac{1}{0.4} \times 10 = 0.04\Omega.$$

MAINS VOLTAGE ADJUSTER

—continued from the previous page

end so that the assembly could be fastened to the workshop wall. Details are given in Fig. 2.

Measurements will, of course, depend on the size of the transformer and meter. Connection to the mains should be by 3-core cable so that the exposed metal of the transformer can be earthed.

Operation

The prototype is operated from a supply which is nominally 240V but is frequently less. The mains voltage adjustment on the transformer is therefore usually set at 230V and voltages of 200, 220 and 240 are then available by operation of the switch.

In addition to providing supplies to receivers and amplifiers of varying voltage requirement, the unit is extremely useful for supplying a soldering iron. A high voltage can be used for quick heating, after which it can be reduced to normal or, if the iron is not to be used for some time, to sub-normal to keep it "simmering" ready to be brought quickly to working temperature when required.

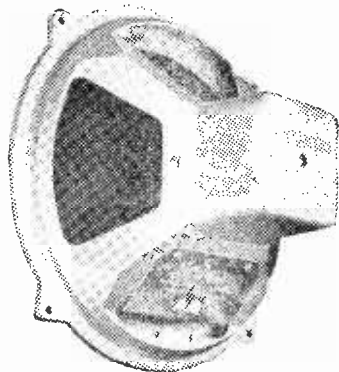
An indicator lamp, supplied from one of the 6V transformer windings could be fitted, if desired, but is not essential as the voltmeter serves the same purpose.

ONE WORD OF WARNING: The unit should not be left unattended for long periods when it is being used to compensate for a reduced supply voltage, because if the supply should return to normal, damage might be done to equipment connected to it.



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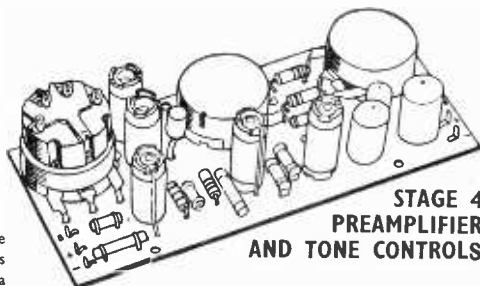
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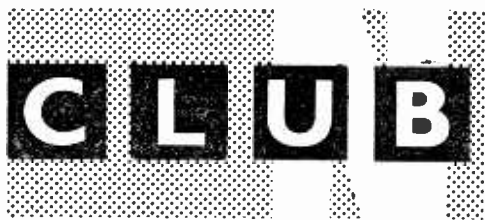
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8Y48	5/6	8Y48	5/6	8Y48	5/6	8Y48	5/6	8Y48	5/6
8Y49	5/6	8Y49	5/6	8Y49	5/6	8Y49	5/6	8Y49	5/6
8Y50	5/6	8Y50	5/6	8Y50	5/6	8Y50	5/6	8Y50	5/6
8Y51	5/6	8Y51	5/6	8Y51	5/6	8Y51	5/6	8Y51	5/6
8Y52	5/6	8Y52	5/6	8Y52	5/6	8Y52	5/6	8Y52	5/6
8Y53	5/6	8Y53	5/6	8Y53	5/6	8Y53	5/6	8Y53	5/6
8Y54	5/6	8Y54	5/6	8Y54	5/6	8Y54	5/6	8Y54	5/6
8Y55	5/6	8Y55	5/6	8					



AMATEUR RADIO SOCIETY OF CHESHAM AND DISTRICT

Hon. Sec.: M.A. Woof, G3SGO/T, "Copperkins", Copperkins Lane, Amersham, Buckinghamshire.

Prospective members are invited to attend any Club meeting, especially those interested in joining the R.A.E. course which is being run at the moment. It should be noted, however, that the club-night has been changed recently to Fridays.

DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue, Littleover, Derby.

At the meeting for December 11th, members reviewed the events of 1963 as they appeared in members' photographs taken throughout the year. Later in the month on the 15th, members competed for the G5YY Trophy and on the 18th the Annual Christmas Party provided an enjoyable evening for all who attended.

The first day of the New Year was marked by a surplus sale.

LICHFIELD AMATEUR RADIO SOCIETY

Hon. Sec.: V. Hickman, 143 Main Street, Stonnall, Walsall, Staffordshire.

A full programme of lectures and social activities is helping to increase the membership of this Society. All meetings are held at the Swan Hotel in Lichfield on the first Monday and third Tuesday of each month.

MITCHAM AND DISTRICT RADIO SOCIETY

Hon. Sec.: A. L. Thurley, 50 Bruce Road, Mitcham, Surrey.

The meeting for December 6th was devoted to a film show arranged by G3LCH, the Society's Chairman.

The main event of the meeting on December 20th, was a constructional contest.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

The Society's third Annual Dinner was held on December 11th and this proved to be a most enjoyable event. This was followed a week later by a ragchew meeting.

The first meeting of the New Year was held on January 1st, when Mr. H. Makin gave a lecture entitled "The Building of a 10-80 Transmitter."

READING AMATEUR RADIO CLUB

Hon. Sec.: R. G. Nash, G3EJA, "Peacehaven", 9 Holybrook Road, Reading, Berkshire.

A session of questions and answers was the main event at the December meeting of this Club, when members met at the Palmer Hall in Reading on the 28th. However the competition for a Club badge design, was judged on the same evening.

SCARBOROUGH AMATEUR RADIO SOCIETY

Hon. Sec.: P. B. Briscombe, G8KU, "Roseacre", Irton, Scarborough, Yorkshire.

The meeting for December 12th was devoted to a review of the past year, in photographic slides, and on December 19th members, their families and friends, had an enjoyable time at the Society's Christmas party.

SPEN VALLEY AMATEUR RADIO SOCIETY

Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Nr. Leeds.

Because of the Season's festivities only one meeting was held during December. This was on the 12th and was a film show.

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: R. A. G. MacIntosh, 50 Field Lane, Oldswinford, Stourbridge, Worcestershire.

On December 20th, members gathered in the Bell Hotel in Stourbridge for the usual Christmas informal get-together.

UXBRIDGE RADIO SOCIETY

Hon. Sec.: A. Duell, "Treetops", Bakers Wood, Denham, Buckinghamshire.

Activities currently under progress in this Society include an R.A.E. class (in preparation for the May examinations) and also a series of lectures on oscilloscopes and communications.



WEST KENT AMATEUR RADIO SOCIETY

R. Trevitt, 28 Dales Avenue, Tunbridge Wells, Kent.

On December 13th a group of members went out on a pre-arranged visit, and later in the month on the 20th, the Society's Christmas party was held.

WIRRAL AMATEUR RADIO SOCIETY

Hon. Sec. A. Seed, G3FOO, 31 Withert Avenue, Bebbington, Wirral, Cheshire.

On December 18th, members attended a lecture given by Mr. Roberts, (G3EFX), his subject being valves.

On January 1st the Society held a symposium under the title of "Why Amateur Radio Appeals to me."

TEST GEAR TECHNIQUES

An error in Fig. 9 of this article (page 429 of the September issue) has been pointed out by several readers. The cathode of V1 should have inserted a 300Ω resistor, and the grid 3 load, shown as 300Ω, should in fact be 500kΩ.

THREE-WATT AMPLIFIER

Two errors appeared in this article which was published in the November issue. In the circuit diagram and components list V2 is given as an EL86. This should be an EL84 as mentioned in the text. Also in the components list, the mains transformer is shown to have a rating of 8mA instead of the correct 80mA.

HELP FOR HOME BUYERS

When you are buying or selling property it is vitally important to know where you stand as far as the law is concerned. Ignorance or carelessness might cost you hundreds of pounds. There's sure to be a big welcome, then, for the new FREE LEGAL ADVICE SERVICE just announced by Newnes *Property Advertiser and Holiday Guide*. Every week, from now on, this paper will carry questions and answers on such topics as mortgages, insurance, surveying and general legal points. In addition any reader may have his own particular questions answered by a panel of experts simply by filling in a Query Coupon on the Legal Advice Page. Newnes *Property Advertiser and Holiday Guide*, which contains details of thousands of houses, flats, shops, business and holiday addresses, is on sale every Thursday, price 4d.

LETTERS TO THE EDITOR

DEFINITELY THE LAST WORDS ON "LICENCES"

SIR.—I offer the following in reply to all those who seek "novice licences":

Enough, let's hear no more these weary tales,
These jealous cries of Tired Tims and mental snails.
Let their authors, miserable souls,
Use up their leisure playing bowls.

A curse on all these armchair critics
Seeking complimentary tickets.

Away ye parasites and infant bawlers,
Spawn of Weirdies, Lids and Creepy Crawlers.

Let's hear, instead, the voice of men,
Who though they fail will try again,
And when they finally succeed
Their Call Sign is a prize indeed.
—GW3PHH.

MAGNETIC PICKUP

SIR.—I do not wish to criticize unduly, but I do think that the pre-amplifier described by Mr. Banthorpe in his very interesting article on a "Magnetic Pickup" in the July 1963 issue, is worthy of attention. The circuit as shown on page 274 will not work unless the transistors are chosen for their current gains (β).

Consider: the base current of Tr1 is $4.2/330\text{mA}$ assuming a V_{be} of 0.3V. This equals 0.013mA. In order that this stage should conduct properly and not "bottom", the voltage drop across the collector load ($22\text{k}\Omega$) should not be more than 3.5V approximately.

This means that the β of Tr1 should be less than $\frac{3.5}{0.013 \times 22} = 12.2$. If the β is greater than 14, Tr1

will "bottom". From the Mullard data, the average β of an OC71 is 40. Admittedly, at the low values of collector current used that β will be lower than this figure, but it cannot be guaranteed that it will be less than 12.

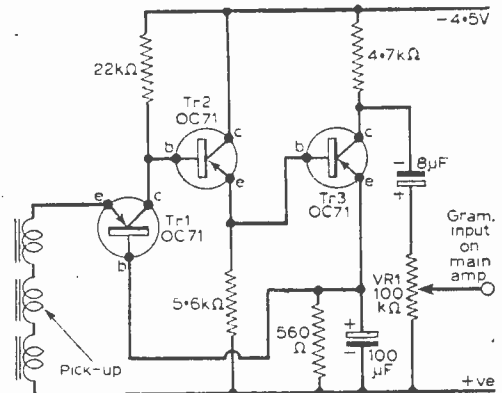
It can likewise be shown that if the current gain of Tr3 is greater than 9.5 this stage will be permanently "bottomed" which will make it insensitive to all but the positive peak signals—a very effective clipping device. Unfortunately, if the first stage is "bottomed" this will only be sensitive to negative peaks, so as a whole the circuit is rather insensitive.

I enclose a somewhat better circuit. This has the advantage that the circuit is d.c. stabilised by negative feedback and is thus unlikely to "run

away". It is also tolerant of β in all stages. It should be noted that the method of biasing a transistor with a single resistor in the base lead, makes the circuit extremely critical since the value of the resistor depends upon β which is a variable parameter. The only advantage is a reduction in the number of components required. However, a method of overall d.c. feedback as shown, can have this advantage with none of the disadvantages of instability.—D. G. WHITEHEAD (Marple, Cheshire).

[The author of this article has read and agreed with Mr. Whitehead's observations and has suggested they should be published for the benefit of any readers who have built or are contemplating building the pre-amplifier.—Ed.]

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



The revised circuit of the Magnetic Pickup pre-amplifier.

IN DEFENCE OF THE HAM

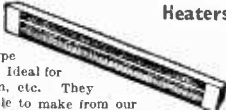
SIR.—After reading the letter from Mr. H. A. L. Wagner (December issue) in his self-appointed role of "picador of the air", like any tortured animal in the ring, I have been goaded into making this reply.

Practically everyone knows, of course, that the average licensed radio amateur, far from being a ham (a detestable misnomer, this) is more likely to be a professional of very high standing, and indeed the electronics and associated industries would look very sick without him.

Reading between the lines of Mr. Wagner's letter, it appears to me to be a strong case of "sour grapes", and your correspondent displays a great

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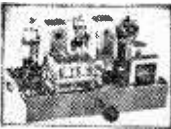
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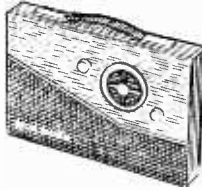
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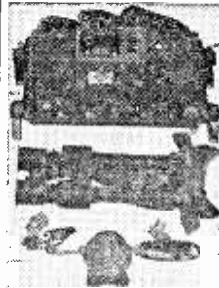
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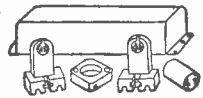
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deal of ignorance. He unmercifully criticizes the licensed amateur and yet praises the pirate operator to the full. The obvious reason why pirates "cut the cackle to a minimum" is the perpetual fear of being traced by the authorities because they are breaking the law.

Mr. Wagner states neither which system of emission nor which bands he operates, and he does not indicate the subject matters heard under discussion, but most of us are quite capable of exchanging technical data if the occasion arises. Conversely, by virtue of our licensing regulations, we are at liberty to discuss much more personal matters at any time—and we do! — REX TOBY (London, W.1.).

EVEREST PRAISE

SIR.—May I say a word of praise for the "Everest" tuner, which was described in the June and July 1962 issues of P.W.? As stated by the author, alignment needed plenty of patience, however once this has been mastered, it certainly does all that was claimed of it, and was well worth the cost of the crystal.—J. SMETHURST (Oldham, Lancashire).

A DIFFERENCE OF OPINION

SIR.—Mr. Hellyer in his article "Test Gear Techniques", published in the November issue of P.W., appears to be confused.

He says: "Mathematically, $NdB = 10 \log_{10}(P2/P1)$, where $P1$ is the input and $P2$ the output power."

This is perfectly correct. The bel is a ratio (logarithmic) of powers. This can be also written,

of course, as: $NdB = \log_{10} \left(\frac{V1^2 \times R2}{R1 \times V2^2} \right)$ and, as the

author states, if $R1 = R2$ then: $NdB = 10 \log_{10}(V1^2/V2^2)$, or: $NdB = 20 \log_{10}(V1/V2)$.

This however, is not equivalent to: $NdB = 10 \log_{10}(V2/V1)$. . . (a) and therefore cannot be termed as a voltage ratio or as a voltage decibel, which (a) would represent. As $V^2/R = P$ however, therefore: $20 \log_{10}(V1/V2)$ can be said to be again a ratio of powers. There is only one type of decibel—power. Anyone who speaks of the other types of decibels—voltage, resistance, current—either has no knowledge of what he is speaking, or is being deliberately misleading. — P. J. MCGOLDRICK (London, S.E.9).

SIR—In reply to Mr. Goldrick's letter. This is an example of the academic versus practical controversy more often found in the pages of the "glossy" technical magazines. Mr McGoldrick is as right in his facts as he is rude in his conclusions.

While it is perfectly true that the bel is a logarithm to the base 10 of the ratio of two powers, it is also true that since the power ratio is also the square of the voltage or current ratio for a given load impedance, the power ratio in decibels can be stated as 20 times the logarithm to the base 10 of the voltage or current ratio $V1/V2$ or $I1/I2$. When

using this convenient measuring tool, we do not always state that the expression dB is a power ratio: this is understood. Engineers who regularly employ the dB as a means of response curve, bandwidth and sensitivity checks are quite familiar with its use. They are concerned with comparative voltages, but are well aware that the use of the dB is a mere convenience, not an absolute measurement. They know quite well that $20 \log_{10}(V1/V2)$ is a ratio of power, and do not speak of different types of decibel. In doing so, they are not intentionally misleading and could hardly do their work without knowledge of what they were saying.

A closer reading of page 646 of the November P.W. will show that this stricture was indeed put forward. Space prevented a fuller theoretical discussion in an article of this nature. It would have been quite proper to continue to the effect that voltage ratios are more correctly stated in *nepers*. But to bring in logarithms to the base "e" would have done nothing to improve the article, or clarify the subject. However, if a more technical (less misleading?) treatment is needed, the author will be happy to oblige.—H. W. HELLYER (Gilfach, Glamorganshire).

Sir—I would be grateful if any reader could sell or loan me . . .

. . . the May and June 1957 issues of P.W.
J. M. ROBERTSON, 38 Silverhill Drive, Denton Burn, Newcastle upon Tyne 5.

. . . the circuit diagram or data of a Beethoven B106 television receiver.—S. STAFFORD, 25 Sithson Avenue, Bolsover, Derbyshire.

. . . the manual of a Marconi Canadian receiver No. 52.—H. C. LOXLEY, 51 Guy Street, Warwick.

. . . the June 1957 issue of P.W.—D. W. FROST, 6 Queen's Road, Harpurhey, Manchester 9.

. . . the circuit and data of the a.m. test set, type 74.A.—G. H. PARK, 32 Stonefield Street, Moorside, Cleckheaton, Yorkshire.

. . . the issues of P.W. giving the modification details of the No. 19 set.—J. AULESBROOK, 61 South Road, Beeston, Nottinghamshire.

. . . the instruction book for a G.E.C. four-valve portable receiver, type BC.1255.—M. SELLARS, 9 Oaklea, Sherwood Road, Heath Grove, Buxton, Derbyshire.

. . . the January 1961 issue of P.W.—A. Crabb, "Jara", Central Avenue, Hullbridge, Essex.

. . . data for the No. 38 and No. 46 transmitter/receivers.—23861901 Tpr. HARGREAVES, A. W., Q.M. Troop, 2nd Royal Tank Regiment, Lisemally Camp, Omagh, Co. Tyrone, N. Ireland.

. . . the September 1960, September and December 1961 issues of *Practical Television*.—R. F. DARBY, 5 The Firs, Bell Bar, Hatfield, Hertfordshire.

. . . the August, September and October 1961 issues of P.W.—P. A. BLAKEY, Cox Hill, Boxford, Colchester, Essex.

. . . the September 1956 issue of P.W.—M. A. FORRESTER, 58 Bede Avenue, Sherburn Road Estate, Durham.

. . . details of the valve line-up and internal connections to the coil pack plugs of the receiver type M.C.R.I.—L. O. BEALING, Del Monica, 93 Alma Road, Bournemouth, Hampshire.

. . . the September 1957 issue of P.W.—A. GUY, 27 The Drive, Lightcliffe, Halifax, Yorkshire.

. . . the issues of P.W. dealing with the conversion of the R1155 receiver.—J. REED, 14 Firth Road, Rondebosch, Cape Town, South Africa.

. . . the circuit and wiring diagram of the supply unit Mk.III No. 2.—S. M. MARGHALL, 18 Anne Way, Barking-side, Ilford, Essex.

. . . the circuit and/or any other data for the R.107 Mk.I/I set. R. S. KING, 46 Maesteg Road, Cwmfelin, Maesteg, Glamorganshire.

. . . information on the type of batteries used in an American Philco signal generator No. B76920.—H. C. CLARK, 63 Queensway, Moss Bank, St. Helens, Lancashire.

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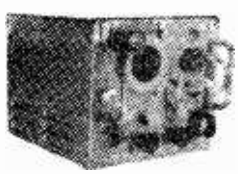
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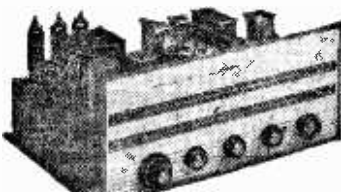
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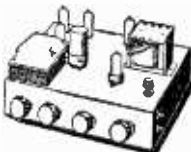
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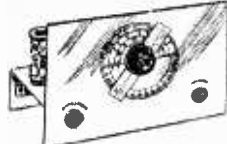
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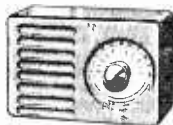
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1R5	4/9	6L19	12/6	25ZAGT	6/9	E841	8/3	HV22	8/6	U52	4/9
184	7/6	6LD20	5/9	25Z5	7/9	E8C33	5/9	KT32	8/-	U76	5/8
185	3/9	6N7	5/-	25Z8	8/-	E8C41	9/6	KT38C	4/-	U78	4/6
1T4	2/9	6P1	12/6	27S0	17/6	E8C81	6/9	KT38	14/-	U107	12/6
1U5	5/3	6P25	7/-	30C1	5/9	E8F80	6/9	KT44	6/6	U191	9/6
2D21	3/3	6P28	4/3	30C15	9/8	E8F83	5/9	KT55	17/6	U201	9/-
3A4	4/-	6Q7G	5/6	30F5	6/-	E8F59	7/6	KT78	7/-	U282	12/6
3A5	8/9	6Q7GT	7/9	30FL1	9/6	E8L21	9/-	KT63	4/6	U301	11/6
3D6	4/-	6R7G	6/-	30L1	5/6	E8C52	4/3	KT66	12/6	U309	5/6
3Q4	6/9	6A7	5/8	30L15	9/6	E8C91	3/-	KT78	7/8	U329	9/-
3S5	4/9	68C7	4/8	30P4	4/8	E8C35	7/6	KT81	19/-	U339	9/6
3V4	5/6	6S67	4/6	30P12	7/8	E8C31	7/8	KT82	6/8	U342	8/6
3R4GY	8/9	68H7	3/-	30P19	9/6	E8C32	3/9	KT69	5/8	U404	5/6
5T4	7/9	68J7	5/-	30PL1	8/8	E8C33	4/9	KT63	5/8	U801	16/6
5U4G	4/9	68K7	4/8	30PL13	8/8	E8C34	9/-	KT763	5/8	UABC80	8/6
5V4G	4/8	68T7	5/8	30P1	8/6	E8C35	5/9	L83	3/-	UAF42	7/-
5Y3G	4/8	68N7GT	4/8	35L8GT	7/8	E8C40	7/8	L82	6/8	U182	6/8
6Y8GT	4/9	68S7	5/8	35W4	4/9	E8C34	9/6	MU14	6/8	UBC41	9/6
5Y4G	8/8	68S7	3/8	35ZAGT	4/9	E8C32	4/3	N37	10/6	UBC81	6/9
6Z4	8/-	6U4GT	9/8	35Z5GT	6/8	E8C38	5/6	N78	11/6	UBF80	6/9
7Z4G	7/-	6V2G	4/8	4/1	6/8	E8C38	6/8	N108	13/-	UBF89	7/3
5Z4GT	8/8	6V6GT	6/8	4/2	6/8	E8C35	6/9	N152	8/3	UBL21	10/6
6/30L2	8/3	6X4	6/8	50B5	6/8	E8C88	10/6	P41	11/6	UCB2	7/6
6A8	3/8	6X5G	4/9	50C5	6/9	E8C80	6/9	P61	2/6	UCB34	9/6
6A7	8/-	6X5GT	6/8	50LGT	7/-	E8C82	7/3	PABC80	7/8	UCB85	8/9
6A8G	6/8	6Z6	8/8	55K9	9/6	E8E21	10/9	PC86	10/3	UCF80	11/9
6AGT	12/6	7B7	6/8	61T	17/6	E8E35	7/6	PC87	8/-	UCH21	9/-
6AC7	3/-	7C5	7/3	62B7	13/6	E8H42	9/8	PC84	6/8	UCH42	8/6
6AG5	2/6	7C6	7/-	75	4/8	E8E81	6/9	PC85	7/8	UCH81	8/6
6AG7	5/9	7H7	5/9	78	4/8	E8H83	7/9	PC88	11/-	UCL82	8/8
6AK5	4/9	7R7	15/-	80	5/8	E8L80	5/9	PC89	8/8	UCL88	9/8
6AL5	6/8	7Y4	4/8	82	9/6	E8C11	9/8	PC189	10/8	UF41	7/6
6AM6	2/9	7Z4	5/-	18B2T	19/6	E8L83	9/6	PC84	6/8	UHC42	8/6
6AQ5	5/9	8D3	2/8	18BTA	10/6	E8L82	9/6	PC82	6/8	UF80	6/9
6AT6	5/-	10C1	9/8	807(A)	8/-	E8E22	6/6	PCF84	9/3	UF85	7/6
6A06	6/-	10C2	12/6	807E	5/8	E8F88	3/3	PCP86	6/8	UF89	6/8
6A76	6/8	10P1	6/8	81C	4/8	E8F74	5/8	PC82	8/8	UL41	6/9
6B7	8/-	10P9	10/-	832	14/-	E8F83	4/8	PC89	8/8	UL44	14/-
6B8G	3/-	10P18	9/8	866A	11/6	EF40	9/8	PC84	6/8	UL46	6/9
6BA8	5/6	10L1D11	12/6	954	3/8	EF41	6/8	PC85	8/6	UL84	6/9
6B88	5/-	10P13	8/3	955	2/3	EF42	5/8	PC86	9/6	UM80	8/6
6B06G	13/-	10P14	6/8	956	5/8	EF50-BR13	3/8	PC85	3/8	UR1C	6/6
6B16	5/6	10P18	6/9	1825	5/8	EF80(A)	2/6	PC85	7/6	UT6	8/9
6B18	5/6	12A8	2/3	5763	7/8	EF84	3/3	PC84	4/3	U07	8/6
6BR7	8/-	12A8H	9/-	9001	3/-	EF80	3/6	PL33	9/6	U08	11/6
6BR9	8/-	12A78	6/8	9002	4/3	EF85	5/6	PL38	8/3	UY18	10/6
6B86	6/8	12A7	3/9	9003	5/8	EF86	6/8	PL38	15/-	UY21	8/6
6BW7	5/-	12AU6	7/8	ATP4	9/-	EF89	5/8	PL1	7/9	UY41	5/9
6C4	2/3	12AU7	4/3	AZ31	6/9	EF91	2/6	PL82	8/8	UY45	8/6
9C5	5/8	12AV6	6/9	AZ41	6/8	EF92	2/6	PL83	5/3	VP48	9/-
8C8	3/-	12AX7	5/6	B36	6/9	EF183	8/6	PL84	5/9	VP23	2/3
8C9	10/6	10P1	6/8	C1C	8/-	EF184	8/6	PL80	7/9	VP41	5/3
8CD8G	15/8	12B8B	6/8	CH35	15/8	EF83	5/8	PC84	8/8	UL44	14/-
6C86	5/-	12B8H7	7/-	CL33	9/-	EL32	3/6	PC84	9/8	VR105	5/6
6D2	2/3	12C8	3/9	CY31	6/8	EL33	7/-	FX25	8/9	W76	4/9
6D8	9/6	12E1	18/-	D77	2/3	EL34	9/8	PY31	6/-	W81	5/8
6D6	3/6	12E6	6/8	D80	11/6	EL35	7/6	PY32	9/-	X61M	11/-
6E1	6/8	12H5G	6/8	EL32	8/-	EL32	11/6	FX25	9/8	X63	5/8
6E6	6/8	12J7GT	7/8	DAF91	4/8	EL41	4/8	EL41	5/8	X68	5/8
6F8G	4/6	12K70T	4/6	DAF98	6/8	EL42	7/8	PY81	5/8	X68	7/6
6F13	4/6	12K8	9/9	DF31	8/-	EL81	8/8	PY82	5/-	X76M	11/-
6F14	9/6	12K83GT	8/9	DF91	2/9	EL84	5/8	PY83	6/-	X78	21/-
6F18	6/8	12K97	6/8	DF96	9/6	EL85	7/8	PY88	8/8	X79	21/-
6F19	5/-	12K87	6/9	DF97	7/6	EL81	2/9	PY80	8/8	X83	5/-
6F32	4/-	12K87	3/9	DH63	5/6	EL85	6/-	PZ30	9/6	X23	4/9
6F33	4/-	12K87	3/8	DH76	4/8	EM34	8/8	R18	9/6	Z68	7/6
6F16	1/6	12K87	5/8	DK32	8/-	EM80	8/8	R19	7/9		
6F15	4/8	12K87	6/8	CLC	4/8	EM81	7/6	SP41	2/-		
6F5G	4/3	12N7GT	6/9	DK92	6/8	EM82	8/6	SP41	2/-		
6F5GT	3/8	12K87	4/-	DK96	7/3	EM85	9/-	SU25	18/-		
6F6	3/8	12K87	4/9	DL38	7/3	EM31	9/8	SD150	4/6		
6F7G	7/8	12D8	5/8	DL35	7/-	EY51	5/8	T41	6/8		
6F7GT	6/8	12H46	7/8	DL83	6/9	EY88	9/8	TD4	8/8		
6K6GT	6/-	12B86	14/-	DL76	6/-	EY88	9/8	UL14	7/6		

3 VALVE AMPLIFIERS

Kit of new parts, consisting chassis, mains and output transformers, valves (P91, 6X6G, 6X4G) and all components. With full instructions for making high gain amplifier with separate bass and treble controls, negative feedback-lackets. Truly unusual value! 29/-

MAINS TRANSFORMERS

Excellent Quality Guaranteed. Upright mounting 250-0-250 V 9/6
60 mA, 6.3 V 3 A.
Ditto semi-dropt 9/6. Ditto dropt 80 mA 12/6.

NEW SHOP SOUTHAMPTON

OPENING ON JANUARY 18, 1964
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We look forward to seeing all our old customers in the area
With Widest Stocks. Keenest Prices: TV's, Radios, Valves, Transistors, Hi-Fi Equipment, Loudspeakers, Autochangers, Cables, Components, etc.

Tubes

HIGHEST QUALITY - COMPARE OUR PRICES

Most Mullard, Mazda, Cossor, Emitron, Emiscope, Brimar, Ferranti types, processed in our own factory

Guaranteed	12 Months	New Types
6 Months		
£2. 0.0	£3. 0.0	MW 31/74
£2. 10.0	£3. 10.0	MW 36/84
£3. 5.0	£4. 5.0	CRM 172
£3. 15.0	£5. 15.0	MW 43/84
		£6. 0.0

BULK BARGAINS

12 POTS. Popular values. 5K to 2 Meg. Unused, mixed, preser. long sp. switched, etc. 4/6
CONDENSERS. 25 Mixed. Electrostatic. Many popular sizes. List Value 25. Our Price 10/-

100 RESISTORS 6/6
Excellent. Sizes 1.5 watt.

100 CONDENSERS 9/6
Miniature Ceramic and Silver Mica Condensers. 3 pF to 3,000 pF. LIST VALUE OVER 25.

25 TAG STRIPS 4/-
2, 4, 6 way etc. Unused.

100 HI STABS 9/6
1% to 5%, 100Ω to 3MΩ.

TELEPHONE C.O.D. ORDERS DISPATCHED THE SAME DAY.

VALUE!

4 watt AMPLIFIERS
Excellent amplifier with high gain preamp stage, 10P3 driving 10P14 output stage, complete with Sin. speaker, in attractive 2-tone case. Tone control, negative feedback, ready for immediate use, individually tested. Amazing volume and clarity, ideal for guitars, record players, p.a. in small halls, baby alarms etc. Easily worth £5. Our price whilst stocks last. Carr. Packing, etc. 7/6. 45/-

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Post: 2 lbs 2/-, 4 lbs 2/6, 7 lbs 3/6, 15 lbs 4/-, etc. (C.O.D. 2/- extra). ALL ITEMS LESS 5% AND POST FREE IN DOZENS.
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We supply from stock most of the components and items specified or circuits published in this and other magazines and radio books. Let us quote for your circuit, first grade components at realistic prices.

MINIATURE 'SCOPE

Features 2½ in. DG7/5 Tube. Level 2dB, 50 c/s to 2 Mc/s. 3½ Sec. to 80½ Sec. Sweep. High sensitivity. Fully portable scopes. Ideal for all transistor and valve design or servicing. 22 to 30 volt D.C. operated.

MODEL CT84

£16-10-0

CARRIAGE 7/6

DEAC RECHARGEABLE BATTERIES

- (a) 18 volt 100mA/H 4 x 1in. diameter. Brand new sleeved, 30/-.
 - (b) As above but 150mA/H, 35/-.
 - (c) 3.9 volt 450mA/H, 12/6.
- All types easily split into any multiple of 1.2 volt. Brand new.

MULTI-METERS

Multi-range test meters featuring easy to read scales and provided with full operating instructions, lead and batteries. Suitable for amateur, designers, repair shops, all domestic uses. Full details and specification in our catalogue.



- ★ PT34 1 Kohm/volt £2 5 0
- ★ MI 2 " " £2 9 0
- ★ THL33 2 " " (illus.) £3 15 0
- ★ EP10K 10 " " £4 9 0
- ★ ITI-2 20 " " £5 5 0
- ★ TP55 20 " " £5 19 6
- ★ EP30K 30 " " £6 19 6
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- ★ EP50K 50 " " £9 19 6

SUBSTITUTION BOXES

- Capacitor Box. Provides 9 standard values from 0.001 to 0.22 mfd at 600 volt working. 29/6.
- Resistor Box. Provides 24 standard values at 1 watt. 15 ohms to 10 meg., 37/6.

Each box fully calibrated with insulated leads. Invaluable for service and design.

NOMBREX TEST EQUIPMENT

All transistor portable units supplied with full instructions.



LEAFLETS ON REQUEST

- ★ 150 Kc/s to 350 Mc/s generator. RF, Mod., AF. 8 ranges. Leads, batt., instructions. £7.18.6, P.P. 2/6.
- ★ Resistance/Capacitance Bridge. 1 pF to 100mF and 1 ohm to 100meg. leakage. PF Tests, with batt. and Instructions. £7.2.3, P.P. 2/6.
- ★ Power Supply. Gives any voltage 1 to 15 D.C. up to 0.1 amp. From Mains. £5.17.6, P.P. 2/6.
- ★ Audio/Generator, 10 c/s to 100,000 c/s. Sine and square wave. With batt. and Instructions. £15.2.3, P.P. 2/6.

HI-FI SPEAKERS

- CX300 12 inch 25 watt 12 Gns.
- CR12AE 12 inch 20 watt 8 Gns.
- CR30AE 12 inch 20 watt triple range... 10 Gns.
- 8A7 8 inch 6 watt 79/6
- 10 watt Horn Tweeter 29/6

TEST LEAD KIT

supplied in Pocket Pouch. Contains probes, leads, clips, etc. 8/6, P.P. 9d.

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5in. 600ft. 12/6; 5in. 900ft. 15/-; 7in. 1,200ft. 18/6; 7in. 1,800ft. 25/-; 7in. 2,400ft. 27/6. Excellent quality.

100 Kc/s QUARTZ CRYSTALS

- 2 Pin: Octal or 3 Pin 15/- ea.
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 - 5000 Kc/s 2 Pin 10/-
 - 10 Mc/s 2 Pin 15/-
 - 27 Mc/s Radio Control 15/-
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- (Over 600 Frequencies in Stock for all purposes).

MAINS AND BATTERY RECORD AND TAPE DECKS

- All Decks Complete with Cartridges
- ★ BSR UA14 4-speed £5 19 6
 - ★ Garrard Autoslim £6 10 0
 - ★ Unpluggable Head Version £6 19 6
 - ★ Stereo Version £7 19 6
 - ★ SRP10 4-speed or GU7 £5 5 0
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 - ★ 4-track Deck £13 19 6
 - P. & P. 3/6 any type above.
 - ★ 9 volt Star. 45 r.p.m. 39/6
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Complete with full function pre-amplifiers and controls.

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- ★ SA150 7+7 watts £16 10 0
- ★ SA30015+15 watts £32 10 0

Each amplifier completely self contained and designed for Mono and Stereo output. Supplied complete with full manual. Leaflets on any type on request. (Full range of Speakers, Tweeters and Decks in stock, see catalogue).

STETHOSCOPE HEADSETS

Crystal and Magnetic 10/6 each.

CRYSTAL MICROPHONES

- Acos 39-1 Stick Microphone 32/6
- Acos 60-1 Stick Microphone 27/6
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- Acos 45 Hand Microphone 25/-
- Lapel/Hand Microphone 12/6
- MC24 Stick Microphone 25/-
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- BM3 Stick with Stand 52/6
- Lapel/Hand Magnetic 12/6

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- *0/50µA (D.C.) 39/6 *0/5mA (D.C.) 27/6
 - *0/500µA (D.C.) 32/6 *0/300V (D.C.) 27/6
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- All Brand New Boxed. *Available Clear Plastic Front or Black Moulded.
- 200µA D.C. Edge meter 69/6
 - 1 mA D.C. Edge meter 59/6
- 3½ x 1 inch Front Panel.

POCKET SOLDERING IRON. 30 watts. 220/250 volts A.C. Complete with pointed bit, mains plug, carry pouch. 14/6, P.P. 1/6.

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2000 ohms 12/6. 4000 ohms 14/-.

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- 4-Channel Transistor Mixer Unit 59/6 P.P. 1/6
- Tape Jack Radio Tuner 29/- P.P. 1/-

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- Complete units with CS 5A VHF Detector, 5—V6/8R (OC4A) Transistors, 3.9V. 450mA rechargeable Deac battery 2—OA91, OA 10 rectifiers, 1 Kohm stethoscope headset, moulded casing, etc.
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Complete with 5 valves. In new condition. These sets are sold without guarantee but are serviceable. 22/6 P.P. 2/6

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Henry's Radio Ltd

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PLEASE TURN TO BACK PAGE

Practical Wireless

ALL of these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for those marked thus (*).

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

DOUBLE-SIDED BLUEPRINTS

Each blueprint in this series contains details of two separate instruments or items of equipment.

The Strand Amplifier }	5/-
The PW Signal Generator }	
The Savoy VHF Tuner }	5/-
The Mayfair Pre-amplifier }	
The Berkeley Loudspeaker Enclosure }	5/-
The Luxembourg Tuner }	
The PW Troubadour }	7/6
The PW Everest Tuner }	
The PW Britannic Two }	6/-
The PW Mercury Six }	
The PW Regency }	5/-
The PW International Short Wave Two }	

RECEIVERS

The Tutor *	3/-
The Citizen *	5/-
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Dual-wave Crystal Diode	PW95 2/6
Modern One-valver	PW96 2/6
All-dry Three	PW97 3/6
Modern Two-valver	PW98 3/6
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A.C. Coronet-4	PW100 4/-
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The PW Roadfarer	5/-
The PT Band III TV converter	1/6
The Mini-amp	5/-
The PT Olympic *	7/6
The PT Multimeter *	5/-

SOME EARLIER DESIGNS

THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. The majority of the components for these receivers are no longer stocked by retailers.

Experimenter's Short Wave	PW3Ca	2/6
Midget Short Wave Two	PW3Ea	2/6
Simple S.W. One-valver	PW88	2/6
Pyramid One-valver	PW93	2/6
BBC Special One-valver	AW3E7	2/6
A One-valver for America	AW429	2/6
Short-Wave World Beater	AW436	3/6
Standard Four Valve S.W.	WM3E3	3/6
Enthusiast's Power Amplifier	WM3B7	3/6
Standard Four Valve	WM391	3/6
Listener's 5-Watt Amplifier	WM392	3/6

QUERY COUPON

This coupon is available until 7th February, 1964, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, FEBRUARY, 1964.

BLUEPRINT SERVICE

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AM TRANSISTOR PORTABLE RECORD PLAYER



● Made by well known British manufacturer. Features ready built 4-transistor printed circuit 1 watt amplifier, elliptical speaker and volume control. Low current Star, constant speed 45 r.p.m. turntable with crystal pick-up. Strong moulded two colour cabinet with handle. Plays anywhere on long life 9 volt battery. Requires less than half an hour's work to connect up using ready built units and easy instructions.

TOTAL COST 79/6 P.P. 5/-

(BATTERY 3/9 EXTRA)

ALL UNITS SOLD SEPARATELY

- ★ **READY BUILT AMPLIFIER WITH SPEAKER AND VOLUME CONTROL 35/- P.P. 2/-**
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- **EXCELLENT QUALITY AND VALUE** ●

TOT. £5

Fully Detailed Illustrated Leaflet on request. All parts sold separately. Guaranteed the Best Obtainable. Attractive Appearance. Reliable Design. Quality Performance.

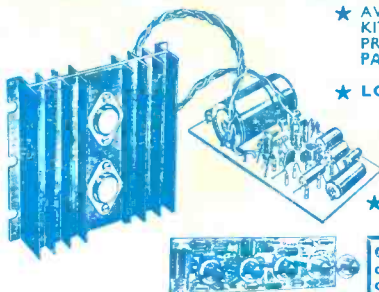
radio market. printed composite building blocks. Full tuning of long wave bands. Unbeatable sensitivity and selectivity. Excellent tone and volume with over 600mW push-pull output.

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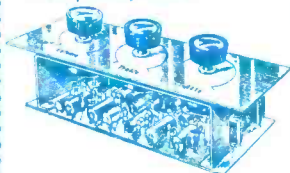
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