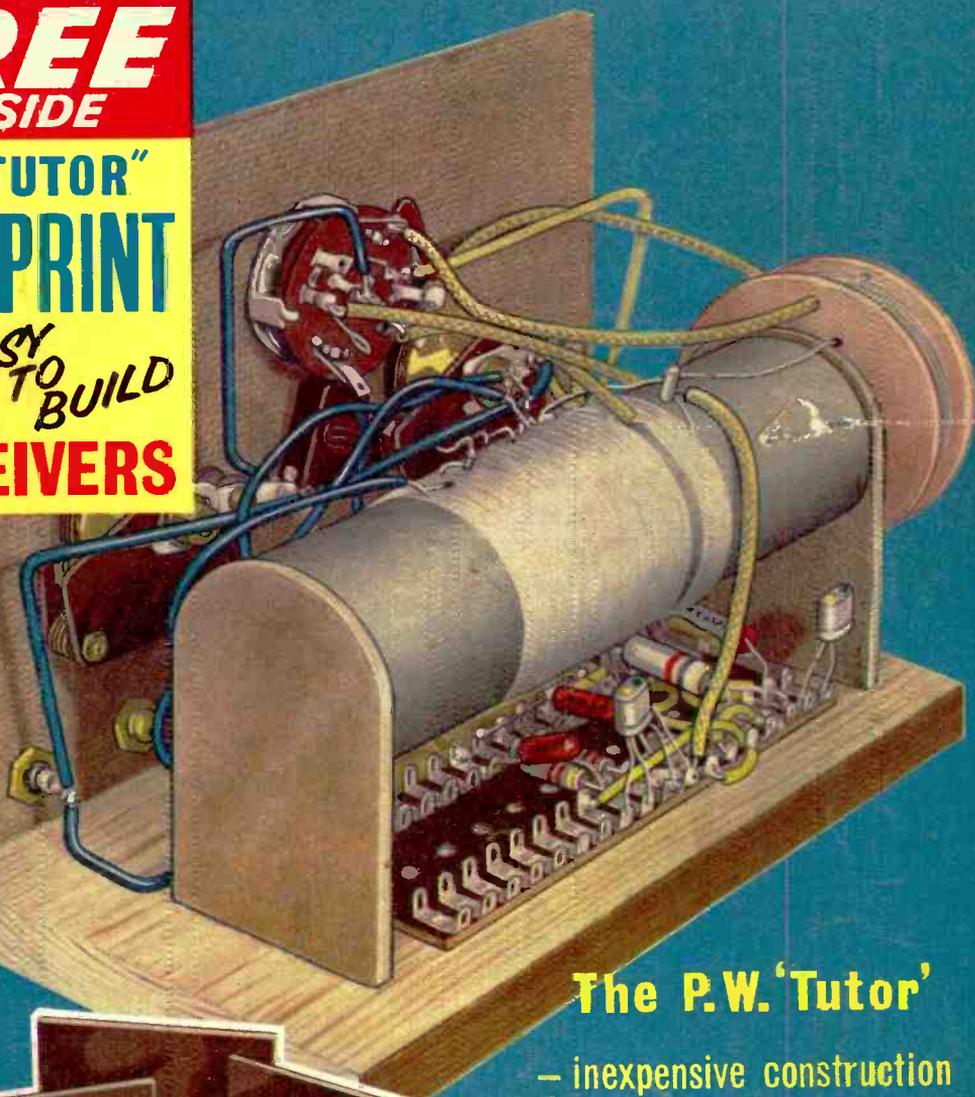


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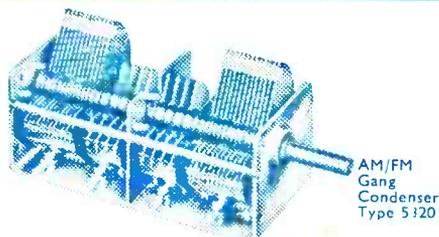
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3S4	8/-	6L19	21/-	12K8GT	12/6	85A2	12/6	DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U442	9/6	
3V4	9/-	6L34	10/-	12Q7GT	8/6	150B2	12/6	DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U443	9/6	
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5Z3	10/-	6M1	10/6	12SK7	8/-	305	7/6	DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U447	9/6	
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6KA5	8/-	6SA7GT	7/6	14R7	12/6	9002	7/6	DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U453	9/6	
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6BE6	7/6	6X5GT	5/-	20P5	22/6	ACVP2	17/6	DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U466	9/6	
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6BW6	7/-	7C6	8/-	25Z4	9/6	AC2		DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U469	9/6	
6BW7	5/-	7D5	15/-	25Z5	9/6	PENDD21/-		DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U470	9/6	
6BX6	6/-	7D6	15/-	25Z6	10/6	AC2		DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U471	9/6	
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6C4	6/6	7H7	8/-	30	13/6	B36	21/-	DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U473	9/6	
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6C5	6/6	7Q7	11/6	30F5	11/6	B152	8/6	DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U475	9/6	
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6C10	12/6	7S7	10/6	30L1	11/6	B329	9/6	DF97	9/6	EF92	5/-	KT33C	PM202	16/-	U477	9/6	
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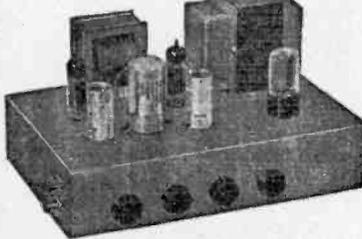
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HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

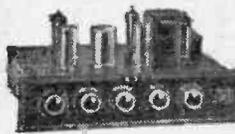
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Two input sockets with associated controls allow mixing of "mike" and gram, as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, 5Y3. High Quality sectionally wound output transformer specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE**, "Lit" and "Cut". Frequency response ± 3 D.B. 30-30,000 c/s. Six negative feedback loops. Hum level 80 D.B. down. **ONLY 23 millivolts INPUT** required for **FULL OUTPUT**. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD or LONG PLAYING RECORDS** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS, etc.** **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT**. Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 8 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/-

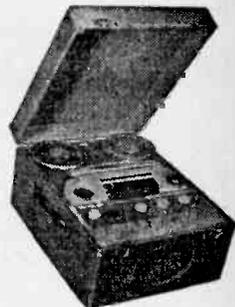


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R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER



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



25 1/2 GNS.
 Carr. 17/6

H.F. TERMS. Deposit 25.7.6 and 12 monthly payments of 2 gns. Cash price if settled in 3 months.

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COLLARO CONQUEST 1-SPEED AUTO-CHANGER, with high fidelity Studio pick-up. Latest model. For 200-250 v. 50 c.p.s. A.C. mains. Our price 26-19.6. Carr. 5/6.

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 A design of a 3-valve long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Valve line-up 6K7, 6F6, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams, instructions and parts list. 1/8, maximum building costs 24-18.6, inc. attractive Walnut veneered wood cabinet 12 x 6 1/2 x 5 1/2 in.

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

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



Assembled 6 v. or 12 v. 4 amps.

Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused 69/6 and ready for use with Carr. 5/- mains and output leads. Terms: Deposit 13/3 and 5 monthly payments 13/3.

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 Midget Battery Pentode 68:1 for 3S4, etc. 3/9
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 60 mA. 10 H 400 ohms. 4/11

CHARGER TRANSFORMERS
 All with 200-230-250 v. 50 c/s Primaries:
 0-9-15 v. 1 1/2 a. 11/9; 0-9-15 v. 2 a. 14/9; 0-9-15 v. 3 a. 18/9; 0-9-15 v. 5 a. 19/9; 0-9-15 v. 6 a. 23/9; 0-9-15 v. 8 a. 28/9.

AUTO (Step up/Step down) TRANS
 0-110-120-230/250 v. 50-80 watts. 13/9;
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A complete set of parts to construct a Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and point-to-point wiring diagrams supplied. Only good quality components and latest high grade valves used. Exceptionally realistic reproduction can be obtained at ample volume for the home, as can be demonstrated in typical surroundings at our County Arcade premises. A really sensational offer.

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A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response—3 db. 30-30,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 13 millivolts so that ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE. The unit is designed for CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS, etc. For use with Electronic ORGAN, GUITAR, STRING BASS etc. For standard or long-playing records. OUTPUT SOCKET PROVIDES L.T. and H.T. for a RADIO FEEDER UNIT

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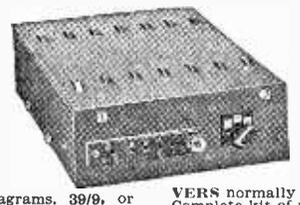
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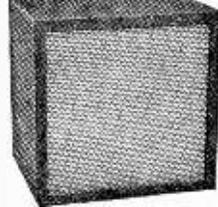
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£8.19.6

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OB2	17/6	6F12	4/6	12AD6	17/8	7/8	6/1	DL68	15/1	EF50(E)	5/1	KF35	8/6	PY32	12/6	UBF89	9/1	Z77	4/6
OZ4	5/1	6F13	11/6	12A6	14/3	8/0	9/1	DL72	15/1	EF54	5/1	KL35	8/6	PY80	7/6	UCL21	23/10	Transistors	
IA5	6/1	6F23	10/6	12AH7	8/1	8/3	15/1	DL92	7/1	EF73	10/6	KL32	25/2	PY81	8/6	UCC84	14/11	and diodes	
IA7GT	12/1	6F24	12/6	12AH8	12/6	85A2	16/1	DL94	7/6	EF80	6/1	KT2	5/1	PY82	7/1	UCC85	9/1	CG1C	3/1
IC5	12/6	6F32	10/6	12AT6	7/6	90AG	67/6	DL96	8/6	EF85	6/1	KT33C	10/1	PY83	8/6	UCH2	9/1	CG4E	3/1
ID6	10/6	6F33	7/6	12AT7	6/1	90AV	67/6	DM70	7/6	EF86	10/6	KT36	30/7	PY88	13/7	UCH213/10	CG6E	3/1	
IF5GT	17/6	6H6	3/1	12AU7	6/6	90C1	16/1	EB0F	30/1	EF39	9/1	KT41	23/10	PZ30	20/5	UCH42	9/6	CG7E	7/6
IL4	10/6	6J5	5/1	12AX7	7/6	90CG	37/6	EB3F	30/1	EF91	4/6	KT44	12/6	QP21	7/1	UCH81	9/6	CG10E	3/1
ILD5	5/1	6J7G	6/1	12BA6	8/1	101	13/6	EA50	2/1	EF92	4/6	KT61	12/6	QP25	14/6	UCL82	11/6	CG12E	3/1
ILN5	5/1	6J7GT	10/6	12BE6	9/1	150B2	18/1	EA76	9/6	EF97	13/7	KT63	7/1	QS150/15		UCL83	19/9	GD3	4, 5,
INSGT	10/6	6K7G	5/1	12BH7	21/9	185BT	34/1	EABC80	9/1	EF98	13/7	KT66	15/1		10/6	UF41	9/1	6, 8	4/1
IR5	6/6	6K7GT	6/1	12IGT	4/6	304	10/6	EAC91	4/6	EF183	19/1	KT88	24/1	R12	9/1	UF42	12/6	OA70	3/1
IS4	9/1	6K8GT	10/6	12KS	18/4	807	7/6	EAF42	2/6	EF184	12/6	KTW61	6/6	R18	14/1	UF80	10/6	OA73	3/1
ISS	4/1	6K8G	6/6	12K7G	5/6	956	3/1	EB41	8/6	EB32	5/1	KTW63	6/6	R19	20/5	UF85	9/1	OA81	3/1
IT4	3/6	6K25	20/5	12K8GT	14/1	1821	17/1	EB91	4/1	EL33	12/6	KTZ41	8/1	RG1/240A		UF86	18/4	OA89	3/1
IU5	6/1	6L1	23/10	12QGT	5/1	4033L	12/6	EB3C	23/10	EL34	15/1	KTZ63	7/1	RK34	54/1	UF89	9/1	OA86	4/1
2P	27/2	6L6G	8/1	12SA7	8/6	5763	12/6	EB33	5/1	EL38	27/2	L63	6/1	SP47	7/6	UL41	9/1	OA91	3/6
3A4	6/1	6L6M	9/6	12SC7	8/6	7193	5/1	EB41	8/6	EL41	9/1	MHL4	7/6	SP41	3/6	UL46	14/6	OA210	11/1
3A5	10/6	6L7GT	7/6	12SG7	7/1	7475	7/6	EB81	8/1	EL42	10/6	MHL6D	12/6	SP42	12/6	UL84	8/6	OA11	20/1
3B7	12/6	6L18	13/1	12SH7	8/6	90C2	5/6	EBF80	9/1	EL81	17/1	M4	8/6	SP61	3/6	UM4	17/8	OC16	48/1
3D6	5/1	6LD20	16/4	12S17	8/6	AC/PEN		EBF83	14/3	EL83	20/5	M54B	23/10	SU25	27/2	UM34	17/8	OC19	48/1
3Q4	7/6	6N7	8/1	12SK7	8/1	5-pin	23/10	EBF89	9/6	EL84	7/6	MU21/14	8/1	T41	9/1	UM80	15/8	OC22	28/1
3Q5GT	9/6	6P28	27/2	12SQ7	11/6	7-pin	15/1	EBL1	30/6	EL85	14/3	N37	23/10	TD4	12/6	UR1C	19/1	OC23	87/1
3S4	7/6	6Q7G	16/6	12SR	8/6	AC/PEN		EBL21	23/10	EL86	17/8	N78	20/5	TH41	27/2	UU6	20/5	OC26	25/1
3V4	7/6	6Q7GT	11/1	12T4	10/6	DD	12/6	EBL31	23/10	EL91	5/1	N108	23/10	TP22	15/1	UU8	27/2	OC28	25/1
5R4G	17/6	6R7G	10/1	19AQ5	10/6	AC/PEN	7/6	EC52	5/6	EL95	10/6	N308	21/1	TP25	15/1	UY1N	19/1	OC35	25/6
SU4G	6/6	6SA7GT	8/6	19A10	10/6	AC/TP	34/1	EC54	6/1	EL820	19/1	N339	15/1	TY26	20/5	UY21	17/1	OC44	11/1
SU4G	6/6	6S7G	8/1	20F1	15/8	ATP4	5/1	EC70	12/6	EL822	25/1	P61	3/6	TY867	13/7	UY41	7/6	OC45	10/1
SY3	6/1	6S7GT	8/1	20F2	27/2	AZ1	19/1	EC92	13/7	EM34	9/6	PABC80	14/3	U12/14	8/6	UY85	7/1	OC65	22/6
SZ3	20/5	6S7GT	8/1	20F1	27/2	AZ1	19/1	EC92	13/7	EM34	9/6	PABC80	14/3	U12/14	8/6	UY85	7/1	OC65	22/6
SZ4G	9/1	6S7GT	8/1	20P1	27/2	AZ1	19/1	EC92	13/7	EM34	9/6	PABC80	14/3	U12/14	8/6	UY85	7/1	OC65	22/6
6A7	10/6	6S7GT	6/1	20P3	23/10	B36	14/3	ECC32	5/6	EM71	23/10	PCC84	8/1	U16	10/6	VMP4G	15/1	OC66	25/1
6A8	9/1	6S7GT	6/6	20P4	27/2	BL63	12/6	ECC33	8/6	EM80	9/1	PCC85	9/6	UB/20	8/6	VMS4B	15/1	OC70	6/6
6AC7	4/1	6S7GT	6/6	20P5	23/10	C1C	12/6	ECC34	25/2	EM81	9/1	PCC88	11/6	U19	36/1	VP2	12/6	OC71	6/6
6AG5	5/6	6S7GT	9/1	25A6G	10/6	CBL1	27/2	ECC38	8/6	EM84	17/8	PCC89	11/6	U22	8/1	VP4	15/1	OC72	8/1
6AG7	5/6	6S7GT	8/1	25L6GT	10/6	CBL31	23/10	ECC82	6/6	EY51	9/1	PCF80	10/6	U24	30/7	VP28	14/6	OC73	16/1
6AK5	8/1	6U4GT	12/6	25Y5G	10/6	CCH35	8/6	ECC83	7/6	EY83	17/1	PCF82	10/6	U25	18/4	VP4B	23/10	OC75	8/1
6AL5	4/1	6U5G	7/6	25Z4G	9/1	CC506	6/6	ECC84	9/1	EY84	14/1	PCF84	17/1	U26	9/6	VP3C	6/6	OC78	8/1
6AM6	4/6	6U6G	8/6	25Z5	9/6	CL33	19/9	ECC85	8/6	EY86	9/1	PCF86	15/1	U31	9/6	VP2	6/6	OC81	8/1
6AQ5	7/6	6V7G	7/1	25Z6G	10/6	CV63	10/6	ECC88	18/1	EZ35	6/1	PCL84	12/6	U33	27/2	VP41	6/1	OC81	8/1
6AT6	7/1	6V6GTG	8/1	27S1	20/5	CY1	11/1	ECC91	5/6	EZ40	7/1	PCL85	17/1	U45	13/6	VT61A	5/1	OC171	11/6
6AU6	10/1	6X4	5/1	28D7	7/1	CY31	19/1	ECF80	10/6	EZ41	7/1	PCL86	17/1	U50	6/6	VT501	5/1	OC200	16/6
6B8	5/1	6XS7G	6/1	30C1	8/1	DIS	10/6	ECF82	10/6	EZ80	7/1	PENA423/10	U52	6/6	W76	5/6	OC203	24/1	
6BA6	7/6	6/30L2	10/1	30F5	6/1	D77	4/1	ECF86	20/5	E281	7/1	PENA433	U54	20/5	WM18	6/1	OC271	29/6	
6BE6	6/1	7B7	8/6	30FL1	10/1	DAC32	10/6	ECH3	27/2	FC4	15/1	U272	U76	6/1	W107	19/1	TJ1	40/1	
6BGG6/23/10	7/6	7C5	8/1	30L1	8/1	DAF91	6/6	ECH21	23/10	FW4/500	8/6	PEN25	4/6	U78	5/1	W729	20/5	TJ2	45/1
6BH6	8/1	7C6	8/1	30L15	11/6	DAF96	8/6	ECH35	6/6	FW4/800	8/6	PEN45	19/6	U201	17/1	X41	15/1	TJ3	50/1
6B16	6/1	7H7	8/1	30P4	12/1	DD41	14/3	ECH42	9/1	GU50	27/6	PEN46	7/6	U251	14/1	X61(C)	12/6	TP1	40/1
6BQ7A	15/1	7B7	12/6	30P12	7/6	DET25	7/6	ECH81	9/1	GZ30	9/1	PEN383	U281	20/5	X63	9/1	TP2	40/1	
6BR7	12/6	757	9/6	30P13	16/6	DF33	10/6	ECH83	14/3	GZ32	10/1	PEN/DD	U282	23/2	X65	12/6	TP1	10/1	
6BW6	8/6	7V7	8/6	30R13	16/6	D666	15/1	ECL80	9/1	GZ33	20/5		U301	23/10	X66	12/6	TS2	12/6	
6BW7	6/1	7Y4	7/6	35A5	21/9	DF91	3/6	ECL82	10/6	GZ34	14/1	4020	U329	14/1	X76M	14/1	TS3	15/1	
6C4	5/1	8D2	3/6	35L6GT	9/6	DF96	8/6	FCL83	19/9	GZ37	20/5	PL33	19/9	U339	17/1	X78	23/10	TS4	24/1
6C5	6/6	9BW6	15/8	35W4	7/6	DF97	9/1	ECL86	17/1	HABC80		PL36	12/1	U403	17/1	X79	23/10	V30/10P	28/6
6C6	6/6	9D2	4/1	35Z23	10/6	DH63	6/6	EF9	23/10	HL2	13/6	PL38	27/2	U404	8/6	X109	17/8	XA101	9/1
6C9	13/6	10C1	13/1	35Z4GT	6/1	DH76	5/1	EF22	14/1	HL2	7/6	PL81	10/6	U801	30/7	XD(1.5)	6/6	XA102	10/1
6C10	9/1	10C2	27/2	35Z5GT	9/1	DH77	7/1	EF36	4/1	HL23	15/8	PL82	7/6	U4020	18/7	XFG1	15/8	XA103	15/1
6CDE6G	37/5	10F1	27/2	43	10/1	DK32	12/1	EF37A	8/1	HL23DD	7/6	PL83	9/1	UABC80	9/1	XFY2	9/6	XA104	18/1
6CH6	9/1	10LD11	16/4	50C5	10/1	DK91	6/6	EF39	5/6	HL42DD		PL84	13/1	UAF42	9/6	XFY34	18/1	XB102	6/6
6D6	6/6	10P13	15/1	50CD6G		DK92	9/1	EF40	15/1		19/9	PL820	19/1	UB41	12/1	XH(1.5)	6/6	XB103	6/6
6E5	12/6	10P14	19/9		37/5	DK96	8/6	EF41	9/1	HN309	25/2	PM84	17/8	UBC41	8/6	XHG(1.5)	6/6	XB104	7/1
6F1	27/2	12A6	5/1	50L6GT	9/6	DL33	9/6	EF42	10/6	HVR2	20/1	PX4	10/6	UBC81	11/6	Y63	7/6	XC101	6/6

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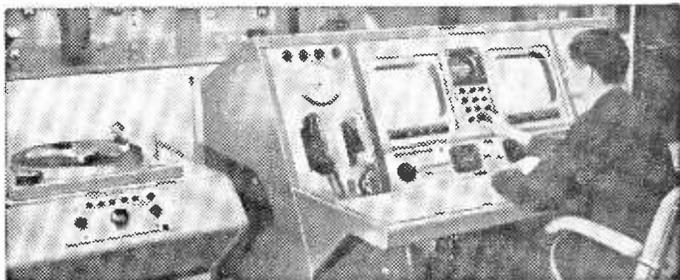
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PORTABLE RADIOPHONES MODEL MK II

Brand New British Army Portable Transmitter Receivers

Designed for reliable voice intercommunication operating up to 10 miles depending upon obstructions and elevation. The combined Transmitter Receiver covers the whole frequency range between 7.4-9 Mc/s, and is fully tunable on both Transmitter and Receiver. Simple and a delight to operate as all controls are mounted on the front panel of the set and clearly marked. Operates from standard dry batteries 3 v. L.T. and 120 v. H.T. Incorporates 5 valves: R.F. Amplifier, I.F. Amplifier, Second Detector, Output and Power Amplifier.

All sets are supplied complete with all accessories comprising dynamic sound powered headphones, electro magnet super-sensitive microphone, 4ft. aerial, junction box, battery connection details and full circuit diagram.

PRICES:
80/- EACH (F. & P. 4/-).
TWO FOR 28.00 (Post Free).
Batteries 20/- per set.

P.217A. MINIATURE 2 1/2 in. SPEAKER

A miniature Hi-Fi speaker that outperforms all others. Designed to meet today's requirements for transmitters, miniature and sub-miniature applications. Size 2 1/2 in. sq. x 1 in. deep. Voice coil impedance: 8 ohms. Freq. range: 150-5000 c/s. Power: 200mW. 16/8. P. & P. 1/-.

HOOVER ROTARY TRANSFORMERS
12 v. input, 500 v. output at 65 r.p.m. or 8v. input, 250 output at 75 m.a.
Only 10/8 each. P. & P. 2/-

SPARE VALVE SET
Here's a gift for all 38 and 18 Set owners! Case contains 4 ARP12 & 1 A.T.P.4 valves.
Only 10/- P. & P. 2/6.

SLIM RADIO PLUGS
A.N.D. SOCKETS. Two-way, black bakelite, solder terminal PLUG and STURDY standard SOCKET, 5/6 per pair. Post Paid. Panel mounting, neat finish.

HI-FI HEADPHONES
These miniature Hi-Fi phones use high quality permanent magnetic speakers with regulated voice coil. The soft rubber ear moulds give correct spacing for optimum acoustic load. Each unit has a built-in miniature Hi-Fi transformer to ensure the finest music and voice reproduction. Supplied free is a small transformer unit which steps impedance up to 4000 ohms. Only 15/- P. & P. 2/6.

BC-221 HETERODYNE CRYSTAL CONTROLLED FREQUENCY METERS

Frequency range: 125 Kc/s to 20 Mc/s. Calibration. Individual Calibration Books and numerous Crystal Check Points. Accuracy: 0.01% or 25 cycles. Power supplies: 6 v. and 135 v. batteries. Size 1 1/2 x 10 1/2 x 9 1/2 in. Weight 43 lbs.

Offered for the first time at the ridiculous price of only **£16 CARR. PAID.**

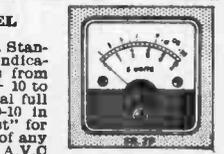


NEW DYNAMIC MICROPHONE
MODEL DM-175 Beautifully designed and attractively finished, lightweight dynamic microphone complete with stand. Output impedance 1K ohm, frequency response 150-9000 c.p.s. ± 3db. Sensitivity -73db. Perfect for almost all applications and offered at only 49/6, complete post and packing 2/6d.

A.R. 88D RECEIVERS
Frequency coverage 550 kc/s to 32 Mc/s supplied fully reconditioned and in perfect working order. **ONLY £39.10.0** Carr. 30/-

MINIATURE CLEAR PLASTIC PANEL METERS

"S" METER MODEL SR. 2P. Standard "Ham" Signal strength indicator. Calibrated in "S" units from 0-9 with scale terminating in + 10 to + 30 db calibrations. Additional full scale calibrations of 0-5 + 0-10 in linear scale divisions. A "must" for radio amateurs for conversion of any Communication Receivers with A.V.C. action to give calibrated signal strength action. 35/-



VU METER MODEL VR. 1P. Calibrated and damped in accordance with standard VU Meter Practice. Upper scale reads -20 to +3VU. Lower scale 0-100% modulation. Uses precision carbon film multiplier resistor and full wave rectifier. 49/6

DC MICROAMMETERS Model MR.25 0 to 50 uA 39/6
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All Models Individually Boxed and Fully Guaranteed. P. & P. 2/6 each.



MINIATURE EARPHONE
A really sensitive dynamic earphone of exceptionally fine quality. Provides clear reproduction of music as well as speech. Fully Guaranteed and complete with transparent ear insert, 3 feet cord, sub-miniature plug and socket.
CR-5 High Imp. crystal 8/- Each
MR-4 Low Imp. magnetic 8/- Post 1/-

RH-30 RADIO HEADPHONES

Hi-Fi in performance. 2,000 ohms-general use headset. Black and Ivory plastic cased electro-magnetic units with adjustable head-band for comfortable fit. Individual listening for all types of applications. Individually packed, with flexible cord attached. 14/8. Post paid.



ACCUMULATORS. 2 volts 16 A.H. (unsplittable). Ideal for 8 and 12 volts supply, etc. Brand new. Original cartons. Size 4 1/2 x 7 1/2 x 2 1/2 in. 5/8 each. P. & P. 1/6, 3 for 15/- P. & P. 3/8, 6 for 27/6. P. & P. 5/-.

AERIAL VARIOMETERS

These magnificent instruments will enable you to receive maximum signal strength on all S.W. receivers. Precision calibrated control. 12/8. P. & P. 2/6.



MINIATURE DUBILIER CONDENSER SPECIAL!

Miniature lots of one dozen from these assorted values: .002; .04; .01; .005; .001; all at 100 volts A.C. and 300 volts D.C. Recent Manufacture ONLY 5/- per dozen. P. & P. 6d. (Please state values required).

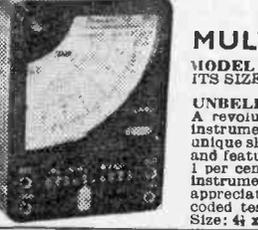


PS.35. SUB-MINIATURE PLUG AND SOCKET

Two-way bakelite barrel Jack plug only 1 in. long. Socket only 1 in. long. 3/6 per pair. Post paid.



FULL SCALE RANGES:
D.C. VOLTAGE: 0-6-30-120-600-1200v. (10,000 o.p.v.).
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RESISTANCE: 0-20K, 0-2 Meg. (150 ohm, 15K at centre scale).
CAPACITANCE: 0.005 to 0.15 uF. (at A.C. 37 1/2 v.).
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ACCURACY: D.C. Voltage and Current ± 2% i.s. A.C. Voltage ± 4% i.s. Resistance ± 3% of total scale length.



NEW! 10,000 O.P.V.

MULTI-TESTER ON BOTH AC & DC MODEL EP-10K OUTPERFORMS INSTRUMENTS MANY TIMES ITS SIZE AND PRICE!

UNBELIEVABLE BARGAIN!
A revolutionary new Multi-Tester. A complete wired and tested instrument (not a kit) incorporating extra large 3 1/2 in. meter face and unique slide range switch. Can be conveniently carried in the pocket and features unusually sensitive 10,000 ohms per volt AC-DC meter. 1 per cent precision resistors, and largest meter ever placed on an instrument this size. Simple, easy to use range selector switch, can be appreciated by the novice and engineer alike. Complete with colour coded test leads and battery.
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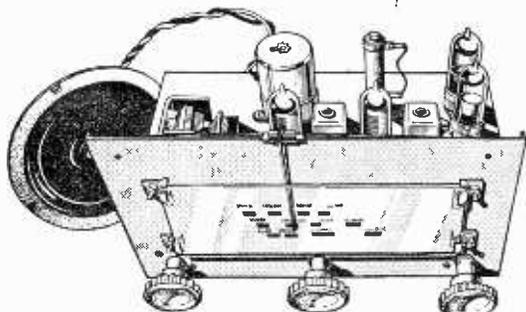
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PLEASE TURN OVER FOR ADDRESS AND MORE BARGAINS

2 BAND SUPERHET CHASSIS with Speaker

ONLY £5.17.6

Plus 6/6 Post & Packing.



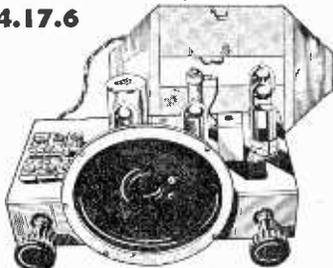
A quality 4 valve AC/DC superhet chassis made by a world famous manufacturer. Long and Medium wave coverage. Fitted with a cord and drum reduction tuning drive and attractive illuminated glass dial (size 6½ x 2½ in.). Controls: Volume on/off, tuning and wave change. The receiver is self-powered, employing a mains dropper and a valve rectifier. Chassis dimensions 6½ x 9 x 5½ in. high. Supplied complete with a good quality 5-inch loudspeaker, valves (UCH42, UAF42, UL41, UY41), AC/DC mains input lead, ivory knobs, etc.

DON'T HESITATE, ORDER NOW! This unbeatable bargain is bound to sell out quickly at only £5.17.6, plus 6/6 post and packing.

4 STATION PRESET CHASSIS with Speaker

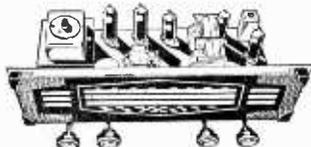
ONLY £4.17.6

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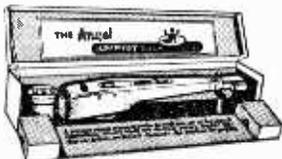
A compact, 4 station preset mains transportable receiver for operation from AC/DC mains. Two simple controls, volume on/off and 4 position station selector. The latter is set to Light Programme (Long Wave), Third Programme, Home Service and Light Programme (Medium Wave), but may of course be adjusted to alternative selections if required. A frame aerial with throw-out extension is supplied, making this receiver ideal as a general purpose transportable set for the home. A fully smoothed power supply is provided from AC/DC mains input by a mains dropper and a valve rectifier. The good tonal qualities are assisted by the provision of a quality 5in. speaker, which is ready-mounted on the chassis (this is easily detachable if alternative positioning is required). Valve line up: UCH, UAF42, UL41, UV41. This chassis (size 9 x 6½ x 5½ in. high) is supplied complete with valves, knobs, mains lead, aerial, etc. It is beautifully made by a famous maker, and is a first-class buy at the rock bottom price of only £4.17.6, plus 6/6 post and packing.

A.M. RADIOGRAM CHASSIS



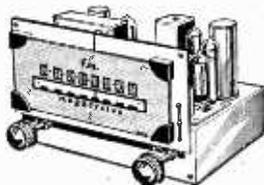
A chassis of distinction, by a famous maker. Covering Long, Med. and Short Waves, plus gram position, this chassis (size 15½ x 7 x 6½ in. high) incorporates the latest circuitry, using fully delayed A.V.C., and negative feedback. Controls: Tone, Vol. On/Off, W/Change (L.M.S. and Gram), Tuning, Tapped input (200-250 v. A.C. only). An attractive brown and gold illuminated dial with matching knobs, make this one of the most handsome, in addition to being one of the best performing chassis yet offered. Complete with valves (ECH81, EF89, EBC81, EL84, EZ81), knobs, output transformer, leads, etc. **OUR PRICE ONLY £9.19.6** plus 4/6 post & packing.

THE WORLD FAMOUS E.M.I. ANGEL TRANSCRIPTION P.U. (Model 17A)



A Pick-up for the connoisseur originally priced at £17.10.0. The last remaining few offered at £5.15.0, plus P. & P. 5/-.

HARVERSON'S F.M. TUNER KIT



At last a quality F.M. Tuner Kit at a price you can afford. Just look at these fine features, which are usually associated with equipment at twice the price.

- ★ F.M. Tuning Head by famous maker.
- ★ Guaranteed Non-drift.
- ★ Permeability Tuning.
- ★ Frequency coverage 88-100 Mc/s.
- ★ OAB1 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 ECC85, two EF80's, and EZ80 (rectifier).
- ★ Fully drilled chassis.
- ★ Everything supplied, down to the last nut and bolt.
- ★ Size of completed tuner 8 x 6 x 5½ in.
- ★ All parts sold separately.

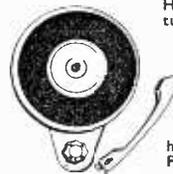
£4.19.6 Plus 8/6 P.P. & Ins.

Circuit diagram and illustrations, 1/6, post free.

OUTPUT STAGE & SPEAKER FOR F.M. TUNER UNIT

All parts, including speaker, ECL82 valve, and simple instructions to make two-stage output unit for converting F.M. tuner into F.M. receiver. **ONLY 45/6**, plus 4/6 P. & P.

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



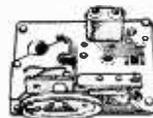
Heavy 8½ in. metal turntable. Low flutter performance 200/250V shaded motor with tap at 80V for amplifier valve filament if required. Turnover LP/78 head. **Price 89/6**. Plus 4/6 P. & P.

SUPER STEREO KIT MK. II

A kit of ready-built units only requiring interconnection. Comprising two midgeet 3W amplifiers, push button switch, transformer, control unit (bass, treble and vol.), power pack, two speakers, indicator light, valves (ECL82, EZ80 range), and comprehensive instructions.

£3.19.6 Plus 6/6 P. & P.

F.M. TUNER HEAD



A permeability tuned tuner head by a famous maker, supplied without valve (ECC85) 18/6 plus 1/9 P. & P. Valve 8/6 extra.

HARVERSON SURPLUS CO. LTD.

Introducing HARVERSON'S Monaural Amplifier Kit

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In response to numerous requests from delighted purchasers of our "SUPER STEREO KIT" we have produced a "MONAURAL AMPLIFIER" on similar lines.

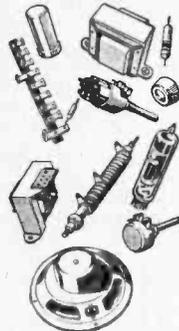
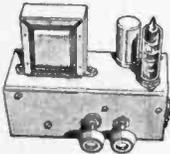
★ A UCL 82 valve provides a triode amplifying stage, and a pentode output stage (3 watts), enabling good amplification and sparkling reproduction to be combined with physical compactness (amplifier size, 7 x 3½ x 8½ in. high).

★ Modern circuitry design, good quality O.P. transformer (to match ★30) keep hum and distortion to a low level.

★ The controls, volume on/off, and tone, are complete with attractive cream and gold knobs.

★ The amplifier has a built-in fully smoothed power supply, using a good quality mains transformer (A.C. mains only) and metal rectifier.

★ All you need is supplied including easy to follow instructions which guarantee good results for the beginner and expert. All components, leads, chassis, valve, knobs, etc., are first grade items by prominent manufacturers.



OUR PRICE
Plus 4/6 Post and Packing. **39/6**

5in. LOUDSPEAKER TO SUIT 14/6 EXTRA
ALL PARTS SOLD SEPARATELY

CHILD'S NURSERY LAMP

A child's night light of unusual design. Contemporary styled lampholder of robust construction finished in either red or yellow. Entirely safe (bulb socket shielded from "prying fingers"), complete with flex and a push-button switch. 200/250 volts A.C. only. The low-consumption bulb element is made in the shape of either flowers or angel fish, and when switched on, glows in fluorescent colours (the flowers pink with green leaves, or the fish green with purple weed). Made by a famous manufacturer and originally priced at 29/6. Please state lampholder colour preference, and whether fish or flower element is required.



OUR BARGAIN PRICE ONLY
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SUPERHET CHASSIS—less Valves & Cabinet

Modern AC/DC chassis with printed circuit and ferrite rod aerial. Although not completely built, the main components are mounted. L & M. wave coverage. 4 valves (UBF89, UCL83, UCH81, UY85). Everything supplied except valves and cabinet. With speaker and simple instructions. **£3.6.6** plus 3/6 P. & P.

TRANSISTOR AMPLIFIER KIT

A complete kit of parts to build a compact 4-transistor amplifier, with volume control and printed cct. board. Two GT3 driver transistors, transformer coupled. 1 watt output from matched pair GT15. Supplied with output transformer and 2½ in. 3 ohm speaker. Ideal for record player, etc. **59/6** plus 4/6 P. & P.

CONDENSER/RESISTOR PARCEL

50 mixed P.F. Condensers and 50 mixed Resistors. An assortment of useful values. All popular sizes—all new—a must for the serviceman and constructor **ONLY 10/-** P. & P. 1/-

AT ½ PRICE WHILE THEY LAST!
**GOLDRING MU-METAL
CASED CARTRIDGES**
Sapphire styli. Brand new and boxed
Our Price £2.15.0 P & P 1/6 including Ins.

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OC78	6/6	2N1485	6/6
OC78D	6/6	2S712	7/6
GET15	9/-	DIODE	
GET15 (matched pr.) ...	16/6	OA81	3/-

Please add 6d. postage for each transistor.

TRANSISTOR SPEAKER

Weston Electric 3Ω speaker. Size 2½ x 1½ in. deep. 12/6 p.p. 1/-

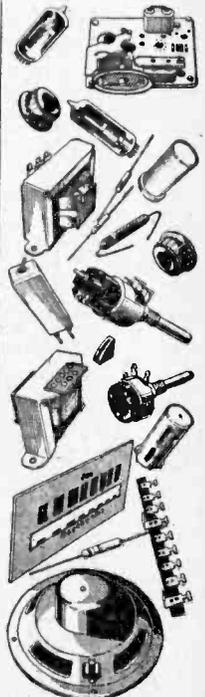
THE HARVERSON COMPLETE F.M./V.H.F. RECEIVER KIT **£6.19.6**

AT LAST—A COMPLETE F.M. RECEIVER IN KIT FORM!

Specially designed with the home constructor in mind, this kit enables the construction of a completely self-contained V.H.F. receiver, at fraction of the normal cost of comparable equipment. This is basically a quality self-powered F.M. tuner plus 2 separate audio amplifier stages, and output transformer and speaker.

- ★ F.M. Tuning Head by famous maker.
- ★ Guaranteed Non-drift.
- ★ Permeability Tuning.
- ★ Frequency coverage 88-100 Mc/s.
- ★ ★81 Balanced Diode Output.
- ★ Two I.F. Stage and Discriminator.
- ★ Self powered using a good quality mains transformer and valve rectifier.
- ★ Valves used ECC85, two EF80's, ECL82 and EZ80 (rectifier).
- ★ Fully drilled chassis.
- ★ Good quality speaker.
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- ★ Attractive maroon and gold glass dial.
- ★ Two output stages (using ECL82).
- ★ Everything supplied, down to the last nut and bolt.
- ★ Compact size.
- ★ All parts sold separately.

OUR PRICE £6.19.6 Plus 4/6 P. & P.



83 HIGH ST., MERTON, S.W.19

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★HARVERSON'S UNEQUALLED VALVE SERVICE★

OA2	17/6	6F6G	7/1	10D2	12/	53W4	7/6	DK32	12/	EF50(A)	7/1	KF35	8/6	PM2B	12/6	U4020	16/7	XFY12	9/6
OB2	17/6	6F11	17/3	10F1	26/6	35Z3	10/6	DK91	6/6	EF50(E)	5/1	KL35	8/6	PM84	17/3	U4BC80	9/4	XFY34	17/6
OZ4	5/1	6F12	4/6	10F9	11/6	35Z4GT	6/1	DK92	9/1	EF54	5/1	KLL32	24/7	PX4	10/6	U4F42	9/6	XH(1.5)	6/6
IA5	6/1	6F13	11/6	10LD3	8/6	35Z5GT	9/1	DK96	8/6	EF73	10/6	KT2	10/1	PY32	12/6	UB41	12/1	XSG(1.5)	6/6
IA7GT	12/1	6F15	15/3	10LD11	4/3	50C	10/1	DL33	9/6	EF80	6/1	KT33C	10/1	PY80	12/6	UBC41	8/6	Y63	7/6
IC5	12/6	6F23	10/6		15/11	50C5	10/1	DL66	17/6	EF85	6/1	KT36	29/10	PY80	13/1	UBC81	11/4	Z63	7/6
ID6	10/6	6F32	10/6	10P13	15/1	50CD6G		DL68	15/1	EF86	10/6	KT41	23/3	PY81	8/6	UBF80	9/6	Z66	17/6
IC6	17/6	6F33	7/6	10P14	19/3		36/6	DL72	15/1	EF89	9/1	KT44	12/6	PY82	7/1	UBF89	9/6	Z77	4/6
IH5GT	10/6	6G6	6/6	12A6	5/1	50L6GT	9/6	DL92	7/1	EF91	4/6	KT61	12/6	PY83	8/6	UBL21	23/3	Z719	6/1
IL4	3/6	6H6	3/6	12AC6	15/3	53KU	19/11	DL94	7/6	EF92	4/6	KT63	7/1	PY88	13/1	UCC84	14/7		
ILD5	5/1	6J5	5/1	12AD6	17/3	77	8/1	DL96	8/6	EF97	7/6	KT66	15/1	PZ30	19/11	UCC85	9/1	Transistors	
ILN5	5/1	6J6	5/6	12AE6	13/11	78	9/1	DM70	7/6	EF98	13/3	KT88	24/1	QP21	7/1	UCC80	16/7	and diodes	
IN5GT	10/6	6J7G	6/6	12AH7	8/1	80	9/1	EB0F	20/1	EF183	18/7	KTW61	6/6	QP25	14/6	UCC81	23/3	CG1C	7/6
IR5	6/6	6J7GT	10/6	12AH8	12/6	83	25/1	E3F	37/6	EF184	18/7	KTW62	7/6	Q5150/15	10/6	UCH42	9/6	CG4E	7/6
IS4	9/1	6K7G	5/1	12AT6	7/6	85A2	10/6	E5A0	2/1	EK32	8/6	KTW63	6/6		10/6	UCH81	9/6	CG6E	7/6
IS5	15/6	6K7GT	6/1	12A7E	6/1	150B2	2/1	E5A7E	9/6	EL32	5/1	KTZ41	8/1	R12	9/1	UCL82	11/6	CG7E	7/6
IT4	3/6	6K8GT	10/6	12AU6	23/3	161	10/6	EAB30	9/1	EL33	12/6	KTZ63	7/6	R18	14/1	UCL83	19/3	CG10E	7/6
IU5	6/1	6K8G	6/6	12AV6	12/6	185B	33/2	EAC91	4/6	EL34	15/1	L63	6/1	R19	19/11	UF41	9/1	CG12E	7/6
2P	26/6	6K25	19/11	12AV6	12/6	304	10/6	EAF42	9/6	EL38	26/6	MHL4	7/6	RG1/240A	45/1	UF80	10/6	GD3, 4, 5,	
2X2	4/6	6L1	23/3	12AX7	7/6	305	10/6	EB34	2/6	EL41	9/1	MHL4	12/6		45/1	UF80	10/6	6, 8	4/1
3A4	6/1	6L6G	8/1	12BA6	8/1	807	7/6	EB41	8/6	EL42	10/6	ML4	8/6	RK34	7/6	UF85	9/1	OA70	4/1
3A5	10/6	6L6M	9/6	12BE6	9/1	956	3/1	EB91	4/1	EL81	16/7	MS4B	23/3	S130	22/6	UF86	17/11	OA73	4/1
3D6	12/6	6L7GT	7/6	12B7H	21/3	1821	16/7	EB93	23/3	EL83	19/11	MU12/14	8/1	SP4(7)	14/6	UF89	9/1	OA79	4/1
3Q4	5/1	6L18	13/1	12E1	30/1	4033L	12/6	EB93	5/1	EL84	7/6	N37	23/3	SP41	3/6	UL41	9/1	OA81	4/1
3Q4	7/6	6L19	23/3	12J5GT	4/6	5763	12/6	EB41	8/6	EL85	13/11	N78	19/11	SP42	12/6	UL44	26/6	OA86	5/1
3Q5GT	9/6	6LD3	8/6	12J7G	9/6	7193	5/1	EB81	8/1	EL86	17/3	N108	23/3	SP61	3/6	UL46	14/6	OA91	4/1
3S4	7/1	6LD20	15/11	12K5	17/11	7475	7/6	EBF80	9/1	EL91	5/1	N308	20/7	SU25	26/6	UL84	9/6	OA95	5/1
3V4	7/6	6N7	8/1	12K7GT	5/6	9002	5/6	EBF83	13/11	EL95	10/6	N339	15/1	SU61	9/1	UM4	17/3	OA211	40/1
5R4GY	17/6	6P25	12/6	12K8GT	14/1	AC/PEN		EBF89	9/6	EL820	18/7	P61	3/6	T41	4/1	UM30	15/3	OC16	54/1
5U4G	6/6	6P26	19/11	12Q7GT	5/1	5-pin	23/3	EBL21	23/3	EL822	25/1	PABC80		UD4	12/6	UM84	18/7	OC19	54/1
5V4G	10/1	6P28	26/6	12A7E	8/6	7-pin	15/1	EBL31	23/3	EM34	9/6		13/11	TH41	26/6	UR1C	18/7	OC19	54/1
5Y3	6/6	6Q7G	6/6	12C5T	7/6	AC2/PEN		EC52	5/6	EM71	23/3	PC88	8/1	TH233	33/2	U06	19/11	OC23	87/1
5Z3	12/6	6Q7GT	11/1	12C5G	7/1	DD	12/6	EC54	6/1	EM80	9/1	PC88	9/6	TH2321	20/1	U07	16/7	OC26	44/1
5Z4G	9/1	6R7G	10/1	12C5H	7/6	AC6/PEN	7/6	EC70	12/6	EM81	9/1	PC88	11/6	TP25	15/1	U09	26/6	OC28	25/1
6A7	10/6	6SA7GT	8/6	12C5T	8/6	AC/TP	33/2	EC92	13/3	EM84	10/6	PC88	11/6	TP25	15/1	U09	26/6	OC35	48/1
6A8	9/1	6SCT	7/6	12C5K	7/6	ATP4	5/1	EC93	5/6	EM85	10/6	PCF80	8/1	TP2620	33/2	UY1N	18/7	OC44	26/1
6AC7	4/1	6S7GT	8/1	12C5Q	11/6	AZ31	18/7	ECC33	8/6	EN51	37/1	PCF82	10/6	TY86F	13/3	UY21	16/7	OC45	23/1
6AG5	5/6	6S7GT	8/1	12C5R	7/6	AZ41	13/11	ECC35	8/6	EY83	16/7	PCF86	15/1	U16	10/1	UY85	7/1	OC66	25/1
6AG7	7/6	6S7GT	8/1	12C5T	10/6	B36	15/1	ECC40	23/3	EY84	14/1	PCL82	10/1	U18/20	8/6	VMP43	15/1	OC70	14/1
6AK5	8/1	6S7GT	6/1	12C5T	10/6	BL63	7/6	ECC81	6/1	EY86	9/1	PCL83	10/6	U19	36/1	VMS4B	15/1	OC71	14/1
6AM6	4/6	6S7GT	5/6	19H1	10/1	C1	12/6	ECC82	6/6	EZ35	6/1	PCL84	12/6	U22	8/1	VP2	12/6	OC72	17/1
6AQ5	7/6	6S7GT	9/1	20D1	15/3	C1C	12/6	ECC83	7/6	EZ40	7/1	PCL85	16/7	U24	29/10	VP4	15/1	OC73	20/1
6AT6	7/1	6S7GT	8/1	20F2	26/6	BL61	26/6	ECC84	9/1	EZ41	7/1	PEN44	23/3	U25	17/11	VP2B	14/6	OC75	15/1
6AU6	10/6	6U4GT	12/6	20L1	26/6	BL31	23/3	ECC85	8/6	EZ80	7/1	PENB4	26/6	U26	10/1	VP4B	23/3	OC77	21/1
6AV6	12/6	6U5G	7/6	20P1	26/6	CKH35	23/3	ECC88	18/1	EZ81	7/1	PEN4DD	U31	9/6	VP13C	7/1	OC78	17/1	
6B8	5/1	6U7G	8/6	20P3	23/3	CK506	6/6	ECC91	5/6	FC4	15/1		26/6	U33	26/6	VP1	6/1	OC170	35/1
6BA6	7/6	6V6G	7/1	20P4	26/6	CL33	19/3	ECF80	10/6	FW4/500	8/6	PEN25	4/6	U35	26/6	VP105	8/1	OC200	54/1
6BE6	6/1	6V6GTG	8/1	20P5	23/3	CV63	10/6	ECF82	10/6	FW4/800	8/6	PEN40DD	U37	26/6	VP150	7/6	OC203	58/1	
6BG6G	23/3	6X4	5/1	25A6G	10/6	CY1	18/7	ECF86	19/11	GU50	27/6		U45	9/1	VT61A	5/1	TJ1	40/1	
6BH6	8/1	6X5GT	6/1	25L6GT	10/1	CY31	11/1	ECH3	26/6	GZ30	9/1	PEN44	26/6	U50	6/6	VT501	5/1	TJ2	45/1
6BJ6	6/1	6/30L2	10/1	25Y5G	10/1	D1	3/1	ECH21	23/3	GZ32	9/1	PEN45	19/6	U52	6/6	W76	5/6	TJ3	50/1
6BQ7A	15/1	7A7	12/6	25Z4G	9/6	D15	10/6	ECH35	6/6	GZ33	19/11	PEN45DD	U52	6/6	W76	5/6	TJ3	50/1	
6BR7	23/3	7B6	21/3	25Z5	9/6	D63	5/1	ECH42	9/1	GZ34	14/1		26/6	U54	19/11	W81M	6/1	TP1	40/1
6B57	25/1	7B7	8/6	25Z6G	10/1	D77	4/1	ECH81	9/1	GZ37	19/11	PEN46	7/6	U76	6/1	W107	18/7	TP2	40/1
6BW6	8/6	7C5	8/1	27S0	19/11	DA3C2	10/6	ECH83	13/11	H63	12/6	PEN383	23/3	U78	5/1	W279	19/11	TS1	10/1
6BW7	6/1	7C6	8/1	28D7	7/1	DAF91	6/1	ECL80	9/1	HABC80		PEN453DD	U07	16/7	X24M	24/7	TS2	12/6	
6BX6	6/1	7H7	8/1	30C1	8/1	DAF96	6/6	ECL82	10/6		13/6		33/2	U91	16/7	X41	15/1	TS4	24/1
6C4	5/1	7R7	12/6	30F5	6/1	DD41	13/11	ECL83	19/3	HL2	7/6	PEN/DD	U201	16/7	X61(C)	12/6	TS4	24/1	
6C5	6/6	7R7	12/6	30FL1	10/1	DET25	7/6	ECL86	16/7	HL23	15/3		4020	33/2	U251	14/1	X63	9/1	
6C6	6/6	7R7	8/6	30L1	8/1	DF33	10/6	EF9	23/3	HL23DD	7/6	PL33	19/3	U281	19/11	X65	12/6	XA101	23/1
6C6	13/6	7Y4	7/6	30L15	11/6	DF66	15/1	EF22	14/1	HL41DD		PL36	12/1	U282	22/7	X66	12/6	XA102	26/1
6C9	9/1	8D2	3/6	30P4	12/6	DF91	3/6	EF36	4/1		19/3	PL38	26/6	U301	23/3	X76M	14/1	XA103	14/1
6CD6G	36/6	8D3	4/6	30P12	7/6	DF96	8/6	EF37A	8/1	HL42DD		PL81	10/6	U329	14/1	X78	23/3	XA104	18/1
6CH6	9/1	9BW6	15/3	30PL1	10/6	DF97	9/1	EF39	5/6		19/3	PL82	7/6	U339	16/7	X79	23/3	XB102	10/1
6D6	6/6	9D2	4/1	30PL13	16/6	DH63	6/6	EF40	15/1	HN309	24/7	PL83	9/1	U403	16/7	X109	17/3	XB103	14/1
6E5	12/6	10C1	13/1	35A5	21/3	DH76	5/1	EF41	9/1	HVR2	20/1	PL84	12/6	U404	8/6	XD(1.5)	6/6	XB104	10/1
6F1	26/6	10C2	26/6	35L6GT	9/6	DH77	7/1	EF42	10/6	HVR2A	6/1	PL820	18/7	U801	29/10	XFG1	18/1	XC101	16/1

For one month only the above prices less 10%. This list supersedes all previous issues

WE SPECIALISE IN OBSOLETE VALVES—IF YOU DON'T SEE IT ABOVE WRITE AND ASK

SPECIAL OFFER! ONE DOZEN 6K7G £1, plus 2/6 P. & P.

BRAND NEW COSSOR 10-inch TUBE, 108K OR 75K, 18/6, plus 6/6 P. & P.

Regunned Tubes Supplied—Any Type—Any Size. Write for List

OSCILLATOR COIL FOR ANY TAPE DECK, 5/6, plus 6d. P. & P.

Transistorised Stethoscope

Trace signal right through: Radio, TV, Tape amplifier, Hi-Fi, etc.—simplest way to fault-find—carry it like a fountain pen—all parts including transistor barrel crystal, everything except battery, 12/6 plus 1/6, data included or separately 1/6. Or complete with dear aid type earphone, 20/-.



Speaker Bargain



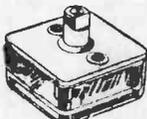
12in. Hi-fidelity loudspeaker. High flux permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price 32/6, plus 3/6 post and insurance.

Hi-Fi Snip Infinite Wall Baffle



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

Smallest Possible 2-gang



With built-in trimmers, polystyrene case, size only 1 x 1 x 7/16in., price 17/6. Smallest IF and oscillator to match. 21/- P.P. input and P.P. output transformers, 12/6. Circuit diagram free with any of above.

Building A Scope?



3in. oscilloscope tube, American made type No. 3FP7, 6.3 v. 0.6 amp. heater, electrostatic deflection, brand new and guaranteed with circuit diagram of scope. 15/- each, plus 1/6 post and insurance.

Transistor Set Cabinet



Very modern cream cabinet, size 5 1/2 x 3 x 1 1/2in. with chrome handle, tuning knob and scale. Price 7/6, plus 1/6 postage and packing.

BATTERY CHARGER BARGAIN

Components Would Cost More

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



MOTOR SNIP

Miniature motor 2 1/2in. long x 1 1/2in. diameter, laminated poles and armature, separate winding for reversing. Operates off 20-30 v. D.C. or off A.C. mains through stepdown transformer. Original cost at least £3 each. Snip price for one month only 8/6, plus 1/6 postage and insurance.

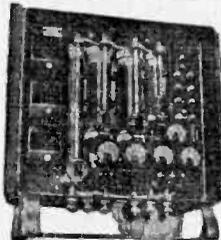


INFRA-RED HEATERS

Make up one of these latest type heaters ideal for bathroom, kitchen, bedroom etc. They are simple to make from our easy to follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and instructions 15/6, plus 2/6 post and insurance.



CHARGING SWITCHBOARDS

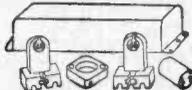


Type A. 550 v. 18 v.—contains three reverse current relays, one voltmeter rated 25 v. f.s.d., one main ammeter rated 40 amps. f.s.d., one secondary ammeter rated 15 amps. f.s.d. and two secondary meters rated 20 amps. f.s.d., one 2 ohm variable resistor, one 11 ohm variable resistor and two 1.2 ohm variable resistors. Complete in metal case 2ft. 6in. x 2ft. 8in. approx. Price 22-15-0, carriage and ins. 15/-.

Type B. 1250 v. 50 v., 0.12 amps.—contains one 14 ohm variable resistor and four 1 ohm variable resistors, one main ammeter rated at 40 amps. f.s.d., four secondary meters rated at 20 amps. f.s.d. and one voltmeter rated at 50 volts, and two reverse current relays. Complete in metal case—size approximately 2ft. 6 in. x 2ft. 8 in. Price 24-15-0, carriage 15/-.

Connectix Leads for these switchboards, with Nifam plus 30/- each.

FLUORESCENT LIGHT BARGAIN



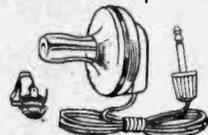
Kit of Parts comprising: choke, two lamp holders, starter holder and starter, 40 watt. 19/6; 80 watt. 23/6. Plus 2/- post and insurance.

THIS MONTH'S SNIP

A fully-built, tested and ready to work pocket radio using six semi-conductors and tuning over the long and medium wave bands. An excellent performer and a real bargain at £5/15/- post free.

Seven days approval. Send for one today. If you are not 100% pleased then return it within seven days and your money will be refunded.

Miniature Earphones



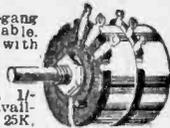
For Transistor Circuits or Dear Aid Very lightweight and easy to wear, cord almost invisible, good quality production of music and voice, complete with miniature plug and socket, ready to use—correct impedance OK for red spot and silver transistors, Crystal and Magnetic, 6/- Post and Insurance 1/-.

Morganite Potentiometers

Single and 2-gang types available standard size with good length spindle, all new and boxed.

Single types, 1/- each, values available: 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg.

2-gang type 3/- each, values available: 5K±5K, 10K±10K, 1 meg. ±1 meg., 2 meg. ±2 meg.



The Taylor Meter Model 127A



A pocket size meter but with a big scale and a sensitivity of 20,000 ohms per volt D.C., therefore an ideal unit for television servicing—robustly made and complete with leads and prods—20 ranges as follows: D.C. current 50 microamps. to 1 amp. D.C. voltages—0-1,000 volt in seven ranges (25 kv) with external probe, optional extra. Volts A.C.—0.2-50 in six ranges. Ohms—0-20 meg. ohm in three ranges (self-controlled). Self-contained, 3 1/2" movement. Price £10 or 10/- deposit and 23 fortnightly payments of 10/-. Non-callers add 5/- carriage and insurance.

"Dim and Full" Switch

Particularly useful for controlling photoflood lamps which have only a short life at full brilliance. This switch has three positions; the first position puts two lamps in series at full brilliance or setting up, the second position is off and the third position full brilliance for the operation shots. Also useful for controlling night lights, heaters, etc., etc. Price 3/9 each, post 9d. Circuit diagram included. Ditto but without the off position, i.e. d.p.d.t., 10 amp. 2/9.

Miniature Microphone

American made, Dynamic type, real bargain at 2/6, plus 8d. postage.



Transistor Amplifiers

2 x CX71's direct coupled cascade drive to 2 precision matched OC74's in Class B push-pull provide up to 1 W undistorted output from 5 mV. In at 1.5 K-ohm frequency response, 60-16,000 c/s ± dB. Overall size 3 x 2.2 x 1.2in. 92/6. Post and ins. 2/6. 750 M/WATT AMPLIFIER, Similar specification. 22-2-6

SUB-MINIATURE COMPONENTS

1. Ferrite aerial with Long and Medium Wave Coils. 4in. long, for pocket superhet., complete with circuit showing component values, etc., 7/6.
2. Ferrite aerial, as above, but 1in. diameter, 8in. long, for table model receiver or portable, 10/6.
3. Three I.F. Transformers with oscillator coil and circuit details to work with item 1, 19/6.
4. Three I.F. Coils and oscillator to work with item 2, 23/6.
5. Smallest possible electrolytics. 1MFD, 2MFD, 4MFD, 6MFD, 8MFD, 10MFD, 20MFD, 30MFD, 50MFD, 100MFD, 200MFD, all 1/8 each.
6. Smallest ½ watt resistors, all 10 per cent values. 5d. each.
7. Miniature condensers, .1, 1/-, .05, .04, .02, .01, all 8d values, below this 7d.
8. Miniature slide switch double pole change over, 2/6.
9. Edgewise volume controls, 2K, 5K, 10K and 20K, 2/6 each.
10. Small edgewise controls with switch, 2K, 5K, 10K and 20K, 4/9 each.
11. Red Spot Transistors, tested and suitable all A.P. applications, 2/6.
12. White Spot Transistors tested and suitable as I.F. or mixer, 3/6.
13. Set of six Mullard transistors for superhet in original packets, fully guaranteed, comprising OC44, OC45, OC81D and matched pair OC81, £2 the set.
14. Special 500 sub-miniature diodes, 1/6 each.
15. Surface Barrier transistors, 5-10 Mc/s, 6/6 each; 10-15 Mc/s, 8/- each; 20-30 Mc/s, 9/- each; 40-50 Mc/s, 15/- each.
16. Push-Pull Driver and Push-Pull output transformers for pocket superhets, 150 mW, 10/- pair; 400 mW, 15/- pair; 750 mW (driver only, no o.t. needed), 8/6, all complete with circuit details.
17. Smallest Tuning Condenser, size approx. 1in sq, 16pF and 85pF, with trimmers, 17/6 each.
18. Oscillator coil to suit the above, 6/-.
19. Three I.F.s, 455 kc sub-miniature to suit items 17 and 18, 18/- the set.
20. Jackson 00 2-gang tuning condensers, 208pF plus 176 pm. spindle tapped 65A, with trimmers, 10/6, less trimmers 9/6.
21. Tuning condensers for items 1 and 3, 9/6.
22. Tuning condensers for items 2 and 4, 10/6.
23. Printed circuit for items 1 and 3, 6/6.
24. Printed circuit for items 2 and 4, 7/6.
25. 2in. speaker, 3 ohm, 19/6; 80 ohm, 18/6.
26. 3in. speaker, 3 ohm, 18/6; 80 ohm, 18/6.
27. 5in. speaker, 3 ohm, 18/6; 35 ohm Hi flux, 19/6; 35 ohm Super Hi flux, 22/6.
28. Elliptical speaker, 7 x 4, 3 ohm, 19/6; 35 ohm, 19/6.
29. Battery connectors, large, 1/- pair; miniature, 1/- pair.

NOW THE MARK IV Pocket '5' Transistor Radio

Read these Testimonials

D. A. Hilton, Leigh, Lancs.
 "I received Pocket 4 on Christmas Day. I made it up on Boxing Day and I am very pleased with the results. It brings in local stations and many foreign stations including Luxembourg at good strength. I am 13 years old!"

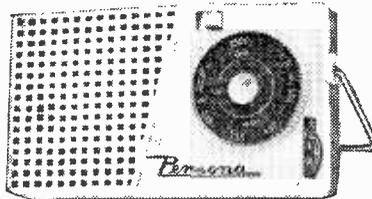
Mr. J. Bell, Wolverhampton.
 "I am writing to express my satisfaction at the standard of your kit for your Pocket 4 Transistor set and also to state that it has come up to my expectations in regard to performance."

Mr. K. Bell, Newcastle-on-Tyne.
 "I have built your Pocket 4 Transistor set. I am very pleased with it."

Mr. F. Jackson, Ickenham, Middx.
 "I have built the Pocket 4 and am more than pleased with the results."

Mr. G. Bamford, Ransgate.
 "I find this set even better than you claim it to be and most certainly up to your usual standard of quality. I feel that nobody could fail to build it and get results. Even the first-time-ever novice, as your circuit diagrams and instructions are so clear and precise."

Mr. A. J. Simmonds, Welling, Kent.
 "I purchased from you a week ago the Pocket 4 Transistor Kit. I put it together last night in 1½ hours, on switching on the set I was right on Radio Luxembourg! I must say thank you because not only has the set a very attractive appearance, it also behaves fantastically!"



Our famous Pocket "4" which is doing yeoman service all over the country has been modified and improved to make it an even better receiver. The new features include:—

- New elegant dial graduated for Long and Medium Waves.
- Switched Long and Medium Waves.
- Slide switch on/off control.
- Printed circuit.
- Ferrite Rod Aerial.
- Improved reaction circuit.
- Positive spindle coupling to tuner.
- Battery containers.

The Pocket "5" of course retains its original r.f. circuit which means still no aerial or earth needed. The Pocket "5" Mark IV uses 4 transistors, crystal diode, miniature loud speaker and has all the above refinements, complete in case as illustrated (less motif) 52/6, battery 10d., post and insurance 2/6. Motif 2/-.

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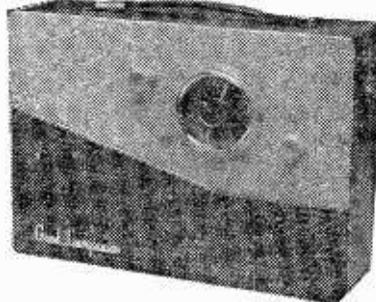
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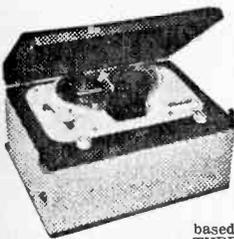
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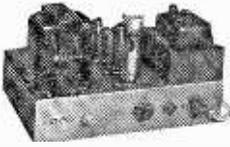
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- Equalisation for the latest R.I.A.A. characteristics.
- Input for Crystal Pick-ups, and variable reluctance magnetic types.
- Input (a) Direct from High Imp. Tape Head. (b) From a Tape Amplifier or Pre-amplifier.
- Sensitive Microphone Channel. ●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

COMPLETE MULLARD "5-10" AMPLIFIER

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

KIT OF PARTS £11.10 OR ASSEMBLED AND TESTED £13.10

H.P. (Assembled Amp. only). DEPOSIT £2.14. 0/12 months at 19/10. ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6. extra.



COMPLETE MULLARD "3-3"

THE IDEAL AMPLIFIER FOR A SMALL HIGH QUALITY INSTALLATION PROVIDING EXCELLENT REPRODUCTION OF UP TO 3 WATTS OUTPUT. COMPLETE KIT £7.10 OR ASSEMBLED £8.19.6 (plus 6/6 carriage and insurance) H.P. Terms: Deposit £2.0.0 and 8 Months at £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and a PARMEKO OUTPUT TRANSFORMER.



SPECIAL CASH OFFER

This very attractive PORTABLE AMPLIFIER CASE, together with a good quality GRAM AMPLIFIER and a matched P.M. SPEAKER. ALL FOR ONLY £8.7.6 (Plus 7/6 Carr. & Ins.)

The Amplifier consists of a 2-stage design incorporating 3 modern E.V.A. valves and has separate BASS and TREBLE CONTROLS.

The Portable Case will also accommodate almost any make of Autochanger and is attractively finished in Mushroom Grey Rexine. WE ALSO SUPPLY SEPARATELY—

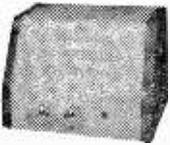
- (a) The 2-stage (plus Rectifier) AMPLIFIER £4.2.6
- (b) THE PORTABLE CARRYING CASE £3.17.6
- (c) 6 1/2 in. P.M. SPEAKER 18/9 Carriage and Insurance 4/- extra.



STERN'S INTER-COMM or BABY ALARM

A small versatile Unit employing the new MULLARD ECL86 valve and designed to provide two (or three) way conversation up to extreme distances. Operates from A.C. mains 200 to 250 Volts.

PRICES... MASTER UNIT and ONE EXTENSION



KIT OF PARTS £6.17.6 ASSEMBLED AND TESTED £8.0.0

Consists of a MASTER UNIT, size only 8 1/2 x 5 1/2 x 6 in. and ONE EXTENSION (a second extension may be added to any time). The Master Unit incorporates switching and power supply and with the chassis completely isolated from the mains is operated in absolute safety. Cases covered in quality leatherette.

PRE-ANNOUNCEMENT TO STEREO ENTHUSIASTS

In response to the growing demand for Stereophonic equipment we have completed the design of a

HIGH FIDELITY STEREO TAPE PRE-AMPLIFIER

PRICE REDUCTIONS

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

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

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

(d) The DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED and TESTED. £25.0.0

H.P. Terms: Deposit £5 and 12 months of £1.16.6.

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

(f) ONE "5-10" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER both ASSEMBLED and TESTED. £25.0.0

H.P. Terms: Deposit £5, 12 months of £1.18.8.

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

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

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

Carriage and Insurance 7/6 extra. Prices quoted are subject to £1.6.0 extra for Partridge Transformer.

STEREO PRE-AMPLIFIER

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



COMPLETE KIT £12.10.0 ASSEMBLED AND TESTED £15.0.0

H.P. £3 Dep. and 12 mths. at £1.2.0

MULLARD FOUR CHANNEL MIXER UNIT

Self powered with Cathode follower output. Incorporates two inputs for MICROPHONES and one for CRYSTAL PICK UP and a fourth for RADIO or TAPE. Complete Kit of Parts £8.8.0

Assembled and Tested £10.0.0

TERMS: Deposit £2 and 12 months at 15/-.

MODEL LL one microphone input matched for moving coil or Ribbon Mike. £11.7.0 extra.



RECORD PLAYERS THE LATEST MODELS ARE IN STOCK, MANY AT REDUCED PRICES

SEND S.A.E. FOR ILLUSTRATED LEAFLET

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

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

The NEW COLLARO C80 4-speed Autochanger unit with Studio "O" Pick-up. £7.19.6

The E.M.I. 4-speed Single Record Player with crystal Pick-up. £6.9.6

B.S.R. MODELS UA12 and UA14. Each a 4-speed mixer autochanger with Crystal Pick-up. £7.19.6

Both available incorporating the B.S.R. STEREO Pick-up, plays LP, 78 and Records. £8.13.10

GARRARD MODEL TA/MK11 4-speed Player fitted high output Crystal Pick-up. £8.10.0

GARRARD MODEL RC/209 Autochanger 4-speeds. High output. Crystal Pick-up. £8.19.6

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

Incorporates the latest circuitry, the design is based on the popular Mullard "Type O" Unit and employs a sensitive meter for accurately setting record level.

STERN RADIO LTD.

Stern's "fidelity" TAPE EQUIPMENT

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

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



The "HI-FI" link to add full tape recording facilities to High Fidelity home installations. Incorporates FEROXUCUBE POT CORE PUSH FULL OSCILLATOR and 3-speed treble equalisation by FEROXUCUBE POT CORE INDUCTOR FOR WEARITE-ARATE PRE-AMPLIFIER AND POWER UNIT ASSEMBLY OR ASSEMBLED KIT OF PARTS. Includes separate power Supply Unit.

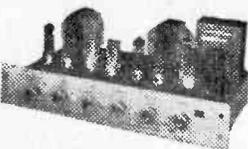
£14.00 H.P. £23.8.0 Deposit and 12 months £14.11
£17.00 OR ASSEMBLED PARTS
 Including power unit £11.5.0 and £14.10.0 respectively.

SPECIAL "COMBINED ORDER" PRICES

- (a) The COLLARO "Studio" Deck with the Model "C" Pre-amplifier and POWER SUPPLY UNIT ASSEMBLED AND TESTED **£29.10.0**
- (b) As above but the TYPE "C" Unit and POWER UNIT supplied as COMPLETE KIT OF PARTS. Deposit £5.18.0. 12 monthly payments of £23.3.8 **£26.10.0**
- (c) The TRUVOX Mk.VI Deck (incorporating Pause Control and Rev. Counter) with the Model "C" PRE-AMPLIFIER and POWER UNIT ASSEMBLED AND TESTED **£40.0.0**
- (d) As above but the Model "C" PRE-AMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£36.10.0**
- (e) The BRENELL Mk.V Deck with the Model "C" PRE-AMPLIFIER and POWER UNIT. ASSEMBLED AND TESTED **£46.0.0**
- (f) As above but the Model "C" PRE-AMPLIFIER and POWER UNIT supplied as a COMPLETE KIT OF PARTS **£43.0.0**
- (g) Deposit £3.12.0. 12 monthly payments of £3.3.1 The WEARITE MODEL "4" DECK with ASSEMBLED AND TESTED Model "C" PRE-AMPLIFIER and POWER UNIT incorporating WEARITE HEADLIFT TRANSFORMER, Etc. **£56.0.0**
 Deposit £11.4.0 and 12 months at £4.2.1
 (Carriage and Insurance on above is 10/- extra)

A NEW DESIGN!!!

MULLARD'S STEREO-PHONIC POWER AMPLIFIER



A high fidelity design based on the famous Mullard "5-10". Provides up to 10 watts (per channel) Superb reproduction. Frequency response flat to within 3 db from 3c/s. To 60 Kc/s at 50Mw.

- Total Harmonic Distortion at 10 watts 0.1% **PRICE: £21.0.0**
- (a) ASSEMBLED COMPLETE AMPLIFIER. including CONTROL UNIT (as illustrated) **£21.0.0**
 - (b) A complete KIT OF PARTS will be available in OCTOBER for **£18.10.0**

Built to the very highest technical standards and presented strictly to MULLARD'S specification. Incorporates complete Mullard valve line-up including two of the new valves, type ECL86, in each channel. Two specially designed GILSON OUTPUT TRANSFORMERS with 20% taps are used for ultra linear operation.

The matching CONTROL UNIT is designed to be either attached to the Amplifier (as illustrated) or can be detached for separate mounting on a Cabinet panel. Provides inputs for CRYSTAL PICK UPS, RADIO TUNING UNIT, and also for replaying from our STEREO TAPE PRE-AMPLIFIER (Briefly mentioned opposite).

AS AUDIO SPECIALISTS WE CONFIDENTLY RECOMMEND THIS DESIGN IT IS A MUST to the serious minded sound enthusiast. We can also supply the assembled MAIN AMPLIFIER only (excludes control unit) for operation with our DUAL CHANNEL PRE-AMPLIFIER, this provides for a more versatile or elaborate installation and would be essential if a low output Magnetic Pick Up, such as the Decca, is to be used.

- (a) THE ASSEMBLED MAIN AMPLIFIER with the ASSEMBLED DUAL CHANNEL PRE-AMPLIFIER **PRICE: £30.0.0**
 Deposit £6.0.0. 12 months of £2.4.0.
- (b) A complete KIT OF PARTS for both Units will be available in October for **£26.0.0**

HOME CONSTRUCTORS BUILD A HIGH FIDELITY TAPE RECORDER LIKE THIS



for £35.0.0

Deposit £7.0.0, 12 months at £2.11.4.

FOR THIS WE SUPPLY

- Complete Kit of Parts to Build the HF/TR3 Tape Amplifier.
- The New Collaro "Studio" Tape Deck.
- Portable Carrying Case (as illustrated).
- Rola/Celestion 10 x 6in. p.m. Loudspeaker.
- ACOS Crystal Microphone and 1.200ft. Spool E.M.I. Tape.

Alternatively for those who prefer another make of Tape Deck—we will supply precisely as above—but in place of the Collaro "Studio" Deck, We will include: **£45.0.0**

- The New Truvox Mk. VI Deck. Deposit £9.0.0, 12 months at £3.6.0.
- For Constructors with their own cabinet—WE OFFER—
- (a) COMPLETE KIT to build the HF/TR3 Mk.II Amplifier together with the COLLARO "STUDIO" DECK. Deposit £5.4.0. 12 monthly payments of £1.18.2 **£26.0.0**
- (b) As above but with the HF/TR3 Mk.II supplied ASSEMBLED AND TESTED **£29.10.0**
- (c) Deposit £5.18.0. 12 monthly payments of £2.3.4. COMPLETE KIT to build the HF/TR3 Mk.II together with the TRUVOX Mk. VI TAPE DECK **£36.10.0**
- (d) Deposit £7.8.0. 12 monthly payments of £2.13.6. As above but with HF/TR3 Mk.II supplied ASSEMBLED AND TESTED **£40.0.0**
- (e) Deposit £9.0.0. 12 monthly payments of £2.18.8. COMPLETE KIT to build the HF/TR3 Mk.II AMPLIFIER with the BRENELL Mk.V TAPE DECK **£42.0.0**
- (f) As above but with HF/TR3 Mk.II supplied, ASSEMBLED AND TESTED **£45.10.0**
- (g) Deposit £9.2.0. 12 monthly payments of £3.6.9. THE ASSEMBLED AND TESTED HF/TR3 Mk.II AMPLIFIER with the WEARITE MODEL 4A DECK, incorporates Wearite Head Lift Transformer etc. **£56.0.0**
 Deposit £11.0.0. 12 monthly payments of £4.0.8.
 (Carriage and Insurance on each above is 10/- extra)

MODEL HF/TR3 MK.II TAPE AMPLIFIER

(Mullard Type "A" design)

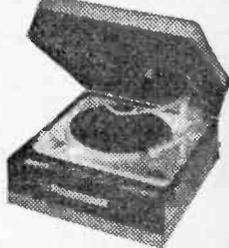
A very high quality Amplifier incorporating 3-speed treble equalisation, by the latest FEROXUCUBE POT CORE INDUCTOR, FOR COLLAROTR U V O X - B R E N E L L WEARITE Tape Decks, has GILSEN Output Transformer. Includes separate Power Supply Unit.



KIT OF PARTS **£13.13.0** OR ASSEMBLED **£17.0.0**
 H.P. Deposit £3.8.0 and 12 months at £1.4.11

STEREOPHONIC RECORD PLAYER FOR SIMPLE UNIT ASSEMBLY

A most compact portable design consisting of TWIN CHANNEL AMPLIFIER based on the latest design by MULLARD LTD., incorporating top grade Output Transformers, and the new audio Triode-Pentode Valves Mullard E.C.L.86. Separate Bass and Treble controls. Suitable for use with Crystal Pick Ups, and capable of genuine high quality reproduction up to 3 watts per channel. An attractive and contemporary Portable Case in two tone colours. The unique feature of the design is the loudspeaker mounting. Two 8 x 5in. p.m. elliptical loudspeakers are separately baffled and mounted in the lid, which is detachable, allowing for each speaker to be individually positioned in any part of the listening area.



We offer a very versatile stereo arrangement tested and guaranteed which can be assembled in the minimum of time, at a comparatively Very Low Cost.

- PRICE for the ASSEMBLED AMPLIFIER, Two 8 x 5in. ROLA SPEAKERS and PORTABLE CASE **£14.0.0**
- Deposit £2.16.0. 12 months of £1.0.6 **£7.15.0**
- ASSEMBLED AMPLIFIER, supplied for **£1.1.0**
- 8 x 5in. ROLA LOUSPEAKERS (3 ohms) each. **£5.0.0**
- PORTABLE CASE **£5.0.0**

A CHOICE OF SINGLE RECORD PLAYERS and AUTOCHANGERS are available from Stock (Send S.A.E. for details)

Dept. P.W. 109 FLEET ST., LONDON, E.C.4

Telephone: FLEET STREET 5812/3/4

Brand new, individually checked and guaranteed VALVES

ACSPENDD	EB34	1/6	EL91	7/6
	EB91	3/9	EM80	8/1
AL60J	EB21	9/1	EN31	22/6
AP4	EB41	7/9	EN32	7/6
AR8	EB90	5/1	ESU208	8/1
ARD55	EB91	3/9	EY51	8/1
ARP3	EC52	3/1	EY86	8/1
ARP4	EC90	10/1	EY91	3/6
ARP12	ECC81	5/6	EZ40	7/9
ARP21	ECC82	6/6	EZ41	6/9
ARP24	ECC83	7/1	EZ80	6/6
ARP34	ECC84	7/1	EZ81	6/9
ARTH2	ECC85	7/9	GL450	10/1
ATP4	ECC91	4/1	GG32	9/1
AU1	ECH82	8/6	HL23	6/1
AU4	ECH42	7/6	HL23DD	8/1
AW3	ECH81	7/9	HL41DD	8/1
AZ31	ECL80	8/1	HVR2	12/6
BL63	ECL82	9/1	KF35	5/1
BS4A	EF22	7/3	KRN2A	19/1
BT45	EF32	5/1	KT31	8/1
BT83	EF36	3/6	KT32	8/1
BT98	EF37A	8/1	KT33C	4/9
CY31	EF39	4/3	KT44	6/3
D41	EF50	2/6	KTV62	7/6
D77	EF54	3/3	KTV63	6/6
DA30	EF55	6/1	MH4	3/1
DAF86	EF70	4/1	MH41	3/1
DAF91	EF73	6/1	ML4	4/1
DETS	EF80	5/6	MS/PEN	6/1
DF22	EF85	6/10	NT37	
DF91	EF86	9/1	(4033A)	10/1
DK96	EF89	7/9	NU12	5/1
DF96	EF91	3/6	OD3	5/1
DL92	EF92	4/6	OZ4	5/1
DL94	EF95	7/6	PCC84	7/1
DL96	EK32	7/1	PCC85	8/3
DX25	EL32	3/9	PCF80	7/1
E1232	EL33	8/1	PCF82	8/1
E1323	EL35	8/3	PCL82	8/6
E1524	EL41	8/3	PEN25	4/6
EAS0	EL42	9/1	PEN46	5/1
EABC80	EL84	7/6	PEN65	6/6
EAC91	EL85	10/1	PEN220A	3/1

PENDD/	1360	9/6	VP41	5/6	6AK7	8/1	6SS7	6/1	58	6/1	6475	5/1	
PL81	9/1	VR78	4/1	VR78	4/1	6AM6	6/3	6V6G	5/6	59	6/1	8013A	25/1
PL82	8/1	VR99	8/1	VR99	8/1	6AT6	5/1	6V6GT	6/1	75	5/1	8020	6/1
PL83	7/9	VR105/307/6	6/6	VR105/307/6	6/6	6BA5	6/1	6X4	5/1	76	8/1	9001	4/6
PT25H	7/6	VR150/307/3	6/6	VR150/307/3	6/6	6BB8	5/6	6X5GT	6/6	77	6/1	9002	5/6
PX4	19/1	VT4C	25/1	VT4C	25/1	6BB8G	2/6	6Y6G	8/1	78	7/1	9004	4/1
PX25	9/1	VU39	6/1	VU39	6/1	6C4	3/6	6Z4	8/1	80	8/1	9006	4/1
PY83	7/3	VU111	3/3	VU111	3/3	6C5	6/1	7B7	7/6	82	6/1		
PY80	7/9	VX3138	12/1	VX3138	12/1	6C6G	4/3	7C6	7/1	8V3	12/1		
PY81	7/1	W31	7/1	W31	7/1	6C9G	5/1	7C7	6/6	84	8/1		
PY82	8/1	Y63	5/1	Y63	5/1	6D6	4/6	7H7	7/3	89	6/1		
QP21	6/1	Y66	8/1	Y66	8/1	6F6	7/1	7Q7	7/1	210LF	3/1		
QP25	5/3	Z31	6/1	Z31	6/1	6F6G	4/1	7V7	5/1	210VPT	3/1		
Q575/20	6/9	IA3	3/4	IA3	3/4	6F8G	6/6	7Y4	6/1	7 pin	2/6		
Q595/10	6/9	IA5GT	7/1	IA5GT	7/1	6F12	4/6	7Z4	6/6	2748	3/1		
Q5108/456/9	6/9	IC5GT	7/6	IC5GT	7/6	6F17	7/6	8D2	2/1	350B	8/1		
Q5150/156/9	6/9	ID8GT	6/1	ID8GT	6/1	6G6G	3/1	9D2	3/1	393A	15/1		
QV04/7	12/6	IE7GT	7/6	IE7GT	7/6	6H6M	2/1	12A6	5/1	705A	17/6		
R3	8/1	IG6GT	12/1	IG6GT	12/1	6I5	3/6	12AH7	7/1	715B	97/6		
R10	12/6	IL5	3/6	IL5	3/6	6J5G	3/1	12AT7	5/6	717A	8/1		
REL21	25/1	ILN5	4/9	ILN5	4/9	6J6	4/3	12AU6	9/1	801	6/6		
RK34	2/6	IR5	6/1	IR5	6/1	6J7G	5/1	12AU7	6/1	803	22/6		
RX235	10/1	IT4	4/1	IT4	4/1	6K6GT	6/6	12AX7	7/1	804	5/6		
SP2	4/1	2A3	8/1	2A3	8/1	6K7GT	2/3	12C8	3/1	805	30/1		
SP13C	4/6	2A5	8/1	2A5	8/1	6K8G	5/9	12E1	22/6	807AMER	6/1		
SP41	2/6	2A6	7/1	2A6	7/1	6K8GT	8/3	12H6	2/1	807BR	5/1		
SP61	2/1	2034	2/6	2034	2/6	6K8M	8/6	12J5GT	3/6	808	8/1		
STV280/80		2D4A	4/1	2D4A	4/1	6L5G	6/1	12K7G	4/6	810	80/1		
		2X2	4/1	2X2	4/1	6L6	9/1	12K8M	9/1	813	67/6		
SU2150A	4/9	3A4	5/1	3A4	5/1	6L6G	6/6	12SA7	7/6	815	40/1		
T41	7/1	3B7	5/1	3B7	5/1	6L3A	4/6	12SC7	4/6	816	30/1		
TH41	8/1	3B24	8/1	3B24	8/1	6N7G	5/9	12SG7	6/6	826	10/1		
TP25	15/1	3E29	2/1	3E29	2/1	6N7GT	6/1	12SH7	3/1	829A	30/1		
TT11	16/1	(829B)	60/1	(829B)	60/1	6O7G	6/1	12S17	6/1	832	15/1		
TZ20	1/1	3Q5GT	9/1	3Q5GT	9/1	6R7G	6/1	12S17	7/1	843	7/6		
U17	5/1	3S4	5/1	3S4	5/1	6R7GT	8/1	12SN7	8/1	866A	12/6		
U18	5/1	3V4	7/3	3V4	7/3	6S47	6/1	12SG7	4/6	872A	35/1		
U27	8/1	5T4	9/1	5T4	9/1	6S7G	5/6	12S7R	6/1	930	8/1		
U52	5/1	5U4G	5/1	5U4G	5/1	6S7GT	6/1	15D2	6/1	956	2/1		
UBC41	7/6	5Y3GT	6/1	5Y3GT	6/1	6S7G	5/1	15R	5/1	958A	2/1		
UCH42	7/6	5Z3	8/6	5Z3	8/6	6SH	5/1	20A2	7/6	958A	5/1		
UL41	7/1	5Z4G	8/1	5Z4G	8/1	6S17G	5/9	21B6	9/1	1616	3/1		
UL84	7/6	6AB7	4/1	6AB7	4/1	6SK7	5/3	30	5/1	1619	5/1		
UL85	7/1	6AC7	3/1	6AC7	3/1	6SL7GT	6/6	35L6GT	8/1	1625	6/1		
UU9	5/6	6AG5	3/6	6AG5	3/6	6SN7GT	6/6	35T	30/1	1626	4/6		
UY41	6/1	6AG7	6/1	6AG7	6/1	6SQ7	4/1	35Z4GT	7/1	1629	4/6		
UY85	6/6	6AJ7	4/3	6AJ7	4/3	6SR7	6/6	37	4/1	4120	4/1		
VP23	3/6	6AK5	5/1	6AK5	5/1			38	4/1	7193	1/9		

BRAND NEW ORIGINAL SPARE PARTS FOR AR88 RECEIVERS

- I.F. Transformers. 1st, 2nd, 3rd, 4th (for type D), 12/6 each or complete set of 6, 60/1.
- I.F. Transformers. Crystal Load, 12/6 each.
- Plates escutcheons (for D and LF), 15/1 each.
- Dials (for type D), 10/1 each.
- Logging Dial (for D and LF), 10/1 each.
- Filter Chokes (for D and LF), 22/6 each.
- Output Transformers (for LF), 30/1 each.
- Antenna Trimmers (LF and D), 2/6 each.
- Filter Condenser 3 x 4µF, £2.10.0
- Condensers:
 - 3 x .25µF (D and LF), 2/6 each.
 - 3 x .10µF (D and LF), 2/6 each.
- RF Antenna Inductors (D and LF), 7/6 each.
- Mains Transformers (LF), £3 each.
- Small Trimming Tool, 7/1.
- Small Mica Condensers, various values, 1/6 each.
- Instruction Manual for AR88D, £1.
- Specialty Built Power Pack for TCS Receiver 230 v. A.C. mains, including 6X5GT valve, £3.10.0. Carriage 5/1.
- T.C.S. Receivers. Made by Collins of U.S.A. In fully guaranteed working condition. 1.5-12 Mc/s. Line up: 12SA7 (1) 12SQ7 (1), 12A6 (2), 12SK7 (3). Power requirements 12 v. L.T., 225 v. H.T. £11.10.0. Carriage 12/6.

R209 Reception Set. A 10-valve High-Grade Super Heterodyne Receiver with facilities for receiving R/T (A.M. or F.M.) and C.W. Frequency 1-20 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, openwire or dipole aerial with built-in loud-speaker or phone output. Overall measurements: Length 12in., width 8in., depth 9in. Weight 23 lbs. In as new, tested and guaranteed condition £23.10.0, including special headphone and supply leads. Carriage £1/1.

Supply Unit Rectifier No. 21. Fully sealed enabling all sets built for 6 v. (R209, R109, etc.) to work from A.C. mains. Input 90-260 v. A.C. (Taps at 10 v. intervals). Output excellently smoothed up to 10 amps with meter indicating exact output voltage. Measurements: 12 x 9 x 10in. Price £8. Carriage and packing 15/1.

19 Set Owners. To increase output of your set to 10 times use RF Amplifier No. 2 with built-in rotary converter for 12 v. input. Four 807 valves output. Simple connection with transmitter. Fully tested condition, £9.15.0, including necessary connectors and instructions. Carriage and packing 15/1.

Famous T.17. Carbon Microphones. £2.5.0 Post & packing 3/1.

Carbon Insert Microphone, G.P.O. Type 2/6. P. & P. 1/6.

Vacuum Condenser, 32,000 v, 50pF, 12/6. P. & P. 3/6.

ARC 88's. Completely rebuilt with new PVC wiring. Type "D" £75; Type "LF" £70. Marconi SIGNAL GENERATOR. TF144G. 85 kc/s, 25 Mc/s. Made up to new standard. £70 delivered free.

P. C. RADIO LTD.
 170 GOLDHAWK RD., W.12
 Shepherds Bush 4946

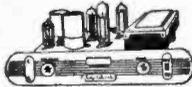
**DELUXE RECORDER
CABINET
79/6**



Beautifully styled rexine covered cabinet in Red or Beige. Size 14½ x 13 x 9½ in. Storage comp. in lid for tapes and mike. Easily adapted to Record Player Cabinet. Ins., Carr. 4/6.

TAPE RECORDER AMPLIFIER

£7.19.6



Compact, well designed 5 valve amplifier. Output 3.5W. Input for Microphone, Radio and Gram. Size 8½ x 3 x 4½ in. Ins., carr. 4/6. 12 months' guarantee. Terms available. Extras: Dial plate, including sockets and superimpose switch, 3/6. Knobs 2/6.

**TAPE RECORDER
AMPLIFIER £9.15.6**

By famous manufacturer. Superb 4 valve amplifier. Two controls and superimpose switch. Sockets for Mike and Gram. Size 11 x 4 x 6 in. Ins., Carr. 4/6. Drawings FREE with Order.

SCOTCH BOY TAPES

19/9 5½ in. 7 in. 25/-
Limited quantity. POST FREE.

MINIATURE SPEAKERS

16/9 Brand new 2½ and 3 in. P. & P. 1/-

ELLIPTICAL SPEAKERS

15/9 Brand new slot type. 8 x 3 in. and 7 x 4 in. P. & P. 2/9.

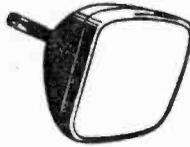
**EXTENSION
SPEAKERS
19/9**



8 in. P.M. Speaker fitted into polished cabinet. Complete. Switch and flex included. P. & P. 3/9.

REPLACEMENT
REBUILD

TV TUBES



12
Months' Guarantee
HP Terms available

21in. 99/6
17in. 90/-
15, 14, 12in. 70/-
Ins., Carr. 15/6

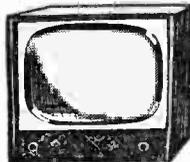
£1 extra without old bowl, refundable if same received within 14 days.

14in. TV TUBES 35/-

14KP4 and 36/24. Due to purchase of Rental replacement stocks. Carriage 5/-.

COMPLETE 17in. TV

£11.10.0



An excellent Ex-Rental Table Model. Famous manufacturer. Tuned ITA/BBC. Guaranteed 12 months. Terms available. Personal collection advised. Special delivery rate by arrangement up to 50 miles, or despatched in 3 parcels for easy assembly. Cart. & Ins. 25/-.

COMPLETE 14in. TV

£7.10.0

ITA/BBC. As above. Ideal for Caravans—Chalets—Weekend Bungalows etc. Carriage and Insurance 20/-.

VALVES

Salvage Guaranteed

2/9d. each 30/- Dozen
ECC31, ECC34, ECC81, ECC82, ECC85, ECC91, ECH42, EF80, EF92, EL32, EL36, EY51, KT36, L63, N18, N37, PL33, U22, U31, U35, U151, U281, U282, 6L18, 6U4GT, 10D1, 10F1, 12A7, 275U,

5/9d. each 60/- Dozen
EBC33, EBF80, ECF80, ECL80, EL33, EL38, EL41, EY85, GZ32, KT63, LNI52, LNI309, PCC84, PCF80, PCF82, PL81, PL82, PL83, PY80, PY81, 6F6, 6K8, 6Q7, 6V6, 7AN7, 9BW6.

POSTAGE

1 Valve—7d. 6 Valves—1/6. 12 Valves—2/6.

DUKE & CO.

(LONDON) LTD.
621/3 Romford Road,
MANOR PARK, E.12.

ILF 6001/3

9 a.m.—6 p.m.
Half Day Thursday

STAMPS FREE
CATALOGUE

RECORD PLAYER CABINET

69/6



Luxury cabinet in two tone coffee colour. Size 15½ x 17 x 9½ in. Takes all popular record player units and amplifiers. Position for 8 in. Speaker. Detachable lid for Stereo conversion. P. & P. 4/6.

**"ARGOSY" RECORD
PLAYER CABINET 19/6**

Exceptional offer. A lightweight portable player Cabinet by famous manufacturer. Size 14½ x 11½ x 6 in. Takes our single player; 2 control Amplifier; 5 in. Speaker. Post, packing and Insurance, 5/6.

TAPE RECORDER AMPLIFIER

12 months' guarantee **MK. D.2**

79/6



Latest design incorporating negative feedback, giving 4 watts undistorted output. Valves: ECL82, and metal rectifier. Tone and volume control panel on flying leads. P. & P. 3/6.

TRANSISTORS

Complete Set **47/6**

POST FREE

MULLARD
1—OC81D 6/9 2—OC81 6/9
1—OC44 9/9 2—OC45 8/9
1—Diode 1/9

EDISWAN
XC121 8/9 XB113 8/9

G.E.C.
114 6/9 873 8/9
2—874 9/9

SOLO SOLDERING TOOL

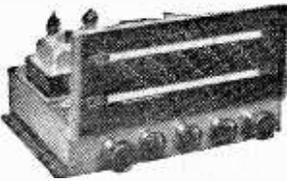
ONLY

12/6



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

ARMSTRONG AF208 AM/FM RADIOGRAM CHASSIS



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

PRICE 22 GUINEAS Carr. Free

LATEST "E.M.I." 4 SPEED SINGLE RECORD PLAYER

Acos Hi-Fi Pick-up for LP, and/or 78, 7, 10 and 12in. records. Silent motor, heavy turntable, auto stop.

Special offer **£6.5.0** post free. Stereo/Monaural **£8.19.6**.

BUILD THIS REPRODUCER BARGAIN

SPECIAL SINGLE PLAYER KIT
 B.S.R. TU9 4-speed Gram-Pick-up Unit £4.5.0
 Handsome portable case, 13 1/2 x 15 x 8 1/2 " £2.9.6
 Ready-built 3-watt, printed circuit, amplifier with two valves and speaker ... **£3.12.6**
 or **£9.9.0** complete kit, post free.

L.F. TRANSFORMERS 7/6 pair

465 kc/s slug tuning miniature can 1 1/2 x 1 x 1/2 in. High Q and good band width. Data sheet supplied.

New Boxed VALVES 90-day Guarantee

1R5	7/6	6K9G	7/6	EA50	1/6	EZ90	7/6
1R5	3/6	6L6G	10/6	EA8C80	8/6	K1148	1/6
1T4	6/-	6N7M	6/6	EB91	6/-	HAB80	3/6
2X3	3/6	6Q7G	8/6	EB33	8/6		12/6
284	7/6	68A7	6/-	EB41	8/6	HVR2A	6/6
3V4	7/6	68J7M	6/6	EBP80	10/-	MU14	9/6
5U4	7/6	68N7	6/6	EC83A	9/6	PG1	3/6
5Y3	7/6	6V6G	6/6	EC80	9/6	PC84	9/6
5Z4	6/6	6X4	7/6	EC142	10/6	PCP80	9/6
6AM6	5/-	6X5	7/6	EC180	10/6	PCL82	11/6
6B8	5/-	12A6	6/6	EC20	10/6	PEN25	6/6
6BE5	7/6	12AT7	8/-	EP39	5/6	PL81	12/6
6BE6	9/6	12AU7	8/-	EP41	5/6	PL82	10/6
6BW6	9/6	12AX7	8/-	EP50	5/6	PY80	7/6
6D6	6/-	12BE6	6/6	EP80	8/-	PY82	9/6
6F6	7/6	12K7	8/6	EP86	12/6	PY82	9/6
6H6	6/6	300	6/6	EP92	5/6	SP61	3/6
6J5	5/6	35L6	6/6	EL32	5/6	UC41	9/6
6J6	5/6	35Z4	7/6	EL41	9/6	UC42	9/6
6J7G	6/6	30	9/6	EL54	8/6	UF41	9/6
6K6GT	6/6	807	5/6	EY51	9/6	UL41	9/6
6K7G	5/-	954	1/8	EZ40	7/6	UY41	8/-

DK96, DP96, DAF96, DL96, 8/6 each or 80/- set.

NEW ELECTROLYTICS TUBULAR		FAMOUS MAKES TUBULAR		CAN TYPES	
1/350V	2/-	50/350V	5/6	18/45V	5/-
2/350V	2/3	100/25V	3/-	32/350V	5/-
4/450V	2/3	250/25V	2/-	100/270V	5/6
8/450V	2/3	500/12V	3/-	2,500/2V	5/6
8/500V	2/9	8+8/450V	3/8	5,000/8V	5/-
16/450V	3/-	8+8/500V	3/8	32+32/350V	6/-
16/500V	4/-	8+16/450V	3/8	32+32/450V	6/-
32/450V	3/9	8+16/500V	5/6	32+32+32/350V	7/-
25/25V	1/9	16+16/450V	4/3	50+50/350V	7/-
50/25V	2/-	16+16/500V	6/-	64+120/350V	11/6
50/50V	2/-	32+32/350V	4/6	100+200/275V	12/6

C.R.T. BOOSTER TRANSFORMERS

For Cathode Ray Tubes having heater cathode short circuit and for C.R. Tubes with falling emission, full instructions supplied.

Type A. Optional 25% and 50% Boost. 2V or 4V or 6.3V or 10.8V or 13.3V. Mains input. 12/6

Type A2. High quality, low capacity. 10/15PF. Optional boost 25%, 50%, 75%. Mains input. 16/6

Type B. Mains input. Low capacity. Multi output 2, 4, 6.3, 10 and 13V. Boost 25% and 50%. This transformer is suitable for all TV tubes, 21/- each.

QMAX CHASSIS CUTTER

The cutter consists of three parts: a die, a punch and an Allen screw.

Sizes	Prices	Key
1/4 in. ...	12/9	1/-
1/2 in. ...	13/9	1/-
3/4 in. ...	13/9	1/-
1 in. ...	13/9	1/-
1 1/4 in. ...	16/-	1/6
1 1/2 in. ...	16/-	1/6
1 3/4 in. ...	16/-	1/6
2 in. ...	18/-	1/6
2 1/4 in. ...	18/-	1/6
2 1/2 in. ...	18/-	1/6
2 3/4 in. ...	20/-	2/3
3 in. ...	20/-	2/3
3 1/4 in. ...	20/-	2/3

lin. square hole ... 20/-
 O.P. TRANSFORMERS. Heavy Duty 50 mA, 4/6. Multitap, push-pull, 7/6. Ditto, 10 w, 15/6. Miniature, 384, etc., 4/6. L.F. CHOKES 15/10 H, 60/65 mA, 5/-; 10 H, 85 mA, 10/6; 10 H., 150 mA, 14/-.

MAINS TRANSFORMERS 200/250 v. A.C. STANDARD, 250-0-250, 80 mA, 6.3 v. 3.5 a.	
tapped 4 v. 4 a. Revider 6.3 v. 1 a. 5 v. 2 a. or 4 v. 2 a. ditto, 350-0-350	22/6
MINIATURE 200 v. 20 mA, 6.3 v. 1 a.	10/6
MIDGET, 220 v. 45 mA, 6.3 v. 2 a.	15/6
SMALL, 220-0-220, 50 mA, 6.3 v. 2 a.	17/6
STD., 250-0-250, 65 mA, 6.3 v. 3.6 a.	17/6
HEATER TRANS. 6.3 v. 1 1/2 amp.	7/6
Ditto, tapped sec. 2, 4, 6.3 v., 1 1/2 amp.	8/6
Ditto, sec. 6.3 v. 3 amp.	10/6
GENERAL PURPOSE LOW VOLTAGE, 2a, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24, 30 v.	22/6
AUTO TRANS. 110-240 v. 150 w.	22/6
Ditto, 500 w.	32/6

TELEVISION REPLACEMENT Line Output Transformers

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

FULL WAVE BRIDGE SELENIUM RECTIFIER: 2, 5 or 12 v. 1 1/2 amp., 8/9; 2 a., 11/3; 4 a., 17/6. CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1 1/2 amps., 15/6. 2 amps., 17/6; 4 amps., 22/6. Circuit included. 4 AMP CAR BATTERY CHARGER with amp meter Leads, Fuse Case, etc., for 6 or 12 v., 69/6.

BOOKS

40 Circuits for Germanium Diodes 3/-. "W.V." Radio Valve Data, 6/-. High Fidelity speaker Enclosures, 5/- Valve and TV Tube Equivalents, 9/6. TV Fault Finding, 5/-. Quality Amplifiers, 4/6. Radio Valve Guide. Books 1, 2, 3 or 4, 5/- each. Transistor Superhet Receivers, 7/6.

CRYSTAL MIKE INSERT
 by Acos 8/6
 Precision engineered. Size only 1 1/2 in. dia x 1 in.
ACOS CRYSTAL MIKE 40 .. 25/-
DE LUXE STICK MIKE .. 35/-

LOUDSPEAKER P.M. 3 OEM. 5in. Rols, 17/6; 8in. Plessey, 19/6. 7in. x 4in. Plessey, 18/-; 6in. Rols, 18/6. 10 x 6in. 27/6. 10in. Rols, 30/-; 6in. Tweeter 25/-; 13in. R.A., 30/-; 14 x 8in. 45/-; STENTORIAN HF1012. 10in. 3 to 15 ohms, 10 w., 86/-.

BAKER SELHURST LOUDSPEAKERS



12in. Baker 15w. Stalwart, 3 or 15 ohms ... 90/-
 12in. Baker ditto, foam suspension, 15 ohms ... 26
 12in. Baker Ultra Twelve, 20 c.p.s. to 25 kc/s £17.10
 15in. Auditorium, 35 w., £16

CRYSTAL DIODE G.E.C. 2/- GEX34, 4/-
 HIGH RESISTANCE PHONES, 4,000 ohms, 15/- pr. MIKE TRANSF. 50 : 1, 3/9 ea.; 100 : 1, Potted, 10/6. SWITCH CLEANER. Fluid squirt spout, 4/3 tin. TWIN GANG TUNING CONDENSERS. 365 pF miniature lin. x 1 1/2 in. x 1 1/2 in., 10/-; 500pF Standard with trimmers, 9/-; midget, 7/6; with trimmers, 9/-; SINGLE, 50 pF, 2/6; 75 pF, 100 pF, 160 pF, 6/6. Solid dielectric 100, 300, 500 pF.

CONDENSERS. New stock, 0.001 mfd. 7 kv; T.C.C., 5/6; Ditto, 20 kv, 9/6; 0.1 mfd., 7 kv, 9/6. Tubular 500 v. 0.001 to 0.05 mfd., 9d., 0.1/1/-; 0.25, 1/6; 0.5/500 v., 1/8; 0.1/350 v., 9d.; 0.01/2,000 v., 0.1/1,000 v., 1/9; 0.1 mfd., 2,000 volts, 3/6. CERAMIC COND. 500 v., 0.3 pF to 0.01 mfd., 9d. SILVER MICRA CONDENSERS. 10% 5 pF to 500 pF, 1/-; 500 pF to 3,000 pF, 1/3. Close tolerance. (All pF) 1.5 pF to 47 pF, 1/8. Ditto 1% 50 pF to 815 pF, 1/8; 1,000 pF to 5,000 pF, 2/-.

465 kc/s SIGNAL GENERATOR. Total cost 15/- Uses B.F.O. Unit ZA 30038 ready made. POCKET SIZE 2 1/2 x 4 1/2 in. Slight modifications required, full instructions supplied. Battery 7/6 extra 69V+1 1/2V. Details S.A.E.

Wavechange Switches, 2 p. 2-way, 3 p. 2-way, short spindle, 2/6; 6 p. 4-way 2 water, long spindle, 6/6; 2 p. 6-way, 4 p. 2-way, 4 p. 3-way, long spindle, 3/6; 3 p. 4-way, 1 p. 2-way, long spindle, 3/6;

Wavechange "MAKITS". Wafers available: 1 p. 12 water, 2 p. 6 wafer, 3 p. 4 wafer, 4 p. 3 wafer, 5 p. 2 wafer, 8 wafer, 8/6; 2 wafer, 12/6; 3 wafer, 18/-; additional waters up to 14, 3/6 each extra.

Toggle Switches, s.d., 2/-; d.p., 3/6; d.p.d.t., 4/-.

JASON FM TUNER COIL SET

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

Valveholders, Pax. int. oct., 4d. EA50, 6d. BLA, CRT, 1/3. Eng. and Amer. 4, 5, 6 and 7 pin 1/-. MOULDED Mazda and int. oct., 6d.; BTG, B8A, B8C, B8A, 9d. BTG with can, 1/6. B8A with can, 1/8. Ceramic, EF50, 1/8. BTG, B8A, int. oct., 1/-; BTG, B8A cans, 1/- each.

THE ORIGINAL RADIO COMPONENT

Our written guarantee with every purchase. Bus 133 or 68 pass door S.R. Station Selhurst.

Volume Controls 80 ohm COAX

Long spindles. Midget 5K ohms to 2 Meg. No. 8w. D.P.5w. 3/-
Linear or Log Tracks. Fringe Quality 11- yd.

COAX PLUG .. 1/- **LEAD SOCKET** .. 2/-
PANEL SOCKETS 1/- **OUTLET BOXES** .. 4/6
BALANCED TWIN FEEDER yd. 6d. 80 or 300 ohms
DITTO SCREENED per yd. 1/6. 80 ohms only
WIRE-WOUND POTS, 3 WATT. Pre-set Min. TV Type. All values 10 ohms to 25 K., 3/- ca. 30 K., 30 K., 4/- (Carbon 30 K., to 2 meg., 3/-).
WIRE-WOUND 4 WATT Pot. Long spindle. Values, 50 ohms to 50 K., 9/6; 100 K., 7/6.

TRIMMERS, Ceramic. 30, 50, 70 pF., 8d.; 100 pF., 150 pF., 1/3; 250 pF., 1/8; 500 pF., 750 pF., 1/9.
RESISTORS, Preferred values. 10 ohms to 10 meg., -w., 4d.; 1 w., 4d.; 1 w., 6d.; 1 w., 8d.; 2 w., 1/-.
HIGH STABILITY, 1 w., 1%, 2/- Preferred values. 100 to 10 meg. Dkto. 5%, 100 to 5 meg., 9d. 5 watt... **WIRE-WOUND RESISTORS** .. 1/8
10 watt... 25 ohms—10,000 ohms .. 1/-
15 watt... .. 2/6
12.5K to 50K 10 w 3/-

AMERICAN "BRAND FIVE" PLASTIC RECORDING TAPE

Double Play	7in. reel, 2,400ft	80/-	Spare Plastic
	5in. reel, 1,900ft	37/6	Reels
Long Play	7in. reel, 1,900ft	35/-	3in. 1/6
	5in. reel, 1,200ft	23/6	4in. 2/-
	5in. reel, 900ft	18/6	5in. 2/-
Standard	7in. reel, 1,200ft	25/-	5 1/2 in. 2/-
	5in. reel, 600ft	16/-	7in. 2/6

"Instant" Bulk Tape Eraser and Head Defuser, 2000 ft. A.C., 27/6. Leaflet. S.A.E.

Neon Mains Tester Screwdriver, 5/-
Solder Radiograde, 4d. yd., 1lb 5/-, 1lb 9/-
Black Crackle Paint. Air drying, 3/- tin.

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

Tunable channels 1 to 5. Gain 18db. ECC84 valve. Kit price 29/6 or 49/6 with power pack. Details 6d. (PC804 valves if preferred).
BAND III I.T.A.—Same prices. Tunable channels 8 to 13. Gain 17db.

Paxolin Panels, 10 x 8in., 1/6.
Miniature Contact Cooled Rectifiers, 250V 60mA. 7/6; 250V 60mA. 8/6; 250V 85mA. 9/6; 200mA. 21/-; 300mA. 27/6.

Selenium Rect. 300V 85mA. 7/6.
Coils. Wearite "P" type, 3/- each. Osrom Midget "Q" type, adj. dust core. from 4/- each. All ranges.

Teletron D.W.R. L. and Med. T.R.F. with reaction. 3/6.

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

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

Ferrite Rods, 8 x tin., 2/6.

H.F. Chokes, 2/6.

T.R.F. Coils, A/HF, 7/- pair; HAX, 3/-, DRR2, 4/-.

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., 5/6; 11 x 7in., 6/9; 13 x 9in., 8/6; 14 x 11in., 10/6; 15 x 14in., 12/6; 18 x 16 x 3in., 16/6.
Aluminium Panels, 18 s.w.g., 12 x 12in., 4/6; 14 x 8in., 4/-; 12 x 8in., 3/-; 10 x 7in., 2/6.

AUTOCHANGER ACCESSORIES

Suitable player cabinets (except 4 H.F.) .. 49/6
Amplifier player cabinets (except 4 H.F.) .. 63/-
2-valve amplifier and 6 1/2in. speaker 79/6
3-valve amplifier and 6 1/2in. speaker 95/-
Wired and tested ready for use with above.

QUALITY 2-STAGE HI-FI AMPLIFIER, A.C. only, 200-250V. Valves ECL82 and E280. 3 watt quality output. Mullard tone circuits, bass boost, treble and volume controls. Separate engraved Perspex front-panel with de luxe finish. Heavy duty output transformer 3 ohm. Shrouded mains transformer. Stove enamelled chassis size 8 x 5 x 3in. Bargain price £4.10.0. Circuit supplied.

Wirewound Ext. Speaker Control, 100. 3/-.

ALADDIN FORMERS and cores. 1in., 8d.; 1 1/2in., 10d.

0.3in. FORMERS 5937 or 8 and cans TV1 or 2, 1in. sq. x 2 1/2in. or 1 1/2in. sq. x 1 1/2in. 2/- with cores.

SLOW MOTION DRIVES, Epicyclic ratio 6-1. 2-3.

SOLENOID IRON, 25W, 200V or 230V. 24/-
MAINS DROPPER, 3 x 1 1/2in. With adjustable sliders. 0.3A, 1,000 ohms. 4/3; 0.2A, 1,000 ohms. 4/3.

LINE CORD, 0.3A 60 ohms per foot. 0.2A 100 ohms per foot. 2-way, 1/- per foot; 3-way, 1/- per foot.

MIKE TRANS. 50-1, 3/9; 100:1, potted, 10/6
P.V.C. Conn. Wire, 8 colours, single or stranded, 2d. yd. Sleeving, 1.2mm, 2d.; 4mm, 3d.; 6mm, 5d. yd.

Speaker Fret, Gold cloth, 17 x 25in., 5/-; 25 x 35in., 10/-; Tygan, 52in. wide, 10/-; 26in. wide, 5/- ft. Samples. S.A.E. Expanded Metal, Gold, 12 x 12in., 6/-.

"REGENT" 4 VALVE



"96" RANGE VALVES
KIT PRICE
£6.6.0.
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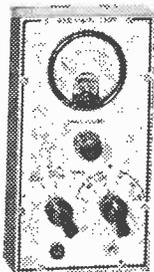
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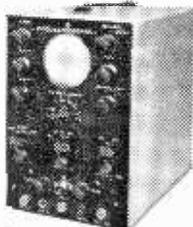
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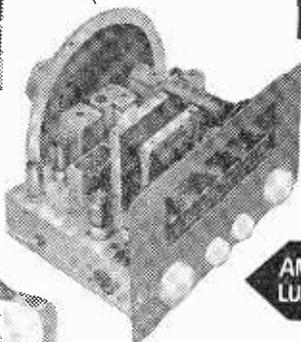
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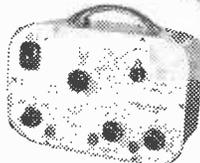
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Practical Wireless

VOL. XXXVII No. 656 OCTOBER, 1961

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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 to 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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The "Tutor" Blueprint

WITH each copy of this issue of PRACTICAL WIRELESS, we are giving away another blueprint: the "P.W. Tutor", as it is called, has been designed for absolute beginners to radio construction, those who are, perhaps, new readers of this magazine, or those who have for some time wished to know more of the basic principles from which many of the more advanced designs appearing in these pages obtain their origin. This blueprint then does not only constitute details of simple radio receivers which anyone can build, confident that successful sets will result from their efforts, but it has also been designed by our experts—leaders in the field of technical journalism—to provide also a foundation of the principles of radio reception and receiver construction. This surely is the only way to begin a satisfactory association with this hobby—from a sound knowledge of the absolute fundamentals.

The article relating to the "Tutor", on pages 504 to 509, shows, by easy stages, how four simple radio receivers may be built by anyone who is prepared to follow the step-by-step instructions, learn the meaning of the various circuit symbols (page 508), and spend a few minutes reading and practising the "Hints on Soldering" given on page 509.

The components used in all the sets are inexpensive and readily obtainable and most of them are mounted on a group-board which greatly simplifies the construction.

The first receiver is a crystal set. This type of circuit has long been recognised as the ideal introductory circuit for the newcomer to the ranks of the amateur radio enthusiasts. It is for this reason that we feel justified in describing, in detail, the construction of a simple crystal set as the starting point for the beginner.

Three other sets follow this first receiver, each being progressively more advanced than the one before, and incorporating long and medium waveband coverage, transistor amplifying stages, as well as regeneration to improve volume and selectivity. The construction of a simple cabinet is also described which will be suitable for any of the four sets, and will give the final receiver a professional appearance.

Many of the more experienced readers of PRACTICAL WIRELESS may feel that in publishing this blueprint for the beginner, we have neglected our responsibility to those who have already established themselves as radio enthusiasts. We can but hope that any such readers will be patient, for this blueprint is the first of three; the other two are to be published in the November and December issues. The November blueprint will be of a transistorised amplifier, using the group-board method of construction, which will be capable of operating a loudspeaker from a battery record player or radio tuner. The December blueprint will give details of a superhet receiver, again built on a group-board, and designed to operate with the amplifier of the November issue, to form a complete radio set which the experienced constructor and the beginner alike will find to be a useful domestic receiver with an excellent performance.

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

Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of June, 1961, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	Total
London	688,067
Home Counties	648,049
Midland	469,169
North Eastern	508,102
North Western	437,436
South Western	387,442
Wales and Border Counties	225,973
Total England and Wales	3,364,237
Scotland	375,848
Northern Ireland	118,799
Grand Total	3,856,884

International Trade Fair

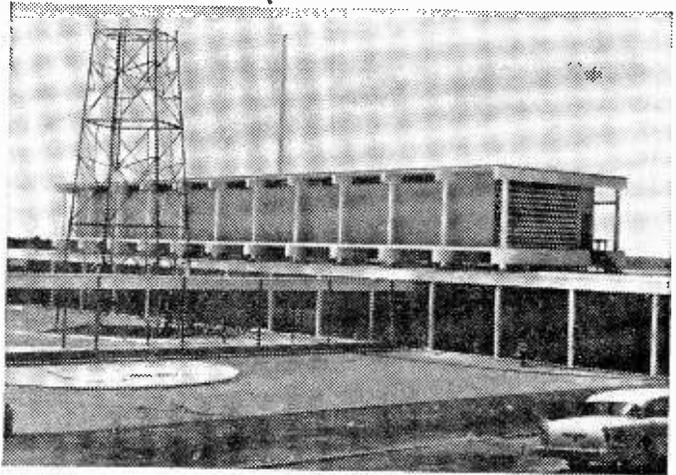
THIS year's Pacific International Trade Fair is to be held in Lima, Peru, during October.

The British pavilion will be of modern design and will be one of the main attractions for visitors. The Board of Trade and the British delegation, in designing the pavilion, have ensured that British products will be exhibited to best advantage. Exhibitors' and general trade 16mm films will be shown to visitors in a fully equipped cinema, with projection equipment from the RCA Great range.

President Nkrumah Visits New Broadcasting Station

PRESIDENT Nkrumah recently visited the new external broadcasting station at Tema, near Accra, Ghana, which is being constructed by Marconi's Wireless Telegraph Co. Ltd. This station will give Ghana a modern high-power short-wave broadcasting system.

Under the contract Marconi's have designed and erected the transmitting station buildings and supplied and installed four 100kW high frequency radio transmitters. Marconi's will also supply technical staff for the supervision and maintenance of the station



The transmitter hall and partially completed tower of a new broadcasting station at Tema, Ghana, which is being constructed by Marconi's Wireless and Telegraph Co. Ltd.

(Picture by courtesy of "Radio Review and TV Times", Ghana.)

for a period for four years and train personnel of the Ghana Broadcasting System.

New BBC VHF Sound Broadcasting Station

THE BBC's new VHF sound broadcasting station on the site of the Air Ministry radio station on the cliffs some 400ft above Dover, was brought into service on 8th August.

The Home Service is transmitted on 94.4Mc/s, the Light Programme on 90.0Mc/s, and the Third Programme with Network Three on 92.4Mc/s, each with a mean effective radiated power of 3.5kW. A large number of listeners in South-East Kent, including Deal, Ramsgate, Broadstairs and Margate, Dover and Folkestone, are now able to receive greatly improved BBC sound broadcasting services.

The new station is of the translator type and will operate unattended. It will receive its programmes from the Wrotham VHF sound station by radio and make a direct frequency change on each without demodulation.

Weather Ship Improvements

FOLLOWING the completion of an Air Ministry contract for the supply and installation of new radio communication and

automatic direction finding equipment, and the modernisation of the radar on two ocean weather ships the Marconi Company has been awarded a similar contract for a third ship. The Marconi equipment at present being installed includes four 1kW independent side band transmitters, eight receivers, a medium frequency direction finder and a VHF automatic direction finder and displays.

Ionising Radiations in Industry

A SAFETY code for workers exposed to ionising radiations in industry is laid down in the Ionising Radiations (Sealed Sources) Regulations, 1961, made by the Minister of Labour, Mr. John Harcourt, and presented to Parliament on 3rd August.

The regulations impose requirements for safeguarding the health and safety of persons employed in factories and other places to which the Factories Acts apply, who may be exposed to ionising radiations from sealed radio-active substance, and from certain machines, such as X-Ray apparatus. They require the restriction of the exposure of workers to such radiations, the adequate shielding of sources of ionising radiations and instructions for workers likely to be

exposed to them, about the hazards involved and the precautions to be taken.

Maximum permissible doses of radiation are laid down, and the regulations include requirements for the medical supervision of workers, and for the wearing of film badges to measure personal doses received.

Valve Manufacturers' Interests Merge

ON the 1st August this year, Thorn-AEI Radio Valves and Tubes Ltd. began trading.

It was announced on 16th June that Associated Electrical Industries Ltd., were to merge their respective interests in the manufacture and sale of cathode ray tubes and radio valves. The productive capacities of both companies in this field have been pooled and include factories at Sunderland, Harlow, Rochester and Foots-cray.

AEI and TEI are both represented on the board and have equal shareholdings. TEI is responsible for management.

From 1st August all AEI's interests in radio valves and cathode ray tubes for the entertainment industry were transferred to Thorn-AEI Radio Valves and Tubes Ltd., but AEI is continuing to manufacture valves and cathode ray tubes for industrial purposes.

Radio Equipment for New Aircraft

THE "Sixty Series" of airborne radio equipments and navigation aids, made by Marconi's, has been specified by British European Airways for use in their fleet of de Havilland Trident.

The principal design aim in the "Sixty Series" has been for greatly improved reliability through new concepts of mechanical and circuit design. The units are transistorised, are very small and light and have an extremely low power consumption.

The equipment will include VHF communication equipment, VHF navigation and approach guidance equipment, automatic direction finder or radio compass and an aircraft selective calling system.

The "Sixty Series" has also been specified by BOAC for their fleet of Vickers VC 10's.

The Centre of Sound

IN June this year, the Centre of Sound was opened in London and established as the national headquarters of the British Recording Club. The Centre also aims at promoting the growth of the audio industry in this country and on the ground floor is housed a permanent exhibition of audio equipment. This exhibition is open to the public every day except Sunday, from 9.30 a.m. to 11.00 p.m.

Also for the benefit of the general public there is an Information Bureau on the ground floor which will give advice on all audio problems. It is staffed by a team of experts and is open every day from 9.30 a.m. to 5.30 p.m. For the benefit of evening visitors a skeleton staff is employed from 5.30 p.m. to 11.00 p.m.

Full club members of the Centre of Sound automatically become members of the British Recording Club. Facilities for members include a small theatre with a bar, a cinema, a library, a restaurant and television lounges.

The Centre of Sound is in Archer Street, Piccadilly, London W1.

Engineering Division Appointments

THE BBC recently announced the appointment of Mr. J. A. G. Mitchell as Scottish engineer. He succeeds the late Mr. F. W. Endicott and becomes responsible for the engineering services of the BBC's sound and television studios and outside broadcast units in Scotland.

Audio Avenue at the Radio Show

AN extensive display tracing the history of sound recording from 1888 to 1961 was a feature of the Audio Avenue at the Radio Show this year. Occupying some 500 sq. ft. this feature, "Milestones in Recording", was presented in conjunction with the E.M.I. group of companies.

Among the many vintage instruments featured in this display was one of the earliest weight-driven acoustic recording machines, an Edison phonograph and the microphones used exclusively by the Royal Family from 1924 to 1945. The modern era of recording was represented by the latest type of studio tape recorders, stereo mixer consoles and other high-fidelity equipment.

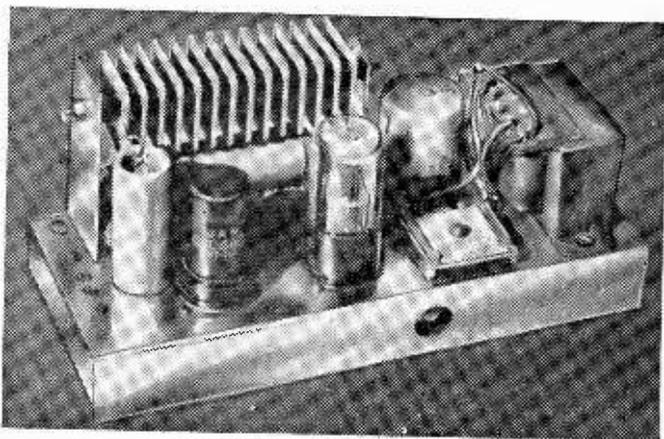


The Centre of Sound; headquarters of the British Recording Club.

Remote Control Unit

THIS INSTRUMENT WAS DESIGNED TO OPERATE AN AUTOMATIC MECHANISM OVER A SHORT RANGE

By V. E. Holley



THIS apparatus was designed so that the door of a garage could be made to open automatically on receipt of a command signal from the driver of an approaching vehicle. It is, of course, suitable for any other control service where only a short range is required. While the mechanical part of the installation is rather outside the scope of these pages, it must be said briefly in explanation that the controlled door is of the roller shutter type which, when the retaining bolt is withdrawn, rises

under the influence of springs incorporated in the roller. The bolt is in fact the armature of a solenoid which the apparatus here described is designed to energise. It requires a current of 0.25A at around 240V D.C.

Command Signal

The more obvious methods of control by photoelectric circuits, contact pads laid in the approach road, etc., suffer from the defect that they can be operated by unauthorised persons. They were therefore rejected in favour of the following arrange-

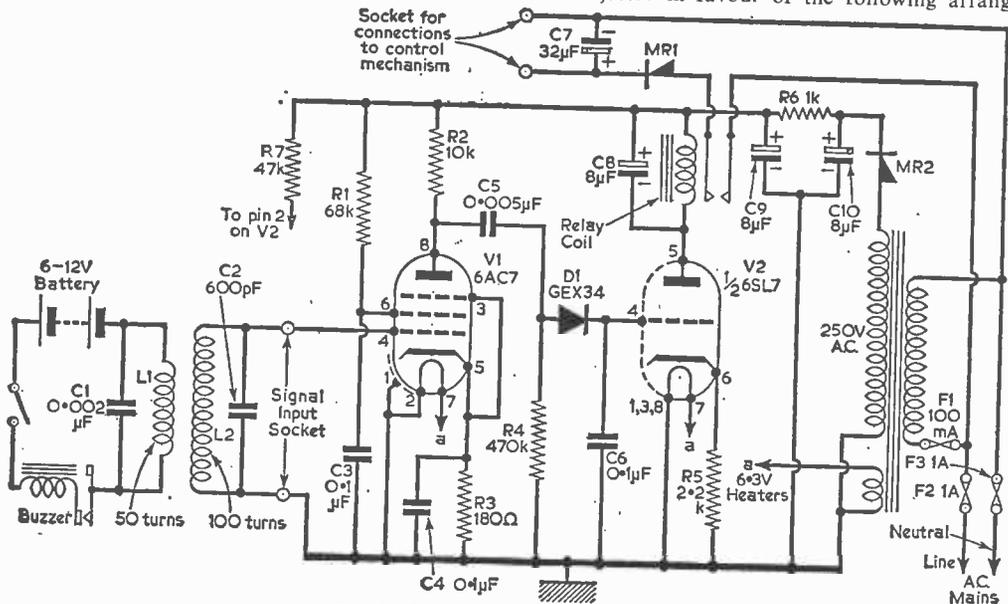


Fig. 1.—The circuit of the instrument.

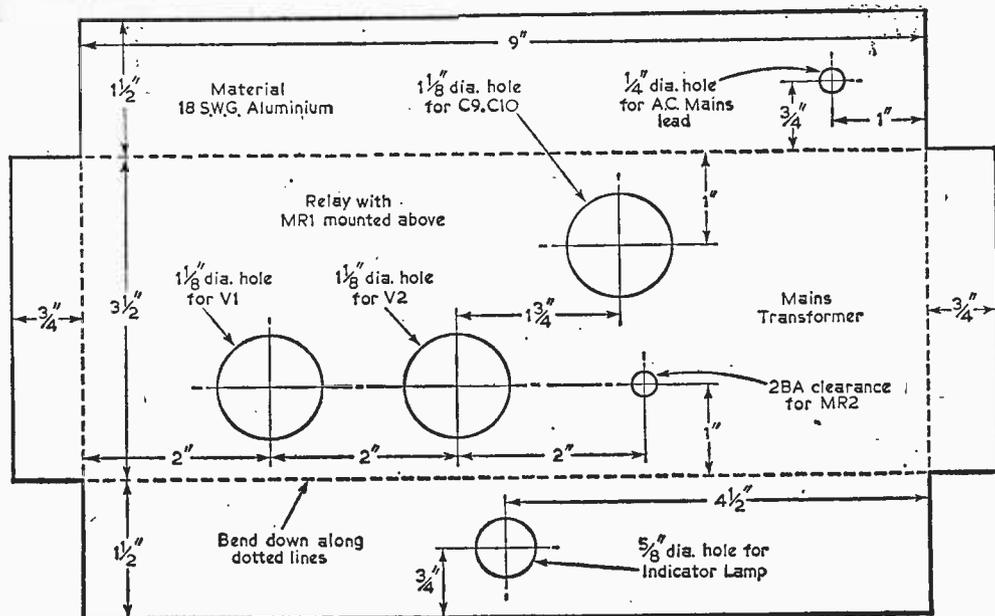


Fig. 2.—The drilling dimensions of the aluminium chassis.

ment which depends upon a secret signal given by the driver of the car. Referring to Fig. 1, the tuned circuit L1/C1, is carried on a bracket beneath the car and the buzzer and switch or bell-push in some convenient operating position inside. The second tuned circuit L2/C2 is buried several inches below the surface of the approach road in such a position that the car must pass over it to enter the garage. Operation of the buzzer energises L1 at its resonant frequency and the signal is transferred inductively to L2; the two coils may in fact be regarded as the two windings of an R.F. transformer with a step-up ratio of 1:2. With the circuit shown, sufficient signal transference is obtained with the coils three or four feet apart and, as the service operating distance is less than 18in., there is sufficient sensitivity in hand. It is not necessary that L1 should pass exactly over L2; satisfactory operation is obtainable with a divergence of up to 18in. either side.

Signal Amplification

The signal induced in L2 is taken by underground cable into the garage and presented to the grid of the valve V1. This is a high-gain pentode, 6AC7, arranged as an R.F. amplifier. An inductive load in the anode circuit would no doubt increase the gain considerably but the 10k resistor R2 is adequate provided the screen and cathode resistors are efficiently bypassed. The amplified signal is transferred via C5 to the diode, D1, where it is rectified and the resultant voltage is applied to the grid of the valve V2. Any other high-gain R.F. pentode can be used for V1, the values of the associated components being adjusted as necessary.

Output Stage

The function of V2 is to operate the relay and both valve and relay must be selected for compati-

COMPONENTS LIST

Resistors $\frac{1}{2}$ W (unless otherwise stated)

R1 68k R4 470k
R2 10k R5 2.2k
R3 180 Ω R6 1k, 1W

Capacitors 350VW (unless otherwise stated)

C1 0.002 μ F C4 0.1 μ F
C2 600pF C5 0.005 μ F, 1000VW
C3 0.1 μ F C6 0.1 μ F
C7 32 μ F (electrolytic)
C8 8 μ F (electrolytic)
C9 8 μ F (electrolytic)
C10 8 μ F (electrolytic)

Valves

V1 6AC7 (octal base)
V2 6SL7 (octal base)

Diode

GEX34

Relay

See text

Rectifiers

MR1 RM4, 250V, 300mA
MR2 Contact-cooled, 250V, 20mA
(minimum)

Mains Transformer

250V, 20mA, half-wave;
6.3V, 1A

Fuses

F1 100mA F2 1A
F3 1A

Sockets

Two (dissimilar) for external circuits
Buzzer and bell push
Any type

bility. The relay in the original equipment is of a simple type which is obtainable for a few shillings; the energising coil has a D.C. resistance of 4k and the operating current is 3mA. This fits in well with a high- μ triode valve and the prototype uses one half of a double triode, 6SL7. In the quiescent condition, the valve is biased by the resistor R5 so that the anode current is 2mA. Diode D1 is connected so that the arrival of a signal produces a positive voltage on the grid of the valve which

(Note that R7 is used to feed H.T. to the spare, or unused, half of the 6SL7 to prevent cathode poisoning.)

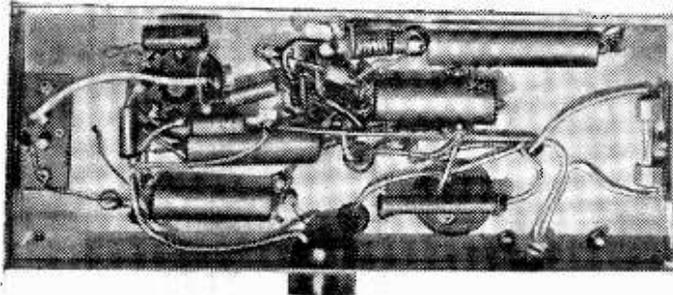
Power Supply

The H.T. requirement is about 15mA at 250-300V, while the heaters and indicator lamp need a little under 1A at 6.3V. This is supplied by a miniature mains transformer of the type used in television converters. The 250V half-wave secondary feeds a contact-cooled rectifier and smoothing is provided by R6 in conjunction with the 8 μ F-capacitors C9 and C10. No mains switch is included as it is convenient to control the supply to the prototype from the mains outlet to which it is connected.

Controlled Circuit

The direct current for operating the door control mechanism is produced by the rectifier MR1 and its associated reservoir capacitor, C7. The supply is taken direct from the mains and the relay contacts are included in the A.C. portion of the circuit. The

connection to the mains should be made as in Fig. 1 so that, in the quiescent condition, line voltage is present in the controlled circuit only as far as the relay contact. The three fuses are a necessary precaution since the equipment will be switched on for long periods unattended and they should not be omitted. In the prototype, F2 and F3 are at the mains connection and F1 is on the chassis.



An underchassis view of the unit.

increases the anode current and operates the relay. The capacitor C6 acts as a reservoir and removes any R.F. which might otherwise be present on the grid. The anode of V2 is decoupled by the 8 μ F capacitor C8 to ensure clean make and break. Note that the decoupling is to H.T. +, since if it were taken to chassis, the flow of charging current into C8 would operate the relay when the equipment is switched on.

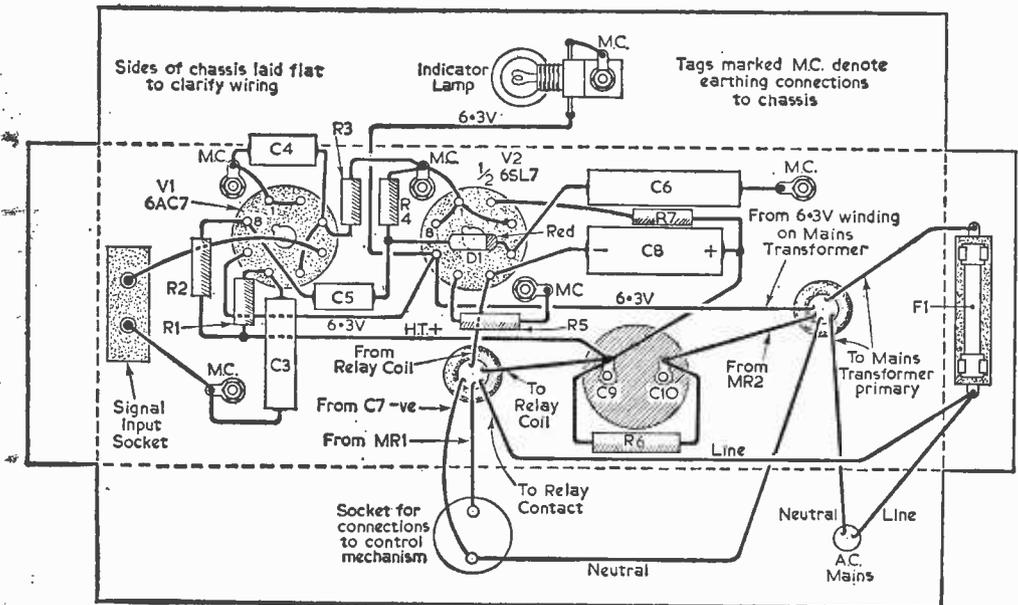


Fig. 3.—The underchassis wiring diagram.

Construction

The unit may be constructed in any desired form. A chassis about 9in. x 3½in. x 1½in. of 18s.w.g. sheet aluminium is convenient with the drilling dimensions given in Fig. 2. A point-to-point wiring diagram with the wiring and components opened out for clarity, is given in Fig. 3.

Coils

The coils L1 and L2 are wound with enamelled copper wire of 30s.w.g. on identical formers made from three layers of ¼in. plywood glued together as a "sandwich". The centre layer is 6in. x 6in. and the outers 6½in. x 6½in. so as to form a slot ¼in. deep all round in which the winding can be laid; the corners of the centre layer should be rounded off. The ends of the windings are brought through holes in the cheeks and soldered to two small wood screws which serve also to anchor the tuning capacitor. The details are shown in Fig. 4. Fifty turns are required for L1 and 100 for L2, giving a step-up ratio of 1:2.

When the construction is complete and the unit is operating satisfactorily, the coils should be thoroughly dried out and immersed in molten pitch or bitumastic paint to make them impervious to moisture. If pitch is used it should be heated very slowly to a temperature at which it is just sufficiently viscous to coat the coils thoroughly and the immersion should not be prolonged unduly. Waxed paper capacitors do not take kindly to this treatment and ceramics should be used for C1 and C2. The bracket for securing L1 beneath the car should of course be fitted before immersion.

Other Components

The relay must suit the valve as already mentioned and the contacts must be capable of carrying the current of the controlled circuit. Nothing is required of the buzzer except that it should buzz healthily and any type will do; the prototype uses an electric door bell with the gong removed. The diode should be suitable for low radio frequency operation and a GEX34 performs very well. The resistors may be half watt except R6 (1 watt) and the capacitors 350V.V except C5 for which a

1000VW component is advisable because breakdown or leakage here would cause the relay to operate. Sockets are required for connection of the signal circuit. L2/C2, and the circuit to be controlled. They should be dissimilar to avoid accidental wrong connection.

Testing

The completed unit should be set up on the bench with the coils L1 and L2 facing each other and about 3ft apart. If consistent and reliable operation is obtained at this range, it can be assumed that the equipment will be satisfactory in service. A range of 5ft was obtained with the prototype by tuning L2 accurately to the signal and capacitors of values between 500pF and

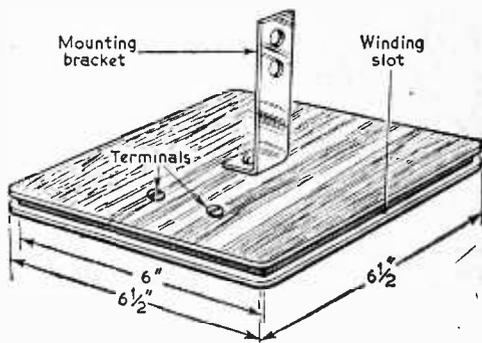


Fig. 4.—The constructional details of the former for L1.

1000pF can be tried across the coil for optimum results if maximum range is required.

A 9V grid bias battery is suitable for operating the buzzer, or power can be taken from the car battery. The original equipment is designed for operation from a 12V car system but satisfactory operation will be obtained from a 6V system provided that the buzzer does not require too much current.

MULTIRANGE INSTRUMENT PROTECTION DEVICE

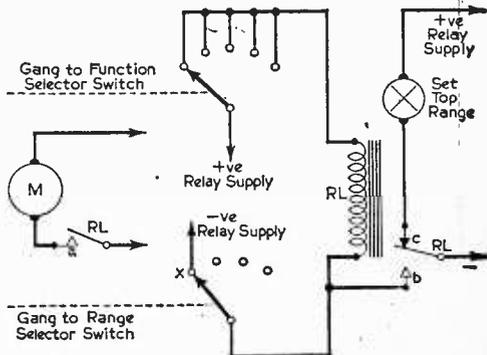
By J. B. Ayer

The protection system described here approaches the ideal; it consists of a relay (6V to 28V D.C.), two switch banks ("break before make" types), a lamp (6V to 28V D.C.), and a D.C. supply.

One switch bank is ganged with the range selector switch of the instrument and the other ganged with the function selector switch.

The protection system provides the following facilities.

- (i) The instrument will be switched on only if the range selector switch is on the top range position initially.
- (ii) It will disconnect the instrument instantaneously if the function selector switch is operated without previously setting the range selector switch on top range.



Note: X is position of Range Selector Switch on top range
Fig. 1.—The circuit of the unit. Relay contact (a) is wired in series with the meter leads.

TROUBLE in the LOCAL OSCILLATOR

RECOGNISING AND CURING SOME
FAULTS TO BE FOUND IN SUPERHET
RECEIVERS

By G. J. King

IN a superheterodyne receiver the local oscillator section of the frequency changer stage often gives trouble and results either in complete failure of the receiver, lack of sensitivity or apparent misalignment. In effect, the local oscillator is the heart of a superhet receiver. If the frequency is incorrect or the heterodyne signal voltage too high or too low, then the performance is impaired.

Operation

In spite of its importance, the local oscillator is probably the section of the receiver which is most taken for granted. Should the oscillator fail to produce a heterodyne signal of any kind, the receiver will not tune signals since the operation of a superhet depends on the mixing of a locally generated signal with the incoming signal to produce an intermediate-frequency signal in the anode circuit of the mixer section of the frequency changer valve, this being subsequently amplified to the required degree before being applied to the detector stage.

The difference between the frequency of the incoming signal and that of the local oscillator gives the intermediate frequency, a common value nowadays being 470kc/s. The oscillator frequency may be 470kc/s (or whatever the I.F. is) above or below the incoming signal frequency, depending on the design of the receiver or, sometimes, on the waveband to which the receiver is adjusted.

I.F. Pick-up

It is clear that if the local oscillator fails, no I.F. signal will be produced. Nevertheless, the receiver may not be totally dead. The receiver will not tune stations, of course, but it may pick up odd morse signals or even a Continental station. The reason for this is that the I.F. stages are still operative and sensitive and if any signal appears on the aerial at a frequency within the I.F. passband, and if the signal is strong enough, it may well break through the first stages of the receiver and undergo amplification in the I.F.

channel, where it will be detected in the normal way and give a signal from the loudspeaker.

If the tuning is operated, the station will occur over the entire tuning range, though it may be slightly stronger when the tuning is set to one extreme end of its range. This is because at one end of the range the first tuned circuits are brought closer to the intermediate-frequency and the attenuation which they offer at the I.F. is progressively reduced. If the receiver features an I.F. trap in the aerial circuit, then this may afford sufficient attenuation to prevent such I.F. pick-up.

What usually happens, however, is that when a receiver fails the experimenter or service technician endeavours to locate the faulty section by removing the aerial lead from the aerial socket and applying it to various internal points around the frequency changer stage. If the local oscillator is responsible for the failure, when the aerial lead is connected to the signal grid of the mixer or to an associated lead or component (point A in Fig. 1), I.F. pick-up may occur loud and clear. This is because the signal (or signals) in the range of the I.F. is applied direct to the I.F. amplifier stage, which then acts as a fixed-tuned TRF section.

Partial Failure

In some cases the oscillator may not fail completely over the whole of the tuning range, but may suddenly burst into life at certain critical points on the dial, while at other points the symptoms already described may occur. This is typical local oscillator trouble, but which may occur only on some bands and not on others.

Low sensitivity of the receiver, if not due to any other cause, may be the result of low heterodyne voltage. This would point either to coil trouble or to alteration in value of an associated oscillator component. Sometimes in old sets, the oscillator coil or coils lose their "goodness"—their Q-value probably diminishes—and this results either in intermittent operation or complete failure.

On the other hand, if the oscillator is operating too strongly, as may be caused by a feed resistor decreasing in value, the sensitivity may in some cases also be reduced. In addition, harmonics of the oscillator fundamental frequency may be generated, and these may well cause spurious I.F. signals which could possibly cause disconcerting

whistles and interference on certain signals tuned in the normal way.

In order to obtain the best results, the local oscillator must produce a signal voltage within a certain range, usually between 5 and 15V, and for any given signal level there is a heterodyne voltage which provides optimum conversion conductance in the frequency changer valve. Fortunately this optimum value is not highly critical, and deviations to either side of the optimum will not normally impair the operation of the frequency changer by any marked degree. However, if the oscillator voltage deviates considerably from the optimum value, then poor results are bound to occur.

the tuning gang for the oscillator is usually of smaller capacitance (and size) than those sections used for tuning the aerial and R.F. circuits.

The signal output or attenuator of the signal generator should be adjusted to give reception comparable to that obtained with the oscillator of the receiver, and then the signal strength should be increased and decreased so that the effect of too much and too little oscillator voltage may be noted.

Too little voltage will mostly cause a hiss on reception as well as decreasing the sensitivity, while too much voltage will cause whistles and if further increased will also cause a fall-off in sensitivity, as already described.

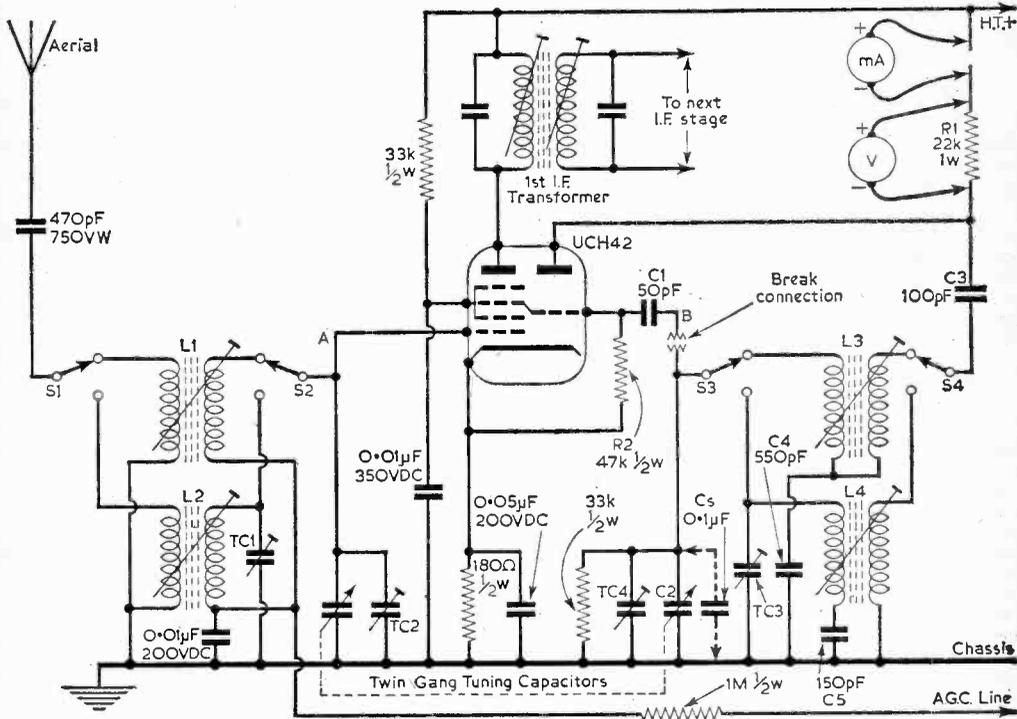


Fig. 1.—The local oscillator or frequency changer stage of a superhet receiver.

Worthwhile Exercise

The effects of changes in oscillator voltage can easily be observed by the experimenter and service technician by first tuning the receiver to a medium power transmission, making the local oscillator inactive and then injecting into the mixer section a signal of correct frequency from a signal generator—unmodulated, of course!

The correct frequency for the signal generator can be found first by tuning it to a frequency equal to the incoming signal frequency minus the I.F. and if this does not bring back the station, then tuning it to a frequency equal to the incoming signal frequency plus the I.F. In sets where the local oscillator is above the signal frequency,

This exercise is well worth while for it may be practised as a test procedure when a receiver is in for repair with a suspect local oscillator. This will quickly prove whether or not the oscillator is responsible for lack of signals.

It is best to inject the generator signal at the grid of the oscillator valve after first breaking the connection between the oscillator coupling capacitor and the oscillator coils or switch. The oscillator coupling capacitor is C1 in Fig. 1 and the point of injection is shown at B.

Checking Oscillator Voltage

One of the best ways of checking quickly whether an oscillator is working is by breaking

the connection from the anode feed resistor (R1 in Fig. 1) to the H.T. line, inserting a milliammeter in circuit, as shown, making a note of the current reading and then purposely making the oscillator inactive. One way to do this is to put a short-circuit across the oscillator tuning capacitor section of the gang or, preferably, to swamp the oscillator tuner circuit by a large value capacitor. This latter method is shown in Fig. 1 by the 0.1 μ F capacitor Cs. A change in oscillator anode current should be observed; if it is not, then one can be almost certain that the oscillator was not working before the short or swamp was applied.

The oscillator current may fall or rise, depending on the characteristics of the oscillator circuit. The main factor to observe, however, is a change in current, and this should be very marked when a healthy oscillator is temporarily put out of action.

Voltage Method

Another method is to put a voltmeter across the oscillator anode load resistor, R1, as shown. This will avoid having to break the oscillator feed circuit, but the voltmeter should be of the high resistance type to prevent the normal circuit conditions from being appreciably disturbed. When this method is adopted the change in current will be reflected as a change in voltage across the load resistor.

It should be noted that the oscillator voltage rarely remains constant over a waveband as the tuning capacitor is swung from one end of its travel to the other. There may also be a difference in voltage between wavebands. In an endeavour to keep the heterodyne voltage reasonably constant, the design engineer may find it necessary to damp the feedback on one band relative to the other bands. This is often achieved by switching a resistor in the oscillator circuit of the band requiring damping, this action being accommodated by a separate switch section on the wavechange switch.

The primary elements of the oscillator circuit given in Fig. 1 are C1 the oscillator grid coupling capacitor; R2 the oscillator grid resistor; R1 the oscillator anode load resistor; C3 the oscillator anode coupling capacitor; C2 the oscillator tuning section of the gang; L3 the L.W. oscillator coil; L4 the M.W. oscillator coil; S3 and S4 (which are ganged to S1 and S2); C4 the L.W. padding capacitor; C5 the M.W. padding capacitor; TC3 the L.W. oscillator trimmer, and TC4 the M.W. oscillator trimmer.

The components most likely to break down and cause oscillator failure are C1, C3 and R1. For weak oscillation, or oscillation which cuts off at certain points on the band, C1 should be checked by substitution, for this may have gone high in value. R1 should also be checked if necessary. Across C3 and the padding capacitors, C4 and C5 an appreciable R.F. voltage exists and this sometimes causes one or more of these components to go intermittent or noisy.

A noisy component in the oscillator circuit will give rise to background crackles which may be weak but progressively build up to quite a loud noise, and may then suddenly go weak again.

Should this occur on only one waveband, the associated padding capacitor should be an immediate suspect. Poor insulation on the associated oscillator coil is another frequent cause of this symptom. Should the trouble be present on all wavebands, C3, C1 or R1 are likely suspects and each should be checked by substitution in turn.

It should be noted that similar crackling effects sometimes originate in the I.F. amplifier stages owing to a noisy capacitor across one of the I.F. transformer windings. To prove this, the oscillator should be made inactive temporarily as already described, and if the crackling ceases, then the oscillator section is almost certainly to blame.

Frequency Change

If one of the padding capacitors alters in value, not only will the oscillator voltage change from optimum, but the frequency of oscillation will also change. The local programme will no longer tune in at the correct point on the dial, but if the frequency change is not too great, will occur at a point somewhere on the dial, depending upon the extent of capacitance change. For example, if the trouble occurred on the L.W. band of the receiver in Fig. 1, the fault would either be in L3 or in C4. Coils which contain dust-iron cores in their formers should also be checked to ensure that the cores have not shifted.

The valve itself should not be overlooked, of course, and if there is any doubt a substitution test will prove the matter conclusively. The triode section of the valve in this circuit works as the local oscillator, while the hexode section constitutes the mixer, the valve as a whole being known as a frequency changer. ■

Thermal Tests on Transistor Miniatures

INTERMITTENT performance on transistor portables in the form of increasing distortion with time, cessation of local oscillator and cone warping of speaker, can often be due to heat action. This accounts for trouble on a hot beach, and fade-outs in the hot dash pockets of motor vehicles. The thermal lag between exposure to heat and the slow heating of the components can cause the radio to work in the car, but to remain dead for an hour or so after the removal from the hot surroundings. This is due to a period of time elapsing while the circuit cools down again—although the case exterior seems cool enough. Tests made in normal air temperatures fail to show the fault condition.

To avoid the favourite dodge of using a hot hair dryer (450W), it has been found that gentle heat radiated from the bench lamp (75W) on an exposed printed circuit of a transistor portable, the lamp being placed within 3-6in. of the open back of the radio, brings on the fault after a short period without the risk of overheating.

ABOUT

L O U D S P E A K E R S

CURING ELECTRICAL AND MECHANICAL FAULTS

By P. J. Good

Loudspeaker faults can be divided into two primary classes, mechanical and electrical. An electrical fault usually causes either complete failure or intermittent operation, while a mechanical fault can produce a diversity of symptoms. Some of which may not immediately be associated with the loudspeaker, but may be put down to distortion in the A.F. stages of the receiver.

Electrical Faults

Electrical faults are few, as a modern loudspeaker simply comprises a coil of wire, called the speech coil, which is arranged to move in a magnetic field. The output transformer is sometimes included on the loudspeaker chassis, and for this reason the transformer will be considered as part of the loudspeaker in this article. It should be noted, however, that the output transformer may not, in fact, be on the loudspeaker itself, but on the chassis of the receiver.

The transformer serves to match the impedance of the speech coil to the output valve, and thus has two windings; a low resistance winding which is connected across the loudspeaker's speech coil, and a high resistance winding which is connected to the anode circuit of the output valve. The transformer has a step-down ratio from the output valve to the speech coil, and this ratio is computed in relation to the impedances of the anode circuit and the speech coil.

In Fig. 1 is given the basic loudspeaker circuit, and it is fairly obvious that there are four main possibilities of failure. These are a break in the speech coil winding, a break on one of the windings of the transformer, a disconnected or broken wire in the loudspeaker circuit and, possibly less obvious, shorting turns in the output transformer.

Complete Failure

The first hint that the loudspeaker may be responsible for the failure of a receiver is complete absence of the residual mains hum which is normally detected on any receiver by holding an ear close to the loudspeaker. In this event, the speaker should be unplugged from the transformer

and the speech coil connected across a 1.5V battery in series with a resistor of about 100Ω. The resulting 15mA of current in the speech coil should produce quite loud clicks and crackles as the battery connection is scraped (see Fig. 2). If this happens, then the speaker can safely be said to be electrically sound. The resistor is included to limit the current, for without it, a relatively high current can flow in low resistance speech coils and damage the winding on low-power units.

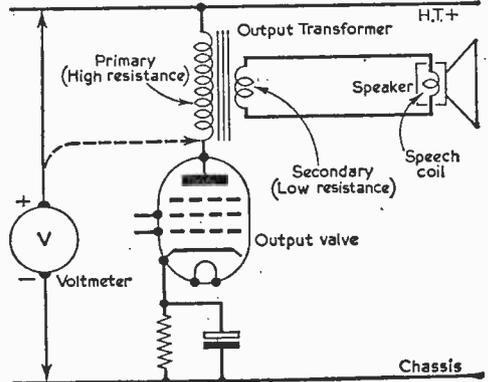


Fig. 1.—A typical output stage of a receiver, showing the loudspeaker circuit.

If the speaker remains dead, then there is a break somewhere in the speech coil circuit. Very flexible wire is used to connect the speaker terminals to the speech coil and a break sometimes occurs at one of the terminations, which can usually be mended by skilful soldering. If these wires are in order, a check should be made of the soldered connections or small wire tags in the centre of the cone which anchor the ends of the speech coil. Although these wires are held by cement, they can be traced to the soldered blobs

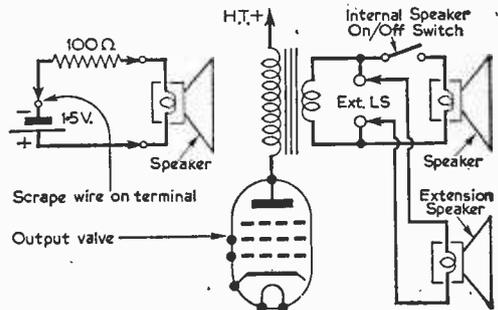


Fig. 2 (left).—A method of checking loudspeakers.

Fig. 3 (right).—Here, an extension speaker is used and an on/off switch is incorporated in the circuit.

with a pin or pointed tweezers. If the break is located, the wire should be freed from the cement, cleaned of enamel, resoldered and finally re-cemented in position to avoid vibration. If there is no break at these points, the trouble lies in the

speech coil winding and, apart from replacing the cone and speech coil assembly complete, there is little that can usually be done.

If the test given in Fig. 2 produced crackles, the wires connecting the loudspeaker unit to the secondary of the output transformer should be checked for continuity. On some sets a switch is incorporated in the speech coil circuit to switch on and off the internal speaker if an extension speaker is connected, as shown in Fig. 3. The switch may simply be a plug and socket arrangement or something more elaborate, but in either case it should be checked for continuity.

Output Transformer Test

There are two methods of checking the output transformer complete with speaker. One is to connect a voltmeter between the anode of the output valve and the chassis of the set, after first checking that H.T. voltage is in fact present on the H.T. line, as shown in Fig. 1. If the primary of the transformer is in order, a voltage slightly lower than the H.T. line voltage will be registered at the anode of the valve (assuming that the anode circuit is taking current). If the speaker circuit is normal, slight crackles should be heard from the

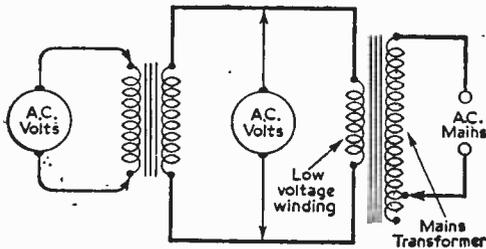


Fig. 4.—A method of determining the turns ratio of an output transformer.

loudspeaker as the voltmeter test probe is scraped on the anode tag. An alternative method is to disconnect the primary of the transformer from the valve anode and H.T. line and connect the winding across a 1.5V battery. If all is in order, crackles should again be heard from the loudspeaker as the battery connection is scraped.

Transformer Turns Ratio

The turns ratio of the output transformer is governed by the "optimum load" of the output valve and the impedance of the speech coil, both in ohms. Optimum load values are given in valve data booklets and the speech coil impedance is sometimes marked on the loudspeaker chassis. It should be noted that the impedance is generally taken at 1,000c/s, and is, therefore, slightly higher numerically than the D.C. resistance of the speech coil. As a rough guide, the impedance is a little over twice the D.C. resistance value.

The turns ratio is equal to the square root of the optimum load divided by the speech coil impedance which, put in mathematical terms is:—

$$Tr = \sqrt{(Lo/Zs)}$$

where Tr is the turns ratio, Lo the optimum load and Zs the speech coil impedance. The expression may be altered to find Lo or Zs.

For example,

$$Lo = Tr^2 \times Zs,$$

$$\text{and } Zs = Lo/Tr^2.$$

Thus, given any two factors, the third or unknown can always be found.

If, for instance, the optimum load were 2,000Ω and the speech coil impedance 5Ω, then 5 divided by 2,000 is 400, and the square-root of 400 is 20. The required transformer in that case would have a turns ratio of 20:1, which is a fairly common value.

The same reasoning applies to any loudspeaker matching problem. Some transformers have tapped primaries or secondaries or both to enable the best match to be obtained from any optimum load to any speech coil impedance. Tapped transformers of a similar nature are also available to match a low impedance loudspeaker into a low impedance source. For example, a matching transformer would be required to match, say, a 15Ω loudspeaker to a 3Ω extension loudspeaker socket on a radio or radiogram, or vice versa.

Checking the Turns Ratio

An approximate idea of the turns ratio of an output transformer can be obtained by applying low voltage A.C. across the secondary winding (low resistance winding) and measuring the voltage appearing across the primary winding, as shown in Fig. 4. About 2V A.C. should be used, and this can be obtained from a step-down mains transformer. It should be measured as accurately as possible on an A.C. voltmeter, as also should the voltage across the primary winding. The ratio of the two voltages is approximately equal to the turns ratio of the transformer. For example, if 2V were applied and 60V appeared across the primary winding, then the turns ratio would be 60:2, or 30:1.

Shorting Turns

An output transformer with shorting turns may not cause total failure of the set or amplifier, but will most certainly cause low volume and distortion, with loss of bass frequencies. By using the set-up shown in Fig. 4, shorting turns will give an obviously low output voltage and the transformer will quickly heat up.

Mechanical Faults

Mechanical faults rarely cause total failure of the set, but they produce noises, such as buzzes, rattles and distorted reproduction. A distinct buzz may be caused by the speech coil being out of centre and touching the magnet pole pieces, or by a damaged or broken centring device, a split or tear in the cone, loose turns of wire on the speech coil, loose mounting bolts, holding the loudspeaker in the cabinet, vibrating connecting leads, etc.

Such faults can usually be located by operating the set with the loudspeaker in its normal position and touching the various parts of the loudspeaker in an endeavour to pin-point the source of the noise. If the speech coil is out of centre, lightly pressing a finger at a certain point on the cone will often either clear the effect or, at least modify it.

Eventually, it will be necessary to remove the loudspeaker from the cabinet in order to effect a

(Continued on page 502)

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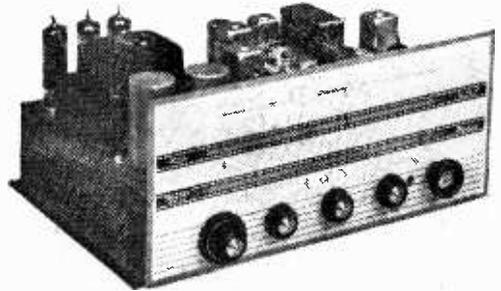
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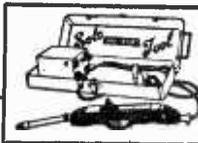
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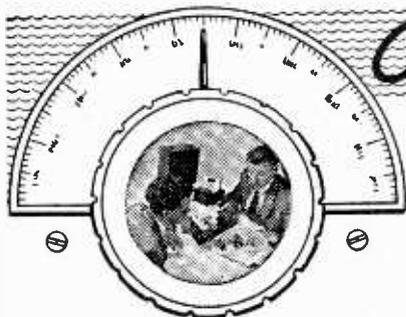
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On Your Wavelength

BY THERMION

Transistorised Organ

IN the August issue I commented on the apparent absence of a commercial transistorised organ, and I must thank the many readers who sent me letters and details of one such instrument which is on sale in South Africa. Mr. Marks of Johannesburg sent me a brochure of this very interesting instrument which, he tells me, is completely transistorised and delivers an output in the region of 25W. According to the literature this is a most fascinating instrument and shows that the transistor can be used to give results probably better than the valve. Of course, there is also the point that the overall weight becomes so very much less. Apart from the interesting circuitry, the case for this instrument has the back enclosed with timber so that it can be pushed out into the middle of a room, if desired (the back is actually hand-rubbed satin finish), and this prevents any tampering with the essential adjustments. In addition to the normal organ features, this instrument includes chimes, built-in reverberation which is adjustable, and percussion. It appears to be a very noteworthy development of the application of the transistor and I hope to have an opportunity of hearing one some time. Incidentally, it is apparently manufactured in S. Africa under licence from an American company.

Constructor Difficulties

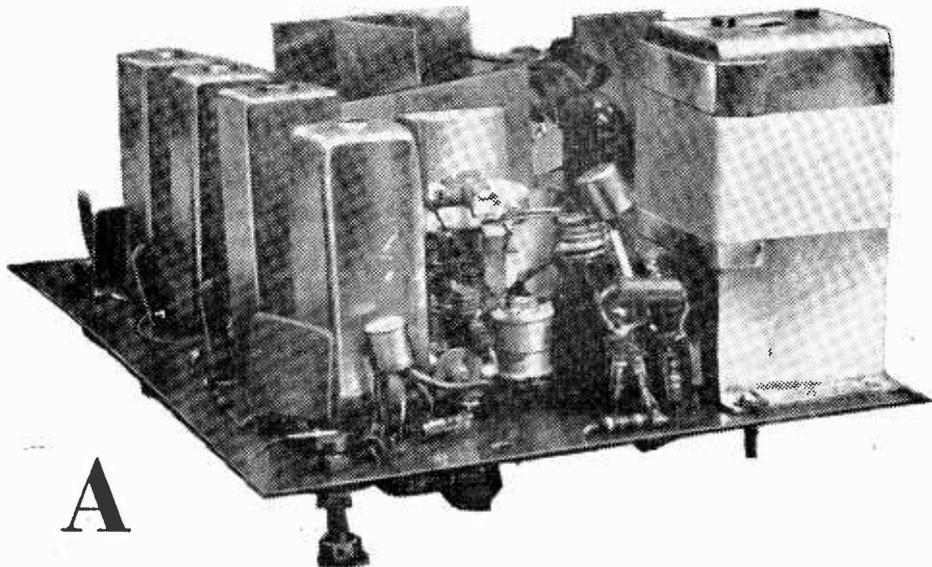
I know that the constructor often experiences difficulties and disappointment in his hobby, but I recently heard from a reader who has, apparently, met all the troubles in the world. He contends that the amateur cannot possibly build a satisfactory transistor superhet unless he has the most expensive test gear. He says that he has spent over £200 during the past two years and has built thirty-four of these sets, not one of which has worked satisfactorily—if at all. He also says that many of his workmates experience similar difficulties, but I do feel that this is a very exceptional case. It is true that a superhet, even of the valve type, needs some care in aligning and it is always an advantage to have a signal generator. But I do know of many amateurs, even those who have never built a set before, who have attempted these modern pocket type receivers, and have been most successful. Perhaps the new Beginner's series which begins in this issue will offer some assistance to any others who find difficulty in building transistor sets.

A Recording Problem

I have not yet got round to owning one of the modern tape recorders—mainly because I feel that I have no need for one. I have a very good record reproducing installation and this fills all my requirements so far as “mechanical” music is concerned. But I recently heard of a recording problem which seems to be rather mysterious, and perhaps one of my readers may be able to offer a suitable suggestion as to the cause and, perhaps the cure. An enthusiast had a recorder of well-known make and one day purchased a used spool of tape, but successfully made a recording of his own over the existing recording. When played back this was perfectly satisfactory (it included many of his own remarks and he was able to recognise his voice perfectly). The record was put away with others, but next time he played it, his voice had dropped several tones. The speed was correct but his voice was definitely much lower, although the speed was correct, and he wonders whether the molecular structure of the tape deposit could have altered in some way to produce this variation in reproduction. If so, of course, then tape will require special care if it is saved, as it may give a false impression when played at a later date. I suggest that there must have been some magnetic material near the tape where it was stored, and that he was lucky that the recording was not completely erased. Has anyone any other opinions?

Revenge!

I recently commented on the increasing outdoor use of transistor portables and, apart from many letters agreeing with my dislike of this form of abuse, and the many boroughs and districts which have so far enforced a ban on their use, one reader has suggested a neat form of counter-attack. I am afraid the Post Office would not look kindly on his suggestion, but I feel that this is something which needs thinking about. He suggests the use of a low power R.F. oscillator, switched on when the offending receiver is audible. If the oscillator were tuned to the same frequency, the R.F. would tend to swamp the AVC and reduce the output. Failing that, modulation of the R.F. at 1kc/s would effectively jam the receiver. Two transistors would do the job, tuned over the medium waveband or operating at $465\text{kc/s} \pm 10\text{kc/s}$ to cause I.F. break-through. The range required, the reader says, would be about 20ft. He adds, in rather a sarcastic vein, “Keep clear of G.P.O. detector vans.” I would be interested to know whether such a device would be contrary to the Post Office regulations, and if not, what steps could be taken by anyone with an offending portable who might be annoyed at the “interference”?



A Transistorised VHF Superhet

HEAT SINKS, I.F. TRANSFORMERS AND
COILS

By D. R. Bowman

(Continued from page 397 of the September issue)

MENTION was made last month of the very thorough decoupling which was found to be necessary in the audio section of the receiver. However, layout is not at all critical and no difficulty should be experienced with instability.

Negative Feedback

With the transformers specified, leakage inductance is low enough for quite a large amount of negative feedback to be applied if desired. Here however, a moderate amount only is used, approximately 6dB.

Overall Gain

Moderate amounts of gain per stage have been designed for, in the interests of stability, except in the R.F. stage where the maximum feasible has been required. The R.F. stage gives about 15dB, the frequency changer 10dB, the I.F. stages 25dB

each, and the audio amplifier about 70dB. The total is thus 170dB, from which has to be deducted approximately 8dB per stage (as far as the detector) as transformer insertion loss, and about 20dB for loss in the detector stage. This, with 6dB negative feedback in the audio section, gives a total of approximately 112dB overall gain.

Power Supplies

A 9V supply is required. The DT9 is a convenient battery, and will last a reasonable time—about a month or six weeks if the receiver is used

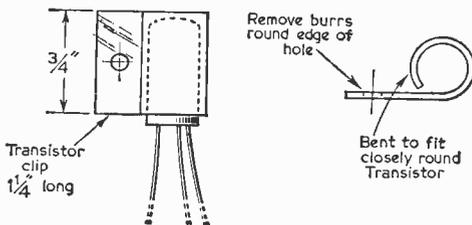


Fig. 2.—The construction of the clips for the output transistors—these clips are used to fasten the transistors to their heat sinks (which are described in the text).

COIL WINDING DATA

All formers are bakelite 0.27in. diameter
 Screening cans required for transformers T2,
 T3, T4 and T5 are $\frac{1}{2}$ in. x $\frac{1}{2}$ in. x $2\frac{3}{8}$ in. All dust
 cores are VHF (purple-coded) type

L1 $3\frac{1}{2}$ turns 18s.w.g. bare, spaced 0.3in.
 outside length. Unscreened; one core
 required

T1 Primary—6 turns 18s.w.g. bare, spaced
 0.6in. outside length
 Secondary— $1\frac{1}{2}$ turns PVC-covered connect-
 ing wire interleaved each side of last
 (H.T.) end of primary; one core is
 required

All the following coils are wound in the same
 direction. The primary and secondary would
 thus form a winding of continuous direction
 but for the interruption at the "middle"

T2 Primary—28 turns 28s.w.g. enamelled,
 close-wound
 Secondary—12 turns 24s.w.g. enamelled,
 close-wound

Spacing: $\frac{1}{2}$ in. between winding ends
 (Note: The secondary is tapped 3 turns
 from the earth end of the winding; this
 tapping is the base connection to V3.)
 Two cores are required

T3 } Primary—12 turns 24s.w.g. enamelled,
 close-wound, tapped 3 turns from "inner"
 T4 } end

Secondary—12 turns 24s.w.g. enamelled,
 close-wound, tapped 9 turns from "inner"
 end of winding

Spacing 0.4in. between ends of winding
 Two cores are required for each trans-
 former

T5 Primary—28 turns 28s.w.g. enamelled,
 close-wound, tapped 7 turns from "outer"
 end

Secondary—8+8 turns 24s.w.g., close-
 wound, bifilar; Spacing 0.3in. between
 ends of winding

Tertiary— $9\frac{1}{2}$ turns 28s.w.g. enamelled,
 close-wound, wound over 10 turns of
 primary nearest the tap. 1 turn Sellotape
 as insulation

Three cores are required

much reduced output quality, down to a battery
 voltage of 4. The oscillator section continues to
 operate down to 2.6V with the particular trans-
 istor used, though, of course, overall receiver
 gain at this voltage is negligible.

Heat Sinks

Before fixing, the driver and output transistor
 heat sinks should be prepared as follows. Three
 pieces of sheet aluminium, 16s.w.g., measuring 3in.
 x $2\frac{1}{2}$ in. are sawn out of a flat sheet. Snipping with
 tin-snips causes curvatures which must be
 avoided. A $\frac{1}{4}$ in. flange is turned over on one short
 side. Then a flat is filed, very lightly, on the middle
 side of the sheet. It is most important to see that this
 flat is really accurate. A $\frac{1}{8}$ in. hole is now drilled
 in the flat portion and burrs carefully removed.
 Three pieces of 22s.w.g. aluminium, $\frac{1}{2}$ in. x $1\frac{1}{2}$ in.
 are sawn out of a flat sheet and bent round over
 the shank of a $\frac{3}{16}$ in. drill. The final curvature has
 to be $\frac{1}{8}$ in. to accommodate the OC81 transistors,
 and the natural springiness of soft aluminium
 sheet, with a very little force, will enable the trans-
 istors to be inserted firmly and closed into these
 cooling clips. Fig. 2 shows the arrangement. The
 assembly should be inspected against a strong light
 to ensure that no gaps occur between the trans-
 istors and the cooling clip. If small gaps appear,
 silicone grease—a smear only—may be used to
 assist dissipation of heat, but gaps should be
 avoided even if it means making six clips to get
 three good ones. Before assembly, the tuning con-
 denser should be inspected. If the bearings carry
 an appreciable amount of grease it should be
 wiped away, and if at all slack the bearings should
 be tightened up. This precaution is mentioned here
 because in the prototype receiver some consider-
 able trouble was found in obtaining electrical con-
 tact of the required effectiveness; the capacitor
 tuned very noisily through stations. This instability
 was removed partly by tightening up, partly by
 soldering to a side pillar of the capacitor an
 additional phosphor-bronze leaf-spring contact
 which was arranged to press heavily on the spindle

for about 4 hours daily. The receiver gives good
 output even when the battery voltage has dropped to
 6, and continues to provide a useful signal, at

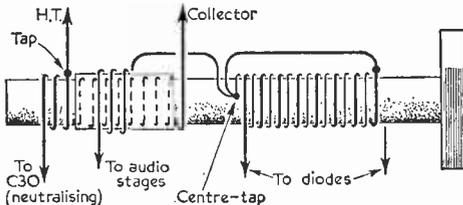


Fig. 3.—The discriminator transformer windings (T5
 in the circuit). The method of winding the bifilar
 secondary has been shown by using thick and thin
 lines to represent the two halves, but, of course, the
 same gauge of wire is used for both.

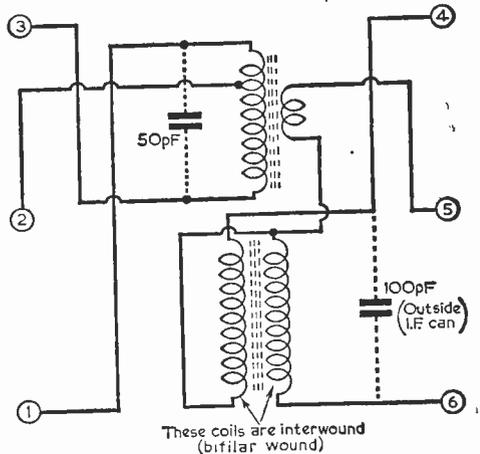


Fig. 4.—The connections of the windings of the
 discriminator transformer—the numbers refer to the
 coil base connections given in Fig. 6 overleaf.

between R.F. and F.C. sections. This spring was connected to chassis through a short length of copper braid. The capacitor had seen previous service, and it is not expected that a new component would cause trouble.

The R.F. and F.C. Stages (see table, page 493)

The coils for R.F. collector and oscillator are wound on 0.3in. bakelite formers, and the direction of winding is immaterial. The wire is 18s.w.g. bare and, preferably silver-plated, for the collector and oscillator coils; these coils are first wound on

a 1/16in. drill shank and then slipped, with some force, on to the former. The F.C. emitter winding, of 22s.w.g. copper wire, in thin sleeving (or PVC-covered connecting wire) is added between the "earthy" turns of the R.F. collector winding. The spacing is adjusted to the specified value, and then the whole windings are covered with contact adhesive (clear) and allowed to dry thoroughly. The properties of this adhesive have not been measured but appear to be not markedly inferior to polystyrene cement, and the job is much more reliable than when polystyrene cement is used with thick wire.

The I.F. and Discriminator Transformers (see Figs. 3, 4, 5, 6 and 7).

The I.F. transformers could be constructed in the normal way, and for mounting, the lugs of the

Slot cut in securing lugs

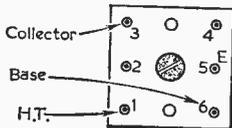
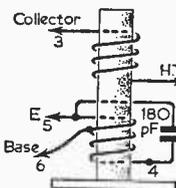
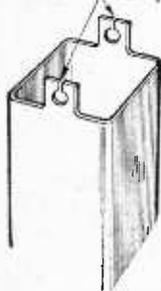


Fig. 5.—The mounting lugs of the transformers are cut as shown to enable them to be passed over the fixing bolts (see text).

Fig. 6.—The I.F. transformer windings and the numbering of the base connections.

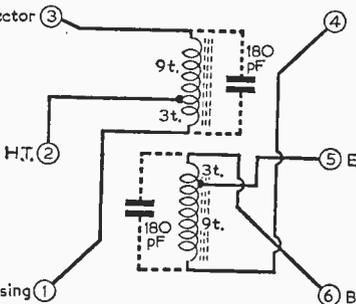


Fig. 7.—The connections of the I.F. transformer windings.

LIST OF COMPONENTS

Capacitors and resistors are as shown in the circuit diagram.

All resistors are of 1/2W rating and of 10 per cent tolerance, except as shown below:

R38 5 per cent

R37 5 per cent

R39 3 x 10Ω 10 per cent, in parallel

Volume control: 10k with D.P.D.T. switch, log or semi-log

Capacitors: All 180pF capacitors are 5 per cent silver-mica types

C5, C10 are type N750K (Erie)

Capacitors C2, C3, C4, C8, C11, C14, C15, C19, C20, C21, C23, C25, C28, C29, C31, C40 are of the ceramic miniature type (Erie)

CC1 and CC2 are 10pF ± 10 per cent silver-mica

C37, C39, C43 are 8μF electrolytic 6VW sub-miniature types

C38, C45 are Plessey type CE 7037

C42 is Plessey type CE205

C46 is 0.25μF tubular (TCC)

C41, C44 are TCC type CE100DE

The tuning capacitor is Jackson Bros. type C808 (catalogue number 5103)

Transformers (Gilson):

Driver transformer: type WO.1806

Output transformer: type WO.929/6v (3Ω)

Speaker: 7in. x 4in. elliptical, 3Ω

Battery: DT9 or equivalent

can slipped through slots in the printed circuit board ready for bolting down. However, cutting neat slots in the laminated board is not a simple matter, and in the prototype the following method of canning the I.F. transformers was adopted.

When the transformers have been wound, all cement is thoroughly dry and all exposed metallic surfaces are covered with Sellotape, the 1/16in. 6B.A. bolts are screwed through the fixing holes from the "inside" and are tightened up. The can is then slipped over the assembly. The lugs are then snipped through so that, on bending over, the halves can be worked round the 6B.A. bolts and flattened against the underside of the bakelite former. A brass washer is placed over the bent-over lugs and then a brass nut is screwed down firmly. Nearly 1/16in. of bolt will stand proud for insertion through holes in the laminated board, and when these in turn are screwed down, with washer and nut, against the copper surface of the printed circuit board a good electrical earth to the can is achieved.

(To be continued)

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An Earthed Grid R.F. Amplifier

By E. A. Parker

ATMOSPHERICS and other interference generated outside the receiver limit its useful sensitivity on the communications bands below about 20Mc/s, but at higher frequencies they are much less intense and interference (except that generated by motor car ignition systems, of course) is virtually non-existent. At these high frequencies, then, receiver noise is very important, and the noise level of the receiver and the associated aerial will set the level below which signals will be inaudible. Since noise generated in the earlier stages of a receiver will undergo far more amplification than that generated in the later stages, any effort made to reduce receiver noise must be concentrated on the first R.F. stage, and to a progressively lesser degree on any subsequent R.F. or frequency changing stages.

In the case of an average communications receiver using one R.F. stage, the addition of a low noise pre-amplifier will give a most marked improvement in the signal-to-noise ratio. The existing R.F. stage has now been moved one stage away from the aerial, and the noise which it generates receives less amplification than before for a given signal output at the speaker or 'phones. The writer modified his R208 receiver in this way, using the grounded grid triode unit to be described. It was also found that the replacements of the original octal based R.F. valve — an EF39 — with an EF50 or the more recent EF91 or EF80 miniature valves again improved the performance of the set. Octal-based valves are unsuitable for use above 40-50Mc/s owing to their inherent noise and the fact that their gain tends to fall off fairly rapidly above this frequency range.

Valves

Triode valves are much less noisy than pentodes or tetrodes, but they cannot be used in normal amplifying circuits at radio frequencies owing to their high anode-grid capacitance, which permits positive feedback at R.F. and so causes instability and oscillation. In the early days of wireless, this problem was overcome by introducing a further electrode—a grid was placed between the control grid and anode and maintained at earth potential with respect to the R.F. signal. This shielded the input to the valve from the output and prevented

positive feedback. Thus was born the tetrode valve, but, the extra electrode increased the inherent noise of the valve. However, methods were found where by the triode could be used as an amplifier at R.F. The most important of these was to earth the grid and apply the R.F. signal between cathode and earth. The amplified signal was in effect taken from anode and earth, as indicated in Fig. 1.

The cathode impedance should have a value of about 150Ω at D.C. and the voltage drop across it provides bias for the valve. At R.F., the cathode impedance is conveniently provided by an R.F. choke, and a glance at Fig. 2 will indicate that in the actual unit, a choke and resistor are used in series. The anode impedance may be an R.F. choke or a tuned circuit.

Screening

The earthed grid mode of operation thus provides shielding of output from input in the form of an earthed grid, and the arrangement functions well with remarkably high signal-to-noise ratio. Valves designed for earthed grid operation differ from normal triodes in that care is taken to ensure that the grid extends along the whole length of the cathode, thereby totally screening it from the anode. Examples of such valves are types CV66, EC91 and 6C4. Any of these valves will work well in the circuit of Fig. 2—the circuit used by the writer. To lessen the effects of lead inductance, the grid is brought out to four pins each of which is then separately earthed; the anode is brought out to two pins for the same reason. (The inductance of inductors in parallel is less than the smallest.)

Yet another advantage of the addition of this unit was the fact that the aerial damping was removed from the first tuned circuit of the receiver, enabling the associated trimmers to be peaked sharply. This in itself resulted in an increase in gain. In addition, the input impedance of the circuit was low and matching the aerial to the receiver no longer presented any problems. Matching was far from critical. It will be noted that the circuit is aperiodic—untuned or non-

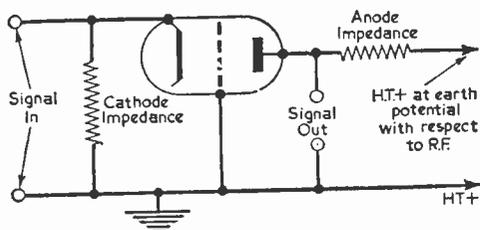
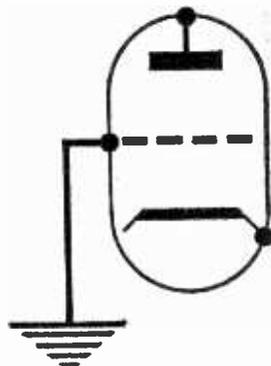


Fig. 1.—The effective circuit of an earthed grid triode.

resonant—which has the advantage that no extra gang is demanded on the main tuning capacitor.

Constructional Details

Turn again to Fig. 2; the radio frequency choke in the aerial circuit is best made by winding in one layer a length of fine wire [about 40s.w.g.] (equal in length to one third of the wavelength of the lowest frequency to be received) on to a glass or ceramic former, so that the length of the solenoid is about twice its diameter. However, the writer had several radio frequency chokes of miscellaneous design in his junk box, and these

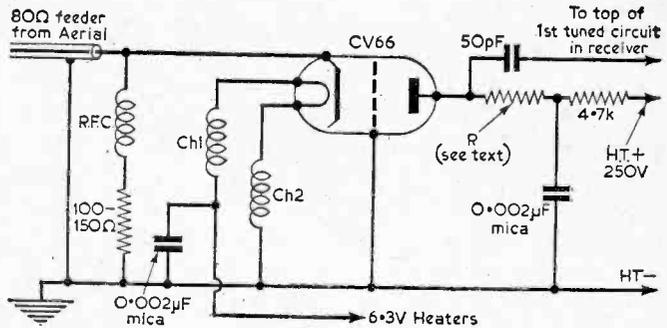


Fig. 2.—The circuit diagram of the unit.

circuit form a filter which eliminates mains-borne noise, and the chokes tend to isolate the heater and cathode from earth at radio frequencies. (The heater-cathode capacitance may be great enough to bypass to earth the signal applied to the cathode in the absence of the chokes.)

Anode Load

A point of interest is that the anode impedance (R) was derived from a 3W wire-wound resistor of D.C. resistance 4.7k—the D.C. resistance of R limited the anode voltage of the triode to within safe bounds, and the inductance of the component presented an additional impedance to R.F. signals which increased with frequency. This tended to offset the effects of stray capacitance elsewhere in the receiver, and sensitivity at all frequencies was much greater than expected.

Fig. 3 indicates the arrangement of components used by the writer. The unit was built on a sub-chassis made from aluminium and measuring 2in. x 3½in. x 1½in. Although the layout was not found to be very critical (a welcome point at high frequencies), all leads should be kept as short as possible. Most components can be wired directly to the valveholder. The chassis should first be drilled to take the valveholder (ceramic)—a 1½in. hole if a CV66 type valve is used (B9G base)—which should then be bolted in position. The tinfoil screen should be soldered firmly to the valveholder as shown in Fig. 3, and the various components may then be mounted. "Tin" boxes provide a convenient source of tinfoil—which is very easily soldered. Any paint should be removed for appearance's sake.

When the unit has been completed it should preferably be bolted securely inside the communications receiver as near as possible to the first tuned circuit. In many receivers it will be possible to mount it so that the anode pin of the earthed grid triode lies fairly close to the top of the first gang on the main tuning capacitor. The output lead may then be kept very short.

The unit consumes very little power, and may be run without trouble from the existing power supplies of most communications receivers.

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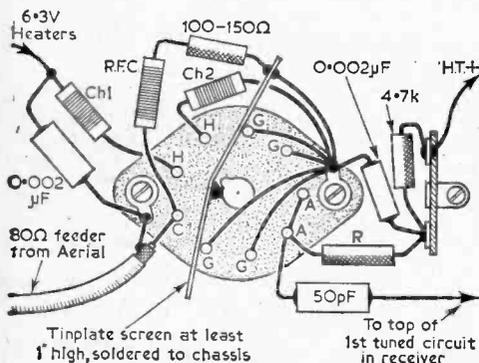


Fig. 3.—The layout of the R.F. preamplifier.

were found to function equally as well as that specified above. The value of the resistor in series with this choke should be adjusted so that the D.C. resistance of the combination is 150Ω approximately—the value required will be found to lie between 100 and 150Ω. The chokes in the heater leads are not very critical and it was found that 40 turns of 26s.w.g. wire on a ½in. diameter paxolin former was all that was required for satisfactory operation between 10 and 60Mc/s. It has been found that this circuit will function readily at all frequencies up to 400Mc/s; and the inductance and consequently the number of turns required on the choke decreases with increasing frequency. At frequencies above 100Mc/s, however, ceramic or glass formers are essential. The chokes and capacitor in the heater

COMPONENTS LIST

Earthed grid triode valve, e.g. CV66 or EC91
Ceramic valveholder to suit

Resistors (see text)

100-150Ω ½W; 4.7k, 3W w.w.; 4.7k, ½W

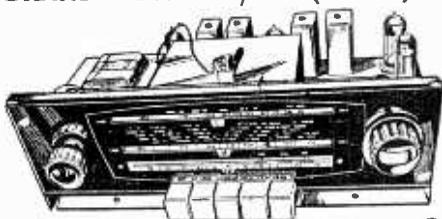
Capacitors

50pF, two 0.002μF, mica.

Single layer R.F. choke, or 40s.w.g. wire to wind and former

Two heater chokes, 26s.w.g. wire to wind and formers

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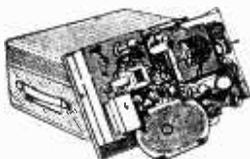
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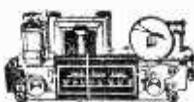
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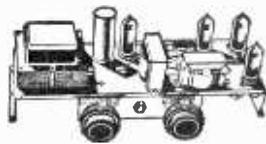
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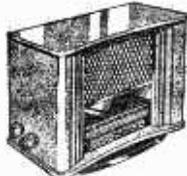
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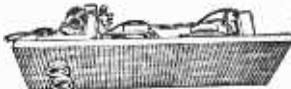
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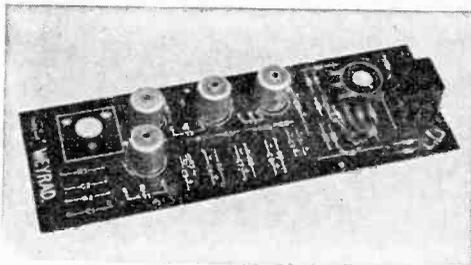
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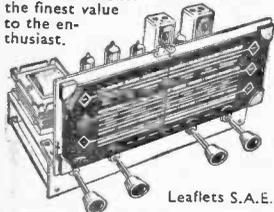
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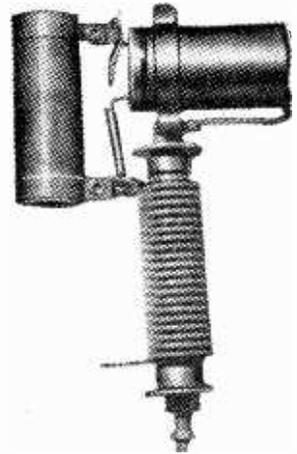
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A Compact Power Supply

By
J. C. Flind



Above—The completed unit.

A PROBLEM which frequently confronts the constructor is the provision of power supplies to equipment which has been built up on a chassis which "happened to be handy"—all too often, after a series of modifications and improvements there is insufficient space left for the rectifier and associated smoothing components. The rather neat assembly described here was evolved to meet just such an emergency which arose when a battery receiver had to be converted to mains operation, and the idea is offered in the hope that it will help other constructors who may come up against the same difficulty.

Layout

The unit requires only a single $\frac{1}{4}$ in. hole for fixing to the chassis, and the space taken up at chassis level is no more than the diameter of the metal rectifier—say one square inch at the most. The smoothing components are carried some inches above the chassis where there is usually some spare space and where risks of overheating are reduced.

The diagrams are almost self-explanatory; the main feature of the design is the familiar Westing-house-type air-cooled metal rectifier, obtainable from surplus dealers for a few shillings. The screwed rod which forms the "backbone" of the rectifier is used to carry a Terry spring tool-clip, which in turn holds a metal-cased twin electrolytic smoothing condenser of suitable capacity and rating; the case of the condenser, forming the negative pole, is effectively earthed through the metal rod, the other end of which is passed through the fixing hole in the chassis and secured by a nut. (In the illustration at the top of the page the capacitor employed had a polythene covering—hence the earthing wire which is visible, running to a solder-tag just under the Terry clip.)

Construction

Soldered to the red or positive terminal of the rectifier is a suitable dropper resistor, chosen according to the current demands of the equipment; a useful value for general purposes is a wire-wound $2,000\Omega$ 10W resistor, with a ceramic former and having substantial lugs. One of the "positive" wire leads from the condenser is also connected to this terminal of the rectifier, and the other end of the resistor goes to the second positive tag of the condenser, the thick wire lead giving adequate mechanical strength. This is point B (see Fig. 2), the output lead, and the unit is now ready to be connected up.

The simple circuit is shown in Fig. 1. A small eliminator-type transformer, having a single H.T. winding, is employed, thus isolating the chassis from mains and increasing safety.

This power pack can be made up in a few minutes, usually from odd components which can be found in the spares-box, and one or two kept ready-built will be found invaluable when power supplies are wanted in a hurry during experiments.

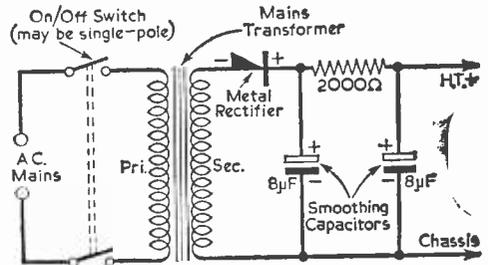
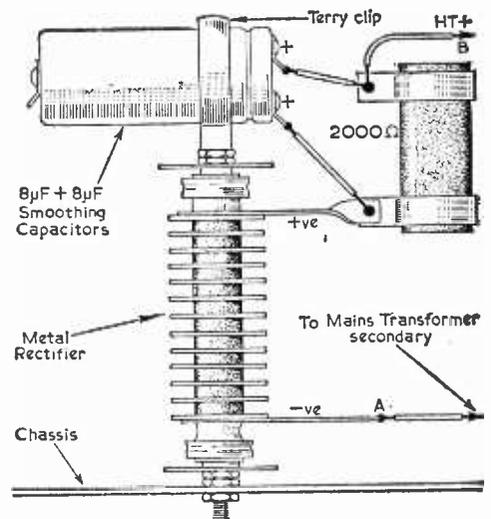


Fig. 1 (above).—The simple circuit of the unit.

Fig. 2 (below).—The straightforward construction of the power pack.



CALCULATING π -NETWORKS

DETERMINING COMPONENT VALUES FOR THESE COUPLING CIRCUITS

By G3OGR

THE common use of a π -network is to couple a transmitter to the line feeding the aerial. In these circumstances, the network is nearly always required to provide an impedance transformation from a fairly high impedance to a much lower impedance. When it cannot do this satisfactorily, various difficulties in tuning and loading arise and it is hoped that means of arriving at suitable values may be useful, together with ways of overcoming the troubles which can arise when values are not suitable.

With circuits of reliable design, difficulties of this nature may not be encountered, unless an attempt is made to operate outside the conditions originally intended (e.g., with a very high impedance aerial). But, with converted or home-built equipment, or the pressing into service of unsuitable components which may be to hand, trouble may be experienced.

A typical π -network is shown in Fig. 1. The amplifier will probably be working Class C, which means it is provided with bias beyond cut-off, and anode current flows for only about 120° to 150° of the excitation. In these circumstances, the anode voltage can be expected to reach about twice the H.T. voltage. If a 600V supply were used, the isolating condenser should thus be rated at 1200V or higher. A 2kVW or 3kVW condenser would serve. If anode modulation drives the anode voltage from zero to 1200V, the isolating condenser should be for at least twice this figure—2400V. A 4kVW or 5kVW condenser would probably be used. As the capacity is not large, a component of adequate rating can easily be fitted. The choke is usually 1mH or larger, and needs to withstand the R.F. voltage developed. A receiver type choke is only suitable for low power.

The π -network consists of C1, L1 and C2. For a low output impedance, C2 is large. The anode or plate load R1 for the Class C amplifier can be found by dividing the plate resistance by 2. The plate resistance can be taken as E/I. If the valve is loaded to 100mA at 600V, this is 600/0.1=6,000 Ω . One half of this is 3,000 Ω .

It would be usual to employ a minimum Q of about 12, for such purposes. The capacitive reactance Xc of C1 is given by:

$$X_c = \frac{\text{Plate load}}{Q} = 250\Omega.$$

Assume the circuit is to be used for 3.6Mc/s. The capacitor reactance $X_c = 1/2\pi fC$. From the above, Q may be expressed as $R1/X_c$. The coil reactance may be expressed by:

$$\frac{Q \cdot R1 + (R1 \cdot R2 / X_{c2})}{Q^2 + 1}$$

Approximate values are suitable, because both C1 and C2 will be variable, for tuning and load adjustment. This gives approximately 170pF for C1, 12.5 μ H for L1, and 1,000pF for C2, where R2 is to be about 70 Ω .

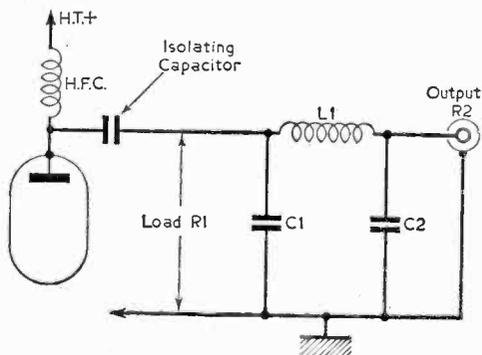
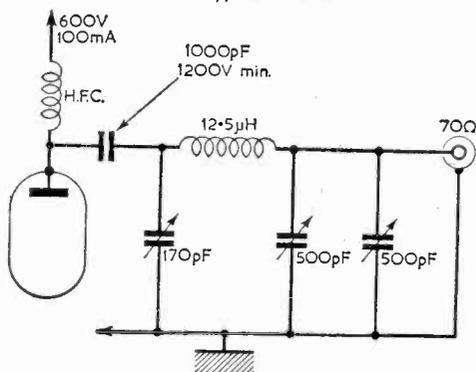


Fig. 1 (above).—A typical π -network output circuit.

Fig. 2 (below).—The values of components determined for a typical circuit.



Practical Circuit

These values are inserted in Fig. 2. A 2-gang 500pF condenser is used for C2, with sections in parallel. If an output impedance higher than about 70 Ω is to be matched, C2 has to be reduced in value. This is readily carried out by adjusting it as necessary. If a very high impedance is wanted, it may be found that C1 is too small, or L1 too low, for resonance.

A symptom of this fault is that C1 is nearly closed, while C2 is still at too high a capacity. As

C2 is opened further, C1 has to be closed, and reaches maximum capacity, with loading still insufficient. This indicates that the network was not designed to operate into so high an impedance, on that frequency. If so, one solution is to use an impedance matching circuit in such a way as to allow the π -network to operate into a lower impedance. This is preferable when the π -network is already correctly arranged. But if it has been made on an experimental basis, it may merely indicate that the condenser actually in the C1 position is too small, or the coil inductance is too low.

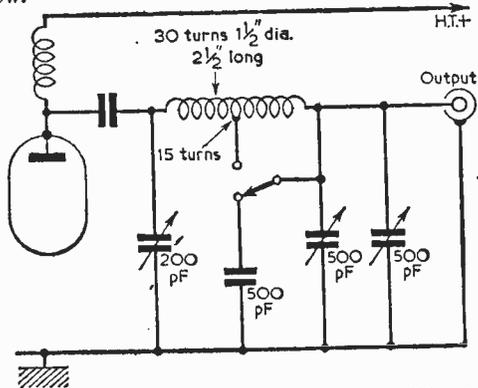


Fig. 3.—A π -network output circuit for 2-band operation.

When obtaining an output of very low impedance, it will be seen that C2 requires to be larger, if C1 and L1 remain unchanged. An indication of this type of fault arises when it is impossible to load up correctly into a low impedance circuit, even with C2 fully closed. The solution is to increase the value of C2 (e.g., employ a 3-gang condenser with all sections in parallel) or wire additional fixed capacity across it.

In Fig. 2, C1 is the approximate total capacity. The valve capacity, etc., will be in parallel with this, but can be neglected in the example given, because C1 is variable, and can be opened slightly to secure resonance.

Coil Windings

When an approximately suitable inductance has been found, a satisfactory number of turns may be calculated, so that the network coil L1 can be wound. A formula suitable for this purpose is:

$$N = \frac{5L}{na^2} \left\{ 1 + \sqrt{1 + \frac{0.36n^2 a^3}{L}} \right\}$$

where "a" is the radius of coil in inches, "n" is the number of turns per inch, "L" is the required inductance in μ H, and the result (N) is the number of turns. A typical coil could thus have 30 turns on a 1 1/2 in. diameter former 2 1/2 in. long, for the 3.5Mc/s to 3.8Mc/s band.

It will be apparent that other values of C1 and L1 could give resonance, but that these values would not also provide the correct impedance match or Q. The fact that C1 and C2 are adjustable allows the network to perform effectively over the band required.

For 2-band operation, it is usual to tap a coil, so that a lower inductance is available for one

band. This can be arranged by fitting a switch. If additional capacity is required to obtain a sufficiently low impedance output on the lower frequency band, a 2-way switch may be used to introduce this as well, as in Fig. 3.

The 170pF condenser used for C1 can readily be adjusted to the value shown in Fig. 2. For 7Mc/s, all values will be approximately one half those given for 3.6Mc/s. Resonance will thus be obtained with C1 at approximately 100pF (including circuit capacity) and C2 at 500pF. For lower

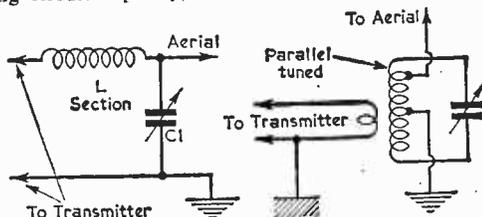


Fig. 4.—Two methods of impedance matching.

impedance transformation (e.g., higher impedance output) C1 will be increased, and C2 reduced. For higher impedance transformation (e.g., lower impedance output) C1 will be reduced in value, and C2 increased. It will thus be possible to load into low-impedance circuits with the 2x500pF capacity at C2, and the extra fixed condenser, switched in for the lower frequency band, is not required on the 7Mc/s band.

Impedance Matching

When the π -network is correctly built, but it is impossible to load up the transmitter correctly, the impedance being fed is outside the range for which the network was designed. A frequent example of this arises with a high impedance aerial, such as an end-fed half-wave type. In these circumstances, no adjustment of C1 and C2 will give adequate loading. In addition, the voltage across C2 may become too high, and the spacing of the condenser used here is not intended for the high voltage swing in a circuit of high impedance. If so, both the inability to load sufficiently, and the

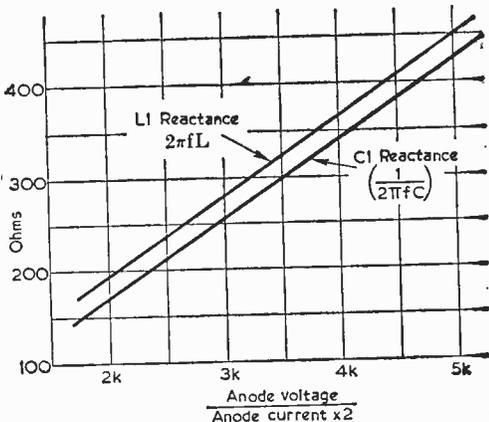


Fig. 5a.—Values for reactance of C1 and L1 for a Q of approximately 12

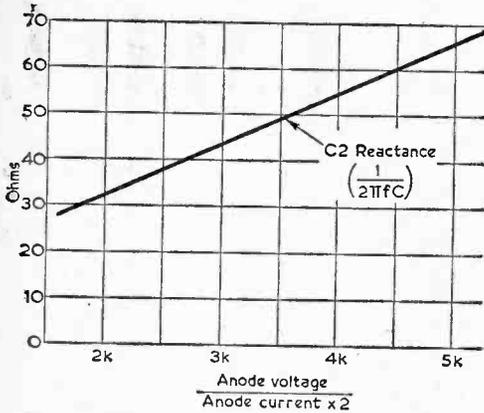


Fig. 5b.—Values for outputs in the region of 50Ω

flash-over, may be avoided by an impedance matching circuit such as those in Fig. 4.

The L-section circuit allows the transmitter condenser C2 to be adjusted for a low impedance output, while C1 in Fig. 4 is of small capacity and wide spacing, for the high impedance aerial. C1 may easily be chosen by using a component of similar spacing and capacity to C1 in Fig. 3.

The parallel tuner produces a similar result, but in this case the coil is parallel tuned by a condenser of about 150pF to 200pF, and with adequate spacing. The coil can resemble that in the transmitter. Only a few turns are required for the link, and loading can be adjusted by modifying the link

coupling, and the tapping of the aerial on the coil, as well as by adjusting the π -network output condenser.

In the case of a commercially made transmitter which cannot be loaded into an end-fed aerial, one of the circuits in Fig. 4 will provide a solution. The parallel tuned circuit may also be used to feed twin high impedance lines.

Chart Values

To simplify working, the figures required may be taken from Fig. 5, which is for a Q of approximately 12. The load is found as already explained, for the anode voltage and anode current required.

It will be more convenient to express values directly in Mc/s, μ H, and pF, to simplify calculation. For example, if the frequency is expressed in Mc/s, inductance will automatically be obtained in μ H, which is more convenient than employing cycles per second and Henries.

With C2, the actual reactance required for a 50Ω output would be lower than for a 75Ω output, so that the condenser values would be greater for 50Ω, than 75Ω. However, except for the cases previously described, this can be accommodated by the adjustment of the condenser.

For a given load and frequency, lower reactances may be used for C1, L1 and C2, when a higher Q is required. It would normally be satisfactory to take a Q of 12 as near the lowest to be used. In some circuits it will be possible to plan the π -network for a Q of 15, or even 20, but when the load R1 is fairly low, it will be found rather impracticable to provide the values of capacity needed, because they will become so large.

ABOUT LOUDSPEAKERS

(Continued from page 488)

permanent repair. If the fault is due to the speech coil being out of centre and the centring device has not shifted, the centring "spider" may have come loose from the cone or the speech coil former may have warped. A centring device which has cracked or parted from the cone can usually be repaired without difficulty, and repairs have been carried out successfully when the speech coil has actually broken away from the centre of the cone. The cone and speech coil assembly should be removed from the loudspeaker chassis and a cellulose cement should be applied between the coil former and the cone and allowed to set hard before reassembling. Loose turns on the speech coil can also be locked with a similar cement applied in a very thin layer.

If the speech coil former has warped, there is usually little that can be done, for even if the former is squeezed back to approximate its original shape, it very often warps again as soon as it warms up in the set. This trouble, in fact, often happens in small mains-type radio receivers, which become very hot inside and use a small loudspeaker. When the set is first switched on the reproduction may be normal, but after a warm-up period loudspeaker distortion becomes apparent, owing to warping of the speech coil. The only cure here is to replace the loudspeaker.

Speaker Centring

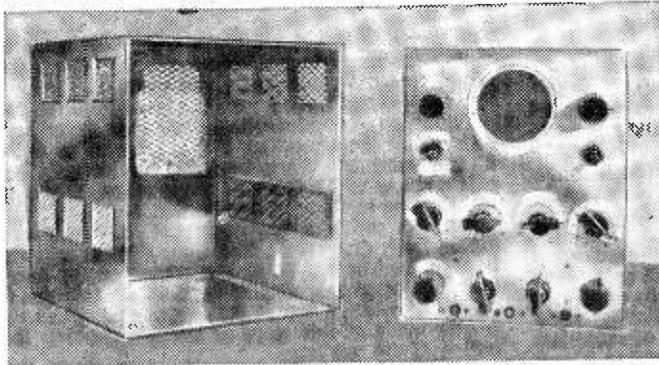
To re-centre a loudspeaker, the retaining screw or screws of the centring device should be slackened. Pressure should then be applied to the cone as required and the retaining screw or cones tightened. The process may have to be repeated several times in order to achieve the best results. The speech coil must, of course, operate within the magnet gap without touching the pole pieces.

Gauges for pushing between the coil former and the magnet to hold the former in the correct position while tightening the centring screws are available, but if these are used care should be taken to avoid using too much pressure, otherwise the former may spring out of centre when the gauges are removed. One way of checking whether the speech coil is correctly centred is to apply about 2V A.C. via a 100Ω current limiting resistor, to the speech coil terminals on the loudspeaker chassis. If all is well, the cone will vibrate freely without harshness or obvious fouling. The correct centring position can be established, if necessary, by adjusting the centring device with the loudspeaker connected to the A.C. supply, but the speech coil should not be allowed to rub on the pole pieces for any length of time, otherwise the coil winding may be damaged.

Metallic particles of a ferrous nature, or even rust, sometimes reduce the magnetic gap or stick to the pole pieces. These can be removed by pressing a piece of Plasticine or soft wax on the pole pieces and magnet assembly.

HOW TO KEEP RADIO EQUIPMENT

COOL



VENTILATING HOME-CONSTRUCTED INSTRUMENTS PRONE TO OVERHEATING

By W. Cleland

Left.—Expanded aluminium was used in this oscilloscope for ventilation.

ONE factor that can be overlooked in home-constructed equipment is the necessity of adequate ventilation. The problem hardly arises with transistors except in output stages handling heavy currents, but in valve equipment (some valve heaters dissipate as much as 4W each) it can make the difference between a successful or an unsatisfactory design

Temperature Stability

For example, in an A.F. oscillator of the phase-shift, Wien Bridge, or similar type, the calibration may be unreliable owing to frequency drift with heating. Similarly, in an R.F. signal generator where the oscillator has to be well screened, it is still necessary to provide ventilation, with suitable precautions against R.F. radiation through the openings. Lack of sufficient ventilation would cause the frequency to drift for a lengthy period before reaching a steady value. Radio receivers are normally well ventilated by openings at the rear, and this enables the local oscillator rapidly to settle down to a steady condition. The use of components of low temperature coefficient may prove necessary especially at VHF.

Local "hot spots" also require careful consideration. A wire-wound resistor that is too hot to touch should not be situated in close proximity to carbon resistors, as the latter would be liable to become faulty. Nor should capacitors be placed close to hot components, as capacitors of the waxed type would melt, and their electrical characteristics would be impaired at such high temperatures. Metal-cased capacitors can be used up to the temperature of boiling water, but their voltage rating is reduced by some 30% under these conditions.

Electrolytic capacitors should not be used at all above 70°C (158°F), and above 60°C (140°F), their working voltage rating has to be taken as 50VW less than at lower temperatures. Metal rectifiers require still lower ambient temperatures to work in, and their current ratings are decreased by 25per cent or more at 55°C (131°F).

Equilibrium

Usually electrical apparatus should be capable of continuous working. Laboratory equipment is sometimes kept switched on permanently to maintain steady conditions. This means that thermal equilibrium must be reached at a reasonable temperature. Cooling only begins to take effect as the temperature rises sufficiently above that of the surrounding air. Heat loss then increases rapidly until it balances heat production, and a steady temperature level above ambient is then maintained.

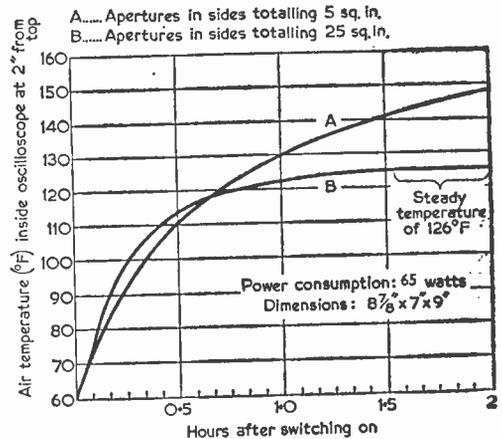


Fig. 1.—The curve "A" represents the result of inadequate ventilation, curve "B" with more ventilation.

Provision of ample ventilation not only ensures a lower ultimate temperature, it also considerably shortens the heating up period, and allows the heat to be distributed evenly in a shorter time. When numbers of valves are involved with an appreciable wattage dissipation in a confined space,

(Continued on page 534)

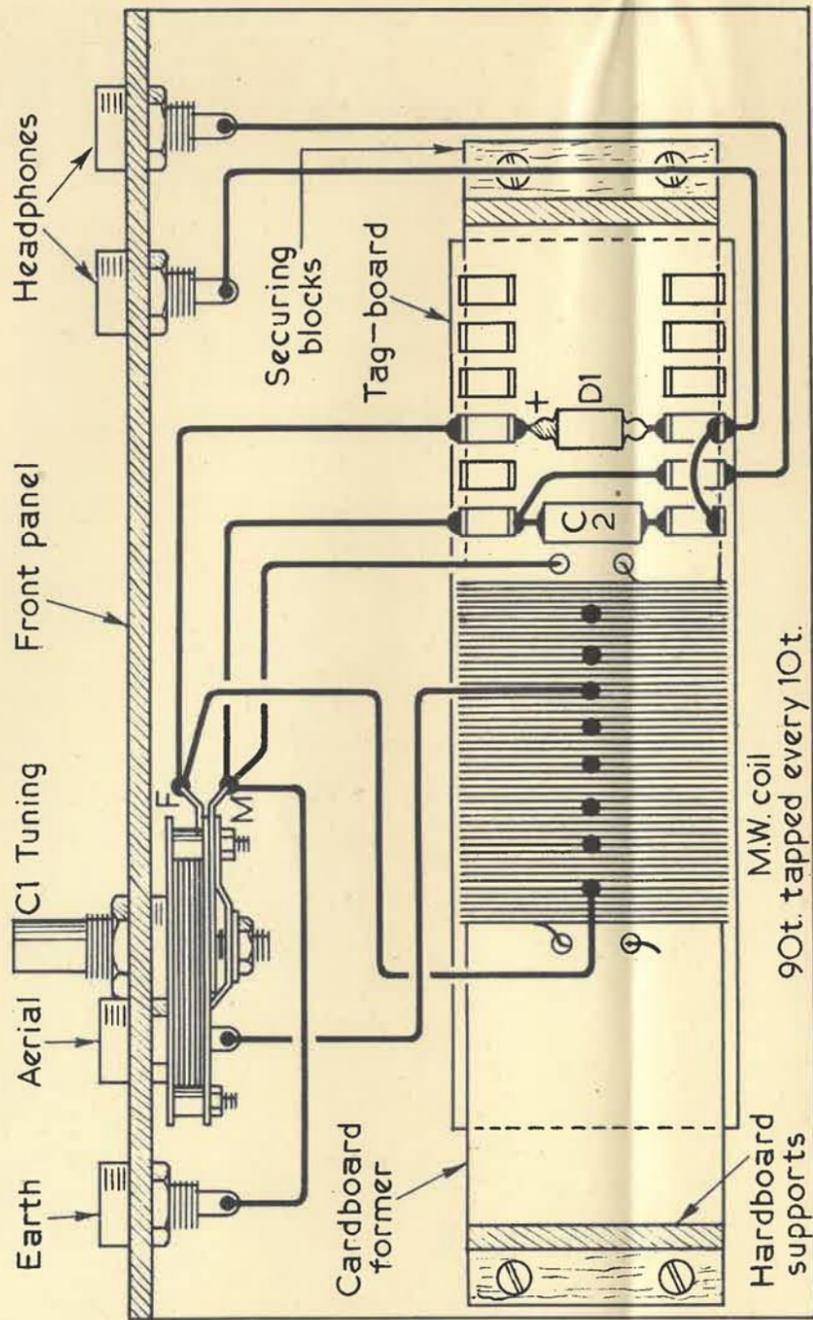
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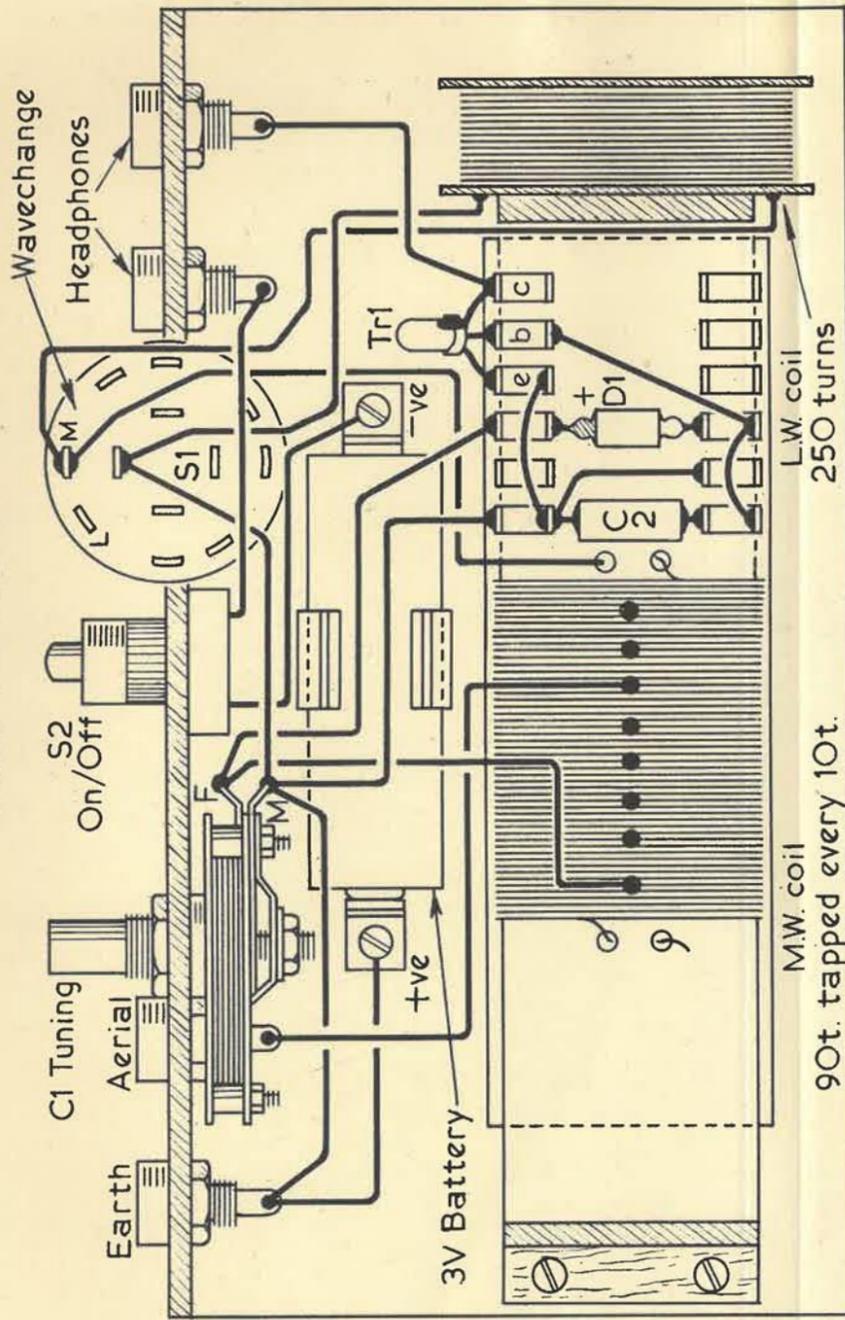
'TUTOR'

PRICE 3/-

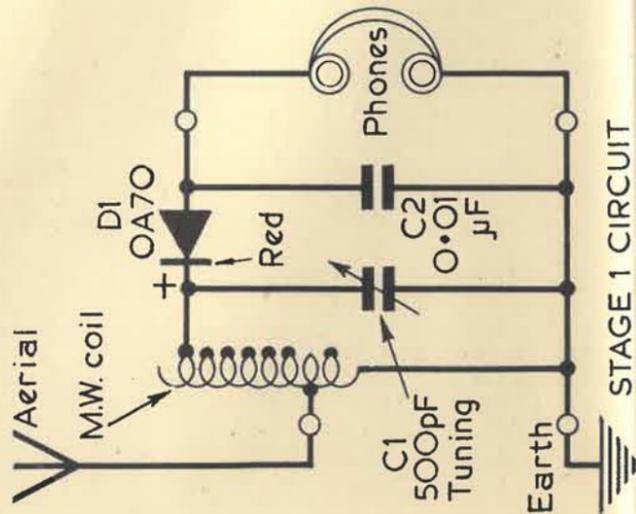
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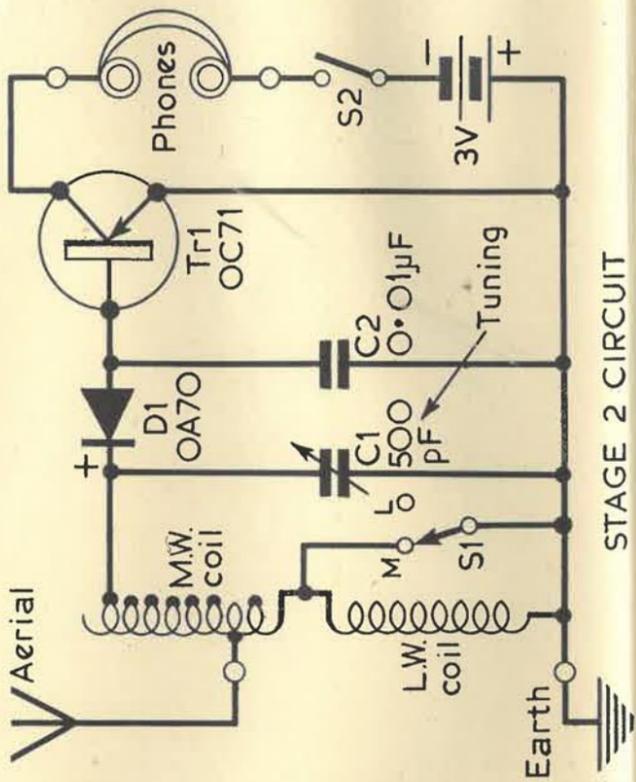
STAGE 1 RECEIVER



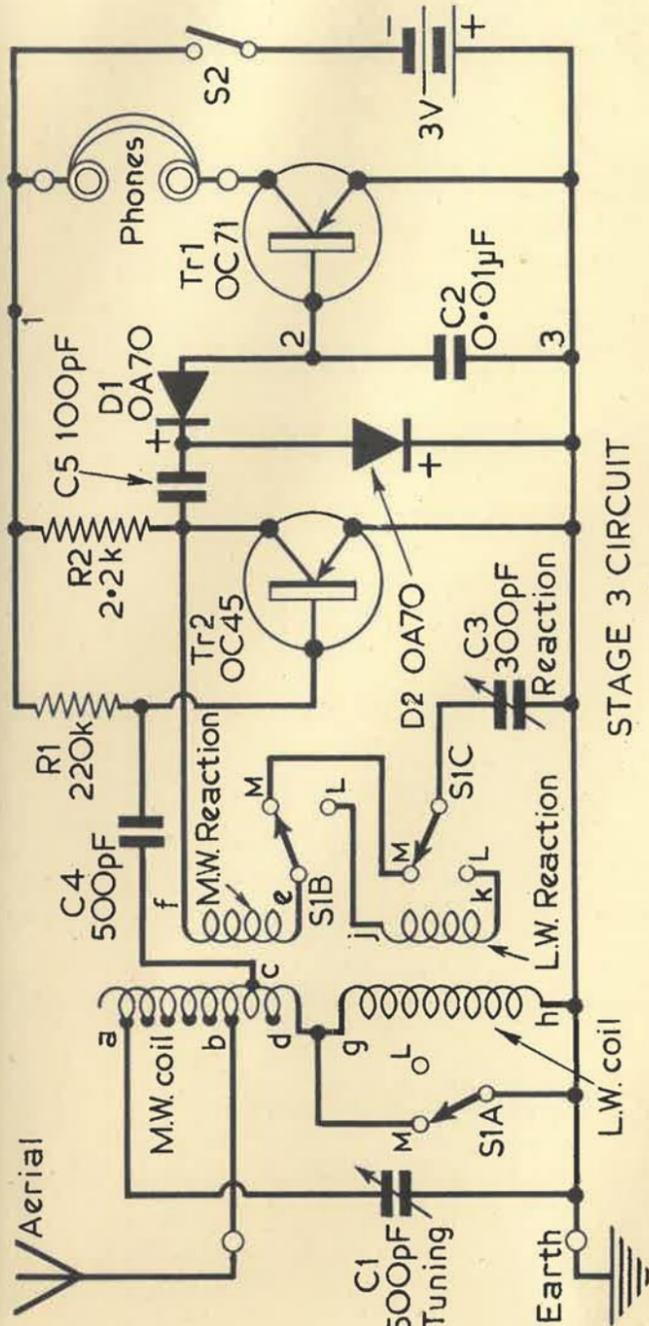
STAGE 2 RECEIVER



STAGE 1 CIRCUIT



STAGE 2 CIRCUIT



STAGE 3 CIRCUIT

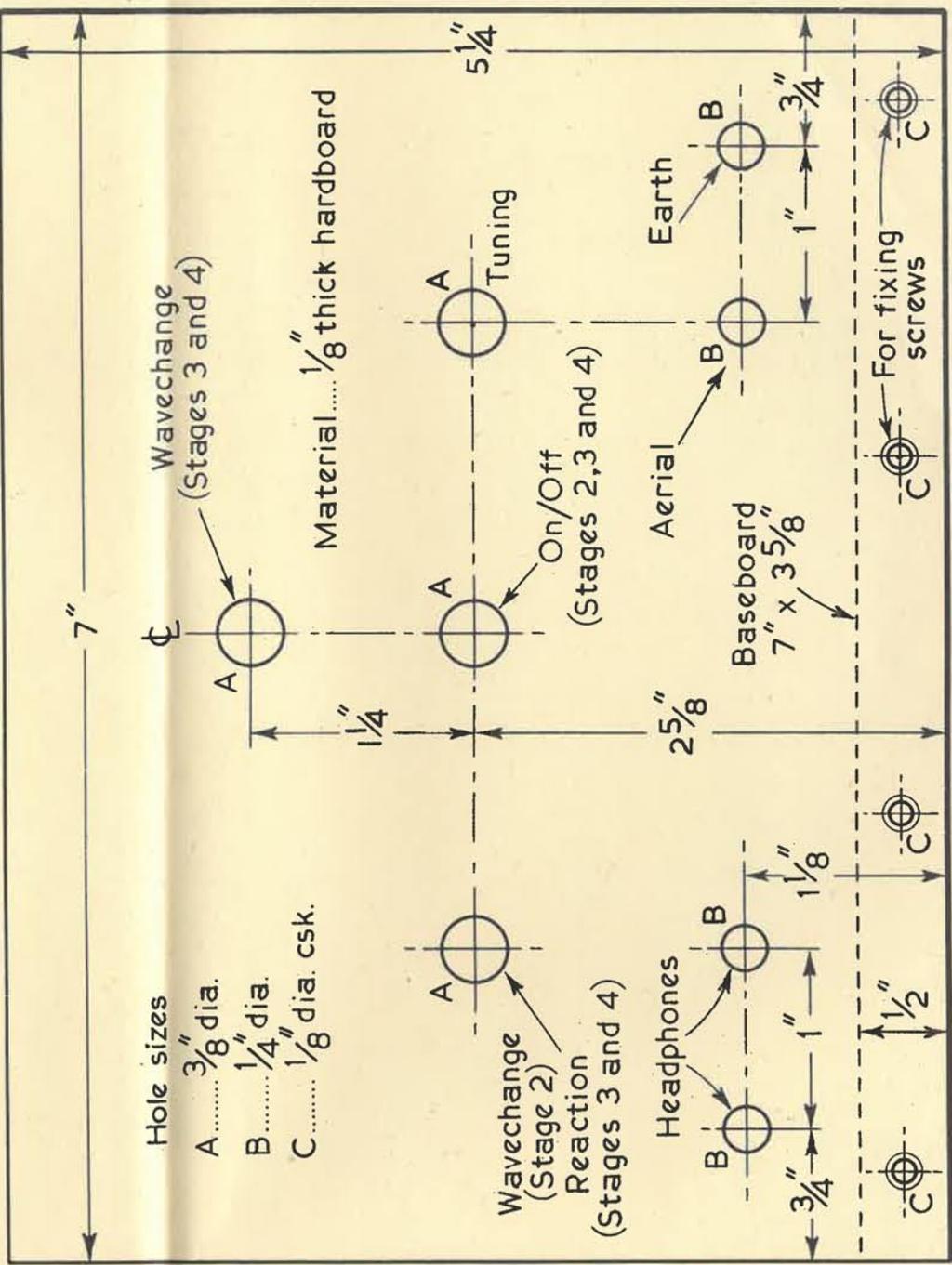
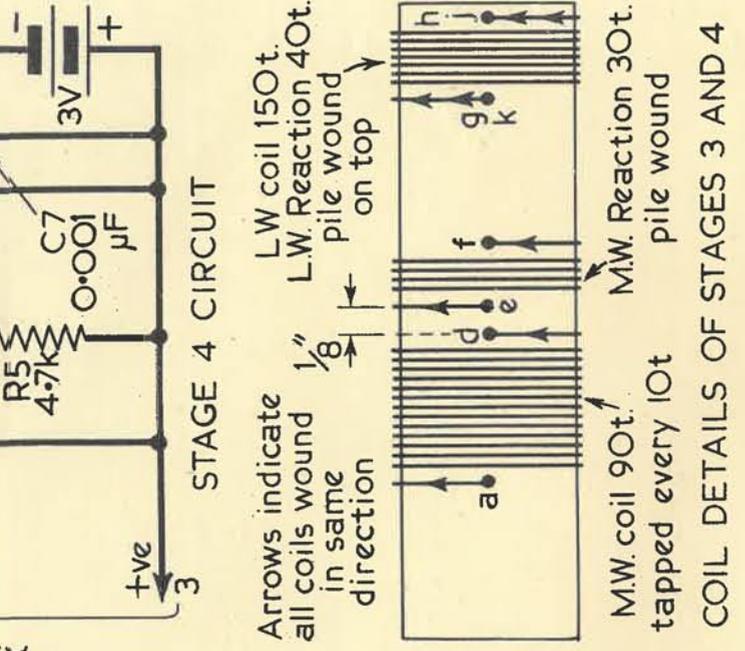
LIST OF PARTS

- For Stage 1
- Cardboard coil former, about 1 1/2 in. in diam. x 5 1/2 in. in length
- 2 oz. of 34s.w.g. copper wire (DCC)
- Hardboard panel 7 in. x 5 1/4 in.
- Baseboard 7 in. x 3 5/8 in. x 1/2 in.
- High impedance headphones
- 4 wanderplugs and 4 sockets to match (Radiospares)
- Crystal diode (Mullard OA70)
- 500pF tuning capacitor (Dilecon-Jackson Bros.)
- 0.01µF capacitor (miniature type)

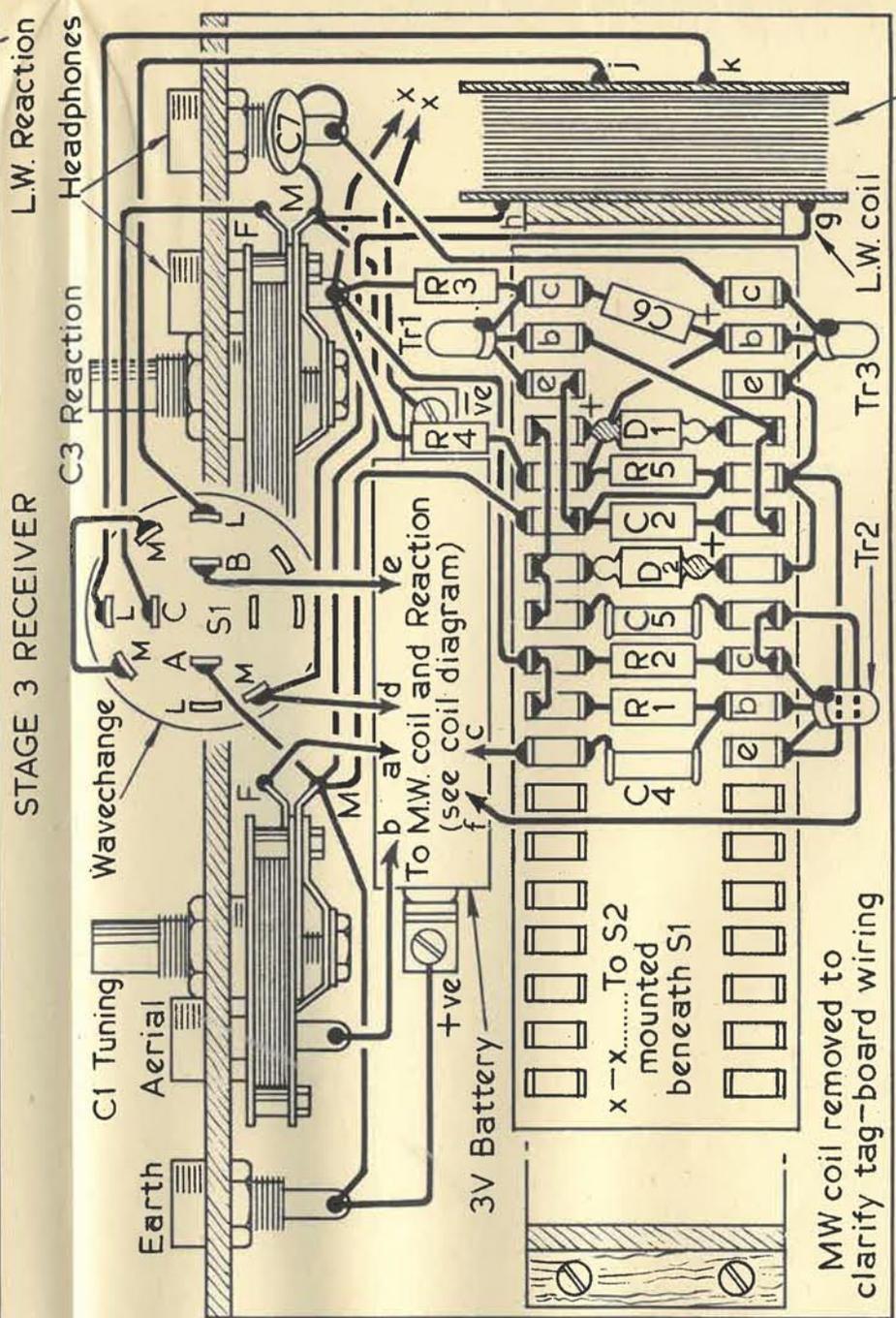
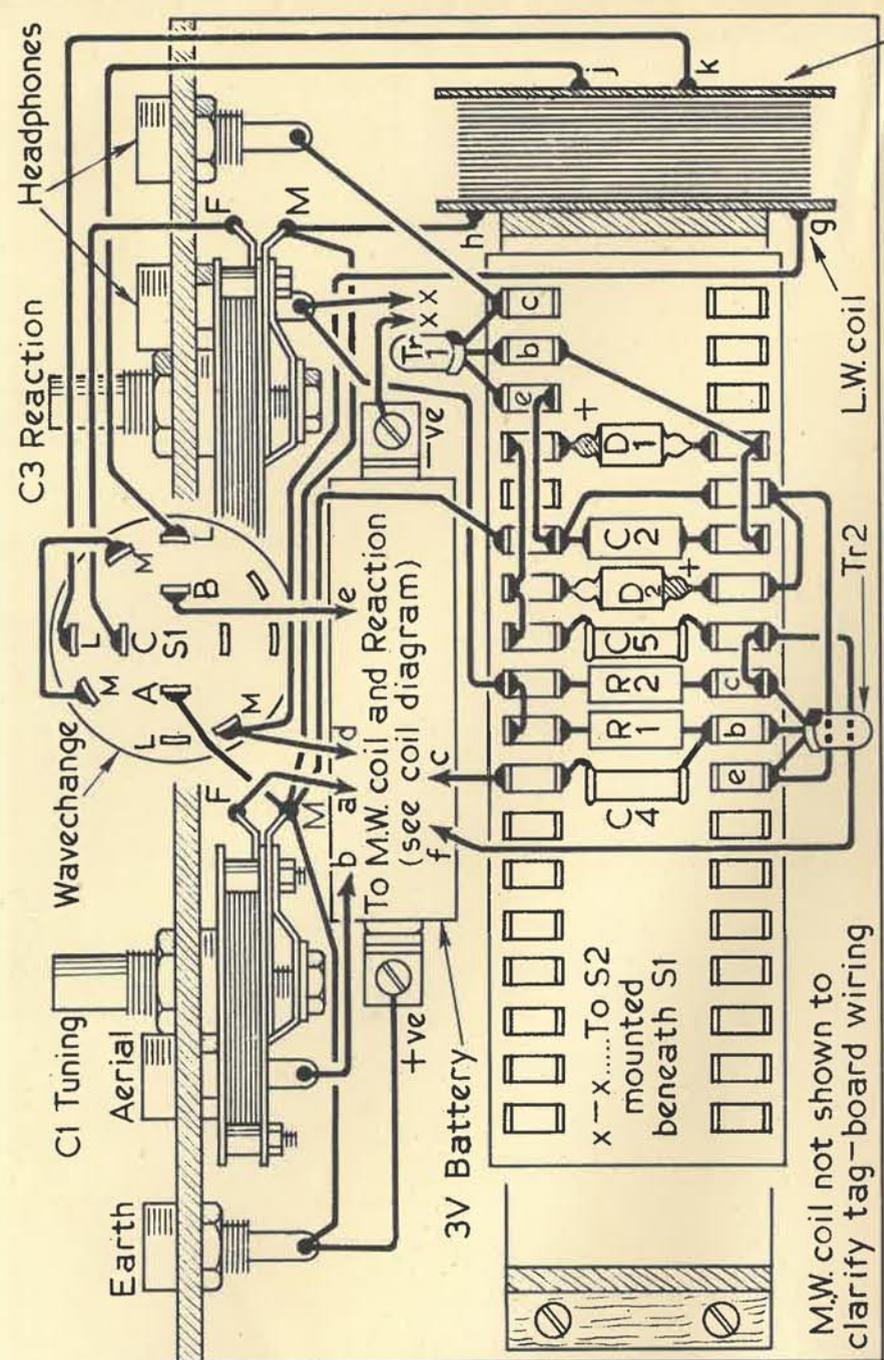
... in stage 3 circuit

12-way or 18-way tag-board (Radiospares)
Connecting wire, solder, Balsa cement etc.

- Additional parts for Stage 2**
 OC71 transistor (Mullard)
 4-pole, 2-way rotary switch (Radiospares)
 Push-button on off switch
 3V battery (Ever-Ready No. 8)
 3 tool clips to hold battery (Terry's)
 2 oz. of 36s.wg. copper wire (DCC)
- Additional parts for Stage 3**
 300pF reaction capacitor ("Dilecon"-Jackson Bros.)
 OC45 transistor (Mullard)
 500pF and 100pF capacitors (ceramic or mica)
 220k and 2.2k resistors (1/4W or 1/2W)
 Crystal diode (Mullard OA70)
- Additional parts for Stage 4**
 OC71 transistor (Mullard)
 8µF 6VW electrolytic capacitor (miniature type)
 47k and two 4.7k resistors
 0.001µF capacitor (ceramic)



PANEL DRILLING VIEWED FROM FRONT



PANEL DRILLING VIEWED FROM FRONT

Practical Wireless

T U T O

WITH each copy of this issue is included a PRACTICAL WIRELESS "Tutor" blueprint. This blueprint has been designed to give the complete beginner to radio construction a graded course to introduce him to the techniques and theory of wireless. The "Tutor" describes four simple receivers, each complete in itself, which can be built by the complete beginner with certainty of good results. The instructions for building the first receiver are more detailed than those for the remaining three as the constructor will gain proficiency and will need less guidance as he works his way through the course. The main difficulty which the beginner will encounter is the art of soldering. A second difficulty will be in recognising circuit symbols. Both of these difficulties will, however, be overcome by a study of pages 508 and 509 where circuit symbols are given together with illustrations of the components concerned. Details of the soldering process are also given together with illustrations.

The First Receiver

The first receiver consists of a crystal set using the modern equivalent of the old "crystal and cat's whisker" of the early days of radio. The results from this set are very good, particularly if a good aerial and earth are used. The results obtained will encourage the constructor to build the second and subsequent receivers.

Construction

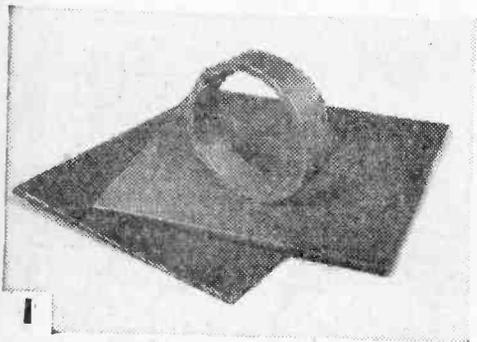
The set is built on a wooden baseboard and this is the first part to be made. The baseboard is cut from inexpensive timber and is 7in. long and about

3½in. wide—the nearest stock width of wood is quite suitable although it is better to err on the larger side. A hardboard front panel is then cut 7in. x 5½in. and drilled with the holes required for the first set (see blueprint)—the other holes can be made at the same time if it is intended to build all four receivers. When the panel has been drilled, it is screwed to the front of the baseboard. A case can then be made as shown in Fig. 1 on page 507, but if the width of the timber of the baseboard differs from that given, then some dimensions will have to be altered. When the wood for the baseboard is bought, it should be possible to have it cut to the width given at little extra cost. The case is best made at this stage to avoid disturbing the wiring of the sets later.

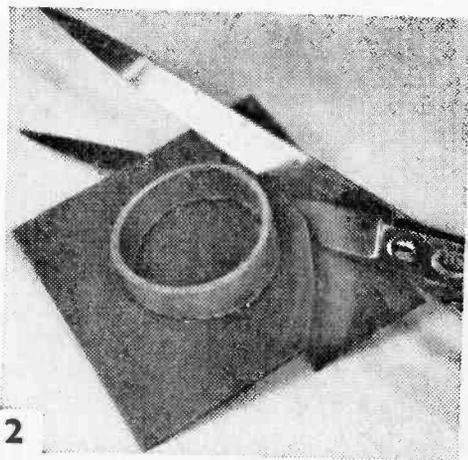
The case may be given a coat of varnish or paint and the baseboard a coat of clear varnish before starting construction.

Construction

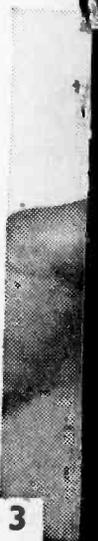
First, the components concerned are mounted on the front panel: four terminals and the tuning condenser (C1). Then the coil must be made. The former for the coil is made from a 5½in. length of cardboard tube about 1½in. in diameter. Pierce a small hole (with a sewing needle) at a point 1½in. from one end and pass the end of the 34s.w.g. DCC (double cotton covered) wire through it. The wire may be passed through another hole to anchor it securely as shown on the blueprint. Now wind on ten turns of the wire side by side in the direction shown on the blueprint. Now, double the wire back on itself for about 2in. and twist the doubled-back portion together quite tightly so that does not come untwisted when it is pulled gently.



1 Making the Long Wave coil for the Stage 2 Receiver—two square pieces of cardboard are required together with a ½in. length cut from the cardboard tube used to make the Medium Wave coil, and a tube of Balsa Cement. The cardboard ring is glued to one of the cardboard squares and when the cement has set, the excess cardboard is cut away to within a ¼in. of the ring—see 2. The remaining square of cardboard is then glued to the other side of the ring. These two pieces of cardboard eventually form the cheeks of the former. The corners of this square are bent (3) so that the 36s.w.g. wire may be wound on to the former more easily. When winding the coil, pin holes are made in one cheek of the former and



2 the wire passed through to anchor it. Balsa Cement may be applied where the wire passes through the cheek. When the coil has been completed, the remaining square of cardboard is cut to leave a circle of the same diameter as the first.



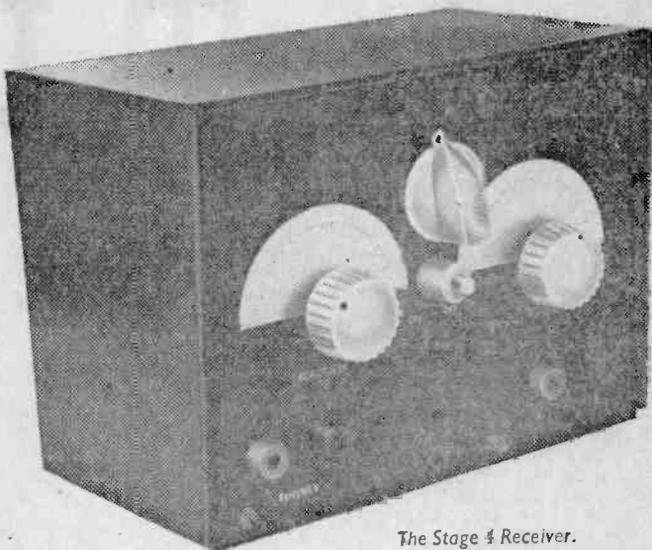
R

By R. E. F. Street

Wind on another ten turns and again double the wire back on itself for about 2 in. and twist it as before. Arrange the twisted portion so that it is in line with the first as indicated on the blueprint. Wind on another ten turns and make another twist. Carry on winding, ten turns at a time and twisting until 90 turns have been wound on altogether. Then, pierce another small hole at the "finishing" end of the winding, and wedge the wire in it, using a piece of wood—a sharpened match-stick is ideal. The wire does not pass through the hole, but is only anchored there. Cut the wire to leave about 6 in.

Balsa cement can now be used to fix the wire to the former securely. Spread it liberally around the twists of wire and the two end wires of the coil. Allow the cement to dry and cut the wire at each twisted loop. Two ends will thus be formed at each twist. Unravel the cotton covering at each of these ends or remove it by scraping gently with a knife. Twist each pair of bare wires together and in such a way as to form a small "bunch" of copper wire at each twist or "tap". These taps can now be tinned with solder—apply the soldering iron to each in turn together with the solder and leave a small blob of solder at each tap.

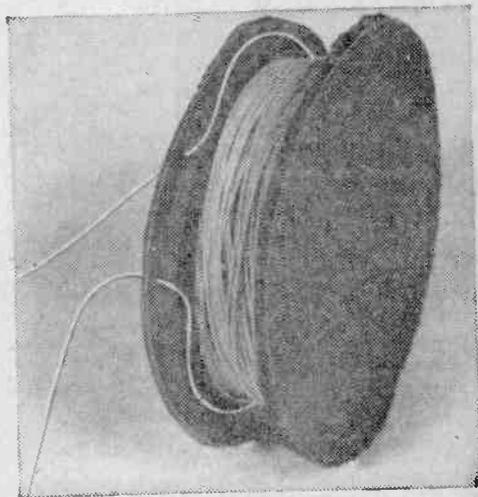
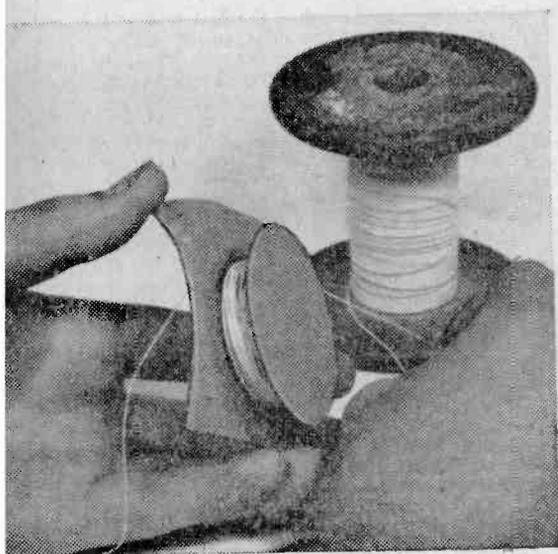
The supports for the coil are next to be made.



The Stage 4 Receiver.

Cut two pieces of hardboard 2½ in. long and as wide as the diameter of the cardboard tube. Place the tube at one end of each and mark a semicircle to be cut away so that the supports are circular at one end. One of the supports may now be cemented to the tube on which the coil is wound (so that the taps on the coil will be in the position shown on the blueprint). When the cement is dry, the other support may be glued in place—the two supports must, of course, be parallel.

The group-board may now be mounted and components C2 and D1 soldered in position. These are the only ones to be mounted on the group-board in this receiver. Note the position of the red, or positive, end of the diode D1. When soldering, remember not to overheat the compo-



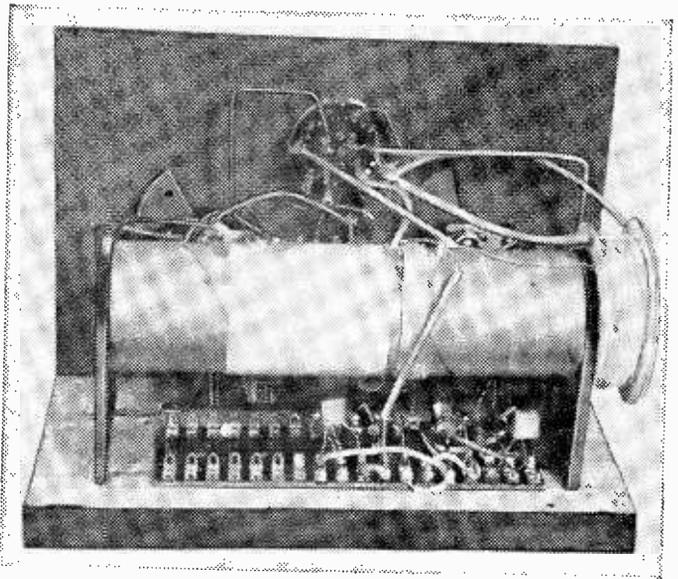
The completed L.W. coil.

nents, especially the diode. Leave the leads of the diode long—do not cut them at all—and conduct the heat away when soldering with a damp cloth or with pliers as shown on page 509.

Solder in the two wire links on the group-board which are shown on the blueprint. Connect the earth terminal to the moving plates connection of the variable condenser C1 (M) and take a wire from there to C2. Keep this wire near to the baseboard—the battery will be fixed over this wire in the three other stages. Connect the fixed plates of the condenser (F) to D1. Connect the headphone terminals to the tags indicated on the group-board. Two pieces of thin plastic-covered flex will now be required: one of these is connected to the aerial socket and the other to the fixed plates connection of the variable condenser.

Mount the coil—the end at which winding was begun should be on the left (viewed as shown on the blueprint). Connect the right hand end of the coil (6in. of wire was left) to the moving plates connection of the condenser. Connect the flex lead from the aerial terminal to the third tap from the right on the coil, and the one from the fixed plates to the first tap from the left. The end wire of the coil is, of course, not used.

Connect the aerial and the headphones, rotate the variable condenser (C1) and at least one programme should be heard. If not, check the connections and if still no results can be obtained, connect the aerial to the same tap as the wire from the fixed plates to the condenser. The signal should now be heard. If a programme was



The Stage 4 Receiver.

obtained before the aerial tap was moved, then it will be noticed that although the signal is louder, it spreads over the full range of the condenser C1. The set is now not so selective—it does not tune so sharply—but it is more sensitive—the signal is louder.

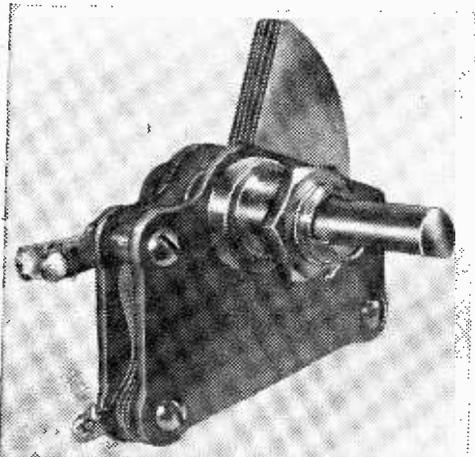
Note that a good aerial and earth are essential for a crystal set of this type and poor results will often be due to insufficient signal reaching the set.

The tapping of the aerial on the coil can be altered to improve results and the best position will soon be found.

The Stage 2 Receiver

Disconnect and remove the coil so that it is not damaged when the new parts are being added. Mount one of the Terry clips as shown to hold the battery. Cut off one "arm" from each of two Terry clips (to leave the holes for mounting). Each clip is then screwed to the baseboard to contact the two ends of the battery when it is in position. Use $\frac{1}{2}$ in. brass screws to mount the clips for ease of soldering later. Connect the left hand—positive—battery terminal to the earth socket, and the right hand—negative—battery terminal to one side of the on/off switch (S2). Connect the other side of S2 to the left hand headphone terminal. At the same time, remove the wire already there, shorten it and solder it to the tag marked b on the group-board of the Stage 2 receiver. Join tag e to C2 as shown. Remove the wire linking the other headphone terminal to the group-board and connect this terminal to tag c.

Now make the Long Wave coil as shown in the illustrations (pages 504 and 505). 250 turns of the 36s.w.g. wire are needed. Note that both ends of the wire should be anchored through holes in the same cheek—the left hand one, and the direction of winding should be the same as for the M.W. coil, i.e. as shown on the blueprint.



A variable condenser of the type used in all four 'Tutor' receivers. (The fixed plates connection is the lower of the two soldering tags.)

Now join one of the inner tags of the wave-change switch S1 to the moving plates connection of the variable condenser C1.

Solder the transistor to tags e, b and c, with the emitter to tag e, base to b and collector to c. Do not cut the wire short and use pliers or a piece of wet cloth to conduct away the heat when soldering the leads. The procedure is described and illustrated on page 509. Make sure that the transistor is soldered in the correct way round. A diagram is given on page 508. Great care should be taken where transistors are concerned or these expensive components will be ruined.

Remount the coil, and connect the M.W. winding as before, except that the right hand wire goes to an outer tag of S1—corresponding to the inner tag used. To this outer tag is also connected the inner end (or starting end) of the L.W. coil—the other end goes to the inner tag in use on S1.

Replace the battery and switch on. Turn C1 with S1 in the M.W. position. The same stations as in the Stage 1 Receiver should be heard, but much louder and the aerial may be moved more to the right to reduce volume and improve selectivity. Several programmes should be audible, particularly at night.

Move S1 to the L.W. position and the Light Programme should be received. To improve results the tappings on the M.W. coil may be altered as required.

By now, even the complete beginner should have an idea of the meaning of the circuit diagrams and how they constitute a short way of describing receivers. It is a useful exercise to compare the circuit of the set just completed with its actual physical layout.

The Stage 3 Receiver

Remove the battery and then disconnect and remove the coil. Mount components C4, R1, R2, C5, D2 as shown on the blueprint. Note the position of the red, or positive, end of D2. Wire in the associated links on the group-board and mount C3, the other variable condenser, on the front panel, moving S1 to the new fixing hole.

Coil alterations

An $\frac{1}{4}$ in. to the right of where the M.W. coil finishes, pierce a small hole and anchor the end of the 34s.w.g. wire, leaving a 6in. end. Wind on 30 turns in the same direction as the M.W. coil over a length of about $\frac{1}{4}$ in. Pierce another hole and anchor the wire and leave a 6in. end. Now remove 100 turns from the L.W. coil (leaving 150 as shown on the blueprint) and rewind 40 turns on top of the 150 turn coil as a separate coil. The ends of this coil are passed through the right hand cheek.

Solder in transistor Tr2—take great care not to damage it by incorrect connections or by excessive heat. Connect the wave-change switch to C3

and C1 as indicated, and also wire in the link shown (the one which joins two of the outside tags). Now remount the coil and connect it as shown. Note that if the windings have been made exactly as given on the blueprint, the letters on the diagrams can be used to assist wiring in of the coil.

Finally, insert the battery and switch on with S1 in the M.W. position. Stations should be heard, and if C3 is rotated, should become louder until an oscillation is heard. Adjust C3 so that it is just short of the point at which oscillation begins and it should be found that selectivity is much greater than with the Stage 2 Receiver.

If it is found that closing C3 makes results worse, reverse the connections to the M.W. reaction coil. When results are satisfactory on M.W., try L.W. If reaction cannot be obtained, reverse the connections to the L.W. reaction coil. It should be noted once again that if the blueprint is followed exactly, the reaction will be obtained on both wavebands from the start.

The Stage 4 Receiver

The Stage 4 Receiver is the circuit of the Stage 3 Receiver with an extra transistor amplifier added to increase volume.

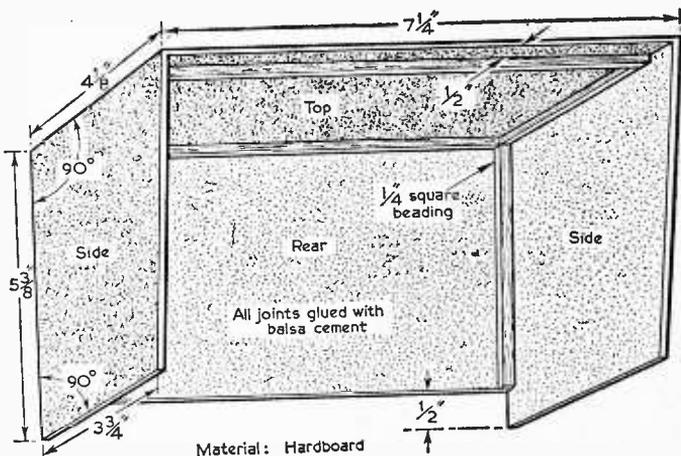
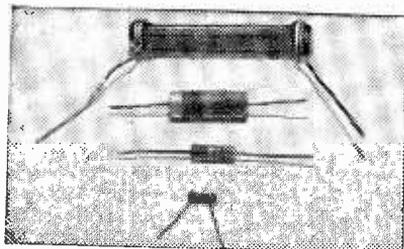


Fig. 1.—The dimensions of a suitable cabinet for any of the receivers.

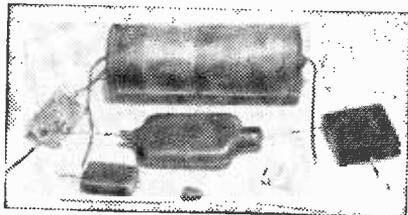
Remove the coil and add the extra components to the group-board, adjusting the wiring accordingly. Add R3, R4, R5, C6 and C7. Note that with C6 the red end or the end which has a rubber washer (which may be black) is connected to b (Tr3) and the other end—plain metal—is connected to c on Tr1.

Finally, connect Tr3, taking the usual precautions. Remount the coil as it was for Stage 3, and replace the battery and switch on. The signal should now be much louder and may be too loud. If this is so, add a condenser in series with the aerial lead—a value of 20pF to 200pF will be suitable. Alternatively, it may be necessary to try using an indoor aerial or to alter the tappings of the aerial on the coil.

to help the beginner build the 'Tutor'



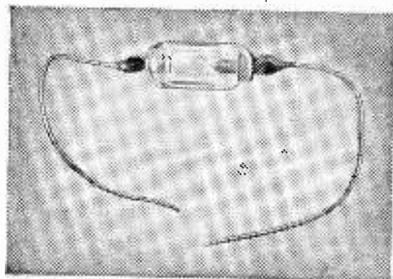
Fixed resistors.



Capacitors (condensers).



Headphones.



Crystal diode.



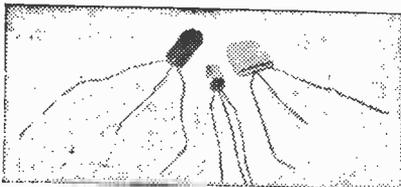
CIRCUIT SYMBOLS

The four 'Tutor' receivers described in this issue were designed especially for the absolute beginner to radio construction. It is therefore probable, that to some readers intending to build these sets, the circuits diagrams relating to them (on the Blueprint) appear too complicated for them to comprehend. These circuits are, in fact, very simple and with the help of the diagrams, illustrations, and hints on soldering given in these two pages, even those with no previous knowledge of radio should be able to build any or all of the four sets satisfactorily.

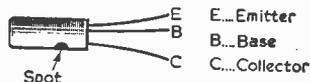
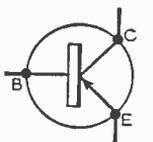
The diagrams on this page of the various circuit symbols, and the accompanying photographs of actual components, are, on the whole, self-explanatory. For instance, no one would mistake the symbol for a pair of headphones, but the sign for a tuning condenser (bottom left of this page) might prove confusing until it was pointed out that in circuit diagrams, a component crossed with an arrow usually means it is variable, e.g. variable resistors and condensers. The circuit symbol for a battery is given, without an illustration as it is felt that of all the components used in making these receivers, this, at least, is likely to be recognised by those unfamiliar with radio construction. Similarly, no photograph is given of a switch but the physical appearance of the two types used in the 'Tutor' may be seen from the Blueprint. The dimensions and construction of the tuning coil may be obtained from the article on the receivers and from the Blueprint.



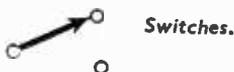
Tuning coil.



Tuning condenser—the type used in the 'Tutor' is shown on page 506.



Transistor



Switches.



Battery.

HINTS ON SOLDERING

It is essential in radio construction to be able to make good soldered joints. If poor joints are made, then the receiver or other apparatus may not work at all or may work for only a short period. The beginner may think that good soldering is difficult: it is not. Soldering consists of coating the parts to be joined with a thin layer of molten solder and allowing it to solidify over the join.

THE TEMPERATURE OF THE IRON

The first essential is that the soldering iron should be at the correct temperature—if the iron is electric, then it will automatically be at the correct heat, but if it has to be heated in the gas or in a fire, then it may easily be too hot or too cold. The correct heat is shown when the iron causes a green coloration to the flame of the source of heat.

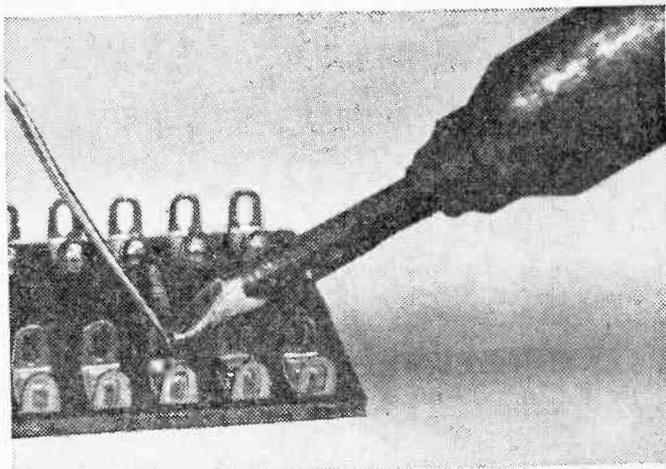
The second essential is that the iron should be clean and tinned—if a new iron is bought, then before it is used for the first time, it should be heated to the correct temperature, cleaned with a file or sandpaper, and solder applied to the tip. This action will give a coating of solder on the tip or bit of the iron. **Note that this is the only time that solder is applied direct to the iron.**

THE CORRECT SOLDER

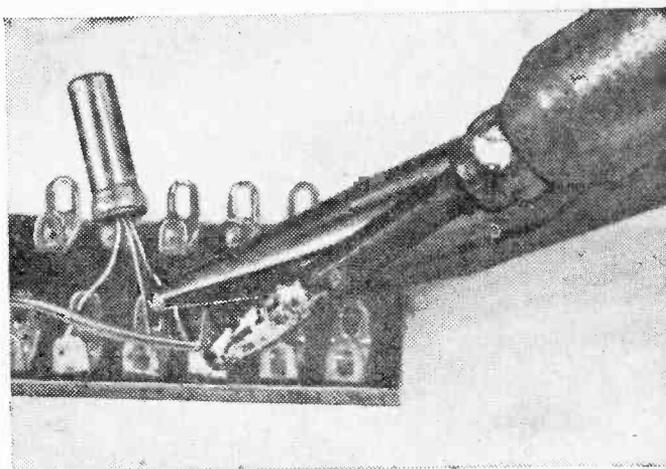
The third essential is that cored solder should always be used—preferably "Multicore Savbit" which contains a non-corrosive flux and also prevents erosion of the copper bit of the iron.

When soldering, heat the surfaces to be joined and apply the solder direct rather than carry it to the joint on the tip of the iron. This procedure is clearly illustrated on the right. If the solder is not applied direct to the parts to be joined, then the flux which is included in the solder to make good joints easier serves no purpose and dry joints, which can be pulled apart easily, will result.

Transistors and diodes need very careful soldering if the heat of the operation is not to ruin them. The best method of conducting the heat away from transistors and diodes is shown in the illustration on the right. A pair of long-nosed pliers is used to hold the lead to be soldered and provided that the joint is made quickly, the pliers will conduct the heat away from the transistor. This procedure will also be found useful for other parts. Note that if the soldering iron is not sufficiently hot, it will take a long time to make joints, and the parts being soldered will become very hot.



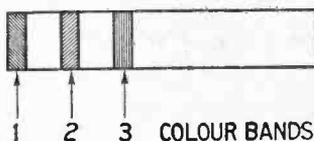
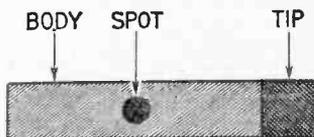
(Above) Soldering a resistor to a tag-board, and (below) using pliers as a heat shunt when soldering transistor leads.



RESISTOR COLOUR CODE

- | | | | |
|----------|-----------|----------|----------|
| 0. Black | 3. Orange | 6. Blue | 9. White |
| 1. Brown | 4. Yellow | 7. Mauve | |
| 2. Red | 5. Green | 8. Grey | |

First Number—Body or Band 1 } Yellow = 4
 Second Number—Tip or Band 2 } Mauve = 7 } 47,000 Ω (47k)
 Number of Noughts—Spot or Band 3 } Orange = 3



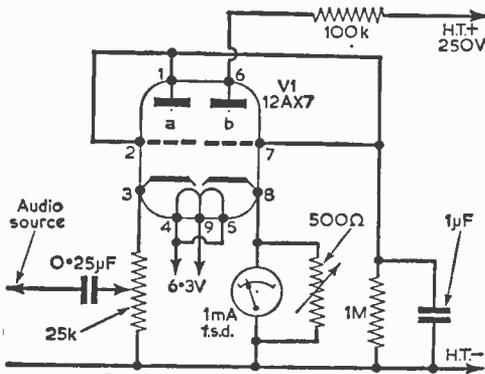


Fig. 1.—The circuit of the meter.

A Recording-level Meter

By R. Dowling

A USEFUL ADDITION TO ANY TAPE RECORDERS

TAPE RECORDERS are at present enjoying an unprecedented popularity owing to their versatility and ease of use. This has made it possible to produce tape recorders at prices much below those of a few years ago. Despite the high sales, however, manufacturers have to make one or two economies in order to produce machines at the lowest possible price. For example, some decks have only one motor (with ingenious pulley switching to carry out the various functions); most decks have a combined record/playback head; and very few of the cheaper tape recorders have anything other than a simple "magic-eye" in order to estimate the optimum recording-level.

The purpose of this article is to describe a single-valve recording-level meter constructed in such a way that it makes an easy "add-on" unit to any tape recorder. It will be found that the mean recording-level may be determined with much greater accuracy than the average "magic-eye", resulting in a much improved signal-to-noise ratio on the recordings made.

General Circuit Description

The circuit of the unit is quite straightforward, and is shown in Fig. 1. The valve used is a 12AX7 double-triode, one half of which is strapped as a diode. The audio signal from the tape recorder is fed to the cathode of V1a through an isolating capacitor (0.25µF) and the "set-level" potentiometer (25k). The rectified output of V1b is then fed to the grid of V1b. Between this point and earth is connected a CR combination (1µF and 1M) giving a one-second time constant. This prevents the meter from trying to follow the audio signal peaks too closely, and accordingly gives a better measure of mean audio level. It should be noted, however, that if a milliammeter is used which is inherently rather sluggish, better results will be obtained with a rather smaller time constant (say, 0.5µF and 1M).

The indicating milliammeter is connected in the cathode circuit of V1b. It should have a f.s.d. of

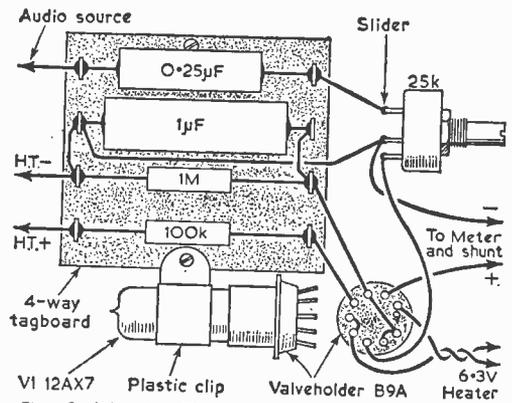
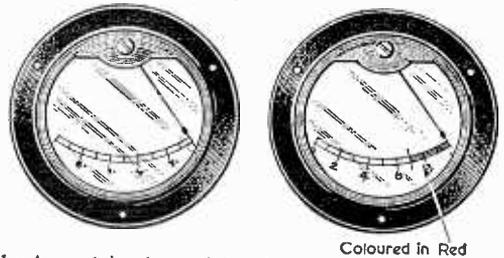


Fig. 2 (above).—The component layout: the 25k potentiometer may be mounted on any small bracket. Fig. 3 (below).—A method of modifying the milliammeter scale; left, the original scale; right, the modified scale.



1mA, and is shunted by the "set-zero" potentiometer (500Ω_{ww}).

The power supply required for the unit is only about 1mA at 250V and 0.3A and 6.3V. The tape recorder will itself usually be able to provide this light extra load with no difficulty. The whole unit may be built up on a small tag-board as suggested in Fig. 2.

Calibrating the Meter

In the zero-signal condition, the meter will read full scale deflection: this is the reason why the milliammeter is shown mounted upside-down in Fig. 3. It is seen that the face of the meter is renumbered from 0 to 10, the portion from 7 to 10 being painted in red. A good plan is to unscrew the original meter dial and paint over the back with white paint. Then a new scale may be easily marked out, using ink-compasses and Indian ink.

The meter is set to the new zero by means of the set-zero potentiometer, and a signal (preferably a continuous tone) applied to the input of the tape recorder. The recording-level control on the machine is then slowly advanced in the normal way until the correct level is indicated on the "magic-eye". The set-level potentiometer is now adjusted until the needle of the meter reads about 7, and thus the 7 to 10 portion in red will indicate over-modulation.

Finally, a word about the actual audio take-off point in the tape recorder. A satisfactory point on most small machines is the "magic-eye" grid; in the unlikely event of the signal voltage level at this point being too low, one may alternatively take off a signal at the grid of the output valve. ■

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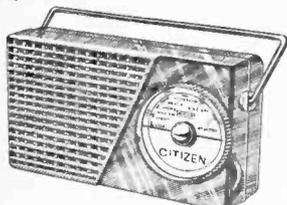
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★ Completely self-contained—No external aerial or earth required. ★ Genuine 2 1/2" High Flux P.M. Speaker. ★ Push-pull output 250 milliwatts. ★ Genuine Edison transistors. ★ Socket provided for personal listening. ★ Socket provided for connection to Car Aerial. ★ Volume Control with on/off switch—Condenser tuning. ★ Easy assembly on colour coded pre-tagged circuit board. ★ Attractive red polystyrene cabinet measures 5 1/2 x 3 x 1 1/4 in., chrome handle, attractive dial. All required components including full instructions, solder, etc. and battery at special inclusive price of only 95/- (Yes! Ninety-Five shillings only) Plus 2/6 P. & P. Nothing more to spend. Suitable crystal deat-aid type miniature earpiece fitted with miniature jack plus 7/8 extra only if reqd. All parts available separately—Itemised list and full assembly instructions, sent for 1/6 post free. Hear this amazing little receiver working, at any of our branches.

LIGHT-WEIGHT HIGH RESISTANCE HEADPHONES. 4,000 ohms, adjustable headband, brand new. Limited quantity at 13/6 per pair, plus 1/- P. & P.

SMALL SOLDERING IRON. Complete with vinyl carrying case, mains lead and 2 pin plug. A.C. 230 v. Handle unscrews and becomes protective cover for the bit. Only 18/6 plus 1/- P. & P. Spares available. Bit 1/3. Element 4/6.

CRYSTAL MICROPHONE (Hisu). Sensitive Miniature Lapel-type. Complete with clip and screened lead. Brand new 17/6, plus 6d. P. & P.



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20,000 ohms per volt!

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Hanks: A.C. Voltage: 10, 50, 170, 500, and 1,000 volts 10,000 ohms per volt. D.C. Voltage: 5-25, 50, 250, 500, and 2,5k. 30,000 ohms per volt. D.C. Current: 0-50 microamps. 0-2.5 ma. 0-250 ma. Resistance: 0-6k, 0-6 meg. (300 ohm and 30k at centre scale). Capacitance: 10 pF to 301 mfd. 300 mfd. to 1 mfd Decibels: -1 mid to +22 dB.

A truly guaranteed pocket size meter. (actual size: 4 1/4 x 3 1/2") knife edge pointer, top quality supplied complete with test prods and full operating instructions at £8.19.6 ONLY. Plus 2/6 P. & P. Optional extra, attractive carrying case 13/6 only. (Bona-fide trade enquiries invited). Leaflet available

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Completely portable—No external Aerial or Earth Reqd.

An amazing little receiver with built in aerial and small enough to be held in the palm of the hand. Medium wave reception at wonderful volume. No fiddly tuning! Condenser tuned.



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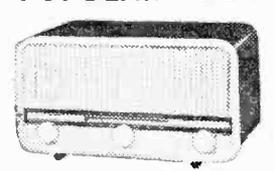
Covers local medium wave stations variably tuned. Compact self contained unit requiring only connection to aerial (no power supplies reqd.) for let class reception when used in conjunction with your tape recorder or high gain amplifier. All necessary parts available at a special inclusive price of ONLY 19/6. P. & P. 1/6.

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IMPROVED APPEARANCE AND PERFORMANCE

A new three valve plus miniature contact-cooled rectifier, mains T.R.F. Receiver is now available. New De Luxe Cabinet polished walnut finish, cream trim, attractive horizontal dial (as illustrated). Quality 5in. P.M. speaker. Specially wound high gain super-sensitive Denco coils. Medium and Long Wavebands. Excellent Continental reception! Overall dimensions: 12in. x 6in. x 5in. A.C. 200/250 v. Simple construction with guaranteed results. Easy to follow practical and theoretical diagrams supplied. All necessary components, down to the last nut and bolt, are offered at a SPECIAL INCLUSIVE PRICE of £5.5.0, plus 3/6 p. & p. Instruction book available separately 1/6, post free. ALL PARTS AVAILABLE SEPARATELY.

THE "WAVEMASTER" 7-TRANSISTOR LUXURY PORTABLE

400 Milliwatt Output

To build yourself! Medium and Long Waves—Push-Pull Superhet A. V. C. Perfect Car Radio reception. Size 10in. x 6 1/2in. x 4 1/4in. at base tapering to 4in. at top.



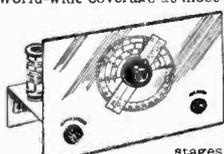
Very attractive two-tone grey Vynide covered cabinet with black and gold printed escutcheon plate, cream and gold knobs, handle and cabinet fittings ★ Weight—complete with long-life 7 1/2 volt battery—4 lb. ★ Mazda high-grade transistors throughout. ★ High-Flux 7in. x 4in. Elliptical Speaker. ★ Slow motion tuning. ★ Co-axial socket at rear for direct connection to Car Radio Aerial ★ Improved reception by use of seven-section plated telescopic aerial disappearing into Cabinet when closed. 3 1/2in. above cabinet when fully extended. Construction simplified by Bakelite chassis board with the following components already mounted: I.F. Transformers (3), Oscillator Coil, Trimmer Bank, Output Transformer, Interstage Transformer, Aerial Brackets and Earth Bar. SPECIAL INCLUSIVE PRICE for all required components, full assembly instructions—nothing more to buy—is £10.19.6 plus 3/6 P. & P. Alignment service available. Full assembly instructions and individually priced parts list, all of which are available separately, 2/6, post free.

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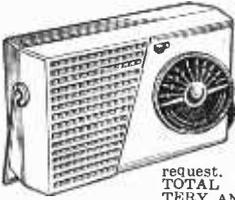
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Attractive cabinet as illustrated above for "P.W.6". Uses miniature speaker, proper tuning condenser, and volume control. Built-in aerial makes unit efficient and portable. Ideal for the beginner. Full medium wave coverage. All components for only 42/6 (p. & p. 2/6). Ten-page constructional book free with parts or separately 1/6. S.A.E. for parts price list.

SUMMER SPECIAL

"GOOD COMPANION" 6 TRANSISTOR COMBINED PORTABLE & CAR RADIO. ★ 750 mW output. ★ 6 transistors and 2 diodes. ★ Full Medium and Long Wave coverage. ★ Quality speaker. ★ Pre-aligned I.F.T.'s ★ Brilliantly styled 2 tone cabinet, size 11 x 8 x 3ins. ★ Very fine tuning with calibrated dial. ★ Latest printed circuit. ★ Internal high gain aerial with car aerial socket. ★ Easy to follow construction data (available separately 3/6).

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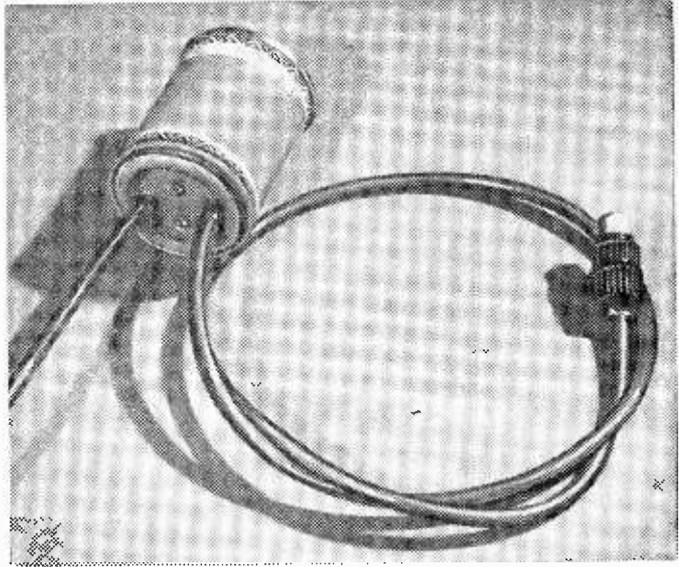
THE CABINET,
POWER OUTPUT METER
AND DUMMY AERIAL

By E. V. King

(Continued from page 391 of
the September issue)

THE P.W. SIGNAL GENERATOR

LAST month, Chassis No. 4 was constructed. This unit was the crystal check oscillator, and if the construction was completed and the multivibrator set on 10kc/s as described, the unit should give marker, or check frequencies at intervals of 100kc/s or 10kc/s according to whether switch S11 is on or off. The complete circuit of Chassis No. 4 is given in Fig. 32a on this page so that the constructor will have a diagram of the unit as a whole if a fault should develop and repairs become necessary.



A dummy aerial unit.

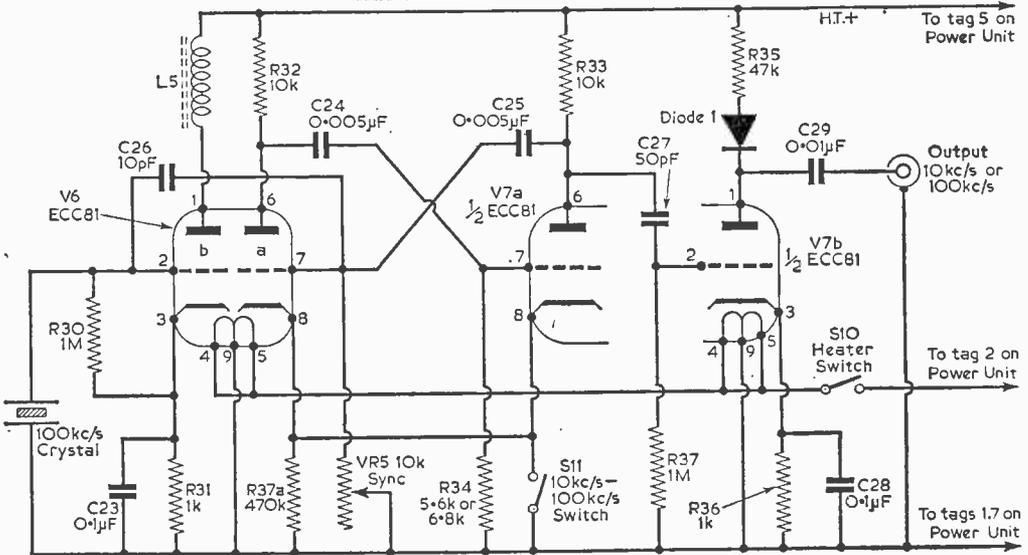
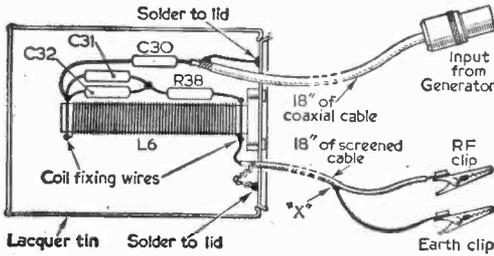
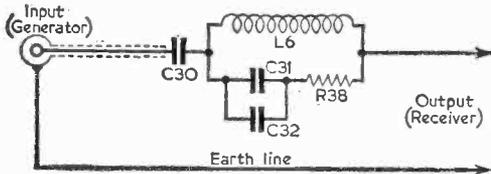


Fig. 32a.—The complete circuit of Chassis No. 4—the crystal check oscillator.



Figs. 33 and 34.—The circuit and construction of the dummy aerial unit.

The Dummy Aerial

When an R.F. signal generator is connected to a receiver instead of the ordinary aerial, it is best, though not absolutely essential, to connect it through a device which has approximately the same characteristics as the original aerial. This is particularly necessary when dealing with radio frequency amplifiers as in TRF receivers.

A special lead is therefore made which plugs in to the R.F. output socket of Chassis No. 2. It passes through a small can containing the
(Continued on page 517)

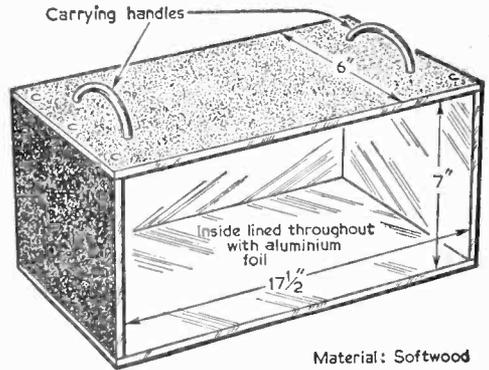
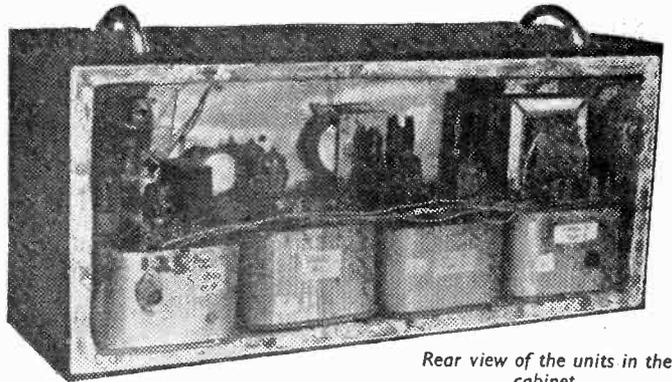


Fig. 35.—The construction of the cabinet of the generator.



Rear view of the units in the cabinet.

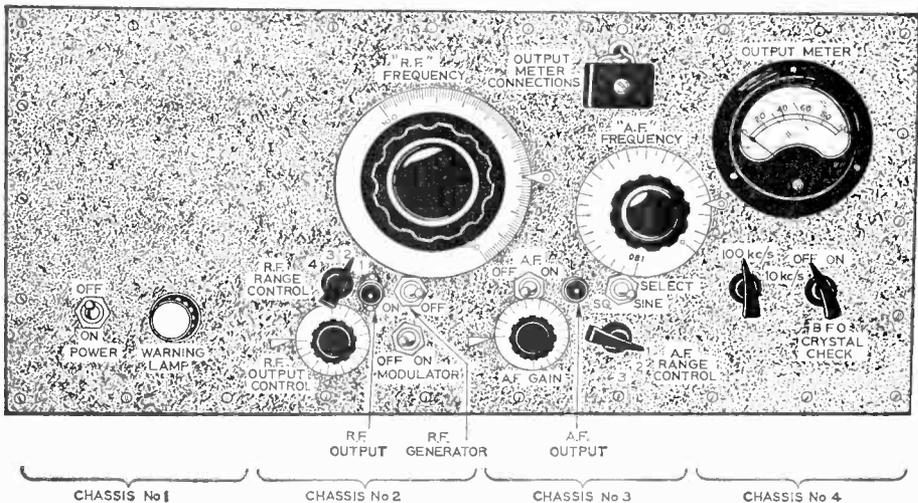


Fig. 36.—The front panel of the completed signal generator.

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highest quality at lowest cost

AMATEUR TRANSMITTER Model DX-100U
Covers all amateur bands from 160-10 metres. 150 watts D.C. input. Self contained including Power Supply Modulator V.F.O. **£81.10.0**

AMATEUR TRANSMITTER Model DX-40U
From 80-10 m. Power input 75 w. C.W., 60 w. peak C.C. phone. Output 40 w. to aerial. Compact and self-contained. Prov. for V.F.O. **£32.10.0**

VAR. FREQ. OSCILLATOR VF-1U
From 160-10 m. ideal for our DX-40U and similar transmitters. Price less valves **£8.19.6** **£11.2.0**

R.F. SIGNAL GENERATOR Model RF-1U
Up to 100 Mc/s fundamental and 200 Mc/s. on harmonics and up to 100mV. output on all bands. **£11.18.0**

AUDIO SIGNAL GENERATOR Model AG-9U
10 c/s to 100 kc/s. switch selected. Distortion less than 0.1% 10 v. sine wave output metered in volts and dB's. **£19.19.6**

VALVE VOLTMETER Model V-7A
Measures volts to 1,500 (D.C. and R.M.S.) and 4,000 pk. to pk. Res. 0.1 Ω to 1,000 M Ω. D.C. input impeded. 11MΩ. Complete with test prods leads and standardising battery. **£13.0.0**

Portable 2 3/4 in. **SERVICE 'Scope Model OS-1**
Compact portable scope ideal for servicing and general work. Y amplifier sensitivity 10 mV/cm; response ±3 dB 10 c/s-2.5 Mc/s. Time base 15 c/s-150 kc/s. Printed circuit. Case 7 1/2 x 4 1/2 x 1 1/2 in. long Wt. only 10 1/2 lb. **£19.10.0**

5 in. **OSCILLOSCOPE Model O-12U**
Has wide-band amplifiers, essential for TV servicing. F.M. alignment, etc. Vertical freq. response 3 c/s. to over 5 Mc/s. without extra switching. T/B covers 10 c/s to 500 kc/s. in 5 ranges **£36.10.0**

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Measures resistance 100Ω to 5MΩ, capacity 10pF to 1000μF, and power factor. Test voltages 5-450 v. with automatic safety switch. **£8.6.6**

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10-12 watt Hi-Fi amplifier. Extremely low distortion and wide frequency range. **£10.19.6**

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Coverage from 2 Mc/s. to 250 Mc/s. Complete set of plug-in coils provided. **£10.9.6**

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Monaural (TA-1M) **£18.2.6**. Conversion unit to Stereo **£6.10.0**. Stereo (TA-1S) **£23.6.0**

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Equipment including TAPE DECKS RECORD PLAYERS and DECCA ffs PICK-UPS.

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F.M. TUNER



S.33



S.88



DX-40



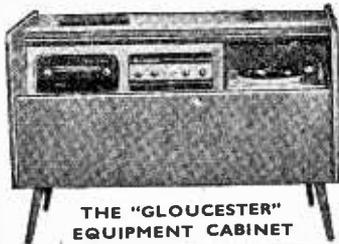
UXR-1



OS-1



SSU-1



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THE "MOHICAN" GENERAL COVERAGE RECEIVER Model GC-1U

Fully transistorised, including 4 piezo-electric transmitters. The very latest and an excellent portable or Fixed Station receiver for the Ham and short-wave listener. **£38.15.0**

SHORT-WAVE TRANSISTOR PORTABLE Model RSW-1

Extending aerial leather case, four band (2 short-wave bands Trawler and Medium). **£22.10.0**

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This sensitive headphone set is a fine introduction to electronics for any youngster. **£2.16.6**

HI-FI F.M. TUNER
Tuning range 88-108 Mc/s. For your convenience this is available in two units sold separately as follows: Tuner Unit (FMT-4U) with 10.7 Mc/s. I.F. output 33.5.0 (inc. P.T.). I.F. Amplifier (FMA-4U) complete with cabinet and valves (11.11.0). **£14.16.0**

HI-FI 16W STEREO AMPLIFIER Model S-88
20mV. basic sensitivity (4 mV. available, 7/6 extra). Ganged controls. Stereo-Monaural gram. radio and tape recorder input. Push-button selection. Two-tone grey metal cabinet. **£26.12.6**

6W STEREO AMPLIFIER Model S-33
3 watts per channel, 0.3% distortion at 25 w/ch 20dB N.F.B. Inputs for Radio (or Tape) and Gram. Stereo or Monaural, ganged controls. Sensitivity 200 mV. **£12.8.6**

TRANSCRIPTION RECORD PLAYER, GL-58
Goldring—Lenco four speed unit. G.60 pick-up arm and infinitely variable speed adjustment between 33 1/2 and 80 r.p.m. with fixed speed at 16 r.p.m. Balanced turntable (3 1/2 lb.). Stereo. **£20.12.2**

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Ducted-port bass reflex cabinet "in the white" Twin speakers. With legs **£11.18.6** **£10.17.6**

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Acoustically designed enclosure "in the white", 26 x 23 x 15 1/2 in., housing a 12in. bass speaker with 2in. speech coil, elliptical middle speaker and pressure unit to cover the full frequency range of 30-20,000 c/s Complete with speakers, cross-over unit, level control, etc. **£21.19.0**

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includes record player, amplifier and twin speaker systems (pedestal speaker legs optional **£2.2.0** extra). **£44.9.4**

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Luxury model with press-button inputs to suit any pick-up or tuner and most tape-heads. Output 1.3 v. R.M.S. per channel. Printed circuit construction. **£18.18.6**

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Ideal for boosting tape-head output and low output pick-ups (e.g. Decca ffs). **£6.17.6**

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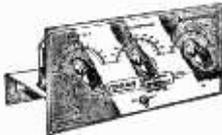
CODAR "CLIPPER" ALL BAND RECEIVERS 10-2000 METRES

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THE MINI-CLIPPER

39/6

The miniature valve radio with the BIG SET features. Covers all Short, Medium, Long waves 10-2000 metres (5 coils). Smart all satin silver ali. front panel with engraved dials, etc. Ball bearing, air spaced variables. Size only 6½ x 3½ x 4in. Battery lasts months. No drilling. Total building cost including punched chassis, valve, front panel, one coil for 20-60 metres, nuts, bolts, wire, Step-by-step pictorial plans, 39/6. P. & P. 2/-. Additional coils and electrical



bandspread optional extras. Parts sold separately. Full plans, parts list, 2/-.

THE SUPER CLIPPER 88/6

This world-famous hybrid receiver has achieved remarkable success. Tremendous performance with Hi-gain valve detector PLUS two Ediswan transistor amplifiers which are supplied assembled, only 3 wires to connect. Large precision dial, 7 x 4in., with 2 pointers, bandset and bandspread, dual slow-motion drives, air spaced variables. Punched chassis 8 x 5½in. Batteries last months. Covers 10-2000 metres (5 coils). Total building cost including chassis, valve, 2 transistor stages, 2 coils 20-60 and 55-190 metres. Step-by-step pictorial plans, nuts, bolts, wire 88/6. P. & P. 2/6.



THE CLIPPER. As above but one transistor stage, 79/6. P. & P. 2/6. Optional Front Panel, Silver Hammer finish, all holes, 6/9.

THE CLIPPER CR 45

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No technical knowledge is required to build these fine receivers. Only new guaranteed components are supplied. Send 3d. stamp for illustrated leaflets, testimonials. Suppliers to Educational Authorities, Government Departments, etc. Coming shortly, The Clipper CR 66 A.C. Superhet Communication Receiver.

CODAR RADIO COMPANY, COLEBROOK ROAD, SOUTHWICK, SUSSEX

(continued from page 514)
components of Fig. 33 and passes out to the receiver under test.

Making the Dummy Aerial

Obtain a suitable "tin" can of 1½ in. diameter or more, and 2½ in. or more long. The lid may be clipped on or screwed on. The prototype uses a tin which contained Chinese Lacquer.

Refer to Figs. 33 and 34. Make L6 by winding 32s.w.g enamelled copper wire on the 2½ in. former in a single layer for 100 turns. Apply cellulose cement and let it set. Fix the coil in the centre of the lid and remove any dust cores from the former. Fix one band of wire (about 26s.w.g) at each end by twisting and soldering and solder the ends of the coil to these "bands" (Fig. 34).

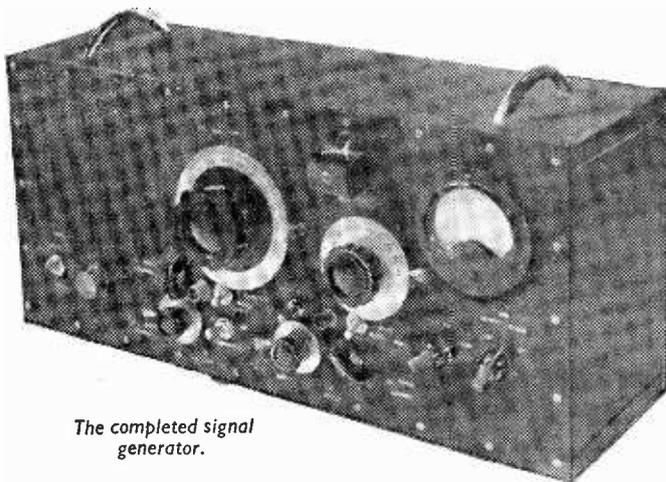
Drill two ¼ in. holes in the lid to take the two screened cables, and if necessary file away a little of the base of the coil former. Prepare the screened cable so that it can be fixed on the inside of the can by soldering the metal braiding to the can. Use rubber grommets to protect the cable where they pass through the can.

Connect the centre lead of one of the cables to the bottom of the coil, and attach crocodile clips to the ends of this lead as shown. The best method is to cut off the outer plastic covering for a few inches and twist the copper braiding into a "pigtail" and solder a length of single flex to it as shown. The joint can then be bound with insulating tape so that the lead does not break off with use.

The coaxial lead is taken through C30 to the top coil connection. Between the top and bottom of the coil attach R38, C31 and C32 as shown (Fig. 34). A single condenser of 400pF may be used instead of C31 and C32. The other end of this second coaxial lead is taken to a plug for the R.F. socket. Be careful to connect this plug correctly. Check with a battery and bulb that the braiding and centre conductor are not shorting.

Testing the Dummy Aerial

Connect the unit between the generator and any type of receiver. Switch on R.F. (modulated) for the correct waveband, and tune the receiver or generator until a note is heard. Even with com-



The completed signal generator.

paratively simple receivers, the dial positions for certain "wavelengths" should still be about the same as when used with the normal aerial.

Making the Cabinet

The three units are placed side by side with the power unit (Chassis No. 1) on the left and finishing with No. 4 (Crystal Check) on the right. The necessary wires are connected at the back, keeping to definite colours for the various connections in case servicing is required later. Verify that all the units still work as they did when tested separately. Note that all units must not be switched on at once or the mains transformer will be overloaded. When the crystal check unit is switched on, then the R.F. unit may also operate, but not the audio oscillator as well.

Four square-cut pieces of planed soft wood are purchased and assembled as shown in Fig. 35. Verify that the units will all fit in it and then cut out a piece of aluminium sheet from which to make the front panel. Another may be used, with ventilation holes for the back. Fix this aluminium sheet to the front of the case.

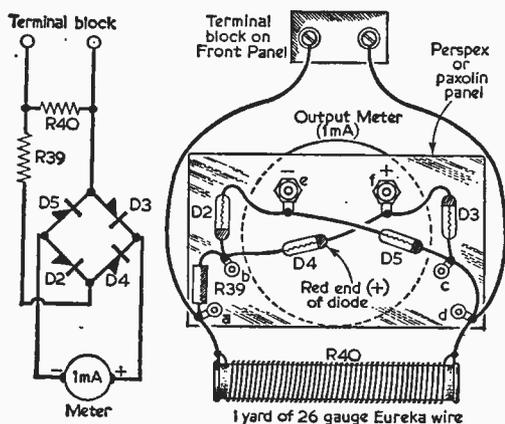
Place the four units inside the cabinet shell, and put a little Vaseline on the tip of each control spindle and switch. Offer the aluminium sheet

COMPONENTS LIST FOR THE DUMMY AERIAL

1yd of coaxial cable; about 1ft of single flex
One coaxial plug (Belling-Lee)
Two crocodile clips
1½ in. x ½ in. diameter coil former (no cores are required)
A few yards of 32s.w.g. enamelled copper wire
Three 220pF condensers—mica or ceramic
One resistor—390 Ω ½ W

COMPONENTS LIST FOR THE POWER OUTPUT METER

1mA moving coil meter—the prototype used a meter having a 2½ in scale, but a smaller type would be suitable. The internal resistance is immaterial
Four diodes—'surplus' types are suitable
R39 about 8·2k—see text
R40 Any physically large, high-valued, resistor wound with one yard of 26s.w.g. Eureka wire (see Fig 38)
Two pole terminal block for fixing to the front panel of the completed generator
Nuts and bolts, soldering tags, Perspex etc.



Figs. 37 and 38.—The circuit and construction of the power output meter.

carefully to the cabinet shell. The longest control knob will leave a Vaseline mark on the panel. This point is then drilled to take the spindle or switch concerned. The sheet is then offered up again with *that spindle* hole only cut. Another mark will then appear; this is then drilled out. The remaining holes are drilled in the same manner. A round file will be necessary and the actual switch holes must be sufficiently large so that the threaded portion of the switch may project right through the panel to receive a nut on the outside. This connects the panel (electrically) with the four chassis.

Remove the drilled panel.

Screening

All of the inside of the cabinet is now screened with aluminium foil as is used for cooking purposes and obtainable from household stores. A few drawing pins will hold it in position. Bend it over so that when the panel is fixed, it will clamp the aluminium screen in place. Likewise the back will also clamp it and make the screen continuous.

The back may be of hardboard covered with aluminium foil, but be careful that it does not touch the terminal strips on each unit. Aluminium sheet (18s.w.g.) will also be suitable, and in either case ventilation holes will be necessary—four or five lin. holes along the bottom *and* top. For good screening, these will have to be covered with wire gauze as is obtainable, for petrol filters, from a garage.

Marking the Panel

The units are placed in position and extra nuts are then put on to hold the units in place. The assembly is tested.

The panel now has to be marked in some way. First roughen the surface of the panel with sandpaper and then give it a coat of cellulose or lacquer. When the paint is dry, mark the panel. The following methods may be used:—

1. white paper, paste and Indian ink. Cover each piece with Sellotape.

2. white ink and cover the lettering with clear spirit varnish (*not* cellulose varnish) afterwards.
3. transfers obtainable from most radio shops.

Control knobs of any type may be used, but the diagrams show types which are very suitable. The following Bulgín types are suggested:

Main R.F. Frequency, 1/K403

Main A.F. Frequency, 2/K402 (this has to be modified as explained later).

R.F. Output Control, 4/K400

A.F. Output Control, 4/K400.

All other controls use types 38.

It must be stressed that large diameter knobs are essential for the two frequency controls.

The Power Output Meter

It will be very useful to have a power output meter in the completed generator so that receivers may be tested and aligned without disturbing other members of the household. Various possibilities will occur to readers, but in this design a 3Ω dummy load is used with a meter fitted with a bridge rectifier working as a voltmeter. The meter is arranged to read directly up to 10V, but it could be calibrated easily in Watts. "Wattage" is equal to the voltage multiplied by itself (i.e. squared) and divided by 3. For instance, if the dummy load were connected to a receiver instead of its 3Ω loudspeaker and the reading was 6V, the wattage or power would be $(6 \times 6)/3 = 12W$. Readers will note that the meter is not very sensitive, but this is purely in the interests of safety and R39 (Figs. 37 and 38) may be reduced. However, if the amplifier under test overloads the meter it will burn out, or the rectifiers will be ruined or both. The meter will not give a true power reading on a 15Ω loudspeaker, but will still be useful as an indicator when trimming receivers.

Making the Output Meter Assembly

Refer to Fig. 38. A small sheet of Perspex or paxolin is drilled to take the meter terminals (e and f). Four other holes are also drilled at a, b, c and d. Soldering tags are bolted at each of these four holes and the panel is then fixed to the meter as shown.

Take the output leads from a and d, make up the resistor R40 and solder it to a and d—if R40 burns out or is open-circuited in any way the meter will be ruined. Solder R39 ($\frac{1}{4}W$) from a to b.

Now, wire in the diodes: hold the wires in cold pliers when soldering so that the diodes are not heated. The red or positive ends must be wired as shown in Fig. 38. Tag e has a diode wired to c and one to b, and f has one wired to c and one to b. Check that tag e has two uncoloured ends connected to it and that f has two red ends connected to it. If the meter used has the positive terminal on the right, reverse all the diodes and check the wiring against Fig. 37. Fix the unit to the front panel and wire the leads from d and a through a grommet to the terminal block.

Next month the calibration of the R.F. and A.F. oscillators will be explained in detail so that the frequencies corresponding to various settings of the dial are known quite accurately.

(To be continued)

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 Hire purchase deposit £2.7.0 and 8 monthly... £1. 5. 6

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 Total kit as above. CASH £29. 0.0
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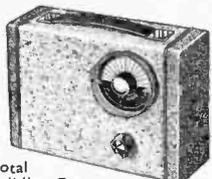
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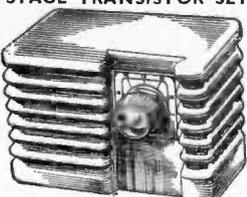
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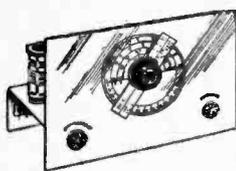
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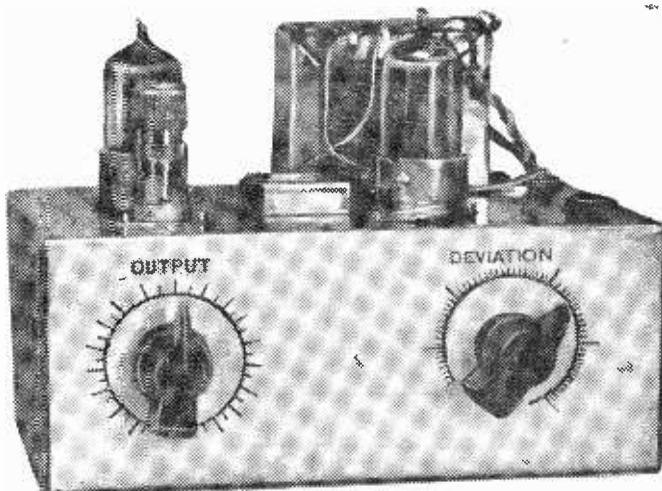
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I.F. AMPLIFIER AND
DISCRIMINATOR
CHARACTERISTICS



A WOBBLULATOR

for F.M. I.F. Alignment

(Continued from page 430 of the September issue)

As mentioned last month, the centre frequency of 10.7Mc/s is set by moving a dust core in the former of L1. This method, of setting the centre frequency ensures that the ratio of inductance-to-capacity in the oscillator tuned circuit is as high as possible—the only capacity in the oscillator tuned circuit consists of “strays” and

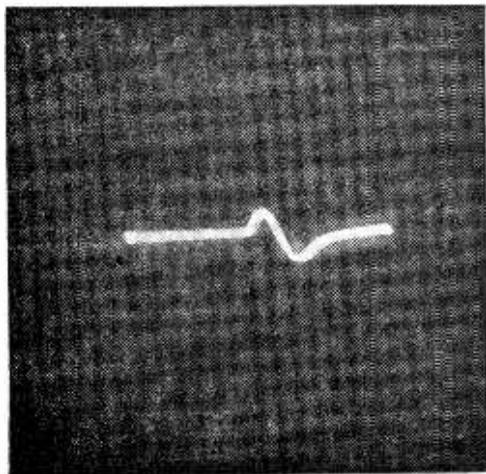
that contributed by the valve. (It is advantageous to have a high L/C ratio so that the variations in the capacity of the diode have maximum effect on the frequency of operation of the oscillator.)

The second half of V2 functions as another cathode-follower and enables the output of the unit to be controlled by the variable control VR2.

Layout of the unit is not unduly critical, apart from that of the R.F. oscillator section where the aim should be to keep leads as short as possible—the layout shown in Fig. 3 should be followed carefully.

Using the Unit

In use, the unit and the F.M. set to be aligned are switched on and allowed to reach their final operating temperature. A lead is connected from the X-deflecting plate of the oscilloscope to the input terminal provided. This lead can be of coaxial cable but at the oscilloscope end the outer sheath may be left unconnected: the earth connection will be made by way of the cable from the receiver to the oscilloscope. Coaxial cable will also be needed for the lead from the unit to the receiver. At the receiver end, the braiding of the coaxial cable is twisted together and soldered to a crocodile clip which is used to connect it to the chassis of the set under test. Another length of coaxial cable is needed for the input lead to the oscilloscope. One end is terminated with plugs suitable for the oscilloscope and the other end with a crocodile clip to form the chassis connection from the outer of the coaxial cable. At the receiver end, the inner of the cable is terminated



Discriminator response of an F.M. receiver.

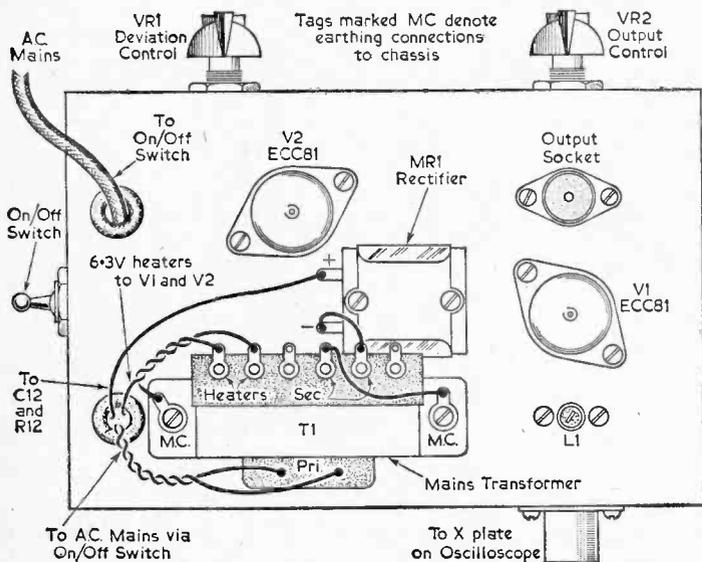


Fig. 4.—The above chassis view, showing the layout of components.

with a resistor of about 10k, to act as a stopper to prevent instability. This resistor should be soldered as near to the point where the inner leaves the outer as possible. In use the other end of the resistor is soldered to the desired point in the receiver. This lead is connected between earth on the scope and the Y-amplifier input—if one of these connections has to be long, be sure that it is the "earthy" one and keep as much of the inner wire screened as possible.

For the alignment, the oscillator valve of the set is removed or the oscillator is prevented from working—methods of doing this can be determined from the circuit diagram. The output from the unit is fed into the grid of the mixer—a stopper resistor may be required to avoid instability and may have a value of 33 to 470Ω, the exact value being determined by experiment.

During alignment, it is an advantage if the output of the set can be heard, and this should be fed to an audio amplifier. The oscilloscope is switched to a low sweep speed—10 to 20 per second—and the voltage at the grid of the limiter valve, of the receiver, fed to the Y-amplifier of the oscilloscope. The deviation control on the unit is set to maximum and a hum may be heard from the loudspeaker. If not, the setting of the dust core in L1 is altered until a hum is heard and a trace is obtained on the screen. When some evidence of the response is seen, the various controls on the unit and the oscilloscope may be altered for best results, bearing in mind that the input to the set should be kept as low as possible.

Marker Signals

The shape of the trace may be altered to give the optimum characteristic by altering the cores on the I.F. transformers. If another signal generator is available, a signal may be injected in parallel with the main signal and this will give a

marker on the trace which will enable the I.F. to be set correctly. Note that when once the unit has been set to give a centre output frequency of 10.7Mc/s, the open, underside, of the chassis may be fitted with a metal bottom plate to prevent unwanted radiation from the oscillator circuit—the core of the oscillator coil will still be accessible from the top of the chassis. If further screening is thought, or found, necessary, then the unit as a whole may be fitted into a perforated metal case. Radiation from the oscillator should then take place only from the centre conductor of the output coaxial socket.

If the trace is observed to pulsate at a definite frequency, the effect is probably due to hum voltages from the mains and it may be removed by using the sync control on the oscilloscope to lock the sweep to a submultiple of the internal (mains) sync frequency—say 12½c/s, which is also a good sweep frequency.

When the I.F. amplifier has been aligned satisfactorily, the output to the oscilloscope may be taken from the audio take-off point, but before the capacitor which feeds the audio to the output socket of the tuner or the A.F. stages of the receiver. This is essential if a distorted trace is not to result.

The deviation control should be set so that the response curve occupies the centre of the trace; in this way, the non-linearity of the frequency-sweep circuit may be ignored for most purposes.

Of necessity, an outline only has been given of the method of using the unit and for a more detailed explanation, the reader is referred to the article by R. Brown in the September 1960 issue of *Practical Television* entitled "Using the Wobulator", and to "Semi-conductor Diodes as Variable Capacitors" by R. B. Archer in the November 1960 issue of *Practical Television*. ■

Another Pye Installation

THE Airfield at Bahrein in the Persian Gulf has been fitted with a Pye Instrument Landing System.

This internationally specified approach aid incorporates a directional localiser and is now being used at over 100 airfields throughout the world. It gives accurate and safe guidance to airliners in their approach to landing, especially under conditions of low visibility.

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● STEREO COMPONENTS

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Denco Chassis for the Mullard circuits. All drilled with printed front panel. Three Valve Stereo Amplifier Chassis. 22/-. Seven watt Stereo Amplifier Chassis. 24/6. Stereo Pre-Amplifier Chassis. 24/6. Set of switches for Pre-Amp. 34/8. Pick-up cartridges. B.S.R. TC95 £2.4.11. Ronette DC294. £3.19.6. Both are turn-overs for Stereo. L.P. and 78 records.
List of all components for Mullard Stereo Designs is available.

● GRAMPHONE EQUIPMENT

ALL LATEST MODELS ALL POST FREE	Cash Price	Deposit	Mthly/Pmts.	Hire Purchase
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GARRARD RC210 (GC8 PU)	£10. 6.0	£2. 2.0	12 of 15/4	
B.S.R. UA14 (TC8 PU)	£7.15.0	£1.11.0	12 of 12/-	
B.S.R. UA14 Monarch (TC85 Stereo/EP78)	£8.18.0	£1.16.0	12 of 13/6	
SINGLE RECORD PLAYERS				
GARRARD TA (GC8 PU)	£8.10.0	£1.14.0	12 of 13/-	
B.S.R. TU9 (TC8 PU)	£4.10.0	£1. 5.0	3 of £15.0	
E.M.I. (Acos Stereo/Mono PU)	£6.15.0	£1. 7.0	12 of 10.8	
TRANSCRIPTION UNITS				
GARRARD 4HF (GC8 PU)	£18.18.0	£3.16.0	12 of £1.7.8	
PHILLIPS AG2009	£10.10.0	£2. 2.0	12 of 15/8	

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

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● LOUDSPEAKERS

GOODMANS: Axiom 110 10in. £5.2.0; Axiom 112 10in. £8.14.0; Axiote 8in. £6.15.0; Axiom 300 12in. £11.5.9; Axiom 400 12in. £16.1.0; Audiom 60 Bass, 12in. £9.12.9; Trebas Tweeter £6.4.0; CX 500 Cross-over unit £1.18.0.
WHITELEY: HF 1016 10in. £8.0.0; HF 1012 10in. £5.2.0; HF8168in. £6.17.3; F8168in. £6.10.0; T10 Tweeter £4.8.3; T359 Tweeter £1.15.0; CX3000 Cross-over unit £1.11.6; CX1500 Cross-over unit £2.0.6. H.P. Terms available.

● LATEST TEST METERS

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AVO Model 8 with leather carrying case	£27.18.0	£5.12.0	12 of £2. 0.11	
AVO Model 7	£21. 0.0	£4. 0.0	12 of £1.10.11	
AVO Model 7 with leather carrying case	£24.18.0	£5. 0.0	12 of £1.16. 6	
AVO Multiminor	£29.10.0	£1.18.0	12 of 14.4	
AVO Multiminor with leather carrying case	£11. 8.0	£2. 5.0	12 of 17/-	
TAYLOR Model 127A	£10. 0.0	£2. 0.0	12 of 15/-	
CABY A-10	£4.17.6	£1. 7.6	3 of £1. 6. 8	
CABY B20	£6.10.0	£2. 0.0	3 of £1.13. 4	

Full details of any of the above supplied free on request.

● 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, GEC 912 Plus. Fully detailed list on any of these sent upon request.
Instruction Manuals: All Mullard Audio Circuits in "Circuits or Audio Amplifiers", 9/5. GEC 912, 4/6. All post free.

● "BRAND FIVE" RECORDING TAPE

Standard Play: 600ft (5") 16/-; 1,200ft (7") 25/-.
Long Play: 900ft (5"), 18/6; 1200ft (5"), 23/6; 1800ft (7"), 35/-.
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● TAPE DECKS

	Cash Price	Deposit	Mthly/Pmts.	Hire Purchase
All carriage free				
B.S.R. TD2	£8.19.6	£1.18.6	12 of 13/7	
COLLARO STUDIO	£12.18.6	£2.12.6	12 of 19/-	
ARMSTRONG FAB03 Tape Pre-amp	£16.16.0	£3. 8.0	12 of £1.4.7	

All components in stock for the Mullard Tape "C" Pre-Amplifier Kit. Fully detailed list available.

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PARTRIDGE: P9667, 52/6, post 2/-; P4014, 99/6, post free; P4131, 80/-, post free; P3551A, 99/-, post free; P5202, P5203, 95/-, post free.
PARMEKO: P2641, 28/-, post 1/6.

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● MULLARD CATHODE RAY TUBES

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

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ELSTONE: MT/MU, 45/-, post 2/9; MT/3M, 35/-, post 2/6.
PARMEKO: P2631, 32/3, post 2/3.

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Long Play: 210ft. (3"), 9/-; 900ft (5"), 28/-; 1200ft (5"), 35/-; 1800ft (7") 50/-.
Double Play: 300ft (3"), 14/-; 600ft (4"), 25/-; 1200ft (5"), 42/-; 1800ft (5"), 58/-; 2,400ft (7"), 77/6. All post free.

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Uses 6 Mullard matched transistors including two OC81 in push-pull, plus 1 diode, 1-watt undistorted output. I.F. 470 Kc/s. Med/long wave. Ferrite rod aerial, high flux 7 x 4in. Speaker. Walnut veneer finish Cabinet, 18 x 18½ x 5in. Circuit diagram and full data supplied.

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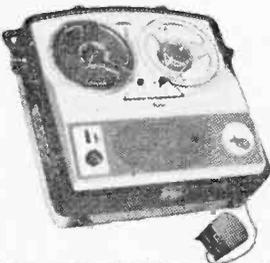
12 v. operation. Transistor output. Medium and long waves. CAN BE BUILT COMPLETE WITH SPEAKER FOR £9.19.6, post 3/6. Booklet 2/6 (refunded if you order).

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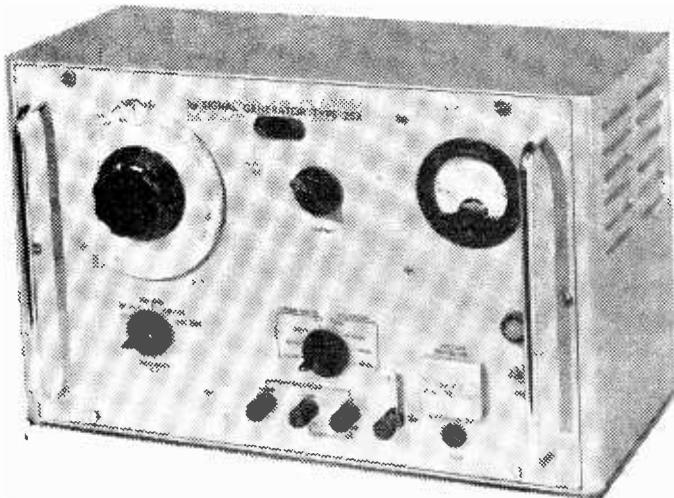
L.F. SIGNAL GENERATOR

THE Airmec L.F. signal generator, type 252 is designed for the generation of pure and highly stable sinewave signals in the frequency ranges 30c/s to 300kc/s.

The oscillator consists of a Wien Bridge network with thermistor feedback amplitude control, followed by a negative feedback push-pull amplifier; tuning is by means of a variable capacitor and covers the frequency band in four decade ranges.

A screened and balanced output transformer provides either balanced or unbalanced outputs at an impedance of 600 Ω ; circuit design is such that the output impedance remains constant regardless of frequency and attenuator setting, and the output is monitored by a crystal diode voltmeter.

An output control provides smooth variation of output over the meter range; in conjunction with a step attenuator, it enables the output level to be



An L.F. signal generator made by Airmec Limited.

Right.—The EM87 valve; a new voltage level indicator for tape recorders. It is manufactured by Mullard Ltd.

set to any value from less than 1mV to 15V open circuit.

This signal generator is made by Airmec Limited, High Wycombe, Buckinghamshire.

VOLTAGE LEVEL INDICATOR

THE EM87 is a new Mullard voltage indicator valve primarily intended for use as a recording level indicator in tape recorders.

In many recorders the A.F. voltage appearing at the anode of the recording output stage is about 10V, which is insufficient to close the display of currently available level indicators. The EM87 has a grid base of only 10V and in addition it has a high sensitivity in the initial region of the control characteristic ($V_g = 0V$).

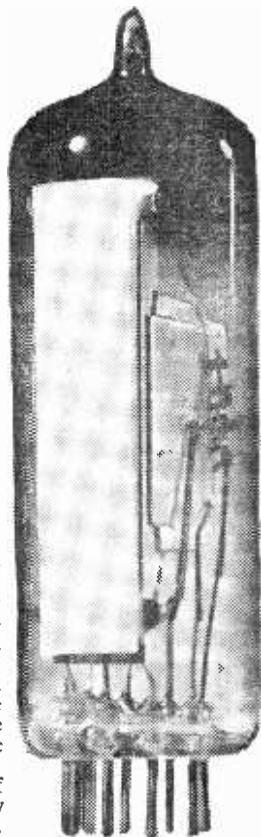
Over modulation of the tape is immediately apparent, since A.F. signals greater than 10V in amplitude cause the luminous areas to overlap, giving a brighter centre portion to the display.

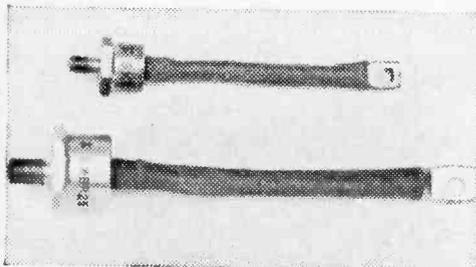
Maximum ratings are: anode voltage 300V, anode dissipation 600mW, cathode current 5mA, and deflection electrode voltage 300V. The heater draws a current of 300mA at 6.3V.

The EM87 has the same overall physical dimensions (72.8mm overall length, 22.2mm diameter) and the same pin connections as the EM84. The fluorescent strip is 32.6mm in length by 4mm in width. This new valve is made by Mullard Limited, Mullard House, Torrington Place, London, W.C.1.

2-BAND POCKET PORTABLE RECEIVER

THE Ajax TR-220 de luxe portable receiver is now available in this country for £13 17s. 6d., which includes the battery (9V), leather carrying case and magnetic earpiece for personal listening. This receiver covers the long and





The two new silicon diodes now available from Westinghouse Brake and Signal Co. Ltd.

medium wavebands and supplies a 2½ in. loudspeaker with a 200mW output. The TR-220 is housed in a plastic case, measuring only 4½ in. x 2½ in. x 1½ in.

Six transistors are employed in the circuit which uses a ferrite rod aerial. The Ajax TR-220 is distributed in this country by *Acme Electric Co. (Finsbury) Ltd.*, 63 Great Eastern Street, London, E.C.2.

DOMESTIC RADIOS AT EARLS COURT

A COMPLETE range of radio, television, record players, etc. were on show at the Pam stand at the Radio Show this year.

The model 222 portable transistor radio, which was shown, incorporates a printed circuit chassis and is presented in a cabinet of cream and royal blue. It costs 13 guineas.

Model TB.77 is a fully transistorised table radio. It covers four wavebands and operates from an internal aerial. It is finished in a high gloss walnut veneer and costs 28 guineas.

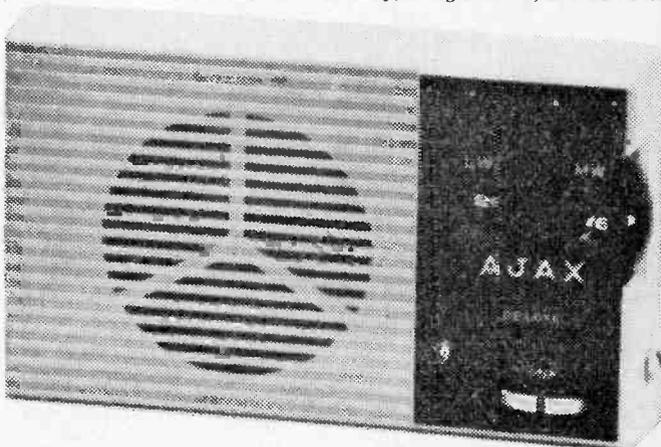
Two car radios were shown this year; one of them, the model CR.40, is operated from a 12V D.C. supply. It covers two wavebands and will fit any make of car. It costs 18½ guineas.

A stereophonic radiogram (model RG.630) was also on show. This instrument includes a two waveband VHF receiver and a four-speed autochange for monaural or stereo record reproduction. The loudspeakers are fixed into swing doors for better stereo reproduction. This model, which costs 69 guineas, and the three other radios mentioned are all made by *Pam Radio and Television Ltd.*, 295 Regent Street, London, W.1.

MEDIUM POWER SILICON DIODES

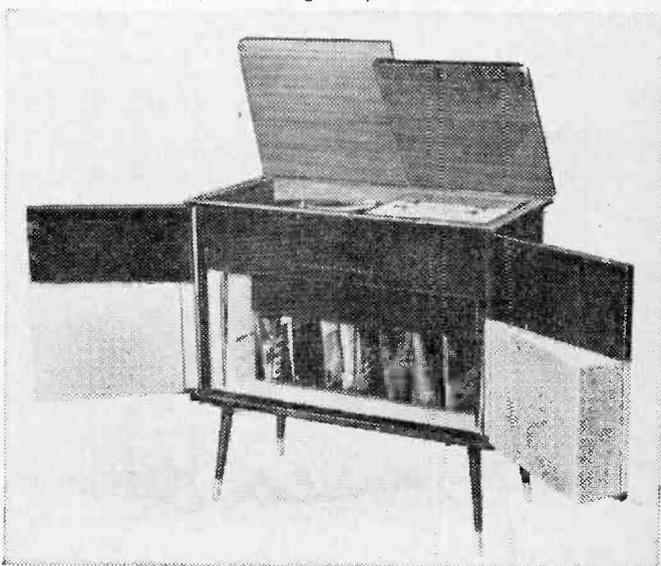
TWO new ranges of high voltage, medium power silicon diodes are available from Westinghouse Brake and Signal Co. Ltd. The SxBR8 is rated at 18A and may be used at case temperatures up to 140°C, whilst the SxBR25 is rated at 30A and may be used at similar case temperatures. Both ranges are available in voltage ratings of 100 to 1500V peak, with ten intermediate voltages.

The diodes are hermetically sealed, using glass/metal seals and the latest press seal techniques. Mounting is by means of a stud base which also serves as the anode connection. The cathode connection is made by means of an insulated flexible lead through the glass/metal seal. These diodes are manufactured by *Westinghouse Brake and Signal Co. Ltd.*, 82 York Way, King's Cross, London N.1.



(Above).—The Ajax portable receiver, distributed in this country by Acme Electric Co. (Finsbury) Ltd.

(Below).—A stereophonic radiogram by Pam Radio and Television Ltd.



PORTABLE RADIO OR CAR RADIO

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(6 Ediswan Transistors plus 2 Diodes)

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350 Mw XC101's push-pull output Transistors. Powerful magnet 3in. high grade speaker. Miniature push-pull transformers. This is a top performing receiver. Nearly 30 stations listed in one evening including Luxembourg loud and clear. A pleasure to listen to. **FERRITE ROD AERIAL.** All parts sold separately, including pale blue gleaming poly-

styrene case with duo-diffusion grilles in red. Uses 9 volt battery. Sockets for car aerial.

Total building cost **£6.19.6** Size 6½ x 4½ x 1½in.

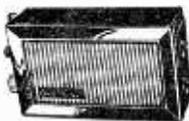
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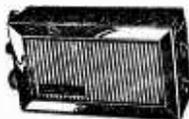


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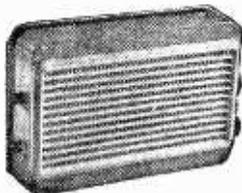
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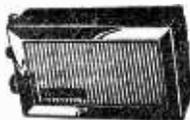


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| 0—250 V. | |
| 0—1000 V. | |
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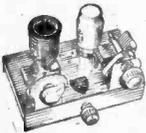
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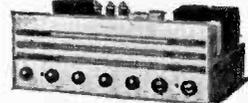
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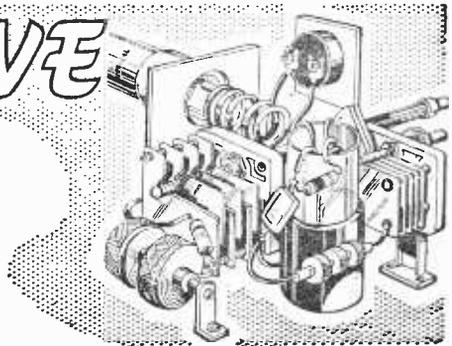
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SHORT-WAVE SECTION



MAKING A TUNED DOUBLET

An All-band Aerial for Receiving and Transmitting

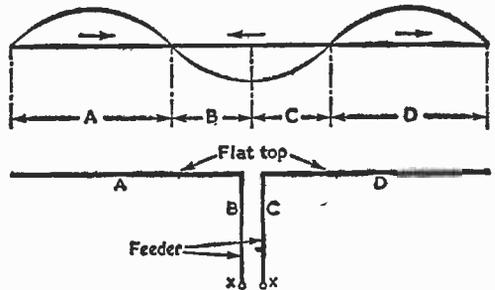
By "Amateur Transmitter"

JHE use of a tuned doublet for transmitting purposes is quite well known, but the efficiency of this type of aerial for receiving can be overlooked by short-wave listeners who have not yet used anything except the simplest form of aerial. An ordinary dipole with coaxial feeder has the advantage that no tuning is required, but such aerials only work effectively on frequencies which give a fairly accurate impedance match to the feeder. As a result they are usually cut for one band only, and not used on other bands. The tuned doublet requires a tuned circuit (which may be regarded as part of the system) but this is

B and C, each one quarter-wave, make up the centre half-wave, and D is the final half-wave. If the portions B and C are brought down to make a feeder, parts A and D will form the flat top, and this part of the aerial will consist of two half-waves in phase.

When a station is received, the current flow in parts B and C will be in opposite directions, and thus provide a signal at the tuning coil connected

Fig. 1.—A doublet with two half-waves in phase.

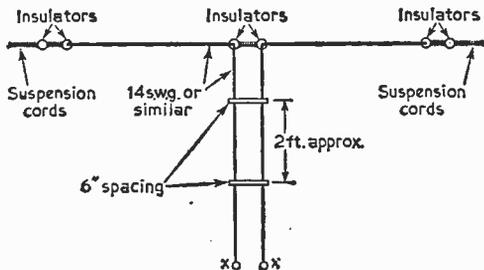


easily arranged, and the aerial will work effectively over a very wide range of frequencies. A single aerial may thus be used for harmonically related bands, such as 80m, 40m, 20m etc., and also for 49m, 31m, 25m, 19m and other short-wave broadcast bands. On all bands it is tuned to resonance, a coil and condenser being used for this purpose. This tuning can compensate for modifications in the length of the aerial top, or feeder, and so exact dimensions are not necessary for these items.

to the feeder ends X. A static impulse will, however, flow down B and C in the same direction, and thus cancel out at the tuning coil. This explains the reduction in static interference. Cancellation will not in fact be complete, owing to lack of exact balance, but will usually be worthwhile.

When the aerial is used on other frequencies, A and D will not be a half-wave each, but this has little effect on results. In the same way, the

Fig. 2.—Practical construction of the aerial.



feeders B and C will no longer be a quarter-wave each, but this is unimportant because of the tuned circuit attached to the ends X. It is thus possible to use a wide range of lengths, for both the flat top, and the feeder. For the same reasons, one aerial will work over a wide range of frequencies.

Doublet Construction

Fig. 2 shows how the doublet, with tuned feeder, can be made. Single 14s.w.g. copper wire is often used for aerials, but other types of aerial wire can be employed instead. Hard-drawn wire is satisfactory for the flat top, but soft-drawn or stranded wire will be more convenient for the feeder.

A balanced aerial can also give a considerable reduction in static and similar noise, compared with a single wire or end-fed or end-coupled aerial. This reduction in noise is somewhat similar to that achieved with a coaxial feeder.

Fig. 1 shows the approximate current distribution in an aerial wire which is three half-waves long at operating frequency. Section A is one half-wave;

Each end of the flat top has one or two aerial insulators, and suspension cords or wires are taken to suitable supports. The leads forming the feeder are roughly 6in. apart, and spacers can be obtained for this purpose, or made. The spacers will be needed at about 2ft intervals: A pair of insulators in the flat top enables each feeder to be attached as shown. At this point the feeders should either be parallel, or fan out slightly. They should not run closer, as might be so if only one short insulator were used. If the top and feeders are not made with single lengths of uncut wire, joints should be soldered to avoid noises in the receiver.

The top of the aerial should be as high and in the clear as possible, and especially removed from local interference. Long distance results may easily be achieved with an indoor aerial, but when space is available outside, indoor erection is pointless, and reduces signal strength.

If the top of the aerial slopes, because the supports are of unequal height, this will modify the directional pattern. The latter also depends on the aerial length. However, the position of the aerial usually depends on the available supports, so there is little point in being too concerned about directional effects.

Top and Feeder Lengths

When the system is operating as in Fig. 1, and the feeder is just short of an odd number of quarter-waves, parallel tuning is needed at the ends X. When the feeder is just short of an even number of quarter-waves, series tuning is necessary. For all-band operation, it is thus necessary that the tuner condenser can be placed either in parallel, or series with, the coil.

It will be noted that parallel tuning can be used with anything up to one quarter-wave; that is, with very short feeders. Approximate quarter-wave lengths for 160m, 80m, 40m and 20m are 132ft, 66ft, 33ft and 16ft. Some typical top and feeder lengths, with the tuning to be expected, are given in Table I

TABLE I			
Top	Feeder	Frequency	Tuning
66ft	66ft	7 and 21 Mc/s	Series
		3.5, 14 and 28 Mc/s	Parallel
106ft	82ft	3.5, 7 and 14 Mc/s	Parallel
67ft	42ft	3.5 Mc/s	Series
		7 and 28 Mc/s	Parallel
134ft	70ft	3.5, 7, 14 and 28 Mc/s	Parallel

The top is the total overall length. Except when the aerial is very high, or a long way from the receiver or transmitter, the feeder will often be shorter than the examples.

A suitable aerial for reception can be an aerial with a 66ft top (A and D each 33ft) and a feeder of any length. The type of open feeder described may, if desired, be replaced by 300Ω twin flat ribbon. This is slightly less efficient than the 600Ω open-wire line, but the losses are not particularly great if the feeder from flat top to receiver is not too long.

If it is desired to find out the particular top and feeder lengths for special bands, this can be found

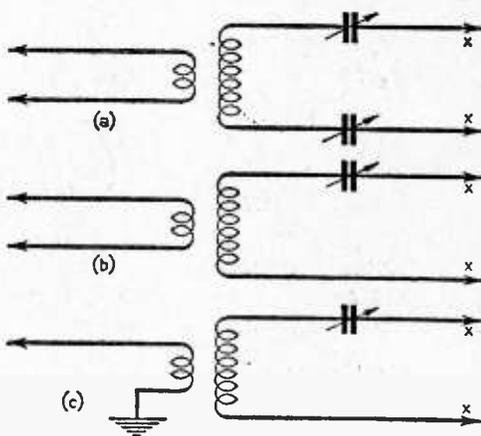


Fig. 3.—Series tuning of the feeder.

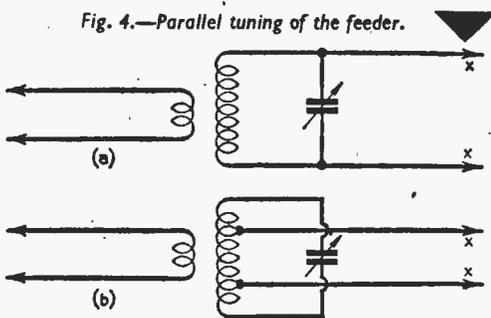


Fig. 4.—Parallel tuning of the feeder.

directly in feet, for a half-wave, from:—

$$\frac{468}{\text{frequency in Mc/s}}$$

It will have been seen that the tuning varies from band to band. When the system of tuning for a band has been found, it should be noted down, so that it can be returned to at once, when necessary.

Feeder Tuning

Circuits for this purpose are shown in Fig. 3. At "a" one variable condenser has been included in each feeder. In practice, one condenser is sufficient, if near the coil, and this can be included as at "b". In both "a" and "b" a coupling loop is taken to the dipole input of the receiver. When the receiver has no dipole input, but only a single aerial terminal, the coupling loop is connected to aerial terminal and earth, as at "c".

For parallel tuning, the condenser is placed across the coil, as shown at "a" in Fig. 4. Either of the receiver coupling methods shown in Fig. 3 may be used.

When the aerial is used for transmitting, it may be necessary to tap the feeders in an equal number of turns from each end, as at "b" in Fig. 4, to secure proper loading. In some cases where the impedance is improved by this, tapping in the feeders can also give improved reception.

(Continued on page 533)

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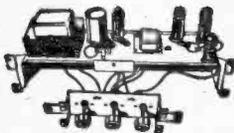


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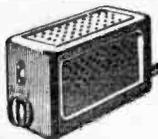
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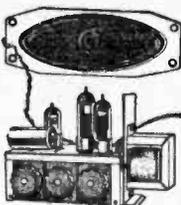


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(Continued from page 530)

With parallel tuning, the effect of taking an earth connection to a centre-tap on the coil can be tried, as this can further reduce static interference.

A suitable tuning coil is shown in Fig. 5. If this is wound with 20s.w.g. or similar wire on a ceramic former, it will do for both receiving and transmitting purposes. When the aerial is to be used for receiving only, the ribbed former is still convenient, as clips can easily be attached to the coil turns. There is, however, no need that the coil be of the dimensions given, provided it has a number of turns which allow it to be tuned to resonance on the bands required. Tinned copper wire will allow easy tapping, and tags or leads can be soldered on when the tapping points are found. Adjoining turns must not be shorted.

The loop consists of 2 or 3 turns of well insulated wire wound round the centre of the coil. The number of turns has to be a compromise for all bands, and more turns may well be used if the higher frequency bands are not of much interest.

For receiving purposes, almost any air-spaced tuning condenser will be satisfactory. A value of about 200pF will generally be convenient. Smaller condensers may be used, but it will be necessary

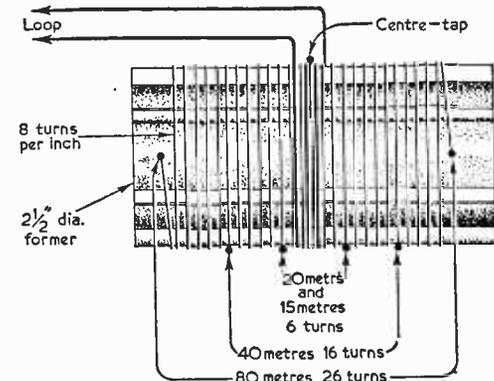


Fig. 5.—Details of the tuning coil for the feeder.

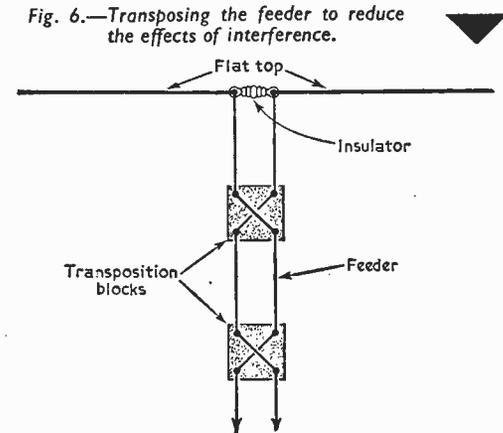


Fig. 6.—Transposing the feeder to reduce the effects of interference.

to move tappings on the coil more frequently. A receiver type condenser will be suitable. For transmitting, a condenser with wide spacing may be required, except for low power.

If the feeder is taken to terminals equipped with short lengths of flex, and clips, this will allow easy adjustment. The condenser may also have flexible leads and clips, so that it can be placed in series or parallel with the coil, as required, and to permit changing the number of turns.

Tuning Method

If the receiver has a signal strength meter, the tuning condenser is simply rotated to obtain best signal strength on the required band. The correct tuning point should show an improvement of several times in signal strength, but is not very critical as the circuit tunes flatly. If the condenser cannot be adjusted to give a definite peak in results, the number of turns in circuit may need adjusting. If results improve with the condenser fully open, too many turns are in use. On the other hand, if results are improved when the condenser is fully closed, more turns are required in circuit.

Once tapping points, method of tuning, and tuning condenser settings have been noted, they can be returned to easily.

When the receiver has no tuning meter or indicator, weak transmissions should be tuned in, and the aerial tuner adjusted for best results. Settings should then be noted, for future reference.

For transmitting purposes, the aerial can be tuned up roughly on the receiver, by noting the signal strength meter. The loop can be coupled by a short length of coaxial cable to the π -output of a transmitter, the coaxial sheath and one end of the loop being earthed as at "C" in Fig. 3. Meters may be included in one or both feeders, to show feeder current. Current will be fairly large for series tuning (low impedance), and fairly small with parallel tuning (high impedance).

Transposed Line

When the aerial is used for receiving, the line may be transposed, as in Fig. 6, as a further aid to reducing interference. For reception in such circumstances, there is no need for the spacers to be so long, and the feeder leads can thus be closer together. The wires cross at each transposition block. The blocks may be cut from perspex or other insulating materials. To avoid contact between the leads where they cross, one lead can be each side of the block.

Local interference is less likely to cause trouble with a transposed feeder, because the interference strength will be more nearly equal in each wire, and will thus cancel out better at the ends of the feeder. The aerial may be used untuned by taking its feeders directly to a receiver dipole input, or by omitting the tuning condenser, so that the coil merely acts as a coupler.

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Short-wave Listeners' Log

MOST Dx reception of amateur stations is usually on the 20m and 15m bands, these bands being from 14.00Mc/s to 14.35Mc/s and 21.00Mc/s to 21.45Mc/s respectively. Circumstances may make it difficult for some S.W. listeners to erect an extremely efficient or high aerial. Fortunately, however, a half-wave aerial for either the 20m or 15m band does not have to be particularly long. The actual lengths are 33ft for the 20m band, and 22ft for the 15m band. In very many cases it should be possible to erect an aerial of this length.

Tests with a simple dipole of this kind show that it can give excellent reception. Good results are obtainable even if the aerial is not at all high. A few listening periods with such an aerial, at a height of about 12ft to 15ft above ground, enabled many Amateur stations to be logged.

For a centre-fed dipole, the length of aerial wire mentioned is cut in half, a few inches extra being allowed to attach to the insulators. A low impedance feeder of any length is then taken from the centre. This feeder may be of 75Ω twin

flat lead, or of twin twisted flex, or may be a co-axial cable. In the case of the 15m aerial, for example, the aerial itself would have two sections, each 11ft long, with the feeder descending from the centre, so that the whole resembles the letter "T".

Confined Spaces

If space is limited, it is in order to turn down vertically a few feet at each end, to accommodate the correct length. It is interesting to note, in this, that the HP9 station (Panama) was heard on two days at very good strength. As a transmitter was available, this station was called, and when describing his equipment he said that space was so limited that he was using a 20m indoor dipole, with both ends turned down in the way explained.

It is not necessary that the dipole top should be horizontal, so supports of unequal height may be used. The slope does, however, change the directive pattern. This is not usually of much importance, unless the best possible reception is wanted from one area, or unless experiments are to be made with directivity. ■

How to Keep Radio Equipment Cool

(Continued from page 503)

it may be difficult to make the heating-up period take less than an hour, and quite often the apparatus may be in use for a shorter time, so it is desirable that it should have a stable performance as independent of temperature changes as possible.

Curve

The heating-up curve is easily plotted if an accurate mercury thermometer is inserted to measure the air temperature inside the case, an inch or two from the top. The thermometer can be inserted through a hole with a rubber grommet for protection. If it is of the total immersion type, the stem can be covered to avoid cooling of the projecting part of the thermometer. The thermometer must of course have a sufficient range, e.g., up to 240°F, to ensure that it will read up to the maximum temperature reached without breaking. Over the first part of the curve, readings can be taken at intervals of five minutes. After half an hour, less frequent readings would suffice. All that is really important, however, is to check that a steady and not excessive temperature is reached in a reasonable time. If 140°F is exceeded, the test should be discontinued before any damage to components can occur, and the ventilation arrangements will require improvement.

This was well-illustrated by a small home-made oscilloscope contained in an aluminium case measuring 8½in. x 7in. x 9in. The case had not been painted black, and this was an additional factor in retaining the heat, as unpainted alumin-

ium will not radiate heat so well. Reliance was placed on convection via 24 small louvres pressed in the sides. These provided apertures only ¼in. wide, and the total area of the openings was only 5sq in. The louvres proved to be ornamental rather than efficient.

65W Dissipation

The oscilloscope contained seven valves and a cathode ray tube, and there was a total dissipation of 65W inside the cabinet. The heating-up curve (A) shows no sign of a steady temperature being reached even after two hours (see Fig. 1 on page 503). It was obvious that worked for long periods under these conditions, the oscilloscope would soon break down, and the only way to avoid this was to provide larger apertures. Experiments however were first made in separating the top and bottom of the case from the sides by ¼in. spacers, but such a small gap had a quite negligible effect, and the original louvres had to be replaced by rectangular openings measuring 1½in. x 1¼in., covered with expanded aluminium material of the type used for loudspeaker grilles—which reduced the effective area of the openings by about 50% (see the illustration on page 503).

Six of these openings were made in each side, and two at the back of the case, giving a total estimated area of aperture of roughly 25sq in., or about five times the previous amount.

The ventilation now proved to be reasonably effective (Curve B) and the final working temperature did not quite reach 130°F in a room temperature of 60°F. ■



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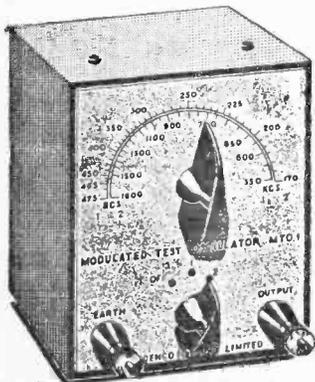
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Club News

REPORTS OF CURRENT ACTIVITIES

AMATEUR RADIO MOBILE SOCIETY

Hon. Sec.: G3FPK, 79 Murchison Road, London E.10.

At the Longleat Mobile Rally many A.R.M.S. members were present to enjoy the many attractions of this event, held in this local beauty spot. There were five notable rallies during August; the Derby Mobile Rally and Hamfest, held as part of this Society's Golden Jubilee Year celebrations; the Hetton Show and Mobile Rally, which included show jumping in its attractions; the Stamford Rally Fest; the Luton Mobile Rally and the South Manchester and Stockport Amateur Radio Rally, the main event of which, was a navigation and mobile contest.

Future Events:

September 10th—National Mobile Rally.

September 17th—Lincoln Hamfest and Mobile Rally.

BLACKWOOD AMATEUR RADIO SOCIETY

Hon. Sec.: P. M. Fulton, GW3MMU, 36 Sunnybank Road, Blackwood, Monmouthshire, Wales.

For the past three months members have been helping to transform an old cottage into new headquarters for the society. Both inside and outside the cottage have been subjected to alterations and it is hoped that it will be officially opened quite soon. New members are still wanted urgently.

BURSLAM AMATEUR RADIO CLUB

Hon. Sec.: W. Luscott, 36 Rothsay Avenue, Sneyd Green, Hanley, Stoke-on-Trent.

Meetings are held at Burslem Town Hall on the third Wednesday of each month and start at 7.30 p.m. A Morse class is included at each meeting.

A series of lectures and demonstrations have been planned for the winter months—commencing in September. New members are always welcome.

DUDLEY AMATEUR RADIO CLUB

Hon. Sec.: D. H. W. Pratt, G3MHS, 23 Kent Street, Upper Gornal, Dudley, Worcestershire.

This newly formed club held its first general meeting on the 18th August. Until a headquarters can be found all meetings will be held at 23 Kent Street, Upper Gornal, Dudley, Worcestershire.

GUILDFORD AND DISTRICT RADIO SOCIETY

Hon. Sec.: J. R. Barker, 35 Banders Rise, Merrow, Guildford, Surrey.

The July meeting was designed to give younger members experience in setting up a portable station. On the 28th July, Ken Orford gave a talk on "Propagation—Past, Present and Future."

Future Event:

October 1st—A Car Treasure Hunt.

LEEDS AMATEUR RADIO SOCIETY

Hon. Sec.: D. Dinsdale, 69 Spen Lane, Leeds 16, Yorkshire.

This society will soon begin a new programme of activities, starting on September 20th with an informal exhibition of members' equipment.

Future Events:

September 27th—Demonstration of 4m equipment.

October 4th—Spares Sale.

MITCHAM AND DISTRICT RADIO SOCIETY

Hon. Sec.: M. Pharaoh, G3LCH 1 Madeira Road, Mitcham.

G3NFA/P was at Hindhead during the 2-metre field day and made quite a good score. The number of contacts made by G3NFA (assisted by G3LSP and G3LCH) was 195 with several contacts with stations other than English. G3LAR, who was operating from the Norfolk area during the contest, made about 72 contacts.

NEWBURY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: G. T. Allen, G3JTK, 83 Huntsmoor Road, Tadley, Hampshire.

At the August meeting, members brought/items of test equipment etc., to the headquarters and explained their various uses.

Future Events:

September 29th—"On understanding radio"; a short talk by G3LLK.

October 1st—The Southern Regional Meeting.

October 27th—Constructional Competition.

NORTHERN HEIGHTS AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogdan, Halifax, Yorkshire.

Recent activities have included a talk by G2SU on his "50 Years of Radio," and a visit to a local television factory. The subject of the meeting on September 6th was Radio Astronomy.

Future Event:

September 20th—An informal meeting.

PETERBOROUGH RADIO SOCIETY

Hon. Sec.: D. Byrne, G3KPO, Jersey House, Eye, Peterborough.

A barbecue has been planned for September 10th at the Society's riverside site at Alwalton. Autumn and winter meetings will be held at the Peterborough Technical College at 7.15 p.m. on the first Friday in each month.

Future Events:

October 6th—"Aerials".

November 3rd—The Annual General Meeting.

READING AMATEUR RADIO CLUB

Hon. Sec.: R. G. Nash, G3EJA, 9 Holybrook Road, Reading, Berkshire.

From August 25th, Friday evenings have been taken up by slow Morse classes given by G5XB or G6WO, starting at 7 o'clock. On August 25th D. Keable discussed the method of aligning superhet receivers.

Future Event:

September 30th—G5TP will demonstrate and discuss the G2DAF SSB transmitter.

SLADE RADIO SOCIETY

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

On August 25th members visited an electrical control manufacturer's factory for a demonstration of automatic control equipment.

Thursday evening meetings include informal discussions, operation of the club transmitter, and instruction in Morse. Slow Morse transmissions are radiated each Monday evening from G3AYJ on 1.9Mc/s from 8 p.m. to 8.30 p.m.

Future Events:

September 8th—Exhibition of members' equipment.

September 16th—Annual dinner.

September 22nd—A lecture called "How far can radio waves be heard?"

WANSTEAD, WOODFORD AND DISTRICT RADIO CLUB

Hon. Sec.: J. R. Seaman, 67 Beattysville Gardens, Ilford, Essex.

During August the club held its field-day. Members operated on 1.8, 14 and 144Mc/s for most of the time.

Members for the junior section is continuing to grow.

COURSES OF INSTRUCTION

BATTERSEA MEN'S INSTITUTE

Latchmere Road, Lavender Hill, Battersea, London S.W.11.

The radio course, in preparation for the City and Guilds Examination in May 1962, has been extended, and now takes place on Monday and Thursday evenings, from 7.30 to 9.30 p.m., at the Spencer Park School, Trinity Road, London S.W.11. The course covers the entire syllabus of the examination and no prior knowledge of radio is required.

There are also two classes—beginners and advanced—in general radio and television at the Battersea Institute.

Classes commence on the 25th September and the schools will be open for enrolment during the week 18th to 22nd September. Fees: one class £1 0s. 0d., two classes £1 2s. 6d.

ILFORD LITERARY INSTITUTE

High School for Girls, Cranbrook Road, Ilford.

Classes for the eight month RAE course will be held on Wednesdays at 7.15 to 9.15 p.m. Classes of the six month Morse course will be held on Mondays from 7.30 to 9.30 p.m.

Fees for those living in the Essex County Council area are: 30s. for the RAE course and 20s. for the Morse course.

Classes commence September 18th. Those interested should apply to, Mr. C. H. L. Edwards, 28 Morgan Crescent, Theydon Bois, Epping, Essex.

STREATHAM AND TOOTING L.C.C. INSTITUTE

J. Caley, 6 Farnan Road, Streatham, London S.W.16.

Radio and television classes at Durraven, Penwortham and Hillcroft schools will be held on Mondays, Wednesdays and Fridays at 7.30 p.m.

For the benefit of new students instruction will be given on basic principles assisted by practical demonstration and test equipment.

Classes commence on September 25th.

WEMBLEY EVENING INSTITUTE

99 Watford Road, Wembley, Middlesex.

Radio Amateur's Examination classes will be held on Mondays at the Wembley Evening Institute, Copland School, High Road, Wembley. Morse practice will be held from 7 to 8 p.m., and radio theory from 8 to 10 p.m. Persons wishing to enrol may do so from 11th September to 14th September, and classes start the following week.

Letters to the Editor

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

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

YOUNG ENTHUSIASTS

SIR,—I made my first radio (a crystal set) when I was 12½. Since then I have made a transistor set and a few one-valve receivers (some of the designs were taken from issues of P.W. dated 1930 to 1940). I also made a morse oscillator.

I would be pleased if anyone could supply information about a station received on Sunday, 23rd July, at 10.15 p.m. The transmissions were repeated alternately in English and Italian and as far as I could make out were as follows: "This is Rome Radio, Maritime Radio Telephone Service. This is a test transmission for receiver . . ." I could not ascertain the wavelength but it was on the lower part of the S.W. band. — **D. HILL** (Edinburgh).

LIGHT PROGRAMME AMPLIFIER

SIR,—I read with interest Mr. Joyce's letter in the August issue, concerning reception of the Light Programme on his amplifier without a tuner. This occurrence is common among audio amplifiers and is caused by rectification taking place in one of the circuits. Most probably the input wires to the amplifier form a tuned circuit which resonates at one of the Light Programme frequencies. Rectification in the amplifier is often caused by a grid bias resistor "going high", making the valve operate nearly at cut off, thereby producing anode bend rectification.

Mr. Joyce could, with advantage, connect a tuning capacitor across the input terminals to his amplifier, thus enabling another station to be tuned in. — **S. H. NANKIVELL** (New Mills, Derbyshire).

PHONETIC ALPHABET

SIR,—I thoroughly agree with Mr. P. A. Ellis's plea (August) for an official phonetic alphabet. The situation is made worse by those gentlemen who use geographical names in their transmissions, so that one is likely to hear something like: "Glasgow, Fife, Cardiff".

The I.C.A.O. alphabet is not ideal, but if everyone used this there would at least be some uniformity. — **F. DORMAN BYERS** (London, S.E.19).

LIGHT PROGRAMME VOLUME

SIR,—I have noticed, while listening to the Light Programme on medium waves, that a marked increase in volume occurred immediately the television receiver was switched on in the next room. The two aerial systems are quite independent and

the mains supply for one is from a power point, while the other is connected to the lighting circuit.

The receiver is a conventional four-valve TRF. I wonder if any reader can explain this occurrence? — **T. F. WALL** (Preston).

CORRESPONDENTS WANTED

SIR,—I would very much like to correspond with anyone interested in Short-wave reception, transmitting and radio construction in general. I will answer all letters received. — **R. CHIPPERFIELD** (4 Bayston Road, Stoke Newington, London N.16).

TRANSISTOR RESULTS

SIR,—I have built a number of transistor receivers over the past year or so and have been very intrigued with the ferrite type of aerials. So far I have not seen a single article, either in your magazine or in any other, which gives characteristics or calculations for such an aerial. In examining some commercial sets I find that there are single rods, flat slabs and, in some cases, two or three rods bound together. I have experimented with these types of aerial and cannot find any basis upon which I could draw up my own data. Using the same winding, placed upon slabs and doubled-up rods, the performance is distinctly different, and I was unable to find the optimum arrangement; single wires, Litz, silk and cotton covered, of all gauges seeming to give quite unrelated results. I do not own any reliable test apparatus, so I could not make quantitative measurements, but I should like to see some definite data, preferably issued by one of the better firms, on this important aspect of the modern portable receiver. — **G. HUTCHEON** (Derby).

TRANSMITTER LICENCES

SIR,—Recent correspondence in your magazine about the possibility of a novice licence, brings to mind my own wish of a couple of years ago, when I was all for such a scheme. Now, however, after passing the RAE and the GPO morse test, I realise that such a licence would do more harm than good, particularly as it is evidently those people who do not have the necessary knowledge to pass the examinations who want low-power transmitter licences.

I do not consider it so difficult to learn what is required for the RAE and to learn the C.W. code. — **C. R. MORLEY** (Reigate).

CORRECTION

Will readers please note that the advertisement for Messrs. Stern Radio Ltd., in both issues dated August and September, for the "special offer of tape" should have read 1,200ft on 7in. Spool 21/-, 1,800ft on 7in. Spool 32/6, and not vice-versa as printed.

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(Continued on next page)

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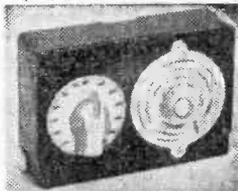
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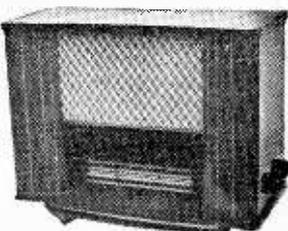
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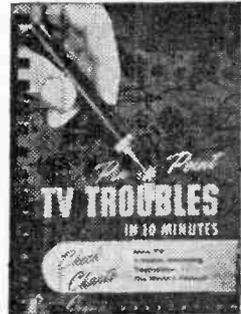
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Practical Wireless

BLUEPRINT

SERVICE

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 the PW Monophonic Electronic Organ.

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

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to

PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2.

SPECIAL NOTE

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.

Title	Number	Price
CRYSTAL SETS		
Junior Crystal Set	PW94	2/-
Dual-wave Crystal Diode	PW95	2/6

STRAIGHT SETS		
Battery Operated		
Modern One-valver	PW96	2/6
All-dry Three	PW97	3/6
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The PW Pocket Superhet	—	5/-

SUPERHETS		
Mains Operated		
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A.C. Coronet-4	PW100	4/-
A.C./D.C. Coronet	PW101	4/-

MISCELLANEOUS		
The PW 3-speed Autogram	—	8/-
The PW Monophonic Electronic Organ	—	8/-
<i>(No constructional details are available with this blueprint)</i>		
The PW Roadfarer	—	5/-
<i>(No constructional details are available with this blueprint)</i>		

TELEVISION		
The PT band III converter	—	1/6

Title	Number	Price
A.C. Fury Four	PW20	2/6
Experimenter's Short Wave	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Band-Spread Three (Battery)	PW68	2/6
Crystal Receiver	PW71	2/-
Signet Two (Battery)	PW76	2/6
Simple S.W. One-valver	PW88	2/6
Pyramid One-valver	PW93	2/6

BBC Special One-valver	AW387	2/6
Short-Wave Two	AW429	2/6
Short-Wave World Beater	AW436	3/6

Standard Four Valve S.W.	WM383	3/6
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Listener's 5-Watt Amplifier	WM392	3/6

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PRACTICAL WIRELESS, OCTOBER, 1961

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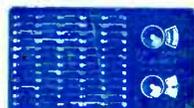
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