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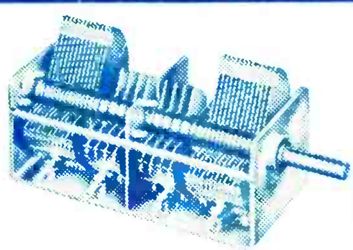

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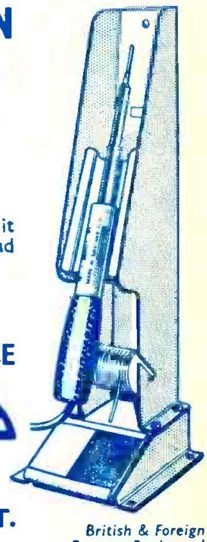

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6C10	12/6
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6E5GT	10/-
6F1	15/6
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6F7	15/-
6F12	4/9
6F13	17/6
6F14	17/6
6F15	14/9
6F17	12/-
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6J6	7/6
6J7GT	9/6
6K7G	3/-
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6L6	7/6
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6LD3	9/6
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6N7GT	7/6
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6SH7	6/6
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6SN7GT	5/6
6U4GT	11/6
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7D8	15/-
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7Q7	11/6
7R7	12/-
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12K8GT	12/6
12Q7GT	8/6
12SC7	8/-
12SG7	8/6
12SH7	4/-
12SJ7	4/-
12SK7	8/-
12SQ7	11/6
12SN7	17/6
12Z3	15/-
13D3	12/6
14H7	12/6
14R7	12/6
14S7	21/-
15A2	17/6
15D2	23/9
19AQ5	10/6
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20D1	12/6
20D2	23/-
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20L1	26/6
20P1	26/-
20P3	23/-
20P5	22/6
25L6GT	9/6
25Y5	10/-
25Z4	9/6
25Z5	9/6
25Z6	10/6
27SU	17/6
30	13/6
30C1	12/6
30F5	11/6
30FL1	10/6
30L1	11/6
30P4	22/-
30P12	11/6
30P16	10/-
30PL1	15/-
32	13/6
35A5	15/-
35L6GT	10/6
35W4	8/-
35Z4	7/6
35Z5	9/6
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41STH	23/6
42	15/-
43	15/-
50C5	15/-
50CD6G	32/-
50L6GT	9/-
61BT	17/6
61SPT	17/6
62BT	17/6
75	12/6
77	12/6
78	12/6
80	10/-
85A2	12/6
150B2	12/6
150B3	15/-
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304	7/6
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ACTH1	34/9
ACVP1	17/6
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AC2/PEN	21/-
AC2 PENDD	21/-
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B152	8/6
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CL33	18/6
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D42	12/6
D63	3/6
D77	5/6
D152	6/-
DAC32	10/6
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DF33	10/6
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DH77	8/3
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DK91	9/-
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DL92	8/6
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EC90	9/6
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ECC34	15/-
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ECC40	21/-
ECC81	8/-
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ECC83	9/6
ECC84	9/6
ECC85	9/6
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EF22	17/6
EF36	7/6
EF37	8/6
EF37A	8/6
EF39	4/-
EF40	15/-
EF41	9/3
EF42	10/6
EF50(E)	3/6
EF50(A)	4/-
EF80	6/-
EF85	6/6
EF86	11/-
EF89	10/-
EF91	4/9
EF92	5/-
EF93	7/6
EF95	15/-
EL31	12/6
EL32	5/-
EL33	12/6
EL35	12/6
EL37	18/6
EL38	23/9
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EL42	10/-
EL81	14/9
EL84	7/-
EL85	10/6
EL90	8/6
EL91	5/-
EM80	10/-
EM81	10/-
EY51	8/6
EY81	10/6
EY84	10/6
EY86	9/6
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EZ35	7/-
EZ40	7/6
EZ41	7/6
EZ80	7/6
EZ81	7/6
EZ90	7/6
FC2	21/-
FC13	17/6
FC13C	21/-
FW4,500	10/-
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GZ30	10/6
GZ32	11/6
GZ34	13/6
H30	5/6
H63	9/6
HBC90	9/6
HL92	6/6
HL133DD	10/-
HL23	12/6
H23DD	10/6
HL41	12/6
HL41DD	13/6
HL42DD	13/6
HY90	8/-
IW4/350	10/-
IW4/500	10/-
KBC32	9/6
KF35	8/6
KL32	10/6
KLL32	11/6
KL35	9/6
KT2	7/6
KT32	10/-
KT33C	10/-
KT36	28/6
KT41	22/6
KT44	13/6
KT55	22/6
KT61	18/6
KT63	8/6
KT66	17/6
KT71	9/-
KT74	12/6
KT76	12/6
KT101	25/-
KTW63	7/6
KTZ41	8/-
KTZ63	10/-
L63	4/9
LN309	15/-
LZ319	12/6
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MS4B	17/6
MSP4	17/6
MU14	9/-
MX40	17/6
N18	8/-
N19	8/-
N37	18/6
N78	17/6
N108	18/-
N142	9/6
N147	18/6
N150	10/-
N153	11/6
N309	11/6
N329	10/-
N727	7/6
N729	8/-
P2	10/-
PCC84	9/6
PCF80	10/6
PCF82	9/6
PCL82	11/6
PCL83	12/6
PENA4	17/6
PENB4	17/6
PEN4DD	22/6
PL33	18/6
PL38	23/9
PL81	14/9
PL82	8/-
PL83	10/6
PL820	21/-
PM2A	12/6
PM2HL	14/-
PM22A	13/6
PM24M	21/6
PM202	16/-
PY31	16/6
PY32	15/6
PY80	8/-
PY81	7/6
PY82	8/-
PY83	8/6
PZ30	18/6
QP25	14/6
QP230	17/6
QP21	12/6
R10	21/-
R19	19/6
SD6	8/6
SP4	14/6
SP41	3/6
SP42	12/6
SP61	3/6
T41	22/6
TDD4	17/6
TDD13C	17/6
TH41	23/9
TP22	17/6
TP25	17/6
U14	15/9
U16	10/-
U18/20	10/-
U22	10/-
U24	29/6
U25	14/-
U26	12/6
U31	9/6
U33	21/-
U35	21/-
U37	25/-
U45	21/-
U47	21/-
U50	8/6
U52	7/-
U76	7/6
U78	7/-
U142	8/-
U145	15/-
U147	7/-
U153	9/6
U191	20/-
U251	17/6
U281	20/-
U282	22/-
U301	22/6
U329	17/6
U339	19/-
U403	11/6
U404	10/-
U801	29/-
U4020	15/6
UABC80	8/-
UAF42	9/6
UB41	9/-
UBC41	9/6
UBF80	9/6
UBF89	8/6
UCC85	10/-
UCH42	9/-
UCH81	9/-
UCL82	12/6
UCL83	13/6
UF41	9/-
UF42	11/6
UF80	9/-
UF85	9/-
UF89	8/-
UL41	9/-
UL44	24/6
UL46	21/-
UL84	9/6
UU6	20/11
UU7	15/-
UU8	26/-
UY21	15/6
UY41	7/6
UY85	7/6
VP2B	17/6
VP4B	17/6
W17	8/6
W76	7/-
W77	5/-
W81	6/-
W142	9/-
W719	7/6
W727	7/6
X18	11/6
X61M	21/-
X65	23/9
X66	21/-
X78	21/-
X79	21/-
Y61	10/6
Y63	9/-
Z21	12/6
Z63	7/6
Z66	19/6
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For use with the MULLARD 2-valve pre-amplifier with which undistorted power output of up to 10 watts is obtained. We supply **SPECIFIED COMPONENTS AND NEW MULLARD VALVES**, including **PARMEKO MAINS TRANSFORMER** and choice of the latest Ultra-Linear **PARMEKO** or the **PARTRIDGE** Output Transformer.

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Alternatively we supply **ASSEMBLED** and **TESTED**. **£11.10.0**

ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER, £1.6.0 EXTRA

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

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- Input for Crystal Pick-ups, and variable reluctance magnetic types.
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- Sensitive Microphone Channel.
- Wide range **BASS** and **TREBLE** Controls.

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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.

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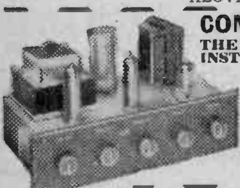
COMPLETE MULLARD "3-3"



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

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

(plus 6/6 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.**

THE "ADD-A-DECK"

Incorporating GARRARD "MAGAZINE" TAPE and the MATCHED MODEL HF/G2P PRE-AMPLIFIER

Supplied on ONE CHASSIS (as illustrated) READY FOR USE **18 Gns.**

(Carr. & Ins. 10/- extra).

Price includes Garrard Magazine and a 4in. Spool Double Play Tape

H.P. Deposit £3.16.0, and 12 months of £1.7.8.

Provides complete tape recording facilities and designed to operate through the pick-up sockets of the standard type of RADIO RECEIVER, or an AMPLIFIER, from which really first class reproduction is obtained. It consists of a Twin Track Deck connected to the Pre-amplifier and operates at 3¾in/sec. speed providing up to 1 hr. 10 mins. playing time.

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

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B.S.R. MONARCH UA8 4-speed mixer Autochanger with Crystal Pick-up.	£6.19.6
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(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 £1.16.8.

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

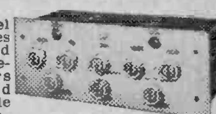
(f) ONE "5-10" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER both ASSEMBLED and TESTED **£25.0.0**
H.P. Terms: Deposit £5, 12 months of £1.16.8.

(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

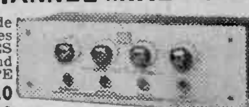


This model incorporates two Mullard 2-valve Pre-Amplifiers combined into a Single unit enabling it to be used for both **STEREOPHONIC** or **MONAURAL** operation. It is designed primarily to operate with our range of **MULLARD MAIN AMPLIFIERS** but will also operate equally well with any make of Amplifiers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

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

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 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 I.L. one microphone input matched for moving coil or Ribbon Mike. £1.17.0 extra.

Mk.11 "Fidelity" FM TUNING UNIT

An attractively presented Unit incorporating MULLARD PERMEABILITY TUNING HEART and corresponding Mullard valve line up. FOR THE CONSTRUCTOR **£10.10.0** ASSEMBLED **£14.5.0**

A SPECIAL CASH OFFER!!

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

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

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

WE ALSO SUPPLY SEPARATELY—

(a) The 2-stage (plus Rectifier) **AMPLIFIER** £4.2.6

(b) The **PORTABLE CARRYING CASE** £3.17.6

(c) 6½in. **P.M. SPEAKER 18/9** Carriage and Insurance 4/- extra.

BENTLEY ACOUSTIC CORPORATION LTD.

38 CHALCOT ROAD, CHALK FARM, LONDON, N.W.I. Telephone: PRIMROSE 9090

EXPRESS POSTAL SERVICE! ALL ORDERS DESPATCHED SAME DAY AS RECEIVED. TELEPHONE AND TELEGRAM ORDERS FOR CASH ON DELIVERY SERVICE ACCEPTED UP TO 3.30 P.M.

OA2	17/6	6F11	17/3	10F1	26/6	35Z3	10/6	DK91	6/6	EF54	5/-	KLL32	24/7	PM24M	21/3	U4020	16/7	XFY12	9/6
OB2	17/6	6F12	4/6	10F9	11/6	35Z4GT	6/-	DK92	9/-	EF73	10/6	KT2	5/-	PM84	17/3	UABC80	9/-	XFY34	17/6
OZ4	5/-	6F13	11/6	10LD3	8/6	35Z5GT	9/-	DK96	8/6	EF80	6/-	KT33C	10/-	PX4	10/6	UAF42	9/6	XH(1.5)	6/6
1A5	6/-	6F15	15/3	10LD11		43	10/-	DL33	9/6	EF85	6/-	KT36	29/10	PY31	16/7	UB41	12/-	XSG(1.5)	6/6
1A7GT	12/-	6F23	10/6		15/11	50C5	10/-	DL66	17/6	EF86	10/6	KT41	23/3	PY32	12/6	UBC41	8/6	Y63	7/6
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1D6	10/6	6F33	7/6	10P14	19/3		36/6	DL72	15/-	EF91	4/6	KT61	12/6	PY81	8/6	UBF80	9/-	Z66	17/6
1G6	17/6	6G6	6/6	12A6	5/-	50L6GT	9/6	DL92	7/-	EF92	4/6	KT63	7/-	PY82	7/-	UBF89	9/6	Z77	4/6
1H5GT	10/6	6H6	3/-	12AC6	15/3	53KU	19/11	DL94	7/6	EF97	13/3	KT66	15/-	PY83	8/6	UBL21	23/3	Z719	6/-
1L4	3/6	6J5	5/-	12AD6	17/3	77	8/-	DL96	8/6	EF98	13/3	KT88	24/-	PY88	13/3	UCC84	14/7		
1LD5	5/-	6J6	5/6	12AE6	13/11	78	6/6	DM70	7/6	EF183	18/7	KTW61	6/6	PZ30	19/11	UCC85	9/-	*Transistors*	
1LN5	5/-	6J7G	6/-	12AH7	8/-	80	9/-	E80F	20/-	EF184	18/7	KTW62	7/6	QP21	7/-	UCF80	16/7	*and diodes*	
1N5GT	10/6	6J7GT	10/6	12AH8	12/6	83	15/-	E83F	37/6	EK32	8/6	KTW63	6/6	QP25	14/6	UCH21	23/3	CG1C	7/6
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1S4	9/-	6K7GT	6/-	12AT7	6/-	150B2	15/-	EA76	9/6	EL33	12/6	KTZ63	7/6		10/6	UCH81	9/6	CG6E	7/6
1S5	6/-	6K8GT	10/6	12AU6	23/3	161	10/6	EABC80	9/-	EL34	15/-	L63	6/-	R12	9/-	UCL82	11/6	CG7E	7/6
1T4	3/6	6K8G	6/6	12AU7	6/6	185BT	33/2	EAC91	4/6	EL38	26/6	LN152	9/-	R18	14/-	UCL83	19/3	CG10E	7/6
1U5	6/-	6K25	19/11	12AV6	12/8	304	10/6	EAF42	9/-	EL41	9/-	MHL4	7/6	R19	19/11	UF41	9/-	CG12E	7/6
2P	26/6	6L1	23/3	12AX7	7/6	305	10/6	EB34	2/6	EL42	10/6	MHLD6	12/6	RG1/240A		UF42	12/6	GD3, 4, 5,	
2X2	4/6	6L6G	8/-	12BA6	8/-	807	7/6	EB41	8/6	EL81	16/7	ML4	8/6		45/-	UF80	10/6	6, 8	4/-
3A4	6/-	6L6M	9/6	12BE6	9/-	956	3/-	EB91	4/-	EL83	19/11	MS4B	23/3	RK34	7/6	UF85	9/-	OA70	4/-
3A5	10/6	6L7GT	7/6	12BH7	21/3	1821	16/7	EBC3	23/3	EL84	7/6	MU12/14	8/-	S130	22/6	UF86	17/11	OA73	4/-
3B7	12/6	6L1B	13/-	12E1	30/-	4033L	12/6	EBC33	5/-	EL85	13/11	N37	23/3	SP4(7)	14/6	UF89	9/-	OA79	4/-
3D6	5/-	6L19	23/3	12J5GT	4/6	5763	12/6	EBC41	8/6	EL86	17/3	N78	19/11	SP41	3/6	UL41	9/-	OA81	4/-
3Q4	7/6	6LD3	8/6	12J7GT	9/6	7193	5/-	EBC81	8/-	EL91	5/-	N108	23/3	SP42	12/6	UL44	26/6	OA86	6/-
3Q5GT	9/6	6LD20	15/11	12K5	17/11	7475	7/6	EBF80	9/-	EL95	10/6	N308	20/7	SP61	3/6	UL46	14/6	OA91	5/-
3S4	7/-	6N7	8/-	12K7GT	5/6	9002	5/6	EBF83	13/11	EL820	18/7	N339	15/-	SU25	26/6	UL84	8/6	OA95	5/-
3V4	7/6	6P25	12/6	12K8GT	14/-	AC/PEN		EBF89	9/6	EL822	25/-	P61	3/6	SU61	9/-	UM4	17/3	OA210	25/-
5R4GY	17/6	6P26	19/11	12Q7GT	5/-	5-pin	23/3	EBL21	23/3	EM34	9/6	PABC80		T41	9/-	UN34	17/3	OA211	40/-
5U4G	6/6	6P28	26/6	12SA7	8/6	7-pin	15/-	EBL31	23/3	EM71	23/3		13/11	TDD4	12/6	UM80	15/3	OC16	54/-
5V4G	10/-	6Q7G	6/6	12SC7	8/6	AC2PEN/		EC52	5/6	EM80	9/-	PCC84	8/-	TH41	26/6	URIC	18/7	OC19	54/-
5Y3	6/6	6Q7GT	11/-	12SG7	7/-	DD	12/6	EC54	6/-	EM81	9/-	PCC85	9/6	TH233	33/2	UU6	19/11	OC23	87/-
5Z3	12/6	6R7G	10/-	12SH7	8/6	AC6PEN	7/6	EC70	12/6	EM84	10/6	PCC88	18/-	TH2321	20/-	UU7	16/7	OC26	44/-
5Z4G	9/-	6SA7GT	8/6	12SJ7	8/6	AC/TP	33/2	EC92	13/3	EM85	17/3	PCC89	11/6	TP22	15/-	UU8	26/6	OC28	25/-
6A7	10/6	6SC7	7/6	12SK7	6/-	ATP4	5/-	ECC32	5/6	EN31	37/-	PCF80	8/-	TP25	15/-	UU9	7/6	OC35	48/-
6A8	9/-	6SG7GT	8/-	12SQ7	11/6	AZ1	18/7	ECC33	8/6	EY51	9/-	PCF82	10/6	TP2620	33/2	UY1N	18/7	OC44	26/-
6AC7	4/-	6SH7GT	8/-	12SR7	8/6	AZ31	10/-	ECC34	24/7	EY83	16/7	PCF84	16/7	TY86F	13/3	UY21	13/11	OC45	23/-
6AG5	5/6	6SJ7GT	8/-	12Y4	10/6	AZ41	13/11	ECC35	8/6	EY84	14/-	PCF86	15/-	U12/14	8/6	UY41	7/6	OC65	22/6
6AK5	8/-	6SK7GT	6/-	14S7	27/10	B36	15/-	ECC40	23/3	EY86	9/-	PCL82	10/-	U16	10/-	UY85	7/-	OC66	25/-
6AL5	4/-	6SL7GT	6/6	19AQ5	10/6	BL63	7/6	ECC81	6/-	EZ35	6/-	PCL83	10/6	U18/20	8/6	VMP4G	15/-	OC70	14/-
6AM6	4/6	6SN7GT	5/6	19H1	10/-	C1	12/6	ECC82	6/6	EZ40	7/-	PCL84	12/6	U19	36/-	VMS4B	15/-	OC71	14/-
6AQ5	7/6	6SQ7GT	9/-	20D1	15/3	C1C	12/6	ECC83	7/6	EZ41	7/-	PCL85	16/7	U22	8/-	VP2	12/6	OC72	17/-
6AT6	7/-	6SS7GT	8/-	20F2	26/6	CBL1	26/6	ECC84	9/-	EZ80	7/-	PENA4	23/3	U24	29/10	VP4	15/-	OC73	20/-
6AU6	10/-	6U4GT	12/6	20L1	26/6	CBL31	23/3	ECC85	8/6	EZ81	7/-	PENB4	26/6	U25	17/11	VP2B	14/6	OC75	15/-
6AV6	12/8	6U5G	7/6	20P1	26/6	CCH35	23/3	ECC88	18/-	FC4	15/-	PEN4DD		U26	10/-	VP4B	23/3	OC77	21/-
6B8	5/-	6U7G	8/6	20P3	23/3	CK506	6/6	ECC91	5/6	FW4/500	8/6		26/6	U31	9/6	VP13C	7/-	OC78	17/-
6BA6	7/6	6V6G	7/-	20P4	26/6	CL33	19/3	ECF80	10/6	FW4/800	8/6	PEN25	4/6	U33	26/6	VP23	6/6	OC81	18/-
6BE6	6/-	6V6GTG	8/-	20P5	23/3	CV63	10/6	ECF82	10/6	GU50	27/6	PEN40DD		U35	26/6	VP41	6/-	OC170	35/-
6BG6G	23/3	6X4	5/-	25A6G	10/6	CY1	18/7	ECF86	19/11	GZ30	9/-		25/-	U37	26/6	VR105	8/-	OC200	54/-
6BH6	8/-	6X5GT	6/-	25L6GT	10/-	CY31	16/7	ECH3	26/6	GZ32	10/-	PEN44	26/6	U43	9/-	VR150	7/6	OC203	58/-
6BJ6	6/-	6/30L2	10/-	25Y5G	10/-	D1	3/-	ECH21	23/3	GZ33	19/11	PEN45	19/6	U45	9/-	VT61A	5/-	TJ1	40/-
6BQ7A	15/-	7A7	12/6	25Z4G	9/6	D15	10/6	ECH35	6/6	GZ34	14/-	PEN45DD		U50	6/6	VT501	5/-	TJ2	45/-
6BR7	23/3	7B6	21/3	25Z5	9/6	D63	5/-	ECH42	9/-	GZ37	19/11		26/6	U52	6/6	W76	5/6	TJ3	50/-
6BS7	25/-	7B7	8/6	25Z6G	10/-	D77	4/-	ECH81	9/-	H63	12/6	PEN46	7/6	U54	19/11	W81M	6/-	TP1	40/-
6BW6	8/6	7C5	8/-	27SU	19/11	DAC32	10/6	ECH83	13/11	HABC80		PEN383	23/3	U76	6/-	W107	18/7	TP2	40/-
6BW7	6/-	7C6	8/-	28D7	7/-	DAF91	6/-	ECL80	9/-		13/6	PEN453DD		U78	5/-	W729	19/11	TS1	10/-
6BX6	6/-	7H7	8/-	30C1	8/-	DAF96	8/6	ECL82	10/6	HL2	7/6		33/2	U107	16/7	X24M	24/7	TS2	12/6
6C4	5/-	7R7	12/6	30F5	6/-	DD41	13/11	ECL83	19/3	HL23	15/3	PEN/DD		U191	16/7	X41	15/-	TS3	15/-
6C5	6/6	7S7	9/6	30FL1	10/-	DET25	7/6	EF9	23/3	HL23DD	7/6	4020	33/2	U201	16/7	X61(C)	12/6	TS4	24/-
6C6	6/6	7V7	8/6	30L1	8/-	DF33	10/6	EF22	14/-	HL41DD		PL33	19/3	U251	14/-	X63	9/-	V30/10P	28/6
6C9	13/6	7Y4	7/6	30L15	11/6	DF66	15/-	EF36	4/-		19/3	PL36	12/-	U281	19/11	X65	12/6	XA101	23/-
6C10	9/-	8D2	3/6	30P4	12/-	DF91	3/6	EF37A	8/-	HL42DD		PL38	26/6	U282	22/7	X66	12/6	XA102	26/-
6CD6G	36/6	8D3	4/6	30P12	7/6	DF96	8/6	EF39	5/6		19/3	PL81	10/6	U301	23/3	X76M	14/-	XA103	15/-
6CH6	9/-	9BW6	15/3	30PL1	10/6	DF97	9/-	EF40	15/-	HN309	24/7	PL82	7/6	U329	14/-	X78	23/3	XA104	18/-
6D6	6/6	9D2	4/-	30PL13	12/6	DH63	6/6	EF41	9/-	HVR2	20/-	PL83	9/-	U339	16/7	X79	23/3	XB102	10/-
6E5	12/6	10C1	13/-	35A5	21/3	DH76	5/-	EF42	10/6	HVR2A	6/-	PL84	12/8	U403	16/7	X109	17/3	XB103	14/-
6F1	26/6	10C2	26/6	35L6GT	9/6	DH77	7/-	EF50(A)	7/-	KF35	8/6	PL820	18/7	U404	8/6	XD(1.5)	6/6	XB104	10/-
6F6G	7/-	10D2	12/-	35W4	7/6	DK32	12/-	EF50(E)	5/-	KL35	8/6	PM2B	12/6	U801	29/10	XFG1	18/-	XC101	16/

RADIO BOOKS. MULLARD AMPLIFIER MANUAL 9/6d. MULLARD TRANSISTOR MANUAL 13/6d. BRIMAR VALVE MANUAL 7/-. ALL POST FREE.

VOLUME CONTROLS

All with Long Spindle and Double-pole Switch, 4/6 each.

10 K	25 K	50 K	100 K
¼ mg.	½ mg.	1 meg.	2 meg.

METAL RECTIFIERS *Full List with ratings free for S.A.E.*

DRM1B	13/-	RM-1	5/3	14A86	17/6	14B130	35/-	14RA 1-2-8-3 (FC31)	21/-	18RA 1-1-16-1 (FC116)	6/6
DRM2B	15/6	RM-2	7/6	14A97	25/-	14B261	11/6	16RD 2-2-8-1	12/-	18RA 1-2-8-1	11/-
DRM3B	15/6	RM-3	7/9	14A100	27/-	14RA 1-2-8-2 (FC101)	17/6	16RE 2-1-8-1	8/6	18RD 2-2-8-1 (FC124)	15/-
LW7	21/-	RM-4	14/-	14A124	28/-						
RM-0	7/11	RM-5	19/6	14A163	38/-	16RC 1-1-16-1	8/6	18RA 1-1-8-1	4/6		

JUST OUT. MIDGET SILICON RECTIFIERS. OUTPUT 120 VOLTS AT ½ AMP. TWO IN SERIES GIVE 240 VOLTS AT ½ AMP. NO LARGER THAN A RESISTOR. 10/6 EACH.

ELECTROLYTIC CONDENSERS

Standard Can
- 16 x 8 x 8 mfd., 500 v. 4/-
- 32 x 32 mfd., 450 v. 5/9
- 64 x 120 mfd., 350 v. 8/3

- 60 x 250 mfd., 275 v. 9/6
- 100x400 mfd., 275 v. 12/6
- 100 mfd., 275 v. 3/-
- 200 mfd., 275 v. 4/-
- 100x200 mfd., 275 v. 9/6

Wire-ended tubular
- 8 mfd., 450 v. 1/9
- 16 mfd., 450 v. 2/9
- 32 mfd., 450 v. 3/9

- 8 x 8 mfd., 450 v. 3/-
- 16 x 16 mfd., 450 v. 4/-
- 32 x 32 mfd., 350 v. 4/-
- 8 x 16 mfd., 450 v. 3/9

Post/Packing Charge 6d. per item. Orders over £3 post free. C.O.D. 2/6 extra. Full List, with Terms of Business, 6d. Any parcel insured against damage in transit for only 6d. extra. Shop Hours 8.30-5.30. Early Closing Saturday.

Solderless Transistor 3

Any boy from eight years onwards will easily make this pocket size transistor set. No soldering is involved and in fact the set can be made up virtually without tools. It is nevertheless a workmanlike job which, when completed, will receive Luxemburg and local stations entirely without aerial or earth. Uses two transistors and diode in reflex circuit. Other features include optional medium and long waves and loud speaker.

The parcel contains everything necessary to complete as follows:—
Packet of Solderless terminals.
Packet of Condensers.
Packet of Resistors.
Packet of Transistors.
Connecting wire.
Proper plastic transistor set case with printed scale and tuner.
Hearing aid type headphone.
Plug and socket with on/off switch, and full comprehensive easy to follow instructions.
Price 37/6 plus 2/6 post and insurance.

Miniature Earphones

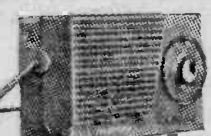
For Transistor Circuits or Deaf Aid. Very lightweight and easy to wear, cord almost invisible, good quality production of music and voice, complete with miniature plug and socket, ready to use—correct impedance OK for red spot and similar transistors. Crystal and Magnetic, 9/-. Post and Insurance 1/-.

Miniature Plug and Socket

as used with the above can be supplied separately. Price 3/6.

Smallest Possible 2-gang

With built in trimmers, polystyrene cased, 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.

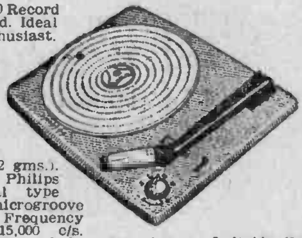


Transistor Set Cabinet

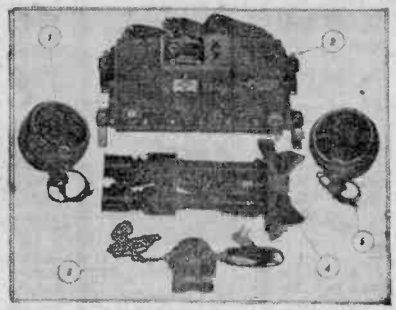
Very modern cream cabinet, size 5½ x 3 x 1½ in. with chrome handle, tuning knob and scale. Price 7/6, plus 1/6 postage and packing.

PHILIPS TRANSCRIPTION UNIT

Philips AG 200 Record Player, 4 speed. Ideal for the enthusiast. Pick-up arm wired for stereo, fine adjustment on all four speeds. Continuously variable pick-up weight (2.12 gms.). Supplied with Philips Hi-Fi crystal type AC3019 for microgroove and 78 r.p.m. Frequency response 30-15,000 c/s.



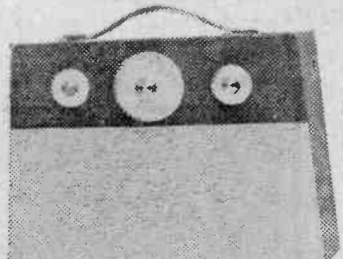
Pick-up lifting and lowering device. Individually balanced heavy turntable. Muting switch. Can be used with any amplifier or radio set. Complete with monaural pick-up £10.10.0. or 2gns. deposit and 20 fortnightly payments of 10/-. Available also with stereo head diamond or sapphire stylus. Prices on request.



TABBY EQUIPMENT COMPLETE

Complete equipment for seeing in the dark, as fitted to Army vehicles for night driving, etc. Complete working equipment comprises: 2 Infra Red Radiators, adjustable binoculars, power pack for 6 or 12 volts, control units and inter-connection cables. Original cost probably around £100. Unused and in perfect order—£6.19.6 or 10/- deposit and 15 fortnightly payments of 10/-.

THE REAL COMPANION
CAR RADIO PORTABLE



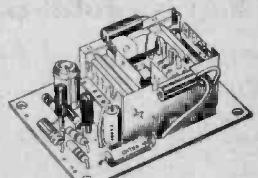
There's nothing to compare with this so don't buy your portable until you have heard this one—call at any branch for demonstration—you will be well satisfied—why not earn spare time cash making them up for your friends?

NOTE THESE FEATURES

★ 400/500 mw. Output Push-Pull. ★ 6 First Grade Transistors. ★ Latest Type Superhet Circuit. ★ Medium and Long Wave. ★ Internal Ferrite aerial litz wound. ★ High "Q" coils. ★ Latest type printed circuit with components plan. ★ Slow motion tuning. ★ Car aerial attachment. ★ Two-tone cabinet. ★ High flux elliptical speaker. ★ Size 11 x 8 x 3in. approximately. ★ Easy to follow instructions. ★ 12 months' guarantee all components. ★ No technical knowledge required. ★ Service available at moderate charges.

ORDER IN CONFIDENCE

Money returned in full if parcel not up to expectation and returned unassembled. Price complete, less battery £9/19/6. Battery 3/6 plus carr. and insurance 7/6.



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, £2.2.6.

Yaxley Switches

1 Pole 3 Way	1/6
1 Pole 5 Way	2/-
1 Pole 8 Way	2/6
1 Pole 12 Way	3/-
2 Pole 2 Way	2/6
2 Pole 4 Way	2/-
2 Pole 6 Way	2/6
2 Pole 12 Way	4/6
3 Pole 3 Way	1/6
3 Pole 6 Way	3/6
4 Pole 4 Way	3/-
6 Position Shorting	2/-
6 Pole 3 Way	2/6
6 Pole 3 Way	3/6
8 Pole 2 Way	2/-
9 Pole 3 Way	2/6
12 Pole 2 Way	2/-

Hi-Fi Snip Infinite Wall Baffle

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

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.

Connecting Wire

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

Miniature Microphone

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

POCKET LOUDSPEAKER TRANSISTOR RADIO

Available Again at 42/6

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 Luxemburg 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".

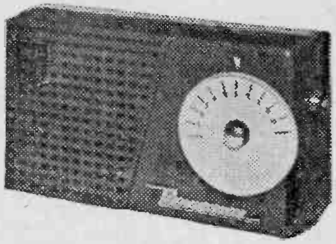
Mr. R. Belt, Newcastle-on-Tyne.
"I have built your Pocket 5 Transistor set. I am very pleased with it".

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

Mr. G. Bamford, Ramsgate.
"I find this set even better then 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 Luxemburg. I must say thank you because not only has the set a very attractive appearance, it also behaves fantastically".

Over 1,000 letters received.



AVAILABLE WITH FIRST GRADE TRANSISTORS AND FOR LONG AND MEDIUM WAVES

Circuit comprises 2 HF transistors reflexed to equal 4 stages. Permanent germanium diode and high gain AF output stage, fitted with miniature speaker, proper tuning condenser, volume control and in case with handle as illustrated (less monogram), completely portable. No **aerial or earth required.** Pocket 4 uses 3 transistors and 1 diode, price **52/6**, plus 2/6 post and insurance. Pocket 5 uses 4 transistors and 1 diode and has feedback control, price **67/6**, plus 2/6 post and insurance.

GOOD RESULTS EVERYWHERE

Nothing can be more disappointing than to find that despite care in making up, your radio just will not work or needs a long high aerial and water pipe earth. We can prove good results in all areas and we guarantee all components for 12 months. Read just a few of the hundreds of testimonials we have received from constructors who have made these sets. Send in confidence. Money refunded if not up to your expectations. Plans free with parts, or separately 1/6. More details S.A.E.

Also again available with S.B. transistors as last year 42/6 and 52/6, plus 2/6 post and packing M.W.

SUB MINIATURE COMPONENTS FOR TRANSISTOR SETS

★ Push-pull o.p.t. and driver 17/9 pair (500 milliwatt). 12/6 pair (300 milliwatt).

★ Push-pull driver with Sep. Secondaries for transformerless output 6/6.

★ 3 IF transformers and oscillator and circuit 23/6.

★ Ferrite aerial with coils for medium and long wave with circuit for pocket sets 7/6. Ditto for standard size set 10/6.

★ Two gang tuning condenser to suit above I.F.S. and rod aerial—11/6, fast and slow; 9/6, ordinary.

★ Printed circuit for above with construction data superhet pocket size 8/6. Standard size 7/6.

★ Smallest possible electrolytics 1/9 each. 1 mfd., 2 mfd., 8 mfd., 10 mfd., 20 mfd., 30 mfd., 50 mfd., 100 mfd., 200 mfd.

★ Smallest ½ watt resistors 5d. each all popular values.

★ Miniature 0.1 mfd., 1/-. 0.05,0.01 8d. values up to 0.005 6d. each.

★ Miniature slide switch 2/6.

★ Transistor holder 1/6 each.

★ Edgewise Volume controls, 2K., 5K., 10K., 20K., all 2/6 each.

★ Ditto, with switches 8/- each.

★ Set of 6 transistors for superhet in original packets guaranteed. Mullard OC44., OC45., OC71 matched pair OC72 £3.10.0 the set.

★ Superhet 6 all first grade includes matched pair 45/- and 35/-.

★ Oscillator and 2 IF—new American High gain 35/-.

★ Red Spots 3/6.

★ White Spots 3/9.

★ Surface barrier (super white spot) 6/6.

★ Surface barriers 15 M/cs 9/6.

★ Diodes 1/-. Sub-miniature 2/6.

★ 3in. Speakers 3 ohm 18/6.

★ 3in. Speakers 80 ohm 18/6.

★ 2½in. Speakers 3 ohm 19/6.

★ Elliptical Speaker, 7" x 4", 3 ohm or 35 ohm 19/6.

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.

P.W. ROADFARER
Come to us for all the parts—or send for list.

TRANSISTORISED STETHOSCOPE

Trace signal right through: Radio, T.V., 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 deaf aid type earphone, 20/-.

AGENTS WANTED to build these sets. Excellent commission. S.A.E. for more details.

Transistors for R.F., F.M., T.V. and U.H.F.

Frequencies quoted are approx. cut-off.

SB 078	15-20 Mc/s	8/6
SB 305	20-30 Mc/s	9/-
SB 231R	40-50 Mc/s	15/-
AMERICAN 2N1727	100-150 Mc/s	15/-
AMERICAN 2N1728	100-150 Mc/s	12/6
AMERICAN T1832	1000-1300 Mc/s	25/-
AMERICAN T1833	1000-1300 Mc/s	25/-

THIS MONTH'S SNIP

Budgerigar Amplifier complete with microphone, long lead and transistor amplifier in bakelite cabinet. Can also be used as baby alarm. Full details S.A.E. Price: £4.15.0. Post and insurance 2/6.

THE POCKET 5 Q.P.P.

This pocket receiver has a remarkable performance comparable in fact with portables being sold at £12 and over. It uses the 3in. moving coil speaker to give really good quality tone and the circuit is reflex R.F. with push-pull output. It completely tunes the medium and long wave bands. Price for all parts and pocket sized cabinet £4.15.0. Post and insurance 2/6.

"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 half brilliance for setting up, the second position is off and the third position full brilliance for the operation shots. Also useful for controlling night lights, heaters, etc., etc. Price 3/9 each, post 9d. Circuit diagram included.
Ditto but without the off position i.e. d.p.d.t., 10 amp 2/9.

ELECTRONIC PRECISION EQUIPMENT LTD.

post orders are dealt with from Eastbourne, so for prompt attention please post your orders to 66 Grove Road, Eastbourne, marked Department 7. Callers may use any one of the Companies below.

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Phone: CRO 6558
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Phone: ARChway 1049
Half day Thursday

520 High Street North, Manor Park, E.12.
Phone: ILFord 1011
Half day Thursday

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Phone: RUIslip 5780
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Brand new, individually checked and guaranteed

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- EF54 3/3
- EF55 6/-
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- 6N7GT 6/-
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- 3A/1481 45/-
- 723AB 45/-
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- 3J/170/E £35
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AND MANY OTHERS IN STOCK, INCLUDING CATHODE RAY TUBES AND SPECIAL VALVES. All U.K. Orders below 10/-, P. & P. 1/-; over 10/-, 1/6: Orders over £2, P. & P. free. C.O.D. 2/- extra. Overseas Postage extra at cost.

Transmitter/Receiver No. 22. 2 Mc/s to 8 Mc/s. Built almost exactly as No. 19 set but much more economical in battery consumption. Complete in fully working condition with power pack for 12 v., Headgear and Microphone assembly and Key, £9.19.6. Carriage 15/-.

Telephone Handset. Standard G.P.O. type, new, £1. P. & P. 1/6.

Marconi SIGNAL GENERATOR. TF144G. 85 kc/s. 25 Mc/s. Made up to new standard. £70 delivered free.

U.H.F. SIGNAL GENERATOR TYPE T.S.14. 3,200–3,370 Mc/s, power measuring range 20–200 mW. R.F. output power —20 to —100 dbm below 1 mW. Power supply 115 w A.C. Price £15. Carriage 15/-.

S.C.R. 522 Receivers (BC624) 100–156 Mc/s, without valves, 7/6. P. & P. 5/-.

H.T. Chokes made by Bendix Radio (U.S.A.), 3 Henry's 0.600A D.C. 25 ohms D.C. resistance 18,000 v. R.M.S. 60 cycle test, £1.12.6. P. & P. 6/-. Ditto 10 Henry's 250A D.C. 90 ohms resistance 1,500 v. R.M.S. 60 cycle test, 16/6. P. & P. 3/6.

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

Miniature Relays. Changeover 12–30 v. D.C. supply, 5 amps contacts, 5/-. P. & P. 2/-.

Pre-set Double Potentiometers. 2 x 3,000 ohms linear 4 w, 5/-. P. & P. 1/6.

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

Laboratory Precision Variable Condenser. Manufactured by General Radio Co., U.S.A. 50–1,500pF with micro metric drive and calibration chart. Overall dimensions of case 9 x 8 x 7in. Price £15. Carriage 15/-.

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/-.

I.F. Transformers. Crystal Load, 12/6 each.

Plates escutcheons (for D and LF), 15/- each.

Dials (for type D), 10/- each.

Logging Dial (for D and LF), 10/- each.

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Antenna Trimmers (LF and D), 2/6 each.

Filter Condenser 3 x 4μF, £2.10.0

Condensers:

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Instruction Manual for AR88D, £1.

Specially Built Power Pack for TCS Receiver. 230 v. A.C. mains, including 6X5GT valve, £3.10.0. Carriage 5/-.

Marconi CR-100 Communications Receiver. 60 kc/s–30 Mc/s with noise limiter. Completely reconditioned, £25. Carriage 25/-.

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.

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

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, open-wire 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.

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/-.

19 Set Owners. To increase output of your set 6 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/-.

AR 88's. Completely rebuilt with new PVC wiring. Type "D", £75; Type "LF", £70.

R109 Receivers. 1.8–8.5 Mc/s working from 6 v. D.C. Complete with all valves and built-in speaker. In excellent, guaranteed working condition. £5.5.0. Carriage and packing 15/-.

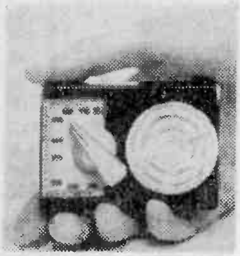
SENSATIONAL NEW 1961 DESIGNS—*BY CONCORD*

LOW PRICES ★ PICTORIAL STEP-BY-STEP PLANS ★ EASY AS A.B.C.

THE NEW "LISBON" TRANSISTOR SET

19/6

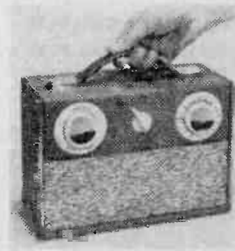
Build the miniature, highly sensitive **"LISBON"** design. This is a pocket 2-stage transistor set not much larger than a matchbox. Excellent clear reception covering all medium waves and working for months and months off a tiny 1½ or 3 volt battery costing only 3½d. A very simple set to build and an excellent introduction to transistor circuitry. Everything can be supplied down to the last nut and bolt including **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS FOR ONLY 19/6**, plus post and packing 1/6. (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



"MAJORCA" 7 TRANSISTOR RADIO

Build this 7-TRANSISTOR "MAJORCA" **£10.19.6**

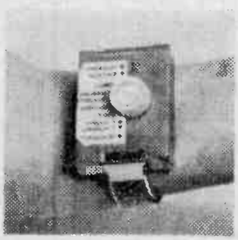
superhet portable with Car Radio aerial attachment. An exceptional high quality design giving remarkable tone with push-pull output. Can be built for ONLY £10.19.6, including everything down to the last nut and bolt and **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS.** Post and packing 3/6 (C.O.D. 3/- extra). Parts sold separately.



OUR NOVEL WRIST RADIO

22/6

Our engineers have designed this novel Wrist Radio using latest transistor techniques. Size only 1½ x 1 x ¾in. "Featherweight" yet gives clear, crisp reception over all medium waves. Tiny battery lasts months and months costing only 4d. No snags—anyone can build it in an hour or two using our **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS.** All parts can be supplied including case and strap **FOR ONLY 22/6**, plus post and packing 1/6 (C.O.D. 2/- extra.) Parts sold separately, priced parts list 1/-.



THE NEW "FLORIDA" VALVE RADIO

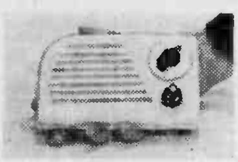
27/6

This sensational **"FLORIDA"** model is one of our most sensitive valve radios. It is a highly compact, self-contained, miniature push button base, valve pocket radio at absolutely rock bottom building cost. Covers all medium waves with very latest circuitry bringing in stations from all over Europe without fuss. Size only 4½ x 2¼ x 1½in. A fascinating pocket radio. We can supply all the parts including beautiful 2-tone case and **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**, screws, wire, etc. Can be built for the exceptionally **LOW PRICE OF 27/6**, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.

OUR NEW 4 STAGE "MINUETTE"

39/6

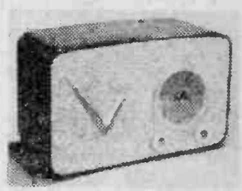
Build this newly-designed **"MINUETTE" 4-STAGE** transistor set in very strong ready drilled **ULTRA-MODERN CASE**, size only 6 x 3½ x 1in. Uses three transistors and diode and **SELF-CONTAINED LOUD SPEAKER.** Very sensitive, ideal for office, bedroom, holidays, etc. Months and months of listening off an 8d. battery. Can be built **FOR ONLY 39/6**, including **PROPER CASE**, miniature speaker, etc. **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS**, etc., plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



THE NEW "MONTE-CARLO" RADIO

£5.15.0

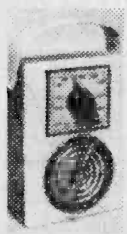
One of our new, exciting designs, the **"MONTE CARLO"** is a powerful, all mains, miniature table radio with the latest trimmings, gold insert knobs, special unmarkable plastic veneer, etc. The amazing circuit covers all medium and long waves with good selectivity, fantastic tone and output. Includes ready drilled and punched chassis, standard octal base valves, etc. All the parts can be supplied including **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS.** Everything down to the last nut and bolt **FOR ONLY £5.15.0**, plus post and packing 3/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-



THE NEW 3-STAGE "RIO"

29/6

Our fabulous new **3-STAGE MINIATURE LOUDSPEAKER DESIGN THE "RIO"** covers all medium waves including Home, Light, etc. Very reliable and lightweight. Works for months and months off an 8d. battery. Can be assembled in an hour or two. All parts can be supplied including miniature speaker and everything down to the last nut and bolt with **SIMPLE AS A.B.C. PICTORIAL STEP-BY-STEP PLANS** for **ONLY 29/6**, plus post and packing 1/6 (C.O.D. 2/- extra). Parts sold separately, priced parts list 1/-.



BRAND NEW RECORD CHANGERS

ONLY £8.15.0 BRAND NEW! the latest 4-speed Autochanger, B.S.R. UA14, as illustrated, few only **OUR PRICE £8.15.0. P.P. 3/6**

BRAND NEW! the B.S.R. 4-speed Autochanger, UA8, few only left. **OUR PRICE £6.15.0. P. & P. 3/6.**

BRAND NEW! the COLLARO Junior 4-speed record player. **OUR PRICE 75/-. P. & P. 3/6.**

BRAND NEW! COLLARO "Conquest", 4-speed Autochanger. **OUR PRICE £7.15.0 P. & P. 3/6.**

CONCORD ELECTRONICS

Dept. PW31

210, Church Road, Hove, Sussex

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

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

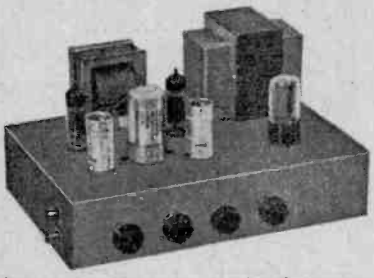
REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN HALF AN HOUR
The Recorder incorporates the Latest Collaro Studio Tape Transcriptor. The Linear LT45X High Quality Tape Amplifier listed £12.12.0 High Flux P.M. Speaker listed 30/-, empty Tape Spool, a Reel of Best quality Tape listed 22/6, and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 18 x 13 x 9in. high, listed £4.10.0, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflet.

25½ GNS. Carr. 17/6

H.P. TERMS. Deposit £5.7.6 and 12 monthly payments of 2 gns. Cash price if settled in 3 months.

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

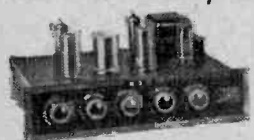
PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram, as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, 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 "Lift" and "Cut." Frequency response ± 3 D.B. 30-30,000 c/cs. Six negative feedback loops. Hum level 60 D.B. down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS,** etc., **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/- (Or factory built 51/6 extra).

If required louvred metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/3. and 9 monthly payments of 25/-.** Send S.A.E. for illustrated leaflet detailing Ready-to-assemble Cabinets. Speakers, Microphones, etc., with cash and credit terms.

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



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

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

COLLARO CONQUEST 4-SPEED AUTO-CHANGER with high fidelity Studio pick-up. Latest model. For 200-250 v. 50 c.p.s. A.C. mains. Our price £6.19.6. Carr. 5/6.

COLLARO RC 457 4 SPEED MIXER AUTO-CHANGERS. Turnover Studio Pick-up head, for 200-250 v. A.C. £7.19.6. Carr. 4/6.

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

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

R.S.C. BATTERY CHARGING EQUIPMENT

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

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

DEAF AID EARPIECES. Low Impedance with lead, 8/9. High Impedance Crystal 8/9.

MICROPHONE INSERTS. Crystal type, 6/9.

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 and ready for use with mains and output leads. **69/9** Carr. 5/- Terms: Deposit 13/3 and 5 monthly payments 13/3.

ASSEMBLED CHARGER 6 v. or 12 v. 2 amps. Fitted Ammeter and selector plug for 6 v. or 12 v. Louvred metal case finished attractive hammer blue. Ready for use With mains and output leads. Double Fused. Only **49/9** Carr. 3/9.

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

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

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

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

Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened

TOP SHROUDED DROP THROUGH

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

FULLY SHROUDED UPRIGHT

250-250 v. 60 mA, 6.3 v. 2 a. 5 v. 2 a. Midget type 2½-3-3in.	17/11
250-0-250 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.	26/9
300-0-300 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.	26/9
350-0-350 v. 100 mA, 6.3 v. 4 a, 5 v. 3 a.	26/9
350-0-350 v. 150 mA, 6.3 v. 4 a, 5 v. 3 a.	35/9
425-0-425 v. 200 mA, 6.3 v. 4 a, C.T. 6.3 v. 4 a, C.T.. 5 v. 3 a	49/9

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

OUTPUT TRANSFORMERS

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

ELIMINATOR TRANSFORMERS Primaries 200-250 v. 50 c/s.

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90 v. 15 mA, 4-0-4 v. 500 mA	9/9

SMOOTHING CHOKES

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

CHARGER TRANSFORMERS All with 200-230-250 v. 50 c/s Primaries: 0-9-15 v. 1½ a, 11/9; 0-9-15 v. 2 a., 14/9; 0-9-15 v. 3 a, 16/9; 0-9-15 v. 5 a, 19/9; 0-9-15 v. 6 a, 23/9; 0-9-15 v. 8 a, 28/9.

AUTO (Step up/Step down) TRANS. 0-110/120-230/250 v. 50-80 watts, 13/9; 0-110/120-200/230/250 v. 150 watts, 27/9.

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

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D.C. VOLTAGE: 0-6-30-120-600-1200 v. (10,000 o.p.v.).
A.C. VOLTAGE: 0-6-30-120-600-1200 v. (10,000 o.p.v.).
D.C. CURRENT: 0-120 uA, 0-12-300 mA.
RESISTANCE: 0-20K, 0-2 Meg. (150 ohm, 15K at centre scale).
CAPACITANCE: 0.005 to 0.15 uF. (at A.C. 6 v.).
DECIBELS: −20 to +63db. (600 ohm, 1mW. 0dbm = 0.775 v.
ACCURACY: D.C. Voltage and Current ± 2% f.s. A.C. Voltage ± 4% f.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 3½ 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. Single, easy to use range selector switch, can be appreciated by the novice and engineer alike. Complete with colour coded test leads and battery.
Size: 4½ x 3½ x 1in. Model EP-10K **ONLY £5-19-6** P. & P. 3/6.

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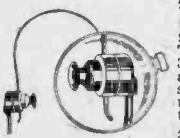

These H.S. 30 phones are the smallest used by the U.S. Air Force. 250Ω imp. using soft rubber miniature ear moulds for maximum music and voice reproduction of the finest quality. Supplied free is a small transformer unit with cord and plug which steps impedance up to 4,000Ω. ONLY **15/-**. P. & P. 2/6.
Standard High Resistance Phones. 12/6. P. & P. 2/6.

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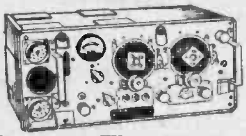
Range: 540 kc/s–32Mc/s in 6 bands. Undoubtedly the finest communication receiver ever produced for service and laboratory use. Now Relda's exclusive purchase enables you to obtain this Rolls-Royce of communication receivers at the lowest price ever offered. Fully guaranteed. FEW ONLY AT **£39.10.0.** carr. 50/-.

WIRELESS SET No. 19



Incorporates TX/RX covering 2-8 Mc/s (37.5-150 metres), and intercom. amplifier. 500 microamp check and tuning meter. circuit and instruction book.
ONLY 65/-, Carr. 10/-.

BOOST YOUR 19 SET!
No. 19 Set High powered amplifier offered for the first time! Can be used easily with all 19 set models previously released. Contains its own generator and two or four 807's giving 50 or 100 watts output, identical size to 19 set and a must for all owners. Price **65/-**, carr. 10/-.

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

U.S.A. WHIP AERIALS. 12ft. Now only 8/-, P. & P. 2/-.

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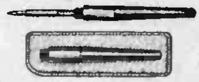
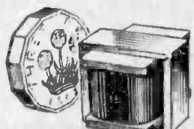
MODEL SP-1. 30 watt Portable Hand Soldering Iron. The latest — smallest — coolest 30 watt iron available. Especially suited for precision wiring. Highly stable heat characteristics assure long life and safety in use. Features a removable handle that may be used to cover the tip and barrel to permit the iron to be carried safely even while hot. Supplied complete with vinyl bag, lead and plug. Only **18/9.** P. & P. 1/3.



SLIM CRYSTAL MICROPHONE

MODEL 100-C. A unique design offering tremendous value. Has detachable 7 ft. shielded cable and muting switch. Smooth wide range response 60-10,000 CPS. Sensitivity: 52 db. High impedance. Satin chrome finish metal case. Only **32/6.** P. & P. 2/6.

SUB-MINIATURE TRANSFORMERS
Here is outstanding value in transistor transformers consisting of one Driver Transformer and one Output Transformer. Ideal pair for miniature transistor portables, etc.
Driver Model LT44: Primary: 20k. Secondary: 1k. Centre Tapped. Ratio: 5 : 1.
Output Model LT700: Primary: 1.2K. Centre Tapped. Output: 3.2 ohms. Ratio: 2 : 1. Complete with detailed instructions. Only **9/6** per pair. P. & P. 1/6.



TELEPHONE PICK-UP COILS

MODEL FC-8 Induction Pick-up coils enabling conversations to be picked up without tapping of wires or special telephone circuits. No electrical connections! Simply place telephone on the pick-up platform and connect lead to the input of any medium gain amplifier or direct to any tape, disc, or wire recorder. The coil is electrostatically shielded to minimise hum pick-up. Brand new complete with 5ft. shielded cable. FC-8 only. **16/-** plus 1/6 P. & P.

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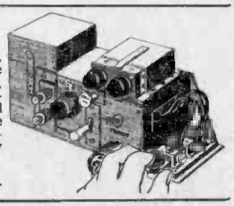
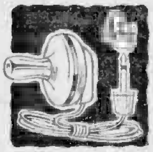
Complete morse code set, includes headphones, morse key, buzzer, pitch control, internal battery. Magnificent appearance and housed in portable wooden case with carrying strap. Supplied complete and ready for immediate use.
ONLY **19/6.** Carr. 4/6.

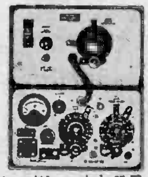


MINIATURE EARPHONE



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 / MR-4 Low imp. magnetic **8/-** Each, Post 1/-

PORTABLE TRANS/REC. No. 18



A self-contained Trans/Receiver for Telephone and C.W. Range approx. 10 miles. Freq. 6-9 Mc/s. (50-33.8 metres). Valve line-up: 3 ARP-12, 2 AR-8, 1 ATP4. Complete with aerial, H.T. and L.T. meter and all accessories. Weight 20 lbs. Size 8 x 10 x 17in. ONLY 80/-. Carr. 10/-.

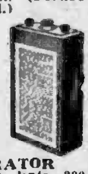
BC-221 HETERODYNE CRYSTAL CONTROLLED FREQUENCY METERS
Freq. range: 125 Kc/s to 20 Mc/s. Calibration: Individual Calibration Books and numerous Crystal Check Points. Accuracy: 0.01% or 25 cycles. Power supplies: 6 v. and 135 v. batteries. Size 14 x 10½ x 9½in. Weight 43 lbs. **Offered for the first time at the ridiculous price of only £25.** Carriage Paid.

HI-FI HEADPHONES

Uses high-quality permanent magnetic speakers with regular voice coil. The padded chamois earmuffs give correct spacing for optimum acoustic load, giving finest music and voice reproduction. Each unit has a built-in Hi-Fi 50Ω trans. total 100Ω. Only **25/-**. P. & P. 1/6.

MINIATURE DUBILIER CONDENSER SPECIAL!
Minimum 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. per dozen. **(Please state values required.)**

ACCUMULATORS.



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

SIGNAL GENERATOR
Model SWO-300 150 kc/s—300 Mc/s. Frequency Range: 150 kc/s-150 Mc/s on fundamentals (6 bands), 150 Mc/s-300 Mc/s on harmonics. Calibration Accuracy within ± 1 per cent. Modulation Internal and external. Attenuation: To—40db. Output: Facilities for high and low. Power Supply: Internal 230 v. A.C. Size: 7 x 10 x 5in. Complete with test leads and instruction manual. Fully guaranteed. ONLY **£14.19.6** Carriage 5/6.

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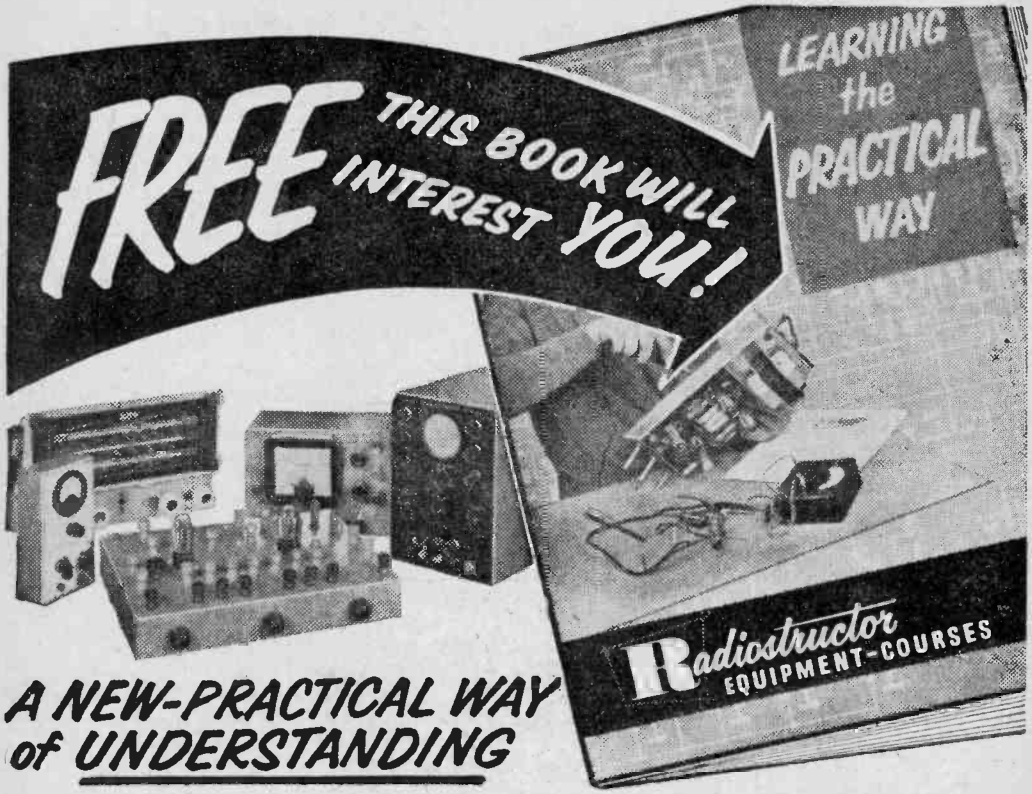

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VOL. XXXVII No. 652 JUNE, 1961

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Contents

MODERN SOUND REPRODUCTION

IN a recent lecture, a well-known personality was heard to say that it was his opinion that modern sound reproduction was little better than that of twenty years ago. This statement was reported in the national press and must give lay readers, in particular, the impression that when they buy, for instance, a new radio or gramophone, they are buying equipment which is virtually the same as the one which they are discarding. Radio enthusiasts, and readers of *Practical Wireless* especially, know that modern electronic equipment for the home—whether for radio or for gramophone records—is far removed from that on sale in, say, 1930. However, it must be admitted that certain aspects of sound reproduction appear to change very little over the years—the design of loudspeaker enclosures is one particular instance; in fact, one of the earliest horns is still worthy of attention today. The main advantage of modern loudspeaker enclosures is their small size compared with their predecessors; the quality of the sound reproduced may not be better than that of the best older designs, but when sizes are compared, then the modern enclosure stands supreme. Early loudspeakers, too, do not bear comparison with contemporary models—unless the listener prefers a frequency range which is restricted at both extremes.

Not only have loudspeakers and enclosures improved, but also the sources of the reproduced signal. Gramophone records have been given an increased frequency range and, much more important, a greatly increased playing time; interference has been removed from radio by the use of new frequency bands—VHF—and at the same time, fidelity has been improved—the list is endless.

There is no justification whatever for the statement that modern sound reproduction differs little from that of the early days of radio and gramophone records; any true belief in such a statement must stem from a nostalgic longing for the days of large, ugly, equipment and restricted frequency ranges with their associated resonances, rather than an impartial examination of the facts.

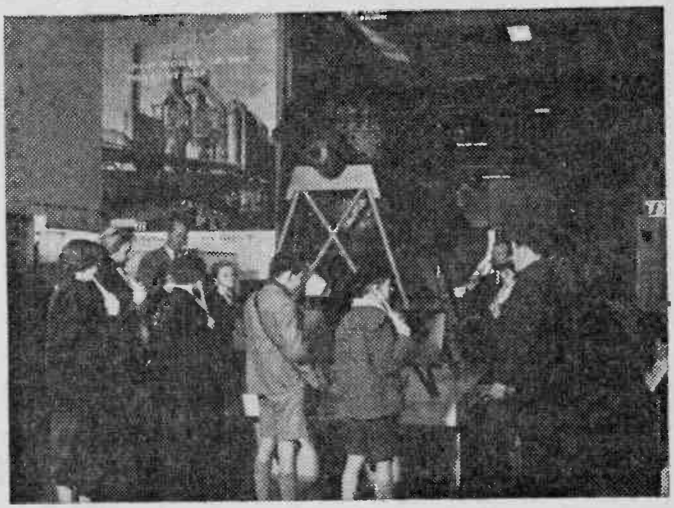
INDEXES

INDEXES to Volume 35 of *Practical Wireless* and Volume 10 of *Practical Television* are now available and will be found of great help for easy, quick, reference to articles and information; many cross-references have been included to facilitate their use. Both indexes may be purchased at 1s. 3d., each including postage, from the Publishing Department, George Newnes Limited, Tower House, Southampton Street, London W.C.2.

Our next issue, dated July, will be published on June 7th.

Round the World of Wireless

POTENTIAL AND CURRENT NEWS



Radio-guided tours have been introduced at the Science Museum in Kensington. It is the first time that such a system has been in operation at a national museum in this country.

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of February 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 Postal	697,246
Home Counties	657,662
Midland	477,279
North Eastern	524,914
North Western	450,971
South Western	393,952
Wales and Border Counties	233,133
Total England and Wales	3,435,157
Scotland	387,517
Northern Ireland	118,185
Grant Total	3,940,859

Radio Guided Tours for the Science Museum

VISITORS to the Science Museum in Kensington are now able to hire small radio receivers in some of the galleries which will give them a guided tour and a commentary on the exhibits.

For some months, the Ministry of Works, the Museum authorities and Multitone Electric Company Ltd., the designers and makers of the equipment, have been experimenting with a system in which tape-recorded commentaries are transmitted over a limited area, where they can be received by small hand-held sets.

So successful have these tests been that the Ministry has equipped three galleries at the Museum with the system and it came into regular operation on Monday, 13th March. It is the first time that such a system of radio guided tours has been installed in a national museum. Visitors borrowing the receivers are asked to pay a hire charge of 1s. plus a returnable deposit.

In each of the three galleries operating the system a loop aerial transmits the commentary relating to that particular gallery. The visitor tunes into this by setting a switch on his hand-held receiver.

The receiver is enclosed in a grey plastic moulding about 20in. long and about 2in. in diameter, and weighing only 7oz. The receiving equipment, operated by a small torch battery, is at one end, and a circular loudspeaker, about 1½in. across, is at the other.

When the receiver is held to the ear, a recorded talk or discussion can be heard, a typical example being a guide directing a party round the museum and describing the various exhibits.

The visitor listening in merely has to follow the instructions contained in the commentary while making his tour. They take him from display to display.

Each commentary lasts about twenty minutes. Once the system is switched on at the control point it works automatically, the tape recorders in various key parts of the museum playing their commentaries, re-winding their tapes for the next transmission without any attention.

Ballistic Missile Early Warning System

SIR ALEXANDER GIBB AND PARTNERS, consulting engineers, have engaged Belling and Lee Limited on behalf of the Air Ministry, to assist in the design and implementation of R.F. shielding and interference suppression on the ballistic missile early warning system project at Fylingdales Moor. This installation is to form part of the United States chain of early warning stations, with a range of 3,000 miles, capable of detecting high-trajectory missiles approaching over north polar routes.

The purpose of the shielding is two-fold; to protect operating personnel from the extremely high R.F. radiated power which will be used, and to ensure interference free conditions of working for all the varied electronic equipment, including the computers, etc., to be housed there.

British Equipment for German Airfields

AMONG orders announced at the Leipzig Fair by the Government of the German Democratic Republic was one for £40,000 which was awarded to Pye Telecommunications Limited of Cambridge.

The equipment to be supplied includes an Instrument Landing System (I.L.S.) for Dresden International Airport and the latest VHF ground-to-air communications equipment for Schoenefeldt airfield and the East German area.

The Pye I.L.S. gives highly accurate guidance to an aircraft on approach to landing by the use of a directional localiser and stabilised glide path. It has already been supplied to airfields in Geneva, Hong Kong, Canada, Nairobi, Belgian Congo, Persian Gulf, Russia, Hungary, Yugoslavia and Britain.

BOAC Comet Fleet to have Döppler Navigator

THE British Overseas Airways Corporation, after an intensive evaluation, has elected to equip its fleet of 19 Comets with the Marconi Döppler Navigator type AD2300A.

This important step forward in civil aviation navigation means that Comet captains will now have instrumentation to provide them with instantaneous and continuous information on ground speed, angle of drift and distance flown. The equipment is completely self-contained in the aircraft and requires no ground stations for its operation.

The AD2300A is a basic Döppler sensor operating on a frequency-modulated continuous wave system and consists of several sub-units.

Radar Equipment on Television

MARCONI'S traffic radar—the portable electronic device which measures the speed of passing vehicles — was recently demonstrated on the BBC television programme "Tonight". The device, known as "Peta," is now in use by the police forces of fifteen counties in Great Britain.

The team of Marconi engineers demonstrated a modified version of Peta which can differentiate between men and women walking in the radar beam. The "Tonight" film unit showed this device in action, using a vehicle, men and women and a dog to illustrate the different signals given out by the instrument when different moving objects are picked up.

When a loudspeaker is connected to the radar set the object is picked up as a whistle, and the faster it moves the higher pitched the whistle.

Arc Furnace Transformers for Electric Melting Projects

THE Transformer Division of Associated Electrical Industries Ltd. has received an order from Birlec-Efco (Melting) Ltd., Westgate, Aldridge, Staffordshire. covering two 35-MVA arc-furnace transformers to be installed at the Tinsley Park Works of English Steel Corporation Ltd., Sheffield.

The transformers will be designed and manufactured at the AEI Rugby Works. Each will supply power to a Birlefco arc furnace of one hundred tons capacity, with a 22ft diameter shell, rotatable about its vertical axis through an angle of 30° on either side of its mean position. The shell bottom will be of non-magnetic steel in order to permit the use of a stirrer of the electro-magnetic type. The transformers will operate on a 33kV, 3 phase, 50 cycle supply, and will transform this voltage down to a range of furnace voltages, these voltages being variable on load by means of AEI resistor-transition tap changers under the control of the furnace operator.

The maximum rated current of each of the furnaces will be approximately 40,130A.

Oscillators for Long Distance Navigation System

USED as "clocks" in navigational experiments now being carried out by the Royal Aircraft Establishment at Farnborough, quartz oscillators, designed by the Marconi Company, have shown remarkable stability and accuracy.

Experiments on a recent flight of over 4,000 miles by Comet were made possible by the new oscillator which was designed specifically for airborne purposes.

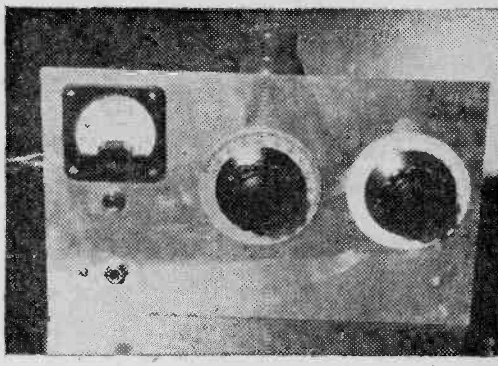
During recent flight tests, when the Comet was guided by the low frequency signals of the Rugby radio transmitter, operated by the Post Office, the Marconi oscillator was shown to be stable over long flying hours to better than one part in a thousand million. Therefore, as "clocks", the oscillators introduce navigational errors no greater than about two nautical miles in a flight of 3,000 miles.

Crucial tests are now on hand to establish to what extent this navigational accuracy is degraded by radio propagation uncertainties over various routes, at various times and seasons.

The design of the new oscillator follows on research the Marconi Company has been conducting since 1946 into low frequency signals as a medium for long distance navigation. Research on stable oscillators indicated that a "clock" could be made sufficiently accurate to assess the system if it were possible to design the equipment for airborne use.

Marconi's traffic radar, known as Peta, was recently demonstrated to viewers of "Tonight".

A 10 Watt One Valve Transmitter



ANOTHER UNIT FOR THE NEW HAM

By J. Ross

(This transmitter must not be used without a transmitting licence.)

THIS transmitter is particularly intended as a stand-by while rebuilding or modifying larger equipment, or as a first transmitter for newly licensed operators who are seeking something straightforward with which to get on the air. It is singularly free from snags, and not critical as regards operating voltage. With a 6L6, considerably more than 10W input is possible, if desired. It is also feasible to use the receiver power pack to supply the transmitter, or to use a small separate power pack.

Circuit

The circuit is shown in Fig. 1, and will operate satisfactorily with valves other than that mentioned. Regeneration is purposely omitted, because satisfactory output is obtainable without this, and because incorrect adjustment could then possibly cause oscillation at other than crystal frequency.

A conventional π-output circuit is used, and this allows simple end-fed aerials to be matched. The transmitter may also be coupled to a dipole, and permits easy adjustment of loading.

Cathode keying is used, a meter also being included here. Safety bias, to protect the valve from destructive anode currents if oscillation should cease, is obtained from the 220Ω resistor. The H.T. supply line may receive 200V up to 400V, or more, according to the valve and input required.

Panel and Chassis

Fig. 2 shows the panel layout, a metal panel about 10in. x 6in. being convenient, with a chassis about 9in. x 7in. and 2in. deep. Exact dimensions are of little importance.

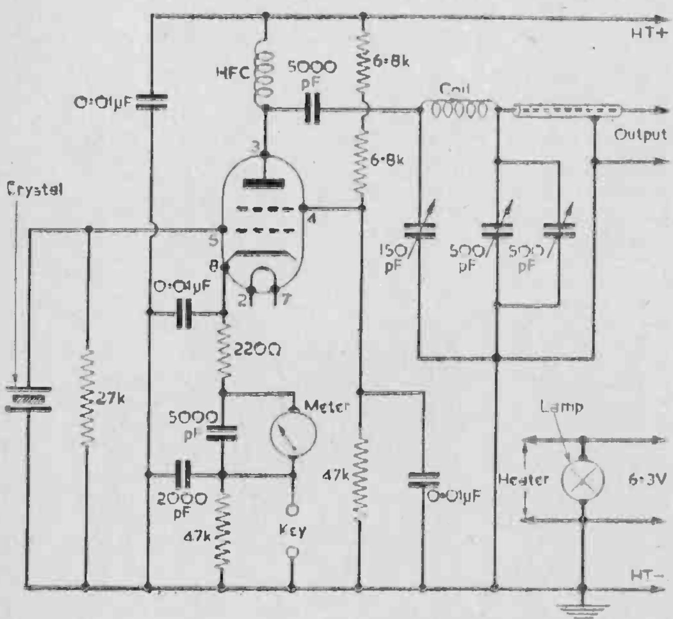


Fig. 1.—The C.W. transmitter circuit. (The valve is a 6V6 or 6L6—see text.)

The loading condenser is a 2-gang receiver type, of about 500pF capacity each section. These are usually mounted by feet or tapped holes, and will be secured to the chassis. The height at which the spindle comes may then be marked on the panel, and a clearance hole may be drilled. The 150pF condenser, which is secured to the panel by means of a nut, can then be fitted at the same height.

Fairly large knobs with numbered dials will be most convenient for tuning up. No reduction drives are required.

Meter, key jack, and heater stand-by indicator lamp fitting are positioned as in Fig. 2. Extra bolts hold the panel to the front runner. An enclosed box-type chassis will give maximum rigidity.

Chassis

The chassis is shown in Fig. 3, and clearance holes are required for crystal, valve, and coil holders. Eddystone plug-in coils, with holder, were used

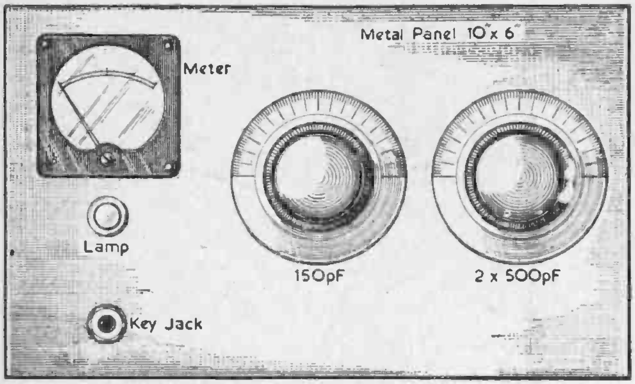
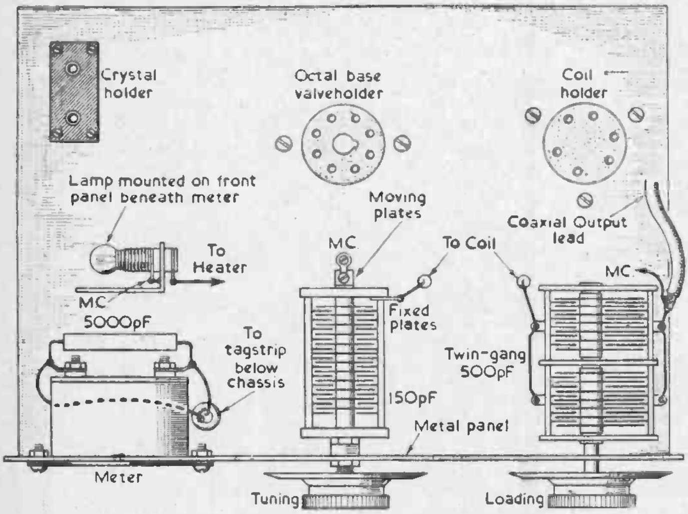


Fig. 2 (above).—The front-panel layout of controls.

Fig. 3 (below).—The above-chassis component layout.



in order to permit easy changing, but a fixed coil is equally satisfactory if operation is to be upon a single band.

The 2-gang condenser is earthed directly to the chassis. A short lead passes from the moving plates tag of the 150pF tuning condenser, to a tag bolted on the chassis. As a coaxial output will often be convenient, a few feet of coaxial cable may be soldered directly to the 2-gang condenser, as shown in Fig. 3. This cable can then go to the aerial coupler, aerial, or aerial changeover relay or switch. If a coaxial connector is preferred, fit the socket at the back of the chassis, as in Fig. 4, and wire the coil to this, as shown. An aerial or coaxial lead may then be plugged in here.

Leads from the meter and lamp fitting pass through a rubber grommet. A 6·3V, 0·3A, or 0·15A bulb will be satisfactory. Its purpose is to show that the valve heater is on, for stand-by.

The 6L6 cathode current will run up to about 80mA, so a 100mA or similar meter will be convenient. The instrument actually used was surplus, scaled 0-300, but with a full scale deflection of 100mA. Meters of more sensitive type can be shunted to obtain a suitable range.

Wiring

All resistors are 1W. A 12k or 15k 2W resistor may be used instead of the two 6·8k 1W resistors. For maximum input with relatively small H.T. voltages, these resistors may be reduced in value, or even omitted.

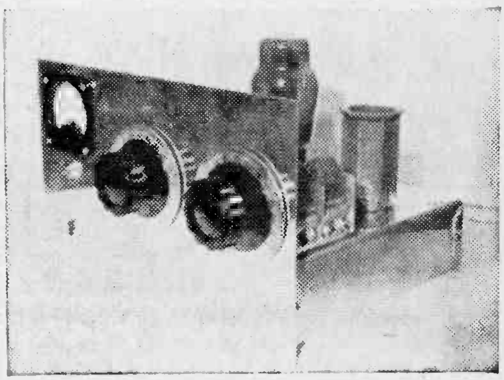
Connections should be short and direct. The capacity of bypass condensers is not particularly important. The 5000pF π-network coupling condenser should be a mica component with a working rating of 1000V to 2000V. The H.F. choke is any small transmitting type of about 1·5mH upwards.

Power Supplies

The receiver power pack will provide some 60mA to 80mA, at 250V to 350V, according to design. As the transmitter has only one valve, adequate power can be obtained with such a supply. For example, if the transmitter draws 50mA at 250V this represents a power input of 12½W.

A typical receiver power supply circuit is shown in Fig. 5, with a 2-way switch added to give send/receive operation. This switch ensures that receiver and transmitter will not both be drawing current together, thereby overloading the power pack.

The 6L6 will require 0·9A at 6·3V for the heater, plus 0·3A or 0·15A for the lamp. This is usually too much additional load for the receiver. A small 1½A 6·3V heater transformer



The completed transmitter

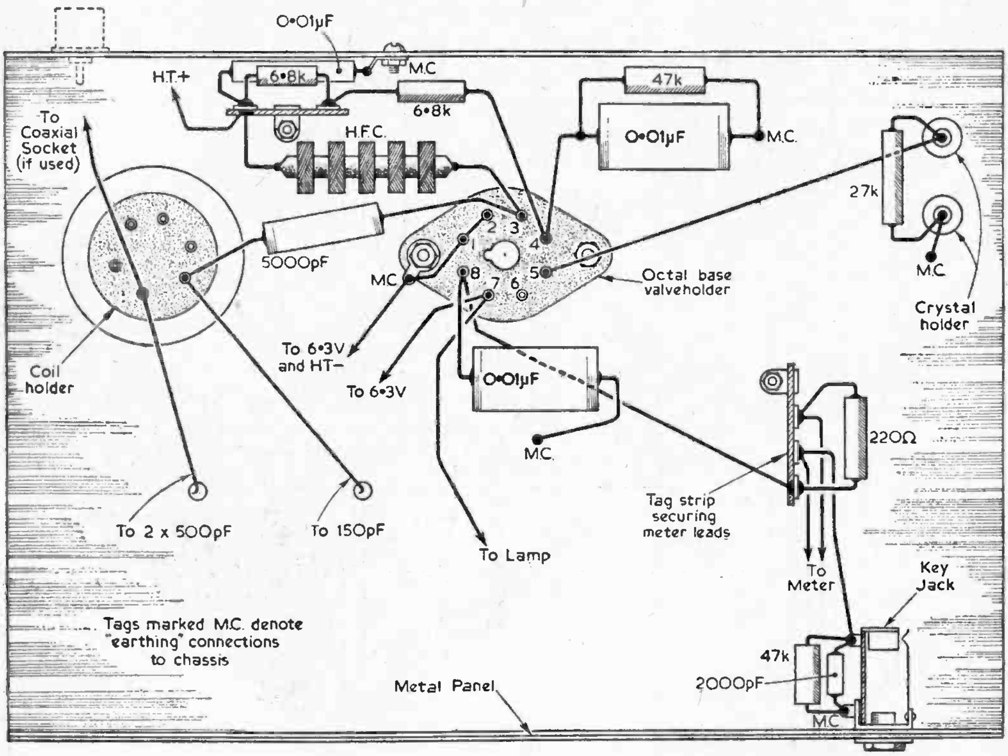
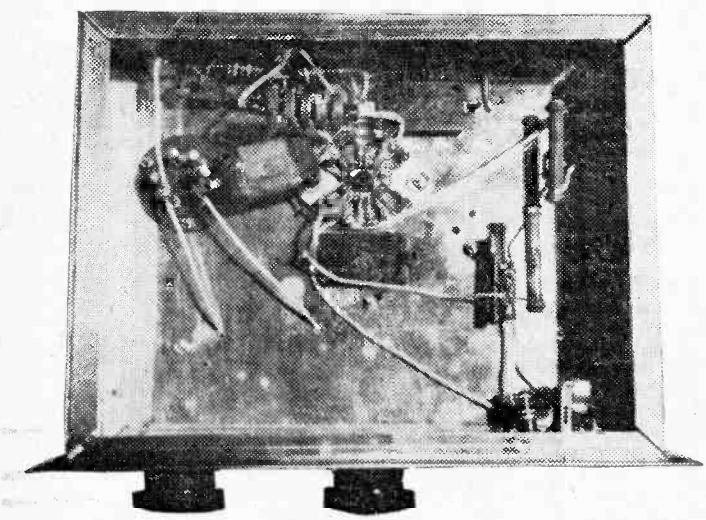


Fig. 4.—The under-chassis wiring diagram (shown below as it was on the prototype).



may thus be used. The receiver and transmitter heaters are left on continuously, in the usual way.

If a smaller valve, such as a 6V6, is employed, this will only require 0·45A for the heater (again plus signal lamp current). It may then be practicable to take the 6·3V supply from the receiver, especially if one or more dial lamps can be removed, or replaced by low consumption bulbs. With a 6V6, cathode current should not exceed about 45mA to 50mA. With the 6L6, it may run up to about 80mA to 85mA maximum.

If a separate power pack is to be constructed, the circuit can be shown as in Fig. 5. A 5V4 or similar rectifier will be satisfactory, and will require a 5V 2A heater winding. The transformer H.T. secondary may be from 250/0/250V to 375/0/375V. A 60mA to 100mA choke may be used, with $8\mu F$ or $16\mu F$ smoothing condensers. A 6·3V secondary delivering $1\frac{1}{2}$A will be adequate.

With a separate power pack, the transmitter is virtually switched by the key, so no further switching is required. This does have the advantage of permitting rapid break-in operating, which is not possible when a send/receive switch has to be manipulated.

Coils and Crystals

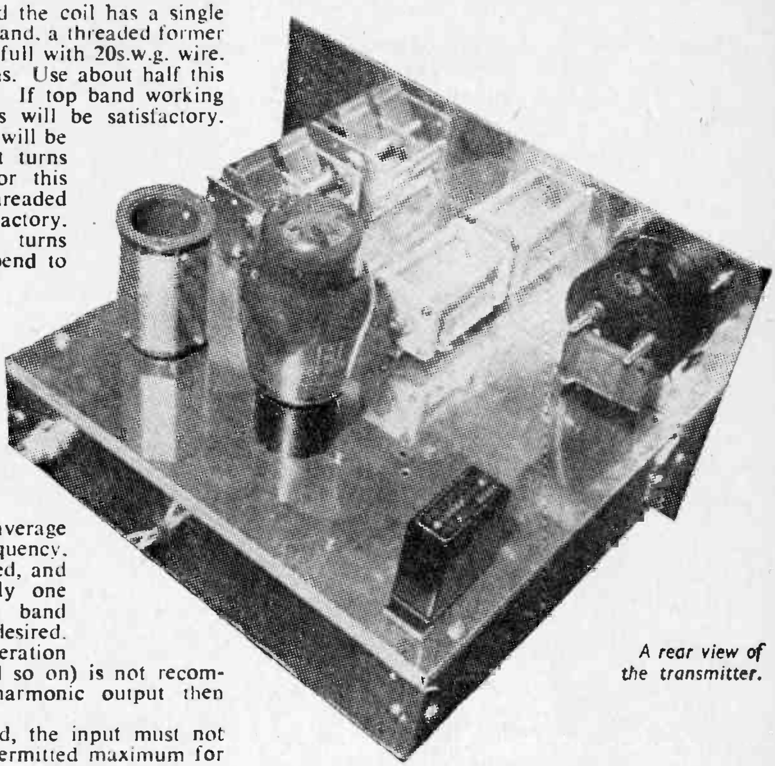
Standard plug-in coil formers are convenient.

Only two pins are used, and the coil has a single winding. For the 3·5Mc/s band, a threaded former of this type may be wound full with 20s.w.g. wire. This will give about 30 turns. Use about half this number of turns for 7Mc/s. If top band working is required, about 55 turns will be satisfactory. Insulated wire, close-wound will be necessary, so that sufficient turns can be accommodated. For this type of winding the unthreaded formers will be most satisfactory.

The actual number of turns which can be used will depend to some extent on the loading required, and aerial, but may readily be adjusted if necessary. If the 150pF condenser is fully closed without reaching the required loading, at resonance, the coil needs more turns.

Ordinary fundamental crystals are used, and need not be of expensive type, provided they have average efficiency. To change frequency, the crystal is simply removed, and another one inserted. Only one coil is required for each band upon which operation is desired. Doubling (for 7Mc/s operation with a 3·5Mc/s crystal, and so on) is not recommended because of the harmonic output then likely.

If the 160m band is used, the input must not exceed 10W, which is the permitted maximum for these frequencies. A larger input may be used on the other bands, if desired.



A rear view of the transmitter.

Tuning and Loading

An initial test can be made with an "artificial aerial" consisting of a clear 25W 200/250V domestic lamp, in holder. The holder is connected to the coaxial output socket, or to the length of coaxial lead soldered to the gang condenser.

With crystal and coil for the same band inserted, and the 2-gang condenser fully closed, heater and H.T. voltages may be applied. The key can be closed or shorted temporarily.

(Continued on page 169)

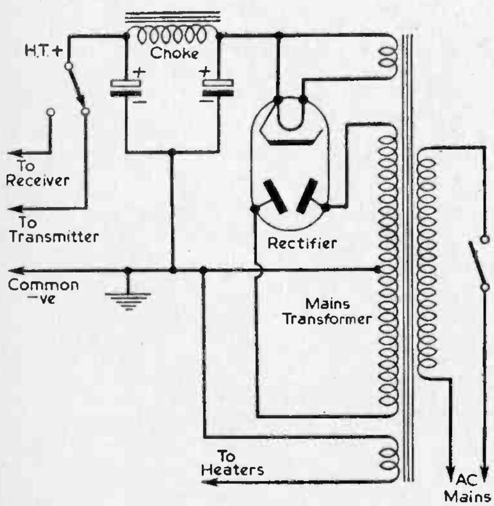


Fig. 5 (above).—The circuit of the receive/transmit switch for the receiver powerpack.

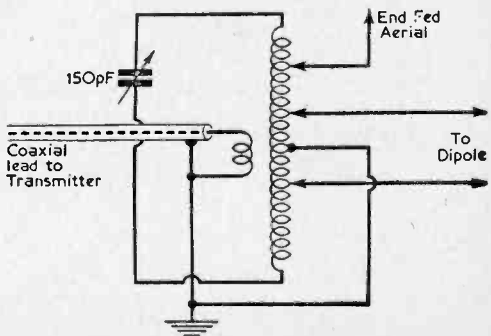


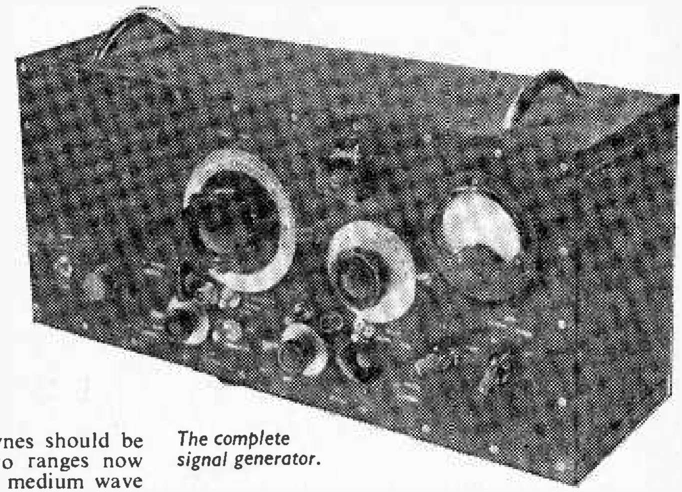
Fig. 6 (right).—The circuit and connections for the aerial coupler.

THE P.W. SIGNAL

COMPLETING CHASSIS No. 2

(Continued from page 47 of the May issue)

By E. V. King



The complete signal generator.

LAST month, the R.F. generator and modulator sections were tested with the first coil only in position. The remaining wiring should have been carried out as described on page 47 of the May issue, and it now remains to test the other three coils.

Testing L2

Connect up to the receiver with S8/9 switched to the L2 position and the set switched to the medium wave band. (Use PHF2 coil with the crystal set.) Heterodynes should be very frequent and strong. The two ranges now fitted will cover all of the long and medium wave broadcasting bands.

Incidentally, if the range L1 is used near a superhet, heterodynes will occur at the frequency of the I.F. transformers, probably 465kc/s in most receivers.

Testing L3

Check that oscillation is occurring by shorting at the test point as before. The receiver may still be switched to the medium wave band for the time being, or to any band between 3 and 5Mc/s if the receiver has one. This is approximately the 75m band. Many heterodynes, somewhat weaker than received with L1 and L2, should be heard, the gap between the first audible, high pitched whistle and the zero pitch position will be much smaller. It will be easier to tune the generator if a large knob is fitted on the tuning condenser VC1. Should the valve not oscillate, try a substitute valve (all valves in this unit except the rectifier are the same) or, only as a last resort with second-hand valves, decrease R26 gradually, keeping it as high in value as possible with the valve oscillating at all settings of VC1. If R26 is reduced unduly the waveform will suffer.

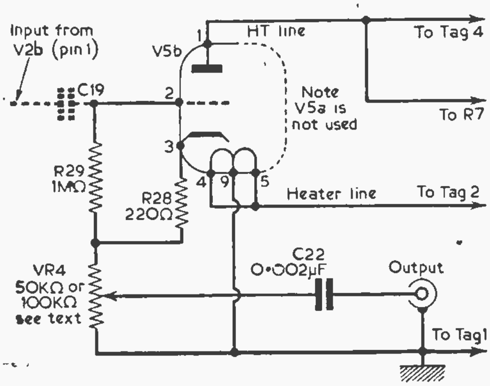


Fig. 14 (above).—The circuit of the cathode follower stage.

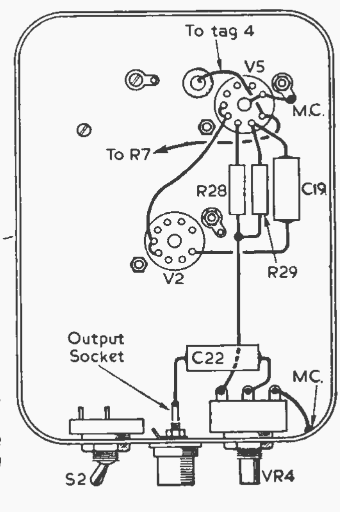
Fig. 15 (right).—The wiring of the cathode follower stage.

When carrying out the wiring in Fig. 15, check that the heater pins of V5 have been connected—as described on page 1106 of the April issue.

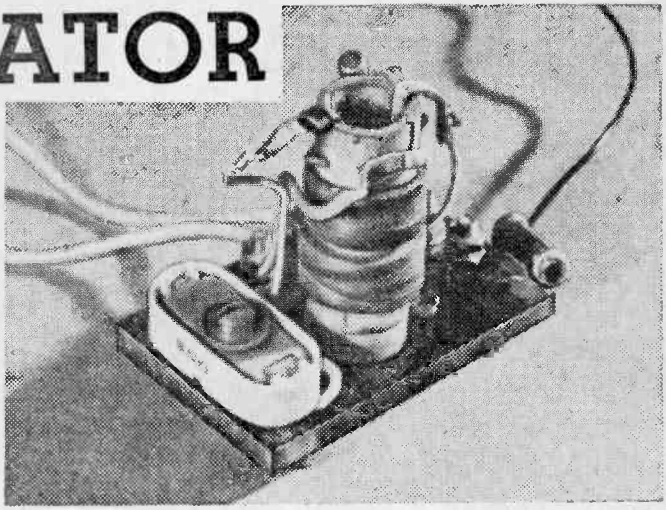
Testing L4

Test with the meter and short at the test point as before. The anode current should still drop by 0·02mA to 0·05mA at all positions of variable condenser.

If the receiver used will tune to 20, 30, or 40m, so much the better; if not, use the medium wave band. Hundreds of small heterodynes should be heard, thus showing that the oscillator is working on this band. If there is any trouble over oscillation on this band it will be due to faulty wiring, poor emission of the valve, or incorrect component values. Try substitution with the valves first, as some will oscillate on high frequencies better



GENERATOR



A view of the crystal receiver used for testing.

than others. As a last resort make R26 lower in value as described for L3.

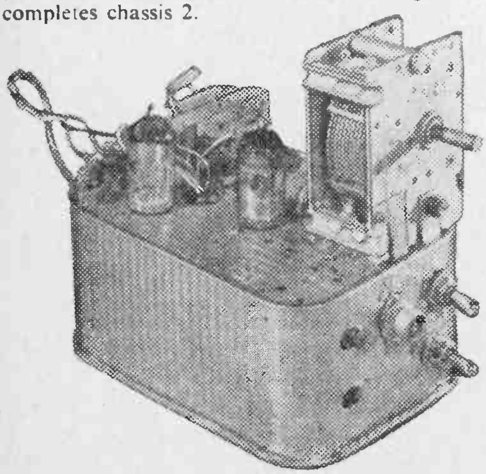
Squegging Test

This is best carried out when a buffer stage has been added, but it is interesting and instructive to carry out the test at this stage. Connect a good, *sensitive* pair of phones to the output socket or via a small amplifier to boost the signal. The *unmodulated* output of the generator should give no *hissing* noises at any setting of VC1 on any range. Slight hum may, however, be present. The hissing sound is caused by an additional audio vibration superimposed on the H.F. output. This is known as "squegging" and if it is present it may be due to incorrect component values, especially R27 and C20, which should be checked, possibly by substitution (the values given will *not* cause squegging).

The beginner can make the unit "squeg" (instead of hissing, a rough audio note can be obtained) by replacing R27 temporarily by a higher value (say 100k or 500k) and C20 by a higher capacity (say 500 pF or even 0·001μF). Squegging will occur more readily at certain settings of VC1. For most purposes a squegging oscillator is useless, so revert to the proper values of R27 and C20 afterwards.

The Cathode Follower Stage

At the moment the oscillator is working but the output is not controllable, and the external circuit conditions will have some slight effect on the frequency. An isolating stage, with an output control, is to be fitted. The circuit is shown in Fig. 14. This is added to the circuit of Fig. 7 and completes chassis 2.



The R.F. generator chassis with the tuning capacitor in position.

Point to Point Wiring Details

Remove C19 from the output socket and connect to pin 2 of V5 (see Fig. 15). Connect R29 to pin 2 as well and leave the other end unused temporarily. Connect R28 to pin 3 and its other end to the spare end of R29 just connected. Join the junction of these two resistors to one side of VR4, the position of which is shown in Fig. 15. Connect the other side of this control to earth and the centre tag to the output socket via C22. If the output control works the wrong way round reverse the outside connections.

Reference to Figs. 5 and 6 (April issue) will show that R7 has already been wired in the audio modulator section to tag 4 (for power unit). It is now wired instead to pin 1 of V5 and from there a wire is taken to tag 4, i.e. tag 4 supplies H.T. for V5b and then for V2b, and note that V2a receives its H.T. from another source: tag 3.

Testing the Cathode Follower Stage

Switch the range switch to any convenient position and connect a receiver as in Fig. 13. Switch on both power unit and R.F. section, but leave the modulation switched off. Heterodyne whistles should be audible provided VR4 is not fully "off". Now switch on the modulation and tune for maximum noise. Turn down VR4 and the noise should gradually diminish almost to zero; if it does not do so, VR4 is faulty.

The H.T. current of this stage, shown by fitting a milliameter in the lead from VR4 to earth, is approximately 4·0mA.

Complete calibration will be carried out later when the units are shielded and in a cabinet.

(To be continued)

ADDITIONAL COMPONENTS LIST	
C19	Check that this is 50pF
C22	0·002μF mica
R29	1M $\frac{1}{4}$W R28 220Ω $\frac{1}{4}$W
VR4	50 or 100k linear potentiometer (small size, i.e., 1in. diameter)
V5	ECC81
	Section (a) of the valve is not used.

An Introduction to Stereo

CONSTRUCTING THE PRE-AMPLIFIER AND MAIN AMPLIFIERS

By N. A. Walter

(Continued from page 54 of the May issue)

WHEN considering the power output per channel, it will be found that stereo has the effect of apparently louder volume for a given power output. In the largest room likely to be found in a normal house, 3W per channel will be found more than adequate.

To keep cost and hence the valve complement to a minimum, single ended amplifiers are essential, and since we need only 3W per channel, by using heavy negative feedback, distortion can be kept to a minimum.

Fortunately a design already exists in the Mullard 3-3 amplifier, which is very small, inexpensive to build and excellent in operation. A simplified version of the Mullard 3-3 is used and a full circuit diagram of one amplifier is shown in Fig. 6. The Mullard publication, "Mullard Circuits for Audio Amplifiers" will be found helpful.

The Circuit (Fig. 6)

Considering only one channel (the right hand channel), the output from the pre-amplifier is fed to the main amplifier by a single-core screened cable terminated in a single-pole jack plug. This jack plug is inserted into a single-pole jack socket (JK3) on the main amplifier chassis.

The first valve is an EF86, a low noise, low microphony, pentode (somewhat similar in its electrical characteristics to the older 6J7). The EF86 is used under starvation conditions, with anode and screen voltages much lower than is

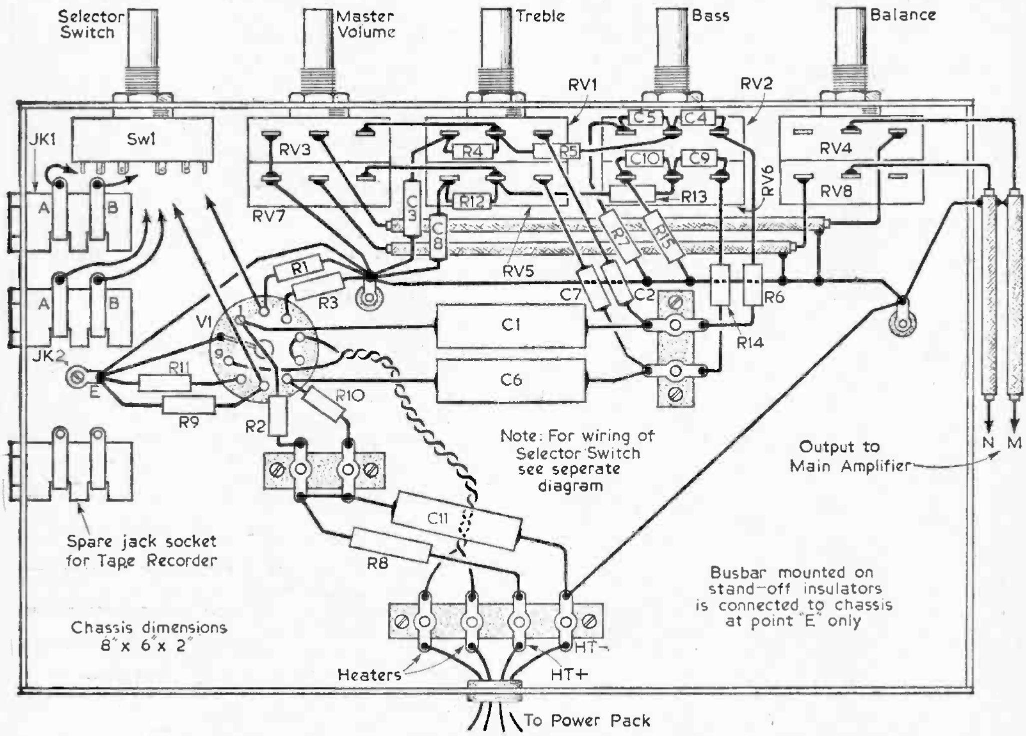
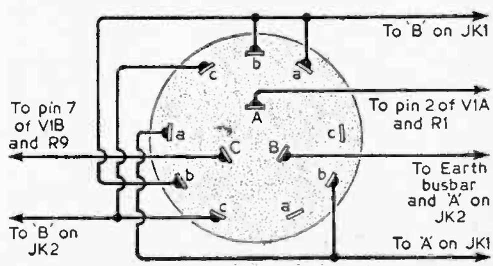


Fig. 3a (above).—The wiring of the pre-amplifier. (JK1, JK2 and the spare jack should be positioned as close to SW1 as possible).

Fig. 3b (below).—The wiring of the switch SW1.



usual. The total current consumption is low and a 1M high stability resistor is used as an anode load. It is important to use a high stability resistor here to prevent noise. The circuit configuration results in very high gain, and the valve is direct-coupled to a high slope output valve, an EL84. Such high gain is achieved that approximately 26dB of feedback can be used, and is taken from the secondary of the output

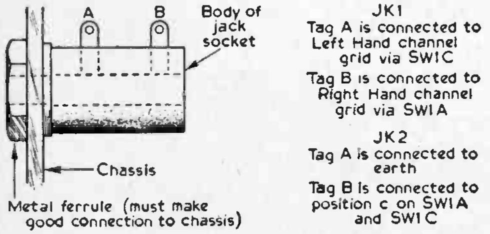
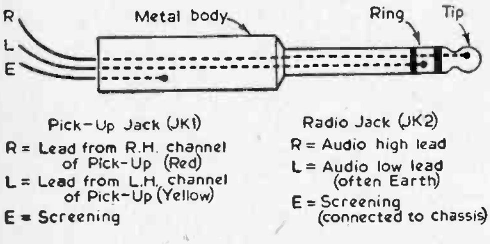


Fig. 4 (above).—The wiring of the input sockets, JK1 and JK2.

Fig. 5 (below).—The connections to the input jack plugs.



transformer and fed back into the cathode of the EF86. The overall result is 3W ouput at less than 1per cent total distortion, and a good damping factor for the loudspeaker.

It should be noted that the anode of the EF86 is directly coupled to the grid of the EL84 via R5 and the screen voltage for the EF86 is obtained from the cathode of the EL84. In this way a high degree of stability of electrode voltage is obtained.

Feedback is supplied by R11 and C5 in shunt and no variable controls are needed on the modified chassis, since these are taken care of in the pre-amplifier and tone control unit.

The secondary of the output transformer is taken to colour-coded sockets on the chassis, and a 1k resistor is shunted across the output. This is to prevent instability and possible damage to the output transformer if the loudspeaker should be inadvertently disconnected.

The same wiring precautions should be adopted as detailed

COMPONENTS LIST

R1	10M $\frac{1}{4}$W
R2	10k $\frac{1}{4}$W
R3	1M $\frac{1}{2}$W high stability
R4	390k $\frac{1}{4}$W
R5	1k $\frac{1}{4}$W
R6	22k $\frac{1}{4}$W
R7	150Ω $\frac{1}{2}$W
R8	3·9k $\frac{1}{2}$W
R9	560Ω 3W w.w. wound
R10	1k $\frac{1}{4}$W
R11	6·8k $\frac{1}{4}$W
Rx	120Ω for 3Ω loudspeaker 82Ω for 15Ω loudspeaker
C1	0·25μF 350VW
C2	8μF 450VW
C3	50μF 50VW
C4	50μF 50VW
C5	390pF 350VW
C6	0·02μF 350VW
V2	EF86
V3	EL84
T1	Output transformer:

Colne 03077
Parmeko P2641
Wynall W1452
Gilson W.O.767
Partridge P4073

Valve holders:
V2 B9A skirted, nylon loaded
V3 B9A moulded type
JK3 Single pole input jack socket
Loudspeaker output socket
Aluminium chassis 8in. x 6in. x 2in.
(both amplifiers are built on one chassis)

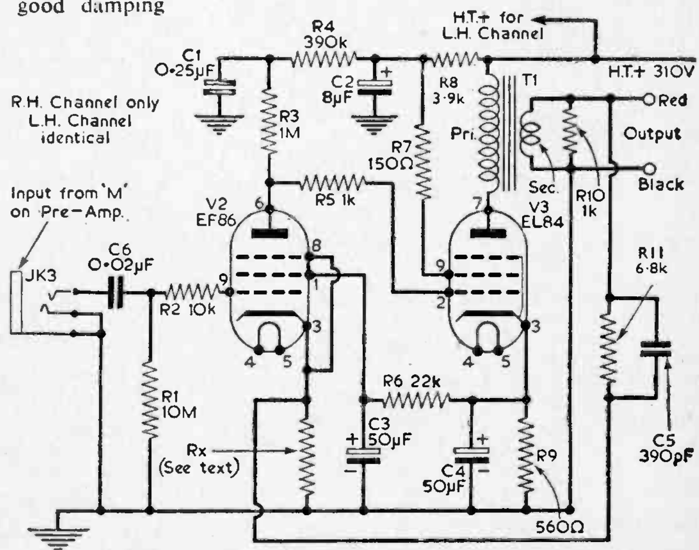


Fig. 6.—The circuit of one of the main amplifiers—the other is identical.

under the pre-amplifier and tone control unit. Both main amplifiers may be built on a single 8in. x 6in. x 2in. chassis, and it is advisable to mount the output transformers at 90° to each other to minimise coupling.

Output Transformer

The component list should be closely followed, and the only component which needs special mention is the output transformer. This is quite straightforward and has an 8H primary inductance and secondary to match 3 or 15Ω speakers. It should be noted that resistor Rx should be altered depending upon which output impedance is used (see components list).

The Loudspeaker System

Several full length articles could be written on this subject, and most people have their own idea of what is the best arrangement. It is useless to build an amplifier with low distortion and then use it on ordinary small speakers built into a small radiogram cabinet.

(To be continued)

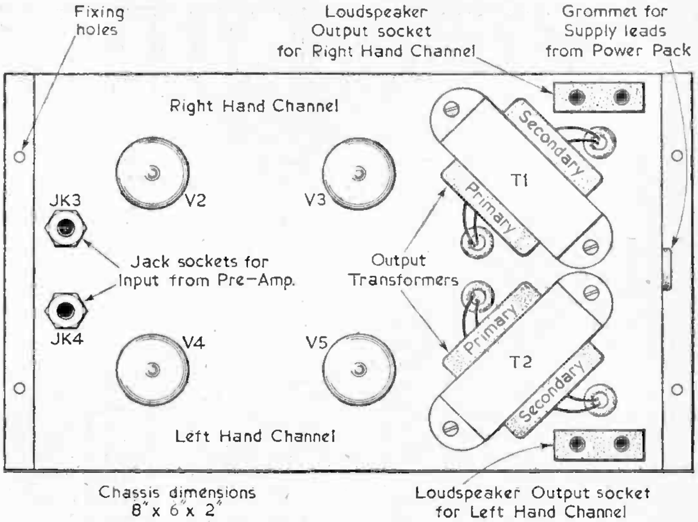


Fig. 7.—The above-chassis layout of the main amplifiers.

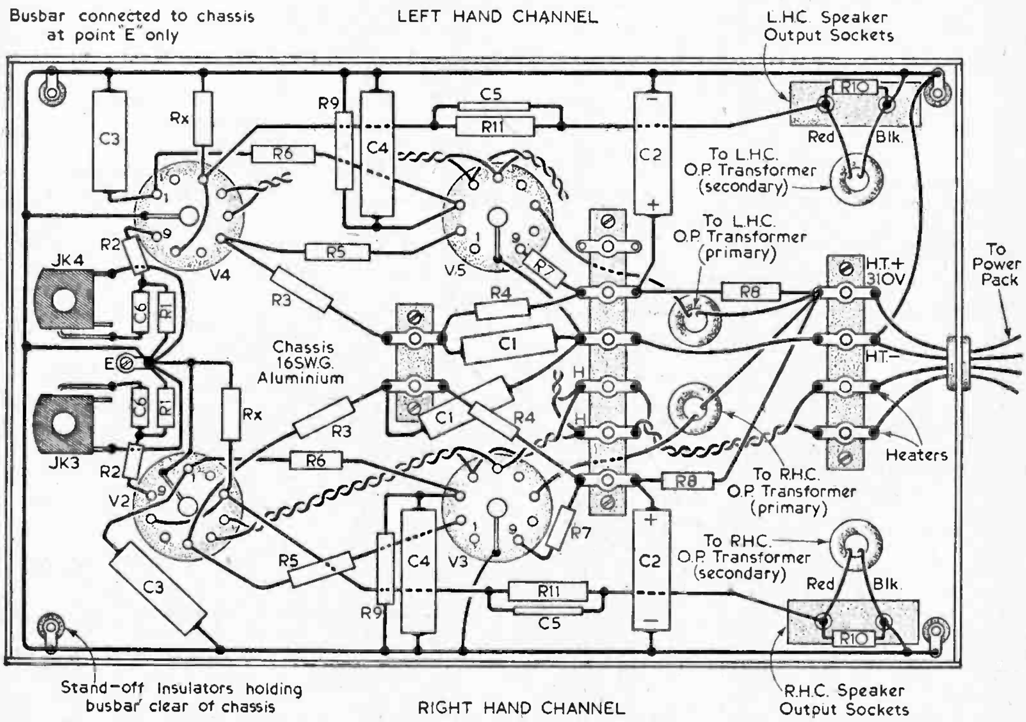
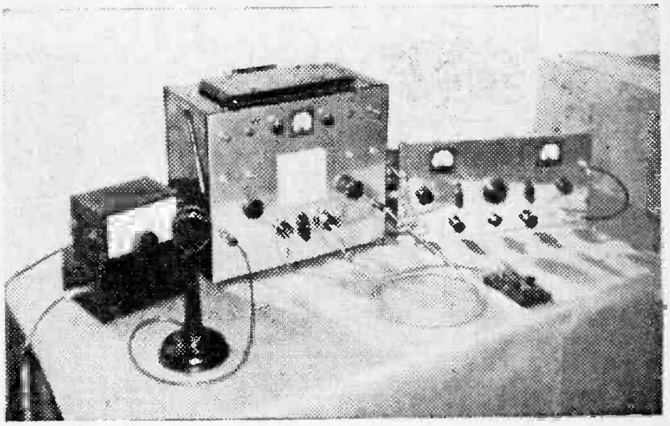


Fig. 8.—The underchassis wiring of the main amplifiers; note that resistors and condensers in the left-hand channel have the same numbers and values as those in the right-hand channel. All electrolytic condensers must be wired with the correct polarity—check with Fig. 6, the circuit diagram.

AN ALL BAND 75 W TRANSMITTER



THE R.F. SECTION

(Continued from page 81 of the May issue)

By G. Favour

THE R.F. unit is built with 16s.w.g. aluminium for which drilling diagrams are given in Figs. 8, 9 and 10. The screening partitions (Fig. 10) are fixed to the chassis by small aluminium brackets and screws. Since the only tools used in the construction were a hand-drill, hacksaw, file, screwdriver and pliers, the lack of a workshop need not deter potential constructors. The larger holes were cut out by marking the required extremities, drilling a number of overlapping ⅛in. holes, and finishing off with a file having a curved cross-section. Great care should be exercised in all drilling, since a slip of the drill can ruin the appearance of the front panel. Aluminium is very soft, and may be scratched even by the fingernails. All drilling should take place before the chassis is bent. The indicator lamp on the front panel was removed from a 19 set control box, and contains a 6V 60mA

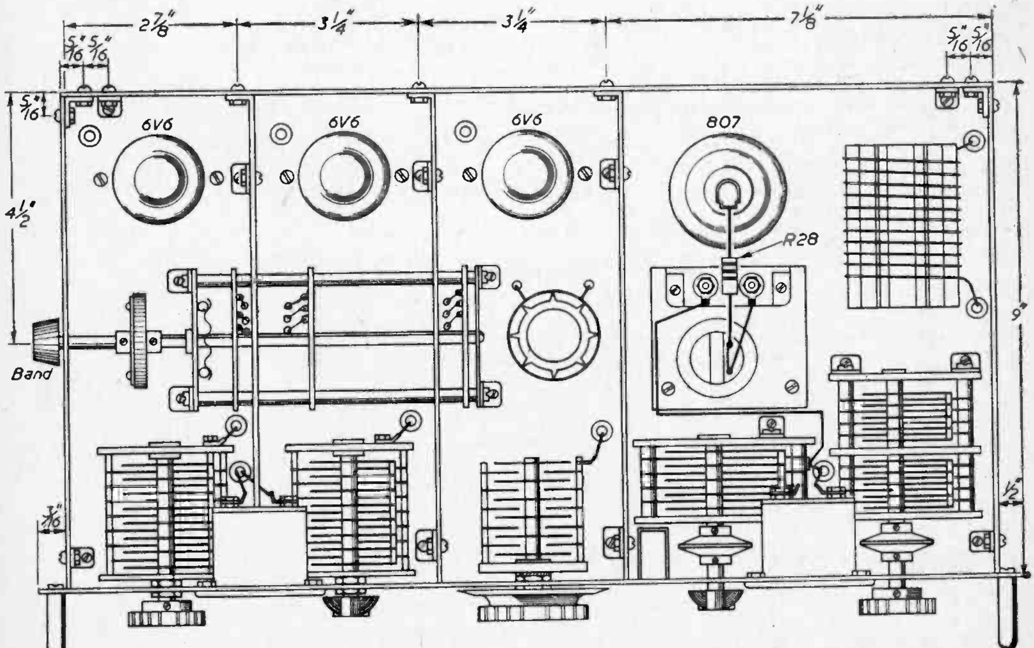


Fig. 8.—The above-chassis layout of the R.F. section.

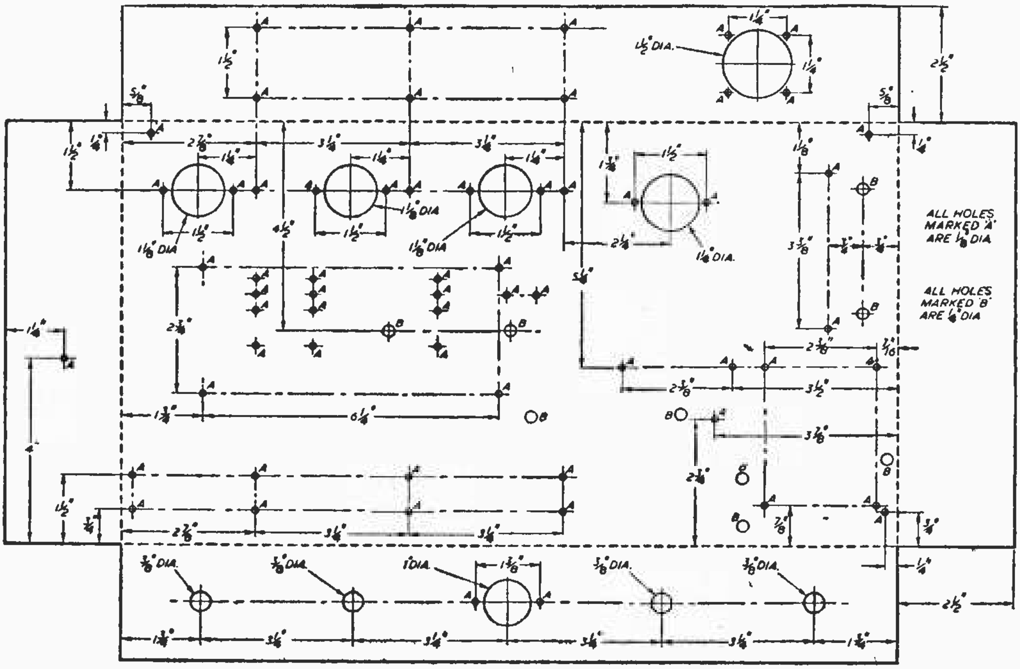


Fig. 9.—Chassis drilling diagram for the R.F. section.

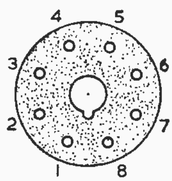
bulb. The panel handles were removed from R.F. 24 and 25 units.

Circuit

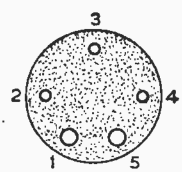
The input from the V.F.O. is by airspaced coaxial cable through a Pye elbow and socket. A short piece of similar cable goes from the input socket to a point adjacent to V5 valveholder. Since the input is at high impedance, this cable causes some mismatch, but this is not important if the length is made about four feet. V5 is a 6V6 operating as a driver stage on 80m and as a doubler on the remainder of the bands. While this valve is possibly not the best for the position, and a 6AG7 might perform better, it has proved perfectly satisfactory in this, and many other transmitters, and is very cheap on the surplus market. The cathode of this valve is keyed on CW. The anode circuit is tuned by the parallel combination of L1 and VCI. VCI is a broadcast type ceramic insulated 500pF type, obtained from a 1930 radio. This large capacity is necessary, since it is required

VALVE BASE CONNECTIONS

Valve Holder	6V6 I.O.	5P61 M.O.	5R4GY I.O.	807 UX5	6F8 I.O.
Pin 1	Metal shell	Heater	—	Heater	Metal shell
Pin 2	Heater	Cathode	Heater	Screen grid	Heater
Pin 3	Anode	Anode	—	Control grid	Anode 1
Pin 4	Screen grid	Screen grid	Anode 1	Cathode	Cathode 1
Pin 5	Control grid	Suppressor grid	—	Heater	Control grid 2
Pin 6	Beam plates	Metal shell	Anode 2	—	Anode 2
Pin 7	Heater	—	—	—	Heater
Pin 8	Cathode	Heater	Heater	—	Cathode 2
Top cap	—	Control grid	—	Anode	Control grid 1



International Octal base and Mazda Octal base



UX5 base

COMPONENTS FOR THE R.F. SECTION
(see Fig. 7, page 66, May issue)

R14	270Ω 2W	R22	47k ½W
R15	47k ½W	R23	33k ½W
R16	33k ½W	R24	270Ω 2W
R17	47Ω ½W	R25	24k 5W (see text)
R18	47k ½W	R26	33k ½W
R19	270Ω 2W	R27	100Ω ½W
R20	47Ω ½W	R28	47Ω ½W
R21	47Ω ½W		

(Note the values of R14 and R15 which differ from those of R14 and R15 in the power unit and modulator)

C16	0·01 μF paper	C30	200pF mica
C17	0·001 μF mica	C31	300pF mica
C18	0·1 μF paper	C32	0·1 μF paper
C19	0·001 μF mica	C33	0·001 μF mica
C20	0·001 μF mica	C34	0·01 μF ceramic
C21	0·1 μF paper	C35	0·01 μF ceramic
C22	0·1 μF paper	C36	100pF mica
C23	0·1 μF paper	C37	0·01 μF ceramic
C24	0·1 μF paper	C38	0·01 μF ceramic
C25	0·001 μF mica	C39	0·01 μF mica
C26	0·001 μF mica	C40	0·1 μF paper 1kVW
C27	0·001 μF mica	C41	0·004 μF (see text)
C28	0·1 μF paper	C42	100pF mica
C29	0·1 μF paper	C43	500pF mica

(Note: All paper condensers are 350VW)

V5	6V6	V7	6V6
V6	6V6	V8	807

M2 100mA (ex T1154)
M3 100mA (ex T1154)

L1 (see text)
L2 Denco—Yellow or Blue Range 5
L3 Denco—Yellow or Blue Range 5
L4 Plug-in—see text

VC1	500pF	VC5	500+500pF
VC2	500pF	VC6	50pF (air-spaced trimmers)
VC3	100pF	VC7	50pF (air-spaced trimmers)
VC4	150pF		

S2 1·5Ω w.w. (see text)

SW1 (see text)
SW2 1-pole, 3-way
SW3 2-pole, 3-way

Three ceramic I.O. or M.O. valveholders
One B.5A. (807) valveholder
Two 5:1 epicyclic drives
One length of air-spaced coaxial cable
Two Pye sockets with matching elbows
One 8- or 10-pin plug and matching socket
Ten suitable knobs
Handles for R.F. unit
One 1½in. long, ¼in. diameter spindle
16s.w.g. aluminium

to tune two bands. L1 is the H.F. oscillator coil from the 1154, with the taps removed.

Band-Switch

The band-switch is the ex1154 range-switch, with one of the banks removed leaving three 1-pole 3-way switch sections. The spacing of these is also slightly altered to fit between the above-chassis screens. A ceramic switch would be better, but the paxolin type is quite satisfactory.

The second stage doubles the frequency from 40 to 20m or triples to 15m, and is essentially the same as the first stage except for the tuned circuit. L2 (Denco yellow or blue chassis mounting range 5 type) has its larger winding tuned by VC2 (500pF) in series with C30 (200pF). This reduces the effective capacity to about 140pF. A small air-spaced trimmer VC7 is soldered across L2, and by the adjustment of both this and the core, both bands should be covered easily. This should be done initially in conjunction with an absorption wavemeter, since it is possible to choose incorrect harmonics. When operation is on 80m, L2 is short-circuited.

The third doubler stage is also identical, with the exception of the tuning. L3 is identical with L2, but the effective tuning capacity is smaller. The trimmer VC6 should be at almost minimum capacity, and the core out further. This stage is only in operation on 10m.

The T1154 Mag Feed 100mA meter is switched by SW2 to read the anode current in the doubler stages. A sharp dip should be obtained; fairly deep when the fundamental is being amplified, but only a flicker when third harmonic output is used. The grid current meter gives a more exact tuning indication. The 0·004μF mica condenser across the meter should not be removed.

Decoupling

The H.T. and heater wiring should be decoupled by 0·01μF disc ceramic condensers when passing from stage to stage. It possible, all R.F. chokes in the circuit should have different inductances in order to prevent tuned anode—tuned grid oscillation occurring. The highest inductance (larger) type should be used in the first stage anode, with slightly smaller sizes for the other stages. If parasitic oscillations are found to be taking place in the doubler stages (indicated by 807 grid current flowing even when the V.F.O. is disconnected), the provided screening cans should be fixed over L2 and L3, and 47Ω ¼W resistors connected in each anode lead.

The output from these stages is passed to the control grid of the 807 P.A.. The grid leak R25 (24k ex 1154) is decoupled from R.F. by RFC4, C34 and C35, and its earthy end is taken through the connecting cable to the grid current meter. The P.A. is driven into class C, automatic bias being developed by rectification between grid and cathode. The insulated anode cap is connected through a 47Ω anti-parasitic resistor to the ex 1154 unit comprising R.F.C. 4 and C41. An ex 1154 half screening can is fixed around the 807 to prevent the output reaching the grid. The anode current meter M_3 is identical with M_2, and is obtainable for 3/6d. from an advertiser. The shunt S_2 increases the FSD current to 150mA, and is made of a short length of michrome wire. The resistance per foot or metre is usually stated on the reel of wire, and, by a simple calculation, the length required to make a resistance of 1·5Ω can be determined.

The anode tuning condenser (ex 1154) is about 150pF. A fixed mica condenser is switched in by one section of the ceramic switch SW3 in order to cover the L.F. end of 80m. The output loading condenser is a double-gang 500pF broadcast type, with epicyclic drive.

The output π coil is changed for each band of operation. It is supported on stand-off insulators. If suitable ceramic types are not available, the switch supports on the 1154 200kc/s loading coil may be used, if suitable terminals are fixed on the top.

On 80m, L4 is the 1154 L.F. tank coil with tappings removed. This is a high Q semi-airspaced silver plated type.

On 40m, the 1154 H.F. tank coil is used. All tappings must be removed.

Coils

On 20m, the coil is a home-made airspaced type: six turns 12s.w.g. wire, 2in. outside diameter, length 1in.

On 15m, L4 is also home-made: three turns 12s.w.g., 2in. outside diameter, length $\frac{1}{2}$in.

On 10m, four turns $\frac{3}{16}$in. dia. copper tubing, $1\frac{1}{2}$in. outside diameter, 1in. long.

The three home-made coils are silver-plated to increase the efficiency, since high frequency currents flow on the surface, rather than in the centre of conductors. Since silver nitrate is expensive, only a very small quantity is used. A little of the liquid is soaked up with a small paint-brush. The positive terminal of a $1\frac{1}{2}$V cell is connected to the metal part of the brush, and the negative to the coil, which should be perfectly clean and free from grease. By slow, gentle brushing, a thin permanent film of metallic silver is deposited.

The output to the aerial is through another Pye elbow and socket to coaxial cable.

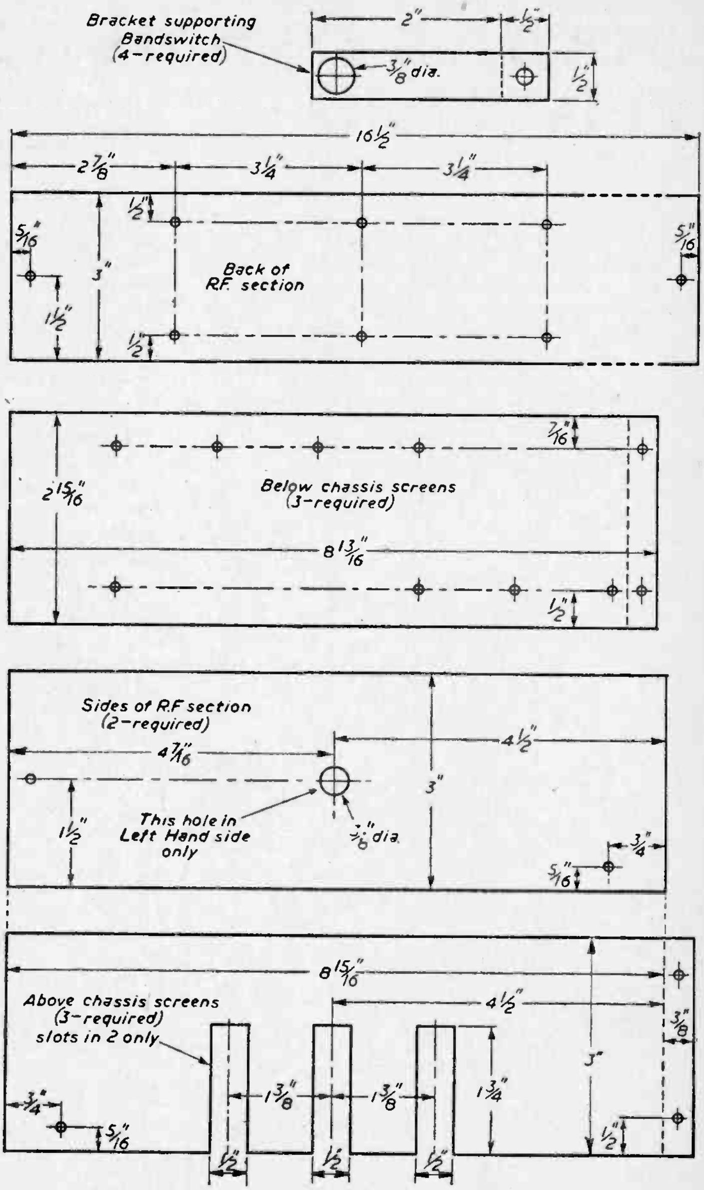


Fig. 10.—The screens and brackets for the R.F. section.

Connectors

These are very simply constructed using either multi-strand cable, or a number of strands of ordinary single wire wrapped around one another. The four way VFO lead is about four feet long, terminated by old Mazda octal valve bases, with pin 1 connected to pin 1, etc. The eight way R.F. section lead is about five feet long, terminated on the power unit end by an international octal base, and the other end by any suitable 8 to 10 way plug. All the valve bases are filled with pitch or asphalt to improve the appearance and prevent electric shocks and short circuits.

Operation

This is quite standard, and requires no special skill. The three units are connected together, mains switch turned on, and put to receive position. The low H.T. switch is turned on, when the receiver should work normally. It is tuned to an amateur band (80m best for first testing) the "listen-through" control set at zero, the meter

(Continued on page 146)

ADDING COMMUNICATIONS FEATURES

IMPROVING THE OPERATION OF HOME CONSTRUCTED AND COMMERCIALLY MADE RECEIVERS

By F. G. Rayer

A "COMMUNICATIONS" receiver is a superhet of advanced design, with features which permit better or more comprehensive operation. Many of these circuit improvements can be added to a superhet of ordinary type, to achieve more satisfactory reception especially under difficult conditions. Such additions can greatly improve results, and the extra components can often be accommodated on the chassis fairly easily. The features to be described can be very suitable indeed for a home-constructed receiver having a fairly large chassis, but some may be added to commercially-made sets, and to receivers of compact design.

There is, of course, no need whatever to add all the items described. For example, a BFO may not be desired, if there is no need for the reception of C.W. signals. Some of the other features, such as provision for single-side band reception, or the use of bandspreading or "Q" multiplier circuits, are not employed in many popular communications receivers, though they will be found in expensive receivers of very advanced design.

Additions to be covered include beat-frequency oscillators for C.W. reception, crystal markers for exact dial calibration, the use of regeneration and "Q" multipliers in F.C. and I.F. stages, bandspreading and the addition of other wave ranges, noise limiters and tuning and signal strength indicators, function switching, suppressing interference and improving AVC action, using a crystal filter or additional I.F. stage, SSB (signal side band) carrier injection, and other circuits which may be employed in a communications receiver, but which will usually be absent from a general purpose superhet.

Some, at least, of these features can be added to almost any receiver, and will give improved results, greater ease of operating, and other advantages.

A Typical Receiver

Fig. 1 shows a typical receiver circuit of popular type, such as might be originally used. Coils for one waveband only are included, though two or more bands will generally be available. Component values and valves may differ from those indicated, but this will not usually be of any importance. There is, of course, no need whatever that the original receiver should resemble that in Fig. 1, which is merely an indication of the general type of circuit to which additions can be made.

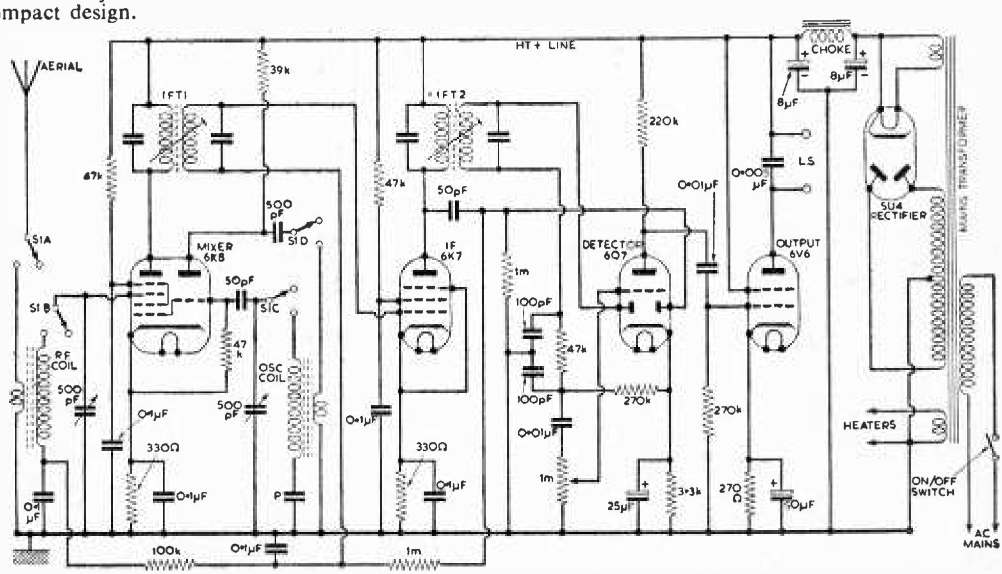


Fig. 1.—A typical circuit of a mains superhet receiver.

If a radio frequency stage is present, this will be of advantage. In larger receivers, there may also be an additional I.F. amplifier. Other circuit details may also be different.

If a receiver is to be constructed, and the additions mentioned are to be made later, the circuit in Fig. 1 will be a good starting point for easily obtainable octal valves. If preferred, miniature valves can be used instead.

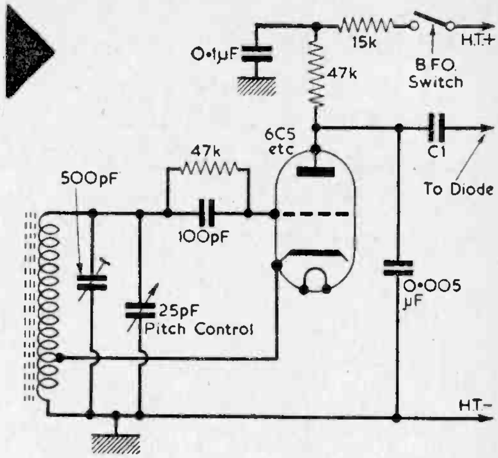


Fig. 2.—The circuit of a triode beat frequency oscillator.

Quite a number of useful additions can also be made to battery operated receivers, except for those of miniature type, where parts are difficult to reach, and where there may be no space for additional components.

Beat Frequency Oscillator

A BFO is always provided in a communications receiver, so that C.W. (Morse) may be copied. If C.W. reception is not required, the BFO may be used to locate crystal marker harmonics, when a frequency crystal is provided for dial calibration. In some circumstances the BFO can also provide the required local carrier, for reinsertion in single-sideband voice signals, which would otherwise be unintelligible.

Fig. 2 shows a suitable BFO circuit. This will operate with any small triode, or one section of a twin-triode may be used, when the other section will be employed for other purposes. This may be convenient when an additional stage of A.F. amplification is to be provided to boost weak signals.

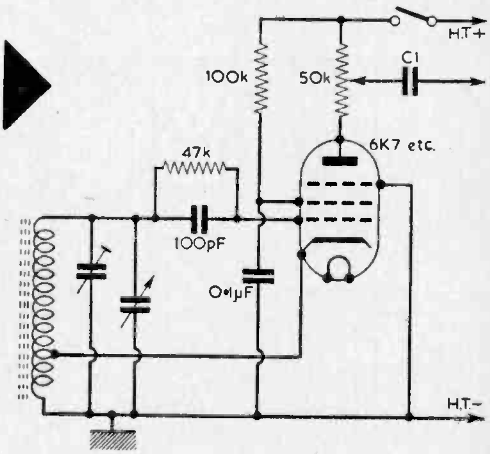


Fig. 3.—A B.F.O. circuit with variable output.

Most receivers have 465kc/s as the intermediate frequency. The BFO then needs to tune from about 464kc/s to 466kc/s. If the BFO is adjusted to 464kc/s or 466kc/s, and a C.W. signal at 465kc/s is available at the detector, these frequencies beat to produce a 1kc/s (1,000 cycle) audio tone. The BFO switch is opened for ordinary reception.

A winding from a disused I.F. transformer may be used for the BFO coil. As it may be difficult to tap the winding, the same effect can be achieved by winding on a few extra turns. Three or four turns will usually be sufficient. They are close to the original winding, and in the same direction. The end of the original coil and beginning of the extra winding then form the cathode tap, the end of the new winding being taken to chassis.

The 500pF or similar trimmer is adjusted until the BFO tunes to about 465kc/s with the 25pF or similar pitch control condenser half closed. No extra trimmer will be needed if the I.F. coil is fitted with a fixed condenser, and has an adjustable core.

The capacitor C1 should be very low in capacity, and can be made from a loop of insulated wire taken round the appropriate connecting point. The BFO is coupled to the detector diode, which will generally be one electrode in a double diode triode. The 0·1μF condenser and 15k resistor in Fig. 2 need not be added unless troublesome back-coupling to earlier stages arises.

Variable Output BFO

A BFO with variable output is shown in Fig. 3. C1 can again be very small, but the actual signal applied to the diode depends largely on the setting of the 50k potentiometer. Any type of H.F. pentode may be used.

A variable control of this kind is useful if the BFO is to be employed for the reception of SSB signals. An appropriate carrier strength can then be obtained from the BFO.

Construction and Adjustment

The BFO stage is best constructed in a small screened box, or the coil and valve may be screened. It should be located near the detector, to avoid a long connection from C1. If stray coupling arises with earlier stages in the receiver, whistles may be heard at multiples of 465kc/s on the tuning dial. If this is suspected, the trouble may easily be identified, as it will cease when the BFO is switched off. If so, screening should be improved, and the H.T. feed may be bypassed, as in Fig. 2. C1 may need reducing in value, and can best be in the BFO screening can.

The heater is wired in parallel with other heaters, and is normally left on. A fairly weak C.W. signal should be tuned in, and the trimmer or BFO coil core is adjusted until the BFO can be tuned through the intermediate frequency by means of the 25pF condenser. This component should have a panel control, and it can be operated by an extension shaft.

(To be continued)

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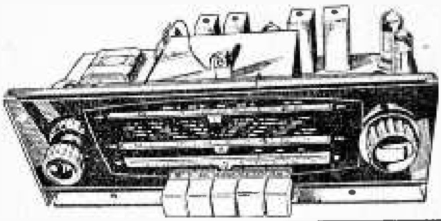

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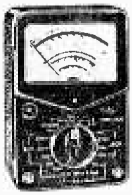

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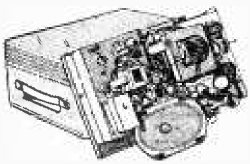

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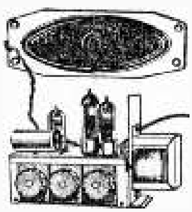

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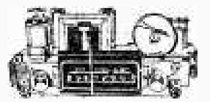

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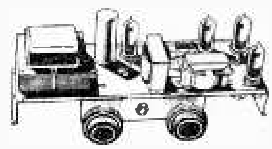

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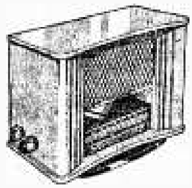

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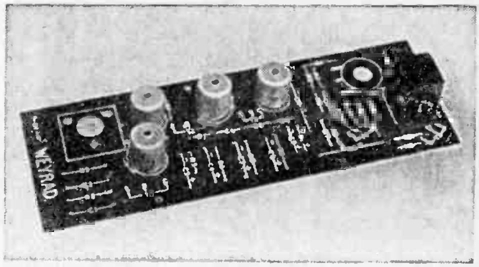

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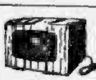
SPEAKER  **SALE**

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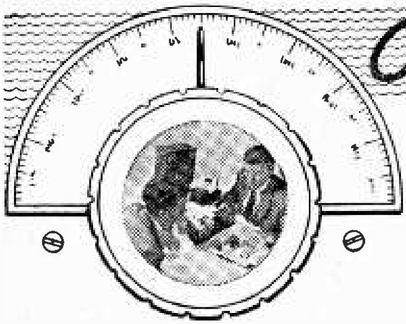


On Your Wavelength

BY THERMION

Difficult Requests

I AM receiving an increasing number of letters from readers and old friends, thanking me for some of my recent notes—especially those on transistor sets—and many of these correspondents ask me to let them have circuits of either receivers or test gear. Whilst I am at all times only too willing to help those who are unable to find circuits, etc., which meet their special requirements I must unfortunately turn down requests of this type. It is not that I do not have the time or am unwilling to prepare circuits, but this type of request is one which I know the editorial staff continually encounter and it is not possible to fulfil it. First of all, it is a fairly simple matter to draw out a theoretical circuit of either a simple type of set or a simple piece of test equipment. Obviously such things as a multi-valve communications receiver, or a complete oscilloscope are in a different category. But what happens when one has drawn such a circuit? It may prove useless to the reader. Old hands will know that when one is designing a new set the *first* step is to prepare a circuit which follows the lines or principles involved. The next step is to make up a rough layout—which most conveniently takes the form of the "bread-board" arrangement, and this is then tried out. Often one finds that there are many changes which have to be made in component values, and sometimes even in the valves, in order to obtain either a stable or an efficient working arrangement. Static and dynamic characteristics can vary widely in some cases, and therefore the supply of a circuit to an individual request is likely to be worthless. It is the layout and the working conditions which are most important, and unless it is possible to supply a tried and tested arrangement, requests of this type regretfully have to be refused.

Whilst talking about the bread-board layout and the experimental work involved in developing a set, I remember on one occasion I was visiting a very well known Radio club to give a talk on a certain subject and was drawn into an argument about a set which the club were trying to build. They had been at work on it for weeks and everything had been checked and double checked, even to the extent of sending the circuit to the valve manufacturers (who at that time were very helpful in vetting circuits using their products) and according to everybody it should work. But it wouldn't. At least, not in the manner anticipated. I heard later that it never did come to fruition and had been thrown out in disgust—in spite of the fact that several of those involved in its design were active transmitters.

Miniature Apparatus

One hears much today about miniaturisation, but until one sees a really miniature set the full meaning of the word is not realised. I recently had the opportunity of seeing a piece of apparatus in which the components were almost microscopic. The transistors were of a type which may now be seen incorporated in the type of hearing aid which is enclosed in the frame of a pair of spectacles or in a complete unit which is inserted inside the ear. The tiny volume controls appear to be so small that it is a wonder that the coating does not scrape off when the arm is rotated, and electrolytic condensers have been reduced to almost the thickness of the metal normally used on a printed circuit! I wonder if any reader has been able to get hold of some of these small components and made up a workable set round them? Unfortunately most of them—even in some cases the transistors themselves—are controlled by the manufacturer and supplied to Government sources only.

Unusual Transistor Application

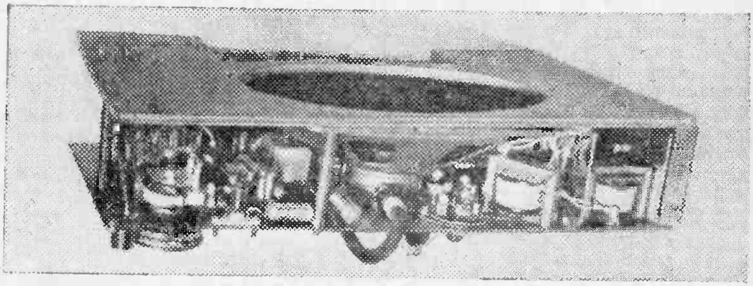
Whilst on the subject of transistors I recently heard of a most novel application of these interesting little components. We have all heard how they are taking the place of valves in many pieces of test equipment and in America a complete electronic organ has been built—without the employment of a single valve, no mean feat when one remembers that there are 60 notes to each keyboard and each is a separate oscillator, duplicated in the case of a two-manual instrument. There must also be the necessary amplifiers, but I do not know what power was developed by this organ, although I know that they have transistors over there which are not yet available in this country.

The novel application to which I referred in my earlier paragraph was for an instrument for St. Dunstan's, and consisted of a "responder". This comprised a tuned transistor amplifier with a microphone input. The instrument was made sensitive to a high audio-frequency signal, and the blind person carries a whistle which is tuned to that frequency. If the whistle is blown, a relay in the output circuit of the instrument is actuated and rings a bell for a pre-determined period. From the direction of the sound emitted by the bell the blind person can gauge his or her position relative to the responder. The range of this instrument is stated to be about 60yd on a still day, so that it can be used in a fairly large garden. This instrument has been developed by the Transistor Division of the Standard Telephones and Cables company and is, I understand, at present undergoing field trials in South Africa.

The P.W. "Roadfarer"

GENERAL ASSEMBLY AND ALIGNMENT DETAILS

(Continued from page 49 of the May issue)



The P.W. "Roadfarer".

THE power unit should have been constructed as described last month, and it now remains to connect the mains cable. The terminations are clearly shown on the board and these connections should now be made. The mains selector plug should now be connected with a short piece of insulated wire to one side of the fuse holder tag. This connection is shown in Fig. 3, last month. The other side of the fuse holder should be connected to the printed board as shown. Next solder two 3in. lengths of insulated wire to the battery clips and then solder each lead to the appropriate hole in the board. Using 8in. lengths of insulated connecting wire, and in accordance with the printing on the board, the two slide switches should be connected.

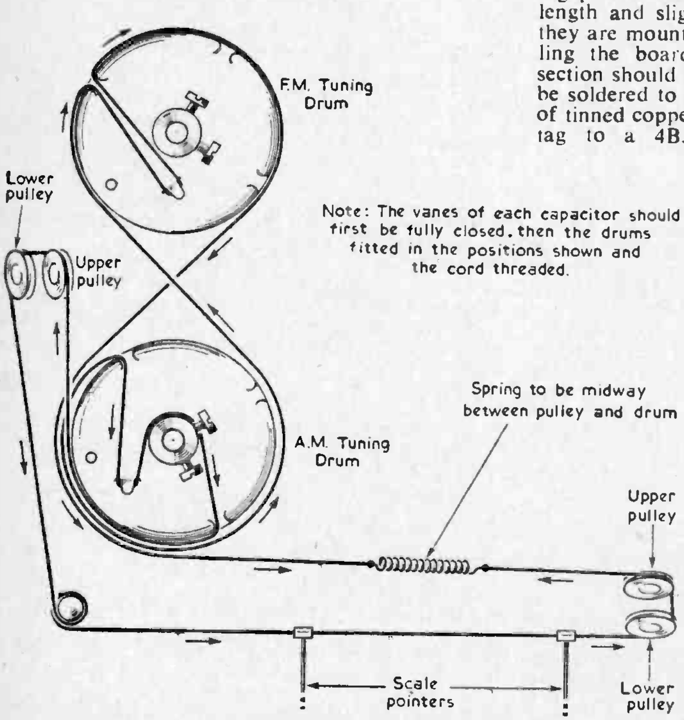


Fig. 4.—Details of the cord drive system.

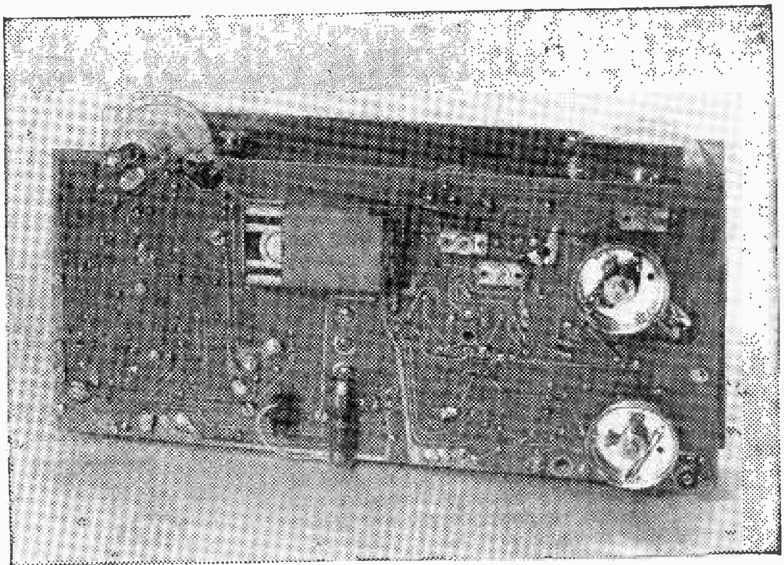
General Assembly

The dial plate assembly, drive pulleys, cord-drive and drums should now be assembled. The loudspeaker should be mounted on to the baffle board and secured loosely with two 4B.A. screws. Using mounting pillars, the printed board should be assembled on to the baffle but first ensure that the edge control has been fitted on to the spindle of the volume control potentiometer. The board is fitted to the baffle using 4B.A. bolts and mounting pillars. The outer mounting pillars are 2in. in length and slightly shorter pillars are used where they are mounted over the speaker. Whilst assembling the board, the aerial socket for the F.M. section should be fitted. The coupling coil, L8 may be soldered to the aerial socket, and a short length of tinned copper wire connected from the capacitor tag to a 4B.A. solder tag which should be incorporated in the aerial socket fixing.

The cord for the drive may now be threaded and the tension spring fitted. The assembled receiver may be fitted into the case and this is carried out by first positioning the edge controls below the appropriate slots and sliding the set upwards into the case. The assembly is secured by four wood screws which are inserted from the front of the case and screw into the wooden baffle holding it firmly against the front of the case. The speaker grille may be "clicked" into position on the front of the case. Finally fit the telescopic aerial and connect the coupling capacitor C33. The two slide switches should then be fixed into the top of the case and the receiver is now ready for alignment.

Medium Wave Alignment

Set the A.M./F.M. switch to "A.M." and set the battery/



Rear view of the "Roadfarer".

mains switch to "Battery". Turn the volume control to maximum. Adjust C9 for minimum capacity (fully unscrewed). Adjust C3 and C4 to maximum capacity and then unscrew the adjusting screws two turns. Move LC1 to the extreme end of the rod. Tune to the L.F. end of the band (tuning capacitor fully closed) and inject a modulated signal of 540kc/s into the base of TR1, via a 100pF capacitor. Adjust the AE rod winding LA1 and the core of L1 for maximum signal. Tune to the H.F. end of the band (tuning capacitor fully open) and inject a modulated signal of 1·64Mc/s. Adjust trimmers C3 and C4 for maximum signal. Repeat this operation several times until no further improvement can be obtained. The input signal should be progressively reduced and adjustments made with a minimum input level.

Tune to the H.F. end of the band and inject a 1·64Mc/s signal into the base of TR1 via a 100pF capacitor in series with a 100kΩ resistor. Increase the capacity of trimmer C9 until an increase in signal level occurs. Then readjust C3 and C4 for maximum signal. Return to C9 and increase capacity *slowly*, readjusting C3 and C4 for maximum signal and also adjusting the level of the injected signal, keeping it at a level which gives a low output from the speaker.

Repeat the operation until the point is reached where any further increase in the capacity of C9 results in instability and oscillation. If insufficient adjustment is available on C9 the reaction winding LF1 may be pushed further on to the rod.

Now tune slowly over the band and should instability occur at any point adjust the core of L2 until the oscillations cease.

Final adjustments are best made using the signals from actual stations on the band. The adjustment should be carried out using a new battery. As the battery ages, it is possible to compensate by adjusting C9 to give increased signal level.

F.M. Alignment

Switch the A.M./F.M. switch to "F.M." and the battery/mains switch to "Battery"; set the volume control to half rotation. Fully extend the telescopic aerial. Adjust the core of L4 until a loud rushing noise is heard. Tuning over the band, signals from the Home or Light Programmes should be heard. The rushing noise should disappear as the station is tuned in.

If a signal generator is available, the output terminal needs only to be connected to a short length of wire to give radiation sufficient for the tuner. Using either a programme, or the signal generator, the tuner may be calibrated by adjusting the spacing of the turns on the coil L3.

Each station will be found to tune in clearly twice, i.e. either side of the carrier frequency. L4 should be adjusted to give maximum signal.

In areas of lower signal strength, an additional F.M. dipole may be used and should be connected using about 4ft of coaxial cable. Long lengths of cable or outdoor aerials *must not be used* because of the possibility of interference with other receivers by radiation from the oscillatory circuit of the 2N502.

The F.M. tuner is *not* intended to operate in fringe areas without an F.M. pre-amp which may be used with an external aerial.

When using the receiver in conjunction with the mains, if no method is available of measuring the supply voltage, plug the mains selector into the 225V position. If instability on A.M. results, then plug into the 250V position. *Always disconnect the set from the mains supply before handling the voltage selector.*

Comprehensive Power Supply Unit

A VALUABLE EXPERIMENTAL CIRCUIT

By W. Morle

THIS article is concerned with a feature of construction that can be applied, at a cost of only a shilling or two, to most power units, with the object of improving their adaptability, and making them usable without alteration for a variety of purposes.

A Number of Designs

There are a number of designs of equipment intended for home construction which require a separate power supply unit, including tape amplifiers, pre-amplifiers, F.M. tuners and so on. For the main part, it would be possible to devise a power supply unit that would satisfy the requirements of most or all of these units so far as the necessary current and voltage are concerned. A power supply unit giving, say, 250 and 300V at about 60 to 80mA would serve for most of these units, especially if there were some provision for minor changes of voltage when the different units were used.

The advantages of a common design of power unit will be readily appreciated: if a fault develops or is suspected in one unit, it can be checked at once by substituting the unit from another piece of equipment.

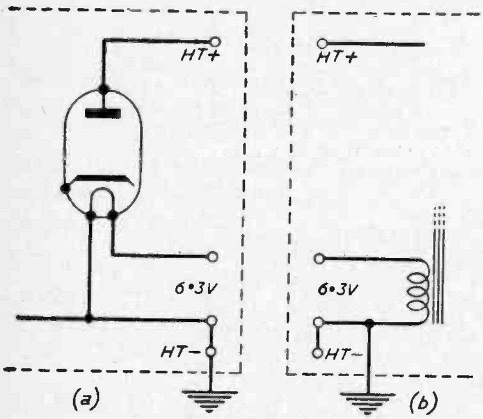


Fig. 1.—If an F.M. tuner, for example, with one side of its heater circuit connected to earth or chassis—represented by diagram (a)—is connected to a power-pack, the power-pack must be wired as in diagram (b).

When a new piece of equipment is made, it is not necessary to complete the power unit for it before testing it. Again, when a new piece of equipment is being designed, involving experiments, it is very convenient to have available a power supply that can be borrowed temporarily from existing equipment.

At first sight, it might appear a simple matter to devise a power unit that could be used in this way, but closer examination shows that there are considerable difficulties in doing so. In the first place, the smoothing required may differ: an amplifier might require the highest available voltage, with minimum smoothing, whilst a pre-amplifier would require a lower voltage with the maximum smoothing available. This problem is not insuperable, and various solutions come to mind.

A much more difficult point arises with heater connections, owing to the fact that some designs call for one side of the transformer winding supplying the heaters to be earthed, whilst others call for the centre-point to be earthed. In the latter case, the earth connection may be required to be made in the power unit itself through a low value potentiometer, so that the centre point can be adjusted.

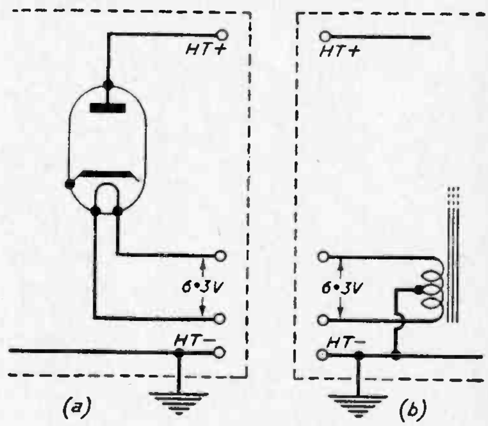


Fig. 2.—If a unit such as a tape amplifier, for example, has a heater circuit which is not earthed—represented by diagram (a)—the centre tap of the heater winding in the power-pack must be earthed as in diagram (b).

This last difficulty can be illustrated with two items of equipment that have been made in large numbers by home constructors; an F.M. tuner and a tape amplifier. In one design of the former, the heaters are earthed on one side, in the manner shown in the circuit detail of Fig. 1(a). Three wires extend between the tuner and its power unit, the heater arrangement of which has to be as in Fig. 1(b). On the other hand, the heaters of the tape amplifier are not earthed in the amplifier itself, and require the centre-tap of the heater winding to be earthed in the power unit, as shown in Figs. 2(a) and (b). The amplifier takes its power supply through a four-pin plug and socket, and it is not an easy matter to modify it in this respect.

If equipment of the type shown in Fig. 1(a) were used with a power unit connected as shown in Fig. 2(b), or vice versa, it will be seen that in either case the heater winding will be short-circuited as soon as the two chassis are connected together. The short circuit is shown in Fig. 3 by the dotted line. In passing, it is to be observed that the earth connection in the power unit of Fig. 2(b) cannot be omitted in an attempt to solve the difficulty, as such a practice is conducive to hum.

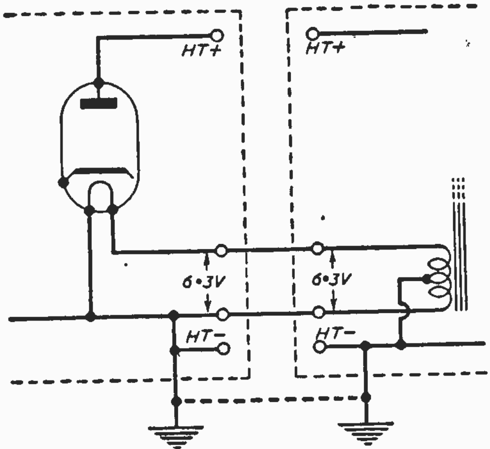
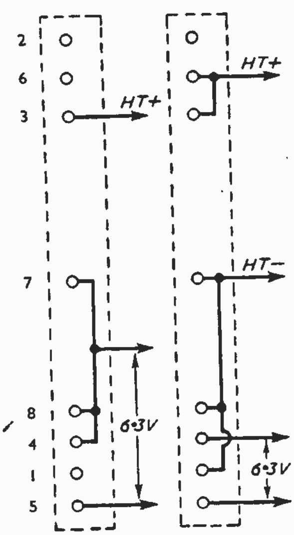


Fig. 3 (above).—If a unit having one side of its heater circuit earthed were connected to a power-pack having a heater winding with an earthed centre tap, as shown above, then part of the heater winding would be short-circuited.

Below: Fig. 5 (left) and Fig. 6 (right).—Alternative arrangements of the connecting plug. (The pin connections correspond to those in Fig. 4.)



Plug and Socket Connection

In the power supply unit which is now to be described, a solution to this problem is offered which consists of using a plug and socket connection at the power supply unit: no connection is made in the unit itself between the heater winding and the chassis of the unit, the necessary connections being made in the plug. The plug forms part of the equipment supplied with power, and the appropriate connections to the power unit are therefore made when the plug is inserted. In the interests of economy, an octal valveholder is used as the socket; the plug can be a cable-mounting octal plug or an old octal valve base pressed into this service. Additionally, the plug can be used to select different output voltages, so that when the plug of a particular piece of equipment is inserted into the socket of the unit, the correct voltage will automatically be supplied to the equipment without further adjustment.

Power Supply Circuit

The circuit of a power supply unit designed on these lines is shown in Fig. 4. The unit consists for the most part of a conventional full-wave rectifier arrangement and that part of the circuit which lies to the left of the dotted line can be replaced by any equivalent circuit within the resources or needs of the constructor. The transformer T1, used in the unit described, had secondary windings giving 290-0-290V, 6·3V for the rectifier and 6·3V for the heaters. The primary winding can be embellished with voltage taps, switches, fuses and plugs and sockets as desired. The rectifier valve is an EZ80.

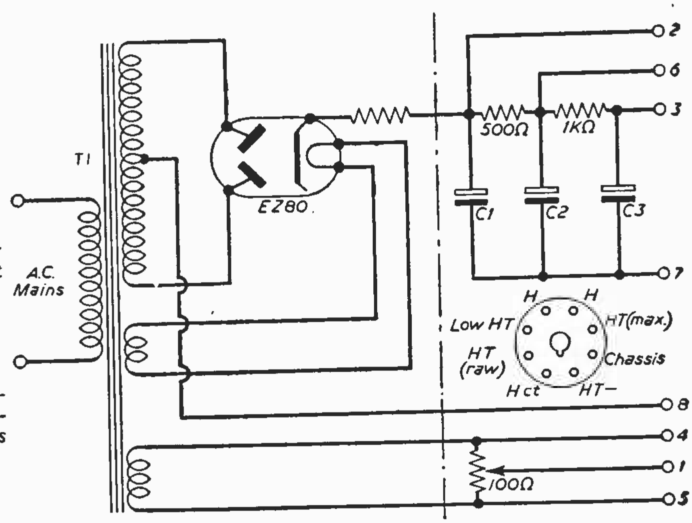


Fig. 4 (right).—The circuit of the power supply unit. (Details of the socket connections are included.)

Smoothing

Smoothing is effected by two resistors of 500 and 1000Ω respectively, in conjunction with a three-section electrolytic capacitor C1, C2, C3, 350VW. The 500Ω resistor can be replaced by a smoothing inductance in the usual way.

We now come to the less conventional parts of the circuit. Various connections to the circuit are brought out to eight terminals, numbered 1 to 8 using the convention usually adopted with octal plugs and sockets; with the socket viewed from the under-side, the contacts are numbered clockwise starting from the location projection on the key. Connections are brought out from the top of C1, C2 and C3, from the centre tap of the H.T. winding, from the common can of C1, etc.—which is also connected to the chassis—from the ends of the heater

(Continued on page 146)

Transistorised alignme

THE circuit of this signal generator consists of two separate units—an R.F. oscillator and an L.F. oscillator. The L.F. oscillator may be used separately, or, the two units may be used together, the L.F. oscillator then serving to modulate the R.F. oscillator. For simplicity, both oscillators utilise a tuned collector circuit and the minimum of components is used throughout. A transistor is used in both units, making possible a small, portable, instrument which works from a miniature torch battery. Because both units are oscillators, the gain of the transistors is of little importance and little advantage is obtained by using preferred types—surplus transistors will serve just as well.

L.F. Oscillator (TR2)

The L.F. oscillator comprises a grounded emitter A.F. transistor with a tuned collector circuit and a feedback winding connected in its base/emitter circuit. The output is taken from its emitter load, a 1k resistor, which is shared by the R.F. oscillator.

The output level of this oscillator is made variable by connecting a 5k potentiometer—fitted with a switch—across the 1k emitter resistor; the switch serves as the battery on/off control. For simplicity, the output impedance of the signal generator has not been made constant for all output levels — but this omission should not cause inconvenience for most applications.

R.F. Oscillator (TR1)

The circuit of the R.F. oscillator is very similar to that of the L.F. oscillator except that the L.F. transformer is replaced by two R.F. transformers—one for medium-wave and one for long-wave frequencies—with the necessary switching to connect the appropriate transformer into the circuit. A 500pF (0·0005μF) variable capacitor is used to tune to the required frequency.

Modulation of the R.F. oscillator is achieved by injecting the L.F. signal into the emitter circuit of the R.F. oscillator—both oscillators sharing a common emitter resistance. An additional output, for higher level signals, is available, and this output is taken from the collector of the R.F. oscillator transistor via a 0·01μF isolating capacitor. The R.F. oscillator may be rendered inoperative by the wave-change switch; the signal generator may thus be used for A.F. signals only. Both of the R.F. transformers have tunable cores enabling the required bandwidth of oscillations to be covered.

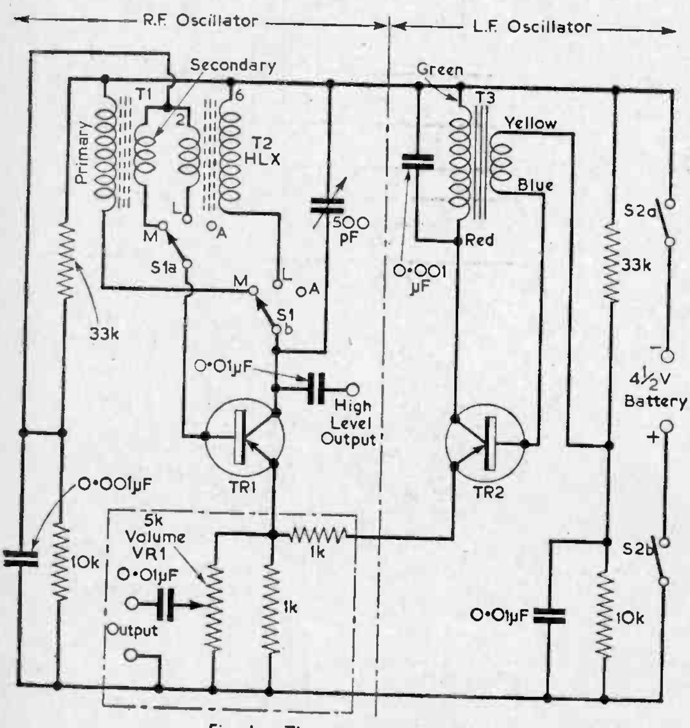


Fig. 1.—The circuit diagram.

Construction

Both oscillators are constructed on two pieces of $\frac{1}{16}$in. paxolin with the exception of the tuning capacitor, the potentiometer, and the wave-change switch. The complete circuit is mounted on the inside of the front panel of the instrument, as shown in the illustration on page 142. The instrument case is made entirely from hardboard. The end pieces are veneered and then French polished. The remaining surfaces are covered with adhesive-backed plastic material. Alternatively, the end pieces of the cabinet may be cut from $\frac{1}{4}$in. hardwood and polished.

The supply battery—three U16 cells connected in series—is mounted on the hinged back of the instrument case and held in position by a case formed

t aid

A TWO-TRANSISTOR CIRCUIT FOR MEDIUM AND LONG WAVES

By D. Saull

by wrapping thin cardboard round the cells and cementing in position. Details of the cabinet construction are shown in Figs. 3 and 4.

When making the cabinet, all the components should be fitted into position before the front panel is cemented to the sides and to the top and bottom, and then removed for completion of the cabinet. This ensures that all the components will fit and that screw holes, etc., are in the correct position, making final assembly easier.

Where the front panel meets the top and the bottom of the cabinet, because of the inclined angle of the front panel, a gap occurs between the meeting surfaces. This gap may be filled with plastic wood which, when dry, may be sanded into a gentle curve.

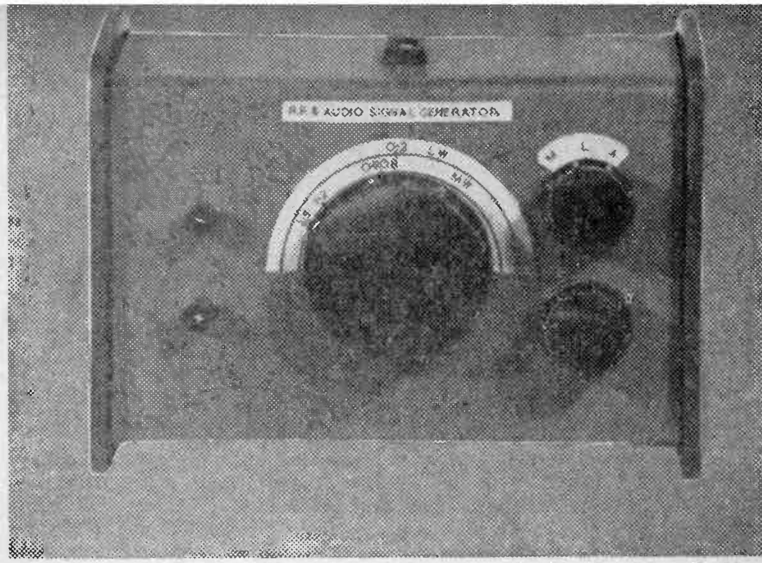
The back of the cabinet is hinged by means of a strip of cloth cemented to the edge of the base and the back of the cabinet.

Impact adhesive (e.g., Evostick, Dunlop 708, etc.) is used throughout the construction, and the corners of the cabinet are reinforced with strip wood.

Wiring and Assembly of Components

The tuning capacitor should be inserted into the cabinet first and two leads connected to it. The volume control should be wired before inserting into position, and the output terminals connected into circuit. Fig. 5 illustrates the initial wiring. Then insert the R.F. and the L.F. oscillators panels and complete the wiring.

Should, on completion, either oscillator fail to function, then reverse the connections of the feedback winding on the relevant coil.



Front view of the unit.

Calibrating the Signal Generator

The calibration of the instrument—a simple process—is carried out as follows:—

(1) turn the supply switch to "on";

(2) connect two leads from the signal generator to the aerial and earth sockets of an ordinary domestic receiver;

(3) turn the wave-change switches on the domestic receiver and the signal generator to the medium-wave position and tune the domestic receiver to the Home programme;

(4) adjust the frequency tuning control on the

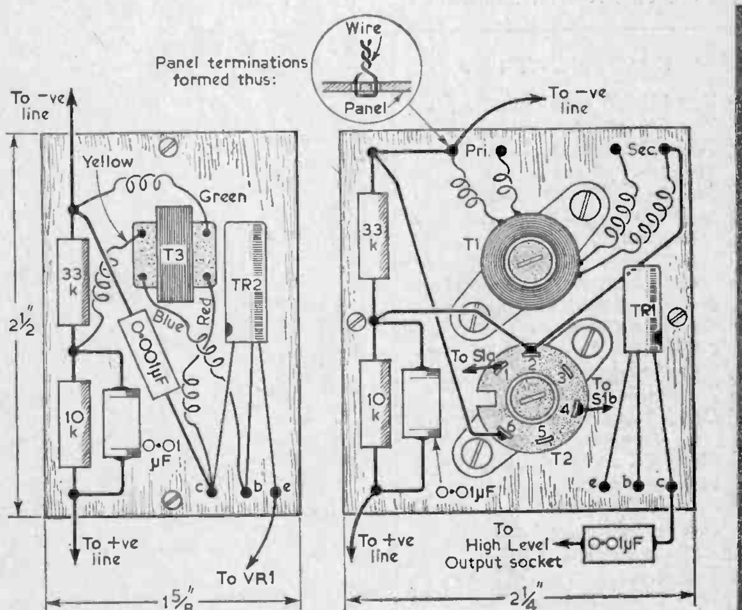


Fig. 2.—The wiring of the L.F. and R.F. oscillators.

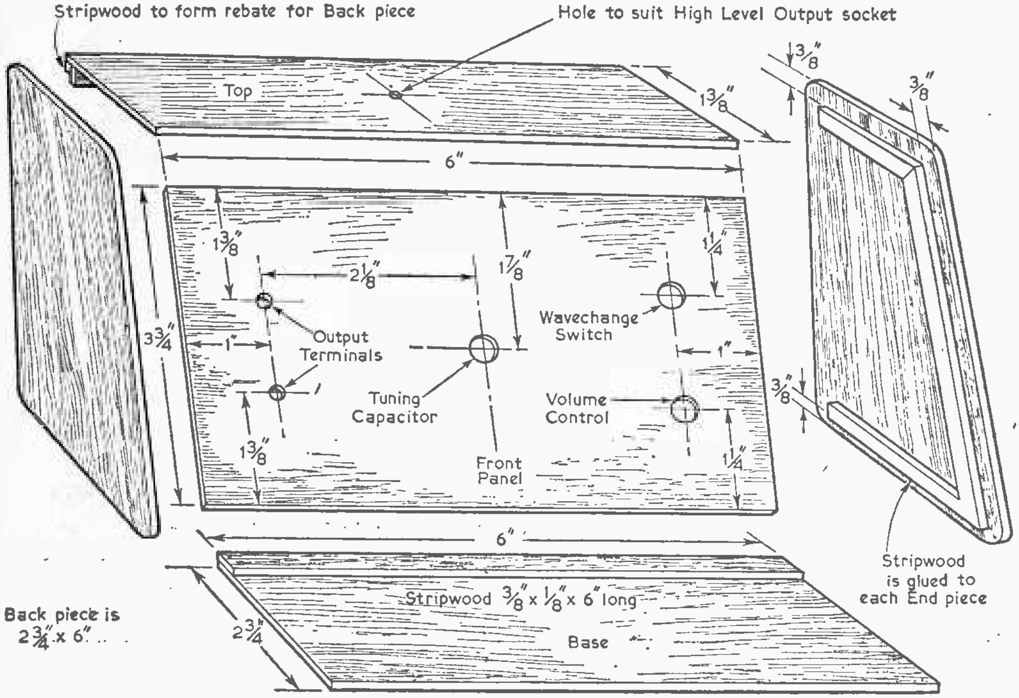
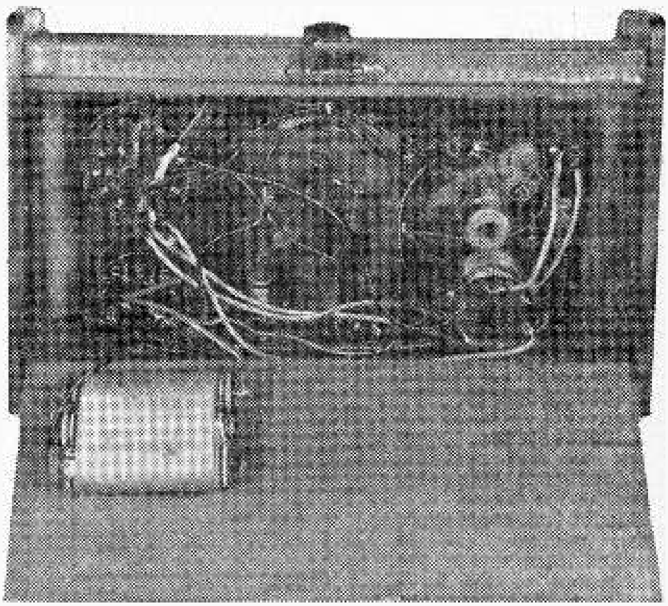


Fig. 3.—The construction of the cabinet.

signal generator until a 1kc/s audio tone is heard superimposed on the broadcast programme from the domestic receiver and mark the setting—wavelength or frequency (note: the output of the signal generator is insufficient to cause interference to other listeners by radiation). Finally, steps (3)

COMPONENTS LIST

Two 33k ½W resistors
Two 10k ½W resistors
Two 1k ½W resistors
Three 0·01 μF capacitors
Two 0·001 μF capacitors
Miniature pot.—5k with double-pole switch
500pF mica dielectric tuning capacitor
4½:1 miniature interstage transformer (Ardente)
4-pole, 3-way wafer switch (two of the poles are not used)
Three U16 batteries
One ⅜in. diameter polystyrene coil former with slug
One HLX coil (Teletron)
Two small terminals
One small socket
One large tuning knob (about 2in. in diameter)
Two knobs, ¾in. in diameter
TR1: White spot transistor
TR2: White or red spot transistor



Internal wiring of the unit.

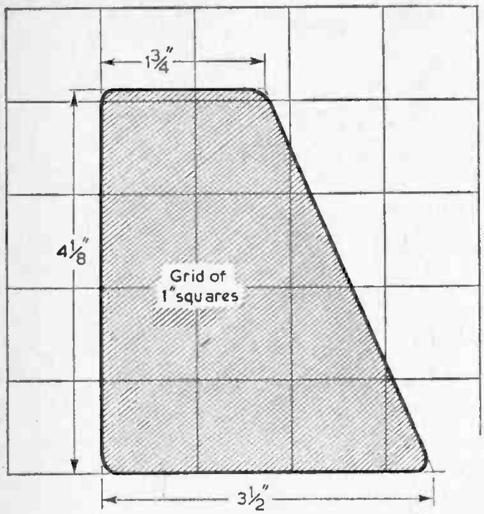


Fig. 4.—The dimensions of the sides of the cabinet.

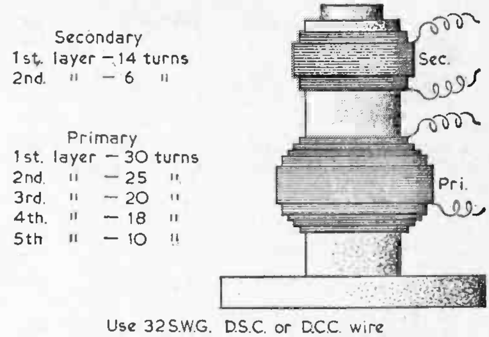


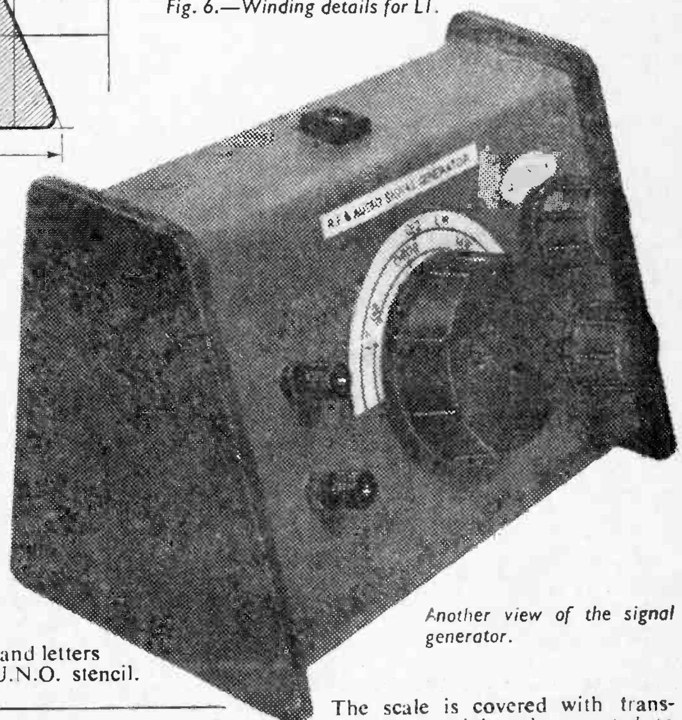
Fig. 6.—Winding details for L1.

and (4) should be repeated for the Light programme on the medium and long wavebands. Other intermediate calibration points can be inserted on the scale based upon the calibration of the domestic receiver tuning dial, but three highly accurate calibration points will have been obtained at the broadcast signal frequencies.

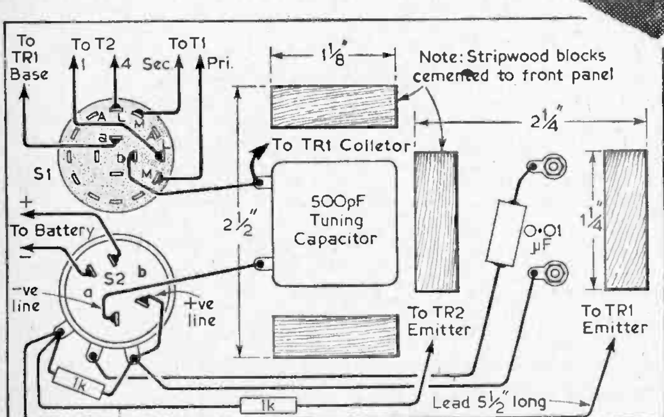
(Note: Local broadcasting transmitter frequencies and wavelengths can be found in the local edition of *Radio Times*.)

Signal Generator Frequency Scale

The frequency scale is made from a piece of white cardboard; the markings are made in black ink. If care is taken, a professional appearance may be obtained. Figures and letters may be in free-hand style—or by U.N.O. stencil.



Another view of the signal generator.



The scale is covered with transparent material and cemented to the front panel of the instrument.

When connecting the signal generator to a receiver for calibrating or for checking a receiver's performance, the following observations may be found useful:—

(1) The greatest signal is available when two connections are made between the signal generator and the receiver, one lead being connected to the receiver chassis and the other to

(Continued on page 154)

Fig. 5 (left).—The wiring to be completed before the oscillator panels are mounted.

HI-FI
Pre-amp and Equaliser

A COMPREHENSIVE CIRCUIT

By J. Haskell

THE circuit described comprises the latest techniques in hi-fi pre-amplification. It is suitable for use with any amplifier.

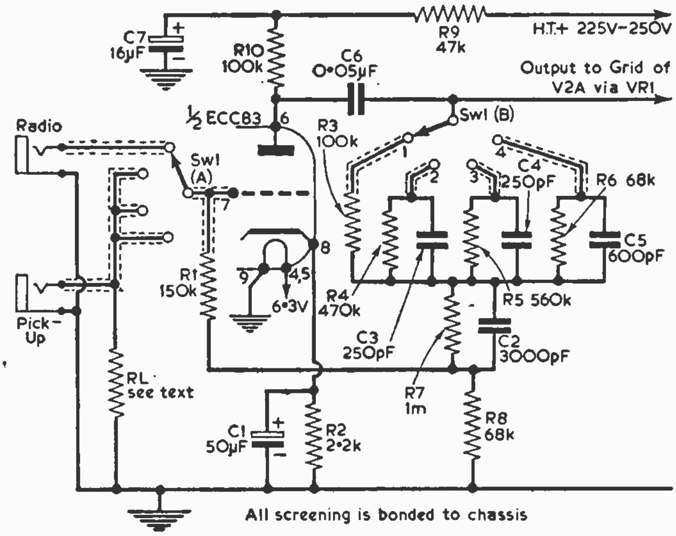


Fig. 1.—The equaliser circuit.

Equaliser

The circuit in Fig. 1 is focused around V1 which can be either one section of the double triode ECC83 or any high gain, double-diode-triode, such as the EBC41 or 6AT6.

The circuit of V1 comprises equalisation for radio and records, as well as additional amplification for an amplifier with an input impedance of 1M requiring 500mV input. Equalisation for radio is on position 1 of SW1, RIAA position 2, U.S. Col. LP's position 3, and 78's position 4. A negative feedback resistance/capacity network in the anode/grid circuit of V1 provides the necessary frequency correction. RL is not the load resistor of the pick-up, as it is in parallel with (R1 + R8) and its value should, therefore, be calculated bearing this fact in mind. Adequate decoupling by C7 serves to keep hum and distortion at low level.

Tone Control System

In Fig. 2, the second stage incorporates a well-known tone control circuit with independent cut and boost in both treble and bass frequencies, as referred to a frequency of 1,000c/s.

An interesting change was the omission of C15, as a result of which a degree of current feedback was applied to V2, keeping hum and distortion at a minimum. C15 could, however, be inserted if extended high frequency response is required and where the extra gain is useful. The potentiometer VR2 is centre-tapped, giving treble boost and cut at the extreme ends of its travel; this also applies to VR3.

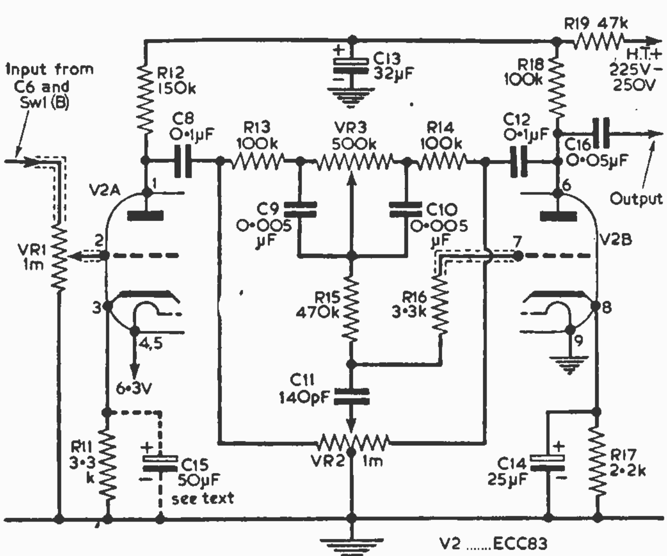


Fig. 2.—The tone and volume control circuit.

Construction

As many constructors design their own layout, a few points must be stressed: 1, all control-grid wires are to be screened; 2, the tone control casings should be earthed; 3, owing to the high gain, screening might be required, though it was not used in the prototype; 4, all heater wires should be twisted tightly and positioned close to the chassis, as far away from the grid leads as possible.

The author found construction on group boards gave a neat appearance and facilitated servicing. It should be remembered that the layout of components can make or mar the capabilities of

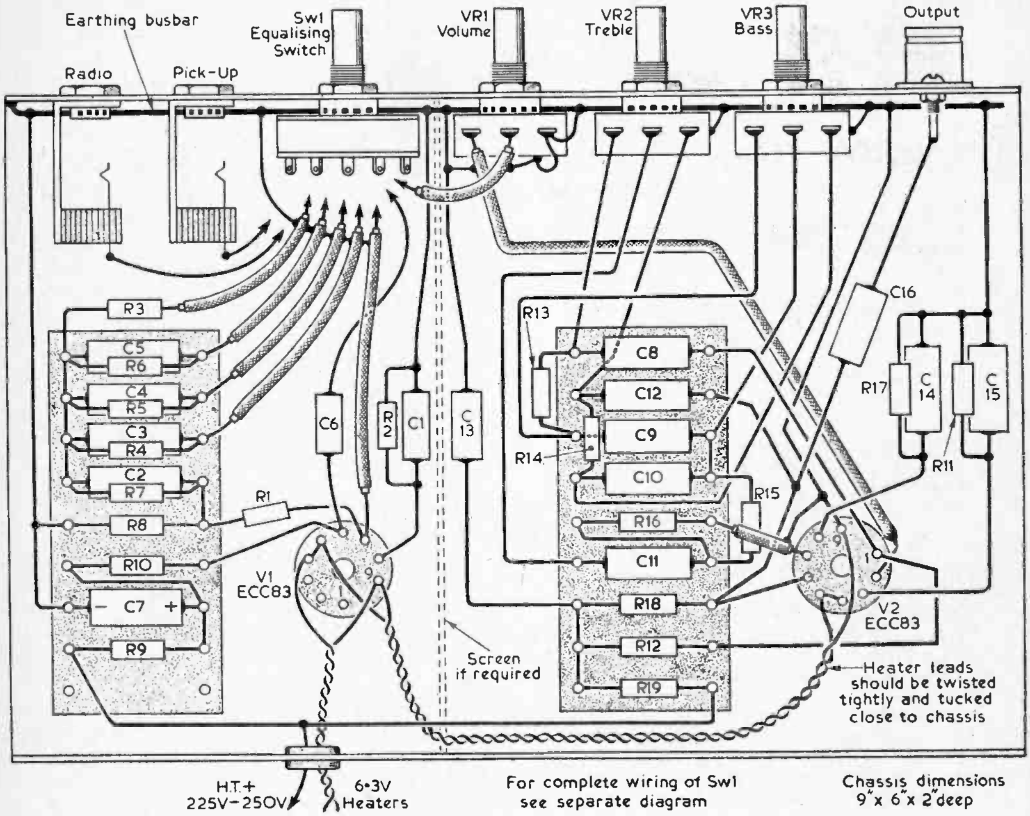


Fig. 3.—The under-chassis layout.

the pre-amp. The lead going to R11 should be kept close to chassis since the absence of C15 (if, in fact, it is omitted) may cause induced hum. All earthing must be made to a bus-bar, earthed as close to the input sockets as possible, and there only.

Best results would be obtained if C11, C3, C4, C5, R4, R5, R6 were of close tolerance, i.e. 5per cent.

COMPONENTS LIST

Resistors

(All resistors are ¼ or ½W)

R1	150k	R11	3·3k
R2	2·2k	R12	150k
R3	100k	R13	100k
R4	470k	R14	100k
R5	560k	R15	470k
R6	68k	R16	3·3k
R7	1M	R17	2·2k
R8	68k	R18	100k
R9	47k	R19	47k
R10	100k		

Capacitors

C1	50 μF 50VW	C4	250pF
C2	3000pF	C5	600pF
C3	250pF	C6	0·05 μF

C7	16 μF 450VW	C14	25 μF 450VW
C8	0·1 μF	C15	50 μF 50VW
C9	0·005 μF	C16	0·05 μF
C10	0·005 μF	VR1	1M
C11	140pF	VR2	1M centre-tapped
C12	0·1 μF		
C13	32 μF 450VW	VR3	500k

SW1 4-pole, 4-way rotary switch
2 B9A holders if using two ECC83's

Miscellaneous

One piece of aluminium 10in. x 9in. for the chassis (which is made as the constructor wishes). Connecting wires, shielded wire, etc.

Valves

Two ECC83's (or one ECC83 and one double-diode-triode)

Component layout

For constructors wishing to follow the prototype, the layout of components on the group boards is shown in Fig. 3.

For constructors with a modest income, the author advises that the tone control circuit be made first, and if used with the popular crystal cartridges, which have a fair degree of record equalisation owing to their response curves, quite good results will be obtained. If, however, the best results are desired, both units should be constructed together.

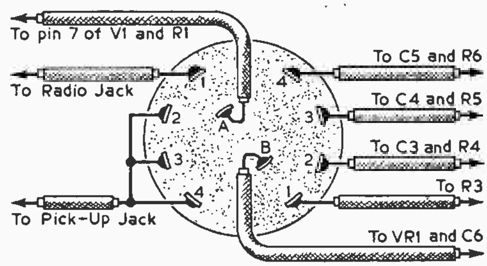


Fig. 4.—The wiring of SW1—the equalising switch.

COMPREHENSIVE POWER SUPPLY UNIT

(Continued from page 139)

winding and from the centre-tap of this last winding. The centre-tap can be a direct tap on the winding, if one is provided; if it is not it can be an artificial one formed by two resistors connected in series, of about 20 to 100Ω each, across the winding. In the circuit described, which was intended to be used with equipment where hum had to be kept to a minimum, a potentiometer (100Ω) is used. Any value between about 50 to 200Ω would be suitable.

Plug Wiring

In Fig. 5 is shown the way in which a plug would be wired to supply a piece of equipment such as the F.M. tuner mentioned earlier, with one side of the heaters earthed, and a single H.T. connection, as in Fig. 1(a). As before, the numbers refer to the standard octal contacts. In the plug (Fig. 5), the H.T. connection is made to contact 3, the heater connections to contacts 4 and 5 and contacts 7, 8 and 4 are joined for the common earth and H.T. negative.

The reason for bringing out the separate connection to the centre-tap of the main H.T. winding may not be apparent at first but it has the important practical advantage that, should the unit be operated with the mains supply switched on, but with no plug in position in the outpupt socket, no damage to the electrolytic capacitors will ensue. Otherwise, if there were no current being drawn from the unit, the voltage on the capacitors would rise to approximately the peak voltage of the H.T.; with 290V, this would be about 400V, which is in excess of the voltage ratings of the capacitors. The indirectly heated EZ80 prevents excessive voltage on the capacitors when switching on in normal use.

A further arrangement of the connecting plug is shown in Fig. 6, intended for use with the tape amplifier. In this case the H.T. connection is made to contacts 6 and 3 which are shorted in the plug. The effect of this is to give a higher output voltage, and to short out the 1k resistor and connect capacitors C2 and C3 in parallel, to make best use of them for smoothing. Contacts 7 and 8 are joined together in the plug as before, and the centre-tap contact 1 is also connected to them. For convenience, a view of the socket base, from the underside, is shown in Fig. 4.

In both the uses of the unit described, only a single H.T.+ connection has been made to the associated equipment, but if desired connections can be made to both terminals 6 and 3 provided that the total current drawn from the unit does not exceed the permissible maximum. ■

All-Band 75W Transmitter

(Continued from page 130)

switch set to "grid current," the "'phone/CW" switch to "'phone," the bandswitch set to 80m and the appropriate tank coil plugged in. The "net" switch is depressed, the receiver R.F. gain reduced, the BFO turned on, and the V.F.O. tuned for a medium frequency beat note. The "net" switch is turned off, and the receiver R.F. gain control reset for normal reception. The transmit/receive switch is depressed, and VCI tuned around three quarters capacity for a dip in anode current and a jump in the grid current reading from zero to a high value. The tuning of the VFO output stage is adjusted for maximum grid current. VCI is adjusted until the grid current reads about two thirds of FSD. The high H.T. switch is depressed and the P.A. anode tuning quickly adjusted for a sharp deep dip. The loading condenser should be moved to maximum capacity during this adjustment. The loading condenser is now adjusted for a rise in anode current, the tuning condenser adjusted for a dip, and so on, until a reading of about 100mA is obtained at the dip position. It is quite possible to load up to almost 150mA, when an input of 112W is being taken. but this may damage the valve. The "listen-through" control is slowly advanced until the beat note is again heard loudly. The receiver B.F.O. is turned off, a suitable microphone plugged in, and headphones used for reception. The modulator gain control should be advanced until good clear modulation is heard, on speaking. At this point, the P.A. anode current meter will give slight upward kicks. You may now have a QSO: switching back to "receive" carries out all the switching necessary to return to normal reception. By simple modifications, press-button microphone, or voice controlled switching can be used. Normally, when operating on 'phone, the "listen-through" control is turned down sufficiently to prevent audio feedback. On CW, monitoring of the output is possible using this control.

Operation on the other bands is just as simple, but it should be remembered that around 5mA of grid current is required for efficient output. Excess drive will reduce the output. ■

Loudspeaker One-valver

A BEGINNER'S MAINS CIRCUIT

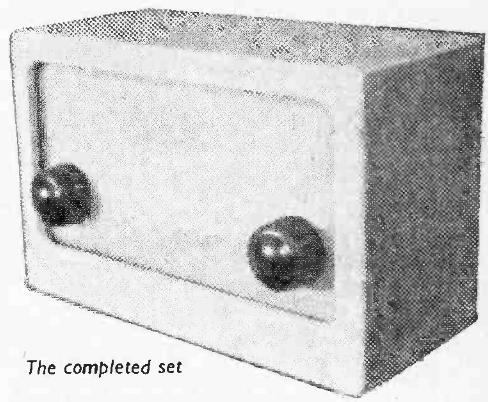
By K. Severn

THIS receiver is of small size, but neither miniature components nor a very compact layout have been adopted. Construction is thus very easy indeed, and the completed receiver is inserted as a single unit into its cabinet. The circuit is shown in Fig. 1, and uses an ECC83 or 12AX7 double triode. This valve has a heater which may be operated from a 6·3V or 12·6V transformer. In the wiring plan the heater is wired for 6·3V operation. If a 12·6V transformer is to hand, heater circuit connections are made to pins 4 and 5 on the holder, and pin 9 is not used.

The Function of the Components

The set covers long and medium waves. C1 is an isolating condenser, and is screwed on the inside of the cabinet, so that a length of thin flex may be attached to it, to use as a "throw out" aerial. If a short aerial will always be used, a 500pF mica condenser will be satisfactory here. If a longer or better aerial can be provided, results can be improved by using a much smaller capacity, such as 50pF. Alternatively, a small pre-set condenser may be joined in series with C1, and adjusted for best results. The value is in no way critical, but selectivity is improved if C1 (or the pre-set) is of fairly low capacity.

C2 is for tuning, and in the interests of small size a 384pF air-spaced condenser was fitted. The usual 500pF air-spaced condenser is too large to be accommodated, unless panel and chassis dimensions are slightly increased. A 500pF solid-dielectric condenser may be used, but is less efficient.



The completed set

As the valve has a high gain, some negative feedback is introduced by the 1M resistor between anodes. The anode current is small, and permits a personal portable type of output transformer to be used. (These are intended for 3S4 and similar all-dry output valves.)

H.T. is obtained from a small contact-cooled rectifier, with series resistors for smoothing, and to keep the voltage down to a suitable figure. The mains switch is a lead-through type, as used for lamps, etc., and included in the flex to the receiver.

Chassis and Panel

The chassis is 7in. x 3in., with ½in. runners, and can be made from a piece of aluminium 8in. x 3½in. The front ends of the side runners are bent over, forming brackets which are bolted to the panel (Fig. 3). The panel is of 3-ply, and is 7in. x 4¼in., with holes for variable

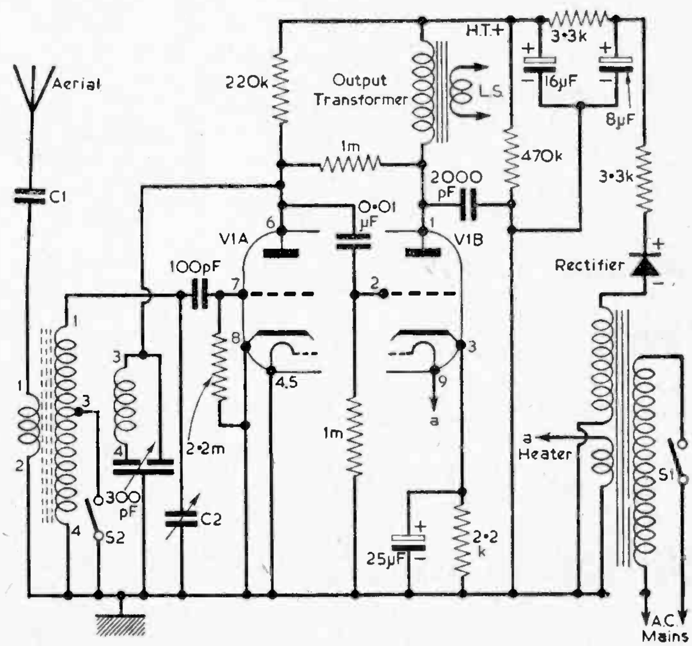


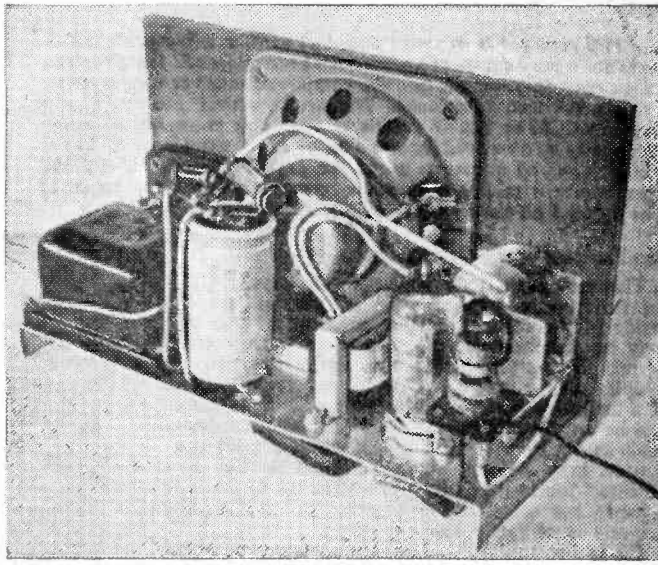
Fig. 1.—The circuit diagram.

condensers and speaker, as shown in Fig. 4. It is covered with silk or similar material after construction is finished.

Fig. 2 shows components and wiring above the chassis. The heater consumption is only 0·3A at 6·3V so the smallest type of mains transformer will suffice. That actually fitted was a "converter" transformer. The H.T. winding should give about 200V at 20mA but transformers giving 150-180V will be suitable also.

The smoothing condenser has a tag soldered to its common negative lug so that it can be bolted to the chassis. The frame of the tuning condenser C2 is also connected to the chassis. To obtain the 384pF capacity with the small condenser listed, both sets of fixed plates are wired in parallel, as in Fig. 2.

The reaction condenser is a differential type, and thus has two sets of fixed plates. These are marked F1 and F2 in Fig. 2. The moving plates tag is joined to the chassis.



Rear view of the receiver.

Transformer Wiring

Leads from the speaker transformer secondary pass to the speaker unit speech coil tags, as in Fig. 2. Primary leads from the transformer pass through the chassis, to the H.T. positive line, and pin 1 on the valveholder. The rectifier is bolted to the chassis, under the speaker. The total H.T. consumption is only a few milliamps, so a very small rectifier is satisfactory. It must, however, be intended for a 250V A.C. input.

Connect a length of twin flex to the mains transformer primary. Take one side of the circuit to the neutral pin of the mains plug—this is marked "N" in Fig. 2. Wire the on/off switch mentioned in the "L" conductor of the flex, at a convenient distance from the receiver. Take this lead to the "L" pin, or internal fuse, on the mains plug.

Components and wiring under the chassis are shown in Fig. 3. The insulated tag forms a connecting point for H.T. positive. The 470k resistor from here to the chassis serves to discharge the large condenser.

(Continued on page 153)

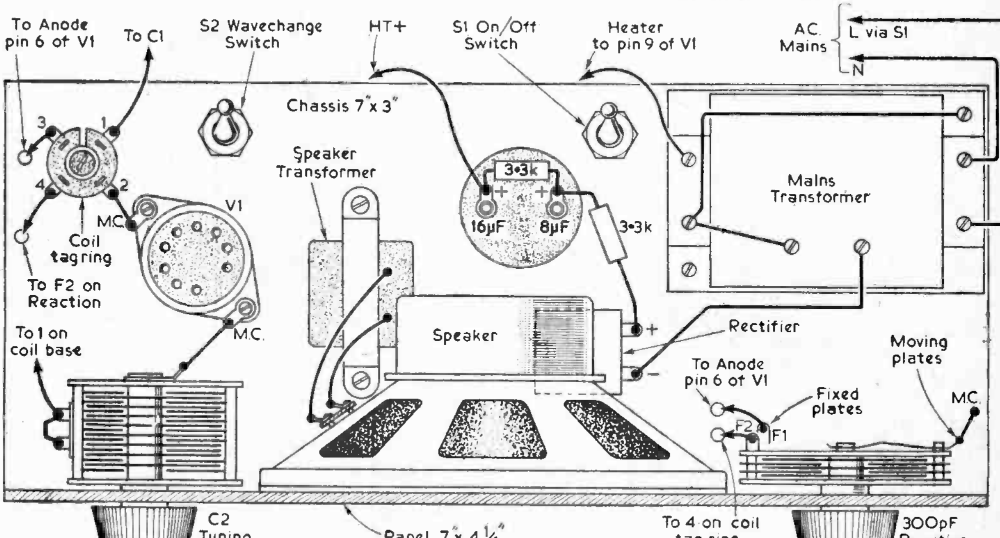


Fig. 2.—Layout, and dimensions, of the chassis and front panel.

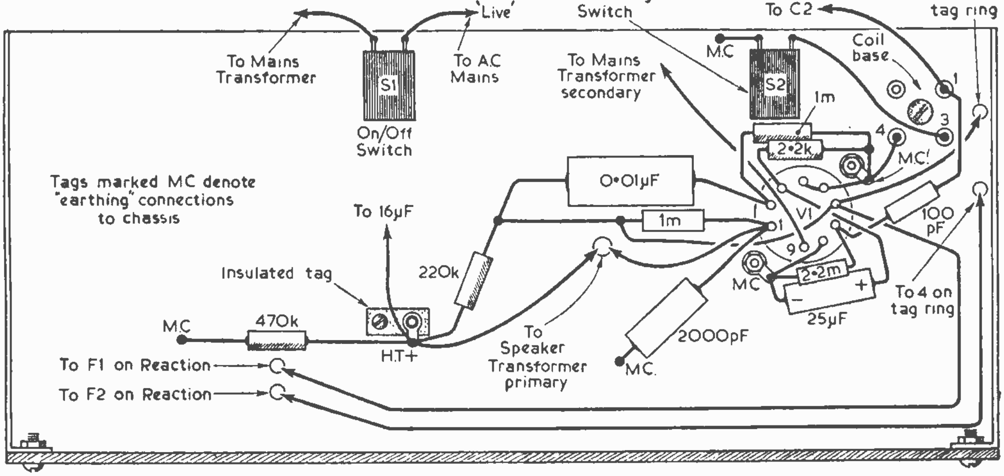


Fig. 3.—Wiring and components under the chassis (S1 and S2 may be mounted on the side of the cabinet if desired.)

(Continued from page 150)

Anode and grid leads should be kept short and direct, and run near to the chassis. A 0·01μF mica condenser is recommended for coupling between stages, as any leakage will upset working.

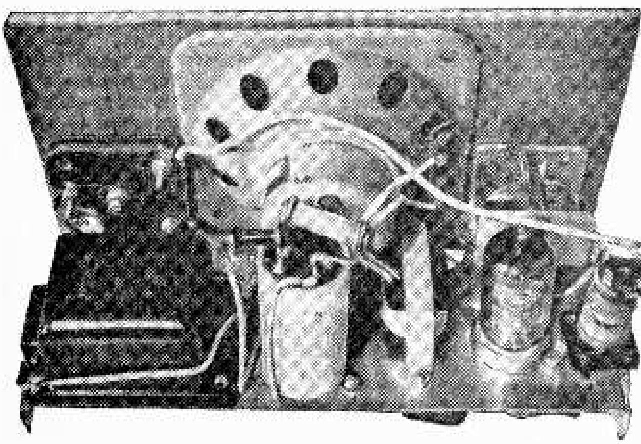
Coil Connections

The coil listed has a square base with numbered tags, and a circular tag ring, with slot. Connections to the square end of the coil are shown in Fig. 3. The coil is supported by a very short, stout lead from tag 4 to a soldering tag, which is bolted to the chassis. Tag 1 goes to the 100pF fixed condenser and the fixed plates of the tuning condenser C2. A short length of thin flex is taken from tag 3 to the wavechange switch, which is returned to chassis. This switch may be mounted on the side of the cabinet.

The tag ring end of the coil is shown in Fig. 2. Tag 1 goes to C1, for the aerial connection. Tag 2 is connected to the chassis. Tag 3 goes to anode (pin 6 on the valveholder) while tag 4 is connected to F2 on the 300pF reaction condenser. If it should be found that reaction is unsatisfactory, reverse the leads going to tags 3 and 4.

COMPONENTS LIST

ECC83 or 12AX7 valve, B9A holder
Jackson Bros. 208 + 176pF tuning condenser
300pF differential reaction condenser
Osmor QR11D coil
Insulated toggle switch
Lead-through mains switch
Condensers: 8 + 16μF 350VW 25μF (small), 100pF, 500pF, 2000pF, 0·01μF mica
Resistors: 2·2M, two 1M, 470k, 220k, two 3·3k, 2·2k
250 V, rectifier
Two 1¼in. diameter knobs
Converter type mains transformer: primary to suit mains; secondaries: 180-200V 20mA; 6-3V 0·6-2A
3½in. permanent magnet speaker with transformer



Another view of the receiver.

Panel and Cabinet

The loudspeaker is attached by means of wood screws, taking care these are not long enough to penetrate the front of the panel. A quick-drying adhesive is then applied round the perimeter of the panel, and a piece of silk or similar material is prepared by cutting clearance holes for the variable condensers. This material is then placed on the panel, and kept taut with a few drawing pins at the edges, until the adhesive has dried. Any surplus material can then be cut away.

Constructional details of the cabinet are shown in Fig. 5. Take care to leave a little clearance so that the receiver can be inserted from behind. The parts are held together with glue and panel pins. When the glue has hardened, all edges and corners can be smoothed with a glasspaper block.

The finish given to the cabinet is a matter of choice. The author's receiver was given a coat of quick-drying cream enamel. If there are defects in the joints or the wood has open grain, fill with one of the packet fillers sold for such purposes, allow to dry and smooth off with glasspaper.

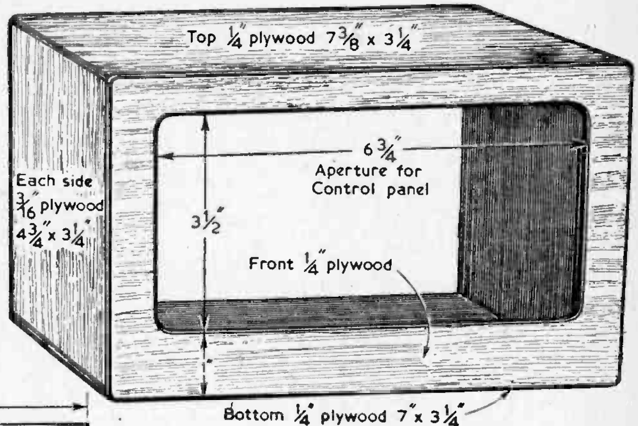


Fig. 5.—Details of the cabinet.

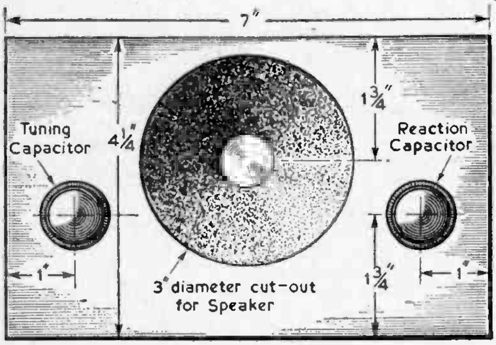


Fig. 4.—The front panel.

If varnishing is preferred, two coats are best. The first should be allowed to dry, and should then be lightly sanded before applying the second coat.

The actual wavebands tuned will depend somewhat on the position of the coil core, so this should be altered, if necessary, to obtain the required coverage. Reaction should be carefully adjusted to build up the volume of weak stations. This control should not, however, be turned fully clockwise, as this will only cause oscillation and poor reception. ■

TRANSISTORISED ALIGNMENT AID

(Continued from page 143)

the point of injection into the receiver circuit. It will be found that the output signal is strongest at the higher frequency end of the M.W. band and falls progressively with decrease in frequency, necessitating turning up the volume control on the signal generator. If a connection is made to the chassis of a receiver, care should be taken if the latter is of the D.C. variety and has a live chassis.

If too great a signal is available, it will be found that removing the connection to the receiver chassis will decrease the signal applied to the receiver. Overloading the receiver will give a distorted output note—when correctly adjusted a good clear note is heard from the speaker of the receiver.

(2) Because the signal generator is of simple design, it has at its output terminals harmonics of the fundamental signal. It may be possible to tune to the signal at two positions of the receiver tuning dial. The signal generator output and the gain of the receiver should always be adjusted to give an audio output from the receiver under test of sufficient strength just to be comfortably heard. The fundamental signal amplitude is always greater than its harmonics.

(3) The signal generator output impedance is of a low order, thus making it ideal for injecting into low-impedance circuits—i.e., the aerial coil of a receiver, the base of a transistor, etc. However, if the output is applied direct across a tuned circuit in a receiver it will damp the tuned circuit and render it almost inoperative. The output from the signal generator when taken from the collector of the R.F. oscillator transistor has a higher source impedance and is more suitable for such purposes. (A separate terminal is available for this facility on the signal generator.)

(4) When wishing to check a receiver with a ferrite rod aerial (such as a modern portable superhet), a lead taken from the socket connected to the collector of the transistor in the R.F. oscillator circuit of the signal generator positioned over the top of the receiver will give ample test signal.

(5) The battery consumption of the instrument is only 1½mA, permitting long periods of operation without frequent battery replacement.

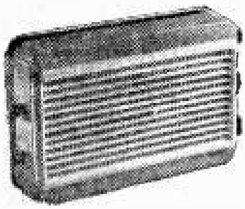
The signal generator will provide a useful source for test signals, and although, by very reason of its simplicity, it has limitations, with a little practice and time to become familiar with its charactertistics, it should prove both useful and effective to the user. ■

PORTABLE RADIO OR CAR RADIO

PUSH-PULL SIX

(6 Ediswan Transistors plus 2 Diodes)

MEDIUM, LONG WAVE AND TRAWLER BAND EXTENDING TO 80 METRES WITHOUT COIL CHANGING



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

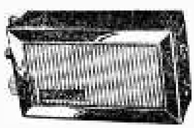
Build for **£6.19.6** Size 6¼ x 4⅛ x 1½in.

"Agreeab'y surprised with Trawler Band reception. Luxembourg as loud as local. Your easy build diagrams helped a lot . . . my first attempt."—H.S., Penzance Cornwall (poor reception area).

ALL PARTS SOLD SEPARATELY

TRANSONA-4

(4 Ediswan Transistors)

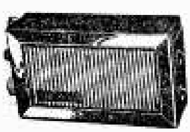


Miniature speaker. **FERRITE ROD AERIAL.** MW/LW and Trawler Band coverage down to 80 metres On test tuned in over 30 stations. This sensational new radio is simple to build with our easy-build plans Handsome pocket case.

May be built for **65/-** P.P. 2/6.

NEW! POCKET RADIO

(5 Ediswan Transistors and 2 Diodes)



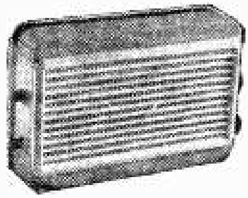
MEDIUM, LONG WAVE AND TRAWLER BAND TO 80 METRES. Designed round super sensitive ferrite rod aerial and 3in. speaker. Home and Continental stations at your finger tips. Attractive 2-tone pocket size case in gleaming polystyrene. No aerial, No earth required. Over 30 stations listed test receiver. Easy-build plans for beginners. Powered by 9 volt battery.

This amazing receiver may be built for **£4.19.6** P.P. 2/6.

ALL PARTS SOLD SEPARATELY

NEW PUSH-PULL FIVE

(MW/LW and TRAWLER BAND)
(5 Ediswan Transistors)



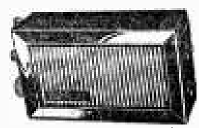
Now greatly improved Sensitive FERRITE ROD AERIAL. Pale blue polystyrene case with speaker grilles in red. Volume/sensitivity control. Noiseless compression tuning condenser. Miniature push-pull transformers. 350 Mw XC101's in push-pull. Sensitivity R.F. stage for station selection.

Total building cost **£5.7.6** P.P 2/6.

ALL PARTS SOLD SEPARATELY

PUSH-PULL POCKET SIX

MEDIUM AND LONG WAVES AND 400 TO 750 METRES WITHOUT COIL CHANGING.



Sensitivity of a superhet, tonal quality of a TRF. Volume control. Tuning condenser. Latest type switches. Handsome two-tone pocket case. Ferrite rod aerial. 3in. quality speaker. Easy build diagrams. 6 **Transistors** (including Ediswan and Semiconductors) **plus 2 diodes.**

All parts **£5.19.6** P.P. 2/6

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(3 Ediswan Transistors plus 2 Diodes)

Easy to build, easy to operate. This transistor radio operates over the M.W. and L.W. extending down to 80 metres without coil changing. Ferrite rod aerial, volume/sensitivity control. Sonotone high fidelity miniature earpiece.

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First-grade Miniature Push-pull Transformers......pair.11/-
Ferrite Rod Aerial, M/L wave (7in.)..........................8/6
Ferrite Rod Aerial, M/W (4in.)................................5/-
Transformers: 300 ohms primary, 5 ohms secondary. Brand new, boxed..3/6

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XA102, 2—XA104, XB113, 2—XC101 (matched pairs).

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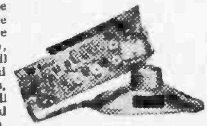

Mfrs. Current Production Offer—A fortunate bulk purchase enables us to offer one of the season's most outstanding bargains in Portable Transistor Radio Kits. This kit is a modern, sensitive quality circuit Receiver Unit with all the latest features. Six latest Transistors and 1 Diode, Printed Circuit, Med. and Long Waves, Ferrite Aerial, Car Radio Input, ½w Push-Pull output into 3 ohm Speaker, Calibrated Dial and Slow Motion Tuning, etc. Size: approx. 7 x 2¾in.

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12v. operation Medium and Long Waves

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Complete Kit Reduced Bargain Price
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JASON FM TUNER UNIT KITS (87–105 Mc/s) Standard Model (FMT1)—as previously extensively advertised. Complete Kit—5 gns. P.P. 2/6. Set of 4 spec. valves now only 20/-.
Tuner Coil Set, IFs and Ratio Detector, etc., 26/-.
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Latest Model—JTV2—Switched Band 1-2-3 AM/FM Unit with AFC. Kit £12.19.6. P. & P. 2/6.
New Jason Comprehensive FM Handbook 2/6, post free. 48-hr. Alignment Service, 7/6. P. & P. 2/6.

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Manufacturers' brand new, current production offer. Latest 5-valve circuit based on Mullard's famous design. Magic eye level indicator. Volume and tone controls. T.C.C. printed circuit already wired. Only power pack and controls to assembly and wire. Valves EF86, ECC83, EL84, EM84 and EZ80. A sensitive quality recorder at Special Unit Prices.

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Set of 5 valves 45/-
Send Stamp for detailed Unit Bargain Prices. Illustrated Circuit Handbook 2/6 post free.

TRANSISTORS—BVA 1st grade—ex Mfrs. Mazda XA102, 16/6; XA101, 14/6; XC101, 10/6; OC70, 9/6; XB102, 10/-; XA103, 15/-; OA81, 3/6; OA70, 2/9.
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★ MEDIUM AND LONG WAVEBANDS
★ POSITION FOR CAR RADIO AERIAL
★ PRINTED CIRCUIT WITH COMPONENT NUMBERS MARKED
★ PUSH-PULL OUTPUT
★ FERRITE SLAB AERIAL

Step by step instructions. 1/6, post 3d.

2—COMPONENT PACK No. 3
CONTAINS REPANCO COMPONENTS FOR THE "JOURNEYMAN". FS30, 5½in. Ferrite Slab Aerial, two XT26's 1st and 2nd IFT's XT27 3rd IFT, XO28 osc. coil, all pre-aligned, TT29, single ended push-pull driver transformer, printed circuit and aerial fixing brackets. £2.15.6.

3—MINI-4. A REMARKABLE FOUR TRANSISTOR SUPERHET POCKET RECEIVER
★ MEDIUM AND LONG WAVEBANDS
★ SIZE OF CASE 5¼ x 3½ x 1$\frac{1}{16}$in.
★ AUTOMATIC GAIN CONTROL
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4—COMPONENT PACK No. 2
CONTAINS **REPANCO COMPONENTS** FOR THE **MINI-4.** FS39, Ferrite slab aerial, two XT26's, 1st and 2nd IFT's, XT27 3rd IFT, XO28 osc. coil, all pre-aligned. TT5 transformer group board, switch and speaker pillars. £2.7.6.

5—SHORT WAVE TRANSISTOR COILS
All coil litz wire, enclosed in high frequency Ferrite pots and tuned with Ferrite cores. Can size ½in. sq. x $\frac{11}{16}$in. Send S.A.E. for Full Details. 10/- each.

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Trade News

NEW PRODUCTS AND DEVELOPMENTS

LOW DRIFT AMPLIFIERS

THREE new amplifiers are available from Honeywell Controls Ltd., each having low noise, low drift and high common mode rejection characteristics.

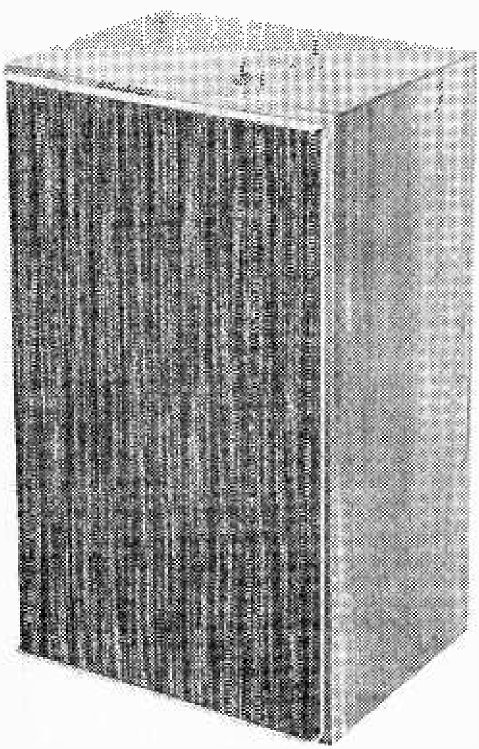
The Accu Data III D.C amplifier is chopper-stabilised and designed primarily for use with strain gauges and thermocouples.

The other two units are preamplifiers for use with direct-recording or self-balancing potentiometer recorders.

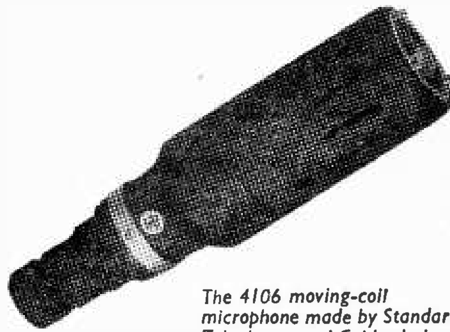
The 2HLA-8 preamplifier is designed to accept D.C. inputs as low as 20μV and give full scale deflection on a 12in. strip chart recorder with a response time of ½sec.

The model 2HLA1-4a is a general purpose differential input D.C. amplifier for laboratory or process use.

Both units are built to high industrial standards. Their mechanical features include input and output connections at the front and rear, and they may be bench or panel mounted. All three amplifiers are produced by *Honeywell Controls Ltd.. Greenford. Middlesex.*



The "Sandwich" full range loudspeaker, made by H. J. Leak and Co., Ltd.



The 4106 moving-coil microphone made by Standard Telephones and Cables Ltd.

NEW MICROPHONES AT THE AUDIO FAIR

TWO new microphones, made by Standard Telephones and Cables Ltd., were on show at this year's Audio Festival and Fair, recently held in London.

The 4106 is a moving-coil, studio grade microphone, and has a frequency range of 30c/s to 12kc/s. It is approximately 4·6in. in length and has a diameter of 1·6in.

The other microphone, the 4108, is a condenser type and is also intended for studio use. It has a frequency response of 30c/s to 15kc/s and a transistor and valve head amplifier and a separate power unit.

Both of these new microphones are manufactured by *Standard Telephones and Cables Ltd., Connaught House, Aldwych, London, W.C.2.*

LOW DISTORTION LOUDSPEAKER SYSTEM

AN exhibitor at the Audio Festival and Fair was H. J. Leak and Co. Ltd., who demonstrated their "Sandwich" full-range loudspeaker. Contained in a cabinet only 26in. x 15in. x 12in., it provides a very low distortion moving-coil loudspeaker system. Its construction damps panel resonances and permits the loudspeaker to reproduce full clean bass. A 3in. and a 13in. loudspeaker and a half-section cross-over network, complete the system which gives high quality reproduction, over the whole frequency range of the input signal from records, radio. tape or microphone. The loudspeaker costs £39 18s. 0d. and is produced by *H. J. Leak & Co. Ltd., Brunel Road, Westway Factory Estate London, W.3.*

CAR RADIO AERIALS

THREE new car radio aerials have been added to the Antiference range. All of them are one-hole fixing and designed for roof mounting.

The "Monte-Carlo" aerial is fixed at 45° to the base which incorporates an anti-damage spring. It comes complete with an 80in. screened lead and plug.

The "Goodwood" has a two section telescopic collector rod, extending from 21in. to 38in.

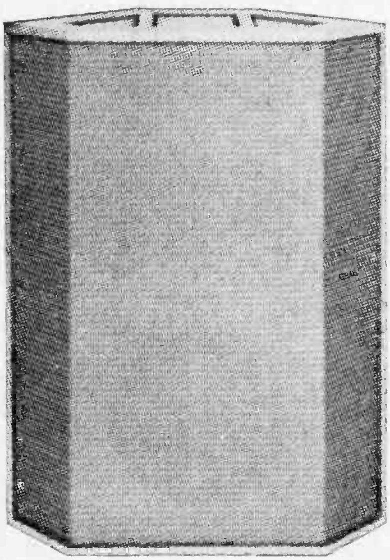
The "Silverstone" aerial also has a two section telescopic collector rod. The angle of the rod is adjustable through 90° with self-locating action and is fitted with an anti-damage spring.

The prices of the "Monte-Carlo," "Goodwood" and "Silverstone" are respectively, 29s. 6d., 37s. 6d., 42s. They are all finished in chrome plate and are made by *Antiference Ltd., Television and Radio Aerial Division, Bicester Road, Aylesbury, Buckinghamshire.*

FREE-STANDING SPEAKER ASSEMBLY

THE main feature of Wharfedale's exhibit at the Audio Festival and Fair was the new Airedale loudspeaker. Basically this consists of a three-speaker system in a free standing enclosure. The main panels of the Airedale cabinet are filled with sand to minimise panel resonance. The crossover frequencies are 400c/s and 5kc/s.

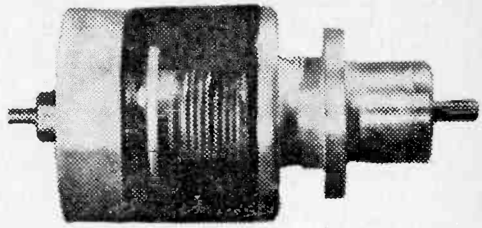
Finished in walnut, oak or mahogany veneers, the Airedale measures 38in. x 28in. x 14in. The price of this loudspeaker is £65, and it is made by *Wharfedale Wireless Works Ltd., Idle, Bradford, Yorkshire.*



The Wharfedale "Airedale" free-standing speaker assembly.

HIGH VACUUM VARIABLE CAPACITORS

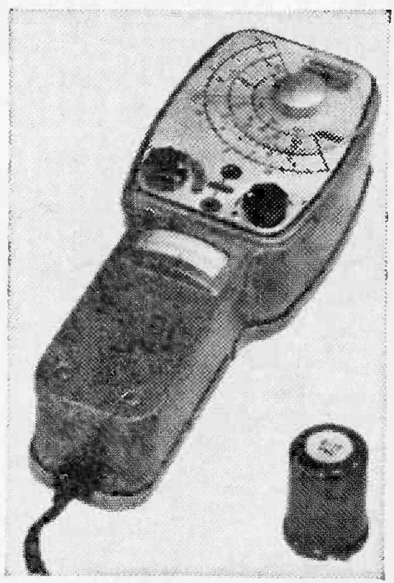
A RANGE of high vacuum variable capacitors has been made available by the English Electric Valve Company. Five units comprise the range, three with capacitances of 5-30, 8-50, 16-80pF and two with capacitances of 5·5-206pF. The peak R.F. voltage is 15kV for the first three and 8 and 10kV for the other two. *English Electric Valve Co. Ltd., Chelmsford.*



A U50/15 high vacuum variable capacitor manufactured by the English Electric Valve Company Limited, Chelmsford, Essex.

GRID-DIP RESONANCE METER

A NEW instrument by Grundig may be used for detecting the resonant frequencies of all kinds of tuned circuits and also frequencies of working oscillators. It may also be used as an A.M. test oscillator and as a simple receiver. The circuit consists basically of an R.F. oscillator, the frequency of which is determined by interchangeable coils and by setting of a tuning condenser. A meter indicates the oscillator grid current.



The Grundig grid-dip resonance meter.

The unit—type 701—covers from 1·7Mc/s to 250Mc/s in six ranges. The frequency is by direct reading from the tuning scale and is within a tolerance of +1·5per cent.. *(Wolsey Electronics Limited, Cray Avenue, St. Mary Cray, Orpington, Kent.)*

We regret that in "Trade News" in the May issue, an illustration was given an incorrect caption; the photograph at the top of page 62 was in fact of the "Studio de Luxe" model of Sound Tape Recorders (Electronics) Limited, and not of their "Sound Master" model.

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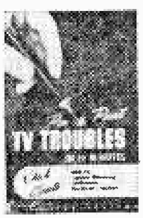

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Letters to the Editor

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

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

TRANSISTOR USE

SIR,—In reply to Mr. G. May's letter in the April edition of PRACTICAL WIRELESS, I would like to make a few points clear.

A junction transistor, as with any other transistor, can be used with its collector-emitter leads reversed, but as the transistor is not symmetrical (it has a larger collector contact) there is a loss in gain.

Reversing the battery connections, and hence the base bias causing the base-contact current to be greatly increased, will probably destroy the transistor. But if the resistance in the base is high enough to prevent a heavy current flowing, the transistor will not be destroyed.—P. W. ROACH (Hove, Sussex).

SIR,—With reference to G. May's query on transistors (P.W. April), the collector-base junction of a transistor behaves, when battery polarity is correct, as a rectifier connected in its reverse direction and passes only a small leakage current. When the battery polarity is reversed, the junction behaves as a rectifier with a forward voltage applied so that its resistance is very low, and current high enough to destroy the transistor flows in the circuit (usually the collector load resistor limits the current to a safe value).

The base-emitter junction behaves anyway as a rectifier with a forward voltage applied and thus an incorrect bias does no harm to the transistor. The dangerous condition is if the bias resistor is short circuited and an excess of current flows.

There is no fundamental difference between the base-emitter and base-collector junctions. The transistor may be connected so that the electrode coded as emitter functions as collector and vice versa, but in practice amplification usually suffers owing to the fact that there are slight differences in the two electrodes to allow for dissipation in the collector.—A. W. LAWFORD (Reading).

BBC TELEVISION RECEPTION

SIR,—I wonder if any readers could explain why I can receive BBC television on 3·5Mc/s?

I often hear this station whilst listening on the 80m amateur band. Could it be that a signal is being emitted from my own television receiver?—G. SHUCKSMITH (Barton-on-Humber).

TRANSISTOR SET RECEPTION

SIR,—I thoroughly endorse all that Mr. A. S. Fielding (April issue) says about receiving stations on transistor portables. I have made four such receivers and have been disappointed with all of them. Loudspeaker reception is possible using an aerial and earth, but who wants that; it must be portable or it ceases to be useful. I think that designers of portables should state in which part of the country they have been used with success.

I have built the nine valve receiver in the June 1957 issue of PRACTICAL WIRELESS*, and spend many happy hours listening to stations all over the world. May I add that, althought I am 71 years of age, I still enjoy constructing any new circuits I find.—J. JAMES (Winslow, Buckinghamshire).

[*Now out of print.—Ed.]

SIR,—Mr. Fielding (PRACTICAL WIRELESS, April) does not seem to understand that the distortion appearing on the Luxembourg signal is inherent in any receiver, since the signal arriving at the aerial suffers distortion on its passage through the ionosphere. AVC does not help this problem, but only increases the distortion, as it is only present at low signal strength. A vertical aerial, responsive only to a signal coming via the ionosphere, will give a more steady output. —P. GOODHART (Oxford).

FRENCH TELEVISION RECEPTION

SIR,—While tuned in to 355m on January 1st, between 7.59p.m. and 8.03p.m., I picked up the sound of the French Television Service. I thought at the time that it was a news bulletin as it was preceded by the French National Anthem. I have since been assured by a French pen-friend that the particular programme was one in which viewers sent in political questions.

I wonder if any other readers have heard foreign TV programmes on their receivers?—D. G. FORSYTH (Fife, Scotland).

THE YOUNGEST CONSTRUCTOR

SIR,—I am aged 8. I have made a short-wave set. All it is is a crystal set with a short-wave coil it has 12 turns on a ferrite-rod, the ferrite-rod is 2 inches long. The crystal is a Mullard OA79. The condenser is an ordinary tuning condenser. The aerial is 12 yards long, 14 feet high. I got Russia and France and Germany.—Jonathan Shirley (Bucks).

[We would like to hear a lot more from young enthusiasts.—Ed.]

A BASS REFLEX ENCLOSURE

DIMENSIONS OF SUITABLE CABINETS

By J. B. Francey

INEXPENSIVE equipment for stereophonic sound production has opened up an interesting field of investigation to the home constructor. It is not always appreciated. however, that a substantially high level of fidelity can be obtained with conventional equipment when this is used under proper conditions. Nor, indeed, it is always appreciated that the value of stereo systems can be completely lost through an ineffectual and asymmetrical positioning of the twin speakers in a room.

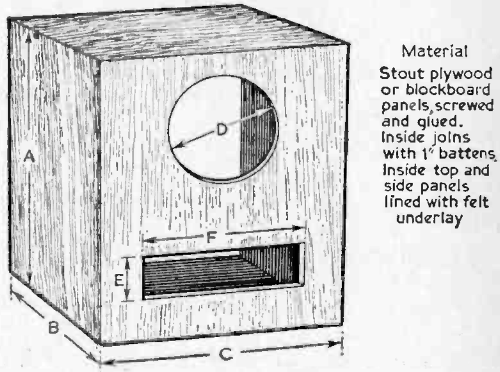
After a consideration of various possibilities, it was decided to construct an experimental "bass reflex" speaker enclosure using an old receiver cabinet. This system has had considerable commercial application in America. and many cabinets with internal and external refinements may be obtained from our own audio equipment stockists at a cost of about five pounds. Since the present quest was of the nature of a "salvage operation", however, an attempt was made to apply the principle to a home-constructed cabinet. The effort proved well worth while.

Reflex Enclosure

Most radio constructors will be aware that an effective baffle suppresses the back waves of a speaker to prevent these being mixed "out of phase", with the waves from the front of the speaker cone. The indiscriminate joining of waves from two sources would not only nullify part of the speakers' output by cancellation. but would also set up harmonic distortions in the total sound produced. A large or "infinite" baffle will effectively prevent this mixing, but only by rejecting the back waves from the speaker which may, in a small system, form quite a large proportion of the available sound. Since output of the higher sound register is comparatively easy to obtain, the main defect is the rejection of the more valuable bass register of frequencies which cannot be replaced at normal levels, that is, domestic levels of amplification. A really critical hearing of many baffle systems. moreover, will reveal an absence of tonal variation. or colour, in the lower register of sound. even though boom effects tend to make the condition not too obvious.

With the reflex enclosure system, the waves from the back of the speaker cone, which would normally be lost to sound production by suppression. are emitted from a port of rectangular shape which is cut in the baffle below the circular speaker cut-out. A very high proportion of these waves are emitted in proper phase. For this reason the overall efficiency of a reflex enclosure is high, since sound in its desired form is emitted at two sources from one speaker.

It should be noted. however, that phase reversal is not aimed at for the whole register of frequencies. For this reason, the enclosure and port dimensions are somewhat critical for best results, and if some form of sliding shutter for the port is included in the arrangement. to enable the area of port discharge to be varied initially, the effort would be well worthwhile. Actually, one particular frequency is discharged from the port out of phase. and its reaction is used in opposition to the natural resonance of the speaker.



Speaker Diameter	Cabinet o/a sizes A	B	C	Cut-out sizes D	E	F
8"	23"	10"	18"	6½"	3"	9½"
10"	28½"	12½"	22"	8½"	4"	12½"
12"	34"	14¾"	26"	10½"	5¼"	16½"

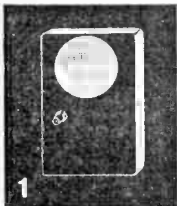
Fig. 1.—A suitable cabinet, with sets of dimensions for different loudspeaker sizes.

Construction

Readers will be aware that really professional directions on cabinet construction have been published in PRACTICAL WIRELESS from time to time, and for that reason it is not intended to do more than provide a materials and dimensions guide for this particular application. The illustration shows sizes of cabinet and associated cut-outs for three standard speakers. and in the search for accuracy reference was made to figures which were published some five years ago in America.

A stout blockboard or ½in. thick plywood should be used for the panels, and wood battens should be used to reinforce the joints. It will be found to be an advantage to line the inside face of the top and the side panels with a felt underlay material as is used with carpets, or with off-cuts of foam rubber which can be obtained from some stores. Where glue is used, ample time should be allowed for this to set so that the continuous bonding of the substance is not impaired. The back panel should, of course, be made removable.

CHECK with these BARGAINS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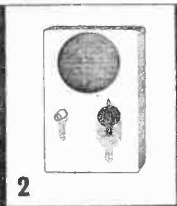
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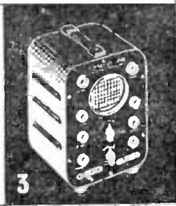
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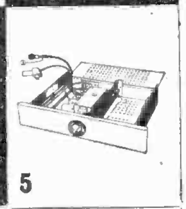
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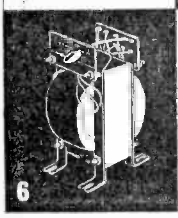
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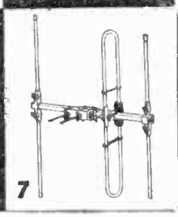
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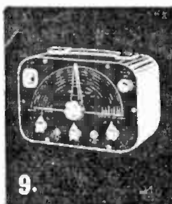
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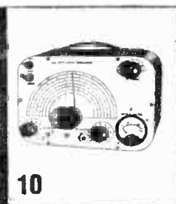
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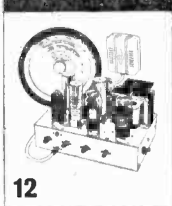
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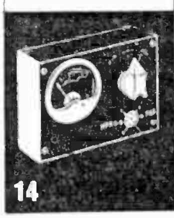
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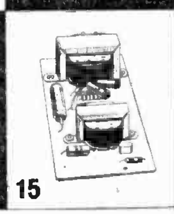
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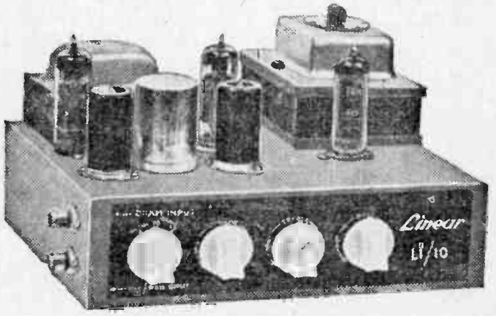

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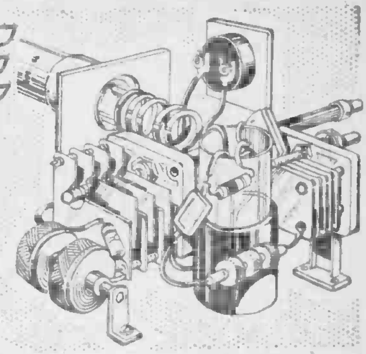

WAYS TO LEARN MORSE

By "Amateur Transmitter"

THE writer first learnt Morse over twenty years ago, and in the interval since then has noted several "methods" which help to speed up progress, or avoid boredom. Some of these methods can be used alone, while others require a second person. It seems wise to obtain variety in the manner of learning, so as to avoid a set habit which in time becomes almost essential.

GPO Test

It is assumed that the code has already been memorised, and that the aim is to pass the GPO 12 w.p.m. amateur transmitting test. To give reliable reading during the actual test, it is a good plan to achieve 14 or 16 w.p.m., rather than rely on a minimum speed. The various punctuation and procedure signals can be ignored for the time being, as the test is in plain language and figures only, and other signals can be dealt with later. The plain language speed required is 12 w.p.m., or 60 letters per minute.

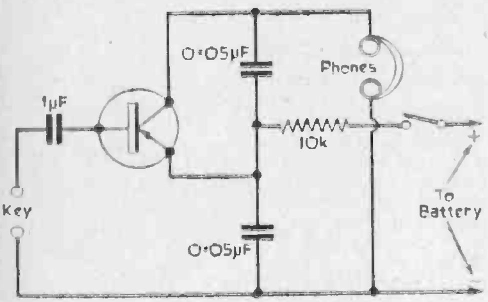

Fig. 1.—The circuit of a transistorised practice oscillator.

To practise sending alone, or sending and reading with another person, or reading with a tape recorder, an oscillator is necessary. One of the simplest transistor circuits is shown in Fig. 1. Any audio transistor is suitable, with a small dry battery. High impedance phones are recommended. The note depends greatly on the phone windings, but can be changed by substituting other condensers for the 0·05μF components or changing the transistor or battery voltage.

A valve oscillator, using any R.F. or A.F. screen-grid pentode, or triode, is shown in Fig. 2. Almost any transformer of about 1 : 3 or 1 : 5 ratio will work. If no oscillation is obtained, reverse connections to one winding. The pitch of the note may be reduced by wiring a condenser across one winding. Alternatively, the pitch may be raised by adding a resistor at "X". Changing the H.T. voltage, or phones, or wiring the latter in parallel with the primary, will also change the note obtained.

A good, clear note around 1000c/s is usual, but it is as well to gain practice in reading with equal ease when there is some change in frequency.

Letter and Word Speed

Speed in reading depends on the immediate recognition of the complete "sound" of a letter. (Later, complete words will be read in this way.) It is thus as well to get accustomed to the 12 w.p.m. sound of letters as early as possible.

In Fig. 3, "and" is shown with drawn-out letters, such as might represent sending at 6 w.p.m. If this is speeded up to 12 w.p.m., the sound of the letters will be different. Fig. 3 also shows letters sent at a speed which would allow 12 w.p.m., but with extra spacing, so that the actual speed is only 6 w.p.m. With this form of sending, individual letters will sound the same as if they were part of a 12 w.p.m. text. Accordingly, no change in

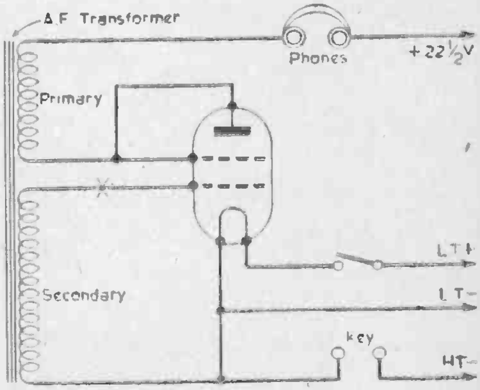

Fig. 2.—An oscillator circuit which uses a valve.

recognition becomes necessary, as increased speed is achieved by reducing the gap between letters, the letters themselves remaining unchanged.

For initial practice in sending and reading, some time spent on rather slow letters will do no harm. But an actual *letter* speed of about 12 w.p.m should be adopted as soon as possible, the *word* speed being kept down to a suitable figure by increasing spacing.

Reciprocal Practice

When two persons can practise together, one sends while the other writes down the text as he reads it. Great care should always be taken to form letters correctly, and not to rush the sending speed so that accuracy suffers.

One key will suffice, but two pairs of 'phones, or a loudspeaker, will be required. Short periods of practice, such as twenty minutes on each of a few evenings a week, will give better progress than trying to put in an hour or two of practice only once a week.

Straightforward text should be sent, and occasional random letter groups, to avoid guessing. Learning facility depends on the person, but in actual fact the process can become very interesting, especially when modified by the methods suggested later, or by copying radio messages.

A "learning plateau" or inability to increase speed is often encountered. If so, all practice can be dropped for a week or so. It will then probably be found that speed has increased during this interval.

Speed may sometimes be increased by having a copy of the text being sent, and reading this while listening to the code. Afterwards, the text should be copied without the printed or written copy. Occasionally running through the alphabet at greater than usual speed also helps rapid reading.

Using a Tape Recorder

If a person has to practise alone, and a tape recorder is available, this will be extremely useful. Set up the equipment to make a recording of the oscillator. This can most easily be done by placing the recorder microphone against the oscillator phones.

As it is easily possible to keep sending speed ahead of reading speed, code can be recorded on the tape at the required speed for reading practice.

As memory will come into action and allow much guessing, random letters will have to be employed. One way of obtaining these, and still making it possible to compare the copied code with the original, is to prepare a few squares like those in Fig. 4. These each have 64 letters, and thus represent about 12 w.p.m., when each is sent in one minute. Lines may be read in either direction, and up and down, as well as diagonally, to ensure that sequences are not remembered. Occasional words may be interspersed at any point.

Some letters are much easier to read, and the required speed can most rapidly be achieved with them. But no letter should be wholly omitted. In addition, practice with the difficult letters from time to time will give added accuracy.

Smaller squares, for lower speeds, can easily be prepared. If care is taken to avoid repeating a square in the same form too often, one recording may be used many times for reading practice.

Reading from Radio

A TRF receiver or short wave superhet with B.F.O., will provide many code signals. Initially it may be almost impossible to read any characters at all. But when a reading speed of several words per minute has been achieved, occasional intervals spent in reading transmitted code will become very helpful indeed.

Try to select a slow transmission, and write down any letter as it is recognised. Some simple letters, such as O and H, will soon be read easily.

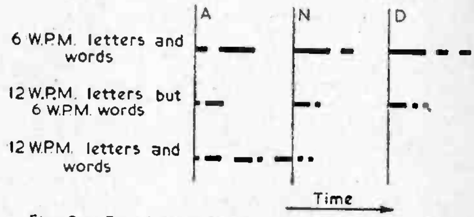

Fig. 3.—Fast letter speed with slow word speed.

It will be found that other letters can be added from time to time, until the copy becomes more and more complete.

If the message proves to be unintelligible, when written down, this need not cause concern. The text may be in code, or a foreign language, or employ abbreviations.

If possible, other forms of practice should be interspersed with reading off the radio, to obtain an improvement in recognising those letters which are not being read in the transmitted text.

High Speed Easy Reading

A useful gain in reading speed can be achieved by choosing those letters which can be read easily, and copying these at the required 60 per minute, or faster. This requires a tape recorder, or, for preference, a second person.

For an absolute beginner, only one letter may be read at this speed. But other letters can soon be added. Easy letters include T, M and O (-, - -, and - - -) and E, I, S and H (·, · ·, · · ·, and · · · ·). Others can soon be added.

To use this method, the sender confines himself to such letters as the reader can copy at the chosen speed, but adds a new letter when the existing letters are being copied reliably. For example, EEIEEIIEIEEIIIEI until this is read, then, say, EIEITITEETITIEIITTI until this is read, and so on. The reader will then be copying the chosen speed all the time, though the number of letters will only constitute a part of the alphabet.

From time to time a change should be made by copying difficult letters, or random letters, or actual words. Some of the easy letters already being read easily and quickly can also be temporarily dropped.

Clearing Difficulties

After some time a number of habitual errors, such as inverting (e.g. reading Y for Q), may become apparent. If so, these should be cleared up as soon as possible, since the mistake is only being made more permanent by allowing it to

(Continued on page 169)

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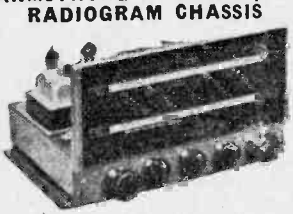

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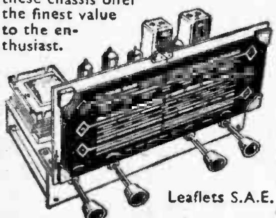

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ALL BRITISH RADIOGRAM CHASSIS, 3 WAVEBANDS 5 MULLARD VALVES ECH81, EF89, EBC81, EL84, EZ80

Brand new and guar. A.C. 200/250v. Short - Medium - Long Gram. P.U. High Q dust core coils. Latest circuit technique. AVC and neg. feedback. 4 watts. Chassis size 13½ x 6 x 7in. Aligned and calibrated ready for use. **Quality at Low Cost.** Chassis isolated. H.P. Dep. £5 and five monthly of £1.

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MODEL UA8
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OZ4	6/-	6BA6	7/-	6SJ7M	6/-	DF96	8/-	EL41	9/-	PCL82	8/-
IR5	6/-	6BE6	7/-	6SN7GT	6/6	DK96	8/-	EL84	8/6	PY80	7/6
IS5	6/-	6C4	5/-	6U5G	7/6	DL96	8/-	EM81	9/6	PY81	8/6
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2X2	2/6	6F6G	7/-	6X5G	6/-	EB91	4/-	EY86	7/-	PY83	9/-
3Q5	9/-	6G6	5/-	12AT7	6/-	EBC41	8/-	EZ40	7/-	QP25	7/-
3S4	7/6	6H6	3/6	12AU7	6/-	EBF80	10/-	EZ80	7/-	R3	7/6
3V4	7/6	6J5	5/6	12AX7	6/-	ECC84	8/-	E1148	1/-	SP61	3/6
5U4	6/-	6J6	5/6	12K7GT	6/6	ECH42	10/-	HABC80	12/-	UF41	8/6
5Y3G	6/-	6J7G	6/6	12Q7GT	6/6	ECL80	10/-	HVR2A	6/-	UL41	8/6
5Z4G	9/6	6K6GT	5/-	25YG5	9/6	ECL82	10/-	KT33C	10/-	UY41	7/-
6AC7	3/6	6K7G	5/-	35L6	9/6	EF39	5/6	MU14	7/6	U22	8/-
6AG5	5/-	6K7M	7/6	35Z4	6/6	EF41	9/-	P61	3/6	VP23	6/6
6AL5	4/-	6K8G	6/-	807	5/-	EF80	7/-	PCC84	8/-	U76	6/6
6AM6	4/-	6N7M	6/-	954	1/6	EF91	4/-	PCF80	7/6	VR105/30	9/-
6AT6	7/6	6Q7G	7/6	956	2/6	EF92	5/-				
6B8G	5/-	6SA7M	6/-	DAF96	8/-	EL32	4/-				

American Magnetic Recording Tape

FERRODYNAMICS		"BRAND FIVE"	
5in. 600ft.	16/–	MYLAR DUPONT	
5in. 900ft.	18/6	Super High Fidelity	
5¾in. 1,200ft. ...	23/6	Double Play	
7in. 1,200ft. ...	25/–	5in. 1,200ft. ...	37/6
7in. 1,800ft. ...	35/–	7in. 2,400ft. ...	60/–

Illustrated leaflet S.A.E.

Spare Reels, 3in. 1/6; 4, 5, 5¾in. 2/-; 7in. 2/6.

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SETS OF VALVES

19/6	IR5, IT4, IS5, 3S4 or 3V4.
27/6	DK96, DF96, DAF96, DL96.
27/6	6K8, 6K7, 6Q7, 6V6, 5Z4 or 6X5.
37/6	ECH42, EF41, EBC41, EL41, EZ40.
39/6	ECH81, EF89, EBC81, EL84, EZ80.
35/–	12K8, 12K7, 12Q7, 35L6, 35Z4.

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MAXI-Q REGD.

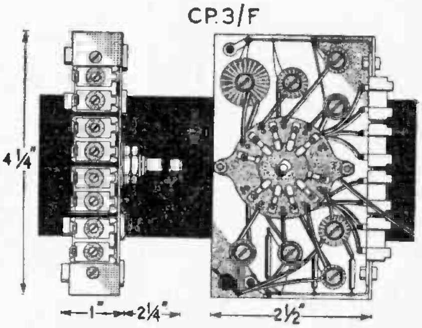
COIL PACKS

CP.3/370 pF and **CP.3/500 pF.** These 3 waveband Coil Packs are available for use with either 370 pF or 500 pF tuning condensers. The coverages are: Long Wave 800-2,000 metres. Med. Wave 200-250 metres, Short Wave 16-50 metres. Designed for use with "MAXI-Q" glass scale type S2. Retail price of each unit: **32/-** plus **10/8 P.T.—total 42/8.**

CP.3/G. As above but with Gram. position, suitable for use with 500 **pF** tuning condenser: **39/-** plus **13/-** P.T.—total **52/-.**

CP.3/F. This Coil Pack is for use with a 500 pF tuning condenser and covers the standard, Long, Med. and Short wavebands with the addition of the band 50/160 metres. This covers the Trawler band, Aeronautical and the 80 and 160 metre Amateur bands: **49/-** plus **16/4** P.T.—total **65/4.**

CP.3/F



CP.3F/G. As CP.3/F but with Gram. position: **57/-** plus **19/-** P.T.—total **76/-.**

CP.4/L and **CP.4/M.** These compact 4-station Coil Packs are available for either 1 Long Wave and 3 Medium Wave Stations (CP.4/L) or 4 Medium Wave Stations (CP.4/M.). They are fully wired and require only four connections for use with any standard frequency changer valve. **25/-** plus **8/4** P.T.—total **33/4.**

CP.4L/G and **CP.4M/G.** As CP.4/L and CP.4/M but with provision for Gram. position. **31/-** plus **10/4** P.T.—total **41/4.**

See Technical Bulletin DTB.9 for details of all Coil Packs, 1/6.

GENERAL CATALOGUE covering full range of components, send 1/4 in stamps or P.O. PLEASE SEND S.A.E. WITH ALL OTHER ENQUIRIES:

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STOP PRESS: TDO.3 Tape Oscillator Coil for Mullard 3 watt Tape Amplifier, **7/6** each.

(Continued from page 166)

continue. Occasional periods confined to difficult letters, or those wrongly read, will be very helpful.

Exclusive use should not be made of random letters, or squares like those in Fig. 4. In addition, ordinary words should be used. Otherwise it may well be found that squares like those in Fig. 4 can be read at 12 w.p.m., even when wholly unfamiliar, yet at the same time straightforward text at 12 w.p.m. cannot be copied. (This arises because with straightforward text the mind becomes aware of a word forming, and this diverts attention from the code signals being read.)

O	J	K	E	T	A	H	S
W	Y	M	T	F	T	B	O
P	S	H	R	Z	O	I	G
I	O	A	X	I	X	U	M
H	W	K	E	W	I	G	N
A	M	N	C	T	U	D	H
S	E	U	B	Q	K	A	D
R	N	T	L	E	J	V	O

Y	T	G	B	H	C	P	Q
I	N	D	R	G	Y	Y	G
P	X	V	B	J	S	V	G
W	M	C	V	L	B	C	X
F	D	D	A	Q	F	Y	K
Q	F	L	Q	P	X	O	L
P	W	U	Y	J	C	E	Z
B	Z	N	R	Z	N	R	J

Fig. 4.—Easy and difficult letter squares.

An occasional rest from letter reading can be usefully employed by concentrating on figures. Blocks of figures like the letters in Fig. 4 can be prepared. The Post Office test requires 50 figures in 1½ minutes. These are in ten groups of five figures. Usually, learning to send and read figures up to this speed will prove quite easy.

When reading text or figures, always leave the required break between words or figure groups. Also observe the breaks in sending. When sending errors are made, correct them in the proper manner (8 dots) as would be required in the test. Such points will then become automatic, and cause no difficulty or anxiety.

When possible, reading practice should be undertaken before sending practice. Sending may then be modelled on receiving. But if a person is learning alone, or two help each other, sending will be necessary almost from the beginning. In this case, accuracy is the essential point, as speed in sending will soon come quite easily.

When some speed has been gained, it will be found that short, frequent words, or repeated combinations of letters, such as "ed". "qu", "ll", etc., are recognised as a unit. As this happens it will be found of immense help, and at this stage practically all the reading required can be straight off the radio.

Testing

If a second, skilled operator is available, it is a good plan to carry out a simulated "test" occasionally, and also have him point out sending errors. The sending test is 36 words in 3 minutes, with not more than 4 erasures, and no uncorrected errors, plus 10 groups of 5 figures in 1½ minutes, with up to 2 erasures, and no uncorrected errors. The reading test is 36 words in 3 minutes, with up to 4 errors, plus 10 groups of 5 figures in 1½ minutes, with up to 2 errors. In duration, 3 dots equal a dash; the space between dots and dashes in a letter is equal to 1 dot; the space between letters is equal to 1 dash; and 5 dots space should be left between words. Writing in longhand (not block letters) will prove best for the higher speeds. ■

A 10 WATT ONE VALVE TRANSMITTER

(Continued from page 119)

When the 150pF condenser is rotated, a sharp dip in cathode current should be found, and the household lamp should light. Loading will probably be inadequate, and is increased by slightly opening the 2-gang condenser, and re-tuning the 150pF condenser for the cathode current dip. The current will now be higher, and the lamp will have increased in brilliance. Loading is progressively increased, by opening the 2-gang condenser, and re-tuning with the 150pF condenser, until the required cathode current rating has been reached.

It will be found that if loading is too heavy, the valve will not commence oscillating cleanly, when keyed. Best results in this direction will also be achieved with the 150pF condenser very slightly off resonance. However, adjustments are in no way critical, especially when the transmitter is not run up to the maximum possible input.

Aerial

A single wire, end-fed, aerial may be loaded by connecting it directly to the centre of the coaxial socket or lead. With the aerial connected, the transmitter is loaded in the same way as described for the lamp.

The end impedance of such an aerial will depend on its length, and can become very high when it approaches a ½-wave (½λ) for the band in use. In these circumstances, the transmitter may be insufficiently loaded, even with the 2-gang condenser reduced to minimum capacity. If this arises, and the aerial length is not to be changed, an aerial coupler should be added. This can consist of a coil and condenser tunable to the band used. A centre tap on the coil is taken to earth. A loop consisting of a few turns of insulated wire is then used to couple to the transmitter, as shown in Fig. 6. The aerial is tapped along the coil until satisfactory loading is obtained.

Dipole

If a dipole is available, the same aerial coupler can be employed. It should be connected as in Fig. 6, but the two leads of the dipole feeder are tapped at equal distances from the centre tap, as shown. When first putting the transmitter into use, listen to its signal on a receiver, to assure that it keys and starts cleanly. If not, excessively heavy loading, for the H.T. voltage available, is probably the cause. With large H.T. voltages, operating the transmitter with no load, or inadequately loaded, may cause heavy crystal currents. This can be watched by inserting a 60mA type bulb in series with the crystal. With any average aerial and supply voltage, operation will be very easy indeed. ■

Club News

REPORTS OF CURRENT ACTIVITIES

AMATEUR RADIO MOBILE SOCIETY
Hon. Sec.: G3FPK, 79 Murchison Road, London E.10.

On March 24th, Norman Fitch gave a lecture on "Mobile Operation and its Problems", at the London meeting of the R.S.G.B. The "S.X. Mystery Rally" was held at High Beech, in Essex, on March 28th, and operation was on 10 and 160m.

Future Event:
May 18th—A meeting to discuss the proposed Midlands Section of A.R.M.S.

CHESTER AND DISTRICT RADIO SOCIETY
Hon. Sec.: H. Morris.
Press Sec.: A. Bagley. Oak Lea, Long Lane, Saughall, Chester.

At the Annual General Meeting on January 10th, H. Morris was re-elected Hon. Sec.; D. Wardle, Chairman; D. Richers, Vice-chairman; and J. Butler, Treasurer. The Annual Dinner was April 15th. On April 25th G30PT gave a lecture on Detector Circuits.

Future Events:
May 9th—Top Band Net Night.
May 16th—Commercial v Home Built Equipment.

CITY OF BELFAST Y.M.C.A. RADIO CLUB
Hon. Sec.: W. A. R. Bell, 78 Orangefield Avenue, Bloomfield, Belfast 5.

The transmitter rooms are available for the use of members on club nights—Wednesdays and Saturdays from 20.00hrs. The club exhibited a live station in Ulster TV's "Hobbies and Holidays" Exhibition at Balmoral, Belfast.

CLIFTON AMATEUR RADIO SOCIETY
Hon. Sec.: C. H. Bullivant, G3DIC, 25 St. Fillas Road, London S.E.6.

During February, Dave Deacon (G3BCM) explained some of the International Radio Regulations which apply to amateur stations and also demonstrated his miniature amateur bands receiver. On April 21st, C. Hatfull (G3H2I) gave the annual D/F lecture.

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

At the Annual General Meeting T. Darn was elected Chairman, F. C. Ward was elected Hon. Sec., S. Swindell is the Vice-chairman, and H. Shaw the treasurer. On April 19th, Tom Douglas gave a lecture entitled "Two Metres", and on April 22nd the Founder Members' Dinner was held at the Derbyshire Yeoman.

Future Events:
May 7th—144 Mc/s Field Day.
June 3/4th—National Field Day.

FLINTSHIRE RADIO SOCIETY
Hon. Sec.: J. Lawrence, "Perranporth", 9 East Avenue, Bryn Newydd, Prestatyn.

"Introduction to Transistors" was the title of a lecture given by J. Lawrence on March 27th, and on April 24th G. Ralph told of his "Trip to Woomera".

Future Event:
May 29th—Final arrangements for the National Field Day.

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

On March 7th members discussed the National Field Day arrangements.

Future Events:
June 6th—A talk about Model Aircraft.
June 20th—An informal evening.

LIVERPOOL AND DISTRICT AMATEUR RADIO SOCIETY, G3AHD
Hon. Sec.: H. James, G3MCN, 448 East Prescot Road, Knotty Ash, Liverpool 14.

On April 4th members enjoyed a film show, and on April 18th, G3IQO gave a lecture about D.F. equipment. G3LIS lectured on TVI Precautions on May 2nd.

Future Events:
May 16th—D.F. Contest.
May 23rd—"Single Side Band" by G3JPJ.

LLANELLY AND DISTRICT AMATEUR RADIO CLUB
Sec.: H. J. Hughes, 4 Pen-y-morfa, New Dock, Llanelly, Wales.

The club meets on Thursdays for lectures on radio technology and on Tuesdays for Morse training, and work benches are available for the building and stripping of equipment. On both evenings licensed operators are present to instruct amateurs on lining up and operating the club transmitter.

MANCHESTER AND DISTRICT RADIO SOCIETY (G3HOX)
Chairman: A. D. Camp, G3MYR, George 6th Club, North Road, Manchester 10.

Meetings are held every Wednesday evening from 7 to 7.30 p.m. until 10.30 p.m.

On being reorganised last October, new premises were obtained at The George VI Club in Manchester and the new Committee includes two Short Wave Listener members (adult and junior) to enable the Committee to keep in mind all sections of the club membership when making any decisions.

The call-sign G3HOX has been re-issued to the club and instruction in "operating procedure" is available to those members interested in becoming licensed. The Committee has introduced Morse instruction and practice classes, a technical class, lectures on A.M. S.S.B. transmitter construction, frequency control etc., in an endeavour to help SWL members to become licensed operators.

MITCHAM AND DISTRICT RADIO SOCIETY
Hon. Sec.: M. Pharaoh, G3LCH, 1 Madeira Road, Mitcham.

G4ZU gave a talk on the "Birdcage" aerial on March 24th, and on Friday, 7th April, National Field Day arrangements were discussed.

Future Event:
May 21st—National Field Day dummy run.

PADDINGTON AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: N. A. Lambert, Beauchamp Lodge Settlement, 2 Warwick Crescent, London W.2.

An extensive programme has been laid on for the summer months, which includes C.W. training by W1BHZ, and a series of talks on "Interpretation of Circuits" by G3JEA and "Practical Construction" by G3KNL, and many other subjects.

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

At the Peterborough Technical College on June 2nd, the evening will be spent listening to a lecture on Aerials. A Mobile Rally is to be held at Hunstanton on May 28th.

Talk-in stations will operate on Two Metres (160m and 80m).

PLYMOUTH RADIO CLUB
Hon. Sec.: R. Hooper, 2 Chestnut Road, Peverell, Plymouth, Devon.

On May 10th it is proposed to show some slides to accompany a tape-recording called "Round the Local Hams".

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

On April 29th Mr. Kirkpatrick and Mr. Horsnell discussed the Transmitter Licensing Regulations.

Future Event:
May 27th—A. M. Mills, G3NNF, will be informing the members of the results of his experiments on "Aerials in restricted places for 160m and 80m".

SLADE RADIO SOCIETY
Church House, High Street, Erdington, Birmingham 23.

The first Harcourt Trophy Test was held on April 23rd.

Future Event:
June 11th—Harcourt Trophy Test.

STOKE-ON-TRENT AMATEUR RADIO SOCIETY
Hon. Sec.: V. J. Reynolds. G3COY. 90 Princes Road, Hartshill, Stoke-on-Trent.

The North Midlands Mobile Rally was held on April 30th. V. J. Reynolds has been appointed to the posts of ASR and TR R.S.G.B. for Stoke-on-Trent. The Annual General Meeting was held on April 6th.

SUTTON COLDFIELD RADIO SOCIETY
Hon. Sec.: L. Hall, 24 Calthorpe Road, Walsall, Staffordshire.

H. Symes gave a talk on "SSB for Beginners" on April 27th.

Future Events:
May 25th—A Film Show at T. Parton's QTH.
June 8th—"Transistors".

WANSTEAD AND WOODFORD RADIO SOCIETY
K. Smith, G3JIX, 82 Gransille Road, Walthamstow, London E.17.

The Junior section had a successful outing to the Science Museum recently. Future events include a possible field day with a transmitter and a D.F. competition. Coming lectures include "Superheterodyne Reception"; "Transistor Action" and "The use of powers and logarithms in calculations".

RECEIVERS & COMPONENTS

SPRAGUE & MICAMOLD Condensers: metal cased, wired ends .01 mfd 1,000V D.C., and .1 mfd 350V D.C. respectively. 5/- per dozen including postage and packing. 49 Hudson Road, Southsea, Hants.

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10C2	4/6	ECL80	4/6	PL83	4/6
10F1	3/-	EF80	2/-	PY31	4/6
10P13	4/6	EF91	2/-	PY80	4/6
10P14	4/6	EL33	4/6	PY81	4/6
20D1	3/-	EL38	4/6	PY82	4/6
20F2	4/6	EY51	4/6	PZ30	4/6
20P1	4/6	KT36	4/6	U24	7/6
20P3	7/6	N37	4/6	U281	7/6
27SU	10/-	PL33	4/6	U301	10/-
185BT	12/6	PL38	10/-	U801	12/6

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TRANSISTORS BRAND NEW. Mullard OC81D 2 OC81MAT **30/-**. Newmarket set of 6 + 1 diode **45/-**; Red spot **3/6**, White spot **4/-**, Green/Yellow **4/-**, Yellow/Red **6/-**. Diodes general **10d.**, GEX34 **3/3**, OA81 **3/3**. Miniature cap **2/3** ea. Rectifiers RM5 **12/6**, SM5 **13/6**. All postage paid by CHAPPLE RADIO, 107 Neasden Lane, N.W.10.

SPEAKERS — ELAC 5in., 3 ohm: 12 **£5**; 50 **£17**. C. HEYWOOD, The Croft, Ladybrook Rd., Bramhall, Ches.

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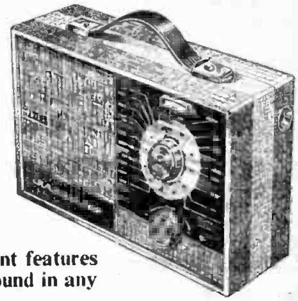

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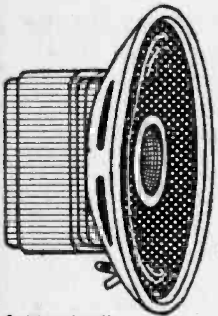

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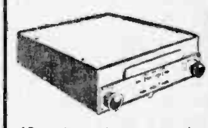

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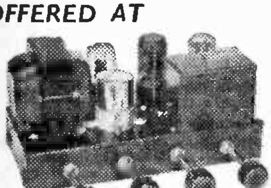

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—BLUEPRINT— —SERVICE—

ALL OF these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, an asterisk in the list below denotes that constructional details are available free with the blueprint.

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
Modern Two-valver	PW98*	3/6
SUPERHETS		
Mains Operated		
A.C. Band-pass Three	PW99*	4/-
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/-
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
Enthusiast's Power Amplifier ..	WM387*	3/6
Standard Four Valve	WM391*	3/6
Listener's 5-Watt Amplifier ..	WM392*	3/6

QUERY COUPON

This coupon is available until 7th June, 1961, and must accompany all queries in accordance with the notice on our "Letters to the Editor" page.

PRACTICAL WIRELESS, JUNE, 1961.

Published on the 7th of each month by GEORGE NEWNES, LIMITED, Tower House, Southampton Street, London, W.C.2, and printed in England by WATMOUGHS LIMITED, Idle, Bradford; and London. Sole Agents for Australia and New Zealand: GORDON & GOTCH (A/sia), Ltd., South Africa and Rhodesia: CENTRAL NEWS AGENCY, LTD. Subscription rate including postage for one year: Inland £1.3.0. Abroad £1.1.6 (Canada 19s.). Registered at the General Post Office for the Canadian Magazine Post.

★ RANGER 3 ★

NO EXTERNAL AERIAL OR EARTH

3-TRANSISTOR and 2-DIODES

PERSONAL POCKET RADIO with 5 stages giving clear reception on medium wave, amateur top band and shipping. Only first grade components used throughout. As described in March P.W.

Size $4\frac{3}{8}$ x 3 x $1\frac{1}{4}$in.

ALL COMPONENTS **79/6** P.P. 1/6
NO EXTRAS TO BUY
Everything Supplied.

- Easy to follow instructions with pictorial layout.
- Reception of **Radio Luxembourg guaranteed** (most areas).

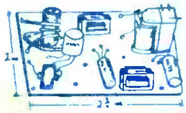
Free Instructions and Price List on request. Easy to build.

● **AFTER SALES SERVICE, GUARANTEED SUCCESS** ●

27 Mc/s. MODEL CONTROL RECEIVERS

● **"SUPERTONE I-C"**

New design 3-transistor transformer coupled receiver for 27 Mc/s model control. Uses OC169/OC71/OC72 transistors. Overall size $2\frac{3}{4}$ x 2 x $1\frac{1}{8}$in. Range about $\frac{1}{4}$ mile. Easy to build.



● OUTPUT to MIN. RELAY.
$4\frac{1}{2}$-VOLT OPERATED: RELAY 24/-
"SUPERTONE 3-C". 69/6 P.P. 1/6.
3-CHANNEL VERSION.

★ **GUARANTEED RESULTS—DIAGRAM FREE** ★

Total Cost of Parts **69/6** P.P. 1/6
RELAY 24/-

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ALL TRANSISTOR BABY OR INVALID ALARM

Battery operated, push-pull, 250mW output. Low impedance microphone enables unit to be used up to 200 yards. Output on 5in. speaker.

● GUARANTEED for 6 MONTHS and 100% SAFE.

● Microphone is placed within 6 ft. of Baby: twin flex is taken to amplifier unit and placed in any room required.

COMPLETELY BUILT AND TESTED **£5.10.0** P.P. 2/6.

● **Used All Night, Every Night, Battery Life 3 to 4 months**

750mW TRANSISTOR AMPLIFIER

OVER 1 WATT PEAK OUTPUT

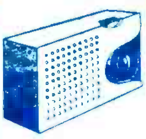
● Uses OC71, OC81D and, 2—OC81 matched transistors on Printed Circuit. Size 4 x $2\frac{3}{4}$ins. 3 ohms output. Very sensitive.

Ideal for **Record Player, Intercomm, T.R.F. or Superhet Tuners, etc.**

★ **BUILT AND TESTED** **79/6** P.P. 1/-

9 volt supply, 3 ohm output.

REPANCO MINI-4



- 4-Mullard Transistor 5-stage medium and long-wave superhet. OC44/2-OC45/OC72
- $2\frac{1}{2}$-inch SPEAKER.
- Easy to build and use.
- Moulded Case Size: $5\frac{1}{4}$ x $3\frac{1}{4}$ x $1\frac{1}{2}$ins.

ALL PARTS **£6.19.6** P.P. 1/6.

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PARTS LIST FREE ON REQUEST

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WE STOCK OVER 800 TYPES OF VALVES AND TUBES AT REALLY COMPETITIVE PRICES. ● **FREE LIST ON REQUEST** ●

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(as described in April edition of *Practical Wireless*)

A.M. and F.M.

7-transistor mains/battery portable in attractive moulded case. Slow motion tuning; telescopic aerial; 7 x 4in. speaker; Ferrite aerial, etc.

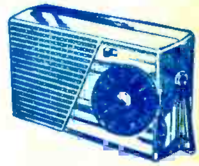
- Full tuning medium wave and VHF F.M. for clear reception of all programmes anywhere in the country.
- 500mW push-pull output with Mains or Battery supply built in.
- PRINTED CIRCUIT—SEVEN TRANSISTORS.
- **FULLY ILLUSTRATED BUILDING INSTRUCTIONS**

All Parts as Specified **£17** P.P. 3/6
All components sold separately.
List on request.

★ 'PW' 6-TRANSISTOR ★

MEDIUM AND LONG WAVE SUPERHET

(as described November *P.W.*)



- A sensitive superhet with 150mW push-pull output on $2\frac{1}{2}$in. speaker. Uses 6 first grade **Mullard transistors** and printed circuit. Moulded cabinet. Red. Blue or Cream.
- All parts sold separately. Send for list. Illustrated Building Plans, 1/6 plus post.

Size $5\frac{1}{4}$ x 3 x $1\frac{3}{4}$in.

ALL PARTS REQUIRED **£8.19.6**

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3-TRANSISTOR and DIODE PERSONAL POCKET RADIO ★ SUPER 3 ★

QUALITY OUTPUT ON PERSONAL EARPHONE

A simple to build local station radio with personal earphone output. Built-in Ferrite Aerial and Battery lasting 9 months.

ALL PARTS **37/6** P.P. 1/6
● NO EXTRAS TO BUY
Size $4\frac{3}{8}$ x 3 x $1\frac{1}{4}$in.

★ **IDEAL for BEGINNERS**

● *CONTESSA* ●

COMBINED PORTABLE AND CAR RADIO

6 TRANSISTOR MEDIUM AND LONG WAVE SUPERHET

TERRIFIC SENSITIVITY

UNBEATABLE IN PERFORMANCE AND APPEARANCE

SPECIFICATION

- 425mW Push-Pull Output
- 6 "Top-Grade" Ediswan Transistors
- New Type Printed Circuit with all Components marked
- Full Medium & Long Wave Tuning
- High "Q" Internal Ferrite Aerial
- Car Radio Adaption and AVC
- Slow Motion Fingertip Tuning with Station Names
- "Hi-Fi" Quality Speaker
- Attractive Rexine Covered Cabinet

TOTAL COST OF ALL PARTS **£11.10.0** P.P. 3/6
● **NO EXTRAS TO BUY** ●

Call for demonstration. No technical knowledge necessary. All parts sold separately. Only the best in components used throughout. New descriptive Leaflet and Prices on request.

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