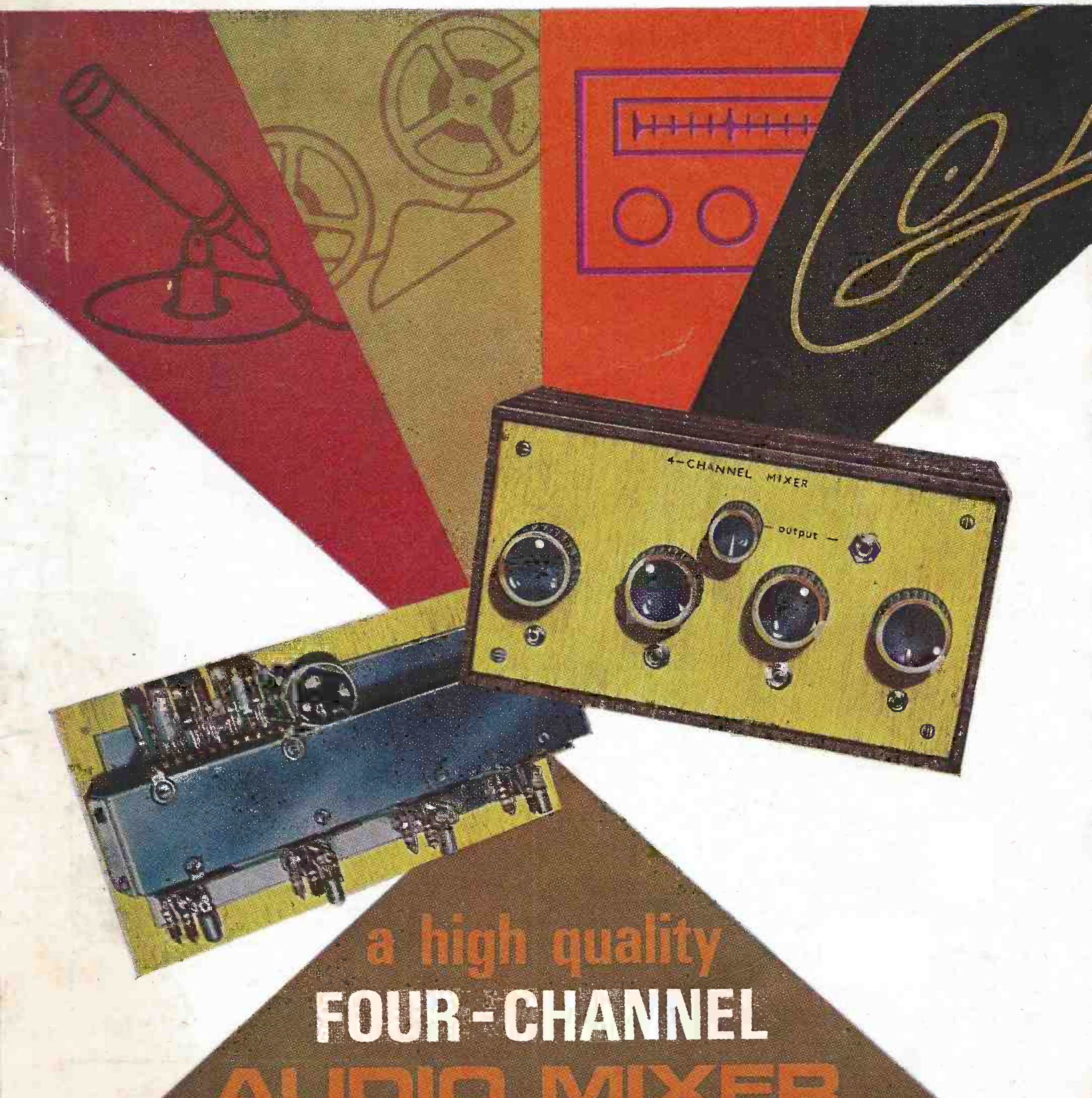
PRACTICAL WIRELESS

SEPTEMBER 1966

2'6



a high quality FOUR-CHANNEL AUDIO MIXER

VALUE IN VALVES GUARANTEED 3 MONTHS BY RETURN OF POST

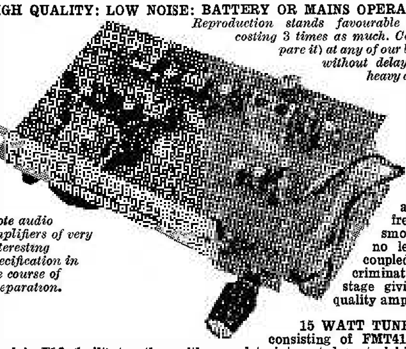
Satisfaction or Money Back Guarantee on goods if returned unused within 14 days. ALL VALVES ARE NEW UNLESS OTHERWISE INFORMED. FREE TRANSIT INSURANCE. POSTAGE 1 valve 9d., 2-11 6d. per valve. Free over 12.

1L4	2/3	6L6G	7/-	30F5	8/3	ECF80	7/6	KT61	11/-	TDD4	7/-
1R5	4/9	6L18	7/9	30FL1	9/6	ECF82	7/6	KT63	5/9	U18	7/6
1S4	4/9	6LD20	8/6	30L15	9/6	ECH21	10/-	KT66	14/-	U22	6/9
1S5	4/6	6P25	11/-	30P4	9/6	ECH35	11/-	KT88	21/-	U25	8/6
1T4	3/-	6P28	9/-	30P12	7/-	ECH42	8/6	KTW61	5/9	U26	8/9
2D21	5/6	6Q7G	5/6	30PL1	9/3	ECH81	6/9	KTW63	5/-	U35	12/6
3A5	6/-	6Q7GT	8/9	35C5	8/6	ECH83	7/3	KTZ63	7/-	U37	11/-
3Q4	5/3	6SL7GT	5/6	35L6GT	8/-	ECL80	5/9	MU14	7/-	U107	12/6
5U4G	4/6	6SN7GT	4/6	35W4	6/-	ECL82	7/6	N37	9/6	U191	9/6
5Y3GT	4/9	6U4GT	9/6	35Z4GT	5/6	ECL83	9/6	N78	13/-	U281	8/6
5Z4G	6/9	6V6G	4/6	50L6GT	8/6	ECL86	9/6	N108	13/-	U282	15/-
5Z4GT	9/6	6V6GT	5/9	80	5/-	EF36	3/3	PC86	10/-	U329	8/6
6/30L2	8/9	6X4	4/6	185BTA	19/6	EF39	5/-	PC97	7/6	U801	19/-
6A8G	7/9	6X5G	5/-	807	8/-	EF40	10/-	PCC84	6/6	UABC80	6/6
6AK5	4/9	6X5GT	6/-	955	2/6	EF41	8/-	PCC85	7/6	UAF42	7/9
6AQ5	5/-	7B6	9/6	956	2/-	EF50	3/3	PCC88	11/9	UB41	6/6
6AT6	5/-	7B7	6/6	AZ31	7/9	EF80	4/3	PCC89	9/9	UBC41	7/6
6BA6	5/6	7C5	7/9	CBL31	19/-	EF85	6/-	PCC189	11/-	UBC81	6/3
6BE6	5/6	7C6	6/9	CL33	9/-	EF86	7/6	PCF80	6/9	UBF80	7/6
6BH6	5/-	7H7	5/-	CY31	7/6	EF89	6/6	PCF82	6/-	UBF89	7/6
6BJ6	5/-	7S7	14/6	DAF96	7/3	EF91	3/-	PCF86	8/3	UBL21	9/9
6BR7	8/6	7Y4	5/-	DF92	3/-	EF92	3/-	PCL82	7/9	UC92	6/9
6BW6	7/6	10C1	11/-	DF96	7/3	EF183	8/-	PCL83	8/9	UCC85	7/3
6BW7	5/-	10C2	12/6	DK92	7/-	EF184	8/-	PCL84	8/3	UCF80	8/6
6C4	2/3	10F1	7/6	DK96	7/3	EL32	3/9	PCL85	8/6	UCH21	9/3
6C5	5/6	10LD11	14/6	DL92	5/-	EL33	11/-	PCL86	9/6	UCH42	8/6
6C6	4/-	10P13	8/6	DL94	6/6	EL34	11/-	PL33	8/6	UCH81	7/-
6C9	11/-	10P14	9/6	DL96	7/3	EL35	6/-	PL36	8/9	UCL82	8/-
6CD6G	17/-	12AT7	4/9	EABC80	6/6	EL38	15/-	PL38	12/6	UCL83	10/-
6D6	3/-	12AU7	4/9	EAF42	7/6	EL41	8/6	PL81	7/9	UF41	7/9
6F1	6/6	12AX7	6/-	EB41	4/-	EL42	8/6	PL82	5/9	UF42	6/9
6F6G	4/-	12J7GT	8/-	EB91	2/-	EL84	6/6	PL83	6/-	UF85	7/6
6F13	4/6	12K7GT	4/-	EBC33	6/-	EM80	7/-	PL84	7/-	UF89	5/9
6F14	5/-	12K8GT	9/6	EBC41	6/6	EM81	7/3	PY31	7/6	UL41	8/6
6F15	9/6	12Q7GT	5/-	EBC81	6/6	EM84	7/9	PY32	9/-	UL44	14/-
6F23	8/6	14S7	14/6	EBF80	7/6	EY51	7/6	PY33	9/-	UL46	8/3
6J5G	3/-	19AQ5	5/-	EBF89	7/-	EY86	7/3	PY80	5/9	UL84	6/9
6J5GT	4/6	20D1	8/9	EBL21	10/6	EY88	8/6	PY81	5/9	UM80	9/6
6J6	3/3	20F2	9/6	ECC40	6/9	EZ40	6/6	PY82	5/6	UY21	8/9
6J7G	4/9	20L1	16/-	ECC81	4/9	EZ41	6/6	PY83	5/9	UY41	6/-
6J7GT	7/9	20P1	9/6	ECC82	4/9	EZ80	5/6	PY88	8/6	UY85	5/6
6K7G	1/6	20P3	9/6	ECC83	5/9	EZ81	6/-	PY800	6/6	VR105	5/-
6K7GT	4/9	20P4	17/-	ECC84	7/-	FC4	8/-	PZ30	9/6	VR150	5/-
6K8G	3/-	25L6GT	7/9	ECC85	5/6	GZ32	9/6	SP61	2/-	X66	7/9
6K8GT	8/-	25Z4G	6/6	ECC88	9/-	GZ34	10/6	T41	6/9		
6L1	9/6										

Transistorised FM Tuner

HIGH QUALITY: LOW NOISE: BATTERY OR MAINS OPERATION

Reproduction stands favourable comparison with tuners costing 3 times as much. Come and hear it (and compare it) at any of our branches or send to Brighton without delay as we anticipate a very heavy demand.



Note audio amplifiers of very interesting specification in the course of preparation.

This beautifully compact 6 transistor machine (size 6in. x 4in. x 2½in.) will give quieter, more interference-free reception. Months of use from a standard 9 volt battery or its small power requirements can be drawn from any amplifier. Low noise frequency changer with smooth 2 gang tuning feeding no less than three I.F. stages coupled to a double-tuned discriminator terminating in an L.F. stage giving ample output for all quality amplifiers.

15 WATT TUNER AMPLIFIER KIT consisting of FMT41 tuner and the excellent Sinclair Z12 (built) together with complete integrated control kit consisting complete vol. on/off, treble and bass, component sets with complete connecting instructions and circuits.

£13.19.0 or complete with AC mains power pack £17.18.6. Complete control kit only with circuits 25/-.

avoid disappointment

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100 HI-STABS 1% to 5% 100 Ω to 5m Ω 9/6

CO-AX. low loss, 6d. yd., 25 yds. 11/6; 50 yds, 22/-; 100 yds. 42/6. Plugs, 1/3.

100 RESISTORS SIZES ⅛–3 watt 6/6

MICROPHONE CABLE. Highest quality black, grey, white, 9d. per yard.

100 CONDENSERS 9/6

Miniature Ceramic, Silver Mica, etc. 3pF to .1μF. LIST VALUE OVER £5.

BARGAIN 7lb. PARCELS

Including variable condensers, i.f. coils, loudspeaker plugs/sockets, knobs, pots, condensers, resistors, nuts, bolts, cabinet fittings, switches, transformer choke, rectifier, transistors. List value over £6. Carr. 5/-. Try one! **17/6**

DUNCI (VHF) FM TUNERS

MODEL FMT/5. Self powered 200/250 v. A.C. A.F.C. High sensitivity for fringe and long distance reception. Size 11¾ in. x 8⅝in. x 3¼in. high. Weight 7½lb. In case finished in satin chrome and black. We can offer these high fidelity instruments. Normally £21.13.5. Limited number only at **15 Gns.**

LOUDSPEAKERS. 3 Ω Top Makes. 6½in. **7/6** 5in. 7 x 4in. **8/6**

HITACHI PORTABLE TAPE RECORDER

STOCKS GOING FAST! Latest Hitachi. Fabulous quality reproduction of music, 6-transistor, 1⅞in. and 3¾in. speeds. Output 500 mW high quality speaker. Fast forward and rewind. Battery level and record level meter. Precision capstan drive. Size 8³/₁₆ x 3⅜ x 6⅞in. Genuine normal price of 35 gns. Unrepeatable. All spares available. With tape, tape reel, mike, etc. **19 Gns.**

CAR RADIOS

Latest Autolux fully transistorised complete with speaker and fittings. Large purchase enables us to sell these superb sets (normally approx. 14 gns.) at the amazing price of **8 Gns.**

RADIOGRAM CHASSIS

QUALITY BARGAINS

Heavy duty A.C. mains, complete with large dials.

Stereo AM, 6 valve, all wave (normally 17 gns.). **11 Gns.**

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Stereo AM/FM, 7 valve (normally 23 gns.). **17 Gns.**

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Large purchase well known portable Record Players with ingenious Split Cabinet giving two separate high quality loudspeakers, plus main unit with Garrard Deck and crystal clear amplifiers. Compact, powerful, amazing value. Autochanger Model complete Diamond Cartridge normally 39 gns., **19 gns.** Non-Autochange model with SRP72 Deck, normally 29 gns., **14 gns.** S.A.E. full description.

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Standard Play			Double Play		
3in.	150ft.	2/3	3in.	300ft.	4/-
4in.	300ft.	4/6	4in.	600ft.	8/-
5in.	600ft.	7/6	5in.	1,200ft.	15/-
5¾in.	900ft.	10/6	5¾in.	1,800ft.	19/6
7in.	1,200ft.	12/6	7in.	2,400ft.	27/-
Long Play			**Triple Play**		
3in.	225ft.	2/9	4in.	900ft.	13/-
4in.	450ft.	5/6	5in.	1,800ft.	25/-
5in.	900ft.	10/6	5¾in.	2,400ft.	34/-
5¾in.	1,200ft.	13/-	7in.	3,600ft.	44/-
7in.	1,800ft.	18/6			
			Quadruple Play		
			3ft.	600ft.	8/-

Postage 1/- reel Post Free less 5% on three reels. Quantity and Trade enquiries invited.

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DPA15. Latest black/satin chrome finish multiple input channels selector, bass and treble controls. Matches all pick-ups and mikes. Provision tape recording. Normally 10 gns. our price **5 Gns.**

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General Purpose miniature detector A.V.C. etc. 6/6 doz. **8d.**

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Guaranteed performance. Top makes. Tested 250v. working.

120 ma. (3 for 6/6) **2/9** 500 ma. (3 for 10/6) **7/6**

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All Factory Fresh. All with cartridge.

B.S.R.

TU14—Single player Complete	59/-
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TUBES SATISFACTION GUARANTEED

Satisfaction Guaranteed or money refunded if returned unsoiled within 14 days

MOST MULLARD, MAZDA, COSSOR, EMITRON, EMISCOPE, BRIMAR, FERRANTI TYPES PROCESSED IN OUR OWN FACTORY

Carr. & Ins. 12/6	6 Months	12 Months
12in.	£2. 0.0	£3. 0.0
14in.	£2.10.0	£3.10.0
15-17in.	£3. 5.0	£4. 5.0
19in.	£3. 5.0	£4. 5.0
21in.	£3.15.0	£5.15.0
23in.	£3.15.0	£5.15.0

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AW59-91 £7.10.0

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ATP7	5/6
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BS4	8/-
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D1	1/6
D41	6/-
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D77	3/3
DA30	12/6
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DET20	2/-
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EF73	5/-
DF91	3/-
DF92	3/-
DF96	6/-
DH63	5/-
DK92	8/-
DK96	6/6
DL92	4/-
DL93	4/-
DL94	5/9
DL96	7/-
DLS10	8/-
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E80F	23/-
E88CC	12/-
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E1148	2/6
E1266	50/-
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E1524	12/6
EA50	1/-
E173	7/-
EABC80	5/9
EA91	3/6
EAF42	8/-
EB34	1/6
EB91	3/-
EBC23	6/-
EBC41	8/6
EBC81	5/-
EBF80	6/6
EBF83	7/6
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EBL31	20/-
EC52	4/-
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EC70	4/-
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EC91	3/-
ECC81	4/-
ECC82	5/-
ECC83	6/-
ECC84	5/6
ECC85	6/6
ECC88	9/-
ECC91	4/-
ECC189	9/6
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ECH42	9/-
ECH81	5/-
ECH83	7/6
ECL80	6/-
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ECL83	10/-
ECL86	9/-
EF36	3/4
EF37A	7/-
EF40	8/-
EF50	2/6
EF52	6/-
EF53	4/6
EF55	8/-
EF71	7/6
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EF73	5/-
EF74	4/-
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EF85	4/6
EF86	6/6
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EF95	5/-
EF183	8/-
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EHT1	300/-
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EL34	10/-
EL36	5/-
EL38	17/6
EL41	8/-
EL42	8/-
EL50	8/-
EL81	8/-
EL84	5/-
EL85	8/-
EL91	4/6
EL95	5/-
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EM81	7/6
EM84	6/3
EN31	10/-
ESU74	80/-
ESU208	6/-
EY51	5/6
EY86	6/6
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EZ80	5/6
EZ81	4/6
F/6057	5/-
F/6061	5/-
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FW4/500	6/6
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G50/2G	5/-
G180/2M	15/-
GM4	45/-
GZ32	10/-
GZ34	10/-
HK54	22/6
HL2K	2/6
HL23	6/-
HL23DD	5/-
HL41	4/-
HVR2	9/-
K3A	60/-
KT8C	22/-
KT32	8/-
KT44	5/9
KT33	4/-
KT66	16/-
KT67	15/-
KY76	8/6
KT88	22/-
KTW61	4/6
KTW63	2/-
KTZ41	6/-
KTZ63	5/-
M8100	9/-
M8141	12/-
M8161	7/-
MH4	5/-
MHLD6	10/-
ML6	6/-
N78	15/-
NE17	7/-
OA2	5/9
OB2	6/-
OB3	7/-
OC3	5/-
OD3	5/-
OZ4A	5/-
PC86	9/-
PC88	9/-
PC97	9/6
PC900	12/-
PCC84	6/-
PCC89	10/-
PCC189	9/6
PCF80	7/-
PCF82	6/6
PCF84	6/-
PCF86	8/-
PCF802	11/-
PCF805	11/-
PCL81	9/-
PCL82	7/-
PCL83	8/6
PCL84	7/-
PCL85	8/6
PCL86	8/-
PEN25	4/6
PEN46	3/-
PEN200A	3/-
PFL200	17/6
PL36	9/-
PL38	16/-
PL81	7/-
PL82	6/6
PL83	6/-
PL84	6/6
PL500	15/-
PM24A	5/-
PT15	10/-
PT25H	7/6
PT25M	7/6
PX4	14/-
PX25	9/-
PY33	6/-
PY80	5/6
PY81	5/6
PY82	5/6
PY83	6/-
PY800	8/-
PZ1·35	9/-
PZ1·75	12/-
QP21	6/-
QP25	5/-
QP230	5/-
QS95/10	5/6
QS150/15	10/-
QS1202	8/-
QV04/7	8/2
R3	8/-
R10	9/-
RG4/1250	60/-
RK72	6/-
SL30P	15/-
SL30	12/6
SP2	8/6
SP41	1/6
SP61	1/6
SP210	6/6
STV280/40	12/6
SU2150A	10/-
S11E12	10/-
T41	10/-
TDOX-20	70/-
TP22	5/-
TP25	15/-
TT11	5/-
TT15	35/-
TTR31	45/-
TZ0520	4/-
TZ20	16/-
U81	18/-
U12/4	8/-
U17	5/-
U18	6/-
U25	11/-
U26	11/-
U27	8/-
U50	4/6
U52	4/6
U191	11/6
U801	17/-
UABC80	6/-
UAF42	9/-
UBC41	6/-
UBF80	5/6
UBF89	6/6
UBL21	10/-
UCC85	6/6
UCH42	8/-
UCH81	6/-
UCL82	8/-
UCL83	9/-
UF41	8/6
UF89	6/-
UL41	7/6
UL84	5/6
UU5	7/-
UU9	8/6
UY21	7/6
UY41	6/6
UY85	5/-
V1120	4/-
V1507	5/-
V1924	20/-
VP23	3/-
VP133	9/-
VR99	8/-
VR105/30	5/-
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W21	5/-
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W119	8/-
X66	7/6
X81M	18/-
X118	8/-
X145	8/-
Y63	5/-
Y65	4/-
Y66	8/-
Z800U	20/-
Z801U	10/-
1A3	8/-
1A5GT	5/-
1B22	30/-
1C5GT	6/-
1D8GT	6/-
1E7G	7/6
1F2	3/-
1G6GT	6/-
1L4	2/6
1LA6	6/-
1LC6	7/-
1LH4	4/-
1N21B	4/-
1N43	4/-
1N70	4/-
1R4	5/-
1R5	3/6
1S4	5/-
1S5	4/6
1T4	3/-
2A3	5/-
2C26	7/-
2C26A	3/-
2C34	2/6
2C45	22/6
2C46	30/-
2C51	12/-
2D21	5/-
3A4	4/-
3A/108A	20/-
3A/46J	35/-
3A/167/M	25/-
3B7	5/-
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3D6	4/-
3E29	50/-
3Q4	6/-
3Q5GT	7/-
3S4	5/-
3V4	5/9
3X2	3/-
4C27	35/-
4D1	4/-
5A173G	5/-
5A174G	5/-
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5B/253M	15/-
5B254M	40/-
5B255M	35/-
5R4GY	9/-
5T4	7/-
5U4G	4/6
5V4G	8/-
5X4G	8/6
5Y3G	4/6
5Y3GT	5/-
5Y3WGTB	9/-
5Z4G	6/6
5Z4GT	8/-
6AB6	4/-
6AC7	2/-
6AG5	2/6
6AG7	6/-
6AH6	10/-
6AJ7	2/-
6AK5	5/-
6AK7	6/-
6AL5	3/-
6AL5W	7/-
6AM5	2/6
6AM6	4/-
6AQ5	7/-
6AQ5W	9/-
6AS6	4/-
6AS6W	9/-
6AS7G	20/-
6AT6	4/-
6AU6	7/-
6AX4	8/-
6B4G	16/-
6B7	6/-
6B8G	2/6
6BA6	5/-
6BA7	5/-
6BE6	6/-
6BJ6	7/6
6BJ7	7/-
6BQ7A	8/-
6BR7	9/-
6BW6	8/-
6C4	2/-
6C5G	2/6
6C5GT	6/-
6C6	4/-
6C6G	3/-
6C8G	3/-
6CH6	4/6
6C21	80/-
6CL6	9/-
6CW4	12/-
6D6	3/-
6E5	6/-
6F5GT	5/9
6F6G	4/-
6F7	6/-
6F8G	6/6
6F12	4/6
6F13	5/-
6F14	5/-
6F32	4/-
6F33	3/-
6G6G	2/6
6H6M	1/6
6J4WA	10/-
6J5	6/-
6J5G	2/-
6J6	3/6
6J6W	6/-
6J7G	5/-
6J7M	8/-
6K6GT	5/6
6K7G	2/-
6K7GT	4/9
6K8G	3/-
6K8GT	8/3
6K8M	6/6
6L5G	6/-
6L6GA	7/6
6L6M	11/-
6L7G	4/-
6L34	4/6
6LD20	5/9
6N7	6/-
6N7G	5/9
6P25	12/6
6Q7G	5/-
6R7	5/6
6SA7	7/-
6SA7GT	6/6
6SC7	7/-
6SG7GT	5/-
6SFGT	5/6
6SH7	6/-
6SJ7	5/-
6SJ7G	6/6
6SK7GT	4/-
6SK7	4/6
6SL7GT	5/6
6SN7	3/6
6SQ7GT	6/-
6SS7	2/-
6U4GT	9/6
6V6G	5/-
6V6GT	7/6
6V6M	8/-
6X4	3/6
6X5G	5/-
6Z5GT	5/3
6Y6G	6/-
6-30L2	10/-
6Z4	5/-
7B7	7/6
7C5	10/-
7C6	7/-
7C7	6/-
7H7	7/3
7Q7	7/-
7S7	18/-
7V7	5/-
7Y4	8/-
7Z4	4/6
8D2	2/6
9D2	3/-
9D6	3/6
10F9	9/-
12A6	2/6
12AH7	5/-
12AT6	5/-
12AT7	4/-
12AV6	5/6
12AU7	5/-
12AT7WA	5/6
12AX7	6/-
12AY7	10/-
12BA6	5/-
12BE6	7/-
12BH7	7/-
12C8	3/-
12H6	2/-
12J5GT	2/6
12J7GT	6/6
12K7GT	2/-
12K8M	10/-
12Q7GT	3/3
12SA7	7/-
12SC7	4/-
12SG7	3/-
12SH7	3/-
12SJ7	5/-
12SK7	5/-
12SN7GT	5/9
12SR7	5/-
12Y4	2/-
12L7	7/-
14S7	18/-
15D2	6/-
19E2	15/-
19G3	20/-
19G7	5/-
19H1	6/-
19M1	5/-
20P4	12/6
21B6	9/-
25L6GT	5/-
25Y5	6/-
25Z4G	6/6
25Z5	7/6
25Z6GT	8/6
25D7	6/-
30	5/-
30C15	9/6
30C18	11/-
30F5	8/6
30FL1	10/6
30L15	11/-
30P12	10/-
30P19	15/-
30PL1	8/-
30PL13	27/6
3516GT	7/-
35T	17/6
35W4	5/-
35Z3	10/-
35Z4GT	6/-
35Z5GT	6/-
37	4/-
38	4/-
215SG	6/-
50CD6G	27/6
50L6GT	8/-
53A	7/6
57	6/-
58	6/-
59	6/-
75	5/6
76	5/-
77	6/6
78	5/-
80	5/6
81	9/-
84	8/-
85A2	8/-
210VPT 7-pin	2/6
220PA	7/-
220TH	4/-
225DU	9/-
307A	5/6
310C	25/-
350B	8/-
357A	7/-
368A	5/-
393A	15/-
446A	8/-
703A	30/-
705A	10/-
715B	60/-
717A	3/-
724A	15/-
801	6/-
803	22/6
807	8/-
808	8/-
813	65/-
815	35/-
829B	50/-
830B	4/-
832A	45/-
843	5/-
866A	14/-
884	10/-
954	4/6
955	2/6
956	2/-
957	5/-
958A	4/-
1612	5/-
1616	3/-
1619	5/-
1625	6/-
1626	3/-
1629	4/6
2051	5/-
4043C	13/6
4063	8/-
4313C	30/-
5704	9/-
5726	6/-
6060	5/-
6064	7/-
6065	6/-
6080	22/-
6146	25/-
7193	1/9
7475	2/-
8013A	25/-
8020	8/-
9001	3/-
9002	4/6
9003	6/-
9004	2/6
9006	2/6

C.R. Tubes

E4504/B/16	28/-
VCR97	28/-
VCR138A	40/-
VCR517	35/-
VCR517B	40/-
VCR517C	40/-
3FP7	45/-
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5PC1	30/-
5FP7	12/6
88D	44/-

Photo Tubes

GS16	12/6
931A	55/-
6097	350/-

Special Valves

ACT6	£8
K301	£4
KRN2A	£3.10.0
1B24	25/-
2J22	£2.10.0
2J54	£3
417A	30/-
3J/92/E	£37.10.0
714AY	£4
725A	30/-
726A	19/-

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

SPARES FOR AR 88 D RECEIVERS. Ask for your needs from our huge selection.

PANEL METERS

0-3 amp RF	2in. square	20/-
100mA AC	3½in. round	25/-
15v AC	2½in. round	20/-
150v AC	2½in. sq. (black dial)	25/-

2 KW ULTRASONIC GENERATOR together with power supply unit for 200-250 v. A.C. Complete two chassis with interconnecting cables. Frequency 37 to 43 kc/s adjusted by fine control. Peak output 2 kw., average output 500 w. Completely new with valves and manual £65, carriage paid U.K.

LARGE SELECTION of mains and Heavy Duty L.F. TRANSFORMERS.

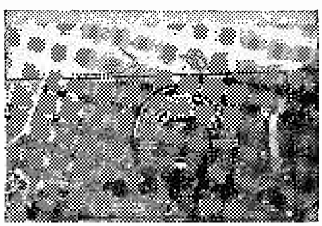
VARIOMETER for No. 19 sets, **17/6**. P. & P. 3/-.

MARCONI SIGNAL GENERATOR TYPE TF 801B/3/S. Frequency range 12-485 Mc/s. in five ranges. Directly calibrated frequency dial. Output waveform: C.W. sinewave A.M., pulse A.M. (from ext. source only). Internal modulation frequency 1,000 c/s. Output: a, normal—continuously variable directly calibrated from 0.1 µv.—0.5 v. b, high: up to 1 v. modulated or 2 v. unmodulated, output impedance 50 ohms. Fine frequency tuning control, carrier on/off switch, built-in crystal calibration for 2 Mc/s and 10 Mc/s. Stabilised voltage supply. In excellent "as new" condition. Fully checked and guaranteed. **£115.** Carr. 30/-. Including necessary connectors, plugs and instruction manual.

C.R. 100 RECEIVER. 60kc—420kc, 500kc—13mc. In 6 bands, 2 HF stages, 3 IF stages, AVC on both phone and CW. Excellent condition, correctly tuned and guaranteed, **£31.** Carr. 30/-.

MARCONI VALVE VOLT METER TYPE TF 428-B. 1.5v to 150v RMS in five ranges. A.C. and D.C. stabilised power supply. Complete with probe unit for RF measurements. In new condition and Laboratory tested **£12.10.0.** Carriage 10/-.

WELL PROVEN RELIABLE COMMUNICATION RECEIVER P.C.R.3



(Made by Pye). 3 bands, 1:medium wave, 2: 120-43m, 3:43-13m. Overall sensitivity 1-2µV. S/Noise ratio 10 dB at 6µV. Circuit incorporates an RF stage, two I.F. stages, tone control, A.V.C. antenna trimmer. 6V6 output. Set in new condition together with headphones and speaker plug, **£9.5.6.** With vibratory supply unit, 12v, **£10.4.0.** With specially built-in P.S.U. for 210-250v. A.C., **£11.17.6.** Carriage either set 10/-.

EDISWAN SEALED RELAYS TYPE H 96 C. 145 ohms plus 145 ohms, **12/6.** P.P. 2/-.

TELEPHONE HANDSET. Standard G.P.O. type, new **12/-.** P. & P. 2/-.

P. C. RADIO LTD.

170 GOLDHAWK RD., W.12

SHEpherd's Bush 4946

Open 9-5.30 p.m. except Thursday 9-1 p.m.

PERSONAL CALLERS WELCOME

TRANSISTORS

OC16	20/-	OC81D	5/-	OC201	12/6	XC141	10/-
OC22	23/-	OC81M	7/-	OC202	15/-	XC142	15/-
OC25	12/-	OC82	10/-	OC203	12/6	XC155	20/-
OC35	12/6	OC82DM	5/-	OC204	17/6	XC156	22/6
OC44	6/-	OC83	5/-	OC206	22/6	2N247	9/6
OC45	5/-	OC83B	5/-	AAZ12	6/-	2N412	7/6
OC71	4/6	OC122	16/-	AC128	7/6	2N502	47/-
OC72	6/-	OC170	6/-	BCZ11	7/6	2N585	10/6
OC73	10/-	OC200	10/6	BY38	7/6	2N1090	20/6
OC81	5/-					2N1091	29/-

INSET MICROPHONE for telephone handset, **2/6.** P. & P. 2/-.

A.R.88D. RECEIVERS. Fully reconditioned, **£55.** Rebuilt model, **£85.** Carriage paid U.K.

ULTRA MODERN POWER SUPPLY UNIT. Supply voltage A.C.: 105, 110, 115, 200, 205, 210, 220, 225, 230, 240, 245, 250 v. Available voltages D.C.:

(a) 1700-1900 v. Stabilised, adjustable approx. 1 mA.
(b) HT2 approx. 45mA.
(c) 260-350 v. stabilised, adjustable, approx. 45 m.
(d) 450 v. approx. 30 mA.
(e) 50 v. approx. 150 mA.
(f) 4.5 v. A.C. amp. common earth.
(g) 6.3 v. A.C., 4.5 amp. common earth.

5 valves, 7 silicon rectifiers, 4 Selenium HV rectifiers. Brand new, **£9.10.0.** Carriage 12/-.

PHASE MONITOR ME-63/U. Manufactured recently by Control Electronics Inc. Measures directly and displays on a panel meter the phase angle between two applied audio frequency signals within the range from 20-20,000 cps to an accuracy of $\pm 1.0°$. Input signals can be sinusoidal or non-sinusoidal between 2 and 30v peak. In excellent condition together with handbook and necessary connector, **£45.** Carriage 30/-.

H.R.O. SENIOR TABLE MODEL TYPE M (50 KCS-30 MCS) with "S" meter and crystal filter in excellent, fully checked and tested condition together with set of 8 general coverage coils and original mains P.S.U. for 110/210v., **£26.10.0.** Carriage and packing 30/-.

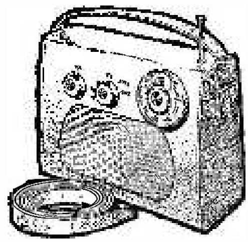
RACK MODEL also available at the same price.

Why NOT BUILD ONE OF OUR PORTABLE TRANSISTOR RADIOS... *FIRST FOR PERFORMANCE, QUALITY & PRICE!*

BACKED BY OUR SUPER AFTER SALES SERVICE

"A wonderful range of transistor radios using first grade components for guaranteed results."

NEW ROAMER SEVEN Mk IV



7 WAVEBAND PORTABLE OR CAR RADIO

Amazing performance and specification ★ *Now with PHILCO MICRO-ALLOY R.F. TRANSISTORS*

FULLY TUNABLE ON ALL WAVEBANDS ● **9 stages—7 transistors and 2 diodes**

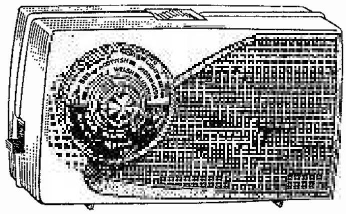
Covers Medium and Long Waves, Trawler Band and three Short Waves to approx. 15 metres. Push-pull output for room filling volume from rich toned 7 x 4in. speaker. Air spaced ganged tuning condenser. Ferrite rod aerial for M. & L. Waves and telescopic aerial for S. Waves. Real leather-look case with gilt trim and shoulder and hand straps. Size 9 x 7 x 4in. approx.
The perfect portable and the ideal car radio. (Uses PP7 batteries, available anywhere.)

★ **EXTRA BAND FOR EASIER TUNING OF PIRATE STATIONS, etc.**

Total cost of parts now only **£5.19.6** P. & P. 5/6

Parts Price List and easy build plans 3/- (Free with kit)

NEW MELODY MAKER SIX



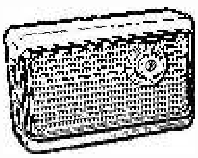
3 WAVEBAND PORTABLE ● **8 stages—6 transistors and 2 diodes**

Covers Medium and Long Waves and EXTRA BAND FOR EASIER TUNING OF PIRATE STATIONS, etc. Top quality 3in. Loudspeaker for quality output. Two RF stages for extra boost. High "Q" 6in. Ferrite Rod Aerial. Approx. 350 milliwatts push-pull output. Handsome pocket size case with gilt fittings. Size 6¼ x 3¾ x 1½in. (uses long-life PP6 battery). Carrying strap 1/6 extra.

This amazing receiver may be built for only **£3.9.6** P. & P. 3/6

Parts Price List and easy build plans 2/- (Free with kit).

NEW TRANSONA FIVE



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

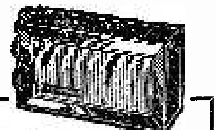
● **7 stages—5 transistors and 2 diodes**

Fully tunable over Medium and Long Waves and Trawler Band. Incorporates Ferrite rod aerial, tuning condenser volume control, new type fine tone super dynamic 2¾in. speaker, etc. Attractive case. Size 6¼ x 4½ x 1½in. with red speaker grille. (Uses 1289 battery, available anywhere.)

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

Parts Price List and easy build plans 2/- (Free with kit)

POCKET FIVE



● **7 stages—5 transistors and 2 diodes**

Covers Medium and Long Waves and Trawler Band, a feature usually found in only the most expensive radios. On test Home, Light, Luxembourg and many Continental stations were received loud and clear. Designed round supersensitive Ferrite Rod Aerial and fine tone 2¾in. moving coil speaker, built into attractive black and gold case. Size 5½ x 1½ x 3½in. (Uses 1289 battery available anywhere.)

STOP PRESS!
Pocket 5 med and Long wave version with miniature speaker.
29/6 P. & P. 3/-

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

Parts Price List and easy build plans 1/6 (Free with kit)

NEW ROAMER SIX

NOW, WITH PHILCO MICRO-ALLOY R.F. TRANSISTORS

● **6 WAVEBAND !!**
● **8 stages—6 transistors and 2 diodes**

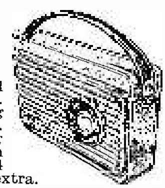
Listen to stations half a world away with this 6 waveband portable. Tunable on Medium and Long Waves, Trawler Band and two Short Waves. Sensitive Ferrite rod aerial and telescopic aerial for short waves. Top grade transistors. 3-inch speaker, handsome case with gilt fittings. Size 7½ x 5½ x 1½in. (Carrying strap 1/6 extra.)

★ **EXTRA BAND FOR EASIER TUNING OF LUX., ETC.**

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

Parts Price List and easy build plans 2/- (Free with kit)

TRANSONA SIX



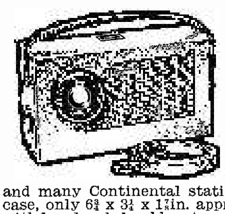
● **8 stages—6 transistors and 2 diodes**

This is a top performance receiver covering full Medium and Long Waves and Trawler Band. High-grade approx. 3in. speaker makes listening a pleasure. Push-pull output. Ferrite rod aerial. Many stations listed in one evening including Luxembourg loud and clear. Attractive case in grey with red grille. Size 6¼ x 4½ x 1½in. (Uses PP4 battery available anywhere.) Carrying Strap 1/- extra.

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

Parts Price List and easy build plans 1/6. (Free with kit)

MELODY SIX



● **8 stages—6 transistors and 2 diodes**

Our latest completely portable transistor radio covering Medium and Long Waves. Incorporates pre-tagged circuit board, 3in. heavy duty speaker, top grade transistors, volume control, tuning condenser, wave change slide switch, sensitive 6in. Ferrite rod aerial. Push-pull output. Wonderful reception of BBC, Home and Light, 208 and many Continental stations. Handsome leather-look pocket size case, only 6¾ x 3¾ x 1⅞in. approx. with gilt speaker grille and supplied with hand and shoulder straps.

Total cost of all parts now only **£3.9.6.** P. & P. 3/6

Parts Price List and easy build plans 2/- (Free with kit)

SUPER SEVEN

● **9 stages—7 transistors and 2 diodes**

Covers Medium and Long Waves and Trawler Band. The ideal radio for home, car, or can be fitted with carrying strap for outdoor use. Completely portable—has built-in Ferrite rod aerial for wonderful reception. Special circuit incorporating 2 RF Stages, push-pull output, 3in. speaker (will drive large speaker). Size 7¼ x 5¼ x 1½in. (Uses 9V battery, available anywhere.)

Total cost of all parts now only **£3.9.6** P. & P. 3/6

Parts Price List and easy build plans 2/- (Free with kit)

Callers side entrance Barratts Shoe Shop.

RADIO EXCHANGE CO.

Open 9—5 p.m. Saturdays 9—12.30 p.m.

61 HIGH STREET, BEDFORD Telephone: Bedford 52367

R.S.C. (MANCHESTER) LTD.

MAIL ORDERS TO: 102 Henconner Lane Bramley, Leeds 13

Terms: C.W.O. or C.O.D. No C.O.D. under £1. Postage 3/6 extra under £2. 5/6 extra under £5. Trade Supplied. S.A.E. with all enquiries please.

Personal shoppers welcome at our HI-FI CENTRES as below. Open all day Sats.

BRADFORD 10 North Parade. Tel. (Half-day Wed.) 25349

BRISTOL 14 Lower Castle St. Tel. (Half-day Wed) 22904

BIRMINGHAM 30/31 Gt. Western Arcade, opp. Snow Hill Station. CENtral 1279. No half-day

DERBY 26 Osmaston Rd., The Spot (Half-day Wed.) Tel.: 41361

DARLINGTON 13 Post House Wynd (Half-day Wednesday) Tel.: 68043

EDINBURGH 133 Leith Street (Half-day Wed.)

GLASGOW 326 Argyle St. Tel.: (No half-day) CITy 4158

HULL 51 Savile Street (Half-day Thursday) Tel.: 20505

LEICESTER 32 High Street (Half-day Thurs.) Tel.: 56420

LEEDS 5-7 County (Mecca) Arcade (No Half-day) Tel: 28252

LIVERPOOL 73 Dale St. (No half-day) Tel: CENtral 3573

LONDON 238 Edgware Road, W2 (Half-day Thursday) Tel.: PADdington 1629 96, High Holborn WC1 Opening Late August

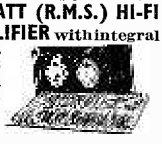
MANCHESTER New large store. (No half-day) 60A-60B Oldham St. Tel.: CENtral 2778

MIDDLESBROUGH (Half-day Wednesday) 106 Newport Road. Tel.: 47096

NEWCASTLE Blackett Street New branch opens Mid-August

SHEFFIELD 13 Exchange Street Castle Market Bldgs. Tel.: 20716 (Half-day Thursday)

R.S.C. A15 15 WATT (R.M.S.) HI-FI TRANSISTOR AMPLIFIER with integral



pre-amp tone control stages. Output for 3, 7.5 and 15 ohm speakers. Kit of parts consisting of Printed Circuit and all components for same including 9 Mullard or Newmarket Post latest semi-conductors. 5/- **£6.19.9** Heat sink and full wiring instructions or with printed circuit fully wired and tested 30/- extra. **Frequency Response:** ± 1dB 20-20,000 cps. **Harmonic Distortion:** 0.1% measured at 1000 c.p.s. **Hum and Noise:** —80dB. **Sensitivity:** 2 mV. **Bass Control:** +9dB to —14dB at 40 c.p.s. **Treble Control:** +8dB to —13dB at 10 Kc/s. Suitable Power Pack Kit 39/6 or ready built 59/6.

ALL LEADING MAKES OF HI-FI EQUIPMENT STOCKED Cash or Terms

LONDON 96 HIGH HOLBORN OPEN LATE AUGUST

HI-FI LOUDSPEAKER ENCLOSURES

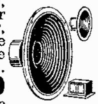
All types of pleasing modern "slimline" design acoustically lined and ported and in alternative finishes of light Teak or medium Walnut.

SE8. For optimum performance with any Hi-Fi 8in. speaker. Size 22 x 15 x 7in. Carr. 7/6 **£5.15.0**

SE10. For 10in. Hi-Fi speaker with provision for tweeter. Size 24 x 15 x 7½in. Or Deposit 21/- and 9 mthly pmts of 15/4 (Total £7.19.0) **£6.19.9**

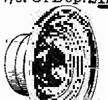
SE12. For outstanding performance with any 12in. Hi-Fi speaker. Cut for tweeter. Size 24 x 20 x 7½in. Or Deposit 27/- and 9 monthly payments of 18/2 (Total £9.10.6) Carr. 10/- **8 Gns.** Carr. 10/-

AUDIOTRINE HI-FI SPEAKER SYSTEMS



Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) and Tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. Or **Senior 20 watt** inc. Fane 122/10 speaker £6.19.9. Carr. 7/6. Or Dep. 21/- and 9 mthly pmts of 15/4 (Ttl £7.19.0). **£4.19.9** Carr. 5/6

AUDIOTRINE HF100D 10in. 15W



HI-FI Loudspeakers. Heavy cast construction. Dual cone. Smooth frequency response 20-20,000 c.p.s. Speech coil 3 or 15 ohms. Exceptional value. Carr. 5/9 **£5.15.0**

AUDIOTRINE HF121D 12 in. 20 w

HI-FI SPEAKER Heavy cast chassis. Latest high efficiency ceramic magnet. Aluminium speech coil and Tweeter Cone for extended frequency range. Response 30–20,000 c.p.s. Impedance 15 ohms. Only **£6.15.0**

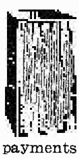
TWEETERS R.A. 3 ohm 25/9. 15 ohm 25/9

SPECIAL PURCHASE of 15 in. 25 WATT 15 ohm BASS SPEAKERS Very limited number. Famous make. Fully Guaranteed. ONLY **£9.19.9**

R.S.C. GRAM AMPLIFIER KIT. 3 watts output. Negative feedback. Controls: Vol., Tone and Switch. Mains operation 200-250v. A.C. Fully isolated chassis. Circuit, etc., supplied. Only 44/9. Carr. 3/9.

HIGH FIDELITY LOUDSPEAKER UNITS

MINI-8. 8 watt, 3 ohms or 15 ohms incorporating specially designed highly efficient 5 in. speaker with low fundamental resonance and high flux density ceramic magnet. Frequency response 50-13,000 c.p.s. Handsome Teak veneered cabinet, size 10½ x 6½ x 7½ ins. 6 Gns. Carr. 5/9.

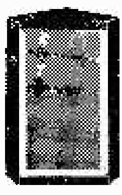


AUDIOTRINE PETITE Really astounding performance. Size only 10½ x 6½ x 7½in. **Rating 10 watts.** Frequency range 45-20,000 c.p.s. Cabinet beautifully finished in Teak (light) or Walnut (medium). Fitted specially designed Heavy cast 5in. speaker with large pole pieces, extra long voice coil and rubber cone surround. Impedance 3 ohms or 15 ohms. Or Deposit 36/- and 9 monthly payments of 25/- (Total £13.1.0). **11 Gns.** Carr. 7/6

The GLOUCESTER Handsome "slimline" cabinet, acoustically lined. Size 24 x 20 x 6½in. Finished light Teak or medium Walnut. 12in. high flux 12,000 line speaker. Cross-over unit and Tweeter. Rating 10 watts. Smooth response 40-20,000 c.p.s. Impedance 15 ohms. Or Deposit 36/- and 9 monthly payments 25/- (Total £13.1.0). **11 Gns.** Carr. 15/-

The BRONTE Handsome cabinet of modern styling. Acoustically lined and finished Teak or Walnut. Size 22 x 15 x 7½in. Fitted Wharfedale Super 8 RSDD Speaker. with Roll surround and dual cone. Rating 6 watts. Impedance 15 ohms. Or Deposit 39/- and 9 monthly payments 27/3 (Total £14.4.3). Carr. 15/- **12 Gns.**

CORNER CONSOLE CABINETS



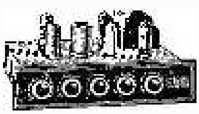
Strongly made. Beautiful polished walnut veneered finish. Pleasing design. **Junior Model.** For up to 8in. speaker. Approx. 20 x 11 x 8in. Carr. 5/6 **49/9**

Standard Model. To take up to 10in. speaker. Size 27 x 18 x 8in. Carr. 7/6 **5 Gns.**

Senior Model. To take up to 12in. speaker and with Tweeter cut-out. Size approx. 30 x 30 x 15in. (Recommended for use with Audiotrine speaker system.) Terms available. Carr. 8/6 **8 Gns.**

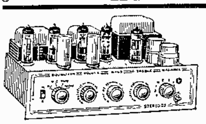
LINEAR TAPE PRE-AMPLIFIER. Type LP/1. Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier, suitable most Tape Decks. Terms available. **10½ Gns.**

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



A complete set of parts for the construction of a stereo amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable all crystal or ceramic stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point to point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. Or supplied factory assembled with 12 months' guarantee for 11 gns. **Terms:** Dep. 36/- and 9 monthly payments 25/5 (Total £13.4.9). Carr. 11/6 **£8.15.0**

R.S.C. STEREO 20/HIGH FIDELITY AMPLIFIER



PROVIDING 10/14 WATT ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL. SUITABLE FOR "MIKE", GRAM, RADIO OR TAPE. Employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. **Frequency Response:** ±2dB 30-20,000 c.p.s. **Hum Level:** 65dB down. **Sensitivity:** 5 millivolts maximum. **Harmonic Distortion:** (each channel): 0.2%. ★ **Four-position tone compensation and Input Selector Switch.**

- ★ **Will amplify direct from Tape Heads.**
- ★ **Stereo/Mono switch.**
- ★ **Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.**
- ★ **Neon panel indicator.**
- ★ **Handsome Perspex Frontplate.**

Output transformers are high-quality sectionally wound to required specification. Output matching for 3 and 15 ohm speakers on each channel. Complete set of parts with point-to-point wiring diagrams and instructions. Send s.a.e. for leaflet. Carr. 12/6 **14 Gns.**

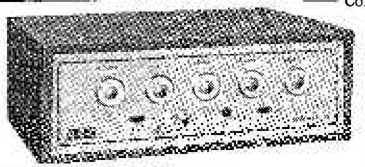
Or factory assembled, tested and supplied with our usual 12 months guarantee. Or Deposit £3 and 9 monthly payments 43/2 (Total £22.4.6). Carr. 12/6 **19 Gns.**

R.S.C. SUPER 15 HI-FI AMPLIFIER

APPEARANCE AND TECHNICAL SPECIFICATIONS COMPARE MORE THAN FAVOURABLY with SIMILAR AMPLIFIERS AT TWICE THE COST

FULLY TRANSISTORISED 200/250v. A.C. Mains.
OUTPUT 10 WATTS R.M.S. cont. into 15 ohms.
15 WATTS R.M.S. cont. into 3-4 ohms.
Maximum instantaneous Peak power output 28 watts.
PRINTED CIRCUIT CONSTRUCTION.
LATEST MULLARD TRANSISTORS. AD149, AD149, OC127Z, OC81Z, OC44, OC44, OC81Z, OC44, AC107.
5 POSITION INPUT SELECTOR SWITCH
EQUALISATION to Standard R.I.A.A. and C.C.I.R. Characteristics for Gram and Tape Heads.
FULL TAPE MONITORING FACILITIES.
SENSITIVITIES: Magnetic P.U. 4 mV, Crystal or Ceramic P.U. 400 mV, Microphone 4.5 mV, Tape Head 2.5 mV, Radio/Aux or Ceramic P.U. 110 mV.
FREQUENCY RESPONSE: ± 2dB 20-20,000 c.p.s.
TREBLE CONTROL: +15dB to —14dB at 10 Kc/s.
BASS CONTROL: +12dB to —15dB at 50 c/s. **HUM LEVEL:** —75dB.
HARMONIC DISTORTION at 10 Watts R.M.S. 1,000 c.p.s. 0.3%.
NEGATIVE FEEDBACK: 52dB. Carr. 10/-
Complete Kit of parts with full constructional details and point to point wiring diagrams. Or ready for use 14½ Gns. **10½ Gns.**
Attractive Walnut or Teak finished cabinet **5 gns.** or Deposit **17/-** and 9 monthly payments **11/3** (Total **£5.18.3**). Or unit factory built and tested, complete with cabinet and with our usual 12 months' guarantee. **18½ Gns.** Or Deposit **£3.9.0** and 9 mthly pmts **40/6** (Total **£21.13.6**). Carr. 12/6.

ALL COMPONENTS ETC. ARE OF A HIGH STANDARD AND SUPPLIED BY LEADING BRITISH MANUFACTURERS.



R.S.C. SUPER 30 STEREO AMPLIFIER

A DUAL CHANNEL VERSION OF THE SUPER 15. Employing Twin Printed Circuits. Close tolerance Ganged Pots. Matched Components.
CROSS-TALK: —52dB at 1,000 c.p.s.
CONTROLS: 5 position Input Selector, Bass Control, Treble Control, Volume Control, Balance Control, Stereo/Mono Switch, Tape Monitor Switch, Mains Switch.
INPUT SOCKETS (Matched Pairs). (1) Magnetic P.U. (2) Ceramic or Crystal P.U. (3) Radio/Aux. (4) Tape Head/Microphone.
Operation of the Input Selector Switch assures appropriate equalisation.
Rigid 18 s.w.g. Chassis. Size approx. 12in. Wide, 3in. High and 8in. Deep. Neon Panel Indicator. Attractive Facia Plate and Spun Silver Matching Knobs. Above facilities, etc., except for Ganging and Balance Control, apply also to Super 15.

THESE UNITS ARE EMINENTLY SUITABLE FOR USE WITH ANY MAKE OF PICK-UP OR MICROPHONE (Crystal, Ceramic, Magnetic, Moving Coil, Ribbon) CURRENTLY AVAILABLE. SUPERB SOUND OUTPUT QUALITY CAN BE OBTAINED BY USING WITH FIRST RATE ANCILLARY EQUIPMENT. All required parts, point to point wiring diagrams and detailed instructions. Carr. 12/6 **18 Gns.**

Attractive Walnut or Teak finished cabinet **5 gns.** or Deposit **17/-** and 9 monthly payments **11/3** (Total **£5.18.3**). Or unit completely assembled ready for use housed in cabinet, **29 GNS.** Carr. 15/-. Or Deposit **£4.12.0** and 9 mthly pmts **64/10** (Total **£33.15.6**). *Send S.A.E. for leaflet.*

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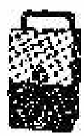
10-12U

	Kit	Assembled
● **5in. OSCILLOSCOPE, 10-12U** TB 10 c/s—500 kc/s.	£35 17 6	£45 15 0
● **3in. OSCILLOSCOPE, OS-2** TB 20 c/s—200 kc/s.	£22 18 0	£31 18 0
● **4½in. VALVE VOLTMETER, V-7A**	£13 18 6	£19 18 6
● **6in. VALVE VOLTMETER, IM-13U**	£18 18 0	£26 18 0

RF and HV probes available as extras



V-7A

	Kit	Assembled
● **REGULATED POWER SUPPLY. IP-20U** (Transistor), 0·5-50v D.C. to 1·5A	£35 8 0	£47 8 0
● **TV ALIGN'T GENERATOR, HFW-1**, 3·6-220 Mc/s	£38 18 0	£49 15 0
● **RF SIGNAL GENERATOR, RF-1U.** (Up to 100 Mc/s fund.) ...	£13 18 0	£20 8 0
● **MULTIMETER, MM-1U** (V, A, Res, dB)	£12 18 0	£18 11 6

	Kit	Assembled
● **ELECTRONIC SWITCH, S-3U** Scope Trace doubler	£13 10 0	£19 10 0
● **AUDIO SIGNAL GENERATOR, AG-9U** 10 c/s—100 kc/s	£23 15 0	£31 15 0
● **AUDIO SINE/SQ GENERATOR, AO-1U** Sine wave 20 c/s-150 kc/s	£14 15 0	£21 5 0
● **SINE/SQ GENERATOR, IG-82U** Freq. range, 20 c/s-1 Mc/s	£25 15 0	£37 15 0
● **AUDIO VALVE MILLIVOLTMETER, AV-3U.** 10 c/s-400 kc/s	£17 15 0	£24 5 0
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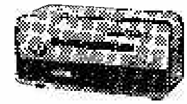
AUDIO Hi-Fi



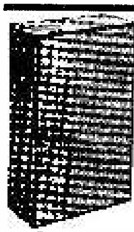
F.M. TUNER

● **F.M. TUNER** (in two parts), 88-108 Mc/s. Total price Kit **£16.8.0,** incl. P.T.

● **A.M./F.M. TUNER** (in two parts), 88-108 Mc/s, L-M-S waves. Total price Kit **£27.5.0,** incl. PT.

	Kit	Assembled
● **3+3W STEREO AMPLIFIER, S-33H.** Inputs for P.U. (Deram) radio, Aux.	£15 17 6	£21 7 6
● **3+3W STEREO AMPLIFIER, S-33.** Inputs for P.U. (crystal) or radio	£13 7 6	£18 18 0
● **9+9W STEREO AMPLIFIER, S-99.** Inputs for radio, tape, Aux., all P.U.s	£28 9 6	£38 9 6
● **20+20W STEREO AMPLFIER, AA-22U.** Transistor, inputs for P.U. (Mag.) and 4 other ...	£39 10 0	(less cabinet)
● **5W MONO AMPLIFIER, MA-5.** Inputs for P.U. and radio	£11 9 6	£15 15 0
● **10W POWER AMPLIFIER, MA-12.** For use with Control units, UMC/USC	£12 18 0	£16 18 0
● **50W POWER AMPLIFIER, MA-50**	£19 18 0	£27 18 0
● **4 CHANNEL MIXER TM-1.** Transistor, battery operated	£11 16 6	£16 17 6
● **TAPE PRE-AMP (MONO) TA-1M.** Needs P.S. and Audio Amplifier	£19 18 0	£28 18 0
● **MAGNAVOX 363 DECK,** ½ Track	£13 10 0	

SPEAKER SYSTEMS

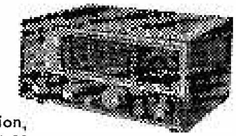


Berkeley

	Kit	Assembled
● **BERKELEY slim-line,** 2-LS. Cabinet fully finished ...	£19 10 0	£24 0 0
● **COTSWOLD standard,** 3-LS Cabinet (in the white) ...	£25 12 0	£33 17 0
● **COTSWOLD MFS,** 3-LS, Cabinet (in the white) ...	£25 12 0	£33 17 0
● **SSU-1 Low-priced System,** 2-LS Cabinet (in the white, less legs)	£11 17 6	incl. P.T.

Ancillary speakers also available.

'AMATEUR' EQUIPMENT



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● **AMATEUR BANDS RECEIVER,** RA-1 (160-10m). The ideal fixed station, portable or mobile receiver. Many features incl.: 'S' meter.
Kit **£39.6.6,** Assembled **£52.10.0**

	Kit	Assembled
● **COMMUNICATIONS TYPE RECEIVER.** RG-1, MW and 32 Mc/s-1·7 Mc/s	£39 16 0	£53 0 0
● **160-10M TRANSMITTER, DX-100U** ...	£81 10 0	£106 15 0
● **80-10M TRANSMITTER, DX-40U**	£29 19 0	£41 8 0

Other kits in range include: **SSB Adaptor,** SB-10U **£39 5 0**
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Full details of model(s)..............................

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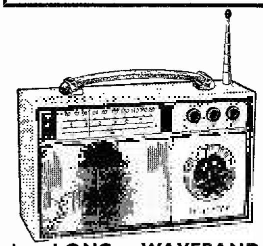
LASKY'S RADIO — FOR THE FINEST VALUE AND TO HOME CONSTRUCTORS

TRANSISTOR PORTABLES

We consider our Construction Parcels to be the finest value available on the home construction market. If on receipt you feel not competent to build the set, you may return it as received within 7 days, when the sum paid will be refunded less postage.



THE SKYROVER De Luxe

7 transistor plus 2 diode superhet, 6 waveband portable receiver covering the full Medium Waveband and Short Waveband 31-94M and also 4 separate switched bandspread ranges, 13M., 16M., 19M., and 25M., with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow, stage by stage instructions. Superhet, 470 Kc/s. All Mullard Transistors and Diode. Uses 4 U2 batteries. 5in. Ceramic Magnet P.M. Speaker. Easy to read Dial Scale, 500 MW Output. Telescopic Aerial and Ferrite Road Aerial. Tone Circuit is incorporated, with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet, size 11½ x 6¼ x 3in. covered with a washable material, with plastic trim and carrying handle. Car aerial socket fitted.

Can now be built for **£8 . 19 . 6** Post 5/- extra

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★ LONG WAVEBAND COVERAGE IS NOW AVAILABLE FOR THE SKYROVER

A simple additional circuit provides coverage of the 1100/1950M. band (including 1500M. Light programme). This is in addition to all existing Medium and Short wavebands. All necessary components with construction data.

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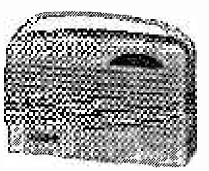
REALISTIC SEVEN



Fully tunable long and medium bands. Uses 7 Mullard Transistors; plus Diode OA70.

STAR features:
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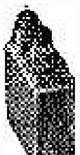
Well known British makers surplus stocks. Now available for the first time to the Home Constructor.



TRANSISTORISED UHF MINIATURE MODEL
Shielded metal case only 3½ x 1½ x 3in. Fully tunable—complete with two AF139 transistors. LASKY'S PRICE **39/6**

VALVE UHF MODEL (illustrated)
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Minature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 4 x 2 x 3½in. LASKY'S PRICE **29/6**

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Add 2/6 Post and Packing on each.

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Permeability tuned—covering 87 to 108 Mc/s. For use with one ECC85 valve. In metal case, size 3 x 2½ x 1½ in. Circuit supplied.
LASKY'S PRICE **15/11** Post 2/-. ECC85 valve 9/- extra.

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GET 81, GET 85, GET 86 **2/6**; 873A, 874P **3/6**; OC45, OC71, OC81D **4/6**; OC44, OC70, OC76, OC81 **5/6**; (match pair **10/6**); AF117, OC200 **6/6**; OC42, OC43, OC73, OC82D **7/6**; OC201, OC204 **15/-**; OC205, OC206 **19/6**; OC28 **24/6**; OC75 **8/-**.

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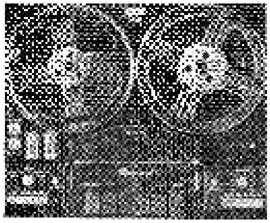
TF—01B 465 kc/s. ± 2 kc/s.
TF—01D 470 kc/s. ± 2 kc/s.

7/6 each Post 6d.

TAPE RECORDERS

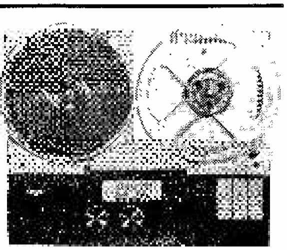


THE NEW GARRARD STEREO DECK

Now available from stock—superb specification: three ¼ track stero/mono heads; 3 speeds—1⅞ 3¾, 7½ i.p.s.; takes 7in. spools; fast forward and rewind; tape position indicator; pause control; separate record, replay and erase heads—4 tracks; piano key controls interlocked for all functions; stop/start can be remotely controlled; auto, tape-end stop. Heavy duty motor, capacitor start and run, large dynamically balanced flywheel. Deck finished in grey plastic, size: 14½ x 12 x 6in., depth below plinth 4in. For 110v. 50 c.p.s. Mains operation. Auto-transformer for 200/250v. included free.

LASKY'S PRICE 29½ GNS. Carriage & Packing Free

MAGNAVOX-COLLARO 363 TAPE DECKS



The very latest 3 speed model—1⅞, 3¾, 7½ ips, available with either ½ track or ¼ track head. Features include: pause control; digital counter; fast forward and rewind; new 4 pole fully screened induction motor, interlocking keys. Size of top plate 13⅜ x 11in. x 5¼in. deep below unit plate. For 200/250v. A.C. mains, 50 cps operation. New, unused and fully guaranteed.

Lasky's Price ½ track model **£10.10.0**
Lasky's Price ¼ track model **£13.9.6**

Carriage and Packing 7/6 extra.

SPECIAL BARGAIN—"THE ARROW" PORTABLE DICTATION/TAPE RECORDER

High Quality British Manufacture: Fully transistorised ● Battery operated ● Simple Cassette loading and single control lever (cassette takes 3in. spools giving 2×22 mins. twin track recording and 3¼in. spools giving up to 2×30 mins.) ● Volume control ● Accidental erasure safety device ● Fast rewind ● Operates on 4 U2 type batts. ● Strong two-tone plastic case size 9in.×6in.×3½in., with transparent cover. ● Fully guaranteed ● *Complete with all these accessories:* * Cassette with 3in. spools and tape. * Microphone with lapel clip and remote pause control (doubles as speaker on replay). * Stethoscope type headset. * Telephone adaptor. * Foot Switch. * Desk speaker. * Reference pad. List price £31.

LASKY'S PRICE £7 . 19 . 6

Carriage 5/-, 4 long life Rayovac Batt. 6/- extra.

INTERNATIONAL TAPE Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft.	2 6	5¾in.	Long play, 1200 ft. Acetate	12 6
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3¼in.	Triple play, 600ft. Mylar	10 0	5¾in.	Triple play, 2400ft. Mylar	45 0
4in.	Triple play, 900ft. Mylar	17 6	7in.	Standard play, 1200ft. Acet.	12 6
5in.	Double play, 1200ft. Mylar	15 0	7in.	Standard play, 1200ft. Mylar	12 6
5in.	Long play, 900ft. Acetate	10 0	7in.	Long play, 1800ft. Mylar	19 6
5in.	Standard play, 600ft. PVC	8 6	7in.	Double play, 2400ft. Mylar	25 0
5in.	Triple play, 1800ft. Mylar	35 0	7in.	Long play, 1800ft. Acetate	15 0
5¾in.	Double play, 1800ft. Mylar	22 6	7in.	Triple play, 3600ft. Mylar	58 6

P. & P. 1/- extra per reel. 4 reels and over Post Free

SPECIAL INTEREST ITEMS!

HIGH QUALITY EQUIPMENT CABINETS

Designed to take the Magnavox 363 Tape Deck and the Princess Auto Record Changer with space for amplifier and speaker (the motor board is ready cut out for the deck and changer). Soundly constructed from solid Afromosia wood with natural oiled finish. Removable hinged lid. Removable metal legs. Internal dimensions 26½in. × 14½in. × 5in. depth below motor board plus 4in. deep lid—16in. legs. Post 7/6.

LASKY'S PRICE £4 . 19 . 6

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THE MICRO-6 miniature radio only $1\frac{4}{5}$ x $1\frac{3}{10}$ x 1½in.	£2 19 6
THE SLIMLINE 2-transistor pocket radio	£2 9 6
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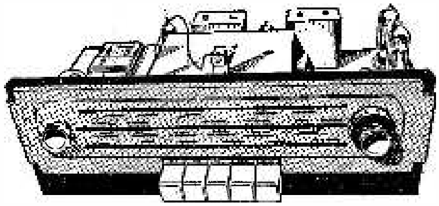
THE X-20 20 watt P.W.M. amplifier	£7 19 6
Available ready built, tested and guaranteed	£9 19 6
THE X-10 10 watt amplifier and pre-amp	£5 19 6
Available ready built, tested and guaranteed	£6 19 6
THE Z-12 12 watt amp. and pre-amp., fully built	£4 9 6

LASKY'S RADIO FOR FINEST VALUE and COURTEOUS SERVICE

BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £15.15.0 (Carriage Paid)



Chassis size 15 x $6\frac{3}{4}$ x $5\frac{3}{4}$in. high. New manufacture. Dial $14\frac{1}{2}$ x 4in. in 2 colours, predominantly cream. 200-250v. A.C. only.
Pick-up Ext. Speaker. Ae., E., and Dipole Sockets. Five push-buttons—LW, MW, SW, FM and Gram. Aligned and tested. O.P. Transformer Tone control 1000-1900M; 200-550M; 88-98 Mc/s. 6-17 mc/s. EZ80 rect.; ECH81, EF89, EABC80, EL84, ECC85. 3-ohm speaker required.
9 x 6in. ELLIPTICAL SPEAKER, **20/-** to purchasers of this chassis.
TERMS: (Chassis). **£4.0.0** down and 5 monthly payments of **£2.10.0.** Total H.P. price, **£16.10.0.** Cheap Room Dipole for V.H.F., **12/6.** Feeder **6d.** per yard. Circuit diagram, 2/6. Carriage to N. Ireland, 20/- extra.

NEW 6 PUSH-BUTTON STEREOGRAM CHASSIS. M.W.; S.W.1; S.W.2; V.H.F.; Gram; Stereo Gram. Two separate channels for Stereogram with balance control. Also operates with two speakers on Radio. Chassis size: 15 x 7 x $6\frac{1}{2}$in. high. Dial cream and red. 15 x 3in. 190-550M; 18-51M; 60-187M; VHF 86-100 m/cs. Valves: ECC85, ECH81, EF89, 2 x ECL86, EM84 and Rect. Price **£19.19.0,** carr. paid or **£5.0.0** deposit and 5 monthly payments of **63/-.** Total H.P. price. **£20.15.0** Cream moulded escutcheon included.

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Chassis $12\frac{1}{2}$ x $5\frac{1}{2}$ x $4\frac{1}{4}$in. high. Plastic front panel "gold" finish—$12\frac{1}{2}$ x $4\frac{1}{4}$in. 200-250 A.C. Record/Playback amp. switch; Off/On-Tone; Vol/Mic; Vol/Gram; Mic. Input; Gram. Input; Monitor; Speaker Sockets. Valves 6BR7; 12AX7; EM84; EL84; 6X4 Separate power pack. Complete amp. and power pack, **£8.19.6.** (6/- P. & P.). Rexine covered cabinet fitted to take amplifier and Collaro Deck. $15\frac{1}{2}$ x 17 x $9\frac{1}{2}$in. high Sloping front for amp.; complete with two tweeter speakers; Tan, **75/-** (plus 8/- rail charge). Cabinet and special brackets for adapting cabinet for Magnavox Deck **85/-** (plus **8/-** carr.), including tweeters.

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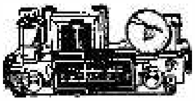
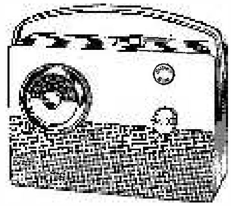


Covering 88-95 Mc/s, Dims. 8 x 6 x 6in. high, Valves ECC85, EABC80 and 2-EF89' with metal rectifier. Mains transformer. Fully wired and tested ONLY **£8.17.6** (carr. paid). Room dipole. **12/6.** Feeder 6d. per yard.

The SUPER 6

LONG & MEDIUM WAVE TRANSISTOR RADIO



A quality radio available as a kit or ready-built. The sparkling performance and superb finish of the completed receiver give you value equivalent to a £12.12.0 commercial model.
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OR FULLY BUILT **£6.7.6.** *Tax and Carr. Paid.*

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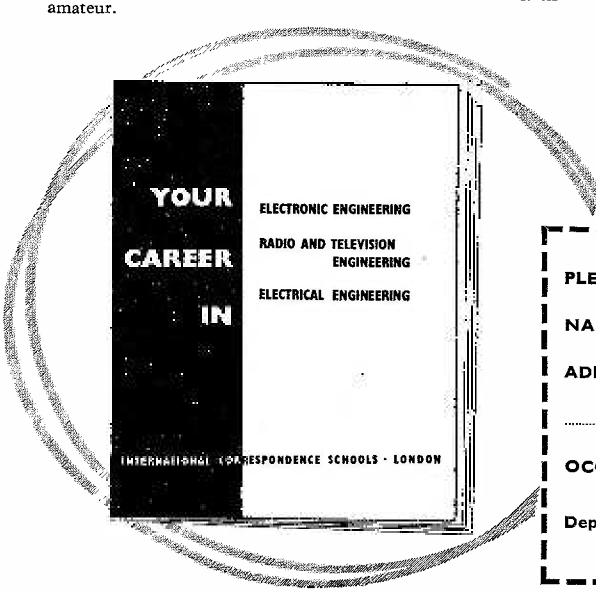

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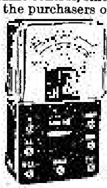
4-speed, plays 10 records, 12in., 10in. or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in., and 12in. records of the same speed. Has manual play position: colour, brown. Dimensions: 12¼ x 10¾in. Space required above baseboard 4¾in., below baseboard 2¾in. Fitted with Ful-Fi-turn-over crystal head. **£4.19.6** P. & P. 7/6.

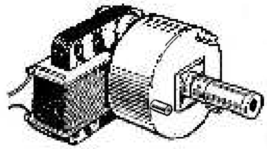
Complete Amplifier Kit comprising E.C.L. 82 Mains transformer, metal rectifier, volume control, smoothing condenser, metal chassis, speaker, etc. To the purchasers of the above changer only **19/6** plus 3/- P. & P.

POCKET MULTI-METER



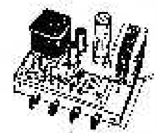
Size 3⅝ x 2¼ x 1⅛in. Meter size 2⅛ x 1⅞in. Sensitivity 1,000 O.P.V. on both A.C. and D.C. volts. 0-15, 0-150 0-1,000. D.C. current 0-150mA. Resistance 0-100kΩ. Complete with test prods, battery and full instructions, **42/6**. P. & P. 3/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

Type E MOTOR



Small A.C. mains motor 230/250 volts complete with gearbox. **6 r.p.m.** Price **15/-** plus 3/- P. & P. Similar to above motor but without gearbox. Price **9/6** plus 2/- P. & P.

8-WATT 5-VALVE PUSH-PULL AMPLIFIER & Metal RECTIFIER



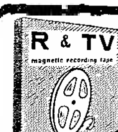
Size: 9 x 6 x 1½in. A.C. Mains, 200-250v. 5 valves. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Output 8 watts at 5 per cent of total distortion. Separate bass and treble lift control. Two inputs, with controls for gram. and mike. Output transformer tapped for 3 and 15 ohm speech coils. Built and tested, **£3.19.6**. P. & P. 10/-.

"MAYFAIR" 5-Transistor TAPE RECORDER

Capstan-driven, battery operated. 7½ and 3¾ i.p.s. Precision made. Push-button controls. High quality 2¾in. speaker. Push-pull circuit. Output 400mW. Frequency response: 200-7,000 k/s. Fast rewind. Up to 1 hour twin track playing time. Automatic erasing for re-recording. Dimensions: 8in. x 11in. x 3¾in. Weighs only 7lb. Takes 5in. spools.

£11.11.0 plus 7/6. P. & P.

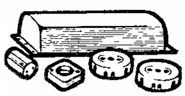
FIRST QUALITY P.V.C. TAPE



5¾in. Std. 850ft.	9/-	5in. L.P. 850ft.	10/6
7in. Std. 1200ft.	11/6	3in. T.P. 600ft.	10/6
3in. L.P. 240ft.	4/-	5in. T.P. 1800ft.	25/6
5¾in. L.P. 1200ft.	11/6	5¾in. T.P. 2400ft.	32/6
7in. L.P. 1800ft.	18/6	7in. T.P. 3600ft.	42/6
5¾in. D.P. 1800ft.	18/6	4in. T.P. 900ft.	15/-

P. & P. on each 1/6, 4 or more post free.

40W FLUORESCENT LIGHT KIT

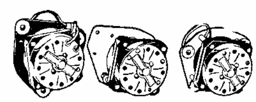


Incorporating **GEC** Choke size 8¼in. x 1⅝in. x 1⅝in., 2 bi-pin holders, starter and starter-holder. P. & P. 4/6. **11/6**

Similar to above: 80W. Fluorescent Light Kit incorporating **GEC** choke size 11¾in. x 1⅝in. x 1⅝in. 2 bi-pin holders, P. & P. starter and starter holder. 5/6 **17/6**

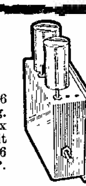
Twin 40W Choke instant start for 2 x 2ft. tubes **17/6**. P. & P. 5/6.

MAGNAVOX COLLARO



Set of three Tape Deck Motors. These are made for 110 v. but suitable auto. transformer is supplied. Three motors **39/6**, P. & P. 6/-.

CYLDON U.H.F. TUNER



Complete with PC.88 and PC.86 Valves. Full variable tuning. New and unused. Size 4½ x 5½ x 1¼in. Complete with circuit diagram. **35/-** plus 2/6 P. & P.

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250 v. P.I.V. 750 milliamps. Six for **7/6**, post paid.

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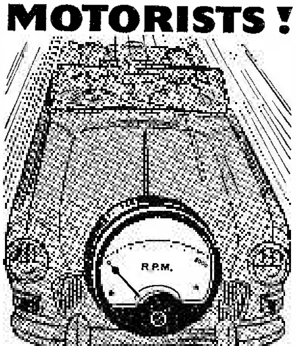

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Can be used for 4 or 6 cyl. engines. It would cost you at least £8 to buy one new, at today's prices, but with a few simple tools you can make one at a fraction of the price! This kit makes a modern efficient rev-counter that is essential to your engine's welfare: it contains moving coil movement and all parts including transistors and a circuit diagram. Maximum reading 8000 r.p.m. for 12 volt operation negative or positive earth. Send for your kit today, enclosing a P.O. 21/6 which includes 2/- postage—it will save you £'s and your engine.

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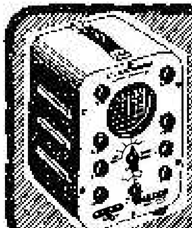

Push-pull X amplifier: Flyback suppression; Internal Time-base Scan Wave form available for external use; pulse output available for checking TV line O/P Transformers, etc. Provision for external—I/P and C.R.T. Brightness Modulation. A.C. mains 200/250 v., **£18/18/-**. P. & P. 10/-.

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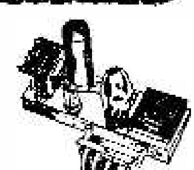

Comprising chassis 8¾in. x 2½in. x 1in. Double wound mains transformer. output transformer. Volume and tone controls, resistors, condensers, etc. 6V6 ECC81 and metal rectifier. Circuit 1/6, free with kit. **29/6** plus 4/6 P. & P. The above Amplifier built and tested. **10/6** extra.

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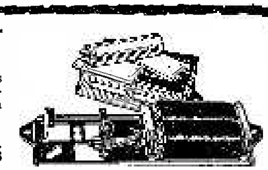

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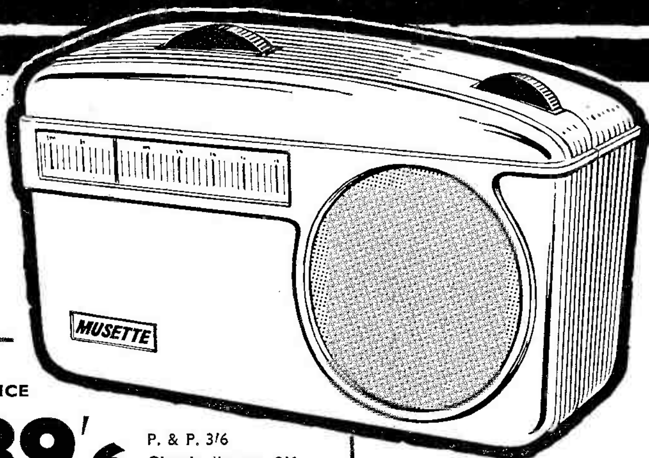


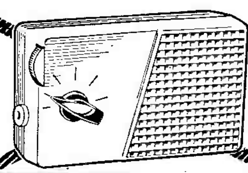
- $2\frac{1}{4}''$ Speaker.
- 6 Transistors Superhet Output 200mw.
- Plastic Cabinet in red, size $4\frac{3}{4}'' \times 3'' \times 1\frac{3}{8}''$ and gold speaker louvre.
- Horizontal Tuning Scale.
- Ferrite Rod Internal Aerial.
- IF 470 Kc.
- All components, Ferrite Rod and Tuning Assembly mount on printed board.
- Operated from PP3 Battery.
- Full comprehensive instructions and point-to-point wiring diagram.
- Printed Circuit Board.
- Tunable over medium and long wave band. Car aerial and ear piece socket.

PRICE

39/6 P. & P. 3/6
Circuit diagram 2/6. Free with parts.

INCLUDING CARRYING STRAP.

NEW TRANSISTORISED SIGNAL GENERATOR



Size $5\frac{1}{2}'' \times 3\frac{1}{4}'' \times 1\frac{1}{2}''$. For IF and RF alignment and AF output 700 c/s frequency coverage 460 Kc/s to 2 Mc/s in switched frequencies. Ideal for alignment to our Elegant Seven and Musette. Built and tested. **39/6** P. & P. 3/6

Elegant Seven Mk II

COMBINED PORTABLE and CAR RADIO

The Radio with the STAR features

★ 4in. Speaker.
★ 7-transistor superhet. Output 350mW.
★ Wooden cabinet, fitted handle with silver coloured fittings. Size $12\frac{1}{4} \times 8\frac{1}{2} \times 3\frac{1}{2}$in.
★ Horizontal tuning scale, size $11\frac{1}{4} \times 2\frac{5}{8}$in. in silver with black lettering.
★ All stations clearly marked.
★ Ferrite-rod internal aerial.
★ I.F. neutralisation on each stage 460 kc/s.
★ D.C. coupled output stage with separate A.C. negative feed back.
★ All components: ferrite rod and tuning assembly mount on printed board.
★ Operated from PP9 battery.
★ Full comprehensive instructions and point-to-point wiring diagrams.
★ Printed circuit board, back printed with all component values.
★ Fully tunable over medium and long waveband.
★ Car aerial socket. Full after-sale service.

ONLY **£4.4.0**
Plus 6/6 P. & P. Parts list and circuit diagram 2/6. FREE with parts.

POWER SUPPLY KIT

To purchasers of "Elegant Seven" parts, incorporating mains transformer, etc. A.C. mains 200-250v. Output 9v. 50mA. 7/6 extra.

ALL ENQUIRIES STAMPED ADDRESSED ENVELOPE

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PRACTICAL WIRELESS

VOL 42 No 5

issue 715

SEPTEMBER 1966

TOPIC OF THE MONTH

The Right Formula?

IN a few weeks from now, the doors of the Earls Court Exhibition building will swing open and the turnstiles will begin clicking as the first visitors to the 1966 Radio Show pass into the halls.

After several years of travail and controversy, it may well be that at last some stability has been introduced into this important event in the calendar of the radio trade.

"Trade" is the key word. No longer have the organisers attempted to effect a compromise between a public exhibition and a trade show, a marriage in which incompatibility became increasingly manifest and has led to the inevitable divorce.

Changing patterns and balances dealt a death blow to the type of show which had prospered for so many years without much radical alteration, although many attempts were made to check the slide and to inject new zest into the enterprise. Either the signs were misread or the changes inadequate, for the Radio Show degenerated into the shambles of recent years with many companies mounting their own splinter exhibitions throughout London's hotel-land.

It emerged, however, that (1) Exhibitors found it more economical and profitable to restrict their shows exclusively to the trade, and (2) Foreign manufacturers could no longer be excluded. Arising from this, springs the 1966 Exhibition—a trade-only exhibition, with British and overseas manufacturers, under the same roof.

But although the conclusion is inevitably reached that a combined trade/public show is economically unviable is it, in fact, desirable or wise to abandon the traditional show?

Figures for attendances steadily declined. The public could see little more at the shows than they could in the radio shops and stores. Elaborate displays and entertainments were a financial luxury for the broadcasting organisations. And genuine radio enthusiasts found dwindling technical and hobbyist interest.

It seems, therefore, that the right solution has been found in dealing with the problem child of the industry. A few weeks hence, we will probably know.

W. N. STEVENS, Editor

NEWS AND COMMENT

CONSTRUCTIONAL

OCTOBER ISSUE WILL BE PUBLISHED ON SEPTEMBER 8th

An Explanation

In response to my letter entitled "Any Offers?" in the February issue of Practical Wireless, I have received innumerable offers from readers all over Great Britain.

However, I have received an anonymous letter admonishing me of alleged misdemeanour and advising me not to live on others' gift subscriptions! If readers would carefully peruse my letter, they will note that I never expected anything free, and my proposition was strictly reciprocal. In fact, I have so far spent a little over the cost of a year's subscription in answering my correspondents and if anyone still thinks that this is a hell of a way of living on others' free gifts, he must surely be an imbecile.

Incidentally, I have since been authoritatively informed that contrary to my belief, technical publications are exempted from exchange restrictions.

B. G. Kamath.

Bombay-52,
India.

Rabble?

In reply to S. Peat on UHF and VHF Designs (P.W. March 1966).

A G8 licence may be an easier way to get a callsign, but to design, construct and operate equipment on u.h.f. is much more of a challenge.

At these frequencies, a hairpin can be a coil, two metal discs with an air gap a capacitor and the amateur has to be a highly proficient metalworker besides being able to solder.

This is the frontier of amateur radio communications and those of us who operate here are not following the well-worn pattern of proven design but are experimenting in the true spirit of amateur radio.

T. C. Challis, G8ALC.

Hull,
East Yorkshire.

Transistor Solo Organ

I should like to thank you for publishing the above-mentioned article. Having built this organ, I then rearranged the circuitry by the addition of another oscillator taking the range to 4½ octaves and added several other tonal effects, feeding each oscillator to a channel of a stereo amplifier, producing the bass section from one speaker and the treble from another. The result is startling with two hand playing—even if with only one finger of each hand.

J. C. Mitchell.

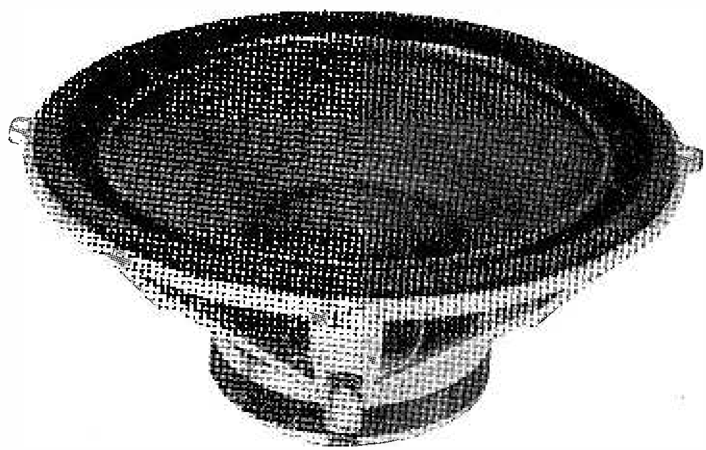
Wallasey,
Cheshire.

NEWS AND..

THE DUKE OF EDINBURGH VISITS MARCONI TEST SITE

The Duke of Edinburgh flew by helicopter the other week to Marconi's test site at Rivenhall, Essex, where he saw Britain's "break-through" in space communications overseas. He inspected the Cable and Wireless Ltd.'s satellite earth station undergoing tests at Marconi's and which has since been dismantled and shipped to Ascension Island, where it is to be used for Apollo "man-on-the-moon" communications. The photograph shows the Duke of Edinburgh chatting to engineers at the site. In the background can be seen the satellite earth station.

LOUDSPEAKER FROM RANK WHARFEDALE



First shown at this year's Audio Fair, Rank Wharfedale Ltd. have introduced a new 12in. bass unit to their range.

Retailing at £11 15s. the W12/FRS replaces the W12/PST and is the first chassis using Flexiprene cone surround to be offered to the public.

Bass units with Flexiprene are used in the Linton and Dovedale systems. When mounted in a suitable enclosure the W12/FRS will produce clean firm bass down to 25 c.p.s.

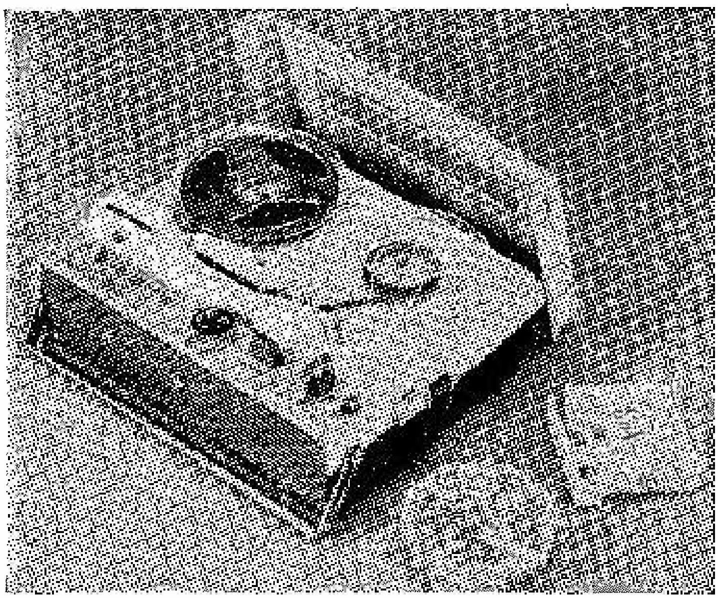
Bass resonance is 23/28 c/s. Flux density, 14,000 oersteds; total flux, 156,000 maxwells; baffle opening, 10⅝in.; chassis diam., 12⅜in.; pole size, 1¾in.; frequency range, 30–4,000 c/s and weight, 12 lbs.

RADIO TRADERS MOVE PREMISES

Radio Traders Ltd. (radio, electronic and electrical wholesalers) formerly of Tudor Place, W.1, have now moved to 8 Stephen St., Tottenham Court Rd., W.1 (Mus 4666). Radio Traders Ltd. have for many years served the trade with a wide variety of components. Enquiries for bulk and manufacturing quantities are invited.

...COMMENT

TWO NEW CROWN TAPE RECORDERS



Two new Crown portable tape recorders, model CTR 5450 and model CTR 3000 are introduced by the Heddon-Smith Group Ltd.

Model 5450—shown in the photograph—operates from four U2 cells or a.c. mains, is twin track, and has two speeds $1\frac{7}{8}$ and $3\frac{3}{4}$ i.p.s. Incorporating 5 transistors it takes up to 5in. spools and has 700mW output. It weighs 7·9 lbs. and measures $11\frac{1}{4}$ x $8\frac{7}{8}$ x $4\frac{3}{16}$in. Price, complete with remote control dynamic microphone and magnetic earphone, is $29\frac{1}{2}$ guineas.

Model CTR 3000 incorporates 5 transistors, takes up to $3\frac{1}{4}$in. spools and has an output of 800mW. It is twin track, has two speeds ($1\frac{7}{8}$ and $3\frac{3}{4}$ i.p.s.), weighs 5·1 lbs. and measures $8\frac{11}{16}$ x $8\frac{9}{16}$ x $3\frac{7}{16}$ in. Price complete with remote control microphone, magnetic earphone, 3in. reel and 3in. tape is 19 guineas.

UNISIL-CORED TRANSFORMERS AND CHOKES

Belclere Company Limited, 385/387 Cowley Road, Oxford, have for the past few years produced a range of Transformer Design Kits. Up to the present, this range has consisted of three types of core: Mumetal, Radiometal and Silicor. Belclere have now added a fourth material—Unisil—to this range.

For power transformers the use of Unisil allows for an increase in output of approximately 25% compared with the Silicor equivalent.

Two leaflets have been printed describing the full range of sixty-two Transformer Design Kits available. These include full dimensional details and necessary design data. Should any reader require copies of these leaflets or details of "one off" transformers, write to Belclere direct.

WEATHER SATELLITE STATIONS

An order for five satellite receiving stations has been placed with Hawker Siddeley Dynamics Ltd.

The stations will be used at meteorological offices around the world to collect information transmitted from American weather satellites. The receivers will pick up television-type pictures of the earth and cloud formations as seen by the satellites' cameras 875 miles up.

International Short Wave Club

WE shall be pleased to send any readers a copy of "International Short Wave Radio" if they make application to the Secretary of the International Short Wave Club at the address below.

Arthur E. Bear.

100 Adams Gardens Estate,
London, S.E.16.

The Meaning of Amateur

YOUR correspondent Mr. R. Hasler has missed one point, and that is that amateur radio is still to a very large extent a "creative" hobby.

It is agreed that followers of other hobbies must of necessity purchase, say for example, a camera to enjoy the results to the full but nevertheless they get the creative end-product that they have set out to achieve.

I have never built a bike, nor knitted my own football socks (spare the thought!) but there are those amongst us who are unfortunately not in a position to enjoy the process of building their own equipment through some physical handicap but this does not detract from their "status" if you like, of amateur.

So, let us enjoy our QSO's during the coming years irrespective of whether our contact owns a "super XYZ at £2,000" or a "one-lung perker", meanwhile scanning the advertisement columns for hand-made bicycles and second-hand socks!

E. W. Bonson, G3JHY.

London,
E.12.

Mobile Registration

MAY I be permitted to wonder if any of your readers are the owners of distinguished motor vehicle registrations, for example, EF 86, ECC 83 or even perhaps, now that 1966 is with us, OC 81D?

C. P. Finn.

Tamworth,
Staffordshire.

Well, has anybody a distinguished registration number? We would be interested to hear of any.—Editor.

Correspondent Wanted

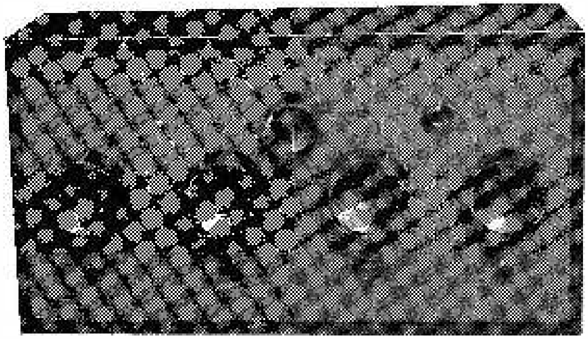
I WOULD like to correspond with somebody of my own age (14) who is interested in transistors and Hi-Fi.

Roger Murphy.

203 Bills Lane,
Shirley, Solihull,
Warwickshire.

More News and Comment on Page 344

4 CHANNEL AUDIO MIXER



F. L. THURSTON

ONE item that is essential in any audio workshop is a good quality audio mixer, this item enabling a number of individual sound sources to be "mixed" or added together to give a single, composite output; the volume level of each of the input channels can be individually controlled, to emphasise or minimise the presence of each channel on the final output, as required.

In practice, audio mixers vary considerably in quality and price, ranging from the simple "passive" types at a couple of pounds each, to the higher quality "active" types, having seven or more transistors, at prices in the order of £17 or more. The unit to be described fits into this latter category as far as quality is concerned, although, being home built, it can be constructed for a fraction of the "normal" retail price.

TYPES AVAILABLE

In view of the diversity of mixture types that are available, it is worth while digressing a little and explaining the basic principles of mixer circuitry, before dealing with the constructional aspects of the actual mixer that forms the basis of this article.

An example of the so called "passive" mixer circuit is shown in Fig. 1 and, as might be expected, the unit consists of a purely resistive network. For the sake of simplicity, only a 2-channel circuit is shown, one input being applied across R1 and the other across R5, while the output is taken from across R3.

The input that is applied across R1 is also connected across the series combination R2-R3, and causes a current to flow in both resistors. If the input equals 1 volt, the resultant current in each of these two resistors will be 10μA since they total 100 kΩ. Similarly, the input that is applied across R5 is also connected across the series combination R3-R4 and, if a 1 volt input is applied, a current of 10μA will result through these two resistors. Thus, each input causes a current to flow in the common resistor, R3, and the total current through this resistor is proportional to the *sum* of the input signals. In the above example, the total current through R3 will be approx. 20μA. It may be noted that, although this circuit is referred to as a "mixer", it is in fact an adding circuit.

INTERACTION

A certain amount of interaction takes place in these simple circuits, but can be minimised in a number of ways. The attenuation factor between input and output could for example, be increased by reducing the value of R3, and thus reducing the interaction between inputs at the expense of loss of signal strength at the output. Alternatively, the attenuation factor can be increased by increasing the values of R2 and R4, but in this case the reduction in interaction is obtained at the expense of an increase in the unwanted "noise" generated by the circuit. Again, the interaction can be reduced by reducing the values of R1 and R5, so that the attenuation factor between (say) input 1 and the output is unchanged, but the attenuation between the output and input 2 is increased, the reduction in interaction being obtained, in this case, at the expense of a reduction in input impedance to the mixer circuit.

Either of these methods may be used to reduce the interaction between inputs but each has its own particular disadvantages, and all practical designs are a compromise between the different "evils". Never-the-less, this "passive" mixer circuit is widely used in electronics, and forms the basis of *all* audio mixers, including "active" types, in general use.

ACTIVE MIXERS

The next step up from the purely "passive" mixer involves adding an amplifier, using either valves or

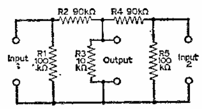


Fig. 1: Simple passive two-channel mixer.

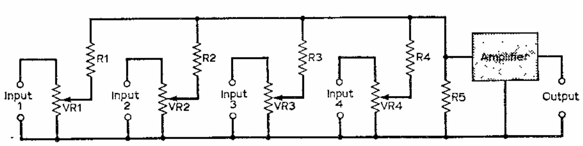


Fig. 2: This four-channel mixer has been made active by adding an amplifier.

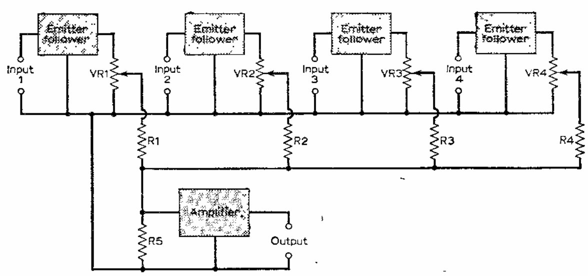


Fig. 3: Block schematic diagram of the mixer described in this article shown on the right.

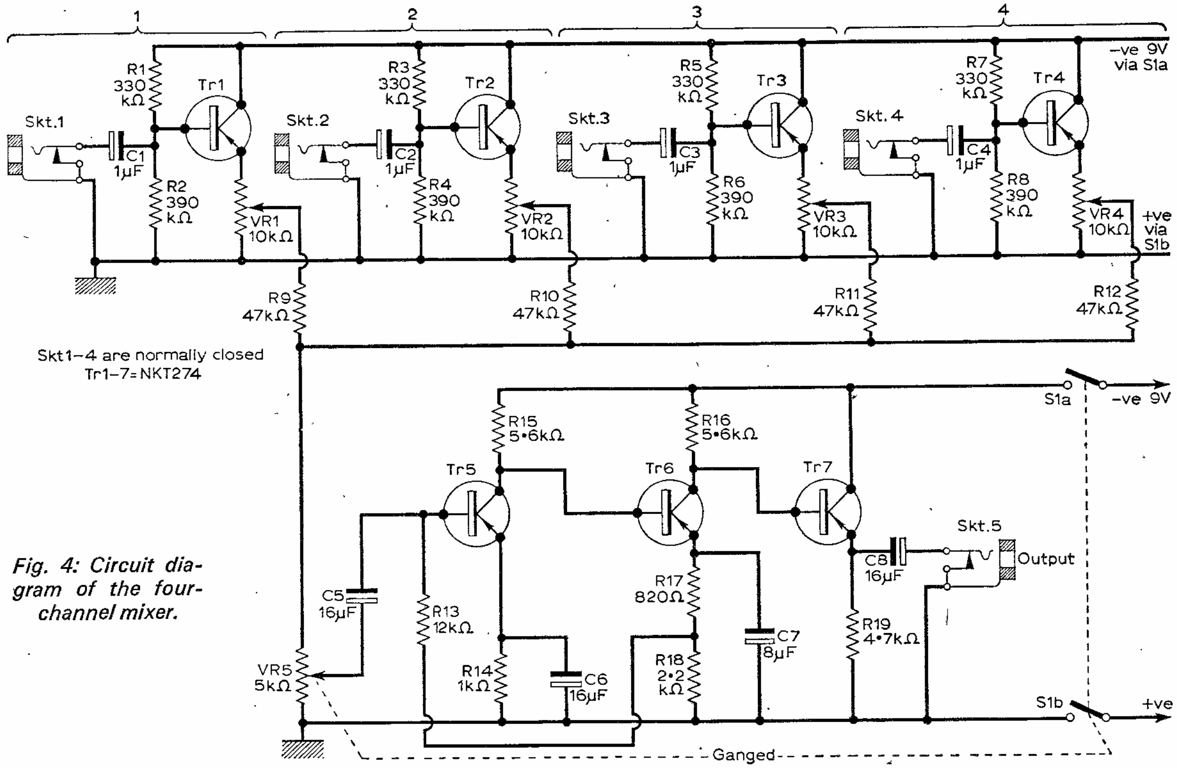


Fig. 4: Circuit diagram of the four-channel mixer.

transistors, connected between the output of the passive network and the output terminal of the complete unit, the amplifier being used merely to make up for the attenuation that normally occurs between the mixer input and output. A simplified diagram of a 4-channel active type of mixer is shown in Fig. 2. As can be seen, each input is applied to a variable resistor, giving individual volume control, and the required proportion of input signal is fed, via a series resistor (R1-R4) to the common resistor, R5, where the signals are added or "mixed". The resulting complex signal is then fed to the amplifier, which compensates for the loss of signal strength that occurred in the mixing stage, and the final compensated signal is fed on to the output terminal.

Finally, we come to what may be called the "high quality" types of mixer. Here, the "passive" section of the circuit is designed to give minimum noise, attenuation, and interaction, at the expense of reduced input impedance, and the actual input impedance to the unit is then increased artificially by interposing an emitter follower between the input socket and the input to the passive stage. A "block" diagram of a typical unit is shown in Fig. 3.

CIRCUIT DESCRIPTION

Each of the four emitter followers are identical. Taking input 1 as an example the signal is fed via blocking capacitor C1 to the base of Tr1, which is held at 4·5V by resistors R1 and R2 enabling input signals of up to approx. 8 volts peak-to-peak to be accommodated. The input impedance to each emitter follower is approx. 150kΩ, irrespective of the settings of the volume controls.

Each of the signals from the emitter follower stages is fed to the passive mixer, the "mixed" signal appearing across VR5. Transistors Tr5 and Tr6 are wired as common emitter amplifiers, using direct coupling to minimise the number of components. To give good d.c.

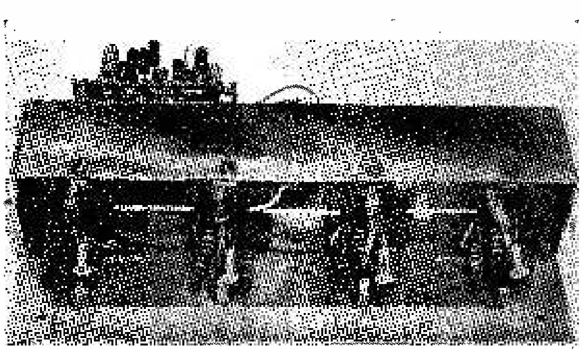
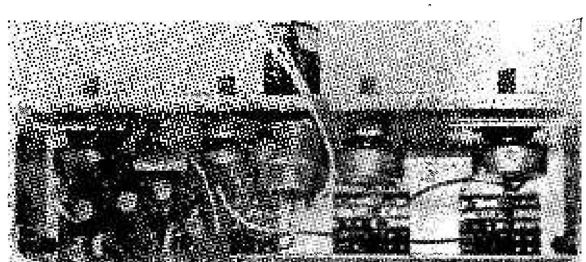


Fig. 5: Two views of the mixer. These should help the constructor locate the position of the major items.



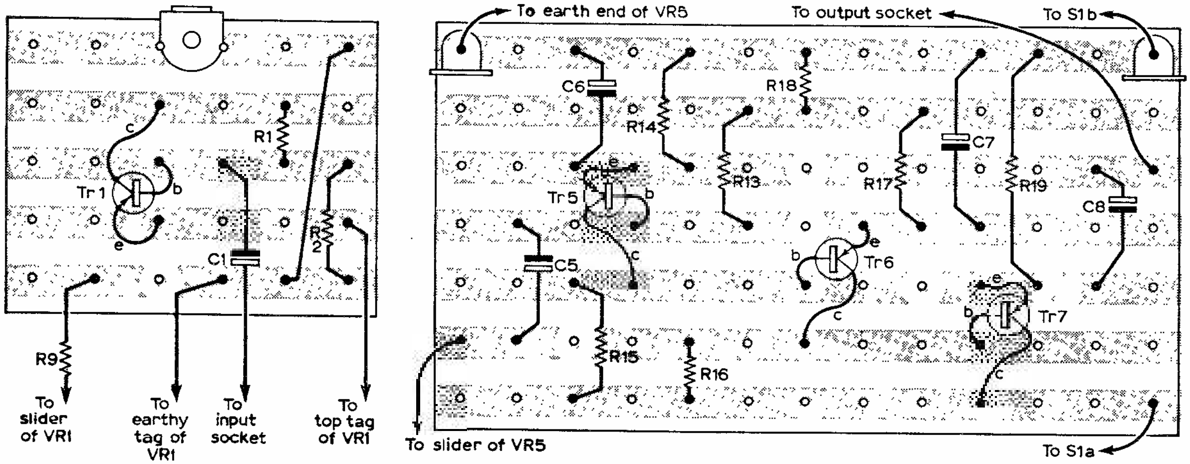


Fig. 6: One of the four identical emitter follower panels shown left along with the main amplifier panel.

and temperature stability, the base-bias to Tr5 is derived from the emitter circuit of Tr6, resulting in a d.c. negative feedback loop. Should the mean emitter current of Tr6 increase for any reason (such as a increase in ambient temperature), the negative voltage at the R17-R18 junction will increase, causing the mean emitter current of Tr5 to increase and the base voltage of Tr6 to fall.

The mixed and amplified signal that appears at Tr6 collector is directly coupled to the base of Tr7, another emitter follower stage, which gives a low impedance output.

CONSTRUCTION

Start construction by cutting the front panel to size. Then drill the holes for mounting the volume controls, sockets, etc., as shown in Fig. 7. When this has been done, the panel can be finished off by covering it with Fablon or a similar self-adhesive plastic decorative material. At this stage, the five small jack sockets can be secured in place, the size and type being chosen to suit individual tastes.

Next, cut the three small brackets to size, and bend and drill them as shown. Screw the three brackets together, and secure the resulting assembly to the front panel by means of VR1 and VR4, after first cutting the spindles of all five variable resistors to the lengths required by the front panel control knobs that are to be used. The remaining three volume controls can also be secured in place at this stage.

Make the four small emitter follower panels, as shown in Fig. 6a, first cutting the panels to size, then breaking the copper strips as shown with the aid of a small drill or the special cutting tool, and finally soldering the electronic components in place. When complete, bolt these panels in place on the main bracket.

Similarly, make up the main amplifier sub-panel, as shown in Fig. 6b, and, when complete, bolt it in place on the main bracket by means of the two modified solder tags.

Now complete the circuit by wiring up the interconnecting links, etc., as shown in Fig. 8, first soldering each of the input capacitors on the emitter follower panels to its respective input socket, and each of the

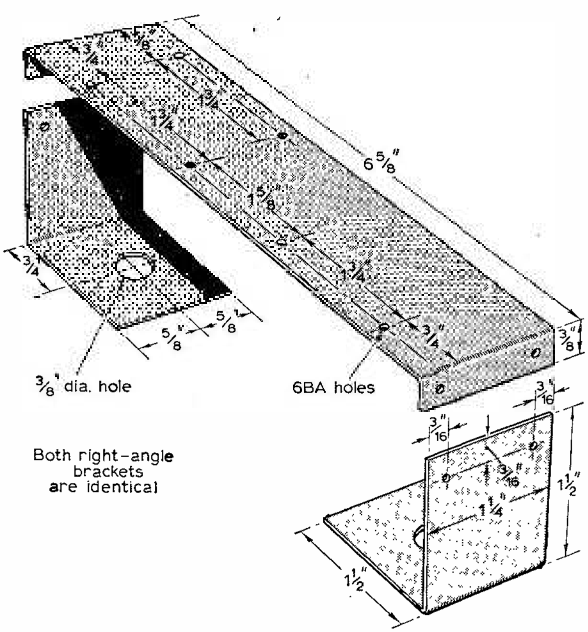
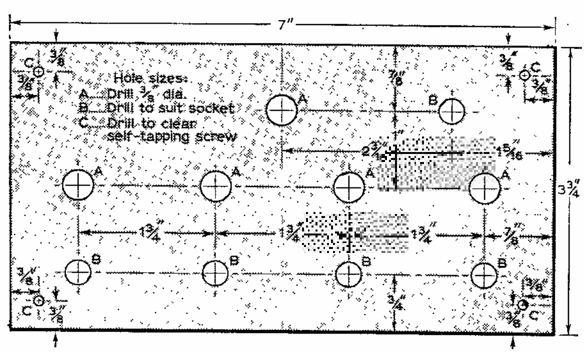


Fig. 7: Constructional details for the front panel and the brackets.



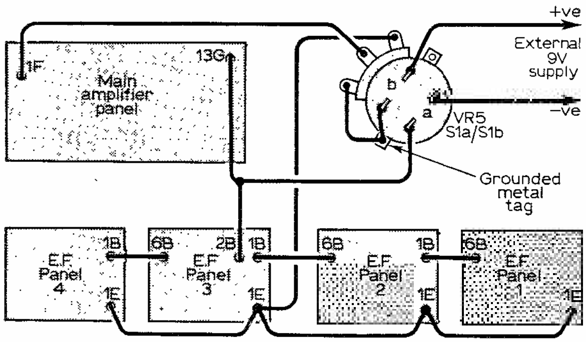


Fig. 8: Exploded view showing the internal connections.

47kΩ series resistors to the centre tag of its respective volume control. When the interconnecting leads have all been soldered in place, finish off by soldering a positive supply lead to the grounded metal tag on VR5, and solder one side of the negative line from the ON/OFF switch on VR5 to the relevant connections on the main amplifier panel and the emitter follower panel, and solder the external negative supply lead to the remaining tag on the ON/OFF switch.

The case can be made from either wood or metal, but must be provided with corner brackets to which the front panel can be screwed. When complete, the case may be covered with Fablon or a similar material.

★ components list

Resistors (all ¼ watt 10% carbon):

R1	330kΩ	R11	47kΩ
R2	390kΩ	R12	47kΩ
R3	330kΩ	R13	12kΩ
R4	390kΩ	R14	1kΩ
R5	330kΩ	R15	5·6kΩ
R6	390kΩ	R16	5·6kΩ
R7	330kΩ	R17	820Ω
R8	390kΩ	R18	2·2kΩ
R9	47kΩ	R19	4·7kΩ
R10	47kΩ		

Capacitors (all sub-min):

C1	1μF 12V electrolytic
C2	1μF 12V electrolytic
C3	1μF 12V electrolytic
C4	1μF 12V electrolytic
C5	16μF 12V electrolytic
C6	16μF 12V electrolytic
C7	8μF 12V electrolytic
C8	16μF 12V electrolytic

Potentiometers:

VR1	10kΩ log	VR4	10kΩ log
VR2	10kΩ log	VR5	5kΩ log with switch
VR3	10kΩ log		

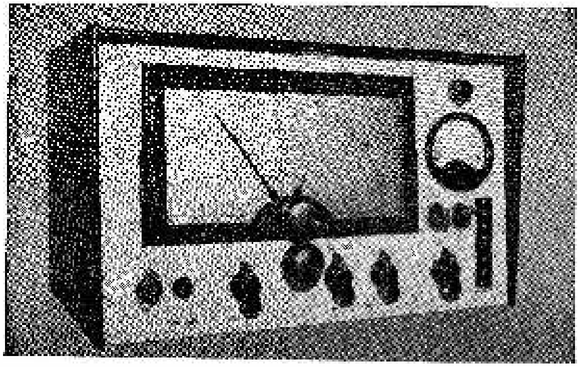
Transistors (Newmarket):

Tr1	NKT274	Tr5	NKT274
Tr2	NKT274	Tr6	NKT274
Tr3	NKT274	Tr7	NKT274
Tr4	NKT274		

Miscellaneous:

SKT1, SKT2, SKT3, SKT4 — Normally closed miniature types to suit individual requirements

SKT5. 9 volt battery, Veroboard, wire, solder, tags, etc.



MODIFICATIONS TO THE '10-5' RECEIVER

A. S. CARPENTER G3TYJ

THE "Ten-Five" was described initially in the October and November, 1964, issues of PRACTICAL WIRELESS. A further article suggesting minor changes appeared in the April, 1965 issue and in the November, 1965, constructional details were given for converting the "front end" to a much more efficient band-switched system.

Tr1 and Tr2 form, with their associated components, a tunable front end converter, producing a 1·6Mc/s output. One coil transformer only for each stage is shown, but fuller details relating to the section may be found in the November, 1965, issue.

After amplification by Tr3, the signal passes to the second mixer/oscillator, the 470kc/s output being fed to a two-stage i.f. amplifier Tr5, Tr6. The i.f. signal is demodulated by D2. The diode D3 acts as a series noise limiter, while D1 is an a.g.c. damping diode. Tr7 is a feedback oscillator, functioning as b.f.o. The audio amplifier consists of driver Tr8 and push-pull output Tr9, Tr10.

I.F. MODIFICATIONS

The new double-tuned i.f. transformers are fitted at i.f.t.1, i.f.t.2, i.f.t.3 and i.f.t.4. Transformers i.f.t.5 and T5 remain unchanged. Other circuit changes are made to the S-meter arrangement, the a.g.c. switching and the noise limiter circuitry. As far as possible, components bear their original references and most are identical. Some minor changes have been made, however, and a complete check is advisable. i.f.t. base connections are shown in the circuit diagram inset.

I.F. transformers 1 and 2 are tuned to 1·6Mc/s to feed transistor Tr4 and it may be noted that the fine tuner (TC4) which was previously connected to the front-end oscillator has now been moved and now may be used to vary the tuning of T4 slightly. T4 is normally fixed-tuned by means of C16, but TC4 proves additionally useful in cases where interference is experienced; it is also an aid to making c.w. and s.s.b. transmissions readable.

Damper diode, D1, is arranged to be non-conductive under weak or no signal conditions, its anode being held slightly negative with respect to its cathode by about 0·4V. If, with the a.g.c. switch set to "In" a strong transmission is tuned in, the base of Tr5 is driven in the positive direction and its collector current falls.

The resultant voltage change across R18 permits

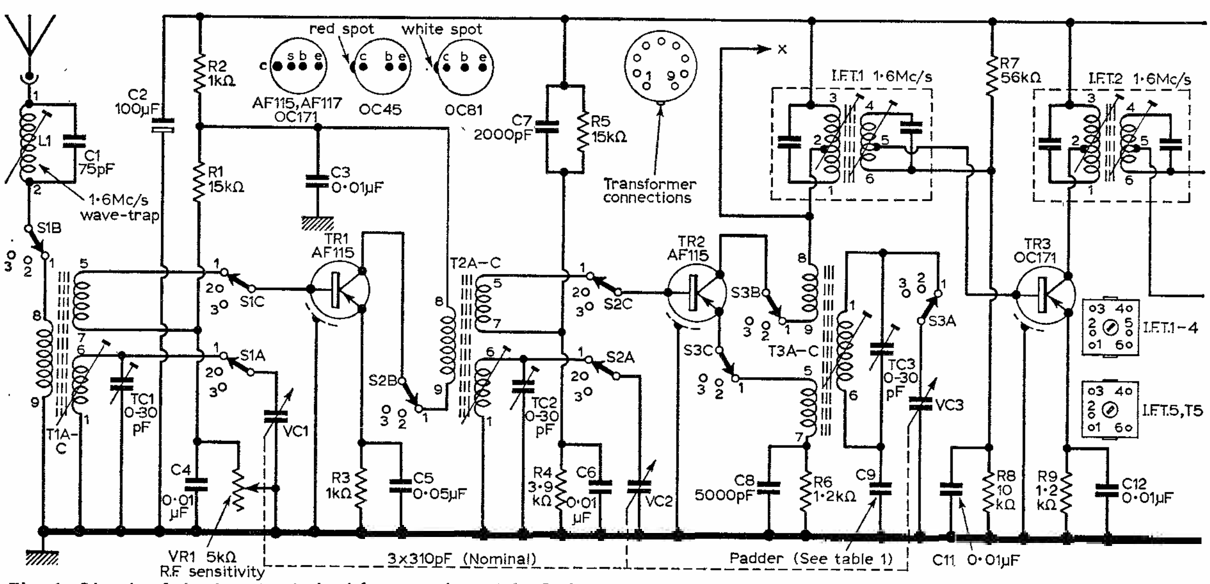


Fig. 1: Circuit of the bandswitched front end model. Only one transformer coil is shown in each stage in the interests of clarity.

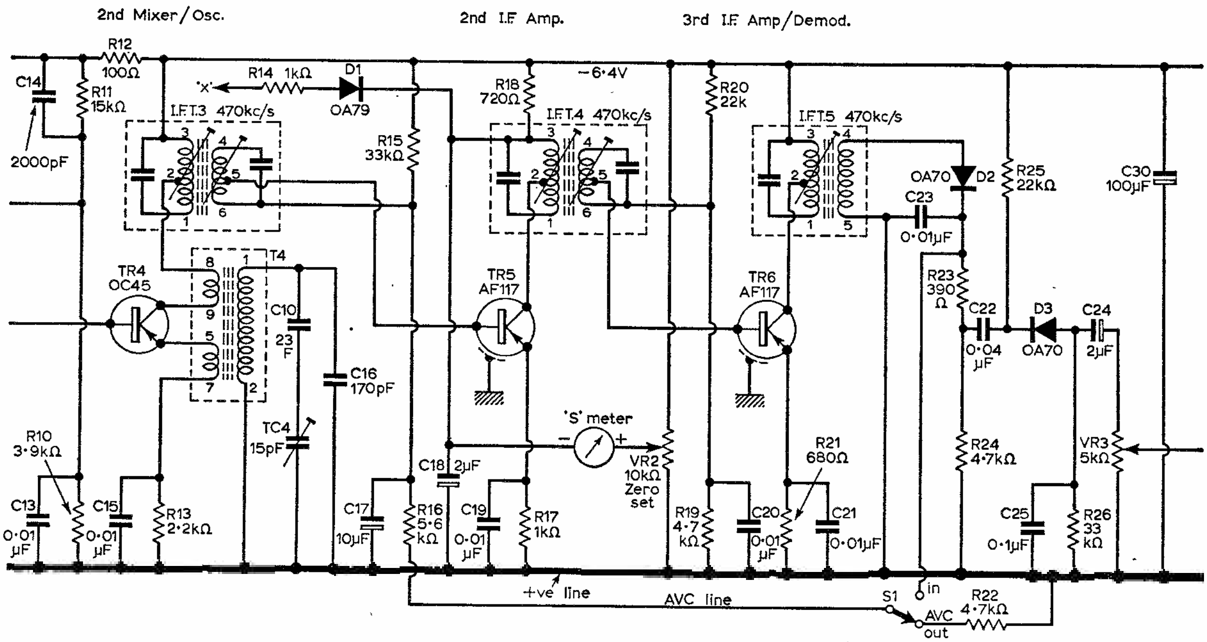


Fig. 2: The complete i.f. amplifier including second frequency changer/mixer.

the diode to conduct to damp the primary of the first i.f. transformer; the " S " meter balance as set by VR2, is also upset and the meter pointer moves across the scale in a forward reading direction by an amount depending on the strength of the received signal. The a.g.c. may be switched in and out irrespective of whether the b.f.o. is in circuit or not, switch S1 being in fact the item originally used in connection with the limiter. Here the revised limiter is left in circuit at all times diode D3 normally being conductive.

In the b.f.o. stage the pitch control is connected between the collector of Tr7 and the positive line yet is effectively across the main winding of T5 when S2 is closed due to C30.

Demodulated output is available at the slider of gain control VR3.

AUDIO STAGES

These are almost unchanged. R38 value is increased. C30 and C31 are transposed. Sockets for use with a monitor volt-meter are provided across C34 and are essential when the receiver is to be run from a healthy 12V car battery—which might easily provide up to 14V under certain conditions.

The voltage reading will also be governed to a certain extent by the position of S3 since when on phone considerably less current is demanded; 10V maximum should be allowed. No meter need be used if the receiver is to be powered by a dry battery—a PP9 for example—which may be connected to the pole of S5 and earth, in which case the remainder of the circuitry can be omitted.

MAINS/BATTERY

By adding the circuitry shown in Fig. 3, optional a.c. mains or car battery powering becomes possible. In the latter case the voltage must be monitored as described above and kept under control by means of VR4. Great care to obtain correct polarity is required and connections should be in the sense shown.

When S5 is moved to position 2 the receiver may be powered from the domestic mains supply when S4 is closed to bring the panel-fitted neon to life. A d.c. potential of 9V is fed to positive and negative lines respectively and is obtained via mains transformer T8 and diodes D4 and D5 connected in a full-wave rectification circuit.

The receiver is prevented from functioning, however, if the rectifier diode cathodes are lifted from the positive line and this suggests a suitable muting circuit. No muting is necessary when the receiver is to be used purely for listening but when it is to work in conjunction with a transmitter some form of disabling circuit must be fitted to the front end or the r.f. transistors will be damaged.

In the prototype a flying lead is taken from pin 2 of the muting link socket to switch SF which is one section of a ganged Function switch contained within the transmitter. Pin 2 of the link plug is automatically grounded when SF is in the " Receive " and " Net " positions and as a result the receiver is made operative.

Immediately " Transmit " is selected, however, the receiver supply is "killed" by breaking the +ve connection. To enable the receiver to remain operative when no transmitter is in use the muting link plug may be moved to connect points 1 and 3.

It should be noted that this muting system will not function when S5 is at " Battery " although it might be possible to achieve it by lifting the +ve terminal of SK1 and connecting it to pin 2 of the link socket. To date, however, the " Ten-Five " has not been used with a transmitter under /M or /P conditions, mainly due to laziness!

ALIGNMENT

Alignment has been dealt with previously and consists mainly of getting the i.f. stages " on the nose ". Use of a signal generator with its output

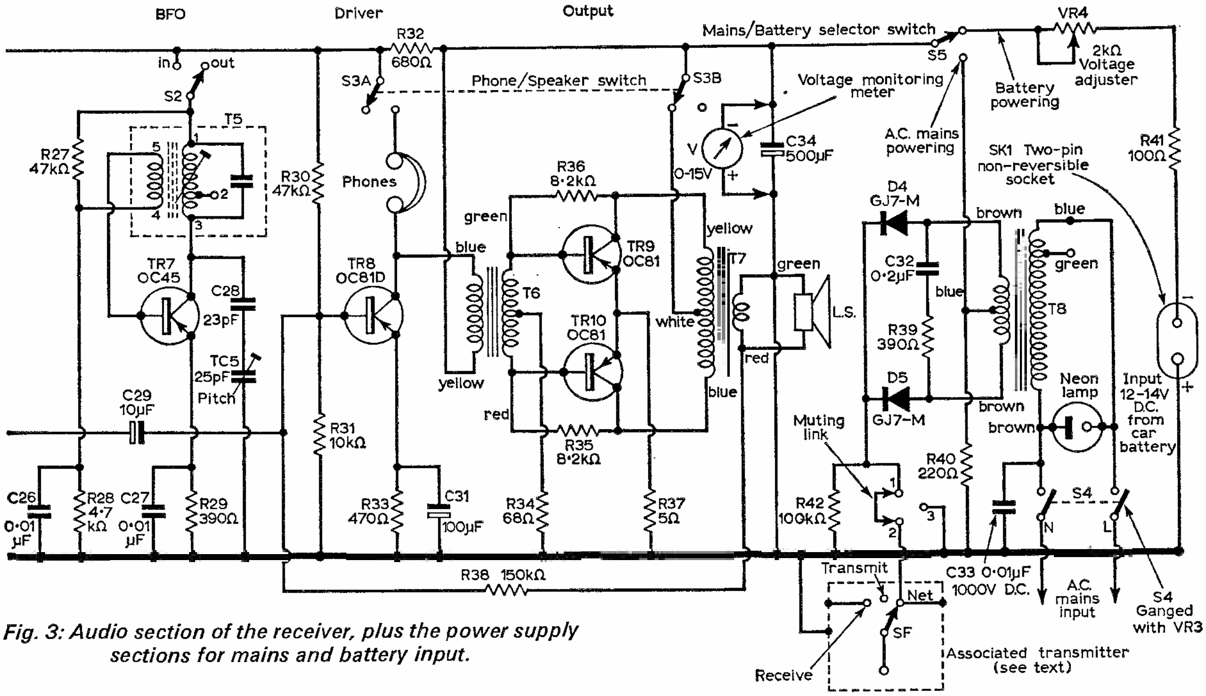


Fig. 3: Audio section of the receiver, plus the power supply sections for mains and battery input.

TABLE I

Front end coverages

Maker's Range No.	Blue/Yellow transformers Coverage Mc/s	Blue/Yellow transformers Coverage Metres	White transformers C9	White transformers Padder Pin No.
3	1·67–5·3	57–180	340pF	3
4	5·0–15·0	20–60	960pF	4
5	10·5–31·5	9·5–28	2000pF	6[1]

[1]Automatic 2nd harmonic mixing occurs on this range

TABLE II

Front end Tracking Points in Mc/s

Range	LF Band end	LF Tracking Point	HF Band end	HF Tracking Point
3	1·67	1·83	5·3	4·5
4	5·0	5·50	15·0	13·5
5	10·5	11·50	31·5	28·5

well attenuated is recommended, whereupon i.f.t.5, i.f.t.4 and i.f.t.3 in that order are peaked for maximum output at 470kc/s.

In the case of i.f.t.5 only one winding is tuned, whereas for all others two cores require adjustment. The core tuning the secondary—or base winding—should be the first one attended to in each case and as small differences will occur the operation should be repeated several times to make certain no improvements can be made.

Reset the signal generator to 1·6Mc/s and inject this to the base circuit of Tr4, with TC4 set to half capacity. The core of T4 is then adjusted to resolve the signal, after which i.f.t.2 and i.f.t.1 may be attended to; the generator output being fed to the collector circuit of Tr2. At all times the signal generator output must be kept as low as is possible.

The b.f.o. is then switched in and the modulation switched out at the generator. TC5 is set to half mesh and the core of T5 adjusted until oscillation is heard. Careful manipulation of the core will now produce the desired zero beat, when the trimming tool may be removed. Subsequent rotation of TC5 slightly either side of centre should result in a beat note of adjustable pitch being heard.

Normally the a.g.c. should be switched out when the b.f.o. is in use as it will be when receiving c.w. and single sideband transmissions.

FRONT-END ADJUSTMENT

Referring to Fig. 1, three transformer coils are required for each stage and these are coded blue in the case of T1A-C, yellow in the case of T2A-C and white for T3A-C. These are supplied by Denco and conform to the maker's range numbers 3, 4, 5. Trimmers (TC) are adjusted at the h.f. tracking points and the coil cores are adjusted at the l.f. tracking points on each range. Details are given in Tables I and II, with the full frequency ranges made available on each band. The core of coil L1 should be adjusted to produce minimum output at 1·6Mc/s.

Should overloading or blocking result on receipt of strong signals, exchange the 5kΩ sensitivity control (VR1) for a 3·9kΩ fixed value resistor and fit instead an r.f. gain control in the form of a 100kΩ potentiometer wired as a variable resistor between one end of R1 (15kΩ) and pin 7, T1A-C. ■

★ components list for the 10–5 receiver

Note: Asterisks denote items not found in the original design

Resistors:

R1	15kΩ	R22	4·7kΩ
R2	1kΩ	*R23	390Ω
R3	1kΩ	*R24	4·7kΩ
R4	3·9kΩ	*R25	22kΩ
R5	15kΩ	*R26	33kΩ
R6	1·2kΩ	R27	22kΩ
R7	56kΩ	R28	4·7kΩ
R8	10kΩ	*R29	390Ω
*R9	1·2kΩ	R30	47kΩ
R10	3·9kΩ	R31	10kΩ
R11	15kΩ	R32	680Ω
R12	100Ω	*R33	470Ω
R13	2·2kΩ	R34	68Ω
R14	1kΩ	R35	8·2kΩ 5%
R15	33kΩ	R36	8·2kΩ 5%
*R16	5·6kΩ	R37	5Ω
R17	1kΩ	*R38	150kΩ
R18	720Ω	R39	390Ω
R19	4·7kΩ	R40	220Ω
R20	22kΩ	*R41	100Ω
R21	680Ω	*R42	100kΩ

Capacitors:

C1 75pF mica
C2 100μF electrolytic 12V.
C3 0·01μF ceramic or paper
C4 0·01μF ceramic or paper
C5 0·05μF paper
C6 0·01μF ceramic or paper
C7 2000pF ceramic
*C8 5000pF ceramic
C9 See Table I
*C10 23pF mica
C11 0·01μF ceramic or paper
C12 0·01μF ceramic or paper
C13 0·01μF ceramic or paper
C14 2000pF ceramic
C15 0·01μF ceramic or paper
*C16 170pF mica
C17 10μF electrolytic 6V.
*C18 2μF electrolytic 6V.
C19 0·01μF ceramic or paper
C20 0·01μF ceramic or paper
C21 0·01μF ceramic or paper
*C22 0·04μF paper
C23 0·01μF ceramic or paper
*C24 2μF electrolytic 6V.
*C25 0·1μF paper
C26 0·01μF ceramic or paper
C27 0·01μF ceramic or paper
C28 23pF mica
C29 10μF electrolytic 6V.
*C30 100μF electrolytic 12V.
*C31 100μF electrolytic 6V.
C32 0·2μF paper
C33 0·01μF paper 1000V.
C34 500μF electrolytic 15V.

Variable capacitors:

VC1/2/3 310pF (nominal) 3-gang tuning capacitor Jackson type "F".
*TC 0–30pF Beehive trimmers (9)
*TC4 15pF variable "Air Tune"
TC5 25pF variable "Air Tune"

Coils and Transformers:

*IFT1 I.F. transformer. Denco IFT18/1·6Mc/s
*IFT2 I.F. transformer. Denco IFT18/1·6Mc/s
*IFT3 I.F. transformer. Denco IFT18/470kc/s
*IFT4 I.F. transformer. Denco IFT18/470kc/s
*IFT5 I.F. transformer. Denco IFT14

The following are Miniature dual-purpose transistor coils by Denco.

T1A Range No. 3. Code Blue
T1B Range No. 4. Code Blue
T1C Range No. 5. Code Blue
T2A Range No. 3. Code Yellow
T2B Range No. 4. Code Yellow
T2C Range No. 5. Code Yellow
T3A Range No. 3. Code White
T3B Range No. 4. Code White
T3C Range No. 5. Code White

Other Transformers:

T5 BFO I.F. transformer. Denco IFT14
T6 Driver transformer, Ardente D3053
T7 Output transformer, Ardente D3027
T8 Mains isolating transformer. MT9. (Norcol or Osmor)
L1 Miniature dual-purpose valve type coil. Denco. Range 2. Code Red.

Semiconductors:

Tr1	AF115	Tr9	OC81 } matched
Tr2	AF115	Tr10	OC81 } matched
Tr3	OC171	D1	OA79
Tr4	OC45	D2	OA70
Tr5	AF117	D3	OA70
Tr6	AF117	D4	GJ7–M
Tr7	OC45	D5	GJ7–M
Tr8	OC81D		

Switches:*

*S1 Single-pole changeover
*S2 Single-pole changeover
*S3 2-pole, 2-way
*S4 D.P. On/Off with VR3
*S5 Single-pole changeover

Potentiometers:

VR1	5kΩ	VR3	5kΩ with switch S4
VR2	10kΩ	VR4	2kΩ

***Switch**

*S1A/B/C, *S2A/B/C, *S3A/B/C } **(Front-end).** 3-wafer, 3-pole, 3-way rotary (Radiospares, etc.)

Miscellaneous:

*Meter (Miniature panel type, 200μA f.s.d) G. W. Smith & Co. Tag strips (10) Lektrokit LK-2231. Aerial socket. Non-reversible 2-pin socket. Phone and L.S. sockets. Transistor mounting clips for OC81's (2). Jackson "Caliband" dial and drive. Epicyclic reduction drive. Control knobs, *3-way muting link socket, sockets for monitoring voltmeter, *Neon warning lamp, 250V, Paxolin sheet $9\frac{1}{2}$ x 6 x $\frac{1}{16}$ in., panel and cabinet material. *Oddment aluminium 4 x $3\frac{1}{4}$ in. for coil pack, solder tags, etc.

practically wireless commentary by HENRY

No 25

Garblese

NOW and again, some journalist "does a Gower", usually citing the involved clauseology of politico-legal regulations, and thundering *"How is the man in the street expected to understand this?"*

The short answer, of course, is that the man in the street can jolly well stay there—leaving legal arguments to those trained in the unravelling of complexities. But sometimes the charge comes nearer home, as when technical writers are accused of making their contributions too specialised and their language too introvertive.

The fun really begins when these specialists deliberately set out to confuse. An hilarious example occurred recently in *"Systems and Communications"*, where readers were invited to provide their descriptions of a *"Yack-Yack"*. They were assured it was a genuine device and given

Yak-Yak or baby alama

a single-sentence hint of its construction and use—deliberately vague.

The response was amazing! Some believed it to be a walkie-talkie set, used in Tibet. Others said it was a *"widget designed to produce at the user's ears a sound field which exactly cancels unwanted external noise—such as nagging wives"*. Many plumped for a two-way telephone system for housewives, or even more way-out, mini-mothers-in-law. One brilliant inventor announced it to be a balanced Yaw-Assisted Cranium Kicker, which tended to keep the inebriated wanderer upright working on rectified brain waves.

The real Yack-Yack is almost as way-out as some of the inventive descriptions. It is an "undercom" for underwater communications between skin divers. It has a face mask with microphone and sound diffuser "to eliminate bubble noise", and a non-corrosive plastic case containing amplifier, battery and speaker. Range, 50 feet. Produced by Raytheon Ltd.

All very fine, but the absolute gem of a letter from S. E. Dinwiddy must be quoted in its entirety to prove my point:

"The information transponder receives dynamic aerial disturbance which it transduces into an electrical analogue which may be propagated along a conducting path to a corresponding installation. The device also contains the complementary transducer which re-transmits, providing conditions are acceptable, a recognisable imitation of the excitation presented to the remote installation.

The transducers are housed in a single module which rests on the second module of the installation when dormant. This second module contains an electro-acoustic transducer employed to attract attention in the event of a request for communication from a distant installation. It also contains a rotating perforated disc by the manipulation of which electrical impulses are transmitted to the complex intermediate apparatus by means of which communication may be effected to any one of a large number of similar apparatus in other locations.'

The example shows clearly what can be done to render a commonplace object practically unidentifiable by a straightforward factual description, using "plain" technical language. No gobbledygook; no copywriters' garblese. Yet the technical man, at whom other technical writers

Down from their high horses

are aiming their contributions, finds it quite clear. Hence the stupidity of those who complain of the unintelligibility of technical articles, when they have not taken the trouble to learn the vocabulary.

We may mention that articles in *Practical* group magazines are deliberately written to be clear to both the technical man and the beginner, without boring the one by babytalk or confusing the other by unexplained terms. It often astounds me that some writers, whom I know personally, can get down so nimbly from their high horses of erudition and meet us common mortals elbow to elbow at the bar.

As a final note—the latest issue of S & C asks for descriptions of "A Whirley"—which is agile, weighs 833 tons and can be swept into position effortlessly. Henry can hardly wait for the answers.

3-VALVE AUDIO AMPLIFIER MODEL HA34

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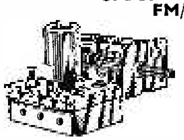

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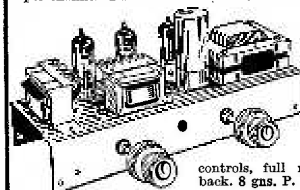

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This kit is similar in appearance to HA34 but employs entirely different and advanced circuitry.

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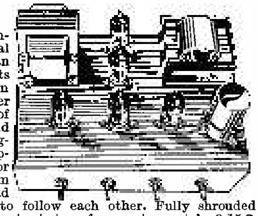

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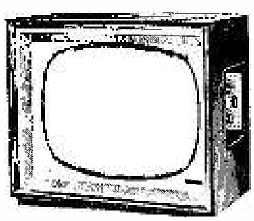

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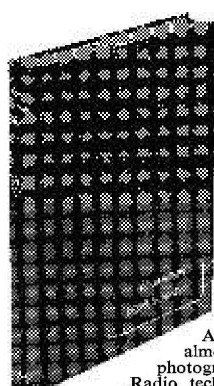

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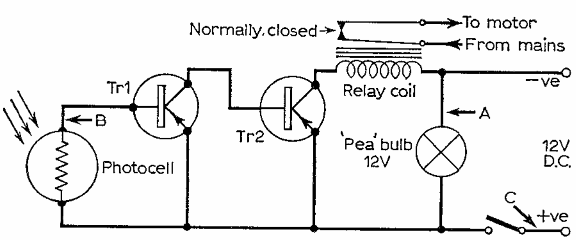
MODIFICATIONS

To add autostop facilities to a BSR tape deck . . .

A PHOTOCELL plus a couple of inexpensive transistors, a lamp and a relay are all the components needed to add autostop facilities to a BSR tape deck. None of the components are critical and most readers should already have the items at hand. The relay will probably cause the most difficulty as it has to disconnect the power (mains voltage) to the tape motor.

Almost any photocell will do (the ORP12 is an example) and can be anchored by one of its lead wires to the pinch wheel assembly—see the accompanying illustrations. The lamp (a tiny " pea " bulb) is also anchored to the pinch wheel assembly, but in a position which puts the tape between it and the photocell.

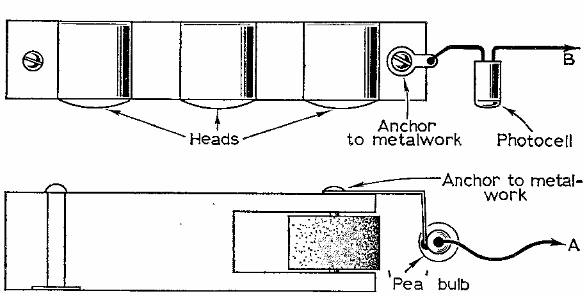
With the tape running from one spool to the other, the light to the photocell from the " pea " bulb is blocked by the tape and the circuit is



Circuit diagram of the autostop.

inoperative. When the leader portion of the tape (the translucent part at either end of the tape) passes between the photocell and lamp there is sufficient light to fire the photocell. This will switch on the control transistor Tr1, which in turn switches the other transistor on, allowing maximum current to flow through the relay coil which causes it to operate and break the power supply connections to the tape motor.

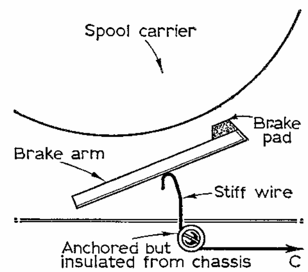
Since the pinch wheel is not brought up to the tape on fast wind, the sensitivity of the circuit is not so high as the lamp is further away from the photocell and the circuit will not operate until all the tape has passed the photocell.



Location information for the photocell and the "pea" bulb.

The transistors are not at all critical and almost any p-n-p device can be used in the Tr1 position. In the other position, a power transistor is needed since it has to be able to draw enough current to operate the 12-volt relay. You may find it necessary to include another transistor to increase the sensitivity to the desired level. If this is the case, it should be inserted between Tr1 and Tr2: connecting the base to the collector of Tr1 and the emitter to the base of Tr2. The author used an OC72 in the Tr2 position.

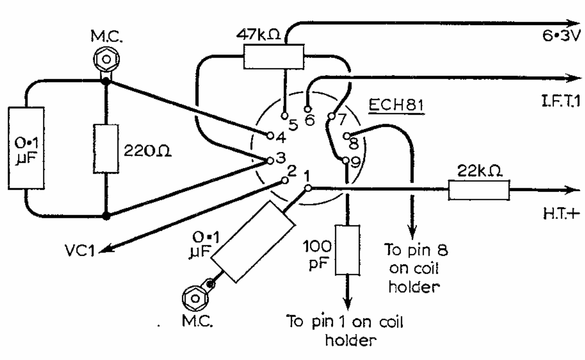
Power for the circuit is taken from a 12-volt battery, via a simple switch on the brake arm on the right-hand spindle which isolates the circuit when the control lever is in the central position.



C. R. Marflow

Alternative Frequency-Changer for the Progressive Short Wave Receiver

Since publishing the Progressive Short Wave Receiver in the February issue, the 12AH8 triode/pentode valve specified for the front end has become difficult to obtain. An ECH81 may, however, be used in the V1 position, but the valve base wiring has to be modified and R1 has to be altered to 22kΩ.



The wiring alterations to the valve base are as follows: remove the chassis connection to pin 5 and connect to the 6·3V heater line: disconnection pin 9 from the heater line and connect it with a short lead to pin 7 on the same base. The diagram shows valve-holder V1 modified for an ECH81.

SHORT WAVE MAINS 2 for the BEGINNER

H. T. KITCHEN

THE receiver to be described was designed to provide efficient but inexpensive reception of the short wave bands without the use of cumbersome batteries which sooner or later (and usually at a most inconvenient time) require replacement.

The disadvantage of any basic t.r.f. is that it is relatively insensitive and not very selective, and ways and means have had to be sought to improve both state of affairs. The universal method is by feeding a portion of the amplified signal back to the grid and reamplifying it ad nauseum! In Fig. 1 this function is performed by L3 which is the reaction coil, and which must be connected so that the feedback is positive; i.e., in phase with the signal at the grid of V1.

The feedback must be made variable so that it can at all times be kept just, and only just, below the point of oscillation at which point both sensitivity and selectivity are at optimum. There are two ways of performing this function, one is by making the trimmer TC1 a variable and using it to adjust the reaction, and the other (which is used in this design) in which TC1 is adjusted initially and then subsequent reaction is controlled by the potentiometer in the screen grid of V1. By varying the potential applied to the screen of V1 we can vary the gain much more smoothly.

Referring to VC1, the greater the band-width covered and the smaller the separation between adjacent stations for every degree of rotation, making it extremely difficult to separate stations who may be separated by only a few kc/s or so. Fortunately, the addition of another tuning capacitor connected in parallel with the main tuning capacitor (VC1), and having a total capacity much less than the former, can considerably assist tuning. The frequency shift is therefore related to the difference in capacity between the main or bandset capacitor and the ancillary or bandspread capacitor.

The anode load of V1 is composed of an r.f. choke and a resistor R1 in series. R.F.C. forms the r.f. anode load across which the feedback voltage is developed. Its inductive reactance is very high to

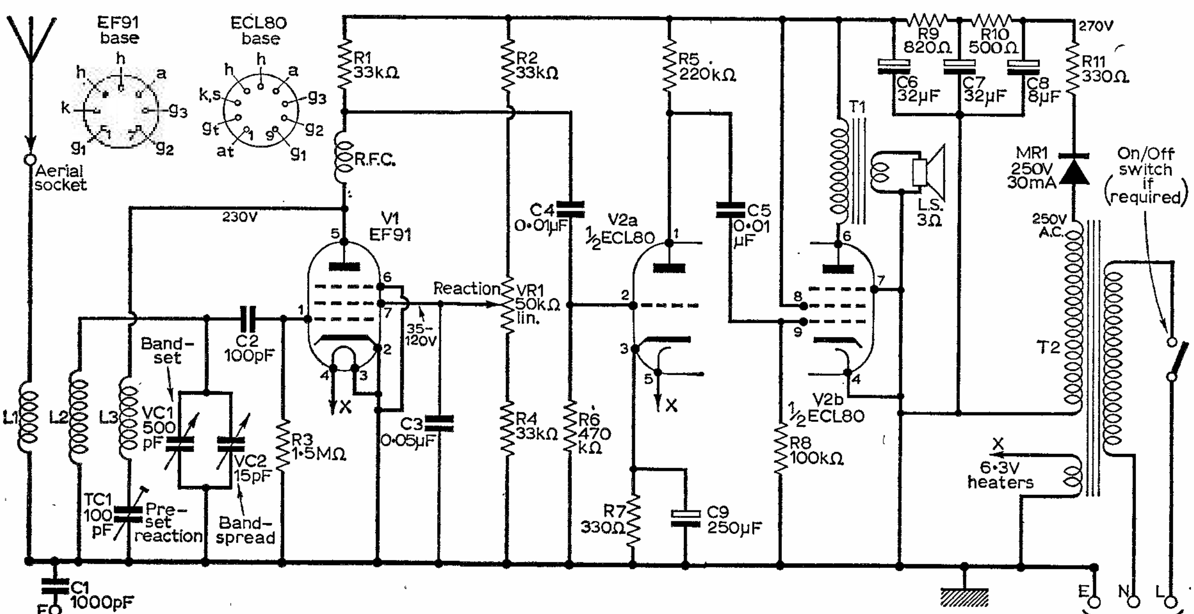
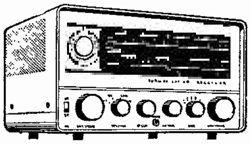


Fig. 1: Circuit diagram of the complete receiver.



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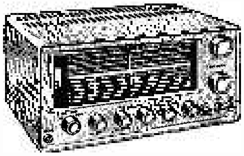

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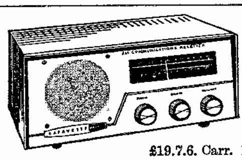
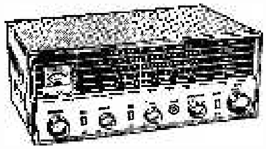


LAFAYETTE HA-55A AIRCRAFT RECEIVER

108-136 Mc/s. High selectivity and sensitivity. Incorporates 2 RF stages including 6CW4 Nuvistor. 8 tubes for 11 tube performance, solid state power supply, adjustable squelch control, slide rule dial, built-in 4in. speaker and front panel phone jack. 220/240V. A.C. Supplied brand new and guaranteed **£19.7.6.** Carr. 10/-. 108-176 Mc/s Ground Plane Antenna **59/6.**

HAM-I COMMUNICATION RECEIVER



5 valve superhet receiver covering 550 kc/s—30 Mc/s on 4 bands. Special features include slide rule dial. Bandspread tuning. 'S' Meter. B.F.O. Built-in 4in. speaker. Operation 220/240 v. A.C. Brand New with handbook. **16 GNS.** Carr. 10/-. S.A.E. for details.

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Z12 Amplifier **89/6**; PZ3 Power Pack **79/6**; X10 Amplifier Built **£6.19.6.** Kit **£5.19.6**; X10 Power Pack **54/-**; X20 Amplifier Built **£9.19.6.** Kit **£7.19.6**; X20 Power Pack **£4.19.6.** Micro FM Radio Kit **£5.19.6.** Micro 6, **59/6**; Micro amp **28/6**; Micro Injection **27/6.** Post paid.

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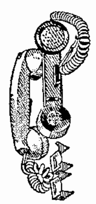

Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. **£6.10.0 pair.** P. & P. 3/6.

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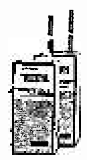

Super quality. Brand new and guaranteed.
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10 transistor with range boost **£22.10.0 pr.**
Post extra.

These cannot be operated in U.K.

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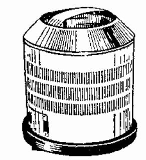

Input 80-120v. and 160-240v. Constant output 110v. or 240v. 250 watts. Brand New. **£10.10.0.** Carr. 7/6.

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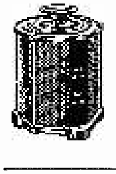

Brand New — fully Shrouded. Input 230v. 50/60 c/s. Output 0-260 Volts.

1 Amp	£4.10.0
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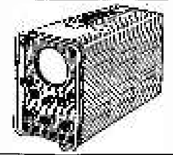
150v. PIV, 165mA	1/-

Discounts for quantities. Post extra.

TEST EQUIPMENT

PORTABLE OSCILLOSCOPE CT.52



A compact (9in. x 8in. x 16½in.) general purpose 'scope T/B 10c/s-40 kc/s. Band width 1 Mc/s. Mullard DG 7/5 2¾in. CRT. For operation on 200/250v. A.C. Supplied complete with metal transit case, strap, test leads, and visor hood. Brand new, **£22.10.0** Carr. 10/-. Supplied complete with instructions.

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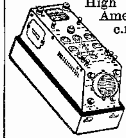

High quality Portable American Oscilloscope, 3in. c.r.t. T/B 3c/s-50kc/s X Amp: 0-500 kc/s Y Amp: 0.2 Mc/s. Power requirements 105-125v. A.C. Supplied in brand new condition. Fully tested. **£25.** Carr. 10/-. Suitable 230-115 v. Transformer, **15/6.**

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Time base 2 c/s-750 kc/s. Calibrators at 100 kc/s and 1 Mc/s. Separate Y1 and Y2 amplifiers up to 5.5 Mc/s. Operation 110/230 volt A.C. Supplied in perfect working order. Carriage 20/-. **£22.10.0**

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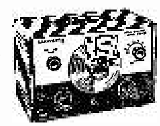
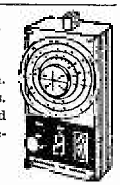
2 PF—2,000 MFD, 2 ohms—200 Megohms. Also checks impedance, turns ratio insulation 200-250 v. A.C. Brand New **£15.** Carr. 7/6.

TE-20 RF SIGNAL GENERATOR



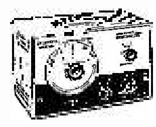
Accurate wide range signal generator covering 120 kc/s-260Mc/s on 6 bands. Directly calibrated. Variable R.F. attenuator. Operation 200/240v. A.C. Brand new with instructions. **£12.10.0.** P. & P. 7/6.
S.A.E. for details.

LAFAYETTE NUVISTOR GRID DIP METER



Compact, true one hand operation. Frequency range 1.7 - 180 Mc/s. 230v. A.C. operation. Supplied complete with all coils and instructions. **£12.10.0.** Carr. 5/-.

TE22 SINE SQUARE WAVE AUDIO GENERATORS



Sine: 20 cps to 200 kc/s. on 4 bands. Square: 20 cps to 30 kc/s. Output impedance 5,000 ohms. 200/250v A.C. operation. Supplied Brand New and Guaranteed with instruction manual and leads. **£15.** Carr. 7/6.

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Transistorised Audio Generator 10-100,000 c/s. Sine or square wave. **£16.15.0.**
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All above post paid with battery.

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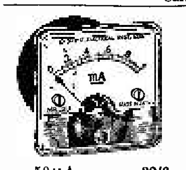

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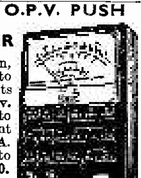
		500-0-500µA	22/6	300mA	22/6	150V D.C.	22/6
		1-0-1mA	22/6	500mA	22/6	300V D.C.	22/6
		1mA	22/6	750mA	22/6	500V D.C.	22/6
		2mA	22/6	1A D.C.	22/6	750V D.C.	22/6
		5mA	22/6	2A D.C.	22/6	15V A.C.	22/6
		10mA	22/6	5A D.C.	22/6	50V A.C.	22/6
50µA	32/6	20mA	22/6	3V D.C.	22/6	150V A.C.	22/6
100µA	29/6	50mA	22/6	10V D.C.	22/6	300V A.C.	22/6
200µA	27/6	100mA	22/6	20V D.C.	22/6	500V A.C.	22/6
500µA	25/-	150mA	22/6	50V D.C.	22/6	'S' Meter 1mA	29/6
50-0-50µA	29/6						

POST EXTRA. Larger sizes available—send for lists.

TE-51 NEW 20,000Ω /VOLT MULTIMETER

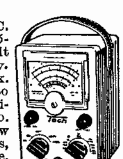
0 / 6 / 60 / 120 / 1,200V. A.C.
0 / 3 / 30 / 60 / 300 / 600/3,000V. D.C.
0 / 60µA / 12 / 300 MA. D.C.
0 / 60K / 6 Meg.Ω
85/-. P. & P. 2/6.

TS-76 20,000 O.P.V. PUSH BUTTON MULTI-TESTER



Simple operation, D.C. volts up to 1,000 v. A.C. volts up to 1,000 v. Resistance up to 10 megohm. Current up to 250 mA. Decibels — 20 to + 36 db. **£5.5.0.** P. & P. 2/-.

MODEL PV-58 VALVE VOLTMETER



11 meg. input. 7 D.C. volt ranges. 1.5-1,500 v. 7 A.C. volt ranges. 1.5-1,500 v. 4,000 Peak to Peak. Resistance .2 ohm to 1,000 megohm. Decibels — 10db to +65db. Supplied brand new with instructions, leads and probe. **£12.10.0.** P. & P. 3/6.

MODEL 500. 30,000 opv, 0/.5/1/2.5/10/25 / 100 / 250 / 500 / 1,000 v. D.C.
0 / 2.5 / 10 / 25 / 100 / 250 / 500 / 1,000v. A.C.
0 / 50µA / 5 / 50 / 500mA. 12 amp D.C.
0 / 60K / 6 Meg. / 60 MegΩ. **£8.17.6.**
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r.f. signal but negligible at a.f. and so R1 is included across which the a.f. voltage is developed. This a.f. voltage is derived from the rectification of the modulated r.f. voltage by the grid and cathode of V1 acting as a diode in parallel with the tuned winding L2. This type of detector is commonly called the grid leak detector.

From the junction of R1 and r.f.c. the a.f. voltage is passed, via C4, to the grid of V2a which is the triode portion of the ECL80 triode pentode audio amplifier. V2b is the power output stage, having as its anode load the primary of the output

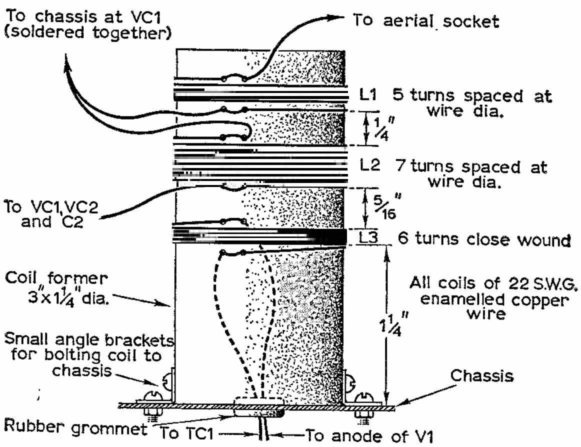


Fig. 2: Details of the tuning coil L1, L2, L3.

transformer, the secondary of which feeds a small loudspeaker.

As far as valves are concerned, we need only consider V1 because on its characteristics will depend the ultimate performance of the receiver. An EF91 was chosen for this position because it has an excellent r.f. performance and can be purchased very cheaply indeed. Identical replacements are Z77, 6AM6, 6F12, CV138 and 8D3.

All the components to be used should be to hand before any attempt is made at constructing the chassis and front panel so that any changes necessary due to a difference in component size can be allowed for. Both the chassis and front panel were made from 18 s.w.g. aluminium, although brass or tinplate could be used with the advantage that all earth connections could be soldered directly to the metalwork. After all the holes have been made the chassis and panel may either be paint sprayed or given a crackle finish. Suitable transfers may be fitted to the front panel giving the unit a really smart finish.

COIL WINDING

The aerial coupling, tuning and reaction windings are all wound on the same former which should be 3in. long with an outside diameter of 1¼in. The wire used was 28 s.w.g. enamelled wire, but this is not critical and other gauges not too far removed from 28 would prove acceptable.

L3 should be wound first and in order to do so two small holes should be pierced in the coil former about 1/8in. apart as in Fig. 2. The end of the wire is threaded through the two holes two or three times to hold it firm and then six complete turns are wound tightly on side by side or "close wound". Two further holes are pierced and the wire threaded through as before. About 6in. should be left at both ends to connect to anode of V1 and to TC1.

L2 is next to be wound and to do this a further pair of holes should be pierced 5/16in. away from L3. The winding is wound in the same direction as L3, but the turns are spaced from each other by the diameter of the wire. Seven complete turns are wound tightly on and a further pair of holes pierced through which the end is threaded. The ends of this winding can be about 4in. long.

L1 is wound in the same manner as L2 but is spaced from it by 1/4in. The start of L1 can be left about 4in. long but the finish should be left some 8in. long so that it can be soldered directly to the aerial input socket. Results comparable to those obtained with the prototype will only be obtained when the coil is wound exactly as the original, but, and this is an important but, results will still be obtained if individual coils vary in diameter, coil spacing, wire diameter and wire spacing.

Actual construction can commence with the fitting of all major components except the coil which should be left until last. The coil is bolted coaxially about a grommet through which

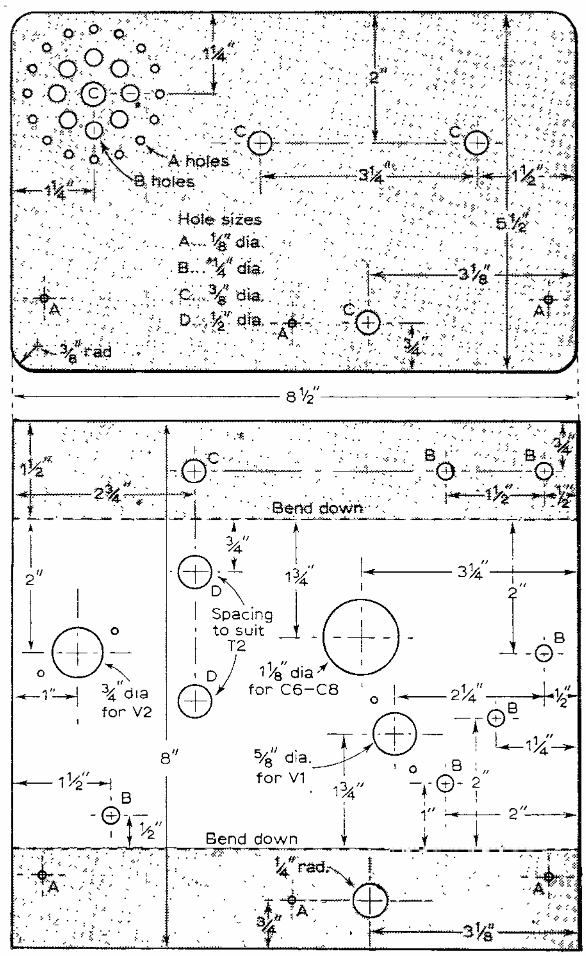


Fig. 3: Layout and drilling details of the front panel and chassis.

the lead out wires from L3 only are passed, thus separating the inputs and outputs and permitting the feedback to be closely controlled. This reaction winding L3 must be correctly wired otherwise feedback will be out of phase or degenerative. The other end of L3 is soldered to TC1 which is bolted to the chassis using one of the 6BA nuts and bolts that are used to bolt the coil above chassis.

The power supply section should be completed first and to this end one side of the heater winding and one side of the h.t. winding should be connected to chassis. It is important to connect the metal rectifier correctly because the application of an incorrect *negative* voltage to the positive side of the reservoir and smoothing capacitors will cause damage. The metal rectifier will also be damaged.

If the front panel and chassis have been sprayed, it is essential to carefully scrape the paint away, leaving bright clean metal before the earth tags are bolted on, as faulty earth connections can give rise to a host of troubles ranging from failure to weak signals or incipient instability, this latter effect manifesting itself as a host of minor whistles where transmissions ought to be.

WIRING OF V2

With the completion of the power supply and r.f. stage wiring, attention can be turned to the audio stages as represented by V2. Pins 4 and 7 of V2, together with its centre skirt, are earthed to a separate earth tag bolted under one of the transformers securing 4BA nuts and bolts. This helps to reduce congestion round V2. The anode of V2b is connected to the primary of T1 by a short length of insulated wire, passing it through the same grommet as the h.t. feed to the other side of the primary. Pin 8 is the screen grid of V2b and makes a convenient tie point for the h.t. lead to the primary of T1 and R5.

Above chassis wiring is simple, but as it is all "tuning" wiring some extra care is worth while. 20 s.w.g. tinned copper wire was used on the prototype covered with sleeving except where the coils' lead out wires were concerned. These were carefully scraped free of enamel and thoroughly tinned with solder and then connected as follows. The "start" of L1 was taken through the grommet, suitably sleeved, and soldered on to the aerial socket. The "finish" of L1 and the "start" of L2 were scraped carefully free of enamel, twisted together, tinned, and soldered to the earth tag or rotor tag of VC1. The "finish" of L2 is soldered to the stator tag of VC1 from which point a short length of sleeved s.w.g. tinned copper wire is soldered to the stator tag of VC2. L3 has been already

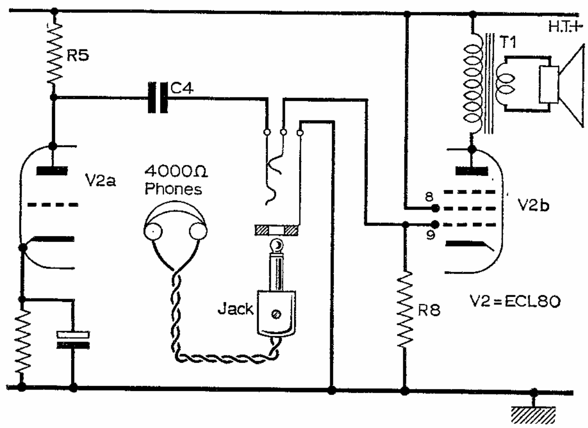


Fig. 5: Simple modification for the inclusion of a jack socket for headphone reception. Phones should be high impedance.

dealt with and need not concern us any further. The importance of making sound soldered joints cannot be over emphasised if the r.f. section is to work at maximum efficiency, and this it will be unable to do if "dry" or high resistance joints are present.

Following completion, a close recheck of all wiring is essential, particularly round the h.t. line, and an ohmmeter check between all "line" points and chassis is very desirable. The initial reading will be a very low resistance one due to the current drawn by the smoothing capacitors, but this should gradually increase to a reading of about 100kΩ.

Once the set has been checked and found satisfactory, the mains can be connected and preliminary tests initiated. Prior to the mains being connected, TC1 should be fully unscrewed so that its capacitance is at minimum. VC1 and VC2 should

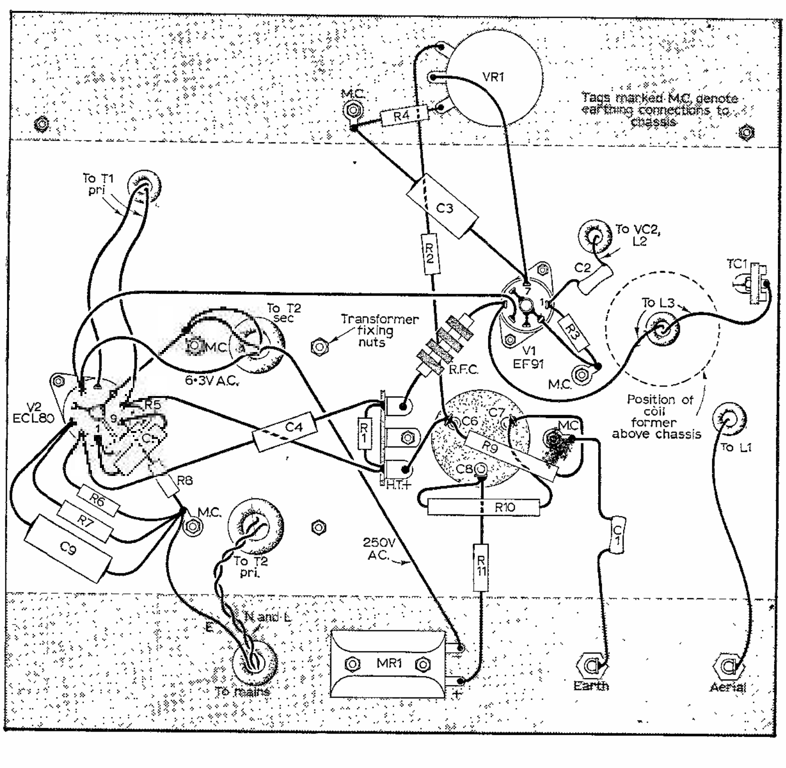


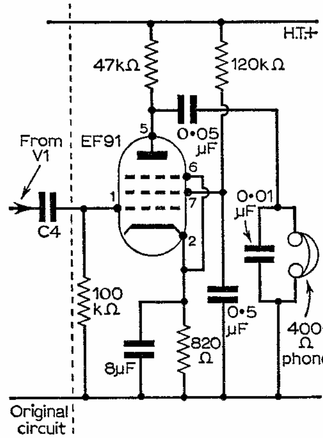
Fig. 4: Underchassis wiring diagram showing positioning of the main wiring. **Important.** *Note the polarity of the midget contact-cooled rectifier MR1.*

be set at maximum capacity and VR1 rotated anticlockwise so that its wiper is at the tag connected to R4. The mains can now be connected and a short while after a rustling noise and possibly a faint amount of hum should be heard from the loudspeaker. VR1 should now be advanced slowly towards its fully clockwise position at which point some signals may be heard, assuming, of course, that an aerial has also been plugged into the aerial socket. If signals cannot be heard by rotating VC2, the bandspread capacitor, TC1, should be slowly screwed in to increase its capacity until signals can be heard on rotating VC2. VR1 should now be backed off slightly and TC1 again slowly screwed in until signals can be heard. The screen grid voltage of V1 should now be in the region of 120V and TC1 can be assumed to be finally adjusted and all subsequent reaction controlled by VR1. As the frequency is increased by unmeshing VC1, the reaction control VR1 will require adjusting in an anticlockwise direction. The ideal range of VR1 is from excessive reaction at the low frequency end of the band to the high frequency end, at its most clockwise or maximum position, to insufficient reaction at its anticlockwise or minimum position. If reaction cannot be obtained with VR1 fully clockwise and TC1 fully tightened up, the coil connections are wrong and the leads from L3 to V1 anode and TC1 will have to be transposed. The mains should be disconnected for this operation and VR1 and TC1 returned to minimum. Upon reconnecting the mains, the reaction circuit should function normally.

FREQUENCY CHECKING

Unless it is desired to cover a particular bandwidth, the receiver can be considered as being fully operational. If a signal generator is available, dial calibration can be checked easily and quickly. If not, reliance will have to be placed on transmissions for calibration. One of the greatest disadvantages common to all simple t.r.f. receivers employing reaction is that the feedback voltage varies with frequency, necessitating an adjustment to the reaction control every time the frequency is changed. This is a fundamental difficulty and one the individual will have to accept if he is to make the most of his own set. The point of optimum sensitivity is when the set is just, and only just, below the point of oscillation. If the reaction is advanced to the point where the set actually oscillates all that will be heard is a high pitched hiss and whistles wherever there is a transmission. If the reaction is not sufficiently advanced only very strong transmissions, or perhaps no transmissions at all, will be heard. The point of correct reaction can be easily determined by slowly advancing the control until a "plop" is heard followed by a hiss and whistles. This is excessive reaction and the control should be "backed off" to a point where the set does not go "plop", and transmissions of voice, music and morse should be heard naturally. The reception of morse is often improved by employing fractionally excessive reaction.

A headphone jack can be easily incorporated between V2a and V2b as shown in Fig. 5 so that with the jack withdrawn the signal from V2a is fed normally, via C4, to V2b when the jack is inserted the connection is broken and the signal is fed to



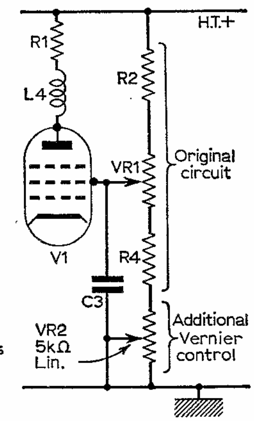


Fig. 6 (left) One way to run headphones only. The EF91 replaces V2.

Fig. 7 (right) Modification for Vernier reaction control.

the headphones instead of V2b thereby muting the speaker (and output stage).

An essential requirement is that the grid leak of V2b, which is R8, must be wired as originally, that is on to the grid pin.

The last modification is a somewhat unusual one and concerns the incorporation of a vernier reaction control; Fig. 7 shows how this can be done.

It makes the adjustment of optimum reaction quite easy, a feature that will be much appreciated when very weak stations are being sought.

Every receiver from the very simple to the very complex benefits from the use of a really first-class aerial and earth system, though both do not, unfortunately, receive the attention they deserve. ■

★ components list

Resistors:

All 10% $\frac{1}{2}$W except where stated.

R1	33 kΩ	R7	330Ω
R2	33 kΩ	R8	100 kΩ
R3	1·5 MΩ	R9	820Ω 3W wire wound
R4	33 kΩ	R10	500 Ω3W wire wound
R5	220 kΩ	R11	330Ω wire wound
R6	470 kΩ	VR1	50 kΩ wire wound

Capacitors:

C1	1000pF	C9	250μF electrolytic
C2	100pF	VC1	500pF
C3	0·05μF	VC2	15pF
C4	0·01μF	TC1	100pF Pre-Set
C5	0·01μF		
C6	32μF		
C7	32μF		
C8	8μF		

C6, C7, C8: Common Can electrolytic

Miscellaneous:

T1 40: 1 o/p transformer, 3 ohms Sec'
T2 PRi. 240V Sec. 250V at 30mA 6·3V at 1A.
L1 L2 L3 See Text.
MR1 Contact Cooled rectifier 250V at 30mA.
L.S. 3 ohms $2\frac{1}{2}$in. square.
R.F.C. Short Wave R.F. Choke.

Valves:

V1 EF91. 6AM6 V2 ECL80

TRANSISTORISED IND

*A.C. PROBE *AUDIO MONITOR

THREE items of test gear are described in this article—an a.c. probe with a 100mV sensitivity in the frequency range 3kc/s to 30Mc/s, a simple audio frequency monitor that will respond to 1mV signal level changes and a 16 to 64Mc/s receiver-oscillator. None of these instruments require expensive components such as moving coil meter movements and all use cheap transistors. A little ingenuity is, however, required in the construction, particularly when putting the r.f. probe together, since part of an old gas lighter refill holds most of the components.

A.C. PROBE

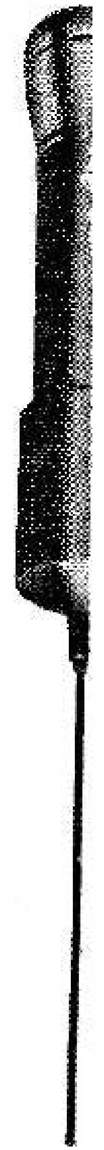
This general purpose instrument is designed to indicate visually the presence of audio or radio frequency voltages in a circuit under test. The sensitivity is such that a clear response can be obtained from signals of less than 100 millivolts in the frequency range 3kc/s-30Mc/s.

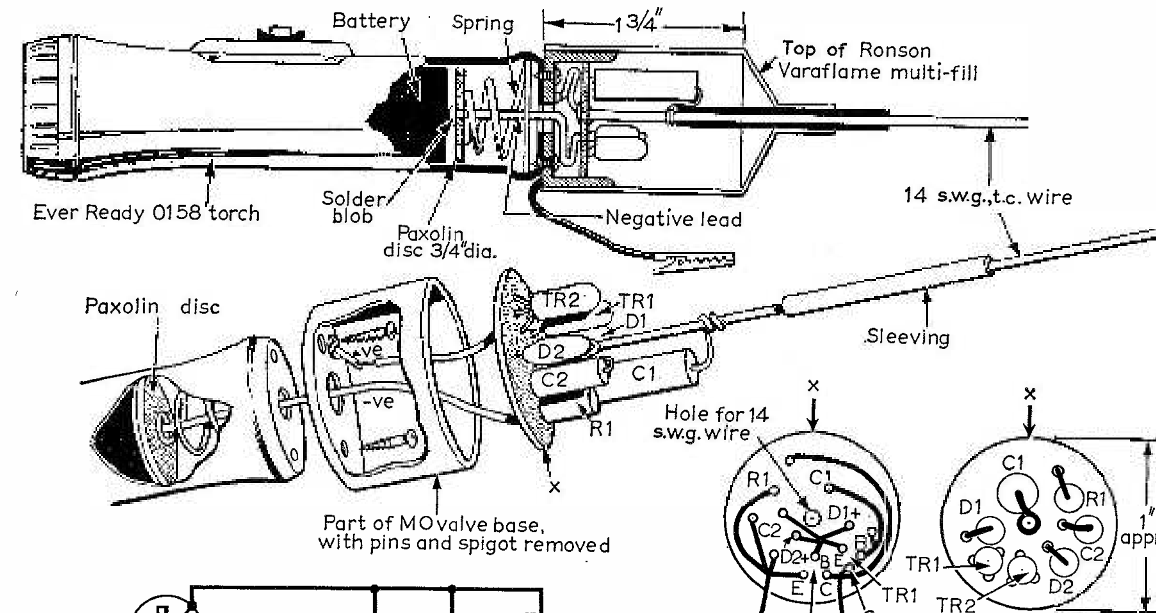
Unlike the familiar signal tracer, which relies on audible detection of the signal, unmodulated r.f. may be checked by this probe. The input is deliberately attenuated at low audio frequencies to enable much higher voltages to be inspected without overloading the instrument; even mains supplies can be tested.

A typical application of the instrument is to check if the oscillator of a superhet receiver is functioning. If the probe needle is touched on the oscillator section terminal of the tuning capacitor the torch bulb should glow brightly if all is well. Similarly, the glow of the bulb can give a useful indication of the comparative output of a radio control transmitter, and will check the quench action of a super-regenerative receiver. To achieve minimum circuit loading and self-capacitance, the torch may be held in the fingertips by its plastic reflector holder, instead of by the metal barrel.

Circuit Description

From the circuit diagram, illustrated in Fig. 1, it can be seen that two transistors are d.c. coupled in a Darlington Pair configuration, with the bulb load in the common supply line, providing a degree of negative feedback. Additional thermal stability results from the diodes D1 and D2 across the base-emitter junctions of the transistors. These diodes





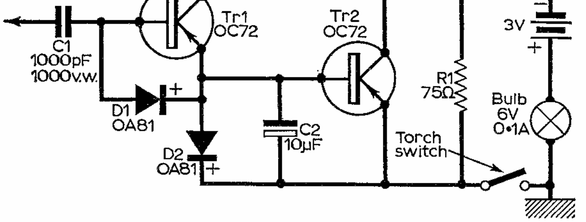


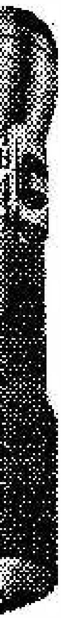
Fig. 1 (left): Circuit diagram of the a.c. probe.

Fig. 2 (above): Constructional details of the a.c. probe.

ICATORS

BY D. BOLLEN

*16-64 MC/S RECEIVER–OSCILLATOR



also rectify the signal. Resistor R1 is selected to bias the bulb so that it will just glow faintly with no input applied. In the original circuit a resistor of 75 ohms was used, but variations between individual bulbs may necessitate a slightly different value.

The earth return lead can be dispensed with when measuring r.f., and also when testing mains supplies, but it should be brought into use for low level audio checks. The bulb specified was found to give the best all round results and is of the type normally used in bicycle dynamo front lamps.

Probe Construction

Constructional details of the probe are given in Fig. 2. The torch is drilled at the battery end to take self-tapping screws and the negative battery lead. A paxolin disc is placed between the battery spring and battery case. This is fitted with a flexible lead and retained by a generous blob of solder which makes contact with the negative end of the battery. The centre spigot and pins are removed from a Mazda octal valve base—taken from an old valve of the ARP 12 variety—and this is retained on the end of the torch by self-tapping screws.

A *used* Ronson lighter refill is first shaken to ensure that no liquid fuel remains inside. If not, the contents may be emptied into a lighter. Residual pressure in the refill is released by inserting a 1/16in. drill into the rubber valve and twisting until the hissing stops. BE VERY CAREFUL AS THIS OPERATION CAN BE DANGEROUS. The drill's grooves provide a gap for the gas to escape freely and the operation should be performed well away from naked flames. When the refill is completely de-pressurized, the alloy body may be cut with a fine saw to form a cap. After the burr has been removed with sandpaper or a file, the cap should be found to be a good force fit on the valve base. If it is too tight the base may be lightly sanded. The valve portion of the refill is finally drilled out to take the probe needle insulating sleeve.

A disc of paxolin, approximately 1in. in diameter, is cut and filed to suit the inside of the valve base and is then drilled as shown in the placement diagrams in Fig. 2. If desired, the disc could be copper clad on one side and etched to make a circuit, but with the prototype the component's leads were inserted in the holes, bent over and soldered together. To ensure correct positioning of components, a tracing may be made from the placement diagram and pasted on the upperside of the drilled disc. This can be torn away after construction is completed.

One must ensure that C1 has an adequate voltage rating, and that the insulation of the probe needle is impeccable if the instrument is to be used at mains voltages. The value for C1, 0·001μF, represents a reactance greater than 3MΩ at 50c/s, reducing to about 30kΩ at 5kc/s. If a flat response is required down to the low audio frequencies C1 may be increased in value to, say, 0·1μF, but the instrument must not then be used for mains checking as the high voltage input would severely overload the circuit.

AUDIO MONITOR

The circuit shown in Fig. 3 is a straightforward development of that given in Fig. 1. Here the bulb is employed as the collector load of Tr3 and a stage of a.f. amplification has been added. The monitor may be used as a modulation peak level indicator in tape recorders and portable transmitters; the complete unit occupying much less space than a meter. Other possible applications are as a null detector in a c.r. bridge, and as a pulse rate monitor in a simple Geiger counter. Response to a signal is unambiguous and changes of less than 1mV in signal level are discernible. As a rough indication of sensitivity, when a crystal microphone insert is connected directly to the input of the monitor the bulb will flash brightly in response to a human whistle five yards away. Standing current is around 10mA, rising to approximately 100mA on signal peaks.

When comparing close audio frequencies, both may be simultaneously fed into the monitor and the slow resulting beats counted and timed with a stop-watch, giving an exact determination of frequency when one of the inputs is a closely controlled standard, such as the 1000c/s tone radiated by the BBC at commencement of transmissions. This is more positive than aural methods since beats of only a few cycles per second are not easily resolved by either ordinary amplifying equipment or the human ear, but the bulb's rate of flashing is obviously plain when the difference between compared frequencies is a fraction of a cycle per second, and up to as fast as the operator can count.

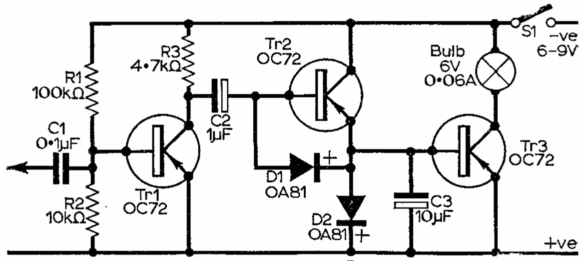


Fig. 3 (above): Circuit diagram of the audio monitor.

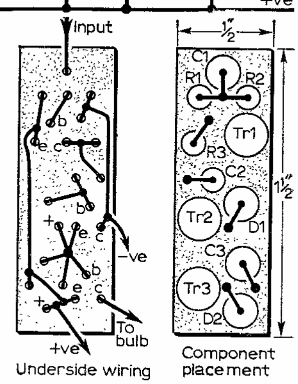


Fig. 4 (right): Layout and wiring diagrams for the audio monitor.

On 9 volts the bulb will be overrun at high input levels. This was not thought to be critical as such levels would seldom be sustained for lengthy periods and bulb replacement could hardly be termed expensive. However, when running with large inputs Tr2 and Tr3 tend to warm up and, with d.c. coupling, their leakage current increases. Under such conditions the bulb will not extinguish completely when the signal is removed, until the transistors have had a chance to cool. To minimise this effect, Tr2 and Tr3 may be fitted with heat sinks, when the application demands continuous illumination of the bulb.

In this case, construction is almost certain to be a matter of individual preference as the unit would normally be incorporated with some larger item of equipment. As a guide the layout of the prototype, on a paxolin panel measuring $1\frac{1}{2}''$ x $\frac{1}{2}''$, is given in Fig. 4.

If a light dependant resistor is coupled to the bulb this can be used as a noiseless, remote volume control in an amplifier or radio receiver. A small a.c. voltage injected into the monitor will control the effective resistance of the LDR, and a feedback loop can be arranged to provide volume compression.

RECEIVER-OSCILLATOR

Anyone who has tried winding their own coils will appreciate the usefulness of an instrument which confirms that *n* turns on a *d* diameter former do, in fact, produce the required value of inductance. When a radio control receiver is first constructed its tuned circuit, or circuits, may peak many megacycles above or below the allotted band. Without a signal generator or grid-dip meter, much time can be spent screwing cores in and out, in the hope that at a certain stage in the proceedings the receiver will respond to a nearby transmitter, assuming that the transmitter is on frequency also. The major problem with most types of home-built frequency standards is that of initial calibration, and the same applies to conventional short-wave receivers. Although a dial marked 0-100 may look good, it is better to know what the divisions represent in terms of megacycles or metres.

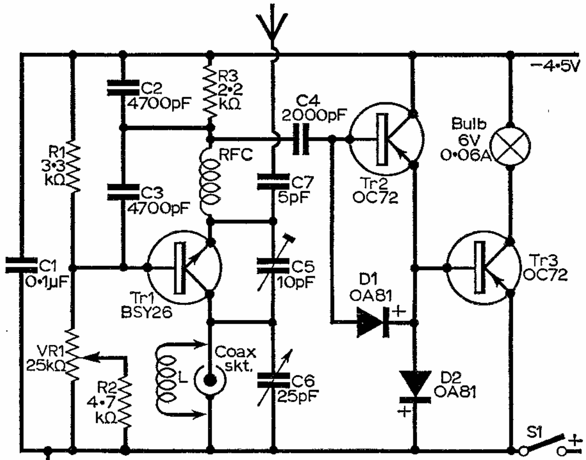


Fig. 6: Circuit diagram of the Receiver-Oscillator.

With little more than a simple 1Mc/s crystal marker and a length of wire, the Receiver-Oscillator may be accurately calibrated for use as a frequency sub-standard, to check the resonance of both passive and active tuned circuits. In other words, the instrument has more uses than can be listed here. Sufficient to say that it may be utilized to test field strength meters; receivers, oscillators, TV, many instruments, and will stand-in as a signal generator. Even if a signal generator is already available, together with a wide range communications receiver, it is often quite useful to have a means of duplicating their functions, or to transfer a signal from one piece of equipment to another.

Circuit Description

The super-regenerative detector offers a convenient and simple way of arranging for two-terminal plug-in coils, with one end of the winding earthed. It is also highly sensitive, and with careful design will cover a wide frequency range without complicated switching and adjustments.

The circuit, Fig. 6, gives the salient details. An n-p-n epitaxial transistor is used for Tr1, allowing the coil L to be connected directly to the earth rail, thus ensuring stability and ease of operation. These transistors are now readily available at moderate prices and give excellent results.

The unusual point about the circuit is that the quench frequency, arising from the mode of operation, is used to bias the bulb amplifier; via C4 from the emitter network of Tr1, and is controlled by VR1, which also determines the operating point of the detector, and hence its sensitivity. If VR1 is fully advanced to its minimum resistance position

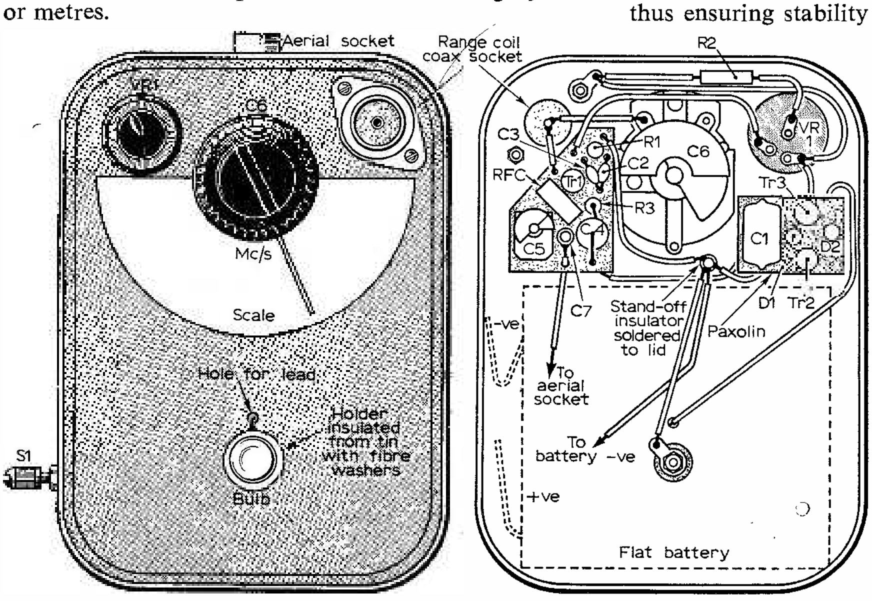


Fig. 5: Constructional diagrams of the Receiver-Oscillator. Range scale and coil-winding details are included in Fig. 7.

the quench disappears and the circuit oscillates only at r.f. The feedback trimmer C5, once set, can be left alone and the instrument will operate quite successfully over the entire frequency range—with or without quench—covered by adjustment of the main tuning control C6 and non-critical rotation of VR1. The choice of range, 16-64 Mc/s, may appear arbitrary, but this covers those frequencies not normally to be found on ordinary short-wave receivers, to link up with the lower television bands, and also embraces model control, two amateur bands and the Industrial, Scientific, and Medical allocation at 40.68 Mc/s. If switched values for C5 can be tolerated then the instrument could be made to cover 10-150Mc/s, but tests indicate that operation at those limits would tend to be critical. Many circuits claim to cover a wide range but this desirable end is seldom achieved without complexity or unreliable operation.

It will be noted that the electrolytic capacitor, shown in the previous circuits, across the base-emitter junction of the output transistor, has been omitted. This is to allow a pair of low-impedance headphones to be connected in place of the bulb for the purpose of identifying certain signals when calibrating the instrument. Without the electrolytic capacitor, the bulb current consists of rectified a.c., resulting in slightly less brilliance, but this has no important effect on performance.

The circuit is not at all critical where component spreads are concerned. The r.f.c. may be pile wound, with one or two hundred turns of 40 s.w.g. wire on the body of a miniature resistor, or can be a pi winding taken from a small medium wave coil or an i.f. transformer, as in the original. Provision for an aerial is made, feeding via 5pF capacitor C7 into the low impedance side of Tr1. Even if the aerial socket is shorted to earth no resetting of the dial is necessary to compensate for frequency variation with load, hence this socket may be confidently used both as an input and output without impairing the instrument's accuracy.

Construction

A 2oz. tobacco tin is not the most ample of all-metal containers, even if it is easy to come by, consequently a slightly unconventional mode of assembly was resorted to when building the instrument, allowing for the fact that most of the internal space was taken up by a large long-life battery. The 25pF capacitor, C6, could just be accommodated without packing under its bush so a thick paxolin panel was out of the question; C6, VR1, coaxial coil socket, and bulb holder were mounted as shown in Fig 5. After a certain amount of brooding and twiddling of spindles it was realised that the only space left for wired components were two disconcertingly small areas of bare metal on either side of C6, squeezed between the battery, VR1 and socket. In response to this challenge, two pieces of paxolin were cut and drilled and after the components were mounted, soldered, and tested, these panels were glued to thin pieces of foam plastic which were then, in turn, glued to the tin-lid in the positions shown in Fig. 5. With the battery in place there was not even enough room for the most miniature of switches so S1 was made up with a 6BA screw and nuts, soldered to the side of the tin, so that when screwed in it shorts the positive terminal of the battery to the instrument's case.

Range	26 s.w.g C.W.
A	13t
B	7t
C	3½t

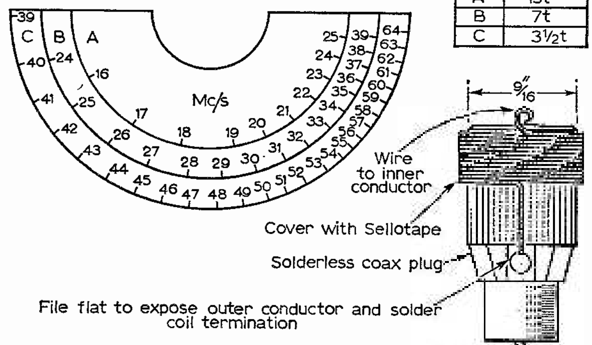


Fig. 7: Calibration data and coil-winding information for the Receiver-Oscillator.

Three coils were wound, according to Fig. 7, on a modified Radiospares 'Normal' coaxial plug, with 26 s.w.g. enamelled wire. Part of the plug outer-casing is filed away to expose the outer conductor and the end of the enamelled wire—after being scraped clean—is soldered to this before winding the coil. Also, a length of insulated 20 s.w.g. wire is fitted to the centre conductor by means of the solderless connector supplied with the plug, as a winding anchorage. The prototype's scale is given as a guide and may be referred to when calibrating the instrument. The rest of the construction and link-up wiring should be plain from the diagrams. C5 is a miniature solid-vane printed-circuit trimmer, but if its replica cannot be found, two insulated wires, twisted together, may be used in place of C5 as the value of capacitance required is only a few pF. C2 and C3 are very small high K ceramic sub-miniature capacitors. All resistors used were also sub-miniature types.

Calibration and Use

The battery may be temporarily connected to negative lead and tin-lid, and coil 'A' inserted in its socket. Rotation of VR1 should cause the bulb to glow. If not, the wiring must be re-checked, and a signal can be applied from an audio oscillator to the base of Tr2 to ensure that bulb and associated amplifier are working. C5 is set to the mid-capacitance position and can be used later to shift the dial calibration points so that the ranges meet or overlap slightly. Even with the vanes fully out of mesh, however, the original circuit oscillated reliably.

When the bulb lights, back off VR1 to approximately half brilliance and then couple the aerial socket to a 1Mc/s crystal marker. The bulb's glow should peak up sharply at each 1Mc/s division as C6 is slowly rotated. If a piece of paper is lightly glued to the lid, the points of maximum brilliance may be marked with a pencil.

Repeat the procedure for coils B and C, slightly re-adjusting VR1 to maintain maximum sensitivity at different dial settings. The resulting scale should consist of a number of regular pencil marks, with a taper towards closer spacing at the high frequency end of the dial, representing 1 Mc/s intervals. To identify the marks numerically, plug in coil C and about two yards of aerial. Replace the bulb with a

—continued on page 351

In answer to Henry

On opening my copy of Practical Wireless this month, I was shattered to find that Henry had done me the honour of bringing his big guns to bear on me and my "polite reprimand". Did I really stick my neck out that far? Rallying from the shock however, I take my courage in both hands and a pen in one and set out to defend myself.

Given Henry's fuller explanation of the more sophisticated uses to which synthesisers may be put, I see where the misunderstanding has arisen. In his first article, Henry said: "By transmitting a great number of channels *simultaneously*" whereas, in his second, he modifies the description to "both transmitter and receiver can be continually *changing* frequency"—a very different thing since "simultaneously" implies that the channels are all being used at the same instant in time, as in the simultaneous broadcasting system of the BBC where the same programme is radiated on various frequencies by several transmitters throughout the country. Incidentally, *channels* are not transmitted, surely it is information which is transmitted *on* channels.

All this, of course, only serves to underline the difficulties which a columnist faces when he attempts a general description of apparatus or technique; inevitably, absolute accuracy must be sacrificed to the limitations of space.

Pax Henry!—our differences are semantic, not technical.

John Niven Douglas.

Glasgow, N.W.

Roding Boys Society folds

We would like to inform your readers that, following the resignation of the leader of the Roding Boys' Society, this Society has been disbanded. However, some of the ex-members have now formed the Redbridge Scientific Society, meeting at the same premises: Wanstead Community Centre, The Green, E.11.

We would be obliged if you would print this letter as an announcement to those earlier members of the Roding Boys' Society, who remained loyal to the Society although distant from its core.

R. J. Lipscombe.

187 Markhouse Road,
Walthamstow E.17.

Wrong address

Thank you for printing my request in the Sell or Loan section of August Practical Wireless. Unfortunately the address is wrong; it should be:—Mr. D. Mines, 41 Sandringham Road, Bitterne Park, Southampton.

NEWS AND..

"CIR-KIT" FROM PEAK SOUND

From Peak Sound (Harrow) Limited, 10 Asher Drive, Off Mill Ride, Ascot, Berkshire, comes "CIR-KIT", 0·002in. copper-coated on one side with a special heat-resistant adhesive which in turn has a protective paper backing. It can be used for modifying existing printed circuits, building up prototype or experimental circuits, small quantity production runs on simple circuits or as flexible connectors, etc.

"CIR-KIT" is available in kit form. Kit No. 1 consists of 1ft. of 6in. wide CIR-KIT; three 6 x 12in. Bakelite E.10 laminate boards; 25ft. of $\frac{1}{8}$in. wide CIR-KIT and 25ft. of $\frac{1}{16}$in. wide CIR-KIT. Kit No. 2 contains 4ft. of 6in. wide CIR-KIT; five 6 x 12in. Bakelite E.10 laminate boards; 100ft. of $\frac{1}{8}$in. wide CIR-KIT; 200ft. of $\frac{1}{16}$in. wide CIR-KIT; one Craft knife and a spare blade. There is also a trial kit, which contains 4 x 6in. sheet of CIR-KIT; one piece of 12 x 6in. Bakelite E.10 laminate board, and 15ft. of $\frac{1}{8}$in. wide CIR-KIT.

FI-CORD INTERNATIONAL RELEASE THE "300"

A new pocket-sized battery-operated dictating machine, the Fi-Cord 300 has recently been introduced. It is a compact lightweight Swiss precision-built fully transistorised unit, complete with all transcribing facilities for the office. Fitting into the palm of the hand, the 300 measures $6\frac{5}{8}$ x $3\frac{1}{4}$ x $1\frac{5}{8}$in. and weighs 25 ounces. It provides simple and rapid 1-2-3 operation for record-rewind-listen in addition to fast forward and stop.

Tape speed is $1\frac{7}{8}$i.p.s. and tapes recorded on this machine can be played back on any tape recorder having the same speed and using $\frac{1}{4}$in. tape. A digital counter is employed and a warning buzzer indicates the end of the tape.

The exclusive Fi-Cord accessory socket for both input and output accepts a choice of accessory microphones, stop-start (remote control) and lapel types, either for reducing background noise or for general purpose.

Price of the Fi-Cord 300 is £63 retail. For further details contact Fi-Cord International, Charlwoods Road, East Grinstead, Sussex.

FIRST INTERNATIONAL TV & RADIO SHOW

For the first time London will be the centre for a major international trade exhibition of audio and video electronic equipment—including colour television receivers—when The Television and Radio Show is at Earls Court, London from August 22 to 26, 1966. As well as many thousands of retailers and wholesalers and their salesmen and service technicians, attendance will include hundreds of traders from abroad.

Unlike previous national public radio shows at Earls Court, this year's is international and trade-only. Organised with the backing of the distributing side of the trade and British and foreign manufacturers and import agencies, it is timed to enable the home trade prepare for an exceptionally vigorous sales drive this winter.

The show will highlight the way in which compact transistor equipments and small but good loudspeakers are making good quality reproduction available to everyone, not just the comparatively small group of hi-fi music/electronic enthusiasts.

...COMMENT

STEREO—AT LAST !

Regular stereo transmissions started from the BBC on July 30. At present, the ration is two to three stereo programmes each day, using the fully compatible pilot-tone system (as used in the U.S.A., Germany, France, Italy and Holland) which was previously tested in the Music Programme.

The stereo service is broadcast from the Third Network v.h.f. stations at Wrotham and Dover, but it is planned to increase coverage to Sutton Coldfield within a year and then to Holme Moss some months later.

Emphasis will, naturally, be on music—both recorded and live—and it is hoped to cover the Promenade Concerts during the forthcoming season. All stereo programmes will be identified in the *Radio Times.*

Further extensions of the service, both in relation to coverage and character of programmes, will be considered in the light of public reaction and the economic resources available.

MINI SOLDERING IRON

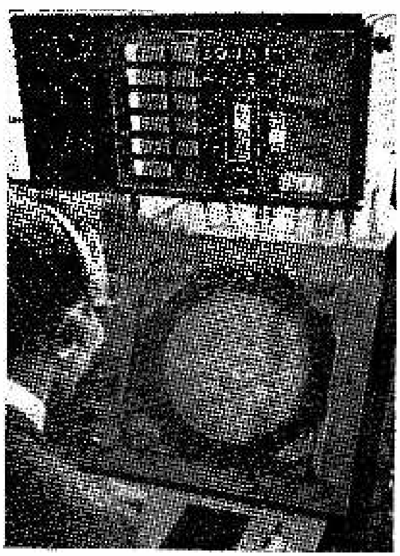
Rawlplug Co. Ltd., Rawlplug House, 147 London Road, Kingston, Surrey, are marketing a miniature soldering iron for light use. Its copper alloy tip is ready for use in 2 minutes, and it reaches 750°F in less than 4 minutes. The cork handle is a good insulator which is also very comfortable to hold over long periods, and which enables the soldering iron to be laid on the bench without the danger of the tip touching the surface. Obtainable from Ironmongers and Hardware shops, the Mini iron costs 19s. 6d.

R.S.G.B. NATIONAL MOBILE RALLY

The R.S.G.B. National Mobile Rally is to be held by kind permission of His Grace the Duke of Bedford, at Woburn Abbey, Bedfordshire, on Sunday, September 11, 1966. The park opens at 11 a.m. There are ample car parking facilities and there is a children's playground, pets' corner and a boating lake for the youngsters.

The talk-in stations will be GB2VHF and GB3RS on 2m (144·86 Mc/s), 4m (70·260Mc/s), 80m s.s.b. (3·75Mc/s) and 160m (1940kc/s).

SECAR SECONDARY RADAR SYSTEM



This photograph shows the prototype Marconi/Thompson SECAR control and indicator unit, mounted above a standard radar (PPI) display. The display screen shows secondary radar responses with a video-map of the airways and coastline of southern England and parts of France, Belgium and Holland.

Secondary radar is a ground-to-air data link designed to provide the radar controller with the identity and height of any aircraft, to supplement the "plan position" information given by the normal, or "primary" radar.

Station interference

WITH reference to N. D. Mugford's letter in July 1966 PRACTICAL WIRELESS.

It's not only the Communist Bloc that is responsible for the chaos on the short waves.

The Voice of America with its excessive bandwidth caused through deliberate misoperation as a counter to jamming is responsible for a lot of interference. There is not a single Missionary radio station that beams to the U.K. that does not suffer either the whole time, or part time from V.O.A. or A.F.R.S. interference. Even the 260 kW Bonaire station suffers.

Radio Free Europe and Radio Liberty also offend as they attract jamming. HCJB was coming through the best for some time on 15.115 Mc/s. until one of the latter opened up nearby, causing HCJB to shift to 15.325 Mc/s, where reception is not so good.

The BBC also is not wholly blameless. Despite protests the interference at critical times to the transmissions of Transworld Radio Monte Carlo on 7.26 Mc/s is notorious.

Lastly, some commercial operators of communication transmitters are also to blame. I'm certain that while the bulk of such interference is image reception, some is not.

Present day high power transmitters have taken the interest out of the hobby, and the shortwaves are being misused for a verbal slanging match between East and West. Missionary radio stations together with the stations belonging to some of the smaller nations are an oasis in an otherwise dry and uninteresting territory.

D. O. French.

Stroud Green,
London, N.4.

Can anyone help?

I WOULD like to purchase a copy of PRACTICAL WIRELESS for October 1964 and wonder if any of your readers could oblige, I will gladly refund the postage with the price of the book.

G. E. Newman.

4 Laburnum Grove,
Hayling Island,
Hants.

* * *

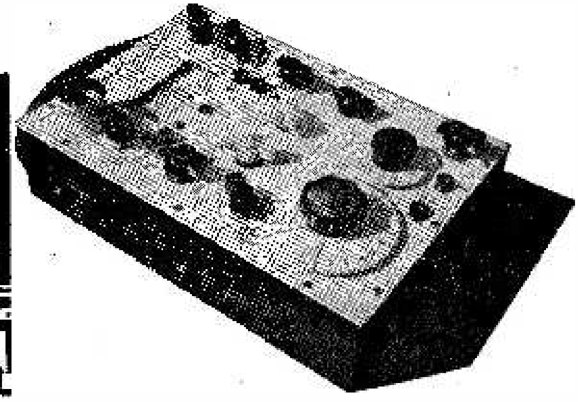
I SHALL be grateful if any reader will sell me a copy of "Amplifiers, Design and Construction" by F. J. Camm since all efforts to purchase through normal trade channels have failed.

Cyril H. Rowe.

16 Ty Fry Road,
Rumney,
Cardiff.

THE MULTITEST

MULTIMETER·MULTIMETE
L.C.R. BRIDGE·L.C.R. BRIDG
SIGNAL TRACER·SIGNAL T
SIGNAL INJECTOR·SIGNA
INSULATION TESTER·INSL



PART II

R. D. OWEN

CIRCUIT details of the multimeter section of this instrument were given last month along with details on how to work out the various shunt and load resistor values. In this part, the bridge section is discussed and constructional information is given on the complete instrument.

An important point to remember when constructing measuring equipment is that the accuracy of the instrument can only be as good as the components that are used in it. The author specifies high-stability 1% resistors for the bridge section and has achieved an overall accuracy of ±3% on most of the resistance ranges. He has achieved the same accuracy on the two lowest capacitance ranges, but has sacrificed accuracy on the higher capacitance ranges owing to the cost of the necessary components. This is not too serious as accuracy is not all that important on the higher ranges as often one only requires to know if a component is serviceable and not its precise value.

BRIDGE

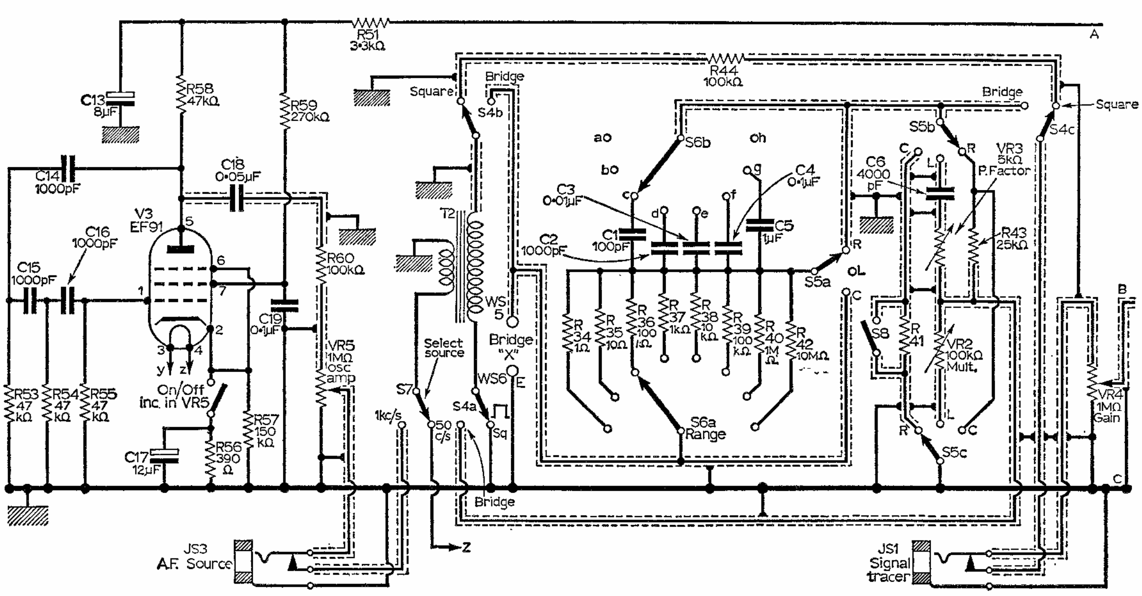
A circuit diagram of the bridge section of this instrument appears in Fig. 6. Also included in this diagram are the three valve stages which are also associated with the signal injection and tracing circuits. The bridge itself is fairly straightforward, making use of a single direct reading scale which carries all nineteen ranges. Null indication is by means of a magic eye (V2).

A full list of the bridge ranges was given in Part I (Fig. 2), but recapping there are eight resistance ranges from 4Ω to 40MΩ, five capacitance ranges from 400pF to 4μF and six inductance ranges from 40mH to 4000H. All ranges are in multiples of 10.

CIRCUIT DESCRIPTION

The basic bridge circuits for resistance, capacitance and inductance are shown in Figs. 7a, 7b and 7c. Depending upon the range selected, one of the resistors R34 to R40, or R42, is used as a standard for one arm of the bridge on the inductance and resistance ranges. The standard in the other arm is then R43 for resistance, or C6 for inductance.

The 2·5kΩ potentiometer VR3 is the power factor control. This gives an idea of the efficiency of the inductance being tested. D.C. resistance or leakage in the inductance causes a phase change relative to the phase of the a.c. if a pure inductance were present. The power factor control VR3 in effect



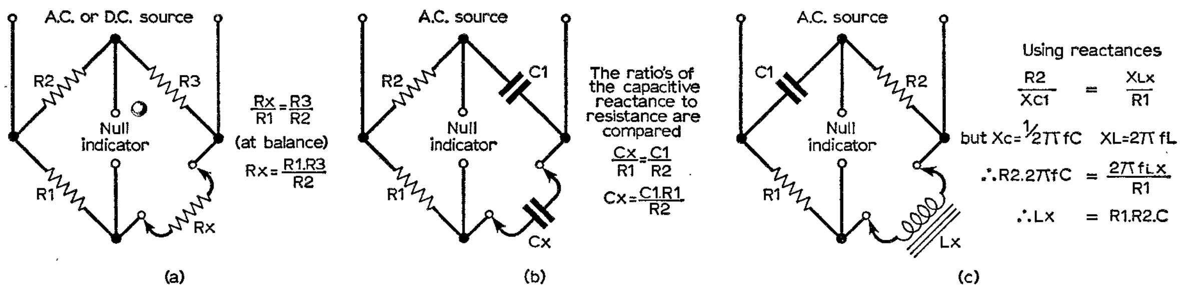


Fig. 7: Basic resistance (a), capacitance (b) and inductance (c) circuits as used in the bridge section. Circuit component references in these diagrams do not tie-in with those given on the main circuits.

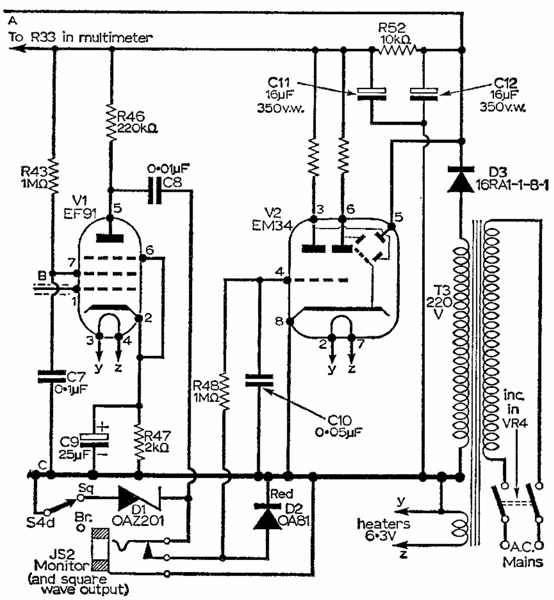
varies the efficiency of the standard C6 and hence can be adjusted to produce the same phase shift as the inefficiency in the inductance being measured. In the author's unit the power factor control was only calibrated in resistance, since the actual power factor corresponding to a particular resistance depends upon the range to which the bridge is switched. If, for best null point, the power factor control is set at low resistance, then the power factor is obviously good, and vice-versa.

On capacitance ranges, C1 to C5 are standards in one arm of the bridge and R43 in the other. The positions of VR2 and the one standard are interchanged on the capacitance ranges so that the direction of the calibrations on VR2 scale remain constant.

The bridge circuit is arranged so that one "X" connection is in fact earth, to minimise external pick-up.

The 50c/s bridge source is derived from the heater winding of the mains transformer and is isolated and stepped up by T2; a three-to-one transformer. The 1kc/s source is derived from a phase shift oscillator employing an EF91 (V3) and is fed to the bridge via a switched jack JS3. This permits the 1kc/s supply to the bridge to be cut-off and used as a signal injector.

The null indicator part of the bridge circuit consists of a pentode amplifying stage V1, coupled to a magic eye indicator V2. The connection with the actual bridge is via a switched jack, JS1, which serves to disconnect the bridge and allow the null indicator to be used as a signal tracer when a jack plug is inserted.



SIGNAL INJECTOR

The phase-shift oscillator V3 is switched on and off by the switch included in the amplitude control, VR5. When the switch closes it connects R56 and C17 in parallel with R57, which is left in circuit when the oscillator is switched off to avoid cathode poisoning of the valve.

If a square wave output is desired S4 is switched to "square" and the output taken from the monitor socket. In this position V3 is then connected to V1 via step-up transformer T2 (bridge is disconnected) which gives a very large voltage swing at the grid of V1. The valve "bottoms" when the grid voltage exceeds 2V positive, and the valve cuts off when it goes more than 2V below the zero line. The output of the oscillator is thus squared by the limiting action. Further squaring is achieved by zener diode D1, which is in the output side of V1. This shorts out all negative and positive excursions in excess of 6V.

The 50c/s square wave output can also be used for synchronising purposes, testing amplifiers in conjunction with an oscilloscope and for signal injection into r.f. circuits since it has a high harmonic content.

SIGNAL TRACER

The pentode amplifying stage, V1, has a gain of about 350. For visual null indication or visual indication in signal tracing the output of V1 is rectified by D2, and the resulting negative voltage is smoothed by R48 and C10 before being applied to the grid of the magic eye. Null point (maximum "opening" of the magic eye) corresponds to minimum negative grid voltage.

An external amplifier or a crystal earpiece are advised for signal tracing, whereas the magic eye gives the better null indication.

Fig. 6: Circuit diagram of the bridge section of the multitest. Only one connection has to be made to the multimeter section of this instrument and that is to R33 from the h.t. rail—the junction of C11 and R52. The circuit for the multimeter section was given in Part I, Fig. 1 (last month).

R.F./A.F. PROBE

S9 is the r.f./a.f. selector switch. On a.f. it simply connects the probe tip, via isolating capacitor C22 (500VW) to the output jack JS4. This is connected by a screened lead (terminating in jack

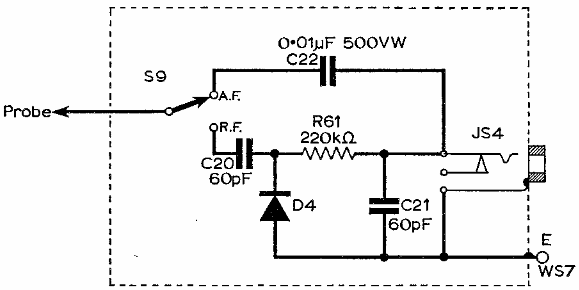


Fig. 8: Circuit of the probe attachment.

plugs at both ends) to the "signal tracer" input, JS1. When switched to r.f. the signal is fed via a 60pF capacitor to diode D4 which functions as a detector. The output is "smoothed" (to remove the r.f. component) by R61 and another 60pF capacitor and then fed to jack JS4. WS7 is the earth connection to the probe and should be connected to the chassis of the set being tested. (Beware of live chassis sets!)

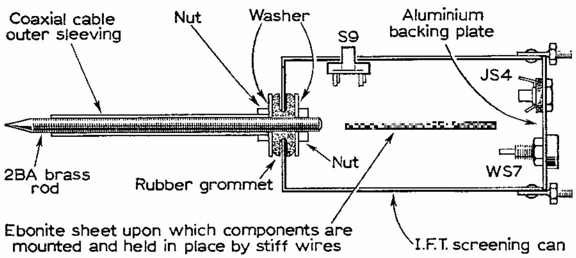


Fig. 9: Cross-sectional drawing of the author's metal work for the probe.

CONSTRUCTION

No difficulties should arise in constructing this instrument, particularly if readers use one of the universal chassis with the separate sides and top. One can, of course, do the "tin bashing", but the author found the manufactured chassis to be more robust than the home-built units. Also, one can purchase one with a hammer finish which gives the finished job the professional touch. These chasis are available through most dealers: the author's unit, which measures 10 x 7 x 3in., came from Home Radio Ltd., 187 London Road, Mitcham, Surrey.

The completed unit is rather compact and the author recommends the instrument should be constructed in the following sequence: multimeter section, bridge section, power supply, power feed lines, etc., and finally mounting the separately constructed sub-chassis for V1 and V3. Following this sequence will minimise disturbance to wiring already done.

The switch layout used by the author is illustrated in Fig. 3 and the position of the main under-chassis components is shown in Fig. 5: both of these illustrations appeared in Part I of this article. Layout is not critical and can be varied to suit individual readers' needs. One should, however, be careful to ensure that the major components (including the switches) all go in without touching one another before drilling any holes.

MARKING THE CONTROLS

Several methods are available to the constructor for marking the front panel controls nowadays, including the instant, self-adhesive lettering. The range switch S6 will probably cause the most difficulty as nineteen ranges have to be included. A close-up of this switch is illustrated in Fig. 10. This gives the information that has to be written on the card which can be covered with a varnish or some perspex before it is glued to the control knob.

The companion control VR2 may also cause a little trouble, as again one has to prepare a card.

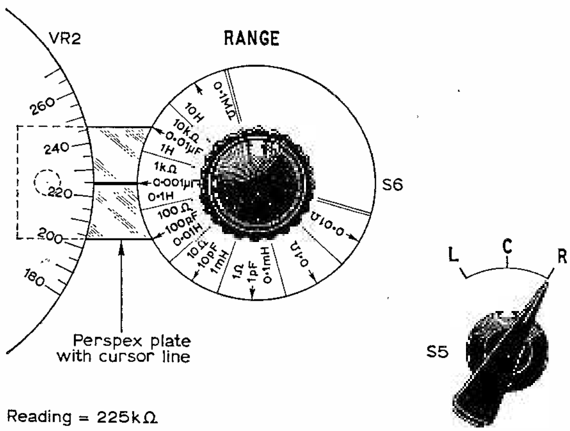


Fig. 10. Close-up of the range switch and the multiplier.

One should first find the electrical maxima and minima, using a ohmmeter. This will give you the total angle of rotation, which has to be divided into 80 equal divisions; every second division being drawn longer than the rest since it corresponds to tens. The scale is thus calibrated in fives and tens from zero to four hundred.

It is extremely important that the calibration markings are accurately drawn since the accuracy of the bridge depends upon it. Reference to the front panel illustration shows how the two scales are arranged. The perspex cursor is simply glued to the front panel.

To read the value of a component under test, one simply adjusts for null indication and then multiplies the reading on the range scale (S6) by the reading on the multiplier scale (VR2).

COMPENSATION RESISTOR VALUE

To obtain the correct value for R41, the bridge section should be switched to the 0-400 pF range, switch S8 closed and the 1 kc/s bridge source selected (with maximum gain). The null indicator gain is then reduced until the course section of the magic eye is about three-quarters closed. The multiplier is then rotated until the null point is found; the null indicator gain being increased as necessary to provide a more sensitive indication. The correct value for R41 in kΩ is one quarter of the indicated capacitance.

continued on page 351

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8μF	3 volt	6μF	9 volt	8μF	50 volt
20μF	3 volt	20μF	9 volt	3·2μF	64 volt
100μF	3 volt	64μF	9 volt	5μF	70 volt
200μF	3 volt	250μF	9 volt	4μF	100 volt
2μF	6 volt	10μF	10 volt	2μF	150 volt
10μF	6 volt			8μF	275 volt

All at **1/-** each or **9/-** per dozen.

3μF	12 volt	8μF	15 volt	4μF	25 volt
4μF	12 volt	10μF	15 volt	25μF	25 volt
6μF	12 volt	30μF	15 volt	32μF	25 volt
10μF	12 volt	50μF	15 volt	64μF	25 volt
25μF	12 volt	100μF	15 volt	150μF	25 volt
100μF	12 volt	750μF	15 volt	16μF	30 volt
200μF	12 volt	2·5μF	25 volt	6·4μF	40 volt
6μF	15 volt	3μF	25 volt	12·5μF	40 volt

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·002μF	500 volt	7d.	5/3	29/-	£7/5/0
·015μF	300 A.C.	9d.	6/9	37/6	£9/7/6
·005μF	750 volt	7d.	5/3	29/-	£7/5/0
·02μF	350 volt	6d.	4/6	25/-	£6/5/0
·02μF	600 A.C.	1/3	11/3	62/6	£15/12/6
·1μF	350 volt	7½d.	5/8	31/3	£7/16/3
·1μF	750 volt	9d.	6/9	37/6	£9/7/6
·25μF	350 volt	10d.	7/6	41/8	£10/8/0
·5μF	150 volt	1/-	9/-	50/-	£12/10/0
·5μF	350 volt	1/3	11/3	62/6	£15/12/6
·5μF	500 volt	1/6	13/6	75/-	£18/15/0

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·001μF .. 200 volt
·002μF .. 200 volt
·005μF .. 200 volt
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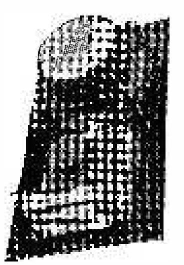

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TECHNICAL DETAILS:

The unit is a compact and self contained loudspeaker system which only needs to be fitted into a simple cabinet of the recommended design to produce a high fidelity loudspeaker of the highest quality.

The unit consists of a 5in. bass unit, 4in. tweeter and crossover network mounted on a duralumin plate which forms the front panel of the complete enclosure.

The method of assembly of the module is unique in that the cone and synthetic rubber surround of the 5in. bass unit are mounted directly on to the duralumin front panel and the ceramic magnet is supported on substantial pillars attached to the panel. The conventional chassis with all its disadvantages is thus eliminated.

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The unit forms the drive system of the 'Minette' enclosure, for details see separate leaflet. Patents applied for.

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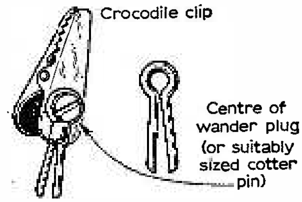
Richard Allan

—continued from page 348

Insertion of R41 should transfer the null point to 0pF when switch S8 is opened. If it does not, slight adjustment should be made to its value until it does. With R41 set correctly, capacitances as low as 2pF can be measured.

Fig. 11: This crocodile clip come wander plug is ideal for capacitance measurements since it keeps the stray capacitance to a minimum.



OPERATION

While it is not worth laying down strict operating details, it is probably worth pointing out that the 1kc/s source is best for low capacitance and inductance measurements and the 50c/s source for measuring low value resistors. Generally speaking, for all other values either a.c. source may be used, although one or the other usually gives a better null point.

When making insulation tests it is necessary to bridge the negative terminal to earth with a "jumper" and connect the test leads to WS3 and WS4.

Although the switch incorporated in the "ohms set zero" control has no effect on most ranges, one must be careful to ensure that it is left open while measuring a.c. voltages as if closed it would shunt the meter through R16, T1 and R17. The control must, however, be closed for alternating current measurements.

The circuit diagram of the multimeter section given last month is incorrect. The lead at present shown connected to the 2·5V position of S1a should, in fact, go to 0·1mA position on the same switch wafer; the 2·5V position is blank (no 2·5V range on a.c.). ■

Transistorised Indicators

—continued from page 343

pair of low impedance headphones soldered to an old bulb screw. It should be possible to hear, at good strength, a local Band I television transmission, sound and vision. The frequencies for these are given in the table. Obviously, given the 1Mc/s points, a single known identification of any point on the scale will enable the whole range to be calibrated.

The C range can be used as a reference for the other two ranges. The 2nd harmonic of a 27Mc/s signal will be heard, or will cause the bulb to glow brighter, at precisely 54Mc/s on scale C, and will correspond to a pencil mark on range B representing 27Mc/s. If the signal is 27·5Mc/s, the harmonic will then coincide with 55 on range C, and will be half way between divisions on Range B. A 16Mc/s signal will appear at 16, 32, 48 and 64Mc/s. It is possible also, with a good length of aerial, to pick up several short-wave transmissions on ranges A and B, as further frequency checks. If a calibrated short-wave receiver is to hand, it may be tuned to the self-radiated characteristic hiss of the instrument's super-regen, as added confirmation of calibration points.

Finally, when satisfied that all dial markings are correct, the piece of paper may be removed, traced, and an inked scale made. When in use, a passive tuned circuit brought near the instrument's coil will cause bulb brilliance to dip, and a nearby oscillator will increase the brilliance of the bulb. The aerial socket can be utilized for very weak input signals, and for injecting a signal into other apparatus when the instrument is employed as a signal generator. ■

★ components list

A.C. Probe:

R1	75Ω
C1	0·001μF 1,000VW
C2	10μF 9VW
D1, D2	OA81
Tr1, Tr2	OC72 or near equivalent
Torch	Ever-Ready 0158, with battery
Bulb	6 volt, 0·1A
Misc.	Empty Ronson Multi-fill refill, paxolin, Mazda octal valve base. 14 s.w.g. wire

Audio Monitor:

R1	100kΩ
R2	10kΩ
R3	4·7kΩ
C1	0·1μF 100VW
C2	1μF 9VW
C3	10μF 9 VW
D1, D2	OA81
Tr1, Tr2, Tr3	OC72 or near equivalent
S1	On-off, single pole
Bulb	6 volt, 0·06A
Misc.	Bulb holder, paxolin, 6 or 9 volt battery

Receiver-Oscillator:

R1	3·3kΩ
R2	4·7kΩ
R3	2·2kΩ
VR1	25kΩ miniature
C1	0·1μF
C2, C3	4,700pF sub-min ceramic
C4	2,000pF tubular
C5	10pF Oxley SMT9/10·9 printed circuit
C6	25pF Jackson C804
C7	5pF tubular ceramic
Tr1	BSY26
Tr2, Tr3	OC72 or near equivalent
D1, D2	OA81
Bulb	6 volt 0·06A
RFC	See text
S1	See text
L	See text and Fig. 7
Misc.	Three Radiospares 'Normal' type coax plugs, one coax socket, bulb holder, aerial socket, knobs, 4·5 volt 1289 battery, paxolin.

BAND I TELEVISION FREQUENCIES

Mc/s Vision	Mc/s Sound	
45	41·5	Crystal Palace, Divis.
51·75	48·25	Holme Moss, North Hessary Tor, Truleigh Hill and Dover, Londonderry, Rosemarkie.
56·75	53·25	Kirk O'Shotts, Norwich, Rowridge, Blaen Plwyf.
61·75	58·25	Sutton Coldfield, Sandal, Meldrum, Folkstone and Les Platons.
66·75	63·25	Wenvoe, Pontop Pike, Douglas, Orkneys.

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequences in kc/s

THE BROADCAST BANDS

by JOHN GUTTRIDGE

Austria: *Osterreichischen Rundfunk* (Wien IV, Argentinieistrasse 30a) now has a regular overseas service which follows the schedule pattern established during a long period of test transmissions. The station has been noted in Europe at 0900—1100 on 6,155/7,245/17,755 and 1500—1700 on 9,770/11,785/17,750.

Brazil: *Radio Bandeivantes* (Casilla Postale 372, Sao Paulo) has been sending out silk World Cup shields. *Radio Jornal do Comercio* (Rua Marquez do Reife, Pernambuco) may be heard after 2100 on 9,565. *Agencia National* (Setor Radio and TV, Casilla Postale 95, Brasilia) is believed to be using 14,730 instead of 14,690 for the 2230—2330 transmission over PSF.

Bulgaria: *Radio Sofia* (4 Bd. Dragan Zankov Street, Sofia) now uses 9,560 in addition to 6,070 for its European English transmissions at 1930—2000 and 2130—2200.

Colombia: *Radio Sutatenza* (Accion Cultural Popular, Aereo 1770, Bogota) heard at 2300 over HAGC, 5,075.

Cuba: *Radio Habana Cuba* (Apartment Postal 7026, Habana) now transmits in English at 0100—0330 9,525; 0330—0600 6,135; 1800—1900 17.735; 2010—2140 15,155 (Europe) and 2050—2150 15,300/15,340.

Czechoslovakia: *Radio Prague* (2 Vinohradska 12) has English at 0330—0430 on 5,930/7,120/7,345/9,795 and at 0100—0200 on same frequencies plus 11,910. There is a further English transmission at 1730—1830 on 5,930.

Denmark: *Radio Denmark* (Shortwave Department, Radio House, Copenhagen V) is now using 15,165 for its 1945—2015 and 2145—2215 transmissions.

Ecuador: *La Voz de los Andes* (HCJB) (Casilla 691, Quito) is now using 15,325/17,880 for the 1800—2400 transmission to Europe. English is at 1845—2000, 2100—2130 and 2330—2400. The morning European transmission is 9,645/11,910 and the new frequency of 6,025 between 0430—0630.

Finland: Finnish Broadcasting Company (Unioninkatu 16, Helsinki) has a DX programme on 9,555/11,805/15,185 at 1600—1700 on Fridays, 1215—1315 on Saturdays and on 6,120 at 2100—2200 on Fridays.

German Federal Republic: *Deutsche Welle* (Bruederstrasse 1, Postfach 344, Skoln) is now using 11,945/9,530 for the 0300—0340 English transmission. Other English transmissions affected by changes include 0845—0940 11,925/15,275/17,845; 1550—1630 17,875/15,295; 0130—0250 11,945/9,640; 0500—0540 11,890/9,735; 1510—1555 9,675/15,405/11,925.

Holland: *Radio Nederland Wereldomroep* (P.O. Box 222, Hilversum) now has one of the most attractive QSL cards. A special Spanish vocabulary for use when reporting on Spanish stations is available on application. Frequencies for English transmissions are 0020—0110 800 (Bonaire); 0130—0220 9,590 (Bonaire); 0730—0820 11,730/9,715/9,525; 1430—1530 17,810/15,425/6,020; 1900—2000 11,730/9,590/6,020; 2000—2050 11,730/9,590/6,020; 2100—2150 15,425/11,730; 2130—2220 15,220 (Bonaire).

Monaco: *Trans World Radio* (Rue de la Poste 5, P.O. Box 141, Monte Carlo) is now using the Radio Monte Carlo transmitter on 1,466 in the early morning and evening. English is at 2130—2230. The new frequency of 11,760 is being used for the Russian programme from 1805—1840 when it swamps the Voice of America transmitter on the same frequency.

Netherlands Antilles: *Trans World Radio* (5c Zootpannenweg, Bonaire) now has English 2115—2130 instead of 2115—2145 on 15,245. On Sundays there is a DX programme at 0330 on 11,820.

Radio New York Worldwide has moved its offices and studios to 485 Madison Avenue, New York, N.Y., 10022, U.S.A., and has changed its call sign from WRUL to WNYW. New transmitters are expected to be on the air next year.

U.S.A.: WWVH (Box 578, Puunene, Maui, Hawaii) has been heard at between 1150—1210 on 15,000 under the more powerful WWV. Both these stations are standard frequency time signal stations. Positive identification was possible due to the split second difference between signals at the receiver because of the different transmission paths.

Voice of America (U.S. Information Agency, 330 Independence Avenue, S.W., Washington 25, D.C.): Frequency usage for English to Europe is now 3,980 0300—0730, 1400—2345; 5,965 0300—0730, 1630—2200; 5,995/7,200/7,250/9,540/9,635/9,740, 0300—0730; 7,210 1500—2245; 9,565 1700—2245; 9,760 1700—2215; 11,760 0500—0730: 11,790 0300—0730, 1700—2200; 15,205/17,780 1400—2215; 15,290 1400—2245; 15,295 0600—0730; 1,196 0400—0415, 0500—0730, 1600—1830, 2200—2345.

————

A special word of thanks this month to the Swiss Broadcasting Corporation which is now supplying "On the Short Waves" with the script of its broadcast band Dx News programme. Help has also come this month from S. Shaw, J. W. Smith, S. Ormerod, M. Goodwin, A. B. Thompson, J. Clark, G. Roberts, P. de Lacey and Sweden calling Dx-ers.

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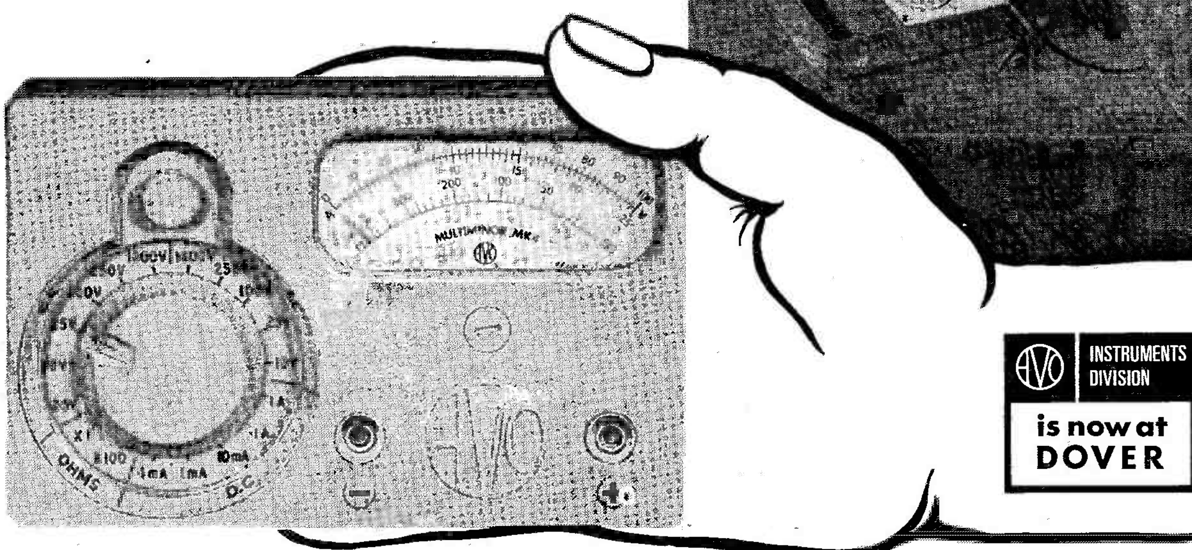

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MM 19

HEY ho! It's been one of those months between 1·8 and 30Mc/s. Reports coming in from all over the country bear the same story as that told by the G3JDG rx, incidentally now an HA-230. To sum-up the month and conditions at the time of writing would sound rather like the usual weather forecast—variable with occasional showers of DX. One "Colin", 840A and a bent nail, informs that 20 was a hive of activity around 1 a.m. BST, yet on one recent late session at '3JDG the only signals which stirred any excitement in the 130 ft. l.w. were numerous Boris's and Vlads happily chirping to each other with T3 notes. (Needless to add T9's were being exchanged.)

Fifteen metres has been wide open to the Far East at times and JA's running 20 watts have romped in at 5 and 7.

Ten metres is becoming more and more interesting with a bit of DX showing up now. The 28Mc/s logs this month are from people with modestly priced receivers and straightforward wire antennas. If you want to be with it "like I dig 10 man" then take 16 ft. 8 ins. of wire, cut it in the middle and feed it with co-ax (any length). Try Sundays for a first listen.

7 Mc/s and Down

A horrible state of affairs this month, almost too terrible to relate but alas I must. Out of all the piles of logs that arrived only two were for the l.f. bands. (Pauses, dries eyes on dirty hanky, and continues). The first log from **E Goonan** (Manchester), 19 set plus a.t.u., 30 ft. end fed, logged some forty odd stations on 7Mc/s. Mostly Europeans (EU's) but from further out came UI8KNA, HM4CS and HM2AXU. Another log from **M Pemberton** (Bucks) CR150, 66 ft. end fed heard G, GC, GW, and DJ, DL, F2, ON5, on eighty, while on forty DJ, DL8, EI, G, GM, LA3 ON5, OZ6, and PY8QM (Brazil).

No reports for top band although several EU's are about down the l.f. end. How about an l.f. month? 1·8/3·5/7Mc/s only. I know this is quite a task and much more difficult than 20 and 15 where the DX just falls like ripe plums. To request someone to listen on 40 metres is like asking them to walk through a pack of mad dogs with a pork chop on each ear—nevertheless, I'm asking! One hour on 40 for each hour on the h.f. bands. Go on live dangerously—I dare you. (No—I will not provide the pork chops!)

The Aitch Eff Bands

Never any shortage of logs for these bands particularly 20 and 15. So many at times that I sort them into those who took the trouble to put the log in alphabetical order and those who did not. Here are reports from those who did. **Chris Claydon** (Fife) 840C, 60 ft. l.w. had a brief listen on 20 and heard BV1USA (Taipei), CR3KD (Bissau, Port Guinea) CR4BC, HI8LC (Santa Domingo), KH6FRI (Hawaii), LU1ZC (Deception Is. Antarctica) UAØ KAE, UWØIF, VP2AZ, VP8IN (Base F, Grahamland Antarctica). **D. Skidmore** (Belper), HE40, 100 ft. end fed, 20 metres all s.s.b.—CN8BB, CR6GC, CX9AAK, EA8AH, EL3C, ET3WH, HV3SJ, IS1VAZ, JA4BJO, JA6AD, KL7EBK, KM6SEN (Midway Is), KR6DI, PY2BEH, SVØWV, TF3EA, UA9TE, UL7BF, VE2ABJ/SU, VE8MP, VK5MS, VP6KL, WA6EKD, W6EDB, XE1FFW, XW8BJ, YV1EC, YV3CN, ZB2AK, ZD7RH, ZD9BE, ZE3MV, 4X4AM, 5N2AAW. **Ian Haworth** (Preston) CR100, 33 ft. end fed, 20—BV1USA, CR6BX, CX2CO, HI7ATM, HK3RQ, HP1FR, JA1,2,6, MP4BBA, KZ5PW, OA3PZ, OX3BF, PY1,2,3,4,5,7, ST2SA, TI8LN, VK1,2,3,4,6,7, 9VW, VP2GR, YV5BIG, ZL5AA (Antarctica), 4X4VH, 5A1CV, 9Q5HF, all phone.

On 15 a log from **F. Le Blancq** (Jersey, C.I.), Pye domestic rx 50 ft. end fed, CR5CA, CR6GL, CX8PS, HB9GR/P, KP4AXC, LU5DJV, LX1DC (Luxembourg), OD5ET, PY2CDY, PZ1BO, SV1BL, TR8IAD (Gabon), TU2BA, XE1RC, ZC4MO, ZS1DV, 5A1TK, 6W8DD (Senegal), 9H1R, 9Q5CB. **Michael Leck** (Lancs) 87OA, 66 ft. end fed, CR6KR, CR7FM, CT1CJ (Portugal), EAØJM, EP3RO, JA2GDT, JA7DTF, K1FZS, K2YXY, K4DI, LX1YL, MP4BBA, PI1HTG, SV1CX, SV1DL, VE3FRV, ZC4HR, ZE2JA, ZE6JL, ZSBD, 4X4KX, 5A1TK, 5A5TE, 5N2AAR, 5X5JK, 9J2K, 9N1JP, 9Q5IA.

Colin Morris (see Ten Metres), found twenty busy with FM8CD, FL8AC, HC8JG, HM9DL, HR1SO, HS1AK/P2, KH6FMS, KW6EJ, KX6BU, OA5W, PJ2MI, PJ3CR, ST2BSS, TI3AA, VP2KD, XE1FFW, YK1AA, 3A2CP, 9M6WQ. **M. Levy** (Kirkella), runs a "not so very good receiver", an S38E. With 66 ft. of wire twenty yielded EP2GF, HC1SM, HS1AK/2, HV3SJ, JA3HF, KL7EBK, KR6MM, LU1CM, MP4BCC, OX3KI, VK2PP, VP6KL, ZD9BE, 5Y3GT, 5Z4IR.

Ten Metres

Yes a separate heading again. Brazil coming in 59, Cyprus 57, Venezuela 59, half Africa at 58 average, this is the story now. **Colin Morris** (Tenbury Wells), double s/het homebrew, dipole—DJ7RD 1852, EL2AK 1724, OD5BU 1853, PY1BYK/P7 1814, PY2BYI 1816, YV5BPJ 1812, YV5AGM 1755, ZC4MO 1747, 5H3JJ 1746, 5Z4AA 1726, 7X2AH 1340, 9H1A 1748, 9J2VX 0825, 9J2MM 1806. Times g.m.t. **Paul Baker** (Pontygasseg) (Fancy sending that on c.w.!) HE30 60 ft. end fed, CT1, DJ, DL, DM, EA4, F, HB9, I1, IT1, OE, ON, OZ, SM, SP, UA2, UB5, UC2, UR2, YO, CR6GP, CR7IZ, K4DI, PY1CRC, ZC4MO, ZS1BV, 4X4IH, 5N2AAR, 9J2VX, 9Q5GW.

News and Notes

Little items of gossip passed my way and now offered for your discerning palates includes VP8IK (Antarctica) bottom end of 7Mc/s (still no pork chops—not even if you hear him!) VS9OC back in business again on the h.f. bands on s.s.b. Kure Island at it on 20 metres look for a /KH6. Also Japanese amateurs, at present JA's are also to include JH call signs shortly. A reminder that now is the time to check the local schools and technical colleges for R.A.E. classes, enrolment usually being early September. Contests for sunny August—alas just one, the WAE c.w. section contest. September 3-4th VHF-NFD. Deadline for next month is the 25th, how about a log from you?

CRYSTAL CONTROLLED OSCILLATORS and TRANSMITTERS

HAM FEATURE

by F.G. RAYER G3OGR

CRYSTAL control of a transmitter has several advantages. Such circuits are simple, easily made and adjusted, and a single h.t. supply can be used for oscillator, p.a. and modulator. There is no need for voltage stabilisation, buffer stages, or other means of avoiding frequency drift with changes in loading, etc. The output frequency is also known from the crystal. For these reasons, crystal control is popular with simple transmitters, or those for portable use. Two or three crystals can provide quite a range of operating frequencies in a number of bands. In addition, the crystal controlled circuit can generally be adapted for a v.f.o. later, the crystal oscillator stage then acting as a buffer.

Triode Oscillators

These are not much used, but are worth considering for a very small or simple transmitter. Two circuits are shown in Fig. 1. The "a" circuit requires no coil, output being at the crystal frequency. A 6C5, 6J5, 6C4 or other triode can be used, or the triode section of a triode-pentode. With the latter, the pentode serves as p.a., allowing very small size in the 5W-10W input range. Most valves and crystals require some capacity from grid to cathode. The 30pF trimmer is adjusted from zero capacity until all crystals oscillate well. About 100-150V will be sufficient for the anode, so the anode resistor can be adjusted or replaced by an r.f. choke, if only a low voltage is available.

Fig. 1b uses a coil L1, tuned to near crystal frequency. If a meter is included in the h.t. circuit, a dip in current is found when oscillation commences. Tune for nearly minimum current, which gives nearly maximum r.f. output. Normally, L1 is not tuned *exactly* to resonance, because the circuit will then not start oscillating when switched on.

With these circuits, output is generally at crystal frequency. This does not matter with single-band operation, but is rather a limitation for multi-band working.

Crystal Harmonics

Various tetrode and pentode oscillators allow output to be obtained on the crystal frequency, and multiples of this frequency. It is necessary that the harmonic falls within the higher frequency band in view. This will be so with some crystals, but not with others. As example, a 3520kc/s crystal would allow working on 3·52, 7·04, 14·08 and 21·12Mc/s. But a 3650kc/s crystal has harmonics (multiples) falling outside the 7, 14 and 21Mc/s bands.

The circuit in Fig. 2 is particularly easy to adjust. L1 is tuned to the crystal frequency, or the wanted harmonic. A fixed or plug-in coil can be used, or coils can be selected by switching. A single fixed coil can sometimes be used for two adjacent bands.

At high multiples, output falls off, until sufficient grid drive for the following stage is no longer obtained. With values shown, a 3·5Mc/s crystal should provide enough grid drive for a 6146, 807, or similar p.a., on 3·5, 7, 14, and 21Mc/s. The 6CH6 requires about 25mA. Grid current in the following stage can be adjusted by slightly detuning L1.

When first setting up an oscillator or transmitter of this kind, check that the correct harmonic is being used. This is most readily done with a wavemeter. Wrong harmonics can then be avoided.

It is helpful to prune L1, or have an adjustable core, so that only one correct harmonic is tunable

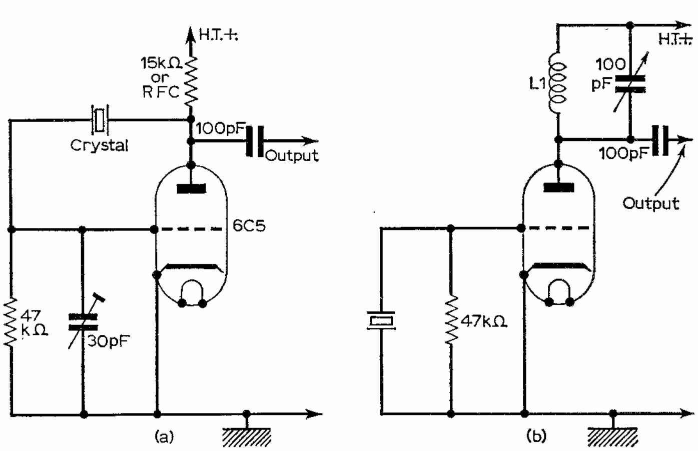


Fig. 1 (a and b): Two simple triode oscillators.

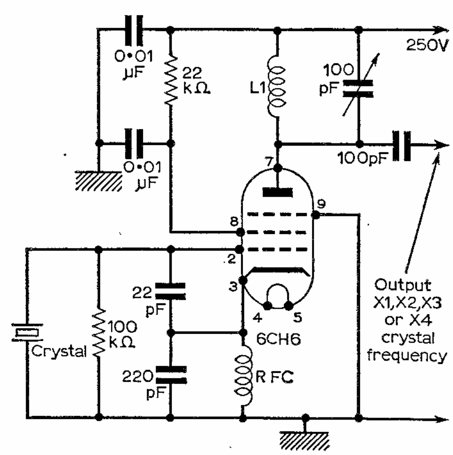


Fig. 2: Oscillator with output on fundamental and harmonics.

with each coil. If this is done, the capacitor can be reduced to 25pF. Wrong harmonics cannot then be reached.

When obtaining maximum grid drive to the next stage, with a high frequency multiplication, L1 should be chosen so that the parallel capacity is small. This is not important on 3·5, or 7Mc/s, and may not matter on 14Mc/s, but may make all the difference on 21 and 28Mc/s. With switching, absorption by unused coils can also cause losses which reduce grid drive.

Crystal Switching

It is often convenient to have the crystal holder on the front panel or fit a switch for easy changes in frequency. Fig. 3 shows a suitable circuit for three crystals, X1, X2 and X3.

Fig. 3 also allows the input from a v.f.o. to drive the crystal stage. Even with a v.f.o. available, it is sometimes convenient to have a crystal or two for frequency checks.

A co-axial lead takes the v.f.o. output to the socket shown. To avoid instability or frequency pulling it is generally better to use the crystal stage as a doubler. So the v.f.o. can be on 1·8Mc/s for 3·5Mc/s, or 7Mc/s for 14Mc/s (doubling). The crystal stage can also triple (21Mc/s operation with 7Mc/s v.f.o.) with good results. A v.f.o. giving outputs on 1·75Mc/s and 7Mc/s bands will permit working all frequencies from 3·5-28Mc/s.

Crystal Holders

Crystals have a wide range of bases, with holders to suit. It is best to have all with similar pins. If some different crystals are to hand, an adapter can be made as in Fig. 4. This has two pins to fit the normal crystal holder, mounted on a paxolin strip. Two "sockets" bent from brass receive the pins of the crystal. The adaptor allows a small crystal to be used in a large holder, or the reverse, according to construction. Holders can also be purchased which take either ½in. pin spacing or ¾in. pin spacing crystals, but some of these will no longer be satisfactory with small pin crystals once a large pin crystal has been inserted.

An ordinary octal holder will take FT243 type crystals. Other sockets can be used for heater and h.t. circuits, as in Fig 4. This allows a crystal or v.f.o. to be plugged into the same panel mounted octal holder.

The ¾in. spacing type of crystal will fit a UX5 (807 type) holder. Again, spare sockets can be used

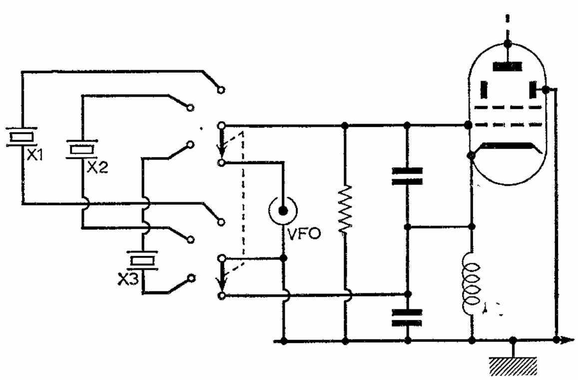


Fig. 3: Crystal switching and v.f.o. input circuitry.

to supply power to an optional v.f.o. It is also possible to have crystal/v.f.o. switching, with power for the v.f.o. from a separate power pack, or taken from the transmitter by means of a separate multi-way plug.

Multi-Band Transmitter

Fig. 5 is a transmitter circuit allowing multi-band working with a minimum of difficulty. L1 is tuned to the crystal frequency, or required multiple. About 3mA to 4mA grid current is usual for the 807, and a 3·5Mc/s crystal should give 5mA drive on 14Mc/s and lower frequency bands.

For a single band, L1 and L2 can be fixed. This simplifies building when interest is mainly in one band. For multi-band work, plug-in coils or switching is required. Normally, the p.a. (807) is always driven on the same frequency as the output, because doubling here reduces efficiency.

H.T. for the crystal oscillator can be drawn from the same pack as supplies the p.a. If so, add a series resistor so that about 250-300V is obtained. A single meter, with switching, can be used for p.a.

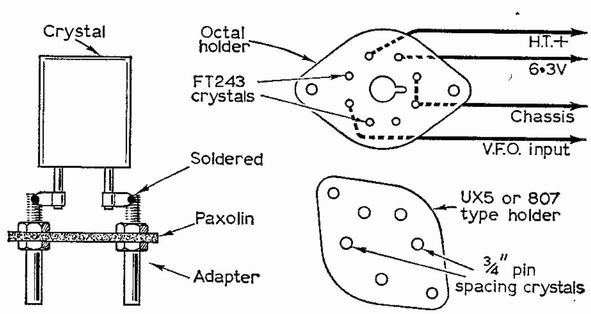


Fig. 4: Crystal adapter and plug-in holder for v.f.o.

grid and anode, but separate meters are an added convenience. A switch to apply h.t. to the oscillator only is also very useful indeed, so that grid current can be checked and operating frequency noted with the receiver.

The p.a. anode anti-parasitic choke can be 5 turns of 20 s.w.g. wire in a coil ½in. long and ⅜in. The diameter. around a 1-watt 47 ohm resistor. The 807 works well with 100mA anode current. This is 30W input with 300V, 40W with 400V, and so on up to 60W with 600V. The screen resistor Rs is adjusted to obtain about 250-275V on the screen grid, measured with the transmitter working.

For c.w., any of the usual keying methods can be employed. Cathode keying is most simple. For phone, a push-pull modulator furnishing an audio output equal to about one-half the p.a. input gives excellent results. Fixed capacitors should have a voltage rating at least twice that of the h.t., or preferable 1·5kV or higher for 600V.

VC1 should be wide spaced. A 200pF capacitor is suitable for all bands, but for h.f. bands only 100pF is easily sufficient. VC2 is a 2-gang or 3-gang broadcast receiver type component, with a maximum total capacity of about 800pF to 1500pF in all. The p.a. should not be operated without a load—aerial, r.f. output meter, 60-watt domestic lamp, or other equivalent device. With VC2 closed, VC1 is dipped for minimum anode current. VC2 is then opened until the dip on VC1 corresponds to 100mA (or other chosen input).

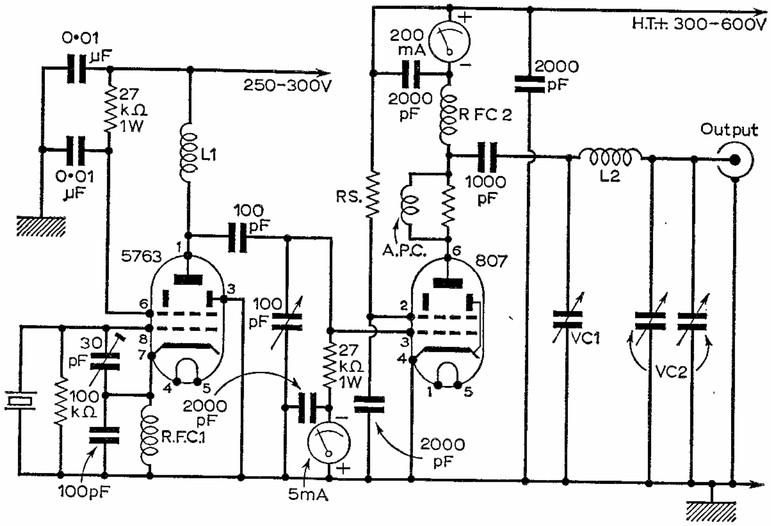
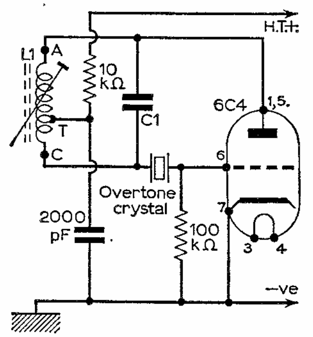


Fig. 5: Transmitter circuit for the 3·5–28 Mc/s bands.

Fig. 7: Overtone oscillator for h.f. or v.h.f. bands.



The 30pF trimmer is only screwed down sufficiently to obtain enough grid drive with all crystals. Grid current is reduced, when necessary, by detuning the p.a. grid capacitor.

Oscillator Anode Coils

Very many different coils are suitable for L1 (shown in Figs. 2 and 5). Receiver type coils can often be used. A frequency check can be made with a grid dip oscillator, so that the coil core (or number of turns) can be adjusted, if necessary. Alternatively, apply h.t. to the oscillator only, tune the unknown coil for maximum p.a. grid current, then check the harmonic obtained with a wavemeter.

Two circuits for switch selection of various bands are shown in Fig. 6. Circuit "a" employs a single, tapped coil. This can be wound on a 1in. diameter paxolin tube. Section 1 is 35 turns of 26 s.w.g. enamelled wire side by side, followed by ⅛in. space. Section 2 has 15 turns side by side, also 26 s.w.g. enam. A ¼in. space is left and sections 3 and 4 are wound so that there are 13½ turns in all, of 20 s.w.g. enamelled or bare wire, occupying ⅞in. Section 3 is 6 turns, and section 4 is 7½ turns. Connections must be short and direct, with C1 from coil to VC1 rotor, and C2 having short leads from anode and coil to VC1 also.

The "b" circuit uses separate coils and VC1 can be smaller, without causing difficult coil pruning, because 3·5, 7, and 14Mc/s band coils have adjustable cores. The 21Mc/s coil can be made out of self supporting, stout wire, and can be adjusted by compressing or stretching it. The 28Mc/s band coils can also be made in this way. The individual coils must be placed to avoid absorption by unused windings, or grid drive will be reduced badly.

For 28Mc/s six turns of 18 s.w.g. wire in a coil ⅝in. diameter and ½in. long should prove suitable. The 21Mc/s coil can be nine turns of 20 s.w.g. wire ⅝in. diameter and ¾in. long. For 14Mc/s, 17 turns of 20 s.w.g. ⅝in. diameter and 1in. long may be used. On these bands, stray wiring and capacity greatly influence coverage, so turns may have to be adjusted.

It is not worth winding coils for the lower frequency bands. For 7Mc/s, a coil adjustable through about 11µH should suffice, with about 40µH for 3·5Mc/s. If VC1 is larger, there is much more latitude in coil inductance, but h.f. bands should be reached with VC1 nearly completely open for the reason described.

PA Coils

Individual coils, placed across terminals or plugged in, are very satisfactory here. For one band only, a fixed coil is used. For multi-band coverage, a coil can be wound on a 1½in. diameter former, with 16 s.w.g. wire for 21/28Mc/s, and 20 s.w.g. for 7/3·5Mc/s. Wind 25 turns of 20 s.w.g. and 10 turns of 16 s.w.g. in series, with a space of ¼in. between them, separating turns so that the 25 turns occupy 1¼in. and the 10 turns 1¼in. Tap the larger winding at 16 turns for 7Mc/s, and the smaller coil at six turns for 21Mc/s. The whole 10 turns are employed for 14Mc/s. Switching is the same as in Fig. 6 "a". Turns in circuit are thus 6 for 21Mc/s, 10 for 14Mc/s, 19 for 7Mc/s and 35 for 3·5Mc/s. Switch rotor goes to VC2.

A 28Mc/s coil can have five turns, ¾in. in diameter and 1in. long, using 14 or 16 s.w.g. wire. It may need a little adjustment, depending on layout.

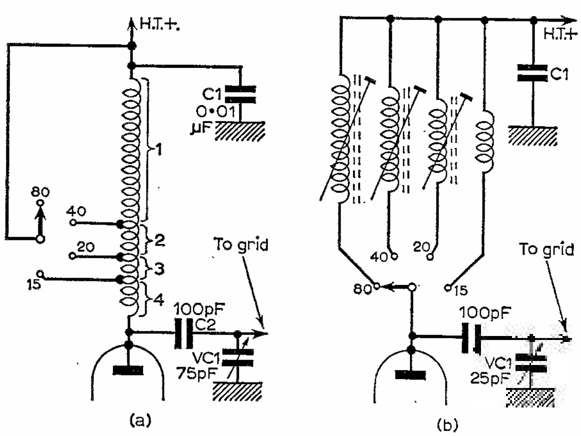


Fig. 6: Oscillator anode coil circuits.

Construction

The construction of a transmitter with a circuit such as that in Fig. 5 is very straightforward and snags are unlikely. A normal layout permits L1 to be under the chassis, with L2 and all anode components in the p.a. above the chassis. Wiring is short and direct, with by-pass capacitors directly to the chassis.

When first using the transmitter, a test should be made that grid drive is in fact on the correct frequency, as mentioned. The tuning of the p.a. anode coil should be done on low power; by reducing h.t. or temporarily fitting a 47kΩ screen grid resistor. Some change to grid current, with anode tuning, is normal, especially on the h.f. bands.

Adjusting VC1, Fig. 5, should cause a smooth dip in anode current. Changes in anode current at other settings are unlikely, but indicate parasitic or other unwanted oscillation. Stray back coupling from anode to grid, due to a poor layout, is a likely cause.

With the crystal removed, grid current should be zero, and no r.f. output obtained. For these tests, p.a. input (with an 807) should not exceed 20-25 watts.

Overtone Oscillator

For h.f. and v.h.f. bands, an overtone crystal oscillator has several advantages. A typical circuit is shown in Fig. 7. One or more stages of multiplication will be avoided, and the lowest frequency obtained is the overtone frequency (not the crystal frequency).

One application of this circuit is in a 144Mc/s transmitter. A 8Mc/s overtone crystal will provide a direct output on 24Mc/s, L1 being tuned to this frequency. A tripler stage then gives 72Mc/s, with a doubler providing the final conversion to 144Mc/s.

C1 may often be omitted, or is very small (say 2·5pF). If a number of crystals are used, a miniature variable capacitor, panel controlled by an insulated extension, is handy to obtain reliable starting and best output. The crystal should be an overtone type. Some are marked with the overtone frequency they produce (e.g., 24 Mc/s) while others have the fundamental (not used) specified.

When first testing the circuit, the tapping T on L1 may have to be moved. If this is too near the crystal end C, output may be poor, or no oscillation obtained. But if T is too near the anode end A, oscillation may arise on any frequency to which L1 is tuned, and is no longer crystal controlled. With T correctly placed, oscillation only arises as L1 is tuned through the overtone frequency, as with a conventional oscillator (shown in Fig 1b).

For 24Mc/s output with an 8Mc/s 3rd overtone crystal, 20 turns of 26 s.w.g. wire on a ¼in. diameter cored former should be found suitable, using a 1·5pF fixed, or preferable 2·5pF pre-set or variable capacitor in the C1 position. The tapping T can initially be 7 turns from C.

Similar circuits can be used for 28Mc/s band working, to avoid multipliers. The overtone obtained by L1 should be checked with a grid dip oscillator or wavemeter. The coils needed may appear unusually large for the band, because of the extremely small capacity.

Wavemeter

A simple wavemeter for checking in the 3·5-28Mc/s range can be made from a coil and parallel variable capacitor. It can be calibrated from a grid dip oscillator, signal generator, or receiver. To calibrate from a receiver, loosely couple the wavemeter to a loop in the aerial connection, and tune it to produce a dip on the signal strength meter of the receiver, with transmissions for the wanted bands.

An easily made wavemeter is shown in Fig. 8. If made *exactly* as described, calibration should be of sufficient accuracy to allow the Amateur bands

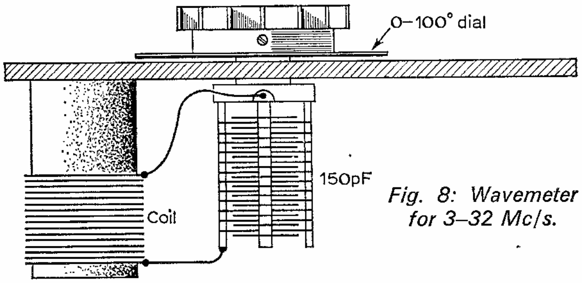


Fig. 8: Wavemeter for 3–32 Mc/s.

to be identified, and a check on readings can be made, so that they can be corrected, if necessary. Two coils are required. In view of the few items needed, it is easy to make two complete wavemeters, one for each band.

Each coil is wound on 1in. diameter smooth paxolin, using 24 s.w.g. enamelled wire, with turns side by side. The small coil has seven turns, and the large coil 35 turns. The free ends of windings are 2in. long. The capacitor is 150pF, with semicircular vanes. The dial is 0-100, zero being with the plates unmeshed. The following calibration was obtained:

Small coil		Large coil	
Frequency (Mc/s)	**Dial Reading**	**Frequency (Mc/s)**	**Dial Reading**
10·0	8	32	8
9·0	9	30	9
8·0	12	28	10
7·0	15	26	12
6·0	20	24	14
5·0	30	22	16
4·5	38	20	20
4·0	57	18	25
3·5	62	16	31
3·0	82	15	36

To check the p.a. drive frequency, place the wavemeter coil near the oscillator anode coil L1, and tune the wavemeter until a dip is observed in p.a. grid current. The band (crystal harmonic) can then be seen on the wavemeter dial.

An initial check of p.a. anode tuning can be made with no h.t. applied to the p.a. If VC2 (Fig. 5) is closed a fairly steep rise in signal strength, as shown by a receiver signal strength meter, will be seen when VC1 is tuned to resonance. That is, L1, L2 and the receiver all tuned to the same frequency. Normally, a small dip in grid current can also be seen on the grid meter when L2 is tuned through resonance. This is extremely small on 3·5Mc/s, but may be 0·1mA or so on the h.f. bands. ■

CLUB SPOT

Left to right: David Jeanes VK2BSJ (visitor), Peter Hearson G3SIU (treasurer), A. E. Roberts G3RUR, R. J. Pigou G3CRP, John Stuart G3TUM (chairman), E. K. Williams G8VY, George Herbert (assistant secretary), J. A. Payter G3GXA, Rev. Fr. Ray Sturzenhecker DJ5SJ (visitor) and Gordon Lloyd-Dalton (secretary).

The Science Museum Radio Society, founded in 1955 by a small group of Civil Servants on the Museum staff, widened its membership to take in all Civil Servants and those in allied occupations in 1957. At the same time the Society's name was changed to the Civil Service Radio Society. Today the Society is over one hundred strong and has a balanced membership—about half holding transmitting licences.

REGULAR MEETINGS

Monthly meetings take place on the third Tuesday of the month throughout the year in the Demonstration Room, First Floor, Science Museum. Members may operate the well-known GB2SM transmitter and meet in the less formal atmosphere of a general gathering. These "informal" meetings are very popular and the evening PRACTICAL WIRELESS attended, two other visitors came along — Rev. Fr. Ray Sturzenhecker DJ5SJ from Frankfurt, Germany, and David Jeanes VK2BSJ from Rockdale, NSW, Australia. Although neither visitor operated GB2SM, Dave spent all Sunday on-the-air at the chairman's home (John Stuart G3 TUM) before returning to Australia. Ray will be in Britain for some time lecturing at Wimbledon College, where he plans to start a boys' radio club.

UNLICENSED STATION

Station GB2SM listens out for members from 6 to 6.45 p.m. on club nights. This station is unique in as much as it is unlicensed (being on Crown property) and is extremely well equipped—most of the gear being on "permanent loan" from manufacturers.

The Society provides operators for station GB2SM for many of the amateur contests and their skills (coupled with the first-class gear) can be seen from the premier awards displayed in the clubroom. The Society also runs a "ham" competition, open to all members, annually awarding a trophy known as the "Museum Key". John Springate G3CAZ, is the current recipient.

WORKSHOP FACILITIES

Later this year the Society will be able to offer workshop facilities to members, through the co-operation of the Civil Service Sports Council—at a Westminster address.

Beginners to radio and audio are already made welcome at the Society and most members are only too willing to loan technical publications and textbooks.

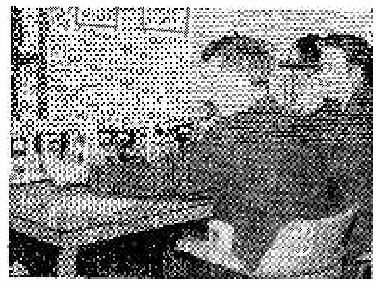
FORTHCOMING LECTURES

Although the 1966/67 winter season meetings have not yet been finalised, the society hope to include talks on the following subjects: relays, their uses, and practical circuits; short-wave listening; the Post Office Tower; general approach to aerials (by a consultant); building-up kits; a hi-fi demonstration by a noted manufacturer; and propagation, etc. These meetings will be additional to the "informal" meetings.

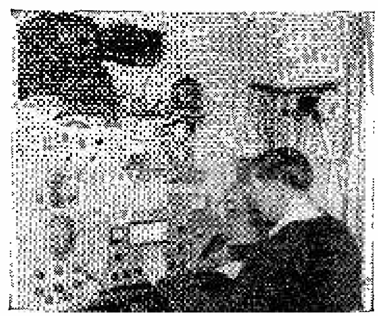
MEMBERSHIP

Full membership is only granted to members of H.M. Civil Service and their wives, whereas anyone in comparable employments (in the railway service, banking, industry, etc.) can become associate members.

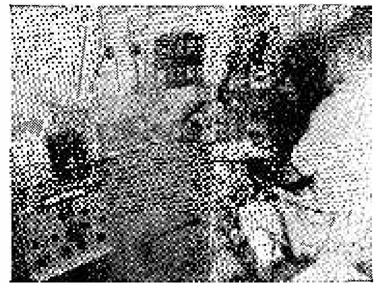
Readers interested in joining the Society should either go along to one of the "informal" meetings held at the Science Museum or drop a line to the secretary: G. Lloyd-Dalton, 2, Honister Heights, Purley, Surrey.



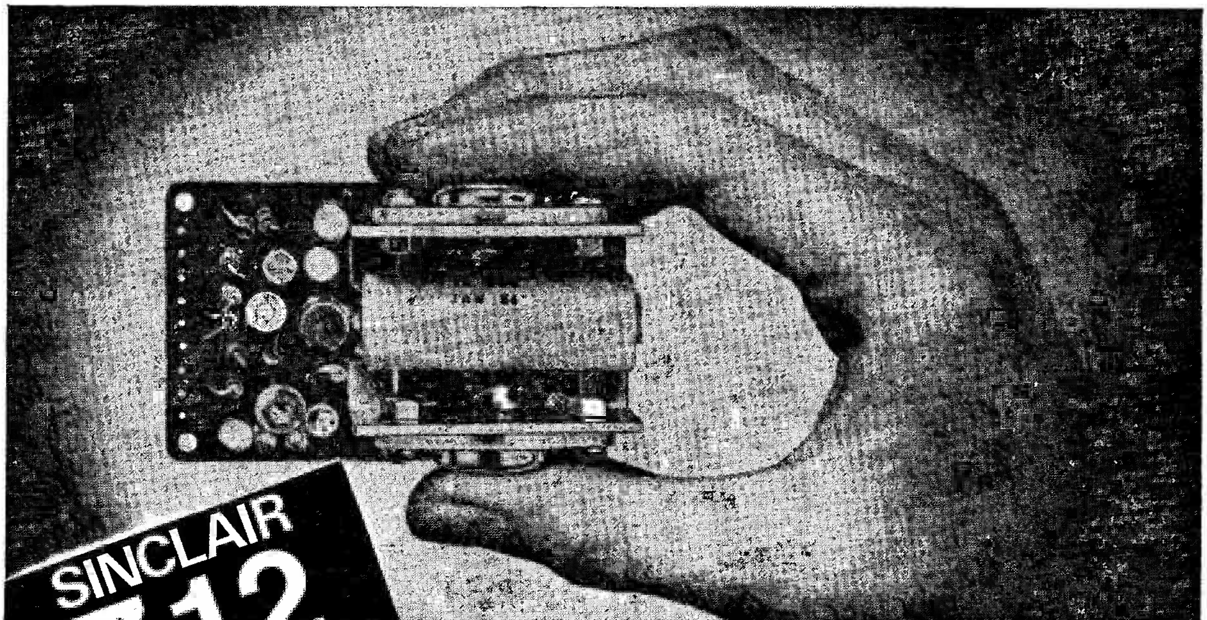
G3CRP and G3RUR operating the GB2SM s.s.b. transceiver.



Peter Hearson G3SIU has just completed the s.s.b. transceiver (G2DAF, Mk.II) shown in centre of the photograph. It took him the best part of two years to build.



John Stuart uses two transmitters, a home-made top-band job with 10 watts output and a Heathkit DX 40U with v.f.o.



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UNEQUALLED FOR QUALITY AND POWER

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CONTINUOUS SINE WAVE (24 W. PEAK)

15 WATTS R.M.S. MUSIC POWER
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The Sinclair Z.12 has been developed to the highest possible standards for an amplifier of its size and power. At the same time its rugged construction and its amazing adaptability make it possible to use just ONE type of amplifier in an exceptionally wide variety of applications. Eight special H.F. transistors are used in a highly original circuit to achieve the characteristics demanded of any quality amplifier, irrespective of price, yet this Sinclair unit costs well under £5.0.0, including its own integrated pre-amplifier stage. It will function efficiently from anything between 6 and 20 volts, making it very convenient to run the Z.12 from a car battery, for example. Where it is required to run the Z.12 from mains supply, the PZ.3 is recommended. The Z.12 accepts radio, microphone and pick-up inputs, and detailed instructions for connecting these in mono and stereo are given in the manual supplied with every unit, together with a variety of matching control networks. Those wishing to have the very finest pre-amplifier and control system can connect inputs via the Stereo 25, a new unit designed specially for use with the Z.12 to produce the very finest stereophonic hi-fi you have ever heard—and the saving to you in cost is fantastic.

TECHNICAL SPECIFICATION

The Sinclair Z.12 combined twelve watt amplifier and pre-amplifier uses eight H.F. transistors in an original design developed by Sinclair Radionics to ensure exceptional standards of reproduction. The pre-amp incorporated accepts all types of inputs. For the very best possible hi-fi stereo, two Z.12's should be used with the Sinclair Stereo 25 described opposite.

- **OUTPUT**—Class B, ultra-linear, with generous negative feed-back
- **FREQUENCY RESPONSE**—15 to 50,000 c/s ± 1dB
- **INPUT SENSITIVITY**—2 mV into 2 K ohms
- **SIGNAL TO NOISE RATIO**—better than 60dB
- **OUTPUT IMPEDANCE**—suitable for 3, 7·5 and 15 ohm loudspeakers. Two 3 ohm speakers may be used in parallel
- **POWER REQUIREMENTS**—6 to 20 volts D.C. or Sinclair PZ.3.
- **QUIESCENT CURRENT CONSUMPTION**—15 mA

Z.12 USERS WRITE

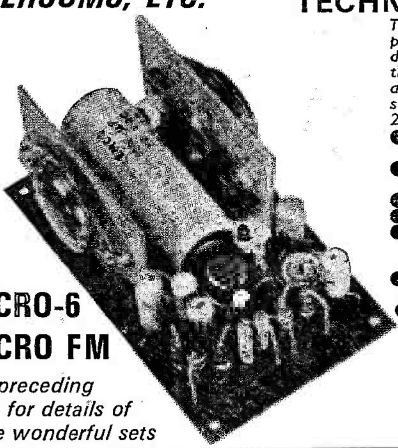
"I fitted it up for a guitar. It (Z.12) is a marvellous instrument and money well spent." *R.M.K., Lanark.*

"Members of our staff are ordering Z.12's for personal use they were so impressed by the one we have in use now. I now need a second Z.12 (by air mail please)." *A.J.V., O'sea Telecommunications Commission, New Guinea.*

"I am most pleased with its terrific performance." *H.R.L., Weston-super-Mare.*

"Fidelity is well up to the standards I require for a tuner and record player system." *A.C.R., Nottingham*

"It gave us all the power we required to compete with all comers as well as traffic. We can thoroughly endorse your claims for this truly remarkable piece of equipment." *H.T.N., Orpington. Kent.*



MICRO-6
MICRO FM

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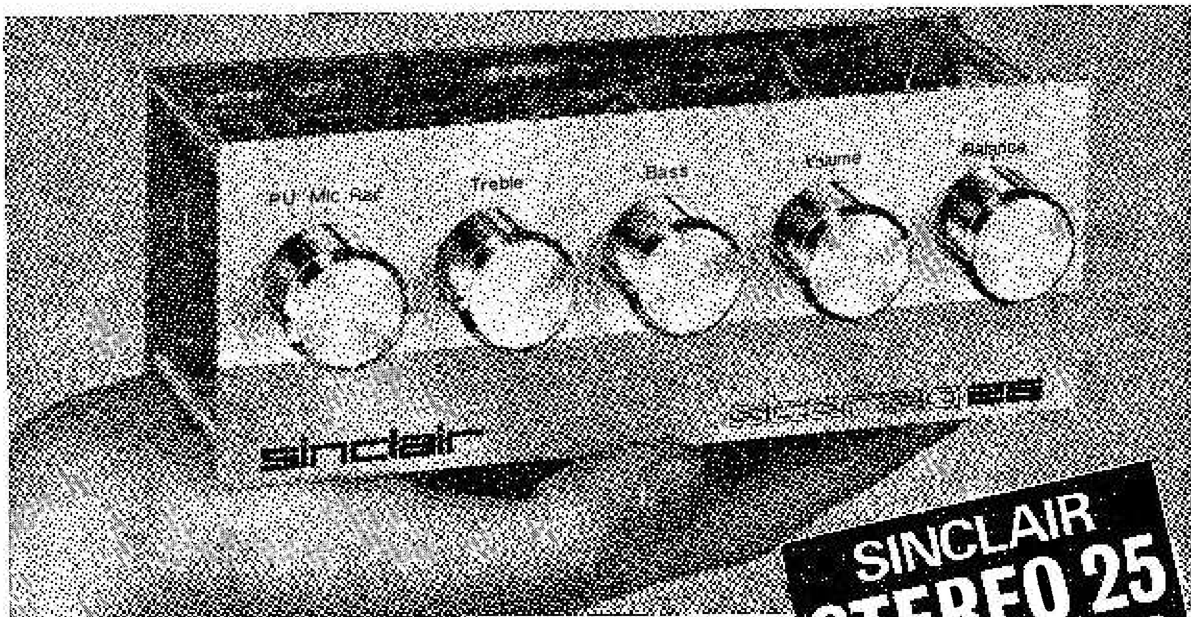

SINCLAIR STEREO 25
DE-LUXE PRE-AMPLIFIER AND CONTROL UNIT

A new design built to the finest standards of high fidelity

Sinclair's newest unit, the Stereo 25 has been designed specially to obtain the very finest results used in conjunction with the Sinclair Z.12 for stereo reproduction. The best quality components, individually tested before acceptance, are used in its construction, ganged controls are carefully checked for matching, whilst the overall appearance of this very compact de-luxe pre-amp control unit reflects the professional elegance which characterises all Sinclair designs. The front escutcheon panel is in solid brushed and polished aluminium with beautifully styled solid aluminium knobs. Mounting the unit is simple, and the generous output of the PZ.3 is more than enough to power the Stereo 25 together with two Z.12's for stereo. Hi-fi enthusiasts seeking the ultimate in equipment for domestic listening will find all they want from this combination of Sinclair units, and with a Micro FM to provide the radio, their installation will compare favourably with anything costing up to five times as much. When fitted, the Sinclair 25 will grace any type of hi-fi furniture.

TECHNICAL SPECIFICATION

Performance figures quoted here were obtained using the Sinclair Stereo 25 fed to two Z.12's and the entire assembly powered by a PZ.3 Mains Power Supply Unit.

- **SENSITIVITY** for 10 watts into 1.5 ohms load per channel
  Mic.—2 mV into 50 K ohms
  Pick-up—3 mV into 50 K ohms
  Radio—20 mV into 4.7 K ohms
- **FREQUENCY RESPONSE** (Mic. and Radio) 25 c/s to 30 kc/s ± 1dB extending to 100 kc/s ± 3dB
- **EQUALISATION FOR P.U.** Correct to within ± 1dB on RIAA curve from 50 c/s to 20 kc/s.
- **TONE CONTROLS**
  Treble +12dB to—10dB at 10 kc/s
  Bass +15dB to—12dB at 100 c/s
- **SIZE**—$6\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{2}$ ins. overall, plus knobs
- **FINISH**—Front panel in brushed and polished solid aluminium with solid aluminium knobs. Black figuring on front panel.

BUILT TESTED AND GUARANTEED **£9.19.6**

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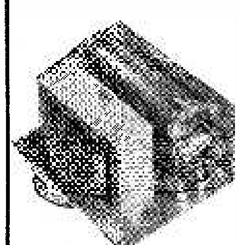
All you need is one **Stereo 25** Pre-amp Control Unit (£9.19.6), two **Z.12's** (£8.19.0) and one **PZ.3** Mains Power Supply Unit (£3.19.6) to possess the finest possible hi-fi stereo installation. As a very desirable optional extra, you could include the **Micro FM** (£5.19.6) described on page one of our advertising. The overall saving to you in cash will be staggering, and you will have an installation second to none irrespective of price.

SINCLAIR PZ.3
TRANSISTORISED POWER SUPPLY UNIT



Designed specially for the very high standards of the Z.12, this entirely NEW power supply unit uses advanced transistorised circuitry to achieve exceptionally good smoothing. Ripple is a barely measurable 0.05 V. The PZ.3, will power two Z.12's and the Stereo 25 with ease.

79/6

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30 SUGGESTED PROJECTS

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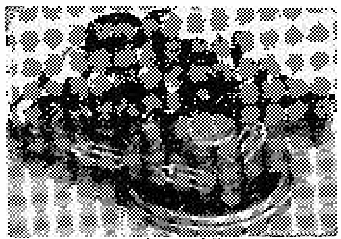
6 TRANSISTOR PRINTED CIRCUIT RADIO



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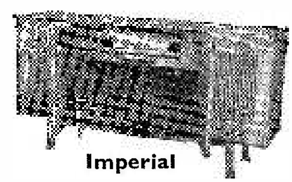

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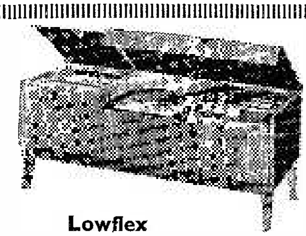

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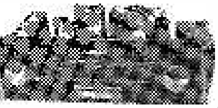

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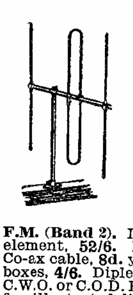

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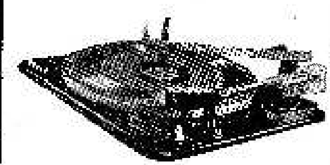

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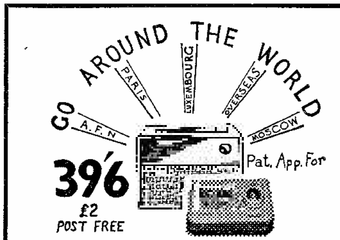

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OC25	12/-	OC83	6/-	ACY21	7/-
OC26	8/-	OC139	12/-	ACY22	5/-
OC28	17/6	OC140	16/-	AF114	9/-
OC29	17/6	OC141	25/-	AF115	9/-
OC35	15/-	OC170	7/-	AF116	8/-
OC36	15/-	OC171	8/-	AF117	6/-
OC42	7/6	OC200	9/6	AF118	17/6
OC44	6/-	OC202	15/-	GET114	5/6
OC45	5/-	OC204	17/6	GET115	8/6
OC70	5/-			GET116	12/-
OC71	5/-	OC205	20/-	GET875	9/-
OC72	6/-	OC206	22/6	GET880	10/-
OC73	11/-	2N697	13/-	MAT101	8/6
OC75	6/-	2N1132	37/-	MAT121	8/6
OC76	6/-	2S002	20/-	T1166	6/-
OC77	8/-	2S004	15/-	V30/30P	20/-
OC78	6/-	2S006	20/-		

Complementary pair: One 2N697 and one 2N1132, 50/-.

STC SILICON JUNCTION RECTIFIERS, HALF WAVE, 3 AMPS D.C.

RS320, 280 piv, 5/- RS350, 700 piv, 7/6
RS330, 420 piv 6/- RS360, 840 piv, 8/-
RS370, 980 piv, 9/-
RS340, 560 piv, 7/- RS380, 1120 piv, 10/-

ZENER DIODES

230mW OAZ242 (5.6v ± 5%) 7/6
250mW 10% BZY11 (60v); BZY13 (80v), 6/6
260mW 5% OAZ200 (4.7v), 10/-; OAZ201 (5.1v), 9/6
OAZ202 (5.6v), 6/-; OAZ203 (6.2v), 7/-
OAZ204 (6.8v), 6/6; OAZ205 (7.5v), 6/-
OAZ206 (8.2v), 8/-; OAZ207 (9.1v), 9/6
260mW 15% OAZ208 (4.3v), 6/-; OAZ209 (4.7v), 6/-
OAZ210 (6.2v), 6/-; OAZ211 (7.5v), 5/6
OAZ212 (9.1v), 7/6; OAZ213 (12v), 6/6
1.5W 5% ZNB10 (10v), 7/6; ZNB20 (20v), 9/6
2.25W 10% VR425 (4.25v); VR475 (4.75v);
VR575 (5.75v), all at 6/6
5.25W 10% VR7A (7.0v); VR11A (11v); VR13A (13.0v)
VR575A (5.75v), all at 8/-
7W 5% OAZ224 (7.0v), 10/-

GERMANIUM POINT CONTACT DIODES

OA5	4/6	OA79	2/3	AAZ12	8/4
OA6	4/-	OA81	2/-	CG4E	2/-
OA7	4/-	OA85	3/-	CG10E	1/6
OA10	8/-	OA86	3/6	CG12E	2/-
OA70	2/-	OA90	2/-	GEX23	1/6
OA71	4/6	OA91	2/3	GEX44	1/6
OA73	1/6	OA95	3/-	GEX54	2/-

TEXAS SILICON FULL-WAVE BRIDGE RECTIFIERS

1B20K10 100 piv, 2 amps., dimensions 1.4 x 1.4 x .6in. 25/-
1B40K10 100 piv, 4 amps, dimensions 1.4 x 1.4 x .6in. 30/-
1B100M10, 100 piv 10 amps, dimensions 2¼ x 2¼ x 1in. 85/-
Postage 1/6 per rectifier.

GERMANIUM JUNCTION STUD MOUNTED POWER RECTIFIERS

GJ3M, 200 piv, 500mA/1 amp 3/6
GJ5M, 300 piv, 500mA/1 amp 3/6
GJ6M, 150 piv, 800mA/1 amp 3/6
GJ7M, 80 piv, 500mA/1 amp 3/6
Higher ratings refer to cooling fin mounting

HEADPHONES No. 10 ASSEMBLY

Moving Coil Headphones with moving coil Hand Microphone fitted with press-to-talk switch. Rubber earpads. Cord terminated with army type 5-point moulded connector. Low impedance. Brand new. 20/- each.

Small quantities available of second hand assemblies, checked, in perfect order. 8/6 each.

P. & P. 3/6 per set.

MISCELLANEOUS SILICON HALF WAVE POWER RECTIFIERS

SJ102A (AEI) 100 piv, 2.4A 7/6
SX642 (AEI) 120 piv, 270mA 3/6
OA202 (Mullard) 150 piv, 160mA 5/-
IS001 (Texas) 200 piv, 750mA 3/6
BYZ13 (Mullard) 200 piv, 6 amps 7/6
DD006 (Lucas) 400 piv, 500mA 6/-
OA210 (Mullard) 400 piv, 500mA 6/6
DD226 (Lucas) 400 piv, 1 amp 6/-
RS26AF (STC) 500 piv, 100mA 3/6
1IS004 (Texas) 500 piv, 750mA 7/6
RS27AF (STC) 600 piv, 100mA 4/-
BY100 (Mullard) 700 piv, 450mA 7/-
RS28AF (STC) 800 piv, 100mA 5/-
OA211 (Mullard) 800 piv, 500mA 9/6
DD058 (Lucas) 800 piv, 500mA 12/6
SL800 (AEI) 800 piv, 6 amps, equiv. to BYZ10.... 10/-

SPECIAL OFFER OF METERS

350mA R.F. Thermocouple 2in. plug-in 12/6
1 Amp R.F. Thermocouple 2½in. projecting 12/6
500μA D.C. M.C. 2in. Round Flange Mounted 10/-
30mA D.C. M.C. 2½in. Round Flange Mounted 12/-

Please offer us your surplus valves; urgently required klystrons 723A/B and 2K25, 30/- paid subject to test

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The following blueprints are available from stock. Descriptive text is not available but the date of issue is shown for each blueprint. Send, preferably, a postal order to cover the cost of the blueprint (stamps over 6d. unacceptable) to Blueprint Department, Practical Wireless, George Newnes Ltd., Tower House, Southampton Street, London, W.C.2.

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The PW Britannic Two ... ... / The PW Mercury Six	(May 1962)	6/-
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(*b*) We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuitry.

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