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MARTIN RECORDAKITS

HALF TRACK

Collaro Studio Deck. Very latest model, 3 speeds, 7in. spools £10.19.6
Deposit £1.2.0 and 8 monthly £1.7.3

Tape Amplifier for Studio Deck with ready wired printed circuit, control and input panels, mains and output transformers, knobs, plans, screws, etc. EF86, ECC83, EZ80, EM85 and 2 EL84. 3 watts output. Magic eye, radio and Mic. inputs. Ext. speaker socket. Tone and Monitor controls. Can be used as an amplifier £11.11.0
Deposit £1.4.0 and 12 monthly 19/-

Case for above, with 9 x 5in. speaker, two tone grey £5.5.0

Complete Kit with Tape and Microphone £29.0.0
Deposit £2.18.0 and 12 monthly £2.8.2

B.S.R. Monardeck TD2, latest model 5¾in. spools £9.9.0
Deposit £1.0.0 and 9 monthly £1.1.0

Tape Amplifier for B.S.R. Deck, printed circuit ready wired with ECC83, ECL82, EM85 and EZ80. Complete with all plugs, sockets, panels, knobs, etc. The whole amplifier mounts on to the deck making a self-contained unit £8.8.0
Deposit £1.0.0 and 8 monthly £1.1.0

Building Instructions available at 2/6 each kit (refunded if kit bought).

JASON F.M. TUNERS

FMT1, complete with 4 EF91 valves £8.6.6
Deposit £1.0.0 and 8 monthly £1.0.9

FMT2, less power, complete with 4 EF80 valves £10.12.6
Deposit £1.8.6 and 12 monthly 17/5

FMT2, with power, complete with 4 EF80 and 1 EZ80 ..... £12.18.6
Deposit £1.8.6 and 12 monthly £1.1.1

FMT3, Fringe complete with valves, less power £12.10.0
Deposit £1.5.0 and 12 monthly £1.0.8

FMT3, with power, complete with all valves £14.15.0
Deposit £1.9.6 and 12 monthly £1.4.5

JTV/2, switched F.M. and TV sound, self powered, all valves £17.0.0
Deposit £1.14.0 and 12 monthly £1.8.2

Mercury II, as JTV/2 but less power, all valves £11.12.6
Deposit £1.5.6 and 8 monthly 19/-

Instruction book is included in all kits, but otherwise 2/6 and 3/6.

JTV/2, ready built, state channels £22.5.0
Deposit £2.4.6 and 12 monthly £1.16.11

Monitor, ready built (as Mercury II) £16.10.0
Deposit £1.13.0 and 12 monthly £1.7.4

AMPLIFIERS (MONO)

Linear L45. 3 watt, 3 valve £5.19.6

Linear Diatonic, 12 watt, suitable Mic. or Guitar £12.12.0
Deposit £1.7.0 and 12 monthly £1.0.8

Linear Concord, 30 watt, ideal Guitar amp. with case £18.0.0
Deposit £1.16.0 and 12 monthly £1.9.10

Dulci GA5, integrated amp. and P.A., 5 watt, ECL86 valve £13.2.6
Deposit £1.8.6 and 12 monthly £1.1.6

Dulci DPA15, 15 watt with 2 valve pre-amp £25.4.0
Deposit £2.10.6 and 12 monthly £2.1.11

Tripletone Hi-Fi Major with pre-amp. Guitar or Mic. £15.18.9
Deposit £1.15.3 and 12 monthly £1.6.1

Leak TL/12, 10 watt Main amp. only £18.18.0
Deposit £2.0.6 and 12 monthly £1.11.1

Leak Varislope III pre-amplifier £15.15.0
Deposit £1.11.6 and 12 monthly £1.6.1

Quad, 15 watt Main amplifier only £22.10.0
Deposit £2.5.0 and 12 monthly £1.17.4

Quad pre-amplifier, Mono £19.10.0
Deposit £1.19.0 and 12 monthly £1.12.4

AMPLIFIERS (STEREO)

Dulci AC202, Integrated £12.12.0
Deposit £1.7.0 and 12 monthly £1.0.8

Dulci GA505, Integrated £18.18.0
Deposit £2.0.6 and 12 monthly £1.11.1

Rogers Cadet Mk. 2 with pre-amplifier, 4 ECL86 valves £26.15.6
Deposit £2.13.6 and 12 monthly £2.4.5

Leak Stereo 20, Main amplifier £30.9.0
Deposit £3.4.6 and 12 monthly £2.10.3

Leak Varislope III, stereo pre-amplifier £25.0.0
Deposit £2.10.0 and 12 monthly £2.1.6

Quad 22 Stereo Control Unit £25.0.0
Deposit £2.10.0 and 12 monthly £2.1.6

For Quad Main Amplifiers see Mono section above.

Armstrong 222, integrated 10 watts per channel £27.10.0
Deposit £2.15.0 and 12 monthly £2.5.8

QUARTER TRACK

Collaro Studio Deck Marriott "X" Series heads £17.17.0
Deposit £1.7.6 and 12 monthly £1.9.5

Tape Amplifier for Studio Deck, as over, but quarter track £12.12.0
Deposit £1.17.0 and 12 monthly £1.0.8

Case for above, with speaker two tone grey £5.5.0

Complete Kit with Tape and Microphone £35.0.0
Deposit £3.10.0 and 12 monthly £2.18.2

B.S.R. TD2 Deck with Marriott "L" Series heads £11.11.0
Deposit £1.4.0 and 12 monthly 19/0

Tape Amplifier for B.S.R. deck, as over, but quarter track £9.9.0
Deposit £1.0.0 and 9 monthly £1.1.0

Tape Pre-amplifier for Studio Deck, with power supplies. ECC83, ECL82, EZ80 and EM84. Mic. and Radio sockets, gives an equalised output of 400 m/Volts ..... Half Track £8.8.0
Deposit £1.0.0 and 8 monthly £1.1.0
Quarter Track £9.9.0
Deposit £1.0.0 and 9 monthly £1.1.0

TAPE HEADS

MSS Quarter track. Record/Playback and Erase per set £3.3.0

Bradmatic Half track Record Playback head only £1.12.6

Bradmatic Half track Record Playback and Erase on plate £1.19.6

Collaro pressure pad for third head position 4/-

Brenell Mk. 5 Series 2 Deck, Half track 4 speed £32.11.0
Deposit £3.5.0 and 12 monthly £2.14.0

Brenell Mk. 5 Series **2 Tape Amplifier** with power pack £26.0.0
Deposit £2.12.0 and 12 monthly £2.3.2

NEW ARMSTRONG TUNER-AMPLIFIERS

Armstrong (Moon) AF208 A.M./F.M. Radio chassis, bass and treble controls P.U. inputs, etc. £21.4.0
Deposit £2.6.0 and 12 monthly £1.14.10

Armstrong (Mono) 227M A.M. F.M. Radio chassis, 10 watts £33.18.0
Deposit £3.10.6 and 12 monthly £2.16.1

Armstrong (Stereo) Stereo 55 A.M., F.M. Radio chassis, with Stereo gram £29.18.0
Deposit £3.2.6 and 12 monthly £2.9.5

Armstrong (Stereo) 227 A.M./F.M. Radio chassis, Stereo gram, 10 watts each channel £48.15.0
Deposit £4.17.6 and 12 monthly £4.1.1

Armstrong (Stereo) 226 A.M. F.M. Radio chassis, Stereo gram, 10 watts each channel, Filters etc. £56.0.0
Deposit £5.12.0 and 12 monthly £4.13.2

Rogers Switched F.M. Tuner, un-powered £14.12.3
Deposit £1.11.6 and 12 monthly £1.4.0

Tripletone F.M. Tuner, less power £13.19.6
Deposit £1.8.0 and 12 monthly £1.3.2

Tripletone F.M. Tuner, self-powered £15.14.6
Deposit £1.11.6 and 12 monthly £1.6.1

Armstrong 224 V.H.F. Tuner, self powered £22.10.0
Deposit £2.5.0 and 12 monthly £1.17.4

Armstrong 223 A.M./V.H.F. Tuner, self powered £28.15.0
Deposit £2.17.6 and 12 monthly £2.7.9

GRAMOPHONE UNITS

Garrard SRP10 with GCS cartridge, Mono, single player £5.9.11

B.S.R. UA14 with TC8 cartridge, Mono, 4 speed changer £6.19.6
Deposit £1.0.0 and 6 monthly £1.3.3

Garrard Autoslim, Mono GC8 cartridge, 4 speed changer £7.17.0
Deposit £1.0.0 and 7 monthly £1.2.6

Garrard AT6 Autoslim de Luxe, GC8 Mono cartridge £11.9.0
Deposit £1.6.6 and 9 monthly £1.4.9

Philips AG1016, stereo cartridge, will change 7in. records £12.12.0
Deposit £1.7.0 and 12 monthly £1.0.8

Decca Deram Arm and Plug-in Shell £5.5.0

Decca Deram Transcription Cartridge £4.14.6

Decca Deram Auto Cartridge £3.13.6

Goldring GL58 with arm, less cartridge £15.19.8
Deposit £1.12.0 and 12 monthly £1.6.6

Goldring "88" Transcription, no arm £17.14.0
Deposit £1.19.0 and 12 monthly £1.9.0

Goldring GL55X, as GL58 but less pick-up arm £18.1.7
Deposit £1.7.7 and 12 monthly £1.1.6

Garrard 4H/F with Mono GCS cartridge £17.0.0
Deposit £1.14.0 and 12 monthly £1.8.2

Garrard Lab Type "A" Transcription auto-changer Mono GC8 ..... £19.14.9
Deposit £1.19.6 and 12 monthly £1.12.9

Garrard 301 ..... £20.12.2
Deposit £2.3.2 and 12 monthly £1.14.0

Garrard 301 Strobe £22.0.0
Deposit £2.4.0 and 12 monthly £1.16.6

LOUDSPEAKERS

Goodmans Axiette 8 ..... £5.5.7

Goodmans Axiom 10 ..... £6.5.11

Goodmans 5K/20/XL £7.0.0

Wharfedale Super 8/RS/DD £6.14.2

W.B. HF1012 10in. £4.7.6

R.T.C. 12in. Unit, 15 watt £5.5.0

R.T.C. Hi-Fi Master £8.8.0

Goodmans XO 5000 cross-over £1.19.0

Goodmans Axiom 201 12in. Unit £10.7.0
Deposit £1.1.0 and 8 monthly £1.5.9

Goodmans Axiom 301 12in. Unit £14.10.0
Deposit £1.9.0 and 12 monthly £1.4.0

Wharfedale W12/EG 12in. 15 watt Guitar speaker £10.10.0
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Wharfedale Super 10/RS/DD 10in. high quality unit £10.18.0
Deposit £1.3.8 and 12 monthly 17/11

Wharfedale RS/12/DD 12in. 15 watt Hi-Fi speaker £11.10.0
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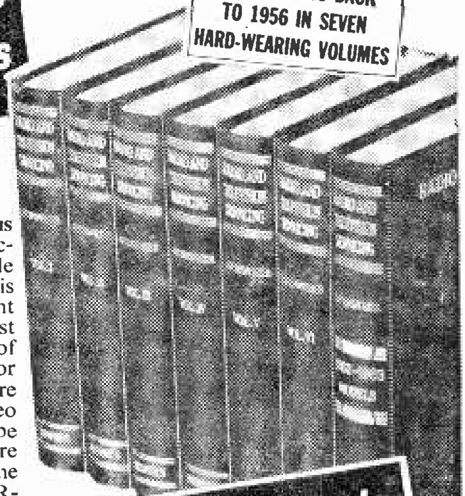

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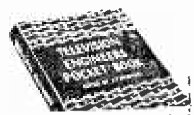

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DF91	2/3
DF96	5/9
DF97	10/-
DH30	15/6
DH63	4/6
DH76	3/6
DH77	3/9
DH81	23/3
DH101	25/-
DH107	19/11
DK32	8/-
DK40	18/8
DK91	4/-
DK92	6/9
DK96	6/3
DL33	7/-
DL35	6/3
DL63	5/9
DL68	15/-
DL72	15/-
DL73	30/-
DL92	4/9
DL94	5/6
DL95	6/-
DL96	5/9
DL810	10/6
DM70	5/-
DM71	9/9
DW4/350	8/6
DW4/500	8/6
DY86	7/-
E80F	24/-
E83F	24/-
E88CC	10/-
E180F	19/6
E1148	1/9
EA50	1/6
EA76	6/9
EABC80	5/6
EAC91	3/3
EAF42	7/6
EB34	1/-
EB41	4/9
EB91	2/3
EBC3	20/6
EBC33	8/6
EBC41	6/6
EBC81	6/-
EBC90	5/6
EBF80	5/6
EBF83	7/3
EBF89	6/3
EBL21	8/6
EC52	4/6
EC53	12/6
EC54	6/-
EC70	4/9
EC81	27/6
EC90	2/6
EC92	6/6
ECC31	7/6
ECC32	4/-
ECC34	21/7
ECC35	5/9
ECC40	7/6
ECC81	3/6
ECC82	4/6
ECC83	4/6
ECC84	5/9
ECC85	6/3
ECC88	10/-
ECC91	3/-
ECC189	10/6
ECC807	22/6
ECF80	6/3
ECF82	6/6
ECF86	11/6
ECF804	24/-
ECH3	21/6
ECH21	10/-
ECH33	22/8
ECH35	6/3
ECH42	7/9
ECH81	5/9
ECH83	6/6
ECH84	9/6
ECL80	6/-
ECL82	7/-
ECL83	9/9
ECL86	8/9
EF6	20/6
EF9	20/6
EF22	6/9
EF36	3/3
EF37A	5/6
EF39	3/9
EF40	8/3
EF41	6/9
EF42	5/3
EF50	2/6
EF54	3/-
EF73	5/-
EF80	4/-
EF83	9/9
EF85	4/9
EF86	6/-
EF89	4/3
EF91	3/-
EF92	2/6
EF97	11/6
EF98	10/-
EF183	7/9
EF184	7/6
EF804	20/5
EH90	15/2
EK2	25/11
EK32	6/-
EL2	19/6
EL3	21/-
EL32	3/6
EL33	6/9
EL34	8/6
EL35	10/-
EL37	17/6
EL38	12/-
EL41	7/3
EL42	7/6
EL81	8/3
EL83	6/9
EL84	4/9
EL85	7/-
EL86	7/6
EL91	2/6
EL95	5/6
EL360	27/-
EL820	16/4
EL822	18/6
ELL80	20/5
EM4	17/9
EM34	8/9
EM35	12/-
EM71	13/6
EM80	6/3
EM81	7/-
EM84	6/9
EM85	8/-
EM87	15/2
EN31	45/-
EN91	5/6
EY51	5/9
EY81	7/3
EY83	9/3
EY84	10/6
EY86	5/9
EY88	9/3
EY91	3/-
EZ35	4/6
EZ40	5/3
EZ41	6/-
EZ80	4/-
EZ81	4/-
EZ90	3/9
FC4	8/9
FC13	14/6
FC13C	17/-
FW4/500	6/6
FW4/800	6/6
GTIC	10/-
GU50	52/6
GZ30	7/-
GZ32	7/6
GZ33	17/6
GZ34	10/-
GZ37	14/6
H30	5/-
H63	6/9
HABC80	9/9
HL2	7/6
HL13C	4/-
HL23	11/6
HL23DD	5/-
HL41	3/9
HL41DD	8/6
HL42DD	8/6
HL133DD	9/6
HN309	25/-
HVR2	8/9
HVR2A	8/9
IW3	5/6
IW4/350	5/6
IW4/500	6/-
KBC32	20/5
KF35	12/6
KL35	11/6
KLL32	21/7
KT2	7/6
KT8	15/-
KT32	5/6
KT33C	4/-
KT36	29/1
KT41	7/6
KT44	5/-
KT61	6/3
KT63	4/-
KT66	13/6
KT74	12/6
KT88	23/-
KTW61	4/9
KTW62	5/6
KTW63	5/6
KTZ41	5/6
L63	3/-
LN152	6/-
LN309	8/-
LN319	9/-
LP2	9/6
ME41	15/2
ME91	12/6
MH4	3/6
MHD4	8/3
MHL4	7/6
MHLD6	12/6
ML6	5/9
MS4B	20/5
MSP4	12/-
MU12/14	5/-
MX40	8/9
N37	23/3
N78	26/-
N108	26/2
N339	15/-
P61	2/9
PABC80	6/9
PC86	10/6
PC88	14/7
PC95	11/6
PC97	8/-
PCC84	5/6
PCC85	6/9
PCC88	10/6
PCC89	7/6
PCC189	10/6
PCF80	5/6
PCF82	6/3
PCF84	8/6
PCF86	7/9
PCL82	6/6
PCL83	8/-
PCL84	7/-
PCL85	8/3
PCL86	8/9
PCL88	12/6
PEN4DD	25/-
PEN25	3/9
PEN40DD	34/-
PEN45	7/-
PEN45DD	12/-
PEN46	4/3
PEN383	11/6
PEN453DD	10/-
PENA4	7/-
PENB4	23/11
PEN DD 4020	17/6
PL33	9/-
PL36	8/6
PL38	16/6
PL81	6/9
PL82	5/3
PL83	5/3
PL84	6/-
PL500	15/6
PM84	9/3
PT15	10/-
PX4	9/-
PX25	8/6
PY31	6/6
PY32	8/9
PY33	9/9
PY80	5/-
PY81	5/3
PY82	4/9
PY83	5/9
PY88	8/-
PY800	7/-
PY801	7/6
PZ30	15/-
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SU61	5/9
T41	9/-
TDD2	12/6
TDD4	8/3
TH21C	12/6
TH30C	14/6
TH41	13/-
TH233	14/9
TP22	5/-
TP25	5/-
TP2620	17/6
TY86F	11/8
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UAF42	7/6
UB41	10/6
UBC41	6/3
UBC81	6/3
UBF80	6/3
UBF89	6/9
UBL21	9/9
UC92	6/9
UCC84	9/-
UCC85	6/6
UCF80	8/9
UCH21	8/6
UCH42	7/-
UCH81	6/6
UCL82	7/9
UCL83	8/6
UF41	6/9
UF42	5/-
UF80	6/6
UF85	7/-
UF86	8/6
UF89	6/-
UL41	6/9
UL44	23/3
UL46	8/9
UL84	6/-
UM4	15/2
UM34	16/10
UM80	8/6
UR1C	6/6
UU5	7/-
UU6	9/-
UU7	8/6
UU8	11/6
UU9	5/8
UU12/14	4/-
UY1N	10/9
UY21	8/9
UY41	4/6
UY85	4/3
U10	9/-
U12/14	7/6
U16	8/9
U17	5/-
U18/20	6/6
U19	48/6
U22	5/-
U24	15/-
U25	8/9
U26	7/9
U31	7/-
U33	13/6
U35	16/6
U37	23/3
U41	19/6
U43	5/9
U45	15/6
U47	8/9
U50	4/6
U52	4/3
U76	4/9
U78	3/9
U84	10/6
U101	19/6
U107	17/6
U191	10/-
U251	9/6
U281	9/6
U282	13/-
U301	12/-
U329	9/6
U330	10/-
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U404	6/-
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VP4	14/6
VP4A	14/6
VP4B	20/5
VP13C	7/-
VP23	2/6
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VP133	9/9
VR75	21/-
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W61M	24/6
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W77	2/6
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W107	10/6
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X41	15/-
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X63	6/-
X64	4/6
X65	5/6
X66	7/6
X76M	9/-
X78	26/-
X79	20/6
X81M	29/1
X101	23/6
X109	26/-
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Z77	3/-
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AF126	10/-
AF127	9/6
BYZ13	11/6
GD3	5/6
GD6	5/6
GD14	10/-
GET102	8/6
GET103	3/6
GET104	10/-
GET106	17/6
GET111	12/-
GET113	8/-
GET114	6/6
GET872	10/-
GET873	9/3
GET874	9/6
GEX35	3/-
GEX36	10/-
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MAT101	8/6
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OA81	3/-
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OA90	3/-
OA91	3/-
OA95	3/6
OA210	9/6
OA211	13/6
OC16W	35/-
OC19	25/-
OC22	23/-
OC23	57/-
OC25	12/-
OC26	25/-
OC28	12/6
OC29	27/6
OC35	18/-
OC36	21/6
OC41	8/-
OC42	9/6
OC43	12/6
OC44	8/3
OC44PM	9/3
OC45	9/-
OC45PM	9/-
OC65	22/6
OC66	25/-
OC70	6/6
OC71	8/6
OC72	8/-
OC73	16/-
OC74	8/-
OC75	8/-
OC76	8/6
OC77	12/-
OC78	8/-
OC81	4/-
OC81D	4/-
OC81M	8/-
OC82	10/-
OC83	6/-
OC84	8/-
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OC140	19/-
OC170	8/6
OC171	10/6
OC200	10/6
OC201	29/-
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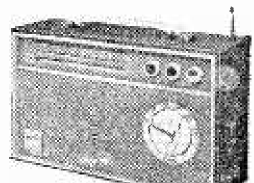
THE SKYROVER

and the SKYROVER De LUXE



The SKYROVER

Controls: Waveband Selector, Volume Control with on/off Switch, Tuning Control. In plastic cabinet, size 10 x 6½ x 3¼in. with metal trim and carrying handle.

Can be built for

£10.19.6

Post & Pkg. 5/- extra.

GENERAL SPECIFICATION:
7 transistor plus 2 diode superhet, 6 waveband portable receiver. Operating from four 1.5 v. torch batteries. The SKYROVER and SKYROVER DE LUXE cover the full Medium Waveband and Short Waveband 31-94 M, and also 4 separate switched band-spread ranges, 13M, 16M, 19M and 25M, 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.

SPECIFICATION:

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

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

The SKYROVER de luxe

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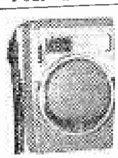

Can be built for

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P. & P. 3/6 extra.

★ Six-Transistor Superhet Miniature Personal Pocket Radio. ★ Long and Medium wavebands. ★ Ferrite Rod aerial. ★ I.F. Frequency 470 Kc/s. ★ 3in. Speaker. ★ Printed circuit 2¾ x 2in. ★ Slow Motion Drive. ★ In Plastic Case. Size 4 x 2½ x 1in. In order to ensure perfect results, the SPRITE is supplied to you with R.F. and I.F. stages. Driver and Output stages ready built with all components mounted on the printed circuit. The SPRITE pre-assembled, plus cabinet, speaker and all components for final construction, can be built for:- **79/6**
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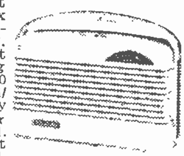
★ 7-transistor Superhet. ★ 350 milliwatt output into 4in. high flux speaker. ★ All components mounted on a single printed circuit board, size 5¼ x 5¼in. in one complete assembly. ★ Plastic cabinet with carrying handle, size 7 x 10 x 3¼in., in Red/Grey, Blue/Grey or all Grey. ★ Easy to read Dial. ★ External socket for car aerial. ★ I.F. frequency 470 Kc/s. ★ Ferrite rod internal aerial. Operates from PP9 or similar battery. ★ Full comprehensive data supplied with each receiver. ★ All coils and I.F.'s etc. fully wound ready for immediate assembly.



An Outstanding Receiver. **LASKY'S PRICE** for the complete parcel including Transistors, Cabinet, Speaker, etc., and Full Construction Data. Can be built for:- **£5.19.6**
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HARVERSON SURPLUS CO. LTD.

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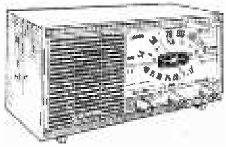
OUR LATEST BULK PURCHASE!



BRAND NEW A.C. MAINS 5 VALVE SUPERHET RADIO RECEIVERS

Housed in beautifully styled cabinets offering terrific performance and very high quality reproduction. Built-in ferrite rod aerial for reception of all your favourite programmes. Fully guaranteed.

MODEL 55 (as illus.). Covers Medium, Long and Short waves. Size 8½in. w. x 3¾in. d. x 4½in. h. **PRICE ONLY £7.17.6.** P. & P. 5/6.

MODEL 36. Similar circuitry to above but covers Medium wave only. Size 7½in. w. x 3¾in. d. x 4½in. h. **PRICE ONLY £4.14.6.** P. & P. 5/6.

Either of the above can be easily adapted for use as A.M. Feeder unit.

3-VALVE AUDIO AMPLIFIER. MODEL HA34

Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½in. w. x 4in. d. x 4¾in. h. Incorporates ECC83, EL84, EZ80 valves, heavy duty double wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls.

The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs, valves, etc., wired and tested for only **£4.5.0** P. & P. 4/-

TWO VALVE AMPLIFIER similar to above but using ECL82 and EZ80 with tone and volume controls. Output 3 watts. PRICE 75/-. P. & P. 4/-

SPECIAL OFFER!

MARCONI QUARTZ CRYSTALS TYPES ZHB

Glass encapsulated, 2 wire lead out Size 1¼in. high x ½in. dia. Following frequencies (Kc/s) only available
13521, 13583, 13646, 13708
13771, 13833, 13995, 13958
14021, 14083, 14146, 14208
14271, 14333, 14396, 14459
6/- each. P. & P. 1/- per crystal, 3 or more Post Free.

4-SPEED PLAYER UNIT BARGAINS

All Brand New in Makers' Original Packing

SINGLE PLAYERS
TU/12 .. £3.10.0 Carr. 3/6

AUTO CHANGERS
B.S.R. UA14 .... £6.2.6
Latest B.S.R. UA16 .... £7.2.6

LATEST GARRARD AUTO-SLIM with heavy-duty 4-pole motor. FEW ONLY £7.7.0 (Standard Auto-Slim £6.17.6). Carr. 5/- on each.

SPECIAL TRANSISTOR BARGAINS

ALL BRAND NEW
GET 15 (Matched Pair) 15/-

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

Set of Mullard 6 transistors, OC44, 2—OC45 OC81D matched pair OC81, 25/-.

EDISWAN MAZDA
R.F.1 Pack: 1—PXA102 Mixer; 2—PXA101 I.F. Amp.: (Equiv OC44 and OC45) 10/6
R.F.2 Pack: 2-PXA101 I.F.; —PXA102 Osc.: 1—PXA102 Mixer 12/6
L.F.6 Pack: Consisting of PXB113 Driver, Matched pair PXC171, mounted complete with heat sinks (Equiv. OC81D and OC81).... 12/6
ALL TRANSISTORS POST FREE

CARTRIDGE BARGAINS!

B.S.R. TC8S High output compatible **Stereo Cartridge.** Brand New. Complete with Stereo/LP/78 sapphire stylii and universal mounting bracket. Original list price 44/11. OUR PRICE 22/6. P. & P. 1/-.

COLLARO HI-FI STEREO T/O CARTRIDGE
Type "C". Complete with universal bracket and stylii for Stereo LP and 78. Original list price 59/8. OUR PRICE 25/-. P. & P. 1/-.

ACOS GP65/1 T/O MONO CRYSTAL CARTRIDGE. Comp. with sapphire stylii and mounting bracket. Limited number only at 12/6. P. & P. 1/-.

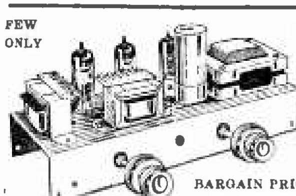
FEW ONLY!

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

TELEFUNKEN HI-FI STEREO AMPLIFIER

Model 882 with BALANCE CONTROL 110/250 v. A.C. input 5 watt undistorted output (10 watts nominal). Size 12 x 9 x 2in. Weight 9 lb. Complete with spec. and instructions STILL ONLY £5.19.6. Carr. 7/-.

FEW ONLY



STEREO AMPLIFIER

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

BARGAIN PRICE **89/6** P. & P. 5/-

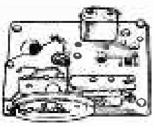
Also available complete with two 8 x 5in. Speakers for only £5.10.6. P. & P. 6/6.

SPECIAL PURCHASE! TURRET TUNERS

by famous maker

Brand new and unused. Complete with PCC84 and PCF80 valves. 34-38 Mc/s I.F. Biscuits for Channels 1 to 5 and 8 and 9. Circuit diagram supplied.
ONLY 25/- each. P.P. 2/6.

F.M. TUNER HEAD



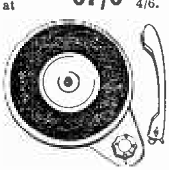
A permeability tuned tuner head by a famous maker, supplied without valve (ECC85) and drum and spindle. **18/6,** plus 1/9 P. & P. Valve **8/6** extra. Drum and spindle **3/6** extra.

GÖRLER F.M. TUNER HEADS

10.7 Mc/s I.F.
15/-, plus 1/9 P. & P. ECC85 valve. **8/6 extra.)**

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

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



Heavy 8¾in. metal turntable. Low flutter performance 200/250 v. shaded motor with tap at 45v. for amplifier valve filament if required. Turnover LP/78 head.

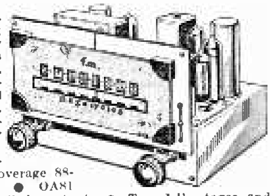
RECORD PLAYER AMPLIFIER

2 valve (EZ80 ECL82) A.C. mains, 3 watts output, ready built, tested and complete with valves and output transformer. Size 7in. w. x 2½in. d. x 5½in. h. **55/-.** P. & P. 3/-. Suitable speakers: 6½in. **15/-** P. & P. 1/6. 10 x 6in.. **26/-,** P. & P. 1/6.

SPEAKER & CABINET FABRICS

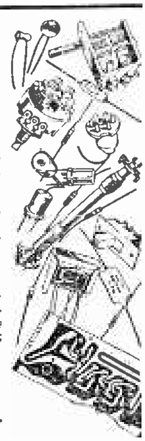
Oatmeal. Red and Gold fabrics and various patterns in Vynair and Tygan for speaker and cabinet covering, also Red Rexine for cabinet covering only. All 54in. wide and usually sold at 35/- yard.
OUR PRICE 13/6 per yard length.
plus P. & P. 1/6.
(Minimum order 1 yard). Send S.A.E. for samples.

HARVERSON'S F.M. TUNER Mk. I



● F.M. tuning head by famous maker. ● Guaranteed non-drift. ● Permeability tuning. ● Frequency coverage 88-100 mc/s. ● OA81 balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used ECC85, two EF80's, and EZ80. (rectifier) ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5½in. ● All parts sold separately. Set of parts if purchased at one time **£5.19.6.** plus 8/6 P.P. and ins. Circuit diagram and instructions 1/6 post free. **Mark II Version** as above but complete with magic eye, front panel and brackets. **£6.12.6.** P. & P. 8/6.
Mark III Version as Mark I but with output stage (ECL82) and tone control. **£7.7.0.** P. & P. 8/6.
Handsome Metal Cabinets. Choice of Grey, Black or Green. To fit Mark I. **25/-.** P. & P. 2/6. To fit Mark II. **17/6.** P. & P. 2/6.

6 TRANSISTOR AND DIODE SUPERHET



A first-class 2 wavebands transistor superhet. ● Printed circuit panel (size 8½ x 2¾in.) ● 3 pre-aligned I.F. transformers. ● High-gain Ferrite rod aerial. ● All First-grade transistors. ● Car aerial winding. ● Push-pull output. ● All parts supplied with simple instructions.
All parts sold separately. Set of parts if purchased at one time.
ONLY £4.5.0 P. & P. 2/6

35 OHM SPEAKERS

Suitable for use with above 2in. Goodmans. Ideal replacement for most pocket portables **8/6;** 2½in. **10/6;** 3½in. **12/6;** 5in. **17/6;** 7 x 4in. **21/-.** P. & P. 1/6 per speaker.

Portable CABINET

Size approx. 9½ x 6⅞ x 3½in. Suitable for above using 3½in. speaker. **25/-.** P. & P. 2/-.

COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

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

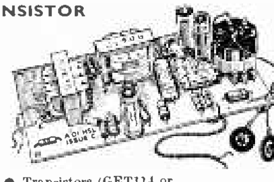
QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. This amplifier (which is used in a 29 gn. record player) employs ECC83, EL84, EZ80 valves. Bass, treble and volume controls. Complete with output transformer matched for 3 ohm speaker.
PRICE 69/6 P. & P. 3/6
DITTO. Mounted on board with output transformer and 6in. speaker.
Complete at 89/6 P. & P. 4/6.

QUALITY PORTABLE RECORD PLAYER CABINET

Uncut motor board. Will take above amplifier and B.S.R. or GARRARD Autochanger or Single Record Player Unit. Size 18 x 14 x 8½in.
PRICE £3.9.6 Carr. 5/-

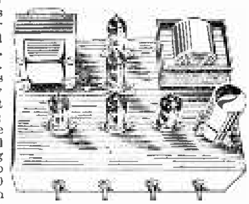
HIGH GAIN 4-TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT Type TAI



● Peak output in excess of 1½ watts. ● All standard British components. ● Built on printed circuit panel, size 6 x 3in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (GET114 or 81 Mullard OC81D and matched pair of OC81 o/p). ● 9 volt operation. ● Everything supplied, wire, battery clips, solder, etc. ● Comprehensive easy to follow instructions and circuit diagram 1/6 (Free with Kit). All parts sold separately.
Also ready built and tested, **52/6.** P. & P. 2/6.
A pair of TA1's are ideal for stereo.

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

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram. allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15 Ω speaker and 2 independent volume controls and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts.)
All parts sold separately. ONLY **£6.19.6** P. & P. 6/6
Also available ready built and tested complete with input jack plugs. **£8.15.0** P. & P. 6/6.

BRAND NEW 3 OHM LOUDSPEAKERS

2½in. **12/6;** 5in. **12/6;** 6½in. **15/-;** 8in. **21/-;** 10in. **25/-;** 12in. **27/6**
E.M.I. 2½in. tweeter .. **10/6**
8in. x 5in. By famous maker **10/6**
Rola Celestion approx. 9in. x 6in. middle register speaker **10/6**
10in. x 6in. **26/-**
Also 15 ohm 12 inch, **30/-.**
P. & P. up to 6in. 1/6; over 6in. 2/6 per speaker.

AMPLIFIER CARRYING CASES

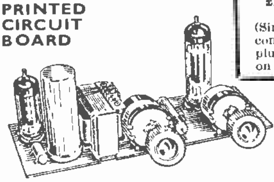
BRAND NEW

Strongly made wooden construction, tough vynide covered, complete with carrying handle. Overall size 13¾in. wide x 9in. deep x 8in. high with sloping front panel. Weight only 4½ lbs. Ideal for our 10/14 watt amplifier and many others.
BARGAIN PRICE **28/6** P. & P. 4/-.

TAPE DECKS

COLLARO STUDIO DECK
£10.10.0 plus 5/6 carr. and ins.
B.S.R. MONARDECK
(Single speed) 3¾in. per sec.. simple control. uses 5¾in. spools. **£6.15.0** plus 5/6 carr. and ins. (Tapes extra on both).

AMPLIFIER ON PRINTED CIRCUIT BOARD



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

Superior CABINET To take 8 x 5in. speaker. with motor board will accommodate BSR UA14 or UA16. **£3.9.6.** Carr. 5/6. Speaker **10/6** extra. P. & P. 1/6 extra.
LARGE CABINET Similar to above with 3 ohm speaker. **£3.9.6.** Carr. 5/-.

ACOS CRYSTAL MIKES. High imp. For desk or hand use. High sensitivity, **18/6.** P. & P. 1/6.
TSL CRYSTAL STICK MIKE. Listed at 45/-. Our price **18/6.** P. & P. 1/6.
CARBON MIKE INSERTS. Brand new, 2½in. dia.. **3/6.** P. & P. 9d.
STANDARD COLVERN 50K W/W Pre-set Pots. 2 for 4/-. P. & P. 1/-.
CONDENSERS. 5000 mfd. 12 v. wkg. Size 3 x 1in. dia. **3/-** each. P. & P. 6d. each.
STANDARD 1¼in. FUSE HOLDERS Laminated Twin, 2 for **1/6.** P. & P 9d. Laminated Single, 2 for **1/-.** P. & P. 6d. Belling-Lee Panel mounting, single **2/-** each. P. & P. 6d.
TRANSISTOR DRIVER and O/P TRANSFORMERS. (Tapped 3 ohms and 15 ohms output). plus 4 suitable Transistors giving approx. 1 watt output. **30/-.** P.P. 2/-
Precision made .0005 2-gang **TUNING CONDENSERS.** Size 2¼ x 2¼ x 1½in. **4/-** each. P. & P. 1/6.

MAINS TRANSFORMER

Drop thru' type. Tapped primary 110v., 200v., 220v., 240v. 320-0-320v. at 80mA and 6.3v. at 3 amps. Generous core. Stack size 3¾ x 2¾ x 1⅝in. Weight 4lbs. ONLY **15/-.** P. & P. 3/6.

4-WAY NON-TANGLE TELEPHONE CABLE

Latest spring back coil type, extends 12in. to 5ft. Complete with rubber bushes. **3/6 each.** P. & P. 1/-.

8 x 2½in. 3 ohm SLOT SPEAKERS Specially designed to handle large output. Ideal for high quality reproduction when speaker space is limited. Special purchase, regret no further technical details available but an absolute snip at **8/- each.** P. & P. 1/6 per speaker.
FEW ONLY 6 x 4in. 3 ohm Speakers Similar to above. Only **9/-.** P. & P. 1/6 per speaker.
8 x 5in. 3 ohm SPEAKERS BY WELL KNOWN MAKER. Unrepeatable at only **10/6 each.** P. & P. 1/6 per speaker.
A pair of these are ideal for Stereo.

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R.S.C. Manchester Ltd.

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

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DERBY 26 Osmaston Road THE SPOT

FANE HEAVY DUTY HI-FI SPEAKERS

12in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.
122/10 20w., 5 gns. 122/10A 20w., 6 gns.
122/12 20w., 6 gns. 122/12A 20w., £7.19.6
122/14 22w., 9 gns. 122/14A 22w., 10 gns.
122/17 25w., 11gns. 122/17A 25w., 12 gns.
15in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies.
152/12 20w., 12 gns. 152/12A 20w., 13 gns.
152/14 27w., 14 gns. 152/14A 27w., 15 gns.
152/17 35w., 16 gns. 152/17A 35w., 17 gns.
"A" indicates dual cone type, 30-17,000 c.p.s. Send S.A.E. for leaflets. Terms available.

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 dB down. Frequency response ±3 dB 30-30,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS** or **OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for **RADIO FEEDER UNIT.** An extra input with associated vol. control is provided so that two separate inputs such as Gram and "Mike" can be mixed. Amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete Kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required perforated cover with carrying handles can be supplied for 19/9. The amplifier can be supplied, factory built with EL34 output valves and 12 months' guarantee, for **14 gns.** Send S.A.E. for leaflet.

11 Gns. Carr. 10/-

TERMS: DEPOSIT 33/9 and 9 monthly payments of 33/9.
Suitable microphones and speakers available at competitive prices.

ARMSTRONG, DULCI, LINEAR, ROGERS, LEAK and JASON EQUIPMENT, GOODMANS, W.B. AND FANE SPEAKERS. GARRARD AND GOLDRING T/TABLES CASH or H.P.

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

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

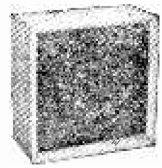
TWEETERS. R.A. 3 ohm. 25/9; 15 ohm 25/9

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

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

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for any record playing unit and most microphones. Negative feed-back 12 dB. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves EZ80, ECC83, EL84. Size only 7 x 5 x 5½in. high. Guaranteed 12 months. Only **£5.19.6.** Send S.A.E. for leaflet. Terms: Deposit 22/6 and 5 monthly payments of 22/6.

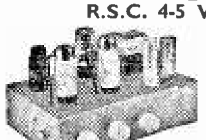
12in. 10 WATT HIGH QUALITY LOUDSPEAKER



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

LINEAR LG34 GRAM. AMPLIFIER. High quality. Separate Bass and Treble controls. Handsome appearance. Completely enclosed. Black/Gold Frontplate 5 gns.

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



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high fidelity pick-up heads, in addition to all other types of pick-ups and practically all "mikes". Separate Bass and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 dB down, 15 dB of Negative feedback is used. H.T. of 300 v. 25 mA and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape-Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue Hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4.15.0, or assembled ready for use 25/- extra. Plus 3/6 carr., or deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

GLASGOW Opening late January 326 Argyle St.

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

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

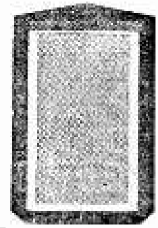
MULTI-METERS. CABY MI. Sensitivity 2,000 ohms per volt. A.C. and D.C., **54/-. A.10.** Basic Meter sensitivity 155 microamps A.C. and D.C. ranges **£4.17.6. B.20.** Sensitivity up to 10,000 ohms per volt A.C. and D.C., **£6.10.0.** 30,000 ohms per volt, with overload buzzer, **£8.19.6.**

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

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

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

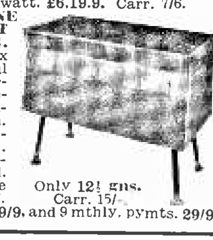
R.S.C. CORNER CONSOLE CABINETS



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

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

AUDIOTRINE EQUIPMENT CABINETS.



Size 36 x 15 x 18in. Beautiful walnut veneered finish. Elegant contemporary design. Robust construction. Uncut, removable baseboard. Depth above baseboard 5½". Only 12½ gns. Carr. 15/-.
Terms: Dep. 29/9, and 9 mthly. pymts. 29/9

R.S.C. BATTERY TO MAINS CONVERSION UNITS

R.S.C. BATTERY TO MAINS Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 and 90 v.** This includes low consumpton types. Complete kit with diagrams, 39/9, or ready to use, 46/6.

Type BM2. Size 8 x 5½ x 2½in. Supplies 120 v. 90 v. and 60 v. 40 mA and 2 v. 0.4 a. to 1 amp. fully smoothed. **Thereby completely replacing both H.T. batteries and L.T. 2 v. accumulators when connected to A.C. mains supply** 200/250 v. 50 c/s. **SUITABLE FOR ALL BATTERY RECEIVERS** normally using 2 v. accumulators. Complete kit of parts with diagrams and instructions, 49/9, or ready for use, 59/6.

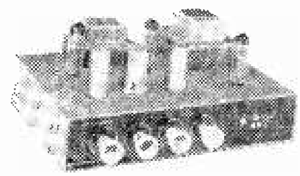
AUDIOTRON HI-FI TAPE RECORDER KIT 25½ GNS. Carr. 17/6.

REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR
Incorporating the latest Collaro Studio Tape Transcriptor. The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a Handsome Portable Carrying Cabinet with latest attractive two-twone polychrome finish size 14¾ x 15 x 8¼in. high and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.A.E. for leaflets. **TERMS. Deposit £2.13.9** and 12 monthly payments of **44/-**. Cash price if settled in 3 months.

ONLY 3 PAIRS OF SOLDERED JOINTS PLUS MAINS

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

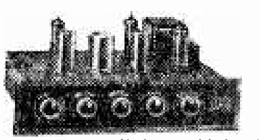
PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP STAGES



Two input sockets with associated controls allow mixing of "mike" and gram., as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, EZ81. High Quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut". Frequency response ± 3 dB 30-30,000 c/s. Six negative feedback loops. Hum level 60 dB down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs for **STANDARD or LONG PLAYING RECORDS.** For **MUSICAL INSTRUMENTS** such as **STRING BASS, LEAD OR RHYTHM GUITARS,** etc.
OUTPUT SOCKET with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-. (Or factory built 51/- extra.)
If required louvred metal cover with 2 carrying handles can be supplied for 18/9. **TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9** and 9 monthly payments of **24/9**. Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.

LINEAR TAPE PRE-AMPLIFIER. Type LP/1. Switched Negative feedback equalisation. Positions for Record 1⅞in., 3¾in., 7½in. and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriptor and a high fidelity amplifier, but suitable for almost any Tape Deck. Only 9 gns. S.A.E. for leaflet.

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



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

HI-FI CRYSTAL PICK-UP HEADS. (Cartridges.) Acos Standard replacement for Garrard, B.S.R. and Collaro, **16/9.** Acos Stereo-Monaural, **29/9.** Ronette Stereo-Monaural **39/9.** B.S.R. Stereo **39/9.**
BRADMATIC RECORDING HEADS. High Impedance Record/Playback **22/-.** Low Impedance Erase, **12/6.**
MARRIOTT RECORDING HEADS. High Impedance, Record/Playback **15/-.** Low Impedance, Erase, **10/-.**
PICK-UP ARMS. Complete and with latest Acos/hi-fi Turnover Cartridge **29/11.**
CRYSTAL MICROPHONES. Hand type NP110 **14/9,** R.T.C. **19/9,** Acos Mic 40 **25/9.** Acos Mic 45 **29/9,** Stick type Acos 39-1 **39/9.** BM3 with neck band and heavy table stand **59/9.** Lapel type **29/9.**
COLLARO JUNIOR 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. Only **£3.19.6.**
B.S.R. UA14 4-sp'd AUTO-CHANGERS with hi-fi turnover head, **£6.19.6.** Carr. 4/6.
GARRARD AUTO-SLIM 4-SPEED AUTO-CHANGER with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains. **£7.19.6.** Carr. 4/6.
GARRARD AT6 AUTO-SLIM DE-LUXE 4-SPEED AUTOCHANGERS. Turnover GC8 head, for 200-250 v. A.C. mains. **£11.9.0.**
GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. A.C. mains. Size 11¼ x 2¼ x 2¼in. Controls: Vol. and Tone with Switch. Only **59/6.**
B.S.R. MONARDECK TAPEDECKS. Speed 3¾in. per sec. With high quality recording heads, **£6.19.6.** Carr. 5/-. Cabinets to take Deck and amplifier **39/6.**

SENSATIONAL STEREO OFFER

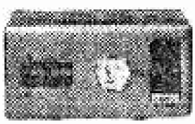
A complete set of parts to construct of a good quality Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head **19/9** extra with above only. **4 Gns.**

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

R.S.C. BATTERY CHARGING EQUIPMENT

Guaranteed 12 months.

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



ASSEMBLED 4 amps 6/12 v. Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved grey hammer finish. Fused and ready for use with mains and output leads and battery clips. **59/9** Carr. 4/6.

Terms: Deposit **12/-** and 5 monthly payments **12/-**.

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

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

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

6 v. or 12 v. 1 amp	22/9
As above, with Ammeter	28/9
6 v. 2 amps.	19/9
6 v. or 12 v. 2 amps.	25/9
6 v. or 12 v. 2 amps. inclusive of Ammeter	35/9
6 v. or 12v. 4 amps. with Ammeter and variable charge rate selector	52/9

CHARGER AMMETERS
0-1.5 a., 0-4 a., 0-7 a. 8/9 ea.

CHARGER KIT, 12v. 10 Amp with variable charge rate adjustment and ammeter. **£4.19.6.** Carr. 10/-.

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

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

TOP SHROUDED DROP THROUGH

250-0-250v. 70mA. 6.3v. 2a. 0-5-6.3v. 2a	17/9
350-0-350v. 80mA. 6.3v. 2a. 0-5-6.3v. 2a	18/9
250-0-280v. 100mA. 6.3v. 2a. 6.3v. 1a	21/9
250-0-250v. 100mA. 6.3v. 3.5a. C.T.	19/9
250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	25/9
300-0-300v. 130mA. 6.3v. 4a. 6.3v. 1a. for Mullard 510 Amplifier	29/9
300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	26/9
350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a	26/9
350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a	29/9
425-0-425v. 200mA. 6.3v. 4a. 5v. 3a	49/9

FULLY SHROUDED UPRIGHT

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

FULLY SHROUDED (continued)—

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

OUTPUT TRANSFORMERS

Midget Battery Pentode 66:1 for 3S4. etc.	4/6
Small Pentode, 5,000Ω to 3Ω	4/6
Small Pentode 7/8,000Ω to 3Ω	4/6
Standard Pentode 5,000Ω to 3Ω	5/9
Standard Pentode 7,000Ω to 3Ω	5/9
10,000Ω to 3Ω	5/9
Push-Pull 8 watts. EL84. or 6V6 to 3Ω or matched to 15Ω	9/9
Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 to 15Ω	19/9
Following types for 3 and 15Ω speakers:	
Push-Pull 10-12 watts 6V6 or EL84	18/9
Push-Pull 15-18 watts, 6L6, KT66	22/9
Push-Pull Mullard 510 Ultra Linear	29/9
Push-Pull 20 watts, sectionally wound, 6L6, KT66, EL34, etc.	49/9

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

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

Both above size 2¼ x 2¾ x 2¼in.

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

SMOOTHING CHOKES

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

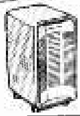
CHARGER TRANSFORMERS
All with 200-230-250v. 50 c/s Primaries: 0-9-15v. 1½a. **12/9**; 0-9-15v. 2a. **14/9**; 0-9-15v. 3a. **16/9**; 0-9-15v. 5a. **19/9**; 0-9-15v. 6a. **23/9**; 0-9-15v. 8a. **28/9.**

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

MICROPHONE TRANSFORMERS
120: 1 high grade, clamped. **8/9.**

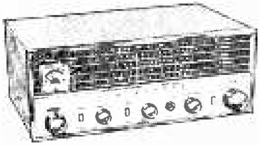
HE-30 SUPER AMATEUR COMMUNICATION RECEIVER

4 bands covering 550Kc/s to 30Mc/s continuous. Operation 200/240 volt A.C. Special features include: Easy to read illuminated slide rule dial—Built in Q multiplier—Aerial trimmer—calibrated electrical bandspread on amateur bands—0-100 logging scale—noise limiter—AVC/MVC selector—stable oscillator and B.F.O. for clear CW and SSb reception— built in edgewise "S" meter. Output for phones or STD speaker. Supplied brand new and guaranteed with manual. £42 carriage paid. S.A.E. for full details.



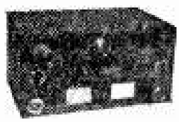
SPECIAL BONUS. With purchase of HE-30 receiver matching speaker for only 32/6 or separately for 62/6.

HE-40 DE LUXE 4-BAND COMMUNICATION RECEIVER



Frequency coverage 550Kc/s to 30Mc/s continuous. Operation 220/240 volt A.C. The perfect receiver for short short wave listening. Special features include: Slide rule tuning dial—electrical bandspread—0-100 logging scale—improved selectivity—built in "S" meter—A.V.C.—Noise limiter—B.F.O.—Phone jack built in 5 in. speaker—tone control—standby switch—supplied with three aerials, ferrite loop for broadcast band, adjustable 58in. whip for short wave and wire aerial. Smartly styled durable metal cabinet. Supplied brand new and guaranteed with manual. £24.15.0 carriage paid. S.A.E. for full details.

NATIONAL H.R.O. RECEIVER



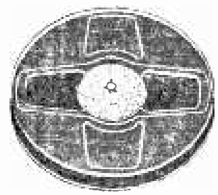
SENIOR MODEL. Supplied complete with full set of nine coils covering 50Kc/s to 30Mc/s. Each receiver thoroughly checked before despatch and available as follows:

Table Model. Good used cond...	£19.19.0
Rack Model. As new cond.	£22.10.0
Rack Model. Good used cond...	£18.18.0

N.B.—Rack model is identical to table model with extended front panel to fit a 19in. rack. Carriage £1 extra.

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

LAFAYETTE BRAND RECORDING TAPES



First grade quality American tapes. Brand new and guaranteed. Discounts for quantities.

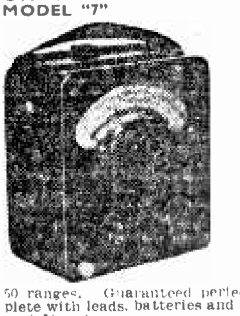
5in.	600ft.	std.	plastic ..	8/6
5in.	900ft.	L.P.	acetate ..	10/-
5in.	1200ft.	D.P.	mylar ..	15/-
5¾in.	1200ft.	L.P.	acetate ..	12/6
5¾in.	1800ft.	D.P.	mylar ..	22/6
7in.	1200ft.	std.	mylar ..	12/6
7in.	1800ft.	L.P.	acetate ..	15/-
7in.	1800ft.	L.P.	mylar ..	20/-
7in.	2400ft.	D.P.	mylar ..	25/-

Postage 2/-. Over £3 post paid

COSSOR DOUBLE BEAM OSCILLOSCOPE 1035

4in. tube. Calibrated Y1 amplifier from 50mV to 50V. Bandwidth 10Mc/s. Calibrated Y2 amplifier from 5V to 500V with bandwidth up to 100Kc/s. Directly calibrated X shift providing time measurements from 15 microseconds to 150 milliseconds. Supplied in guaranteed perfect condition. £40 each. Carr. 30/-.

UNIVERSAL AVOMETER MODEL "7"



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

MINE DETECTOR No. 4A

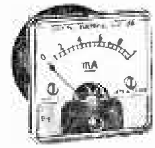
Will detect all types of metals. Fully portable. Complete with instructions. 39/6 each. Carr. 10/-. Battery 8/6 extra.

SILICON RECTIFIERS

SCR. 400V. P.I.V. 4.7 amp ..	7/6
200V. P.I.V. 6 amp ..	5/6
800V. P.I.V. 500mA ..	5/6
400V. P.I.V. 500mA ..	3/6
70V. P.I.V. 1 amp ..	3/6

OA202 miniature silicon rectifiers. 1/- each. Discounts for quantities. Please add postage.

CLEAR PLASTIC PANEL METERS



D'Arsonval Movement. Jewelled Movements. 1²¹/₃₂in. Square Front. 1½in. Overall Behind Panel. 1½in. Dia. Panel Hole. Accuracy 2% of Full Scale. Silver Dials. Black Numerals and Pointers. Front Zero Adjustment. All types moving coil. Individually boxed and guaranteed. Available as follows:

50µA ..	32/6	150mA ..	22/6		
100µA ..	29/6	200mA ..	22/6		
200µA ..	27/6	500mA ..	22/6		
500µA ..	25/-	750mA ..	22/6	300V. DC ..	22/6
50-0-50µA ..	29/3	1A. DC ..	22/6	500V. DC ..	22/6
100-0-100µA	27/6	5A. DC ..	22/6	750V. DC ..	22/6
300mA ..	22/6	3V. DC ..	22/6	15V. AC ..	22/6
1mA ..	22/6	10V. DC ..	22/6	50V. AC ..	22/6
10mA ..	22/6	50V. DC ..	22/6	150V. AC ..	22/6
50mA ..	22/6	100V. DC ..	22/6	300V. AC ..	22/6
100mA ..	22/6	150V. DC ..	22/6	500V. AC ..	22/6

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

FIELD TELEPHONES

Type "L". Two line connection, generator bell ringing. Complete telephone intercom. Supplied in excellent condition, fully tested and complete with batteries. Only 69/6 per pair. Carr. 5/-.

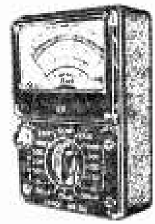
Type "F". As above but moulded bakelite case (as illustrated). Supplied complete with wooden transit case for field use. £4.19.6 per pair. Carr. 5/-.

MULTIMETERS BRAND NEW—FULLY GUARANTEED LOWEST EVER PRICES

Supplied with Leads, Batteries and Instructions.

1,000 Ω/VOLT
0/15/150/1,000 v. A.C. and D.C.
0/150 mA D.C.
0/100 KΩ etc.
39/6. P. & P. 1/6.

20,000 Ω/VOLT
0/10/50/250/500/1,000 v. A.C. and D.C.
0/50µA/0/25/500 mA. D.C.
0/50K/500K/5 meg., etc., 97/6. P. & P. 2/6.



30,000 Ω/VOLT
0/1/1/10/50/250/500/1,000 v. D.C.
0/10/50/250/500v. A.C.
0/50µA/0/10/250mA. D.C.
0/10K/1 meg./10 meg., etc. £5.10.0. P.P. 2/6.

30,000 Ω/VOLT
0/1/1/2½/10/25/100/250/500/1,000 v. D.C and A.C.
0/50µA/5/50/500 mA/0/12 amp. D.C.
0/60K/6 meg./60 meg., etc. £8.17.6. Post paid

50,000 Ω/VOLT
0/10/50/250/500/1,000 v. D.C. and A.C.
0/25µA/2.5/25/250 mA. D.C.
0/10K/100K/1 meg./10 meg., etc., £7.10.0. P.P. 2/6.

100,000 Ω/VOLT
.5/2.5/10/50/250/500/1,000 v. D.C.
2.5/10/50/250/1,000 v. A.C.
10/25µA/2.5/25/250 mA/10 amp. D.C.
20K/200K/2 meg./20 meg ohm etc.
£6.19.6. Post Paid.

P.C.R.2 COMMUNICATION RECEIVERS

Excellent 6 valve receiver. Frequency coverage on 3 bands, 800 2,000 metres, 190-550 metres and 6-22Mc/s. Output for phone or speaker. Supplied in perfect condition, £5.19.6 each. Carr. 10/-. The receiver can be supplied with an internal power supply to operate on 200/250 volt A.C. at 39/6 extra, or plug in external power supplies are 35/- extra. Full circuit supplied.

AVO WIDE RANGE SIGNAL GENERATORS

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

MINIFLUX ¼ TRACK TAPE HEADS

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

MICROAMMETERS

0-500 microamp 2½in. circular flush panel mounting. Dials engraved 0-15, 0-600 volts. Brand new boxed, 15/-. P. & P. 1/6.

HEAVY DUTY AUTO TRANSFORMERS

0/115/230 volt step up or step down. Brand new boxed, ex-U.S.A. 3,000 watt £7.10.0, carr. 10/-; 7,500 watt, £15, carr. £1.

CR.100 COMMUNICATION RECEIVERS

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

FIELD STRENGTH METERS

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

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

G.W. SMITH & CO (RADIO) LIMITED
Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

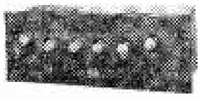
STERN-CLYNE

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

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

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

MULLARD 3-VALVE PRE-AMPLIFIER TONE CONTROL UNIT



Designed mainly for Mullard Range of Amplifiers, also suitable for any Amplifiers requiring input up to 250mV. Incorporates 5 input Channels, including for Tape and Magnetic Pickups. Separate Bass and Treble controls. High pass filter 20 to 160 c/s., low pass filter 5-9 Kc/s. Totally enclosed in case Size 11½" x 4½" x 4½".

KIT OF PARTS **£10.0.0** (Carr. & Ins. 5/-). ASSEMBLED & TESTED **£13.13.0**

Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

MULLARD "5-10" MAIN AMPLIFIER

For use with MULLARD 2 or 3 valve pre-amplifiers with which an undistorted power output of up to 10 watts is obtained SPECIFIED COMPONENTS and MULLARD VALVES including PARTRIDGE MAINS TRANSFORMER and choice of PARMEKO or PARTRIDGE Output Transformer

COMPLETE KIT (Parmeko Output Trans.) **£10.0.0**

ASSEMBLED AND TESTED **£13.10.0**

(Carr. & Ins. 6/6).

ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra.

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

THE MULLARD 5-10RC AMPLIFIER

The popular complete "5-10" incorporating Passive Control Unit providing up to 10 watts high quality reproduction with input of 600 mV Specified components and new MULLARD VALVES. Includes PARTRIDGE MAINS TRANSFORMERS and choice of PARMEKO or PARTRIDGE Output Transformers. Surplus Power available for Tuner.

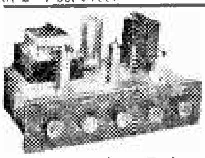
COMPLETE KIT **£12.0.0**

ASSEMBLED AND TESTED **£16.0.0** (Carr. & Ins. 7/6).

With PARTRIDGE OUTPUT TRANS. £1.6.0 ex.

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

THE MULLARD 3-3RC



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

KIT OF PARTS **£8.8.0**

ASSEMBLED AND TESTED **£11.10.0**

Complete to the MULLARD specification including PARMEKO OUTPUT TRANSFORMER. Switched inputs for 78 and L.P. records plus a Radio position. Extra power to drive a Radio Tuning Unit is also available. (Carr. & Ins. 6/6). Please state L.S. impedance.

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

THE "MONO-GRAM"

A small Amplifier of genuine high quality performance. Incorporates MULLARD ECL86 Valve, separate BASS and TREBLE controls. PARTRIDGE output Transformer producing up to 3 watts undistorted output. (Carr. & Ins. 3/6).

Kit of Parts **£4.10.0** Assembled and Tested **£6.0.0**

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

The NEW CHASSIS PUNCH SET

Five of the most used Hole Punches made of the finest hardened steel will save hours of tedious hand labour. Suitable for Aluminium, Sheet Metal, Plastic, etc. Punch Sizes ⅝", ¾", ⅞", 1", 1⅛", complete with Tommy Bar, Tapered Reamer, and Zip Fastening Carrying Case.

PRICE **49/6** P.&P. 3/6

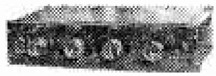
SEND FOR CURRENT PRICE LIST OF ALL LEADING RECORDING TAPES AND ACCESSORIES

PRICE REDUCTIONS

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

With PARTRIDGE OUTPUT TRANSFORMER £1.6.0 extra.

MULLARD 2-VALVE PRE-AMPLIFIER TONE CONTROL UNIT



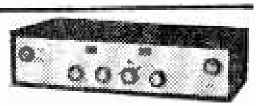
Employing two EF86 valves and designed to operate with the Mullard AMPLIFIERS but also perfectly suitable for other makes with input up to 250 m/V.

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

KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£9.10.0** (Carr. & Ins. 5/-).

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

THE "TUDOR" STEREO AMPLIFIER



PRICE **£15.0.0** (Pkg. & Carr. 7/6)

A self-contained Shelf-mounting Amplifier designed to provide high quality stereophonic and monophonic reproduction. Each channel provides a rated output of 6 watts and for monophonic operation approx. 12 watts is produced. Separate BASS and TREBLE controls. The Cabinet is finished in Black Crackle. Size 14 x 8 x 4in. Send for full specification.

HI-FI STEREO HEADPHONES

For the connoisseur who requires perfection. Each Earphone consists of a 2½" Dynamic Loudspeaker with a full frequency range, fitted with foam rubber Ear Pads for added comfort to keep out noise and to maintain an excellent bass response. The resistance Junction box with change-over switch provides simple transfer from Phones to Speaker. Specifications: Frequency Range - 25-15,000c.p.s. Input Impedance - 16 ohms. Power rating - ½ watt. Weight - 18 ozs.

PRICE **5 Gns.** P. & P. 2/6. (Junction box 15/- ex.)

STEREO STETHOSCOPE HEADSETS

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

MONAURAL STETHOSCOPE HEADSETS

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

ACOS MONAURAL STETHOSCOPE HEADSETS

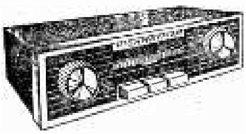
Suitable for Tape Recorders, or monitoring tape recorders, 100 ohm impedance magnetic. Complete with lead. (Originally 21/-) OUR PRICE **12/6** P.&P. 1/6

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

Great Britain's Greatest Electronic Hobbies Organisation

STERN-CLYNE

NEW LOW PRICES — NOW YOU CAN AFFORD A CAR RADIO



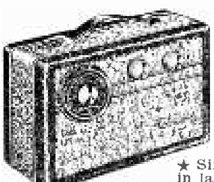
THE 'HIGHWAYMAN' OUR QUALITY CAR RADIO TO BUILD YOURSELF AT A NEW LOW PRICE

Look at these features:
★ Attractive styling. ★ Push-pull output ★ Three latest Mullard transistors plus valves types EBF83 and ECH83. ★ No Buzz, high output and sensitivity. ★ Printed circuit (latest type). 7 x 4in. high flux p.m. speaker and baffle. ★ Medium and Long Waves. ★ Push button for fingertip control. ★ Extremely low battery consumption (less than ½ amp). ★ Easy to fit any make car. (Positive earth only.) ★ 12-volt operation. ★ Compact size, measures only 7 x 7 x 2in. deep. ★ Easy assembly, supplied with dial and drive already mounted.

Special inclusive price of ONLY **£7.19.6** Plus 5/- P. & P.

All parts available separately. Individually priced parts list and comprehensive instruction booklet 2/6 post free. (Deducted from cost if complete parcel purchased later.)

THE "AIR KING"



Our highly successful six-transistor luxury portable with the "SLIM LINE" look. To build yourself, with printed circuit chassis for reliability and simplicity in construction. May be used as Car Radio, with full MEDIUM wave and LONG wave coverage.
Look at these features:
★ 500 milliwatt output to high flux 7 x 3½in. high fidelity loudspeaker. ★ Six selected MULLARD TRANSISTORS in latest super-sensitive circuit plus germanium diode. ★ Compact size only 9½ x 3½ x 6½in. high. ★ Attractive three-tone cabinet, black, dark grey and silver grey with gilt control knobs and all gilt fittings. ★ Coax. socket for car aerial. ★ Brand new guaranteed components. ★ Push-pull output. ★ Automatic volume control. ★ Long-life battery. ★ Super-sensitive internal Ferrite rod aerial. Special inclusive price for all required components. ONLY **£7.19.6** Plus P. & P. 4/-.

Alignment service available. Full assembly details and individually priced parts list, all of which are available separately, price 1/6 post free.

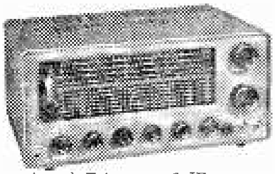
ANOTHER NEW BRANCH!

OPENING SHORTLY AT

20-22 WITHY GROVE MANCHESTER 4

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

THE HE30 4-BAND COMMUNICATION RECEIVER



One of the finest general coverage bandspread Receivers available at this price. Covering 550Kc/s—1600Kc/s, 4.8Mc/s—14.5Mc/s, 1.6Mc/s—4.8Mc/s 10.5Mc/s—30Mc/s. Illuminated slide rule dial, calibrated every 5Kc/s on 80 and 40 metres. Edgewise S-meter. 0.100 logging scale, coverag efrom 0.55—30Mc/s. 8 valve plus Rectifier superhet circuit. RF Stage with an Aerial Trimmer. 2 IF Stages. B.F.O. control Q-multiplier. Controls: Function Switch, Audio Gain, Selectivity (Q-multiplier), Frequency (BFO), Band Selector, IF Gain, Trimmer, AVC-MVC Switch, ANL Switch, Main Tuning, Bandspread Tuning and Headphone Jack. Selectivity −60dB at 10Kc/s, 0.8Kc/s at 6dB (with Q-Multiplier) IF-455Kc/s. External PM Speaker reqd., 4 or 8 ohms impedance. Output 1.5 watts. 8 modern Miniature B7G Base Valves and 5Y3 Rectifier. Size 15 x 10 x 7½in. Grey crackle finish. 220/240 volt A.C. mains, 50-60 cycle operation. Full instructions and circuit diagram supplied. Send S.A.E. for leaflet. PRICE **40 gns.** Carr. & Pkg. 15/-

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

SEE PRECEDING PAGE FOR OTHER STERN-CLYNE PRODUCTS

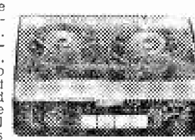
THE "TRAVLER" MkII

Introducing our new ready-built transistorised car radio for ONLY **9½ Gns.** P.&P. 5/- including 7 x 4in. speaker fitted to baffle, fixing brackets, filter unit, all nuts and bolts with fitting instructions
H.P. Terms: Dep. £2.19.6 (Plus 5/- P. & P.) and 7 monthly payments for £1.2.6.

Star Features ★ Handsomely Styled. ★ Mullard Valves and Transistors. ★ Push Buttons ★ 1½ watts Output. ★ Long and Medium Wavebands. ★ Quality Speaker (E.M.I.). ★ Easily Fitted. ★ Radio Luxembourg (and many other foreign stations) 12 volt Positive Earth Only (applies to 99.8% of the cars on the road). ★ Dimensions 7 x 2 x 7in. depth.

Optional extras. 3 section chromium plated weatherproof telescopic aerials type 1 17"/44". **19/6**; type 2. 2"/43". **29/6**, both plus P. & P. 2/6 if purchased separately.

POCKETCORDER TRANSISTORISED RECORDER



Why be bothered with a notepad? Take Pocketcorder with you on those business trips, the mighty Midget is ideal. Simple to operate, a unique 4-way push-button Switch for record/playback, etc., and remote control switch built into microphone ensures complete ease of handling. Fully adjustable speed through the life of Batteries and the volume and tone from the 2¼" internal speaker is outstanding. All accessories included such as Leather Case, Accessory Case, Crystal Earpiece, Tape, Batteries and Microphone, no other extras required. Up to 34 mins. recording time, operates on 1-9 volt PP3 and 2-1½ volt U12 Pen Batteries. Size 5¼ x 4 x 2in. Weight 24ozs. PRICE **12 Gns.** P. & P. 4/-
Spare 2¼" empty spools, 1/-; Spare 2¼" 200ft. L.P. Tape, 5/-.

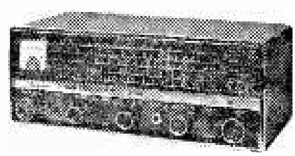
STEREO TAPE DECK WITH BUILT-IN PRE-AMPLIFIER

A professional addition to your Hi-Fi Stereo System consisting of two basic Units, the Tape Deck and Pre-amplifier, which employs 4 Transistors and 4 Valves. The Unit with record and playback ¼ track stereo or ¼ track mono at either 7½ i.p.s. or 3¾ i.p.s. both speeds being fully equalised.

42 GNS. Carr. & Pkg. 15/-

Features: Track System: ¼ track 2 channel stereo or monaural record and playback. Independent single channel recording on either channel while playback on other channel. Head Type: ¼ track 2 channel inline stereo and associated erase heads. Low loss laminated pole pieces. Level indicators: 2 Meters, 1 per channel. Digital Counter: 3 digit tape position indicator. Automatic Stop: When tape runs out or breaks. Inputs: Microphone 1mV (50K. ohms impedance) Gram/Tuner 50mV (high impedance). Output: (cathode follower). Monitor Sockets: 2 x 5K. ohms impedance. Audio Output: 500mV. Oscillator: Push-pull 80 Kc/s. S/N Ratio: −45dB or better at 7½" tape speed. Separation: 45dB or more between stereo channels. Frequency Response: 40 to 15,000 cycles per sec. at 7½ i.p.s., 40 to 9,000 cycles per sec. at 3¾ i.p.s. Single Motor: 4 pole heavy duty induction type. Power Supply: 240v A.C. 50 cycles. Size 6½" x 10½" x 15". Tape Size: Up to 7". Line Up: 4-2SB173 Transistors, 2-12AT7, 1-1AU7, 1-12BH7 Valves.

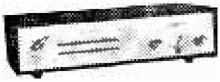
THE HE-40 4-BAND COMMUNICATION RECEIVER



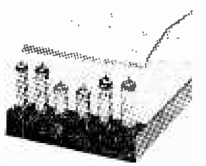
Completely built and ready to go. High sensitivity Superhet receiver covering 550 Kc/s—1,500 Kc/s, 1.6 Mc/s—4.4 Mc/s, 4.4 Mc/s—11 Mc/s 11 Mc/s—30 Mc/s. Electrical Bandspread tuning. Slide rule type tuning dial. Internal ferrite rod aerial for medium waveband reception and a 59in. 10 section chromium plated telescopic whip aerial for the short wave bands. Sockets for optional outdoor aerial. Internal high flux monitor loudspeaker. Latest modern miniature B7G base valves. Headphone socket (may also be used for external loudspeaker). ANL. BFO. built-in "S" meter. 220/240 volt A.C. mains, 50-60 cycle operation. Handsomely styled cabinet with grey crackle finish and handsome front panel, with chrome and satin chrome fittings. Measures 13½in. x 8½in. x 5½in. (high) and weighs only 11¾ lbs. A comprehensive instruction manual is supplied. An ideal receiver for the radio amateur and short wave listeners of all ages. Send S.A.E. for leaflet.

PRICE **£24.15.0** Carr. & Pkg. 12/6

INTRODUCTION OFFER ! ! *Available Shortly*



FOR ONLY **48 gns** Plus 15/- Pkg. & Carr.



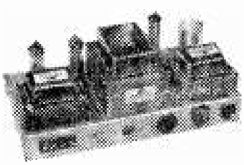
THE TUDOR STEREO HI-FI SYSTEM, comprising a Self Powered AM/FM Tuner, Stereo Pre-amplifier, 12 watt per channel Stereo Power Amplifier. The Tuner and Pre-amplifier are housed in matching black crackle finish metal cabinets for shelf mounting, with silver metal dials and matching knobs. Specifications: **Tuner**—Outstanding quality providing full VHF/FM long and medium waveband coverage, frequency range FM 87.5-108.5 Mc/s, AM/MW 522-1630 Kc/s, LW 145-270 Kc/s 100mV output mains supply 105/240 A.C. Valve line-up: ECC85, ECH81, EBF89, EB91, EM84, ECC83. Multiplex outlet provided. **Pre-amplifier**—Designed for use with the Tudor Stereo Power Amplifier with inputs for most types of Pickups, direct play from Tape-Heads and ample sensitivity for either Crystal or Moving Coil Microphone. Distortion 0.1%, tape outputs 100mV from 90K. ohm source, inputs—Microphone 5 mV, Tape 5.3 mV, R.I.A.A. 4.3mV flat 250 mV, Tuner 100mV. Valve line-up: 2—EF86, 1—ECC83. **Power Amplifier**—14 watts per Channel, sensitivity 1 volt r.m.s. for 14 watts output, frequency response ± 0.5dB 20 c/s.—20 Kc/s. Speaker impedance 4, 8 or 16 ohms, surplus power available for Tape Pre-Amp, mains supply 105/240 v. A.C. Valve line-up, 2—ECC83, 4—EL84, 1—GZ34.

DOUBLE FEATURE POWER AMPLIFIER AND JL10 POWER AMPLIFIER

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

Brief Specifications:

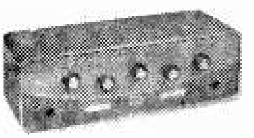
★ J.L.10 POWER AMPLIFIER



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

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

DOUBLE FEATURE PRE-AMPLIFIER



Inputs for microphone, crystal or magnetic pick-ups, tuner unit. Push-button switching for 3 tape speeds equalised. Tape erase Bias Oscillator circuit incorporating ferrox-cube transformer. Function switch, separate base, treble and volume controls, level control and latest EM87 magic eye level indicator. The pre-amplifier is totally enclosed in a silver hammer finish steel case, and an attractive perspex front panel completes the presentation.

KIT OF PARTS **£17.0.0** READY BUILT **£21.0.0** C. & I. 5/-.

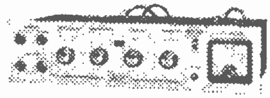
PRICES: If both above units purchased together:
KIT OF PARTS **£27.10.0** READY BUILT **32 Gns.** C. & I. 10/-.

MODEL CR3/S TAPE RECORDER

MODEL CR3/S incorporates the HF/TR3 Mk. II Tape Amplifier (described below) and the Collaro "Studio" Twin Track 3-speed Deck operating at 1⅞in., 3¾in., and 7½in. speeds. Complete with microphone and 1,200ft. tape.

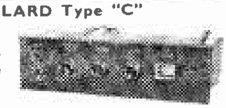
KIT OF PARTS **£33.8.0**
ASSEMBLED AND TESTED **£43.0.0**
(Carr. & Ins. 15/- extra).

STEREO TAPE PRE-AMPLIFIER



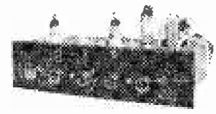
MODEL STP-1. For use with current TRUVOX, BRENELL or COLLARO "STUDIO" ½ and ¼ track Stereo Decks. Incorporates Ferrox-cube Oscillator, 4-speed Equalisation Signal Level Meter and separate Gain Control. Includes separate Power Unit. KIT OF PARTS **£22.0.0** (Carr. & Ins. 8/6.) ASSEMBLED **£28.0.0**
Instruction book and detailed price list (free with kit) available separately at 5/- Post Free.

TAPE PRE-AMPLIFIER MULLARD Type "C"



Suitable for most ¼ track, Mono Tape Decks. Incorporates Ferrox-cube Push-Pull Oscillator. Treble Inductor and 3-sp. Equalisation. Includes separate Power Unit.
KIT OF PARTS **£14.0.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.10.0**
Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.

MULLARD TAPE AMPLIFIER MODEL HF/TR3/MK.II



Based on Mullard's Type "A" design and suitable for most ¼ track Mono Tape Decks. Incorporates Ferrox-cube Treble Inductor, Gilson Output Transformer, and 3-speed Equalisation. Includes separate Power Unit, using PARTRIDGE Mains Transformer.
KIT OF PARTS **£13.13.0** (Carr. & Ins. 7/6). ASSEMBLED **£19.0.0**
Instruction book and detailed price list (free with kit) available separately at 3/- Post Free.

COMBINATION TAPE UNITS

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

	Kit	Assembled
STP-1 Pre-amp with Collaro Studio Tape Deck......	£36. 0.0	£42. 0.0
Assembled with track switch fitted. £44.2.0.		
STP-1 with Brennell Mk.5 Series II with Track Switch fitted	£64. 0.0	
STP-1 with Brenell Mk.5 Series II, ¼ Track Deck......	£74.15.0	
Type "C" Pre-amp with Collaro Studio Tape Deck....	£24.10.0	£30. 0.0
Assembled with deck wired and matched. £32.2.0.		
Type "C" Pre-amp with Brenell Mk.5 Series II Deck..	£46.11.0	£53. 1.0
Assembled with deck wired and matched, £55.3.0.		
HF/TR3 with Collaro Studio Tape Deck............	£24. 3.0	£29.10.0
Assembled with deck wired and matched. £31.12.0.		
HF/TR3 with Brenell Mk.5 Series II Deck..........	£46. 4.0	£51.11.0
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Model 226 De Luxe Stereo	£56. 0.0	£11. 0.0	12 of £4. 2.6
Stereo 55 Stereo	£29.18.0	£5.18.0	12 of £2. 4.0
RADIOGRAM CHASSIS			
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AVO Multiminor Mark 4	£9.10.0	£1.18.0	12 of 14/4
T.M.K. TP10	£3.19.6	£1. 3.6	3 of £1.2.0
T.M.K. TP58	£5.19.6	£1.15.6	3 of £1.11.4
T.M.K. Model 500	£8.19.6	£1.15.6	12 of 13/8
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GARRARD AUTOSLIM De-luxe AT6 (Mono PU)	£11. 9.0	£2. 6.0	12 of 16/11
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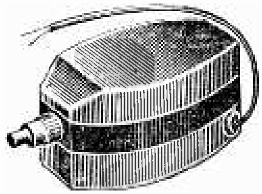

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Double Play	7in. reel, 2,400ft.	42/-		
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	5¾in. reel, 1,200ft.	17/6	4in.	2/-
	5in. reel, 900ft.	15/6	5in.	2/-
Standard	7in. reel, 1,200ft.	17/6	5¾in.	2/-
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Constructor's Booklet	2/-
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OC71 **6/-**, OC72 **7/6**, OC81D **7/6**, OC81 **7/6**, OC44 **8/9**, OC45 **8/6**, OC171 **10/6**, AF117 **9/6.**
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Med. wave, 2 transistors, 2 diodes, min. earphone, ferrite aerial. Micro receiver 3 x 1¾ x ⅝in. **49/6**, batt. 3/6.

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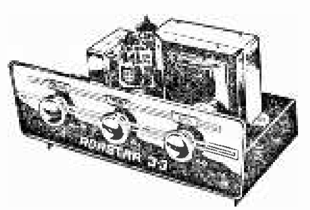

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"Performs agreeably well" (The *Gramophone*)

BUILD YOUR OWN RECORD PLAYER FROM £9.16.0 AND SAVE POUNDS!!

4 Speed Autochange or Single Player units supplied with Brand New 2-tone Portable Cabinets 17x15x8½in. de luxe Strong carrying handle, gilt finish clips and hinges. As used by Famous Make for 20gns. models. Ready cut-out motor board 14x13in. Front baffle with 7 x 4in. high flux loudspeaker and 3 watt 2 valve UY85, UCL82 2-stage amplifier ready built on metal chassis 12 x 3 x 2½in. Quality 3 ohm output transformer, low hum level circuit. Volume and Tone controls. 3-core safety mains lead. All items fit together perfectly. Special instructions enable assembly in 30 minutes, only 5 wires to join! 12-month written guarantee. Available separately or package deals as below.

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Garrard Autoslim ..	£12.18.0	P.P. 5/6
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E.M.I. auto stop/start ..	£11.5.0	P.P. 5/6
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Amplifier with 7 x 4in. speaker	£3.17.6	P.P. 2/6
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B.S.R. UA14	£5.19.6	P.P. 4/6
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Garrard Autoslim ..	£6.17.6	P.P. 4/6
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B.S.R. Autochange UA12 Stereo/Mono	£7.10.0	P.P. 4/6

Replacement sapphire styli available from 5/3.
Replacement Xtals from 15/-; Stereo from 31/6.

BARGAIN SINGLE PLAYER KIT 200/250 v. A.C. (less cabinet)

£5.15.0 Post 5/-.

With 2-stage Amplifier; 3-watt; 2 valves, UCL82, UY85; High-flux 5in. speaker; 4-speed E.M.I. Turntable, 16, 33, 45, 78 r.p.m.; Crystal Pick-up for LP/STD. Records, 7in. 10in. 12in.; Cut out Mounting board 12⅜ x 9⅞ in.

ARDENTE TRANSISTOR TRANSFORMERS

D3035, 7.3 CT:1 Push-Pull to 3 ohms for OC72,	11/-
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D239, 4.5:1 Driver, ⅞in. x ⅝in. x ½in.	11/6
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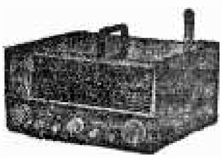

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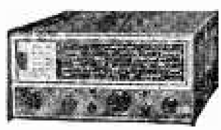

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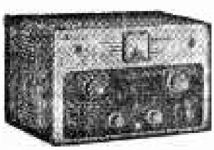

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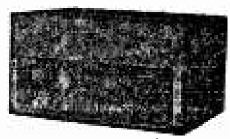

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Practical Wireless

Vol. XXXIX No. 684 FEBRUARY, 1964

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Contents

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

In Search of a Leader!

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

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

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

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

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

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

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

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

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

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

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

ROUND THE WORLD of WIRELESS

NEWS AT HOME AND ABROAD

Retailers Association Adopts New Symbol

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

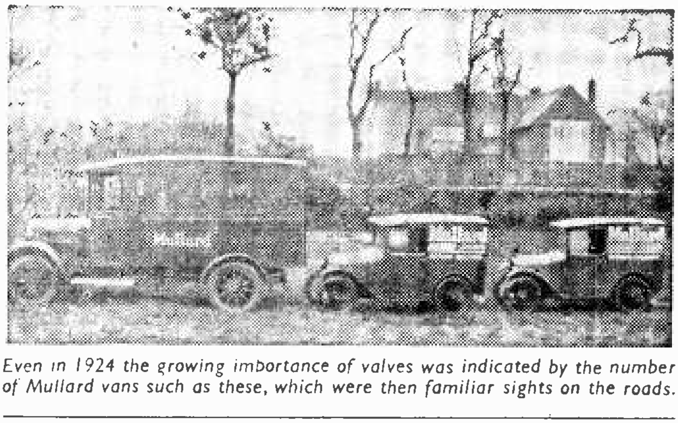
The new symbol has been designed along the same lines of the already well known R.T.R.A. trade mark.

The symbol of the Electrical Appliance Association

25 Years of Valve Manufacturing

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

By 1944 the output from this plant, which had a labour force of 200, was 6·5 million valves a year. This had risen to 33 million by 1955 and to 50 million by 1958, when 5,000 were employed in this one factory. Now the Blackburn plant is only one of 18 Mullard factories throughout England, producing a variety of sophisticated components for the electronics industry, bearing only a technical similarity to the early transmitting and receiving valves, with which S. R. Mullard began his manufacturing company 43 years ago.



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

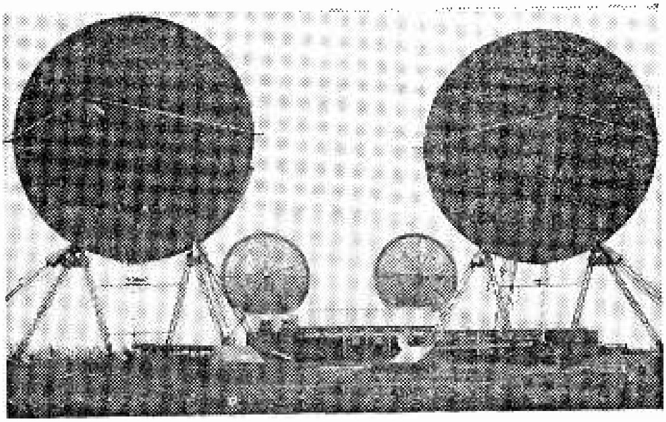
RADIO EQUIPMENT FOR TSR-2

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

The ILS is that of the Marconi Sixty Series equipment. The communication equipment will provide both single and double sideband transmission and reception at high power.

NATO COMMUNICATIONS NETWORK COMPLETE

THE Supreme Headquarters Allied Powers Europe has recently accepted, on behalf of the North Atlantic Treaty Organisation, the final station in NATO's ACE HIGH communications network. This vast system of radio stations stretches from Norway to Turkey; an 8,300 mile link, incorporating 82 stations, located in nine of the NATO countries.



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

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

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

NEW TITLE FOR I.E.E. JOURNAL

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

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

Aircraft Equipment Tours West Germany

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

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

R.T. for Desert Patrols

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

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

STC ACQUIRES HUDSON ELECTRONICS

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

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

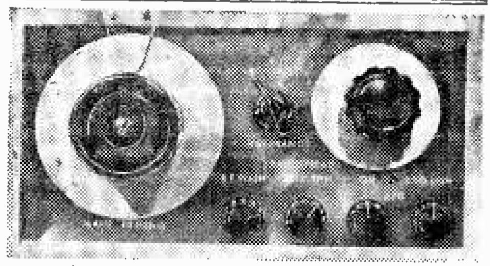
Electronics Symposium in Birmingham

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

A MODERN COMPACT

3-TRANSISTOR S.W. CONVERTER

FOR 1·7—31·5 Mc/s



BY J. VAITES

THE converter to be described is a portable, high performance, transistorised front-end unit covering the short wave bands from 1·7Mc/s to 31·5Mc/s. It is designed to feed into any broadcast receiver without any alteration at all to that receiver.

Being of compact size, it is an ideal companion to any standard transistor portable, provided the portable has an external aerial socket. It can, of course, be used also with any other type of broadcast receiver, whether mains domestic receiver or car radio. This add-on unit thus converts the basic receiver into a double conversion receiver, providing an interesting and useful combination.

The unit provides a cheap introductory step to the short wave bands for the beginner, who will almost certainly have the use of at least one broadcast receiver in the household. At the same time, being electrically bandspread and incorporating facilities for s.s.b. reception, the converter is an ideal piece of equipment for the "ham" station, whether fixed or mobile.

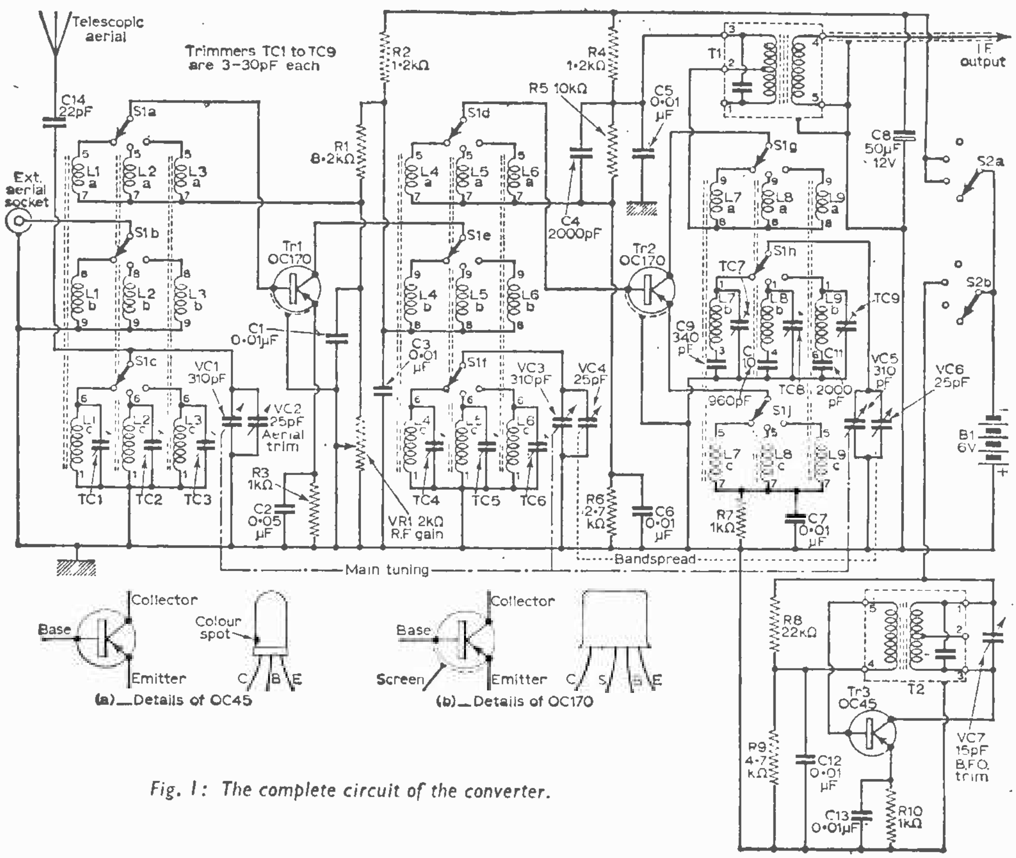


Fig. 1: The complete circuit of the converter.

Circuit Description

The circuit (see Fig. 1) is designed around the new Denco transistor coils—based on their well-tried range of Miniature Dual Purpose Coils. Ranges 3, 4 and 5 are used, covering respectively 1·67 to 5·3Mc/s, 5 to 15Mc/s, and 10·5 to 31·Mc/s. The coil connections are switched by a 3-way 9-pole Yaxley switch (S1), using three wafers with interposed screens.

The r.f. stage uses an OC170 transistor (Tr1) with blue coils in the aerial stage and yellow coils as coupling to the second stage. An r.f. gain control VR1 varies the base voltage of Tr1. An external aerial can be fed to the primary of the aerial coils, or a built-in telescopic aerial can be used, this being connected permanently to the aerial tuned circuit via a small capacitor.

The second stage is the mixer oscillator and the transistor (Tr2) is also an OC170. The white coils are used here and an output of nominally 1·6Mc/s is obtained at T1. The broadcast receiver is, therefore, tuned to this frequency, corresponding to 187·5m on the medium wave band. In practice, since the medium wave band of many receivers only goes down to just below 200m, the lowest clear wavelength on the band is selected (this may fall anywhere between 190 and 200m) and the output of the converter adjusted to it.

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

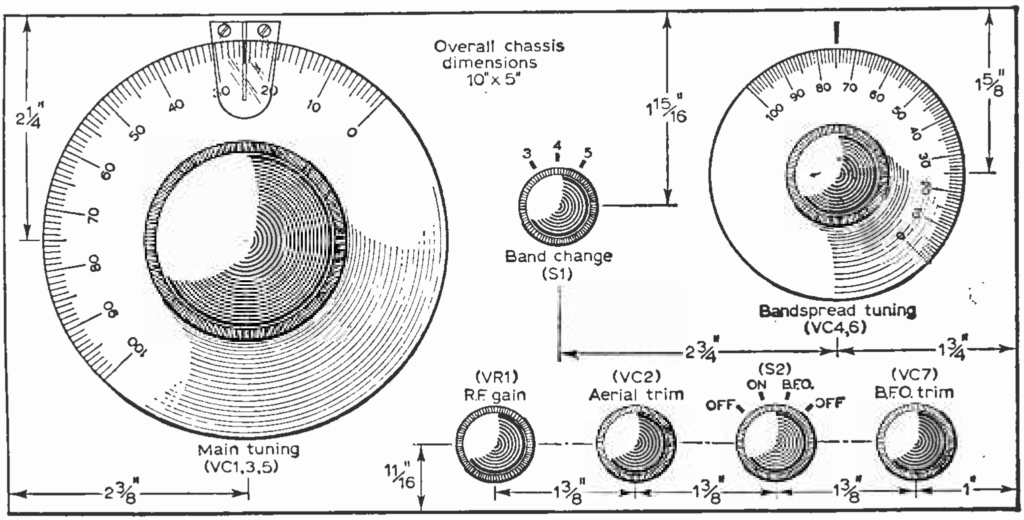


Fig. 2: Drilling details and control layout of the front panel.

TABLE I

Frequency and Wavelength Coverage

Range	DIAL SETTING 100	DIAL SETTING 0
3	1·67Mc/s 180m	5·3Mc/s 57m
4	5·0Mc/s 60m	15Mc/s 20m
5	10·5Mc/s 28m	31·5Mc/s 9·5m

Beat Frequency Oscillator

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

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

Mechanical Construction

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

The chassis, of $\frac{1}{8}$in. bakelite or perspex, size 9in. x 4¾in., is drilled as per Fig. 3.

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

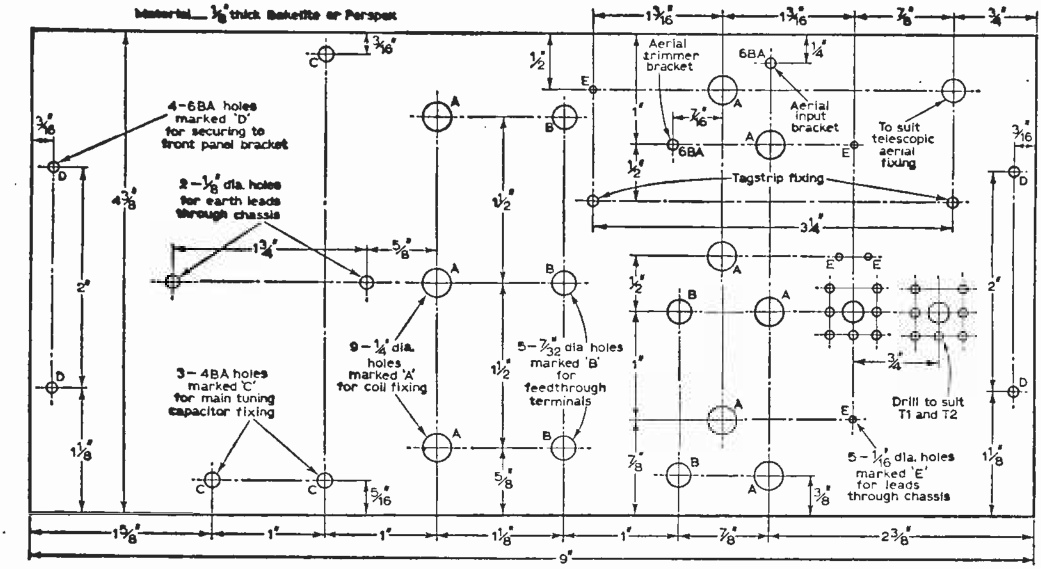


Fig. 3: Chassis dimensions diagram

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

The two supporting brackets are constructed from 20s.w.g. tin sheet as shown in Fig. 4, taking care to make the bends in the two brackets in the reverse mode, so that the whole job is symmetrical when fastened together.

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

The Case

The converter may be housed in a metal case, size 10in. wide x 5in. high x 4¾in. deep (internal

COMPONENTS LIST

Resistors:

R1	8·2kΩ	R6	2·7kΩ
R2	1·2kΩ	R7	1kΩ
R3	1kΩ	R8	22kΩ
R4	1·2kΩ	R9	4·7kΩ
R5	10kΩ	R10	1kΩ

All 10%, ¼W carbon

VR1 2kΩ potentiometer

Capacitors:

C1 0·01μF paper
C2 0·05μF paper
C3 0·01μF paper
C4 2,000pF ceramic or mica
C5 0·01μF paper
C6 0·01μF paper
C7 0·01μF paper
C8 50μF electrolytic 12V
C9 340pF silver mica
C10 960pF silver mica
C11 2,000pF silver mica
C12 0·01μF paper
C13 0·01μF paper
VC1, 3, 5 3-gang variable 310pF each section (Jackson type E 3)
VC2 25pF variable (Jackson type C801)
VC4, 6 25pF split stator (Jackson type C808)
VC7 15pF variable (Jackson type C801)
TC1-9 30pF concentric trimmer (Philips)

Inductors:

L1 Blue, range 3
L2 Blue, range 4
L3 Blue, range 5
L4 Yellow, range 3
L5 Yellow, range 4
L6 Yellow, range 5
L7 White, range 3
L8 White, range 4
L9 White, range 5
} Denco transistor dual purpose coils
Blue=aerial coil
Yellow=r.f. interstage coil
White=oscillator coil (for 1·6Mc/s i.f.)
(for coverage of ranges see Table 1)

T1 I.F. transformer 16/1·6
T2 B.F.O. transformer 17/1·6
} Denco

Switches:

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

Transistors:

Tr1 OC170 Tr3 OC45
Tr2 OC170

Miscellaneous:

Main tuning drive unit (Jackson Ball Drive 4489). Bandspread dial, 2in. dial calibrated 0-100 (Bulgin) with knob to suit. Five feedthrough connectors (Radiospares). Four 1·5V cells (Ever Ready U12).

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

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

Mounting and Wiring-up

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

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

R1 from pin 8 of L4 through hole in screen 2 to pin 7 of L1.

R6 and C6 from pin 7 of L4 to earth tag adjacent.

R7 and C7 from pin 7 of L7 to earth tag adjacent.

C3 from pin 8 of L4 to earth tag adjacent.

C1 from pin 7 of L1 to earth tag adjacent.

C9 from pin 3 of L7 }
C10 from pin 4 of L8 } solder direct to screen 1 at nearest point.
C11 from pin 6 of L9 }

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

Pin 1 of L1 to earth tag adjacent.

Pin 1 of L4 to earth tag adjacent.

Pin 7 of L2 through hole F1 to tag 6 on tagstrip.

Pin 7 of L5 through hole F3 to tag 8 on tagstrip.

Pin 8 of L5 through hole F2 to tag 9 on tagstrip.

Pin 8 of L8 through hole F4 to pin 2 of T1.

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

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

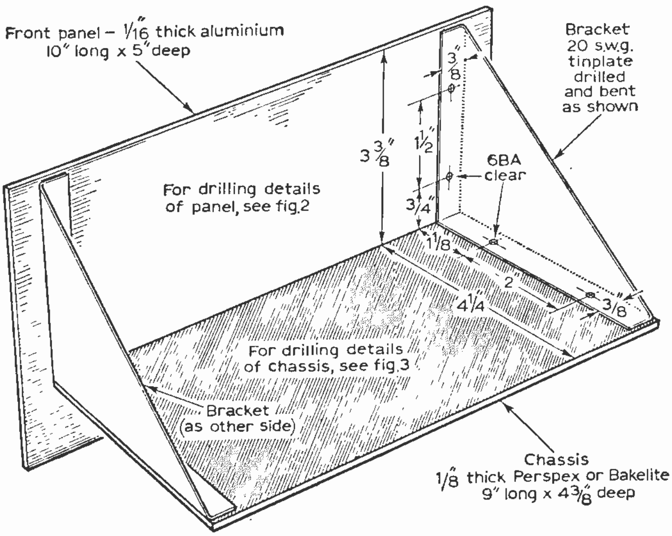


Fig. 4: The assembly of the front panel and chassis.

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

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

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

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

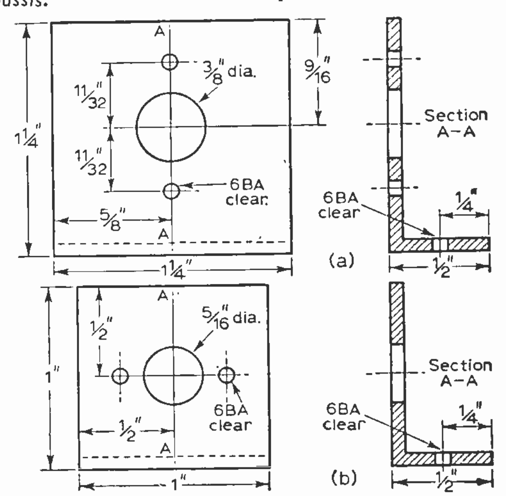


Fig. 5 (a) aerial trimmer bracket; (b) aerial input bracket.

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

The underchassis components are now wired up as follows:

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

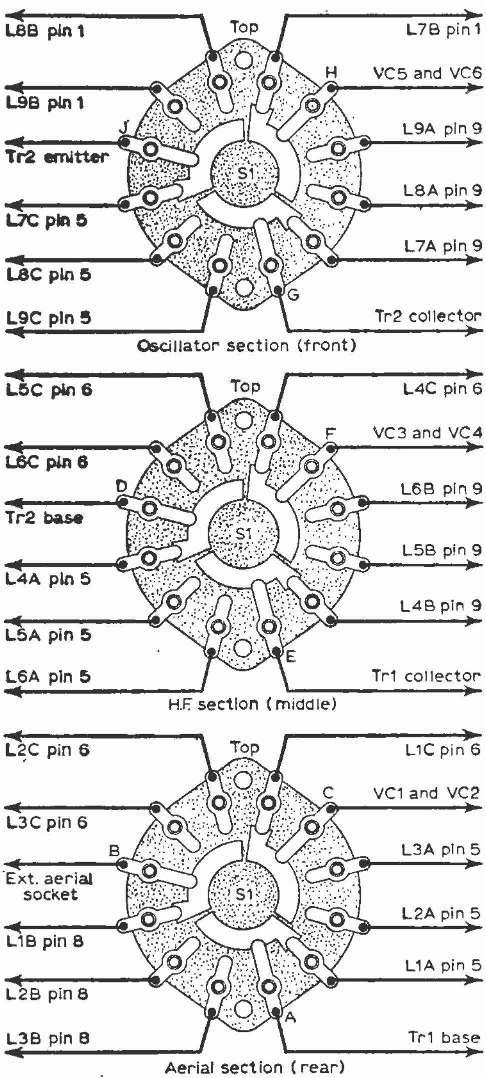


Fig. 6: Wiring of S1. Note: wafers viewed from rear.

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

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

Wiring points are:

Tr1	Collector	-	feedthrough terminal E2.
	Screen	-	tag 2 tagstrip.
	Base	-	feedthrough terminal E1.
	Emitter	-	tag 1 tagstrip.
Tr2	Collector	-	feedthrough terminal E3.
	Screen	-	use earth terminal on VR1.
	Base	-	feedthrough terminal E4.
	Emitter	-	feedthrough terminal E5.
Tr3	Collector	-	pin 3 T2.
	Base	-	pin 5 T2.
	Emitter	-	tag 11 tagstrip.

TABLE 2
Tracking Points

Range	BAND END		TRACKING POINTS	
	L.F. (Dial 100)	H.F. (Dial 0)	L.F. (Dial 89)	H.F. (Dial 8½)
3	1·67Mc/s	5·3Mc/s	1·83Mc/s	4·5Mc/s
4	5·0Mc/s	15·0Mc/s	5·5Mc/s	13·5Mc/s
5	10·5Mc/s	31·5Mc/s	11·5Mc/s	28·5Mc/s

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

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

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

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

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

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

Telescopic Aerial

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

The general idea is that the aerial selected should have a tapped hole in its bottom section A corresponding bolt of some ½in. length is fed up through hole M (Fig. 3) and tightened down with a nut, leaving enough thread to screw into the aerial. A solder tag is placed under the head of the bolt (i.e. underneath the chassis) and C14 is wired from this tag to the " live " tag of VC2.

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

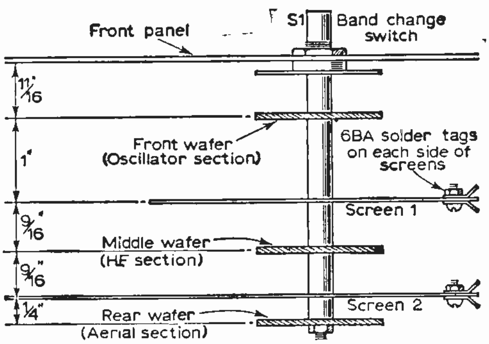
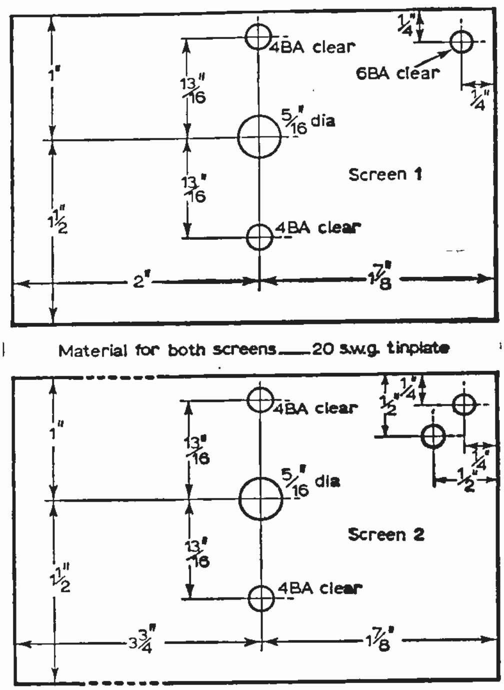


Fig. 7a (above): Showing the build-up of the switch.

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



Lining Up

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

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

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

Once this has been done the converter output lead is plugged in and the unit switched on. Range 3 is selected, with the main tuning capacitor fully meshed and the oscillator temporarily stopped by shorting across L7(b). The signal generator is fed into the aerial input socket via a 400Ω resistor (link generator chassis to converter earth) and adjusted between 1·5 and 1·6Mc/s (modulated) until a note is heard in the speaker. T1 is peaked and is now tuned to the input frequency of the basic receiver.

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

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

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

When this has been done the generator is set to the lower tracking frequency and the main dial set to a reading of 89. The cores of all coils of the appropriate range are now adjusted for maximum signal. The generator is then set to the higher tracking frequency and the main tuning dial set to a reading of 8½. The trimmers of all coils are adjusted for maximum signal. This process is repeated until no further adjustment of cores or trimmers is required.

Lining Up Without a Signal Generator

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

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

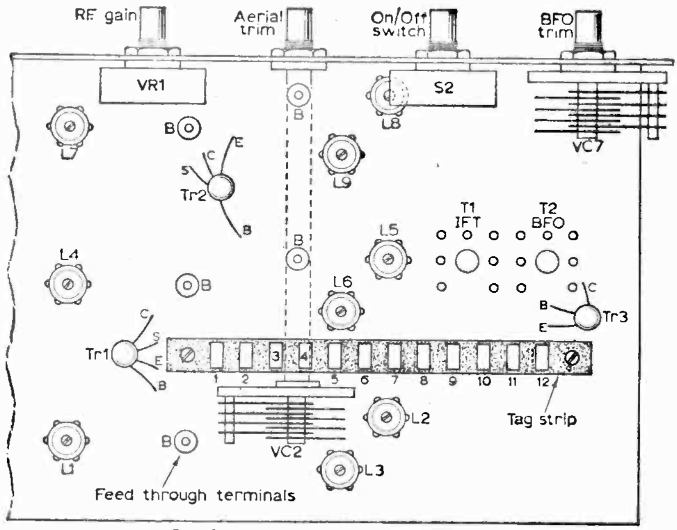


Fig. 8: Underchassis layout diagram.

Operating the Converter

The converter performance has been found to be very good when fed into a standard six-transistor portable and exceptional when backed by a more sophisticated strip.

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

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

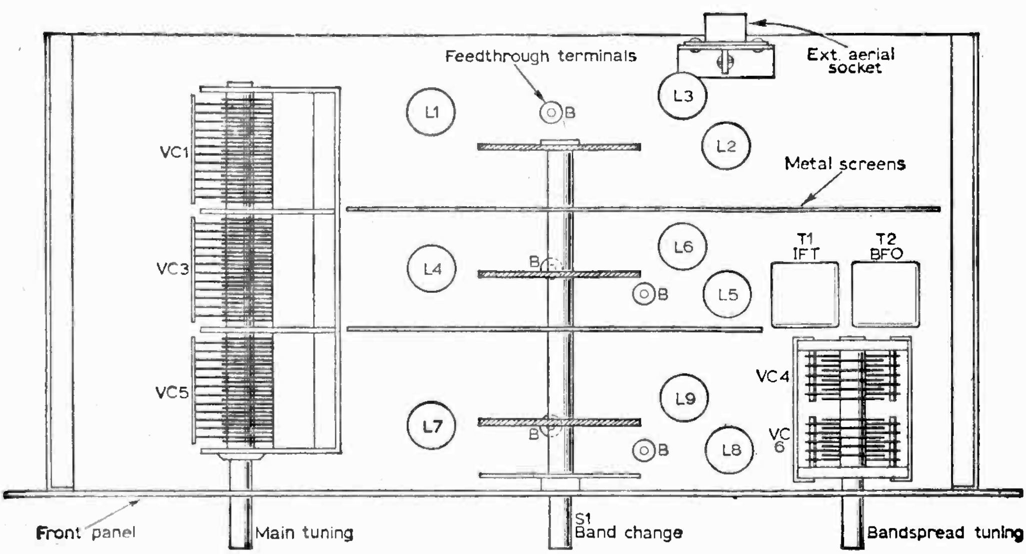
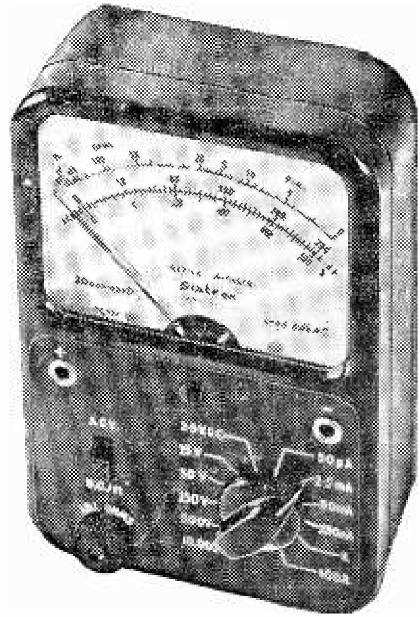


Fig. 9: Above-chassis layout of components.

Further Applications of the PRACTICAL WIRELESS "Sixteen" Multirange METER



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

Capacitor Testing

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

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

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

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

Combining the two formulae,

$$Xc=\frac{10^6}{2\pi fC}=\frac{E}{I}.$$

Transposing, we obtain

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

With an applied frequency of 50c/s the factor $\frac{10^6}{2\pi f}$ becomes 3·18 if the conversion is to milli-amperes, volts and microfarads. Thus $C=K\times I/E$.

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

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

Inductance Testing

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

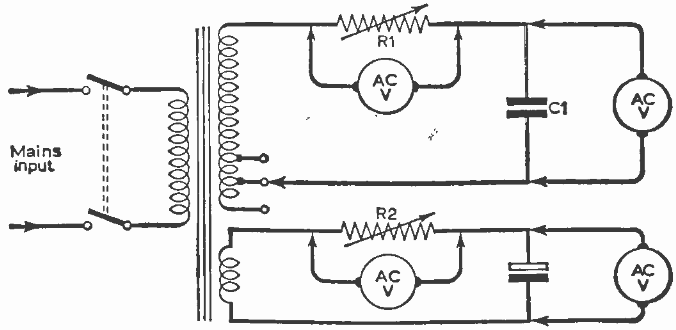


Fig. 1: A suitable circuit for calculating capacitor reactance.

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

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

Alignment Procedures

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

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

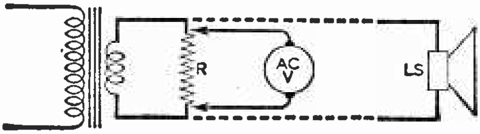


Fig. 2: Output voltage measurements.

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

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

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

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

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

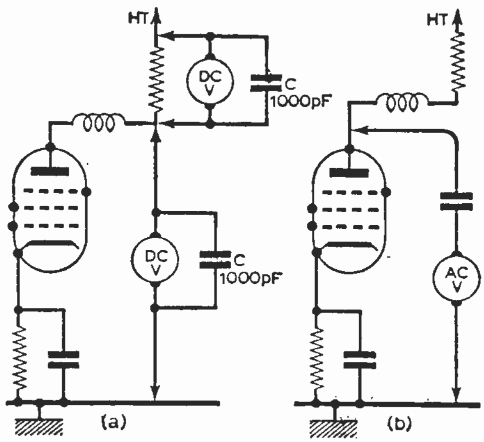


Fig. 3: Output measurements for vision alignment purposes.

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

A modulated input can be measured as in Fig. 3(b). With a capacitor of about 0·25μF in series with the meter, switched to a.c. volts, the signal gives an indication from zero to maximum.

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

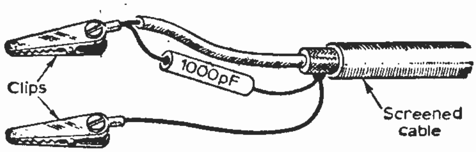


Fig. 4: A method of decoupling the meter which may be used with low currents and voltages.

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

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

Coaxial cable is used to connect the prods or clips to the meter and a decoupling capacitor, 0·001μF, is fitted directly to the "live" prod and the other end soldered to the braided outer of the coaxial cable. This method is not suitable for high voltage or current measurements where normal, separate leads should be used. ■

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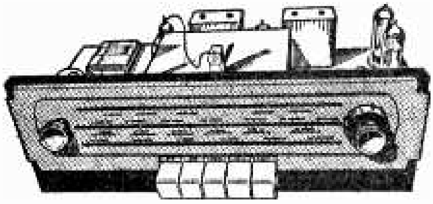

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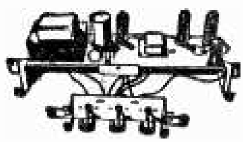

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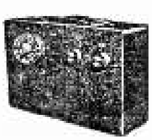

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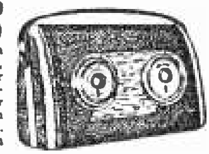

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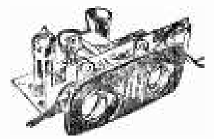

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wiring for SOUND

GETTING THE BEST FROM AUDIO EQUIPMENT

BY R. HINDLE

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

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

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

Speaker Extensions

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

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

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

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

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

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

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

Switching Circuits

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

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

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

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

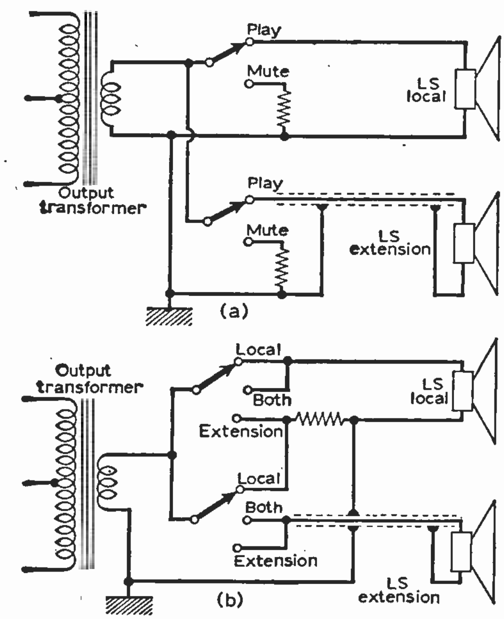

Fig. 1: Switching circuits for extension speakers.

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

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

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

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

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

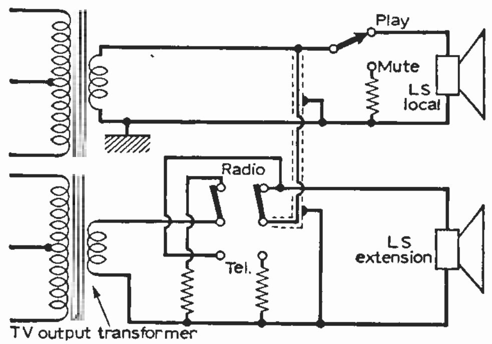

Fig. 2: Utilising a television loudspeaker as an extension speaker.

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

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

Volume Control

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

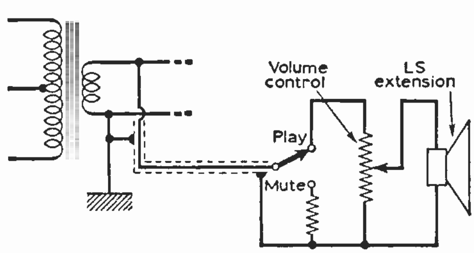

Fig. 3: Volume control for the extension speaker.

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

On the other hand, at low volume levels the potentiometer resistance becomes the amplifier extension load and if this is appreciably higher than the speaker impedance the amplifier will be presented with a mismatch! One must compromise. A potentiometer total resistance of not less than four times the speaker nominal impedance is suggested and, in round figures, 50Ω for a 3Ω speaker and 100Ω for a 15Ω speaker are sizes likely to be available.

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

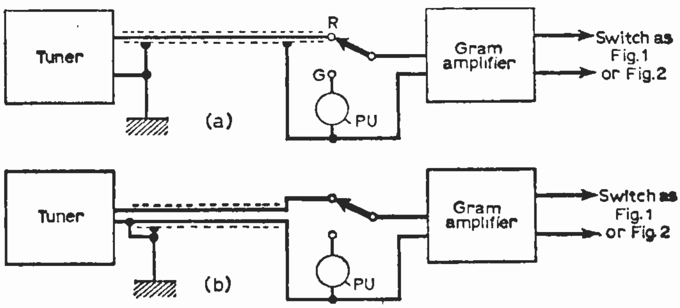

Fig. 4: Inter-wiring between separate tuner and amplifier.

A Personal Problem

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

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

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

Using the Main Amplifier

The first temptation was to provide only a tuner and speaker in the living room and to bring into use for radio the main and comparatively expensive amplifier in the lounge equipment. The tuner output would then be permanently wired by means of a coaxial cable into the lounge equipment where there would be the usual radio-gram switch, and on the output side of the amplifier would be one of the switch versions given in Fig. 1.

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

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

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

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

Self Contained Radio

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

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

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

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

The Method Adopted

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

—continued on page 931

TEST GEAR accessories

Part 1

BY C. MACKAY

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

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

TEST LEADS

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

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

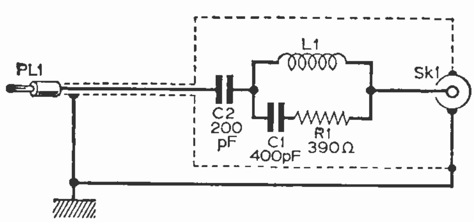

Fig. 1: The circuit of the dummy aerial unit.

COMPONENTS LIST FOR DUMMY AERIAL UNIT

R1	390Ω carbon composition 1W
C1	400pF midget ceramic
C2	200pF midget ceramic
SK1	coaxial socket
PL1	coaxial plug
L1	40 turns 28s.w.g. on ¼in. former (see text)

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

THE DUMMY AERIAL

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

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

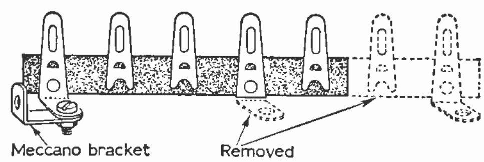

Fig. 2: The dummy aerial tagstrip.

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

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

CONSTRUCTIONAL DETAILS

It is advisable to construct the coil first. The original was made out of a short length of insulated spindle extension rod about 1½in. long and ¼in. in diameter. On it are wound 40 turns of 28s.w.g. wire so as to occupy 1in. of the former. The coil is then made tight and the whole component covered in polystyrene cement or some similar substance.

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

First drill a hole about ¼in. in diameter in the centre of the lid, then drill two 6B.A. holes to suit the coaxial socket used.

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

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

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

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

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

CONNECTIONS FOR OPERATING

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

The unit is now ready for use.

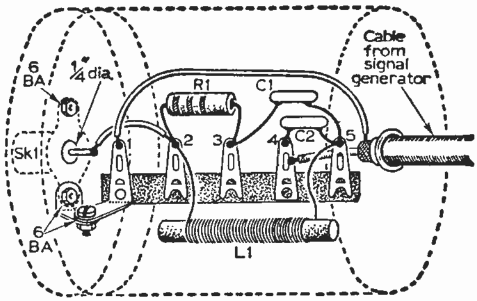

Fig. 3: Wiring and mounting the tagstrip bracket.

WARNING

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

Part 2 appears next month

Wiring for Sound

—continued from page 929

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

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

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

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

Looking again at Fig. 5 it will be seen that both ends can take radio simultaneously, in which case the resistors are in parallel and across the gramophone output. The gramophone equipment need not be switched on, of course. Similarly, both ends can take gramophone.

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

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

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

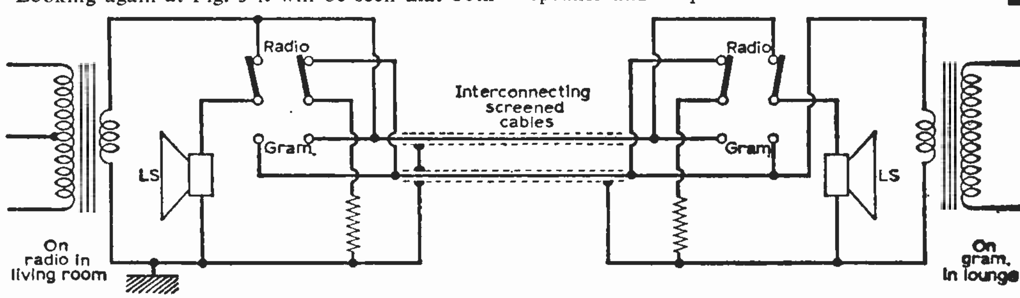

Fig. 5: The radio/gramophone interconnections.

PHOTOGRAPHIC TIMER

This simple design will provide a very functional piece of equipment

By S. A. KNIGHT

THIS simple timer gives time delays from 0·5 second to 60 seconds in two continuously variable ranges, each with a linear scale, and has a reasonable compensation for wide changes in mains supply voltages, so giving, when used as a photographic timer, near constant exposure factor by automatically making the actual switching time a function of the lamp brightness.

Using the specified type relay, normal enlarger bulbs up to 150W rating can be adequately switched, and although the top limit of 60 seconds may not in all cases be sufficient, the exposure set can be repeated if necessary, or the experimenter may increase the range by the addition of an extra capacitor or resistor. This will be dealt with later in the article.

Few Components Required

The complete circuit diagram is shown in Fig. 1 from which the simplicity is at once apparent. No mains rectifier is required as such as the valve used provides its own rectification in addition to its function as the timing control, and the only major components apart from this are a heater transformer capable of supplying 6·3V at 0·3A and a Post Office type 3000 relay, which is readily available on the surplus market.

Note that as the a.c. mains supply is applied directly across the valve circuit, the entire wiring of this circuit must be insulated from any exposed metalwork.

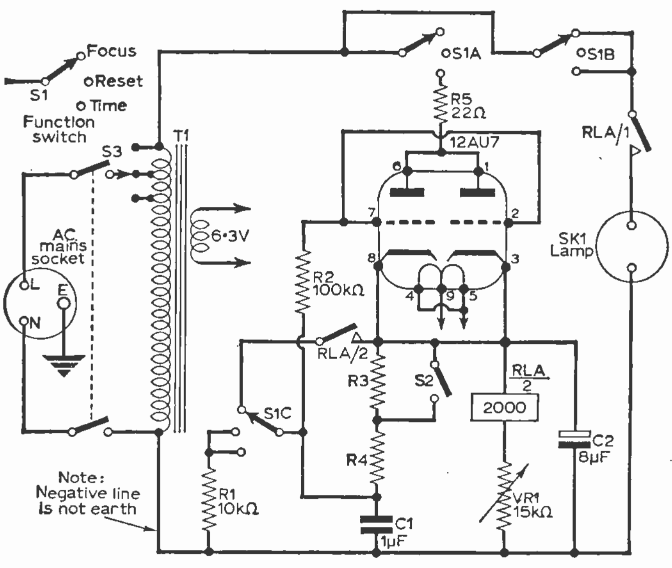

Fig. 1: The simple circuit of the timer. The values of R3 and R4 are found by experiment (see text).

Limitations of Simple CR Circuit

Nearly all timing devices depend upon the charge of a capacitor through a resistance, where the time constant of the combination is given by CR seconds. The major disadvantage of such a basic system is the fact that the charge is not linear with time, and when it is used to trigger off the control valve circuit, the scale used to indicate the time delay in seconds exhibits severe cramping at one end or the other of its rotation. For the charge to be linear, the charging current into the capacitor requires to be constant, and the rise in voltage across the capacitor terminals then increases proportionately with time.

The second failing of the simple C and R charging circuit is the fact that long time-constants call for large values of capacity and resistance, making the assembly bulky. The use of electrolytics is generally precluded from charging circuits where good stability is required, and paper capacitors of large capacity are not only bulky but expensive.

It will be seen from the circuit of Fig. 1 that the charging capacitor C1 is a 1μF and that the charging resistors R3 and R4 are standard ¼W types of a few megohms.

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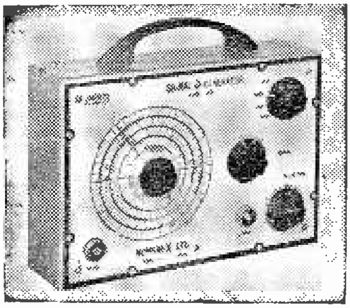

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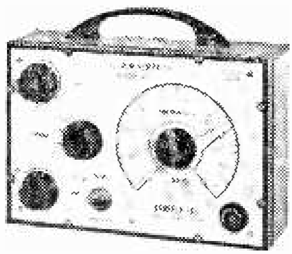

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1P1	6/6	6F12	4/-	16A5	9/-	EB91	4/-	EZ40	5/6	U52	7/6
1P10	5/6	6H6GT	2/-	19AQ5	9/6	EBC41	7/6	EZ80	6/-	U76	7/6
1P11	6/-	6J7GT	7/6	25L6GT	7/6	EBF80	8/6	EZ81	6/9	U78	5/-
1R5	4/9	6K7G	5/6	30C1	7/6	ECC81	4/-	HVR2	9/6	U142	7/6
1S5	4/-	6K8G	6/-	30L1	7/6	ECC82	6/9	KT33C	6/-	UBC41	8/6
1T4	2/9	6Q7G	5/6	35L6GT	7/6	ECC83	6/9	KT66	13/6	UCH42	9/6
1U5	5/6	6SL7GT	6/-	35W4	8/6	ECC84	6/6	N17	5/6	UF41	8/6
3Q4	5/6	6SN7GT	7/6	35Z4GT	8/-	ECC85	7/6	N18	5/6	UL41	8/6
3S4	5/6	6V6G	7/6	5763	7/6	ECF80	6/6	N19	6/-	UY41	7/6
3V4	6/-	6X4	5/-	80	6/-	ECF82	7/6	N709	7/-	W17	3/-
5Y3GT	5/-	6X5G	5/9	DAF91	4/-	ECH42	9/-	PCC84	7/6	W76	4/6
5Z4G	7/6	7Y4	6/-	DAF96	6/6	ECH81	10/-	PCF80	7/6	W142	8/6
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6AM6	4/-	12AD6	11/6	DF96	6/6	EF41	9/-	PCL84	9/-	X150	9/-
6AT6	5/-	12AH8	10/-	DH76	7/6	EF80	8/-	PL81	9/6	Z77	4/-
6BA6	5/-	12AT7	4/-	DH77	5/-	EF86	9/-	PL82	7/-	ZD17	4/-

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EL34 27/6, EL84 15/-, N709 15/-, 6V6G 15/-, 6BW6 14/- per pair. Push-Pull O.P. Transformer for above 3/15Ω 14/6. P. & P. 1/6. 12in. P.M. Speakers 3Ω 24/6. Baker's "Selhurst" 12in. 15Ω 15W Stalwart 80/-. 12in. Stereo Model £6.15.0.

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DK91, DF91, DAF91, DL92 or DL94....16/6
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ECH42, EF41, EBC41, UL41, UY41......35/-

Postage and packing 6d. Over £1 post free. C.O.D. 4/-.

Circuit Operation

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

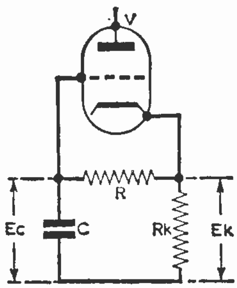


Fig. 2: A much simplified version of the circuit shown in Fig. 1 to illustrate the basic method of operation of the timer.

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

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

As the charge proceeds, the grid moves progressively away from the cathode potential, and after a certain interval, determined by the setting of VR1, sufficient valve current flows to operate the relay. Contacts RLA-1 then open, extinguishing the lamp, while contacts RLA-2 close, shorting out the resistors R3, R4 and clamping the relay fully.

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

Construction

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

The Function Switch

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

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

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

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

COMPONENTS LIST

Resistors:

- R1 10k Ω
- R2 100k Ω
- R3 see text
- R4 see text
- R5 22 Ω

All 10%, $\frac{1}{4}$W carbon

- VR1 15k Ω wire-wound potentiometer (Colvern CLR 3001)

Capacitors:

- C1 1μF paper 350V
- C2 8μF electrolytic 450V

Switches:

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

Miscellaneous:

- RLA P.O. type 3000 relay, 2000 Ω coil. Two sets of contacts; one normally open, one normally closed
- T1 Heater transformer, Primary 200-250V. Secondary 6·3V 0·3A
- V1 12AU7 or ECC82

Setting Up

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

With the unit connected to the mains supply and S2 closed, set the control VR1 to a maximum, that is, all resistance in circuit. Try a resistor of value between 2·2MΩ and 3·3MΩ for R4 and on switching to TIME, check for a period of about 10 seconds, using a stop watch or the second hand of a watch. When a value has been found that will give a maximum of about 10 to 12 seconds, the rest of the scale can be calibrated down to a lower limit of about 0·5 second. Note that the extreme lower part of the scale will be indeterminate, the lowest consistent timing being obtained with about one-eighth travel of the control in circuit.

Now connect a further resistor of about 6·8 to 10MΩ in series with the value for R4 already used, and with the control again at maximum, check the timing to get a value of about 60 seconds. When this has been done, the rest of the scale can be calibrated as before; this time a lower limit of about 3 to 5 seconds will be obtained, so that there is adequate overlap between the ranges. The values for R3 and R4 thus found, they should be permanently wired into the circuit, R3 going across the range switch S2. An idea of what the completed panel of the unit should look like, with a calibrated scale, is shown in Fig. 3.

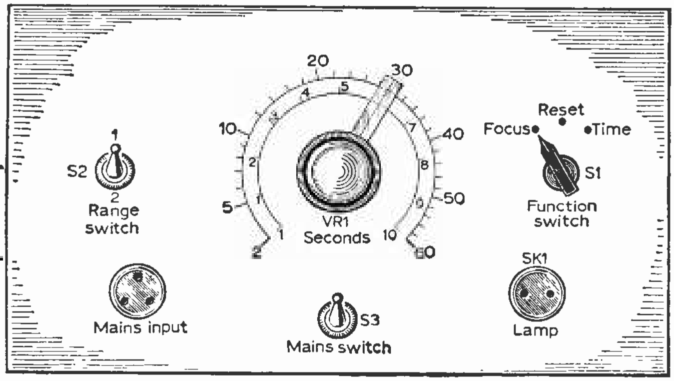


Fig. 3: A suggested layout of controls for the front panel of the instrument.

Extending the Range

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

All resistors may be ¼W rating, though higher ratings may be used if readily to hand. The valve should be of a type such as the 12AU7 (ECC82) using a B9A base, or the 6SN7 or equivalent in the octal series. The two triode sections in these valves are strapped across to make a single triode. ■

A MEDIUM WAVE RECEIVER

An inexpensive two-valve circuit

By D. G. HARDING

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

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

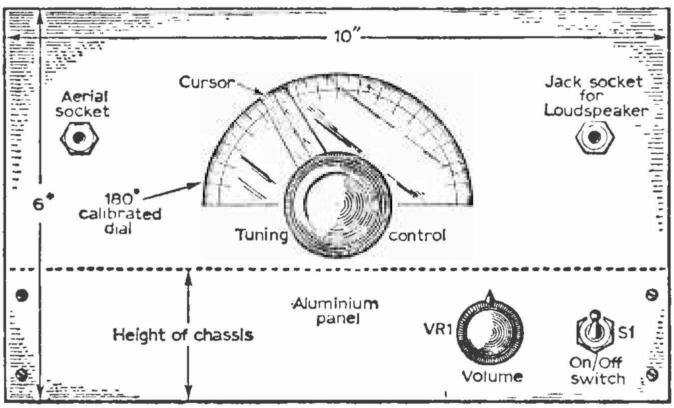


Fig. 1: A view of the front of the receiver.

Circuit Detail

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

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

Power Requirements

The power requirements of this receiver are 6·3V at 1A and 250V at 40mA. This means that a small transformer can be used.

Chassis Layout and Wiring

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

COMPONENTS LIST

Resistors:

R1	1MΩ	R5	47kΩ
R2	15kΩ	R6	47kΩ
R3	47kΩ	R7	15kΩ
R4	33kΩ	R8	150Ω

All 10%, ½W

VR1 0·5MΩ potentiometer

Capacitors:

C1 0·001μF paper
C2 100pF mica or ceramic
C3 100pF mica or ceramic
C4 0·01μF paper
C5 0·01μF paper
C6 25μF electrolytic 25V
C7 16μF electrolytic 350V
C8 16μF electrolytic 350V
VC1 500pF air-spaced variable
TC1 5-40pF trimmer

Inductors:

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

Transformers:

T1 Small pentode output transformer: 7–8,000Ω to 3Ω
T2 Mains transformer. Tapped primary. Secondaries 0–250V 60mA; 6·3V 1A

Valves:

V1 Z63 or EF36 V2 L63 or 6J5

Miscellaneous:

MR1 Selenium rectifier DRM1B or DSM1 (Brimar)
S1 S.P.S.T. toggle switch
Chassis 10in. x 6in. Two octal valveholders. Terminal strip. Jack socket.

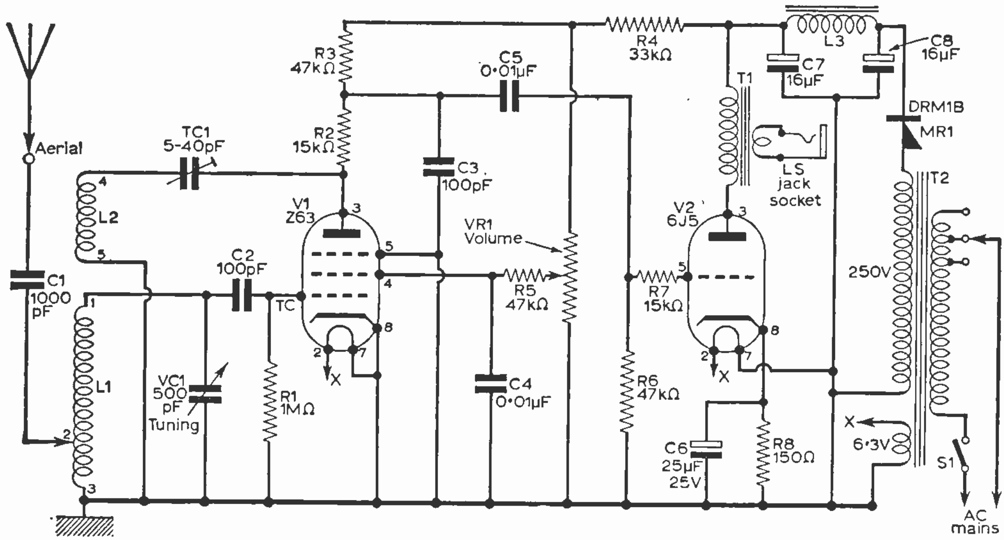


Fig. 2: The simple, two-valve circuit.

The wiring is straightforward and should present no difficulties but a point worthy of note is that the electrolytic capacitors must be connected the right way round with the red tag connected to h.t.+ and the black tag connected to h.t.−.

Coil Data

The coils used in the prototype were wound on a former 2½in. in diameter. At the time of construction a 2½in. custard powder carton was used as this was the only former available. L1 is wound at the top of the former and consists of 48 turns of 26s.w.g. tapped at 28 turns from the start. L2 consists of 25 turns of 26s.w.g. enamelled wire spaced ¼in, from L1 (see Fig. 4).

Alignment

A good aerial and earth are required to operate this receiver. When both of these have been connected the set may be switched on.

With the regeneration control VR1 set about midway, VC1 is now rotated until a station is received. There may be violent oscillations and if this happens VR1 must be turned anticlockwise. The trimmer TC1 is now carefully adjusted so that smooth regeneration can be obtained at all positions of VR1: If the set is aligned correctly there should be good volume and little distortion. ■

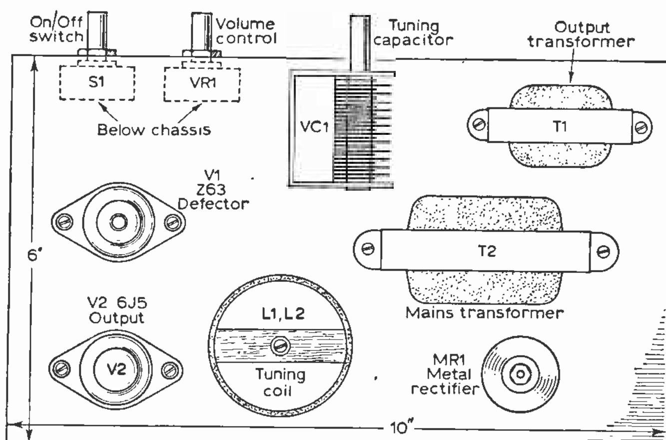


Fig. 3 (right): The layout of the major components on the chassis.

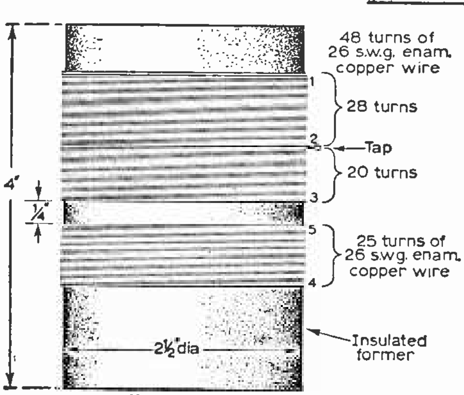
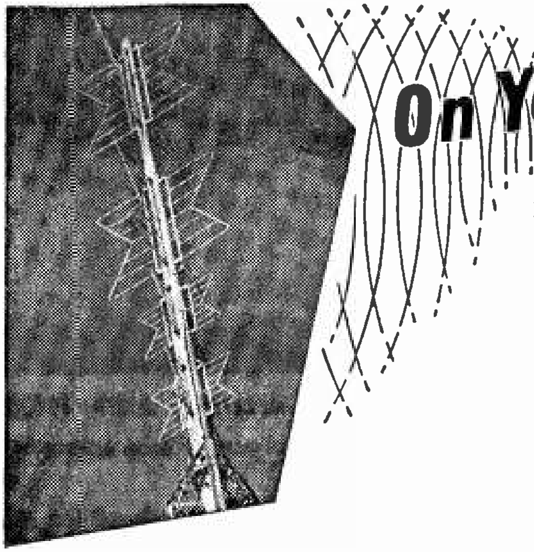


Fig. 4 (below): Winding details of the coils.



On Your Wavelength

By THERMION

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

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

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

What is Your Verdict?

Assuming all these technical problems can be solved so that the security of the recording is no longer in doubt, will it be easy to convince the public that this is so? Remember that tape recorders are widely used by all kinds of people nowadays, and the creation of unusual sound effects by tape trickery is now a common pastime for many amateurs. Will this "inside" knowledge of recording techniques and the appreciation of how flexible this method of recording is help to promote confidence in the minds of these members of the public when it appears a question of conviction or acquittal may depend upon a tape replayed in court? It would seem not.

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

Mains Connections

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

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

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

To Earth, or Not to Earth!

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

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

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

PRACTICAL CIRCUITS FOR ELECTRIC GUITARS

GUITAR AMPLIFIER, PRE-AMPLIFIER AND PICK-UP (

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

Magnetic Pick-ups

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

Control

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

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

REFERENCES 1 AND 2

Electronic Music and Musique Concrête, by F. C. Judd, A.Inst.E. (Neville Spearman Limited).

Radio and Electronic Hobbies, by F. C. Judd, A.Inst.E. (Museum Press).

Control Circuits

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

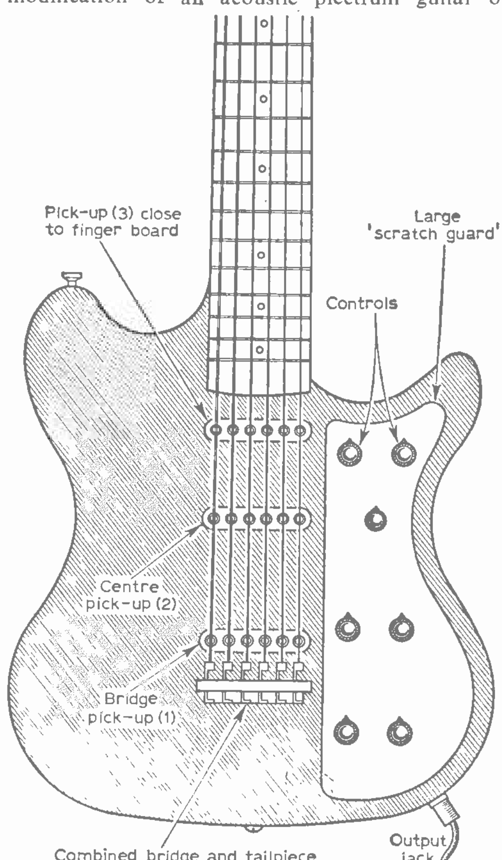


Fig. 1: The layout of controls and pick-ups on a modern guitar.

NTROL CIRCUITS DESCRIBED BY F. C. JUDD

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

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

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

Control for Three Pick-ups

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

A "rhythm switch" S4 and S5 has also been included. This brings a fixed attenuator into circuit, thereby reducing the output automatically for "rhythm" or chord playing. This control system does, of course, require more space but with careful layout can be built into a large "scratch guard" as in Fig. 1.

Tremolo Control

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

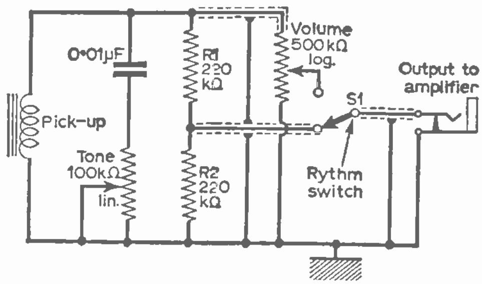


Fig. 2: A tone and volume control circuit. (Note: reducing the value of R2 will reduce the output.)

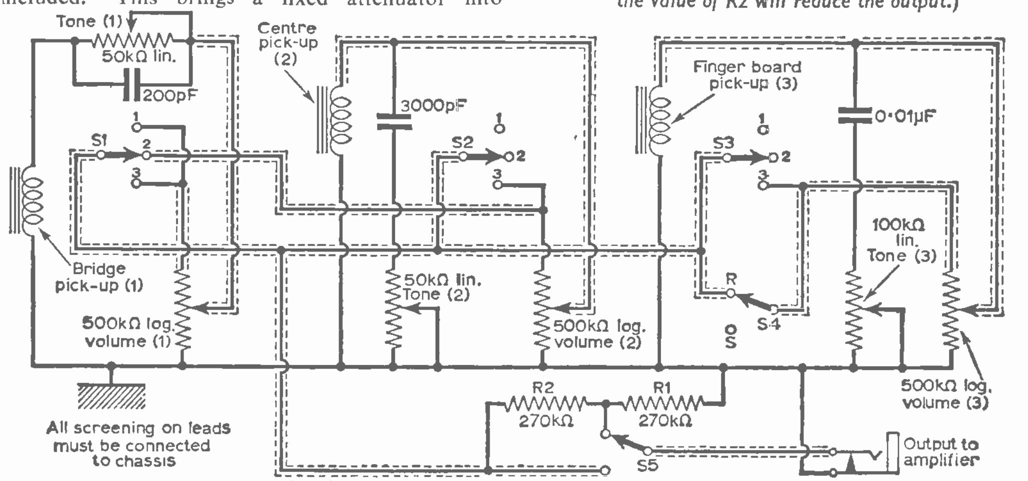


Fig. 3: The control circuit for three guitar pick-ups.

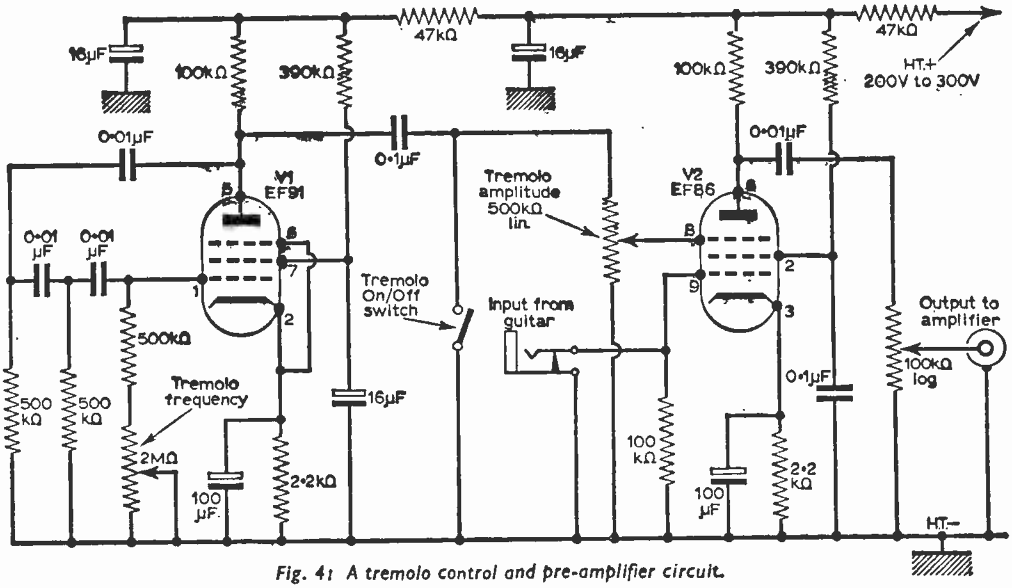


Fig. 4: A tremolo control and pre-amplifier circuit.

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

The tremolo oscillator V1 employs the familiar phase shift circuit and almost any modern h.f. pentode will operate—viz.: EF91, EF80, etc. The preamplifier V2 must be an EF86 because the tremolo signal is applied to the suppressor grid (G3).

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

—continued on page 961

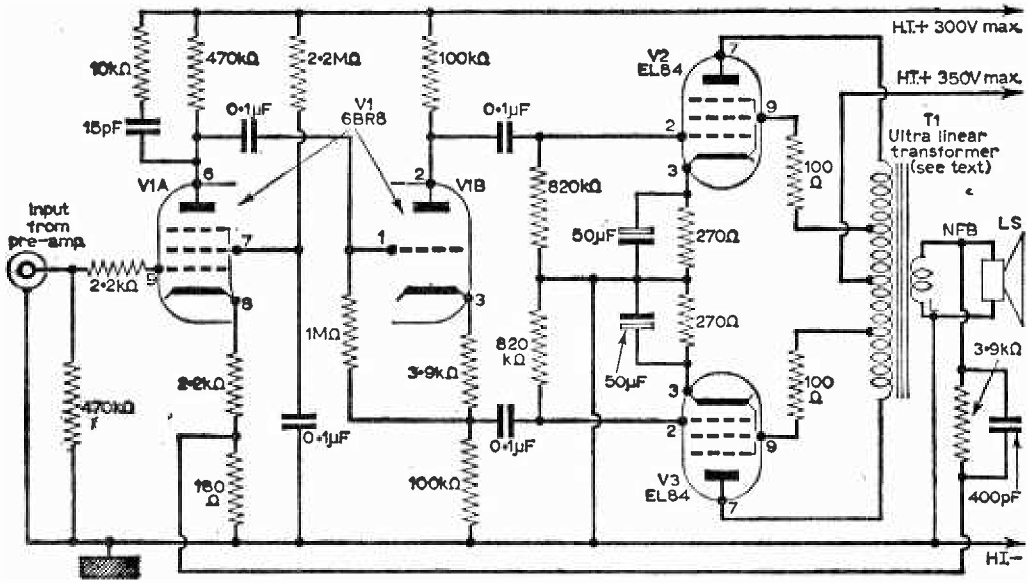


Fig. 5: A power amplifier circuit for electric guitars.

A DOOR INTERCOM

A simple yet versatile piece of equipment

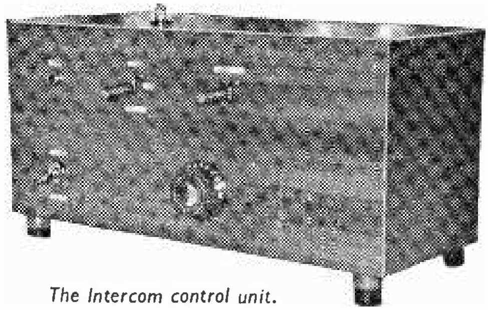
By P. HENDERSON

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

The Amplifier Unit

The basic unit is a two-stage high-gain amplifier, using a 6SH7 resistance coupled to a 6V6 in a simple manner as shown in Fig. 1. The switch S1 connects the unit to any number of separate extensions as well as to the front door. In the prototype for example, there is an extension to the garage-workshop. A relay RLA with a high impedance coil that is actuated from the h.t. line of the amplifier through a suitable ballast resistor when the "press-to-talk" switch S3 is closed, controls the changeover from "Listen" to "Talk". This relay is equipped with two sets of changeover contacts.

Resistors R6 and R7 act as "ballast" for the relays RLA and RLB respectively; their values must be determined by experiment. The connections to and from the relay contacts should be carried out using screened cable to minimise hum pick-up. No feedback is incorporated in the amplifier, and the unit is quite stable after the addition of the $0{\cdot}002\mu F$ mica capacitor C9 across the primary of T2. The design of the amplifier cabinet is not critical. As very little heat is liberated during the quiescent period, only a fair degree of ventilation is required. The power unit is shown in Fig. 2.



The Intercom control unit.

Extension Leads

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

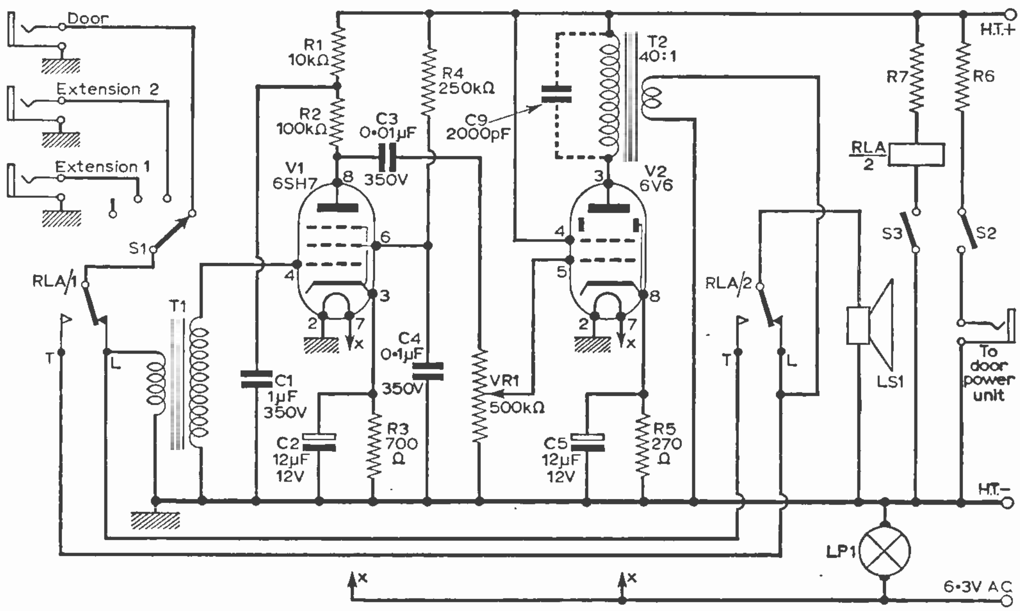


Fig. 1: The two-stage amplifier circuit.

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

Door Loudspeaker

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

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

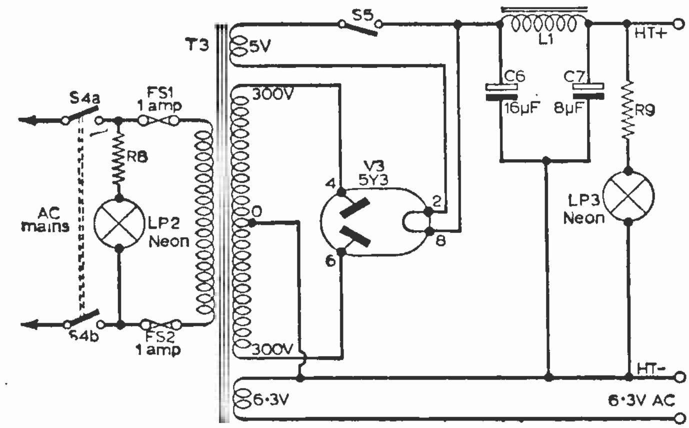


Fig. 2: The power pack circuit.

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

Method of Operation

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

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

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

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

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

A similar neon (V4) is used to indicate that the mains is switched on to the unit: alternatively, a 6·3V dial lamp can be wired into the heater circuit.

Remotely Controlled Door Lock

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

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

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

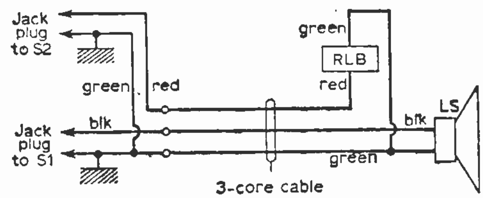


Fig. 3: Interconnecting wiring for the door extension.

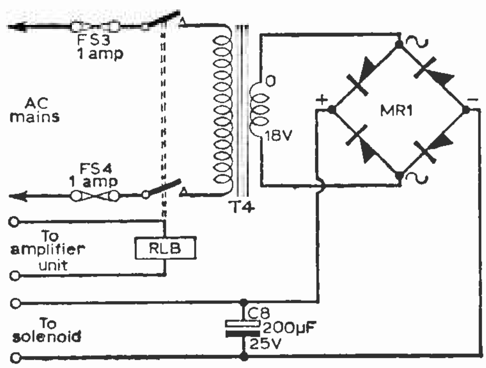


Fig. 4: Wiring between S2 and the l.t. power unit.

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

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

The supply from the l.t. unit to the solenoid is carried out in mains type twin 3/029 in order to minimise volt drop due to the heavy current drawn by the solenoid. The lead is carried up the inside edge of the door frame (see Fig. 6(b)) and each core supplies its own brass contact strip, as shown.

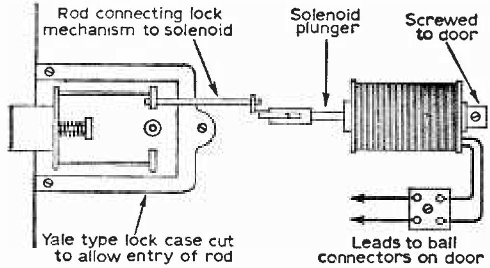


Fig. 5: Modifications to the Yale lock.

COMPONENTS LIST

Resistors:
- R1 10kΩ
- R2 100kΩ
- R3 700Ω
- R4 250kΩ
- R5 270Ω
- R6 (ballast for RLB)
- R7 (ballast for RLA)
- R8 (see LP3)
- R9 (see LP3)
- VR1 0·5MΩ carbon potentiometer

Capacitors:
- C1 1μF paper 350V
- C2 12μF electrolytic 12V
- C3 0·01μF paper 350V
- C4 0·1μF paper 350V
- C5 12μF electrolytic 12V
- C6 16μF electrolytic 450V
- C7 8μF electrolytic 450V
- C8 200μF electrolytic 25V
- C9 2,000pF mica

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

Switches:
- S1 Rotary switch, single pole, number of ways to suit extensions required
- S2 Toggle switch, single pole on/off
- S3 Push button switch, single pole
- S4 Toggle switch, 2 pole on/off
- S5 Toggle switch, single pole on/off
- FS1-4 1A fuse
- L1 Smoothing choke 10-20H 80mA
- MR1 Bridge rectifier 20V 10A
- RLA P.O. type relay, with high impedance coil. Two sets of changeover contacts.
- RLB P.O. type relay, with high impedance coil. Double pole make-break contacts

Valves:
V1 6SN7 V2 6V6 V3 5Y3

Lamps:
- LP1 6·3V lamp
- LP2, 3 Neon indicator, mains type with resistors (R8, R9) included
- LS1 Loudspeaker unit 3Ω
- LS2 "Tannoy" or similar loudspeaker unit 3Ω

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

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

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

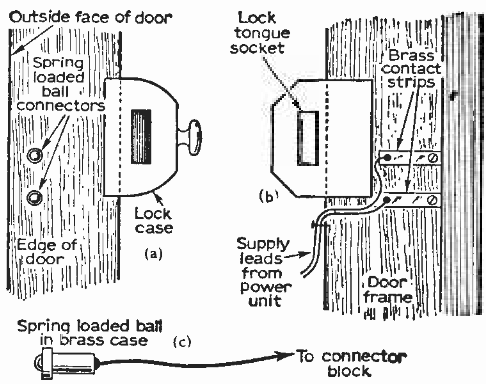
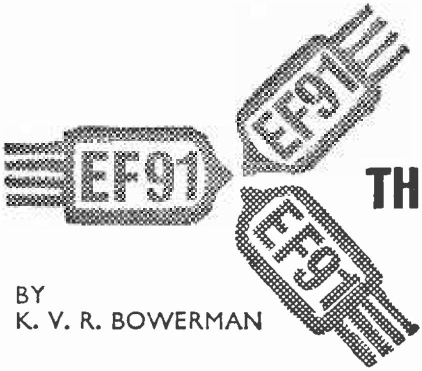


Fig. 6(a): The spring-loaded ball contacts.
Fig. 6(b): Fitting the solenoid supply lead.
Fig. 6(c): Wiring to the ball contact holders.

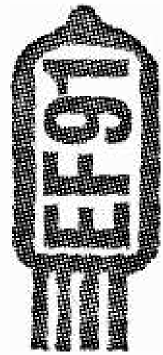
It will be appreciated that the supply to the solenoid will cease when the door has been pushed so far open, and the balls lose contact with the brass strips, but this is of no consequence, as by then the tongue of the lock will be well clear of its socket on the door frame.

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

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



THE VERSATILE EF91



BY
K. V. R. BOWERMAN

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

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

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

EF91 Switched Superhet

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

The Superhet Circuit

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

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

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

A number of complex signals now appear at the anode of V1, including the i.f. The i.f. transformer, T1, selects the required signal and feeds it to the grid of V3. This valve operates as a straightforward, conventional, i.f. amplifier. The amplified i.f. signal now finds it way via C8 and R7 to the grid of V4.

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

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

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

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

Construction

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

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

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

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

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

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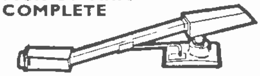

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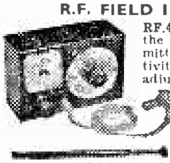
R.F. FIELD INDICATOR



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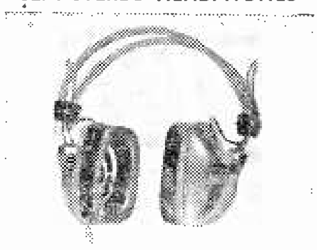

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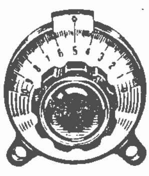

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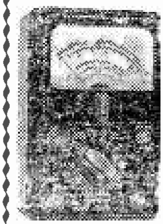

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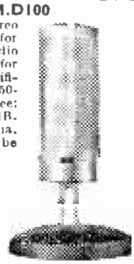

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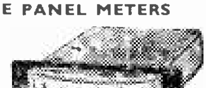

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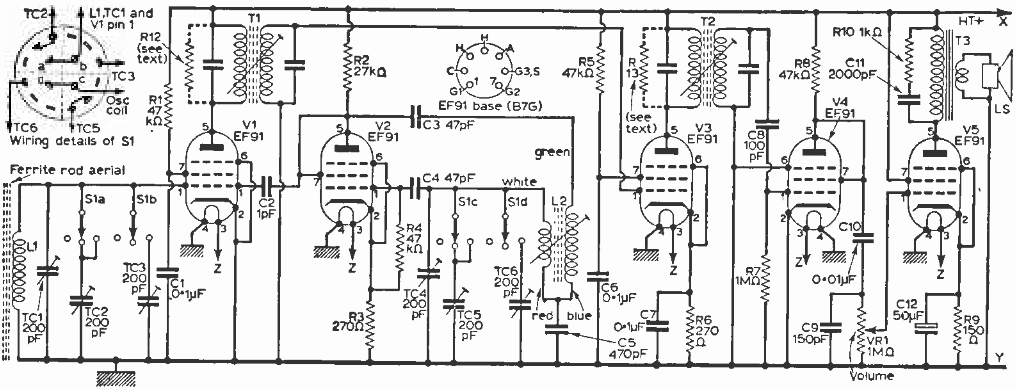
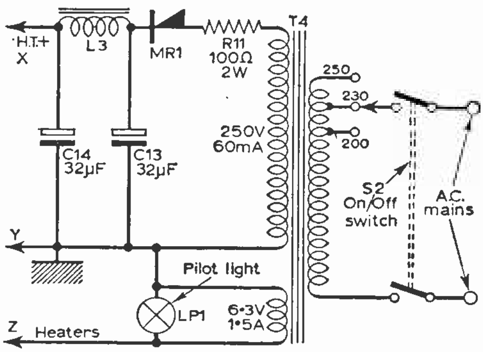


Fig. 1a (above): The superhet circuit.

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



COMPONENTS LIST
SWITCH-TUNED SUPERHET (Fig. 1)

Resistors:

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

All 10%, ¼W unless otherwise stated
VR1 1MΩ potentiometer

Capacitors:
C1 0·1μF paper
C2 1pF silver mica
C3 47pF ceramic
C4 47pF ceramic
C5 470pF silver mica
C6 0·1μF paper
C7 0·1μF paper
C8 100pF silver mica
C9 150pF silver mica
C10 0·01μF paper
C11 2,000pF paper
C12 50μF electrolytic 50V
C13 32μF } electrolytic 300V
C14 32μF }
TC1, 4 200 + 200pF double trimmer
TC2, 5 200 + 200pF double trimmer
TC3, 6 200 + 200pF double trimmer

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

Transformers:
T1, 2 I.F. transformer, 465 kc/s
T3 Pentode output transformer, 3Ω secondary
T4 Mains transformer. Secondaries: 0-250V 60mA; 6·3V 1·5A
S1 4-pole, 3-way wafer switch
S2 Toggle switch, d.p.s.t.
LP1 6·3V 0·5A pilot lamp
MR1 Metal rectifier 250V 75mA
V1-5 EF91

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

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

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

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

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

Testing and Alignment

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

Set meter to 300V d.c. range and again apply it betwen the positive tag of C14 and chassis. The h.t. line voltage should be between 220 and 250V. This is not critical but if much above 250V, increase the value of R11. If all is well, proceed with the alignment, which is given below in numbered steps:

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

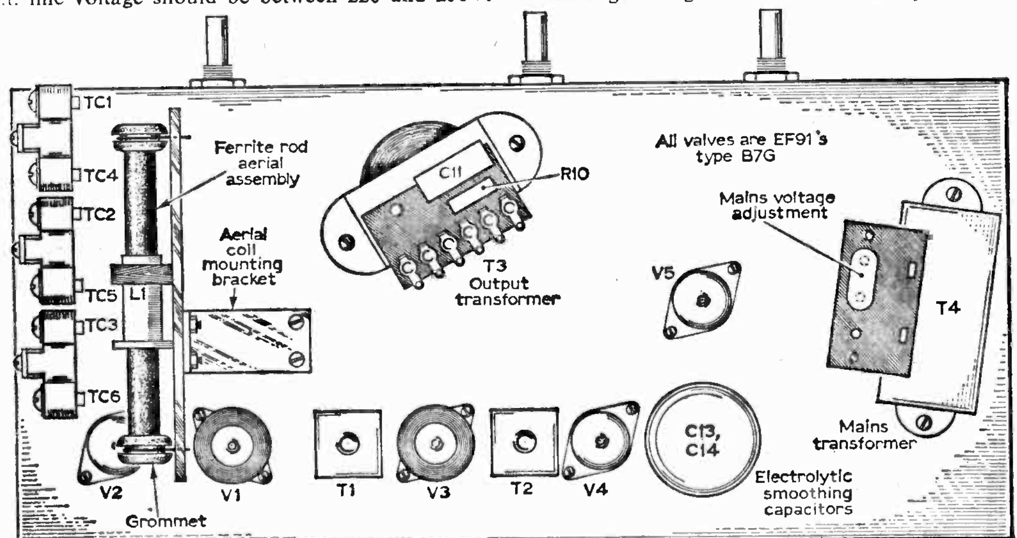


Fig. 2: The layout of components above-chassis.

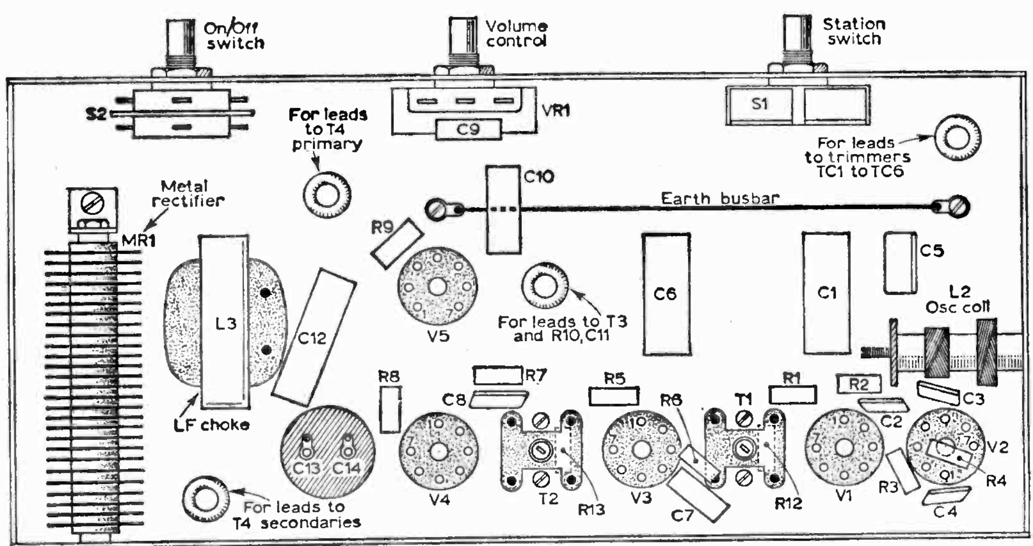


Fig. 3: An underchassis view of the receiver.

4 If nothing is heard even when TC4 is screwed all the way from "fully out" to "fully in", give TC1 one turn clockwise and repeat 3.
5 As soon as the Light Programme is heard, remove the temporary wire aerial and adjust TC4, then TC1 for maximum signal, if necessary swinging the set round to orientate the ferrite rod towards the transmitter.
6 Switch S1 to position 2. Slowly screw in trimmer TC5 until the Home Service is heard.
7 Adjust TC5 then TC2 for maximum signal.
8 Switch S1 to position 3. Slowly screw in trimmer TC6 until the Third Programme is heard.
9 Adjust TC6 then TC3 for maximum signal.

Note that the Light Programme on 247 metres is not receivable in some localities. In these areas the long wave (1,500 metres) station must be brought in. This can be done by using a dual wave ferrite rod and an extra oscillator coil. The wiring modifications are shown in Fig. 4. the same principles in setting up apply.

Cabinet

The cabinet will, of course, depend largely on the shape and size of the chassis. The writer converted an old table receiver cabinet in somewhat crude fashion, see picture.

If the set is to do service in the kitchen it is usually possible to find a small space in a cupboard and build the set into that. Or a simply constructed cabinet made from 5-ply, carefully painted or covered with plastic material, often gives a surprisingly professional-like finish.

EF91 Push-pull Gramophone Amplifier

The circuit shown in Fig. 5 uses four EF91 valves and gives good volume and quality from a crystal pick-up. It is, of course, not in the hi-fi class, but it is ideal for "pop" records and gives reproduction well up to the standard of most "pop boxes". A simple top-cut tone control helps to get rid of surface noise on old records.

The Circuit Stage by Stage

The signal from the pick-up is fed through screened cable to the input terminals (these can conveniently be incorporated in a coaxial socket). The signal appears across VR1, which is the volume control. The slider of the volume control is connected directly to the grid of V1 which acts as a voltage amplifier. VR2 and C1 together form a simple tone control.

R2 and C4 provide automatic bias for V1, and R1 is the screen feed resistor. C5 forms the coupling between V1 and V2.

V2, strapped as a triode, is the phase-splitter. The anode load is split between R7 and R6, R6 being in the cathode line, and two equal signals but 180° out of phase appear, one at the "bottom" end of R7, the other at the "top" end of R6. These out-of-phase signals are fed via the coupling capacitors C7 and C8 to the control grids of V3 and V4.

The anodes of V3 and V4 are fed via the centre-tapped primary of T1, which is a push-pull output transformer.

The power pack shown for the switched superhet is quite suitable for this amplifier.

COMPONENTS LIST

Additional Parts for L.W. Operation (Fig. 4)

C5a	47pF silver mica
TC3a	100pF ceramic
TC6a	100pF ceramic
L1a	Ferrite rod aerial, with l.w. and m.w. windings
L2a	Oscillator coil, l.w. (Weymouth HO1)
S3	3-pole, 2-way wafer switch

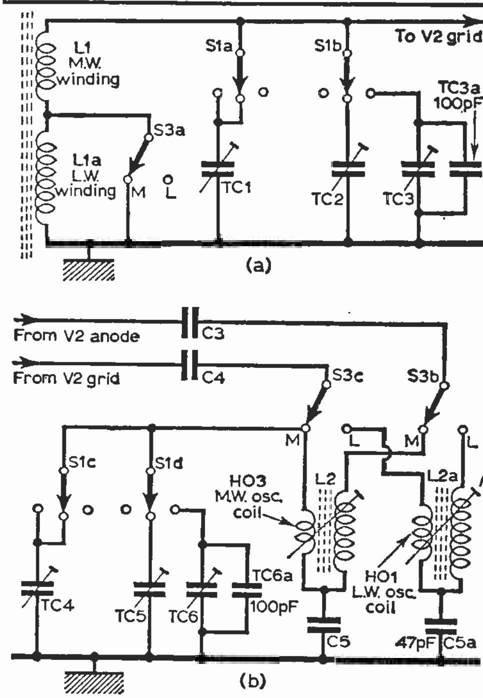


Fig. 4: The circuit modifications necessary to incorporate long waves.

Amplifier Construction

A chassis as small as 8in. x 10in. x 2in. should comfortably accommodate all components. Note that if the mains transformer is mounted on the same chassis as the choke and/or the output transformer, then the cores should be orientated at right angles to one another or separated by a metal screen (or screened by mounting one item under the chassis and another on top).

All earth connections should be made to an earth bus bar of thick copper wire (not less than 18s.w.g.) and this should be connected to chassis at one point only (the coaxial input socket). Heater wiring should be by closely twisted flex tucked well into corners of the chassis. All signal wiring up to the input to V1 must be in screened cable.

Testing

Test the power supply as for the superhet receiver then, after allowing the valves to warm up, turn the volume control up to full volume and

COMPONENTS LIST
PUSH-PULL AMPLIFIER (Fig. 5)

Resistors:

R1	470kΩ	R7	27kΩ 5%
R2	160Ω	R8	27k 5%
R3	47kΩ	R9	470kΩ 5%
R4	47kΩ	R10	470k 5%
R5	1MΩ	R11	100Ω ½W
R6	160Ω		

All ±10%, ¼W except where otherwise stated

VR1 1MΩ carbon potentiometer, log
VR2 0·5MΩ carbon potentiometer, linear

Capacitors:

C1 2000pF paper
C2 8μF electrolytic 300V
C3 8μF electrolytic 300V
C4 25μF electrolytic 25V
C5 0·1μF paper
C6 25μF electrolytic 25V
C7 0·1μF paper
C8 0·1μF paper
C9 50μF electrolytic 50V
T1 Push-pull output transformer. 7000Ω primary, 3Ω secondary (Radiospares multi-tapped)
V1-4 EF91

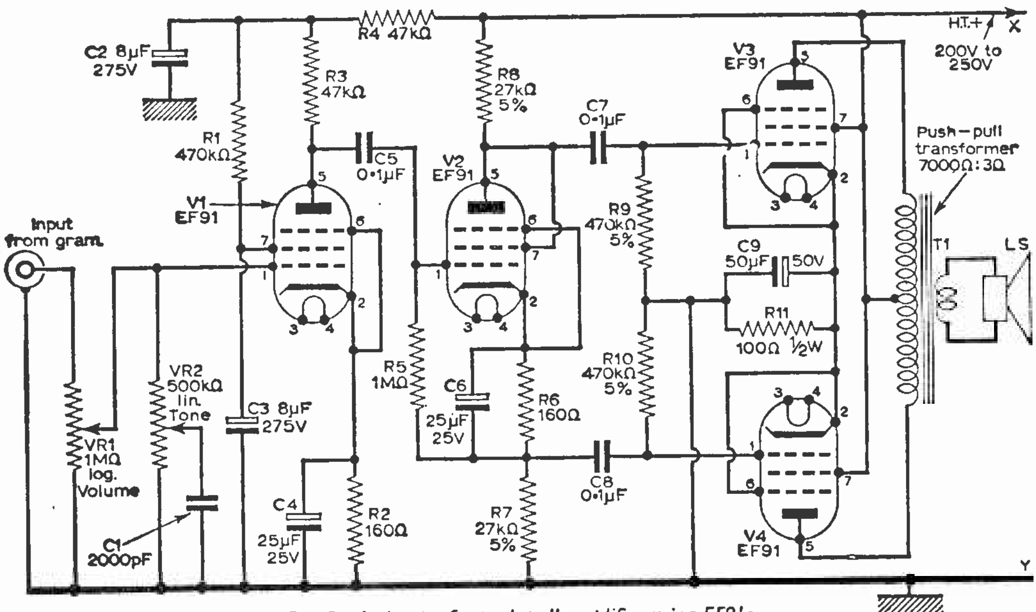


Fig. 5: A circuit of a push-pull amplifier using EF91s.

briefly touch the centre pin of the coaxial socket with a finger. A loud hum should issue from the loudspeaker. If this is reduced nearly to zero as the volume control is operated, and if the character of the hum is altered by the setting of the tone control, then all is well and the pick-up can be connected to the input.

Other Applications

It will be seen from the foregoing what a splendid little valve the EF91 is. One would be hard put to it to find an application for which it could *not* be used!

The author has made a morse practice oscillator and a "valve voltmeter" type of alignment aid using these valves.

Other uses could be in photo-electric relay circuits as an amplifier, as a microphone pre-amplifier, or in a pre-amplifying mixer circuit for tape recorders.

The valve has also been used very successfully in v.h.f. f.m. applications described in this magazine. ■

THE "PRACTICAL WIRELESS" FILM SHOW

The "Practical Wireless" Film Show which is held annually and to which readers of P.W. are invited, is to be held, as before, at Caxton Hall, Westminster. The date and time of the Show, which is arranged in collaboration with Mullard Limited, is the 31st January, 1964, at 7.30 p.m.

The programme will appeal to all readers of "Practical Wireless" and of especial interest will be the illustrated talk on colour, 625-line and u.h.f. television, which will form the first part of the programme. After a break for refreshments, the programme will continue with a film entitled "Ultrasonics".

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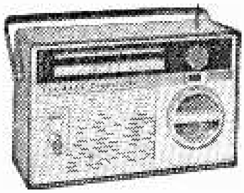

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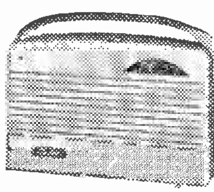

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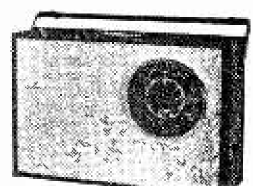

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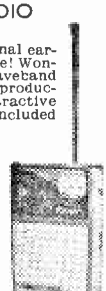

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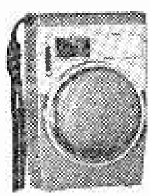

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Simpler Electronic MUSIC

A Guide for the Creative Tape Enthusiast

By Lloyd Brunt

AT one time or another most of us have felt the desire to be creative and, with an interest in sound, music is often the most satisfying outlet. Our mind perhaps first turns to a musical instrument, but most instruments are expensive and require many years of study for complete mastery.

The only other course, then, seems to be electronic music. Again the big problem is money, and electronic computers, and the other complex circuits connected with this form of composition are not the easiest things to obtain and understand!

Frustrated in this way, the author looked around for something within the reach of anyone with a limited budget and a small amount of talent. The only equipment necessary would be that which the ordinary tape recording amateur would possess, and the method that which even the least experienced person could easily master.

The idea devised is simple, yet can give pleasing results, even at the first attempt. A signal varying in frequency within the audio range is recorded in a continuous stream on to ordinary magnetic recording tape. The tape is then cut into lengths varying from about 1 to 5 in., and the pieces thoroughly mixed. A blank tape is also cut into varying lengths and kept separate from the recorded tape.

The pieces are then joined together on an editing block with, say, two recorded pieces and a blank, five recorded pieces and a blank, the length and the number of recorded insertions being left entirely to the whim of the individual.

On the author's first attempt, when a reasonable length was composed, it was found to give an amusingly jig-like tune, and after some substitution, a pleasant melody was compiled.

A problem that must be solved before any "composing" can begin is from where to obtain the varying signal. A signal generator, covering the whole audio range is the obvious and probably the most convenient answer, but it is not essential. The author found that by recording the tuning-in signal transmitted before the beginning of the day's programme on Network Three, several different frequencies were obtained. But this method limited the notes to the number of tape speeds, and was therefore unsatisfactory.

An alternative, using the same transmission was found. The tape recorder is set to "record" but left in the "pause" position. The take spool is then turned by hand at varying speeds. As any speed can be obtained by this method it is found that when the tape is played back at a constant speed many varying notes are obtained, and with care and a little practice any frequency is attainable.

The more musically minded may wish to be more precise and not compose "by accident". If a few basic rules of composition are adhered to, and the notes sorted into groups by the length and pitch, a passable piece of music can be easily compiled. It may even be possible to put together existing musical works by careful following of the score, but the author found that even to set out "Ba Ba Black Sheep" took a great deal of time and patience.

It was found that the quickest way to join the tape was by using "jointing tape" and that the weld joint took much too long to dry for this sort of editing. Leader-tape was first used between the notes but was later discarded in preference of blank tape because of the unnatural pause the former gave.

It must also be noted that the tape must remain the same way up unless used on a single track or twin channel tape recorder as inversion will cause the note to appear on the lower track and therefore disappear upon playback. This inversion was found to give a pleasing stereophonic effect on the author's twin channel recorder but it may be guarded against by using a tape with the manufacturer's name printed along its length, the inversion of the name indicating that the note is inverted.

If you are fortunate enough to have two tape recorders, the edited tape should be re-recorded on to a continuous length as a tape that is so edited will not play very smoothly. Two tape recorders may be used to obtain a rhythm by loading one with a continuous loop arrangement while adding the other notes to the other.

This by no means exhausts the possibilities of this type of recording and these notes are only intended as a guide; echo, superimposition, addition of everyday sounds, are just a few of the numerous extensions which will suggest themselves to the operator. A person with imagination and patience could produce some really worth-while results even with the simplest of equipment. ■

NEON RELAXATION OSCILLATORS

A PRACTICAL UNIT COVERING AN AUDIO RANGE OF 500-2000 c/s

BY M. J. BUNCE

ONE of the simplest types of oscillator available is the neon relaxation oscillator. Operation of this circuit depends upon the charging of a capacitor via a resistor and its subsequent discharge via a neon tube which is caused to "strike" when the voltage across the capacitor reaches a certain value.

The Simplest Circuit

In Fig. 1 we have a neon which will fire at 200V. Across it is a capacitor Cx. The neon and capacitor are connected to 200V d.c. through resistor Rx. On switching the apparatus on, Cx is slowly charged through Rx until the p.d. across the capacitor reaches 200V, whereupon the neon will fire and discharge Cx. Immediately afterwards the capacitor charges up again and the process is repeated.

Component Values

The frequency of the pulses is entirely dependent upon the component values used in the circuit. If, for example, Rx is increased, the charging time of the capacitor would be delayed somewhat, and the frequency would be lower. By using a variable resistor, the frequency may be varied continuously. A word of warning may not be out of place here. If Rx is reduced to a minimum of 5kΩ, the neon may arc across and be damaged. It is usual, therefore, when using a variable resistor as Rx, to include a fixed resistor of not less than 5kΩ in series with the variable component.

Type of Waveform

The waveform produced can be seen from Fig. 2. The sloping part of the waveform represents the capacitor charging and the vertical stroke is where the neon fires. For obvious reasons this is called a sawtooth wave. The ideal shape is indicated in Fig. 2(a), but as a capacitor charges exponentially the slope has a distinct curve in it. This can be seen if the oscillator is used in conjunction with an oscilloscope.

Power Requirements

The consumption of such an oscillator is small indeed. 200-250V d.c. at 15-30mA is ample for such a device. Smoothing is a relatively simple matter (Fig. 3). Two 2μF electrolytic capacitors are all that is required, in conjunction with a resistor of 5·6kΩ or possibly two 4μF electrolytics with a 4·7kΩ resistor. A full-wave rectification system is not essential and if an isolating transformer is used

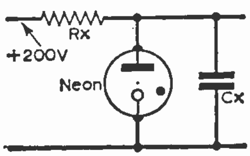
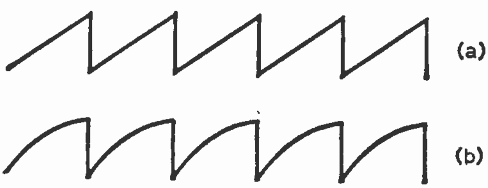


Fig. 1 (right): The simplest circuit for the oscillator.

Fig. 2 (below): The ideal and actual waveforms produced.



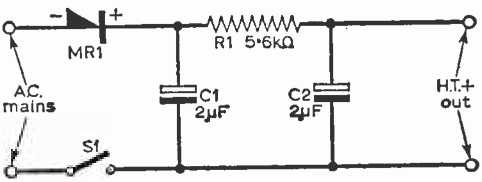
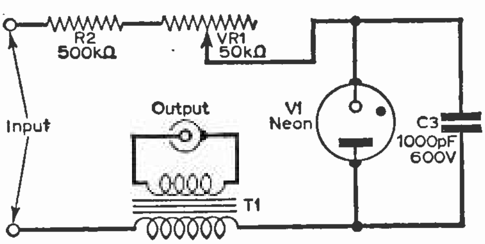


Fig. 3 (above): The h.t. supply circuit.

Fig. 4 (below): A practical circuit for the oscillator.



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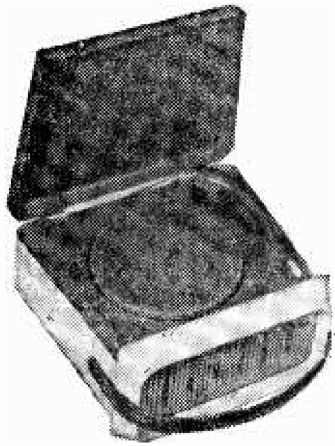

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2½	7000	50	8/6	4	7000	3	8/6	5	6000	5	8/-	5	9500	5	10/6
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Elliptical Size	Gauss in lines	Imped. in ohms	Price	Elliptical Size	Gauss in lines	Imped. in ohms	Price	Elliptical Size	Gauss in lines	Imped. in ohms	Price	Elliptical Size	Gauss in lines	Imped. in ohms	Price
5 × 3	6000	3	7/6	5 × 3	9000	25	11/-	7 × 3½	9500	3	10/6	8 × 2½	8500	5	9/6
5 × 3	7000	3	8/-	6 × 4	6000	3	8/6	7 × 4	7000	3	10/-	8 × 2½	9500	3	10/-
5 × 3	9000	3	8/6	6 × 4	7000	3	9/-	7 × 4	8500	3	10/6	8 × 2½	9500	4	10/-
5 × 3	6000	25	9/6	6 × 4	8500	3	9/6	8 × 2½	6000	3	8/6	8 × 2½	9500	5	10/-
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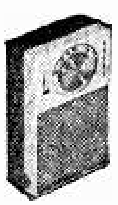

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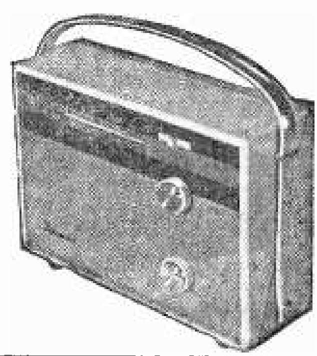

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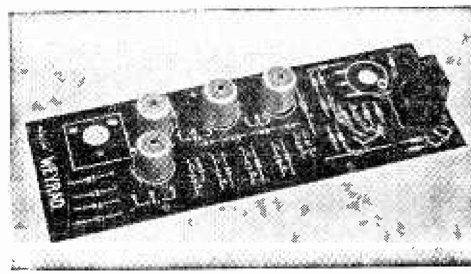

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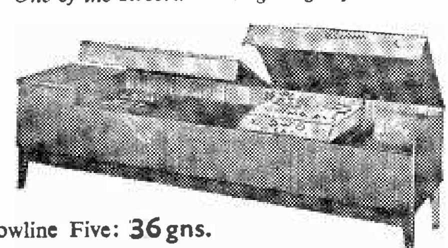

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COMPONENTS LIST

R1	5·6k Ω 3W
R2	5k Ω 3W
VR1	50k Ω wire-wound potentiometer
C1	2μF electrolytic 250V
C2	2μF electrolytic 250V
C3	1000pF ceramic 600V
T1	Interstage transformer 1 : 1
S1	Toggle switch s.p.s.t.
MR1	Rectifier 250V 50mA
V1	Neon tube 200V

in series with the negative lead as shown in Fig. 4, no mains transformer is necessary.

Uses of Neon Oscillators

Neon oscillators may be found in old television sets, operating the timebases. Under these circumstances the lower portion of the waveform only is used to avoid distortion due to its exponential nature. In recent models gas-filled or "thyratron" triodes have been used instead. They are ideal as

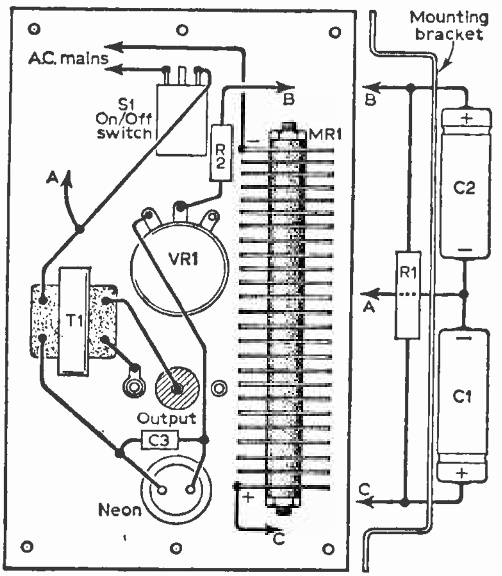


Fig. 5: Constructional details of the unit.

general purpose oscillators for testing radio receivers, amplifiers etc. They are of particular interest to readers possessing oscilloscopes.

A Practical Design

A practical general purpose oscillator which was built for less than £1, using surplus components and spares from the "junk box" will now be described. This oscillator was designed to operate at audio frequency in the range 500-2,000c/s.

The whole unit was made on a panel of 18s.w.g aluminium measuring 6in. x 4in. In the centre of the panel a hole is drilled for a variable resistor (50kΩ). Above this a s.p.s.t. toggle switch is mounted, and below the 50kΩ variable, a coaxial socket (used for TV aerial sockets), is mounted. Below the coaxial socket, the neon is placed. This serves also as an indicator as to whether or not the unit is operating. The toggle switch (S1) controls the mains input and the 50kΩ variable (VR1) is a frequency control.

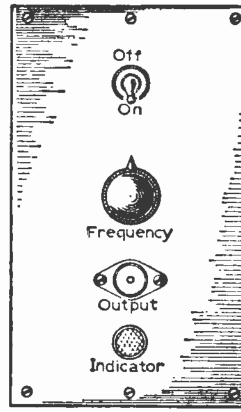


Fig. 6: The front panel layout of the unit.

The coaxial socket is for the output and the wiring is shown in Fig. 5. The underside view of front panel and mounting brackets are shown in Fig. 5. To avoid "live" output sockets an interstage transformer with a ratio of 1:1 was used as shown.

The output can be checked by connecting a loudspeaker with output transformer across the coaxial output socket. When using the oscillator into a high impedance input (i.e. mike socket on a tape recorder) always use screened coaxial cable to avoid hum pick-up. It is advisable to include a 60mA fuse in the negative lead in case the neon or the capacitor C1 should break down. Note that C3 must be a 600V working component to avoid leakage losses. ■

Practical Circuits for Electric Guitars

—continued from page 942

control VR3 must therefore be adjusted with discretion if an existing guitar amplifier is being used.

A Guitar Amplifier

Since all the tone controlling can be best effected at the guitar pick-ups, further tone controls are superfluous.

A combination of the control circuits given in this article, the tremolo/preamplifier of Fig. 4 and the power amplifier of Fig. 5, will provide a complete electric guitar amplification system.

The power amplifier employs a Brimar 6BR8 triode-pentode which functions as a first amplifier and phase splitter. The output stage uses two EL84's in ultra-linear push-pull, providing a maximum undistorted output of 10-12W. For guitar work this output can be taken up to peaks of 15W or so without appreciable distortion. The amplifier has negative feedback between the output and the cathode of V1A and it is most important that this is included and, of course, in the correct phase.

The output transformer in the original design was a Radiospares EL84 type which is supplied with wiring instructions for correct phasing of the negative feedback. ■

BOOKS REVIEWED

ELECTRONICS EXPERIMENTS AND PROJECTS
By Len Buckwalter; 128 pages, 5¾ ins × 8¾ ins. Price 25s.
ELECTRONICS FOR THE BEGINNER
By J. A. Stanley; 190 pages, 5¾ ins × 8¾ ins, Price 25s.
Both published by W. Foulshaw & Co. Ltd.

THESE two interesting American books have now been published in the U.K. and each contains an introductory chapter specially written for the English reader. This is a very sensible idea, since a novice is likely to be mislead or confused by certain Americanisms, while it is also most important to draw attention to the difference in the legal position with regard to the use of transmitting apparatus in this country as opposed to the U.S.A. Thus the English reader is advised not to build the oscillator and simple transmitter described in these books, but to treat these particular articles purely as a theoretical study. However such qualifications hardly diminish the value of these books to beginners on this side of the Atlantic. Both authors have adopted a friendly conversational style, and this helps to create the right atmosphere between teacher and pupil.

With the absolute beginner in mind, it is very difficult to decide which volume should take precedence, for each provides in its own particular way a valuable initiation into the field of Electronics.

Whereas **Electronic Experiments and Projects** sets out to give an understanding of the elementary principles by means of simple experiments that can be performed on the table at home, **Electronics for the Beginner** deals with the building of equipment—not so much for finding out how things work, but rather more for the enjoyment the completed equipment will provide. Actually, to be more correct, this latter book should be entitled "Radio and Audio for the Beginner" because the equipment described is limited to radio receivers and audio amplifiers.

Electronic Experiments and Projects conducts the reader through a series of experiments, most being performed using a piece of perforated hardboard as a "breadboard". Only a small number of commonly available parts are needed and as all electrical connections are made by clips the only tool required is a small screwdriver.

The earlier experiments involve the use of simple home-made circuit elements of R, C and L. Simple tests with a crystal diode and a transistor demonstrate the action of these semiconductor devices. Then follow a variety of experiments (or perhaps the term "projects" is here more applicable) which put into operation the basic ideas. These devices range from a simple telephone and a radio receiver to electronic devices for detecting such quantities as light, moisture and heat. The book concludes with details of how to make a simple computer for multiplication and division.

The arrangement of each article follows a standard pattern with sub sections entitled Preparation. Setup, Operation, Conclusion and Parts List. Each experiment is illustrated with a photograph of the complete breadboard set-up, a layout diagram and a circuit diagram.

The essentially practical character of **Electronics for the Beginner** is indicated by the first Chapter; this is devoted to tools and soldering. The second Chapter "Building a Trap for Radio waves" is not as one might suppose concerned with a high Q rejector circuit but deals with the constructon of an aerial system. Next, a simple crystal receiver is fully described so that the reader is very soon equipped for "listening in".

But having wetted his appetite, the beginner is not allowed to proceed too far on the constructional side before being given some essential basic information regarding components and symbols and the art of circuit reading. Then he is better equipped to continue the exploration of the remainder of the book, and as his mood and fancy takes him, may direct his attention to the realms of world-wide radio or to hi-fi and stereo. The instructions for building the various equipments are clearly written, well illustrated and are well-nigh foolproof. For example, the wiring-up is in every case detailed wire by wire.—*D.D.R.*

TRANSISTOR INVERTERS AND CONVERTERS
By Thomas Roddam; published by Iliffe Books Ltd.
240 pages, 201 diagrams. Price 42s.

DOUBTS that have existed in this reviewer's mind concerning the desirability or logic of giving a fine distinction to the terms "inverter" and "converter" have not been entirely dispelled by Mr. Roddam in his excellent work dealing with transistor circuits for a.c. to d.c. or d.c. to a.c. conversion.

Why not simply use the term "converter" and qualify it by the adjectival use of "a.c. to d.c." or "d.c. to a.c." as the case may be?

This is not, of course, a criticism that one can level at the author personally, since he is using words already generally established in electronic engineering, but I feel this opportunity of drawing attention to another unfortunate choice of terms must not be neglected.

The opening chapter of **Transistor Inverters and Converters** surveys all the present sources of electrical power and suggests that the omnipresence of a.c. is perhaps only transient, since in the future the distribution of power may be performed more effectively by d.c. mains circuits. This prospect, in addition to the existing quite considerable requirements for operating various types of apparatus from low-voltage d.c. supplies, gives a further emphasis to the relevance of this book. Having assured us of the indispensability of these devices the author commences his detailed discussion.

—*continued on page 966*

Trade News

Tape Deck

A NEW tape deck made by Lorlin Electronic Co. Ltd., has recently become available in two or four track models. The deck employs three motors and can be operated at three different speeds. It can accommodate spools up to 7in. in diameter and when running a tape-controlled brake tensions the tape evenly from beginning to end of the reel.

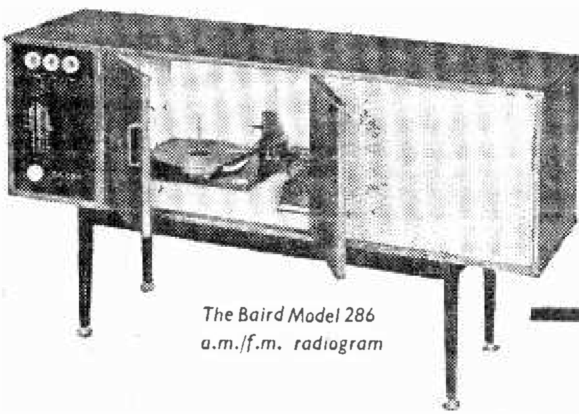
Two models of the tape deck (type SB.26) are available, costing 31 and 39 guineas. The manufacturers are *Lorlin Electronic Co. Ltd., 23 Wardour Street, London, W.1.*

A.M./F.M. Radiogram

BAIRD Television Limited have recently introduced a new radiogram, the model 286. The receiver on this model tunes over the whole of the medium waveband and to the Light Programme on long waves. F.M. transmissions are received from 88 to 100Mc/s.

The gram unit incorporates a four-speed autochange record deck which provides good quality reproduction through the 8in. round loudspeaker, which is housed in a sound chamber at the right-hand side of the cabinet.

The price of the model 286 is 57 guineas and the makers are *Baird Television Limited, Seymour Mews House, Wigmore Street, London, W.1.*



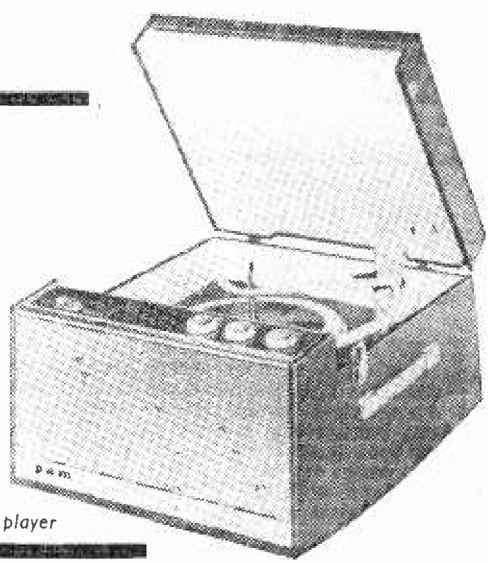
The Baird Model 286 a.m./f.m. radiogram

Seven Watt Record Player

THE new Encore record player from Pam has been designed to give better-than-normal reproduction from a portable record reproducer. Its features include a new Monarch BSR-UA.15 four speed autochanger (taking all sizes of records) and a crystal pick-up.

The circuit of the Encore (Model 5206) delivers an output of 7W through a 6½in. diameter speaker. Three controls atop the attractive cabinet give separate bass, treble and volume control of the output.

The price of the Encore record player, which is made by *Pam (Radio and Television) Limited, 295 Regent Street, London, W.1.*, is 25 guineas.



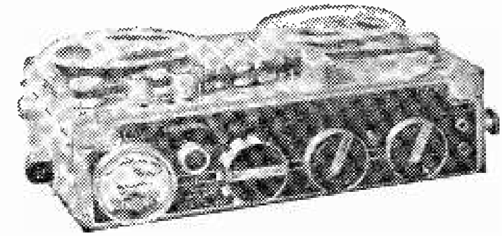
Pam's new 7W record player

Professional Tape Recorder

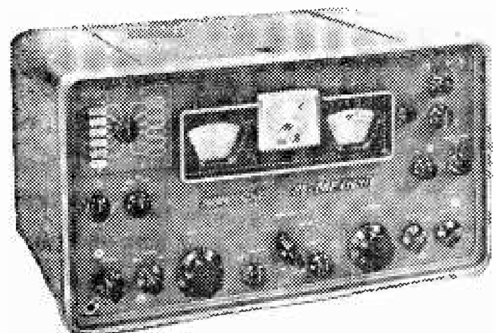
THE Nagra IIINP is a Swiss-made portable tape recorder of professional standards and capable of studio quality performance.

The transistorised circuit operates from self-contained batteries or from a mains unit. The tape deck provides for a choice of three speeds, 3¾in.p.s., 7½in.p.s. and 15in.p.s., and at the highest tape speed the frequency response is 30c/s to 18kc/s.

The Nagra IIINP tape recorder is manufactured by Kudelski of Switzerland and the U.K. agents are *Livingston Laboratories Limited, 31 Camden Road, London, N.W.1.* Its price?—£340.



This is the Nagra IIINP portable tape recorder



The latest communications receiver from Hammarlund

General Coverage Receiver

THE latest general coverage receiver to come from the Hammarlund Manufacturing Company, is the type HQ-180AX, an improved version of the HQ-180A. This receiver features 11 fixed frequency crystals in addition to the v.f.o., six of which are plugged in on the face of the instrument, the remainder being reached through a hinged compartment in the cabinet. An unusual feature of the HQ-180AX is the facility for compensating for minor frequency variations of the crystals by means of a ±3kc/s vernier tuner control.

Complete technical data of this new communications receiver may be obtained from the U.K. agents for Hammarlund equipment, *K. W. Electronics Limited, Vanguard Works, 1 Heath Street, Dartford, Kent.*

BOOKS REVIEWED

—continued from page 962

First, the two principal circuit elements, the transistor and the transformer, are in turn closely examined and their characteristics analysed; they are then brought together in subsequent chapters where various forms of single-ended, push-pull, bridge, sine-wave and driven inverter (or converter) cricuits all receive thorough attention.

Without doubt a valuable reference source for design engineers, this book will also be of great interest to many others who seek more than a mere surface knowledge of the subject.—*F.E.B.*

AUDIO AND ACOUSTICS

By G. A. Briggs, with James Moir; published by Wharfedale Wireless Works Limited, Idle, Bradford, Yorkshire. 168 pages, 8½ in. x 5½ in. Price 10s. 6d. (11s. 6d. post free).

MANY readers have seen, or have on their bookshelves, a book called **Sound Reproduction.** This, published originally in 1949, was an enlarged version of a booklet **Loudspeakers,** but covering a larger field. It was, in fact, the forerunner of the now well known series of audio books by G. A. Briggs. The author's unconventional style and his method of presenting facts and data in a most readable form caught the imagination of audiophiles and **Sound Reproduction** eventually went into three editions.

In 1962, when **Sound Reproduction** ran out of print, it was decided not to reprint again, or to bring out a revised edition, but (in the words of the author) "to divide and conquer and have two or three modest volumes instead of one huge tome running to several hundred pages."

Audio and Acoustics is the first in this programme of revision and, as the name suggests, concentrates mainly on the problems of acoustics. Although some of the material is taken from **Sound Reproduction** much of it is completely new and those who found the original book of value will certainly not be wasting their money in purchasing this new publication.

A very informative historical section deals with audio and acoustical developments, ranging from Edison's phonograph of 1877 to modern demonstration rooms and transistorised videotape recorders. This leads into chapters on the Ear. Resonance, Echo and Reverberation and Room Acoustics, all of which provide hard facts and food for thought. Other sections cover Free-field Sound Rooms, Transient Response, Stereo, Concert Halls and Studios and Live/Recorded Tests.

As the author points out, there is a growing interest in the acoustic aspect of sound, and in any audio set-up the real final link in an audio chain is **not** the loudspeaker system but the acoustics of the listening room. Therefore, this aspect requires more attention than that to which it is generally given.—*W.N.S.*

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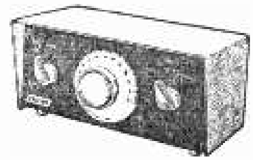

G4HZ writes . . . *I am delighted with it, it improves my Eddystone 640 in all respects. The difference with the Preselector is fantastic, a weak signal on 15 metres about S2 changed to S8. On the L.F. Bands, unwanted noise and mush is cut out.*
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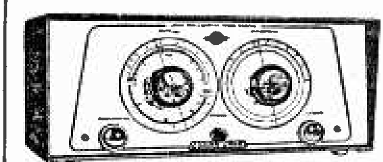
THE NEW CR 45 MAINS T.R.F. SHORT WAVE RECEIVER

World-wide short wave reception, North-South America, India, Russia, Far East, Australia, amateurs, shipping, etc.



- ★ Separate electrical bandspread.
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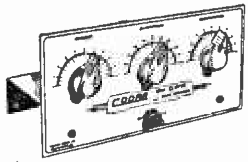

Can be built in one evening, ready to switch on, to bring the fascination of Short Wave listening at very low cost. Complete MINI-CLIPPER CODAR-KIT, valve, and one coil 25-75 metres, Instruction Manual 4 pages, 37/6, carr. 2/6. Extra Coils 4/9 each. Electrical Bandspread available. Instruction Manual only 2/-, post free.

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- ★ Large precision dial, dual slow motion drives.
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- ★ 2 Mullard transistor amplifiers, pre-assembled and tested.
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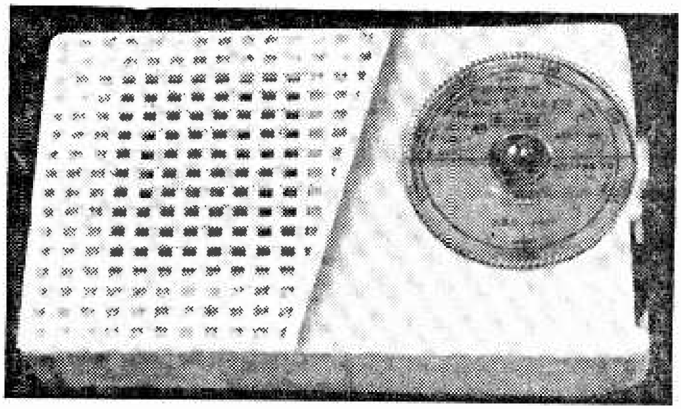
Long Waves for the M.W. Pocket Superhet

By J. G. Thompson



The receiver as it appeared originally.

MODIFYING THIS P.W. TRANSISTOR DESIGN FOR L.W. RECEPTION

THE receiver described in the September, 1962, issue of *Practical Wireless* tunes medium waves only. However, it can quite easily be modified to include long waves if this is required. Two methods will be found satisfactory and either may be adopted.

The simplest arrangement is to add sufficient capacity to give preset tuning of the Light Programme on 1,500m, the original medium wave ferrite rod winding being used on both bands. Reception on the long wave band is then confined to 1,500m only. The second method is to provide a long wave loading coil and coverage is then about 1,100m to 1,750m, allowing reception of other stations in this band. In both cases the oscillator coil remains unchanged, the necessary extra capacity being switched in.

Preset Tuning

The circuit for this arrangement is shown in Fig. 1. When the switch is in the medium wave position medium wave reception is obtained as before. With the switch in the long wave position TC3 and C16 are in parallel with the medium wave aerial winding and the 180pF capacitor is across the oscillator coil. The usual tuning control acts as a fine tuning or manual trimmer.

The receiver is sufficiently sensitive for this arrangement to give adequate volume in very many localities. The set is, of course, intended for reception of the Light Programme only on this band as mentioned.

C16 and TC3 need to total about 1,750pF and this can conveniently be obtained with a 1,600pF fixed disc capacitor and a 300pF or 500pF trimmer. VC1 provides 208pF and this allows further adjustment, since it is not very important where the Light Programme is found on the dial. It should, however, be possible to obtain 1,500m with the gang capacitor roughly half closed, this depending on the exact capacity of the 180pF oscillator capacitor and the coil core. On the long wave band the position of the oscillator coil core has a great effect on frequency. If necessary slight readjustment may be made, followed by realignment on the medium wave band.

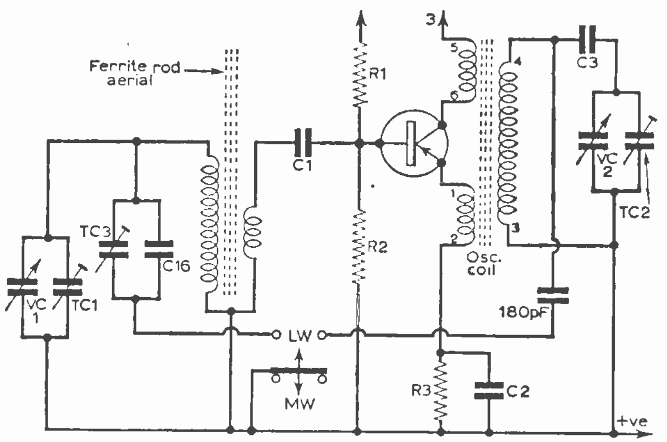
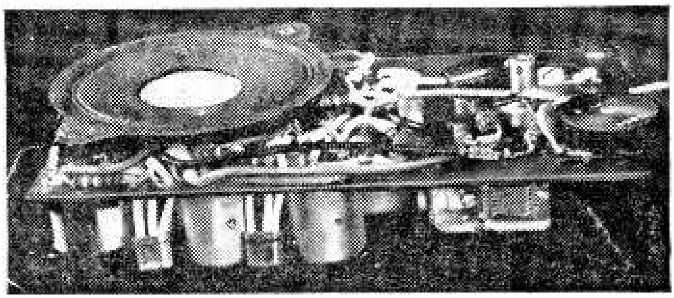


Fig. 1: Circuit modifications to receive the Light Programme on long waves.

It is feasible to obtain 1,500m at a marked point on the dial by adjusting TC3 and C16 and by including a further trimmer in parallel with the 180pF capacitor. But tuning will still be restricted to the Light Programme only.

If a few small fixed capacitors are to hand values



The chassis of the prototype receiver.

may be selected to bring 1,500m within the swing of the gang capacitor. Capacitors can be tried experimentally by wiring them across VC1 and from pin 4 of the oscillator coil to the positive line.

Long Wave Tuning

This method gives normal tuning and allows reception of one or two other stations in addition to the Light Programme on 1,500m. The circuit is shown in Fig. 2.

The long wave loading coil, with TC3 in parallel, is in series with the existing medium wave coil. The base coupling winding is returned to a tapping on the long wave coil. The long wave coil is shorted out when the switch is in the medium wave position. With the switch in the long wave position the loading coil is in circuit and the 180pF capacitor and TC4 are in parallel with the oscillator coil.

It is important that the tapping is near the "earth" end of the long wave coil and that both medium wave and long wave coil turns are in the same direction when they are in series. The long wave section is slid on the free end of the ferrite rod.

Frequency coverage may be modified by adjusting TC4. TC3 is adjusted for best volume around 1,200m. The receiver is then tuned to about 1,650m and the long wave winding is moved along the rod for best results.

Switch Mounting

A miniature slide switch can be positioned in the free space left near the oscillator coil, taking care that it clears the tuning control, as in Fig. 3.

The circuit in Fig. 1 requires two poles closed for long wave reception. A two-pole, two-way

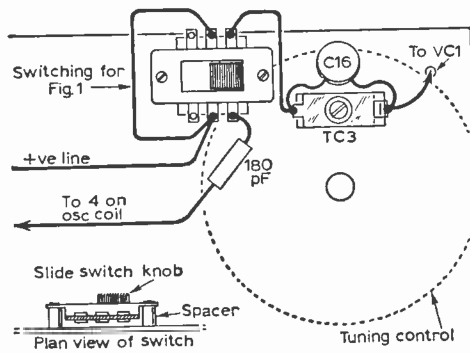


Fig. 3: Mounting details of the wavechange switch.

switch, as actually shown in Fig. 3, will thus be needed. The outer tags will have to be bent over to clear the case.

For the circuit in Fig. 2 a single pole two-way switch is sufficient. The switch shown in Fig. 3 may, of course, be used, but a single pole two-way switch will require less space as one set of contacts will be omitted. The centre tag goes to the positive or "earth" line, exactly as in Fig. 3. One outer tag is wired to the junction of medium wave and long wave aerial coils. The remaining outer tag is connected to TC4 and the 180pF capacitor, which are returned to pin 4 of the oscillator coil.

The switch is held by 8B.A. or smaller bolts with countersunk heads, spacers (or extra nuts) being used so that it is just clear of the paxolin panel. Carefully measure the switch position, drill a small pilot hole through the case and enlarge this with a small file to match the switch slot.

After either of the modifications shown, slight retrimming and realignment will be necessary on the medium wave band because of the stray capacity of switch wiring, etc. ■

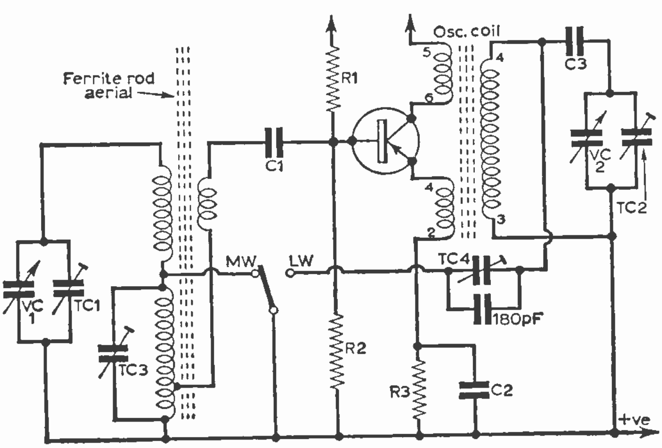


Fig. 2: The circuit for complete l.w. coverage.

Mains Voltage Adjuster

BY V. E. HOLLEY

THIS simple piece of equipment makes it possible by a turn of a switch to vary the mains supply voltage by up to about 50V above or below normal. It will be especially useful to those who have to service receivers in areas where the supply voltage is not uniform and can also be used to compensate for lost volts during peak load periods.

This device consists essentially of an auto transformer arranged so that both the input and output tappings can be varied at will as shown in Fig. 1 and a meter to indicate the output voltage.

Choice of Transformer

It will be seen at once that although the transformer is an indispensable part of the device, it does very little work, so that quite a large output is obtainable from a component of modest size.

An ordinary mains transformer as used in radio receivers is quite suitable and it does not matter if one or more of the secondaries is defective, so long as there are no shorted turns. The transformer must have a tapped primary and needs, of course, to be chosen with some regard to the output required. The following figures refer to the transformer used in the prototype and show how the maximum output current may be calculated.

Secondary ratings:

350-0-350V 120mA (700 x 0·12)	=84 volt-amps
6·3V 2A	=12 volt-amps
6·3V 4A	=24 volt-amps
Total	120

Assuming a transformer efficiency of 80 per cent, this total may be increased to 150 when referred to the primary and it is deduced that the primary will be capable of 150 volt-amperes at the lowest input tapping of 200V; and that the maximum current which can safely be permitted to flow through it is $\frac{150}{200}=0{\cdot}75$A.

This figure however, relates to service in a radio receiver, where the poor form factor of the h.t. secondary current, caused by the presence of the rectifier and reservoir capacitor, contributes appreciably to the heating effect.

A further consideration is that the currents in the two sections of an auto-transformer winding are in exactly opposite phase, so that the current in the section which is common to both input and output circuits is limited to the difference between the input and output currents. Thus the full output current will flow only in that small portion of the winding which is used to step the voltage up (or down) and its heating effect will be correspondingly small.

The result of all this is that the figure arrived at by calculation may be increased by about a third, and in fact, the transformer in the prototype unit becomes only faintly warm when a current of 1A is drawn continuously.

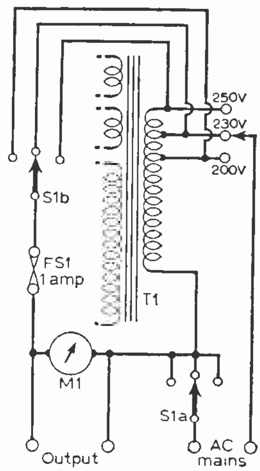


Fig. 1: The circuit of the unit.

Other Components

The 2-pole, 4-way rotary switch, S1, should be of the "make before break" variety. One pole (a) is used as a mains on/off switch in the input circuit and the other (b) to select the required out-put tappings.

An a.c. voltmeter, reading to 300V, is needed to indicate the output voltage. High accuracy is not necessary and a cheap moving iron meter will be quite satisfactory.

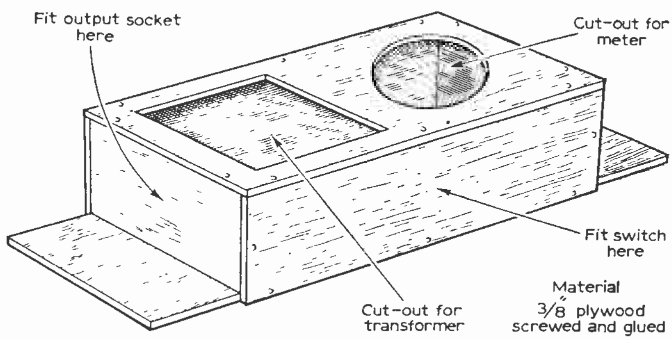


Fig. 2: Construction details of the case.

The cartridge fuse, FS1, in the output circuit should be of the anti-surge type, and its value should be chosen according to the maximum permissible output current.

Construction

The form of construction is unimportant. The prototype was built in a ⅜in. plywood box 9in. x 4½in. x 2½in. the bottom being extended at each

—continued on page 974

Testing Dry Batteries

By G. A. W. Partridge

DRY cells are used extensively as a portable power supply for valve and transistor radios. The cells which give approximately 1·5V each are made into batteries in order to produce the necessary electrical power.

After a certain length of time the cells cease to produce electricity and therefore have to be discarded and fresh batteries installed.

The usual idea, when a dry battery is under suspicion, is to simply test it with a voltmeter (Fig. 1). This is, however, not always satisfactory.

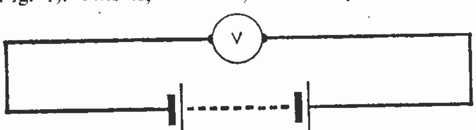


Fig. 1: The straightforward test for dry batteries.

For example, a radio battery was tested in this manner and gave a reading of 9V which was correct, but the radio barely functioned. The answer was that the battery had sufficient power to pass the tiny current necessary to operate the voltmeter but when it was called upon to pass about 25mA for the radio it could not do it.

In other words the e.m.f. (electromotive force) of the battery was still 9V but its p.d. (potential difference) was much less. The answer therefore, is to measure the p.d. and also the e.m.f.

What is the difference?

The e.m.f. can be taken as the battery's open-circuit voltage, and the p.d. is the voltage across the battery when a normal current is being drawn from it. The p.d. varies with this current so the battery should be tested while operating at normal load conditions. The p.d. and e.m.f. readings will therefore show up the condition of the battery (Fig. 2).

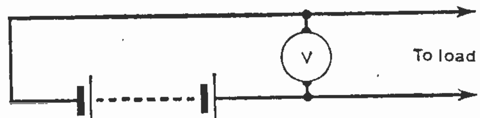


Fig. 2: Testing a battery's p.d.

Another point that is overlooked is that a battery has an internal resistance. Actually the difference between e.m.f. and p.d. is the voltage necessary to overcome this resistance which can be calculated from:

$$r=\frac{E-V}{I}$$

r = internal resistance.
E = e.m.f. (open circuit) in volts.
V = p.d. (closed circuit) in volts.
I = current in amperes.

Here is an example taken from an actual test. A torch cell was found to have an e.m.f. of 1·4V. It was connected through a milliammeter to a small resistance and the current drawn was 240mA. The p.d. was found to be 1·1V. The internal resistance is:

$$r=\frac{E-V}{I}=\frac{1{\cdot}4-1{\cdot}1}{240/1000}=\frac{1{\cdot}4-1{\cdot}1}{0{\cdot}24}=1{\cdot}3\Omega.$$

This cell is starting to deteriorate. The e.m.f. is low and the internal resistance rather high. A test on a good cell indicated an e.m.f. of 1·5 and an internal resistance of 0·37Ω.

A battery of cells will have a higher internal resistance if they are connected in series. For example a 6V dry battery will have four 1·5V cells connected in series. If each cell has an internal resistance of 0·4Ω then the total resistance will be $0{\cdot}4 \times 4 = 1{\cdot}6\Omega$.

Large capacity batteries for low voltages and higher currents have their cells connected in parallel. The total internal resistance will then be:

$$\frac{1}{R}=\frac{1}{r}\times\text{The number of cells.}$$

A battery of ten cells, each with a resistance of 0·4Ω will give a battery internal resistance of:

$$\frac{1}{R}=\frac{1}{0{\cdot}4}\times 10=0{\cdot}04\Omega.$$

MAINS VOLTAGE ADJUSTER

—continued from the previous page

end so that the assembly could be fastened to the workshop wall. Details are given in Fig 2.

Measurements will, of course, depend on the size of the transformer and meter. Connection to the mains should be by 3-core cable so that the exposed metal of the transformer can be earthed.

Operation

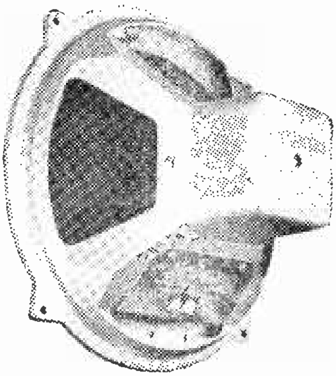
The prototype is operated from a supply which is nominally 240V but is frequently less. The mains voltage adjustment on the transformer is therefore usually set at 230V and voltages of 200, 220 and 240 are then available by operation of the switch.

In addition to providing supplies to receivers and amplifiers of varying voltage requirement, the unit is extremely useful for supplying a soldering iron. A high voltage can be used for quick heating, after which it can be reduced to normal or, if the iron is not to be used for some time, to sub-normal to keep it "simmering" ready to be brought quickly to working temperature when required.

An indicator lamp, supplied from one of the 6V transformer windings could be fitted, if desired, but is not essential as the voltmeter serves the same purpose.

ONE WORD OF WARNING: The unit should not be left unattended for long periods when it is being used to compensate for a reduced supply voltage, because if the supply should return to normal, damage might be done to equipment connected to it.

W B Stentorian



MODEL H.F. 1016 'MAJOR'

This unit makes use of the high flux density available in the magnet system of the previous H.F.1016 unit. A curved diaphragm is used with a rigid centre section coupled to the voice coil. The rigid coupling and the design of the cone termination give a balanced response over the whole audio range. The unit is specially suitable for use in the smaller type of enclosure having a volume of approximately 1½ cubic feet.

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8″ H.F.810	10,000 gauss	£2.14.3	T.10 tweeter	14,000 gauss	£4.8.3
6″ H.F.610	10,000 gauss	£2.5.0 Steel £2.6.9 diecast	T.359 tweeter	9,000 gauss	£1.10.6

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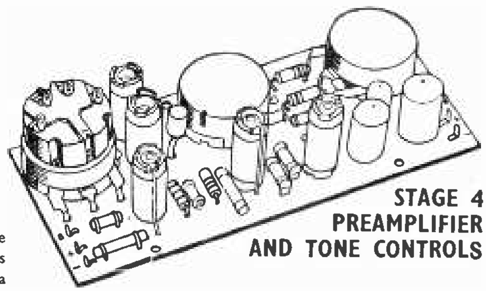

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CLUB NEWS

AMATEUR RADIO SOCIETY OF CHESHAM AND DISTRICT
Hon. Sec.: M.A. Woof, G3SGO/T, "Copperkins", Copperkins Lane, Amersham, Buckinghamshire.

Prospective members are invited to attend any Club meeting, especially those interested in joining the R.A.E. course which is being run at the moment. It should be noted, however, that the club-night has been changed recently to Fridays.

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

At the meeting for December 11th, members reviewed the events of 1963 as they appeared in members' photographs taken throughout the year. Later in the month on the 15th, members competed for the G5YY Trophy and on the 18th the Annual Christmas Party provided an enjoyable evening for all who attended.

The first day of the New Year was marked by a surplus sale.

LICHFIELD AMATEUR RADIO SOCIETY
Hon. Sec.: V. Hickman, 143 Main Street, Stonnall, Walsall, Staffordshire.

A full programme of lectures and social activities is helping to increase the membership of this Society. All meetings are held at the Swan Hotel in Lichfield on the first Monday and third Tuesday of each month.

MITCHAM AND DISTRICT RADIO SOCIETY
Hon. Sec.: A. L. Thurley, 50 Bruce Road, Mitcham, Surrey.

The meeting for December 6th was devoted to a film show arranged by G3LCH, the Society's Chairman.

The main event of the meeting on December 20th, was a constructional contest.

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

The Society's third Annual Dinner was held on December 11th and this proved to be a most enjoyable event. This was followed a week later by a ragchew meeting.

The first meeting of the New Year was held on January 1st, when Mr. H. Makin gave a lecture entitled "The Building of a 10-80 Transmitter."

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

A session of questions and answers was the main event at the December meeting of this Club, when members met at the Palmer Hall in Reading on the 28th. However the competition for a Club badge design, was judged on the same evening.

SCARBOROUGH AMATEUR RADIO SOCIETY
Hon. Sec.: P. B. Briscombe, G8KU, "Roseacre", Irton, Scarborough, Yorkshire.

The meeting for December 12th was devoted to a review of the past year, in photographic slides, and on December 19th members, their families and friends, had an enjoyable time at the Society's Christmas party.

SPEN VALLEY AMATEUR RADIO SOCIETY
Hon. Sec.: N. Pride, 100 Raikes Lane, Birstall, Nr. Leeds.

Because of the Season's festivities only one meeting was held during December. This was on the 12th and was a film show.

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY
Hon. Sec.: R. A G. MacIntosh, 50 Field Lane, Oldswinford, Stourbridge, Worcestershire.

On December 20th, members gathered in the Bell Hotel in Stourbridge for the usual Christmas informal get-together.

UXBRIDGE RADIO SOCIETY
Hon. Sec.: A. Duell, "Treetops", Bakers Wood, Denham, Buckinghamshire.

Activities currently under progress in this Society include an R.A.E. class (in preparation for the May examinations) and also a series of lectures on oscilloscopes and communications.

WEST KENT AMATEUR RADIO SOCIETY
R. Trevitt, 28 Dales Avenue, Tunbridge Wells, Kent.

On December 13th a group of members went out on a pre-arranged visit, and later in the month on the 20th, the Society's Christmas party was held.

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

On December 18th, members attended a lecture given by Mr. Roberts, (G3EFX), his subject being valves.

On January 1st the Society held a symposium under the title of "Why Amateur Radio Appeals to me."

TEST GEAR TECHNIQUES

An error in Fig. 9 of this article (page 429 of the September issue) has been pointed out by several readers. The cathode of V1 should have inserted a 300Ω resistor, and the grid 3 load, shown as 300Ω, should in fact be 500kΩ.

THREE-WATT AMPLIFIER

Two errors appeared in this article which was published in the November issue. In the circuit diagram and components list V2 is given as an EL86. This should be an EL84 as mentioned in the text. Also in the components list, the mains transformer is shown to have a rating of 8mA instead of the correct 80mA.

LETTERS TO THE EDITOR

DEFINITELY THE LAST WORDS ON "LICENCES"

SIR.—I offer the following in reply to all those who seek "novice licences":

Enough, let's hear no more these weary tales.
These jealous cries of Tired Tims and mental snails.
Let their authors, miserable souls,
Use up their leisure playing bowls.

A curse on all these armchair critics
Seeking complimentary tickets.
Away ye parasites and infant bawlers,
Spawn of Weirdies, Lids and Creepy Crawlers.

Let's hear, instead, the voice of men,
Who though they fail will try again,
And when they finally succeed
Their Call Sign is a prize indeed.
—GW3PHH.

MAGNETIC PICKUP

SIR.—I do not wish to criticize unduly, but I do think that the pre-amplifier described by Mr. Banthorpe in his very interesting article on a "Magnetic Pickup" in the July 1963 issue, is worthy of attention. The circuit as shown on page 274 will not work unless the transistors are chosen for their current gains (β).

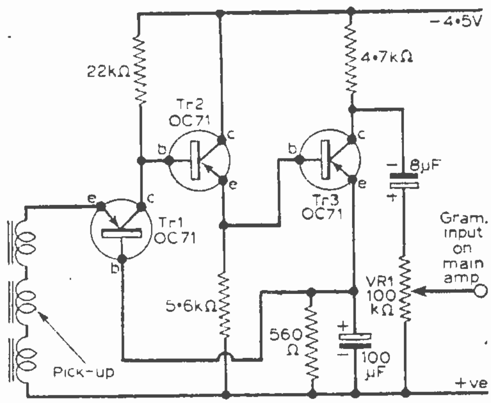
Consider: the base current of Tr1 is 4·2/330mA assuming a Vbe of 0·3V. This equals 0·013mA. In order that this stage should conduct properly and not "bottom", the voltage drop across the collector load (22kΩ) should not be more than 3·5V approximately.

This means that the β of Tr1 should be less than $\frac{3\cdot5}{0\cdot013\times22}=12\cdot2$. If the β is greater than 14, Tr1 will "bottom". From the Mullard data, the average β of an OC71 is 40. Admittedly, at the low values of collector current used that β will be lower than this figure, but it cannot be guaranteed that it will be less than 12.

It can likewise be shown that if the current gain of Tr3 is greater than 9·5 this stage will be permanently "bottomed" which will make it insensitive to all but the positive peak signals—a very effective clipping device. Unfortunately, if the first stage is "bottomed" this will only be sensitive to negative peaks, so as a whole the circuit is rather insensitive.

I enclose a somewhat better circuit. This has the advantage that the circuit is d.c. stabilised by negative feedback and is thus unlikely to "run away". It is also tolerant of β in all stages. It should be noted that the method of biasing a transistor with a single resistor in the base lead, makes the circuit extremely critical since the value of the resistor depends upon β which is a variable parameter. The only advantage is a reduction in the number of components required. However, a method of overall d.c. feedback as shown, can have this advantage with none of the disadvantages of instability.—D. G. WHITEHEAD (Marple, Cheshire).

[The author of this article has read and agreed with Mr. Whitehead's observations and has suggested they should be published for the benefit of any readers who have built or are contemplating building the pre-amplifier.—ED.]



The revised circuit of the Magnetic Pickup pre-amplifier.

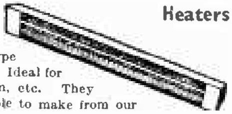
IN DEFENCE OF THE HAM

SIR.—After reading the letter from Mr. H. A. L. Wagner (December issue) in his self-appointed role of "picador of the air", like any tortured animal in the ring, I have been goaded into making this reply.

Practically everyone knows, of course, that the average licensed radio amateur, far from being a ham (a detestable misnomer, this) is more likely to be a professional of very high standing, and indeed the electronics and associated industries would look very sick without him.

Reading between the lines of Mr. Wagner's letter, it appears to me to be a strong case of "sour grapes", and your correspondent displays a great

Infra-Red Heaters



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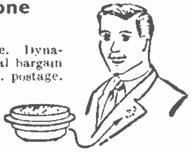

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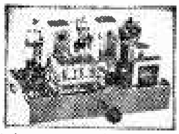

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Cabinet Snip

This fine cabinet as illustrated but less control knobs is available this month at a special snip price of **15/6**, plus 4/6 post and insurance. Size is 13½in. x 9in. x 4in. and it is nicely covered in two tone I.C.I. fabric.

Yaxley Switches

1 pole, 2 way	2/-	1 pole 3 way	2/-
1 pole, 4 way	2/3	1 pole, 5 way	2/6
1 pole, 7 way	3/-	1 pole, 9 way	3/-
1 pole, 11 way	3/-	1 pole, 12 way	3/3
2 pole, 2 way	2/3	2 pole, 4 way	2/6
2 pole, 5 way	5/-	2 pole, 6 way	3/6
2 pole, 12 way	5/6	3 pole, 3 way	3/-
3 pole, 6 way	4/-	3 pole, 12 way	8/6
4 pole, 2 way	3/-	4 pole, 3 way	3/6
4 pole, 4 way	3/6	4 pole, 5 way	6/6
4 pole, 6 way	6/6	4 pole, 11 way	10/6
4 pole, 12 way	11/6	5 pole, 3 way	4/6
5 pole, 6 way	8/-	5 pole, 12 way	14/6
6 pole, 6 way	9/6	6 pole, 3 way	4/6
6 pole, 12 way	17/6	6 pole, 11 way	16/6
6 pole, 4 way	6/6	8 pole, 2 way	6/6
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12 pole, 5 way	16/6	12 way fader	3/6

1 pole, 6 way incremental shorting, **3/6**

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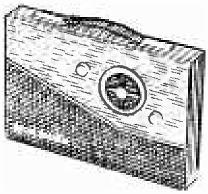

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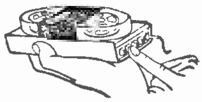

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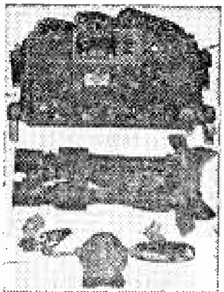

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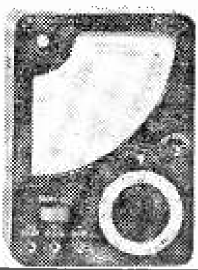

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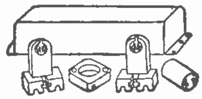
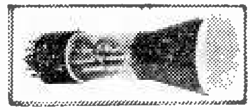


Building A 'Scope



3in. oscilloscope tube. American made type No. 3FP7. 6.3 v. 0.6 amp. heater, electrostatic deflection, brand new and guaranteed with circuit diagram of scope, **15/-** each, plus 2/6 post and insurance.

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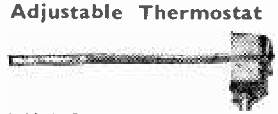

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deal of ignorance. He unmercifully criticizes the licensed amateur and yet praises the pirate operator to the full. The obvious reason why pirates "cut the cackle to a minimum" is the perpetual fear of being traced by the authorities because they are breaking the law.

Mr. Wagner states neither which system of emission nor which bands he operates, and he does not indicate the subject matters heard under discussion, but most of us are quite capable of exchanging technical data if the occasion arises. Conversely, by virtue of our licensing regulations, we are at liberty to discuss much more personal matters at any time—and we do! — REX TOBY (London, W.1.).

EVEREST PRAISE

SIR.—May I say a word of praise for the "Everest" tuner, which was described in the June and July 1962 issues of P.W.? As stated by the author, alignment needed plenty of patience, however once this has been mastered, it certainly does all that was claimed of it, and was well worth the cost of the crystal.—J. SMETHURST (Oldham, Lancashire).

A DIFFERENCE OF OPINION

SIR,—Mr. Hellyer in his article "Test Gear Techniques", published in the November issue of P.W., appears to be confused.

He says: " Mathematically, $NdB=10\log_{10}(P2/P1)$, where P1 is the input and P2 the output power."

This is perfectly correct. The bel is a ratio (logarithmic) of powers. This can be also written, of course, as: $NdB=\log_{10}\left(\frac{V1^2\times R2}{R1\times V2^2}\right)$ and, as the author states, if $R1=R2$ then: $NdB=10\log_{10}(V1^2/V2^2)$, or: $NdB=20\log_{10}(V1/V2)$.

This however, is not equivalent to: $NdB=10\log_{10}(V2/V1)$ . . . (a) and therefore cannot be termed as a voltage ratio or as a voltage decibel, which (a) would represent. As $V^2/R=P$ however, therefore: $20\log_{10}(V1/V2)$ can be said to be again a ratio of *powers*. There is only one *type* of decibel —power. Anyone who speaks of the other *types* of decibels—voltage, resistance, current—either has no knowledge of what he is speaking, or is being deliberately misleading. — P. J. MCGOLDRICK (London, S.E.9).

SIR—In reply to Mr. Goldrick's letter. This is an example of the academic versus practical controversy more often found in the pages of the "glossy" technical magazines. Mr McGoldrick is as right in his facts as he is rude in his conclusions.

While it is perfectly true that the bel is a logarithm to the base 10 of the ratio of two powers, it is also true that since the power ratio is also the square of the voltage or current ratio for a given load impedance, the power ratio in decibels can be stated as 20 times the logarithm to the base 10 of the voltage or current ratio V1/V2 or I1/I2. When using this convenient measuring tool, we do not always state that the expression dB is a power ratio: this is understood. Engineers who regularly employ the dB as a means of response curve, bandwidth and sensitivity checks are quite familiar with its use. They are concerned with comparative voltages, but are well aware that the use of the dB is a mere convenience, not an absolute measurement. They know quite well that $20\log_{10}(V1/V2)$ is a ratio of power, and do not speak of different *types* of decibel. In doing so, they are not intentionally misleading and could hardly do their work without knowledge of what they were saying.

A closer reading of page 646 of the November P.W. will show that this stricture was indeed put forward. Space prevented a fuller theoretical discussion in an article of this nature. It would have been quite proper to continue to the effect that voltage ratios are more correctly stated in ***nepers***. But to bring in logarithms to the base "e" would have done nothing to improve the article, or clarify the subject. However, if a more technical (less misleading?) treatment is needed, the author will be happy to oblige.—H. W. HELLYER (Gilfach, Glamorganshire).

Sir—I would be grateful if any reader could sell or loan me . . .

. . . the May and June 1957 issues of P.W. J. M. ROBERTSON, 38 Silverhill Drive, Denton Burn, Newcastle upon Tyne 5.

. . . the circuit diagram or data of a Beethoven B106 television receiver.—S. STAFFORD, 25 Sithson Avenue, Bolsover, Derbyshire.

. . . the manual of a Marconi Canadian receiver No. 52—H. C. LOXLEY, 51 Guy Street, Warwick.

. . . the June 1957 issue of P.W.—D. W. FROST, 6 Queen's Road, Harpurhey, Manchester 9.

. . . the circuit and data of the a.m. test set, type 74.A.—G. H. PARK, 32 Stonefield Street, Moorside, Cleckheaton, Yorkshire.

. . . the issues of P.W. giving the modification details of the No. 19 set.—J. AULESBROOK, 61 South Road, Beeston, Nottinghamshire.

. . . the instruction book for a G.E.C. four-valve portable receiver, type BC.1255.—M. SELLARS, 9 Oaklea, Sherwood Road, Heath Grove, Buxton, Derbyshire.

. . . the January 1961 issue of P.W.—A. Crabb, "Jara", Central Avenue, Hullbridge, Essex.

. . . data for the No. 38 and No. 46 transmitter/receivers.—23861901 Tpr. HARGREAVES, A. W., Q.M. Troop, 2nd Royal Tank Regiment, Lisemally Camp, Omagh, Co. Tyrone, N. Ireland.

. . . the September 1960, September and December 1961 issues of *Practical Television*.—R. F. DARBY, 5 The Firs, Bell Bar, Hatfield, Hertfordshire.

. . . the August, September and October 1961 issues of P.W.—P. A. BLAKEY, Cox Hill, Boxford, Colchester, Essex.

. . . the September 1956 issue of P.W.—M. A. FORRESTER, 58 Bede Avenue, Sherburn Road Estate, Durham.

. . . details of the valve line-up and internal connections to the coil pack plugs of the receiver type M.C.R.I.—L. O. BEALING, Del Monica, 93 Alma Road, Bournemouth, Hampshire.

. . . the September 1957 issue of P.W.—A. GUY, 27 The Drive, Lightcliffe, Halifax, Yorkshire.

. . . the issues of P.W. dealing with the conversion of the R1155 receiver.—J. REED, 14 Firth Road, Rondebosch, Cape Town, South Africa.

. . . the circuit and wiring diagram of the supply unit Mk.III No. 2.—S. M. MARSHALL, 18 Anne Way, Barkingside, Ilford, Essex.

. . . the circuit and/or any other data for the R.107 Mk.I/I set. R. S. KING, 46 Maesteg Road, Cwmfelin, Maesteg, Glamorganshire.

. . . information on the type of batteries used in an American Philco signal generator No. B76920.—H. C. CLARK, 63 Queensway, Moss Bank, St. Helens, Lancashire.

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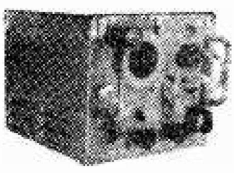

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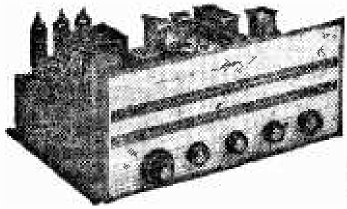

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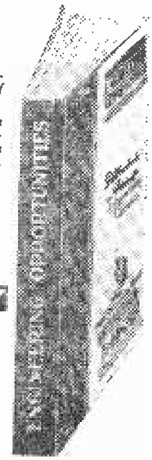

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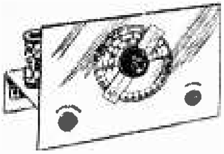

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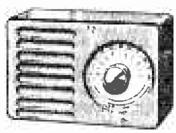

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6AT6	5/-	10C1	9/6	807(A)	8/-	EF22	6/6	PCF84	9/3	UF85	7/-
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6AV6	5/6	10F1	6/9	813	49/-	EF37A	6/9	PCL82	6/6	UL41	6/9
6B7	8/-	10F9	10/-	832	14/-	EF39	4/6	PCL83	8/-	UL44	14/-
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6BE6	5/-	10P13	8/3	955	2/3	EF42	5/9	PCL86	9/6	UM80	8/6
6BG6G	13/-	10P14	9/6	956	2/-	EF50-BR	1/3	PEN25	3/6	UR1C	6/9
6BH6	5/6	10P18	6/9	1625	5/6	EF50(A)	2/6	PEN45	7/9	UU6	9/9
6BJ6	5/6	12A6	2/3	5763	7/6	EF54	3/3	PEN46	4/3	UU7	8/6
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6F6G	4/6	12K7GT	4/6	DAF96	6/9	EL42	7/9	PY81	5/3	X66	7/3
6F13	4/9	12K8	9/9	DF33	8/-	EL81	8/9	PY82	5/-	X76M	11/-
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★ 9 volt Star, 45 r.p.m.	39/6
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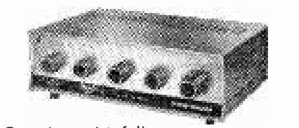

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Practical Wireless

ALL of these blueprints are drawn full-size and although the issues containing descriptions of these sets are now out of print, constructional details are available free with each blueprint except for those marked thus (*).

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS, Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, London W.C.2.

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THE following blueprints include some pre-war designs and are kept in circulation for those constructors who wish to make use of old components which they may have in their spares box. *The majority of the components for these receivers are no longer stocked by retailers.*

Experimenter's Short Wave	PW30a	2/6
Midget Short Wave Two	PW38a	2/6
Simple S.W. One-valver	PW88	2/6
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QUERY COUPON

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PRACTICAL WIRELESS, FEBRUARY, 1964.

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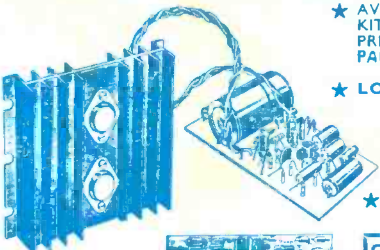

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