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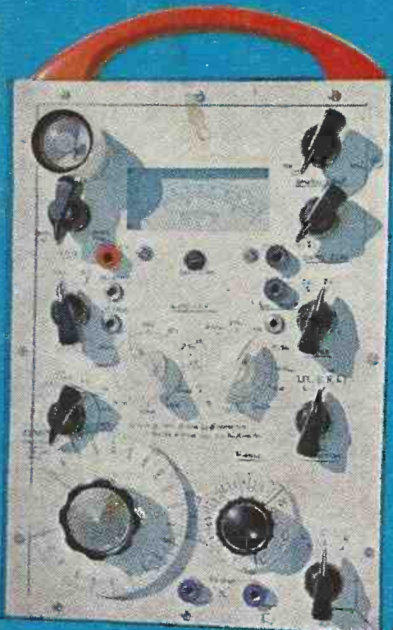

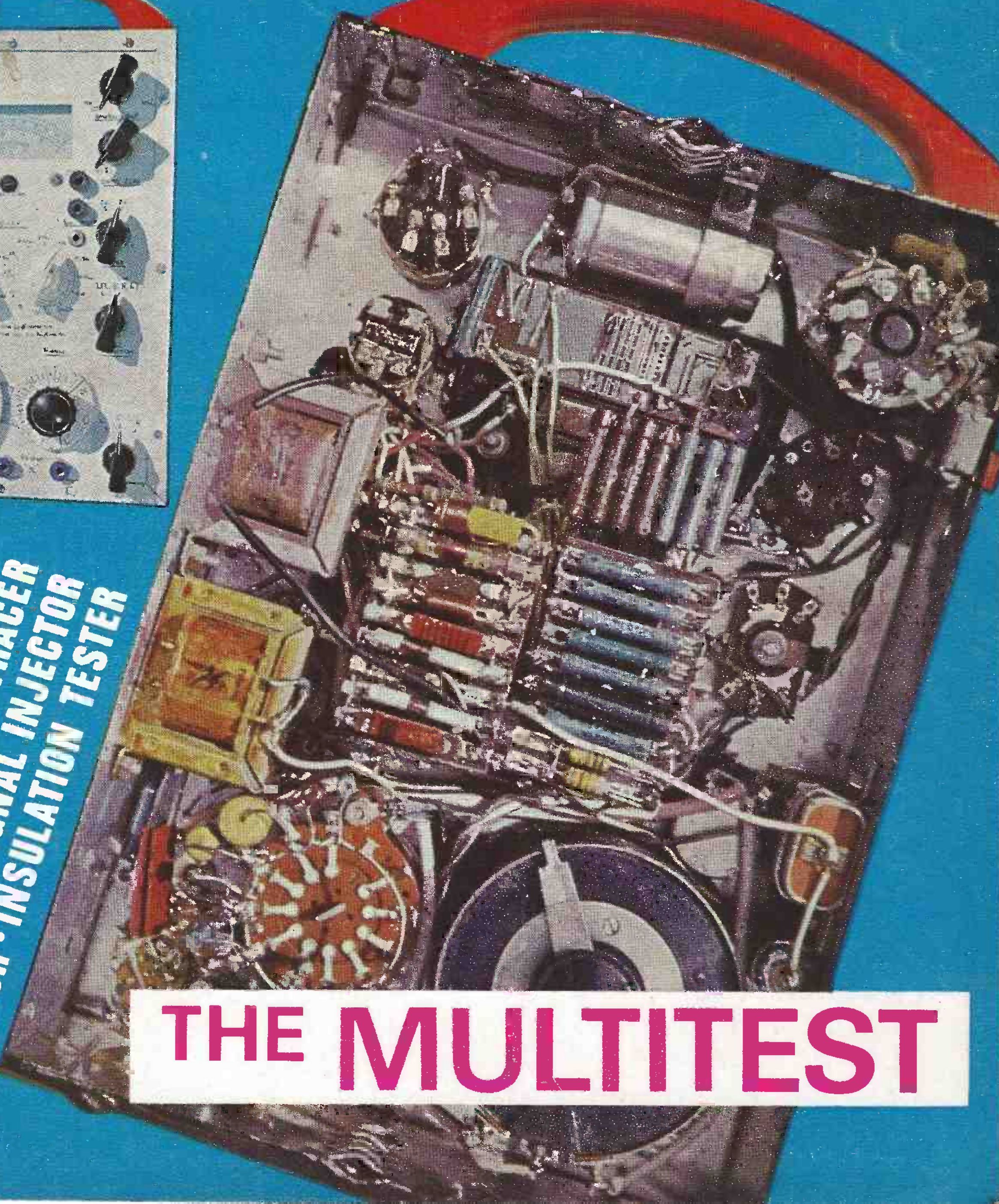

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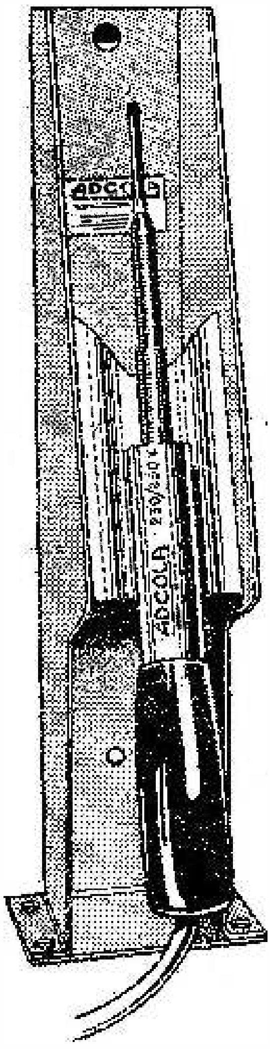

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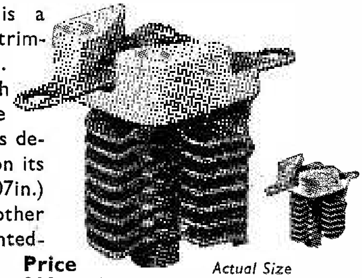

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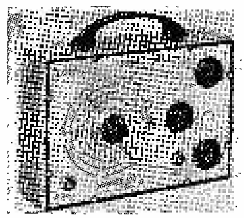

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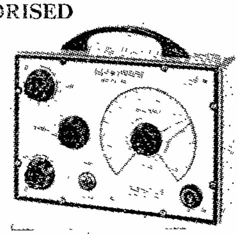

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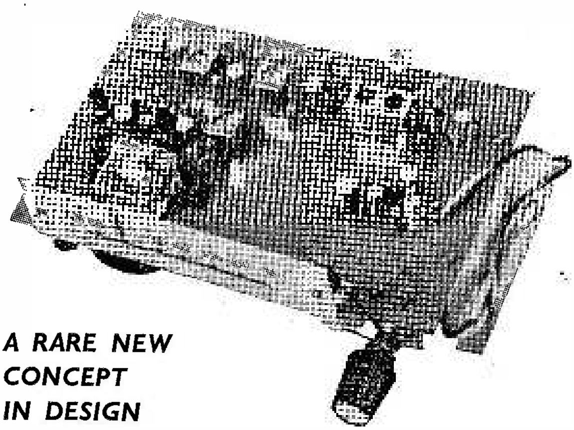

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30L1	5/6
30L15	10/3
30L17	11/6
30P4	12/-
30P12	7/6
30P16	5/3
30P19	12/-
30PL1	9/6
30PL13	10/6
30PL14	11/-
30PL15	9/6
35/51	12/6
35A5	15/-
35L6GT	6/-
35W4	4/6
35Z3	10/-
35Z4GT	4/6
35Z5GT	5/9
40SUA	6/6
41MTL	8/-
41STH	10/-
42	5/-
43	10/-
45	17/6
45Z6GT	15/-
50A5	21/10
50B5	6/6
50C5	6/6
50CD6G	40/9
50L6GT	6/-
52KU	14/6
53KU	14/6
72	6/6
77	5/-
78	4/9
80	5/3
83V	8/-
85A2	6/6
90AG	67/6
90AV	67/6
90CG	34/-
90CV	33/6
90C1	16/-
150B2	16/6
150C2	5/9
161	15/-
185BT	34/11
215SG	6/6
220B	10/6
301	20/-
302	15/-
303	15/-
305	16/6
306	13/-
807	11/9
956	2/-
1203A	7/-
1622	12/6
1821	10/6
2101	12/6
4033	25/-
4687	71/-
5763	7/6
6067	10/-
7193	1/6
7475	2/9
9002	4/6
9006	2/6
A1834	20/-
ACO44	9/-
AC2HL	10/6
AC2PEN	19/6
AC2PEN/DD	17/6
AC6PEN	4/9
AC/PEN (5)	17/6
AC/PEN (7)	17/-
AC/SG	22/6
AC/SG/VM	12/-
AC/TH1	10/-
AC/TP	18/-
AC/VP1	12/-
AC/VP2	12/-
ATP4	2/3
AZ1	8/6
AZ31	7/9
AZ41	6/6
B36	4/9
B319	5/6
B349	10/3
B719	5/3
BL63	10/6
CK506	6/6
CL4	19/6
CL33	11/6
CV6	2/6
CV63	10/6
CV271	12/6
CV428	19/-
CY1	16/4
CY1C	6/6
CY31	5/9
D1	1/3
D15	13/6
D42	10/6
D63	5/-
D77	2/3
DAC32	6/9
DAF91	3/3
DAF96	6/-
DCC90	8/-
DD4	12/6
DD41	10/6
DDT4	7/6
DET25	7/6
DF33	7/6
DF66	15/-
DF72	30/-
DF91	2/6
DF96	6/-
DF97	10/-
DH30	15/6
DH63	5/6
DH76	3/6
DH77	3/6
DH81	23/3
DH101	25/-
DH107	16/11
DH719	5/9
DK32	7/-
DK40	15/6
DK91	4/-
DK92	8/-
DK96	6/6
DL33	6/6
DL35	4/9
DL63	5/3
DL72	15/-
DL75	30/-
DL92	4/3
DL94	5/-
DL96	6/6
DL810	10/6
DM70	5/-
DM71	9/9
DW4/350	8/6
DW4/500	8/6
DY86	6/3
DY87	6/9
E80CC	33/-
E80F	24/-
E83F	24/-
E88CC	12/-
E180F	19/6
E1148	1/9
EA50	1/6
EA76	6/9
EABC80	5/9
EAC91	3/3
EAF42	7/6
EL85	7/6
EL86	7/3
EL91	2/6
EB34	1/-
EB41	4/9
EB91	2/3
EBC3	20/6
EBC33	6/-
EBC41	6/6
EBC81	6/3
EBC90	3/6
EBC91	5/6
EBF80	5/9
EBF83	7/3
EBF89	5/9
EBL21	10/3
EC52	4/3
EC53	12/6
EC54	6/-
EC70	4/9
EC90	2/3
EC91	4/-
EC92	6/6
ECC31	15/6
ECC32	4/6
ECC33	29/1
ECC34	21/7
ECC35	4/9
ECC40	10/-
ECC81	3/6
ECC82	4/6
ECC83	4/6
ECC84	5/6
ECC85	5/3
ECC88	8/9
ECC189	11/6
ECC804	8/9
ECC807	15/-
ECF80	7/3
ECF82	6/3
ECF86	10/-
ECF804	24/-
ECH3	23/3
ECH21	10/-
ECH33	22/8
ECH35	6/-
ECH42	8/-
ECH81	5/6
ECH83	6/6
ECH84	9/-
ECL80	5/9
ECL82	6/6
ECL83	10/-
ECL86	8/-
EF6	20/6
EF9	20/6
EF22	6/6
EF36	3/6
EF37A	7/-
EF39	5/-
EF40	8/9
EF41	8/-
EF42	3/9
EF50	2/6
EF54	3/-
EF73	5/-
EF80	4/3
EF83	9/9
EF85	4/6
EF86	6/6
EF89	4/3
EF91	3/-
EF92	2/6
EF97	10/-
EF98	9/9
EF183	6/9
EF184	6/6
EH90	9/6
EK32	5/9
EL32	3/6
EL33	6/6
EL34	9/9
EL35	10/-
EL36	8/9
EL37	12/3
EL41	7/6
EL42	7/9
EL81	8/3
EL83	6/9
EL84	4/6
EL95	5/-
EL360	20/-
EL820	16/4
EL822	22/6
EM71	15/6
EM80	6/-
EM81	7/-
EM84	6/-
EM87	6/6
EN91	5/6
EY51	5/6
EY81	7/3
EY83	9/3
EY84	9/6
EY86	5/9
EY87	6/6
EY88	8/9
EY91	3/-
EZ35	5/3
EZ40	5/6
EZ41	6/3
EZ80	3/9
EZ81	4/3
EZ90	3/9
FC2	14/6
FC4	8/9
FC13	14/6
FW4/500	6/6
FW4/800	8/6
GU50	55/-
GZ30	7/6
GZ32	8/-
GZ33	12/6
GZ34	10/-
GZ37	14/6
H30	5/-
HABC80	9/3
HL2	7/6
HL13C	4/-
HL23	12/6
HL23DD	5/-
HL41	8/9
HL41DD	19/6
HL42DD	19/6
HL133DD	9/6
HN309	26/-
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	5/-
KT8	15/-
KT32	4/9
KT33C	6/-
KT36	29/1
KT41	19/6
KT44	5/-
KT61	6/9
KT63	3/9
KT66	12/3
KT74	12/6
KT76	7/6
KT88	28/-
KTW61	4/9
KTW62	5/6
KTW63	5/6
KTZ41	5/6
L63	3/9
LN152	5/9
LN309	8/9
LN319	9/6
LP2	9/6
LZ319	6/6
LZ329	6/6
MHD4	7/6
MHLD6	12/6
ML6	5/9
MS4B	20/5
MSP4	12/-
MU12/14	4/6
MX40	8/9
N37	23/3
N78	37/10
N108	26/2
N339	25/-
P41	3/6
P61	2/6
PABC80	7/6
PC86	9/-
PC88	9/-
PC95	6/9
PC97	5/9
PC900	9/6
PCC84	5/6
PCC85	6/9
PCC88	10/6
PCC89	11/6
PCC189	8/9
PCF80	6/6
PCF82	6/-
PCF84	8/6
PCF86	8/3
PCF801	9/6
PCF802	10/-
PCF805	8/-
PCF806	12/9
PCF808	11/-
PCL82	6/6
PCL83	8/9
PCL84	7/6
PCL85	8/6
PCL86	8/6
PCL88	11/-
PEN40DD	34/-
PEN45	7/-
PEN45DD	19/6
PEN46	4/-
PEN383	9/6
PEN384	11/6
PEN453DD	19/6
PENA4	19/6
PEN/DD 4020	17/6
PFL200	14/6
PL33	9/-
PL36	9/-
PL38	16/-
PL81	6/9
PL82	5/3
PL83	6/-
PL84	6/3
PL500	14/-
PM84	9/3
PT15	10/-
PX4	9/-
PY31	6/9
PY32	8/9
PY33	8/9
PY80	4/9
PY81	5/-
PY82	4/9
PY83	5/6
PY88	7/3
PY800	5/9
PY801	6/3
PZ30	9/3
QP21	5/-
QP22B	12/6
QQVO3/10	35/-
QS7520	10/6
QS150/15	9/6
R10	15/-
R11	19/6
R12	5/6
R16	34/11
R17	17/6
R18	9/6
R19	6/9
R52	7/6
RG1/240A	65/-
BK34	7/6
S130	22/6
SP4B	19/6
SP13C	12/6
SP42	12/6
SP61	2/-
SU25	27/2
T41	9/-
TDD2	12/6
TDD4	7/6
TH4B	10/-
TH21C	10/6
TH30C	14/6
TH233	6/9
TP22	5/-
TP25	5/-
TP2620	7/6
TY86F	11/8
UABC80	5/-
UAF42	7/-
UB41	10/6
UBC41	6/6
UBC81	6/3
UBF80	5/6
UBF89	5/9
UBL21	10/9
UC92	6/3
UCC84	8/-
UCC85	6/6
UCF80	8/3
UCH21	8/-
UCH42	8/-
UCH81	6/-
UCL82	7/3
UCL83	9/-
UF41	6/9
UF42	4/9
UF80	6/3
UF85	6/9
UF86	9/-
UF89	5/6
UL41	8/9
UL46	9/6
UL84	5/6
UM4	17/6
UM34	17/6
UM80	8/3
UR1C	6/6
UU5	7/-
UU6	13/-
UU7	13/-
UU8	14/-
UU9	5/6
UU12	4/3
UY1N	10/3
UY21	9/-
UY41	5/-
UY85	4/9
U10	9/-
U12/14	7/6
U16	15/-
U17	5/-
U18/20	6/6
U19	48/6
U22	5/9
U25	8/6
U26	8/6
U31	6/6
U33	13/6
U35	16/6
U37	34/11
U45	15/6
U47	8/6
U50	4/9
U52	4/9
U76	4/6
U78	3/9
U101	19/6
U107	17/6
U191	9/6
U251	9/-
U281	8/9
U282	12/3
U301	11/-
U329	9/-
U339	9/6
U403	9/9
U404	6/-
U801	15/-
U4020	6/6
VMP4G	11/9
VMS4B	12/-
VP2	3/6
VP2B	9/6
VP4	14/6
VP4A	14/6
VP4B	12/-
VP13C	7/-
VP23	2/6
VP41	5/-
VP133	9/9
VR75	21/-
VR105	5/6
VR150	4/9
VT61A	7/-
VT501	3/-
VU111	5/-
VU120	10/-
VU120A	10/-
VU133	7/-
W21	5/-
W42	12/-
W61M	24/6
W63	10/6
W76	3/6
W77	2/6
W81M	5/9
W101	26/2
W107	10/6
W729	17/6
X14	7/-
X18	8/-
X24	16/6
X41	10/-
X61	6/-
X63	5/9
X64	5/6
X65	5/6
X66	7/6
X76M	8/6
X78	26/2
X79	40/9
X81M	29/1
X101	29/1
X109	26/-
X118	9/9
X119	6/-
X142	8/-
Y63	5/-
Y65	5/-
Z63	4/6
Z66	7/3
Z77	3/-
Z329	8/3
Z729	6/6
Z749	9/-
Z759	36/-
Transistors and diodes	
AA120	4/6
AA129	4/6
AC107	14/6
AC113	8/-
AC114	8/-
AC127	9/6
AD140	17/6
AD149	17/6
AF102	27/6
AF114	11/-
AF115	10/6
AF116	10/-
AF117	5/6
AF118	20/-
AF124	11/-
AF125	10/6
AF126	10/-
AF127	9/6
AF139	27/6
AF186	27/6
AFZ12	26/6
ASY27	10/-
ASY29	10/-
BYZ13	11/6
GD3	6/6
GD6	5/6
GD14	10/-
GET103	7/-
GET104	12/-
GET106	17/6
GET111	12/-
GET113	6/9
GET114	6/6
GET116	17/-
GET873	9/3
GET874	9/6
GEX13	3/6
GEX35	3/-
GEX36	10/-
GEX45	6/6
GEX64	11/6
GEX66	15/-
MAT100	7/9
MAT101	8/6
MAT120	7/9
MAT121	8/6
OA5	5/6
OA10	9/6
OA70	3/-
OA73	3/-
OA79	3/-
OA81	3/-
OA85	3/-
OA86	4/-
OA90	3/-
OA91	3/-
OA95	3/-
OA200	5/-
OA211	13/6
OAZ200	12/6
OAZ202	9/6
OAZ203	9/6
OAZ204	9/6
OAZ205	9/-
OAZ210	7/6
OC19	25/-
OC22	23/-
OC23	57/-
OC25	12/-
OC26	8/-
OC28	23/-
OC29	16/6
OC35	9/6
OC36	21/6
OC41	5/-
OC42	6/9
OC43	12/6
OC44	4/9
OC44PM	8/3
OC45	3/6
OC45M	8/-
OC65	22/6
OC66	25/-
OC70	6/6
OC71	3/6
OC72	8/-
OC73	16/-
OC74	8/-
OC75	8/-
OC76	8/6
OC77	13/-
OC78	8/-
OC81	4/-
OC81D	4/-
OC81M	4/-
OC82	10/-
OC83	5/6
OC84	8/-
OC139	12/-
OC140	19/-
OC170	8/6
OC171	9/-
OC200	9/-
OC201	29/-
OC203	12/6
OC204	10/6
OC206	10/6
OCP71	27/6
ORP12	18/6
TS3	15/-
V10/15A	12/-
XA103	15/-

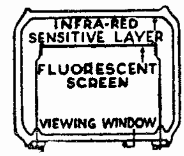
WE REQUIRE FOR PROMPT CASH SETTLEMENT ALL TYPES OF VALVES, LOOSE OR BOXED, BUT MUST BE NEW

ELECTROLYTICS. Can types: 8 x 8/500v. 6/6; 8 x 16/500v. 7/-; 16/500v. 5/-; 16 x 16/500v. 7/6; 16 x 32/450v. 8/9; 32/500v. 6/6; 32 x 32/450v. 6/-; 50 x 50/350v. 6/-; 60 x 250/275v. 9/6; 60 x 250/350v. 15/6; 60 x 250 x 10/275v. 11/9; 64/450v. 8/-; 64 x 100/450v. 15/6; 64 x 120/350v. 9/-; 100/450v. 9/6; 100/275v. 3/6; 100 x 200/275v. 8/6; 100 x 200/350v. 16/6; 100 x 200 x 60/300v. 16/6; 100 x 300 x 100 x 16/275v. 24/-; 100 x 400/275v. 12/6; 100 x 400 x 16/275v. 19/6; 150 x 200/350v. 18/-; 200/275v. 4/-; 200/350v. 10/6; 200 x 200 x 100/350v. 22/6; 1000/50v. 7/-; 2000/50v. 10/6; 5000/25v. 12/-; 5000/50v. 22/6. **Tubular types:** 1/500v. 2/-; 2/500v. 2/6; 4/500v. 2/6; 8/450v. 1/9; 8/500v. 2/6; 8 x 8/450v. 3/-; 8 x 16/450v. 3/9; 10/50v. 1/6; 16/450v. 2/9; 16 x 16/450v. 4/-; 16 x 32/350v. 4/3; 32/350v. 3/-; 32/450v. 3/9; 32 x 32/450v. 4/-; 50 /50v. 1/9; 50/350v. 4/6; 100/50v. 3/-; 250/25v. 3/9; 500/25v. 4/6; 500/50v. 5/-; 1000/12v. 2/6; 2000/25v. 5/9 **Specials:** 16 x 16 x 16/275v. 6/-; 50 x 50 x 50/350v. 10/6; 2/150v. x 500/25v. 5/9; 8/600v. 8/9; 16/600v. 12/-; 47/450v. 6/6.
Midget silicon rectifiers. Types BY100. Output 250 volts ½ amp. No larger than a shirt button, 6/6 each. Series limiting resistance, 1/6.

EXPRESS POSTAL SERVICE! ALL ORDERS DESPATCHED SAME DAY AS RECEIVED

Terms of business—Cash with order only. Post/Packing 6d. per item. Orders over £5 post free. No C.O.D. All orders cleared day of receipt. Any parcel insured against damage in transit for 6d. extra. We are open for personal shoppers 9.00—5 p.m. Sats. 9.00—1 p.m. Complete list of modern and obsolete valves, resistors, condensers, transformers, potentiometers, microphones, etc. with terms of business 6d. Please enquire for any item not listed with S.A.E.

SNIPERSCOPE

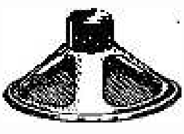


Famous war-time "cats eye" used for seeing in the dark. This is an infra-red image converter cell with a silver caesium screen which lights up (like a cathode ray tube) when the electrons released by the infra-red strike it. A golden opportunity for some interesting experiments. **5/-** each, post 2/-. Data will be supplied with cells, if requested.

MAINS POWER PACK

MAINS POWER PACK designed to operate transistor sets and amplifiers. Adjustable output 6v.-9 to 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries. PR1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer-rectifier, smoothing and load resistor, 5,000 and 500 mfd. condensers, zener diode and instructions. Real snip at only 14/6, plus 3/6 post.

SPEAKER BARGAIN



12in. High fidelity loudspeaker. High flux permanent magnet type with either 3 or 15 ohm speech coil. Will handle up to 10 watts. Brand new, by famous maker. Price **29/6**, with built in tweeter **35/-** plus 3/6 post and insurance.

ARDENTE HEARING AID

If not wanted as hearing aid these could be the basis of radio control units—pocket transmitter—staff locators etc. They are beautifully made little units and they contain many subminiature parts including crystal microphone, on/off switch—volume control with on/off switch—inter-stage transformer—Mullard valves types DL 66 and DF 64 (2 of). All parts in good order, in fact hearing aids believed to be in working order but not guaranteed so—complete in plastic case with pocket clip only **27/6** (earphone not included).

MEDRESCO HEARING AIDS

Also available similar condition to above used but believed working, only **18/-** each.

THERMOSTATS

TYPE 'A' 15 amp for controlling room heaters, greenhouse, airing cupboard. Has spindle for pointer knob quickly adjustable from 30°—80°F. **9/6** plus 1/- post. Suitable box for wall mounting, **5/-**, P. & P. 1/-.

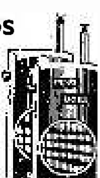
TYPE 'B' 15 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 50-550°F. Internal screw alters the setting so this could be adjustable over 30° to 1,000°F. Suitable for controlling furnace, oven, kiln, immersion heater or to make flamestat or fire alarm, **8/6** plus **2/9** post and insurance.

TYPE 'D' We call this the Ice-stat as it cuts in and out at around freezing point. 2/3 amps. Has many uses, one of which would be to keep the loft pipes from freezing if a length of our blanket wire (16 yds. **10/-**) is wound round the pipes. **7/6**, P. & P. 1/1.

TYPE 'E' This is a standard refrigerator thermostat. Spindle adjustments cover normal refrigerator temperature, **7/6** plus 1/- P. & P.

TYPE 'F' Glass encased for controlling the temp. of liquids—particularly those in glass tanks, vats or sinks—thermostat is held (half submerged) by rubber sucker or wire clip—ideal for fish tanks—developers and chemical baths of all types. Adjustable over range 50° to 150°F—price **18/-** plus 2/- post and ins.

TWO WAY RADIOS



Give communication over ½ mile. FULLY transistorised—crystal controlled, built-in telescopic aerial—press button operation—PP3 batteries—pair instruments complete and ready to use **£7.9.6** plus 5/- post and insurance. **Not to be operated in U.K.**

Three Unusual Items

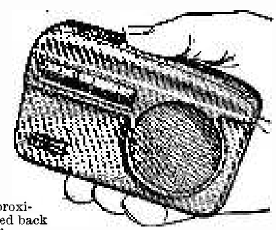
OZONE OUTFIT—for removing smells and generally improving any oppressive atmosphere. Kit consists of Philips Ozone Lamp and mains unit, only needs box, **19/6** plus 6/6 carr. and ins.

BLACK LIGHT UNIT. 40 watt intensity, comprises lamp, lamp holder and 40 watt choke. Only **19/6** plus 6/6 carr. and ins.

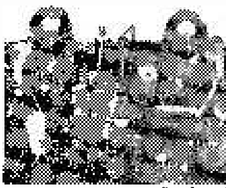
TIMER KIT. Special offer of all components except metal box to make mains operated interval timer for photography etc. **12/6** plus post 2/6.

Where postage is not definitely stated as an extra then orders over **£3** are post free. Below **£3** add 2/9.

STUPENDOUS OFFER—£11 for £2



The Princess superhet described below is a very fine little set that has been carefully designed for high performance. Only recently (under another name of course) this was on offer in many radio shops, for £10.19.6, but we have been fortunate in obtaining the parts at a very low price and now pass this saving on to you. If you act quickly you can purchase this for only **39/6** plus 3/6 post and insurance. Note these features: ● Long and Medium Wave ● Long clear dial with travelling pointer and slow motion drive ● Push pull output approximately 350 m.w. ● A.V.C. and feed back ● Dust cored H.Q. I.F. transformers ● High selectivity ferrite aerial ● Six tested transistors ● Printed circuit board for fool-proof assembly ● Economy output circuit gives long life from PP3 battery ● Permanent magnet moving coil speaker ● Cabinet size 4⅞ x 3 x 1½in. You get over 100 parts (list value over £10). In fact everything you need and easy to follow wiring and aligning instructions. Don't miss this wonderful offer, Make up several while you have the chance. Use them as presents and you'll be loved for ever. **Made up chassis 10/- extra. Battery 1/9 extra.** Data purchased separately **2/6.**



750 mW TRANSISTOR AMPLIFIER

4 transistors including two in push-pull input for crystal or magnetic microphone or pick-up—feed back loops—sensitivity 5 m/v.

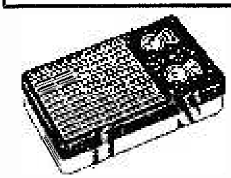
Price 19/6

Post and insurance 2/6.

Speakers 3in. **12/6**; 5in. **13/6**; 6in. × 4in. **14/6.**

THIS MONTH'S SNIP
A MOVING COIL METER BARGAIN

Panel meters are always being needed and they are jolly costly when you have to buy them in a hurry—so you should take advantage of this offer: 2in. moving coil flush mounting meters only **5/6** each or **48/-** a dozen unused and in makers boxes. These are actually R.F. meters and cost about £3 each but if you don't want them for R.F. then all you have to do is to remove the thermo-couple and you will have a 2-3 m.a. meter which you can make into almost anything by adding shunts or series resistor. These are ex-government, of course.



CORONET PARCEL

Here's a bargain for you—parcel comprises: plastic case, printed circuit board, two dial knobs, volume control, earphone socket and plastic carrying case all for **8/6** plus 1/6 post.

AUTOCHANGER BARGAIN

GARRARD AUTO RECORD PLAYER Model 2000

This is one of the latest products of the World's most experienced maker of fine record reproducers—It's superior features include—automatic playing of up to 8 mixed size records—stopping and starting without rejecting—manual playing—pick up pivots to give low stylus pressure—large diameter turn-table for max. stability—adjustments include pick-up height—pick-up dropping position and stylus pressure. Size is 13½in. x 11¾in. clearances 4⅝in. above 2½in. below—fitted with latest hi-compliance cartridge for stereo—and mono., L.P. and 78. Supplied complete with mounting template and service sheet. Offered this month at the Special Snip price of **£6.9.6.** plus 7/6 carriage and insurance.

SELF REPAIRING FUSES

Sounds good doesn't it—we can't offer quite that but we can offer a fast acting overload trip which will save you having to repair fuses every time you do something which would normally blow a fuse. The trip works first and as you would instal this on or near your bench all you do is to switch on again. This is made by Westinghouse. Regular price about £10 each. We offer them this month at **29/6**, plus 5/- post and insurance. Not many in stock so hurry or you will be too late.

Your last chance to buy one of these

125 watt MERCURY VAPOUR SPOT LAMP

In addition to the normal uses in photography and lighting generally you will find that a spot light shining over your shoulder is a great boon when working on intricate and micro-circuits. This month due to a fortunate purchase we are able to offer a complete "Philips" outfit for about one fifth of its proper price thus showing you a saving of 80%. The outfit comprises 125 watt SPOT LAMP (gives approx. same light as 500 watt ordinary lamp)—Polyester filled choke-starter and adjustable mounting bracket, with lamp holder—listed at over £10 we offer the complete outfit in perfect order—unused but a little store soiled only **37/6** plus 6/6 post and insurance.

SUMMER SALE
BARGAINS UNLIMITED

TAPE DECK BARGAIN. 240v. Mains motor with capstan and heavy flywheel to drive the tape at a very steady 3¾ i.p.s. Mounted on deck with high z tape head—the deck is shaped to take a Redi-tune cassette but it's an easy matter to fit two spindles to take normal spools. The deck is enclosed in a metal box, with carrying handle, mains neon indicator, voltage adjustment panel and various input and output sockets. Size of the box is 11½ x 10½ x 7in. and there is plenty of room for an amplifier—this looks just the right unit for anyone wanting to make a playback machine, telephone answerer etc. A limited quantity only of these, price **37/6** plus 7/6 post and insurance.

MINIATURE RELAYS with removable covers. Very sensitive (will close on only 20 mA). Coil resistance 10,000 ohms—contacts are three sets: triple set for change over pair to open circuit and the third pair to close circuit—perfect order unused (removed from equipment), **7/6** each.

MAINS TRANSFORMER. Upright mounting with primary tapped 200, 220, 240v. H.T. secondary is 250-0-250v. at 100 mA and it has two L.T. secondaries of 6.3v. 1½ amp—unused (removed from equipment), **15/-** plus 3/6 post and insurance.

MULLARD SILICON RECTIFIER. 350v. 100 mA. Removed from unused equipment, perfect. Ref. BY100, **4/6** each.

SOUND POWERED INSERTS. These are very delicately made units and work well either as microphones or loudspeakers—mount them on suitable boxes and you will be amazed how sensitive they are. They need no batteries or maintenance. Cost from makers over £1 each. Our price while stocks last is **5/6** each.

REED SWITCHES. A pair of contacts sealed into a glass tube. When a magnet comes close the contacts close immediately and the circuit is switched. For burglar alarms on doors or windows—moving displays for advertising—rev. or batch counting—relay circuits. New and perfect, price is **6/6** each.

½ MEG POTS. By Erie, standard ¼in. spindle, 1in. long. **7d.** each in doz. lots otherwise **10d.**

½ MEG POTS WITH D.P. SWITCH. Again by Erie. Standard size spindle 1in. length. **10d.** each in doz. lots otherwise **1/3** each.

MINIATURE PICK-UP. For pop records—this is made by Cosmocord—has a crystal cartridge and long play sapphire stylus—offered for less than the wholesale price of the stylus only—namely **3/9** each or **36/-** doz.

SYNCHRONOUS METER MOTOR. This is self starting and has a cog ended spindle—add a train of gears and you have a clock or hours elapsed meter, or it would drive a little fan to keep equipment cool or similar job. Brand new and perfect, **5/6** each, **54/-** per doz.

RELAY SWITCHES. These enable micro switches, delicate thermostats or other low current devices to control up to 30 amps—ideal to switch thermal storage heaters—motors etc., made by the famous A.E.I. group these are listed at £25 each—you can buy if you hurry at a very keen price of **39/6** each and we will include diagrams and data. Mounted on panel size approximately 6 x 7 x 2in. deep.

MAINS FROM CAR BATTERY. Rotary generators 12v. input, 240v. output, 110 mA, **40/-** 300 mA **£5**, plus 5/- post.

H.R.O. POWER PACK. Suitable 240 or 115 volt mains give 250 v. H.T. and 6.3v. L.T. Unused but soiled and less rectifier valve **19/6** plus 6/6 post

A.C./D.C. AMMETER. 2½in. flush mounting, 0.9 amps. but external shunt easily removed. Offered at silly price, **8/6** each, **£5** doz.

'C' CORE POTTED OUTPUT TRANSFORMER. Made by the famous "Parmeko" company these are the best money can buy—we can offer a bargain 15 watt rating, centre tapped primary with secondary for 3 ohm speaker. Potted and in black stove enamelled case for upright mounting these will make your amplifier or rig look perfect at only **12/6** plus 3/6 carriage and insurance—hurry for these.

'C' CORE MAINS TRANSFORMER. We have only a dozen or so of these so it will definitely be a case of the "Early Bird". Companion to the above. this transformer 240v. primary arranged with 5v. adjustments and tapped at 115v.—the secondary is rated at 625-0-625-250 mA with a tapping for 3·25-0-325 at 150 mA—so it's a big one. Regular price over £15. We offer these at **£4 10s.** each plus 10/- carriage and insurance.

6.3v. HEATER TRANSFORMERS, 1½ amps, **5/6.**

FLEX CABLE 14/36. Twin figure 8—brown—ideal for most mains leads and flex extensions, **30/-** 200 yds. plus 3/6 post.

COMPLETE FLUORESCENT FITTINGS. These are nicely made in white enamelled metal and are complete with tube ready for immediate use. 2ft. 20 watt **37/6** plus 6/6 post and insurance. 3ft. 40 watt **38/6** plus 8/6 post and insurance. 4ft. 40 watt **39/6**. 5ft. 80 watt **55/-**. These last two unfortunately we cannot dispatch—they are only for callers. This is due to the difficulty we have in packing these so that they do not get smashed up in transit.

FLUORESCENT LIGHT KITS. Comprising choke, lampholders, starter and two chrome tube clips. 20 watt **19/6** plus 3/6 post and insurance. 40 watt **19/6** plus 3/6 post and insurance. 80 watt **22/6** plus 4/6 post and insurance.

ELECTRONICS (CROYDON) LIMITED

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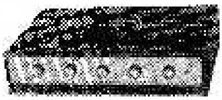
post orders to: **Dept. WW, SPRINGFIELD ROAD, EASTBOURNE, SUSSEX**

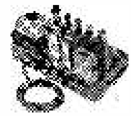
HI-FI AMPLIFIERS —— TUNERS —— RECORD PLAYERS

20+20 STEREO AMP. AA-22U

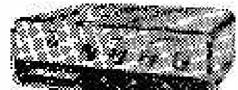


GARRARD PLAYER AT-60

10W POWER AMP. MA-12



9+9W STEREO AMP. S-99



TRANSISTOR MIXER. Model TM-1. A must for the tape enthusiast. Four channels. Battery operated. Similar styling to Model AA-22U Amplifier. Kit **£11.16.6** Assembled **£16.17.6**

20+20W TRANSISTOR STEREO AMPLIFIER. Model AA-22U. Outstanding performance and appearance. Kit **£39.10.0** (less cabinet). Attractive walnut veneered cabinet £2.5.0 extra. Assembled **£59.15.0**

GARRARD AUTO/RECORD PLAYER. Model AT-60, less cartridge **£13.1.7.** With Decca Deram pick-up **£17.16.1** incl. P.T.

Many other Garrard models available, ask for Lists.

HI-FI MONO AMPLIFIER. Model MA-5. A general purpose 5W Amplifier, with inputs for Gram., Radio. Modern functional appearance. Kit **£11.9.6** Assembled **£15.15.0**

HI-FI MONO AMPLIFIER. Model MA-12. 10W output, wide freq. range, low distortion. Use with control unit. Kit **£12.18.0** Assembled **£16.18.0**

3+3W STEREO AMPLIFIER. Model S-33. An easy-to-build, low cost unit. 2 inputs per channel. Kit **£13.7.6** Assembled **£18.18.0**

DE LUXE STEREO AMPLIFIER. Model S-33H. De luxe version of the S-33 with two-tone grey perspex panel, and high sensitivity necessary to accept the Decca Deram pick-up. Kit **£15.17.6** Assembled **£21.7.6**

HI-FI STEREO AMPLIFIER. Model S-99. 9+9W output. Ganged controls. Stereo/Mono gram, radio and tape inputs. Push-button selection. Printed circuit construction. Kit **£28.9.6** Assembled **£38.9.6**

POWER SUPPLY UNIT. Model MGP-1. Input 100/120V, 200/250V, 40–60 c/s. Output 6·3V, 2.5A A.C. 200, 250, 270V, 120mA max. D.C. Kit **£5.12.6** Assembled **£7.2.6**

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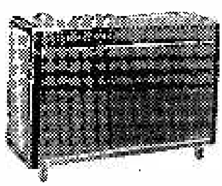
FOR THE INSTRUMENTALIST

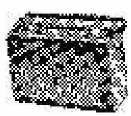


PA-2

TRANSISTOR PA/GUITAR AMPLIFIER, PA-2. 20 Watt amplifier. Two heavy duty speakers. Four inputs. Two channels. Variable tremolo. Speed and depth controls. Weight 51lb. 18″ high x 29″ wide x 10″ deep. Kit **£44.19.0** Assembled **£59.10.0**

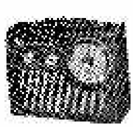
VALVE PA/GUITAR AMPLIFIER, PA-1. 50 Watt amplifier. Kit **£54.15.0** Assembled **£74.0.0** Castors or legs available as extras.

TRANSISTOR RECEIVERS



Oxford

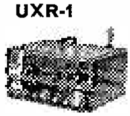
"OXFORD" LUXURY PORTABLE Model UXR-2. Specially designed for use as a domestic or personal portable receiver. Many features, including solid leather case. Kit **£14.18.0** incl. P.T.



UXR-1

TRANSISTOR PORTABLE. Model UXR-1. Pre-aligned I.F. transformers, printed circuit. Covers L.W. and M.W. Has 7″ x 4″ loudspeaker. Real hide case. Kit **£12.11.0** incl. P.T.

JUNIOR EXPERIMENTAL WORKSHOP. Model EW-1. More than a toy! Will make over 20 exciting electronic devices, incl.: Radios, Burglar Alarms, etc. 72 page Manual. The ideal present! Kit **£7.13.6** incl. P.T.



GC-1U

"MOHICAN" GENERAL COV. RECEIVER for Amateur or Short Wave listening. Send for leaflet. Kit **£37.17.6** Assembled **£45.17.6**

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THURSDAY ... ... 11 a.m.–2.30 p.m.
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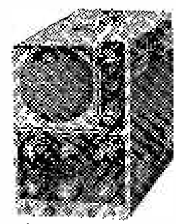
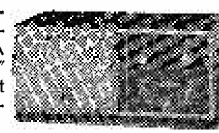


OS-2

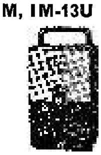
3″ LOW-PRICED SERVICE OSCILLOSCOPE. Model OS-2. Compact size 5″ x $7\frac{3}{8}$″ x 12″ deep. Wt. only $9\frac{3}{4}$lb. "Y" bandwidth 2 c/s–3 Mc/s ±3dB. Sensitivity 100mV/cm. T/B 20 c/s–200 kc/s in four ranges, fitted mu-metal CRT Shield. Modern functional styling. Kit **£23.18.0** Assembled **£31.18.0**

5″ GEN.-PURPOSE OSCILLOSCOPE. Model 10-12U. An outstanding model with professional specification and styling. "Y" bandwidth 3 c/s–4.5 Mc/s ±3dB. T/B 10 c/s–500 kc/s. Kit **£35.17.6** Assembled **£45.15.0**



VVM, IM-13U

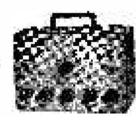
DE LUXE LARGE-SCALE VALVE VOLTMETER. Model IM-13U. Circuit and specification based on the well-known model V-7A but with many worth-while refinements. 6″ Ernest Turner meter. Unique gimbal bracket allows operation of instrument in many positions. Modern styling. Kit **£18.18.0** Assembled **£26.18.0**



V-7A

AUDIO SIGNAL GENERATOR. Model AG-9U. 10 c/s to 100 kc/s, switch selected. Distortion less than 0.1%, 10V sine wave output metered in volts and dB's. Kit **£23.15.0** Assembled **£31.15.0**

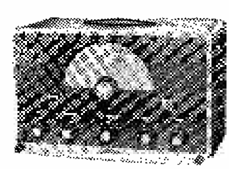
VALVE VOLTMETER. Model V7-A. 7 voltage ranges d.c. volts to 1,500. A.C. to 1,500 r.m.s. and 4,000 peak to peak. Resistance 0·1Ω to 1,000MΩ with internal battery. D.C. input resistance 11MΩ. dB measurement, has centre-zero scale. Complete with test prods, leads and standardising battery. Kit **£13.18.6** Assembled **£19.18.6**



RF-1U

MULTIMETER. Model MM-1U. Ranges 0–1.5V to 1,500V a.c. and d.c.; 150µA to 15A d.c.; 0.2Ω to 20MΩ $4\frac{1}{2}$″ 50µA meter. Kit **£12.18.0** Assembled **£18.11.6**

R.F. SIGNAL GENERATOR. Model RF-1U. Up to 100 Mc/s fundamental and 200 Mc/s on harmonics. Up to 100mV output. Kit **£13.18.0** Assembled **£20.18.0**



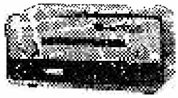
IG-82U

SINE/SQUARE GENERATOR Model 1G-82U. Freq. range 20 c/s–1 Mc/s in 5 bands less than 0.5% sine wave dist. less than 0.15µ sec. sq. wave rise time. Kit **£25.15.0** Assembled **£37.15.0**

TRANSISTOR POWER SUPPLY. Model IP-20U. Up to 50V, 1·5A output. Ideal for Laboratory use. Compact size. Kit **£35.8.0** Assembled **£47.8.0**

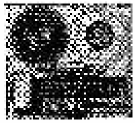
Prices and specifications subject to change without notice

TAPE AMPLIFIERS — TAPE DECKS — CONTROL UNITS

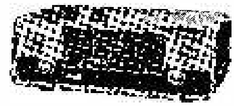


FM TUNER FM-4U

STUDIO-MATIC DECK



TRUVOX DECK



AM/FM TUNER

HI-FI FM TUNER. Model FM-4U. Available in two units. R.F. tuning unit (£2.15.0 incl. P.T.) with I.F. output of 10·7 Mc/s and I.F. amplifier unit, with power supply and valves (£13.13.0). Total Kit **£16.8.0**

STUDIOMATIC "363" TAPE DECK. The finest buy in its price range. Operating speed: 1⅞", 3¾" and 7½" p.s. Two tracks, "wow" and "flutter" not greater than 0·15% at 7½" p.s. **£13.10.0** With TA-1M Tape Pre-amplifier kit **£31.5.6**

HI-FI AM/FM TUNER. Model AFM-1. Available in two units which, for your convenience, are sold separately. Tuning heart (AFM-T1—£4.13.6 incl. P.T.) and I.F. amplifier (AFM-A1—£22.11.6). Printed circuit board, 8 valves. Covers L.W., M.W., S.W., and F.M. Built-in power supply. Total Kit **£27.5.0**

TRUVOX D-93 TAPE DECKS. High quality stereo/mono tape decks. **D93/2**, ½ track, **£36.15.0** **D93/4**, ¼ track, **£36.15.0**

TAPE RECORDING/PLAYBACK AMPLIFIER. Thermometer type recording indicators, press-button speed compensation and input selection.
Mono Model TA-1M. Kit **£19.18.0** Assembled **£28.18.0**
Stereo Model TA-1S. Kit **£25.10.0** Assembled **£35.18.0**

MONO CONTROL UNIT. Model UMC-1. Designed to work with the MA-12 or similar amplifier requiring 0·25V or less for full output. 5 inputs. Baxandall type controls. Kit **£9.2.6** Assembled **£14.2.6**

STEREO CONTROL UNIT. Model USC-1. Push-button selection, accurately matched ganged controls to ±1dB. Rumble and variable low-pass filters. Printed circuit boards. Kit **£19.19.0** Assembled **£27.5.0**

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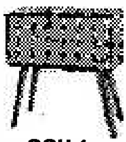
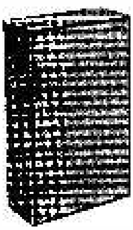
Heathkit DAYSTROM

SPEAKER SYSTEMS



SSU-1



Berkeley

HI-FI SPEAKER SYSTEM. Model SSU-1. Ducted-port bass reflex cabinet "in the white". Two speakers. Vertical horizontal models with legs, Kit **£12.12.0**, without legs, Kit **£11.17.6** incl. P.T.

The BERKELEY SLIM-LINE SPEAKER SYSTEM, fully finished walnut veneered cabinet for faster construction. Special 12" bass unit and 4" mid/high frequency unit. Range 30-17,000 c/s. Size 26" x 17" only 7⅜" deep. Modern attractive styling. Excellent value. Kit **£19.10.0** Assembled **£24.0.0**

COTSWOLD SPEAKER SYSTEMS. Outstanding performance for price.
MFS: Size 36" x 16½" x 14" deep.
Kit **£25.12.0** Assembled **£33.17.0**

STANDARD: Size 26" x 23" x 14½" deep.
Kit **£25.12.0** Assembled **£33.17.0**

HI-FI CABINETS

A wide range available including kits, ready assembled cabinets or assembled and fully finished cabinets, for example:

GLOUCESTER. Kit **£18.10.0** incl. P.T.
MALVERN. Kit **£18.1.0** incl. P.T.
CHEPSTOW. Kit **£11.18.6** incl. P.T.

Malvern

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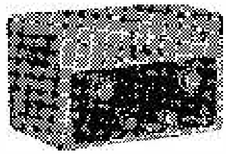
DAYSTROM LTD Dept. P.W.—8 GLOUCESTER

"AMATEUR" EQUIPMENT

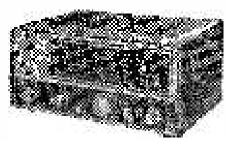
80-10m TRANSMITTER, DX-40U. Power inputs 75W. C.W., 60W peak CC phone. Output 40W to aerial. Provision for VFO.
Kit **£29.19.0** Assembled **£41.8.0**



DX-40U

SSB ADAPTOR, SB-10U
Kit **£39.5.0** Assembled **£54.18.0**

AMATEUR BANDS RECEIVER Model RA-1. To cover all the Amateur Bands from 160-10 metres. Many special features, including: half-lattice crystal filter; 8 valves; signal strength "S" meter; tuned R.F. Amp. stage.
Kit **£39.6.6** Assembled **£52.10.0**

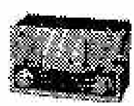


RA-1

160-10M TRANSMITTER. Model DX-100U. Careful design has achieved high performance and stability. Completely self-contained.
Kit **£81.10.0** Assembled **£106.15.0**

COMMUNICATIONS TYPE RECEIVER. Model RG-1. A high performance, low cost receiver for the discriminating listener. Frequency coverage: 600 kc/s–1.5 Mc/s and 1.7 Mc/s–32 Mc/s.
Kit **£39.16.0** Assembled **£53.0.0**

REFLECTED POWER METER and SWR BRIDGE. Model HM-11U. Indicates reliably, but inexpensively, whether the RF power output of your TX is being transferred efficiently to radiating antenna. Kit **£8.10.0** Assembled **£10.15.0**



HM-11U

OUTSTANDING "AMATEUR" EQUIPMENT
A wide range of American Amateur SSB equipments is now available in the U.K. Why not send for full details of range, for example:

FILTER TYPE SSB TRANSCEIVERS
Models for 80, 40 or 20 metre bands.
Model HW-12 (80M) **£67.10.0** Kit.
Model HW-22 (40M) } **£66.0.0 each kit.**
Model HW-32 (20M) } price inc. duty, etc.

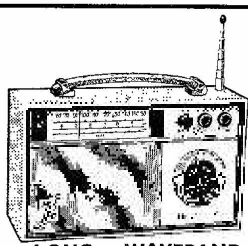
80M Transceiver HW-12

Without obligation please send me (Tick here)
FREE BRITISH HEATHKIT CATALOGUE .... ☐
FULL DETAILS OF MODEL(S) .... ☐
(Please write in BLOCK CAPITALS)
NAME ....
ADDRESS ....
.... **DEPT. P.W.8**

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

TRANSISTOR PORTABLES

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



THE SKYROVER De Luxe

7 transistor plus 2 diode superhet, 6 waveband portable receiver covering the full Medium Waveband and Short Waveband 31–94M and also 4 separate switched bandspread ranges. 13M., 16M., 19M., and 25M., with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow, stage by stage instructions. Superhet, 470 Kc/s. All Mullard Transistors and Diode. Uses 4 U2 batteries. 5in. Ceramic Magnet P.M. Speaker. Easy to read Dial Scale, 500 MW Output. Telescopic Aerial and Ferrite Road Aerial. Tone Circuit is incorporated, with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet, size 11½ x 6½ x 3in. covered with a washable material, with plastic trim and carrying handle. Car aerial socket fitted.

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

H.P. Terms: 45/- deposit and 11 monthly payments of 13/9. Total H.P.P. £9.16.3.

★ LONG WAVEBAND COVERAGE IS NOW AVAILABLE FOR THE SKYROVER

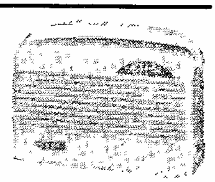
A simple additional circuit provides coverage of the 1100/1950M. band (including 1500M. Light programme). This is in addition to all existing Medium and Short wavebands. All necessary components with construction date.

Only **10/-** extra Post Free.

This conversion is suitable for receivers that have already been constructed.

Data 2/6 extra: Refunded if you purchase the parcel. Four U2 batteries 3/4 extra. All components available separately.

REALISTIC SEVEN



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

STAR features:
● 7 Transistor Superhet. ● 350 Milliwatt output 4in. high flux speaker. ● All components mounted on a single printed circuit board. Size 5¼ x 5½in. in one complete assembly. ● Plastic cabinet, with carrying handle, size 7 x 10 x 3½in., in blue/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.

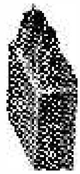
Can be built for P. & P. 4/6 **£5 . 19 . 6**

Battery 3/9 extra. (All components avail. sep.) Data and ins. 2/6, refunded if you purchase parcel.

CONSTRUCTORS BARGAINS

SPECIAL PURCHASE—UHF/VHF TUNERS

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



TRANSISTORISED UHF MINIATURE MODEL
Shielded metal case only 3¼ x 1¾ x 3in. Fully tunable—complete with two AF139 transistors. LASKY'S PRICE 39/6

VALVE UHF MODEL (illustrated)
In metal case size 4 x 6 x 1½in. Fully tunable—complete with PC86 and PC88 valves. LASKY'S PRICE 32/6 Without valves 19/6

TRANSISTORISED VHF MODEL 1
Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 4 x 2 x 3½in. LASKY'S PRICE 29/6

TRANSISTORISED VHF MODEL 2
Sub-Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 3 x 1¾ x 2½in. LASKY'S PRICE 37/6

Add 2/6 Post and Packing on each.

GORLER UT 340 FM/VHF TUNING HEART

Permeability tuned—covering 87 to 108 Mc/s. For use with one ECC85 valve. In metal case, size 3 x 2½ x 1¼in. Circuit supplied.
LASKY'S PRICE 15/11 Post 2/-. ECC85 valve 9/- extra.

TRANSISTORS ALL BRAND NEW AND GUARANTEED

GET 81, GET 85, GET 86 **2/6**; 873A, 874P **3/6**; OC45, OC71, OC81D **4/6**; OC 44, OC 70, OC76, OC81 **5/6**; (match pair **10/6**); AF 117, OC 200 **6/6**; OC42, OC 43, OC 73, OC 82D **7/6**; OC 201, OC 204 **15/-**; OC 205, OC 206 **19/6**; OC 28 **24/6**, OC 75 **8/-**.

TRANSFILTERS by BRUSH CRYSTAL CO., Available from stock.

TO—01B 465 kc/s. ± 2 kc/s
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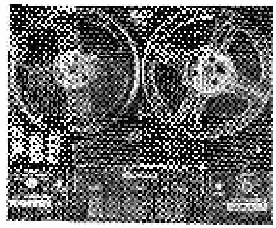
TO—02B 465 kc/s. ± 1 kc/s.
TO—02D 470 kc/s. ± 1 kc/s.
TF—01B 465 kc/s. ± 2 kc/s.
TF—01D 470 kc/s. ± 2 kc/s.

7/6 each
Post 6d.

TAPE RECORDERS

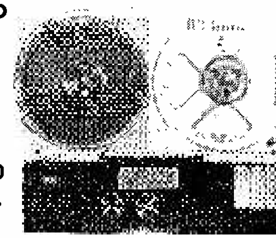


THE NEW GARRARD STEREO DECK

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

LASKY'S PRICE 29½ GNS. Carriage & Packing Free

MAGNAVOX-COLLARO 363 TAPE DECKS



The very latest 3 speed model—1⅞, 3¾, 7½ ips, available with either ½ track or ¼ track head. Features include: pause control; digital counter; fast forward and rewind; new 4 pole fully screened induction motor, interlocking keys. Size of top plate 13½ x 11in. x 5¼in. deep below unit plate. For 200/250v. A.C. mains, 50 cps operation New, unused and fully guaranteed.

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

Carriage and Packing 7/6 extra.

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

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

LASKY'S PRICE £7 . 19 . 6

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

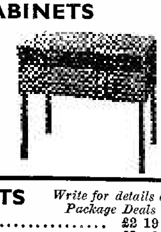
INTERNATIONAL TAPE Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft	2	6
3in.	Message tape, 225ft.	3	9
3in.	Message tape, 300ft.	7	6
3¼in.	Triple play, 600ft. Mylar	10	0
4in.	Triple play, 900ft. Mylar	17	6
5in.	Double play, 1200ft. Mylar	15	0
5in.	Long play, 900ft. Acetate	10	0
5in.	Standard play, 600ft. PVC	8	6
5in.	Triple play, 1800ft. Mylar	35	0
5¾in.	Double play, 1800ft. Mylar	22	6
5¾in.	Long play, 1200ft. Acetate	12	6
5¾in.	Standard play, 850ft. PVC	11	6
5¾in.	Long play, 1200ft. Mylar	15	0
5¾in.	Triple play, 2400ft. Mylar	45	0
7in.	Standard play, 1200ft. Acet.	12	6
7in.	Standard play, 1200ft. Mylar	12	6
7in.	Long play, 1800ft. Mylar	19	6
7in.	Double play, 2400ft. Mylar	25	0
7in.	Long play, 1800ft. Acetate	15	0
7in.	Triple play, 3600ft. Mylar	58	6

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

SPECIAL INTEREST ITEMS!

HIGH QUALITY EQUIPMENT CABINETS



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

LASKY'S PRICE £4 . 19 . 6

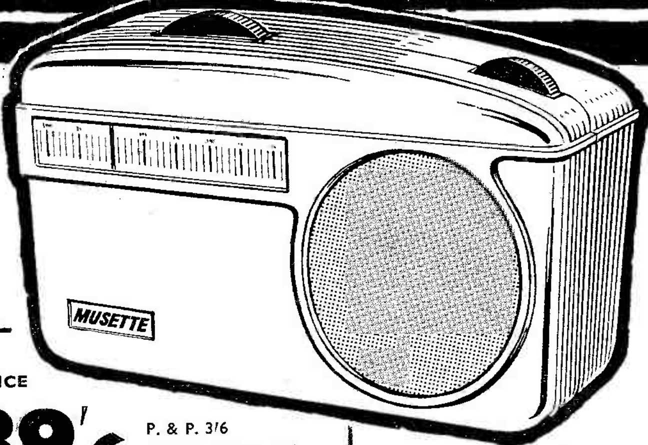
SINCLAIR SUPER MINIATURE KITS

Write for details of Package Deals

	£	s	d
THE MICRO-6 miniature radio only $1^4/_5$ x $1^3/_{10}$ x 1½in.	2	19	6
THE SLIMLINE 2-transistor pocket radio	2	9	6
THE MICRO-FM (tuner/receiver)	5	19	6
THE X-20 20 watt P.W.M. amplifier	7	19	6
Available ready built, tested and guaranteed	9	19	6
THE X-10 10 watt amplifier and pre-amp	5	19	6
Available ready built, tested and guaranteed	6	19	6
THE Z-12 12 watt amp. and pre-amp., fully built	4	9	6

LASKY'S RADIO FOR FINEST VALUE and COURTEOUS SERVICE

MUSETTE 6 TRANSISTOR SUPERHET PORTABLE RADIO



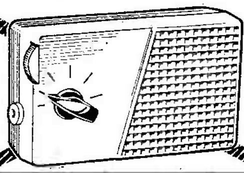
- 2¼″ Speaker.
- 6 Transistors Superhet Output 200mw.
- Plastic Cabinet in red, size 4¾″ x 3″ x 1⅜″ and gold speaker louvre.
- Horizontal Tuning Scale.
- Ferrite Rod Internal Aerial.
- IF 470 Kc.
- All components, Ferrite Rod and Tuning Assembly mount on printed board.
- Operated from PP3 Battery.
- Full comprehensive instructions and point-to-point wiring diagram.
- Printed Circuit Board.
- Tunable over medium and long wave band. Car aerial and ear piece socket.

PRICE

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

INCLUDING CARRYING STRAP.

NEW TRANSISTORISED SIGNAL GENERATOR



Size 5½″ x 3½″ x 1½″. For IF and RF alignment and AF output 700 c/s frequency coverage 460 Kc/s to 2 Mc/s in switched frequencies. Ideal for alignment to our Elegant Seven and Musette. Built and tested. **39/6** P. & P. 3/6

Elegant Seven Mk II

COMBINED PORTABLE *and* CAR RADIO

The Radio with the STAR features

- ★ 4in. Speaker.
- ★ 7-transistor superhet. Output 350mW.
- ★ Wooden cabinet, fitted handle with silver coloured fittings. Size 12¼ x 8½ x 3½in.
- ★ Horizontal tuning scale, size 11¼ x 2⅝in. in silver with black lettering.
- ★ All stations clearly marked.
- ★ Ferrite-rod internal aerial.
- ★ I.F. neutralisation on each stage 460 kc/s.
- ★ D.C. coupled output stage with separate A.C. negative feed back.
- ★ All components: ferrite rod and tuning assembly mount on printed board.
- ★ Operated from PP9 battery.
- ★ Full comprehensive instructions and point-to-point wiring diagrams.
- ★ Printed circuit board, back printed with all component values.
- ★ Fully tunable over medium and long waveband.
- ★ Car aerial socket. Full after-sale service.

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

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

ALL ENQUIRIES STAMPED ADDRESSED ENVELOPE

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E173	7/-
EABC80	5/9
EA91	3/6
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ECC82	5/-
ECC83	6/-
ECC84	5/6
ECC85	6/6
ECC88	9/-
ECC91	4/-
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ECL80	6/-
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EF55	8/-
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EF72	5/-
EF73	5/-
EF74	4/-
EF80	5/-
EF81	6/-
EF85	4/6
EF86	6/6
EF89	5/-
EF91	3/6
EF92	2/-
EF95	5/-
EF183	8/-
EF184	8/-
EH90	7/6
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EL32	3/9
EL34	10/-
EL36	5/-
EL38	17/6
EL41	8/-
EL42	8/-
EL50	8/-
EL81	8/-
EL84	5/-
EL85	8/-
EL91	4/6
EL95	5/-
EL360	20/-
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EM81	7/6
EM84	6/3
EN31	10/-
ESU74	80/-
ESU208	6/-
EY51	5/6
EY86	6/6
EY91	3/-
EZ40	6/6
EZ41	6/6
EZ80	5/6
EZ81	3/6

F/6057	5/-
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H63	7/-
HK54	22/6
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HL23	6/-
HL23DD	5/-
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K3A	60/-
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KT32	8/-
KT44	5/9
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KY76	8/6
KT88	22/-
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PC86	9/-
PC88	9/-
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PCC84	5/-
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PCF80	7/-
PCF82	6/6
PCF84	6/-
PCF86	9/-
PCF802	11/-
PCL81	9/-
PCL82	7/-
PCL83	8/6
PCL84	7/-

PCL85	8/6
PCL86	9/-
PEN25	4/6
PEN46	3/-
PEN200A	3/-
PFL200	17/6
PL36	9/-
PL38	16/-
PL81	7/-
PL82	5/-
PL83	6/-
PL84	6/6
PL500	15/-
PM24A	5/-
PT15	10/-
PT25H	7/6
PT25M	7/6
PX4	14/-
PX25	9/-
PY33	6/-
PY80	5/6
PY81	5/6
PY82	6/-
PY83	6/-
PY800	8/-
PZ1-35	9/-
PZ1-75	12/-
QP21	6/-
QP25	5/-
QP230	5/-
QS95/10	5/6
QS150/15	10/-
QS1202	8/-
QV04/7	8/2
R3	8/-
R10	9/-
RG4/1250	60/-
RK72	6/-
SL30P	15/-
SL30	12/6
SP2	8/6
SP41	1/6
SP61	1/6
SP210	6/6
STV280/40	12/6
SU2150A	10/-
S11G12	10/-
T41	10/-
TDOX-20	70/-

TP22	5/-
TP25	15/-
TT11	5/-
TT15	35/-
TTR31	45/-
TZ0520	4/-
TZ20	16/-
U81	30/-
U12/4	8/-
U17	5/-
U18	6/-
U25	11/-
U26	11/-
U27	8/-
U50	4/6
U52	4/6
U191	11/6
U801	18/-
UABC80	6/-
UAF42	9/-
UBC41	6/-
UBF80	5/6
UBF89	6/6
UBL21	11/-
UCC85	6/6
UCH42	8/-
UCH81	6/-
UCL82	8/-
UCL83	10/-
UF41	8/6
UF89	6/-
UL41	7/6
UL84	5/6
UU5	7/-
UU9	8/6
UY21	7/6
UY41	6/6
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V1120	4/-
V1507	5/-
V1924	20/-
VP23	3/-
VP133	9/-
VR99	8/-
VR105/30	5/-
VR150/30	5/-
VU33A	4/-
VU39	6/-
VX3256	4/-
VX8122	5/-
VX8124	5/-
W21	5/-
W118	8/-
W119	8/-

X66	7/6
X118	8/-
X145	8/-
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Z800U	20/-
Z801U	10/-
1A3	8/-
1A5GT	5/-
1B22	30/-
1C5GT	6/-
1D8GT	6/-
1E7G	7/6
1F2	3/-
1G6GT	6/-
1L4	2/6
1LA6	6/-
1LC6	7/-
1LH4	4/-
1N21B	4/-
1N43	4/-
1N70	4/-
1R4	5/-
1R5	3/6
1S4	5/-
1S5	4/6
1T4	3/-
2A3	5/-
2C26	7/-
2C26A	3/-
2C34	2/6
2C45	22/6
2C46	30/-
2C51	12/-
2D21	5/-
3A4	4/-
3A/108A	20/-
3A/46J	35/-
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4D1	4/-
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5U4G	4/6
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5Y3WGTB	9/-
5Z4G	6/6
5Z4GT	8/-
6AB6	4/-
6AC7	2/-
6AG5	2/6
6AG7	6/-
6AH6	10/-
6AJ7	2/-
6AK5	5/-
6AK7	6/-
6AL5	3/-
6AL5W	7/-
6AM5	2/6
6AM6	4/-
6AQ5	7/-
6AQ5W	9/-
6AS6	4/-
6AS6W	9/-
6AS7G	20/-
6AT6	4/-
6AU6	7/-
6AX4	8/-
6B7	6/-
6B8G	2/6
6BA6	5/-
6BA7	5/-
6BE6	4/3
6BJ7	7/-
6BQ7A	8/-
6BR7	9/-
6BW6	9/-
6C4	2/-
6C5G	2/6
6C5GT	6/-
6C6	4/-
6C6G	3/-
6C8G	3/-
6CH6	4/6
6C21	80/-

6CL6	9/-
6D6	3/-
6E5	6/-
6F5G	5/3
6F5GT	5/9
6F6G	4/-
6F7	6/-
6F8G	6/6
6F12	4/6
6F13	5/-
6F14	5/-
6F32	4/-
6F33	3/-
6G6G	2/6
6H6M	1/6
6J4WA	10/-
6J5	6/-
6J5G	2/-
6J6	3/6
6J6W	6/-
6J7G	5/-
6J7M	8/-
6K6GT	5/6
6K7G	2/-
6K7GT	4/9
6K8G	3/-
6K8GT	8/3
6K8M	6/6
6L5G	6/-
6L6GA	7/6
6L6M	11/-
6L7G	4/-
6L34	4/6
6LD20	5/9
6N7	6/-
6N7G	5/9
6P25	12/6
6Q7G	5/-
6R7	5/6
6SA7	7/-
6SA7GT	6/6
6SK7GT	4/-
6SC7	7/-
6SG7GT	5/-
6SFGT	5/6
6SH7	6/-
6SJ7	5/-
6SJ7G	6/6
6SK7	4/6
6SL7GT	5/6
6SN7	3/6
6SQ7GT	6/-
6SS7	2/-
6U4GT	9/6
6V6G	5/-
6V6GT	7/6
6V6M	8/-
6X4	3/6
6X5G	5/-
6Z5GT	5/3

6Y6G	6/-
6-30L2	10/-
6Z4	5/-
7B7	7/6
7C5	10/-
7C6	7/-
7C7	6/-
7H7	7/3
7Q7	7/-
7V7	5/-
7Z4	4/6
8D2	2/6
9D2	3/-
9D6	3/6
10F9	9/-
12A6	2/6
12AH7	5/-
12AT7	4/-
12AU7	5/-
12AX7	6/-
12AY7	10/-
12BA6	5/-
12BE6	7/-
12BH7	7/-
12C8	3/-
12H6	2/-
12J5GT	2/6
12J7GT	6/6
12K7GT	2/-
12K8M	10/-
12Q7GT	3/3
12SA7	7/-
12SC7	4/-
12SG7	3/-
12SH7	3/-
12SJ7	5/-
12SK7	5/-
12SN7GT	5/9
12SR7	5/-
12Y4	2/-
12L7	7/-
15D2	6/-
19E2	15/-
19G3	20/-
19G7	5/-
19H1	6/-
19M1	5/-
20P4	13/-
21B6	9/-
25L6GT	5/-
25Y5	6/-
25Z4G	6/6
25Z5	7/6
25Z6GT	8/6
25D7	6/-
30	5/-
30C15	9/6
30F5	8/6
30FL1	10/6
30P12	10/-

30P19	15/-
30PL1	8/-
3516GT	7/-
35T	17/6
35W4	5/-
35Z3	10/-
35Z4GT	6/-
35Z5GT	6/-
37	4/-
38	4/-
215SG	6/-
50L6GT	8/-
53A	7/6
57	6/-
58	6/-
59	6/-
75	5/6
76	5/-
77	6/6
78	5/-
80	5/6
81	9/-
84	8/-
85A2	8/-
210VPT 7-pin	2/6
220PA	7/-
220TH	4/-
225DU	9/-
307A	5/6
310C	25/-
350B	8/-
357A	7/-
368A	5/-
393A	15/-
446A	8/-
703A	30/-
705A	10/-
715B	60/-
717A	3/-
724A	15/-
801	6/-
803	22/6
807	8/-
808	8/-
813	65/-
815	35/-
829B	50/-
830B	4/-
832A	45/-
843	5/-
866A	14/-
884	10/-
954	4/6
955	2/6
956	2/-
957	5/-
958A	4/-
1612	5/-
1616	3/-
1619	5/-

1625	6/-
1626	3/-
1629	4/6
2051	5/-
4043C	13/6
4063	8/-
4313C	30/-
5704	9/-
5726	6/-
6060	5/-
6064	7/-
6065	6/-
6080	22/-
7193	1/9
7475	2/-
8013A	25/-
8020	8/-
9001	3/-
9002	4/6
9003	6/-
9004	2/6
9006	2/6
C.R. Tubes	
CV1596 (09J)	55/-
E4504/B/16	28/-
VCR97	28/-
VCR138A	40/-
VCR517	35/-
VCR517B	40/-
VCR517C	40/-
3FP7	45/-
3EG1	40/-
5PC1	30/-
5FP7	12/6
88D	44/-
Photo Tubes	
GS16	12/6
931A	55/-
6097	350/-
Special Valves	
ACT6	£8
K301	£4
KRN2A	£3.10.0
1B24	25/-
2J22	£2.10.0
2J54	£3
417A	30/-
3J/92/E	£37.10.0
714AY	£4
725A	30/-
726A	19/-

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

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

PANEL METERS

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

"CONNECT AND FORGET, CANNOT OVERCHARGE" "ESSTRON" MARK I AUTOMATIC BATTERY CHARGER. Initial charging rate 6-7 amps. The charging rate automatically adjusts itself to the charge in the battery. Automatic current and voltage control. Patented application of magnetic amplification to battery charging. Indicator lights show battery fully charged, receiving charge incorrectly connected or faulty cells. Mains voltage 200/250 v. Built for 6 or 12 v. batteries. Measurements 7 x 5 x 5¼in. Weight 8½lb. Price **£7.19.6.** P.P. 3/6.

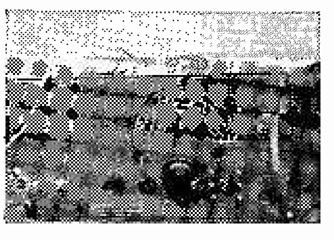
2 KW ULTRASONIC GENERATOR together with power supply unit for 200-250 v. A.C. Complete two chassis with interconnecting cables. Frequency 37 to 43 kc/s adjusted by fine control. Peak output 2 kw., average output 500 w. Completely new with valves and manual £65, carriage paid U.K. Large selection of mains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

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

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

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

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



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

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

P. C. RADIO LTD.

170 GOLDHAWK RD., W.12

SHEpherd's Bush 4946

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

PERSONAL CALLERS WELCOME

TRANSISTORS

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

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

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

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

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

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

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

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

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

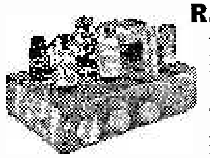
AUDIOTRINE HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN AN HOUR. ONLY 4 PAIRS OF SOLDERED JOINTS PLUS MAINS.

Incorporating the latest Magnavox Tapedeck. The Audiotrine High Quality Tape Amplifier with switched equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a handsome Portable Cabinet of latest styling finished dark grey leathercloth. Size 14½ x 17 x 8½in and circuit. Purchased separately would total approx. £34. Performance equal to units in the £50-£60 class.

26½ Gns. Carr. 19/6. S.A.E. for leaflets. **TERMS: Deposit 4 gns.** and 9 monthly payments of **59/6** (Total 29½ gns.). 4 Track Model 3 gns. extra.

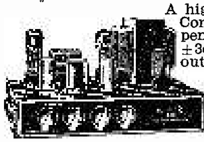
R.S.C. 4/5 watt A5 HIGH GAIN AMPLIFIER



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Suitable for all crystal or ceramic P.U. heads and practically all "mikes". Separate Bass and Treble controls giving "lift" and "cut". Hum level 71dB down. Negative Feedback 15dB. H.T. of 300v. 25mA and L.T. of 6.3v. 1.5a. available for supply of Radio Tuner or Tape Deck pre-amp. For A.C. mains 200-250v. Speaker output 3 ohms. Kit is complete in every detail with fully punched Hammer finished chassis, point-to-point wiring diagrams and instructions. Exceptional value **£4.17.9**

or assembled ready for use £6.2.9, plus 3/6 carr.

R.S.C. A10 30 WATT ULTRA LINEAR HI-FI AMPLIFIER

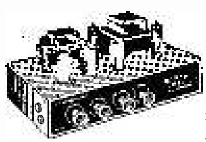


A highly sensitive Push-Pull high output unit with Pre-amp./Tone Control Stages. Performance figures compare equally with most expensive amplifiers available. Hum level —70dB. Frequency response ±3dB 30-20,000 c/s. Specially designed sectionally wound ultra linear output transformer with 807 output valves. All first grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Sensitivity 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. Gram, Radio or Tape. **Output socket provides** L.T. and H.T. for **Radio Tuner.** Two inputs with associated volume controls so that two separate inputs such as Gram and "Mike" can be mixed. 200-250v. 50 c/s A.C. mains. Output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point to point wiring diagrams and instructions. **12 Gns.** Carr. 10/-

Supplied factory built with EL34 output valves, 12 months guarantee for **15 gns.** If required perforated cover with carrying handles can be supplied for **21/-.** Send s.a.e. for leaflet. **TERMS: Deposit 48/-** and 9 monthly payments of **33/7** (Total **£17.10.3**).

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

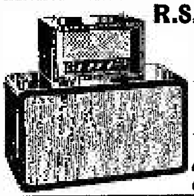
PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP



Two input sockets with associated controls allow mixing of "mike" and gram, etc., etc. High sensitivity. 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. Frequency response ±3dB 30-20,000 c/s. Six negative feedback loops. Hum level —60dB. SENSITIVITY 23 millivolts. Suitable for Crystal or Ceramic P.Us, all types "mikes". Comparable with the very best designs. For **Musical Instruments** such as **String Bass, Electronic Guitars,** etc. **Output Socket** provides 300v. 30mA, and 6.3v. 1.5a. for supply of a **Radio Tuner.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohm speakers. Kit complete to last nut. Chassis fully punched. Full instructions and point-to-point wiring diagrams supplied (or factory built **£11.15.0**). Carr. 11/6 ONLY **£8.15.0**

Metal covers with 2 carrying handles can be supplied for **£1. TERMS ON ASSEMBLED UNITS: Deposit 33/6** and 9 monthly payments of **25/9** (Total **£13.8.3**). Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Mikes, etc.

R.S.C. BASS-REGENT 50 WATT AMPLIFIER



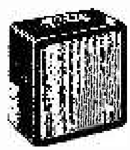
AN EXCEPTIONALLY POWERFUL HIGH QUALITY ALL-PURPOSE UNIT For lead, rhythm, bass guitar and all other musical instruments. For vocalists, gram, radio, tape and general public address

★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION consisting of a FANE HIGH FLUX 15in. 30 watt unit PLUS a FANE 12in. 20 watt unit with extended frequency response. ★ 4 Jack Inputs and two Volume Controls for simultaneous use of up to 4 pick-ups or "mikes".

★ Cabinets covered in two-tone Rexine/Vynair with gold trimming. Fitted carrying handles. ★ Separate Bass and Treble Controls giving "lift" and "cut".

49½ Gns. Carr. 30/-. Send S.A.E. for leaflet. Or call at one of our many branches and compare the Bass-Regent with units at three times the cost. Or deposit **£7.17.6** and 9 monthly payments of **£5.10.10.** (Total **55 gns.**)

R.S.C. B20 MULTI-PURPOSE AMP. especially suitable for Bass Guitar



Incorporating massive 15in. high flux loudspeaker. Rating 25 watts. Individual bass and treble controls. Two jack inputs separately controlled. Substantial cabinet attractively finished in Rexine and Vynair. Size approx. 24 x 21 x 11in. Send S.A.E. for leaflet. Or Deposit **£4.14.6** and 9 monthly payments of **66/-** (Total **£34.8.6**) **29½ Gns.** Carr. 17/6

G15 15 WATT AMPLIFIER for Lead or Rhythm Guitar, Mike, Gram or Radio

High-fidelity output. Separate bass and treble controls. Twin separately controlled inputs so that two instruments or "mike" and pick-ups can be used at the same time. Heavy Duty 12in. 20 watt Speaker. Cabinet covered in attractive Rexine/Vynair. Size approx. 18 x 18 x 8in. Or deposit **3 gns.** and 9 monthly payments of **43/7** (Total **£22.15.3**). S.A.E. for leaflet.

ONLY **19½ Gns.** Carr. 15/-

LINEAR TREMOLO PRE-AMP UNIT

Suitable for use with any of our Amplifiers. Controls are Speed (frequency of interruptions). Depth (for heavy or light effect). Volume and Switch. **4½ Gns.**

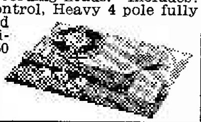
TRANSISTORISED SOUND MIXER

Enables mixing of up to 4 standard jack inputs, i.e., microphone, tape, gram, tuner, etc., into single output. Compact and completely self-contained. Uses standard 9v. battery. **49/9**

COMPLETE POWER PACK KIT

Consisting of Mains Transformer, Metal Rectifier, Electrolytics, smoothing choke, chassis and circuit. 200/250v. A.C. mains. Output 250v. 60mA, 6.3v. 2a or with metal cover 26/9 **22/9**

LATEST MAGNAVOX 363 TAPE DECKS

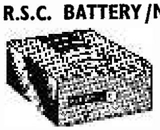


3 speeds 1⅞in., 3¾in., 7½in. per sec. A robust high quality Deck with high fidelity recording heads. Includes: Digital Counter, pause control, Heavy 4 pole fully screened motor, Record Interlock to prevent accidental erasure. For 200-250 v. A.C.

Two Track Model **10 Gns.** Carr. 7/6

Four track Model **£13.19.6**

R.S.C. BATTERY/MAINS CONVERSION UNITS



Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries supplying 1.4v. and 90v. where A.C. mains 200/250v. 50 c/s is available. Complete kit with diagram **44/9** or ready for use **59/6.**

12in. 30 Watt Heavy Duty Loudspeakers. 15 ohms. Flux density 17,000 lines. ONLY **7 Gns.** Carr 10/-

FANE HEAVY DUTY HI-FI SPEAKERS

12in. 20 watt. Type 122/10. **5 GNS.** Post 5/6.

R.S.C. (MANCHESTER) LTD.

R.S.C. COLUMN SPEAKERS

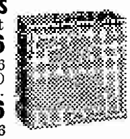
Covered in two-tone Rexine/Vynair. Ideal for vocalists and Public Address. 15 ohm matching. **Type C58, 15-20 watts.** Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. Or Deposit **£2** and 9 mthly pmts **28-/** (Total **£14.12.0**) **12½ Gns.** Carr. 10/-

Type C412, 40 watts. Fitted four 12in. 12,000 line 10 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/- **19½ Gns.** Or Deposit **3 gns.** and 9 monthly payments of **43/7** (Total **£22.15.3**).

18in. 60 WATT EXTRA HEAVY DUTY LOUDSPEAKERS

Famous make. Normal price over **£25.** Very limited number to clear with full guarantee. Terms available. Carr. 15/- **17 Gns.**

12in. HIGH QUALITY LOUDSPEAKERS

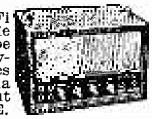


In walnut veneered cabinet. **10 Watt Model.** Gauss 12,000 lines. Speech coil 3 or 15 ohms. **£4.19.6** **Terms:** Deposit **15/-** and 9 monthly payments of **11/2** (Total **£5.15.6**) Carr. 5/6

20 Watt Model. 15 ohm. Size 18x18x10in. **Terms:** Deposit **24/6** and 9 monthly payments of **17/3** (Total **£8.19.9**). **£7.19.6** Carr. 8/6

30 Watt Model. 15 ohms. Or Deposit **32/-** and 9 monthly payments of **22/4** (Total **£11.13.0**). **10 Gns.** Carr. 10/- **Any of above in extra heavy Rexine covered Cabinets, £1 extra.**

30 WATT HI-FI AMPLIFIER for Guitar, Vocal or Instrumental Groups



A Four Input, two volume control Hi-Fi unit with separate Bass and Treble 'cut' and 'boost' controls. Latest type valves. Housed in strong Rexine covered cabinet with twin carrying handles. Attractive black and gold perspex fascia plate. For 200-250v. A.C. mains. Output for 3 or 15 ohm speakers. Send S.A.E. for leaflet. Deposit **£3** and 9 monthly payments of **37/5** (Total **£19.16.9**). Carr. 12/6. **17 Gns.**

HEAVY DUTY SELENIUM RECTIFIERS

12v. 15 amps. F.W. (Bridge). Only **19/9**

TRANSISTOR SALE

Mullard OC71 **2/11,** OC45 **3/11,** OC44 **3/11,** OC72 **2/11,** OC81 **2/11,** OC171 **8/9,** AF117 **6/9.** Ediswan XA101 **3/9,** XA112 **3/9,** XC101A **3/9.** Postage 6d. for up to 3 transistors.

INTEREST CHARGES REFUNDED

on H.P. and Credit Sale Accounts settled in 3 months.

R.S.C. MAINS TRANSFORMERS

FULLY GUARANTEED

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

MIDGET CLAMPED TYPE 2⅝ × 2⅝ × 2¼in.

250v., 60mA, 6.3v. 2a 14/11
250-0-250v., 60mA, 6.3v. 2a 15/11

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a, 2½ × 3 × 3in. 19/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a 33/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a 33/9
300-0-300v. 130mA, 6.3v. 4a c.t., 6.3v. 1a. For Mullard 510 Amplifier 41/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a 33/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a 42/9
425-0-425v. 200mA, 6.3v. 4a, c.t., 5v. 3a 63/9
425-0-425v. 200mA, 6.3v. 4a, 6.3v. 4a, 5v. 3a 65/9
450-0-450v. 250mA, 6.3v. 4a, c.t., 5v. 3a 79/9

TOP SHROUDED DROP-THROUGH TYPE

250-0-250v. 70mA, 6.3v. 2a., 0-5-6.3v. 2a 19/9
250-0-250v. 100mA, 6.3v. 3.5a 21/9
250-0-250v. 100mA, 6.3v. 2a, 6.3v. 1a 22/9
350-0-350v. 80mA, 6.3v. 2a, 0-5-6.3v. 2a 23/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a 32/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a 32/9
300-0-300v. 130mA, 6.3v. 4a, 0-5-6.3v. 1a suitable for Mullard 510 Amplifier 39/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a 32/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a 39/11

FILAMENT TRANSFORMERS

6.3v. 1.5a	6/9	6.3v. 3a	9/9
6.3v. 2a	7/9	6.3v. 6a	19/9
12v. 1a	8/9	12v. 3a or 24v. 1.5a	19/9

AUTO (Step UP/Step DOWN) TRANSFORMERS

0-110/120v.-200-230-250v.

50-80 watts	14/9	250 watts	49/9
150 watts	29/11	500 watts	99/9

CHARGER TRANSFORMERS

0-9-15v. 1½a	13/9	0-9-15v. 5a	21/9
0-9-15v. 2½a	16/9	0-9-15v. 6a	25/11
0-9-15v. 3a	18/9	0-9-15v. 8a	31/9

OUTPUT TRANSFORMERS

Standard Pentode 5,000Ω to 3Ω or 7,000Ω to 3Ω 7/9
Push-Pull 8 watts EL84 to 3Ω or 15Ω 11/9
Push-pull 10-12 watts 6V6 to 3Ω or 15Ω 19/9
Push-pull 10-12 watts to match 6V6 to 3, 5, 8 or 15Ω 21/9
Push-pull EL84 to 3 or 15Ω 10-12 watts 19/9
Push-pull Ultra Linear for Mullard 510, etc. 35/9
Push-pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15Ω 29/9
Push-pull 20 watt high-quality sectionally wound, EL34, 6L6, KT66, etc., to 3 or 15Ω fully shrouded 55/9

SMOOTHING CHOKES

150mA, 7-10H, 250Ω 12/9. 80mA, 10H, 350Ω 7/9. 100mA, 10H, 200Ω 9/11. 60mA, 10H, 400Ω 4/11.

STERN-CLYNE ELECTRONIC CENTRES

MEMBER OF THE PANTIYA GROUP OF COMPANIES

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9 Camberwell Church Street, S.E.5. RODney 2875
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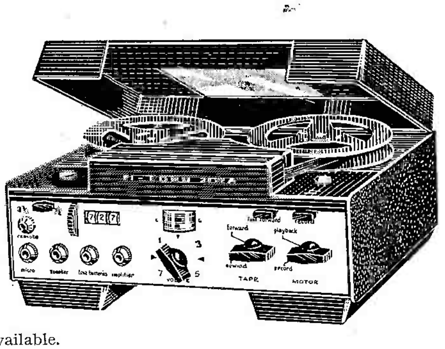
EXCEPTIONAL OPPORTUNITY!



Fabulous FI-CORD 202A TAPE RECORDERS

Current List Price £69.6.0
ONLY from STERN-CLYNE

39 GNS. H.P. terms available

Complete. Suitable Microphones available.

World renowned Fi-Cord. Recognised as one of the finest Hi-Fi battery recorders obtainable. The choice of professional sound engineers for serious outdoor work. Use it for true reproduction of sound—anywhere. Ideal for home film making, and all business and travel work. Magnificently engineered and constructed. Features include: frequency range 50–12,000 c/s (± 3 dB) 2 speeds—$7\frac{1}{2}$ and $3\frac{3}{4}$ i.p.s., level meter/battery tester tape counter, and plug-in provision for external services. Input <0.2 mV for fully modulated tape. Built-in 3 in. speaker. Output 180 mW and 1V at outlet socket. Size: 9 x $6\frac{1}{2}$ x $4\frac{1}{2}$in. **Weight: $6\frac{3}{4}$ lb. including batteries.**

ONLY FROM STERN-CLYNE
The Unique
GRAMSTAND

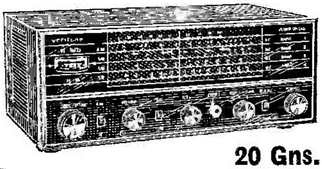
£10.7.6
Carriage 10/-

GRAMSTAND is a superb BSR Autochanger—with many added facilities—already assembled on a handsome, specially designed hardwood plinth. GRAMSTAND is made exclusively for Stern-Clyne to meet the requirements of modern bookshelf mounted and space limited Hi-Fi systems.

Features include:

- **Lightweight tubular arm.**
- **Latest Mono/Stereo Ceramic Cartridge.**
- **Diamond Stylus.**
- **Heavy balanced $10\frac{1}{2}$in. turntable.**
- **Built-in P.U. plug and socket and integral 6ft. mains lead.**

CR150 COMMUNICATIONS RECEIVER



20 Gns.
Carriage and Insurance 15/-

Compact and attractive as a drawing-room radio but packed with communications engineering features to bring in the most distant stations loud and clear. Continuous coverage from 540 Kc/s to 30 Mc/s takes in all broadcast bands, shipping, world-wide short wave and Ham radio. Built-in features include extra large tuning dial, extending rod aerial, "S" meter, B.F.O., Noise Limiter, extra quality loudspeaker, etc. Meticulously constructed, handsomely finished. Essential for superb reception but cheaper than many domestic radios. Size only $13\frac{1}{2}$ x 5 x 8 in. Standard mains operation.

EXCLUSIVE OFFER OF TOP QUALITY RECORDING TAPE

New American branded tape by world renowned manufacturers and equal in quality to the best obtainable anywhere. Guaranteed splice free, red oxide coated, with full frequency response and uniform output. Resistant to moisture, heat, cold and abrasion. Available in a wide range of Acetate and Polyester qualities, each distinctive boxed and cellophane wrapped in colour coded cartons showing recording times at $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i.p.s. Compare the prices!

RANGE AVAILABLE

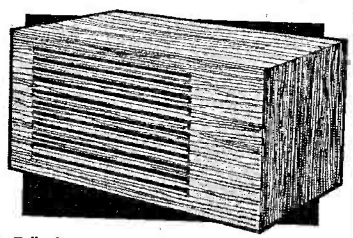
POLYESTER			
$3\frac{3}{4}$in.	600ft. Double Play	11	6
7in.	1,200ft. Standard	12	6
5in.	1,200ft. Double Play	15	0
7in.	1,800ft. Long Play	20	0
$5\frac{3}{4}$in.	1,800ft. Double Play	22	6
7in.	2,400ft. Double Play	25	0
ACETATE			
5in.	600ft. Standard	8	6
5in.	900ft. Long Play	10	0
$5\frac{3}{4}$in.	1,200ft. Long Play	12	6

Both types post and packing 1/- per reel. Four or more reels post free.

Spare spools, splicers and all Tape Accessories in stock.

SPECIAL OFFER
Internationally branded acetate tape, 7in. reel, 1200ft. giving 60 minutes per track at $3\frac{3}{4}$ i.p.s.
Only 10/6, add 1/6 post and packing.

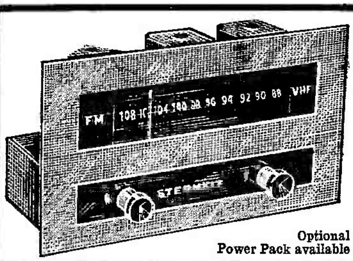
ONLY FROM STERN-CLYNE
New bookshelf size MEGAMITE speaker system



- Full frequency range
- Employs specially designed free-cone bass unit
- Includes matching tweeter and crossover
- Handles 10 watts output

Special 5in. free-cone bass unit uses enormously powerful Feroba magnet to obtain the exceptional cone movement needed to get clean, deep-down bass response equal to much larger speaker performance. Matching 4in. tweeter and crossover is housed with bass unit in heavily lagged, handsome teak veneered cabinet, size only 13 x 7 x 8in. deep. Mounts vertically or horizontally. Ideal for modern Hi-Fi systems where clean, unobtrusive appearance with high performance is required.

£8.19.6 Carriage 7/6.



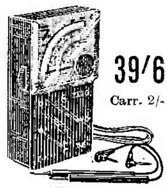
Optional Power Pack available

SUPERB NEW STERN-CLYNE FM1 VHF TUNER

Specially designed for the Amateur builder, a new sensitive tuner unit that provides stable, interference-free reception of BBC FM transmissions. High quality output signal ensures optimum performance from any Hi-Fi audio system; superb styling makes for harmonious installation with existing equipment. Reliable easily aligned circuit employs RF stage, tuned anode grid freq. changer, 2 IF's Noise Limiter and Ratio Detector. Input sens. 100mV for 40dB. Distortion less than 1% at full deviation. Power req. 200v at 20mA and 6.3v at 1.8A. Panel black and silver-grey, size 8 x 5 in.

FM1 Kit of parts **£7.9.6** Carr. 4/-.
Assembled and tested £10.9.6 Carr. 4/-.

TEST 7 Pocket Multimeter



39/6
Carr. 2/-

A really versatile instrument that makes a handy pocket-size tool. Measures AC or DC voltage in three ranges of 0-15-150-1000v. Resistance 0-1000,000 ohms and Current 0-150 mA. DC. Size only $3\frac{3}{4}$ x $2\frac{1}{4}$ x $1\frac{1}{8}$in., with ingenious dial design providing a clear, easily read scale. Complete with battery and test leads.

PRACTICAL WIRELESS

VOL 42 No 4
issue 714

AUGUST 1966

TOPIC OF THE MONTH

Dah Dit Dah!

WHENEVER you hear the cry "Down with Morse" you can be sure that within arm's reach is a frustrated character with an RAE pass wondering if N is dit-dah or dah-dit and proclaiming that the Morse Test is a creaking anachronism maintained simply to thwart would-be radio amateurs.

Superficially there may be a case for confining the Morse Test to limbo, for many prospective amateurs feel no affinity with c.w. It is understandably galling for an enthusiast who wants to use 'phone to find that if he is unwilling to reach his 12 w.p.m. he must be restricted to the nether regions of the 440Mc/s band.

And the existence of a reserve of amateur c.w. operators who could be called in for emergency duties (and which proved so valuable in 1939) is no longer important owing to the shift in military communications techniques and practices.

Even so, we not only support the continuance of the Morse Test but positively encourage a wider use of c.w. even to the extent of desiring *every* amateur station to devote some time to it.

The simplest way to get on the air is via a small c.w.-only transmitter and the surest path to success is to learn the rudiments with small gear and progress step by step to more complex rigs. Also, the range of c.w. is much greater than telephony and simple gear can give satisfactory results for the probationary ham.

Furthermore, letting a newcomer loose with a microphone is like throwing a Christian to the lions! Exposed to the ponderous drivel that passes for conversation on some sections of the amateur bands, he will start off on the wrong foot. But on c.w., he will better learn how to operate a station efficiently. Morse demands economy of message information, encourages snappier communications—and the language barrier does not exist. He will also be spared such delights as having Aunt Maude rip off a few gems on the weather conditions in Scunthorpe on the EL-key!

To mix a metaphor or two, the amateur with his L-plates up will find that a good long baptism of key bashing wins hands down. And so, to those inventing elaborate curses for the shade of Samuel Morse we say: keep at it—you may even, like Dr. Strangelove, learn to stop worrying and love the Code!

W. N. STEVENS, Editor

NEWS AND COMMENT

CONSTRUCTIONAL

GENERAL ARTICLES

SEPTEMBER ISSUE WILL BE PUBLISHED ON AUGUST 4th

Save the Grand Old Sets

I WAS interested in P. J. Plater's letter in the News and Comment of the June issue of PRACTICAL WIRELESS. I, myself, have restored many of these sets, with very little trouble and expense, which in the normal course of events would have found their way to the rubbish dump.

One in particular which I came by some three years ago is still going well and has earned me QSL Cards from all over the world, and apart from its performance, is a lovely piece of furniture and the tone quality is outstanding. I do most of commercial DX'ing on the "old faithful" as I have named it. It compares exceptionally well with the modern outfit I must say. A new valve and variable resistor were the only requirements to restore it to perfect working order.

H. S. Barker.

Dalton-in-Furness,
Lancashire.

The Radio Collector

I FOUND the article "The Radio Collector" in the June issue of PRACTICAL WIRELESS extremely interesting, as I took up radio as a hobby in the early 1920's.

I now have many copies of various wireless magazines, including PRACTICAL WIRELESS of the 1920's and 1930's for disposal. I also have valves, components, catalogues, etc., of that period.

If any readers are interested, please would they send me a stamped, addressed envelope and I will let them have further details.

E. Latham.

45, Beech Road,
Radstock,
Bath, Somerset.

Tape Exchange

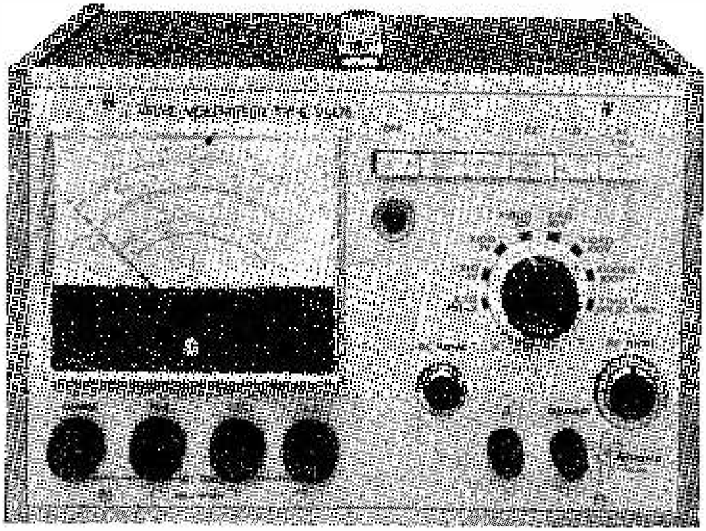
I WILL be pleased to exchange tapes with any of the old timers among PRACTICAL WIRELESS readers, who are still active short wave listeners, no matter what types of receivers are in use. Should there be any H.R.O. users, their tapes will be very welcome. My tape recorders are four track, $5\frac{3}{4}$ in. spools with speeds of $3\frac{3}{4}$i.p.s. and $1\frac{7}{8}$ i.p.s. Let me know receivers used, aerials, results on amateur 'phone and short wave broadcast bands, and the extent of Loran QRM on top band if any. Three-inch letter tapes only, please.

A. W. Mann.

62, Costa Street,
Middlesborough.

NEWS AND..

ADVANCE VOLTMETERS



The latest in the Advance range of five voltmeters is the Advance VM76 which extends the range of voltmeters to include a.c. frequencies in excess of 1000Mc/s and d.c. measurements up to 1000V with accuracies of $\pm 2\%$ up to 100V.

Push-button selection of the various functions is a notable feature of this instrument. In d.c. operation this method can be used to select centre-zero readings and either positive or negative polarity. Resistance measurements between 0·02Ω and 500MΩ to an accuracy of $\pm 5\%$ at midscale can be selected in a similar way. The VM76 is available from Advance Electronics Ltd., Roebuck Rd., Hainault, Ilford, Essex, at a price of £90.

SUBMINIATURE 300mW AMPLIFIER

Messrs. L.S.T. Components have informed us that due to import difficulties the GA02 is not available, but they are able to supply the following specified devices:

Tr1, Tr2, OC45 (Mullard) 5s. 2G374 (Texas) 3s. 1d. 2G374 (not coded) 1s. Tr3, 2N1305 (Texas) 6s. 9d. 2N1305 (not coded) 2s. 6d. Tr4, 2N1304 (Texas) 6s. 9d. 2N1304 (not coded) 2s. 6d.

One shilling post and packing should be added, unless all four devices are ordered, when postage is free.

All enquiries are to be forwarded to the company's new address, 23 New Road, Brentwood, Essex, AND NOT to Benfleet.

ULTRASONIC Tx/Rx

From Beulah Electronics Ltd., 126 Hamilton Road, London, S.E.27, comes the Nuray Ultrasonic Transmitter/Receiver. It consists of two units; an ultrasonic transmitter and a receiver. The range of the equipment is up to 30 feet. Uses include batch counting, burglar alarm, garage door opening and electronic control systems. The units measure $4\frac{1}{2}$ in. x $2\frac{1}{2}$ in. x 3 in. and the price of the battery-operated model Bo/1 (set of transmitter and receiver) is £19 19s. There is a mains-operated model, Mo/1 which costs £26 for the set of transmitter and receiver.

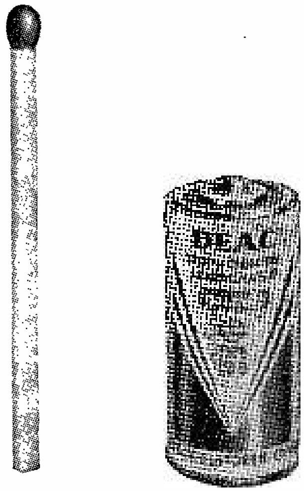
...COMMENT

SWITCHES AND COMPONENTS MADE TO ORDER

Elmbridge Instruments Ltd., West Molesey Trading Estate, Surrey, have started a comprehensive component service for the home constructor.

This service makes available small quantity packs of professional electronic components, including carbon film resistors, polyester capacitors, rechargeable nickel-cadmium cells, push-button and rotary switches, to home constructors who have found it difficult in the past to obtain direct from the component industry.

The photograph shows a DEAC Ni-Cad cell, of which Elmbridge Instruments Ltd., market the PP3, U2, U7 and U11 equivalents.



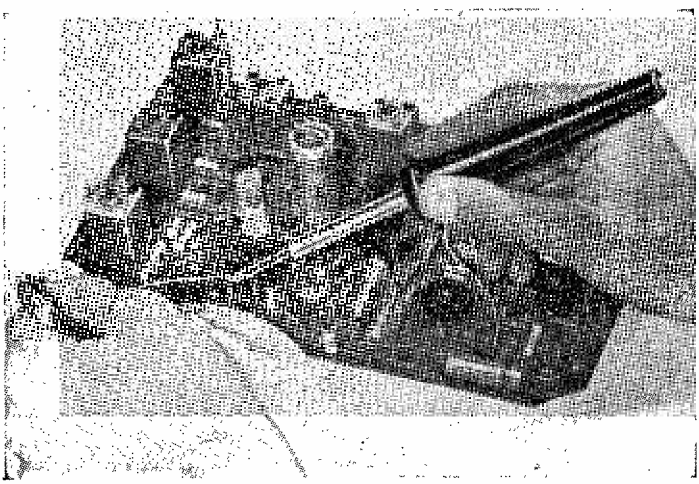
EMI HELPS TO TRAIN POLARIS CREWS

EMI Electronics Limited is taking an active part in the Royal Navy's Polaris project. The company is responsible for part of the electronic equipment used for crew training at the Submarine Base at Faslane in Scotland.

EMI engineers spent some time studying the design of training simulators at the California factory of the Hughes Aircraft Corporation, after which, they tuned the equipment at Faslane and are now training Naval personnel in its use and maintenance.

WELLER "MARKSMAN" SOLDERING IRON

Shown in the photograph below is the latest addition to the Weller range of soldering irons. It is the "Marksman", a small light-weight model that fits easily in the hand and can be used for hours without fatigue. It is rated at 25W and takes a variety of screw-in tips made of nickel-plated copper. Voltage rating is 240V. The "Marksman" is supplied in a vinyl pouch and costs £1 9s. A "Marksman" kit, containing iron, 60/40 solder, two spare bits, and a soldering aid, is available at £1 18s.



Who Wants To Sell?

As a regular reader now of Practical Wireless, I should like to purchase back-numbers, bound or otherwise, of Practical Wireless, "Practical Electronics" and "Radio Constructor" for a reasonable sum. Freight will be paid and all letters of offer will be answered. A cheque from a British bank (Westminster) will be sent to the seller.

John Lawn.

Shek Kwu Chau,
c/o Cheung Chau Post Office,
New Territories,
Hong Kong.

Can Anyone Help?

Can any reader help me in finding the number of a four-pin base rectifier valve used in an old Pilot 7-valve set (the type with a magic eye, model number possibly H.G. 56263, covering l.w., m.w. and s.w.) and possibly the heater voltage. The other valve numbers are as follows: Brimar 6D6, 6D6, Pilot 6A7, 42, Mullard 75 and the magic eye 6G5.

G. Wright.

Bankhead House,
Tranent,
East Lothian,
Scotland.

Congratulations

Congratulations on your "new look" magazine also the idea of the free booklets which I have found very useful indeed.

I have taken Practical Wireless from the first issue and I am now 62 years old. I may be one of your oldest readers, but I still look forward each month to my issue.

I have Practical Wireless going back to 1958 and if any of your readers require back-numbers and send a post card first, I will reply.

E. Brown.

Tiptree Hall Annexe,
Tiptree,
Near Colchester.

Tapespondent Wanted

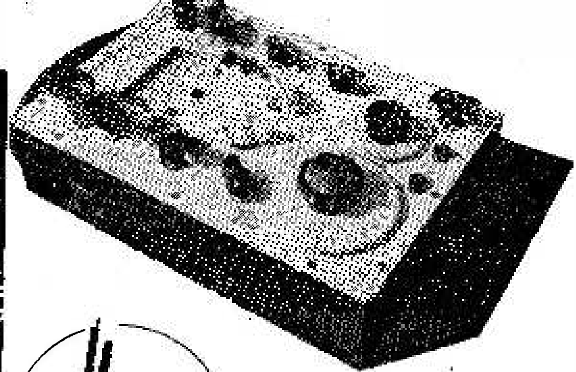
I would like to tapespond or correspond with anyone anywhere in the world. I am 23 and my interests are short wave listening and radio.

I have a 2-track, $3\frac{3}{4}$i.p.s. recorder with maximum spool size of 5 in.

Allen Green.

22A Okahu Road,
Kaitaia, Northland,
New Zealand

More News and Comment on Page 272



THE MULTITEST

MULTIMETER · L.C.R. BRIDGE · SIGNAL TRACER · SIGNAL INJECTOR · INSULATION TESTER

COVER SUBJECT

R. D. OWEN

THIS multipurpose instrument combines a comprehensive twenty-seven range multimeter and an L.C.R. bridge and should provide the radio constructor with sufficient test gear to build and test a host of electronic equipment. A complete list of multimeter and bridge ranges is given in Fig. 2.

Signal injection and signal tracing facilities, and an insulation test facility capable of measuring up to 400MΩ are also provided to assist in fault finding.

Realising that some constructors may already have a bridge or a comprehensive multimeter, the author has split the circuit into two distinct sections. There are, of course, minor problems if one decides to build only part of the complete instrument. For instance, the high voltage supply for the insulation test facility is derived from the bridge section, while

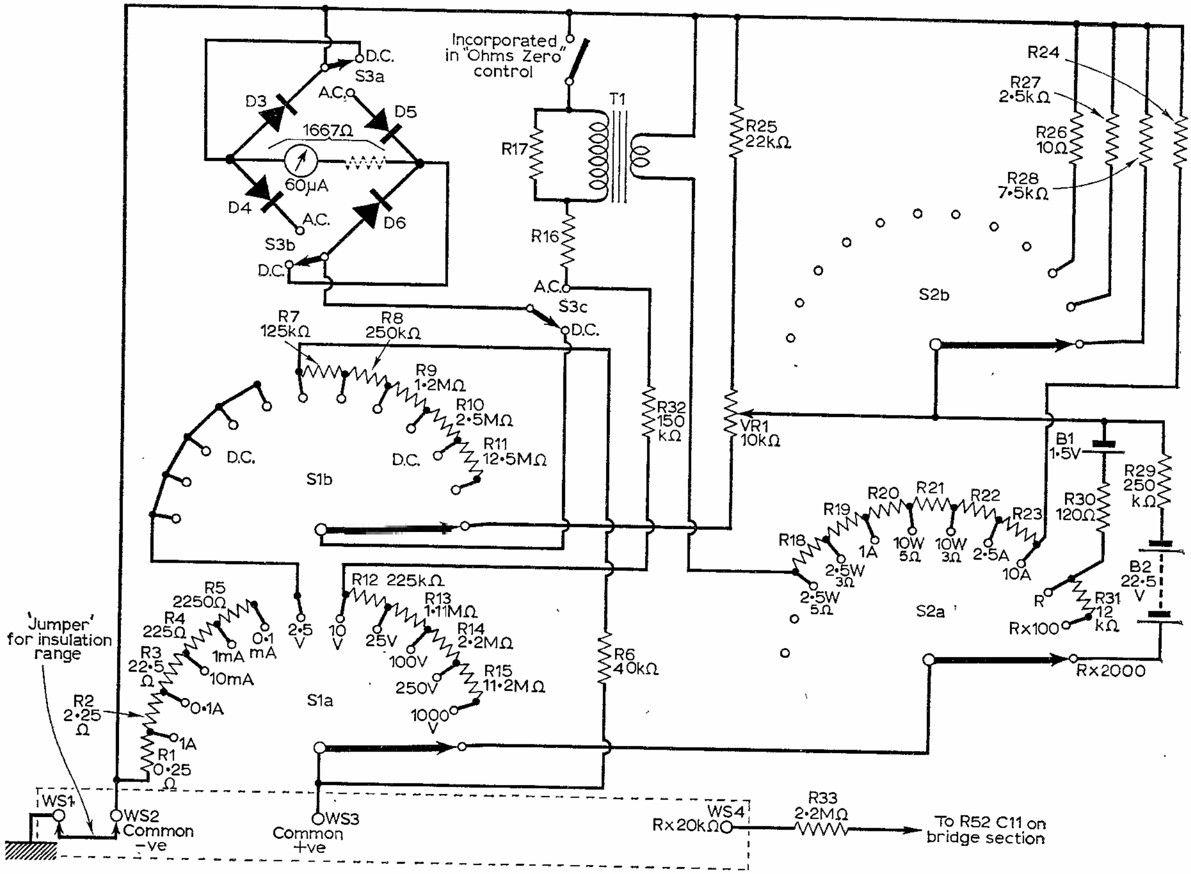


Fig. 1: Circuit diagram of the multimeter section of the multitest. The bridge section of this instrument will be included in next month's issue in part II.

MULTIMETER RANGES

D.C. Voltage	Direct Current
0—100mV	0—0·1mA
0—2·5V	0—1mA
0—10V	0—10mA
0—25V	0—100mA
0—100V	0—1A
0—250V	
0—1000V	

A.C. Voltage	Alternating Current
0—10V	0—1A
0—25V	0—2·5A
0—100V	0—10A
0—250V	
0—1000V	

A.C. Power

3Ω	5Ω
0—2·5W	0—2·5W
0—10W	0—10W

Resistance

0—20kΩ	(with internal batteries)
0—2MΩ	
0—40MΩ	

BRIDGE RANGES

Resistance	Capacitance	Inductance
0—4Ω	0—400pF	0—40mH
0—40Ω	0—4000pF	0—400mH
0—400Ω	0—0·04μF	0—4H
0—4kΩ	0—0·4μF	0—40H
0—40kΩ	0—4μF	0—400H
0—400kΩ		0—4000H
0—4MΩ		
0—40MΩ		

Note:
Bridge sources of 50c/s and 1000c/s.

Fig. 2: List of ranges

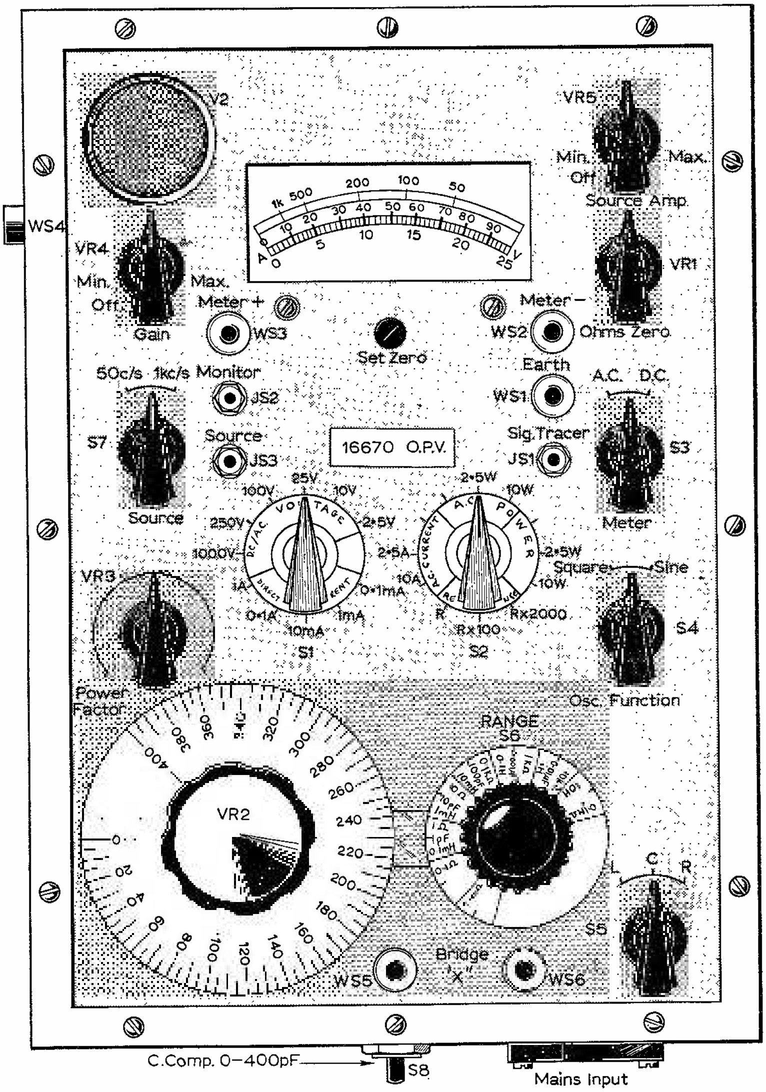


Fig. 3: Front panel view of the multitest, showing author's layout.

the associated meter components are in the multimeter section.

All the circuitry for signal injection and tracing is contained in the bridge section, which will be described in the next issue.

THE METER MOVEMENT

A moving coil type of meter movement having a full scale deflection sensitivity of 60μA and an internal resistance of 1667Ω was used by the author. Other movements can be used so long as the sensitivity is at least equal to the original and the internal resistance is similar.

If a different movement is used, the internal resistance should be made up by inserting a series resistor in the meter circuit (shown dotted in the circuit diagram). To reduce the sensitivity a shunt should be placed across the terminals of the meter movement.

An internal resistance of 1667Ω was chosen as it requires exactly 0·1V for full-scale deflection.

MULTIMETER

A circuit diagram of the multimeter section of this instrument is illustrated in Fig 1. Although the switching looks complicated at first glance, it is really quite simple.

Switch S3 (double-pole, three-way) is the a.c./d.c. changeover. In the a.c. position it knocks out the step-up transformer T1 and two of the bridge rectifiers, D3 and D6. The other two switches S1 and S2 (double-pole, twelve-way) are used to put the correct shunt or load resistor into the meter circuit.

Reference to the circuit diagram will show that there are five resistor banks in the multimeter. Resistors R1 to R5 are for the direct current ranges; R6 to R11 for d.c. voltage; R12 to R15 and R32 for a.c. voltage; R18 to R24 for alternating current; and R26 to R28 for the resistance ranges.

All the shunt and load resistors used are dependent on the internal resistance of the meter, so it is important to know how to check its value should it not be marked on the movement.

FINDING THE METER RESISTANCE

It is a relatively easy matter to determine the internal resistance of a meter if the full-scale sensitivity of the movement is known. (The majority of movements of this order of sensitivity are marked.)

The first step is to get the meter to indicate full-scale deflection by hooking it across a battery, but take care not to damage the movement by inserting a high value variable resistor in series with the meter. Another variable resistor should then be placed across the meter terminals and adjusted to back-off the reading to half full-scale deflection. Then carefully disconnect the shunt resistor (the one across the meter terminals) and measure its value. The answer will give the value of the internal resistance, as it will be the same as the movement.

If a quality ohmmeter is not at hand, the shunt can be made up with high tolerance 1% fixed resistors.

DIRECT CURRENT SHUNTS

Values for the resistors making up the pad to shunt the meter on the direct current ranges are included on the circuit diagram. There should be no difficulty in obtaining R3 to R5 "over-the-counter," but you will have to make the two lower values. Wire tables should be consulted to obtain the resistivity characteristics.

The values for the resistance pad can be calculated mathematically, remembering whatever the range, the voltage across the meter remains constant at full scale deflection. The actual voltage drop across the meter can be found by Ohms law:

$$V = I \times R$$
$$= (60 \times 10^{-6}) \times 1667$$
$$\therefore \quad V = 0{\cdot}10002$$

For all practical purposes the voltage drop can be considered as 0·1V. The ohmic value of the complete shunt can now be found by the following:

$$Rs = \frac{V}{It - Im}$$

where Rs is the shunt resistance, V the volts drop, It the total current for full scale deflection and Im the current through the meter. Maximum resistance is in circut on the 0·1mA (100μA) range and thus:

$$Rs = \frac{0{\cdot}1V}{100\mu A - 60\mu A}$$
$$= \frac{0{\cdot}1V \times 1{,}000{,}000}{40}$$
$$= \frac{10{,}000}{4}$$
$$\therefore \quad Rs = 2{,}500\Omega$$

One cannot use the same formula to calculate the tappings as the switch arrangement is such that part of the pad is put in series with the meter on some ranges. However, as the current through the meter is so small, compared with that through the shunt on the higher ranges, the value of the shunts can be divided by the increase factor in range. Thus, as the 1mA range is ten times larger than the 0·1mA range, the shunt should be one-tenth the size, i.e. 225Ω.

D.C. AND A.C. VOLTS

The load resistors for the d.c. and a.c. volts ranges are quite straightforward. The lowest d.c. volts range (100mV) has no load resistor as the potential can be safely developed across the internal resistance of the meter. On the other ranges a resistor is brought into circuit each time the voltage range is increased to limit maximum current through the meter movement to 60μA.

To determine the values of the load resistors, one uses a form of Ohms law. The example that follows is for the 10 volt d.c. range.

$$Rl - Rm = \frac{Vt}{Im}$$

where Rl is the load resistor, Rm is the internal resistance of the meter, Vt the maximum voltage drop and Im is the current required for f.s.d.

$$\text{Thus:} \quad Rl - 1667\Omega = \frac{10V}{60\mu A}$$
$$Rl - 1667\Omega = 166667$$
$$\therefore \quad Rl \simeq 165k\Omega$$

RESISTANCE SHUNTS

The values of the shunts for the resistance ranges (R26 to R28) are given on the circuit diagram. They effectively shunt the meter to 10mA, 0·1mA and 75μA respectively.

The resistor R33 on the multimeter circuit diagram is for the insulation test facility and the value given is only suitable when taking power from the h.t. rail of the bridge section.

Should one wish to build only the multimeter section and retain the insulation test facility, a d.c. source of about 200 to 300 volts is required. The ohmic value of the series resistor R33 should be of sufficient size to prevent excessive current to pass through the meter movement when the terminals are shorted. A simple way to find the correct value is to place a variable resistor in series with the fixed resistor R33 and, with the terminals shorted, adjust for full-scale deflection. Always start off with a large resistor and work down; to do it the other way, can result in permanent damage to the meter movement.

ALTERNATING CURRENT SHUNTS

Calculating the shunt resistors for the alternating current ranges is a little more difficult as one has to take transformer T1 into consideration. This transformer is used to step up the alternating current (voltage wise, to at least 5V) to overcome the non-linearity of the rectifier diodes in the meter circuit.

The type of transformer is not all that important so long as it has a turns ratio somewhere between 50 and 100 to 1. It is necessary to measure the d.c. resistance of the primary and secondary windings as they are needed for the shunt calculations.

In circuit, the secondary winding (the one with the higher d.c. resistance) should be shunted for impedance matching. The value of this shunt resistor R17 must be about three times the impedance value of Rsec (d.c. resistance in the secondary winding of T1). Impedance, as resistance, is found by dividing current into voltage.

The approximate value of the series limiting resistor R16, linking the meter with transformer T1, can be found from the following formula:

$$R16 = \frac{Vsec}{1{\cdot}1 \times Im} - Rsec$$

where Vsec is the voltage across the secondary of T1, Rsec is the resistance of the secondary of T1 and Im is the meter current for full-scale deflection. The factor 1·1 is introduced to reduce the r.m.s. (root mean square) value to an average value, which is the value indicated by the meter.

The exact value of R16 is determined after the current and power shunts have been completed.

The current in the low impedance side of T1 (that connected to the shunts) can be found from the formula:

$$Ip = \frac{n \times Vsec}{Rsec + R17}$$

where Ip is the primary winding current, n is the turns ratio of the transformer, Vsec is the voltage across the secondary of T1 and Rsec is the d.c. resistance of the secondary winding.

One must consider the impedance of the primary winding in much the same way as the internal resistance of the meter when calculating the a.c. and a.c. power shunts. In fact, the same technique as

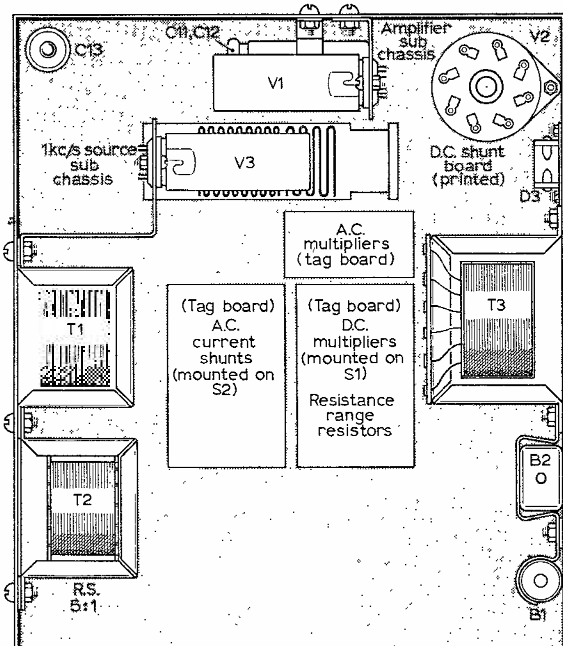


Fig. 5: Under chassis view showing the position of the main components in the multitest. Layout is not critical, but reference should be made to the front panel view for switch and meter positioning.

used for calculating the d.c. shunts is employed for selecting the a.c. shunts—substituting the primary winding current for 10 volts in the secondary for full-scale deflection current.

$$\text{Thus} \qquad Rs = \frac{Vp}{It - Ip}$$

where Rs is the shunt resistance, Vp the voltage across the primary windings of T1, It is the total current and Ip the current in the primary windings.

The shunts for the a.c. ranges are most easily made from copper or eureka wire. Reference to wire tables will give sufficient information on resistivity. Take care to ensure that the current carrying capacity of the wire used is suitable.

POWER RANGES

The a.c. power ranges are, in fact, alternating current ranges with f.s.d. coinciding with power levels at 3 or 5Ω. The ratio of increase of deflection with power is logarithmic ($1 = \sqrt{P/R}$) and the author found it easier to produce a calibration chart in preference to another scale on the face of the meter. Since f.s.d. occurs at either 2·5W or 10W only one graph need be drawn; see Fig. 4.

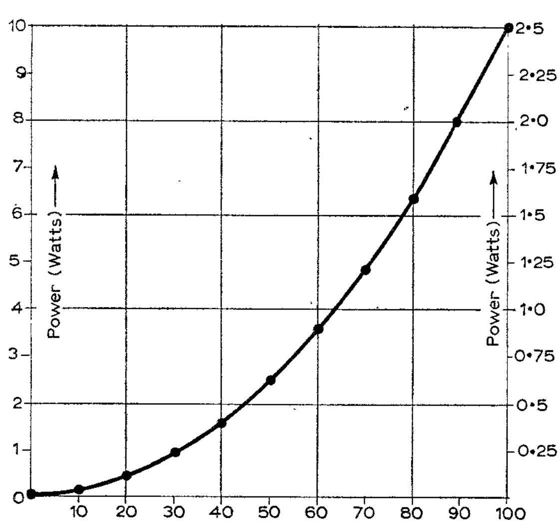


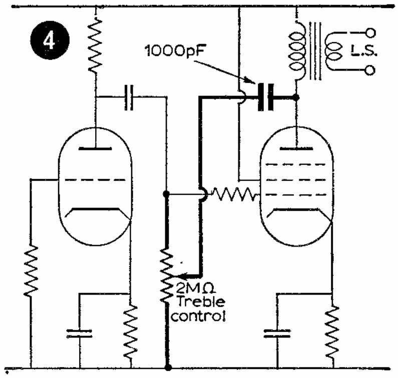
Fig. 4: Specimen chart for the power range.

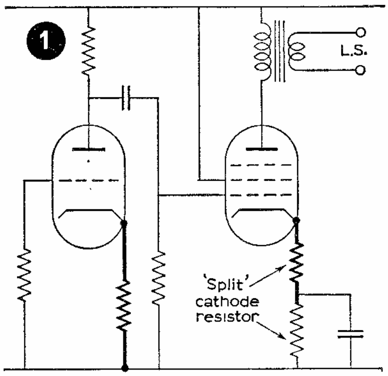
NEXT MONTH

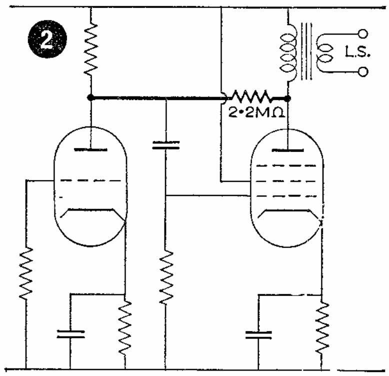
Brief constructional details on the multimeter and comprehensive details on the associated bridge will be in next month's issue.

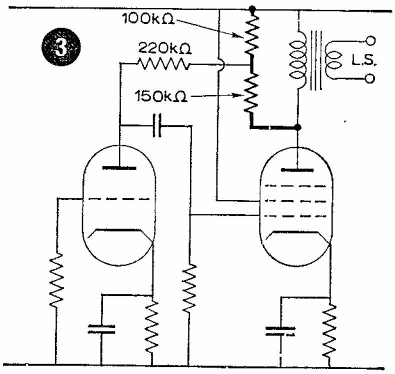
10 WAYS TO APPLY Negative Feedback

BY G. R. WILDING









CORRECTLY applied negative feedback can considerably improve the quality of an audio amplifier or a complete receiver. Care should, however, be taken to select the correct component values as one can easily introduce more distortion through phase changing. In this brief article on the subject, ten different ways of applying negative feedback are touched upon. This is by no means exhaustive, but should give the serious amateur ideas for experimentation.

The values in the examples that follow should be considered as a kicking-off point rather than fixed values. It is, of course, possible to select the values mathematically, but this involves complicated calculations. Trial and error methods are perfectly satisfactory, as one can select component values for optimum personal listening.

Before going into the various methods, one should realise that only a small amount of feedback is necessary to improve the overall response of an audio amplifier or a receiver. Also, it should be noted that negative feedback loops are often frequency conscious and thus, the beginner should be careful of the capacitive elements of a feedback loop as they can introduce phase distortion.

Split Cathode Resistor

One of the simplest methods of introducing negative feedback is to disconnect a cathode de-coupling capacitor. This produces quite a high level of feedback and can often cause too much, causing the output to fall to an unacceptable level.

As there is no capacitance in this method, the feedback is almost entirely independent of frequency. One can control the amount of feedback by splitting the cathode resistor and de-coupling the lower half as shown in Fig. 1. The component values have not been included as they do not have to be changed from the original circuit.

A simple way to split the cathode resistor is to use a potentiometer which has an end-to-end value equal to the resistor it replaces. Then the de-coupling capacitor can be attached to the wiper arm and the potentiometer adjusted for optimum performance. This potentiometer can either be left in circuit so that the feedback level can be changed at will or replaced with two fixed resistors.

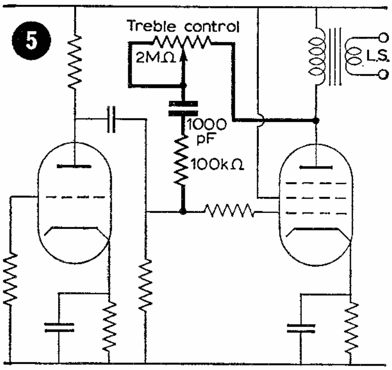
It is unwise to play around with the size of the de-coupling capacitor, as one can easily upset the overall frequency response.

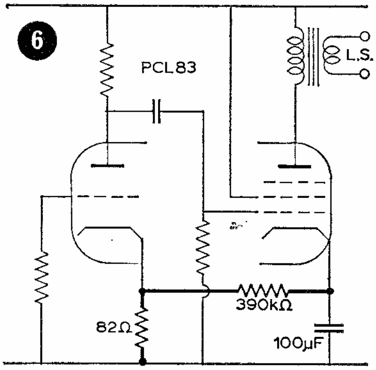
Anode-to-Anode

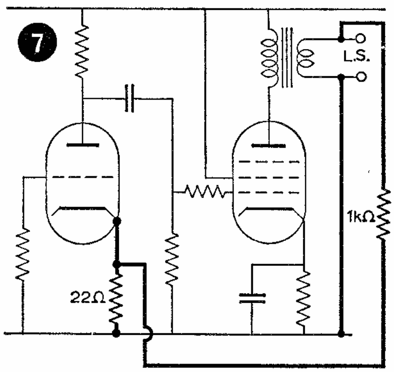
Another very simple and extremely efficient method of obtaining negative feedback is to couple a pair of anodes with a high-value resistor as shown in Fig. 2. The value of this coupling resistor is not critical and a 2·2MΩ should provide a good starting point. To increase the amount of feedback and thus reduce the overall gain, the size of the resistor should be reduced.

A capacitor can be connected in series with the coupling resistor to make the feedback loop frequency conscious. Inserting one having a value somewhere between 0·001 and 0·01μF will increase the limiting effect at the higher end of the frequency band in much the same way as the conventional treble-cut tone control.

Another variation of the anode-to-anode coupling is shown in Fig. 3. This makes use of a potential divider hooked across the primary







windings of the audio output transformer, which lies between the anode of the output valve and the h.t. line. The amount of feedback can be varied by adjusting the ratio of the two resistors forming the potential divider.

One can use the potentiometer method again to determine the best ratio. If one does this, it is advisable to use a potentiometer having a value of at least 250kΩ.

Treble Controls

A further refinement of the feedback loop is illustrated in Fig. 4. This circuit has been specially made frequency conscious to give limiting control of the high frequencies. Again the series capacitor and resistor arrangement is used, but this time the feedback loop is from the anode to grid in the same valve stage.

Although the components are differently arranged in the following circuit (Fig. 5), the feedback loop has the same characteristics of limiting the upper frequencies. Values for the two circuits appear on the relevant diagrams.

Cathode-to-Cathode

An example of cathode-to-cathode coupling is shown in Fig. 6. This type of feedback is used in many Philips television receivers and is quite interesting. One should be careful in adopting this method of feedback for other circuits as value of the resistors is tied to the valve characteristics. The values given on the circuit diagram (Fig. 6) only apply to the PCL83 triode-pentode.

Calculating the values for another valve can be done, but one must know the current and voltage levels in the triode and pentode sections. The common cathode resistor value can then be determined by dividing the total current through the two sections into the triode section voltage. The other value can be found by dividing the current through the pentode section into the pentode voltage minus the triode voltage.

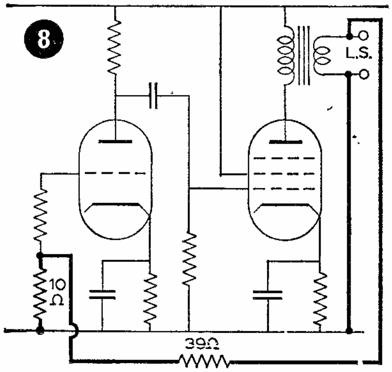
Commonly used Feedback Circuits

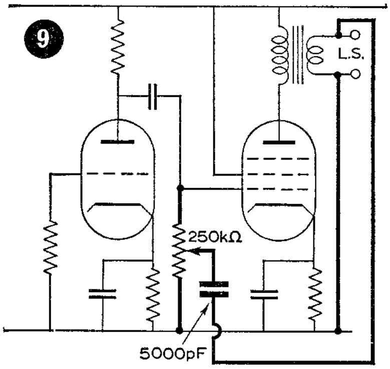
The more usual forms of negative feedback found in audio amplifiers and radio receivers are shown in Figs. 7 to 10. As you can see, the circuits differ from one another; the first (7) feeding back part of the output to an uncoupled cathode resistor in the driver stage, the second (8) to a potential divider in the control grid of the driver, the third (9) to a potentiometer in the grid circuit of the final amplifier and the final illustration (10) shows a loop terminating at a fixed resistor in the grid circuit of the audio amplifier.

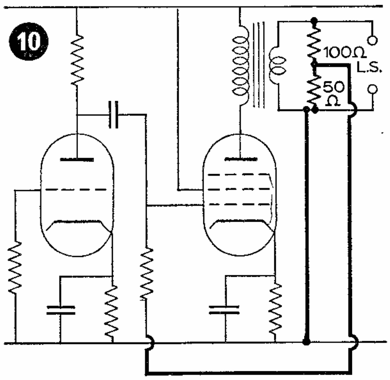
All four circuit arrangements are straightforward, but one must be careful not to reverse the polarity when making connections to the secondary of the output transformer. If it is connected the wrong way round, you will get positive feedback which will increase overall amplification and cause instability.

When you examine the circuit in illustration 7 you will see that there are two feedback paths, one through the cathode resistor and another from the output transformer. The level of feedback can be adjusted by changing the ratio of the two feedback resistors.

The only circuit that is frequency conscious in this group of four is the one illustrated in Fig. 9. In fact, the potentiometer in the feedback loop makes a very good treble-cut tone control.







ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequences in kc/s

THE BROADCAST BANDS by JOHN GUTTRIDGE

Clandestine: *Radio Scali* is probably *Radio Scari,* a station operated by the exiled Spanish Communist Party. Announcements in Spanish call the station the "Voice of the Resistance" and state that transmissions are in the 23 and 26 m.b. An address believed to be B.P. 59, somewhere in France, is given. Has now been heard between 2100 and 2230 on 11,280.

Dahomey: *Radiodiffusion du Dahomey* (Boite Postale 366 Cotonou) has QSC giving date and time. Transmits on 4,870 Monday—Friday 0515—0715, 1130—1300, 1630—2200. Longer transmission periods are utilised at weekends.

Egypt: *Cairo Radio* (Propagation and Monitoring Department, U.A.R. Broadcasting and TV, P.O. Box 1186, Cairo) now uses for 7,075/11,915 for the dictation speed news at 0630—0700.

Guinea: *Radiodiffusion Nationale* (Boite Postale 617, Conakay) has been heard around 1945 on 4,910.

Guinea (Portuguese): *Emissora Provincial da Guine* (Avenue da Republica, Bissau) has been heard signing off at 2400 on 5,017.

Guinea (Spanish): *Emissora de Radiodiffusion Santa Isabel* (Apartmento 195, Santa Isabel, Fernando Poo) is reported to be using an outlet in the 31 m.b. in the early evening. Full QSL is given.

Libya: Libyan Broadcasting Service (P.O. Box 333, Tripoli) has been heard on 674 at 2205.

Sudan: Sudan Broadcasting service (P.O. Box 572, Omdurman) has English 0530—0600 on 4,394/9,508. These frequencies carry Arabic during the day. Some reports say the frequencies are 4,994/9,508.

Tanzania: *Radio Tanzania* (Box 9191, Dar Es Salaam) has been heard at 1900 on 5,050.

China: *Radio Peking* (Broadcasting Administration, Fu Hsin Men, Pekin) has English 1800—1900 on 6,825/7,006/7,075/9,457 and 2000—2100 6,825/6,890/9,860. There is an Arabic transmission on 9,520 at 1830 which suffers from bad QRM.

Cyprus: BBC East Mediterranean relay (Bush House, London, W.C.2) has been heard signing off at 1915 on the new frequency of 9,558.

India: All India Radio (Post Box 500, New Delhi) has introduced a general Overseas Service in English. Transmissions are 1000—1100 in 19—25—16 m.b.; 1330—1500 19—25; 1745—2230 41—25—31 (7,210 is believed to be the 41 m.b. outlet); 2245—0115 75—49—41—31—25 (9,740 is believed to be the 31 m.b. outlet).

Iran: *Radio Iran* (Ministry of Information, Meydan Ark, Tehran) reported to be using 11,795 for the Foreign Service between 1730—2130 but still announces 11,730.

Japan: N.H.K. (Tokyo) now uses 17,875/15,135 for the 2345—0045 transmission. The following frequency usage is now used for general service transmissions: At 0200, 0300, 0400, 0500, 0600, 0700 and 0800 on 15,105/15,195/15,300; at 0900, 9,505/15,195/15,300; at 1000, 1100, 1200, 1300, 9,505/11,815/15,300; at 1400, 1500, 1600, 1700, 1800, 1900, 9,505/9,560/11,815; 2000, 9,560/11,815/15,195; at 2100, 2200, 9,700/11,815/15,195; at 2300, 2400, 9,700/15,105/15,425.

Korea (Peoples' Democratic Republic): *Radio Pyongyang* (Korean Central Broadcasting Committee, Pyongyang) has English on 7,580/13,780 at 0800—0900, 1100—1200 and 1400—1500.

Korea (Republic): Korean Broadcasting System (Yejangdong 8, Chung-Ku, Seoul) has English 0830—0900 on 9,640.

Lebanon: *Radio Lebanon* (Ministry of Orientation, Information and Tourism, Beirut) transmits as follows 1830—2030, 11,955; 2300—0100, 11,760; 0130—0400, 9,575. English is at 1830 and 0230.

Philippines: Far East Broadcasting Company (P.O. Box 2041, Manila) has been heard identifying in English at 1000 on 11,855 (DZH8) with good signal.

Singapore: *Radio Singapore* (Broadcasting Division, Ministry of Culture, P.O. Box 1902, Singapore) has been reported with English at 1100 on 15,010.

Vietnam (Democratic Republic): *The Voice of Vietnam* (No. 58 Quan-Su Street, Hanoi) reported in English at 1300 on new frequency of 11,760. A pennant is sent by this station to those sending in reception reports.

U.S.A.: *Voice of America* (U.S. Information Agency, 330 Independence Avenue, S.W., Washington 25, D.C.) appears to have made major schedule changes. The Thessaloniki relay is now using 5,995 where there is severe interference with Radio Warsaw. The 1500 Estonian transmission is being relayed by the BBC on 11,760. Also at 1500 there is an Urdu transmission over 17,805 Tangier and 21,675.

Armed Forces Radio and TV Service. Schedules are sent out on application only. Requests for them to Det 102, 7122 Spt. Sq. (AFRTS—USAFE), APO U.S. Forces, 09755, Europe. New schedules are issued in March, May, September and November.

Reporters this month were S. Shaw, J. D. Ashworth, P. Watts, Roy Patrick, G. Roberts, G. Lamb, I. Perry, J. W. Smith, I. Taylor, Middlesbrough High School S.W. Club, A. B. Thompson, International Short Wave Club and Sweden calling DXers.

YOUR scribe has been taken to task again by indignant l.f. band of specialists. **Peter Short**, ZS6HL says that there is quite a gang of ZS stations on 80 in the evenings. In particular he quotes ZS8M and ZS9H who are quite happy to arrange skeds with any G's interested.

Opinions seem to vary as to the state of the various bands. "I have tried listening for any amateurs on 40 but the QRM is astounding," writes **D. Harvey** (Salop). "Eighty metres is again very constant with the usual W's and VE's on s.s.b. Ten metres is beginning to open with a lot of European (EU's) signals coming in," observes the SWL/YL team of **Messrs Singleton** and **YL Longbone.** At '3JDG things are about as one would expect. The six bands are all humming at one time or another but 160 has been noticeably quieter. Look out l.f. bands—the sunspots is a-coming. Many people have queried the changing prefixes of some countries, so to answer a few and let you amend those countries' lists, here's the queries to date. 9Y4 is a new one for VP4, 9J2 is Zambia and 9V1 is the new one for 9M4.

Mains to 7,000,000 c/s.

Michael Olsen (Gateshead), Star SR550, 35ft. wire plus 2 coat-hangers (that's what the man said)—3·5Mc/s; CN8FV, ET3AC, LA1CH, OZ, OH, ON4, PAØ, SM6, LX1BW, FM7DOE, VP2AX, W2PZO, VO1GG, **James Brown** (Cardiff), 19 set, dipole, 80 s.s.b. CT1SQ, I1RV, KØJDA, SL2YI, VE1IE, VE8ML, VO1DM, W3PHZ, YV5BTS, ZB2AO. On 40 **F. Simpson** (Hull), RX80, l.w., beheld the wonderment of—IS1DMN, K1GZL, K3UEN, PY4ND, PY7AOT, UW9AF, WA4PNC, W2AZ, W3VP, YV5BZX. **David Avis** (Christchurch), writes: "Sacrilege!! that's what I call it. No news on 40 for two months." He offers the following duly unearthed on the dreaded r.f. segment—CN8AW, HA9OZ, OD5EJ, PY—1CAD, 1CPE, 1MIN, 2DUE, 7OU, VP2SJ, VP6KL, 9H1IA. All on a 4-valve 18 set with a half-wave dipole 12ft. high—cor! **Chris Peel** (Stoke-on-Trent), waved a critical ear complete with S750, 45ft. l.w., and headphones, the results—EL2AX, KP4, LA7RS/MM (Arabian Sea) OX3LP, PY—4ND, 2AUC, 7APN, 7APS, UA1CK, UB5KB, UR2KAA, VE8ML (c.w.), W3MSK, YV5CBM, 9H1IA, 9M20V all s.s.b.

14, 21 and 28

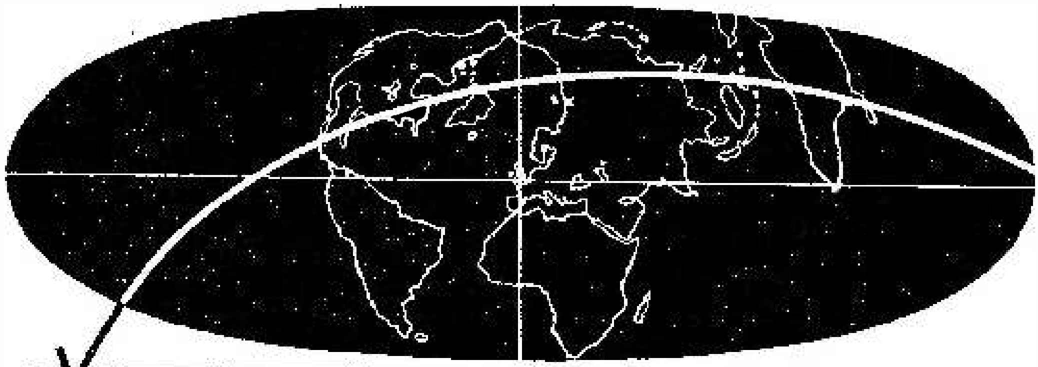
So much activity that even the **'3JDG** t.r.f. is pulling them in on 20 and 15 with 130ft. l.w. to an a.t.u. (plus the t.r.f. of course, they're not that strong) the three valves glowed to the rhythm of CO, CX, EL, ET3, KZ5, with the best ones UL7HB, VS9AMD, 6W8BL, 9K2AD. **Colin Morris** (Worcs.), homebrew s/het, joystick, 20 metres: CR5SP (São Thome) CO8MN, CP5AD, GC8HT, HL9KH, HM2BD, "thousands of JA's", KA7AB, KG6AAY, KH6FMG, KJ6DA, KX6BQ, DU1BA, W6FHM/DU1, OA4EE, PJ2CE, VE1AED/P/SU, PZ1BW, TI2EVA (Costa Rica) TU2BA, TY3ATB, VP—1HC, 2KD, 3AA, 6WR, 8CW (Falkland Is.) VK9XI, XP1AA, XW8AX (Laos), W3KXD/VO2, YA1FV, YN1CML, YS1MA, YK1AA (Syria), ZL—1ARY, 2BE, ZS8L, ZF1GC (Grand Cayman), 6Y5AR, 9M2CP, 9M6AP, 9V1MT, 9K2AM, 9Y4VP. **L. Cox** (West Ham), Mohican, 21ft. vertical, 20 metres s.s.b. —CN3JC, CT1JJ, EA3JE, EP2TR, ET3AC, FB8YY, FG7XX, FM5XM, HB9QK, HZ1AB, JA—4CNS, 4XW, 6CZD, K3TUV/MM, K6JXS/MM, KP4AXC, KR6LL, LA4FG/P, MP4BZO, PY1BAR, UG6AW, UL7GL, VE3CT, VE8MD, VO1FB, VP2AX, VQ2UJ, VK—1FH, 3BG, W2ZXM/MM, W4QCM/M, W5YSM/Fix P/VU1, YQ5RF, YV5ACO, ZS5JM, ZC4SS, 4X4BL, 5A1TZ, 5A3TY, 5N2TWS. **John Farrer** (Bishop's Stortford), Mini-clipper, dipole: EP2GF, ET3AC, HC1SM, JA7ARZ, KH6GAA/MM, KP4AMI, OX1QW, TF3EA, VK3ADR, VP2MW, VP6JC, VQ8AI, VS9AJC, VU2CK, VE1AED/SU, WA6PMG, W7RII, W5YSM/P/DU1, YK1AA, YA3TNC, YV5BNW, ZC4CI, ZL5AA, 5X5GT, 5Z4KW, 7X2AH, 9M6AP, 9V1ND. Not bad for a one-valve plus two transistor amplifier, Wait till he adds an r.f. stage! **R. Adair** (Co. Down), R107, 30ft. l.w. 20: CN8FS, KJ6OA, KL7IEY, PY7AN, VK—3ID, 5DS, 6XX, VP2QP, VS9ARV, ZB2AM, ZL1AIX, 4U1ITU, 5A1TS, 9H1AB, 9X5GG. For 15-metre sleuths the following offerings from headphone-clad enthusiasts. **F. Simpson** (Hull), RX80, l.w., CX8AAW, HC1GB, HK3APC, JA-1DDZ, 1LPZ, 3COX, 4DLP, 6DCE, KV4TX, LU6AJ, YV1QB, ZS6AX, 4X4AS, 5N2AAE, 5Z4AC, 7Q7BN, 9Q5FV, 9V1MX. A mystic signature informing that a 9v. s/het. in Cardiff is worked by **A4378** in conjunction with a 96ft. l.w.: CP8GC, EL2A, HC1SM, HR2GK, KØSVT, KH6FBJ/3, PY1AXP, VK6UP, VP6KL, VS9AJC, ZC4JU, ZF1GC, ZS2NV, 5A4TO, 5H3JR.

On its own No. 10

Two reports of activity on 28 Mc/s come from Staffs. and Notts. In Stoke-on-Trent, S750, 45ft. l.w. in the loft, and **Chris Peel** hooked CE3RC, CR6GO, CT2JA, CX1AV, EA8AE, IT1ALC, LU1DAB, PY1AGP, UP2ADJ, VS9AJC, ZE2JA, ZC4CN, ZS1JA, ZS6AW, 5X5JK, 5Z4JW, 7Q7RN, 9J2WR, 9Q5JG. **R. Iball** (Worksop), SX28 plus PR30, 80ft. l.w.: CR7IZ, PY5ACN, SM2CEK, ZS6BMD, 5Z4JX, 7Q7RM, 9Q5LJ, these on c.w., while on a.m. CR6AT, CR6LAS, CX1AA, EL2O, PY2EQ, ZS1BV, s.s.b. CR4OI, EL2AK, ZD8HR, 5H3JJ.

News and Contests

9M2FI, on Penang Island, 300 miles N.W. of Singapore: VE8BZ at Frobisher Bay, Baffin Island —these two on 15. VEØMB (20) on a lightship off the coast of Yarmouth, Nova Scotia (tnx **Paul Baker**) WB6QOE/VP9 on 40 c.w. The USNS Eltanin signs, KC4AAA/MM or CEØZI/MM, depending where they are. Heard on 28 Mc/s YN1AA, CR6EI, YN1MAV, ZL2PI. For the contest and rally types the following are worth a listen in July. 3rd, 144 Mc/s, portable contest. 9-10th. 1·8 Mc/s summer contest. 10th, Hurn Airport Mobile Rally. 10th, South Shields Mobile Rally. 17th, D/F qualifying event. 24th, 70 Mc/s portable contest. 31st, D/F qualifying event Deadline this month is July 24th.



HAM FEATURE

GREAT CIRCLE CALCULATIONS

DETERMINING BEARINGS AND DISTANCES

W. E. RIGG 9J2AA

THE reception of the maximum energy from a given signal, or the transmission of the greatest energy in a particular direction, necessitates the correct orientation of the aerial in order to realise the optimum. Elementary antenna theory indicates that the simple half-wave dipole, as an example, both transmits and receives in a direction 90° with the plane of the antenna. With the exception of a few odd types this fact is applicable to the majority of aerials. The essential requirement then is that the antenna, whether rotary or fixed, should be correctly aligned for some specific direction.

Straight Lines?

It is generally satisfactory to accept a straight line as the track of radio waves over distances of a few hundreds of miles, although in marine direction finding, as an instance, bearings of radio beacons ascertained by ships at distances exceeding 70 miles are corrected. This correction, known as "half convergency", is necessary in the interests of precise navigation, the tendency of radiated waves being to adhere strictly to the curvature of the earth. The corrected bearings can then be drawn by the navigator on the plane surface of a mercator chart as a rhumb (straight) line.

A fact with which radio men are well conversant is that the shortest distance between any two spots on the earth's surface is not necessarily a straight line but actually the arc of a great-circle passing through both of them. Great-circles are those whose planes pass through the centre of the earth, possessing a radius equal to that of the globe. The meridians of longitude and the equator are great-circles but the parallels of latitude are not since, as they progress north and south of the equator, their radii decrease.

And so if radio signals are to be transmitted or received between London and Buenos Aires, New York and Sydney, or Cape Town and Hong Kong the radiated waves will, without exception, follow the arcs of great-circles.

It is therefore very useful in both radio transmission and reception to be able to ascertain the direction and distance of any spot on the earth's surface from one's own backyard.

There are in existence, based upon a number of the principal cities of the world, great-circle maps (sometimes termed azimuthal maps), enabling the true bearing of any place to be read off a circumferential scale of degrees. These maps, specially calculated and drawn, provide an unusual view of the world and are useful only when used in the areas on which they are based. A great-circle map based on London is quite useless in Cape Town, Hong Kong or elsewhere.

Formulae exist facilitating the calculation of direction and distance. The Fundamental or Cosine Formula is straightforward enough but possesses an inherent disadvantage for logarithmic calculation because the cosine of any angle between 90 and 180 is negative, and if a large number of distances and directions are to be calculated the task becomes onerous. Logarithms, on the other hand, speed and simplify calculation, rendering error less likely.

Haversine Formula

A more convenient formula used by ocean navigators is the Haversine Formula in which the Fundamental is expressed in haversines or half versine. And since the versine of any angle (A) $= 1 - \cos A$ the haversine $= \dfrac{1 - \cos A}{2}$. As an example the cosine of, say, 110 (being between 90 and 180) is $-\cdot 3420$, thus negative. Now the haversines of $110 = \dfrac{1-(-\cdot 3420)}{2} = \dfrac{1+\cdot 3420}{2} = \cdot 6710$. The haversine, then, is always positive, a distinct advantage, avoiding the awkward negative characteristic.

But there is a snag! How many radio enthusiasts can nonchalantly reach up to their technical bookshelves and extract a set of Haversines? The "Seaman's Bible" (Norie's Nautical Tables), a sturdy volume of more than 700 pages, contains 104 pages of natural and logarithmic haversines. We can, of course, calculate haversines as most radio manuals contain trigonometrical tables, but the advantage is lost in the tedium. But it is possible that in the

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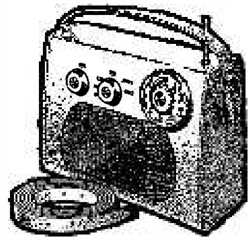

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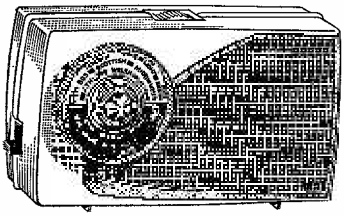

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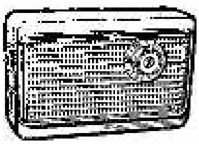

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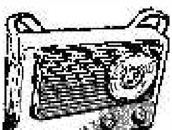

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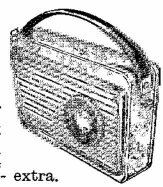

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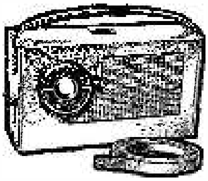

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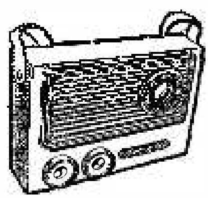

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larger cities reference libraries may be able to supply nautical tables including haversines.

There is, however, a comparatively simple solution to the problem of ascertaining great-circle bearings within a reasonable degree of accuracy, but distances must be calculated or measured on a globe. For very many years an ingenious graphical method of determining the azimuth of a celestial body has been available to ocean navigators; and a little juggling with the essential factors can quickly transform it into a handy means of finding great-circle bearings. Should one desire extreme accuracy then the only solution is to worry a little spherical trigonometry!

Graphical Method

Basically this graphical method comprises a diagram of hour-angle hyperbolas and latitude ellipses, with a semi-circular azimuth scale. Since the astronomical triangle of the celestial sphere is analogous to the spherical triangle of the terrestrial sphere, the hour-angle, zenith distance and azimuth in one can be taken as corresponding to the difference of longitude, great-circle distance and bearing in the other. Thus it is feasible to adapt the diagram for radio use.

In radio work it is fortunate that in order to transmit the maximum energy, or to receive the maximum signal from a given place, we need only find the initial direction. The navigator on the other hand requires to find not only the initial and final courses, but also a number of in-between courses since great-circles cross the meridians of longtitude at constantly changing angles, together with the vertex of the great-circle he proposes the ship should follow, ensuring that the highest latitude attained by the arc does not pass over land, ships displaying a

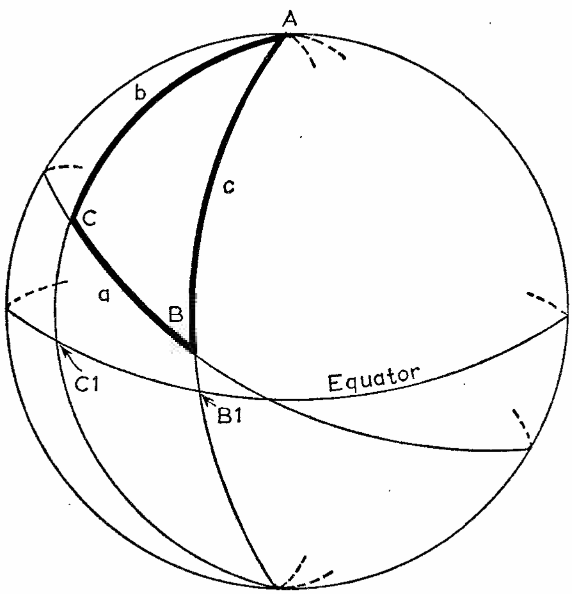


Fig. 1: Illustrating the arcs of three great-circles forming the spherical triangle, ABC. Where, A=Difference of longitude between B and C. B—B1=latitude of B. C—C1=latitude of C. c=Co—lat. of B (90—lat. B). b=Co—lat. of C (90—Lat. C). a=Great-circle distance. NOTE: If a latitude is in the opposite hemisphere, the co-lat. will be 90+Lat.

marked preference for deep water! But our radio signals, completely free are able to skip over sea and land, desert and mountain range, whilst following the shortest route.

The Cosine Formula

Cosine Formula for Distance: (Fig 1).

$\cos a = \cos b \cos c + \sin b \sin c \cos A$ 1

This then becomes:

$\cos a = \cos b\ (90 - \text{Lat B}) \cos c\ (90 - \text{Lat C}) + \sin b\ (90 - \text{Lat B})$
$\sin c\ (90 - \text{Lat C}) \cos A$ (Difference of longitude between B & C).

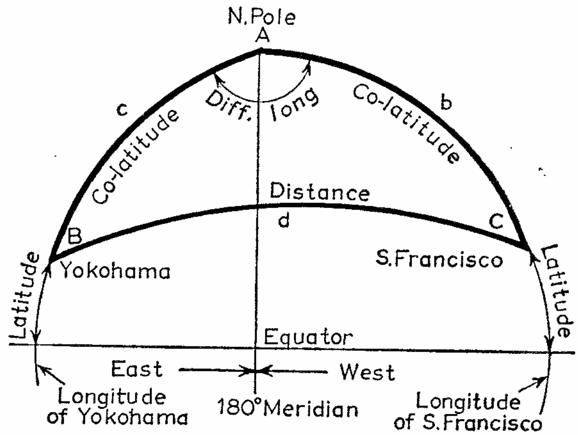


Fig. 2: Illustrating the Yokohama-San Francisco problem.

(At this point it might be well to state that where a latitude is located in the opposite hemisphere it will be (90+Lat). Longitudes on the opposite of the Prime Meridian are added together to find the difference of longitude, but when of like sign are subtracted. Where a great-circle crosses the 180th Meridian, with the places on opposite sides, the difference of longitude is the sum of the differences between the individual longitudes and 180°).

Now, since $\cos(90 - \text{Lat}) = \sin \text{Lat}$, and $\sin(90 - \text{Lat}) = \cos \text{Lat}$, we can simplify the Cosine Formula for places in the same hemisphere, re-writing it:

$\cos a = \sin(\text{Lat B}) \sin(\text{Lat C}) + \cos(\text{Lat B}) \cos(\text{Lat C}) \cos A$ 1a
= distance in nautical miles between B & C.

To find the bearing of B from C:—

$$\sin C = \frac{\sin(90 - \text{Lat B}) \sin A\ (\text{Diff. Long.})}{\sin a} \quad \ldots\ldots 2$$

But since dividing by sine a is the same as multiplying by cosecant a, the formula can be re-written:

$\sin C = \sin(90 - \text{Lat B}) \sin A \operatorname{cosec} a$ 2a

Or $\sin C = \cos(\text{Lat B}) \sin A \operatorname{cosec} a$ 2a

It will be obvious, of course, that to find the bearing of C from B merely calls for a slight re-arrangement of the factors in the formula.

Example

Find the great-circle distance from San Francisco (37° 49′ N., 122° 29′ W.) to Yokohama (35° 26′ N., 139° 39′ E.), and the bearing of Yokohama. Referring to Fig 2:

BAC = Difference of longitude between San Francisco and Yokohama.
BC = Great-circle distance.
ABC = Bearing of San Francisco from Yokohama.
ACB = Bearing of Yokohama from San Francisco.

TO FIND THE DISTANCE (Both places in the same hemisphere):
Using Formula 1a:

$$\begin{aligned}\cos a &= \sin 35^\circ 26' \sin 37^\circ 49' + \cos 35^\circ 26' \cos 37^\circ 49' \cos 97^\circ 52' \\ &= \cdot 5795 \times \cdot 6131 + \cdot 8153 \times \cdot 7904 \times -\cdot 1380 \\ &= \cdot 3553 + -\cdot 0889 \\ &= \cdot 2664 \\ &= 74^\circ 33' \\ &= 74^\circ 33' \times 60 = 4{,}473 \text{ nautical miles.}\end{aligned}$$

(To convert nautical miles to statute miles multiply by 1·152, although the land mile, purely an arbitrary unit introduced during the First Elizabethan Age, bears no relationship to the physical dimensions of the earth, whereas the nautical mile does).

TO FIND THE BEARING YOKOHAMA:
Using Formula 2b:

$$\begin{aligned}\sin C &= \cos 35^\circ 26' \sin 97^\circ 52' \operatorname{cosec} 74^\circ 33' \\ &= \cdot 8153 \times \cdot 9906 \times 1 \cdot 0374 \\ &= \cdot 8378 \\ &= 56^\circ 54' \text{ (N. } 57^\circ \text{ W., or } 303^\circ\text{).}\end{aligned}$$

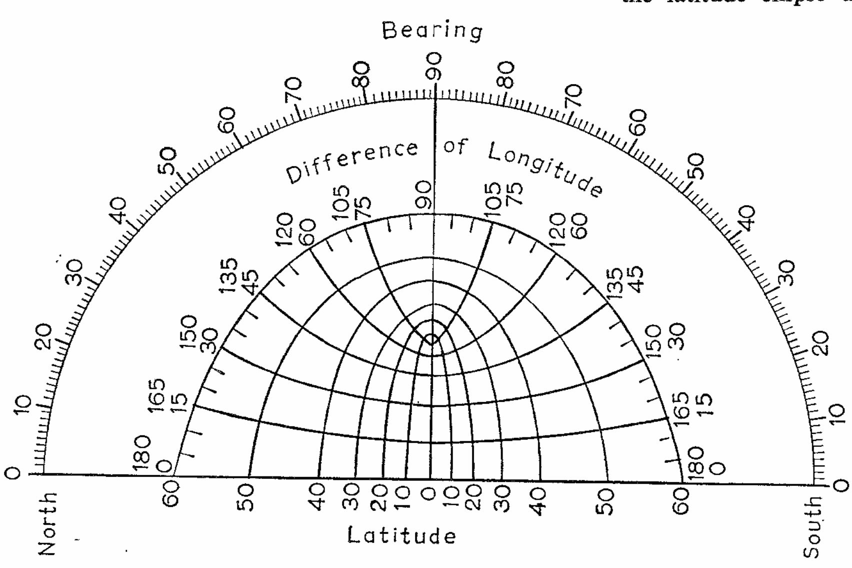


Fig. 3: Great-circle bearing graph. (Weir). The difference of longitude scale is marked in both directions.

From the formula and examples given it should be possible for any distance and direction on the earth's surface to be calculated without any great difficulty; and reference to a world map—or better still, a globe—will dispel any doubt as to whether a bearing is say, west of north or east of north. However, a word of warning!

World maps are often drawn on Mercator's projection, the meridians of longitude being parallel and the parallels of latitude "stretched out" towards the Poles, providing a completely distorted view. A line drawn from San Francisco to Yokohama on such a map will indicate the bearing of Yokohama as approximately S. 89° W., or 269°, whereas we already know from the results of our worked example that the bearing is N. 57° W., of 303°, a difference of no less than 34°.

A ship leaving San Francisco on a true course of S. 89° W. would reach Japanese waters, but the route would be considerably further than on the great-circle course. Yet a signal radiated by a directional aerial on the same bearing (S. 89° W.) would result in the maximum energy passing over the northern part of Australia, some 3,000 miles south of Japan, adhering to the inflexible rule that radio waves confine themselves to great-circle tracks.

Graphical Method

The diagram provides a graphical means of finding the azimuth of a celestial body. The mathematical analysis is rather complex and of no interest to us, but by varying the factors involved we are able to utilise the diagram for determining great-circle bearings of places on the earth. Fig. 3 illustrates the diagram in the form adapted for radio use. The rules are simple. To determine the bearing of a distant place or transmitter:

1. Reverse the names of the latitudes of the two places, marking them on the Latitude Scale.
2. From the latitude of the observer (the place from which the bearing is to be ascertained) follow the latitude ellipse until it intersects the hyperbola corresponding to the difference of longitude between the places.
3. Join the latitude of the distant place to the point of intersection.
4. Transfer this line (by means of parallel-rulers or set-squares) to the centre of the Latitude Scale (0°), extending it to cut the Bearing Scale.

A couple of examples should make the procedure quite clear.

What is the great-circle bearing of Yokohama from San Francisco? (Factors given in the worked example).

1. Mark off the latitudes of both places, reversing the signs. They will now be South.
2. Trace the San Francisco latitude ellipse until it cuts the difference of longitude 97° 52′—almost 98°).
3. Join the latitude of Yokohama to this spot.
4. Transfer the line to zero on the Latitude Scale, extending it to the bearing Scale, reading off the bearing as 57°.

Since the elevated pole in this example is that in the North, the bearing is measured from the North towards the West, thus N. 57° W., Yokohama being

—*continued on page 280*

A Contemporary Case

by E. V. KING

MANY amateurs build excellent transistor radios but often spoil them by obviously home made cases. The writer hopes to show readers a method of making very attractive cases which cost little in time and money. The method is not suitable for mains receivers which generate heat, but for small battery operated ones.

The example described in this article was designed specifically for a 5-transistor receiver but the idea can be adapted to suit individual requirements.

Materials to use

Although plastics such as Perspex and Formica may be used the writer considers that good planed softwood is best. Use $\frac{1}{2}$in. deal planed down (by the shop) to $\frac{3}{8}$in. The front and back panels may be thin plywood, but for ease of cutting, hardboard is difficult to beat. Later p.v.c. quilting will cover all the woodwork so great dexterity is not required.

Making the case

A rectangle is made up to the correct size (Fig. 1b) so that the receiver chassis will fit internally into it. The rectangle is carefully squared up and the back and front pieces of hardboard are then marked to size and cut out. Fixing holes are then drilled and the front and back temporarily fixed to the case with $\frac{1}{2}$in. round-headed japanned wood screws. The back is then removed.

Marking the control holes

A little dab of vaseline is placed on the longest control spindle and the chassis carefully placed in the cabinet until an oily mark has been made on the front panel. This hole ($\frac{3}{8}$in.) is then drilled out. The next longest spindle is then dealt with, and so on. In this way no measuring is required to get the holes in exactly the right place.

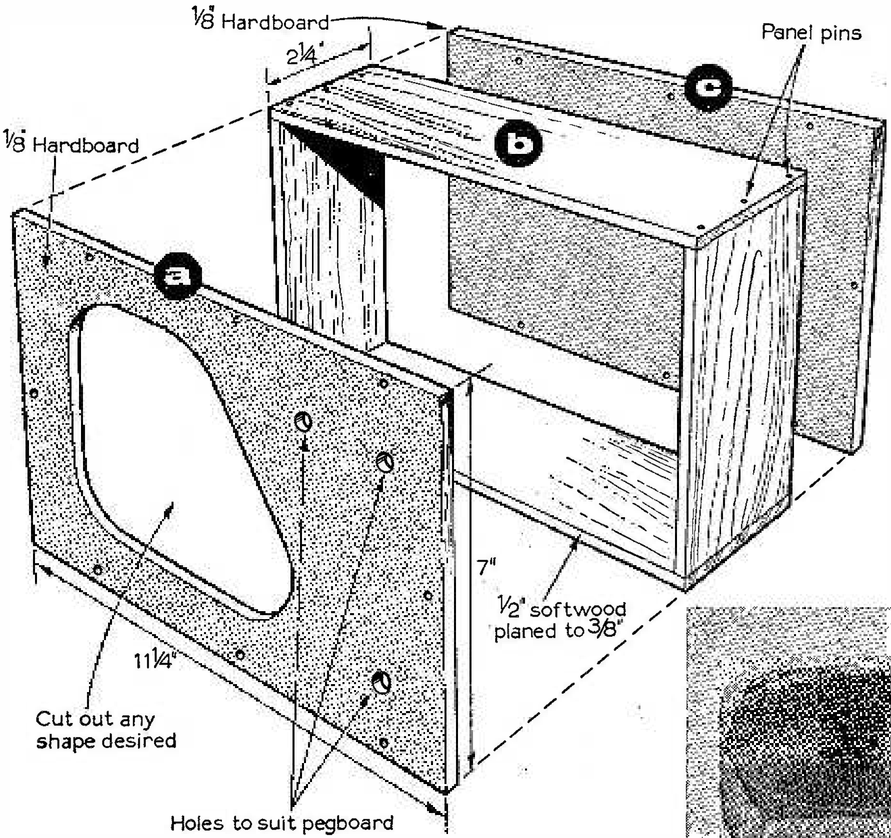
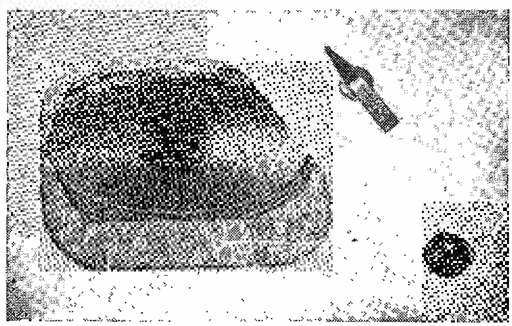


Fig. 1: Wooden framework details

a. The front with speaker cut-out
b. The main casing
c. The removable back

Fig. 2: The transistor receiver fitted into the front panel for testing fit.



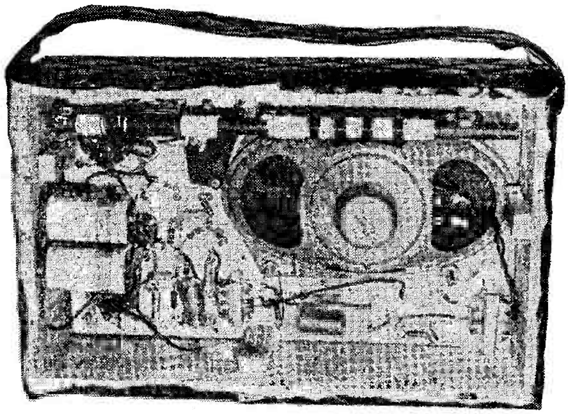


Fig. 3: The transistor receiver fitted into the cabinet. Note the Fablon quilting overlap round the edges.

The loudspeaker hole is then planned. In most cases any artistically designed hole may be cut in the panel as in Fig. 1a, so that when the receiver is placed in the case the appearance will be as in Fig. 2. Round holes are generally to be avoided as they make difficult the use of plastic quilting later. Small radii, such as in Fig. 1a, have some artistic merit, but square corners are easier to deal with.

The loudspeaker hole may be cut with a coping or fret saw, or may be chiselled very easily on a flat piece of waste wood. The receiver is now mounted in the cabinet and the back is put on to make sure everything is satisfactory. Leave the spindles long at this stage. Small wooden blocks screwed to the sides will hold the chassis in position (Fig. 3). Remove the receiver and *both front and back panels.*

Fablon quilting

The main consideration in making the cabinet quilting cover is that no joins must be visible. To

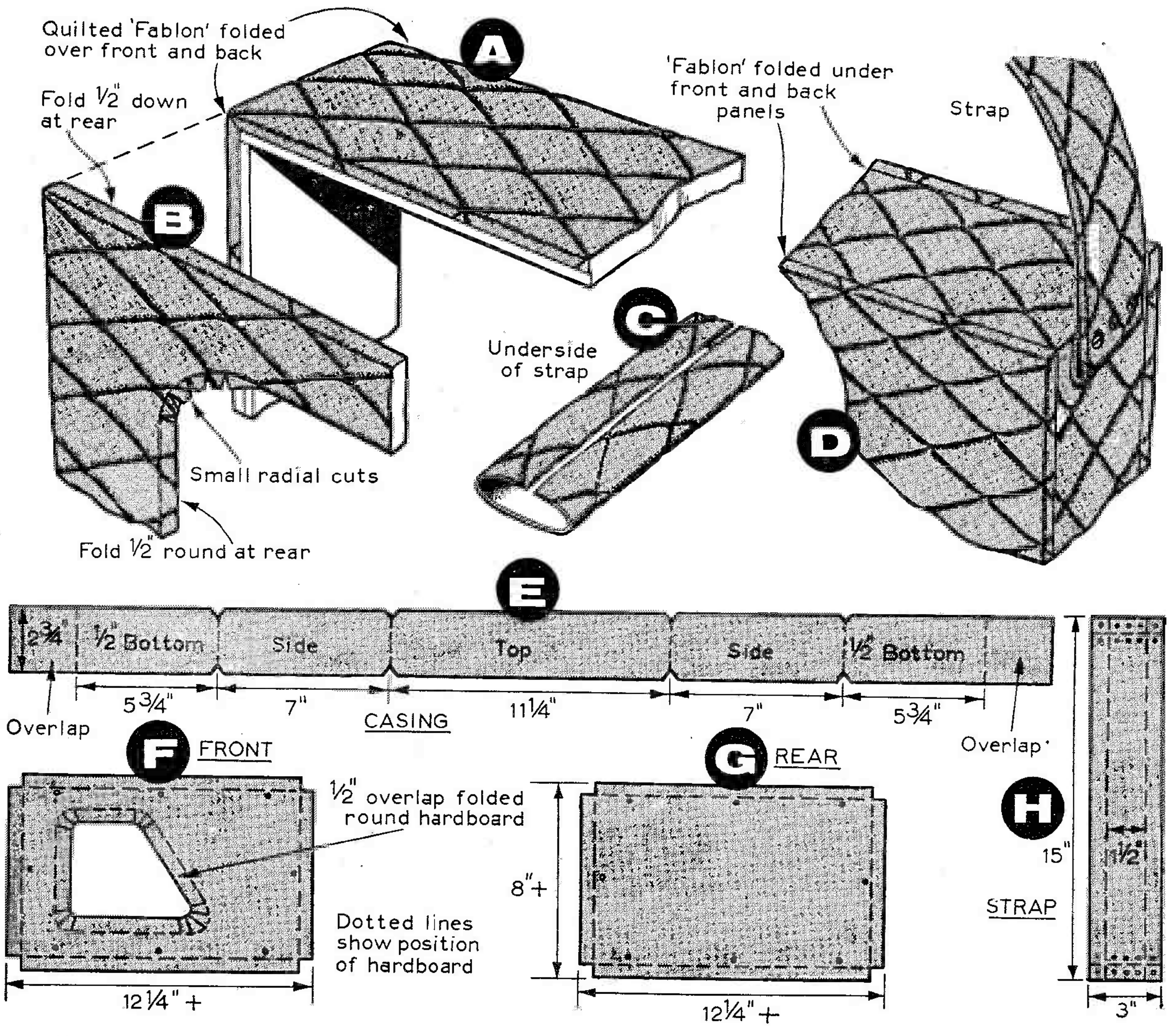


Fig. 4: Using the Fablon quilting.
A. How the main frame is covered.
B. How the front and speaker aperture is dealt with.
C. Making the carrying strap.
D. Fixing the strap.
E, F, G. and H. Dimensions of the Fablon quilting required for the cabinet.

overcome this difficulty and to make sure the Fablon does stay stuck down at the *edges* the writer has found it best to cover the three pieces separately. When screwed together, the effect is very pleasing, no joins are visible and the Fablon is tightly clamped in situ. Fablon is self-adhesive and needs no sticking medium.

Fig. 4E, F and G shows the pieces of Fablon quilting necessary, but it is easier to cut these to size on the actual pieces of wood rather than pre-measure them. The long piece that goes right round the cabinet is fixed on so that the join is underneath and overlaps. A razor blade then cuts through the overlap to give a perfect butt joint. The edges are bent down both sides as in Fig 4A, making sure that there is no double thickness of quilting at the corners.

The back and front are similarly covered, the speaker hole being the most difficult part. Fig. 4B shows how the Fablon is bent round the hardboard; small thin radial cuts are made where a curve is present. If black quilting is used, any slight visibility of white form is camouflaged with a touch of black enamel, and in fact becomes almost invisible.

The front panel is now fitted. Tygan is the most suitable speaker material and can be obtained from any radio dealer. It is sold in various designs and is strong enough to protect the speaker without any metal grille. The Tygan may be fitted with adhesive, or fixed with shortened drawing pins, or made big enough to cover the whole front panel so that it is clamped in place as the front is fixed to the case.

Make sure the Tygan is fixed so that the lines on it are in the desired direction and are straight. In the case of a speaker fixed separately to the front the speaker itself will usually clamp the material. For the example described, the writer takes the Tygan over the complete panel.

The front is now refitted on the case, the radio is inserted and fixed, and the spindles are carefully cut to the correct length to take the knobs required. Fig. 5 shows the completed cabinet made by the author.

The back is similarly covered and a plastics carrying handle is easily made from some of the same material as shown in Fig. 4C, D and H.

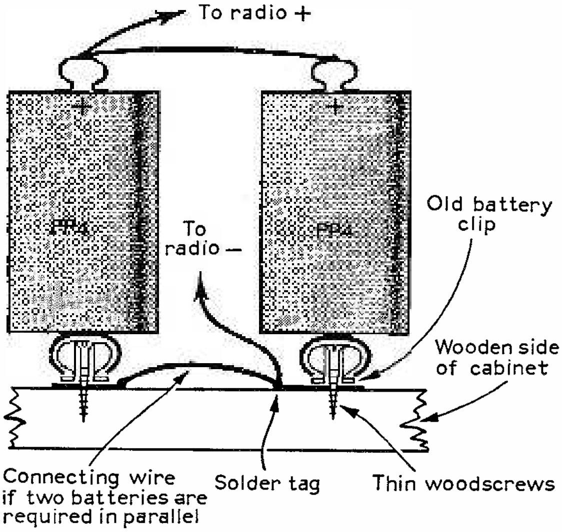


Fig. 6: Diagram showing how small light batteries such as the PP4 may be held in place by fixing the battery clips to the wooden casing. Two PP4's are shown in parallel.

Fixing batteries

Batteries may be fixed in large Terry clips, or the battery connectors may be fixed to the wood with small wood screws so that the battery simply clips in place (Fig. 6). Otherwise rubber bands, or separate wooden compartments may be constructed.

The only places on the cabinet thus constructed where any join may show is for $\frac{1}{8}$in. at the corner of each piece of hardboard. This can be obviated by fitting metal corner covers, but if the visible white foam is carefully painted it will be quite invisible in ordinary use. Scores of cabinets have been made in this manner and have proved entirely reliable, even outdoors in wet weather. ■

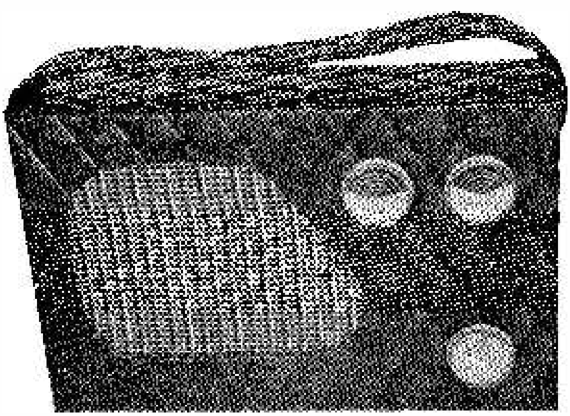


Fig. 5: A completed cabinet made by the incorporation of the ideas given in the article.

PARTS REQUIRED

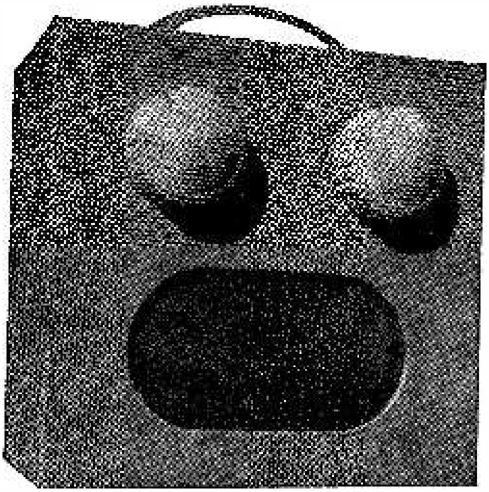
3ft. 6in. x $2\frac{1}{4}$in. x $\frac{1}{2}$in. in planed deal.

$2\frac{1}{2}$ sq. ft. ordinary $\frac{1}{8}$in. hardboard.

$\frac{1}{2}$ sq. yd. Tygan speaker material.

1 yd. Fablon quilting (ironmongers and decorating shops).

Panel pins, touching-up paint, round-headed, thin wood screws.



F.G. RAYER G3OGR

Light Programme can easily be obtained by adding a parallel capacitor and switch, described later.

Components

The components listed are those recommended, but in some cases items to hand may be used. Notes on fitting alternative transistors and other parts are given later. Many other transistors are satisfactory, particularly in the audio and output stages, but it is important to remember that if alternative transistors are fitted it will often be necessary to change some resistor values as well. This is essential in the output stage, where R6 and R7 are chosen to suit the transistors.

Panel

This measures 5½in. x 6in. cut from 1/16th in. thick paxolin, with an opening the same diameter as the speaker cone. Holes for the resistor leads and other wires are made with a 1/16th in. drill. It is is advisable to drill as many holes as possible before mounting any parts.

beginners

A t.r.f. receiver of the type described here can normally give good loudspeaker reception of quite a number of stations, and all the difficulties of superhet alignment and ganging are avoided. If each stage is tested as described, when wired, no difficulty should be encountered. If a wiring or other fault is made, only a portion of the receiver will have to be examined.

Construction is very easy. All components are on one side of an insulated panel, and most of the wiring is on the other side. Here, matters are so arranged that no leads cross, so connecting up should be particularly straightforward.

The circuit (Fig. 1) uses Tr1 as r.f. and a.f. amplifier, in a reflex arrangement which is capable of very good results. Regeneration and gain are controlled by VR1. The ferrite rod aerial tunes medium waves. Reception of the 1500m. long wave

The speaker is mounted with 6BA bolts. Screw holes for the aerial supports will also be required. VC1 is shown as 300pF, but may be anything from 208pF to 350pF or so, preferably of the air-spaced variety. The capacitor may be fitted with a lock-nut, or by short 4BA bolts, according to type. If bolts are used, see they do not penetrate so far as to short circuit the capacitor or bend its plates.

T1 is the driver transformer, coloured leads emerging as in Fig. 3 for the component listed. If a different transformer is used, the tag or lead connections must be as specified for it. T2 is the output transformer, for use with a 2-3Ω speaker.

Ferrite Aerial

This uses a 6in. x ⅜in. diameter rod, the winding being 26 s.w.g. enamelled wire, turns side by side. Two wooden supports are cut to the shape in Fig. 4,

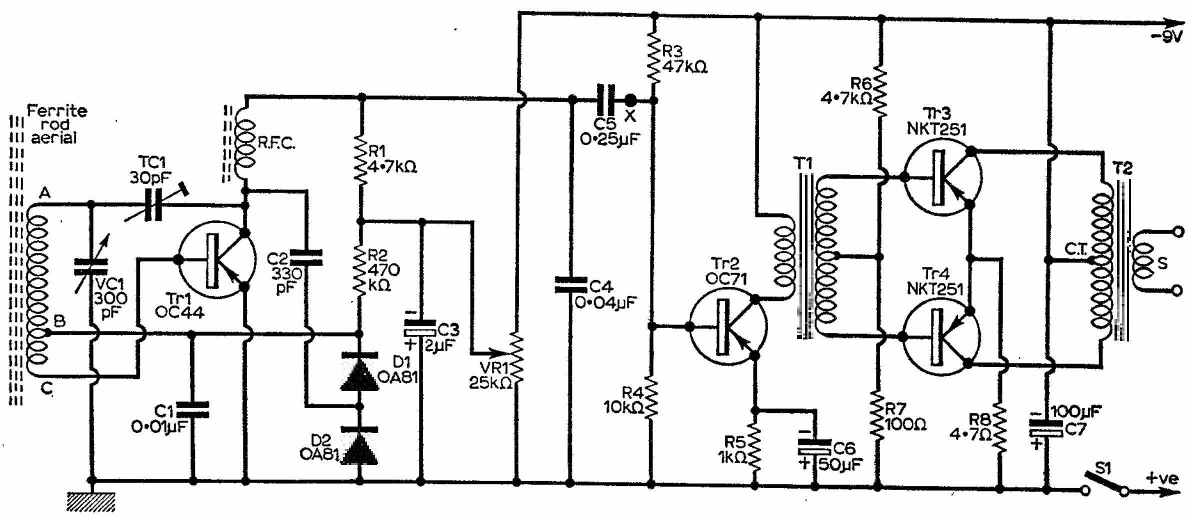


Fig. 1: Complete circuit of the TRF4 receiver.

with screws holding them to the panel. Place a layer of paper on the rod, and fix the wire at A with tape or adhesive. Wind on 76 turns, and make a small loop B. Then continue winding in the same direction for a further 11 turns, and fix the wire at C.

Other rods and wires can be equally satisfactory, though a small rod is likely to give slightly less volume. If no means of checking band coverage is available, the simplest method is to adjust the number of turns until a station around 200 metres (say Radio Luxembourg, 208m) is tuned in with VC1 nearly fully open. Coverage can also be adjusted by sliding the whole winding along the rod.

The tag in Fig. 3 is in contact with the tuning capacitor frame, and forms the moving plates connection. VC1 fixed plates go to TC1 and A on the aerial, Fig. 2.

Wiring

Components are inserted in the position in Fig. 2. Spread the wire ends of resistors and capacitors so

TRF4

that parts do not fall out when the panel is turned over. After soldering, snip off excess wire. All connections on the front of the panel are shown in Fig. 3.

To avoid any difficulty with identifying transistor leads, cut 1in. pieces of 1mm. red, blue and yellow sleeving, placing red over each collector wire, blue over each base wire, and yellow over the emitter leads. There is no need to cut the transistor leads short, so no damage should arise with normal soldering, providing the iron is removed as soon as joints are made.

Note positive and negative ends of the diodes. Each wire can be made into a small loop before passing through the panel, so that the heat of soldering does not easily reach the diode itself.

First Stage

It is easy to test each stage as it is wired. Tr1 operating alone should give good headphone volume. Connect medium or high impedance phones from X on C5 (Fig. 1) to earth line. Unscrew TC1 fully. Connect a $4\frac{1}{2}$V, 6V or similar battery, positive to earth line (via switch).

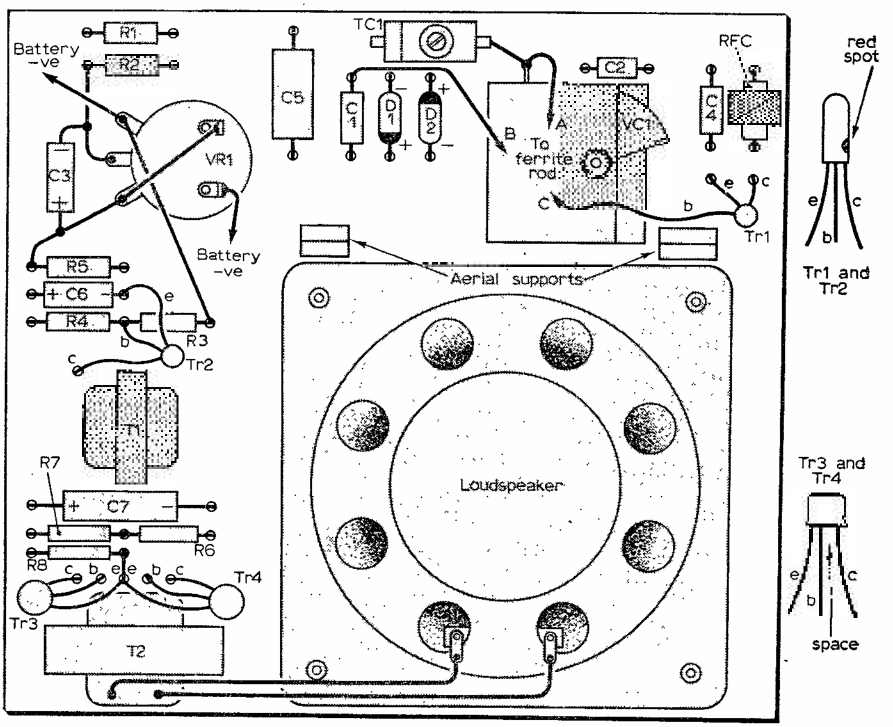
When VR1 is turned up about one-quarter to one-half way, some stations should be tuned in by rotating VC1. Note that VR1 does not have to be turned the whole way, as this does not give maximum volume. Adjust VR1 for best volume, then slowly screw down TC1 until oscillation just begins. Oscillation should cease when VR1 is turned back slightly, and sensitivity should be high.

At this stage, tuning coverage can be adjusted as already described, if necessary. C3 may be anything from about $0{\cdot}25\mu$F to 8μF. Capacitors larger than about 8μF give an unpleasant delayed effect on the control of regeneration.

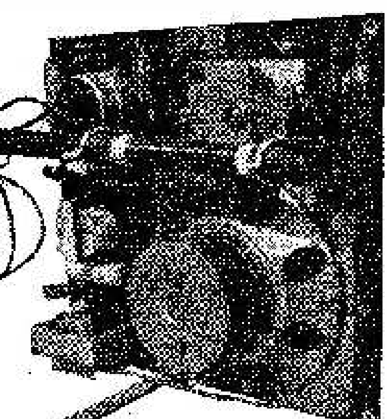
Many good quality r.f. transistors with a cut-off frequency of several megacycles will function well in the Tr1 position. Other diodes than the OA81 have also proved suitable. However, the base voltage of Tr1 depends on the transistor, diodes, and R2. Therefore with a different transistor and diodes, it may be necessary to change R2. The best value will generally lie between about 82kΩ and 680kΩ.

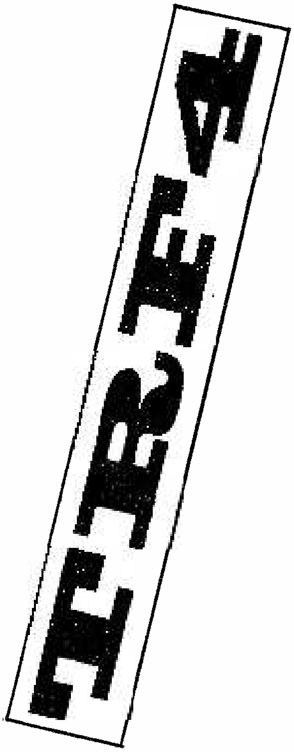
Lack of sensitivity and overloading causing audio distortion shows R2 is too high in value. Violent regeneration and a high background noise indicates that R2 is too low in value. Two or three resistors

Fig. 2: Back-of-panel view showing layout of components.



The completely assembled receiver out of the cabinet.





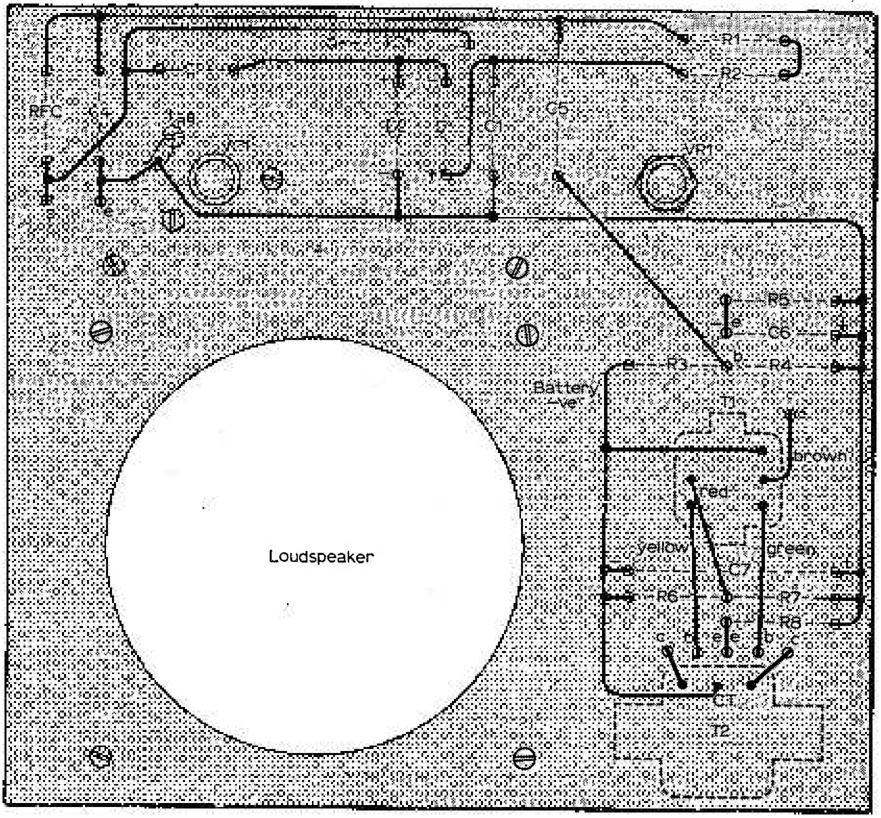


Fig. 3: Front of the paxolin panel showing connections.

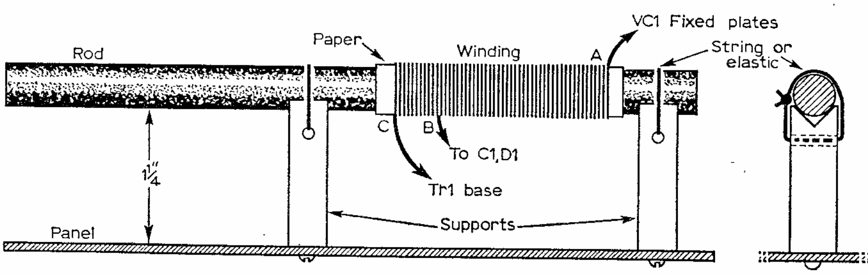


Fig. 4: Details of the ferrite rod aerial assembly and method of mounting.

of about 100kΩ 220Ω, and 470kΩ can easily be tried, singly and in series or parallel.

Second Stage

This is the audio amplifier and driver Tr2. The values given suit most other similar transistors. If the phones are connected across the primary of T1, signals should be much stronger, and free from distortion.

If results are now poor, R3 and R4 should be checked, and also Tr2, if suspected. As reputable transistors are inexpensive, there is little point in using very cheap surplus ones of doubtful merit.

Output Stage

R6 and R7 must be correct for Tr3 and Tr4. For OC81's, change R7 to 82Ω. Alternatively, use 2·2kΩ for R6 and 33Ω for R7.

The resistors R6 and R7 should be 5 per cent tolerance. To check operation with unknown transistors or normal 10 per cent resistors insert a milliammeter in the battery circuit. Distortion (often sounding like a faulty speaker) and a low current with no signal tuned in shows that R7 is slightly too low in value, or R6 a little too high.

On the other hand, lack of amplification, and a high current with no signal, shows that R6 is too low in value, and R7 is too high. The current of Tr3 and Tr4 combined should normally be around 3mA to 5mA, with no signal, rising to peaks of 15mA to 40mA or more, as volume is increased

Changes made to R6 or R7 should be small. On no account switch on with R7 disconnected. You can use a new matched pair of transistors with the 5 per-cent resistors required for them, or a small pre-set resistor may be used for R6 or R7, and adjusted for proper working. Alternatively, find the value by using an ordinary potentiometer, then select a fixed resistor of the same resistance. Or shunt a resistor whose value is to be lowered by a second resistor. In all cases guard against making the base voltage very negative, as this may cause a destructive current.

In general, a midget output transformer and speaker will not give quite such good results as a somewhat larger transformer and speaker.

Cabinet, etc.

TC1 must not be screwed down very far, for if oscillation begins with VR1 nearly at zero (slider at positive end) volume will be poor. With a solid dielectric capacitor at VC1 oscillation may not be sustained towards the high wavelength end of the band.

It was found that the long wave Light Programme was well received by shunting extra capacitance across VC1. About 1,500pF is required, depending on the position of the winding on the rod.

If the capacitor is fixed, slide the winding along the rod to tune to 1500m. This should have little important effect on medium wave coverage. Alternatively, use a 500pF or larger pre-set, with a 1,200pF or similar fixed capacitor in parallel, and adjust the pre-set capacitor for 1500m.

The receiver can be operated from a 6V, 7½V or 9V battery.

The author's simple cabinet is shown in the photograph. The receiver is held by screws inserted from behind. The pieces are coated with adhesive, and fixed together with small panel pins. When the adhesive is dry, glasspaper the cabinet thoroughly. It can then be finished with varnish, coloured paint to choice, or one of the self-sticking covering materials.

Stretch a piece of silk over the speaker opening inside, and glue it. A plastic drawer type handle may be screwed to the top. The back can be hinged at the bottom and have a top clip, or may be held with four small screws. ■

★ components list

Resistors:

R1	4·7kΩ	R5	1kΩ
R2	470kΩ	R6	4·7kΩ 5%
R3	47kΩ	R7	100Ω 5%
R4	10kΩ	R8	4·7Ω

All fixed resistors ¼W, 10% except where otherwise stated.

VR1 25kΩ potentiometer with switch.

Capacitors:

C1	0·01μF 150V	C5	0·25μF 150V
C2	330pF 150V	C6	50μF 6V
C3	2μF 12V	C7	100μF 12V
C4	0·04μF 150V		
VC1	208pF to 350pF variable		
TC1	30pF trimmer		

Transistors and Diodes:

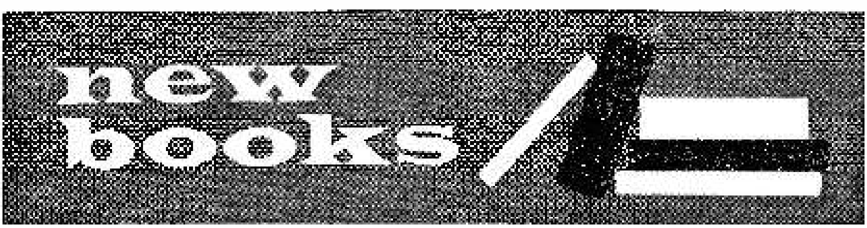
Tr1	OC44	D1	OA81
Tr2	OC71	D2	OA81
Tr3/4	NKT251 matched pair		

Transformers:

T1	Osmor QXD1	T2	Osmor QX02

Other parts:

Ferrite rod, 6 x ⅜" diameter.
3-ohm, 3" diameter loudspeaker.
Paxolin sheet, 6 x 5½ x 1/16".
Battery clips, 26s.w.g. enamelled wire, connecting wire, 1mm. sleeving, two 2" diameter control knobs.



ELECTRIC GUITAR AMPLIFIER HANDBOOK
By Jack Darr. Published by W. Foulsham & Co., Ltd., Slough, Bucks. 144 pages. Size 8½in. x 5½in. Price 24s.

It is rather difficult to see who would benefit by paying 24s. for this book. For the novice who plays a guitar it is perhaps rather technical. For the service engineer it is doubtful if very much would be of interest. Apparently the book has been written to *"dispel any qualms the service man may have about entering a strange field"*.

Your reviewer is unaware of the standard of servicemen in the U.S.A. (from whence this book originated). However to seriously suggest that this be offered as a handbook to service engineers in this country is laughable if not actually insulting. To be told that low-frequency oscillation in a.f. amplifiers is called motor-boating would scarcely bring a gasp of astonishment even from the most junior apprentice who makes the tea!

The book is liberally sprinkled with such sparkling examples as being instructed to turn the amplifier upside down to get at the bottom. For the uninitiated—see this one before you buy. For the service man—stick to reading *Punch.—DLG.*

MICROWAVE PRIMER
By Albert Camps and Joseph A. Markum. Published by W Foulsham & Co., Ltd., Slough, Bucks. 192 pages. Size 8½in. x 5½in. Price 30s.

For those readers who have a knowledge of radio and/or electronics but who fight shy of those mysterious and strange happenings high up in the microwaves then this book offers a chance to peep over the fence and find out, quite painlessly, just what is on the other side.

Although split into only four chapters the division is very effective in grouping together all the relevant facts in a particular section. Transmission lines, r.f. components and Measurement Techniques are very fully covered, while the first chapter affords an introduction to microwaves. Particularly useful is the thorough treatment given to Smith Chart techniques.

One annoying thing which for your reviewer nagged throughout the entire book and that was the question and answer technique used all the way through. Had the questions all been taken out the amount of useful information could have been doubled. Most students can supply their own questions without the help of text!—*LSA.*

Sell or Loans

. . . the circuit, instructions and any other information on the Bendix TA-12C transmitter.—R. C. Beckett, 275, Goldington Road, Bedford.

. . . any information whatsoever on receiver No. 18 Mark 3.—J. Myers, 4, Pollard Street, Middlesbrough, Yorks.

. . . any information on the Army receiver R109A and modern equivalents of the valves AR8 and AR12. — P. Chatham, 58, Longrood Road, Bitton, Rugby, Warwickshire.

. . . the issue of Practical Wireless which contains the instructions for building an Echo Unit. I have almost completely built this unit, but the book was accidentally burned. — T. J. Harrigan, "Holly Villa," 49, Trench Road, Trench, Near Wellington, Salop.

. . . the circuit diagram and any other information on the v.h.f. transceiver P/SU type RLP2; Tx RLS 4.1; Rx RLS 4.3. The separate numbering on each is unfortunately necessary as overall the unit is not named and it is in three separate chassis as assembled. It is made by A. T. and E. Bridgnorth. — James Whitaker, Suetts Farm, Bishops Waltham, Hampshire.

. . . a circuit diagram and any information on Ex-Government receiver R3673 Ref. No. 100/16876.—D Mines, 41, Sandringham Road, Bitterne Farm,

. . . a technical information manual concerning three 8-transistor superhet model KT-1000 made by the Kobe Kogyo Radio Corp.—P. D. Winder, Elizabeth College, The Grange, St. Peter Port, Guernsey, Channel Islands.

. . . the official handbook for the Ex-Army No. 12 set transmitter.—B. King, 17 Windermere Ave., Eastcote, Ruislip, Middlesex.

Transistors Fight Back!

With reference to Mr. Biddlecombe's letter in the May issue, I would suggest that he makes certain of his facts before making sweeping statements ". . . the transistor is an inferior substitute for a valve as far as the matter of music reproduction is concerned".

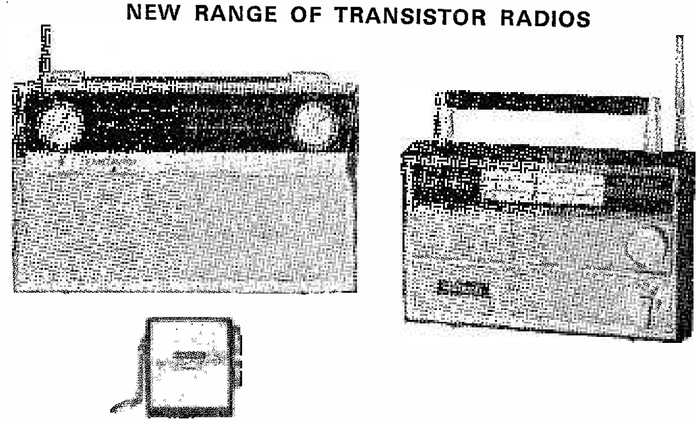
He obviously has never listened to a high quality transistor amplifier. It can produce results of equal quality to many valve amplifiers I have heard, with, if anything a slightly lower noise level. Added to this is the fact that one does not have to wait for the valves to warm up and there is very little heat rise and greater reliability (estimated at 500 per cent).

R. C. Bean.

London, N.W.10.

NEWS AND..

NEW RANGE OF TRANSISTOR RADIOS



E. R. (Factors) Ltd., of 374-378 Harrow Road, London, W.9, announce the introduction of three new models, the "Fantavox" range. These sets are manufactured in Japan by Novel Dempa Co. Ltd.

Model TA-8009 (lower left) is an 8 transistor receiver covering medium waves and costing 5 guineas. Size: 2$\frac{5}{16}$in. x 2$\frac{3}{4}$in. x $\frac{7}{8}$in.

Model TM-1213 (left) is a 12 transistor four waveband a.m./f.m./s.w./l.w. receiver costing 21$\frac{1}{2}$ guineas and measuring 6$\frac{1}{4}$in. x 9$\frac{1}{2}$in. x 3$\frac{1}{2}$in.

Model TM-1015 (right) is a 10 transistor three-band a.m./f.m./l.w. receiver costing 15 guineas and measuring 6$\frac{1}{4}$in. x 7$\frac{1}{2}$in. x 2$\frac{7}{8}$in. Further details on any of these models may be obtained from E.R. (Factors) Ltd., address as above.

MODULAR COMMUNICATIONS RECEIVER

Racal introduce a new modular and flexible communications system based upon their RA.217 h.f. Communications Receiver.

The basic RA.217 is a fully transistorised receiver covering a frequency range of 1 to 30Mc/s, with continuous tuning, using the well-tried Wadley loop principle. It is designed for the reception of SSB, AM, and CW signals, and suitable IF bandwidths and AVC constants are provided for all modes of reception. The receiver may be operated from AC mains or batteries.

New modules of the system allow the basic RA.217 to be adapted or extended into a fully flexible modular communications receiving system which can also receive ISB, FSK and LF signals and can operate either in a single or dual-diversity role. A panoramic adaptor is available together with units for synthesizer control, and extended or remote control.

...COMMENT

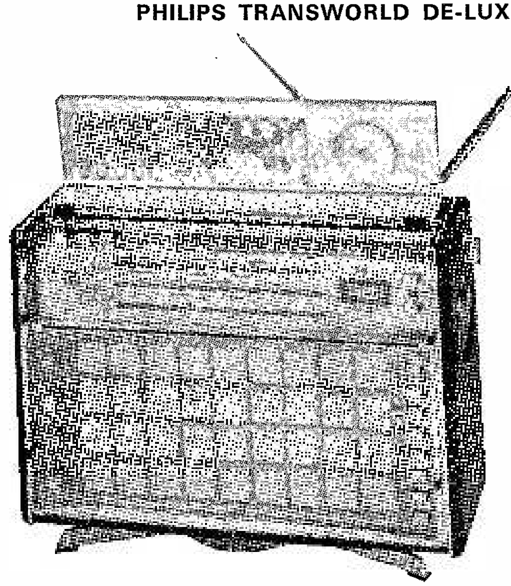
MORE POLICE RADAR TRAPS

Thirty-five more Marconi speed-measuring radar sets have been ordered by the Home Office. This will bring the total number of sets available to the British Police Forces for setting-up speed traps to 200. The basic accuracy of this speed measuring equipment is better than $\pm$ 2% over the entire operating range which extends from zero to 80 m.p.h. This is considerably better than the normal speedometer which has an accuracy of —0%, +10%. Speedometers fitted to police vehicles for checking the speed of other vehicles have accuracies of —5%, +0%.

Most magistrates accept evidence based upon figures derived from these electronic devices, which are extremely accurate so long as they are correctly set-up and correctly operated.

The official line (Marconi) on this gear is "to provide an accurate and safe method of measuring traffic speeds, in an effort to reduce the accident rate due to speeding on busy roads."

PHILIPS TRANSWORLD DE-LUXE



The ultimate in radio luxury is provided by Philips with the Transworld de Luxe Portable radio, model 638T. It features long, medium and v.h.f. wavebands together with four short wavebands. When the top flap opens to reveal the tuning scale the lid shows a map of the world divided into sections for calculating the time in each area. Twin telescopic aerials serve for f.m. and s.w. reception. Price is 100 gns.

ELECTRONICS ADVISORY COMMITTEE

A Technical Advisory Committee on electronics has been set up by the Ministry of Technology under the Chairmanship of I. Maddock, a deputy controller in the Ministry.

The Committee's terms of reference are: to identify within the field of electronics both research and development projects relating to systems, equipments, components and production technologies, the exploitation of which is important industrially and commercially. Also to identify areas where effort and available facilities in relation to these projects are considered to be too fragmented or on too small a scale. The Committee will, of course, make recommendations to Ministry of Technology and review progress on electronics projects in the Department's authorised programme.

The following have been elected Committee members: R. J. Clayton, G.E.C. Electronics; P. D. Hall, International Computers & Tabulators; D. S. Ridler, Standard Telephones & Cables; P. E. Trier, Mullard; A. J. Young, English Electric Valve; Dr. G. G. MacFarlane, Royal Radar Establishment; W. Makinson, National Research Development Corporation; J. H. Merriman, General Post Office; J. R. Mills, Ministry of Technology; Dr. W. H. Penley, Ministry of Aviation; A. W. Ross, Ministry of Defence (Naval); Mrs A. W. Swaffield, Ministry of Technology; and Dr. J. R. M. Granville, Royal Radar Establishment, who has been appointed secretary.

Circuit Boards

IT was good to have an authoritative statement from L. Allen of Arborite Ltd.

I've been using off-cuts of this stuff for quite a few years . . . for two reasons; one, as I happen to have a relative who is the Managing Director of the firm importing Arborite; two, it seemed to me to be just as good as the usual Paxolin.

Both, however, suffer from one slightly annoying feature; they cannot be conveniently cut with metal shears, and I must confess that I love using metal shears. In this heat, the amount of energy expended on cutting and shaping is quite an important factor in the hobby, and shears get me less hotted up than a fret saw.

There is one other type of chassis that might interest readers, and one that I am tending to use more and more. It is vinyl floor tiling off-cuts. The delightful thing about this is its flexibility in one plane and its rigidity in the other. Thus a neat little superhet strip plus audio can be bent around the corners of some old fancy cabinet, and all the space used.

I realise that "building round bends" is going to get me dubbed the "obvious", but we all have our particular brand of bends; the diver, the high flier, and the man who constructs a radio in a plastic sphere representing the World.

H. Wagner.

Kuala Lumpur,
Malaya.

Transistors Fight Back!

SURELY Mr. Biddlecombe must be joking, when he calls transistors inferior!

Mind you, he spoils his case a bit, when he uses a pre-war 8 in. speaker as a source of "Hi-Fi".

I have been making, assembling and modifying radio gear for over 35 years, but I haven't touched any new *valve* apparatus for two years—so convinced am I that they are now back numbers! (Except for high-voltage applications, like TV).

Transistors hiss? Only if badly designed—or chosen. After all, you wouldn't use a 6L6 in a preamp!

Yet that is the kind of thing that I have seen done in "hissy" transistorised amplifiers.

It will shock Mr. B. to hear that I use transistors *because* they are so noise-free! (My latest being a 20dB TV u.h.f. booster.)

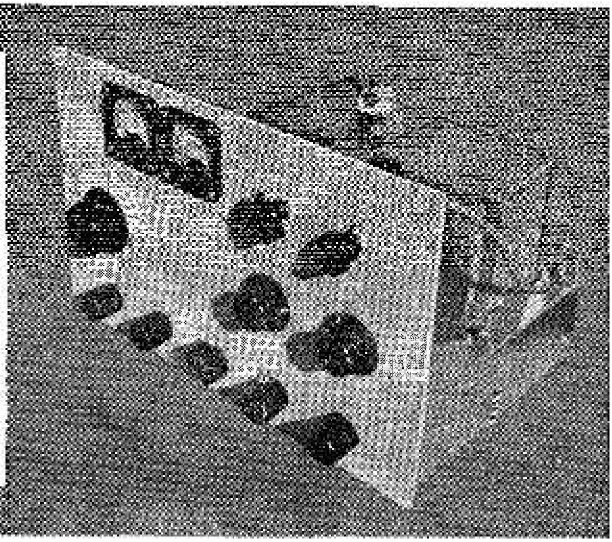
In my categorical opinion, a well-designed (note!) bit of transistor apparatus is always superior to its valve equivalent in reliability, stability, coolness of running and quality of reproduction, even when using the best of modern speakers on f.m./v.h.f.

R. G. Young.

Peacehaven,
Sussex.

THE 'IMPERIAL' 3-band transmitter

F.G. RAYER G3OGR



Part III

KEYING THE TRANSMITTER

The usual methods of keying a transmitter for c.w. (continuous wave) operation are perfectly satisfactory for the Imperial. The first to be described is extremely simple and requires few additional components. In fact, it involves disconnecting the cathode and beam plate connections (pins 1, 4 and 6) to the power amplifier and keying its cathode. It is then necessary to insert a 2000pF disc ceramic capacitor between each of the three valve pins and chassis, keeping the leads as short as possible.

One must also disconnect the h.t. to the screen grids in the modulator and isolate the modulation transformer by shorting the primary winding. It is also advisable to put a 47kΩ resistor across the key in the cathode circuit of the power amplifier.

All of these alterations (not including the 2000pF de-coupling capacitors) should be done through a ganged switch, being careful to keep the h.t. switching away from the cathode switching. The illustration Fig. 8 shows the actual connections.

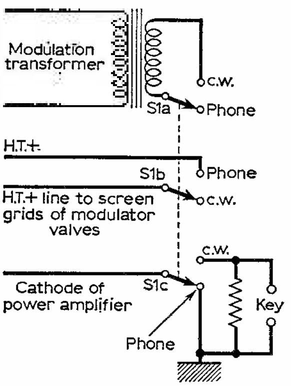


Fig. 8: Switch connections for the simple c.w. modification.

Should one wish to avoid keying the final power amplifier, an alternative method is illustrated in Fig. 9, using a clamp valve 6AQ5. In the original layout a hole was shown for this valve between the tank circuit and the modulator transformer.

The grid circuit of the power amplifier has to be altered so that bias obtained from grid rectification can be applied to the clamp valve 6AQ5. A similar switching arrangement to that of the simpler keying circuit, described earlier, is employed in this circuit. The main difference being that the key is in the cathode circuit of the driver and not in the final p.a. No alternations have to be made to the anode or cathode circuits of the final p.a. A cathode de-coupling capacitor does, however, have to be included in the driver 6CH6.

The three-pole, two-way c.w./phone can be mounted on the rear chassis runner.

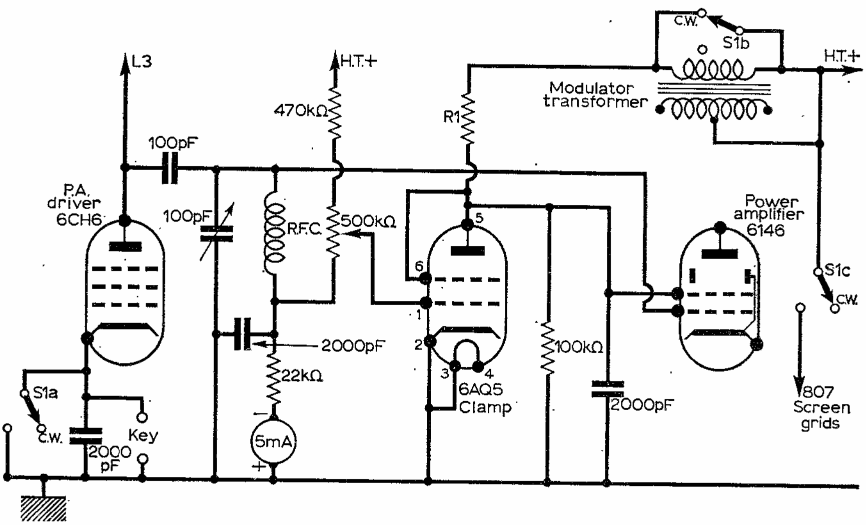


Fig. 9: Circuit showing the clamp valve 6AQ5 connections. Only the basic outlines are included of the driver and the final power amplifier stages.

When grid drive is available from the p.a. driver, bias developed across the 22kΩ resistor almost wholly cuts off the anode current of the clamp valve. No bias is developed when the key is open. This permits the clamp valve to conduct heavily which, in turn, reduces the screen grid voltage and the anode current of the final p.a. and thus kills the r.f. output.

The anode load of the clamp valve (R1) may have to be modified to suit the h.t. voltage; 40kΩ is suggested as a starting point. Before setting-up the 500kΩ potentiometer in the grid circuit of the clamp valve, adjust the slider arm for minimum voltage on the grid. Then tune up the transmitter; with about 2 to 2½mA grid current and 80mA anode current. Now adjust the potentiometer until the anode current on the final p.a. just begins to fall.

With the key open, the screen grid potential of the final p.a. should fall to about 25V and the anode current to about 40mA. Using a 400V supply, this represents an anode input of 16 watts, which is well within the anode dissipation rating of 20 watts. Resistor R1 can be reduced to raise the input with drive, if wanted.

The clamp value is left permanently in circuit, and has no effect on phone working, except to keep the p.a. anode current down if grid drive ceases through a fault. If the maximum possible c.w. output is wanted, fixed bias can be obtained from a battery or a small power supply connected to the positive side of the 5mA meter. The voltage is not critical (between 20 and 60 volts), but the 500kΩ clamp control potentiometer should be adjusted as previously described. The effect of fixed bias reduces the p.a. anode current under no drive conditions.

H.F. BANDSPREAD

As only part of the 3.5 to 3.8Mc/s v.f.o. range is used when operating in the 7 and 14Mc/s bands, it is possible to bandspread. A method found to be very successful with the author is shown in Fig. 10. A twin-gang tuning capacitor having a value of

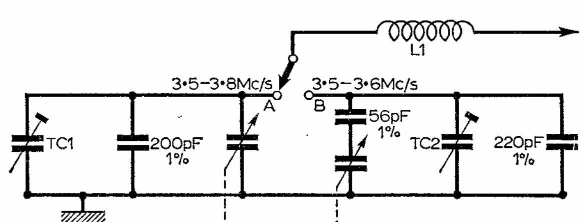


Fig. 10: The bandspread tuning modification for the 7 and 14 Mc/s bands.

about 80pF per section and trimmers with about 50pF are perfectly satisfactory. All the capacitors should, however, have a fairly high stability.

The adjustment procedure is quite straightforward. Adjust range A and B for correct coverage using the trimmers and then switch to the 20 metre band and calibrate range B at 0·1Mc/s intervals with a 100kc/s crystal marker or other generator which may be at hand. Now the v.f.o. range 14 to 15·2Mc/s covers 14·0 to 14·4Mc/s.

The additional components for this modification can be mounted in the v.f.o. box. ■

practically wireless commentary by HENRY

No 24

Spare a Thought

WE are no longer a nation of shopkeepers: merely suppliers and demanders, says a pundit. As far as the marketing of wireless spares goes Henry would amend that to "non-suppliers and pleaders".

We enter the nearest radio shop and an immaculately attired gent appears. He receives our request with a lifted eyebrow and disappears in the back premises. In no time at all he returns to shake his head sadly, regretting that supplies of spares are restricted to their own agency models.

With lifted eyebrows

Recognising the brush-off technique, we toddle along to a branch of one of our better-known multiples, even more resplendent than the last emporium—and even less likely to bother with our one-and-ninepenny item.

* * *

There was a heartrending letter in a trade journal recently asking why the "multiples" should be regarded in such a bad light. The writer worked in the usual crack about the "*man in a dirty coat in a little room above every store*" and the dead flies in the independent dealer's window.

We could have told him one reason why the multiples have a bad image—so seldom is there anyone on the premises that knows anything about the technicalities of the equipment they are trying so hard to sell! The man in the little room, dirty coat notwithstanding, would treat us with more sympathy. We would put up with a few dead flies, and even a dozing cat, to be sure of a modicum of *real* service.

The pattern is repeated in all the radio supermarkets of the High Street. The aristocrats advance, kneading their knuckles at the prospect of a hundred-pound sale, then retire, crestfallen, when it turns out that all we need is an insignificant spare part.

We are forced to try the little chap around the corner, where the proprietor has himself gone through the mill and is now elevated to chief salesman-cum-sweeper - cum - cashier - cum-mechanic's aide - cum-anything else that's needed.

Have you, dear reader, ever *tried* asking a large manufacturer for a small spare part? Either one is completely ignored or referred to the "nearest agent". And as *he* is probably the first of the well-swept emporia we tackled the problem is back in our laps.

Let me offer a few crumbs of comfort. We are not alone in our nail-biting frustration. Even the so-called agents have their troubles when ordering spares. To cite a recent example . . .

Nail-biting frustration

* * *

Wanted: A spool carrier for a well-known make of tape recorder under guarantee. To remove the faulty part was to leave a welter of loose belts and pulleys, so we ordered an advance replacement, quoting the full details of the machine, the owner and the date of sale.

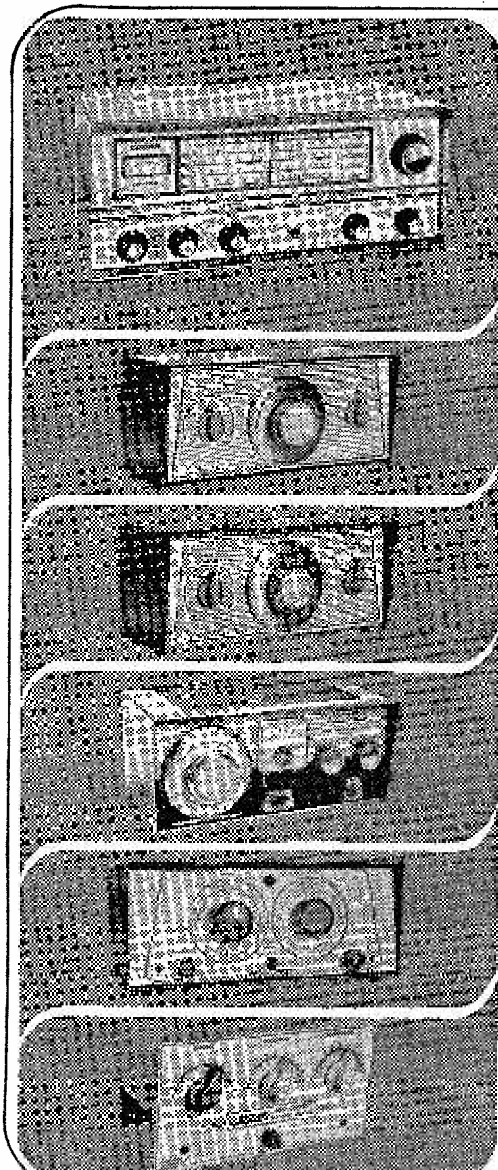
Back came a carrier, minus the tyre—which was the specific part that was causing the trouble. We searched the manual for a separate parts number for the tyre, found none, so wrote to the maker, quoting our previous order number and asking for the missing bit pronto.

By return of post a complimentary slip saying: "Please quote model, etc.". We played safe and sent the dud part this time with explanatory cover note. Back came the wrong replacement with invoice. Three letters later we received *four* replacements with tyres but minus a small bush. We packed the lot off with an acid note, quoting again our original order, and this time received a fresh carrier with bush but minus tyre. And in the following post invoices for the other, unwanted, returned, spares.

So far I calculate we have spent nearly as much on postage as it would have cost to order a new part COD, which would probably have turned up correctly by return!

Perhaps it is understandable after all when the dealer balks like a frightened horse at the sight of our sorry spare part. *Practical Wireless* readers who pride themselves on being what Percy Wilson graciously calls "the dawn of a new dispensation" would be better advised to make the darn gubbins themselves!

CODAR – QUALITY



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CODAR R.F. PRE-SELECTOR MODEL P.R.30. Considerably improves the performance of any superhet receiver over 1.5-30 Mc/s. Uses EF183 Frame Grid Valve, and provides up to 20dB gain plus substantial image rejection, improved signal/noise ratio and selectivity. Selector switch for either dipole or single wire antenna. Power requirements 180-250 volts 12mA H.T. 6.3 volts,.3 amp L.T. Size 8½ x 5 x 4in. Ready built, complete with cables, plugs and instructions, **£5.10.0.** Carr. 3/6. **MODEL P.R.30X.** Self powered model for 200-250v. A.C. Also provides 25mA at 200v. H.T. and 6.3v. 1 amp L.T. for other accessories **£7.4.0.** Carr. 3/6.

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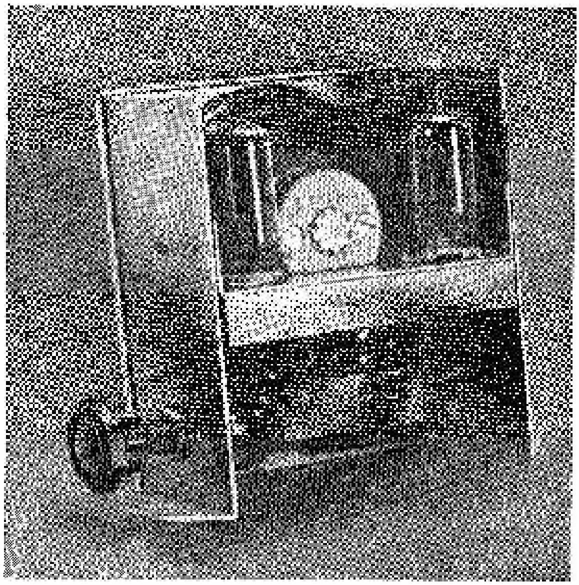
A SIMPLE, inexpensive audio amplifier that can be fitted to an experimental chassis in a few minutes is described in this article. Two easily obtainable valves are used in the amplifier, which incorporates a three-inch round loudspeaker and has an output of about two watts. This should be sufficient for an experimenter to line-up i.f. and r.f. circuits that have no audio stages. A jack socket is also provided to permit the output to be reproduced by a larger speaker or displayed on an oscilloscope.

The circuit, shown in Fig. 1, is extremely simple and functional; a high-gain EF91 being used as a preamplifier and an EL91 as a single-ended output amplifier. The output of the preamplifier is capacitively coupled by C3 to the grid of the EL91 which, with a 13 volt swing on the grid will give a 1½ watt output.

Loading of the output stage is not critical in a circuit of this type. Optimum loading is 16,000 ohms and thus, to match the 3Ω loudspeaker, one should try to obtain an output transformer with a ratio of about 75 : 1.

A little negative feedback from the output transformer is applied to the cathode of the preamplifier



SIMPLE AUDIO AMPLIFIER

for the radio experimenter's workshop

by V. E. Holley

to prevent microphony. One should, however, be careful in wiring the feedback loop, as it is easy to reverse the polarity and put positive feedback on to the cathode of the first stage which will cause instability. Decoupling between the two stages has not been found to be necessary.

The power requirements for the amplifier are quite nominal; 15 to 20mA at a potential of 200 to 250V d.c. for the h.t. rail and 500mA at 6.3V a.c. for the heaters. Often this can be taken from the equipment with which it is working.

★ components list

Resistors:
All 20%, ½W

R1	1·2MΩ	R5	470kΩ
R2	220kΩ	R6	680Ω
R3	2·2kΩ	R7	1kΩ
R4	33Ω	VR1	470kΩ log.

Capacitors:

C1	0·05µF, 350V	C4	0·001µF, 350V†
C2	25µF, 25V*	C5	25µF, 25V*
C3	0·01µF, 350V†		

* Miniature electrolytic. † Tubular ceramic

Valves:
V1 EF91 V2 EL91

Valve Bases:
B7G

Miscellaneous:
Output transformer with approx. 75 : 1 turns ratio. Three inch, 3Ω loudspeaker, round. Closed circuit jack socket.

Construction

The main chassis and the shelf that supports the two valves is constructed out of 18 s.w.g. aluminium sheet; bending and drilling details are given in Fig. 2. Probaby the most difficult hole to cut will be that for the loudspeaker. If no suitable tool is available to cut the 2⅝in. hole in the faceplate, a neat and simple alternative is to drill a large number of one-eighth holes just inside the circumference. It

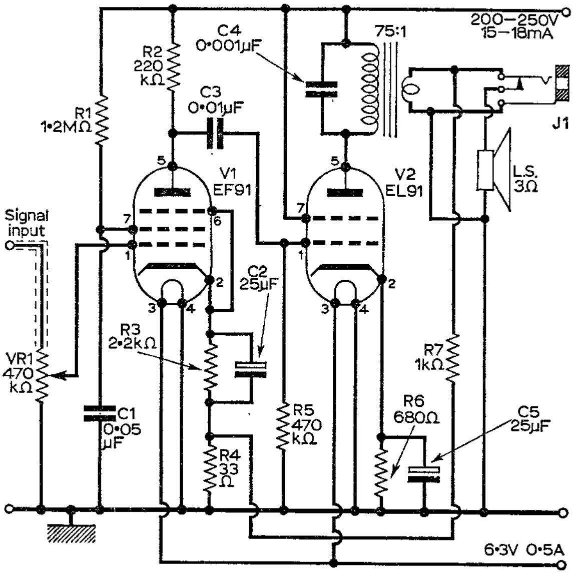


Fig. 1: Circuit of the amplifier module.

is then a simple matter to break the centre out and clean up the ragged edges with a file.

Once the metalwork has been drilled and bent, check that there is sufficient clearance for the loudspeaker before the holes necessary for securing the shelf to the main chassis are drilled. Before making

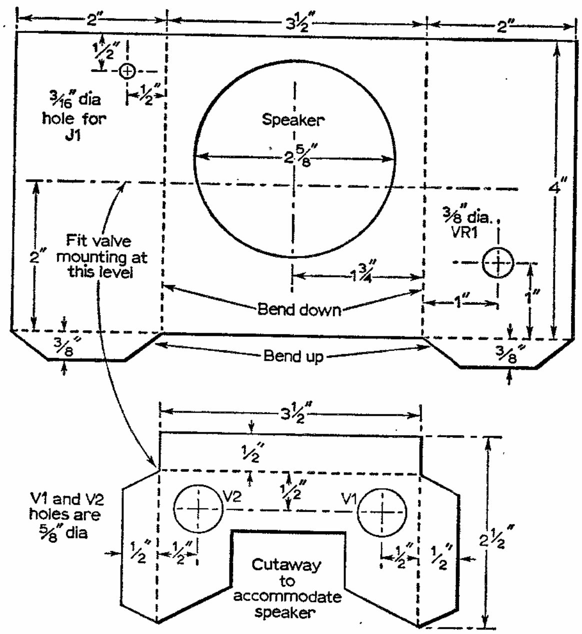


Fig. 2: Drilling and bending data for the main chassis and for the valve shelf.

a permanent fixing, it is best to wire the valve bases as it is difficult to reach these with the shelf in position.

Components and Wiring

Component layout, which is not critical, and the associated wiring information is given in Fig. 3. All the components are standard other than the output transformer which has been fitted with an additional (isolated) tag. This has been done to provide a convenient point for the heater input. The high tension

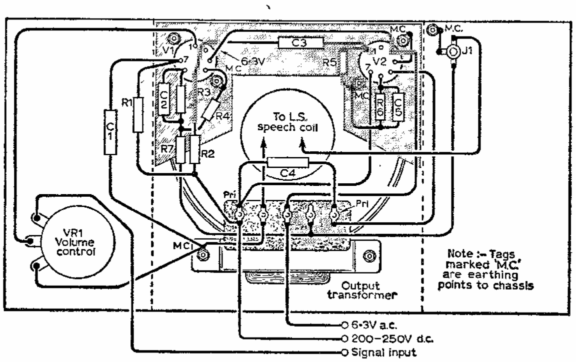


Fig. 3: Wiring diagram of the amplifier. The amplifier is shown laid face down and to simplify the diagram, the valve shelf has been up-ended, so that the under-side can be seen, and the sides of the main chassis are shown "un-bent".

input connection is also made on the output transformer tagboard; on the "hot end" of the primary winding. The only other external connection, the signal input, is made direct to the volume control. Thus, only three soldered connections are necessary when the completed amplifier is fitted to an experimental chassis.

The internal wiring is quite straightforward. Tinned copper wire, covered with sleeving, is suitable for all connections. One should, however, be careful to use tubular ceramics in the C3 and C4 positions and miniature electrolytics in the C2 and C5 positions.

Testing

When the amplifier wiring has been completed, the normal resistance checks should be made before applying power. Should there be any instability, check that the connections to the primary and secondary windings on the output transformer are the right way round. ■

GREAT CIRCLE CALCULATIONS

—continued from page 262

west of San Francisco. This agrees with our worked example.

Find the bearing of Sydney, Australia (34° S., 151° E.) from Luanshya (13° S., 29° E.)

Proceed as in the previous example, reversing the names of the latitudes. Then trace the Luanshya latitude ellipse (now 13° N.) to the difference of longitude, which is 122°. Join the latitude of Sydney (now 34° N.) to the intersection, and transfer this line to zero on the Latitude Scale, reading the bearing on the outer scale as 47°. The elevated (nearest) Pole is the South, thus the bearing will be S. 47° E., Sydney being Eastwards of Luanshya.

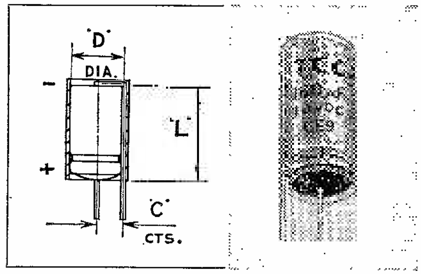
Of course, if a simple transmitting dipole, correctly oriented, were in use in the preceding example a signal of equal strength would be radiated towards Sydney on the reciprocal course—N. 47° W., or 313°. The short route to Sydney from Luanshya, about 6,400 miles, is south of Madagascar towards the Antarctic, within approximately 40 degrees of the South Pole, whereas the long route spans West Africa and the North Atlantic to Canada, curving south-westwards over the U.S.A., skirting the Hawaiian Islands to Sydney, a distance of about 15,200 nautical miles; and it will be observed that the combined distances of the two routes equal 21,600 nautical miles, the circumference of the earth, thus a great-circle.

The use of a directional beam aerial would obviate the wastage of energy radiated over the abnormally long route, although the time of day and the prevailing conditions must always be borne in mind when considering the transmission and reception of signals over very long distances.

Captain Weir

The Azimuthal Diagram, from which the Graphical Method was adapted, was originally devised by Captain Weir for the use of seamen as an aid in celestial navigation. ■

Sub-miniature Electrolytics for Transistor Circuits



T.C.C. TYPE No.	Case Size in inches			Maximum D.C. Wkg. Voltages and Cap. (μF)					
	D	L	C	3V.	6V.	9V.	12V.	15V.	25V.
CE.2 'V' or 'H'	$\frac{1}{8}$	$\frac{1}{2}$	0·07	8	6	4	3	3	—
CE.3 „	$\frac{3}{16}$	$\frac{7}{16}$	0·1	25	20	15	10	6	4
CE.4 „	$\frac{3}{16}$	$\frac{1}{2}$	0·1	40	30	20	15	8	6
CE.5 „	$\frac{1}{4}$	$\frac{7}{16}$	0·14	50	40	25	20	10	8
CE.6 „	$\frac{1}{4}$	$\frac{1}{2}$	0·14	80	60	40	30	15	12
CE.7 „	$\frac{5}{16}$	$\frac{1}{2}$	0·18	100	75	50	40	20	15
	D	L	C	3V.	6V.	10V.	15V.	25V.	50V.
CE.8 „	$\frac{1}{4}$	$\frac{3}{4}$	0·14	100	80	60	40	25	8
CE.9 „	$\frac{3}{8}$	$\frac{3}{4}$	0·2	250	200	160	100	60	20

V=Vertical Mounting H=Horizontal Mounting

Operating Temperature Range. —20°C. to +60°C.

Connection wires are welded for low resistance contact, and solder-coated for ease of assembly, the standard length being $1\frac{1}{2}''$ for the horizontal range, cropped to $\frac{3}{16}''$ long for the vertical range.

The capacitors are in insulated seamless aluminium cases, and sealed with a synthetic rubber bung.

Cap. Tolerance. The standard tolerance of all capacitors is —20% + 100% of the rated capacitance.

Leakage Current. CE.2-7 may be determined from the following: 1 (μA)=·01 C.V. + 10 at applied working voltage and at 20°C. CE.8-9 may be determined from: ·02 C.V. + 20 at applied working voltage and at 20°C.

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

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

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·1μF	750 volt	9d.	6/9	37/6	£9/7/6
·25μF	350 volt	10d.	7/6	41/8	£10/8/0
·5μF	150 volt	1/-	9/-	50/-	£12/10/0
·5μF	350 volt	1/3	11/3	62/6	£15/12/6
·5μF	500 volt	1/6	13/6	75/-	£18/15/0

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·005μF	200 volt

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an ellipse generator

by R. LEYLAND

THE simplest method of comparing two frequencies is by applying one to the X amplifier (or X plates) of an oscilloscope, and the other to the Y amplifier. When the two frequencies are equal, an ellipse is obtained, which at a 90° phase difference between them can be adjusted into a circle by means of the oscilloscope gain controls.

Other recognisable Lissajous figures are obtained when one frequency is at an exact multiple of the other, and it is easy to tell when one frequency is 2, 3, 4, ...times the other frequency. Stationary patterns are also produced at intermediate frequency ratios such as 3:2, but like the higher multiples, are difficult to interpret.

An oscilloscope is thus the most likely means to be used in calibrating an a.f. oscillator in the absence of specialised instruments such as frequency bridges and frequency meters, and the standard frequency will probably be 50c/s from a low voltage mains transformer. Alternative frequency standards are not so easy to use. Examples are BBC tuning signals and television line frequency. Although it is not impossible to work downwards from a 100kc/s crystal oscillator, or even the Long Wave Light Programme, this would require special and very stable apparatus.

If only one or two standards of frequency are available in calibrating an a.f. signal generator, an auxiliary oscillator is necessary to fill in the gaps. Starting with 50c/s mains frequency, the signal generator can be calibrated upwards at 50c/s intervals. The auxiliary oscillator is then brought in and set to a multiple of 50c/s, which enables the process to be continued to higher frequencies, the frequency of the auxiliary oscillator being increased whenever the ratio is too large.

Below 50c/s, the auxiliary oscillator is equally necessary, and setting it at 10c/s one-fifth of mains frequency, allows the signal generator scale to be marked at multiples of 10c/s. It has been found

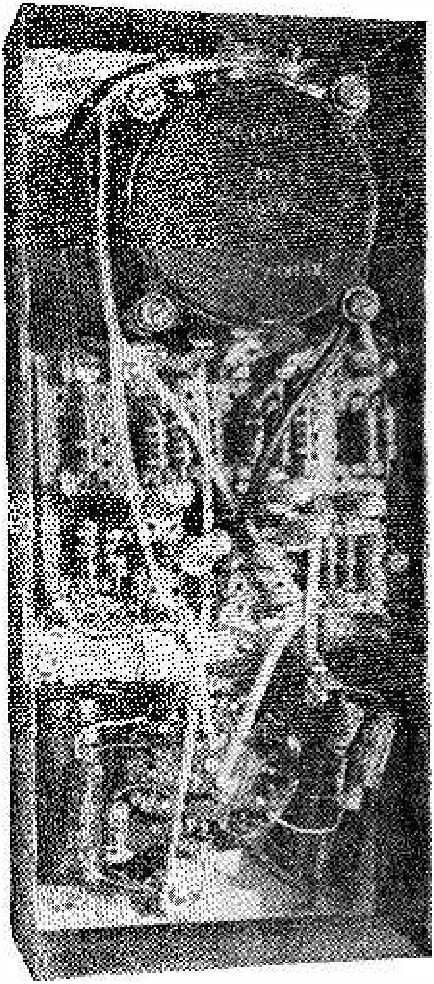


Fig. 2: Top view of the completed unit.

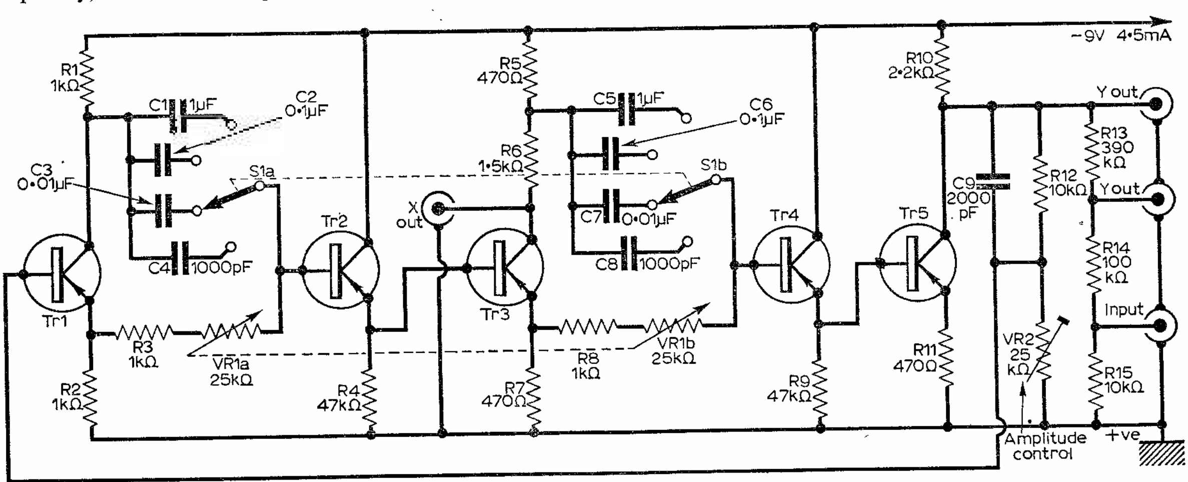


Fig. 1: Circuit of Two-phase a.f. oscillator (Ellipse Generator).

just possible to calibrate down to 5c/s, although at these low frequencies, changes in the pattern occur very slowly and the moving spot is seen, persistence of vision no longer working to produce the effect of a continuous line.

At high frequencies, the reverse is true, and the voltages are changing so rapidly that it becomes increasingly difficult to hold a stationary pattern. It was found that in the wide range a.f. oscillator, the output potentiometer had a very slight effect on the frequency, which could be utilised to produce the very slight frequency adjustment necessary. At frequencies well above the audio range, however, it may only prove possible to hold a pattern momentarily.

It would be possible to introduce a very small amount of synchronisation between the two oscillators, to assist in making the pattern stationary, but the wide range a.f. oscillator was calibrated successfully up to 75kc/s without doing this, although the

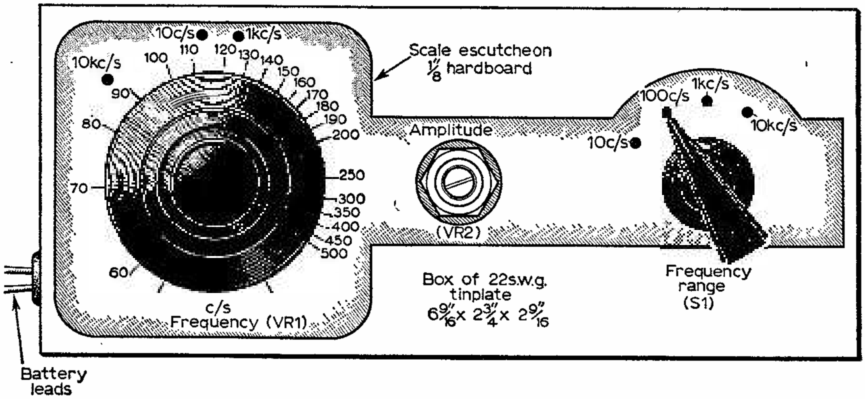


Fig. 2: Top view of the completed unit.

signal. The basic trace is then an ellipse on which the higher frequency is superimposed as a ripple. It is only necessary to count the number of peaks along the ellipse to establish the frequency ratio. Each peak denotes a cycle since the negative (i.e. inverted) peaks are not counted. If the pattern is quite stationary, since the top and bottom of the ellipse have a similar appearance, it is possible to count the peaks in pairs along the ellipse.

A number of photographs have been taken of

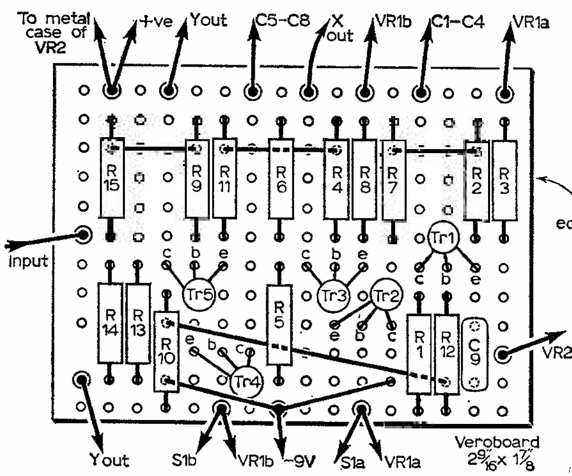


Fig. 3: Layout of components showing jumper links above panel and the external leads.

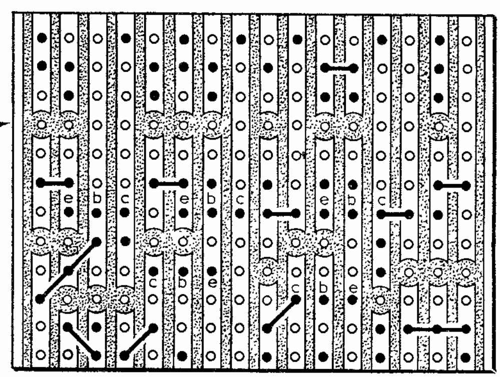


Fig. 4: Underside view showing the cross-links and breaks in the copper strips.

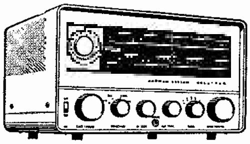
adjustment is very critical at the higher frequencies. The disadvantage of any degree of synchronising is that there will be some inaccuracy due to one oscillator being "pulled into step" by the oscillator at the higher frequency, and consequently shifted slightly from its true frequency.

Elliptical Trace

The main source of confusion with Lissajous figures is that the forward and return traces are superimposed on each other so that it is not always possible to distinguish which is which. A separation of the two wave traces will make the patterns much clearer and enable larger ratios of frequency to be compared. This separation can be made by applying a phase-shifted version of the X signal to the Y amplifier in addition to the higher frequency

the types of oscillogram produced by this method. When the two oscillators have the same frequency, the pattern is simply an ellipse, but its tilt and shape will be seen to alter with adjustment of the superimposed signal. When the higher frequency is an exact multiple of the ellipse frequency, the "wavy ellipse", described, is obtained. The other patterns shown (J.K.L.) are intermediate ones or produced from having the ellipse frequency higher than the other frequency. Although interesting, these patterns need not be considered for calibration purposes, since the simple wave patterns will provide all the frequency ratios needed.

To produce the ellipse, a phase-shifting circuit is required in addition to an auxiliary oscillator. This sounds rather complicated, although it can be a temporary set-up, using, for example, Veropins as



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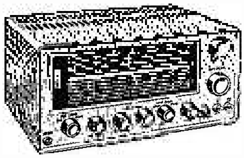

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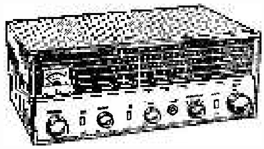

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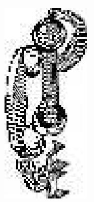

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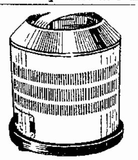

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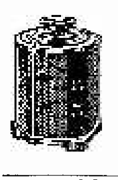

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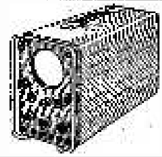

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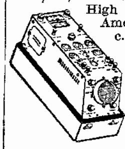

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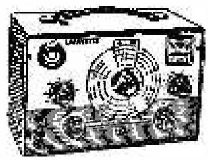

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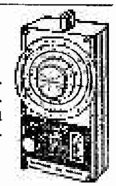

Compact, true one hand operation. Frequency range 1.7 - 180 Mc/s. 230v. A.C. operation. Supplied complete with all coils and instructions. **£12.10.0.** Carr. 5/-.

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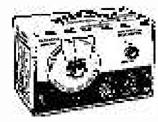

Sine: 20 cps to 200 kc/s. on 4 bands. Square: 20 cps to 30 kc/s. Output impedance 5,000 ohms. 200/250v A.C. operation. Supplied Brand New and Guaranteed with instruction manual and leads. **£15.** Carr. 7/6.

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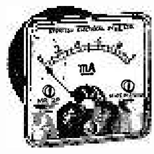

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	2mA 22/6	1A D.C. 22/6	750V D.C. 22/6
	5mA 22/6	2A D.C. 22/6	15V A.C. 22/6
	10mA 22/6	5A D.C. 22/6	50V A.C. 22/6
50µA 32/6	20mA 22/6	3V D.C. 22/6	150V A.C. 22/6
100µA 29/6	50mA 22/6	10V D.C. 22/6	300V A.C. 22/6
200µA 27/6	100mA 22/6	20V D.C. 22/6	500V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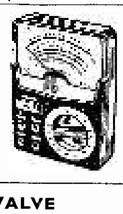

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0 / 3 / 30 / 60 / 300 / 600/3,000V. D.C.
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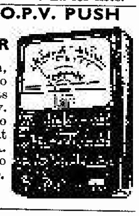

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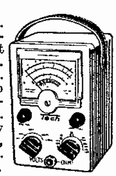

11 meg. input. 7 D.C. volt ranges. 1.5-1,500 v. 7 A.C. volt ranges. 1.5-1,500 v. 4,000 Peak to Peak. Resistance .2 ohm to 1,000 megohm. Decibels — 10db to +65db. Supplied brand new with instructions, leads and probe. **£12.10.0.** P. & P. 3/6.

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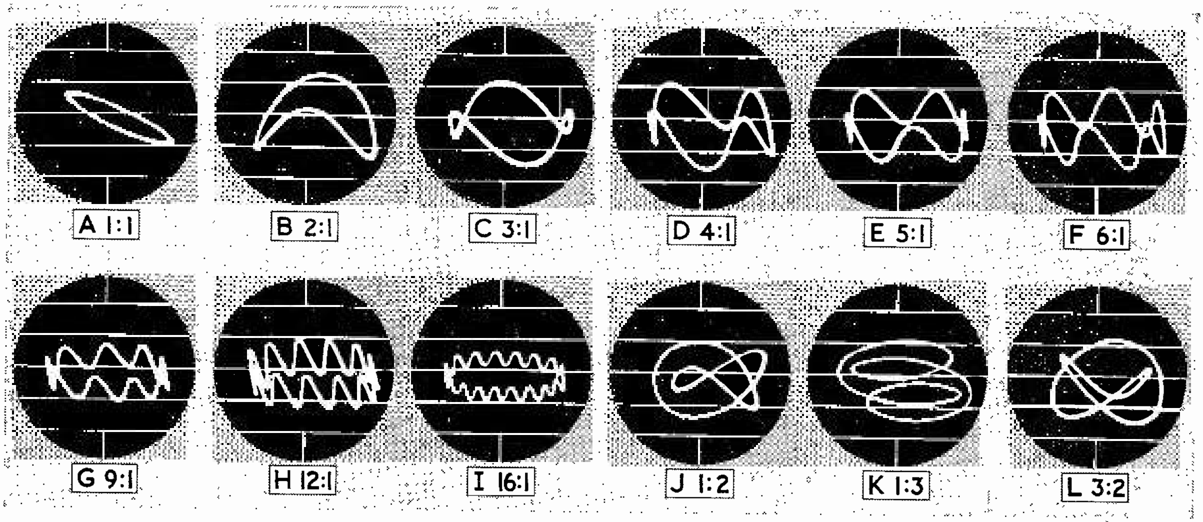
junction points, well-spaced out on a panel of plain Veroboard. The auxiliary oscillator must be sufficiently stable in performance, but it need not be calibrated, and automatic amplitude control is dispensed with, although this necessitates readjustment of an extra potentiometer every time the frequency of the auxiliary oscillator is changed. A simple form of auxiliary oscillator may be preferable, but a two-phase oscillator can be constructed which produces an ellipse without any additional phase-shifting circuit.

to adjust them separately. Separate adjustment would enable a perfect circle to be obtained, if necessary, by compensating with one network for minor phase-shifts in the transistors. Only an ellipse is required, however, for frequency comparison, so the phase shift in the networks need not be precisely 90°.

Direct coupling throughout the oscillator circuit makes electrolytic capacitors unnecessary and enables oscillation to be obtained down to a very low frequency. Apart from the relatively bulky



Typical oscillograms obtained with the two-phase oscillator when another frequency is superimposed on the elliptical trace. Readers may note these oscillograms have been redrawn from the photographs illustrating the wide range oscillator described last month.

Ideally of course the unit should be completely independent of any influences or variables which might affect its ultimate performance. Unfortunately the frequency of the two-phase oscillator is not as completely independent of the transistor characteristics as could be desired for precision, and it could probably be improved in this respect, but it does enable consistent frequency checks to be made, starting from 50c/s as the standard frequency, and enables a useful calibration to be made on another oscillator.

Circuit Description

The circuit diagram, Fig. 1, shows that the oscillator contains two phase-shifting networks separated by transistor stages, an arrangement more common in thermionic circuits. Each network produces a 90° phase shift. At the frequency of oscillation, the overall phase shift around the loop is effectively zero, consisting of the two 90° phase shifts cancelled by the phase inversion of Tr5. The networks are supplied from phase-splitter stages Tr1 and Tr3. The two outputs from each phase-splitter resemble those of a centre tapped transformer winding, the zero volts line being equivalent to the centre-tap. This arrangement enables 90° phase shifts to be produced from networks which normally would yield only phase shifts of 45°.

Loading on the networks is avoided by the insertion of the high input impedance stages Tr2 and Tr4. The oscillator thus consists largely of emitter-follower stages, with Tr5 as the amplifying stage. Tr3 also provides some amplification of the output for the X axis, but functions only as a phase-splitter in the oscillator loop. Variable resistances, VR1a and b are ganged together, as it is awkward

components of the phase-shifting networks, the rest of the oscillator is extremely compact and was constructed on a small piece of Veroboard (Figs. 3 and 4): actually, part of 2·5in. x 3·75in. panel sawn in half. Veropins are used as anchoring points for the external leads. This miniaturisation is not essential, however, as the ellipse generator is only a temporary aid to calibration, and it can be connected up more quickly if well spaced out, by simply following the layout of the circuit diagram.

The potential divider formed by R12 and VR2 is necessary to reduce the direct voltage to the base of Tr1. Prefixing Tr1 by another emitter-follower would improve the performance, but the number of transistors would be increased to six. The inclusion of C9 extends the frequency coverage, but the waveform deteriorates above the a.f. range, even when r.f. transistors are used.

Adjustment of VR2

The pre-set amplitude control VR2, is used to adjust the loop gain in the absence of a thermistor. With too low a setting, oscillation does not occur, while with too high a setting, the ellipse that appears on the oscilloscope screen will be flattened at one end. Suitable adjustment produces a good ellipse, but readjustment is needed as the frequency is changed.

A two-phase oscillator has the special advantage

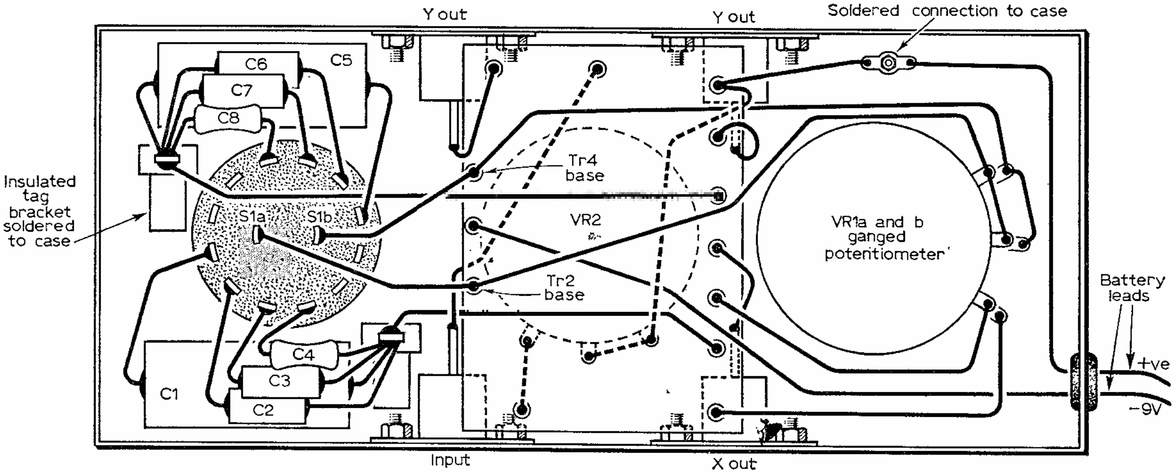


Fig. 5: Interior of the unit. The components are omitted from the components panel in order to show the underneath wiring (dotted).

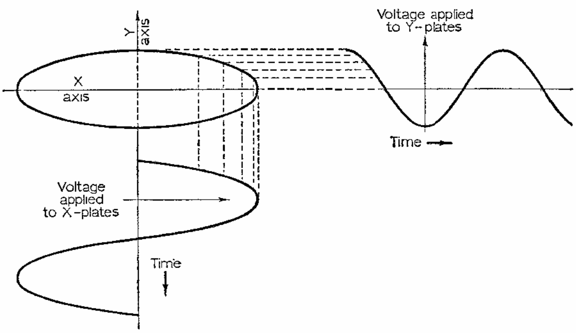


Fig. 6: Elliptical trace produced on oscilloscope screen by applying part of the X-signal, shifted by 90° in phase, to the Y-plates. (Expanding the Y-deflection will produce a circle). At phase differences other than 90° the ellipse is tilted and cannot be adjusted into a perfect circle.

★ components list

Resistors:

R5, R7, R11	470Ω
R1, R2, R3, R8	1kΩ
R6	1·5kΩ
R10	2·2kΩ
R12, R15	10kΩ
R4, R9	47kΩ
R14	100kΩ
R13	390kΩ

Capacitors:

C4, C8	1000pF
C9	2000pF
C3, C7	0·01μF
C2, C6	0·1μF
C1, C5	1μF

C4, C8, C9, tubular ceramic, others Mullard polyester. All resistors are Radiospares Miniature ½W.

Transistors:

Tr1 OC45	Tr2 OC45
Tr3 OC45	Tr4 OC45
Tr5 OC45	

Potentiometers:
VR1a and b 25kΩ ganged potentiometers w.w.
VR2 25kΩ potentiometer, w.w.

Miscellaneous:
Miniature wavechange switch, 2-pole, 6-way. Four flush-mounting coaxial sockets. Belling Lee L734/5.

that it readily produces an ellipse or circle on the screen of an oscilloscope at any audio frequency. The outputs from the collectors of Tr3 and Tr5 are of similar magnitude and can be used to produce a circle. A reduced Y output is available from the junction of R13 and R14 for the ellipse, whose height and width will depend also upon how far the gain controls of the oscilloscope amplifiers are increased. The higher frequency to be compared is applied to the socket marked "Input" from which it is superimposed on the Y output via R14. The resistances R13 and R14 may be high in value, taking advantage of the high input impedance of the oscilloscope Y amplifier, and this avoids any interaction between the oscillators, which might produce synchronising.

Construction

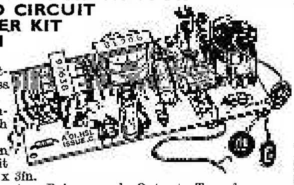
After some temporary set-ups, the oscillator was assembled in a box made from 22 s.w.g. tinplate by soldering. This is in an upper and a lower portion which fit together and there are two coaxial sockets on each side with a small label under each to indicate its function. As an auxiliary oscillator, the ellipse generator does not require calibration, and its frequency scale is too much influenced by adjustment of the amplitude control to be more than an approximate guide.

The interior of the oscillator, Fig. 5, is traversed by sleeved leads from the Veroboard components panel in the centre. This is supported in the wiring by using wires of a stouter gauge from the four coaxial sockets. If VR2 is a metal-cased potentiometer, insulation will be required under the components panel unless there is sufficient clearance to make this unnecessary. The two sets of network capacitors are mounted around the miniature wavechange switch, the common junctions being to insulated tags whose brackets are soldered to the case.

The battery leads pass through a ¼in. grommet at one end of the case and as the 9 volt battery is external, it can easily be disconnected, so an on-off switch is unnecessary. ■

This unit is eminently suited for use with the Wide Range Audio Oscillator described in last month's issue. —(*Ed*)

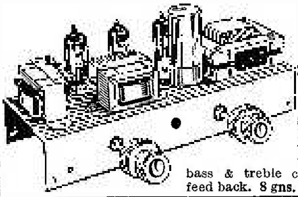
HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT Type TAI



● 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 (GET 114 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.
SPECIAL PRICE 45/-. P. & P. 3/-.
Also ready built and tested. **52/6.** P. & P. 3/-.
A pair of TA1s are ideal for stereo.

STEREO AMPLIFIER

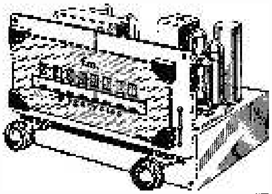
Incorporating 2 ECL82s and 1 EZ80, heavy duty, double wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.



ONLY **£4.19.6** P. & P. 6/6

Super De-luxe version with ECL86 valves sep. bass & treble controls, full feed back. **8 gns.** P. & P. 6/6

HARVERSON'S F.M. TUNER



Few only now left.
Mark I **£5.19.6.** P. & P. **8/6.**
Mark III with output stage. **£7.7.0.** P. & P. 8/6.
See July issue for details.

SPECIAL PURCHASE! TURRET TUNERS

By famous maker. Brand new and unused. Complete with PCC84 and PCF80 valves 34-38 Mc/s IF. Biscuits for Channel 1 to 5 and 8 and 9. Circuit diagram supplied. ONLY **25/-** each. P. & P. 3/9.

GÖRLER F.M. TUNER HEAD

88-100 Mc/s 10.7 Mc/s I.F., **15/-**, plus 2/- P. & P. (ECC85 valve, **8/6** extra).

6 TRANSISTOR AND DIODE SUPERHET

A first-class 2 waveband transistor superhet. ● Printed circuit panel (size 8½ x 2⅞in.). ● 3 pre-aligned IF 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 (Circuit diagram 2/-. Free with set of parts.)

35 OHM SPEAKERS

Suitable for use with above. 2in. Goodmans Ideal replacement for most pocket portables, **8/6**; 3¼in. **12/6**; 7 x 4in., **21/-**; P. & P. 2/- per speaker.

Portable CABINET

Size approx. 9¾ x 6¾ x 3¼in. Suitable for above using. 3¼in. speaker, **25/-**, P. & P. 2/6.

COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 IF transformers one oscillator coil one driver transformer and wound Ferrite aerial (med. long and car aerial coupling), **32/6** complete post 2/-. 6 transistor printed circuit board to match **8/6.** Post 1/-. Circuit diagram **1/6** extra.

MINIATURE PRECISION AIR-SPACED TWO GANG TUNING CONDENSER. 176 + 176 p.F. size 1⅛"w x ⅞"d x 1⅛"h with vanes open. Built in trimmers **5/-.** P. & P. 1/-.

BRAND NEW TRANSISTOR BARGAINS

GET 15 (Matched Pair) **15/-**; V15/10p, **10/-**; OC71 **5/-**; OC76 **6/-**; AF117 **7/6.**
Set of Mullard 6 transistors OC44, 2—OC45 OC81D matched pair OC81 **25/-**, ORP12 Cadmium Sulphide Cell **10/6.**

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PXA101 **6/6**; XA103 **6/6.**
R.F.I. Pack: 1—PXA102 Mixer; 2—PXA101 I.F. Amp. (Equiv. OC44 and OC45) 10/6
R.F. 2 Pack: 2—PXA101 I.F. 1—PXA102 Osc.1—PXA102 Mixer 12/6
L.F.6 Pack: Consisting of PXB113 Driver Matched pair. PX171 mounted complete with heat sinks (Equiv. OC81D and OC81) 12/6
ALL TRANSISTORS POST FREE.

QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. This amplifier (which is used in a 29 gn. record player) employs heavy duty double wound mains transformer, ECC83, EL84, EZ80 valves. Separate Bass, Treble and Volume controls Complete with output transformer matched for 3 ohm speaker. Size 7in. w. x 2¼in. d. x 5½in. h. Ready built and tested. **PRICE 69/6.** P. & P. 4/9.
ALSO AVAILABLE mounted on board with output transformer and 6in. speaker ready to fit into cabinet below. **PRICE 89/6.** P. & P. 5/9.

QUALITY PORTABLE R/P 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. 7/6.

4-SPEED PLAYER UNIT BARGAINS

All brand new in maker's original packing.

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GARRARD SP25 De Luxe **£12.10.6.** Carr. 5/6.
B.S.R. GU7 with unit mounted pickup arm. **£4.18.8.** Carr. 5/6.

AUTO CHANGERS

Latest B.S.R. UA25 Super slim **£6. 2.6**
GARRARD Autoslim **£5.10.0**
GARRARD AT6 ...... **£9.10.0.** Carr. 6/6 on each.
All the above units are complete with t/o mono head and sapphire styli or can be supplied with compatible stereo head for 12/6 extra.

BRAND NEW CARTRIDGE BARGAINS!

RONETTE STEREO 105 CARTRIDGE. Stereo L.P./78 complete with two sapphires. Original list price **67/9.** **Our price 24/-.** P. & P. 1/-.
ACOS GP67-1. Mono complete. List price **21/-.** Our price **13/6.** P. & P. 1/-.

BRAND NEW 3 OHM LOUDSPEAKERS

5in., **12/6**; 6½in., **15/-**; 8in., **21/-**; 10in., **25/-**; 12 in., **27/6**; (12in. 15 ohm. **30/-**). 10in. x 6in., **26/-.**
E.M.I. 13½ x 8in. with high flux ceramic magnet, **42/-** (15 ohm, **45/-**). P. & P. 5" 2/-, 6½" & 8" 2/6, 10" & 12" 3/6 per speaker.

E.M.I. PLASTIC CONED TWEETERS. 2½" 3 ohm. Limited number **12/6** each. P. & P. 1/6.

BRAND NEW HEAVY DUTY 12in. SPEAKERS Response 45 c/s-13 Kc/s. 1½in. voice coil. Available in 3 or 15 ohms. Guaranteed full 15 watts British rating. Heavy cast aluminium frame. These are current production by world famous maker and as they are offered well below list price we are not permitted to disclose the name. LIMITED NUMBER ONLY. UNREPEATABLE at **89/6.** P. & P. 5/-. Also 25 watt Guitar Model available at **£5.5.0.** And 35 watt Guitar Model **£8.8.0.**

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SMOOTHING CONDENSER. 2800 mfd. 25v. 1⅜" dia x 3" high **3/-.** P. & P. 1/-.

MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS. Stack size 1⅛ x 1⅛ x ⅞ in. Output trans. tapped for 3 ohm and 15 ohm output. **10/-** pair plus 2/- P. & P.

7-10 watt OUTPUT TRANSFORMERS to match pair of ECL 86's in push-pull to 3 ohm output. ONLY **11/-.** P. & P. 2/6.

7-10 watt ULTRA LINEAR OUTPUT TRANSFORMERS to match pair of ECL 82's in push-pull to 3 ohm output. ONLY **15/-.** P. & P. 2/6.

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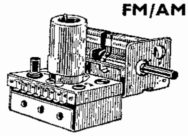
HEAVY DUTY NON-INDUCTIVE D/P MICRO SWITCH. Conservatively rated 10 amps at 250v. Standard one-hole fixing. Body size 1⅝ x ⅞ x 1in. deep inc. terminals **3/-** each. P. & P. 1/- (6 or more post free).

NEON A.C. MAINS INDICATOR. For panel mounting, cut out size 1⅛ x ⅝ x ⅞in. deep inc. terminal. White case with lens giving brighter light. For mains 200/250v. **2/6** each P.P. 6d. (6 or more post free).

ACOS CRYSTAL MIKES. High imp. For desk or hand use. High sensitivity, **18/6.** P. & P. 1/6.

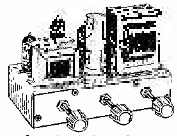
TSL CRYSTAL STICK MIKE. Listed at **45/-.** Our price **18/6.** P. & P. 1/6.

ANOTHER HARVERSON SCOOP! FM/AM TUNER HEAD



Beautifully designed and precision engineered by Dormer and Wadsworth Ltd. Supplied ready fitted with twin .0005 tuning condenser for AM connection. Prealigned FM section covers 86–102 Mc/s. I.F. output 10.7 Mc/s. Complete with ECC85 (6L12) valve and full circuit diagram of tuner head. Another special bulk purchase enables us to offer these at **27/6** each. P. & P. 3/-. Order quickly! Limited number also available with precision geared 3:1 reduction drive, **30/-.** P. & P. 3/-.

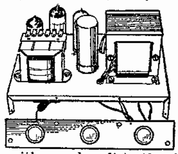
3-VALVE AUDIO AMPLIFIER MODEL HA34



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. 6/-.

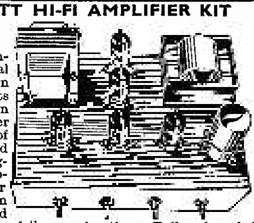
HSL 'FOUR' AMPLIFIER KIT

A.C. Mains 200/250v., 4 watt, using ECC83, EL84, EZ80 valves.



● Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss. ● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar, microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● Chassis size only 7½in. wide x 4in. deep. Overall height 4¾in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves, output transformer (3 ohms only), screened lead, wire, nuts, bolts, solder, etc. (No extras to buy.) PRICE **79/6.** P. & P. 6/-.
Comprehensive circuit diagram, practical layout and parts list 2/6 (free with kit).
This kit although similar in appearance to HA34 employs entirely different and advanced circuitry.

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 3-15Ω 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 **£7.9.6.** P. & P. 8/6. Also available ready built and tested complete with std. input sockets, **£9.5.0.** P. & P. 8/6.
Carrying case for above **28/6.** P. & P. 7/6.

B.S.R. MONARDECK (Single speed) 3¾in. per sec., simple control, uses 5¾in. spools, **£6.15.0** plus 7/6 carr. and ins. (Tapes extra).

LATEST COLLARO MAGNAVOX 363 TAPE DECK DE LUXE. Three speeds, 2 track, takes up to 7in. spools. **10 gns.** Plus 7/6 Carr. & ins. on each (Tapes extra).

TWIN TELESCOPIC AERIAL. Comprising two 3-section heavily chromed rods. Closed 12in. each extending to 32in. Completely adjustable from vertical to horizontal. Supplied complete with universal mounting bracket, coax lead and plug. Suitable for F.M. or TV, **12/6.** P. & P. 2/-.

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Beautifully made and expensively finished in dark grey heavy grade rexine. Satin Chrome metal grille front and chrome fittings. Speaker aperture 9" x 4". Overall size 15¼" w. x 15" d. x 7½" h. Will take any standard tape deck or single record player. Limited number only. Worth at least **£5.** OUR PRICE **49/6.** P. & P. 5/-. Brand new and unused.

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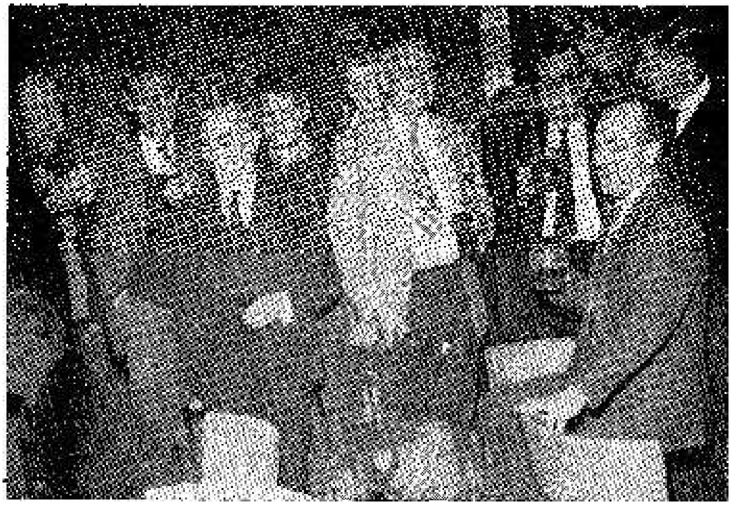
CLUB SPOT No. 10

LOUGHTON & DISTRICT RADIO SOCIETY



Left to right: Club chairman Bill Sheppard G3JBS, club secretary Jim Bunce, Bill Patten G3PAT, Robbin Powell G3OGP, David Penny G3PEN, Martin Railton G8AB, club treasurer Bob Stevens, Jack Atkinson G3OPA and John Stuart G3TUM.

THE Loughton and District Radio Society was formed just over four years ago by John Kay G3AAE and Cliff Waterman G3NKX. Like so many other amateur radio clubs, this was started by circularising local licensed amateurs and known shortwave listeners.

About 30 came to the inaugural meeting, which was held in John Kay's front room. Everyone was enthusiastic and a working committee was formed; Cliff Waterman being elected honorary chairman, Jack Atkinson G3OPA club secretary and Bill Patten G3PAT treasurer. John Kay had to decline office owing to business commitments.

Accommodation was one of the club's biggest headaches until the local Community Association came to the rescue, with a room at Loughton Hall at a most reasonable fee. The club does not have exclusive use of the room—occupying it every other Friday evening—and thus, cannot have its own station. All the facilities of Loughton Hall, which stands in spacious, well-kept grounds, are made available to club members, including the well-stocked bar. Ken Jones, chief warden of the hall, has been of immense help to the club and has done a lot to publicise the activities of the club.

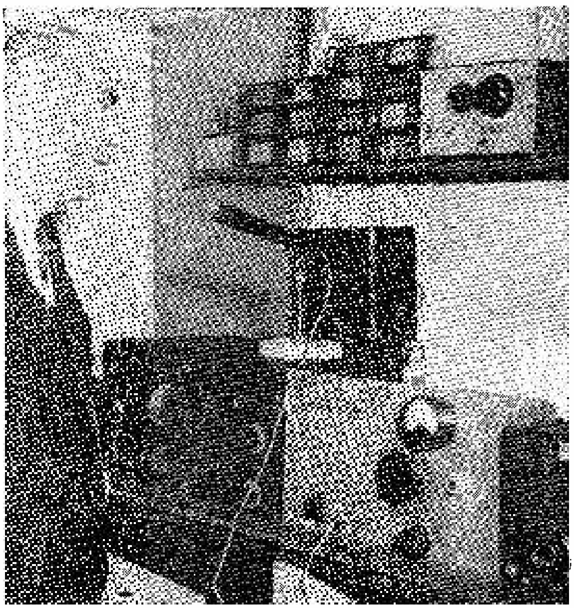
Exhibitions, mobile rallies and social functions laid-on by the club have always been well attended and the revenue raised from these activities has enabled the club to make several purchases. A typewriter and duplicating machine were among the first purchases and are now in regular use producing the club's "Newsletter." One of the more recent acquisitions is a 16 mm sound projector.

A lot of the credit for the success of the social side of the club must go to the club's first entertainments officer Bob Stevens and public relations officer Jack Atkinson. Jack is now the club's entertainments officer and Bob has charge of the club's purse.

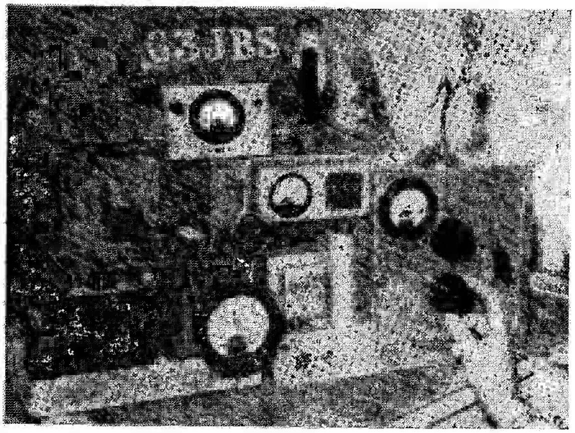
Meetings are held at Loughton Hall every other Friday evening, starting at 8 o'clock and include lectures and film shows on a host of subjects. The evening PRACTICAL WIRELESS visited the club, a lecture was given on the London Post Office Tower, by club member David Penny G3PEN, who actually works "in-the-tower".

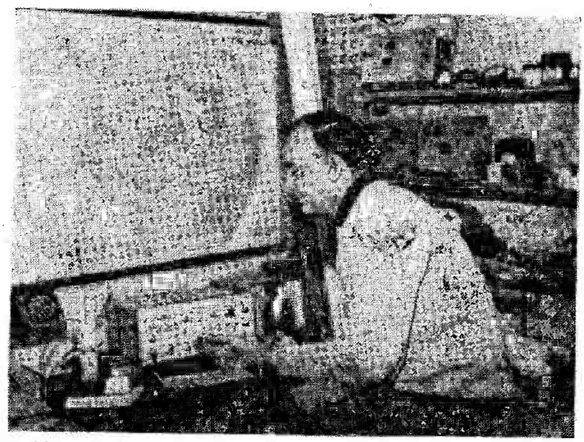
Like all good clubs, most of the "seniors" adjourn to one of the local taverns afterwards to sample the ale and talk "shop." The youngest licensed club member is Stephen Alderton G3UXV, who was 15 last birthday. He got his licence last year and already has quite a selection of QSL cards from countries all over the world. He even has one from Japan.

The club does not run instructional classes for the unlicensed members as there are two first-class evening institutes within easy reach of Loughton. Some of the club-night lectures and film shows are,



Club member Bill Patten G3PAT uses an HRO receiver and a home-built top-band transmitter. He has ten coil packs for the receiver which covers the medium waveband and all the amateur bands up to 30 Mc/s. Some of these coil packs are band-spread. To change the frequency of the transmitter, Bill has to solder in different coils.





Club chairman Bill Sheppard G3JBS is extremely proud of his home-built 280-watt linear amplifier, shown on the left. It cost him under £4 to build. As you can see from the other illustration, Bill has gone "part commercial" with a KW2000 1·8 to 30Mc/s transceiver.

of course, of an instructional nature.

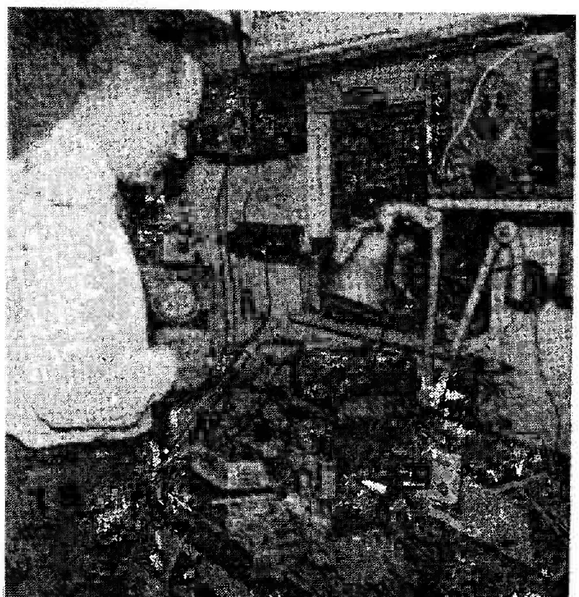
Like many other clubs up and down the country, Loughton is affiliated with the Radio Society of Great Britain and holds an annual field day. Most members participate and all have the time of their lives, whatever the weather conditions. Each year field day takes place in the grounds of the Rainbow and Dove public house, Hastingwood, which is between Epping and Harlow. Wing-Commander Martin Railton's G8AB call sign is always used on field day. Although the weather for this year's event—held on 4th and 5th June—was the best ever, the portable generator failed and it took nine hours to put it right. Only one hundred and forty-six calls were logged in the twenty-four hours.

Last November the club was involved with the Television Viewer's Council and the British Amateur Television Club in a closed-circuit television exercise to demonstrate the potential of television in education and community life. This demonstration took place at Loughton Hall, with the B.A.T.C. driving the vision equipment and club members operating the sound gear.

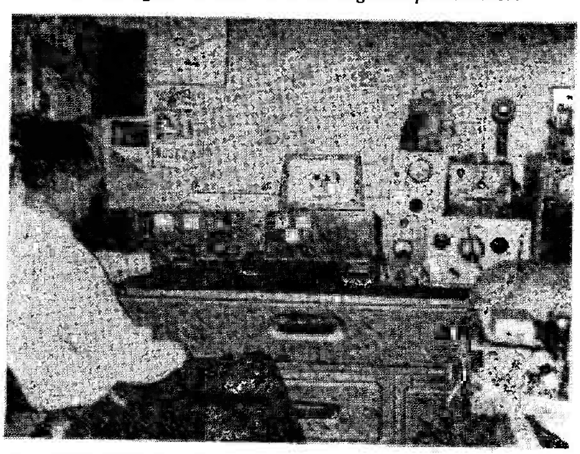
Full three-camera productions were put "on-the-air" under the direction of a professional producer from one of the independent television companies. Other professionals, from the Independent and BBC television organisations, had a hand in the productions and all in all more than 100 people were involved. Club chairman Bill Sheppard G3JBS and club member Jim Brett G6MJZ/T worked extremely hard to make the experiment the success it was. Jim, who is also a member of the B.A.T.C., frequently rigs up his closed-circuit television apparatus at Loughton Hall for club exhibitions and mobile rallies.

The camera outputs were used to feed large-screen monitors in the public viewing rooms in Loughton Hall and to a video recorder. An edited version of the three days' transmissions was shown to members of the Television Viewers' Council, whose annual conference at Loughton Hall coincided with the closed-circuit television experiment.

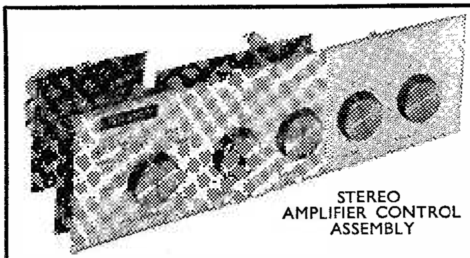
If you live in or around Loughton—or for that matter only visiting the area—do call in on club-night. Club secretary Jim Bunce will be only too pleased to let you know the times and dates; his address is 60, Deepdene Road, Loughton, Essex. ■

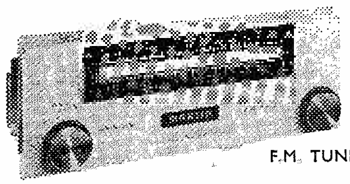


Jack Atkinson G3OPA is another "part commercial" man with a KW2000 transceiver. He is building a 190-watt linear amplifier (shown left) to go with this outfit and has several home-built items, including a Practical Wireless *grid dip oscillator.*



Practical Wireless *invites club secretaries to send details of their own club to the editor.*





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● 10 watt amp. (3 ohms)	**£5.12.6**
● 10 watt amp. (15 ohms)	**£6.12.6**
● Mains power supply	**£2.15.0**

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Translated into the Queen's English . . . "Read all about it!" The gentleman is referring to the fact that Reprint No. 12 of the Home Radio Catalogue is hot off the press. As always, its pages (all 210 of them) are packed with good things, things of absorbing interest to every radio and electronics enthusiast. No increase in price . . . better than ever value at 7/6, plus 1/6 post and packing. And remember, every copy contains five coupons, each value 1/- when used as directed. If you have never had the good fortune to own one of these famous components catalogues, or if your own copy is now a bit long in the tooth, send the attached coupon with your cheque or P.O. for 9/-. Our pleasure in sending you the catalogue will be exceeded only by your pleasure in receiving it.

Please write Name and Address in block capitals

Name ....

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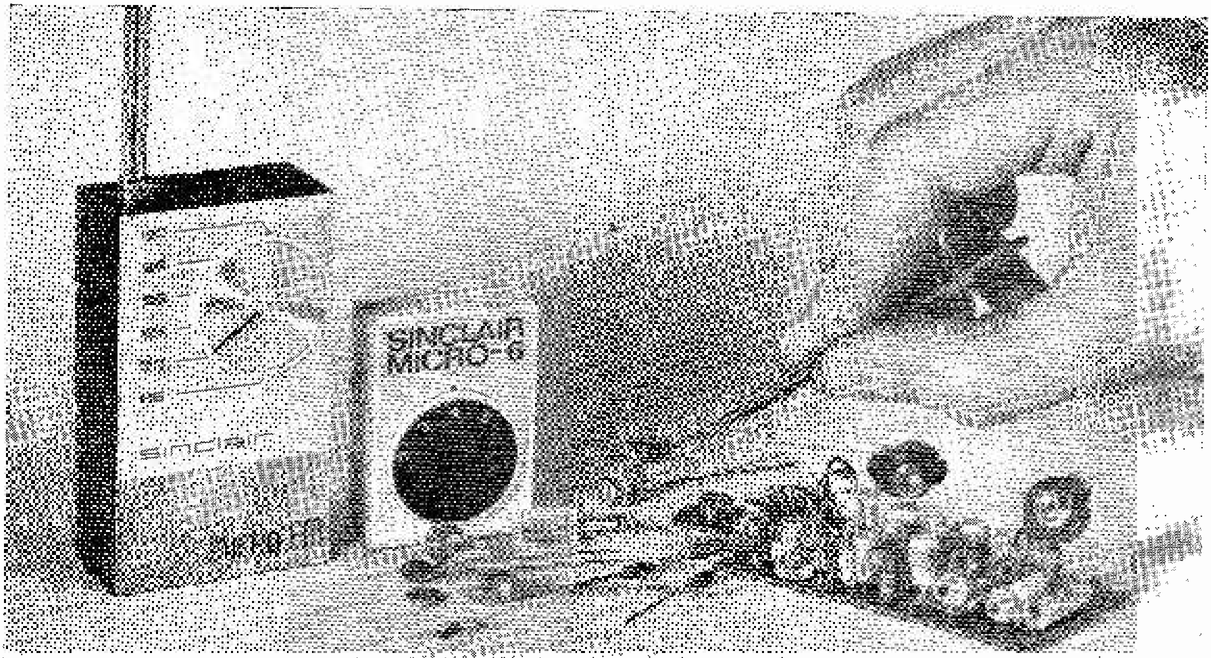
Home Radio Ltd., Dept. PW, London Rd., Mitcham, Surrey

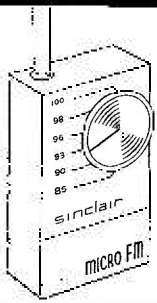


the world's most unique design

SINCLAIR MICRO FM

7 TRANSISTOR SUPERHET FM TUNER/RECEIVER

This unique, superbly engineered superhet FM set is going to give enormous satisfaction, first in building and then in using it. It is completely professional in styling inside and out. When built, the performance of the Sinclair Micro FM is fantastic. It is the only set in the world which can be used both as an FM tuner and as an independent FM pocket receiver just whenever you wish. Problems of alignment which have previously made it almost impossible for a constructor to complete an FM set for himself have been completely eliminated in the Micro FM. It is ready to use the moment you have built it. The pulse counting discriminator ensures best possible audio quality; sensitivity is such that the telescopic aerial included with the kit assures good reception in all but the very poorest reception areas. The Sinclair Micro FM will give you all you want in FM reception and the satisfaction of building a unique design that will save you pounds.



"I am very impressed with the set (Micro FM) which took only five hours to assemble and worked immediately."
(Signed) *D.H.W., Leigh, Reigate, Surrey.*

"I would like to express my complete satisfaction with your Micro FM. In quality it certainly equals my present (expensive) tuner. Congratulations on a fine design."
(Signed) *J.B.K., London, E.C.4.*

★ TECHNICAL DESCRIPTION

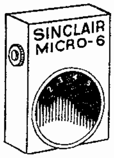
THE SINCLAIR MICRO FM is a completely self-contained double-purpose F.M. superhet. It uses 7 transistors and 2 diodes. The R.F. amplifier is followed by a self-oscillating mixer and three stages of I.F. amplification which dispense with I.F. transformers and all problems of alignment. The final I.F. amplifier produces a square wave which is converted so that the original modulation is reproduced exactly. A pulse-counting discriminator ensures better audio quality. One output is for feeding to amplifier or recorder and the other enables the Micro FM to be used as an independent self-contained pocket portable. A.F.C. "locks" the programme tuned in. The telescopic aerial included is sufficient in all but the worst signal areas.

- ★ **Size: $2^{13}/_{16}$" x $1^{11}/_{16}$" x $\frac{3}{4}$"**
- ★ **Powerful A.F.C.**
- ★ **Pulse counting discriminator**
- ★ **Low I.F. completely eliminates alignment problems**
- ★ **Tunes from 88 to 108 Mc/s**
- ★ **Audio response: 10 to 20,000 c/s ±1dB**
- ★ **Signal to Noise Ratio: 30dB at 30 microvolts**
- ★ **Operates from standard 9V battery, self-contained**
- ★ **Plastic case with brushed and polished aluminium front and spun aluminium tuning dial**

Complete kit inc. telescopic aerial, case, earpiece and instructions

£5.19.6

SINCLAIR MICRO-6 — *Build it in an evening*



THE SMALLEST SET IN THE WORLD

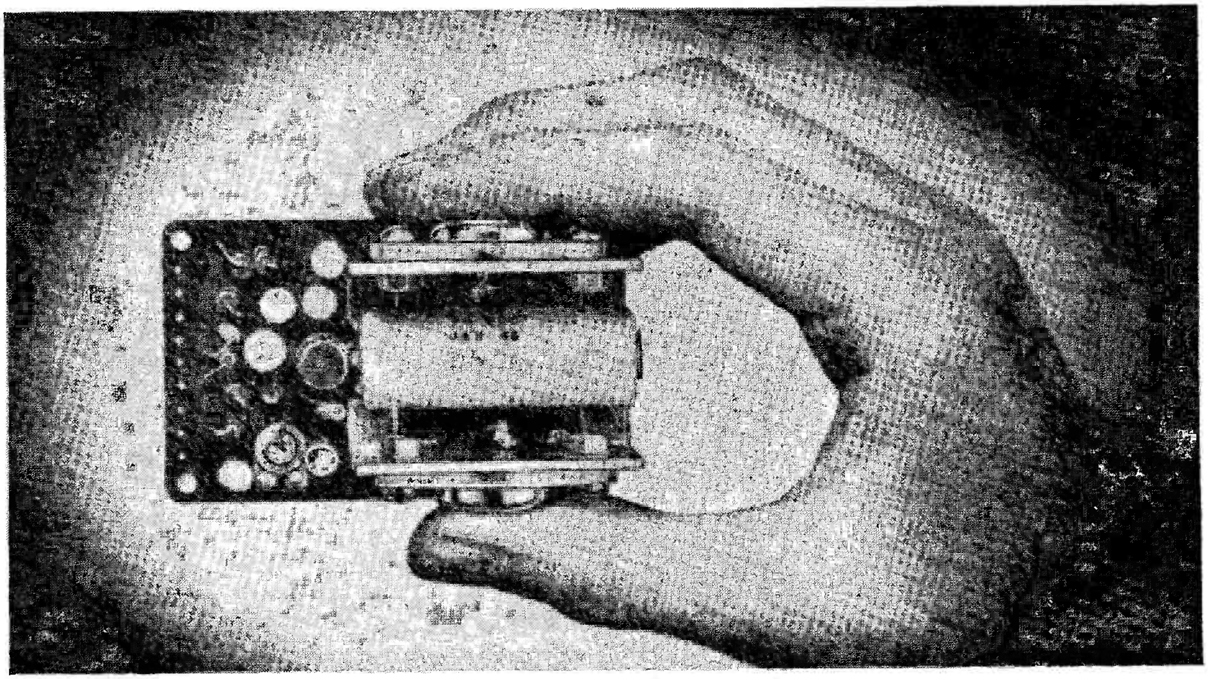
This is the set to build if you want a minutely sized receiver which will slip into a waistcoat pocket without even showing. It is the smallest set in the world, against which a matchbox looks enormous. Yet the Micro-6 is completely self-contained, including aerial and batteries and it virtually plays anywhere. Its clever six-stage circuit (2 R.F., double diode detector, 3 A.F.) ensures all you want in a radio today—power, range, quality and selectivity. It is very simple to build and useful to have with you always. A.G.C. counteracts fading from distant stations, bandspread brings in Luxembourg like a local station. There is great pleasure to be had in building the Micro-6, and it makes a highly acceptable gift once others have seen its white, gold and black case and heard its amazing performance.

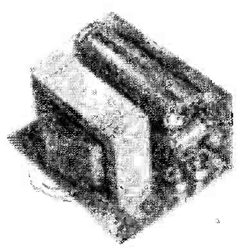
Complete kit including case, aerial, lightweight earpiece & instructions

59/6

sinclair

sinclair radionics ltd.
22 newmarket road, cambridge
Telephone 52731





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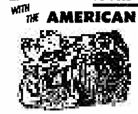

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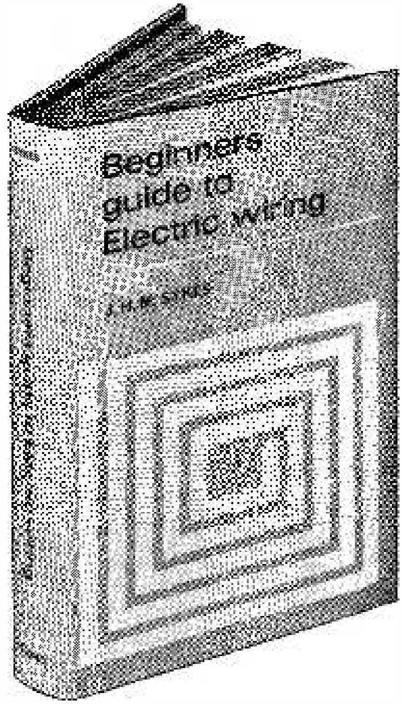

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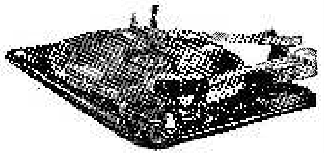

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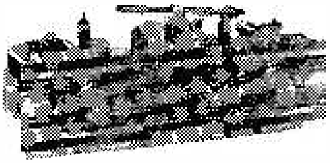

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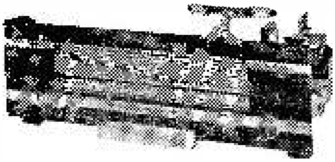

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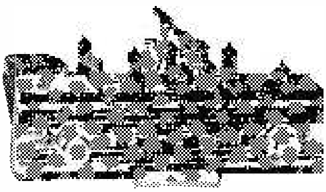

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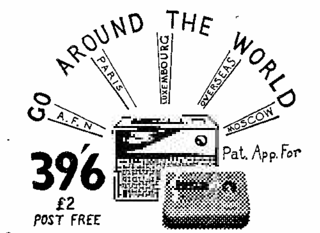

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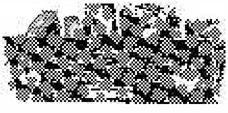

Med. and VHF 190m-550m., 86 Mc/s.-103 Mc/s., 6 valves and metal rectifier. Self-contained power unit A.C. 200/250V operation. Magic-eye indicator, 3 push-button controls, on/off, Med.. VHF. Diodes and high output Sockets with gain control. Illuminated 2-colour perspex dial 11½in. × 4in., chassis size 11⅝in. × 4in. × 5¾in. A recommended Fidelity Unit for use with Mullard "3-3" or "5-10" Amplifier.
Bargain Price. Complete kit of parts, inc. Power Pack as illustrated, **£10.19.6.** Carr. 7/6. Ditto less Power Pack, **£9.19.6.** Carr. 7/6. Circuit and Const. details, **4/6.** Free with kit.

MULLARD "3-3" & "5-10" HI-FI AMPLIFIERS

3 OHM AND 15 OHM OUTPUT. "3-3" Amp. 3-valve, 3 watt Hi-fi quality at reasonable cost. Bass Boost and Treble controls, quality sectional output transformer, 40 c/s-25 kc/s 1 ± dB. 100mV for 3W, less than 1% distortion. Bronze escutcheon panel. **Complete Kit only 7 gns.** Carr. 5/-. **Wired and tested £8.10.0.**
MULLARD "5-10" AMPLIFIER. 5 valves 10W, 3 and 15 ohms output, Mullard's famous circuit with heavy duty ultra-linear quality output tfr. **Basic amplifier kit price £9.19.6.** Carr. 7/6. **Ready built 11½ gns.**
2-VALVE PRE-AMP. UNIT. Based on Mullard's famous 2-valve (2 × EF86) circuit with full equalisation with volume, bass, treble. and 5-position selector switch. Size 9in. × 6in. × 2¼in. **Complete kit 6 gns. Ready built, £7.19.6.** Carr. 3/6.

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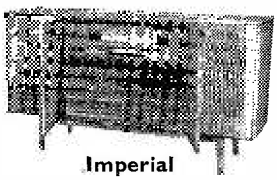

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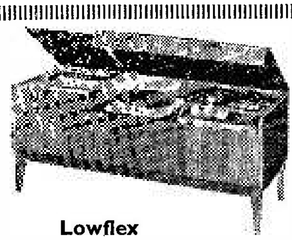

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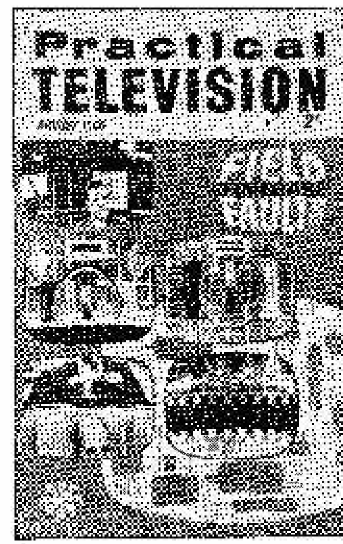

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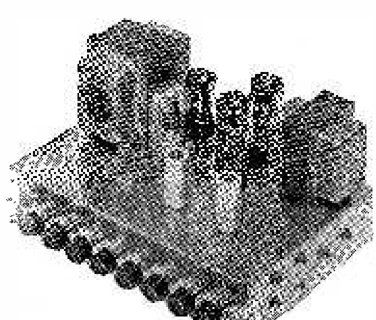

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OA3	11/-	6AF6G	11/-	6CY5	10/-	6U8	7/6
OB2	6/-	6AG5	2/6	6CY7	11/-	6V6	9/-
OB3	6/-	6AG7	6/-	6D1	2/-	6V6G	5/-
OC2	14/-	6AH6	10/-	6D3	7/6	6V6GT	7/6
OC3	6/-	6AK5	5/6	6D4	15/-	6WC5	7/-
OD3	5/-	6AK6	7/-	6D6	3/-	6X4	4/-
1A3	3/-	6AL5	3/-	6DC6	12/6	6X5	7/-
1A5GT	5/-	6AM5	2/6	6DK6	6/-	6X5GT	6/-
1A7GT	8/-	6AM6	4/-	6DQ6	11/-	6Y6G	10/-
1B3GT	7/-	6AN4	15/-	6EA8	11/-	6Z4	5/-
1C5GT	6/-	6AN8	10/-	6EV5	12/-	7A4	8/-
1D5	7/6	6AQ4	5/-	6F1	14/-	7A6	7/-
1D6	8/-	6AQ5	6/-	6F4	30/-	7A7	6/-
1G4GT	8/-	6AQ5A	7/6	6F5	5/-	7A8	5/-
1G6GT	7/-	6AQ6	8/-	6F6	8/-	7AF7	13/-
1H5GT	7/-	6AR5	6/-	6F6G	5/-	7AG7	7/6
1L4	2/6	6AR6	6/-	6F8G	5/-	7B4	8/-
1L6	17/6	6AR8	17/6	6F13	6/6	7B5	10/-
1N5GT	8/-	6AS5	5/-	6F14	15/-	7B6	11/-
1R4	6/-	6AS6	5/-	6F15	11/-	7B7	7/-
1R5	5/-	6AS7G	20/-	6F17	6/-	7C4	4/6
1S4	5/-	6AT6	4/6	6F19	6/6	7C5	10/-
1S5	4/6	6AU6	6/-	6F20	10/-	7C6	7/-
1T4	3/-	6AV6	6/-	6F23	11/6	7C7	5/-
1T5GT	6/-	6AW8A	14/-	6F24	12/-	7D3	8/-
1U4	5/-	6AX4GT	8/-	6F28	10/6	7D5	8/-
1U5	6/-	6AX5GT	12/6	6F32	3/-	7D8	7/-
1V	5/-	6B4G	16/-	6G6G	2/6	7E5	5/-
1V2	10/-	6B7	5/-	6H6	2/-	7E6	4/-
1X2B	7/-	6B8	7/-	6J4	9/-	7E7	10/-
2A3	5/-	6BA6	5/-	6J5G	4/-	7H7	8/-
2A4G	30/-	6BA7	15/-	6J5GT	4/6	7J7	14/-
2A6	6/-	6BC4	17/6	6J6	3/6	7K7	10/-
2A7	7/-	6BE6	5/6	6J7	9/-	7Q7	9/-
2C26A	5/-	6BF6	6/-	6J7G	5/-	7R7	12/-
2CW4	12/-	6BG6G	15/-	6K6GT	8/6	7S7	18/-
2D21	6/-	6BH6	7/6	6K7G	2/-	7Y4	8/-
2E24	40/-	6BJ5	15/-	6K7GT	5/-	7Z4	8/-
2G21	12/-	6BJ6	8/-	6K8	8/-	9BW6	7/-
2X2A	8/-	6BJ7	7/-	6K23	7/6	9D2	3/6
3A4	4/-	6BK4	25/-	6K25	24/-	10C2	13/-
3A5	8/-	6BL7GT	9/-	6L1	10/-	10D1	7/-
3A8GT	8/-	6BN6	7/6	6L5G	6/-	10F1	14/-
3D6	4/-	6BQ6	11/-	6L6GC	8/-	10F3	8/-
3E29	60/-	6BQ7A	8/-	6L7	5/-	10F18	9/-
3Q4	6/6	6BR7	12/-	6L18	8/-	10L1	7/6
3Q5GT	6/6	6BR8	5/-	6N7	8/-	10P13	12/6
3S4	5/-	6BS7	17/-	6P1	11/-	10P14	13/-
3V4	6/-	6BW6	9/6	6P25	12/6	10Y	15/-
5R4GY	9/-	6BW7	10/-	6P28	12/6	12A5	10/-
5T4	8/-	6BZ6	6/-	6Q7G	6/-	12A6	3/-
5U4GB	6/6	6BZ7	11/-	6R7	6/-	12A7	10/-
5V4G	9/-	6C4	2/6	6S7	7/-	12A8GT	5/-
5X4G	8/-	6C5	8/-	6SA7	8/-	12AC6	8/-
5Y3GT	5/-	6C5GT	6/-	6SC7	9/-	12AD6	8/-
5Y4G	6/-	6C6	4/-	6SD7GT	5/-	12AE6	7/6
5Z3	7/6	6C8G	7/-	6SF7	7/-	12AL5	7/-
5Z4G	8/-	6C9	11/-	6SG7	6/-	12AQ5	7/-
6/30L2	11/-	6C31	12/-	6SJ7	8/-	12AT6	5/-
6A7	10/-	6CB6	5/-	6SK7	5/-	12AT7	4/-
6A8	8/-	6CD6GA	17/-	6SL7GT	5/-	12AU6	6/-
6AB4	6/6	6CG7	10/-	6SN7GT	4/6	12AU7	5/6
6AB7	4/-	6CH6	6/-	6SQ7	7/-	12AU7A	6/-
6AC7	4/-	6CL6	9/-	6SR7	8/-	12AV6	6/-
6AD4	18/-			6SS7	3/-	12AV7	8/-
6AD7G	10/-			6SU7GT	10/-	12AW6	20/-
				6T8	7/-		

12AX7	6/-	30L15	12/6	5763	10/-	DY80	7/-
12AY7	10/-	30L17	14/-	5814A	10/-	DY86	8/-
12B4A	9/-	30P12	10/-	5840	10/-	DY87	9/-
12BA6	6/-	30P16	7/6	6060	5/-	E88CC	14/-
12BE6	5/6	30P18	7/-	6080	25/-	E90CC	12/-
12BH7A	7/-	30P19	14/-	6136	9/-	E91H	8/-
12BY7A	10/-	30PL1	12/-	6146	27/6	E92CC	7/-
12C8	4/-	30PL13	12/-	6159	32/-	E180CC	8/-
12E1	20/-	30PL14	12/6	6550	30/-	E180F	20/-
12F5GT	8/-	35A3	12/-	7551	30/-	E182CC	10/-
12H6	3/-	35A5	11/-	7586	22/6	EABC80	7/-
12J5GT	3/-	35B5	12/-	7895	22/6	EAC91	4/-
12J7GT	7/6	35C5	6/6	9001	4/-	EAF42	9/6
12K7GT	7/-	35D5	12/-	9002	5/6	EB41	5/-
12K8	8/-	35L6GT	7/-	9006	2/6	EB91	3/-
12Q7G	4/-	35W4	5/-	A2293	16/-	EBC21	7/6
12SA7	7/-	35Z3	10/-	AZ11	6/-	EBC33	7/-
12SC7	4/-	35Z4GT	8/6	AZ12	9/-	EBC41	8/6
12SF5GT	9/-	35Z5GT	6/-	AZ31	9/-	EBC81	6/6
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25L6GT	8/-	807	9/-	DF92	2/6	ECC85	6/6
25Y5	10/-	832	20/-	DF96	7/6	ECC86	7/-
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EF41	8/6	EZ90	4/-	PEN453/DD	10/6	U801	18/-
EF42	8/-	G55/1K	18/-	PFL200	17/6	UABC80	5/6
EF50	2/-	GD86W	10/-	PL36	10/-	UAF42	9/-
EF55	8/-	GS10H	40/-	PL38	16/-	UB41	11/-
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EF85	6/6	GU20	75/-	PL82	7/6	UBC81	8/-
EF86	8/-	GZ30	8/-	PL83	7/6	UBF80	7/-
EF89	5/6	GZ32	10/-	PL84	7/-	UBF84	7/6
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EF93	5/-	HABC80	8/-	PL500	15/-	UBL21	11/-
EF94	6/-	HBC90	5/-	PL801	10/-	UC92	6/-
EF95	5/6	HBC91	6/-	PP5/400	10/-	UCC84	10/-
EF96	2/-	HF93	6/-	PX4	15/-	UCC85	7/-
EF98	12/6	HF94	6/-	PX25	10/-	UCF80	10/-
EF183	8/-	HK90	5/-	PY31	8/-	UCH21	9/6
EF184	8/-	HL2	3/-	PY33	9/6	UCH42	9/6
EF804	21/-	HL2K	3/-	PY80	60/-	UCH81	7/-
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EH90	7/6	HL23DD	6/-	PY82	6/6	UCL83	10/-
EK2	10/-	HL41	4/-	PY83	7/-	UF41	9/-
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EL35	5/-	N78	15/-	PZ30	10/-	UF86	11/-
EL36	9/-	OCP71	24/-	QP25	5/-	UF89	7/6
EL37	17/6	ORP12	12/-	QQVO3-10	35/-	UL41	9/-
EL38	17/6	ORP60	10/-	QS105/45	15/-	UL84	6/6
EL41	9/6	PABC80	7/6	QS150/15	8/-	UM4	10/-
EL42	9/-	PC86	12/-	QS1200	10/-	UM80	7/-
EL50	6/-	PC87	12/-	QY3-125	160/-	UU5	8/-
EL81	9/6	PC97	9/6	R1	8/-	UU9	7/-
EL82	8/-	PC900	12/-	R17	8/-	UU10	8/-
EL83	8/-	PCC84	6/6	R18	7/6	UY1N	9/-
EL84	5/-	PCC85	8/-	RL18	12/6	UY21	9/-
EL85	8/-	PCC88	12/-	SP41	5/-	UY41	6/6
EL86	8/-	PCC89	12/6	SP42	8/-	UY82	9/6
EL90	6/-	PCC189	12/-	SP61	4/-	UY85	6/-
EL91	2/6	PCC805	12/6	TH233	6/-	VP23	3/6
EL95	6/-	PCC806	14/-	TH2321	7/-	VP41	5/-
EL360	22/-	PCE800	12/-	TP22	5/-	VP210	5/-
EL821	6/-	PCF80	7/6	TP25	5/-	VU120	10/-
EM4	10/-	PCF82	8/-	TP2620	7/6	W21	5/-
EM31	5/-	PCF86	9/-	TT12	60/-	W81M	6/-
EM34	12/-	PCF87	13/-	TT15	35/-	W729	10/-
EM35	8/-	PCF800	11/-	TT21	35/-	X63	6/-
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EM80	7/-	PCF802	11/-	U18/20	7/-	X66	8/-
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EM84	8/-	PCF806	13/-	U22	6/-	X81M	18/-
EM87	7/-	PCF808	12/-	U25	11/-	XB1	12/6
EN30	35/-	PCL80	12/6	U26	11/-	XC12	7/6
EN31	10/-	PCL81	9/-	U76	4/-	XC15	4/6
EN91	6/-	PCL82	8/-			Y63	8/-
EN92	6/-	PCL83	8/6			Z21	7/-
EY51	8/-	PCL84	8/6			Z503M	45/-
EY70	10/-	PCL85	9/6			Z700U	4/-
EY81	8/-	PCL86	9/6			Z759	22/-
EY83	9/6	PCL88	12/6			Z803U	15/-
EY84	7/6	PCL800	12/-				
EY86	7/6						

MULTIMETERS

Type 108-IT; 24 range precision portable meter, 5000 o.p.v; D.C. Volts: 2.5-10-50-250-500-2500V. A.C. Volts: 10-50-100-250-500-2500V; D.C. current 0.5-5-50-500mA. Resistance 2000-20,000 ohms; 2-20 megohms. Power output calibration in A.C. for 600 ohms line. Complete with prods and batteries, **£5.5.0.**

Type U-1; sensitivity 1000 o.p.v. A.C./D.C. voltage ranges 10-50-200-500-1000V; D.C. current ranges 100-500mA; Resistance ranges 2000-20,000 ohms. Complete with prods and battery, **£2.2.0.** P. & P. 7/6.

TRANSISTORS

OC23	17/6	OC78D	6/-	2S004	15/-
OC24	22/6	OC81M	7/-	2S006	20/-
OC25	12/-	OC81DM	7/-	AC127	9/6
OC26	8/-	OC83	6/-	AC128	8/-
OC28	17/6	OC139	12/-	AF114	9/-
OC29	17/6	OC140	16/-	AF115	7/-
OC35	15/-	OC141	25/-	AF116	8/-
OC36	15/-	OC170	7/-	AF117	6/-
OC42	7/6	OC171	8/-	AF118	17/6
OC44	6/-	OC200	9/6	GET114	5/6
OC45	5/-	OC202	15/-	GET115	8/6
OC70	5/-	OC204	17/6	GET116	12/-
OC71	5/-	OC205	20/-	GET875	9/-
OC72	6/-	OC206	22/6	GET880	10/-
OC73	11/-	2N410	3/6	MAT101	8/6
OC75	6/-	2N412	3/6	MAT121	8/6
OC76	6/-	2N697	13/-	T1166	6/-
OC77	8/-	2N1132	37/-	V30/30P	20/-
OC78	6/-	2S002	20/-		

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

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

RS310, 140 piv, 4/- RS350, 700 piv, 7/6
RS320, 280 piv, 5/- RS360, 840 piv, 8/-
RS330, 420 piv. 6/- RS370, 980 piv, 9/-
RS340, 560 piv, 7/- RS380, 1120 piv, 10/-

ZENER DIODES

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

GERMANIUM POINT CONTACT DIODES

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

TEXAS SILICON FULL-WAVE BRIDGE RECTIFIERS

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

GERMANIUM JUNCTION STUD MOUNTED POWER RECTIFIERS

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

HEADPHONES No. 10 ASSEMBLY

Moving Coil Headphones with moving coil Hand Microphone fitted with press-to-talk switch. Rubber earpads. Cord terminated with army type 6-point moulded connector. Low impedance. Brand new. **20/-** each.

Small quantities available of second hand assemblies, checked, in perfect order. **8/6** each.
P. & P. 3/6 per set.

MISCELLANEOUS SILICON HALF WAVE POWER RECTIFIERS

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

SPECIAL OFFER OF METERS

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

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

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PRACTICAL WIRELESS, AUGUST, 1966

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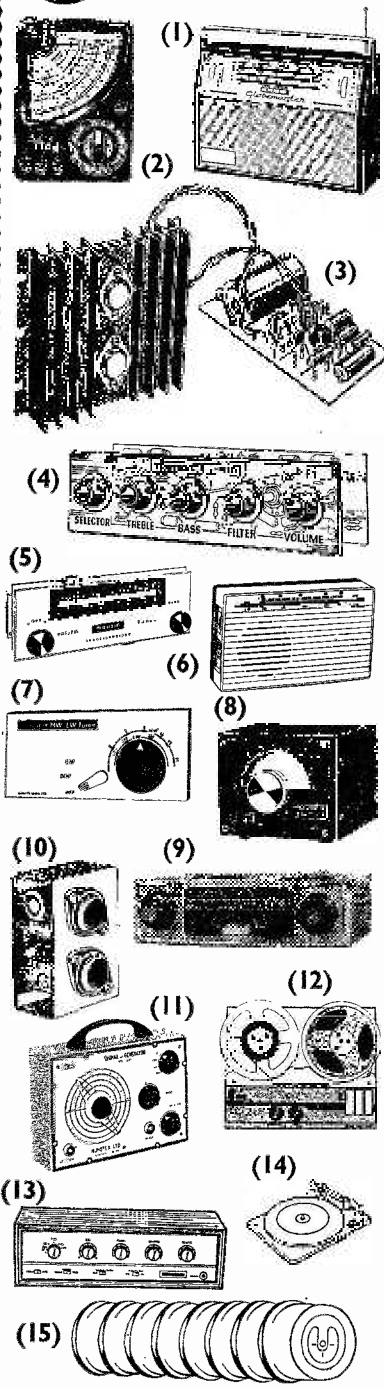
Send 3d. stamp for New Edition. All types of Transistors, Scr's, Diodes, etc. Valves and Crystals.



(9) TOURMASTER CAR RADIO

★ 7-Transistor Superhet with RF Stage. ★ Full tuning on Med. and Long waves. ★ 3 watts output. ★ 12 volts +VE earth. ★ Very sensitive and selective. ★ Push button wavechange. Brand new British made with maker's current guarantee. Complete with speaker, baffle and car fixing kit in cartons. Fully guaranteed.

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TOTAL COST TO BUILD £7.19.6 P.P. 3/6

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(8) V.H.F. FM TUNER

87/105 Mc/s Transistor Superhet. Geared tuning. Terrific quality and sensitivity. For valve or transistor amplifiers. 4 x 3½ x 2½in.

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(4) PREAMPLIFIERS. 8 input selector Treble, bass, volume, filter controls. 1½mV to 300mV inputs. Battery operated or from Mains Unit. Output up to 150mV RMS.

For 10 or 25 Watt Amplifiers.

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● ALL UNITS BUILT AND TESTED

(12) BUILD A QUALITY TAPE RECORDER

Three speeds—3 watts.
Complete kits with new "363" decks. Supplied as preassembled sections. Complete with amplifiers, portable cabinets and Speaker—excellent quality. 1,200ft. tape and spool.

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(10) 5 WATT AMPLIFIER

6-Transistor Push-pull, 3 ohms. 6mV into 1K. 12/18V supply. 2⅝ x 2 x 1½in. New Low Price.

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New matching Preamplifier, 6 inputs, treble/bass/selector/volume controls. 6-10mV o/put. 9-18V supply. **79/6,** p.p. 2/-. *For use with any Transistor Amplifier.*

(6) REGENT-6 MW/LW POCKET RADIO

6-Transistor superhet. Geared tuning. Push-pull output Moulded cabinet 5 x 3 x 1¼in. Phone socket. Printed circuit design.

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(P.P. 5/- any type)

1000 mono	**£5.19.6**	stereo	**£6.6.0**
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(*Deram cartridge add 60/- to mono price.) All autochange (except SP25), complete with cartridge. Brand new. Send for complete list.

(2) MULTI-METERS

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M1	2kV	**49/6**	EP30k	30kV	**£6.10.0**
TP10	2kV	**75/-**	EP50k	50kV	**£8.15.0**
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(5) VHF FM TUNER ALL TRANSISTOR

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