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1 RESISTOR COLOUR CODE CALCULATOR

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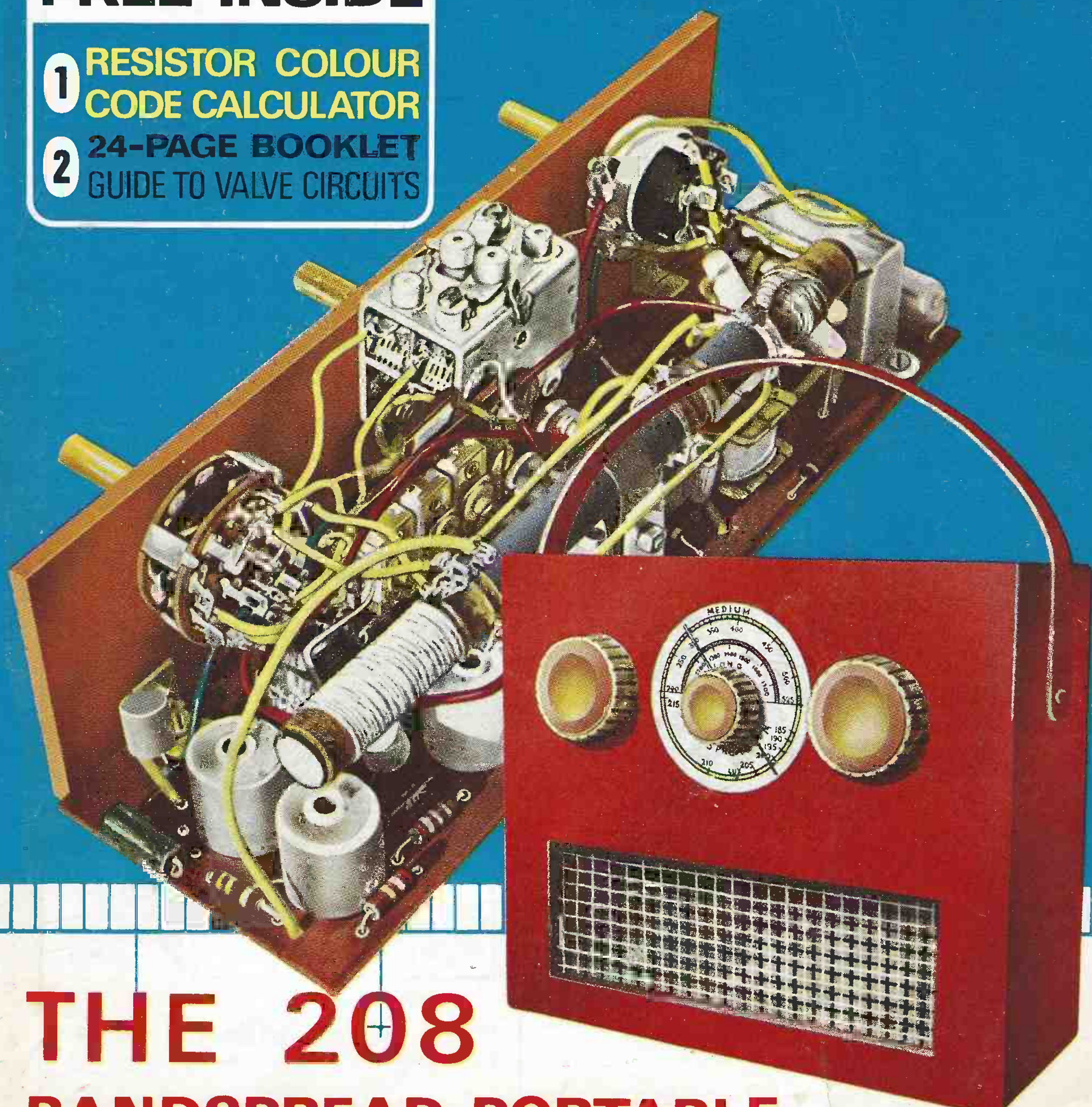


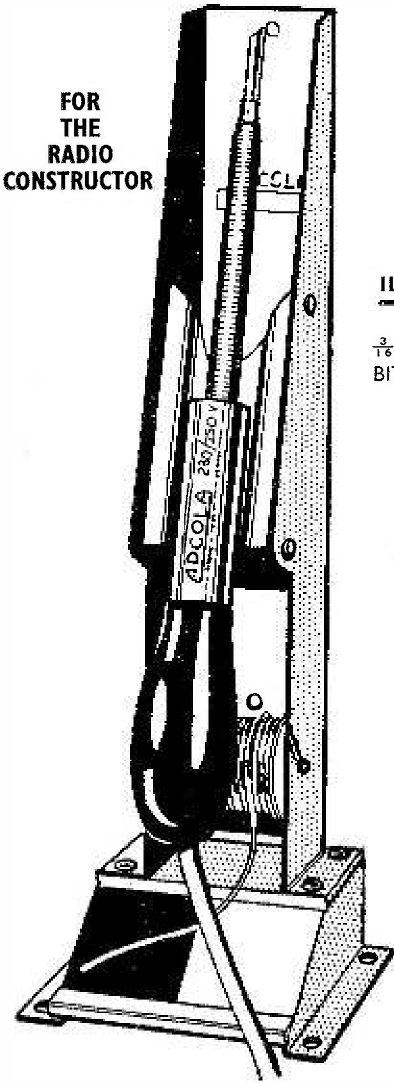
THE 208

BANDSPREAD PORTABLE

ADCOLA PRODUCTS LIMITED
(Regd Trade Mark)

SOLDERING EQUIPMENT

FOR THE RADIO CONSTRUCTOR



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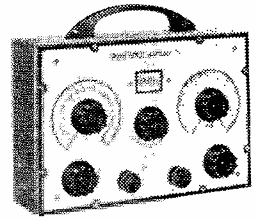

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★ 1 μH to 100H.
★ Q and tan δ.
★ Meter Balance.
★ Direct Scale Calibration.

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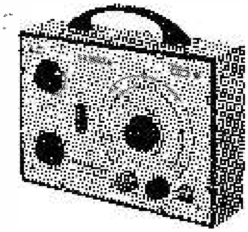
C.R. BRIDGE—Model 62



6 Ranges: 1Ω to 100M
1pF to 100μF
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For quick, easy faultless soldering

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12 ft. of 18 s.w.g. SAVBIT alloy in a continuous coil, used direct from free-standing dispenser.
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Strips insulation, cuts wire cleanly. Adjusts to any size.
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1A7GT	9/6	6K25	8/6	19AQ5	7/9	EBC81	5/9	EZ41	5/9	R19	9/6
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6K8G	5/-	12SQ7	7/6	EBC33	4/9	EY88	8/6	PY800	6/3	Z66	8/6

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

Gold Bonded highest quality Individually tested 9/6 doz. **1/-**

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

120 ma. (3 for 8/6) **3/9** 500 ma. (3 for 19/6) **7/6**

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25 WATT BASE SPEAKERS
Very heavy coned 12in. cast chassis. There is nothing to touch it for power handling and quality at the price. Plus 5/- p.p. **£4.19.0**

CONNECTING WIRE
P.V.C. Bright Colours. Five 25ft. coils only. **4/-**

HITACHI PORTABLE TAPE RECORDER

Latest Hitachi. Fabulous quality reproduction of music. 6-transistor. $1\frac{7}{8}$in. and $3\frac{3}{4}$in. speeds. Output 500 mW high quality speaker. Fast forward and rewind. Battery level and record level meter. Precision capstan drive. Size $8\frac{3}{16}$ x $3\frac{3}{4}$ x $6\frac{3}{4}$in. Genuine normal price of 35 gns. Unrepeatable. All spares available. With tape, tape reel, mike, etc. **19 Gns.**

HITACHI 4 TRACK MODEL TRA-5053

This superb 48 gns. recording machine is on limited very special offer. Two channel recording. Plays stereo tapes, $1\frac{7}{8}$in. and $3\frac{3}{4}$in. per sec. One track can be listened to on an earphone whilst recording on the second track, and thereafter both tracks played simultaneously through the loudspeaker. Ideal for languages, singing to music, etc. Excellent reproduction through high-flux elliptical speaker. A.C. erase. Dimensions: 11in. x $11\frac{1}{4}$in. x $5\frac{1}{2}$in. Weight 12 lb. Dynamic mike. Sound level meter. Footage indicator. Two mixed inputs. **29 Gns.**

MODEL TRA-722

Large 2-track semi-professional model with freq. response 50-13,500 C.P.S. on 7in. reels with mike 'tape' large speaker, latest single hand controls, elegant. Weight 20lbs. **29 Gns.**

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MOST MULLARD, MAZDA, COSSOR, EMITRON, EMI-SCOPE, BRIMAR, FERRANTI TYPES PROCESSED IN OUR OWN FACTORY	Carr. & Ins. 12/6	6 Months	12 Months	NEW TYPES
	12in.	£2. 0.0	£3. 0.0	AW47-91 £5.15.0
	14in.	£2.10.0	£3.10.0	AW59-91 £7.10.0
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	19in.	£3. 5.0	£4. 5.0	
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100 HI-STABS 1% to 5% 100Ω to 5mΩ 9/6

CO-AX, low loss, **6d.** yd., 25 yds. 11/6; 50 yds. **22/-**; 100 yds. **42/6**. Co-ax Plugs, **1/3**. Wall outlet boxes **3/6**.

100 RESISTORS SIZES $\frac{1}{8}$—3 watt 6/6

MICROPHONE CABLE, Highest quality black, grey, white, 1/- yard

100 CONDENSERS 9/6

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

10 x 5in. SPEAKERS

Ceramic High Flux, "pancake" magnets. Hammered gold finish. Most excellent reproduction 3Ω. **25/-**

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MODEL FMT/5. Self powered 200/250 v. A.C. A.F.C. High sensitivity for fringe and long distance reception. Size $11\frac{3}{4}$ x $8\frac{5}{8}$in. x $3\frac{1}{2}$in. high. Weight $7\frac{1}{2}$lb. In case finished in satin chrome and black. We can offer these high fidelity instruments. Normally £21.13.5. Limited number only at **15 Gns.**

LOUDSPEAKERS. 3Ω Top Makes.

$6\frac{1}{2}$in. **7/6** 5in. 7x4in. **8/6**

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Excellent Quality Guaranteed Upright mounting 250 v., 60mA., 6.3v., 3A. Primary 230v. **9/6**

350-0-350v. 120mA, 6.3v. 5A 5v. 3A. Super quality **39/-**

Ditto 80mA. **29/-**

STEREO PORTABLE CABINETS

Latest black and silver metal finish. Consisting of centre cabinet size $16\frac{1}{2}$in. x 13in. x 8in. deep with lift up lid together with two 10 x 6 speaker cabinets which clip on ends of main cabinet size $4\frac{1}{2}$in x 13in. x 8in. making overall size of $25\frac{1}{2}$in. x 13in. x 8in. High quality chrome fittings. Will take most autochanger or tape decks. Half price. **£3.19.0**

DITTO but with vynide 7 x 4 speaker cabinets. **59/-**

TRANSISTOR CAR RADIOS

Latest Autolux fully transistorised complete with speaker and fittings. Large purchase enables us to sell these superb sets (normally approx. 14 gns.) at the amazing price of **9 Gns.**

GELOSO 100W AMPS.

110-240v. AC twin mike and twin gram inputs full mixing, base, treble controls. Fully enclosed case, matches all speaker impedances. Weight 38lbs. Hi-Fi quality output. Normally 56 gns., few only **42 Gns.**

STEREO AMPLIFIERS

AC262 3-4 watts per channel, excellent control panel, excellent quality finish. AC mains. Valve at **6 Gns.**

SPEAKER FABRIC

Superior Gold/Brown Vynide with small holes, gift at **2/6** sq.ft. or 12 sq.ft. (4 x 3) **19/-**

ENORMOUS PURCHASE. GUARANTEED. APPROX. HALF PRICE. WORLD FAMOUS MAKE

★ TAPE ★

We offer you fully tensilised polyester/mylar and P.V.C. tapes of identical quality hi-fi, wide range recording characteristics as top grade tapes. Quality control manufacture. They are truly worth a few more coppers than acetate, sub-standard, jointed or cheap imports. TRY ONE AND PROVE IT YOURSELF!

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

Postage 1/- *reel*

Post Free less 5% on three reels.

Quantity and Trade enqniries invited.

STEREO AM/FM TUNERS

Large de-luxe A/C radiogram chassis. Mullard valves normal value approx. 24 gns. **17 Gns.**

TRANSISTOR PLAYERS

UA25SS Autochanger low noise, 2 external inputs (mike etc.). External speaker socket, with hi-flux speaker, mixer, base, treble controls, really de-luxe portable case with large satin chrome control panel. Normal price 25 gns. **17 Gns.**

ELPICO MONO PREAMPS

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

230V AC CONVERTORS

INPUT 12V D.C. Output 40 watts from car battery (normally $10\frac{1}{2}$ gns.) **£5.10.0**

LATEST GARRARD

All Factory Fresh. All with cartridge.

Stereo cartridge fitted for 17/6 extra.
SRP12 Mono (Single) Player **£4.19.0.**
SP25 Semi-Transcription (Single) **£11.19.0.**
AUTOSLIM Standard Auto. **£5.19.0.**
AT5 Slimline—similar to AT6 **£7.15.0.**
Model 1,000—changer, 10 records **£6.19.0.**
Model 2,000—large turntable **£7.19.0.**
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AT60—Heavy Automatic **£11.19.0.**
A70—Automatic **£19.19.0.**
LAB80—Transcription **£27.10.0.**
401—Transcription **£29.19.0.**
Model 50—Automatic **£9.10.0.**

B.S.R.

TU14—Single player Complete **59/-**
GU7—Single Deck Complete **£4.5.0.**
UA14—Auto Changer **£4.17.6.**
UA16—Blue-silver **£5.10.0.**
UA25SS—Super Slim **£5.15.0.**

Stockists of Leak, Quad, Chapman, Goodman, Armstrong, Tripletone, Linear, Rodgers, Truvox, Ferrograph, T.S.L. Wharfedale, W.B., etc., etc. for value and service.

Post: 1lb. 1/6, $1\frac{1}{2}$lb. 2/6, 2lb. 2/9, 3lb. 3/-, 4lb. 3/3, 5lb. 3/6, 6lb. 4/-, 8lb. 4/6, 14lb. 5/6

TECHNICAL TRADING CO.

ALL MAIL ORDER AND RETAIL SHOP AND ROBOPHONE ORDERS
DEVONIAN COURT, PARK CRESCENT PLACE, BRIGHTON. Tel. 680722

★ **LONDON** 10 Tottenham Court Road, Tel. MUSeum 2639.

★ **PORTSMOUTH** 350-352 Fratton Road, Tel. 22034.

★ **SOUTHAMPTON** 72 East Street, Tel. 25851

...COMMENT

CAMBRIDGE RELAY STATION

The BBC's new television and v.h.f. sound relay station to serve Cambridge was brought into service on 7th March. It transmits BBC-1 television on Channel 2 with horizontal polarization, and the three sound programmes on v.h.f., also horizontally polarized, on the following frequencies: Midland Home Service 93·3 Mc/s, Light Programme 88·9 Mc/s, Third Network 91·1 Mc/s.

RECORDING EQUIPMENT DEMONSTRATED IN AMERICA

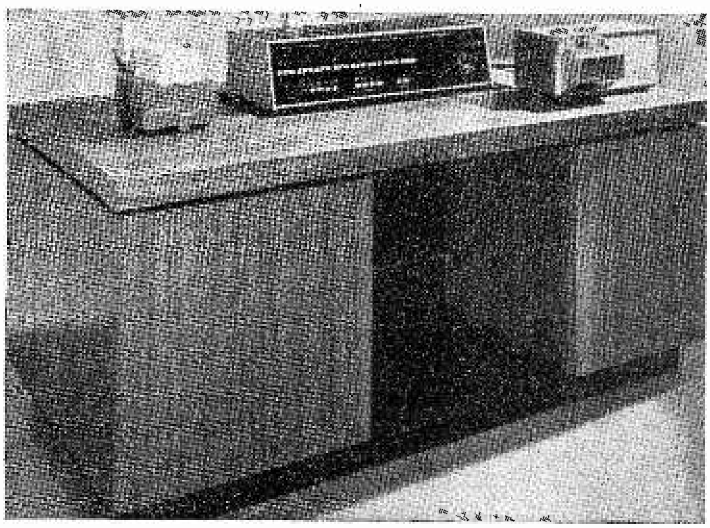
Sound recording equipment developed by EMI Electronics Ltd. aroused wide interest among leading sound engineers during recent demonstrations in the United States and Canada.

EMI senior sales engineer S. G. Griffiths held the demonstrations during a four-week sales and market evaluation tour of the two countries.

Mr. Griffiths visited major television companies in New York and the leading film studios in Hollywood. In Canada he met sound engineers in the major broadcast centres of Toronto and Montreal.

"Everywhere I went the interest shown in our equipment was tremendous," said Mr. Griffiths. "Our new L4 professional portable tape recorder received particular attention and one Hollywood studio has taken an option on 40 of the machines."

MARCONI COMPUTER FOR SAUDI ARABIA



This photograph shows one of the new Marconi Myriad computers of the type which will be used in the radar data handling systems for the Saudi Arabian defence system.

This computer which has been designed by Marconi for radar data processing and other on-line applications, features the latest techniques in microelectronics.

The complete machine is housed in this single desk unit which measures 6ft. x 3ft. x 2ft. 9in. high. All controls and indicator lights are mounted in the low superstructure of the desk top, which provides the operator with full facilities for machine operation and programme checking.

Good Old Henry

I AM now what many people regard as an "oldster" and you and your colleagues are what Ibsen described as "Youngsters knocking at the door".

So I feel that I must congratulate you on the wisdom, the balance and the up-to-dateness of the article by "Henry" entitled Oh, but it Hertz! This is what I call technical journalism at its best.

So, as a westerning planet, I salute the dawn of a new dispensation.

Percy Wilson.

Headington,
Oxford.

We are grateful for this tribute from veteran technical journalist Percy Wilson who, as many readers will know, was for many years Technical Editor of "The Gramophone". He has now established a Consortium of Audio Consultants, in which endeavour we wish him every success.—Editor.

Tapespondent Wanted

I WOULD like to tapespond with anyone, anywhere of my own age (15) who is interested in amateur radio, short wave listening and radio construction generally. My tape recorder is a National 2 track $1\frac{7}{8}$ and $3\frac{3}{4}$ i.p.s. All tapes will be answered

John Adams.

74 Spring Street,
Sandringham,
Victoria,
Australia.

Ham or Sham

WHAT type of person is worried about the "Radio Amateur"—why the concern? If a person is sufficiently interested in radio communications then he would not ask the "Ham or Sham" question. He would know that in amateur radio "Sham" cannot exist, because the operator is fully qualified to operate any equipment he may own, whether it be home constructed or commercial. This "amateur" tag may have been all very well in the far distant past when capacitors and all other equipment had to be hand-made, but of course even when an operator builds his own home-made gear, the components are all commercial.

I say to the Citizens band agitators and the like; put in some hard work and try for the R.A.E. and long before you pass, the "Ham or Sham?" will have disappeared from your minds.—You will know better!

E. W. Phillipson, G3NVE.

Goole,
Yorkshire.

More News and Comment on Page 44.

Fully guaranteed Individually packed VALVES

AC/HL	4/6
ACP4	6/-
AC6PEN	5/-
AL60	5/-
ARP3	3/-
ARP12	2/6
ARP24	3/6
AR8	5/-
ARTP1	6/-
ATP4	2/3
ATP7	5/6
AU7	55/-
AZ31	9/-
B6H	15/-
BD78	40/-
BL63	10/-
BS4	8/-
BS5	20/-
BS84	37/6
B2134	16/-
BT19	25/-
BT35	25/-
BT45	150/-
BT83	35/-
CC3L	2/-
CL33	9/-
CV71	3/-
CV77	5/-
CV102	1/-
CV103	4/-
CV4004	7/-
CV4014	7/-
CV4015	5/-
CV4025	10/-
CV4049	6/-
CY31	6/6
D1	1/6
D41	6/-
D61	6/-
D77	3/3
DA30	12/6
DAF96	6/-
DD41	4/-
DET5	8/-
DET20	2/-
DET25	15/-
DF73	5/-
DF91	3/-
DF92	3/-
DF96	6/-
DH63	5/-
DK92	6/6
DK96	6/6
DL92	4/-
DL93	6/-
DL94	5/9
DL96	6/-
DLS10	8/-
DLS19	15/-
E80F	23/-
E88CC	12/-
E90CC	10/-
E1148	2/6
E1266	50/-
E1415	30/-
E1524	12/6
EA50	1/-
E173	7/-
EABC80	5/9
EA91	3/6
EAF42	8/-
EB34	1/6
EB91	3/-
EBC23	6/-
EBC41	8/6
EBC81	5/-
EBF80	6/6
EBF83	7/6
EBF89	6/9
EC52	4/-
EC53	12/6
EC70	4/-
EC90	2/-
EC91	3/-
ECC81	4/-
ECC82	5/-
ECC83	6/-
ECC84	5/6
ECC85	6/6
ECC88	9/-
ECC91	4/-
ECF82	7/-
ECH42	9/6
ECH81	5/-
ECH83	7/6
ECL80	6/-
ECL82	7/6
ECL83	10/-
ECL86	10/-
EF36	3/4
EF37A	7/-
EF40	8/-
EF50	2/6
EF52	6/-
EF53	4/6
EF55	8/-
EF71	7/6
EF72	5/-
EF73	5/-
EF74	4/-
EF80	5/-
EF81	6/-
EF85	4/6
EF86	6/6
EF89	5/-
EF91	4/-
EF92	2/-
EF95	5/-
EF183	8/-
EF184	8/-
EHT1	300/-
EL32	3/9
EL34	10/-
EL36	5/-
EL38	17/6
EL41	7/-
EL42	8/-
L50	8/-
EL81	8/-
EL83	6/3
EL84	5/-
EL85	8/-
EL91	4/6
EL95	5/-
EL360	20/-
EM80	6/-
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/-
F/6061	5/-
F/6063	4/-
FW4/500	6/6
FW4/800	8/6
G1/236G	9/-
G1/370K	20/-
G50/2G	5/-
G180/2M	15/-
GM4	45/-
GZ32	10/-
GZ34	10/-
H63	7/-
HK54	22/6
HL2K	2/6
HL23	6/-
HL23DD	5/-
HL41	4/-
HVR2	9/-
K3A	60/-
KT8C	22/-
KT32	8/-
KT33C	6/-
KT44	5/9
KT63	4/-
KT66	16/-
KT67	15/-
KY76	8/6
KT88	22/-
KTW61	4/6
KTW63	2/-
KTZ41	6/-
KTZ63	5/-
M8100	9/-
M8141	12/-
M8161	7/-
MH4	5/-
MHLD6	10/-
ML6	6/-
N78	15/-
NE17	7/-
OA2	6/-
OB2	6/-
OB3	7/-
OC3	5/-
OD3	5/-
OZ4A	5/-
PCC84	5/-
PCC89	10/-
PCF80	6/6
PCF82	6/6
PCF84	6/-
PCL81	9/-
PCL82	7/-
PCL83	8/3
PCL84	7/-
PCL85	8/6
PCL86	9/-
PEN25	4/6
PEN46	3/-
PEN200A	3/-
PFL200	17/6
PL36	7/6
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	8/6
PY80	5/6
PY81	5/6
PY82	5/-
PY83	6/-
PY800	6/6
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/-
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	6/6
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	7/-
UF89	6/-
UL41	7/6
UL84	5/6
UU5	7/-
UU9	8/6
UY21	7/6
UY85	5/-
V1120	4/-
V1507	5/-
V1924	20/-
VMP45	12/-
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/-
Y63	5/-
Y65	4/-
Y66	8/-
Z800U	20/-
Z801U	10/-
1A3	8/-
1A5GT	5/-
1B22	30/-
1C5GT	6/-
1D8GT	6/-
1E7G	7/6
1F2	3/-
1G6GT	6/-
1L4	2/6
1LA6	6/-
1LC6	7/-
1LH4	4/-
1N21B	4/-
1N43	4/-
1N70	4/-
1R4	5/-
1R5	3/6
1S4	5/-
1S5	4/6
1T4	3/-
2A3	5/-
2B26	8/-
2C26	7/-
2C26A	3/-
2C34	2/6
2C45	22/6
2C46	30/-
2C51	12/-
2D21	5/-
3A4	4/-
3A/108A	20/-
3A/46J	35/-
3A/167/M	25/-
3B7	5/-
3B24	5/-
3D6	4/-
3E29	50/-
3Q4	6/-
3Q5GT	7/-
3S4	4/-
3V4	5/9
3X2	3/-
4C27	35/-
4D1	4/-
5A173G	5/-
5A174G	5/-
5B251M	25/-
5B/253M	15/-
5B254M	40/-
5B255M	35/-
5R4GY	9/-
5T4	7/-
5U4G	4/6
5V4G	8/-
5X4G	8/6
5Y3G	4/6
5Y3GT	5/-
5Y3WGTB	9/-
5Z4G	6/6
5Z4GT	8/-
6AB6	4/-
6AC7	2/-
6AG5	2/6
6AG7	6/-
6AH6	10/-
6AJ7	2/-
6AK5	5/-
6AK7	6/-
6AL5	3/-
6AL5W	7/-
6AM5	2/6
6AM6	4/-
6AQ5	7/-
6AQ5W	9/-
6AS6	4/-
6AS6W	9/-
6AS7G	20/-
6AT6	3/6
6AU6	7/-
6AX4	8/-
6B7	6/-
6B8G	2/6
6BA6	4/-
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/-
SF14	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	6/-
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/-
12SK7GT	3/-
12SN7GT	5/9
12SR7	5/-
12Y4	2/-
12L7	7/-
15D2	6/-
19E2	15/-
19G3	10/-
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/-
82	8/-
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/-
811	22/6
813	65/-
815	35/-
829B	50/-
830B	4/-
832A	45/-
832	15/-
843	5/-
866A	14/-
884	10/-
954	4/6
955	2/6
956	2/-
957	5/-
958A	4/-
1612	5/-
1616	3/-
1319	5/-
1625	6/-
1626	3/-
1629	4/6
2051	5/-
4043C	13/6
4063	8/-
7313C	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/-
VCR138	30/-
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/-
Transistors	
OC16	20/-
OC22	23/-
OC25	12/-
OC44	6/-
OC45	5/-
OC71	4/6
OC72	6/-
OC73	10/-
OC81M	7/-
OC82	10/-
OC122	16/-
OC200	10/6
XC141	10/-
XC142	15/-
XC155	20/-
XC156	22/6
2N502	47/-
2N247	9/6
2N585	10/6
2N1090	20/6
2N1091	29/-

MANY OTHERS IN STOCK include Cathode Ray Tubes and Special Valves. All 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.

THERMAL PLUS MECHANICAL CIRCUIT BREAKER FOR A.C. & D.C. Current 1 amp. Protects against shorts (instantaneous cut out at approximately 8 amps.) and against overloads: 1.8 amp. 30 seconds, 2.1 amp. 15 seconds, 2.5 amp. 8 seconds. Delayed cut off may be adjusted to different currents and times. Separate pair of contacts to indicating device. Dimensions $3\frac{1}{2} \times 1\frac{3}{8} \times \frac{7}{16}$in. Price **12/6.** P. & P. 2/6.

"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 $7 \times 5 \times 5\frac{1}{2}$in. Weight $8\frac{1}{2}$lb. Price **£7.19.6.** P.P. 3/6.

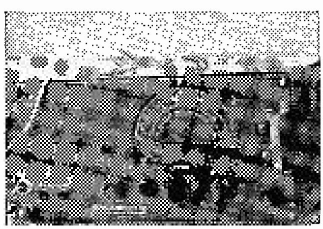
2 KW ULTRASONIC GENERATOR together with power supply unit for 200-250 v. A.C. Complete two chassis with interconnecting cables. Frequency 37 to 43 kc/s adjusted by fine control. Peak output 2 kw., average output 500 w. Completely new with valves and manual £65 carriage paid U.K. Large selection of mains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

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, **£9.12.6.** With vibratory supply unit, 12v, **£10.15.0.** With specially built in P.S.U. for 210-250v A.C., **£11.17.6.** Carriage either set 15/-.

H.R.O. SENIOR TABLE MODEL TYPE 5A 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., **£33.** Carriage and packing 30/-.

Ditto, but model "M", **£28.** 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

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

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

EVERSHED MEGGER CIRCUIT TESTER 2 ranges. 0-1,000 ohms. 100-200,000 ohms with test leads leather carrying case. Tested **£4.19.6.** P. & P. 3/6.

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

MARCONI TF 868 UNIVERSAL BRIDGE. Capacitance 1μS to 100μS, inductance 1μH to 100H, resistance 0.1 ohm to 10 m/ohms. Q 0.1 to 10. Power supply 115/230 v. A.C. In new condition with instruction book. **£65.** Carr. 30/-.

C.R.150/2. Frequency coverage 1.5-22 Mc/s in 4 bands. Price **£31.** Carriage 30/-.

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 Solenium HV rectifiers. Brand new, **£9.10.0.** Carriage 12/-.

PANEL METERS (round)

500mV	$3\frac{1}{2}$in.	D.C.	32/6
0-500 microamps	$2\frac{1}{2}$in.	D.C.	22/6
0-500 microamps	$3\frac{1}{2}$in.	A.C.	22/6
25-0-25mA	$2\frac{1}{2}$in.	D.C.	45/–
150-0-1,500mA	$3\frac{1}{2}$in.	D.C.	29/–
0-5v.	2in.	D.C.	22/6
0-5v.	$3\frac{1}{2}$in.	A.C.	22/6
0-15v.	$2\frac{1}{2}$in.	A.C.	17/6
0-50v.	$2\frac{1}{2}$in.	D.C.	28/–
0-150v.	$2\frac{1}{2}$in.	A.C.	24/–

Weston as usually used also H.R.O. as "S" meter.

Projection only.

500mv.	$3\frac{1}{2}$in.	D.C.	35/–
500mA	$2\frac{1}{2}$in.	D.C.	22/6
500 microamp	2in.	D.C.	19/–

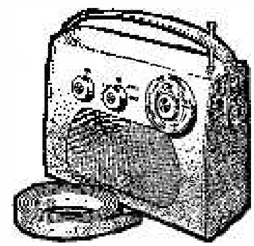
Why NOT BUILD ONE OF OUR PORTABLE TRANSISTOR RADIOS...

BACKED BY OUR SUPER AFTER SALES SERVICE

All components used in our receivers may be purchased separately if desired. Parts price lists and easy build plans available separately at prices stated. Overseas post 10/-.

FIRST FOR QUALITY, PERFORMANCE AND PRICE!

NEW ROAMER SEVEN Mk IV



7 WAVEBAND PORTABLE OR CAR RADIO

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

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

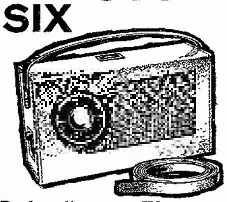
Covers Medium and Long Waves, Trawler Band and three Short Waves to approx. 15 metres. Push-pull output for room filling volume from rich toned 7 x 4in. speaker. Air spaced ganged tuning condenser. Ferrite rod aerial for M & L waves and telescopic aerial for S waves. Real leather look case with gilt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

★ EXTRA BAND FOR EASIER TUNING OF PIRATE STATIONS etc.

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

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

MELODY SIX



"... amazed at volume and performance ... has really come up to my expectations" S.G. Stockton-on-Tees.

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

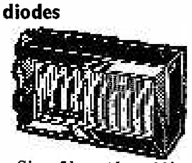
Our latest completely portable transistor radio covering medium and long waves. Incorporates pre-tagged circuit board, 3in. heavy duty speaker, top grade transistors, volume control, tuning condenser, wave change slide switch, sensitive 6in. ferrite rod aerial. Push-pull output. Wonderful reception of B.B.C. home and Light, 208 and many Continental stations. Handsome leather-look pocket size case, only 6¾ x 3½ x 1⅝in. approx. with gilt speaker grille and supplied with hand and shoulder straps.

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

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

POCKET FIVE

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



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

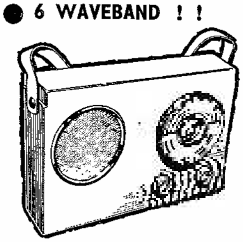
Parts Price List and easy build plans 1/6 (FREE with kit)

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

NEW ROAMER SIX

NOW WITH PHILCO MICRO-ALLOY R.F. TRANSISTORS

● **6 WAVEBAND ! !**



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

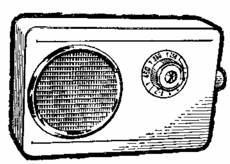
Listens to stations half a world away away with this 6 waveband portable. Tuneable on Medium and Long waves, Trawler band and two Short Waves. Sensitive ferrite rod aerial and telescopic aerial for short waves Top grade transistors, 3-inch speaker, handsome case with gilt fittings. Size 7¼ x 5¼ x 1½in. Carrying strap 1/6 extra.

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

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

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

NEW TRANSONA FIVE



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

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

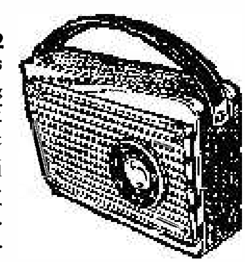
Fully tunable over Medium and Long Waves and Trawler Band. Incorporates Ferrite rod aerial, tuning condenser, volume control, new type fine tone super dynamic 2¾in. speaker etc. Attractive case. Size 6¼ x 4½ x 1¼in. with red speaker grille. (Uses 1289 battery available anywhere.)

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

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

TRANSONA SIX

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

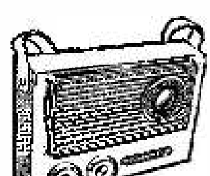


This is a top performance receiver covering full Medium and Long Waves and Trawler Band. High-grade approx. 3in. speaker makes listening a pleasure. Push-pull output Ferrite rod aerial. Many stations listed in one evening including Luxembourg loud and clear. Attractive case in grey with red grille. Size 6¼ x 4½ x 1¼in. (Uses PP4 battery available anywhere.) Carrying strap 1/- extra.

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

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

SUPER SEVEN



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

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

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

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

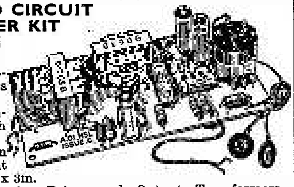
RADIO EXCHANGE CO.

61 HIGH STREET, BEDFORD

Telephone: Bedford 52367

Callers side entrance Barratts Shoe Shop open 9-5 p.m. Sats. 10-12.30 p.m.

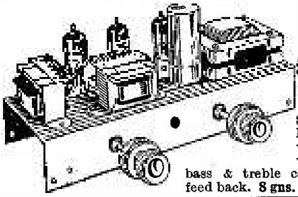
HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT Type TA1



● 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

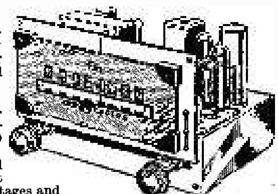
Incorporating 2 ECL82s and 1 EZ80, heavy duty, double wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.



ONLY **£4.19.6** P. & P. 6/6

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

HARVERSON'S F.M. TUNER Mk. I



● F.M. tuning head by famous maker ● Guaranteed non-drift. ● Permeability tuning ● Frequency coverage. 88-100 Mc/s ● Balanced diode output ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used ECC85, two EF80s, and EZ80 (rectifier) ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 5½in. ● All parts sold separately. Set of parts if purchased at one time **£5.19.6,** plus 8/6 P.P. and ins. Circuit diagram and instructions 1/6 post free. **Mark II Version as above** but complete with magic eye, front panel and brackets, **£6.12.6.** P. & P. 8/6.
Mark III Version as Mark I but with output stage (ECL82) and tone control, **£7.7.0.** P. & P. 8/6.

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 2¾in.). ● 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;** 3½in. **12/6;** 7 x 4in., **21/-;** P. & P. 2/- per speaker.

Portable CABINET

Size approx. 9½ x 6¾ x 3½in. Suitable for above using. 3½in. 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.

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/-.

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 2½in. 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.

SINGLE PLAYERS

B.S.R. TU/12	**£3.9.6.**	Carr. 5/6.
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 (4 pole motor) plug-in hd. **£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. 4″ & 5″ 2/-, 6½″ & 8″ 2/6 10″ & 12″ 3/6 per speaker.

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.**

VYNAIR AND REXINE SPEAKER AND CABINET FABRICS. Approx. 54in. wide. Usually **35/-** yard. OUR PRICE **13/6** per yard length. P. & P. 2/6 (min. one yd.) S.A.E. for samples.

MAINS TRANSFORMER For transistor power supplies. Tapped pri 200-250v. Sec. 40-0-40 at 1 amp (with electrostatic screen) and 6.3v at 5 amp for dial lamps etc. Drop thro mounting. Stack size 1¾″ x 3¾″ x 3½″ **27/6.** P. & P. 4/6. Also for use with above 4000 mfd. 40v. Smoothing condenser size 1¾″ dia x 3½″ high. **3/6** each. P. & P. 1/6 and 2800 mfd. 25v. 1¼″ dia x 3″ high **3/-.** P. & P. 1/-.

MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS. Stack size 1¼ x 1¼ x ⅝ 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.

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.**

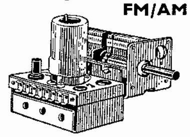
EDISWAN MAZDA

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.

HEAVY DUTY NON-INDUCTIVE D/P MICRO SWITCH. Conservatively rated 10 amps at 250v. Standard one-hole fixing. Body size 1⅜ 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 ⅜ x ⅜in. 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).

ANOTHER HARVERSON SCOOP! FM/AM TUNER HEAD



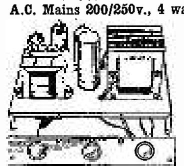
Beautifully designed and precision engineered by Dormer and Wadsworth Ltd. Supplied ready fitted with twin .0005 tuning condenser for AM connection. F M section covers 86-102 Mc/s. I.F. output 10.7 Mc/s. Complete with ECC85 (6L12) valve and full circuit diagram of tuner head. All brand new and realigned F.M. Another special bulk purchase enables us to offer these at **27/6** each, P. & P. 3/-. Order quickly!

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 and tested for only **£4.5.0** P. & P. 6/-.

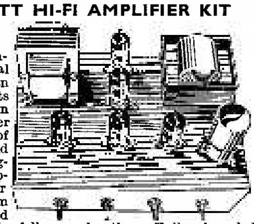
HSL 'FOUR' AMPLIFIER KIT

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 it 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 DELUXE. Three speeds, 2 track. takes up to 7in. spools. **10 gns.** Plus 7/6 Carr. & ins. on each (Tapes extra).

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.

PORTABLE TAPE RECORDER CASE

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 15½″ 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.

Open all day Saturday
Early closing Wed. 1 p.m.
A few minutes from South Wimbledon Tube Station.

HARVERSON SURPLUS CO. LTD.

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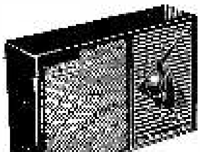
SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

(Please write clearly)

PLEASE NOTE: P. & P. CHARGES QUOTED APPLY TO U.K. ONLY P. & P. OVERSEAS ORDERS CHARGED EXTRA.

EXCLUSIVE TO PRACTICAL WIRELESS READERS
MORE TERRIFIC OFFERS FROM CONCORD!

TRANSISTOR POCKET RADIOS
WITH LOUDSPEAKER

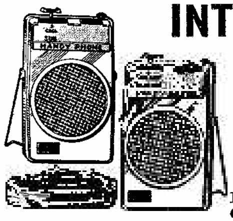


BULK PURCHASE ENABLES US TO MAKE THIS FANTASTIC OFFER

ONLY 28/6
NO MORE TO PAY

The "SAN REMO" . . . so tuned that it brings the voices of star vocalists dramatically to life — in your home, office, etc. Only 4⅞ x 2⅞ x 1½in. Fits easily into your pocket or handbag. Works for months off 1/2d. battery. Should last a lifetime, **anyone can assemble it in an hour or two** with our easy plan. Miniature speaker—everything, only 28/6, 2/6 P. & P. (Parts can be bought separately). Limited supply—so rush your order before it's too late.

SAVE YOUR LEGS!
INTERCOM
OUTFIT & BABY ALARM
Ready Built



LIMITED QUANTITY SAVE £3.16.6

ONLY 49/6

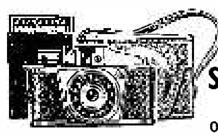
Robustly made, brand new current models. You get 2 separate fully transistorised intercommunicating sets — each can speak or listen to the other — complete with 60ft. connecting wire. **Fixed in a flash.** Ends baby-crying worries. Ideal for Workshop to House, Sickroom, hundreds of uses! Hangs on wall or stands up. **Our absurd price 49/6, battery 2/6 extra. Post, etc. 3/6. Money refunded if not 6 guineas value!**

MAKE 5 DIFFERENT TRANSISTOR RADIOS for 35/-

NO EXPERIENCE NECESSARY. No Soldering. Only 8 connections for first radio to work. Just look, you get Easy ABC Plans, Cabinet, Loudspeaker **(alone 17/6)**. Earphone, 4 Semi-conductors, Coils, Condensers, Resistors, Tuner, Switch, Screws, etc. **YES—EVERYTHING!** Loud clear English and Foreign reception. As supplied to Educational Authorities, H.M. Forces, etc. TESTIMONIALS GALORE. **Mr. R. O'D of Londonderry, writes:** " . . . *I received your components and I must say that I am very satisfied with them, I have it already set up!* . . ." **COMPLETE HOME/RADIO COURSE. Originally £6 SEND ONLY 35/- plus 3/6 post, etc.**

IT HAD TO COME EVENTUALLY! THE "SKYSCRAPER" PERSONAL COMMUNICATIONS RECEIVER. Highly sensitive. World-wide short-waves reception including news in English and countless other broadcasts from RUSSIA, AMERICA, etc., etc. Take it anywhere — it's featherweight! 6in. x 3½in. x 1¾in. Bandspread Tuning. Vernier dial. Miniature Valve Circuits, Plug-in Coils, Own Rod Aerial, etc. 50% of production to be exported. **Anyone can assemble it within 2 hours**—only a few connections to make—experience unnecessary. Parts incl. Case, Personal phone. Easy-to-follow plan—**49/6, plus 6/6 Post, etc.**

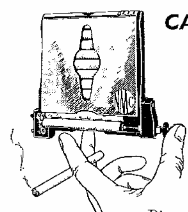
MINIATURE PRECISION
SPY CAMERA



Only 12/6 Post 2/6

Offered at a fraction of its Real Worth. Brand new precision made photographic instrument in chromed steel and leather. Two speed shutter, 2½in. x 1½in.! Easily concealed in palm-of-hand! and takes crystal clear photographs. The rage of America and offered at the absurd price of **12/6**, incl. solid leather case—add 6/- for pack of 6 films which give 60 photos, superb craftsmanship in miniature. Send immediately.

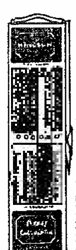
CAR CIGARETTE
LIGHTER—DISPENSER



ONLY 18/6

High Class Stores sell at 3 gns. — save £2.4.6 Top quality chromium Car cigarette lighter — Dispenser, Fixed in a jiffy — Pressing Button delivers ready-lit Cigarette into your hand! **Takes 10 cigarettes — King size or any size! As fitted to luxury cars.** Safe, foolproof. 3⅞ x 4 x ⅞in. Lifetime tested, ready to use. **Refund if not worth 3 gns. 750 only. 18/6 plus 1/6. P. & P. (state 6 or 12v.).**

AUTOMATIC POCKET
CALCULATOR



Adding and Subtracting up to 999,999 at your finger tips for

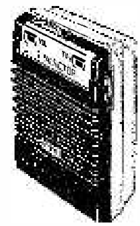
ONLY 8/6 plus 1/6 P. & P.

This superfast, lightweight calculator is simple to operate yet fantastically accurate. Precision engineered by craftsmen and factory tested for reliability. Ideal for use in Offices, Shops, Stores, During Games, etc. Complete with carry case. Slips easily into the jacket pocket or purse. Decimal tables, included for engineers — A terrific bargain that you'll enjoy using.

Read what just a few of our Satisfied customers say:—

R.C. of Harringay writes *Received with thanks Skyroma . . . Very pleased. Working well.*
B.M. of Harrogate writes *. . . I would like to thank you . . . It was a real bargain.*
L.S. of London W.8 writes *. . . given it a good try out and I am very pleased with the results.*
S.B. of Somerset writes *. . . delighted with this radio . . . glad if you could send one more.*
T.F. of Stevenage writes *. . . I would just like to say how pleased my son is with this radio.*

UNIQUE NEW
FULLY TRANSISTORISED
READY BUILT
PORTABLE RADIO

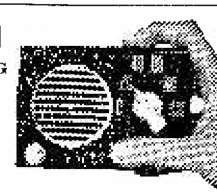


NOW A FRACTION OF THE NORMAL PRICE ONLY 35/-

WHY PAY MORE? All the latest refinements are packed into this new MULTI-STATION ALL transistor radio — the internal aerial picks up even remote stations and the powerful built-in speaker gives room filling volume. Individual tuning, first-class reception. Purchase with confidence — packed in original manufacturer's cartons. *(Personal earpiece and battery 4/6).* Send **35/- plus 4/6 P. & P.**

NEW RADIO

NO SOLDERING VOLKSRADIO ANYONE CAN BUILD IN 2-3 HOURS

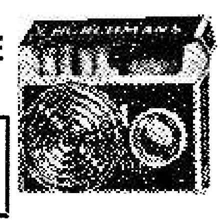


19/6

EVEN THE OLDER CHILDREN BUILD THEM! . . . no soldering — only 16 connections! then hear it reach out bringing in station after station, loud and clear Palm-of hand size 4⅞ x 2⅞ x 1½n. Many Testimonials **M.H. of Bradford, writes:** " . . . *I have just completed one of your sets successfully, it is the first time I have ever tackled anything like a radio, and I must state here and now, I am amazed how easy it is to a layman like me Your instructions and plan have obviously been very carefully thought out so that even the most dim can follow them* . . . " **Direct from Manufacturers to You. Send 19/6 plus 2/6 post, etc**
PARTS AVAILABLE SEPARATELY

NO SOLDERING
AMAZING CIGARETTE RADIO

ONLY 18/6



Yes a perfectly ordinary packet of cigarettes! — but watch your friends astonishment on hearing it fetch in station after station, loud and clear! Still holds 10 cigarettes — yet cleverly conceals highly sensitive, fully transistorised circuit **(including tiny battery)**. Even a young boy can assemble it in under 2 hours. **No soldering. No experience necessary. Only 16 connections to make.** Ideal for taking to work with you. From our bulging testimonial file. **Mr. D. B. of Huddersfield, writes:** " . . . *I have fitted the parts in and it is working wonderfully* . . . " ALL PARTS including Semi-Conductors, A.B.C. Plans, etc. **ONLY 18/6 plus 2/6 post, etc.**
PARTS AVAILABLE SEPARATELY

CONCORD ELECTRONICS LTD
(Mail Order Only) (DEPT. P.W.30) 77 NEW BOND ST., LONDON, W.1

LASKY'S RADIO

FOR THE FINEST VALUE TO HOME CONSTRUCTORS

We consider our construction parcels to be the finest value on the home constructor 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.

TRANSISTOR PORTABLES

THE SKYROVER RANGE

7 transistor and 2 diode superhet portables—covering full med. plus 6 SW Bands.

The SKYROVER Mk III.

(Illustrated). Now supplied with redesigned plastic cabinet in black, grey and chrome with edgewise controls.
Controls: Waveband Selector, Volume Control with on/off Switch, Tuning Control. In plastic cabinet, size 10 x 6½ x 3¼in. with metal trim and carrying handle.
Can 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.

The SKYROVER De Luxe

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. Also car aerial socket fitted.
Can now be built for **£10.19.6** Post 5/- extra
H.P. Terms: 55/- deposit and 11 monthly payments of 16/11. Total H.P.P. £12.1.1.

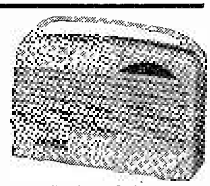
★ LONG WAVEBAND COVERAGE IS NOW AVAILABLE FOR THE SKYROVER

A simple additional circuit provides coverage of the 1100/1950M. band (including 1500M. Light programme). This is in addition to all existing Medium and Short wavebands. All necessary components with construction data.
Only **10/-** extra Post Free.
This conversion is suitable for both receivers that have already been constructed.

Data for each receiver: 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 5¼in.x5¼in. in one complete assembly. ● Plastic cabinet, with carrying handle, size 7in.x10in.x3½in., 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.



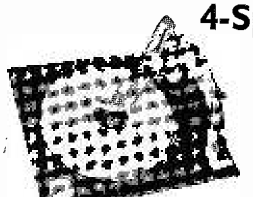
Can be built for **£5 . 19 . 6**
P. & P. 4/6

REALISTIC SEVEN De Luxe

With the same electrical specification as standard model—PLUS A SUPERIOR WOOD CABINET IN CONTEMPORARY STYLING covered in attractive washable material with super-chrome trim and carrying handle. Also a full vision circular dial, externally mounted to further enhance the pleasant styling. **ONLY £1 EXTRA**
Both models: Battery 3/9 extra. (All components available separately.) Data and **instructions separately 2/6, refunded if you purchase parcel.**

RECORD PLAYERS

4-Speed Autochangers



B.S.R.

BRAND NEW AT LOWEST EVER PRICES

Brand new and fully guaranteed—complete with cartridge and stylus.
UA14 4 speed mains model £4. 9.6
UA16 4 speed mains model £4.19.6
UA16 9v. battery model £5.19.6
UA20 4 speed mains model £5.19.6
Add 5/- carriage and packing on each.

GARRARD AUTOCHANGERS

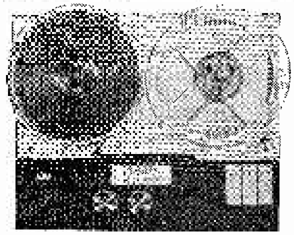
Auto-Slim Mono	£4	19	6	AT60 less cartridge	£10	19	6
AT6 Mono	£8	19	6	A70 less cartridge	£19	19	0
AT6 Stereo	£9	9	0	A50 less cartridge	£9	14	6
3000LM with stereo cartridge	£8	8	0	A1000 with GC8 cartridge	£6	6	0
SP25 Mono	£9	19	6	A2000 with GC8 cartridge	£7	7	0
SP25 Stereo	£10	19	6	Postage on all above 5/-			

SPECIAL OFFER—GARRARD AT5 AUTOCHANGERS

4-speed mains model—brand new and fully guaranteed
LASKY'S PRICE with Mono Crystal Cartridge £5 19 6
with Stereo Cartridge .... £6 9 6 Post 5/-.

TAPE RECORDERS

MAGNAVOX-COLLARO 363 TAPE DECKS



The very latest 3 speed model—1⅞, 3¾, 7½ i.p.s., 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 13¾ x 11in. x 5¼in. deep below unit plate. For 200/250 v. A.C. mains, 50 c.p.s. 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.

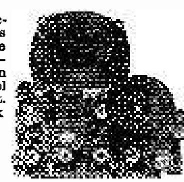
JUST ARRIVED—THE NEW GARRARD TAPE DECK

Fitted with 3 heads—¼ track Stereo/mono; three speeds; takes 7in. spools; piano key controls; digit counter; pause control etc. Send S.A.E. for full details.
LASKY'S PRICE 29½ gns. C. & P. 10/6.

CONSTRUCTORS BARGAINS

TRANSISTOR RADIO CHASSIS

Superhet chassis, fully built—by famous British manufacturer—on printed circuit. Uses 7 Newmarket transistors giving 500 m/w push-pull output—3 I.F. stages, ferrite rod aerial. Covers full, long and medium wavebands—200/550M and 1200/2000M and switched band spread on 208M (Luxembourg). 4½in. speaker; fitted: volume control on/off switch, tuning dial and position for car aerial socket. Uses any 9V battery. Overall dimensions—7in. x 4½in. x 2in. Absolutely complete except for cabinet.



LASKY'S PRICE **69/6** Post 5/-.
Recommended battery PP6 2/9 or PP7 3/3 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, OC 76, OC 81 5/6; (match pair 10/6); AF 117, OC 75, OC 200 6/6; OC 42, OC 43, OC 73 OC 82D 7/6; OC 201, OC 204 15/-; OC 205, OC 206 19/6; OC 28 24/6.

TRANSFILTERS By BRUSH CRYSTAL CO. Available from stock.

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

SINCLAIR SUPER MINIATURES

THE MICRO-6 miniature radio only $1^4/_5$ x 1 x $^3/_{10}$ 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

SPECIAL INTEREST ITEMS!

INTERNATIONAL TAPE Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft.	2	6	5¾in.	Long play, 1,200ft. Acetate	12	6
3in.	Message tape, 225ft.	3	9	5¾in.	Standard play, 850ft., PVC	11	6
3in.	Message tape, 300ft.	7	6	5¾in.	Long play, 1,200ft., Mylar	15	0
3¼in.	Triple play, 600ft., Mylar	15	0	5¾in.	Triple play, 2,400ft., Mylar	45	0
4in.	Triple play, 900ft., Mylar	17	6	7in.	Standard play, 1,200ft., Acetate	10	0
5in.	Double play, 1,200ft., Mylar	15	0	7in.	Standard play, 1,200ft., Mylar	12	6
5in.	Long play, 900ft., Acetate	10	0	7in.	Long play, 1,800ft., Mylar	19	6
5in.	Standard play, 600ft., PVC	8	6	7in.	Double play, 2,400ft., Mylar	25	0
5in.	Triple play, 1,800ft., Mylar	35	0	7in.	Long play, 1,800ft., Acetate	15	0
5¾in.	Double play, 1,800ft., Mylar	22	6	7in.	Triple play, 3,600ft., Mylar	58	6

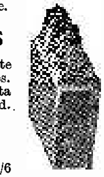
P. & P. 1/- extra per reel. 4 reels and over Post Free.

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 2¾ x 1¼in. Circuit supplied.
LASKY'S PRICE **15/11** Post 2/-
ECC85 valve 9/- extra.

U.H.F. TUNERS

Only a few available. Complete with PC86 and PC88 valves. We regret no circuit or data is available. Knobs included.



LASKY'S PRICE
59/6 Post 2/6

207 EDGWARE ROAD, LONDON, W.2 Tel: PAD 3271
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Both open all day Saturday. Early closing Thursday.

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Mail Orders and correspondence to 3-15 Cavell Street, Tower Hamlets, London, E.1. Tel: STEpney Green 4821/2

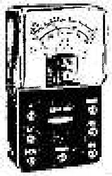
LASKY'S FOR SPEEDY MAIL ORDER SERVICE

BSR MONARCH UA16 with FULL-FI HEAD

4-speed, plays 10 records, 12in., 10in. or 7in. at 16, 33, 45 or 78 r.p.m. Intermixes 7in., 10in., and 12in records of the same speed. Has manual play position, colour, brown. Dimensions: 12½ x 10⅜in Space required above baseboard 4¾in., below baseboard 2¾in. Fitted with Ful-Fi-turn-over crystal head. P. & P. 7/6.

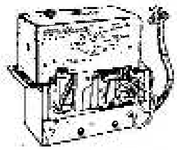
£4.19.6

POCKET MULTI-METER



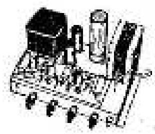
Size 3⅞ x 2½ x 1⅜in. Meter size 2½ x 1⅜in. Sensitivity 1,000 O.P V. on both A.C. and D.C. volts. 0-15, 0.150, 0-1,000. D.C. current 0-150mA. Resistance 0-100kΩ. Complete with test prods, battery and full instructions, **42/6.** P. & P. 3/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter

CHANNEL TUNER I.F.



16-19 Mc/s. Continuously tunable from 174-216 Mc/s. Valves required—PCF80 and PCC84 (in series). Cover BBC and ITA ranges. Also Police, Fire and Taxis, etc. Brand new by famous maker, **10/-**, P. & P. 3/-.

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



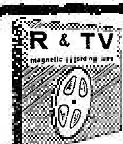
Size: 9 x 6 x 1½in. A.C. Mains, 200-250v. 5 valves. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Output 8 watts at 5 per cent total distortion. Separate bass and treble lift control. Two inputs, with controls for gram. and mike. Output transformer tapped for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

"MAYFAIR" 5-Transistor TAPE RECORDER

Capstan-driven, battery operated. 7½ and 3¾ i.p.s Precision made. Push-button controls. High quality 2¾in. speaker. Push-pull circuit. Output 400 mW. Frequency response: 200-7,000 k/s. Fast rewind. Up to 1 hour twin track playing time. Automatic erasing for re-recording. Dimensions: 8in. x 11in. x 3⅞in. Weighs only 7lb. Takes 5in. spools.

£11.11.0 plus 7/6. P. & P.

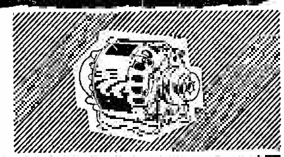
FIRST QUALITY P.V.C. TAPE



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

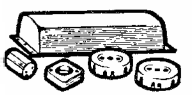
P. & P. on each 1/6, 4 or more post free.

MOTOR



¼ H.P. 1440 revs., **£2.10.0.**
⅓ H.P. 1440 revs., **£2.19.6.**
P. & P. 10/-.
These have been removed from equipment but are fully guaranteed. Single-phase 230/250V.

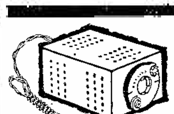
40W FLUORESCENT LIGHT KIT



Incorporating **GEC** Choke size 8½in. x 1¾in. x 1¾in., 2 bi-pin holders, starter and starter holder. **11/6** P. & P. 4/6.

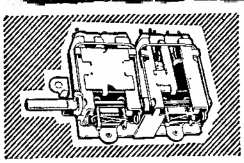
Similar to above: 80W. Fluorescent Light Kit incorporating **GEC** choke size 11¾in. x 1¾in. x 1¾in. 2 bi-pin holders, starter and starter holder. **17/6** P. & P. 5/6

POWER SUPPLY KIT



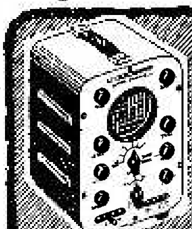
In metal case, size 3⅝in. x 2½in. x 2in. incorporating mains transformer, rectifier and condensers. 230/250 A.C. Mains Output: 9v. 100 mA. Price **10/6** plus 3/-. P. & P.

CYLDON A.M./F.M. PERMEABILITY TUNER FOR ALL TRANSISTOR OPERATION



Size 2½in. x 2½in. approx. By famous manufacturer. A.M.-I.F. 470 kc/s. F.M.-I.F. 10.7 Mc/s. A.M. coverage from 1,620 kc/s.-525 kc/s, F.M. coverage 108 Mc/s.-88 Mc/s. Circuit diagram **2/6.** FREE with Tuner. 1st, 2nd 3rd A.M.-I.F.'s, 1st, 2nd, 3rd and 4th F.M.-I.F.'s, V.H.F. Osc. choke A.M.-F. trape. All the above are the R.F. end of an A.M./F.M. receiver car radio etc. The above items: **£2.10.0**

OSCILLOSCOPE for D.C. & A.C. Applications



Push-pull X amplifier: Flyback suppression; Internal Time-base Scan Wave form available for external use; pulse output available for checking TV line O/P Transformers, etc. Provision for external—I/P and C.R.T. Brightness Modulation. A.C. mains 200/250 v., **£18/18/-.** P. & P. 10/-. FULL 12 MONTHS' GUARANTEE INCLUDING VALVES and TUBE.

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

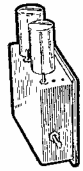
3 to 4 WATT AMPLIFIER KIT

Comprising chassis 8½in. x 2½in. x 1in. Double wound mains transformer, output transformer. Volume and tone controls, resistors, condensers, etc. 6V6, ECC81 and metal rectifier. Circuit 1/6, free with kit. **29/6** plus 4/6. P. & P.

MAGNAVOX COLLARO

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

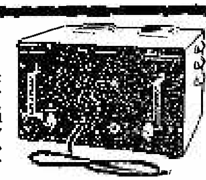
CYLDON U.H.F. TUNER



Complete with PC.88 and PC.86 Valves. Full variable tuning. New and unused. Size 4½ x 5¾ x 1½in. Complete with circuit diagram.

35/- plus 2/6 P. & P.

Fixed Frequency SIGNAL GENERATOR



Crystal control in metal case, size 10in. x 6in. x 6in. Incorporating 2 FC13 valves, mains transformer, metal rectifier, choke, indicator lamp, crystal and numerous components. Modulated and unmodulated output sockets. Originally used for I.T.V. frequencies. Brand new, **39/6**, plus 7/-. P. & P. A.C. Mains 200/250 volts.

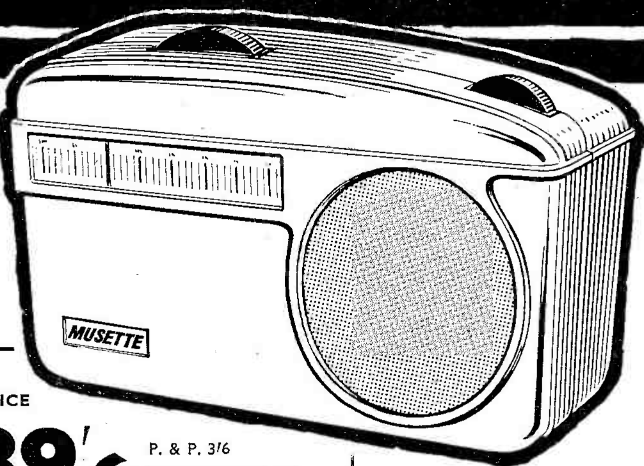
RADIO & T.V. COMPONENTS (ACTON) LTD.

21B HIGH STREET, ACTON, LONDON W.3

SHOP HOURS 9 a.m. to 6 p.m. EARLY CLOSING WEDNESDAY

Goods not despatched outside U.K. All enquiries stamped addressed envelope. Terms C.W.O.

MUSETTE 6 TRANSISTOR SUPERHET PORTABLE RADIO



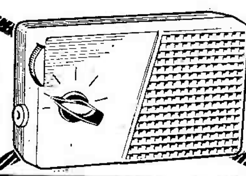
PRICE

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

INCLUDING CARRYING STRAP.

- $2\frac{1}{4}''$ Speaker.
- 6 Transistors Superhet Output 200mw.
- Plastic Cabinet in red, size $4\frac{3}{4}''$ x $3''$ x $1\frac{3}{8}''$ and gold speaker louvre.
- Horizontal Tuning Scale.
- Ferrite Rod Internal Aerial.
- IF 470 Kc.
- All components, Ferrite Rod and Tuning Assembly mounted 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.

NEW TRANSISTORISED SIGNAL GENERATOR



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

Elegant Seven Mk II

COMBINED PORTABLE *and* CAR RADIO

The Radio with the STAR features

★ 4in. Speaker.
★ 7-transistor superhet. Output 350mW.
★ Wooden cabinet, fitted handle with silver coloured fittings. Size $12\frac{1}{4}$ x $8\frac{1}{2}$ x $3\frac{1}{2}$in.
★ Horizontal tuning scale, size $11\frac{1}{4}$ x $2\frac{5}{8}$in. in silver with black lettering.
★ All stations clearly marked.
★ Ferrite-rod internal aerial.
★ I.F. neutralisation on each stage 460 kc/s.
★ D.C. coupled output stage with separate A.C. negative feed back.
★ All components: ferrite rod and tuning assembly mounted 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

RADIO & TV COMPONENTS (ACTON) LTD
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To tackle all those home woodworking jobs you need PRACTICAL WOODWORKING—the great new practical monthly packed with ideas and instructions on the whole field of working in wood. Make sure of the May issue with this invaluable FREE Booklet and extra features inside!

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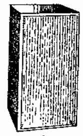
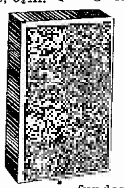
INTRODUCING A NEW RANGE OF HIGH FIDELITY LOUDSPEAKER UNITS

AUDIOTRINE PETITE Really astounding performance. Size only 10½ x 6½ x 7½in. Rating 8 watts. Frequency range 45-20,000 c.p.s. Cabinet beautifully finished in Teak (light) or Walnut (medium.) Fitted specially designed Heavy cast 5in. speaker with large pole pieces, extra long voice coil and plastic treated surround. Impedance 3 ohms or 15 ohms. Or Deposit 29/6 and 9 monthly payments of 19/10 (Total **£10.8.0**). **9 Gns.** Carr. 7/6



The AUDIOTRINE MINI-TEN Size only 12½in High, 6¾in. Wide, 8¼in. Deep. Rating 10 watts. Impedance 15 ohms. De-luxe Teak or Walnut finished cabinet acoustically lined. Heavy cast 5in. Bass speaker with extra high flux density ceramic magnet plastic treated surround and long voice coil giving low fundamental resonance. Cross-over and Tweeter. Really astounding performance. Frequency range 45-20,000 c.p.s. Or Deposit £2 and 9 mthly pymts 27/9 (Total **£14.9.0**). **12½ Gns.** Carr. 8/6.

The GLOUCESTER Handsome "slimline" cabinet, acoustically lined. Size 24in. High, 20in. Wide, 6½in. Deep. Finished light Teak or medium Walnut. 12in. high flux 12,000 line speaker, Cross-over unit and Tweeter. Rating 10 watts. Smooth response 40-20,000 c.p.s. Impedance 15 ohms. Or Deposit 36/- and 9 monthly payments 24/8 (Total **£12.18.0**) **11 Gns.** Carr. 15/-



The BRONTE Handsome cabinet of modern styling. Acoustically lined and finished Teak or Walnut. Size 22in. High, 15in. Wide, 7½in. Deep. Fitted Wharfedale Super 8 RSDD Speaker, with Roll surround and dual cone. Rating 6 watts. Impedance 15 ohms. Or Deposit 39/- and 9 monthly payments 26/10 (Total **£14.0.6**). **12 Gns.** Carr. 15/-

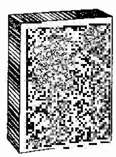
The DORCHESTER Attractive cabinet in luxurious Teak or Walnut finish. Acoustically lined. Size 24in. High, 15in. Wide, 7½in. Deep. Incorporating specially designed 10in. Heavy cast speaker with massive 2in. pole pieces and dual cone with plastic treated surround. Frequency response 20-20,000 c.p.s. Rating 15 watts. Impedance 15 ohms. Or Deposit 48/- and 9 monthly payments 33/- (Total **£17.7.3**). **15 Gns.** Carr. 15/-

The STANWAY Attractive contemporary styled cabinet finished Teak (light) or Walnut (medium). Acoustically lined. Size 24in. High, 20in. Wide, 8 in. Deep. Fitted 12in. high flux Bass speaker with plastic treated surround giving extremely low fundamental resonance and high sensitivity. The smooth frequency response 20-20,000 c.p.s. is achieved by addition of high flux tweeter and cross-over unit. Rating 20 watts. Impedance 9 ohms. Or Deposit 3 Gns. and 9 monthly payments 43/4 (Total **£22.13.0**). **19½ Gns.** Carr. 17/6

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

AUDIOTRINE HIGH FIDELITY LOUDSPEAKER ENCLOSURES

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

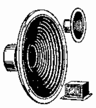


SE8. Designed for optimum performance with any Hi-Fi 8in. speaker. Size 22in. High, 15in. Wide, 7in. Deep. Or Deposit 18/- and 9 monthly payments 12/3 (Total **£6.8.3**). Carr. 7/6 **£5.15.0**

SE10. For 10in. High Fidelity Speaker with provision for tweeter. Especially recommended for use with Audiotrine HF100D speaker. Size 24in. High, 15in. Wide, 7½in. Deep. Or deposit 21/- and 9 monthly payments of 15/- (Total **£7.16.0**). Carr. 10/- **£6.19.9**

SE12. For outstanding performance with any 12in. Hi-Fi Speaker but especially suitable for types with low fundamental resonance. A tweeter cut-out is provided. Size 24 x 20 x 7½in. approx. Or Deposit 27/- and 9 monthly payments of 17/10 (Total **£9.7.6**). Carr. 10/- ONLY **8 Gns.**

AUDIOTRINE HI-FI SPEAKER SYSTEMS
Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) and Tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. Or **Senior 20 watt** inc. Fane 122/10 speaker, **£6.19.9.** Carr. 7/6. Or Dep. **21/-** and 9 mthly pmts of **15/-** (Ttl **£7.16.0**). **£4.19.9** Carr. 5/6



AUDIOTRINE HF100D 10in. 15 watt HI-FI Loudspeakers. Heavy cast construction. Dual cone. Smooth frequency response 20-20,000 c.p.s. Speech coil 3 or 15 ohms. Exceptional value at **£5.15.0** Carr. 5/9

FANE HEAVY DUTY HI-FI SPEAKERS 12in. 20 watt. Type 122/10. Post 5/6. ONLY **5 Gns.**

JASON FMT1. VHF/FM Radio Tuner design. All parts including valves, tuning dial, escutcheon. etc. Carr. 5/- **£6.19.9**

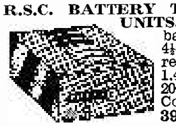
W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS HF1012. 10 watts rating. Where a really good quality speaker at a low price is required we highly recommend this unit with an amazing performance. Please state whether 3 or 15 ohms required. **£4.19.9**

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 25/-. **19/11**

TANNOY RE-ENTRANT LOUDSPEAKERS. For outdoor or factory use, 8 ohms, 8 watts. Carr. 4/6 **27/6**

R.A. 12in. DUAL CONE 3 ohm LOUDSPEAKERS. Ideal for Stereo. 39/9. Carr. 4/6.

R.S.C. BATTERY TO 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 39/9 or ready for use 49/9.



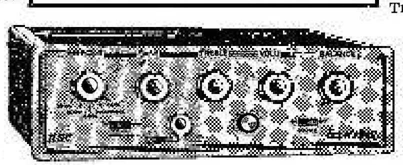
R.S.C. BABY ALARM OR INTERCOMM KIT Parts with diagrams, etc. In two polished Walnut finished cabinets. 3-4 watts output. High sensitivity. For 200-250v. A.C. mains. Fully isolated. Controllable at both units. A unit of this class would normally cost £20-£30. Only 89/6. Carr. 5/-. Ready for use, **6 Gns.**

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

WE PROUDLY INTRODUCE TWO COMPLETELY NEW UNITS WITH TECHNICAL SPECIFICATIONS COMPARING MORE THAN FAVOURABLY WITH SIMILAR AMPLIFIERS AT 2-3 TIMES THE COST

FULLY TRANSISTORISED 200/250v. A.C. Mains Operation.
OUTPUT 10 WATTS R.M.S. into 15 ohms.
15 WATTS R.M.S. into 3-4 ohms.
Maximum instantaneous Peak power output 28 watts
PRINTED CIRCUIT CONSTRUCTION.
LATEST MULLARD TRANSISTORS. AD149, AD149, OC127Z, OC81Z, OC44, OC44, OC81Z, OC44, AC107.
4 POSITION INPUT SELECTOR SWITCH EQUALISATION to Standard R.I.A.A. and C.C.I.R. Characteristics for Gram and Tape Heads.
FULL TAPE MONITORING FACILITIES.
SENSITIVITIES: Magnetic P.U. 4 mV. Crystal or Ceramic P.U. 400 mV. Microphone 4.5 mV. Tape Head 2.5 mV. Radio/Aux or Ceramic P.U. 110 mV.
FREQUENCY RESPONSE: 20-20,000 c.p.s.
TREBLE CONTROL: +15dB to —14dB at 10 Kc/s.
BASS CONTROL: +12dB to —15dB at 50 c/s.
HARMONIC DISTORTION at 10 Watts R.M.S. 1,000 c.p.s. 0.35%. **HUM LEVEL:** —75dB.
NEGATIVE FEEDBACK: 52dB.
Complete Kit of parts with full constructional details and point to point wiring diagrams. Carr. 10/- **10½ GNS.**
Or Kit with Printed Circuit wired and tested **30/-** extra, or Deposit **72/-** and 9 monthly payments of **22/6** (Total **£13.14.6**).
Attractive Walnut or Teak finished cabinet **5 gns.** or Deposit **17/-** and 9 monthly payments **11/-** (Total **£5.16.0**). Or unit factory built and tested, complete with cabinet and with our usual 12 months guarantee. Or Deposit **£3.9.0** and 9 monthly payments **£2** (Total **£21.9.0**). **18½ GNS.** Carr. 12/6

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

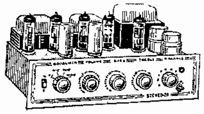


IMPORTANT NOTE. Rated output figures are given in R.M.S. and not speech and music or I.H.F.M., otherwise we could obviously quote much higher outputs.

R.S.C. SUPER 30 STEREO AMPLIFIER

A DUAL CHANNEL VERSION OF THE SUPER 15. Employing Twin Printed Circuits. Close tolerance Ganged Pots. Matched Components.
CROSS-TALK: —52dB at 1,000 c.p.s.
CONTROLS: 5 position Input Selector, Bass Control, Treble Control, Volume Control, Balance Control, Stereo/Mono Switch, Tape Monitor Switch, Mains Switch.
INPUT SOCKETS (Matched Pairs). (1) Magnetic P.U. (2) Ceramic or Crystal P.U. (3) Radio/Aux. (4) Tape Head/Microphone.
Operation of the Input Selector Switch assures appropriate equalisation.
Rigid 18 s.w.g. Chassis. Size approx. 12in. Wide, 3in. High and 8in. Deep.
Attractive Facia Plate and Matching Knobs.
Neon Panel Indicator.
Above facilities, etc., except for Ganging and Balance Control, apply also to Super 15.
THESE UNITS ARE EMINENTLY SUITABLE FOR USE WITH ANY MAKE OF PICK-UP OR MICROPHONE (Crystal, Ceramic, Magnetic, Moving Coil, Ribbon) CURRENTLY AVAILABLE REGARDLESS OF THE COST. SUPERB SOUND OUPTUT QUALITY CAN BE OBTAINED BY USING WITH FIRST RATE ANCILLARY EQUIPMENT. All required parts, point to point wiring diagrams and detailed instructions. If required printed circuits can be supplied with appropriate components assembled, soldered and tested for **£3** extra. Terms: Deposit **6 Gns.** and 9 monthly payments **38/6** (Total **£23.12.6**). Carr. 12/6 **18 GNS.**
Attractive Walnut or Teak finished cabinet **5 Gns.** or Deposit **17/-** and 9 monthly payments **11/-** (Total **£5.16.0**). Or unit completely assembled ready for use housed in cabinet. Or Deposit **£4.12.0** and 9 monthly payments **64/-**. (Total **£33.8.0**). Carr. 15/- **29 GNS**
Send S.A.E. for leaflet.

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



PROVIDING 10/14 WATT ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL

SUITABLE FOR "MIKE", GRAM, RADIO OR TAPE

Based on a current Mullard design and employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. Send s.a.e. for leaflet. **Frequency Response:** ±2dB 30-20,000 c.p.s. **Hum Level:** 65dB down. **Sensitivity:** 5 millivolts maximum. **Harmonic Distortion:** (each channel) 0.2%.

Output transformers are high-quality sectionally wound to required specification. Output matching for 3 and 15 ohm speakers on each channel. Complete set of parts with point-to-point wiring diagrams and instructions. Carr. 12/6 **13 Gns.**
Or factory assembled, tested and supplied with our usual 12 months guarantee **18 Gns.**
Or Deposit **57/-** and 9 monthly payments **39/10** (Total **£20.15.6**). Carr. 12/6

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

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.

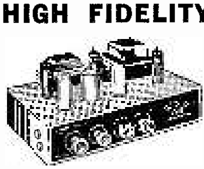
Incorporating the latest Magnavox Tapedeck. The Audiotrine High Quality Tape Amplifier with switched equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a handsome Portable Carrying Cabinet of latest styling and finished dark grey leathercloth. Size 14¼ x 17 x 8¼in. high and circuit. Total cost if purchased individually approximately **£35.** Performance equal to units in the £50-£60 class. S.A.E. for leaflets. **TERMS: Deposit 4 gns.** and 9 monthly payments of **56/-** (Total **28 gns.**). 4 Track Model **3 gns.** extra.

25½ Gns. Carr. 18/6

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

A highly sensitive Push-Pull high output unit with self-contained 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. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All first grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Minimum input required for full output 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/-** & 9 mthly payments of **33/3** (Total **£17.7.3**).

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11



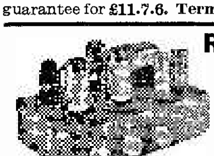
PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP

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 "Lift" and "Cut". 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 ohms speakers. Kit complete to last nut. Chassis fully punched. Full instructions and point-to-point wiring diagrams supplied (or factory built **51/6** extra). Carr. 10/- ONLY **8 Gns.**
Metal covers with 2 carrying handles can be supplied for **£1. TERMS ON ASSEMBLED UNITS: Deposit 33/3** and 9 monthly payments of **24/1** (Total **£12.10.0**). Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Mikes, etc.

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

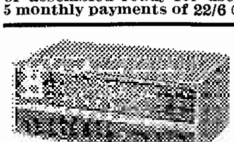
A complete set of parts for the construction of a stereo amplifier giving 5 watts high quality output on each channel (total 10 watts) Sensitivity is 50 millivolts. Suitable all crystal or ceramic stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point to point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. Full constructional details and price list 2/6. **8 Gns.**
Or supplied factory assembled with 12 months' guarantee for **£11.7.6. Terms:** Dep. **2 gns.** and 9 mthly pmts **24/2** (Total **£12.19.6**). Carr. 10/-

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



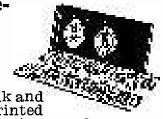
A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Suitable for all crystal or ceramic P.U. heads and practically all "mikes". Separate Bass and Treble controls giving "lift" and "cut". Hum level 71dB down. Negative Feedback 15dB. H.T. of 300v. 25mA and L.T. of 6.3v. 1.5a. available 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 **£4.15.0**
or assembled ready for use 25/- extra, plus 3/6 carr. Deposit 22/6 and 5 monthly payments of 22/6 (Total £6.15.0) for assembled unit.

COMMUNICATION RECEIVERS RX 60 DE LUXE



4 BAND. 220/240v. 50/60 c.p.s. A.C. mains operation. Frequencies covered 1600 Kc/s to 30 Mc/s continuous. Incorporates 5in. speaker. Slide rule tuning dial 'S' meter. Internal ferrite aerial 58in. 10 section for short waves. Fitted sockets for optional outdoor aerial. Headphones, external speaker socket. Other features are electrical band-spread tuning. Noise limiter, A.V.C., B.F.O., stand-by switch. Size approx. 12¼ x 5⅜ x 8¾in. Handsome crackle finished metal cabinet. Brand new with full instructions manual. Usual guarantee. **19 Gns.**
Or Deposit **£5** and 9 monthly payments **37/8** (Total **£21.19.0**). Carr. 10/-

R.S.C. A15 20 WATT (R.M.S.) HI-FI TRANSISTOR AMPLIFIER with integral pre-amp tone control stages



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

£6.19.9 Post 5/-

R.S.C. COLUMN SPEAKERS

Covered in two-tone Rexine/Vynair. Ideal for vocalists and Public Address. Normally supplied for 15 ohm matching but can be supplied for 100v. line for **35/-** extra.
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 **27/9** (Total **£14.9.9**) Carr. 10/- **12½ Gns.**
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 **43/2** (Total **21½ gns.**).

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.**

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

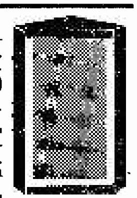
A Four Input, two volume control Hi-Fi unit with separate Bass and Treble 'cut' and 'boost' controls. Latest type valves. Housed in strong Rexine covered cabinet with twin carrying handles Attractive black and gold perspex fascia plate. For 200-250v. A.C. mains. Output for 3 or 15 ohm speakers. Send S.A.E. for leaflet. Deposit **£3** and 9 monthly payments of **37/-** (Total **£19.13.0**). Carr. 12/6 **17 Gns.**

INTEREST CHARGES REFUNDED

on H.P. and Credit Sale Accounts settled in 6 months.

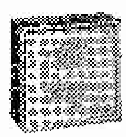
LINEAR TAPE PRE-AMPLIFIER. Type LP/1. Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback, EM84 Recording Level Indicator. Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier, suitable almost any Tape Deck. S.A.E. for leaflet. **9½ Gns.**

CORNER CONSOLE CABINETS



Strongly made. Beautiful polished walnut veneered finish. Pleasing design.
Junior Model. For up to 8in. speaker. Approx. 20 x 11 x 8in. Carr. 5/6 **49/9**
Standard Model. To take up to 10in. speaker. Size 27 x 18 x 8in. Carr. 7/6 **5 Gns.**
Senior Model. To take up to 12in. speaker and with Tweeter cut-out. Size approx. 30 x 30 x 15in. (Recommended for use with Audiotrine speaker system.) Terms available. Carr. 8/6 **8 Gns.**

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 **10/10** (Total **£5.12.6**) Carr. 5/6
20 Watt Model. 15 ohm. Size 18x18x10in. **Terms:** Deposit **24/6** and 9 monthly payments of **17/-** (Total **£8.17.6**). Carr. 8/6 **£7.19.6**
30 Watt Model. 15 ohms. Carr. 10/-. Or Deposit **32/-** and 9 monthly payments of **22/-** (Total **£11.10.0**). **Any of above in extra heavy Rexine covered Cabinets, £1 extra.** **10 Gns.**

R.S.C. JUNIOR BASS REFLEX CABINET. Designed for above speaker, but suitable for any good quality 8in. or 10in. speaker. Acoustically lined and ported. Medium Walnut veneer finish. Size 18 x 12 x 10in. Strongly made. Handsome appearance. Superb reproduction. **£4.7.6** Carr. 5/-

SELENIUM RECTIFIERS F.W. (BRIDGED)

6/12v. 1a. **3/11;** 6/12v. 3a. **9/9;** 6/12v. 6a. **15/3;** 6/12v. 2a. **6/11;** 6/12v. 4a. **12/3:** 6/12v. 10a. **26/9.**

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

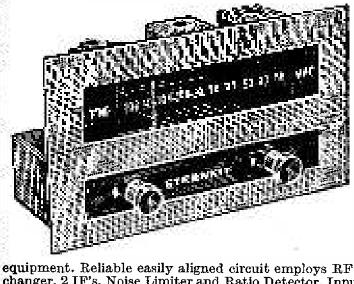
R.S.C. 4 WATT GRAM. AMPLIFIER KIT. Complete set of parts to build a good quality compact unit suitable for use with any record playing unit. Mains isolated chassis, separate Bass and Treble controls. Output for 2-3 ohm speaker. For 200-250 v. A.C. **59/9**

R.S.C. (MANCHESTER) LTD

For addresses see page 11

STERN-CLYNE ELECTRONIC CENTRES

HI-FI AND TAPE EQUIPMENT ● RADIO ● KITS ● ELECTRONIC COMPONENTS



SUPERB NEW STERN-CLYNE FMI 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 tuned grid freq. changer, 2 IF's, Noise Limiter and Ratio Detector. Input sens. 100mV for 40 db. Distortion less than 1% at full deviation. Power req. 200v at 20 mA 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/-.
Optional Power Pack available.

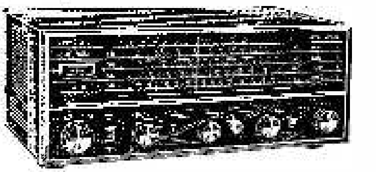
EXCLUSIVE OFFER OF TOP QUALITY RECORDING TAPE

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 distinctively boxed and cellophane wrapped in colour coded cartons showing recording times at 7½, 3¾ and 1⅞ i.p.s. Compare the prices!

Range available:

Polyester	Acetate
3¼in. 600ft. Double Play **11/6**	5in. 600ft. Standard **8/6**
7in. 1,200ft. Standard **12/6**	5in. 900ft. Long Play **10/-**
5in. 1,200ft. Double Play **15/-**	5¾in. 1,200ft. Long Play **12/6**
7in. 1,800ft. Long Play **20/-**	*Both types post and packing*
5¾in. 1,800ft. Double Play **22/6**	*1/- per reel. Four or more*
7in. 2,400ft. Double Play **25/-**	*reels post free.*

TUNE INTO THE WORLD WITH THIS COMPACT PROFESSIONAL STYLE RECEIVER

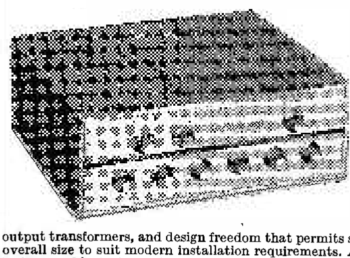


20 Gns.

Carr. & Ins. 15/-

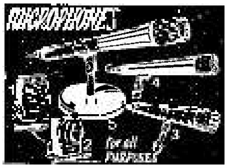
New, highly developed communications receiver has portable radio proportions and a performance comparable with many highly expensive professional receivers. Continuous frequency coverage from 540 kc/s to 30 mc/s takes in all broadcast bands, shipping, world-wide short wave and amateur bands. Built in super features include extra large dial. 'S' meter, variable pitch BFO, Noise Limiter, extra quality loudspeaker, extending rod aerial to receive all but most distant stations. Extras include phone output, Standby switch, etc. Uses ultra modern multi valves 12BE6, 12AU6, 12BA6, 50OC5 and silicon rect. Meticulously constructed and handsomely finished in attractive metal case. Only 13½ x 5 x 8in. deep. Essential for all serious listeners yet cheaper than many commercial sets. For 200/250 volts mains operation.

THE SUPERB VERITONE VEGA



Solid-state Stereo Amplifier with integrated Pre-amplifier/control unit The Vega is a new, solid-state amplifier that provides great purity of sound — comparable with the best valve amplifiers — plus all the advantages accruing from semi-conductor design employing the latest techniques. Important advantages, such as improved reliability, absence of high working temperatures, lack of valve noise, elimination of the output transformers, and design freedom that permits spacious layout within an optimum overall size to suit modern installation requirements. And the Vega is styled and finished in impeccable taste — totally enclosed in a handsome teak case with comprehensive controls functionally arranged on a clear silver grey and black panel. Outputs — 13 watts per channel. Freq. response 40 to 20,000 c/s ± 3 db. Distortion less than 0.5% at 10W. For 200/240v AC. Size 11 x 4½ x 6¾in. deep.

Price £44.2.0. Without Teak Case **£40.19.0** Carr. 8/6.



Top value offers from our wide range, suitable for use with moderately priced equipment up to the finest obtainable.

1. PLANET CM-21 CRYSTAL
Handsomely styled in two-tone grey plastic case with silver trim, and intended for use with most tape recorders and small amplifiers. Fold out stand permits hand or table use. Complete with 4ft. insulated screened lead and moulded standard phono plug. **12/6** P. & P. 1/6.

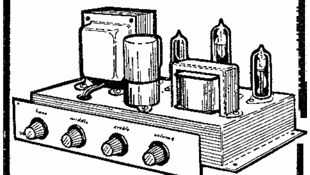
2. DUVIDAL DM-391 DYNAMIC
High-grade dynamic insert in tough, black plastic body with grey grill and silver trim. Fitted with pull-out stand for desk use. Direct replacement for many recorders; standard 50 K ohms impedance permits use with most other equipment. Size 2⅝ x 1⅞ x 1in. deep. Complete with 4ft. cable and standard phono plug. **25/-** P. & P. 1/6.

3. TEISCO CM-30 CRYSTAL
Compact lightweight crystal stick microphone in machined aluminium body with integral thumbswitch. Size overall 5in. long x 1⅛in. diameter. Attractive machined matt finish. Complete with stand adaptor and 6ft. detachable screened cable.
29/6 P. & P. 1/6

4. TEISCO DM-107 DYNAMIC
A really superior stick microphone employing a high quality moving coil insert in a beautifully styled, black anodized body with heavy chrome head and grill. Fitted with integral thumbswitch and removable stand adaptor. Size overall 7in. long x 1⅛in. diam. With 6ft. screened cable and connector. Standard 50 K ohms impedance.
£3.9.6 P. & P. 2/6.

5. DUVIDAL DM-51 DYNAMIC
A superb, non-directional microphone incorporating features normally found only in extremely expensive professional units. An excellent frequency response of 50-15,000 cycles permits use in high quality recording, high-fidelity reproduction and all general microphone usage. Robust, engine turned body has integral slide switch. Beautifully styled with fluted detachable head, matt black and satin silver finish. Complete with desk stand and clamp, floor stand adaptor, and 6ft. lead and plug. In fitted pack. **£6.19.6** P. & P. 3/6

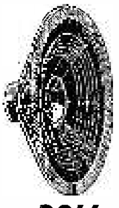
The Remarkable VERITONE 300



ONLY £6-6-0 Carr. 5/-.

A small size, quality constructed amplifier with a big 4 watts output that is adequate for all domestic uses. Features include separate Bass and Treble controls and, when used a good quality speaker, results are indistinguishable from many more expensive outfits. Ideal for quality home-build reproducers, portable lead guitar amplifiers, etc. Size only 8½ x 4 x 1½in. Grey hammer finish with brushed aluminium front panel. For 200/250 V AC mains.

Special offer of 12 inch LOUD-SPEAKERS



39/6
Carr. 3/6

High quality, all-British units with built-in tweeter cone, and a high flux magnet that ensures wide range reproduction. Handles 6 watts easily. Heavy pressed steel construction. Available for 15 ohms or 3 ohms impedance.

TEST 8 MULTIMETER

57/6
Carr. 2/-

Compact all purpose tester with 12 specially selected ranges for all home and motor car wiring and servicing, amateur radio, TV fixing, electronic hobby work, etc. Extremely robust construction employs rugged large scale meter movement and plug-in range selection to obviate switch wear defects and ensure trouble-free life. In tough metal backed impact resisting case. Ranges: 0-10-250-500-1,000v. A.C. and D.C. (sens. 1,000 ohms per volt) 0-1-250 mA D.C. current. 0-10,000-100,000 ohms resistance. Size only 4⅞" x 3⅛" x 1½" deep. Complete with test leads and battery.

GARRARD 3000 AUTOCHANGER

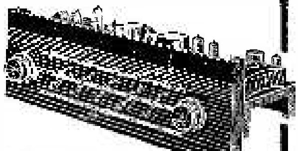
Intended for use with high compliance cartridges and featuring a low mass arm that minimizes record wear. Four standard speeds. Finished dark grey with chrome relief. Clearance required 13⅞in. wide x 12⅛in. front rear. Above board 4⅝in. below 2⅝in. For 100/130v and 200/250v AC. Complete with 9TA/HC cartridge.
£8.3.0 Carr. 5/-

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 3⅝ x 2¼ x 1⅛in., with ingenious dial design providing a clear, easily read scale. Complete with battery and test leads.

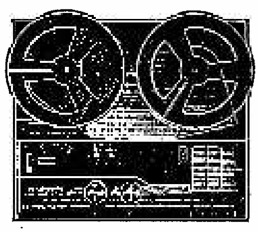
EXCEPTIONAL OFFER OF
AM/FM Radiogram Chassis



16 gns. *Carr.* 10/-.

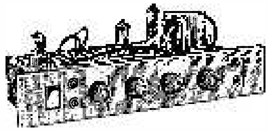
Superb new six valve unit covering long and medium wave on FM and all BBC VHF transmissons on FM. Highly sensitive AM circuit receives most stations through internal aerial, separate FM input employs famous Gorler tuning heart. Uncluttered facia covers whole frontal area and simplifies adaptation to existing cabinets or building into contemporary bookshelf units. Extra large illuminated dial and dual concentric controls for volume, tone selection and tuning simplify operation, enhance appearance. Powerful 4W. output matches standard 3 ohms speaker. Inputs provide for external AM and FM aerials and gramophone pickup. For 200-250 V. A.C. operation. Size overall 15in. x 6½in. x 7⅝in. deep.

MAGNAVOX 363 TAPE TRANSPORTER



Manufactured to precise limits that permit recording and tape playback to the highest standards set by the Music Industry. Simple reliable design employs a single high-duty motor with heavy flywheel. Features include fast wind on and rapid rewind, pause control, 3-speed selection with interlock, built-in revolution indicator, piano key controls. Speeds 1⅞, 3¾ and 7½ i.p.s. Wow and flutter 0.15% on 7½ i.p.s. Max. spool size 7in. Playing time up to 120 min. per track from 1,200ft. standard tape. Size 13½ x 11in. plus 5¼in. below mounting board. With ½ track heads, £10.10.0. With ¼ track heads. £13.19.6. *Add* 10/- *carriage and insurance.*

HF/TR3 TAPE AMPLIFIER



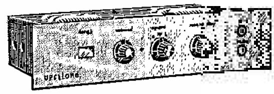
Easily the best complete tape amplifier available to the home builder. Supplied already matched for the Magnavox 363 tapedeck, but may be readily matched to most other decks.

Features include: switched equalization for all speeds (CCIR standards at 7½ i.p.s.) Treble boost incorporated during Record. Bass boost during playback, speaker output matched for 3, 7.5, and 15 ohms, additional outputs for extension speaker, phone monitoring on Record and Hi-Fi playback through existing systems, Inputs for Mic. Pick-up, and VHF Radio. Valves: EF86, ECC83, EL84, EM81, EZ81. Size overall: 11 x 6 x 6in. (Panel 13¾ x 3in.). Power pack on separate chassis size 7½ x 3 x 4¾in. Amp. and power pack. Kit of parts £13.13s. Assembled and tested £19. *Add* 7/6 *carriage.*

Carrying Case specially designed to take Magnavox 363 and HF/TR3 unit. Superbly constructed finish, dark grey cloth. £5 extra.

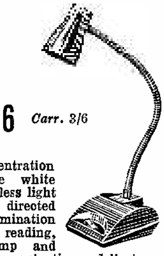
10in. x 6in. eliptical speaker suitable for use with above.

TAPE PRE-AMP AMPLIFIER TYPE 'C'



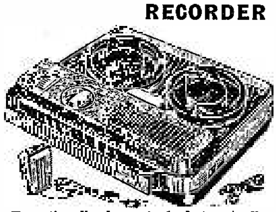
Specially developed by Mullard Laboratories for use with high quality replay systems, and supplied specifically matched for use with the Magnavox 363 tapedeck. Features include: ferroxcube pot core inductors for treble equalization, push pull oscillator incorporating ferroxcube transformer, adjustable output for matching to existing high-quality amplifier systems, inputs for Mic., Pick-up, Radio, etc. Valves: 3 x. EF86, EC82, and EM81. Totally enclosed in case size 11½ x 6½ x 3⅞in. high. (Panel 11⅞ x 3¼in.) Power supply of 300 vdc at 25 mA. and 6.3 v. at 1.5 A. is on separate sub-chassis size 6½ x 4½ x 4⅝in. high to facilitate remote location from tape heads. Pre-amp and power pack Kit of parts £14. Assembled and tested £19. 10s. *Add* 7/6 *carriage.*

HIGH INTENSITY LAMP 49/6 *Carr. 3/6*

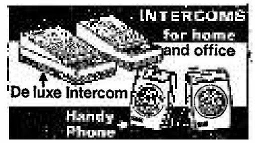


Provides a concentration of intense pure white glarefree, shadowless light that can be directed straight on to illumination area. Ideal for reading, needlework, stamp and minute object examination, delicate craft work and watch repair, table-top photography, etc. Ingenious design combines function with attractive appearance: tough plastic base has on/off switch and is weighted by built-in transformer that reduces mains voltage to permit use of enormous headlamp power of car bulb over small area. 21 watt lamp actually provides greater light intensity than conventional 100 watt bulb with electrical consumption less than one-fifth of usual mains lamp. Gold anodised flexible pillar facilitates light direction from any angle. For 200/240v. AC only; spare bulbs readily obtainable. Base 2¼in. x 3⅝in. x 2in. Height overall 16in.

NEW PORTABLE TAPE RECORDER



Exceptionally low-priced, but actually a robustly made reliable instrument which can be used anywhere for note taking, idea recording, dictation, etc. Mechanism solidly built on to rigid steel chassis and housed in tough grey plastic case with carrying strap and clear plastic tape deck cover. Fitted with single multi-selector function switch and volume control. Hand microphone has Stop/Start thumbswitch for remote control of record and playback transcription. Complete with tape and spare spool, mike and miniature earpiece. Size only: 8 x 7½ x 2¼in. high. *Carriage* 4/6. **£6.19.6**



Identical pocket-size units in cream plastic and gold anodised trim, each unit fitted hinged desk stand or wall hanger. Powerful two-transistor amplifier has sensitivity of 55db plus, consumes only 7mA at no signal condition. With 9V PP3 battery, instructions, and 50 ft. lead with phono plug ends for instant connection. In distinctive yellow and gold hinged gift box.

£2.15.0. Post & Packing 2/6.

DE LUXE INTERCOM

Superb professional style, compact transistor intercom for executive desk and office or home. Compact master unit and identical sub-stations, magnificently styled in pearl white and dark beige plastic case with black and gold anodised trim. Powerful 3-transistor amplifier has 200mW output, but operates 4-5 months on 9V PP3 battery. Master station has Volume. On/Off and Listen/Talk controls. 66ft. cord with phono plugs each end for immediate installation, staples, cable location tape, battery and instructions in attractive gift carton. £4.9.6. Post & Packing 2/6.

Just plug this special extension speaker into the earpiece socket of your pocket transistor set to get a big increase in volume and improved clarity. Handsomely designed, fitted with stand for table and wall mounting, and provided with extra long lead and dual plugs to fit all standard sets. Size only 8⅞ x 2¼in. diam. Attractive gold trim finish.

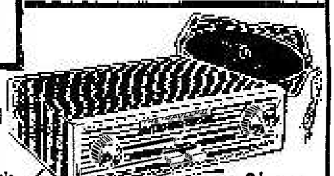
JORDAN WATTS SPEAKER SYSTEM

Hand waxed teak or walnut veneered bookshelf system featuring the famous Jordan-Watts modular unit and specially recommended for use with the Veritone Vega. Ideal also for all Hi-Fi systems with outputs up to 12 watts, and impedance of 7.5 and 16 ohms. Frequency response 30-20,000 c/s ± 6 dB. Size overall 16½ x 8 x 4in. deep Speaker grille finished with black/silver weave.

£17.12.6 Carr. 10/-

TRAVLER 2

Fit your own transistorised car radio at a fraction of the usual cost



8½ gns. P. & P. 5/-

Easily the finest value in car radio obtainable. Robust, all British manufacture with stylish, uncluttered facia that presents simple, 2-knob control and push-button change for medium and long wave. Heavy chrome escutcheon and illuminated dial in black and gold trim. Overall size of 7 x 2 x 7in. and standard location of fixing screws permits simple installation to almost any car. Improved circuit design utilises best features of valves and transistors to ensure high performance with greatest reliability. Complete with 7 x 4in. speaker and baffle trim, brackets, standard fuse coupling and filter, all nuts and bolts, and easy to follow, foolproof fitting instructions.

VANDAL-PROOF CAR AERIAL 39/6 P. & P. 2/6

Automatically locks below wing when pushed down—withdraws only with special key. Very heavily chromed, 5-draw telescope aerial extends to 4ft., retracts into concealed, tough plastic tube. Fits any wing contour. Complete with fitted lead and standard plug, 2 keys, key-ring and fitting instructions.

GUARANTEED BY STERN-CLYNE—Value for money, Quality Facility. Merchandise offered by Stern-Clyne is critically selected and exhaustively tested before it is offered for general sale; where suitable equipment does not exist, certain items are excluively manufactured to our own rigid specifications. In all cases, Stern-Clyne offers are value and quality selected. Satisfaction guaranteed.

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- Simple Transmitter
- Electronic Switch
- Photo-electric Circuit
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- Basic Radio Receiver
- A.C. Experiments
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The full equipment supplied comprises valves, transistors, photo-tube, modern type chassis board, printed circuit board, full range resistors, capacitors and inductors, transformers, potentiometers, switches, transistors, valves, all hardware, wiring and every detail required for all practical work plus CATHODE RAY OSCILLOSCOPE for demonstrating results of all experiments carried out. All practical work fully described in comprehensive PRACTICAL MANUALS. Tutor service and advice if needed.

This complete practical course will teach you all the basic principles of electronics by carrying out experiments and building operational apparatus. You will learn how to recognise and handle all types of modern components; their symbols and how to read a completed circuit or schematic diagram. The course then shows how all the basic electronic circuits are constructed and used, and HOW THEY ACTUALLY WORK BY USING THE OSCILLOSCOPE PROVIDED. *An application is given in all the main fields of electronics, i.e. Radio; control circuits; computors and automation; photo-electrics; counters, etc., and rules and procedure for fault finding and servicing of all types of electronic equipment.*

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PRACTICAL WIRELESS

VOL 42 No 1
issue 711

MAY 1966

TOPIC OF THE MONTH

Face Lift

WELL, here it is! A newly styled and, we hope, improved Practical Wireless. The larger page size will not only allow a more attractive layout of articles but will also make for easier reading. The better quality paper will permit far better reproduction of photographs, which will be of great benefit in constructional articles. In order to carry out these improvements it has been necessary to slightly increase the cost of the magazine, but this is, we trust, a small price to pay for the considerable advantages reaped.

Regular readers need not feel anxious that this face lift will reflect on the general structure of the magazine. All the popular regular features will be retained and we will continue to balance the magazine with a good selection of material contrived to appeal to all the various interests in our hobby. The basic policy will remain as before and there will be no shifting of emphasis except where considered necessary from time to time in the light of our own experiences and the wishes of readers as expressed in correspondence.

Since 1932, Practical Wireless has held a unique position in the realm of amateur radio and through the years has served faithfully the interests of those who are interested in this absorbing hobby. At times, during these eventful 33 years, Practical Wireless has had, for some reason or other, to take stock of the existing situation and, where desirable, to initiate changes.

Such a time has recently passed. And as we start off on Volume 42 we are safely launched on another stage of the development of the magazine. And yet, in essence there is no division, for the fundamental objectives of the present staff are the same as those of the pioneers in the early 1930's—to present each month in the best possible way a magazine dedicated to the interests of all who derive enjoyment from one or more of the facets of amateur radio.

W. N. STEVENS, Editor

NEWS AND COMMENT

CONSTRUCTIONAL

GENERAL ARTICLES

The JUNE ISSUE WILL BE PUBLISHED ON MAY 5th

Were Pre-War Sets Better?

MR. L. WELCH complains of poor quality sound from sets he has made, and also from high priced commercial sets he has heard (P.W. March, 1966).

Most modern sets use inadequate speakers and the cases are undersized and flimsy. Pre-War sets with larger speakers and heavier cases were much better, although they were generally "boomy".

For high quality reproduction, our friend must forget about a "set" and keep the radio equipment separate from the speaker enclosure. The speaker should be of good quality and mounted in a properly designed enclosure placed where it gives the best possible results. The output, as Mr. Welch realises, must be large enough to deal with peaks without distortion.

He writes that no commercial set offers the kind of specification he asks for. Although I would not wish to put him off building such equipment, I must point out that several makers produce tuner-amplifiers which give all he asks for and more. Connected to good speakers, they give results that are really something.

R. E. Barker.

Stockton-on-Tees,
Co. Durham.

R220 MODS

THERE are a lot of R220 crystal-controlled v.h.f. receivers about and radio friends and myself have spent many hours trying to modify this set to make it tunable in the range 120-140Mc/s.

If any readers have managed to do this, we would be most grateful to learn the secrets of their success.

S. M. Giblions.

77 Windlehurst Road,
High Lane,
Stockport,
Cheshire.

How About a Swop?

I REQUIRE the March 1962, December 1963 and January 1964 issues of PRACTICAL WIRELESS, and in order to obtain them, I am willing to exchange some 42 old copies of PRACTICAL WIRELESS, PRACTICAL TELEVISION and WIRELESS WORLD, all between 1949 and 1951.

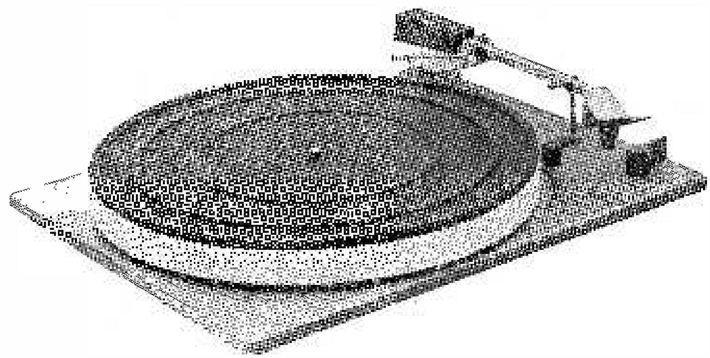
If any readers are interested, would they please write to me first before sending copies, enclosing a stamped addressed envelope.

J. Currie.

156 Hillhead Road,
Kirkintilloch,
Near Glasgow,
Scotland.

NEWS AND..

PRODUCTS FOR AUDIO FAIR



Shown for the first time at the Audio Fair will be the Model GL.68 Transcription Unit (see also photograph above) which also has as a feature infinitely variable speed adjustment, and which is fitted with a new pick-up arm Model G.65. This arm is of low mass tubular design and has counter-balanced stylus pressure adjustment and removable headslide.

In addition, the well-established Model GL.70 will be on view, as well as the inexpensive Turntable Unit Model G.66.

A new pick-up cartridge will be shown, namely the CS.91/E, which is a high quality Stereo Ceramic Cartridge fitted with an elliptical diamond stylus.—Goldring Manufacturing Co. (Great Britain) Limited, 486-488 High Road, Leytonstone, E.11.

ADVERTS SPEEDED UP BY STC

An automatic control system has been installed by Standard Telephones and Cables Ltd., in the Classified Advertisement Department of the "Liverpool Daily Post and Echo", which will now be able to deal with the relevant customer telephone inquiries much more promptly and efficiently.

The STC equipment "scans" 30 operator positions and connects the incoming call to the first free position that it finds. The operator at that position deals straight away with the call if it is a general inquiry. If, however, the caller wants to book space in one of the specialised columns, the call is transferred to the operator who deals specifically with that section. In this way calls are routed to the proper place in the minimum of time.

BALUN FOR HAM BAND INSTALLATIONS

K. W. Electronics Ltd., of 1 Heath Street, Dartford, have just introduced the K. W. Balun, the main features are:

Helps eliminate television interference—Broad band 3-30 Mc/s—Waterproof—For use with all types antennas fed with unbalanced Co-ax—Will handle a kilowatt—Virtually no insertion loss.

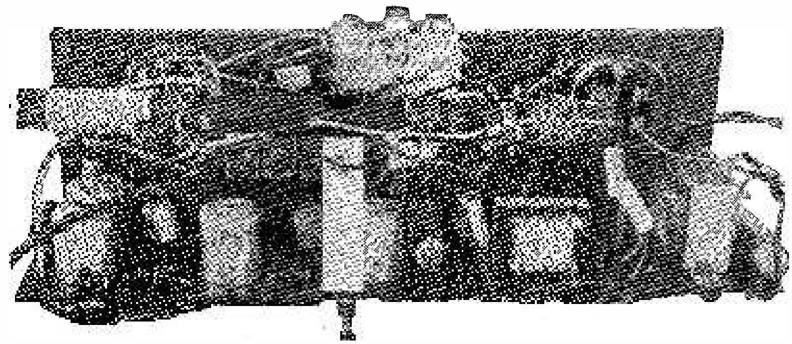
The K. W. Balun is designed for 50/70 ohm unbalanced co-ax input with 1 : 1 impedance ratio. It is intended to be installed at the feed point of a dipole, beam or similar balanced type antenna.

Support it by taping to your beam or dipole "T" insulator and connect the output terminals (marked with a white spot) to the feed point of the antenna with a short length of wire. Connect the co-ax "outer" and "inner" to the terminals marked on the label. The co-ax cable should be suitably sealed to prevent ingress of moisture.

In many cases the installation of the K. W. Balun in balanced antenna systems fed with co-ax cable has improved the efficiency and radiation pattern of the system.

The K. W. Balun is 4in. long and $1\frac{1}{4}$in. overall diameter. The weight is less than 4oz. and the price is 35s. including postage in the U.K.

THE 208



COVER SUBJECT

BANDSPREAD PORTABLE

By F. G. Rayer G3OGR

THIS is a six-transistor receiver with high frequency end bandspread, car aerial, tape output and personal phone facilities. A ferrite rod aerial is fitted, tuning long and medium wavebands. With ordinary 2-waveband circuits, many popular and well-received stations are heard over a small section of the high frequency end of the medium waveband. To simplify tuning these stations, a bandspread range is provided (covering about 185-215 metres), this being extended over almost the whole rotation of the tuning capacitor. As a result, it is easy to select Radio Luxembourg and other transmissions in this range.

Bandspread

The bandspread is achieved, without any particular ganging difficulties, by switch section S4, which places the 1 per-cent capacitor C4 in series with the oscillator section VC2 of the ganged tuning capacitor. S1 introduces the trimmer TC2 in series with VC1, for bandspread aerial tuning. Because of the low capacitance present, the bandspread range extends to a somewhat higher frequency limit than the medium wave range.

S2 selects separate base coupling windings, provided on the medium and long wave coils. S3 shorts the l.w. section for m.w. reception, and brings in C3 for l.w. reception, to obtain suitable oscillator coil coverage. The switch thus has three positions, " Long ", " Medium " and " Bandspread ".

Normal reception is by means of the internal ferrite rod aerial, but an external aerial can be connected to the " car aerial " socket, which has a coupling winding on the aerial rod. An external aerial is often used with a portable in a vehicle, to overcome screening and directive effects of the ferrite aerial.

AF117 transistors are used in mixer and i.f. stages, and need no neutralising. (It should be noted that the oscillator coil and i.f. transformers *must* be of the type intended for AF117's.) The audio signal obtained from the diode D1 may be taken to a tape recorder through the " tape output " sockets. This gives high quality, and an audio level suitable for the usual recorder. The usual automatic gain control bias reaches Tr2 through R5.

VR1 is the 5kΩ volume control, with on/off switch. The OC81D drives two OC81's, having base bias and feedback resistors R15 and R16. This gives excellent volume and quality from a large number of stations.

For personal listening, earphones or a personal phone can be plugged in, thereby automatically disconnecting the speaker. A low impedance type of phone should be used.

Construction is on a circuit board, with VR1, tuning and switch controls on a small panel, so that the finished receiver can be inserted in a cabinet from behind. With this arrangement, the actual positions of VR1, VC1/VC2, and the switch can be modified without any alteration to the circuit board, so that in some cases an existing cabinet can be used. It also gives plenty of latitude for positioning of the speaker.

Unless very small size is important, a 3½in. diameter (or equivalent oval) speaker unit is recommended, as these usually give slightly better results than midget speakers. Some notes on possible alternative transistors, etc., are given later.

The Circuit Board

This is 8 x 2½in. of 1/16in. thick paxolin, and is drilled as in Figs. 2 and 3 first. All wire ends can pass through 1/16in. holes. The oscillator coil and i.f.t.'s require clearance holes for the pins and can tags, and six holes are needed for T1. T2 is held with two 6BA bolts. Three small right-angle brackets hold the panel, but this is not fitted until the circuit board is wired. Complete as much drilling as possible, before inserting any components.

The i.f.t.'s will only fit one way, and are held by spreading the can tags. The oscillator coil P50/1AC has a coloured spot between pins 1 and 6 and this must face the i.f.t. P51/1 so that pins 1 to 6 fall in the positions in Fig. 3.

The driver transformer T1 has a green spot, placed as in Fig. 2, so that its tags emerge correctly (Fig. 3). T2 has three tags on its primary side, and two on the speaker side.

All the resistors may be placed either way round, but check the values because an error in reading them will probably completely upset results. Small capacitors may also be connected either way. But the electrolytic capacitors C6, C8, C13 and C14 must be placed with positive and negative ends as shown. This also applies to C12, running from R10.

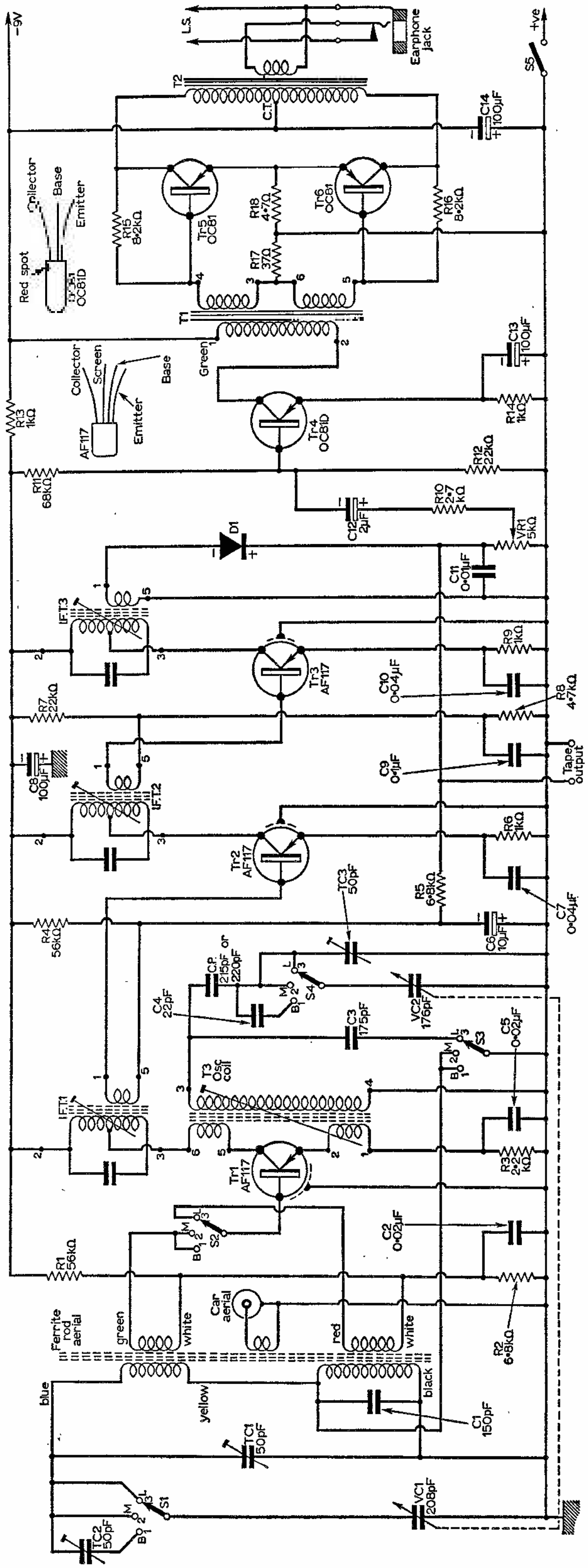


Fig. 1: The Circuit

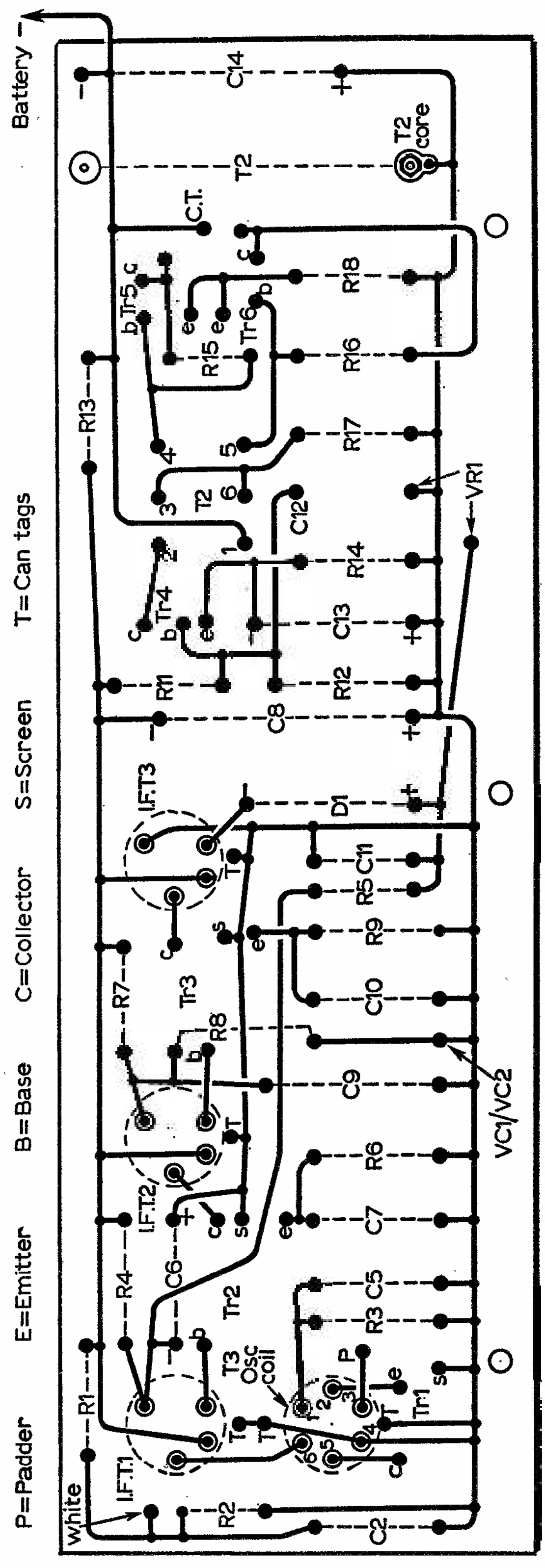


Fig. 2: Wiring of Circuit Board

The circuit layout has been arranged so that no wires cross under the board (Fig. 3). The identification of connections and components is much easier if 1mm, red sleeving is placed on the " earth " or positive line, with black on the negative line, and capacitors having markings upwards. The can tags T are earthed. Solder all joints rapidly but well, and snip off excess wires.

Transistors

These are added when the circuit board is otherwise finished. Identification of the leads is greatly eased by placing lengths of coloured 1mm. sleeving on them. With the AF117's, yellow is suggested for emitter, black for base, and red for collector, the screen wire being left bare. With the OC81D and OC81's, use yellow for emitter, and red for collector. All the pieces of sleeving can be ½in. long.

There is then no difficulty identifying the leads, as they are threaded through in the positions shown in Fig. 2. Small pieces of sleeving of the appropriate colour can also be slipped on the leads as they emerge as in Fig. 3. The transistor leads should be soldered rapidly, the iron being removed as soon as the joint is made. This also applies to the diode D1.

Panel

This is drilled for the switch, VR1, and ganged tuning capacitor. The latter is fixed with three 4BA bolts. These *must* be very short, or have washers, so that they do not protrude behind the capacitor plate, as this will short circuit or damage this component. Small brackets hold the circuit board and panel together.

VR1 is connected as in Fig. 2. Lead X from the positive line runs to the upper tag metal casing, and switch. Lead Y is from diode positive. R10 and C12 are closely in series, negative on C12 going to R11 and R12.

VC1 is the front section of the capacitor, and has more plates than VC2, the rear section. The frame (moving plates) is connected to the positive line of the circuit board.

Switching

This is quite straightforward, but it is also easy to test the receiver temporarily without the switching, to guard against errors. To do this, take green on the aerial to Tr1 base, white to R1 and R2, blue to VC1, and yellow to positive line. Normal medium wave reception should then be obtained, after rough trimming as described later. If all is well, the switch wiring can then be undertaken.

Connections to the ferrite rod aerial and switch will be greatly eased if leads are of the appropriate colours. These coloured wires are then soldered to the same coloured tags of the aerial. Suitably coloured wire is easily obtained, or leads can be marked with paint, sleeving or any other means.

Switch positions are L, M and B, for Long, Medium, and Bandspread. The switch has four poles, S1, S2, S3 and S4. Connections are shown in Fig. 2, and can be checked as follows:

VC1 to S1. M and L tags to blue, TC1 and TC2. B tag to TC2.

TR1 base to S2. M and B tags to green. L tag to red.

Earth line to. S3. M and B tags to C1 and yellow. L tag to C3.

VC2 to S4. M and L tags to C4, CP (215pF or 220pF padder) and TC3. B tag to C4.

The three trimmers have their tags and adjusting screws through holes in a small piece of paxolin, which is secured to the tuning capacitor by a short bolt. Use a soldering tag for frame leads. C3 and CP are soldered together, and sleeving placed on, the lead passing near R3, through a hole, to pin 3 of the oscillator coil. The specified padder is 215pF, but this value may be difficult to obtain. A 1 per cent 220pF capacitor is suitable, and can be readily obtained.

Connections to the switch should be reasonably short and direct, with oscillator circuit leads clear of aerial wiring. The trimmers can be reached from behind when the receiver is in a cabinet.

Aerial

The specified aerial has coloured tags, connected as in Fig. 2. A 1¾in. bracket, cut from aluminium, is bolted vertically near R7, Fig. 2. A 6BA bolt secures the aerial rod to this, using the fitting provided.

The tags should face the rod centre, as in Fig. 2. The white tags of l.w. and m.w. sections are joined together. Yellow on the l.w. coil also goes to yellow on the m.w. coil.

Testing

A test and approximate alignment should be made before fitting the receiver in its case. Note that if the mixer and i.f. sections are working, good 'phone reception of many stations should be possible from the tape output sockets. This test can be made before the audio section is wired, if necessary. Again, if an audio signal is fed in at the tape output sockets, good speaker results will be obtained, if the audio section is working.

The i.f. transformers should be adjusted first. If no signal generator is available, tune in any stable signal, and carefully turn the cores for best volume. Use a properly shaped insulated trimming tool. For final adjustment, use a very weak signal, with VR1 near maximum.

If a signal generator is to hand, apply a modulated signal for all alignment adjustments, and include a meter in one battery lead. Correct alignment then corresponds to an increase in current, though continuous running with a high current should not be allowed. With an unmodulated signal or programme, correct alignment corresponds to minimum current shown on a meter in series with R13. Once the IFT's are touched up for maximum sensitivity, they can be left.

Initially place the aerial coils so that their card tubes are about level with the ends of the rod. Fully unscrew the trimmers. If the tuning capacitor has trimmers, also unscrew these.

TC3 governs the frequency at the h.f. end of the m.w. band, so is adjusted until readings correspond with the tuning dial. Then adjust TC1 for best volume.

Afterwards, tune to the low frequency end of the m.w. band (gang capacitor nearly closed) and, if necessary adjust the oscillator coil core to obtain agreement with the dial. Then slip the m.w. coil along the ferrite rod for maximum sensitivity.

Switch to long waves, tune in a station with the capacitor nearly closed, and move the l.w. coil on the rod, for best results.

After repeating these adjustments, alignment should be roughly correct. Final trimming is then carried out in this order:

(1) Switch at B. Adjust TC3 for correct position of Luxembourg.

(2) Switch at M. Adjust TC1 for best volume.

(3) Switch at B. Adjust TC2 for best volume.

When the receiver is finally in its cabinet, repeat the above until there is no improvement.

Maximum Efficiency

With values as specified, satisfactory results should be obtained at once. But transistors vary somewhat, and in commercially-manufactured receivers it is not unusual for certain resistors of best value to be fitted individually It is not suggested this be done until the receiver is working correctly, and it may be quite unnecessary.

Should battery drain be under 8mA or so with no signal, and results sound a little distorted, R17 can be increased slightly. This will increase the OC81's collector current, and battery drain should be about 10—12mA with no signal, peaking up to about 20—30mA with good volume. R17 may be about 47, 56 or 68Ω, to achieve this. The receiver must not be switched on with R17 disconnected, or of such a high value that a heavy collector current flows.

R4 is occasionally modified slightly, to obtain best sensitivity to weak signals, with low background noise. No confusion about the source of any fault in the tuned circuits should arise if the set is first tested with the m.w. coil only, as explained, VC2 then being wired directly to the padder, which goes to pin 3 of the oscillator coil.

If to hand, popular transistors such as OC71 driver and OC72's for output may be used (maximum power handling capacity is somewhat lower than with OC81's). If so, resistor values in these stages must be those usual for the transistors fitted.

Car Aerial

A coaxial socket is most suitable, so that a screened coaxial lead can be used from an external aerial. No extra licence is needed for a portable used temporarily in a vehicle. Telescopic aerials may be obtained to clip on a window. Such an aerial increases signal strength, which is reduced by the

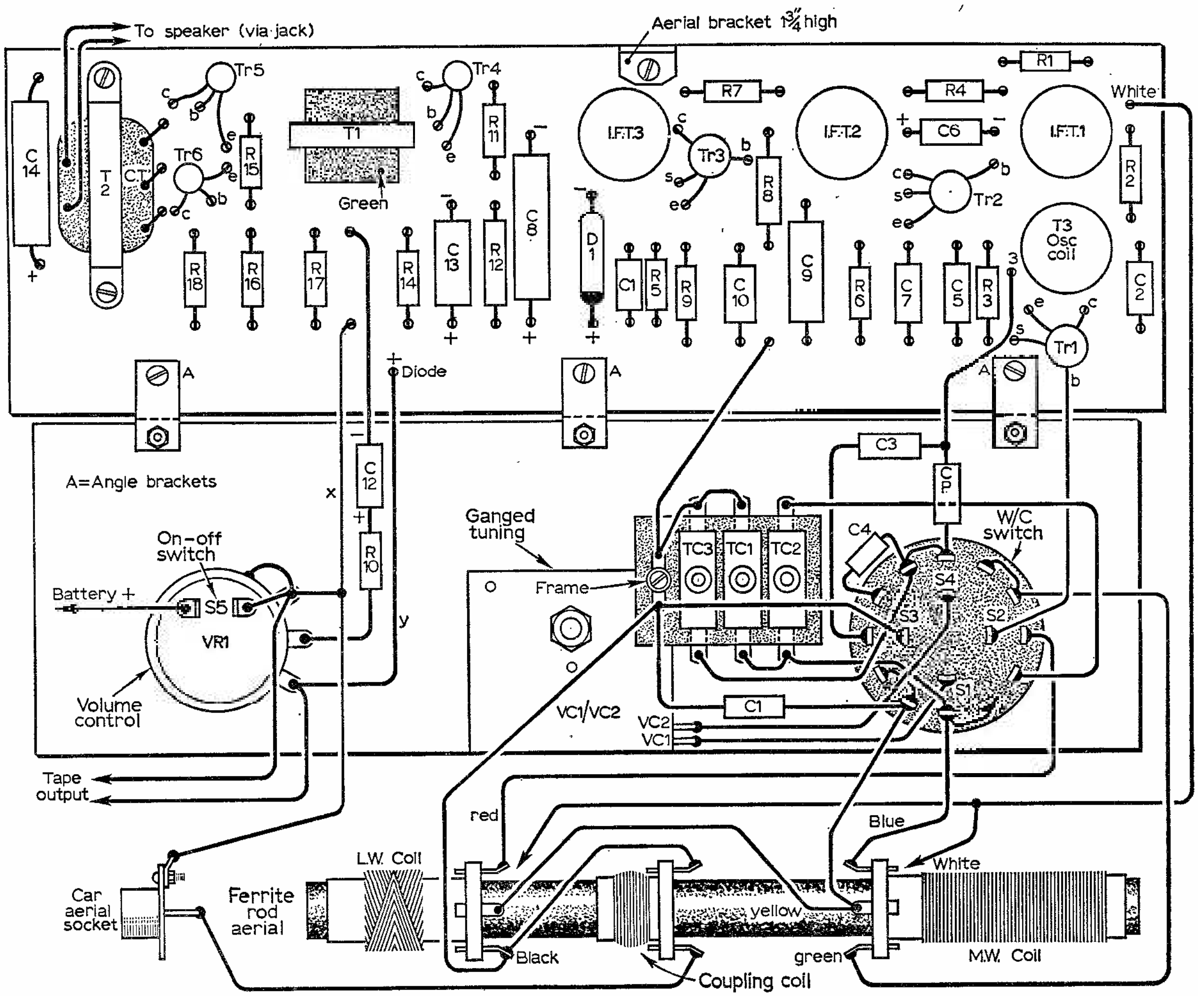


Fig. 3: Layout of components on circuit board and wiring to wavechange switch, ferrite rod aerial and trimmer bank

vehicle screening, and is not directive in the same manner as the ferrite rod.

If a telescopic or other short extended aerial is used merely to boost strength of weak transmissions (e.g., not in a vehicle) then it is better not to screen the connection to it.

Tape Output

These sockets supply an audio signal directly from the diode, at about 5kΩ impedance. Most tape recorders have an input circuit suitable for this, and permit direct recording at high quality. The best method of connecting here is to make up a short screened lead, fitted at one end with a plug to suit the recorder, and at the other with a small audio-type coaxial plug, to fit the receiver; or with separate plugs, if a 2-pin socket strip is provided. The screened lead outer braiding forms the earth circuit return.

The receiver should not be connected to a midget a.c./d.c. type amplifier or any apparatus live to the mains.

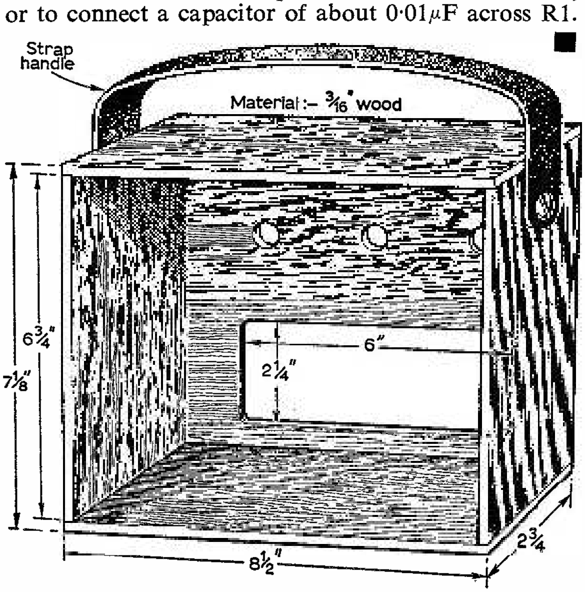
Earphone

The actual impedance is not very important, but is best not higher than about 50Ω. The jack and plug may be ordinary size, or miniature. The circuit from the secondary of T2 to the loudspeaker is completed through the jack contacts. These are closed when the plug is out. When the plug is inserted, it opens the contacts, disconnecting the speaker to silence it. Signals then reach the earphone from the sleeve and tip contacts of the plug.

H.T. Whistles

After dark, some inter-channel whistles or interference may occasionally arise, particularly around 200 metres. If necessary, it may be possible to orient the receiver so that directive effects of the aerial reduce this.

Should actual oscillation arise around 200m. it is in order to place a 100—390Ω resistor between pin 6 of the oscillator coil and pin 3 of the i.f. transformer, or to connect a capacitor of about 0·01μF across R1. ■



★ components list

Resistors:

R1	56kΩ
R2	6·8kΩ
R3	2·2kΩ
R4	56kΩ
R5	6·8kΩ
R6	1kΩ
R7	22kΩ
R8	4·7kΩ
R9	1kΩ
R10	2·7kΩ
R11	68kΩ
R12	22kΩ
R13	1kΩ
R14	1kΩ
R15	8·2kΩ 5%
R16	8·2kΩ 5%
R17	37Ω 5%
R18	4·7Ω
VR1	5kΩ pot. with switch

All fixed resistors 10% except where otherwise specified.

Transistors and Diodes

Tr1	AF117
Tr2	AF117
Tr3	AF117
Tr4	OC81D
Tr5	OC81
Tr6	OC81
D1	GD9, OA70 or OA81

Capacitors

C1	150pF 1% or 3%
C2	0·02μF
C3	175pF 1% or 3%
C4	22pF 1%
CP	215pF 3% or 220pF 1%
C5	0·02μF
C6	10μF
C7	0·04μF
C8	100μF
C9	0·1μF
C10	0·04μF
C11	0·01μF
C12	2μF
C13	100μF
C14	100μF

Variable Capacitors:

VC1/2	208/176pF, Jackson type 00 slow motion, with screen
TC1, 2, 3	50pF trimmers

Inductors:

IFT1	Weyrad P51/1
IFT2	Weyrad P51/2
IFT3	Weyrad P50/3V
T1	Weyrad LFDT4
T2	Weyrad OPT1
T3	Weyrad P50/1AC

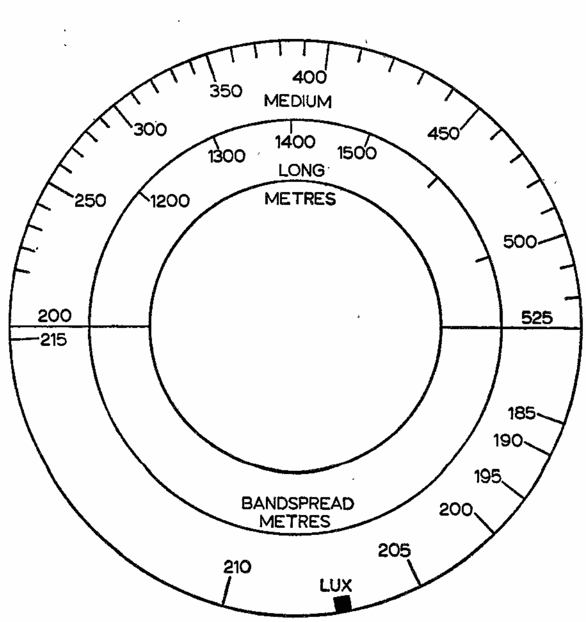
Ferrite rod aerial—Weyrad RA2W

Other Components:

3Ω p.m. loudspeaker. 4-pole 3-way rotary switch. Paxolin (1/16in.) 8 x 2½in. (two pieces). Coaxial aerial socket. Output socket. Closed-contact jack socket and plug. Knobs, sleeving, etc.

Fig. 4 (left): Details of a suggested cabinet

Fig. 5 (below): Calibration of dial



ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequences in kc/s

THE BROADCAST BANDS by JOHN GUTTRIDGE

Albania: *Radiodiffusion et Television Albanaise* (Rue Ismail Quemal, Tirana) has new English transmissions at 1200—1230 on 7,265 and 1630—1700 on 9,520. The 0630—0700 transmission is now on 7,265/9,390.

Czechoslovakia: *Ceskoslovensky Rozhlas* (Praha 2, Vinohradska 12) using 5,930/7,345 for English 1900—1930 to Europe. To Africa 1730—1830 on 5,930/7,285/7,345/9,795/11,990. English to North America is carried at 0100—0200 and 0330—0430 on 5,930/7,115/7,345/9,795/11,990. Also on Sundays 1400—1500 on 15,285/15,448/17,825.

France: *O.R.T.F.* (Maison de l'O.R.T.F., 116 Avenue du President Kennedy, Paris 16). For those interested in French domestic stations the latest issue of 'Paris Vous Parle' lists all French medium wave and v.h.f. stations.

Hungary: *Magyar Radio Es Televizio* (Brody Sandor-S.U., 5-7, Budapest VIII) in English 1930—2030 3,995/6,234/7,220/7,305/9,833/15,160; 2200—2230 3,995/6,234/7,220/7,305/15,160; 2330—2400 539/3,995/6,234.

Luxembourg: *Radio Luxembourg* (Villa Louvigny, Luxembourg) may be heard very faintly around 2200 on 15,350 carrying a relay of the 233 kc/s long wave French programme.

Monaco: *Radio Monte Carlo* (16 Boulevard Princesse Charlotte, Monte Carlo) now has a long wave transmitter. Frequency is 215 and power 1,250 kW. On air from 0500—0100 with same programme as 1,466/6,035/7,135.

Portugal: *Emissora Nacional de Radiodifusao* (Rua Sao Marcal, 1-A Lisbon) now uses 7,130/9,645 for the 0730—0900 English transmission.

Spain: *Radio Nacional de Espana* (General Yague 1, Madrid) has English 2020—2050 on 9,360.

U.S.S.R.: *Radio Dushanbe* may be heard around 1900 on 4,640 carrying the programme of Moscow I. *Radio Frunze* heard around 1600 on 4,008. Relays Moscow I at 1700. *Radio Kiev* (Ukrainske Radio, Radio Centre, ul Khreshchatik 24, Kiev, Ukranian S.S.R.) has formed a Dx club. To qualify for membership listeners must send in three reception reports. Transmits in English Mondays and Thursdays, 1900—1930 on 6020/9,640 and 2230—2300 on 1,241. Also Tuesdays, Wednesdays, and Fridays at 0030—0100 on 7,120/7,140/7,280/7,310/7,330/9,680 and 0430—0500 on 7,180/7,290/7,310/7,330. The 1900 transmission on 6,020 seriously interferes with transmissions from Radio Nederland. *Radio Moscow* (Moscow) now has a 75 m.b. home service transmitter on 3,990. The 2300 English transmission can be heard surprisingly on 4,860 as this programme is intended for North America. The transmission does not appear to be a harmonic of 9,720. *Radio Petropavlovsk* may be heard with relay of Moscow I on 4,055 around 1930. *Radio Vilnius* (Lietuvas T.S.R. Radijas, ul Kanarskio 49, Vilnius) has English, Sundays and Fridays, 2230—2300 on 7,113. Also believed to use transmitters in 51, 50, 41 and 40 m.bs. *Radio Yerevan* (Armenian Radio, Mravian Street 5, Yerevan 25) has Arabic 1900—1930 on 4,040.

Algeria: *La Voz de la Libertad* (F.P.L.N., 3 Rue Auber, Algiers) on air Sundays and Thursdays in Portuguese, 0015—0100 on 6,080.

Angola: *Radio Comercial de Angola* (Casilla Postal 269, Sa de Bandeira) has replaced 3,995 by 4,795. The station is on the air 1700—2400.

Ascension Island: B.B.C. relay station is expected to begin operations in June. Four 250kW transmitters are being installed.

Bechuanaland. B.B.C. relay station beams programmes to Rhodesia 0400—0730 and 1015—1145 on 7,295 and 1545—2015 on 4,842. Power is 10 kW.

Gambia: *Radio Gambia* (Bathurst) transmits 1710—2030 Mondays—Fridays on 4,820. Can occasionally be heard around 1900.

Morocco: *Radiodiffusion Television Marocaine* (I Rue Pierre Parent, Rabat) has English 2130—2230 on 11,735/15,410.

Nigeria: *Nigerian Broadcasting Corporation* (Broadcasting House, Lagos) has replaced 11,900 by 11,915. Other frequencies used for English 1700—1900 and 2100—2200 are 7,275/9,690/15,255.

Zambia: *Radio Zambia* (Broadcasting House, P.O. Box RW15, Ridgeway, Lusaka) can sometimes be heard between 1730—2000 on 3,270 in English.

China (People's Republic): *Radio Peking* (Peking) has English 2030—2130 in 58-51-48-42 m.b. and 2130—2230 in 51-48-42 m.b.

China (Republic): *Broadcasting Corporation of China* (*Voice of Free China*) (New Park, Taipei, Formosa) has English 0250—0350 7,130/11,825/11,860/15,345; 1000—1045 7,130/9,655/9,685/11,825/11,860; 1530—1610 7,130/9,685/9,720/11,725/11,825/15,125/17,890.

Indonesia: *Radio Republik Indonesia* (P.O. Box 157, Djakarta) has news in English on 9,555 from 1000—1010.

Japan: *N.H.K.* (Tokyo). Results of a poll held among its listeners by N.H.K. to find the station they listened to most, apart from N.H.K., were 1: Radio Australia, 2: B.B.C., 3: Voice of America, 4: Radio Peking, 5: Radio Nederland, 6: Radio Canada, 7: Radio Moscow, 8: Swiss Broadcasting Corporation, 9: La Voz de los Andes, 10: Deutsche Welle.

Thanks for information this month go to M. Barraclough, G. Roberts, I. Black, B. Burling, D. Park, S. Haageman, L. Sapiets, R. A. Adair, S. Ormerod and A. W. T. Moore.

THE good openings on the l.f. bands continue as some of the logs received show. Top band has been particularly good and has produced many W's for those who "listened with intent". Eighty has been noisy with a bit of the long distance "stuff" creeping through the chinks now and again. Forty—even noisier with fewer chinks! Twenty, wide open at times and staying open until quite late. Europeans still audible at 2200 hrs!

Fifteen metres, described by one SWL as the Yo-Yo band. One minute half the world and the next minute—the proverbial Miss Adams.

Ten metres getting better but still a bit patchy, though those that do come through usually do it loud and clear and nearly always on a.m. too. W's are reported at 5 and 9 plus on one or two occasions.

All in all and with a bit of luck the summer looks like being a "good 'un" from the amateur bands point of view. If conditions hold it should be a very lively NFD this year.

Low Frequencies

Steve Wilson went on safari into the wilds of 160. Armed only with an HRO/MX, a BC348R and a dipole cut for 1830 kc/s he captured DJ6TK, DL1FF, DL8AM, DL9KRA, EI9J, G, GI, GM, GW, HB9CM, IS1FR, OHØNI (Aaland Is.), OL1AEE, OL8ACC, PAØDC, VE1ZZ, WIBB/1, W2IU, W2GGL, W8RRH, K8MGW ZB2AM, ZB2AJ, 4U1ITU, 9H1AE, 9L1HX, 9M4LP (Malaya).

R. Iball (Worksop), SX28+PR30, 80ft. l.w., K1OYB/1, K2DGT, K8HKB, OE5CR, VE2ATU, VO1FB, W1BB/1, W1HGT, W2FYT, W2GGL, W3ELS, W8FGK, W8HGW, W9EWC, WØVXO, 4U1ITU, all c.w. On 80 metre phone **Alan Lattimore** (Dartford), CR100, 20ft. whip raised many G's plus CT1MS, KP4AST, K9JWV, YU2NZ. **James Brown** (Cardiff), 19 set and a dipole logged EA4GZ, IØFGM, K4AP, OX3LP, OY7ML, many VE's including VE6ALQ, VP5AB, VP9DW, many W's, YV5AFH, ZB2AJ. James would like to know the location of VS3EA (so would I!). No reports for Forty this month—sacrilige, so a new heading and on to the h.f. bands.

High Frequencies

K. Evans (Shepperton), HE30, 132ft. l.w., 20 metres s.s.b., KR6UL, VK2JZ, VK3ALB, VK4SB, VK6SA, VK7SM, VP5GU, YV5AIP, ZL1AS. Congratulations on passing the RAE Keith.

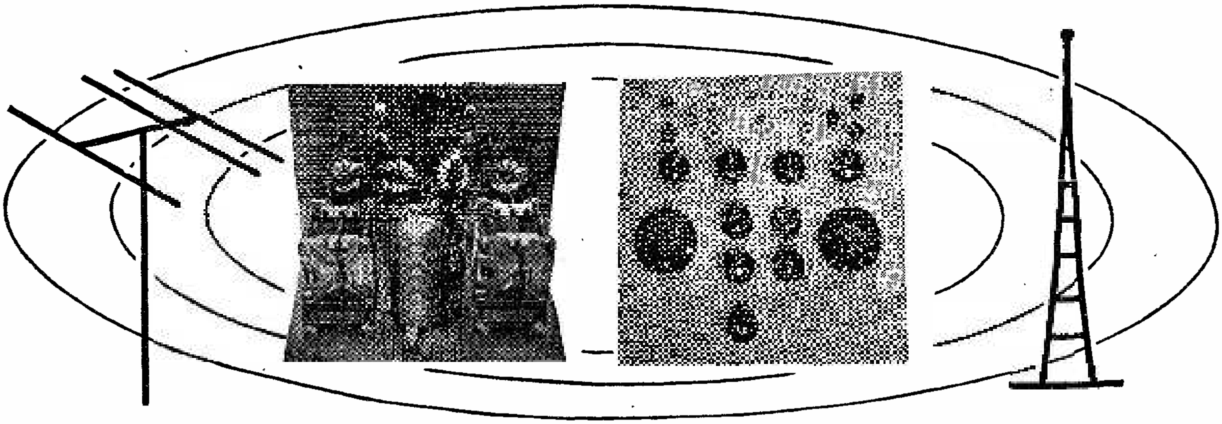
Colin Morris (Tenbury Wells), Electroniques front end into homebrew 9 valve s/het, 33ft. l.w., BV1USA, CN8BB, CP1FOF, CR6AC, EP3AM, FR7ZB, HI8XMT, HK2OQ, HP9FC/MM, JA6NP, KG6APS, KL7EBK, KP4AXC, KR6UL, KV4AB, KZ4PW (no connection with the magazine!), LU5DBS, OX3LP, PY2BFO, PZ1BW, TF2WJK, UA9HA, VE1, 2, 3, 4, 5, 6, 8, Ø, many VK's, VQ9HT, VS9AJR, YS1JRD, ZD8JPL, ZS1VT, ZS6IK, ZL2BE, 7Q7PS, 7X2BG, 9J2AB, all s.s.b. **D. Howell**, 7 valve receiver, 66ft. l.w., KR6QL (Okinawa), KL7EBK (Alaska), MP4BB (Bahrain Is.), VK2NN, VK5NJ, WØNNI, W7ADS, ZS2NV, ZD8ARP, ZL3UY, ZL4BX, 4X4JU. A rare one from **Frank Videan** (St. Albans) who reports hearing WA3BYG/AM on twenty, the /AM meaning aueronautical mobile and giving his location as 35N, 78W.

On Fifteen, **A4378** (Cardiff), 9v. s/het, 95ft. l.w., heard CN8AD, K2EVG, K9WEZ, W1DUJ, WA1BYA, WA2FQG, W3GTL, YO3TL, 9H1R. **A. Trickey** (Bristol), 9R-59+PR30, 100ft. l.w., KP4CNF, W1JRY, W2BLQ, W3TDV, YV4BG, 5A3TX, 9G1FL, 9H1AL. **Paul Baker** (Pantygasseg), HE30, 61ft. l.w., CN8's, CR4AB, CR6CZ, CR7FM, CR8AT, FW8BJ (Wallis Is.), KP4AXC, KZ5AM, MP4BBA, OA4YI, PY1, 2, 3, 5, 9, PZ1BE, SVØWB (Rhodes), SVØWO (Crete), VE1-5, VO1, VP9, W1-Ø, YV1DP, ZB2AG, ZC4AK, ZE2KL, ZE6JL, ZS1BV, ZS6IN, 4X4HB, 5A1TK, 5N2FEL, 5X5FR, 6W8BG, 7X2WW, 9H1R, 9J2DL, 9K2AD, 9Q5GG, 9U5BB, 9X5MW. Paul queries a 9Y4RS claiming his QTH as Trinidad.

Ten metres, **Chris Clarke** (Farnham), sends in a colossal list which includes K1, 3, W1, 2, 3, 4, 8, WA4, plus 52 G's. A4378 again reports GW's, and ZE3JU, ZS9G.

What and Where

Reports from readers and over the air say the following are to be had for the listening. 4S7IW (Ceylon), around 14200, ZL4CH (Campbell Is.), VKØ (Macquarie Is.) still at it, also around 14200. VK9PL (Papua) on 14 Mc/s, CEØAC (Easter Is.), c.w. end of 20, FU8AG (New Hebrides) ditto, TT8BS (Chad) on 15 c.w. and a TY3 ditto (Dahomey). Contests include May 8th, 144 Mc/s Portable contest, 22nd, D/F qualifying event, 28-29th, 420 Mc/s open contest, 29th 1296 Mc/s contest. June 4th and 5th National Field Day.



Comprehensive ATU

by D. Gibson G3JDG

IT is a strange fact that a very great percentage of people tend to spoil the ship for a " ha'porth of tar ". This, unhappily, is all too true in amateur radio. The ham with nice new shiny transmitter, home-built or commercial, will usually have a pi-tank output circuit.

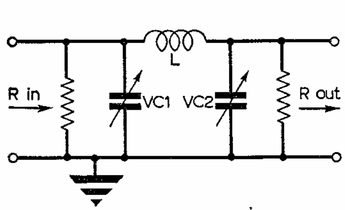
The pi-tank offers many advantages. For instance, it gives good harmonic discrimination against TVI and it will match a variety of impedances. This is another way of saying that it will often tune or load up anything from a dipole to any random length of wire which happens to be to hand. Although this is true, there are drawbacks.

Component values in a pi-network are calculated very carefully and the capacitors and inductor cannot merely be selected to resonate at the desired frequency. As will be appreciated, there are a great number of combinations of L and C which will tune to a given wavelength. How then do we decide which is the correct combination?

Pi Configuration

The pi configuration is often used in low pass filters and again exactly the same problem is present —which combination of inductance and capacitance to use. Fig. 1 shows the circuit in question, and you will notice that, in addition to the two capacitors and inductor, two resistances are shown R_{in} and R_{out}.

These are the flies in the proverbial ointment. R_{in} is calculated from the valve anode voltage and current in the case of transmission, and R_{out} is the impedance of the antenna. A dipole, and indeed most beams and quads etc., are commonly fed with



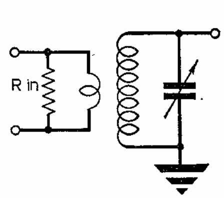


Fig. 1 (left): Pi-network showing input and output impedances. Fig. 2 (right): Parallel tuned circuit showing link input impedance R_{in}.

75Ω coaxial so that pretty well all pi-networks are designed to feed into 75Ω.

If we now stick the odd length of wire in the output terminal it is highly probable that we can still load it, but it is almost certain that it will not present an impedance of 75Ω. Any transmitting amateur will tell you that a low pass filter will only work efficiently if it is set up correctly and is terminated in the correct impedance.

Although perhaps not generally realised, this is also true of the pi-tank. If you use it to load odds and ends it does not follow that it is working efficiently, or that it will give the same harmonic discrimination, the very thing for which it is often used.

In the case of a parallel tuned circuit Fig. 2, it will be seen that R_{in} is shown as a link coupling. Unfortunately optimum coupling will vary from band to band, so that if any degree of constant efficiency is to be maintained this link will need to be variable not only in the degree of coupling, but also its inductance.

The Solution

In the case of matching an aerial to a receiver or transmitter it is found that no one circuit will suit every single need. Some aerials are very high impedance and might require a parallel tuned circuit while others are low impedance and would require a series tuned circuit.

Some time ago the writer wrote an article on a S.W.R. bridge (PRACTICAL WIRELESS, Feb., 1965), and contained in the same case was a coil and a capacitor. If high impedance was desired, then the circuit was wired in parallel, if low impedance then it was altered to series tuned with the aid of a soldering iron.

After a short time it became obvious that some form of switching would be a great saving of opening and closing the case at each change of antenna not to mention the " frigging " about with the link coil at each change of band. Accordingly back copies of various magazines were scanned but the same problem came up again and again.

One a.t.u. was fine for tuned feeders but not long wires. Another tuned only three bands or else no provision was made for varying the link winding. Others had link winding with no alternative input. In short each design, although doing its intended job very well had limitations and the most serious one was lack of flexibility. After writing down all the different desirable properties of the perfect a.t.u. (for the writer) the following was arrived at.

It should be switchable to almost any configuration, and it must match anything from low to high impedance from the longest long wire to the shortest and everything in between. (Yes, even end fed coat hangers and base loaded cufflinks too!) It must have an optional and variable link which should be controllable from the front panel, and be usable with the three main antenna inputs single wire (any length), coaxial feed and tuned feeders. It should also be usable in any of the popular configurations, parallel tuned, series tuned, pi-network, L network, transmatch, balanced transmatched etc.

This unit will do just these things from 1·8Mc/s to 30Mc/s continuous, and it even peaks some of the medium wave band as a bonus. It will also give added discrimination against unwanted harmonics on transmission, and give an extra stage of quite sharp selectivity on reception. *NOTE:* It will not give any gain. However it will match impedances and the difference for the prototype between tuned and untuned peaks up to something like three to four S points.

A six foot length of lighting flex draped across the bench was loaded up on all bands while OK's have been heard on topband. The same set up raised East Coast American stations, plus W6 and W7 and PY.

It will, of course, peak signals on all frequencies between 1·8 and 30Mc/s and is therefore entirely suitable for listening to the commercial bands as well as the amateur bands.

SWL's or those intending to use the unit for reception only can use small Yaxley switches and receiving type capacitors, this will also result in a smaller and more compact unit. The coil too is not critical and some may like to use an inductance which is to hand or wind one themselves. As a guide the inductance of the coil specified is 41μH.

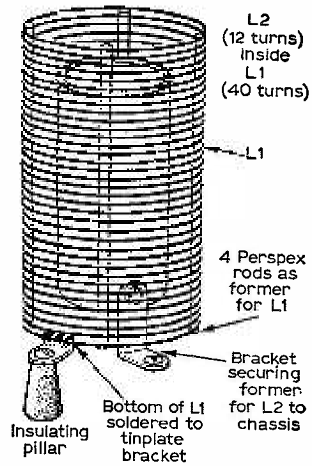


Fig. 4: Mounting details of L1 and L2.

The Circuit

The complete circuit in Fig. 3 shows two coils, three capacitors, eight switches and ten terminals, together with a coaxial socket. The link coil L2 has a variable capacitor VC3 which gives variable loading. Also the link coil itself can be switched to vary its inductance by turning S5.

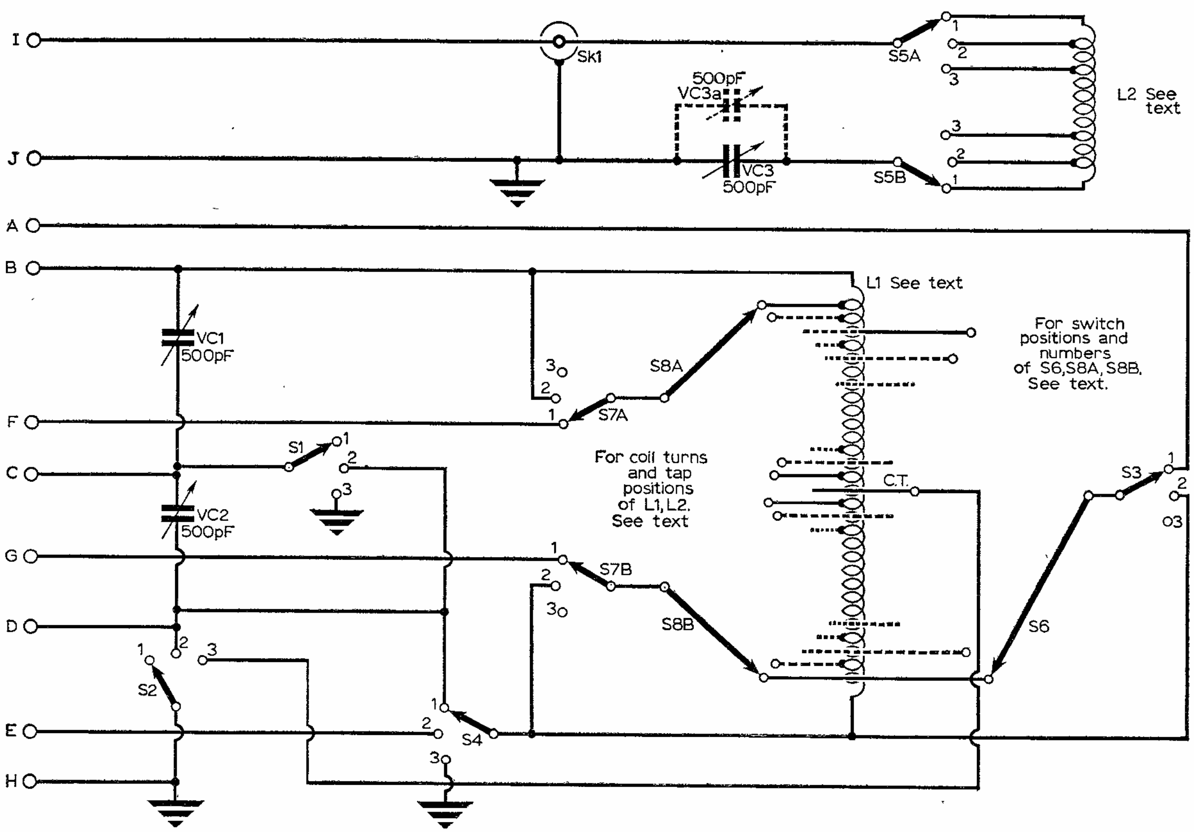


Fig. 3: Complete circuit diagram of the unit.

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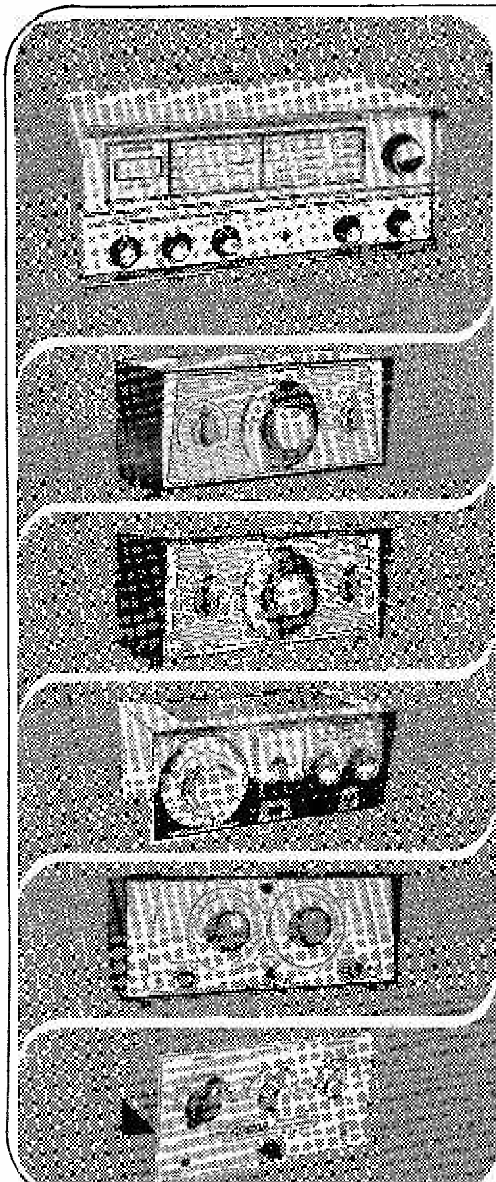

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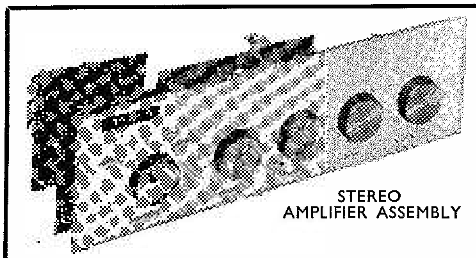

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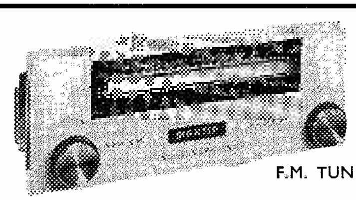

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L2 is wound on a 2in. dia. former and mounted inside L1. This avoids the awkward method of winding it around the outside of L1, a rather difficult task because of the tapping points and numerous lead-off wires coming from L1. Details of the mounting and positioning of L1 and L2 are shown in Fig. 4. VC3a, shown in dotted lines in Fig 3, is an unused gang of a 500pF twin gang and is only included for completeness.

Coil L1

This is the main tuning coil and takes time and patience to wire up. The tapping wires are all lengths of 18s.w.g. tinned copper wire threaded with sleeving. Great care should be exercised as a dry joint or a poorly soldered connection here can prove disastrous later on, especially when the coil is mounted in position and all the taps are soldered on. Fig. 5 gives all relevant information on L1.

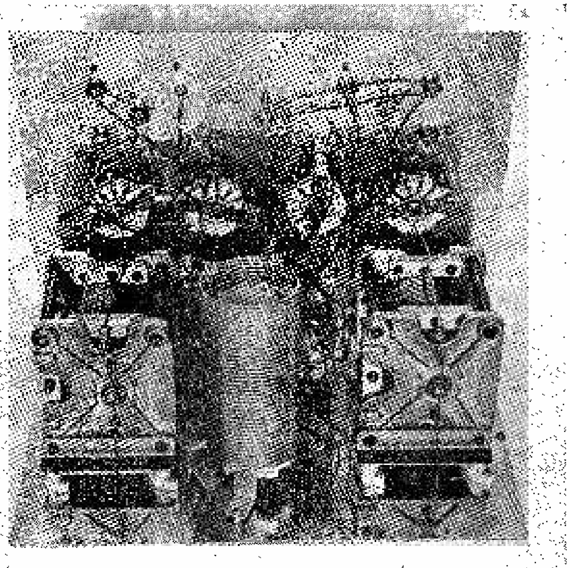
One word of warning before passing on. Ensure that none of the taps, i.e. the lead off wires from L1 touch. Failure to observe this will result not in an a.t.u. but a first-class arc welding unit.

Other Components

VC1 and VC2 must be insulated from the chassis and front panel. In the prototype they are large transmitting types and are mounted off the chassis with small Eddystone stand-off ceramic insulators. The holes in the front panel for their spindles were cut with a B7G chassis cutter to allow ample clearance.

The switches are as shown and are straightforward switches obtained from the "surplus" market. If the unit is to be used for transmission then these should be ceramic. If, however, it is only to be used for receiving then ceramic or ordinary Yaxley type switches will suffice.

Photograph shows rear view of the completed unit.



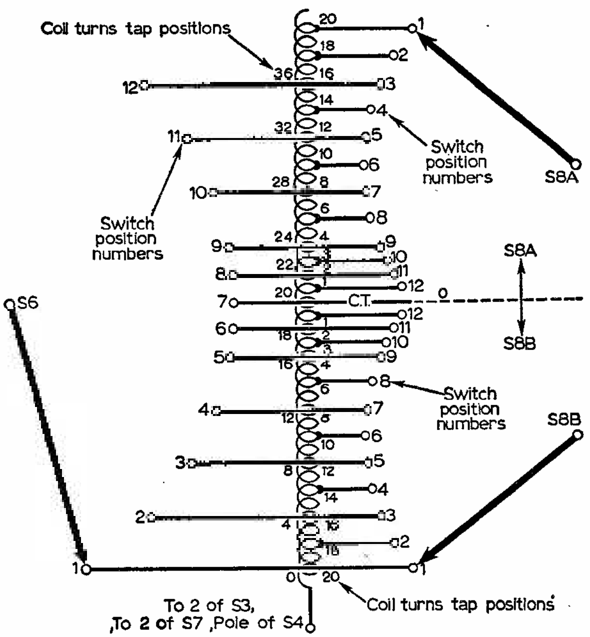


Fig. 5: Positions on main coil L1.

The coloured terminals at the top are arranged in groups of five, the centre one of each bank H and J being earthed. There is also a coaxial socket mounted centrally or if preferred terminal I together with one of the earth terminals may be used. The terminals may be used as either input or output and by this factor alone a large number of permutations are possible without recourse to any switching at all.

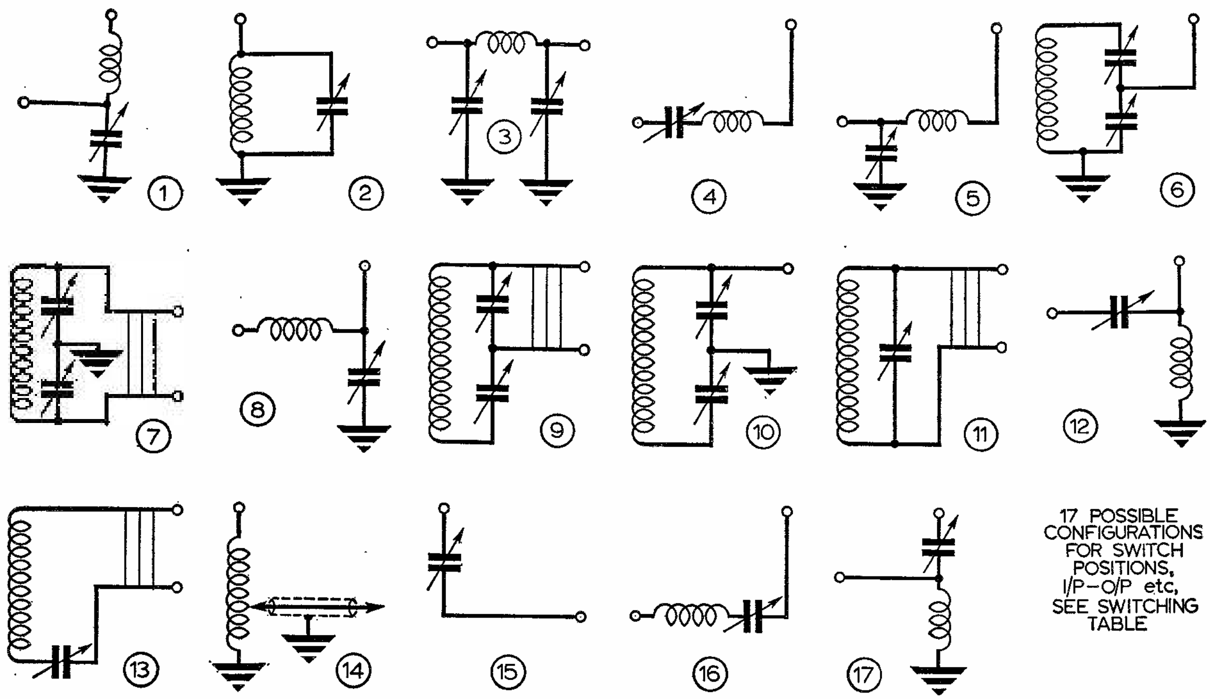
S8 allows the coil to be shorted out equally from either end thus the link coil is always at the centre of the main coil. This would not be so if the inductance were varied by shorting out from one end only. As the switch tapped up the coil the link would, in effect, move down towards the tapping point automatically and once the tap had gone above the link there would be very little coupling at all.

Also, of course, in the case of certain aerials it is desirable to tap in equidistant from the ends of the coil. In this instance with S7 in position 1 and the aerial input on terminals F and G, S8 will perform just this function.

S6 is provided to short out L1 from one end only. This is useful when the unit is switched for a pi-network or L network or wherever the inductance is to be tapped or varied. It is also possible to use the tap as an input or output point by using terminal A and switching S3 to position 1.

Configuration

The different configurations possible appear to be almost limitless so no claim is made as to the maximum possible number. However some of the circuitry available is shown in Table 1, together with the position of the switches, the terminals to use, and which capacitors are in or out of circuit. With most



Above—Table 1 shows some of the configurations possible.

Below—Switching and I/P-O/P connections for configurations shown in Table 1.

SWITCH NUMBERS											
Diagram Number	I/P	O/P	One	Two	Three	Four	Five	Six	Seven	VC1	VC2
1	B	E	3	2	2	2	VARIABLE DEPENDING ON BAND ETC.	DITTO AS SWITCH FIVE	1	IN	OUT
2	See text	B	3	2	1	3			1	IN	OUT
3	D	B	3	1	2	1			1	IN	IN
4	C	E	1	1	2	2			1	IN	OUT
5	B	E	3	2	2	2			1	IN	OUT
6	See text	C	1	2	1	1			1	IN	IN
7	SK1, I/J	B/D	3	1	2	1			1	IN	IN
8	E	B	3	2	2	2			1	IN	OUT
9	SK1, I/J	B/C	1	1	2	1			1	IN	IN
10	SK1, I/J	B	3	1	2	1			1	IN	IN
11	SK1, I/J	B/C	2	1	2	1			2	IN	OUT
12	C	B	1	1	2	3			2	IN	OUT
13	SK1, I/J	E/C	2	1	2	2			2	IN	OUT
14	SK1/A	B	1	1	1	3			1	OUT	OUT
15	B	C	1	1	1	2			1	IN	OUT
16	E	C	1	1	2	2			2	IN	OUT
17	B	C	2	1	2	3			2	IN	OUT

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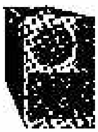

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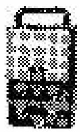

V-7A

	Kit	Assembled
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● **TV ALIGN. GENERATOR, HFW-1**, 3·6-220 Mc/s	£37 18 0	£47 10 0
● **RF SIGNAL GENERATOR, RF-1U.** (Up to 100 Mc/s fund.)	£13 8 0	£19 18 0
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	Kit	Assembled
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● **AUDIO SIGNAL GENERATOR, AG-9U** 10 c/s—100 kc/s	£22 10 0	£30 10 0
● **AUDIO SINE/SQ GENERATOR, A0-1U** Sq wave 20 c/s-25 kc/s	£14 15 0	£21 5 0
● **SINE/SQ GENERATOR, IG-82U** Freq. range, 20 c/s-1 Mc/s	£24 10 0	£36 10 0
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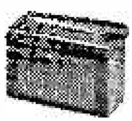

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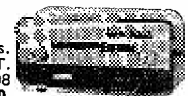

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	Kit	Assembled
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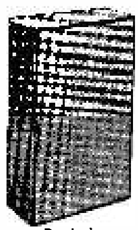

Berkeley

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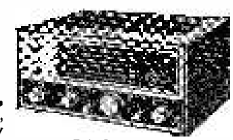

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	Kit	Assembled
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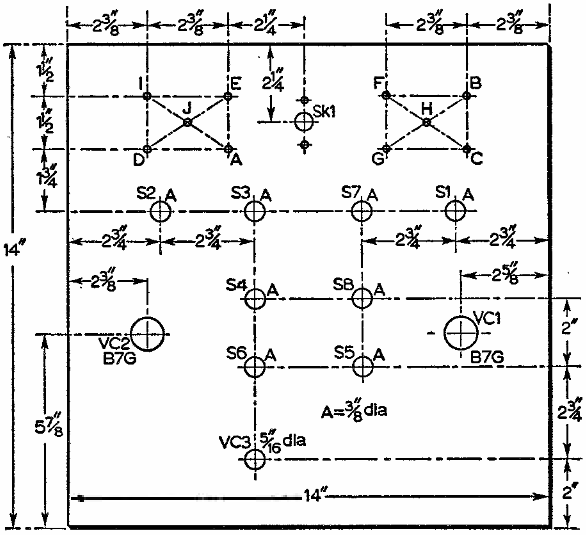
of the arrangements shown the input side is optional. For instance in 3 the input may be either the link or at terminal D. This is so in a number of other instances.

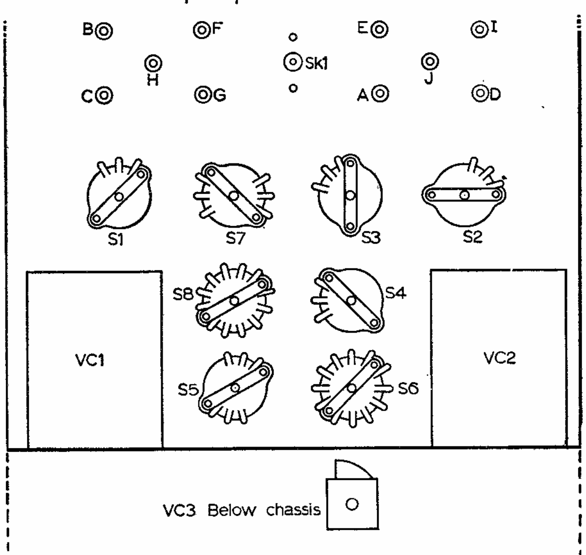
Conclusion

A number of antenna have been successfully loaded up. These include dipoles and odd lengths of wire, also some very unlikely ones have been used with marked success. American stations have been



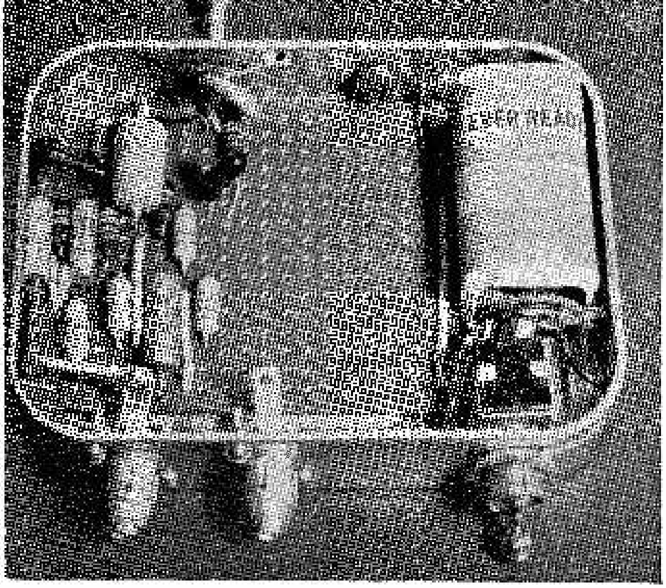
Above—Front panel drilling diagram. Front view.

Below—Orientation of switches and terminal identification on front panel. Rear view.



worked using the garden fence, and the house guttering also loads up very well on all bands.

There is a strange fascination and also a great satisfaction in plugging in all sorts of things into the unit and watching the s.w.r. go down to 1:1 indicating a near perfect match. Originally the unit was designed to present 75Ω to the transmitter and receiver regardless of the type of antenna used. ■



MONO OR STEREO

PICKUP BOOSTER

GORDON J. KING

THE sensitivity of a hi-fi amplifier is expressed as the minimum input signal required to cause the amplifier to deliver its rated output power. The sensitivity often differs between the various signal inputs. For example, the RADIO or AUXILIARY input may demand a signal of 200mV or so, while the GRAM input may need only a few millivolts for full drive.

Many amplifiers, of course, have two pickup inputs, one for "magnetic" and the other for "piezo" (i.e., crystal or ceramic). The magnetic sensitivity is generally higher than the piezo because the signal voltage from a piezo pickup is normally well above that from a good magnetic cartridge.

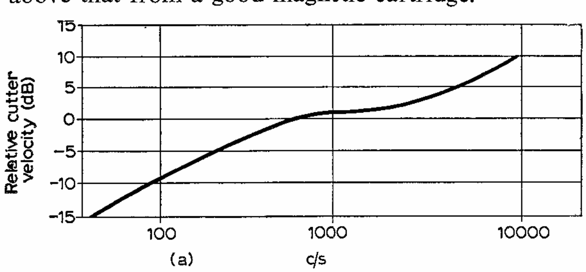
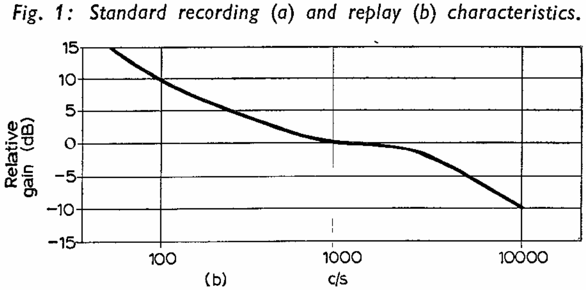


Fig. 1: Standard recording (a) and replay (b) characteristics.



Pickup output is given in terms of root-mean-square (rms) volts for a certain stylus velocity. A typical specification is 1mV/cm/sec. This means that for each cm/sec of stylus velocity the output is 1mV. As the velocity imparted from the groove to the stylus is continuously changing, so also is the output voltage—to the pattern of the audio signal.

Broadly speaking, the amplifier's sensitivity voltage should be about five times the V/cm/sec output of the pickup. Thus, to cater properly for a pickup of the above specification, the amplifier should have a sensitivity of 5mV. It rarely happens, of course, that the amplifier's sensitivity exactly matches the signal voltage in this way. Often the signal voltage is *above* the input sensitivity of the amplifier.

This is fair enough, for a preamplifier can usually cater for a signal a number of times above its sensitivity voltage before overloading starts to cause significant trouble. This has to be so to handle the dynamic range of music.

When the signal voltage is far above the amplifier's sensitivity voltage, there is not a great deal of trouble involved in attenuating the signal prior to its application to the input. All that is generally required here is a simple resistive attenuator to match the source and amplifier impedances.

The biggest problem is when the signal voltage is considerably *below* the sensitivity voltage of the amplifier input. Say, for example, that we have a magnetic pickup with an output of 5mV/cm/sec, and that the sensitivity of the amplifier is 100mV. For full drive conditions the amplifier sensitivity should be around 25mV so the effect of connecting this pickup to the 100mV input would be a serious lack of drive.

Actually, some sort of reproduction would be possible by turning the amplifier's gain (volume) control full on, but even then full power would not be delivered by the amplifier, and the signal/noise ratio would be bad.

The problem would be resolved either by using a pickup with an output of about 20mV/cm/sec, or by using a booster between the pickup and the amplifier. This article describes such a booster, which can have one or two channels for mono or stereo pickups.

Equalisation

The majority of amplifiers that will be used in conjunction with this booster will possess an *equalised* pickup input circuit. It will be understood, of course, that all magnetic pickups require an equalising circuit because the output voltage from this kind of pickup rises approximately at the rate of 6dB per octave, as shown in Fig. 1(a). Actually here is shown the relative velocity of the cutter stylus over the frequency spectrum. On playing back with a magnetic pickup, therefore, the signal output follows a similar curve.

If nothing is done about this at the amplifier the reproduction sadly lacks bass, and treble has predominance. Pickup equalisation simply means that the pickup channel of the playback amplifier should have a gain/frequency response which is the reciprocal of that of the pickup output. This is shown in Fig. 1(b). The curves in Fig. 1 are in reality associated with the recording characteristics of the disc. These differ from the basic 6dB/octave characteristic in that at about 1,000 c/s the output rise is checked and controlled treble lift is applied (a) as a means of improving the signal/noise performance of the reproducing system.

Crystal Pickups

Now, how about piezo or crystal pickups? Well, the output from these is not specifically affected by frequency. That is, when they are loaded to a high impedance of about 2MΩ. The output then is proportional to the level of the recording.

In practice, this means that the output from the pickup is substantially "flat" over the normally recorded frequency spectrum. Such a pickup, then, can be connected direct to an *unequalised* input, and this, indeed, is necessary to preserve correct balance over the spectrum. If, for instance, a crystal pickup were connected to a high impedance *equalised* input, there would be far too much bass and too little treble.

However, an output very similar to that from a magnetic pickup is produced by a crystal pickup when it is connected across a relatively low impedance input circuit. This output, incidentally, is often referred to as "velocity", as the output rises with rise in velocity of the stylus.

Now, on some amplifiers the crystal pickup input is of an impedance below that required for true "piezo" pickup action, meaning that the amplifier incorporates some kind of equalisation on the piezo input as well as on the magnetic. Other amplifiers, on the other hand, utilise an "unequalised" crystal input, loaded to a high value of impedance or resistance.

Moreover, the voltage from a "high-loaded" crystal pickup is considerably above that from the same pickup loaded to a relatively low value for velocity operation. To reconcile all these factors in terms of a pickup booster is nigh impossible without a great deal of complexity, which is what the author set out to avoid.

To provide all facilities would be little different from designing an entirely new preamplifier or control unit to cater for a pickup with an output below that of the sensitivity voltage of the existing preamplifier or control unit.

Compromise

Nevertheless, a reasonable compromise has been created in the booster unit now to be described. The circuit of one channel of this is given in Fig. 2. For stereo operation, of course, a pair of identical amplifiers are necessary. The circuit board and unit design are such that two channels can easily be accommodated, as we shall see.

There is nothing particularly new about the circuit which employs a pair of OC75 transistors in common emitter mode and which is used in all kinds of audio applications. The two transistors are directly coupled. This means that the collector of Tr2 is in d.c. connection with the bass of Tr2. The avoidance of a coupling capacitor here improves the low-frequency response and the phase characteristics.

The pickup signal is applied direct to the base of the first transistor, via the electrolytic capacitor C1. Appearing across the collector load R4 is thus the amplified signal which is fed to the base of Tr2. Again, further amplification takes place and the

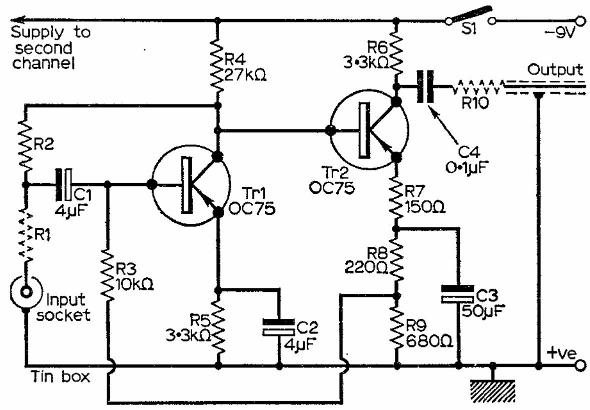


Fig. 2: Circuit of mono booster.

processed signal appears across Tr2 collector load R6. The signal is then passed out of the unit, via C4, and applied to the input of the amplifier which is insufficiently sensitive for direct connection of the pickup in use.

Now, there are several interesting aspects of the booster. Firstly, it arranges the signal from either a magnetic *or piezo* pickup so that at the output it appears as of "velocity" characteristics. This means that the booster must normally be connected to an *equalised* pickup input of the parent amplifier.

Secondly, the overall gain is adjustable by the negative feedback applied from the collector back to the base of Tr1, via R2. The small value of this resistor, the greater the feedback and the smaller the overall gain.

Thirdly, the first transistor is arranged for a current input from either a magnetic or a crystal pickup. Transistors, of course, are current-operated devices, so the more current that can be injected efficiently into their emitter/base junction the better the noise performance.

Pickup Coupling

Fig. 2 shows a resistor R1 connected in series with the pickup signal. Actually, this resistor is used only with a magnetic pickup. Its value is arranged in conjunction with the inductance of the pickup to provide high-frequency roll-off. In effect, the resistor tends to endow the input towards constant-current operation. The greater the inductance of the pickup, the greater should be the value of R1. For the best results it may be necessary to experiment a little here with resistors from about 2·7k to10kΩ.

When a piezo pickup is used (either a crystal or ceramic) the input is coupled direct to C1, and R1 is deleted. The source impedance of a piezo pickup is capacitive, and because of this the signal current into the emitter/base junction of the first transistor increases with increase in frequency. It is this effect that provides the basic "velocity" characteristics. Moreover, it ensures that all the available signal current from the pickup passes into the emitter/base junction.

The signal passing into the first transistor does not match perfectly the requirements of equalisation, but it is fairly close and slight modifications to the settings of the amplifier's tone controls should provide the final tailoring to the response.

The frequency response is also affected to some extent by the value of R2, for since this applies the feedback via C1 there is a tendency towards a rising bass response due to the reducing feedback at the lower frequencies. This is countered, however, by the rising degenerative feedback across the emitter resistor R4, for here C2 progressively has less signal bypassing effect towards the lower frequencies. A further, smaller amount of correction in this respect is given by C3 in Tr2 emitter circuit.

A degree of feedback is purposely introduced into Tr2 by the unbypassed emitter resistor R7. Apart from reducing the stage gain, the action of this increases the impedance at the bases of Tr2 and thus provides improved signal transference from Tr1 to Tr2 due to the resulting improvement in matching.

With the booster and pickup connected to the parent amplifier, the value of R2 should be adjusted to produce the correct output with the amplifier's volume control about half on. Of course, any required gain conditions can be achieved by altering the value of R2. There is rarely any possibility of the booster being overloaded by a too strong pickup signal, for if the pickup signal is that strong then a booster would not be needed anyway!

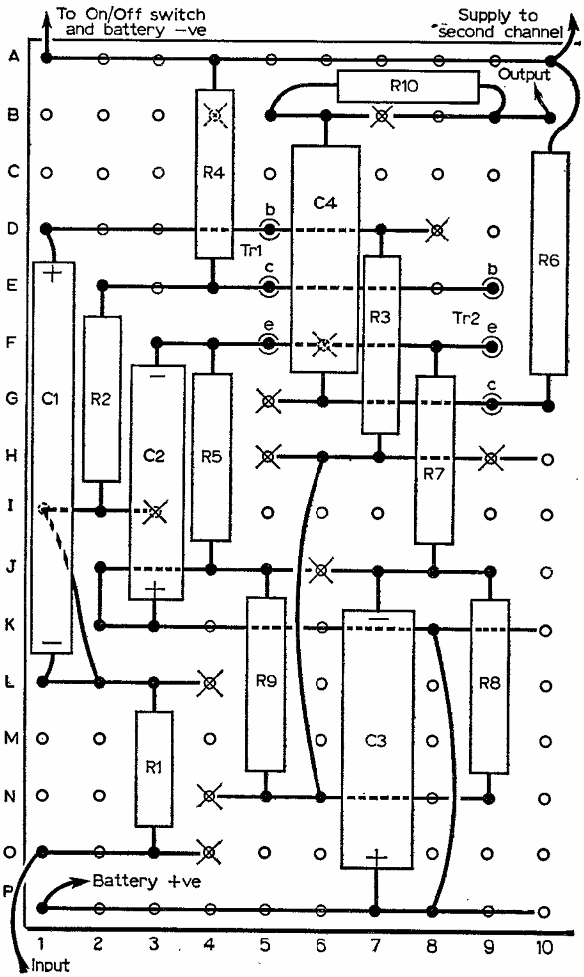


Fig. 3 (left): Layout of components for one channel (Channel A) on Veroboard.

Fig. 4 (right): Underside of Channel A of Veroboard, showing the pattern of the circuit.

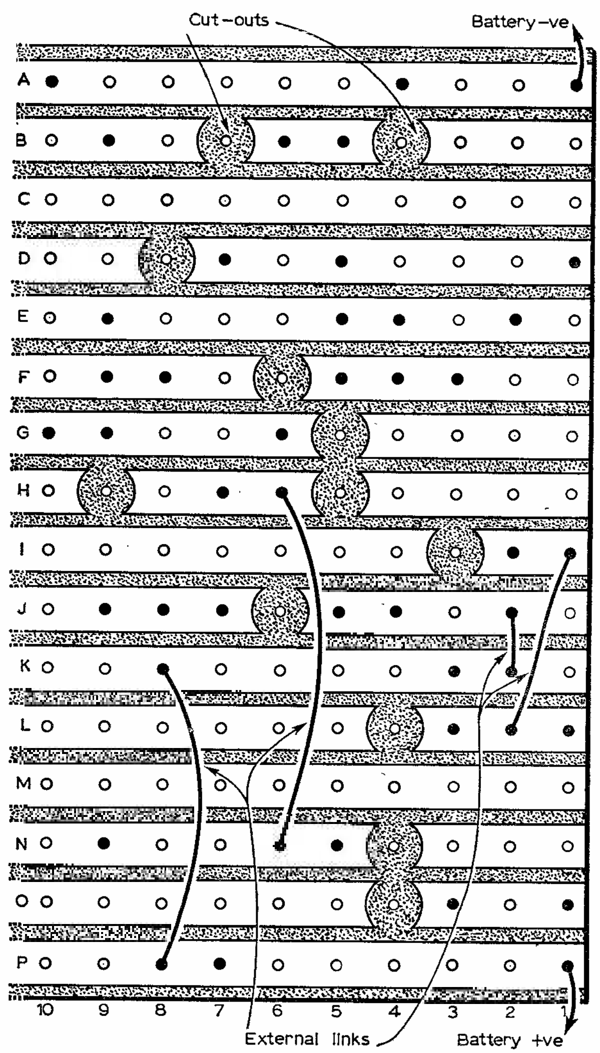
Booster Coupling

It is possible, however, to overload a low-level input on the parent amplifier by the booster delivering too strong a signal, but—as already mentioned—this can be corrected by decreasing the value of R2. This can be set initially at 10kΩ.

Fig. 2 shows a resistor R10 in series with the output signal. This may not be required, depending on the characteristics of the parent amplifier's equalised pickup circuit. Sometimes the equalisation is sensitive to load impedance (or load inductance). This may then make it necessary to put a resistor in R10 position. This usually requires to be about 47kΩ when the equalised magnetic pickup of the amplifier is used.

The booster runs on a 9-volt PP4 or similar type of battery, and the current consumption is approximately 2mA per channel (4mA when a pair of stereo channels are adopted).

The idea has been to produce a booster that is completely self-contained with its own internal battery. A piece of Veroboard was prepared to take both channels and to fit snugly into a 2-oz. tobacco tin, which makes an excellent housing for transistor devices of this nature.



Veroboard Circuit

Vero Electronics Limited make available through the retail trade four standard sizes of Veroboard, and the piece chosen was 16-way board of approximately 3½in. long. About half an inch was cut from the length of the board, giving 21 holes along each metal strip. Thus, the total number of holes in the board is 16 times 21, or 336.

Each amplifier section is accommodated along the length of ten holes over the 16 strips. Thus, the length is divided by 16 holes not employed for either section.

The layout of one amplifier section of the board is given in Fig. 3. The 16 strips are marked "A" to "P" inclusive, while the lines of holes on the other axis are numbered 1 to 10 inclusive. By this means each hole in the board can be identified. The line of holes separating the two sections is marked "O" and then, of course, the numbering starts again to 10 to cater for the other amplifier section, both sections being identical.

The circuit on Veroboard is created by using the metallised strips as the conductors. Thus it is necessary to break some of the strips and interconnect others with external wire links to form the required circuit. A special tool is available for cutting the strips cleanly and without tearing the metallic foil from the insulated laminate.

The reverse of the Veroboard with the holes and strips identified as in Fig. 3 is shown in Fig. 4. This reveals exactly how one section of the board must be processed. Here is shown the foil cut-outs and the external links. The Veroboard should be processed exactly in this way for one section of 10 holes by 16 strips for a single-channel mono amplifier or for two sections of 10 holes by 16 strips for a two-channel stereo amplifier.

It will be seen that there are three strips common to both sections, they are two strips for battery plus and one strip for battery negative. These strips are *not* severed at the line of holes corresponding to "O" in Figs. 3 and 4.

The "X" marks on the component layout plan in Fig. 3 indicate the foil cut-outs on the reverse side of the board, and these, of course, correspond with the cut-outs indicated on the strip side of the board in Fig. 4.

★ components list

Resistors:

R1, R2	see text
R3	10kΩ
R4	27kΩ
R5	3·3kΩ
R6	3·3kΩ
R7	150Ω
R8	220Ω
R9	680Ω

All ½W or ¼W high stability type.

Capacitors:

C1	4μF electrolytic 6V
C2	4μF electrolytic 6V
C3	50μF electrolytic 6V
C4	0·1μF, 160B or less.

Transistors

Tr1	OC75
Tr2	OC75

Other Parts:

S1—SPST toggle on-off switch.* Veroboard—see text.* One phone socket. One 2-oz. tobacco tin.* One rubber grommet. One 9V battery (PP4 or equivalent).* Length of screened signal output cable. Wire, cork, etc.

Note: The above list is for the mono version; for the stereo version, two of each part mentioned will be required, except for those marked.*

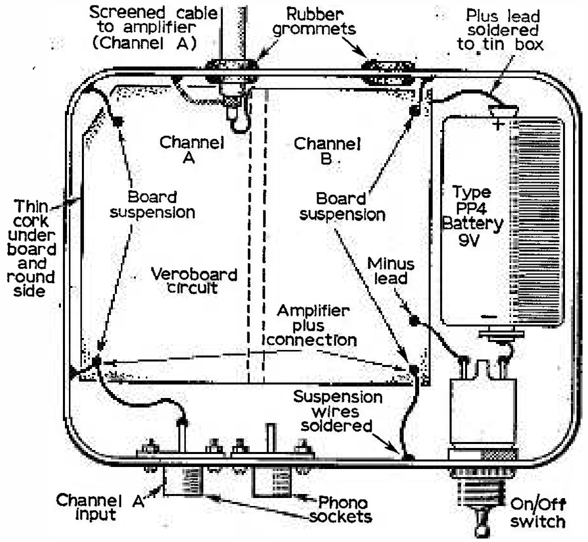


Fig. 5: The arrangement of the Veroboard and other components in the 2-oz. tobacco tin.

The full lines (dotted underneath the components) in Fig. 3 show how the circuit is formed from component to component, and a little study will reveal that this physical circuit follows exactly the theoretical circuit in Fig. 2.

Assembling in Box

Fig. 5 shows how the Veroboard and the remaining components are mounted in the 2-oz. tobacco tin. Phono sockets are adopted for channel A and channel B signal inputs, while screened leads—taken out of the tin through rubber grommets—transfer the boosted signals to the equalised pickup sockets of the parent amplifier.

The positive battery clip wire is soldered direct to the inside of the tin, beneath the Veroboard. The tin box is made common with the supply positive line, this being accomplished by the connection of short lengths of wire from strip "P" on the board to the side of the tin box. Two connections are made here, one to hole P2 and the other to hole P9 on channel B section of the board.

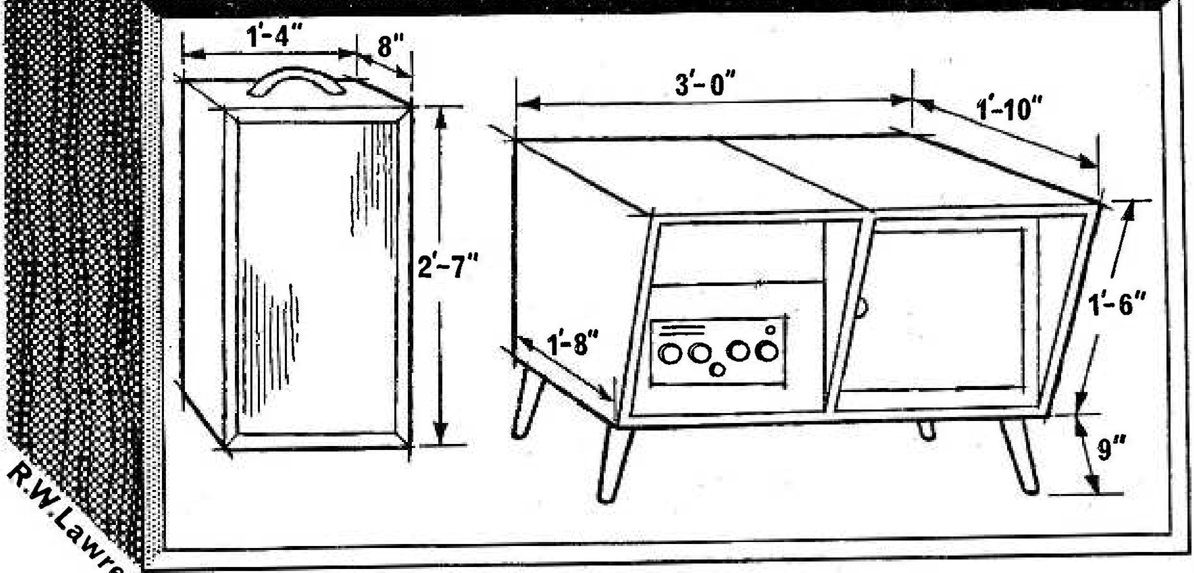
These wires also serve to suspend the Veroboard in the tin box, and balancing suspension wires are soldered on the other side of the board, to the opposite side of the tin box at holes C2 (channel A section) and C9 (channel B section). The strips associated with these two holes are not concerned with the circuit and are thus isolated.

To avoid the circuit side of the Veroboard and the channel A edge from shorting to the tin box, a thin piece of cork is glued to the inside base of the tin, of a size equal to that of the Veroboard, and to the left-hand edge of the tin and corner.

Note also that the outer conductor (braiding) of the signal output leads is soldered to the side of the tin box, the inner conductor being terminated at hole B10. If R10 is not required a wire link is connected between holes B5 and B9.

The "earthy" side of the phono sockets is automatically connected to the tin box and the "live" side of each channel is connected to the strip corresponding to hole O1. ■

SIMPLIFIED CABINET DESIGN



R.W.Lawrence

I HAVE been building radios and electronic equipment for a good number of years now and I find, as I am sure a lot of readers do, that the most difficult stage of construction is the cabinet.

I pride myself that I am "mechanically minded" but when it comes to working with wood my skill is very limited indeed. Evening classes on the various arts of woodwork were out of the question (I work shifts). "D.I.Y." books are very good but I found very little of value even in the excellent shelves of the local library. Space in my "den" is very limited, as also is cash for the purchase of expensive carpentry tools.

My friends were envious of my first transistor radio because it worked so well but were amused at the cabinet which almost housed it. The stabilised power pack which has worked so perfectly right from the initial first "plug in", remains unmoved on the bench: the cabinet will not stand the strain of being lifted. Without "plastic wood" and modern adhesives some of my earlier attempts would, I fear, not even be dustproof.

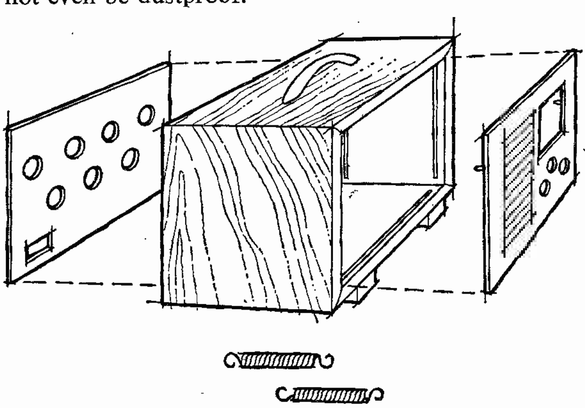


Fig. 1: General view of the radio cabinet as described in the text.

However, all that is now in the dark past, I am pleased to say. I have reorganised my thinking and my methods to produce some examples of cabinet building which has astounded me no less than my friends.

There is, of course, no magic formula, just an application of common sense and the judicial use of a few of the products of the wonderful age in which we live.

I began by reorganising my thinking thus:

1. Keep design strictly simple, this is the modern trend anyway.
2. Be meticulous with your measurements at all stages of construction.
3. Use only new timber. (I found that by careful buying, the extra expense was not large and the results were very much easier to obtain.)

My altered methods consisted of:

1. Using no conventional joints, i.e. dovetail, tenon, butt or mitres. (This was of course my main point.)
2. Keep tools to an absolute minimum, but choose them with care. My basic tool kit consists of: One good quality rip saw, not too coarse and regularly sharpened; one hammer; one fretsaw and good supply of blades; one wheel brace or electric drill with a few twist drills say from $\frac{1}{4}$in. down to $\frac{1}{16}$in. and a "rosebud" type countersink; screwdriver and a good selection of screws. Sandpaper or sanding discs; sharp knife; good ruler and metal set square; panel pins and nails.

The main material used in all my cabinets is "blockboard". This is a material consisting of blocks of softwood sandwiched between two layers of plywood and can be obtained usually in three thicknesses, $\frac{1}{2}$in., $\frac{3}{4}$in. and 1in. It is easy to saw, never splits when nailed or screwed, extremely strong and has a very smooth finish. If, when buying timber, the sizes of the pieces required are accurately known, then you may find, as I did, that the shopkeeper will saw them for you and save a lot of effort and sawdust on your part.

Let us consider the construction of a radio cabinet of average size to house a 3 plus 1 set with a 5in. speaker and covering long and medium wave, in fact a typical constructor's piece often discussed in the pages of this magazine. The cabinet would need to be about 18in. by 12in. by 8in.

Saw four pieces accurately of blockboard, two 18in. by 8in. and two 12in. by 8in. and nail them together with long nails (Fig. 1).

Countersink all nails slightly and fill the holes with plastic wood or putty. Sandpaper the edges to make them level (a high finish is not necessary) and check that all angles are true with the set square.

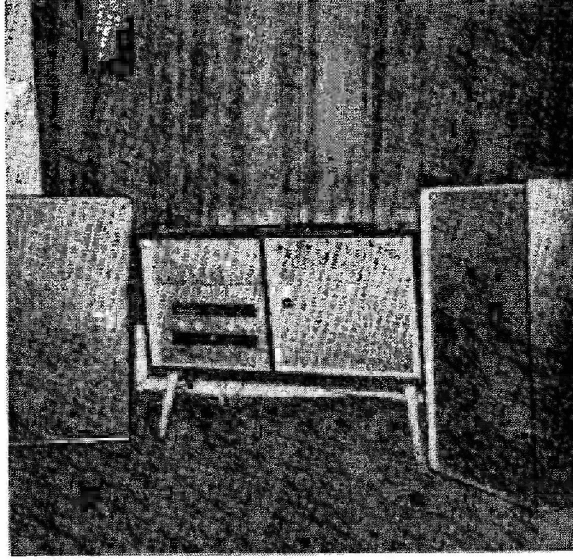
From a length of ½in. by ½in. softwood now saw four pieces 16in. long and four pieces 10in. long. These are panel pinned into the cabinet after carefully drawing a line 1in. on both front and rear of the four sides of the inside of the insides of the rectangle formed.

Two pieces of softwood 6in. by 2in. by 1in. are now cut and screwed, after countersinking, on to the bottom of the cabinet about 1in. This raises the cabinet up and a piece of felt glued on to these two pieces make them virtually scratchproof to furniture.

The two sides and top of the cabinet are now covered with "Con-tact" self adhesive plastic finish to your own colour requirements. This very attractive form of finish can be bought in a variety of colours and either in gloss or matt finish.

The back and front are of hardboard and should fit easily in to rest against the four wooden strips inside the cabinet. The back is "vented" to allow for heat dissipation and suitably drilled for aerial, earth, mains lead, etc. The front will of course be cut to suit the position of dial, knobs, speaker and so on and for this the fret saw is used. The front is finally to be covered with "Con-tact" adhesive but before this is done, a word about how the front and back are held in place. I decided against screwing or nailing for two reasons, as I wished to be able to dismantle any piece of equipment easily and quickly for the purpose of repairs or modifications and, for the fact that hardboard does not take easily to being drilled near the edges, I decided to use springs. The type of springs used can be obtained very easily and cheaply from most hardware shops or even from car accessory shops. In the case of our example, a fairly "soft" spring, 4in. long (when closed) will do nicely. Two are usually sufficient, and placed near to the edges of the cabinet can, as a rule, be kept well clear of the radio chassis. Make two small holes in the front piece and thread a loop of stiff tinned copper wire through as shown in Fig. 1. A groove cut with the knife between the two holes allows the wire to lie flat under its final covering of plastic. The wire is now twisted tightly and soldered, it will now be self supporting in a horizontal position which is ideal for our purpose. The fixing for the spring on the back can be one of the holes which were cut for ventilation.

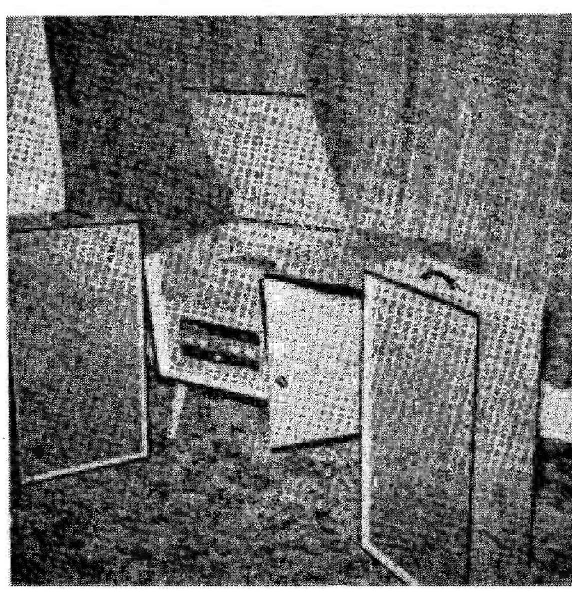
The front panel can now be covered with the plastic adhesive (preferably in a contrasting colour) and with the knife cut out the shapes already in the hardboard. If two diagonal cuts are made in each of



The finished stereogram cabinet.

Inside the record player compartment.

Another view of the stereogram cabinet with speaker units.



the shapes it will be found that the edges can be turned back very neatly.

Attention can now be turned to the front edge of the cabinet which, up to now, has been left unfinished. This edge I cover very carefully with glossy black or black and gold plastic strip. This can be obtained in quarter inch, half inch or three quarter inch widths and is flat on the back and rounded on the front. It is usually fastened with a good quality contact adhesive and if desired can be mitred at each corner. To complete the job, a suitable handle can now be screwed on top for the purpose of making the set "portable". All that remains now is for the radio to be housed in its new and shiny cabinet, the springs to be fastened and the knobs pushed home.

It needs very little imagination to see that almost any type of cabinet can be made in this manner and as there is no paint or varnish involved, no awkward "waiting period" between stages. Blockboard is obtainable in all sizes and I have seen sheets 10ft. square. It has little or no grain to worry about and therefore can be safely sawn and used in any direction. Radio chassis can be screwed directly to it and it does not appear to warp with heat.

After a few trial runs on cabinets of this sort I attempted my most ambitious piece a stereogram. Here as in the other designs, the shape was kept as simple as possible and I carefully measured each piece to be purchased. The pieces were cut for me by the shopkeeper and this ensured a right angle cut on each edge (he used a circular saw). It is essential that the edges are accurately sawn if only nails and screws are to be used. (See heading, page 40.)

The main construction proceeded very quickly and was remarkably easy, long screws were used and each screw hole was drilled and countersunk to give maximum strength to the whole assembly. Screw and nail heads were hidden by plastic wood and sanded flat as were any imperfection in the sawn edges of the blockboard.

The door for the record cabinet (right hand side) was hung on two brass hinges and is held closed by a magnetic catch. The door itself is blockboard and is slightly larger than the opening, when closed it is "proud" of the door jamb and gives a very attractive appearance as well as being easy to make. The front and back are held in by springs in exactly the same way as previously described.

The two speaker cabinets are in blockboard of two thicknesses, three quarter inch for the baffles and half inch for the sides. Again, screws and nails were used throughout. The inside of each is lined with thick felt (carpet underlay) and the back is quarter inch hardboard panel pinned and stuck with contact adhesive. Connection to each speaker is by standard jack plug. The finished product is covered, as explained, in glossy "Con-tact".

The equipment was bought on a strict budget and was selected for a maximum outlay of under £40. This I just managed to do by being fortunate enough to purchase the speakers second hand. Here is a brief description of the rest of the equipment used. Amplifier, "Heathkit" S33 Stereo/Mono. Turntable, Collaro type RP594 but the original arm has been replaced by one built to my own design by an engineer friend. It has jewelled bearings and a tracking weight of 2 to 8 grammes. Tracking error is negligible and adjustment is possible in all directions to correct stylus error. The speaker "line up" consists of one 10in. and one 5in. in each column capacitor connected. A jack is fitted to allow for headphone listening and the speakers are switched out when this is used.

Results are much better than most commercial models of the £80 to £100 range that I have heard and compares favourably with a few very expensive models. ■

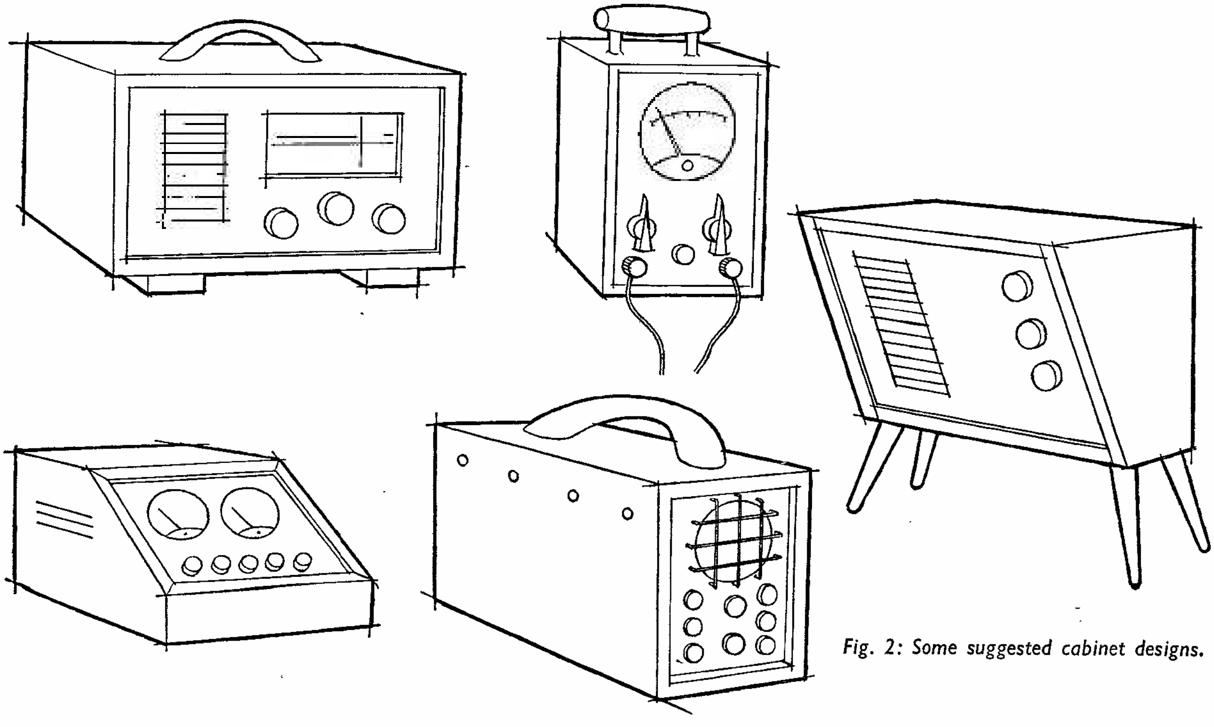


Fig. 2: Some suggested cabinet designs.

MICRO TO TO MEGA

FOR THE BEGINNER

An explanation of Indices, Multipliers and Roots

by B. L. BURROUGH

TO allow the use of manageable figures in radio and electronics, the basic units are often subdivided or multiplied, providing such terms as megacycle (one million cycles) and millivolt (one thousandth part of a volt).

While the terminology may be quickly recognised, complications may result when the beginner is faced with calculations involving values other than the basic or quoted units, and errors can quite easily be made by dropping or adding the odd nought.

The use of mathematical indices provides a simple and, once properly understood, infallible solution to this problem. It also allows any particular calculation to be carried out from *one* basic formula, irrespective of what pre-fixed values are employed.

INDICES

Consider the expression a^x; a may be any number and x, the index, may be any number. Basically, it means that a is multiplied by itself x times. For example, 4^3 (four cubed) is $4\times4\times4 = 64$.

The index x need not be a whole number. If it is a simple fraction a root is indicated, e.g. $4^{\frac{1}{2}}$ is $\sqrt[2]{4}$ (the square root of four) $= 2$. Extending this a little, $4^{3/2}$ (or $4^{1.5}$) is $\sqrt[2]{4\times4\times4} = \sqrt[2]{64} = 8$.

Reciprocals are expressed by a negative index; thus—

$$\frac{1}{a^x} = a^{-x} \text{ or } \frac{1}{a^{-x}} = a^{--x} = a^x.$$

Calculations involving indices could not be simpler. In multiplying, the indices are added:

$$a^x\times a^y\times a^z\times \ldots\ldots = a^{(x+y+z+\ldots)}.$$

Note that when dividing or dealing with reciprocals, the signs of the indices must be observed: e.g.—

$$\frac{a^x}{a^y}\times a^z = a^x\times a^{-y}\times a^z = a^{(x-y+z)}$$

The expression $(a^x)^y = a^{xy}$, i.e. the indices in this case are multiplied. For example $(a^x)^2 = a^{2x}$.

Note that $a = a^1$ and *not* a^0. ($a^0 = 1$, whatever the value of a.) Generally the index is omitted in the expression a^1, but the 1 must be included when adding the indices.

MULTIPLIERS

In applying multipliers to basic units, multiples of 10 are invariably used; these may be applied directly (as in megacycle) or inversely, by dividing (as in millivolt).

We therefore have the case where $a = 10$ and $a^x = 10^x$. Now 10^2 is 100, $10^3 = 1{,}000$, $10^4 = 10{,}000$ and so on. It will be seen that the number of noughts in the resulting number corresponds to the index value.

Similarly $10^{-1} = \frac{1}{10}$, $10^{-2} = \frac{1}{100}$ etc.

It is now apparent that any of the prefixes or multipliers used in electronics can be simply represented by the figure 10 with an index, or 10^x where x is a whole number. The following table gives prefixes commonly used with their corresponding numerical values:

Prefix	Symbol	Multiplier
TERA—	T—	1,000,000,000,000 (10^{12})
GIGA—	G—	1,000,000,000 (10^9)
MEGA—	M—	1,000,000 (10^6)
KILO—	K—	1,000 (10^3)
HECTO—	H—	100 (10^2)
DECA—	DECA	10 (10^1)
deci—	d—	$\frac{1}{10}$ (10^{-1})
centi—	c—	$\frac{1}{100}$ (10^{-2})
milli—	m—	$\frac{1}{1{,}000}$ (10^{-3})
micro—	μ—	$\frac{1}{1{,}000{,}000}$ (10^{-6})
nano	n—	$\frac{1}{1{,}000{,}000{,}000}$ (10^{-9})
micro—micro— or pico—	μμ— p—	$\frac{1}{1{,}000{,}000{,}000{,}000}$ (10^{-12})

Applying this to actual values, 13Mc/s may be written 13×10^6 c/s, 2mA as 2×10^{-3} A and 8μF as 8×10^{-6} F. Going a little further, 300pF may be written as 300×10^{-12} F, but 300 is 3×10^2 and by adding the indices we obtain the value 3×10^{-10} F.

To resolve the result of a calculation in terms of a prefixed unit, just subtract from the index in the answer, Any remainder will normally be incorporated in the value figure. For example

$$4\times10^5\Omega = 400\text{k}\Omega$$
$$3\times10^{-11}\text{F} = 30\text{pF}.$$

A decimal may be eliminated or modified by means of a multiplier. Moving the point to the left introduces a positive index corresponding to the number of digits the point is moved. Conversely, moving the point to

—*continued on page 49*

Mods for Modulated Light

AFTER reading your article on the Modulated Light Telephone link (Feb., 1966, issue of P.W.) I would like to put forward an idea.

There are certain times when one person in a household may need a bit of peace and quiet and another may want to watch the television. Surely this can be overcome without the use of bothersome wires and equipment by connecting a modulated light transmitter to the sound, together with a switch for normal listening. The receiving unit could be completely transistorised and compact enough to stay unobtrusively on a coffee table. Actual listening would, of course, be by means of an earpiece.

J. Douglas.

Newcastle upon Tyne

★ ★ ★ ★

JUST over two years ago, I carried out similar experiments to those described in the February issue of PRACTICAL WIRELESS.

Although I was only able to obtain a range of up to about 20 yards I would like to offer the following hints to anyone thinking of experimenting in this field.

An ordinary household torch with the minimum of alteration (i.e., breaking the circuit and connecting in the output of the transmitter amplifier), makes an almost ideal transmitter, especially if it is of the type that can be focused. Instead of mirrors (which may be difficult or expensive to obtain) the reflectors from car headlamps, obtainable for a nominal fee from scrap merchants, can be used with great success. For short range experiments, both amplifiers can be simple battery-operated transistor types having an output of about 1W.

B. M. R. Green.

Ripon,
Yorkshire.

U.H.F. and V.H.F. Designs

I ENTHUSIASTICALLY echo the request by S. Peat (P.W. March 1966) for designs on u.h.f. and v.h.f. receivers, though not for the same reasons.

Having built the t.r.f. version he mentions, I feel that the next stop is a portable switched band a.m. superhet covering 70—160Mc/s, this covering the amateurs, broadcast and a host of other interesting stations.

How much longer must we put up with the superregenerative hiss?

P. M. Thacker.

Morley,
Yorkshire.

NEWS AND..

IEETE LONDON MEETING

A lecture entitled "Control by Computer" was given by Mr. A. St. Johnston, B.Sc. (Eng.), M.I.E.E., M.I.E.R.E., Joint Managing Director, Elliott-Automation Computers Ltd., to members of the Institution of Electrical and Electronics Technician Engineers and their guests on 7th March in the I.E.E. Lecture Theatre, Savoy Place, London, W.C.2.

The outline of the lecture was that the digital computer is the tool that provides the Auto in automation. The whole technology of computers, not only their electronics, but even more their application, is new.

The power of the computer comes from its quite unique method of operation —the stored programme techniques. The profession of programming is new and offers a completely new career line.

As a control tool, the computer's flexibility holds out a new dimension of "power" in control systems. The ever decreasing size and increasing capability made possible by transistor and microelectric development opens up new fields of application in every walk of life.

1966 PHYSICS EXHIBITION

Mullard Ltd. Educational Service was on stand E.5 at the 1966 Physics Exhibition held at Alexandra Palace, London, from March 28th-31st.

Several experiments designed by the Mullard Educational Service for use in schools, technical colleges and other training establishments were shown. They included a computer demonstration unit, an electronic very high voltage generator, a lc/s sinewave oscillator, an oscilloscope, a simple timer and a binary adder/subtractor.

NEW LABORATORY PREMISES FOR MULLARD

Many of the 3,000 employees at Mullard Southampton Works—the principal establishment of Associated Semiconductor Manufacturers Ltd., the joint Mullard/GEC manufacturing and development company for Mullard transistors—work in the plant's extensive laboratories.

Two important sections of these laboratories are now moving to new premises on the N.E. outskirts of Southampton. These sections are the reliability and quality laboratories. Both of which form part of the 200-strong team under the technical direction of Mr. L. B. Johnson.

When the move is completed, well over £¼ million worth of technical equipment will occupy the 25,000 square feet of space in the new premises.

The West End unit is planned to have a direct link with the new ICT computer at the main factory, which is on Southampton's Millbrook estate. This will enable scientists in the reliability and quality laboratories to feed their problems directly into the new computer.

SELF-ADHESIVE INITIALS

From Convex Ltd., 41 Brecknock Road, London, N.7, come the sets of Myrogram self-adhesive gold coloured plastic initials ⅜in. high. These are especially useful for putting that "finishing touch" to front panels of receivers, equipment, etc. The price is 5s. per sheet (26 letters and various ornamental shapes). Further details from the above address.

HEATHKIT CATALOGUES AND BROCHURES

In addition to the distribution of their normal catalogue, which is published quarterly, Daystrom Ltd., Gloucester, now send—to those people interested —special brochures covering the Electronic Instrument field, and the Amateur Radio market. Copies of the latest Heathkit Catalogue may be obtained by writing to Daystrom Ltd., Gloucester.

...COMMENT

ROYAL VISIT TO CABLE SHIP

Her Royal Highness the Princess Margaret Countess of Snowdon and the Earl of Snowdon were the guests of honour at a reception on the Cable and Wireless Ltd.'s cable repair ship CS Cable Enterprise on March 5th, during the Royal Visit to Hong Kong for the British Week.

In the evening, H.R.H. the Princess Margaret and Lord Snowdon attended a charity premiere which included the Cable and Wireless Ltd.'s new 30-minute documentary film, East-West Island, which portrays life in Hong Kong and the role of the Company's overseas telecommunications in Hong Kong.

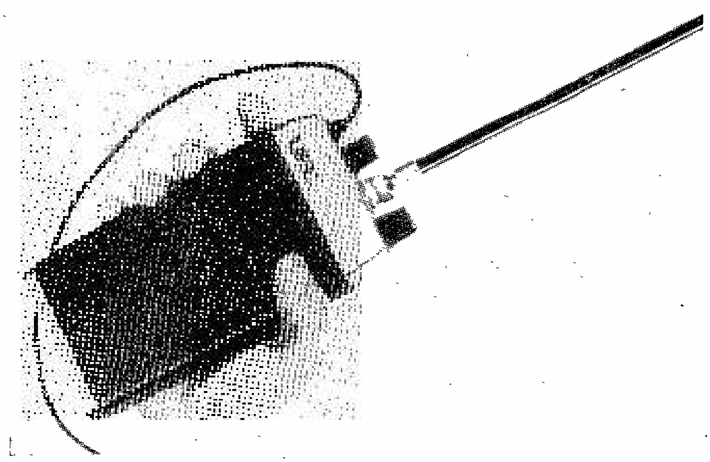
NEW FILTER FOR SHIPS' COMMUNICATIONS

A new magneto-mechanical double sideband filter, trade-named MF 200—0050, was exhibited at the Leipzig Spring Fair last month by VEB Werk für Bauelemente der Nachrichtentechnik 'Carl von Ossietzky'' at Teltow in East Germany.

The filter is earmarked for use chiefly in transmitter and receiver units on board ships, and has a medium frequency of 200 kc/s and a 3 dB band width of 500 c/s.

It can be applied both as a high-speed double sideband filter and as an inert carrier frequency filter. A temperature coefficient of 5×10^{-6} degrees Celsius, the manufacturers claim, obviates the use of expensive and space-consuming thermostats.

POCKET RADIO-TELEPHONE TYPE 4B7



A pocket radio-telephone of only 25 cubic inches and weighing 24 ounces, the Cub, is the latest addition to the successful Vigilant range of equipment from the Telecommunications Division of Ultra Electronics Limited.

This f.m. two-channel transmitter-receiver provides a minimum of half a watt output power on frequencies between 70 Mc/s and 175 Mc/s. It is designed to operate set-to-set, or in conjunction with a base station. Range is typically one to five miles, dependent on terrain.

The Cub is a further extension of the range of portable communications equipment which includes the Vigilant walkie-talkie, already in use in large quantities by police, fire services, armed forces and public utility undertakings, and for many commercial applications in Britain and overseas.

Ultra Electronics Limited, Telecommunications Division, Western Avenue, London, W.3.

A Challenge

I REFER to the letter published in the March 1966 issue of PRACTICAL WIRELESS. Perhaps few people have noticed one unfortunate fact. In 1935, fifteen pounds represented a fair sum to pay for a radio of sturdy build, excellent cabinet work and a good technical design.

Unfortunately, fifteen pounds now is only equivalent of about three pounds ten then. No one, manufacturer or home constructor, can give you three bands, three watts, an 8in. speaker and a good solid wood cabinet for three pounds ten!

However, give the constructor his chance with sixty pounds, he might produce a valve receiver of comparable performance; with f.m., perhaps slightly better musical reproduction.

Why Mr. L. Welch should want this set to be a transistor type working from the mains, I cannot imagine. I have heard of built-in obsolescence, but please do save us from built-in inferiority. As the Homburg hat is an inferior substitute for a nice head of hair; so is the transistor an inferior substitute for a valve, as far as the matter of music reproduction is concerned.

My 1936 Aerodyne is not as good as it once was, but I could not replace it musically with a transistor set. Snakes are said to hiss, but transistors do hiss. If we were really music lovers, we would have hissed the transistor off the audio stage by now.

A. Biddlecombe.

Ickenham,
Middlesex.

To Build or Not to Build

I COMPLETELY endorse a letter in one of your recent issues where the writer states that the cost of building one's own equipment works out more than buying the finished article.

Admittedly I, as a radio experimenter obtain much pleasure from building my own gear. But let us face it, sooner or later finance must be the deciding factor. Although I consider myself at least average at making a decent job of construction, there is still a lot to be desired when surveying the end product, especially as to a neat and professional-looking front panel which is so often a let-down.

I think that the time is rapidly approaching when price and appearance will count for a great deal and radio construction as such, will be a rich man's hobby.

A. J. Simmonds.

Welling,
Kent.

EXPERIMENTERS CORNER

VOLUME EXPANSION

G. R. WILDING

JUST before the war considerable interest was aroused by volume expansion devices in radio receivers, the idea being an attempt to reproduce by the loudspeaker the range of volume level produced in the studio.

As is well known, both in the recording and broadcasting studio, the range of audio volume is compressed, low levels being boosted and high levels attenuated so that a fairly constant output is achieved.

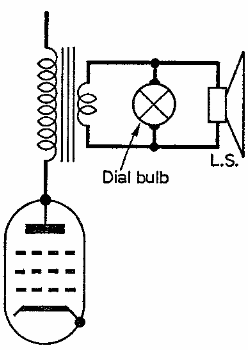
Simple System

If this was not done low-volume levels would insufficiently modulate the carrier or impress the record groove, as the case may be, while loud signals would cause over-modulation or a break through from one record groove to its neighbour.

However, in the interests of good-quality reproduction, which aims to make the speaker output a copy of the original in volume range as well as freedom from distortion, there is much to be said for schemes for restoring, if only partly, the orchestra's wide range of sound output.

Within the confines of the average living-room it would probably be impossible to reproduce, say, a solo artist at adequate strength for comfortable listening and, at the same time, reproduce in full proportion the sound output from the full accompanying orchestra composed of up to 100 players. But undoubtedly there is a case for some degree of volume expansion, adjustable at will.

Fig. 1 (left): Simplest volume expansion device. On low volume the bulb acts as a heavy load: when lit on high volume imposes a reduced load.



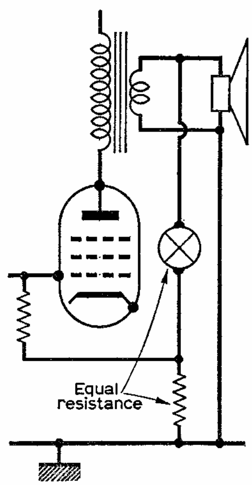


Fig. 2 (right): "Bulb" volume expansion circuit with negative feedback. The greater the volume, the less the feedback.

The simplest device of all, used by Pye in many pre-war models, was the switching in of a small dial bulb across the speaker itself. On loud passages the bulb would light up and as its hot resistance is higher than its cold resistance it would impose a heavier load on low signals than peak signals and thus expand the volume range.

This simple system had great disadvantages, of course. The loading created by the bulb effected a mismatch between speaker and valve, it absorbed power, transient loud passages of duration shorter than the thermal delay of the bulb failed to create effect and the arrangement did not have a linear input/loading curve. But it was simple and it did work.

For experiment in this direction it is advisable to use a tapped speaker transformer so that various types of bulb can be tried. Ideally the bulb should fully light at peak volume and be completely extinguished at about quarter to one-third of this value. Obviously any bulbs should be of low current consumption and with a fine filament for rapid heating up.

Negative Feedback

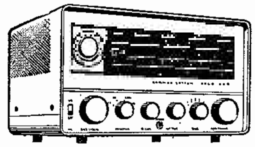
By incorporating negative feedback with this simple arrangement its range of operation can be greatly increased. Instead of shunting the bulb directly across the transformer a resistor is placed in series with it of value about equal to the resistance of the bulb when half-lit, and a voltage will be then developed across the resistor which will not rise proportionately with increase of output but will tend to fall off at high volume.

With the bulb half-lit an equal voltage will be developed across bulb and resistor, but as the signal rises the greater fraction of the voltage will be fed across the bulb and less across the resistor. If the resistor voltage is then fed back as a negative feedback signal to the valve grid it will be apparent that the greater the volume the less the feedback.

This circuit lends itself well to adaptation and experiment to suit individual tastes and receiver characteristics. However, the use of a bulb imposes an undue load on the valve and does not provide anything like an ideal device to satisfy the requirements.

Much more satisfactory are voltage dependent

FIRST OF A NEW IRREGULAR SERIES FOR THE EXPERIMENTER



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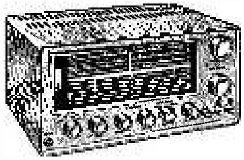

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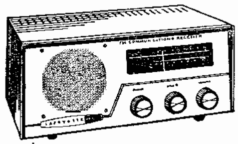

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108–136 Mc/s. High selectivity and sensitivity. Incorporates 2 RF stages including 6CW4 Nuvistor, 8 tubes for 11 tube performance, solid state power supply, adjustable squelch control, slide rule dial, built in 4in. speaker and front panel phone jack.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

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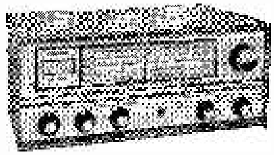

CR70A. Communication Receiver	£19 10 0
PR30 Preselector	£5 10 0
RQ.10 'Q" Multiplier	£6 15 0
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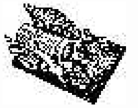
Full details on request.



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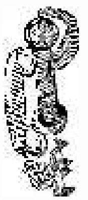

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Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets.
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New 3-speed tape deck, supersedes old Collaro studio deck. 2-track **£10.10.0.** 4-track £13.10.0. Carr. Paid.

CHAMOIS PADDED M/C HEADPHONES

Canadian noise excluding type. Complete with M/C microphone. New and boxed. **25/-.** P. & P. 3/6.

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3in., 225ft. L.P. acetate	4/-
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5in., 900ft. L.P. acetate	10/-
5in., 1,200ft. D.P. mylar	15/-
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5¾in., 1,200ft. L.P. acetate	12/6
5¾in., 1,800ft. D.P. mylar	22/6
5¾in., 2,400ft. T.P. mylar	45/-
7in., 1,200ft. std. mylar	12/6
7in., 1,800ft. L.P. acetate	15/-
7in., 1,800ft. L.P. mylar	20/-
7in., 2,400ft. D.P. mylar	25/-
7in., 3,600ft. T.P. mylar	58/6

Postage 2/-. Over £3 post paid.

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3 Transistor **£7.19.6** pr.
4 Transistor **11 gns.** pr.
5 Transistor **£8.5.0.** pr.
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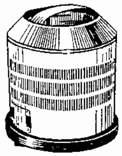
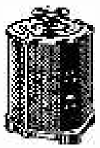
Post extra. (S.A.E. for full details).
These cannot be operated in U.K.

VOLTAGE STABILIZER TRANSFORMERS



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

VARIABLE VOLTAGE TRANSFORMERS



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400v. P.I.V. 3 amp	7/6
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400v. P.I.V. 500mA	3/6
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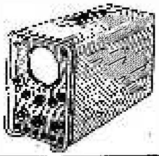
150v. P.I.V. 165mA	1/-

Discounts for quantities. Post extra.

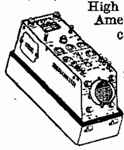
TEST EQUIPMENT

PORTABLE OSCILLOSCOPE CT.52



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

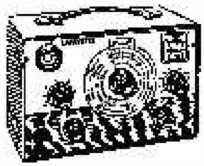
OS/8B/U OSCILLOSCOPES



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

ERSKINE TYPE 13 DOUBLE BEAM OSCILLOSCOPE

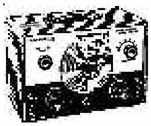
Time base 2 c/s-750 kc/s. Calibrators at 100 kc/s and 1 Mc/s. Separate Y1 and Y2 amplifiers up to 5.5 Mc/s. Operation 110/230 volt A.C. Supplied in perfect working order. **£27.10.0.** Carriage 20/-.



LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYZER

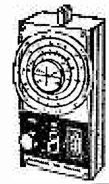
2 PF—2,000 MFD. 2 ohms—200 Megohms. Also checks impedance, turns ratio insulation 200/250v. A.C. Brand New **£15.** Carr. 7/6.

TE-20 RF SIGNAL GENERATOR



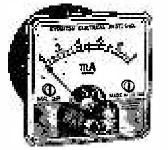
Accurate wide range signal generator covering 120 kc/s-260Mc/s on 6 bands. Directly calibrated. Variable R.F. attenuator. Operation 200/240v. A.C. Brand new with instructions. **£12.10.0.** P. & P. 7/6.
S.A.E. for details.

LAFAYETTE NUVISTOR GRID DIP METER



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

CLEAR PLASTIC PANEL METERS



First grade quality, Moving Coil panel meters, available ex-stock. S.A.E. for illustrated leaflet. Discounts for quantity. Available as follows: Type MR, 38P, 1 21/32in square fronts.

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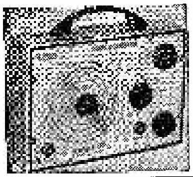
1-0-1mA	22/6	500mA	22/6	300V D.C.	22/6
1mA	22/6	750mA	22/6	500V D.C.	22/6
2mA	22/6	1A D.C.	22/6	750V D.C.	22/6
5mA	22/6	2A D.C.	22/6	15V A.C.	22/6
10mA	22/6	5A D.C.	22/6	50V A.C.	22/6
20mA	22/6	3V D.C.	22/6	150V A.C.	22/6
50mA	22/6	10V D.C.	22/6	300V A.C.	22/6
100mA	22/6	20V D.C.	22/6	500V A.C.	22/6
150mA	22/6	50V D.C.	22/6	"S"Meter1mA	29/6

50μA	32/6
100μA	29/6
200μA	27/6
500μA	25/-
50-0-50μA	29/6

POST EXTRA. Larger sizes available—send for lists.



NOMBREX EQUIPMENT

Transistorised Audio Generator 10-100,000 c/s. Sine or square wave. **£16.15.0.**
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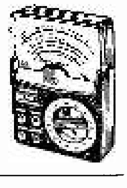
Transistorised Induction bridge, 1μN-100H. **£18.** Mains operated Transistor power supply unit, output 1-15v. up to 100 mA. **£6.10.0.**
All above post paid with battery.

TE-51 NEW 20,000Ω /VOLT MULTIMETER



0 / 6 / 60 / 120 / 1,200V. A.C.
0 / 3 / 30 / 60 / 300 / 600/3,000V. D.C.
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0 / 60K / 6 Meg.Ω
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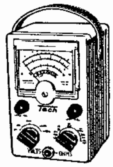
TS-76 20,000 O.P.V. PUSH BUTTON MULTI-TESTER

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

MODEL PV-58 VALVE VOLTMETER



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

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0 / 2.5 / 10 / 25 / 100 / 250 / 500 / 1 000v. A.C.
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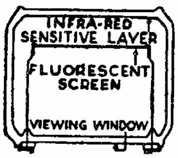
SNIPERSCOPE

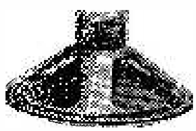


Famous war-time "cats eye" used for seeing in the dark. This is an infra-red image converter cell with a silver caesium screen which lights up (like a cathode ray tube) when the electrons released by the infra-red strike it. A golden opportunity for some interesting experiments. **5/-** each, post 2/-. Date 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 2/6 post.

SPEAKER BARGAIN



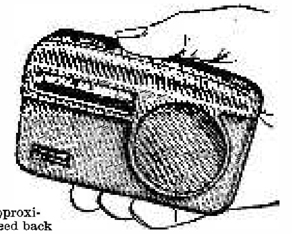
12in. High fidelity loudspeaker. High flux permanent magnet type with either 3 or 15 ohm speech coil. Will handle up to 10 watts. Brand new, by famous maker. Price **27/6,** plus 3/6 post and insurance.

ACOS GP83 TURNOVER PICK-UP CARTRIDGE

For Stereo—LP—and 78 records fitted with two Styli. This is mounted and is standard replacement for most record players using Garrard—B.S.R.—Collaro, etc., etc. The regular price of this cartridge is 55/-. We offer these new and perfect for **15/-** (less than the price of styli), plus 2/- post and insurance.

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 and guaranteed transistors ● Printed circuit board for fool-proof assembly ● Economy output circuit gives long life from PP3 battery ● Permanent magnet moving coil speaker ● Cabinet size 4¾in. x 3in. x 1¼in. With carrying strap.



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. Battery **1/9** extra.

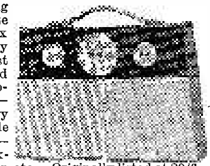
THIS MONTH'S SNIP

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 13¼in. x 11⅜in. clearances 4⅜in. 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 **£6.9.6d.** plus 7/6 carriage and insurance.

TRANSISTOR BARGAIN

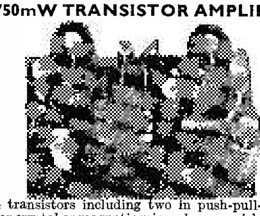


With carrying handle size 10in. x 8in. x 3in. Strongly made from best plywood and covered two-tone fabric—looks very smart, suitable for receiver—amplifier—extension speaker etc.—Originally listed at 29/6—but offered this month at only **15/-** plus 5/- post and insurance: also given free with it is a printed circuit board to suit it and building instructions for fine two-wave radios. Don't miss this grand offer.

FOUR-STATION INTERCOM.

Will save time and improve efficiency. Ideal in home—office—shop—surgery, etc. Complete outfit comprises Master unit and three substations each of which can call the master and have full two-way working. No wiring problems as subs fitted with 60ft. twin flex and they plug into sockets. Also included is packet of staples—and battery. **Nothing else to buy—£7.15.0,** plus 4/6 post and insurance.

750mW 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 ins. 2/6. Speakers 3in. **12/6;** 5in. **13/6;** 6in. x 4in. **14/6.**

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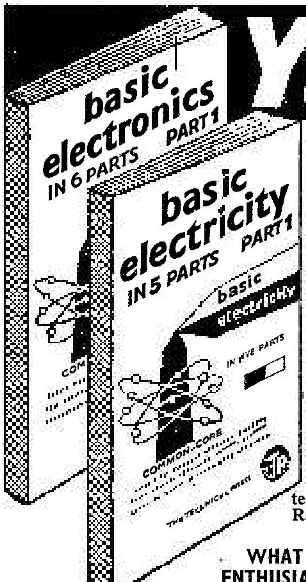
YOURS FREE FOR 7 DAYS



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WHAT THIS MONTH'S ENTHUSIASTIC READERS SAY

"I have recently had the pleasure of perusing your excellent publications on BASIC ELECTRICITY and BASIC ELECTRONICS, which are now available from our (RNZAF) Service libraries . . . " C.W.K., New Zealand.

"I have found BASIC ELECTRICITY and BASIC ELECTRONICS excellent publications and look forward to future publications as available . . . " P.J.T., Blackburn.

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Please send me **Without Obligation to Purchase,** Basic Electricity/Basic Electronics on **7 Days Free Trial. I** will either return set, carriage paid, in good condition within 8 days or send down payment of **15/-** (Basic Electricity) followed by 6 fortnightly payments of **10/-.** Down payment of **15/-** (Basic Electronics) followed by 6 fortnightly payments of **12/6.** Alternatively, I will send **68/-** (Basic Electricity—5 parts), **81/-** (Basic Electronics—6 parts) post free. This offer applies to United Kingdom only.

Tick against set required *(only one set allowed on free trial).*

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Signature ....
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resistors, since these small components have an internal resistance which decreases rapidly as the applied voltage is increased, have a long working characteristic and do not impose a heavy load on low inputs.

To fully take advantage of the characteristics of VDRs it is best to apply them across a high impedance so that there is maximum variation in applied voltage. In practice this means feeding them from the anode of the output valve via a d.c. blocking capacitor and series resistors.

The blocking capacitor should be sufficiently large to have negligible reactance to the signal compared with the ohmage of the series resistors to avoid any phase change, so a value of at least 0·5μF is indicated.

As shown in the circuit of Fig. 3 the ratio R3/R1+R2+R3, without taking into account the effect of the VDR, would determine the percentage of negative feedback. If R3 was 5,000Ω and it was desired to have 5% feedback, then R1 and R2 should have a combined resistance of 5,000×19 or 95,000Ω.

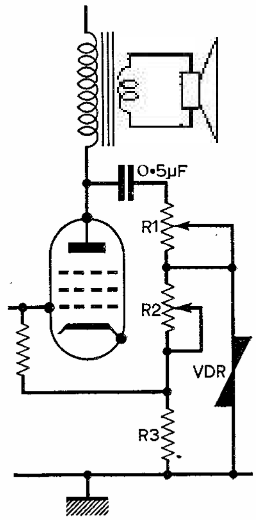


Fig. 3; A volume expansion circuit using a VDR in a negative feedback arrangement. At low volume levels, feedback approximates to R3/R1+R2+R3 and reduces rapidly as volume increases.

If R1 and R2 are made equal at 47,500Ω each the shunting of the VDR across R2 and R3 will lower their effective value and thus reduce the degree of voltage feedback, and as output voltage rises on peak volume the VDR's internal resistance will drop still further and decrease feedback accordingly. Thus the louder the volume handled by the output valve the less is the percentage of negative feedback supplied to the grid.

This is probably an ideal way to approach the problem and by making R1 and R2 variable the characteristics of the feedback can be varied to suit individual receivers and choice.

Matching

There are, of course, very many different types of VDR but practically any type will suffice for this purpose and undoubtedly those used in TV for line or field stabilisation will do. However, it is always necessary to match the VDR to R1 and R2, that is if tests indicate that the particular VDR to hand has a high impedance, so should the resistors and vice versa. Obviously if it was thought desirable to treble the value of these components it would be necessary also to treble the value of R3 if the same percentage of feedback was required.

Altogether this circuit offers many opportunities for experiment and by including a switch in the lead to the VDR normal non-expanded results can be readily obtained and contrasted with the modified output. ■

MICRO TO MEGA

—continued from page 43

the right introduces a negative index. Thus 0·003 is $3=10^{-3}$ and 7·45 is 745×10^{-2}.

More about Roots

From the general expression $(a^x)^y = a^{xy}$ it will be seen that to find the square root of 10^x, the x is divided by 2. Similarly to find the cube root, divide by 3.

One very important consideration in finding roots however. The result of dividing the index by the root divisor must be a whole number and any remainder must be considered separately as shown in the following examples:

$$\sqrt{10^9} = 10^{9/2} = 10^4\times\sqrt{10}$$
$$\sqrt[3]{10^8} = 10^{8/3} = 10^2\times\sqrt[3]{100}$$

Examples

The following examples show simple calculations involving Ohms Law for d.c.

(1) R = 2kΩ; E = 300V.

$$I = \frac{300}{2\times10^3} = 150\times10^{-3} = 150\text{mA}.$$

(2) E = 9V.; I = 300mA.

$$R = \frac{9}{300\times10^{-3}} = \frac{9}{3\times10^2\times10^{-3}} = 3\times10^1 = 30\Omega.$$

A typical example of a calculation involving a square root is that for determining the resonant frequency of a tuned circuit:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

if L = 7·8μH and C = 100pF

$$f = \frac{1}{2\pi\sqrt{7{\cdot}8\times10^{-6}\times100\times10^{-12}}}$$
$$= \frac{1}{2\pi\sqrt{7{\cdot}8\times10^{-16}}} = \frac{1}{2\pi10^{-8}\sqrt{7{\cdot}8}}$$
$$= \frac{10^8}{17{\cdot}55} = 0{\cdot}057\times10^8 = 5{\cdot}7\times10^6 = 5{\cdot}7\text{Mc/s}.$$

Further Uses of Indices

Multiplying base numbers by adding the indices is similar to the multiplication of numbers by adding the logarithms. This parallel is not without justification, for the common logarithm of a number $N = 10^x$ is x, i.e. if $10^x = N$ then $x = \log_{10}N$.

Therefore log 10 = 1, log 100 = 2, log 1,000 = 3 etc.

This principle is extended further to produce the slide rule, which in fact is only an adding device whereby logarithms are added together, the scales being logarithmic.

Footnote

A world of warning about the nomenclature of numbers. The term "million" is readily understood as being 10^6, but there is sometimes confusion about the word "billion". A billion is, strictly speaking, 10^{12} although it is sometimes erroneously attributed the value 10^9. ■

H. T. Kitchen describes

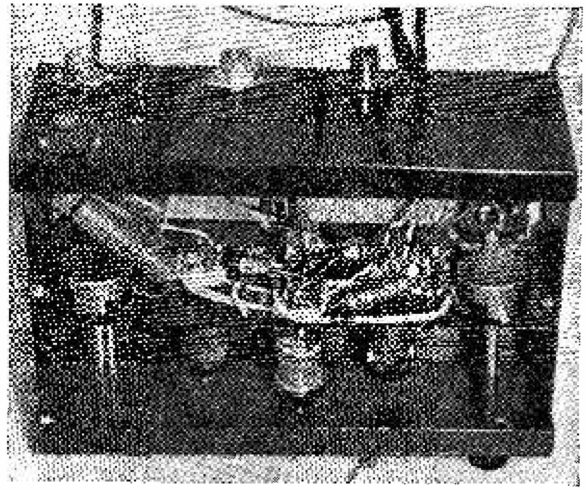
An ELECTRONIC GATE or TRACE DOUBLER

(Continued from page 1081 April)

THE power supply requirements are quite modest and many oscilloscopes should be able to provide them without undue strain. There is no reason, however, why an integral power supply should not be incorporated, though this will almost certainly necessitate an increase in the size of the equipment plus, of course, some provision for ventilation, which was not found necessary in the present equipment, which generates very little heat. Where an external power supply, from the oscilloscope or otherwise, is used, thorough decoupling by means of C18, C19, R16 is essential, otherwise there is a very real danger of the high-amplitude gating waveform interacting with the ancillary equipment or with the oscilloscope's vertical amplifier. It will be noted that two decoupling capacitors, C18 and C19, are used. This is desirable because high value electrolytics have an appreciable self-inductance which renders them less effective at higher frequencies. C19, being a paper component, is less affected and so continues decoupling where C18 leaves off. Some paper capacitors are marked with a band at one end. This is the outer foil and should be connected to chassis.

The gate operated satisfactorily at varying h.t. voltages, these extending from 150V to 350V. At the lower voltages the output was necessarily restricted, whilst the higher values only increased the current consumption, so that an arbitrary value of 250V was selected. This was a convenient value because it allowed a measure of decoupling to be effected from the oscilloscope's h.t. voltage of 270V. The extra 20V was dropped by a 1kΩ 2W resistor R16 which may require some adjustment for differing h.t. voltages.

The metal work is quite straightforward and calls for little comment. The sides are made of aluminium and are 3in. x 5in., whilst the bottom is a piece of aluminium 5in. x 8in. The cover, which is U-shaped, measures 5in. deep x 3in. high x 8in. wide and is best made up after the front and rear panels are made up and joined together by the side pieces. Any errors or alterations can then be allowed for. It must also be borne in mind that components other than those specified may not fit in the available space. The potentiometers and S2 must not exceed 1¼in. diameter and the chassis must be spaced sufficiently far from the front panel to allow the valves to be easily removed or replaced. In the prototype a spacing of 2⅜in. was found to be adequate. The front and rear panels and the chassis are attached to the sides by ¼ in. c/s 6BA screws (and nuts), which then allows the cover to fit snugly all round. This and the



bottom are attached to the front and rear panels by small self-tapping screws, producing a strong and rigid assembly. In the prototype the chassis and front and rear panels were screwed to the sides, the bottom was screwed on and then the remaining edges of the panel were masked off, after which they were sprayed glossy black enamel. The top cover was sprayed black crackle after the inside edges were masked off. All mating surfaces *must* be free from paint so that the electrical continuity necessary for preserving electrical screening can be maintained. Small transfers on the front and rear panels complete the "finishing" of a very presentable little piece of equipment. Note that the " separation " control has been labelled " trace height ". This was resorted to after it was found that the transfers did not include " separation " and attempts to make the word up from individual letters proved a dismal failure—except possibly as an exercise in time wasting!

The operation known as " wiring up " should not provide any difficulty to the experienced constructor, though the novice would be well advised to enlist the aid of an experienced friend, particularly when trying the gate out for the first time. A few notes, however, would not come amiss. C11 and C12 must be of small physical size in order to fit into the available space; 200V components, as suggested, should prove suitable, though it is undesirable to reduce their capacity any further unless R5, R6 are increased in proportion to a maximum value of 10MΩ.

Gating Capacitors

The gating speed capacitors C1-C5 and C6-9 are wired in series from tag to tag of S2a/b, whilst C5 and C10 go from the second last tags of both sections to pins 1 and 6 of V1. The switch S1 is wired so that the slowest speeds are obtained with the switch anticlockwise looking from the front and the highest speeds with the switch rotating clockwise. The last position is connected to earth and puts the multi out of action, though two 4·7pF capacitors could be substituted if higher gating speeds were desired. This is an experimental suggestion which has not been tried with the prototype. The outputs from both halves of V4 are connected directly to the output sockets without the usual coupling capacitors since these are already in the oscilloscope. C15 and C16 are wired directly from the input sockets to S2 and are spaced away from the chassis. C14 and C17 are wired from

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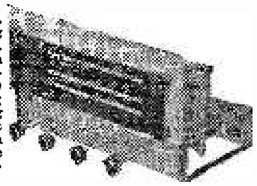

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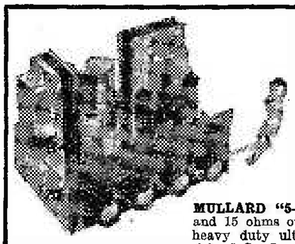

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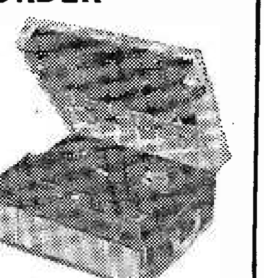

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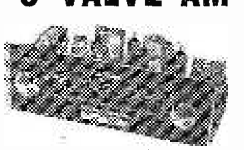

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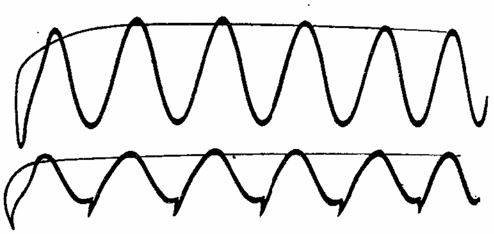
the input sockets to VR2 and VR3 and should be pushed into their respective corners to minimise cross-coupling both mutual and with V4. It is desirable for each stage to have its own earthing point. R1, R2 and the two cathodes of V1 are connected to an earth tag adjacent to V1, to which is also connected the wiper of VR1. R5, R6 are earthed to a tag adjacent to V2, whilst the earthy ends of VR2 and VR3 are connected to a tag adjacent to V3. The centre spigots of V1, V3 and V4 are earthed to their adjacent tags, that of V2 being used as an h.t.+ tie point. This is contrary to commonly accepted practice and was adopted as a convenient way of wiring the various resistors that connect to the h.t. line. R7 is a 1·5 or 2W component and is spaced away from the other components in order that it may safely dissipate its heat. R11, R12 and R13 are connected end-on to the valveholder so that they point towards the sig. o/p socket to which their junction is connected. On the rear panel wiring C18 is held by a clip and has C19 wired across it. The earthy ends of both should be connected to an earth tag on the main chassis. R16, which generates some heat, should be connected between the live end of C18, C19 and a stand-off tag and spaced away from other adjacent components.

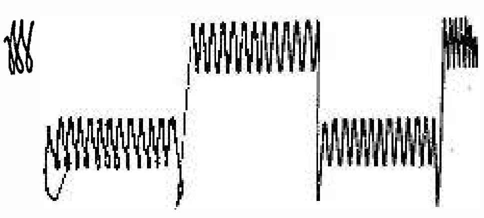
The wiring when completed should be checked over for mistakes (we all make them sometimes!) and the gate can then be tried out. The static voltages should be measured with a 20k/V meter and should agree reasonably closely with those given on the circuit. The voltages on V1 anodes were measured with VR1 at its central position and with S1 at the 1,750c/s position. All the other voltages were measured with S1 at "off". At no time was an external signal fed into the Y1 and Y2 input sockets.

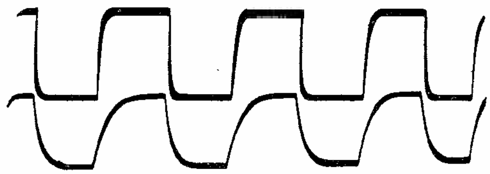
The gating square wave should be checked on the oscilloscope and should appear to be reasonably square. Some sag at the 50c/s position and some rounding off at 5kc/s may be evident but is not worth worrying about unless it is really severe. If the square wave does sag or round off to an excessive extent the oscilloscope can also be suspect unless it is known to have a first-class transient response. Rotating VR1 should cause the positive and negative peaks to transpose, the output being at or near zero



Above—Y1 trace-sine wave as generated 10kc/s. Y2 trace below it is as reproduced at 10W by a 10W amplifier

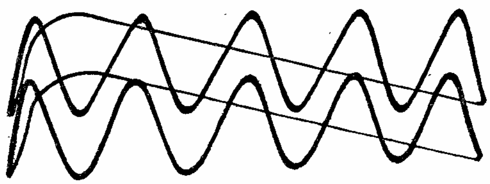
Below—Illustration of gating action. Distortion at left due to excessive sync.





Above—25kc/s square wave, rise time 2μS. Lower trace, ditto reproduced at 1W by a 10W amplifier

Below—200kc/s sine wave fed into both inputs. Gating speed 17kc/s approx.



with VR1 at its mid position. The fact that VR1 is at its mid position for this check shows that the two halves of V2 and V3 are reasonably equal in respect of gain.

If all seems in order the gate can be checked for correct operation. In order to do so the gate's output should be coupled to the oscilloscope input using a short length of coaxial and not ordinary screened wire which has an excessive shunt capacity. The sync o/p should be connected to the "ext sync" input of the oscilloscope. For preliminary tests it is convenient to temporarily connect the Y1 and Y2 inputs in parallel, thereby feeding the same signal to both. This signal should be of fixed frequency and amplitude since this type is the easiest to display. It is most undesirable to experiment with varying or different input signals until some familiarity with the gate's *modus operandi* has been gained, for too many inputs, particularly those varying in frequency or amplitude or both, such as an audio signal, will only tend to confuse.

The oscilloscope's Y amplifier should be set for maximum sensitivity and the timebase adjusted to display a few complete cycles of the input signal. The Y1 and Y2 gain controls can be adjusted as necessary. By setting the oscilloscope's vertical amplifier at its most sensitive position the chances of overloading the gate's amplifier stage is avoided and, also, the separation control need not be used at the ends of its travel, thereby avoiding any possibility of introducing any distortion into the signal due to excessive over or under biasing. Rotating the separation control should cause the two traces to separate, to merge and to transpose without any distortion being evident. If it is the gate should be bypassed and the signal examined directly on the oscilloscope. The effect of the different gating speeds should be noted and then different inputs can be tried, S2 being used to select the input that provides the best sync. If a steady image is difficult to obtain it may be due to it having a direct harmonic relationship to the gating speed and a different gating speed should be tried.

The amount of advice that can be put into print is of necessity limited, whereas *careful* experiments on the part of the user are not. The operation of the gate is by no means difficult, though it may appear so to the novice. Obviously familiarity with an ordinary oscilloscope is of inestimable value, for then the gate is but an extension of it. ■

practically wireless commentary by HENRY

No 21

Mister B

THERE used to be a fellow down our street who could never put a finger wrong. He was always in demand. Replacing washers, knocking up pelmets, changing tyres or gaskets, putting in windows; from electric bells to herbaceous borders, it was all the same to Mr. B.

He called at the shack to borrow a file, just as I was in the middle of a ticklish piece of amplifier building. "*Your fuses—cor!*" said Mr. B expressively.

Now it isn't that Henry cannot tackle a blown house-fuse. My wife had called in Mr. B to help with the constructional aspect—replugging the wall. Somehow, when Henry gets hold of a hammer the theory of Relativity takes a twist. I am happier with a soldering iron.

★ ★ ★

In fact, I was wielding that familiar instrument as Mr. B leaned against the shack door, scraping at the blade of his grub screwdriver. He watched my clumsy efforts for a while.

"*Why don't you use a clothes-peg to clamp those bits together?*" he asked. "*Easier than burning your fingers,*" he added, as I sucked.

Like all the exasperating Mr. B types, he was quite right. Henry just hadn't thought about the simple expedient. Another case of Shute's Mr Honey and the dish-mop. Yet Mr. Honey, faced with the prospect of having to resign from aeronautical research at Farnborough, had been sure of a job at the National Physical Laboratory.

Easier than burning your fingers

Makes one wonder how many of these industrial computerised assemblies, with their sophisticated servo devices, could be supplanted by a part-time Mr. B with Ready Reckoner in the back pocket of his overalls, and pencil stub behind his ear. Perhaps the boffins had not thought of the obvious.

★ ★ ★

A little while ago, the Autonomics Division of the N.P.L. told us that pattern recognition machines were still a long way short of the ability of the human eye. To quote: "*The outstanding performance of the human brain underlines the gap between nature and cybernatic artefacts*".

Well, our Mr. B wouldn't know a cybernatic artefact from a wooden leg! But even he could tell at a glance that Auntie Maud's postcard about the weather and her arthritis really meant she would not be coming to babysit next Friday—which is more than any computer could do, despite all its epitoxical semi-planar micro-module flip-chips.

It all comes down to practical know-how in the end. Down to Mr. B with his odd bits of wire and a dash of ingenuity. Soft-landings on the moon are one thing, but without some equivalent comrade B-ski to polish the old solar cells, Lunik 1X would hardly have got so far as a lift-off.

★ ★ ★

What I am getting at—hold your seats, lads, Henry is approaching the point—is that there will always be room for the capable technician. No matter how complex the design conception, some cost-conscious manufacturer is going to build in a few faults with his flap-happy printed boards and haystack-wired components.

★ ★ ★

In a recent review of a very expensive tape recorder, the remark was made that had it not been for the outstanding *performance* the machine would

Without some equivalent Comrade B-ski to polish the old solar cells.

have been returned to the maker on account of its atrocious construction. Performance, for how long, Henry would like to ask?

One of our esteemed contemporaries has bemoaned the shortage of "skilled labour" coming forward to answer the adverts of some electronics giants. May we suggest they are aiming too high. Instead of recruiting graduates to refine even more sophisticated hardware, flashing their sliderules for brief spasms, then sitting over the Mephisto crossword while they wait for Mr. B to mend the fuses, we suggest they advertise in these pages for a few "practical types" with enough working knowledge of electronics to take the mysteries within those magic black boxes in their stride!

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CLUB SPOT

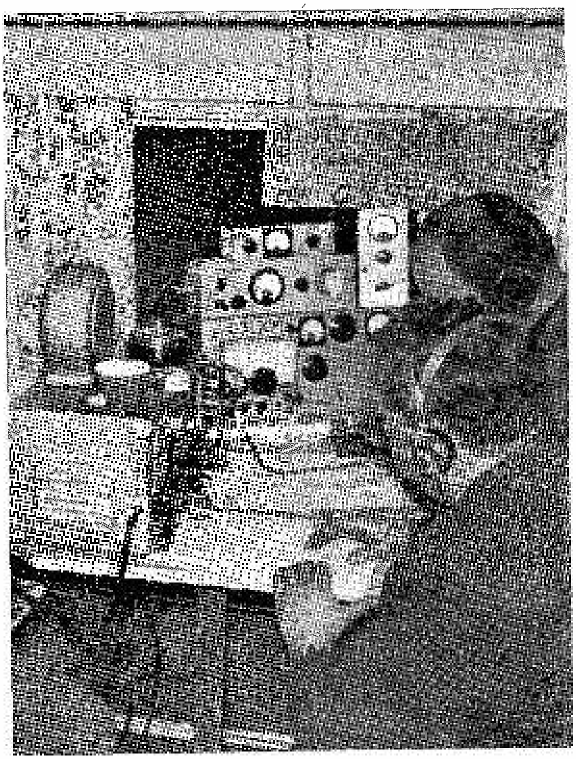
No. 7 VERULAM AMATEUR RADIO CLUB

G3STA

THE Verulam Amateur Radio Club came into being towards the end of 1961 when a short wave listener, Brian Cockell, concientiously, worked through the R.S.G.B. call book, extracted the names of and addresses of some 100 local "Hams" and wrote to each one individually inviting them to a rendezvous at the "Red Lion", St. Albans, with the object of forming an amateur radio club, and partaking of wine in the process.

His efforts were most successful and a committee was duly elected under the steadying hand of C. F. Thomas, G3EKU, whose connection with radio goes back to World War 1, while at one stage he held an Artificial Aerial licence and was connected with airships.

The Club membership, which is steadily rising, includes some 36 licensed operators. Meetings are monthly at Hedley Road, St. Albans, where visitors are always welcome and a quick word with the Secretary G3PAO, 6, Leggatts Wood Avenue, Watford, Herts. (WATford 25526) will bring full details.



Affiliated Societies Contest last year. Logging G3LXP, on the key G3JDG. Gear, "LXP" 10 watt Tx, s.w.r. bridge, Z match, 888A.

Two hours to go and the coax on the Cubical Quad comes adrift, one of the many incidents on NFD.

Club finances are under the watchful eye of our lady treasurer Miss P. Connelly who incidentally is also licensed. Her "stirling" efforts include creeping across a dark meadow last year at three in the morning to operate in V.H.F. Field Day.

The Club's "newspaper" consists of a monthly news sheet sent to all members, edited by G3LXP and dispatched piping hot from the press by our "printer" Wilf Whitehouse G3SKB.

A regular feature is the Club "Owls Net" on 1980kc/s, Saturdays. This usually starts up about 10.30 p.m. with everybody "having to cut it short tonight", and finishing with a final ragchew around 2.0 a.m.

Most contests are entered including N.F.D. V.H.F.N.F.D., M.C.C., etc. Last year a small group of keen types went on safari to nearby Salisbury Hall to rig up a station and take part in the Top

Continued on page 66

A SHORT SERIES FOR THE EXPERIMENTER

OSCILLATOR CIRCUITRY

R. Leyland

3—A.F. OSCILLATOR NETWORKS

THE only kind of waves that can pass through phase-shifting networks without distortion are sine waves. However, changes do take place in their amplitude and phase. The output wave is usually smaller in amplitude and shifted out of synchronism by a fraction of a cycle, or so many degrees.

It is convenient to represent a sine wave by an arrow called a complexor. The length of the arrow (see Fig. 1) is the peak amplitude of the wave, and by turning the arrow through the corresponding angle, the level at any other point of the wave is obtained, A vertical complexor represents the input to the network, and another tilted complexor, shorter in length, represents the output. The angle between them is the amount of phase shift.

There is no phase shift in a network containing only resistance, but a capacitor stores and releases energy, and this causes its current to lead the voltage by 90°. When the current from a capacitor passes through a resistance, the voltage across the resistor will be 90° ahead of the voltage across the capacitor. If, as in Fig. 2(a), the output is from across the resistor, it will lead the input voltage, although by less than 90°. On the other hand, if the output is from across the capacitor, the output voltage will lag on the input.

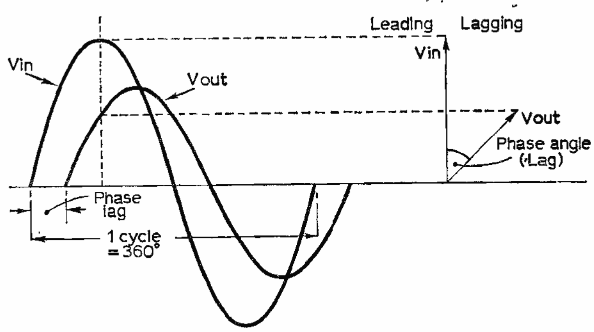
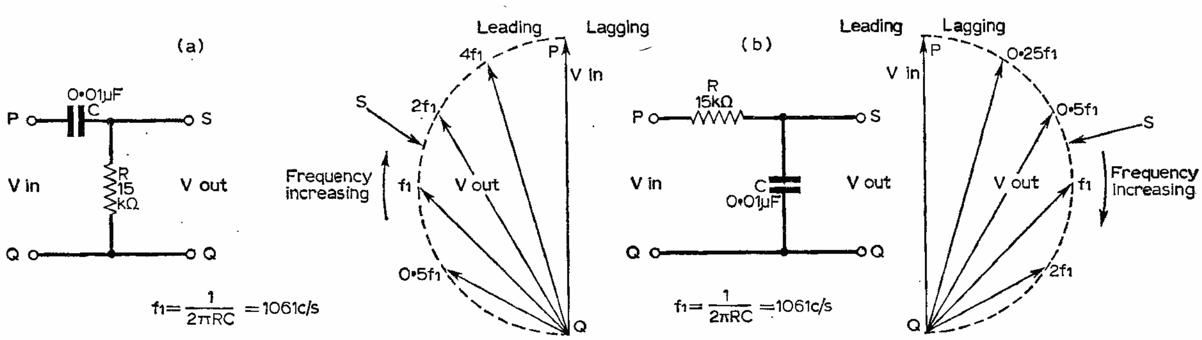


Fig. 1: Method of representing the attenuation and phase shift of a sine wave by means of a complexor diagram.

Fig. 2: The frequency responses of (a) high pass; (b) low pass networks.



Frequency Response

The actual amount by which the output voltage wave is shifted relative to the input depends upon the frequency and, in many types of network, phase shift is accompanied by attenuation; i.e. as the phase shift increases, the output becomes smaller. The vertical arrow or complexor representing the input remains the same, but as the frequency is varied, the other complexor representing the output swings to a new phase angle and also changes in length.

In so doing, it will trace out a path or locus depending upon the type of network. Quite often the locus is circular, although in the case of the simpler networks (Fig. 2), only a semi-circle.

In the diagrams, the locus curve, dotted, shows how the alternating voltage of the output terminal marked S changes as the frequency is varied. At the points on the locus corresponding to a series of frequencies, the complexor is drawn in, giving the magnitude and phase of the output at these frequencies.

It will be noticed that the frequencies are shown as half, twice, etc., of a special frequency, f_1, which can be calculated from the values chosen for R and C. The value of f_1 can be altered without changing the impedance of the circuit at f_1 by multiplying only the capacitance values, since this leaves the reactances unchanged. In the formula C is in farads,

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Alternatively, the impedance of any of these circuits can be altered without changing f_1 if the capacitances are multiplied by the same number used to divide the resistance values, e.g., to double the circuit impedance, leaving f_1 unaltered, double the resistances and halve the capacitances.

Resistors are made in preferred values, and will not give a required frequency exactly. This accounts for the frequencies 1061 c/s, 1160 c/s, 1181 c/s in the diagrams, which are the nearest to 1000 c/s using fixed resistors.

Once component values have been chosen, a locus diagram for the network will show how the output varies with frequency above and below f_1. What this special frequency is can be seen from the diagram, e.g. in Fig. 2, f_1 is the frequency at which the output is 70% of the input, and the phase shift is 45°. Capacitive reactance decreases with frequency, so in (a) the phase shift and attenuation are greatest at low frequencies, while in (b) phase shift and attenuation are greatest at high frequencies.

Notice how as the phase shift increases to 90° the output decreases to zero. We thus have a complete picture of the response of the circuit for different frequencies.

Constant Output

It can be seen that although the circuits of Fig. 2 have a semi-circular locus, in both the output varies down to zero because the complexor radiates from the point Q. If the end of the complexor can be moved further up the diagram until the complexor becomes a radius as in Fig. 3, it will then be possible to vary the phase over a very wide range while keeping the output constant in amplitude.

All that is needed is a centre-tapped input voltage. For this we can use two equal resistors, or a centre-tapped transformer, but the most useful arrangement is probably a " phase splitter " using a valve or transistor. The circuit is shown in Fig. 3. The phase of course varies with frequency as before, and f_1 is now the frequency of 90° phase shift. The output is constant and equal to the " input voltage " which is half the total applied voltage.

An important point is that the anode voltage of a valve is in antiphase to the grid voltage, while the cathode voltage is in phase with the grid. This reversal of phase means that for circuit (b) of Fig. 3, the locus diagram is turned through 180°, so that the output is lagging the input instead of leading as with circuit (a). Grid (or cathode) potential is in antiphase to anode potential (referred to point T as zero potential). Both are additive across the phase-shifting circuit.

In this arrangement the phase can be varied by changing the value of R and C, and the ouput will remain constant, providing the values of RL are low so that no appreciable change in loading occurs. Two such circuits in cascade can give an overall phase-shift of 180° and this can form the basis of a very satisfactory type of a.f. oscillator.

Ladder Networks

To produce this phase shift of 180° by means of a ladder network requires three sections. The locus diagrams (Fig. 4) of ladder networks consisting of equal resistances and equal capacitances are not quite

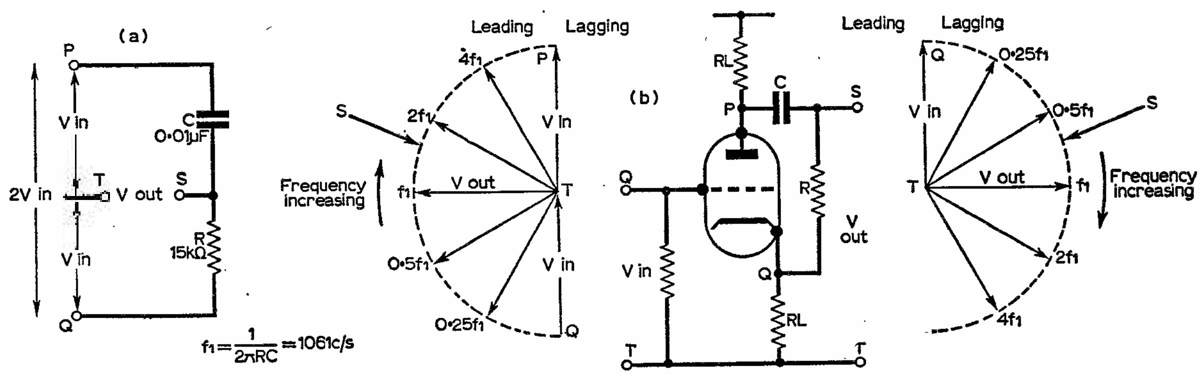


Fig. 3: Phase shifting arrangements with a constant output.

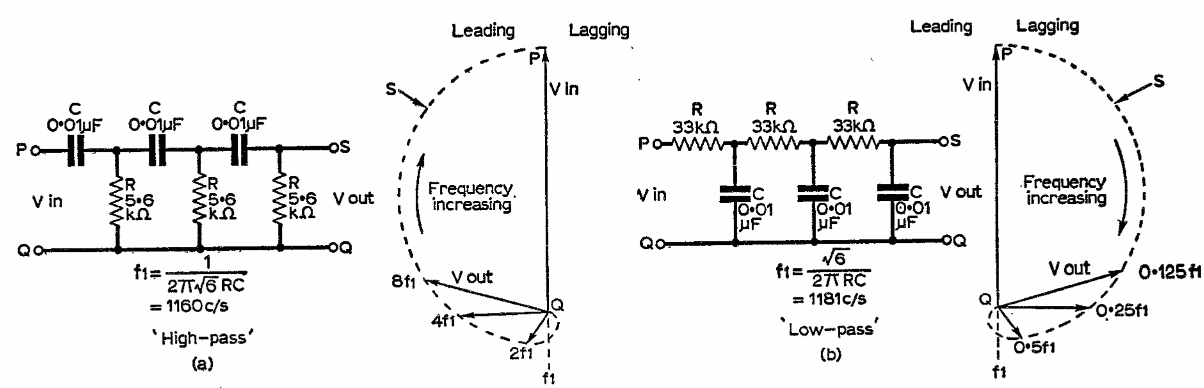


Fig. 4: Frequency responses of ladder networks having three equal sections.

circular in shape. Because the network has three sections, the locus curves into the third quadrant, reaching zero at 270°.

The output at f_1, here the frequency of 180° phase shift, is almost too small to show on the diagrams since it is only 1/29th of the input voltage, but this does not prevent the network from being successfully used in an oscillator, providing there is a sufficient amplifier gain. Since a single valve or transistor gives a phase reversal in the usual arrangement, an oscillator using a single valve or transistor is possible with a ladder network.

The 180° phase shift of the network is cancelled out again by the phase reversal of the amplifying stage to give an overall phase shift of zero as is required for oscillation.

It should be noticed that with these ladder networks, the frequency is six times higher for shunt capacitances and series resistances than vice versa, assuming that the component values are the same in both circuits. This is why in Fig. 4 the series resistances in (b) for a frequency of roughly 1kc/s are six times as high as the shunt resistances in (a).

Used in a transistor oscillator, the frequency would be somewhat different owing to the loading effect of the transistor.

Zero Phase Shift

It only makes sense to employ a phase shifting network to produce zero phase shift when this is obtained at one particular frequency, which in an oscillator determines the frequency of oscillation.

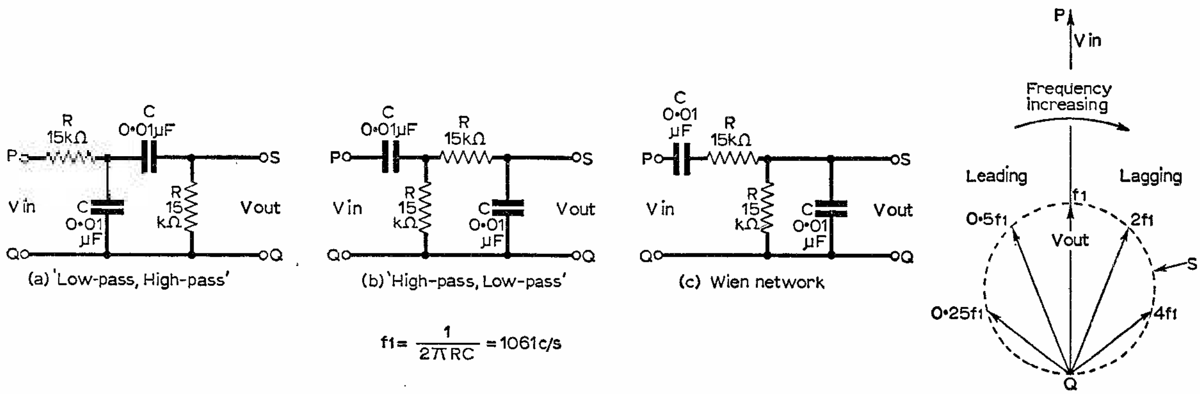
A high-pass network produces a leading phase shift, while a low-pass network produces a phase lag. If we combine the two we might expect that at some frequency the two phase shifts would exactly cancel, making the effective phase shift zero.

This is in fact what happens in the three networks of Fig. 5, and the output also passes through a maximum at f_1, the frequency of zero phase shift, although this maximum is only one third of the input voltage. The output therefore is slightly peaked at f_1 which is at the top of the circular locus, this time a complete circle, but this peaking of the output is relatively unimportant.

What matters in a phase shift oscillator is the phase shift, which takes place with any variation of frequency about f_1, since oscillation can only be maintained at a frequency where the overall phase shift is zero.

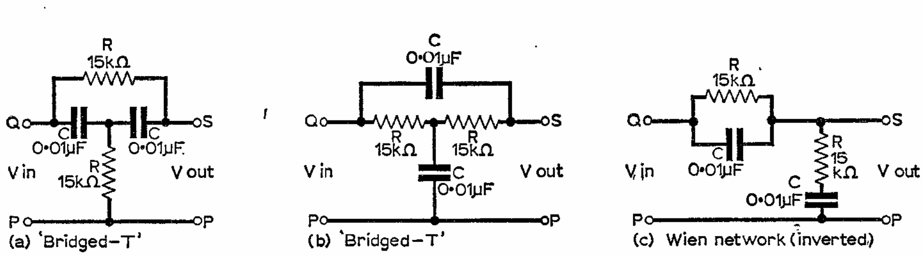
The third of these circuits, Fig. 5 (c) is the most widely used. It is the Wien Network, but all three have the same frequency response, as shown in the locus diagram. At f_1 the phase shift is zero, so positive feedback applied through the network in an oscillator will produce oscillation at this frequency. Usually negative feedback is also applied, and this will alter the locus diagram, moving the end of the output complexor upwards from the point Q. This should increase the rate at which the phase angle changes with frequency variation, so making the circuit more effective.

The combination of positive and negative feedback forms a bridge circuit, and since there is zero phase shift at f_1, a balance or null at f_1 would be possible, as in a Wien Bridge for measuring purposes, but in



$$f_1 = \frac{1}{2\pi RC} = 1061\text{c/s}$$

Fig. 5: Three networks having the same "peaked" frequency response.



$$f_1 = \frac{1}{2\pi RC} = 1061\text{c/s}$$

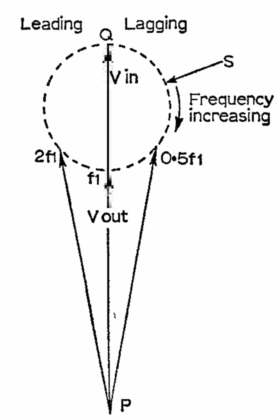


Fig. 6: Three networks with the same "valley" response.

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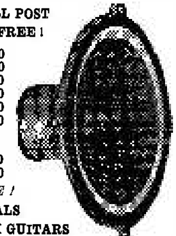

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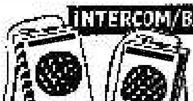

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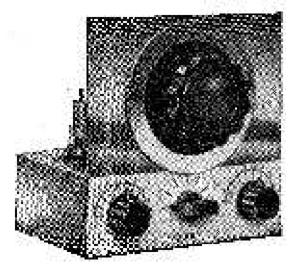

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an oscillator there must be an excess of positive feedback for oscillation, so the bridge must be unbalanced.

"Bridged-T" Networks

After mentioning the four-branch arrangements known as bridges, we now turn to circuits which are "bridged" in the more obvious sense of having one component connected like a bridge across two other components.

The output of the networks in Fig. 5 is from terminals SQ. If, instead, the output is taken from terminals SP, the three networks will re-arrange as shown in Fig. 6 where (a) and (b) are symmetrical "Bridged-T" arrangements. There is now a minimum at f_1 instead of a maximum, because the original "peaked" output has been subtracted from the input to produce a "valley" response.

The re-arranged circuits also can be used in an oscillator, but are placed in a negative feedback path. As before, a surplus of positive feedback at f_1 is needed to produce oscillation, and this has the effect of reversing the complexor in the locus diagram, so that conditions are virtually the same as when one of the original three networks of Fig. 5 is employed.

Many different types of a.f. oscillator are possible incorporating one or another of the phase-shifting networks described, as a substitute for an L-C tuned circuit. Tuned amplifiers and filters are also possible, and in these feedback is used to magnify the effect of the network, so that a more sharply peaked response to the signal input results than is depicted by the locus diagram.

Parallel-T Network

Another circuit of interest is the parallel-T network (Fig. 7). This can be described as a true null network because it is complete in itself and gives zero output at a particular frequency f_1. In this circuit, unlike the previous ones, it is no longer possible to choose all the components alike in value, and

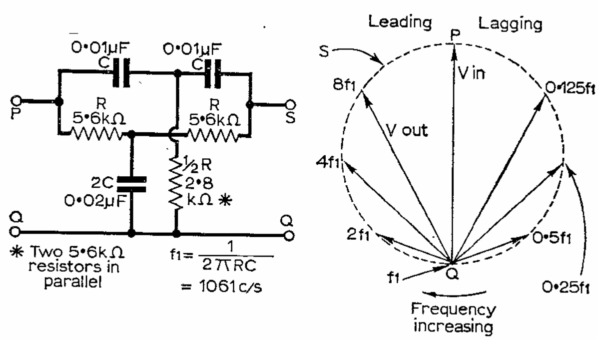

Fig. 7: Frequency response of parallel-T network.

certain ratios must be observed. The simplest arrangement makes the shunt impedances half of the series impedances.

The output follows a circular locus which has a diameter equal to the input. At the frequency f_1 the output decreases right down to zero, so the arrangement is applicable as a filter. An output taken from terminals PQ instead, will be maximum at f_1, and equal and in phase with the input.

Used in an oscillator the circuit requires less amplification than other arrangements, but is restricted to fixed frequency applications, because tuning would require a triple-ganged potentiometer with one section half the resistance of the others.

The full capabilities of all versions of this network are not obvious without a more complete analysis, and it appears that with different ratios one variation of the parallel-T network can produce oscillation from a single transistor.

All of the networks described have been voltage-transfer networks, but the corresponding current transfer networks are easily derived from them, and are often preferred for use in transistorised oscillators. ■

CLUB SPOT

—continued from page 57

band Transatlantics. Armed with ten watts of s.s.b./c.w. and 300 feet of wire the net total for the night was some 50 cups of cocoa, 4lbs. of sausages and six contacts across the pond.

The club owns two 40ft. masts, both homebrew and a demonstration of the simple erecting of these (four men 10 minutes, and a bit of luck, from scratch) was demonstrated by "Verulam" at the Woburn Mobile Rally last year where the club also manned the talk-in stations.

A lecturer is in attendance most meetings either resident or visiting. A fortunate annual event is a visit from Mr. G. Turner of the GPO Engineering Dept., when TVI/BCI is the topic for the evening. Other lecturers in the past year have included Antennas (G3HRH), Working DX (G3AAZ), SSB (G3DZW), and Receiver alignment (J. Akim, Marconi Instruments).

Demonstrations have also proved very popular and have included some well-known names such as T. Withers (G3HGE), Vic Hartopp (J. Beams), and Green and Davis.

The Club has its own test equipment the more impressive of which is v.h.f./u.h.f. signal generators (Marconi), General Purpose Oscilloscope, and a 5-band home-brew transmitter. ■

Tuning the stubs on the Quad for max. front-to-back ratio. Note the novel method of keeping the ladder up. (Method not patented!)

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By building ALL three Sinclair designs featured this month, you can become the proud owner of a unique A.M-F.M/Stereo Hi-Fi system that will give complete satisfaction and save pounds compared with other systems. Each unit is complete in itself and you will have two radio units, each of which can be used separately as an independent self-contained personal receiver. These designs cover all aspects.

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"I was determined to finish it (The Micro FM) at one sitting. Having completed it, I am amazed at its quality of reproduction, and am spending far too much time listening to it; it even works on trains which is more than can be said of AM radios."
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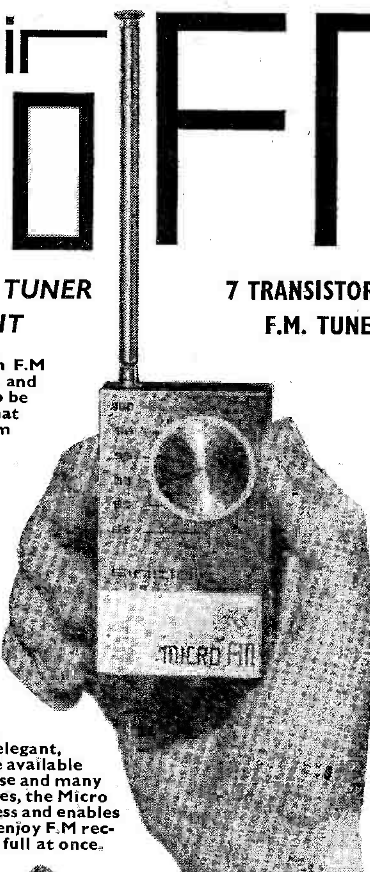

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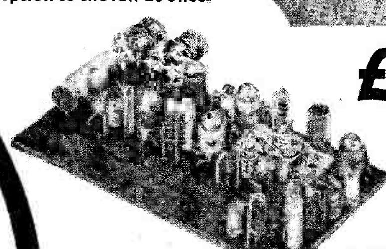

TECHNICAL DESCRIPTION

The Sinclair Micro FM is a completely self-contained double-purpose FM superhet housed within a case less than 3in. high x $1\frac{7}{8}$in. wide with a depth of $\frac{3}{4}$in. It uses 7 transistors and 2 diodes in special superhet FM circuitry. The R.F amplifier is followed by a self-oscillating mixer and 3 stages of I.F. amplification which dispense with I.F. transformer and all problems of alignment. The final I.F amplifier produces a square wave of constant amplitude which is converted into uniform pulses so arranged that the original modulation is reproduced exactly. A pulse-counting detector ensures improved linearity and therefore better audio quality at the output stages. After equalisation the signal is channelled to one output for feeding to amplifier or recorder and to another in which the receiver's own audio amplifying stage enables the Micro FM to be used as an independent self-contained pocket portable. A.F.C. is used to lock the programme tuned in; the telescopic aerial included with the kit will be found sufficient for all but the worst signal areas.

- **Supply voltage—9v from self contained standard battery.**
- **Consumption—5mA.**
- **Sensitivity—Typically 3mV**
- **Signal to Noise Ratio—30dB at 30 microvolts.**
- **Audio frequency response —10-20,000 c/s.**
- **Two Audio Outputs—One for feeding to amplifier or tape recorder. One for feeding to earpiece to enable set to be used as a portable receiver.**
- **A.F.C. for automatically locking on to each station tuned in.**
- *Inserting plug of earpiece or tuner lead switches set ON.*

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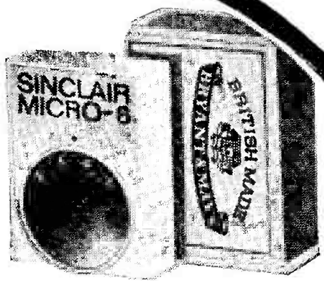

SINCLAIR MICRO-6

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- **$1\frac{4}{5}$in. x $1\frac{3}{10}$in. x $\frac{1}{2}$in.**
- **Weight—1 oz.**
- **Bandspread for Luxembourg**
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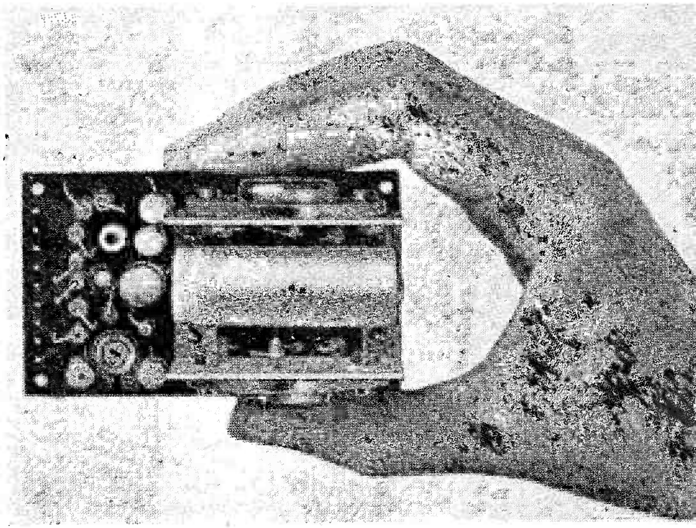

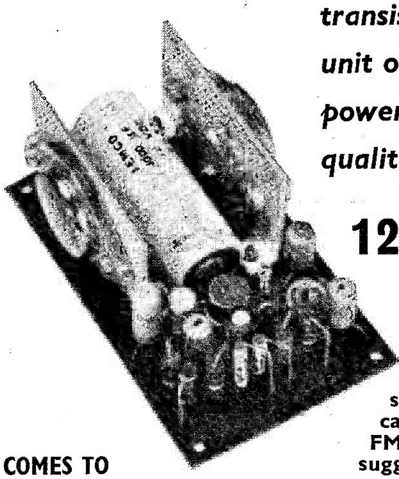

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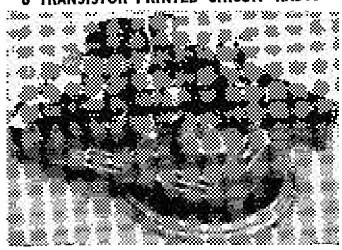

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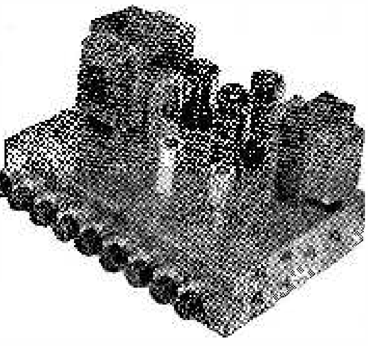

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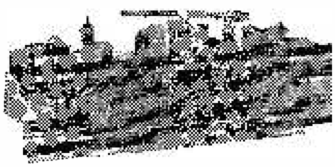

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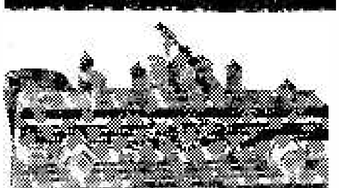

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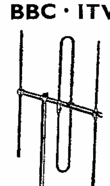

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30C17	13/-	957	5/-	DK96	8/6	ECC88	10/-
30C18	11/-	958	4/-	DL33	6/6	ECC189	12/-
30F5	11/-	959	8/-	DL35	5/-	ECC804	11/-
30FL1	12/-	5654	8/-	DL63	3/-	ECF80	8/-
30FL12	12/-	5670	10/-	DL68	10/-	ECF82	7/6
30FL14	12/-	5763	10/-	DL70	8/-	ECF86	11/-
		5814A	10/-	DL73	12/-	ECF804	13/-

ECH21	10/-	EY51	8/-	PCL85	9/6	U25	11/-
ECH35	12/-	EY70	10/-	PCL86	9/6	U26	11/-
ECH42	9/6	EY81	8/-	PCL88	12/6	U76	4/-
ECH81	6/6	EY83	9/6	PCL800	12/-	U191	11/6
ECH83	7/6	EY84	7/6	PCL801	12/-	U201	6/6
ECH84	10/-	EY86	7/6	PEN45	7/-	U281	13/-
ECL80	7/6	EY87	8/-	PEN45DD		U282	14/-
ECL82	7/6	EY91	3/-		12/-	U301	12/6
ECL83	9/6	EZ35	5/6	PEN46	6/-	U403	7/-
ECL84	12/-	EZ40	7/6	PEN220A		U404	6/-
ECL86	9/6	EZ41	8/-		7/-	U600	10/-
EF36	5/-	EZ80	5/6	PEN383		U801	18/-
EF37A	8/-	EZ81	5/6		10/-	UABC80	5/6
EF39	5/6	EZ90	4/-	PEN384	7/-	UAF42	9/-
EF40	10/-	G55/1K	13/-	PEN453/		UB41	11/-
EF41	8/6	GD86W	10/-	DD	10/6	UBC41	8/-
EF42	8/-	GS10H	40/-	PFL200		UBC81	8/-
EF50	2/-	GTE175M			17/6	UBF80	7/-
EF55	8/-		12/-	PL36	10/-	UBF84	7/6
EF80	5/6	GZ30	8/-	PL38	16/-	UBF89	7/6
EF85	6/6	GZ32	10/-	PL81	8/-	UBL21	11/-
EF86	8/-	GZ34	10/-	PL82	7/6	UC92	6/-
EF89	5/6	HABC80	8/-	PL83	7/6	UCC84	10/-
EF91	4/-	HBC90	5/-	PL84	7/-	UCC85	7/-
EF93	5/-	HBC91	6/-	PL302	14/-	UCF80	10/-
EF94	6/-	HF93	6/-	PL500	15/-	UCH21	9/6
EF95	5/6	HF94	6/-	PL801	10/-	UCH42	9/6
EF96	2/-	HK90	5/-	PP5/400		UCH81	7/-
EF98	12/6	H12	3/-		10/-	UCL82	8/6
EF183	8/-	HL2K	3/-	PX4	15/-	UCL83	10/-
EF184	8/-	HL23	6/-	PX25	10/-	UF41	9/-
EF804	21/-	HL23DD	6/-	PY31	8/-	UF42	9/-
EFP60	10/-	HL41	4/-	PY33	9/6	UF43	8/-
EH90	7/6	KT66	16/-	PY80	60/-	UF80	8/-
EK2	10/-	KT88	22/-	PY81	6/6	UF85	8/-
EK32	6/-	KTW61	7/-	PY82	6/6	UF86	11/-
EK90	5/-	KTZ41	6/-	PY83	7/-	UF89	7/6
EL32	3/-	KTZ63	9/-	PY88	8/6	UL41	9/-
EL34	11/-	N78	15/-	PY301	11/6	UL84	6/6
EL35	5/-	OCP71	24/-	PY800	8/6	UM4	10/-
EL36	9/-	ORP12	12/-	PY801	8/6	UM80	7/-
EL37	17/6	ORP60	10/-	PZ30	10/-	UU5	8/-
EL38	17/6	PABC80	7/6	QP25	5/-	UU7	8/-
EL41	9/6	PC86	12/-	QQVO3-10		UU9	7/-
EL42	9/-	PC87	12/-		35/-	UU10	8/-
EL50	6/-	PC97	9/6	QS105/45		UY1N	9/-
EL81	9/6	PC900	12/-		15/-	UY21	9/-
EL82	8/-	PCC84	6/6	QS1200	10/-	UY41	6/6
EL83	8/-	PCC85	8/-	R1	8/-	UY82	9/6
EL84	5/-	PCC88	12/-	R10	10/-	UY85	6/-
EL85	8/-	PCC89	12/6	R17	8/-	VP23	3/6
EL86	8/-	PCC189	12/-	R18	7/6	VP41	5/-
EL90	6/-	PCC805	12/6	S130	12/6	VP210	5/-
EL91	2/6	PCC806	14/-	S130P	15/-	W21	5/-
EL95	6/-	PCE800	12/-	SP41	5/-	W81M	6/-
EL360	22/-	PCF80	7/6	SP42	8/-	W729	10/-
EL821	6/-	PCF82	8/-	SP61	4/-	X63	6/-
EM4	10/-	PCF86	9/-	TH233	6/-	X65	5/6
EM31	5/-	PCF87	13/-	TH2321	7/-	X66	8/-
EM34	12/-	PCF800	11/-	TP22	5/-	X78	20/-
EM35	8/-	PCF801	11/-	TP25	5/-	X81M	18/-
EM71	12/6	PCF802	11/-	TP2620	7/6	XB1	12/6
EM80	7/-	PCF805	11/-	TT12	60/-	XC12	7/6
EM81	7/6	PCF806	13/-	TT15	35/-	XC15	4/6
EM84	8/-	PCF808	12/-	TT21	35/-	Y63	8/-
EM87	7/-	PCL80	12/6	TZ40	40/-	Z21	7/-
EN30	35/-	PCL81	9/-	U18/20	7/-	Z503M	45/-
EN31	10/-	PCL82	8/6	U19	30/-	Z700U	4/-
EN91	6/-	PCL83	8/6	U21	7/-	Z759	22/-
EN92	6/-	PCL84	8/6	U22	6/-	Z803U	15/-

MULTIMETERS

Type 108-IT; 24 range precision portable meter, 5000 o.p.v; DC 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 live. Complete with prods and batteries **£5.5.0.** P. & P. 7/6.

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.

COUNTER TUBES

GR10A—10-way register-indicator tube, **45/-.**
GC10/4B—bi-directional 10-way computing tube, double pulse, **50/-.**
GC10B—scale-of-ten counter, **35/-.**
GC10D—scale-of-ten counter for single pulse operation **55/-.**
GS10D—Bi-directional 10-way selector tube, **55/-.**
810H—as GS10D but physically small. **40/-.**

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/-**

PHOTO CELLS GS18

Caessium Antimony, side-on window. HT 160V. sensitivity 160μA/Lumen .. .. **5/-** P.P. 1/6

SILICON BRIDGE CONNECTED POWER RECTIFIERS, 100 P.I.V.

1B20K10, 2 amps DC (1·4"x1·4"x·6")	**25/-**
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1B100K10, 10 amps DC (2·25"x2·25"x1")	**85/-**

GERMANIUM DIODES

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

TRANSISTOR COMPLEMENTARY PAIRS:

2N697 (NPN) and 2N1132 (PNP)...... **50/-** per pair

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Transistors, Microwave diodes, Detector diodes, germanium and silicon, zener diodes and power rectifiers in silicon or germanium. Leaflet with prices and short specifications available on request.

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500μA. D.C. MC 2in. round flush, ringnut mounting ..	**17/6**
500μA D.C. MC 2in. round flush, for clip fixing, undrilled flange	**10/-**
1mA. D.C. MC 2in. round flange mounted, sealed, calibration 0-3/30/300	**12/-**
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1mA. D.C. MC 2½in. square flange mounted	**17/6**
30mA. D.C. MC 2½in. round flange mounted..........	**10/-**
50mA. D.C. MC 2in. square flange mounted	**12/6**
50mA. D.C. MC 2½in. round flange mounted..........	**10/-**
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100mA. D.C. MC 1½in. round flange mounted	**15/-**
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(*b*) We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuitry.

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