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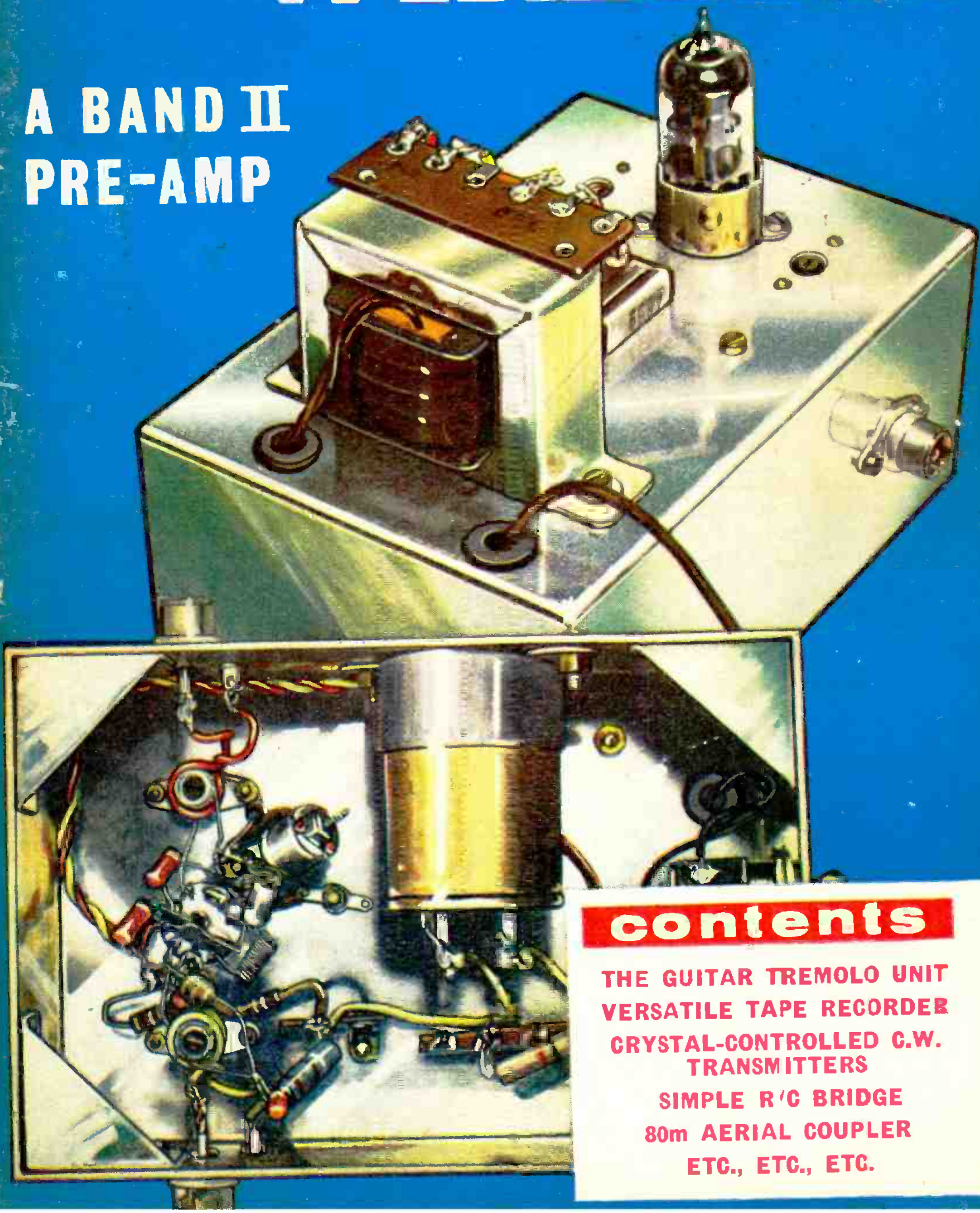

contents

- THE GUITAR TREMOLO UNIT
- VERSATILE TAPE RECORDER
- CRYSTAL-CONTROLLED C.W. TRANSMITTERS
- SIMPLE R/C BRIDGE
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8″ H.F.810	10,000 gauss	£2.19.0	T.10 tweeter	14,000 gauss	£4.4.0
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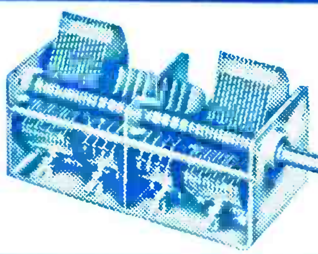

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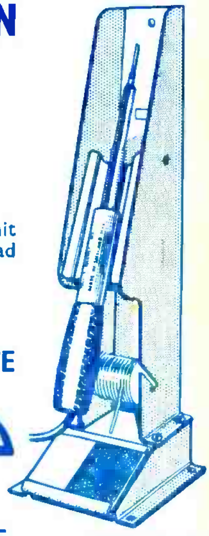

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6D3	15/-
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56EGT	10/-
6F1	15/6
6F6	6/9
6F7	15/-
6F12	4/9
6F13	17/6
6F14	17/6
6F15	14/9
6F17	12/-
6F33	5/6
6H6	2/6
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6J6	7/6
6J7GT	9/6
6K7G	3/-
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12K8GT	12/6
12Q7GT	8/6
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12SH7	4/-
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12SK7	8/-
12SQ7	11/6
12SN7	17/6
12Z3	15/-
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14H7	12/6
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19AQ5	10/6
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20L1	26/6
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25Y5	10/-
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25Z5	9/6
25Z6	10/6
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30	13/6
30C1	12/6
30FS	11/6
30FL1	10/6
30L1	11/6
30P4	22/-
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30P16	10/-
30PL1	15/-
32	13/6
35A5	15/-
35L6GT	10/6
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35Z3	10/-
35Z4	7/6
35Z5	9/6
40SUA	15/-
41STH	23/6
42	15/-
43	15/-
50C5	15/-
50CD6G	21/-
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61BT	17/6
61SPT	17/6
62BT	17/6
75	12/6
77	12/6
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807	7/6
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5763	17/6
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D63	3/6
D77	5/6
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DF33	10/6
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DF96	9/6
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EBC41	9/6
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ECC33	5/-
ECC34	15/-
ECC35	8/-
ECC40	21/-
ECC81	8/-
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ECC83	9/6
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ECC85	9/6
ECC91	5/6
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EF37	8/6
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EF42	10/6
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EF80	6/-
EF85	6/6
EF86	11/-
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EF91	4/9
EF92	5/-
EF93	7/6
EF95	15/-
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EL32	5/-
EL33	12/6
EL35	12/6
EL37	18/6
EL38	23/9
EL41	10/6
EL42	10/-
EL81	14/9
EL84	7/-
EL85	10/6
EL90	8/6
EL91	5/-
EM80	10/-
EM81	10/-
EY81	10/6
EY84	10/6
EY86	9/6
EY91	9/-
EZ35	7/-
EZ40	7/6
EZ41	7/6
EZ80	7/6
EZ81	7/6
EZ90	7/6
FC2	21/-
FC13	17/6
FC13C	21/-
FW4,500	10/-
FW4,800	10/-
GZ30	10/6
GZ32	11/6
GZ34	13/6
H30	5/6
H63	9/6
HBC90	9/6
HL92	6/6
HL133DD	10/-
HL23	12/6
H23DD	10/6
HL41	12/6
HL41DD	13/6
HL42DD	13/6
HY90	8/-
IW4/350	10/-
IW4/500	10/-
KBC32	9/6
KF35	8/6
KL32	10/6
KLL32	11/6
KL35	9/6
KT2	7/6
KT32	10/-
KT33C	10/-
KT36	28/6
KT41	22/6
KT44	13/6
KT55	22/6
KT61	18/6
KT63	8/6
KT66	17/6
KT71	9/-
KT74	12/6
KT76	12/6
KT101	25/-
KTW62	7/6
KTW63	7/6
KTZ41	8/-
KTZ63	10/-
L63	4/9
LN309	15/-
LZ319	12/6
MH4	8/6
MHD4	17/6
MHL	10/-
MKT4 (5,7)	17/6
MS4B	17/6
MSP4	17/6
MU14	9/-
MX40	17/6
N18	8/-
N19	8/-
N37	18/6
N78	17/6
N108	18/-
N142	9/6
N147	18/6
N150	10/-
N153	11/6
N309	11/6
N329	10/-
N727	7/6
N729	8/-
P2	10/-
PCC84	9/6
PCC89	10/-
PCF80	10/6
PCF82	9/6
PCL82	11/6
PCL83	12/6
PENA4	17/6
PENB4	17/6
PEN4DD	22/6
PL33	18/6
PL38	23/9
PL81	14/9
PL82	8/-
PL83	10/6
PL820	21/-
PM2A	12/6
PM2HL	14/-
PM22A	13/6
PM24M	21/6
PM202	16/-
PY31	16/6
PY32	15/6
PY80	8/-
PY81	7/6
PY82	8/-
PY83	8/6
PZ30	18/6
QP25	14/6
QP230	17/6
QP21	12/6
R10	21/-
R19	19/6
SD6	8/6
SP4	14/6
SP41	3/6
SP42	12/6
SP61	3/6
T41	22/6
TDD4	17/6
TDD13C	17/6
TH41	23/9
TP22	17/6
TP25	17/6
U14	15/9
U16	10/-
U18 20	10/-
U22	10/-
U24	29/6
U25	14/-
U26	12/6
U31	9/6
U33	21/-
U35	21/-
U37	25/-
U45	21/-
U47	21/-
U50	8/6
U52	7/-
U76	7/6
U78	7/-
U142	8/-
U145	15/-
U147	7/-
U153	9/6
U191	20/-
U251	17/6
U281	20/-
U282	22/-
U301	22/6
U329	17/6
U339	19/-
U403	11/6
U404	10/-
U801	29/-
U4020	15/6
UABC80	8/-
UAF42	9/6
UB41	9/-
UBC41	9/6
UBF80	9/6
UBF89	8/6
UCC85	10/-
UCH42	9/-
UCH81	9/-
UCL82	12/6
UCL83	13/6
UF41	9/-
UF42	11/6
UF80	9/-
UF85	9/-
UF89	8/-
UL41	8/-
UL44	24/6
UL46	21/-
UL84	9/6
UU6	20/11
UU7	15/-
UU8	26/-
UY21	15/6
UY41	7/6
UY85	7/6
VP2B	17/6
VP4B	17/6
W17	8/6
W76	7/-
W77	5/-
W81	6/-
W142	9/-
W719	7/6
W727	7/6
X18	11/6
X61M	21/-
X65	23/9
X66	21/-
X78	21/-
X79	21/-
Y61	10/6
Y63	9/-
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Z66	19/6
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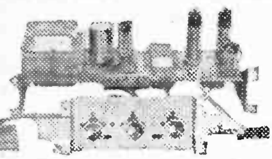

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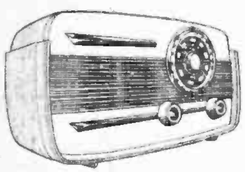

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MATCHED PAIR £1.0.0

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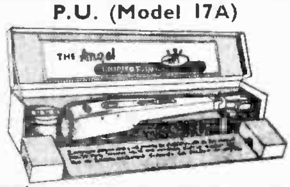

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RC 120 Mk.4H	,, ,,	£9. 0. 0
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RC 121 Mk.4H	,, ,,	£11.0. 6
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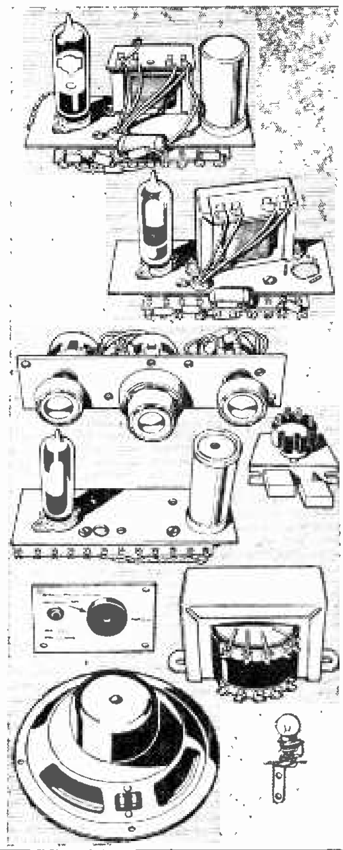
HARVERSONS SUPER STEREO KIT

The product of a renowned maker, this stereo amplifier is composed of "ready-built" units, only requiring interconnection. This system has the advantage of being adaptable to fit any cabinet. Each unit is made from first-grade components, and valves used (ECL82, EZ80 range) are genuine Mullard. The comprehensive instructions supplied make the simple interconnection of units easy even for the novice.



THE KIT COMPRISES...

TWO MIDGET AMPLIFIERS each of 3W output, good reproduction from both your stereo or monaural records. Both amplifiers complete with well-designed O.P. transformers providing perfect matching 3-7 Ω speakers, and have remote bass, treble and volume controls. Size 5" x 2½" x 3" high (each amplifier).

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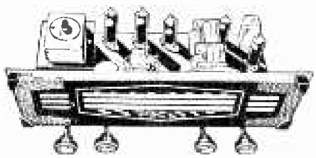

A chassis of distinction, by a famous maker. Covering Long, Med. & Short Waves, plus gram position, this chassis (Size 15½ x 7 x 6½in. high) incorporates the latest circuitry, using fully delayed A.V.C., and negative feedback. Controls:- Tone, Vol.- On/Off, W/Change (L.M.S. & Gram), Tuning. Tapped input 200-250 v. A.C. only. An attractive brown and gold illuminated dial with matching knobs, make this one of the most handsome, in addition to being one of the best performing chassis yet offered. Complete with valves (ECH81, EF89, EBC81, EL84, EZ81), knobs, output transformer, leads etc. OUR PRICE ONLY **£9.19.6** plus 4/6 post & packing.

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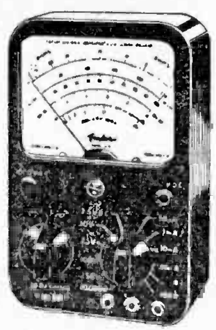

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Filament Transformers. Primary 0-190-210-230-250 v. 50 C. Sec. 1 2.5 v. C.T at 10 amps., 2 2.5 v. C.T. at 10 amps.; 3 10.5 v. C.T. at 11 amps., 4,000 v. insulation. Price £2.19.0. P. & P. 5/-.

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170 GOLDHAWK RD., W.12
Shepherds Bush 4946

Primary 0-190-210-230-250 v., 50 C. Sec. 1 10 v. C.T. at 4.5 amps.; 2 10 v. C.T. at 4.5 amps., 4,000 v. insulation £1.16.0. P. & P. 5/-. Primary 230 v. 50/60 c. 67 v. amp. Sec. 1 6.3 v. 1-6 amps.; 2 6.3 v. C.T. 3 amps.; 3 6.3 v. C.T. 3 amps.; 4 6.3 v. C.T. 3 amps. £1.12.0. P. & P. 5/-.
Ferranti Transformer. Oil cooled, 20/19.5 K.V.A., 3 phase, 50 cycles. Primary 360/380/400/420/440 v. Secondary 2,700/2,900/3,100/3,300/3,500 v., 2.1 amp. Voltage regulation by simple switches on primary and secondary. Weight 1,150 lbs. **Price £125.0.0.** Carriage at cost.
Driver Transformers. Primary 500 ohms imp. Sec. to match two 805 in push-pull. £1.7.6. P. & P. 5/-.
Insulation Test Meter. Testing voltage adjustable up to 6,000 v. D.C Mains supply 180/250 v. in wooden case £25. Carriage 10/-.
Vibrator Unit. 12 v./160 v 35 mA. Exceedingly well filtered and smoothed, excellent for car radios. New, including 6X5G valve and vibrator, 17/6. P. & P. 5/-.
Moving Coil Round Hand Microphone No. 13. 2½in. dia. with press switch, 12/6. P. & P. 1/-.
Complete Set of Strong Aerial Rods (American). Screw-in type MP49, 50, 51, 52, 53, total length 15ft. 10in., top diameter 0.615in., bottom diameter 0-185in., together with matched aerial base. MP37 with ceramic insulator ideal for car or roof insulator, £2.10.0, post free.
Output Transformer n screening can give 9 different ratios 10 : 1 up to 120 : 1 for battery receivers or any high resistance pentodes used as output valves, 6/6. P. & P. 1/6.

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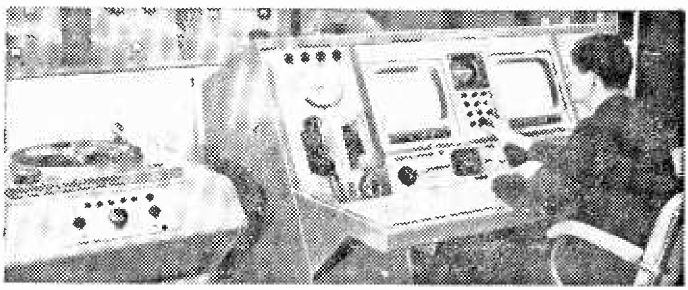

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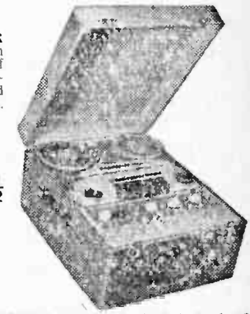
R.S.C. HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST. CAN BE ASSEMBLED IN HALF AN HOUR
The Recorder incorporates the Latest Collaro Studio Tape Transcriptor. The Linear LT45X High Quality Tape Amplifier listed £12.12.0 High Flux P.M. Speaker listed 30/-, empty Tape Spool a Reel of Best Quality Tape listed 22/6, and a Handsome Portable carrying Cabinet with latest attractive two-tone polychrome finish, size 18 x 13 x 9in. high, listed £4.10.0, and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£90 class. S.A.E. for leaflet.

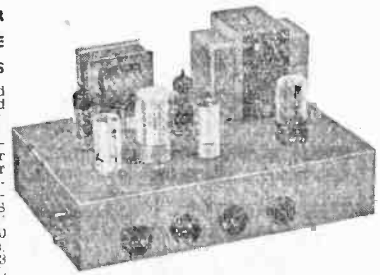


25½ GNS. Carr. 17/6

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

HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

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



Two input sockets with associated controls allow mixing of "mike" and gram, as in A10. High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, 5Y3. High Quality sectionally wound output transformer specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut." Frequency response ± 3 D.B. 30-30,000 c/cs. Six negative feedback loops. Hum level 60 D.B. down. ONLY 23 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and microphones. Comparable with the very best designs. For **STANDARD or LONG PLAYING RECORDS** For **MUSICAL INSTRUMENTS** such as **STRING BASS, GUITARS**, etc., **OUTPUT SOCKET** with plug provides 300 v. 30 mA. and 6.3 v. 1.5 a. For supply of a **RADIO FEEDER UNIT**. Size approx. 12-9-7in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit is complete to last nut. Chassis if fully punched. Full instructions and point-to-point wiring diagrams supplied. Only **8 Gns.** Carr. 10/-
(Or factory built 45/- extra).

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

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

A complete set of parts for the construction of a stereophonic amplifier giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts, suitable for all crystal stereo heads. Ganged Bass and Treble Controls give equal variation of "left" 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.** Carr. 10/-

DEAF AID EARPIECES, High Impedance complete with lead. 15/6.
MICROPHONE INSERTS. Crystal type. 6/9.

TELEVISION RECTIFIERS 250 v. 200 mA. small size. Only 6/9 each.
RE-ENTRANT SPEAKERS. Tannoy, 8 watt, 7.5 ohms. Only 22/6 each. **Parmeko Horn Type.** 10 watt, 15 and 200 ohm matching, 59/6. R.C.A. 20 watt, 15 ohms or 200 ohms, 6 gns.
COLLARO RC 457 4 SPEED MIXER AUTO-CHANGERS. Turnover Studio Pick-up head, for 200-250 v. A.C. £7.19.6. Carr. 4/6.
THE SKYFOUR T.R.F. RECEIVER. A design of a 3-valve Long and Medium wave 200-250 v. A.C. Mains receiver with selenium rectifier. High gain H.F. stage and low distortion detector. Power pentode output. Valve line-up 6K7, SP61, 6V6G. Selectivity and quality excellent. Simple to construct. Point-to-Point wiring diagrams, instructions and parts list, 1/9, maximum building costs £4.19.6, inc. attractive Walnut veneered wood cabinet 12 x 6½ x 5½in.
D.C. SUPPLY KIT. 12 v. 1 a. consisting of a partially drilled metal case, mains trans., F.W. Bridge Rectifier, 2 fuseholders and fuses. Change Direction switch, variable Speed regulator and circuit. For 200-250 v. A.C. mains. Suitable for Electric Trains. Limited number available at 33/9.

R.S.C. BATTERY CHARGING EQUIPMENT

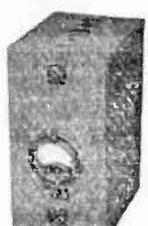
All for A.C. Mains 200-250 v., 50 ccs. Guaranteed 12 months.

ASSEMBLED CHARGERS

6 v. 1 amp.	19/9
6 v. or 12 v. 1 amp.	29/9
6 v. 2 amps.	29/9
6 v. or 12 v. 2 amps.	38/9
6 v. or 12 v. 2 amps. with ammeter	59/9

Above ready for use. With mains and output leads. Carr. 3/6.

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



Assembled 6 v. or 12 v. 4 amps.
Fitted Ammeter and variable charge rate selector. Also selector plug for 6 v. or 12 v. charging. Louvred steel case with stoved blue hammer finished. Fused and ready for use with mains and output leads. **69/9** Carr 5/-. Terms: Deposit 13/3 and 5 monthly payments 13/3.

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

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

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

6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector. 59/9.

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

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

We can quote for special types singly or in any quantity.

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

TOP SHROUDED DROP THROUGH

260-0-260 v. 70 mA. 6.3 v. 2 a. 5 v. 2 a.	17/9
350-0-350 v. 80 mA. 6.3 v. 2 a. 5 v. 2 a.	18/9
250-0-250 v. 100 mA. 6.3 v. 2 a. 5 v. 1 a.	19/9
250-0-250 v. 100 mA. 6.3 v. 3.5 a. C.T.	19/9
250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	25/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	25/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	25/
350-0-350 v. 100 mA. 6.3 v. 4 v. 4 a. C.T. 0-4-5 v. 3 a.	25/9
350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a.	29/9

FULLY SHROUDED UPRIGHT

250-250 v. 60 mA. 6.3 v. 2 a. 5 v. 2 a. Midget type 2½-3-3in.	17/11
250-0-250 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	26/9
300-0-300 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	26/9
350-0-350 v. 100 mA. 6.3 v. 4 a. 5 v. 3 a.	26/9
300-0-300 v. 130 mA. 6.3 v. 4 a. 6.3 v. 1 a. for Mullard 510 Amplifier	35/9
350-0-350 v. 150 mA. 6.3 v. 4 a. 5 v. 3 a.	35/9
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FILAMENT TRANSFORMERS
All with 200-250 v. 50 c/s. primaries 6.3 v. 1.5 a. 5/9; 6.3 v. 2 a. 7/6; 0-4-6.3 v. 2 a. 7/9; 12 v. 1 a. 7/11; 6.3 v. 3 a. 8/11; 6.3 v. 5 a. 17/6; 12 v. 1.5 a twice. 17/6.

OUTPUT TRANSFORMERS

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

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

120 v. 40 mA, 5-0-5 v. 1a.	15/9
90 v. 15 mA. 4-0-4 v. 500 mA	9/9

SMOOTHING CHOKES

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

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

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

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

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R.S.C. A12 STEREOPHONIC AMPLIFIER KIT

A complete set of parts to construct a Stereo amplifier with an undistorted output total 6 watts. For A.C. mains input of 200-250 v. Outputs for matched 2-3 ohm speakers. Sensitivity 130 m.v. Ganged Vol. and Tone Controls. Preset balance control. Full instructions and point-to-point wiring diagrams supplied. Only good quality components and latest high grade valves used. Exceptionally realistic reproduction can be obtained at ample volume for the home, as can be demonstrated in typical surroundings at our County Arcade premises. A really sensational offer.

4 Gns. Carr. and pkg. 5/-

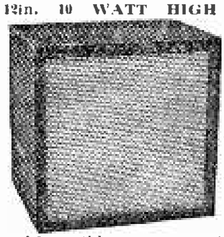
STEREO EQUIPMENT OFFER. Comprising A12 Kit, 2 matched 8in. L/Speakers, and Acos T/O Stereo head with sapphire stylus suitable most pick-ups. **£6.19.6** Carr. 7/7

PICK-UP ARMS complete with Hi-Fi turnover crystal head. Acos GP54. Limited number brand new, perfect, at approx. half price. Only **35/9.**

ACOS CRYSTAL MICROPHONES. Mic40 stand or desk. Listed 45/-. Only **27/9.** 39-1 Stick type. Listed 5 gns. Only **39/6.**

LINEAR L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER. Suitable for use with any record playing unit, and most microphones. Negative feed-back 12 db. Separate Bass and Treble Controls. For A.C. mains input of 200-250 v. 50 c/cs. Output for 2-3 ohm speaker. Three miniature Mullard valves used. Size of unit only 7-5-5½in. high. Guaranteed for 12 months. Only **£5.19.6.** Send S.A.E. for illustrated leaflet. Terms. Deposit **22/6** and 5 monthly payments of **22/6.**

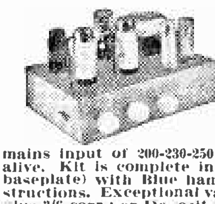
12in. 10 WATT HIGH QUALITY LOUD-SPEAKER IN POLISHED WALNUT FINISHED CABINET



Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only **£4.19.6** Carr. 5/-. Terms: Deposit **11/3** and 8 monthly payments of **11/3.**

12in. 20 WATT HI-FI LOUD-SPEAKERS IN CABINETS. Size 18 x 18 x 18in. Finish as above. Terms: Deposit **17/9** and 9 monthly payments of **17/9.** Only **£7.19.6.** Carr. 8/6.

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



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

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

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 db. down. Frequency response—3 db. 30-30,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ33. Separate Bass and Treble Controls are provided. Minimum input required for full output is only 12 millivolts so that **ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE.** The unit is designed for **CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUTDOOR FUNCTIONS,** etc. For use with Electronic **ORGAN, GUITAR, STRING BASS,** etc. For standard or long-playing records. **OUTPUT SOCKET PROVIDES** L.T. and H.T. for a **RADIO FEEDER UNIT** An extra input with associated vol. control is provided so that two separate inputs such as Gram. and 'Mike' can be mixed. Amplifier operates on 200-250 v. 50 c/cs. A.C. Mains and has output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point-to-point wiring diagrams and instructions. If required cover as for A8 can be supplied for **18/9.** The amplifier can be supplied, factory built with 12 months' guarantee, for **£13.19.6.**

11 Gns. Carr. 10/-

TERMS: DEPOSIT 31/9 and 9 monthly payments of **31/9.**

FULL RANGE OF LINEAR AMPLIFIERS ALWAYS IN STOCK.

R.S.C. PORTABLE GUITAR AMPLIFIERS

Junior 5 watts High Quality output. Separate Bass and Treble 'Cut' and 'Boost' controls. Sensitivity 15 m.v., Twin inputs. High Flux 8in. Loudspeaker 'built-in'. Handsome, strongly made Cabinet (size approx. 14 x 14 x 7in.) finished in satin walnut, and fitted carrying handle. H.P. Terms. Deposit **£1** and 9 monthly payments of **£1.** **£8.19.6** Carr. 7/6

Senior 10 watts High Fidelity output. Separate Bass and Treble 'Cut' and 'Boost' controls. Twin separately controlled high gain inputs so that two instruments such as Guitar and String Bass can be used at the same time. Two loudspeakers are incorporated, a high Flux 12in. for Bass notes and a 7 x 4 in. elliptical for Treble. Cabinet is well made and finished satin walnut. Size approx. 18 x 18 x 18in. H.P. Terms. Deposit **34/9** and 9 monthly payments of **34/9.** **15 Gns.** Both models for 200-250 v. A.C. mains. Carr. 10/-

SPECIAL TRANSISTOR OFFER. TS1 Brimar. Brand new. Perfect. 3 for **10/9**

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

SENIOR MODEL for 12in. speakers, **£6.19.6.** Suitable legs with brass ferrules, **25/-** per set of four.

PLESSEY DUAL CONCENTRIC 12in. 15 ohms HIGH FIDELITY SPEAKER (12,000 lines) with built-in tweeter (completely separate elliptical speaker with choke, condensers, etc.) providing extra-ordinarily realistic reproduction when used with our A8 or similar amplifier. Rates 10 watts. Price only **£5.19.6.**

P.M. SPEAKERS. 2-3 ohm. 2½in. Perdio **21/9.** 5in., **17/9.** 6½in. **16/9.** 8in., **19/9.** 8 x 5in. **25/9.** 10in. **26/9.** 10 x 6in. **29/9.** 12in. **29/11.** 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts. hi-fidelity type. Recommended for use with our A8 Amplifier. **£4.10.9.** 12in. Plessey 3 ohms 10 watts (12,000 lines). **59/6.**

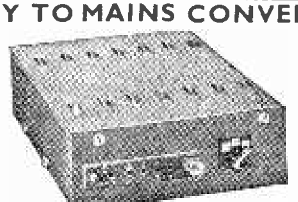
TWEETERS. Plessey 3Ω **19/9.** 15Ω **25/9.**

Hi-Fi CRYSTAL PICK-UP HEADS. (Turnover type with sapphire stylus). HGP59. Standard replacement for Garrard and B.S.R. B.S.R. Ful-fi. Garard GC2, **19/9.** B.S.R. Stereo/Monaural **39/11.**

GL3A MINIATURE 2-3 WATT GRAM AMPLIFIER. For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. 50 c.p.s. A.C. mains. Over-all size 11½ x 2½ x 2½in. Controls: Vol. and Tone with switch. Guaranteed 12 months. Only **59/6.**

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

R.S.C. BATTERY TO MAINS CONVERSION UNITS



Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s is available. **Suitable for all battery portable receivers requiring 1.4 v. and 90 v.** This includes latest low consumption types.

Complete kit with diagrams, **39/9,** or ready to use, **46/9.**

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

R.S.C. 3-4 WATTS A7 HIGH-GAIN AMPLIFIER

For 200/250 v. 50 c/s. Mains input. Appearance and Specification, with exception of output wattage, as A5 amplifier. Complete Kit with diagrams. £3-15.0. Carr. 3/6.

COLLARO JUNIOR 4-speed single player units and Hi-Fi crystal pick-up with turn-over head. **£3.19.6.**

B.S.R. UA8 4-SPEED AUTO-CHANGERS with Stereo/Monaural pick-up head. **£7.19.6.** Carr. 5/-.

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

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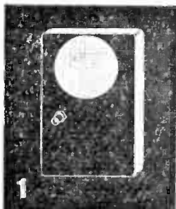
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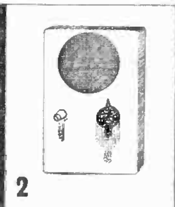
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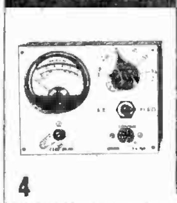
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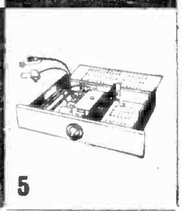
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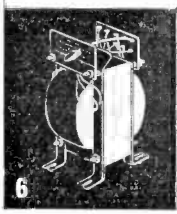
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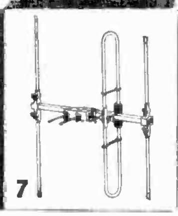
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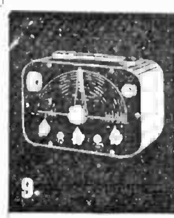
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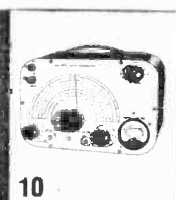
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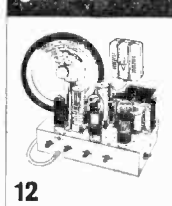
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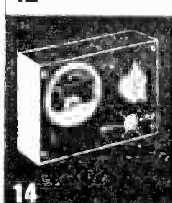
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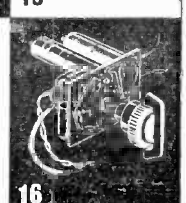
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AMERICAN SEALED RELAYS. Brand new and in Makers original packings. Type A. SIGMA Type 5RJ-761 SPTD. 5,000 ohms. Solder Lug connections. Size: 2¼ x 1½ x 1⅛in. 22/6. each. Type B. HUGHES Pt. No. ME-5092. DPDT. 10,000 ohms. Solder Lug Connections. Size: 2 x 1¾ x 1⅛in. 21/-. Type C. R.C.A. MHX-110. 250 ohms. 4 pole DT. 1¼ x 1in. dia 26.5 v. D.C. 10/6. R.C.A. MHX-84. 300 ohms. 4 pole D.T. 1¼ x 1in. dia 26.5 v. D.C. 10/6. each. COMAR C-3519. 400 ohms. 26.5 v. D.C. SPDT. 3 amps. Size: 2 x 1¾ x 1⅛in. Solder Lug connections. 15/- each.

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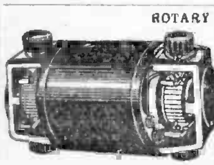

ROTARY TRANSFORMERS TYPE HT. 31 Input: 11.5 volt. Output: 250 volt at 120 mA. **TYPE HT. 32.** Input: 11.5volt. Output: 400 volt at 65 mA HT.31. Ex-Units but tested 35/- ea. HT.32. New in cartons, 20/- ea.

MINIATURE AMERICAN LEAD ACID ACCUMULATORS. 36 volts 20 mA. 4 x 1¾ x ¾in. 3/6 each.

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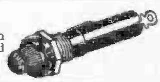

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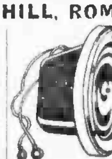

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A must for all Build-it-yourself-Hams. As supplies with all current transistor Kits. Can also be adapted for home phones or Intercom. 2in. diameter. Resistance 70 ohms. ONLY 5/- each.

8 FOOT WHIP AERIALS. Supplied in two sections. No. 1 and 2. ZA/26800 and 26286. Each section collapsible down to 1ft., with retaining wire through each section. Ideal also for radio control, fishing rod or pennant mast. 7/6 complete. New

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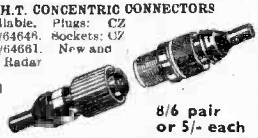
Types available. Plugs: CZ 64662/64658/64646. Sockets: CZ 64647/64659/64661. New and unused. For Radar Stations, TV Link-ups and Atomic research application.



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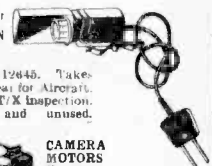

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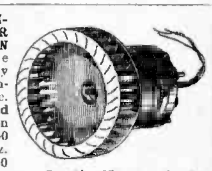

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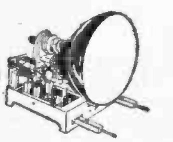

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56 resistances incl. 7 variable controls, 54 condensers incl. electrolytics. Coils, 7 I.F. and R.F. Trans. Mains output, line and frame. Metal rectifier 300 v. at 250 mA. Fuse panel, focus magnet, plugs, sockets, switch, chassis screws, tag strips, etc.; I.F. strip can be separated. Power pack can be used without dismantling. These chassis have been used, but were working when stored. Six-page circuit available with order. Carr. 7/6.

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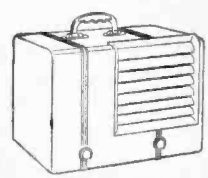
59/6

Ideal for Stereo attachment. Brown/Ivory. Contains 8in. high flux speaker. 3 valves—10F1. 10P14 and U404. Maximum O.P. 4.5 watts. Size 14 x 11 x 6½in. Wonderful for Home, Hall or Amateur Theatricals. SALVAGE. Guarantee. **DEPOSIT 30/-.** Ins., Carr and ten Weekly Payments of 8/-.



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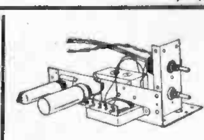

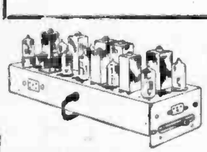

NEW LOOK JUNIOR AMPLIFIER. 49/6. As above but without Cabinet Salvage guarantee. P. & P. 3/6.

PORTABLE AMPLIFIER Mk.D.1. 59/6. Brand new. Latest design Famous manufacturer. Size 7 x 2¼ x 5in. A.C. only. Mains isolated 4 watts output incorporating ECL82 high gain valve. Volume and tone controls. Knobs 2/6 extra. Post, packing and ins., 3/6.

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COLLARO CONQUEST. £7.19.6. 4 speed auto. Incorporating auto and manual controls. Complete with dual turn-over type studio crystal P.U. and sapphire stylus. A.C. mains. 200-250 volts. Post, packing and ins. 5/6.

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Hire purchase Deposit **£1.10.0** and 6 monthly **£1. 3. 4**
Instruction book, 2/6 extra.

FMT1 Power pack kit with ready drilled chassis ... **£2.14. 0**

FMT2 is a new tuner in a modern case, green, which can be used for shelf or cabinet mounting, and has space for power supplies if required. Supplied complete with four EF80 valves ... **£8.12. 6**
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The **JTV/2** and **Mercury 2** are both of the pre-set station type with the addition of BBC and ITA sound. They use the latest "Fireball" turret and the A.F.C. ensures freedom from drift. The **Mercury 2** is for cabinet mounting with external power supplies. The **JTV/2** has the same tuning heart, with power supplies mounted in a case. This again can be used for shelf or cabinet mounting. The **JTV/2** cannot be supplied less power.

JTV/2 Complete with valves and book **£16.14. 9**
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Power pack Kit for Mercury 2 with drilled chassis **£2. 14.0**
Instruction book for all switched tuners, 3/6.

REQUIRED CHANNELS MUST BE SPECIFIED FOR SWITCHED TUNERS

All Jason kits can be supplied less valves. To find the cash price deduct **7/6** for each valve.

A more detailed list can be sent upon request.

ALL JASON TUNERS ARE ON DEMONSTRATION

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All these units are brand new and boxed	Cash	Deposit	Mthly. pmts.	
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COLLARO STUDIO DECK. 3 speed, 3 motors, 7in. spools. Pause control, space for third head, piano keys, counter.
List price £17.10.0 OUR PRICE **£13.10. 0**
Hire purchase Deposit **£3.0.0** and 12 monthly **19. 3**

TAPE AMPLIFIER for Studio deck, with two printed circuit boards, control and input panels, mains and output transformers, complete with knobs and plans, EF86, ECC83, EM84, EZ80, OA81 and two EL84, 4 watts output. Magic eye, Radio and Mic inputs, Mixing and Superimposing facilities, EX L.S. socket, low level output, tone control. Can be used as amplifier.
CASH PRICE **£11.12. 6**
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TAPE RECORDER CASE to house the above deck and amplifier. Two-tone Grey **£5. 5. 0**

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The above recorder complete to PERSONAL SHOPPERS ONLY for **£35. 0. 0**
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900ft 5in. L. play	**18/6**	1800ft 7in. L. play	**35/-**
1200ft $5\frac{3}{4}$in. L. play	**23/6**		

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OC72 Audio	**8/6**	Red spot	Audio ...	**5/-**
OC75 Audio	**15/-**	White spot R.F.	...	**6/-**

The above transistors, except the Red and White spot, are all BRAND NEW MULLARD, and are NOT sub-standard.
Matched pairs of OC71 and OC72 can be supplied at no extra cost.

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OSMOR PRINTED CIRCUIT VERSION

Osmor Rod aerial, **10/-**; IFTs and Osc. coils, **22/6**; Osmor Driver, **11/6**; Osmor Output, **10/6**; Set MULLARD transistors, **61/6**; JB Gang, **11/-**; Trimmer, **1/4**; Set Condensers, **15/-**; Resistors **6/6**; Ardente Volume Control, **10/6**; Ardente W/C, **3/6**; Speaker, **19/10**; OA81 diode, **4/-**; Hardware, **4/6**; Printed circuit, **9/-**; Case and knob, **7/6**; PP4 battery, **2/-**; Press studs, **1/-**. Leaflet, illustrated, giving full instructions and constructional details. **1/9.**

ALL THE ABOVE COMPONENTS IF PURCHASED AT ONE TIME—**£10.0.0.**

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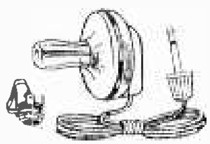
MINIATURE EARPHONES



For Transistor Circuits: Very light weight and easy to wear, cord almost invisible, good quality production of music and voice, complete with miniature plug and socket, ready to use—correct impedance OK for red spot and similar transistors. Crystal **12/6.** Magnetic **10/6.** Post and Insurance **1/-.**

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FOR TRANSISTOR SETS

- Push-pull o.p.t. and driver **17/-** pair.
- 3 IF transformers and oscillator and circuit **23/6.**
- Ferrite aerial with coils for medium and long wave and circuit.
- Smallest possible electrolytics **1/9** each. 1 mfd. 2 mf. 4 mfd. 8 mf. 10 mfd. 20 mfd. 30 mfd. 50 mfd. 100 mfd.
- Smallest ¼ watt resistors **5d.** each all popular valves.
- Miniature 0.1 mfd., **1/-.** 0.05 2.04 **9d.**, valves up to 0.025 **6d.** each.
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- Transistor holder **1/6** each.
- Set of 6 transistors for superhet in original packets guaranteed Mullard OC44. OC45. OC45. OC71 matched pair OC72. **£3.10.0.** the set.
- Set of 6 all first grade includes matched pair **45/-.**
- Oscillator and 2 I.F.—new American High Gain **35/-.**
- Red Spots **3/6.**
- White Spots **3/9.**
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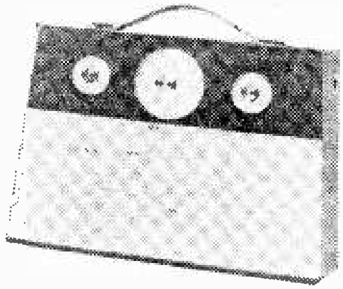
CAR RADIO/PORTABLE



Now available is a modern receiver quite easy to make up and with all the features of sets being sold at twice the price. The circuit has been well tried and proved and will perform well all over the country. Here at Eastbourne, recognised as a bad reception area, performance on the Light, Home and many Continental Stations including Luxemburg, is extremely good. Demonstration Models can be heard at Eastbourne and our London address.

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★ Internal Ferrite aerial litz wound.
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★ High flux elliptical speaker.
★ Size 11 x 8 x 3in. approximately.
★ Easy to follow instructions.
★ 12 month guarantee all components.
★ No technical knowledge required.
★ Service available at moderate charges.

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Money returned in full if parcel not up to expectation and returned unassembled

Price complete, less battery, **£8.19.6.** Battery **3/6,** plus carriage and insurance 7/6.

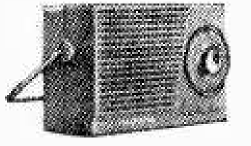
1 Watt Transistor H.F. Amplifier

Four transistors on printed circuit all wired up ready for immediate use—excellent performance on pushkeys or microphone on r.f. input **£4.12.6.** post and insurance 1/6.

Crystal Mike by Acos

Model 39/1, this is ideal for tape or general amplifiers, complete with screened lead. **39/6.** plus 1/- post.

Transistor Set Cabinet

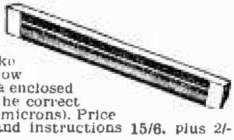


Very modern cream cabinet, size 5½ x 3 x 1½in. with chrome handle, tuning knob and scale. Price **7/6.** plus 1/6 postage and packing.

PHILIPS TRANSCRIPTION UNIT

Philips AG 2009 Record Player, 4 speed. Ideal for the enthusiast. Pick-up arm wired for stereo, fine adjustment on all four speeds. Continuously variable pick-up weight (2.12gms.). Supplied with Philips Hi-Fi crystal type AG3019 for microgroove and 78 r.p.m. Frequency response 30-15,000 c/s. Pick-up lifting and lowering device Individually balanced heavy turntable. Muting switch. Can be used with any amplifier or radio set. Complete with monaural pick-up **£10.10.0.** or **2 gns.** deposit and 20 fortnightly payments of **10/-.** Available also with stereo head, diamond or sapphire stylus. Prices on request

INFRA-RED HEATERS

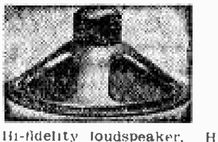


Make up one of these latest type heaters ideal for bathroom, kitchen, bedroom etc. They are simple to make from our easy to follow instructions—uses silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watt element and instructions **15/6.** plus 2/- post and insurance.

Stop Freeze ups!

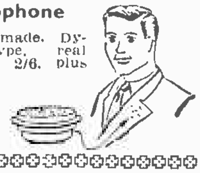
Wrap our heater wire around the pipes in your loft, to prevent freeze-ups. Complete heater wire suitable for up to 50ft. of pipe. **10/-** post free. With instructions.

Speaker Bargain



12in. Hi-fidelity loudspeaker. High flux. Permanent magnet type with standard 3 ohm speech coil. Will handle up to 12 watts. Brand new by famous maker. Price **32/6.** plus 3/6 post and insurance.

Miniature Microphone



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

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TRANSISTOR LOUDSPEAKER POCKET RADIOS

Read these testimonials

Mr. J. Brown, Glamorgan, S. Wales.
"My Pocket 3 arrived safely. I must say I am very pleased with it indeed. It is absolutely wonderful. Thank you very much. I now enclose 16/6 for your conversion parcel to Pocket 4".

Mr. J. Bell, Wolverhampton.
"I am writing to express my satisfaction at the standard of your kit for your Pocket 4 Transistor set and also to state that it has come up to my expectations in regard to performance".

Mr. K. Edwards, Boreham Wood, Herts
"I have completed the assembly of your Pocket 3 and am very pleased with the results".

Mr. N. Elliott, Pontypool.
"I have completed the assembly of your Pocket 4 radio and am pleased to say that it works from the first switching on".

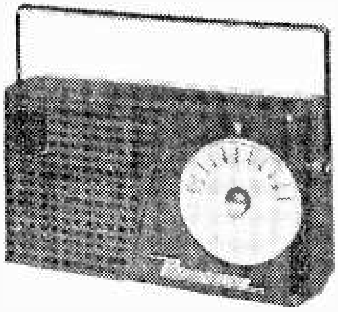
Mr. F. Jackson, Ickenham, Middx.
"I have built the Pocket 4 and am more than pleased with the results".

Mr. G. Bamford, Ramsgate.
"I find this set even better than you claim it to be and most certainly up to your usual standard of quality. I feel that nobody could fail to build it and get results. Even the first-time-ever novice, as your circuit diagrams and instructions are so clear and precise".

Mr. Graham, Birchington-on-Sea.
"Re Pocket 4. I must say that it is all you say of it. The stations roll in, and good volume too".

Mr. T. Bell, London, S.W.11.
"I have made up one of your 55/- transistorised radios and I am very pleased with the results".

Mr. A. J. Simmonds, Welling, Kent.
"I purchased from you a week ago the Pocket 4 Transistor Kit. I put it together last night in 1½ hours on switching on the set. I was right on Radio Luxemburg. I must say thank you, because not only has the set a very attractive appearance, it also behaves fantastically."



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

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

THE ORIGINALS MAY BE SEEN AT THIS OFFICE

Mr. S. Rigby-Jones, South Molton, N. Devon.
"I was delighted to receive my Pocket 4 Transistor set. After I assembled and tested it I was amazed such a small receiver had such good reception".

Mr. E. Balcombe, Manchester.
"I have constructed your Pocket 4 Loudspeaker radio and am delighted with its performance and appearance, for the cost I consider it excellent".

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

Mr. R. Morse, Birchington-on-Sea.
"I knew nothing whatever about radio but I have just made up your transistor set from the kit of parts you sent. I am happy to say that it works perfectly and does all you claim of it. As you see, I live a good way from London, yet the B.B.C. comes in quite loud. The little set can be heard working in a good-sized room. Quite a number of other stations can be heard at night time with quite good separation. Wonderful value for money".

Mr. N. Stewart, Leeds.
"Having completed Pocket 3 Kit, which I received from you I have had results on first attempt. I must say that in my opinion this small transistor radio gives results far better than any other set".

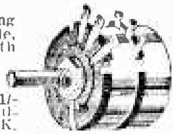
Mr. J. Hayden, Bolton, Lancs.
"I have had great pleasure in buying from you a Pocket Transistor 5. I have built it up and it is perfect".

Mr. R. Dobbin, Ronkswood, Worcester
"I wish to inform you that I am very pleased indeed with the Pocket 5 Transistor Radio set I recently purchased from you. I wish to say the reception is quite good".

A.C./D.C. Multimeter Kit

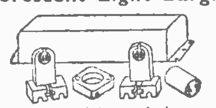
Ranges: D.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000 A.C. volts 0-5, 0-50, 0-100, 0-500, 0-1,000 D.C. milliamps 0-5, 0-100, 0-500. Ohms 0-50,000 with internal batteries. 0-500,000 with external batteries. Measures A.C./D.C. volts, D.C. current and ohms. All the essential parts including metal case, 2in. moving coil meter, selected resistors, wire for shunts, range selector, switches, calibrated scale and full instructions, price **19/6**, plus 2/6 post and insurance.

Morganite Potentiometers



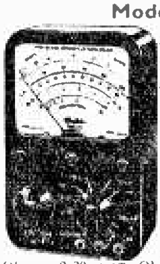
Single and 2-gang types available, standard size with good length spindle, all new and boxed. **Single types**, 1/- each, values available: 5K, 10K, 25K, 50K, 100K, 250K, 1 meg., 2 meg. **Gang type** 3/- each- values available: 5K 5K, 100K - 100K ½ meg. ½ meg, 2 meg 2 meg.

Fluorescent Light Bargain



Kit of parts comprising: choke, two lamp holders, starter holder and starter, 40 watt, **19/6**, 80 watt, **23/6**. Plus 2/- post and insurance.

The Taylor Meter Model 127A



A pocket size meter but with a big scale and a sensitivity of 20,000 Ohms per volt D.C., therefore an ideal unit for television servicing — robustly made and complete with leads and prods—20 ranges as follows:
D.C. current 50 micro-amps. to 1 Amp.
D.C. voltages—0-1,000 volt in seven ranges (25 KV.) with external probe, optional extra.
Volts A.C.—0-2,500 in six ranges.
Ohms—0-20 meg. Ohm in three ranges (self-controlled). Self-contained, 3¼in. movement. Price **£10** or 10/- deposit and 23 fortnightly payments of 10/-. Non-callers add 5/- carriage and insurance.

Yaxley Switches

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

TV Workshop Aids

E.H.T. SEALER. Apply with soldering iron. Stops corona discharge, etc. **2/6** per stick.

POLYTHENE TAPE. 2in. x 10 thou. for E.H.T. insulation up to 25 kV. **5/-** per 12ft. roll.

SPONGE STRIP. ½in. x ½in. For sealing or cushioning, **9d.** per foot.

ANTI-STATIC SCREEN CLEANER For TV tubes and screens. Perspex or glass Delays accumulation of dust. **3/-** per tube.

CELLULOSE CEMENT. Specially prepared for radio gluing of metal, glass, ceramic, wood, fabrics **4/6** per tin.

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EBC41	8/9	PCF80	8/9	1R5	7/6	6X5GT	7/-
EBF80	9/9	PCF82	11/6	1S4	10/6	6/30L2	12/6
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ECC85	9/6	PL83	9/6	3S4	7/6	7S7	9/6
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EF50SYL	7/-	PEN46	7/-	6A7	10/-	12BA6	9/-
EF80	7/-	PEN220A	4/-	6A8G	9/-	12BE6	9/-
EF85	7/-	PENA4	12/6	6AK5	5/-	12C8	7/-
EF86	12/6	TP25	10/-	6AL5	4/-	12J7GT	10/6
EF89	8/9	U10	9/6	6AM5	7/6	12K7GT	6/6
EF91	5/9	U25	13/6	6AM6	4/-	12K8GT	13/6
EF91(BVA)	9/-	U26	10/-	6AQ5	7/6	12K8M	13/-
EF92	6/-	U50	8/-	6AT6	8/6	12Q7GT	6/6
EK32	7/-	UABC80	9/-	6BA6	7/6	12SK7	6/-
EL32	4/6	UAF42	9/6	6BE6	7/6	12SL7	8/-
EL33	14/-	UBC41	8/6	6BH6	9/-	12SM7GT	10/-
EL41	9/-	UBC81	11/4	6BJ6	9/-	15D2	7/9
EL84	9/-	UBF80	9/-	6BW6	9/-	25A6	9/-
EL91	4/6	UCC84	10/11	6C4	4/6	25L6GT	10/-
EM34	9/6	UCC85	9/6	6C5GT	6/6	25Y5	9/9
EM80	9/6	UCH42	9/6	6C6	5/-	25Z4	9/6
EM81	10/6	UCH81	9/6	6D6	5/-	25Z5	8/-
EY51	9/6	UCL82	11/6	6CH6	8/6	25Z6	10/-
EY86	10/-	UCL83	13/6	6F6G	7/-	30FL1	10/6
EZ40	7/6	UF85	9/-	6F6M	7/6	30L15	23/3
EZ41	7/6	UF89	9/-	6F1	14/-	30P4	15/-
EZ80	7/-	UL41	9/-	6F15	14/-	30P12	12/6
EZ81	7/-	UL84	9/-	6J5GT	5/-	30PL1	12/6
FW4/500	10/-	UU6	10/-	6J5M	6/6	35L6GT	10/-
GZ32	11/6	UY1N	12/6	6J6	5/6	35Z4GT	8/-
HL23DD	8/6	UY41	7/6	6J7G	6/6	35Z5GT	9/-
				6K7G	4/-	42	8/-
				6K7M	6/9	50L6GT	8/6
				6K8G	6/6	75	10/6
				6K7GT	5/9	80	8/6
				6K8GT	10/-	142BT	3/6
				6L6G	8/-	210DDT	4/6
				6L6M	9/6	210VPT	3/6
				6L18	11/6		
				6N7GT	7/6		

Best Quality Recording Tape 1,200ft on 7in. spool...21/-; 850ft. on 5¾in. spool...18/6; 600ft. on 5in. spool...13/9; 200ft. on 3¼in. spool...5/3

Collaro Junior
Single 4-speed record player unit in cream, complete with pick-up fitted turnover cartridge. Special Price 75/- each. Post 3/6.

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Alpha range of Guaranteed Bridge Rectifiers, suitable for Battery Chargers 6 and 8 volt output:

2 amp	7/-
3 amp	10/-
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Solid Dilectric Tuning Condenser, Type PVC-2M.
Capacity Aerial 196pF OSC 87pF, size 1 x ½in., **17/6** each.
I.F. Transformers, set of 3 and Oscillator Coil, size of each $\frac{7}{16}$ x $\frac{7}{16}$ x ½in. high, per set **21/-**.
Driver Transformer, Type TR 190/EIP. Ratio 2 : 1+1. Size ⅞ x ½ x $\frac{7}{16}$in., **6/3** each.
Output Transformer, Type TR 190/EIE. Ratio 5.3 to 1, Primary Impedance 240 ohms. Secondary 10 ohms. Max. Output 800 mW. Size ¼ x ⅜ x $\frac{7}{16}$in., **6/3** each.
TSL-Lorenz Loudspeakers. 2¼in. diameter speaker designed for miniature receivers, 4/500mW, impedance 10 ohms. Frequency response 120-14,500 c/s, price **25/-**.

PRACTICAL WIRELESS 6 TRANSISTOR POCKET SUPERHET
Osmor Dualwave Ferrite Rod Aerial 10/-.
Transistor Oscillator Coil and I.F. Transformers, 22/6.
Repanco Transformer TT9, 12/6.
Repanco Transformer TT10 12/6.
J. B. Condenser with Internal Screen and Tapped Spindle **9/6.**
2 Bank 60pF Trimmer 1/10.
Ardente Volume Control with switch 10/6.
Ardente Wave Change switch, 3 position 3/9
Celestion 2½in. 3 ohms speaker 26/8.
Diode OA81 4/-.
Send for our Detailed Price List.

Printed Circuit Version of the PW Pocket Superhet. All components available from stock. Complete Kit £9 15s. 0d. Full detailed shopping list, point to point wiring diagram, fully illustrated 1/6.

Coil Set (Osc. and 3 I.F.T.'s)	22/6
Driver Transformer	11/6
Output Transformer	10/6
Ferrite Rod Aerial	10/-
Printed Circuits	9/-
OO Gang Condensers	11/-
Volume Control V.C. 1545	10/6
Switch	3/6
Hardware Kit	4/6
Transistors (set of 6 plus crystal diode GD9)	70/-
Speaker	19/10
Case	7/6
Complete Kit of Condensers	15/-
Complete Set of Resistances	6/6
Trimmers (2)	2/8

All above components are brand new and are fully guaranteed.

Elstone Multi-Ratio Output Transformer, 10 watts, 23/-.

Westinghouse LW9 Rectifier, 250v, 250mA, 19/6.

WB Stentorian HF 1012, 10 watts, 95/- ea.

BSR Monarch UA8, Record Changer, £6.19.6.

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Repanco FS3 Ferrite Slab Aerial, 7/6.

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Belling Lee Diplexer, L1338. 11/-.

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Repanco TT 10 Push-pull Output Trans.. 12/6.

Linecord 3 way, 0.3A, 600 ohm per ft, 1/9 yd.

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100 Assorted Resistances ¼/1 watt, 12/6 per 100.

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BSR Monarch UA14, in 2-ton Grey, £8.19.6.

Acos Dust Bug for Autochangers, 23/4.

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GRAMOPHONE EQUIPMENT

ALL LATEST MODELS
ALL POST FREE

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GARRARD RC210 (GC8 PU)	£9.19. 6	£1.19. 6	12 of 15/-
B.S.R. UA14 Monarch (TC8 PU)	£7.15. 0	£1.11. 0	12 of 12/-
B.S.R. UA8 Monarch (TC8 PU)	£7. 5. 0	£1. 9. 0	12 of 11/4
B.S.R. UA14 Monarch (TC8S Stereo/LP/78)	£8.18. 0	£1.16. 0	12 of 13/6
SINGLE RECORD PLAYERS			
GARRARD TA (GC8 PU)	£8.10. 0	£1.14. 0	12 of 13/-
B.S.R. TU9 (TC8 PU)	£4.10. 0	£1. 5. 0	3 of £1.5.0
COLLARO RP594 (O, P or T PU)	£9.18. 9	£1.18. 9	12 of 15/-
E.M.I. (Acos Stereo/Mono PU)	£6.15. 0	£1. 7. 0	12 of 10/8
TRANSCRIPTION UNITS			
COLLARO TRP 594 (TX88 PU)	£13.18. 3	£2.16. 3	12 of £1.0.4
GARRARD 4HF (GC8 PU)	£18. 9. 9	£3.15. 9	12 of £1.7.0

Many of the above can be supplied for stereo working. See our Gramophone Equipment List for details.

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	Cash Price	Hire Purchase Deposit	Mthly/Pmts.
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Axiom 110, 10in.	£5. 0. 0	£1.10. 0	3 of £1. 6. 8
Axiom 112, 10in.	£8.10. 0	£1.14. 0	6 of £1. 6. 0
Axiette, 8in	£6.12. 1	£1. 7. 1	6 of £1. 0.10
Axiom 300, 12in.	£11. 5. 9	£2. 5. 9	12 of 16/8
Axiom 400, 12in.	£16. 1. 0	£3. 4. 0	12 of £1. 3. 7
Audiom 60 Bass, 12in.	£9.12. 9	£1.18. 9	12 of 14/6
Trebax Tweeter	£6. 4. 0	£1. 5. 0	6 of 19/10
CX 3000 Cross-over unit	£1.19. 0	—	—
WHITELEY			
HF1016, 10in	£7.12. 3	£1.11. 3	6 of £1. 3. 6
HF1012, 10in	£4.15. 0	£1.10. 0	3 of £1. 5. 0
HF816, 8in	£6.10. 6	£1. 6. 6	6 of £1. 0. 8
T816, 8in	£6. 3. 9	£1. 3. 9	6 of £1. 0. 0
T10 Tweeter	£4. 4. 0	£1. 4. 0	3 of £1. 3. 4
T359 Tweeter	£1.13. 3	—	—
CX3000 Cross-over unit	£1.10. 0	—	—
CX1500 Cross-over unit	£1.18. 3	—	—

LATEST TEST METERS

	Cash Price	Hire Purchase Deposit	Mthly/Pmts.
AVO Model 8	£23.10. 0	£4.14. 0	12 of £1.14. 6
AVO Model 8 with leather carrying case	£27. 8. 0	£5. 8. 0	12 of £2. 0. 4
AVO Model 7	£19.10. 0	£3.18. 0	12 of £1. 8. 8
AVO Model 7 with leather carrying case	£23. 8. 0	£4.12. 0	12 of £1.14. 6
AVO Multiminor	£9.10. 0	£1.18. 0	12 of 14/4
AVO Multiminor with leather carrying case	£11. 9. 0	£2. 5. 0	12 of 17/-
Taylor Model 127A	£10. 0. 0	£2. 0. 0	12 of 15/-
CABY A-10	£4.17. 6	£1. 7. 6	3 of £1. 6. 8
CABY B-20	£6.10. 0	£2. 0. 0	3 of £1.13. 4

Full details of any of the above supplied free on request.

BLANK CHASSIS

The very latest blank chassis for the home constructor. Packed flat for easy and safe posting. These are made in bright tin-plate and have the top plate and four side channels packed flat complete with nuts and bolts assembly. The top plate is completely flat for easy drilling before assembly. Earth connections can be made directly by soldering. Available in the following sizes: 7 x 5 x 2in., 4/9, post 1/3. 10 x 5 x 2in., 5/3, post 1/4. 10 x 7 x 2in., 6/-, post 1/6. 14 x 5 x 2in., 7/3, post 1/6. 14 x 10 x 2in., 8/9, post 1/9.

NEW ILLUSTRATED LISTS

Illustrated lists are available on LOUDSPEAKERS, TAPE DECKS, TEST GEAR, RECORDING TAPES, GRAMOPHONE EQUIPMENT. Any will be sent free upon request.

TAPE DECKS

	Cash Price	Hire Purchase Deposit	Mthly/Pymts.
B.S.R. TD2	£8.19. 6	£1.16. 6	12 of 13/7
COLLARO STUDIO	£12.19. 6	£2.12. 6	12 of 19/5

All carriage free

All components in stock for the Mullard Tape "C" Pre-Amplifier Kit. Fully detailed list available.

"BRAND FIVE" RECORDING TAPES

Double play: 1,200ft. (5in.), 37/6; 2,400ft (7in.), 60/-.
Long play: 900ft. (5in.), 18/6; 1,200ft. (5¾in.), 23/6; 1,800ft. (7in.), 35/-.
ALL POST FREE!

STEREO COMPONENTS

Morganite ganged potentiometers as specified for the Mullard circuits. Log/Anti-Log, 500k, 1 meg., 2 meg. Log/Log, 250k, 1 meg., 2 meg. Lin/Lin, 500k, 1 meg. All 10/6 each.
Denco Chassis for the Mullard circuits. All drilled with printed front panel. Three Valve Stereo Amplifier Chassis, 22/-. Seven watt Stereo Amplifier Chassis, 24/6. Stereo Pre-Amplifier Chassis, 24/6. Set of switches for Pre-Amp, 34/8. Pick-up cartridges. B.S.R. TC8S £2.4.11. Ronette DC284, £3.19.6. Both are turn-over types for Stereo, LP and 78 records. List of all components for Mullard Stereo Designs is available.

JASON FM TUNER KITS

We supply kits for the Jason FMT1, FMT2 and FMT3 (Fringe) Tuners with variable tuning also the JTV2 and Mercury 2 Switched Tuners with TV Sound. We take great care in the making up of these kits to ensure that every item needed is included and we can confidently claim that our kits are the best and most complete available. We are continually receiving compliments on the quality and above all the completeness of our kits. Prices: **Standard Tuners:** FMT1, complete kit, £6.19.6; Power Pack kit, £2.12.6; FMT2, complete kit, less power supply, £8.9.6; Kit with power supply, £10.9.6. **Fringe Tuner:** FMT3, kit less power supply £10.9.6.; Kit with power supply, £12.7.6. **FM/TV Switched Tuners:** JTV2, complete kit, £15.17.6; Mercury 2, complete kit, £11.7.6. (Important. When ordering JTV2 and Mercury 2 kits it is essential to give TV Channel and FM Stations required on Tuner). All kits are supplied complete with valves and instruction manual. Hire Purchase terms available. Fully detailed lists are available free upon request. Instruction manuals available as follows. Data Booklet for FMT1, FMT2 and FMT3, 2/10. JTV2, 3/10. Mercury 2, 3/10. All post free.

MULLARD CATHODE RAY TUBES

ALL AT THE NEW REDUCED PRICES

We supply both Mullard Radiant Screen (Brand new factory fresh) and Mullard Lumenar (Re-builds by Mullard with reclaimed bulbs—all other parts brand new). List of types available with prices and hire purchase terms available.

OUTPUT TRANSFORMERS

GILSON
W0696A, W0696B, 50/6, post 2/-. W0710, W0710/8K, 55/6, post 2/- W0892, 62/3, post free; W0767, 27/-, post 1/6.
PARTRIDGE
P3667, 52/6, post 2/-; P4014, 98/6, post free; P4131, 60/-, post free; P3591A, 99/-, post free; P5202, P5203, 95/-, post free.
PARMEKO, P2641, 27/-, post 1/6. P2643, 41/3, post 2/-.
ELSTONE, OT3, 25/- post 1/6; OT/ML 45/-, post 2/-.

AMPLIFIER KITS

We have full stocks of all components for the Mullard 510, Mullard 2 and 3 Valve Pre-Amplifiers, GEC 912 Plus. Fully detailed list on any of these sent upon request.
Instruction Manuals. Mullard. All Mullard Audio Circuits in "Circuits for Audio Amplifiers", 9/5. GEC 912, 4/6. All post free.

HIRE PURCHASE TERMS

are available on any item. Repayments may be spread over 3, 6 or 12 months. Details as follows: Three months: Deposit 6/- in the £. Service charge 5 per cent but minimum charge of 10/-. Six and Twelve months: Deposit 4/- in the £. Service charge 10 per cent, but minimum charge 20/-

TERMS OF BUSINESS

Cash with order or C.O.D. We charge C.O.D. orders as follows. Up to £3, minimum 2/8. Over £3 and under £5, 1/6. Over £5 and under £10, 1/8. Over £10, no charge. **Postage extra on CASH orders under £3 except where stated. Postage extra on Overseas orders irrespective of price.**

WATTS RADIO
(MAIL ORDER) LTD.

54 CHURCH STREET, WEYBRIDGE, SURREY
Telephone : Weybridge 4556
Please note: Postal business only from this address

www.americanradiohistory.com

Stern's "fidelity" TAPE RECORDERS

BEFORE YOU BUY—YOU SHOULD HEAR THESE RECORDERS. THEY ARE COMPARABLE TO THE MUCH HIGHER-PRICED MODELS

There are no better value-for-money Tape Recorders on the market—if you can't call and hear them, send S.A.E. for fully descriptive leaflets.

MODEL CR3/6 Incorporates the New COLLARO "STUDIO" TWINTRACK 3-speed Deck H.P. Terms: Deposit £7.18.0 and 12 months of £2.17.11. **£39.10.0**

MODEL CR3/T Incorporates the very popular 3-speed COLLARO Mk. IV "TRANSCRIPTOR", Deck which has both upper and lower tape tracks. H.P. Terms: Deposit £9.10.0 and 12 months of £3.9.8. **£47.10.0**

MODEL TR3/Mk.VI Incorporates the New TRUVOX Mk. VI TWIN TRACK 2-speed Tape Deck H.P. Terms: Deposit £9.18.0 and 12 months of £3.12.7. **£49.10.0**

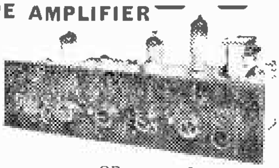
All prices quoted provide for the COMPLETE RECORDER including CRYSTAL MICROPHONE and 1,200 ft. Spool of Tape.

Each Model incorporates the highly successful HF/TR3 Amplifier (described opposite) thus ensuring truly "Hi-Fi" record and playback facilities.

TAPE AMPLIFIERS and PRE-AMPLIFIERS PRESENTED FROM MULLARD DESIGNS

MODEL HF/TR3 TAPE AMPLIFIER

(Mullard Type "A" design)

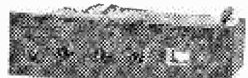


A very high quality Amplifier incorporating 3-speed treble equalisation, using the latest FEROXCUBE POT CORE INDUCTOR. FOR COLLARO-TRUVOX-BRENELL-WEARITE or MOTEK Tape Decks. has GILSEN Output Transformer. Includes separate Power Supply Unit.

KIT OF PARTS **£12.15.0** OR ASSEMBLED **£16.10.0**

H.P. Deposit £3.6.6 and 12 months at £1.4.2.

MULLARD TYPE "C" TAPE PRE-AMPLIFIER—ERASE UNIT



The "Hi-Fi" link to add full tape recording facilities to High Fidelity home installations. Incorporates FEROXCUBE POT CORE PUSH PULL OSCILLATOR and 3-speed treble equalisation by FEROXCUBE POT CORE INDUCTOR FOR WEARITE-COLLARO-TRUVOX-BRENELL or MOTEK TAPE DECKS. Includes separate power Supply Unit.

KIT OF PARTS **£14.0.0** H.P. £3.8.0 Deposit and 12 months £1.4.11. OR ASSEMBLED **£17.0.0**

(Excluding power unit £11.15.0 and £14.10.0 respectively).

FOR THE HOME CONSTRUCTOR SPECIAL 'COMBINED ORDER' PRICES

(a) The COLLARO "STUDIO" TAPE DECK and our Mullard Type "C" PRE-AMPLIFIER and POWER Unit Assembled and Tested...... **£29.10.0**
H.P. Deposit £5.18.0 and 12 months £2.3.3.

(b) As above but TYPE "C" PRE-AMPLIFIER supplied as complete KIT OF PARTS...... **£26.10.0**

(c) The COLLARO Mk. IV TAPE DECK and the MULLARD TYPE "C" PRE-AMPLIFIER and Power Unit assembled, tested...... **£35.0.0**
H.P. Deposit £7, and 12 months £2.11.4.

(d) As (c) but Type "C" as COMPLETE KIT OF PARTS...... **£32.0.0**

(e) The TRUVOX Mk. VI DECK and the assembled Type "C" Pre-amplifier and Power Unit...... **£40.0.0**
H.P. Deposit £8.0.0. and 12 months £2.18.8.

(f) As above but Type "C" as complete KIT OF PARTS...... **£36.10.0**

(g) The BRENELL Mk. V DECK and the assembled Type "C" PRE-AMPLIFIER and POWER UNIT **£46.0.0**
H.P. Deposit £9.4.0. and 12 months £3.7.6.

(h) As (g) but Type "C" as complete KIT OF PARTS **£43.0.0**

(i) THE WEARITE 4A DECK with TYPE "C" assembled and tested...... **£56.0.0**
H.P. Deposit £11.4.0. and 12 months £4.2.1.

(Carriage and Insurance on above quotes 10/- extra.)

EACH OF THE ABOVE CAN BE SUPPLIED IN A PORTABLE CASE THUS FORMING A COMPLETE PORTABLE PRE-AMPLIFIER. FULL DETAILS ON REQUEST.

(a) COMPLETE KIT to build the HF/TR3 Amplifier, together with the COLLARO "STUDIO" DECK. **£25.10.0**

(b) As above but with HF/TR3 supplied ASSEMBLED and TESTED...... **£29.0.0**
H.P. Deposit £5.16.0, and 12 months £2.2.6.

(c) COMPLETE KIT to build the HF/TR3. together with the Mk. IV COLLARO "TRANSCRIPTOR" TAPE DECK...... **£30.15.0**
(£1 extra if we are required to wire up Deck Switch Banks.)

(d) As above but HF/TR3 supplied ASSEMBLED and TESTED...... **£34.10.0**
H.P. Deposit £7.0.0. and 12 months £2.10.5.
(£1 extra if we are required to wire up Deck Switch Banks.)

(e) COMPLETE KIT to build the HF/TR3, together with the NEW TRUVOX Mk. VI TAPE DECK.. **£36.0.0**

(f) As above but HF/TR3 supplied ASSEMBLED and TESTED...... **£39.10.0**
H.P. Deposit £7.18.0. and 12 months £2.17.11.

(g) COMPLETE KIT to build the HF/TR3 AMPLIFIER with the BRENELL Mk. V TAPE DECK.. **£41.10.0**

(h) As above but HF/TR3 supplied ASSEMBLED and TESTED...... **£45.0.0**
H.P. Deposit £9.0.0. and 12 months £3.6.0.

(j) THE WEARITE 4A DECK with assembled and tested HF/TR3 Amplifier including WEARITE Head Lift Transformer...... **£55.0.0**
H.P. Deposit £11.0.0. and 12 months £4.0.8.

Carriage and Insurance on each above is 10/- extra.

Attractive PORTABLE CASE is available to accommodate the TRUVOX or COLLARO TAPE DECKS and we offer it, together with ROLA/CELESTION 10 x 6in. LOUDSPEAKER—ACOS CRYSTAL MICROPHONE—and 1,200ft. SPOOL E.M.I. TAPE—ALL FOR £9.10.0. Carriage and Insurance 5/- extra.

A LARGE PURCHASE OF BRAND NEW AND FULLY GUARANTEED TRUVOX and GARRARD TAPE EQUIPMENT

ENABLES THESE OUTSTANDING PRICE REDUCTIONS

The "MODEL HF/G2R" PORTABLE TAPE RECORDER

(Original Price £33.0.0)

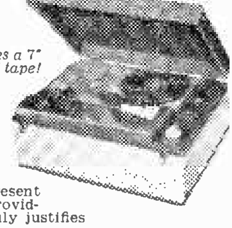
FOR ONLY 22 gns.

H.P. Dep. £4.14.0. 12 months £1.13.9. *(Carr. & ins. 10/- extra).* Incorporates THE LATEST GARRARD "MAGAZINE" TAPE DECK and a HIGH QUALITY AMPLIFIER which is entirely based on the very successful MULLARD TYPE "A" DESIGN and specifically developed to operate the GARRARD DECK. PRICE INCLUDES SUPPLY OF THE GARRARD TAPE MAGAZINE and a 4in. SPOOL of DOUBLE PLAY TAPE. Comprises a Twin Track Recorder operating at 3¾in/sec. speed and providing up to 1 hour 10 mins. playing time. Truly "Portable", weighs only 22 lbs. Outstanding features are excellent performance and simplicity of operation.

The "MODEL TR3/MkIV" PORTABLE TAPE RECORDER

(Original Price £49.10.0

FOR ONLY £36.10.0 *Price includes a 7" spool of EMI tape!*



H.P. Dep. £7.6.0. 12 months £2.13.6 *(Carr and Ins. 10/- extra).* Incorporates the Truvox MkIV Tape Deck. Rola/Celestion 9 x 5 in. Loudspeaker and the Truvox Type "K" Amplifier specifically developed by Truvox Ltd to correctly operate their MkIV Tape Deck. As a result we are able to present a highly perfected tape recorder providing sound reproduction which truly justifies the title "High Fidelity".

A Twin Track Two Speed model operating at 3¾ and 7½ in/sec. speeds and Incorporating Magic Eye Indicator, Safety Button. (Prevents accidental erasure). Ext. Speaker, output, tone and volume controls.

FULLY DESCRIPTIVE LEAFLETS ON ALL OF ABOVE ARE AVAILABLE—BUT PLEASE ENCLOSE S.A.E. AND STATE WHICH LEAFLET IS REQUIRED.

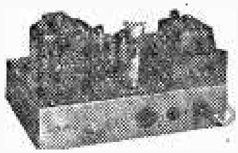
STERN RADIO LTD.

www.americanradiohistory.com

STERN'S MULLARD DESIGNS

Designed by MULLARD—presented by STERN's strictly to specification

COMPLETE KIT OF PARTS— MULLARD "5-10" MAIN AMPLIFIER



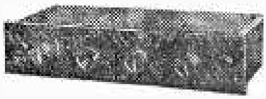
For use with the MULLARD 2-valve pre-amplifier with which undistorted power output of up to 10 watts is obtained. We supply **SPECIFIED COMPONENTS AND NEW MULLARD VALVES**, including **PARMEKO MAINS TRANSFORMER** and choice of the latest Ultra-Linear **PARMEKO** or the **PARTRIDGE** Output Transformer.

PRICE COMPLETE KIT (**PARMEKO** Output Trans.). **£10.0.0**

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

ABOVE INCORPORATING PARTRIDGE OUTPUT TRANSFORMER. £1.6.0 EXTRA

MULLARD'S PRE-AMPLIFIER TONE CONTROL UNIT



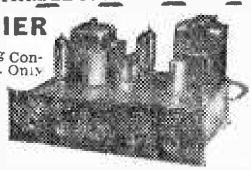
Employing two EF86 valves, and designed to operate with the MULLARD **MAIN AMPLIFIERS**, but also perfectly suitable for other makes.

PRICE COMPLETE KIT OF PARTS **£6.6.0** ASSEMBLED AND TESTED **£8.0.0**

Supplied strictly to **MULLARD'S SPECIFICATION** and incorporating:

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

COMPLETE MULLARD "5-10" AMPLIFIER



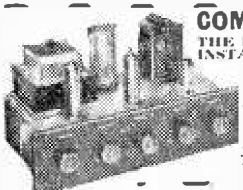
The popular and very successful complete "5-10" incorporating Control Unit providing up to 10 watts high quality reproduction. Only Specified Components and new **MULLARD VALVES** are supplied including **PARMEKO MAINS TRANSFORMERS** and choice of the latest **PARMEKO** or **PARTRIDGE** ULTRA-Linear Output Transformers.

KIT OF PARTS **£11.10.0** OR ASSEMBLED and TESTED **£13.10.0**

HIRE PURCHASE (Assembled Amp. only). DEPOSIT £2.14.0 12 months at 19/10.

ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra

COMPLETE MULLARD "3-3"



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

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

(plus 6/6 carriage and insurance) H.P. Terms: Deposit £2.0.0 and 8 Months at £1.0.0. Complete to MULLARD'S SPECIFICATION including Mullard valves and a **PARMEKO OUTPUT TRANSFORMER**.

STEREO "3-3" MAIN AMPLIFIER

Comprises two MULLARD 3-3 Main Amplifiers on one chassis. Operates with MULLARD STEREO PRE-AMPLIFIER. Output power 6 watts. Inputs for Crystal Pick-up and Radio Tuner.

KIT OF PARTS **£10.0.0** OR ASSEMBLED **£11.15.0**

COMPLETE STEREO AMPLIFIER

Meets the many requests for a low priced but good quality Stereophonic Amplifier. Output power is 4 watts and suitable for Crystal Pick-ups.

KIT OF PARTS **£8.10.0** OR ASSEMBLED **£10.10.0**

RECORD PLAYERS

THE LATEST MODELS ARE IN STOCK, MANY AT REDUCED PRICES

SEND S.A.E. FOR ILLUSTRATED LEAFLET

B.S.R. MONARCH UA8 4-speed mixer Autochanger with Crystal Pick-up.	**£6.19.6**
The **NEW COLLARO MODEL RP594** 4-speed Single Record Player. Studio Cartridge.	**£9.18.9**
The **COLLARO "CONQUEST"** 4-speed Autochanger Studio Pick-up.	**£7.10.0**
The **COLLARO** 4-speed Single Record Player. Studio Pick-up.	**£6.9.6**
THE NEW B.S.R. Model UA12 in Stock. A4 "SPEED" MIXER AUTOCHANGER.	**£8.7.6**
UA12 also available incorporating the **B.S.R. STEREO** Pick-up, plays L.P. and 78 Records.	**£10.10.0**
GARRARD MODEL TA/MkII 4-speed Player fitted high output Crystal Pick-up.	**£8.10.0**
GARRARD MODEL RC/210. Autochanger 4-speeds. High output. Crystal Pick-up.	**£10.10.0**

Carriage and Insurance on each above, 5/- extra.

H.P. TERMS AVAILABLE ON EQUIPMENT OVER £9. DESCRIPTIVE LEAFLETS AVAILABLE FOR ALL EQUIPMENT. PLEASE SEND S.A.E.

PRICE REDUCTIONS

(a) The KIT OF PARTS to build both the "5-10" Main Amplifier and the 2-valve PRE-AMP CONTROL UNIT **£15.15.0**

(b) The "5-10" and the 2-stage PRE-AMP both ASSEMBLED and TESTED H.P. Dep. £3.16.0 and 12 months of £1.7.8 .... **£18.18.0**

(c) The KIT OF PARTS to build the DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT **£21.10.0**

(d) The DUAL-CHANNEL "3-3" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED and TESTED **£25.0.0**

H.P. Terms: Deposit £5 and 12 months of £1.16.8.

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

(f) ONE "5-10" AMPLIFIER and the DUAL-CHANNEL PRE-AMPLIFIER both ASSEMBLED and TESTED **£25.0.0**

H.P. Terms: Deposit £5, 12 months of £1.16.8.

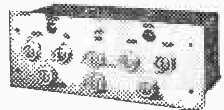
(g) KIT OF PARTS to build Two "5-10" MAIN AMPLIFIERS (incorporating Parmeko Output Transformers and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT **£31.0.0**

(h) TWO "5-10" AMPLIFIERS and the DUAL-CHANNEL PRE-AMPLIFIER CONTROL UNIT BOTH ASSEMBLED & TESTED **£36.0.0**

H.P. Terms: Deposit £7.4.0, 12 months £2.12.0.

Carriage and Insurance 7/6 extra. Prices quoted are subject to £1.6.0 extra for Partridge Transformer.

STEREO PRE-AMPLIFIER



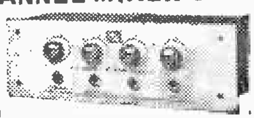
This model incorporates two Mullard 2-valve Pre-Amplifiers combined into a Single unit enabling it to be used for both **STEREOPHONIC** or **MONAURAL** operation. It is designed primarily to operate with our range of **MULLARD MAIN AMPLIFIERS** but will also operate equally well with any make of Amplifiers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

COMPLETE KIT OF PARTS **£21.10.0** ASSEMBLED AND TESTED **£15.0.0**

H.P. £3 Dep. and 12 mths. at £1.2.0

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

MULLARD FOUR CHANNEL MIXER UNIT



Self powered with Cathode follower output. Incorporates Two inputs for MICROPHONES One for CRYSTAL PICK UP and a fourth for RADIO or TAPE

Complete Kit of Parts **£8.8.0**

Assembled and Tested **£10.0.0**

TERMS: Deposit £2 and 12 months at 15/-.

Mk.11 "Fidelity" FM TUNING UNIT

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

A SPECIAL CASH OFFER !!

This very attractive **PORTABLE AMPLIFIER CASE** together with a good quality **GRAM AMPLIFIER** and a matched **P.M. SPEAKER**.

For ONLY **£8.7.6** (Plus 7/6 Carr. & Ins.)

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

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

WE ALSO SUPPLY SEPARATELY—

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

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

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

Dept. P.W. **109 FLEET ST., LONDON, E.C.4**

Telephone: FLEET STREET 5812/3/4

www.americanradiohistory.com

DE LUXE TAPE RECORDER

~~29 gns.~~ OUR PRICE **18 gns.**

Beautifully styled rexine covered cabinet in Red/Beige, with carrying handle. Size: 14½ x 13 x 9½in. Storage space in lid for tapes and mike. Speed 3¾in. per second. Compact set using latest 5-valve amplifier. B.S.R. Tape Deck. 5¾in. standard tape. Fully guaranteed. Ins. and Carr. 12/6. Terms available.

The "STUDIO TWIN"

~~40 GNS.~~ **29 GNS.**

Quality Tape Recorder at amazing low price. 7in. Standard reels. Latest Studio 3-speed Deck, 1⅞, 3¾, 7½ i.p.s. Includes Twin Track reverse counter. Pause control and magic eye recording indicator. Volume and tone control, superimpose switch, 3 watts output. Attractive cabinet in Beige. Size: 19 x 13 x 8in. Fully guaranteed. Terms available. Ins. and Carr. 12/6. Mike 27/6 extra. Tapes 25/-.

DE LUXE TAPE RECORDER CABINET

ONLY **29/9**

Beautifully made Tape Recorder Cabinet. Size: 13 x 10½ x 7in. Covered in two-tone coloured rexine cloth. Stylish design. Carrying handle and detachable lid. Easily adapted to Record Player Cabinet. P. & P. 4/6.

B.S.R. "MONARDECK" £9.9.6
Single speed. 3¾ i.p.s. Uses 5¾in. spools. Size 13 x 8¾ x 2½in. P. & P. 4/6.

COLLARO "STUDIO" TAPE DECK £12.19.6
3 motors, 3 speeds. Takes 7in. spools. Press-button controls. P. & P. 5/6.

REPLACEMENT, REBUILT

TV TUBES!

12 MONTHS' GUARANTEE

Terms available over 10 weeks

Carr. and Ins. 15/-

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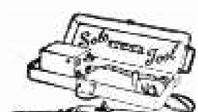

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R.P.1. 2 control, portable cabinet. Impeccable finish in smart two-tone colour scheme. Size 14½ x 6½ x 14½in. P. & P. 4/6.

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WITH EXTENSION SPEAKER CABINET

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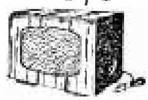

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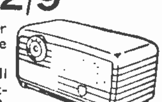
only **2/9**



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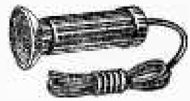

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Relda's Pick-up Coils require no Electric connections—offer virtually unlimited use.

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These miniature Hi-Fi phones use high quality permanent magnetic speakers with regulated voice coil. The soft rubber ear moulds give correct spacing for optimum acoustic load. Each unit has a built-in miniature Hi-Fi transformer to ensure the finest music and voice reproduction. Supplied free is a small transformer unit which steps impedance up to 4000 ohms. Only 15/- P. & P. 2/6.

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1in. dia. 70-6000 c/s response. Brand new. ONLY 6/6. P. & P 6d. 2 for 12/-.

PORTABLE TRANS/RECEIVER No. 18.

A self-contained Trans/Receiver for Telephone and C.W. Range approx. 10 miles. Freq.: 6-9 Mc/s. (50-33.3 metres). Valve line-up: 3 ARP-12, 2 AR-8, 1 ATP4. Complete with aerial, H.T. and L.T. meter and all accessories. Weight 20 lbs. Size 8 x 10 x 17in. Only 80/-. Carr. 10/-.

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6-9.1 Mc/s., 60/-. P. & P. 3/6 ea

ONLY 60/- Per Set P. & P. 4/- Batteries 20/- per Set

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TWO FOR £6 Post Free.

Consisting of trans-receiver covering 7.4-9 Mc/s. range up to 10 miles, complete with 5 valves, headphones, microphone, junction box and 8ft. telescopic aerial. Only 120 v. and 3 v. dry battery.

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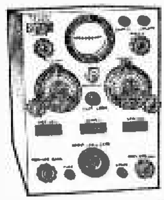

This basic scope represents one of the finest buys we have ever made! Contains Brilliance, Focus, Gain and 2 speed time base controls. Separate X plate terminals. Signal Generator modulated at 2 frequencies over 150-255 Mc/s. Complete with 12 valves. VCR 139A tube, internal A.C. power pack, and complete circuit and technical details.

ONLY 97/6 Carr. 12/6

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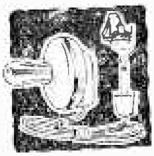
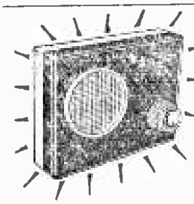


A really sensitive dynamic earphone of exceptionally fine quality. Provides clear reproduction of music as well as speech. Fully Guaranteed and complete with transparent ear insert, 3 feet cord, sub-miniature plug and socket.

CR-5 High imp. .. 12/6 Post
MR-4 Low imp. .. 10/6 1/- each

NEW! TRANSISTOR RADIO With Miniature Speaker.



Simple instructions enable anyone to build this miniature radio. Gives reception over the entire broadcast band. Each kit is supplied with all latest miniature parts including: ★ two transistors ★ ferrite rod ★ speaker ★ coloured plastic case ★ step by step illustrated instructions. Size 4 x 3 x 1in. ONLY 27/6 P. & P 1/6. Battery 1/- ex.

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A really high-speed precision motor with 101 uses: Model control, fan, saw, buffer, etc. Operates from standard battery (3-6 volts). Complete with full instructions at only 5/- each. Post 1/-. 2 for 10/-, post free.

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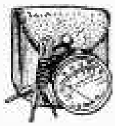
POCKET VOLT TEST METER



Two D.C. ranges: 0-250 v. and 0-25 v. Complete with test prods. and leather case. Very limited quantity. Only 12/6. P. & P. 1/6.

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

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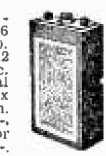

2 volts 16 A.H. (unspillable). Ideal for 6 and 12 volts supply, etc. Brand new. Original cartons. Size 4in. x 7in. x 2in. 5/6 each. P. & P. 1/6. 3 for 15/-. P. & P. 3/6. 6 for 27/6. P. & P. 5/-.

WIRELESS SET No. 19 MK. II

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

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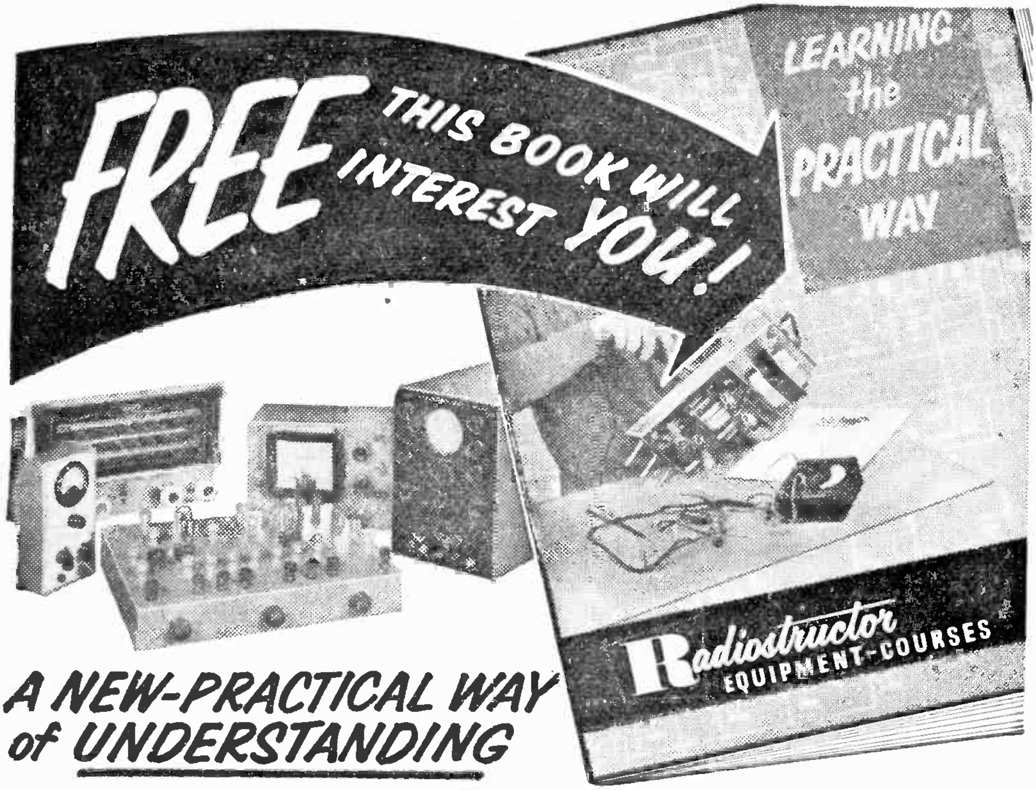

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Practical Wireless

VOL. XXXVI, No. 648, FEBRUARY, 1961

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Contents

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

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COMMERCIAL BROADCASTING

EVER since commercial radio transmissions were first directed at this country from stations on the Continent, there have been periodic comments in the press and elsewhere on the possibility of introducing sponsored radio broadcasting in the United Kingdom. In our editorial in the October issue, we mentioned an announcement by the Government of the setting up of an inquiry into the future of sound and television broadcasting in this country; this announcement has renewed speculation as to whether commercial radio will soon make its appearance. Those who favour its introduction seem, for the most part, to visualise the eventual establishment of one station for every 50,000 people, perhaps with the use of medium waves by day, and Band II by night. The stations would derive their revenue from advertisements, in much the same way as commercial television.

Upon consideration, this clamour for commercial radio seems to be based on a desire for novelty alone. It appears to us that there is insufficient material and talent for the success of local broadcasting to be ensured. In other countries, even where there is no national network, small local stations have generally had to reduce their standards until programmes have eventually degenerated into an output of almost continuous music, with breaks only for advertisements and news summaries.

It may be argued that because the major commercial transmitter on the Continent with programmes directed at the British Isles is a highly successful concern, then similar sources of entertainment operating in this country would also be a success. This is not necessarily a valid argument: if the number of commercial stations is increased, the popularity of the broadcasts may well deteriorate.

The introduction of sponsored local broadcasts could have serious effects on other advertising media—the press for example. Many small firms would be forced to purchase time on the radio programmes and would have no spare funds to continue their advertising in the local evening newspaper.

We are of the opinion that commercial radio would not improve, but detract, from present programme standards. It is generally admitted that to attract and retain a large listening audience, programme quality must be degraded—commercial television is often cited as evidence of this. The BBC at present provides a balanced service which caters for most tastes—even for minorities. By the nature of its source of revenue, a sponsored network cannot transmit programmes which attract small audiences. Only if the revenue of the stations were derived from the small audience concerned could suitable programmes be transmitted and the method for deriving such an income might well cause difficulties.

If there is an increasing demand for some form of local transmission system, and such a system is ruled to be impracticable, the way out of the *impasse* would seem to be to increase the regional activities of the BBC. Naturally, some modification of the present regional divisions would be necessary, but some form of local broadcasting could be achieved without the attendant disadvantages and possible dangers of a sponsored system.

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

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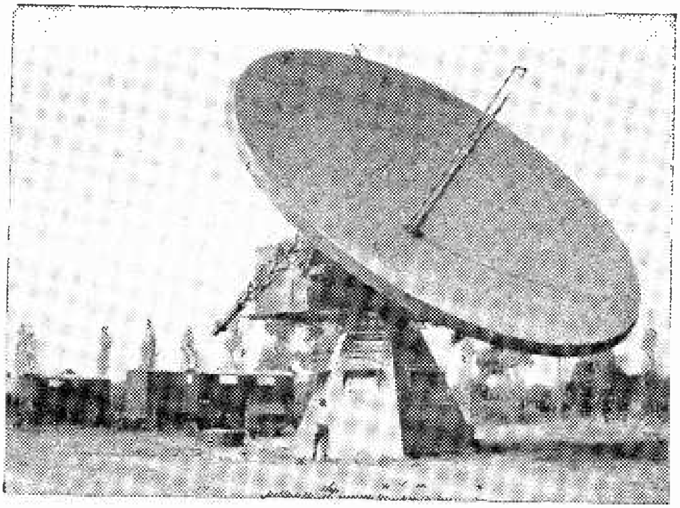
Round the World of Wireless

POTENTIAL AND CURRENT NEWS

Broadcast Receiving Licences

THE following statement shows the approximate number of Broadcast Receiving Licences in force at the end of October, 1960, in respect of wireless receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland. The numbers include Licences issued to blind persons without payment.

Region	Total
London Postal	745.124
Home Counties	700.802
Midland	513.769
North Eastern	566.763
North Western	483.573
South Western	419.036
Wales and Border Counties	251.622
Total England and Wales	3,680.689
Scotland	419,363
Northern Ireland	126,042
Grand Total	4.226.094



The 45ft radio telescope which was used during investigations by the Royal Radar Establishment at Malvern into the roughness of the Moon's surface. Future investigations may possibly include Venus, Mars and Jupiter. An English Electric Valve Co. Ltd. M543 2½MW Magnetron is used in this equipment.

Manuals for Technical Colleges

AN issue of service manuals covering Philips' current radio and television range is to be made to all of the main technical colleges throughout Britain.

Until now, while manuals and other technical information have normally been supplied to technical colleges on request, there has been no "matter of course" issue.

Philips' offer was made direct to the Ministry of Education, and colleges receiving the manuals are being asked to treat the information being made available as confidential and to use it only for academic purposes.

Conference on Microwave Measurement Techniques

THE Electronics and Communications section of the Institution of Electrical Engineers is organizing a conference to discuss recent advances in microwave measurement techniques to be held in the Institution building, Savoy Place, London W.C.2., from the 6th to the 8th September, 1961. The topics to be discussed will include: The measurement of microwave power, frequency, Q factor, impedance, admittance, reflection coefficient and noise.

The organizing committee will welcome the submission of papers for consideration for inclusion in the proceedings of the conference, and invite intending authors to submit, as soon as possible, and preferably not later than 15th February, 1961, abstracts of not more than 250 words for preliminary consideration.

It is proposed to associate with the conference an exhibition of microwave measurement techniques.

Traffic Radars

THE portable electronic device which measures the speed of passing vehicles made by Marconi's has been ordered for the police forces of fifteen counties in Great Britain. The equipment is now being evaluated by police authorities abroad and Australia, Canada, South Africa and Singapore, are amongst the first countries to try this new apparatus.

In the past two years Marconi's have demonstrated the portable electronic traffic analyser to police authorities and local government departments in Portugal, Italy, France, Austria, Belgium, Holland and Switzerland.

The first company in Britain to develop a traffic radar device, Marconi's have received in the last twelve months orders for the apparatus totalling about £14,500.

Appointment

THE BBC announces the appointment of Mr. J. D. MacEwan, B.Sc., A.M.I.E.E., A.M.Brit.I.R.E., as Engineer-in-Charge, Television, Birmingham, in succession to Mr H. G. Whiting, A.M.I.E.E., who recently became Regional Engineer, Midland Region.

Mr. MacEwan joined the Operations and Maintenance Department of the BBC in 1947 and after service in Glasgow and Edinburgh he became a member in 1953 of the staff of the BBC's Television Outside Broadcast unit covering Scotland and north-east England. During the following year he was transferred to the television staff in Glasgow.

In 1956 Mr. MacEwan was appointed Senior Lecturer (Technical Operations) at the Corporation's Engineering Training Department, Wood Norton, Worcestershire, which post he

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has held until taking up his new duties in Birmingham on 14th November, 1960.

New Zealand's First Broadband Microwave Telephone System

NEW ZEALAND'S capital, Wellington, and the country's largest city, Auckland, are now linked by a 262-mile microwave multi-circuit telephone system supplied by Standard Telephones and Cables Limited, London.

The system may be used, with certain additions, to carry television programmes at a later date, using the existing buildings and equipment.

At present the link has one two-way radio channel capable of carrying 600 simultaneous telephone calls. There is also an identical "standby" radio channel to which the telephone traffic is switched automatically in the event of severe fading or excessive noise on the "working" channel.

The radio terminals for the new 4,000Mc/s radio link are at Hamilton and Palmerston North: these are linked by cables to Auckland and Wellington respectively. There is also a spur connection between Urenui, on the main link, and New Plymouth, on the west coast.

Between Hamilton and Palmerston North eight repeater stations amplify the broadband block of 600 telephone channels. The incidence of earthquake shocks and high winds called for special care in the construction of the masts at these stations. This type of communication system uses a transmitter power of only 5W, concentrated into a very narrow beam. Consequently, the alignment of the aerials must remain correct in all circumstances to maintain the quality of the link.

The automatic supervisory equipment for the microwave link uses a VHF radio system also supplied by STC. This supervisory channel enables faults at repeaters to be reported and identified at the terminal control stations: it also allows the control stations to interrogate each repeater for checking its operational condition.

Sound Reinforcement System

THE contract for an installation at the Aldwych Theatre, London, and covering the provision of a comprehensive sound reinforcement system, a dressing call system, programme monitoring system, bar interval signals and staff location has been given to RCA Great Britain Ltd.

The object of the sound reinforcement system is to produce sound effects and some incidental music, and not to amplify actors' voices from the stage. The system provides for inputs from remotely controlled tape decks, one disc player and three microphone channels. These six inputs are fed into a patch panel which incorporates input volume controls and switching to enable the six inputs to be pre-selected into four outgoing channels in any combination.

The main/call programme system has some 30 points, and each is so arranged that the programme volume can be altered to zero, but no control over paging calls is possible. The programme is picked up by a single microphone on the circle front, and paging is done from the prompt corner, and the circuit, being normally "dead", is actuated by a push-button on the microphone. Since programme monitoring is continuous, the action of paging automatically reduces the programme level to a pre-set point.

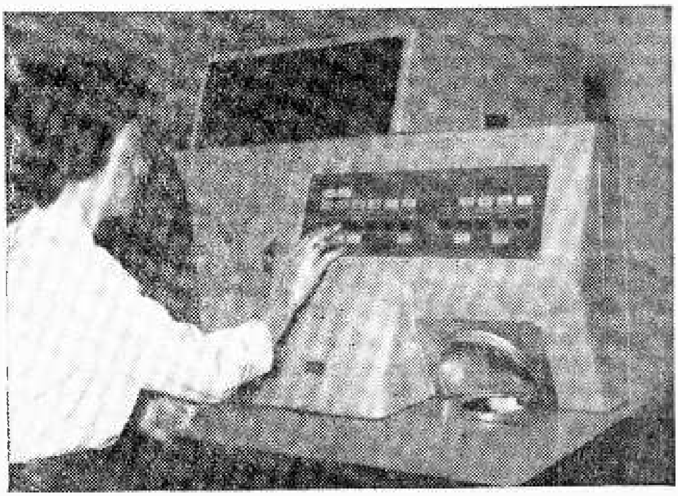
The bar interval signals also use the paging circuit, and by depressing an additional button the backstage paging is cut off and 10 front-of-house speakers are introduced, conditions reverting to normal when the button is released. The staff location system also uses the paging circuit, and is done from the stage door, but the prompt corner microphone has, of course, overriding facilities.

VHF Sound Broadcasting Station

THE BBC has placed contracts with British Insulated Callender's Construction Co. Ltd. for the supply and erection of the 500ft mast to carry the aerials, and with F. R. Hipperson and Son Ltd., for the construction of the building for the new Oxford television and VHF sound broadcasting station to be built near Beckley, some four miles north-east of the city.

This is one of several low-power stations which the BBC is building to extend and improve the coverage of its television and VHF sound servcies.

The Oxford station will improve television reception for about a quarter of a million people in the area including Bicester, Thame, Abingdon and Witney. It will also extend the VHF sound service to more than a quarter of a million people, including those in Swindon, and will give improved reception for a further quarter of a million people. It is expected that the station will be completed in about 15 months' time.



An operator actuating the controls of the reading console of the Solartron ERA (Electronic Reading Automaton). The tally roll on the right-hand side has been read by the machine.

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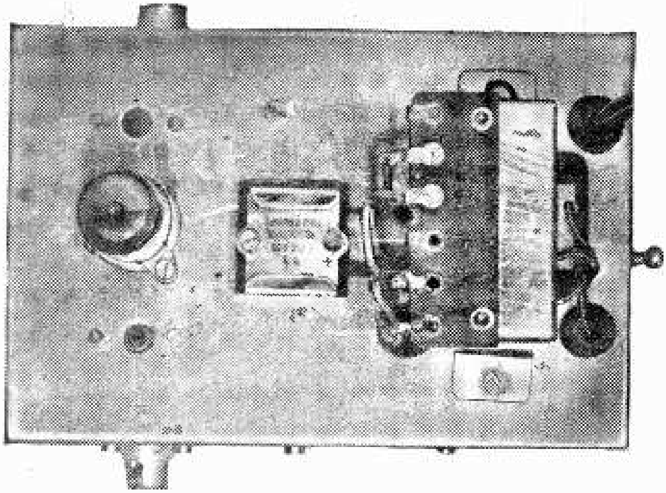


Of course, the use of high gain, low noise valves must be accompanied by the use of the optimum aerials for the particular site: a signal must be present at the input of the receiver before it can be amplified. The best aerial for a particular location is not always the most complicated array: much depends on local conditions, particularly upon the incidence of reflections which give rise to in-phase and out-of-phase effects. Thus, in fringe areas, it is extremely important to test out various aerial arrays, or at least, move the available one around until a comparatively strong signal is found. The use of a low loss downlead is also a necessity which is seldom appreciated; the normal downlead can give rise to sufficient losses to reduce the signal reaching the set to negligible proportions. A low loss downlead, while more expensive, is essential.

a BAND II Pre-Amp

A USEFUL ADDITION TO RECEIVERS FAR FROM THE TRANSMITTER

THE coverage of the BBC's F.M. may now be said to range from "satisfactory" to "excellent" in most parts of the country. However, in certain areas, perhaps because of local conditions, reception is difficult or almost impossible using conventional techniques.

Initially, if signals are weak, it would seem only necessary to use a sufficient degree of amplification. However, upon further consideration, it is realised that the limit to amplification is set by the signal-to-noise ratio: "noise" in this context refers to any unwanted signals which are picked up with the radio signals and amplified with them. These noise signals may proceed through the ether or be caused by the random movement of electrons in the first valve of the receiver. The current flow from the cathode of this valve to the anode and any other electrodes is not steady because it is composed of negative charges (electrons) and the quantity of electrons is not constant. The effect is a change in anode current and this gives rise to spurious signals in the output. The noise voltages are only of appreciable magnitude in the first stage where they can become comparable with the signal voltages. It can therefore be seen that one of the limiting factors in the amplification is the choice of a low-noise valve for the first stage in the receiver.

Cascode Circuit

The standard input circuit which is employed is the "cascode" and this consists of two triode valves in series. The first triode operates as a neutralised, grounded cathode amplifier and the second as a grounded grid amplifier. Triodes are used to reduce the number of active electrodes and thereby reduce noise and, as the same H.T. current flows through both of them, noise is still further reduced. In this pre-amplifier the cascode valve used is the PCC89, a comparatively recent introduction.

General Design

When designing this pre-amplifier various circuits and valve types were reviewed but as previously stated a cascode circuit was chosen with a frame grid valve for low noise and high gain.

One of the problems which arose in the design of this pre-amplifier is worthy of note: whilst it is possible to design a circuit and unit which will give some improvement in most locations it is virtually impossible to make a design to give optimum results with *every* receiver and aerial system. Naturally, the input circuit of the pre-amp tends to be the most critical as regards losses and care should be taken to avoid unnecessary losses.

Circuit Analysis

The circuit employed is conventional. The input is designed for 75Ω coaxial cable but cables of other impedance or balanced cables could, no doubt, be employed with suitable alterations to the input circuit.

Coils L2 and L4 are the input and output tuned coils and L1 and L3 are their associated aerial and output coupling coils respectively. Bias for the first triode is provided by R2 in the cathode circuit and this triode is neutralised by the two capacitors C1 and C2. These two capacitors form two arms of a bridge circuit, the other two arms being the inter-electrode capacitances of V1. Capacitor C2 is made variable so that the bridge circuit can be balanced to give lowest noise. From the anode of V1 the signal passes to the cathode of V2 via the inductance L5 which is adjusted for best results. As previously mentioned the grid of V2 is earthed but only so far as R.F. is concerned and this decoupling is achieved by capacitor C6. Resistors R5 and R3 form a potential divider across the H.T. supply to the valve for biasing purposes. It must be emphasised here that the capacitor C6 must be wired with short leads, otherwise the combination of capacity and inductance may give a resonance resulting in ineffective decoupling.

H.T. Voltage

The H.T. used is not critical and can have a voltage of about 140-180: for highest gain the voltage should be in the region of 180. As might be expected, the decoupling capacitors used in the circuit and their wiring have a large bearing upon the results obtained. The associated leads *must* be made as short as possible and it is best if the "earthy" leads of these capacitors are taken to a common point as indicated on the circuit diagram. This common point can be the metal spigot of the valveholder. The spigot is then wired to chassis by the shortest route, probably to a soldering tag underneath a bolt used to secure the valveholder.

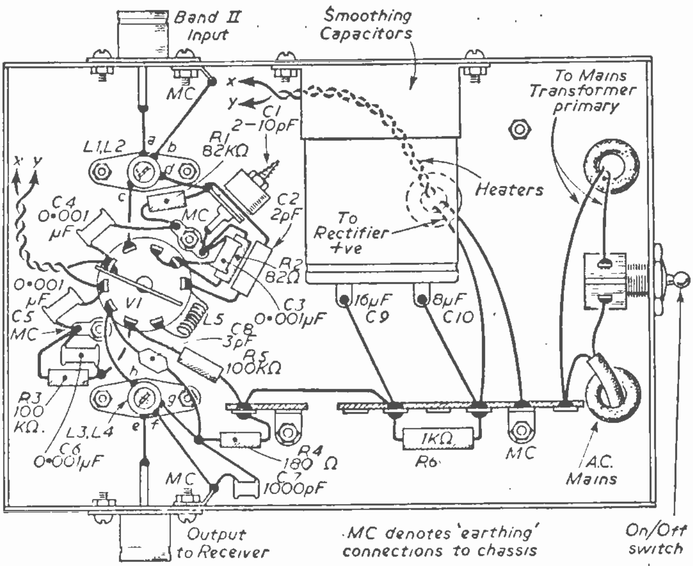
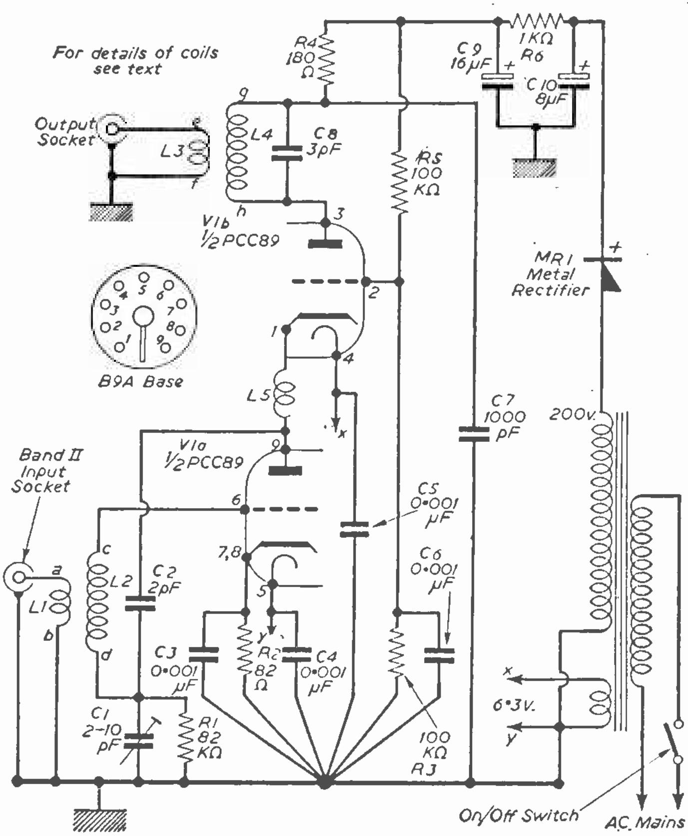


Fig. 1.—Underchassis component layout.



Constructional Details

The construction of this pre-amplifier is not unduly critical but the layout given in the diagrams has been proved to give good results and should be used. The chassis is a box type about 10in. x 6in. x 2in. but these dimensions are not critical and will depend to some extent on the parts employed and on the chassis available.

Coils

The coils are wound on small polystyrene formers with purple coded dust cores. No spacing is employed between turns and the ends of the winding are fixed to the formers with cellulose cement. The coupling windings are wound on a suitable former slightly larger in diameter than the tuned windings so that they

Fig. 2 (left). — The simple circuit employed in this pre-amplifier.

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may be slipped over them before the tuned windings are soldered into circuit.

When final adjustments are made, and the optimum positions of the coupling coils have been found, they may be cemented lightly in position. Coils L2 and L4 may be wound with 18-22s.w.g. bare copper or tinned copper wire. Alternatively, the wire used may be 22-26s.w.g. copper, enamelled or DCC.

Inductance L5 is wound with 22-26s.w.g. copper wire, enamelled or DCC. and on a ⅛in. diameter former. It is wired between pins 9 and 1 on the valveholder.

obtain a transformer with a suitable heater winding rating it should be remembered that many converter transformers rated at 6·3V at 1 or 2A give about 7V when the total load is only 0·3A—the winding resistance is comparatively high. The H.T. smoothing is by R6, C8 and C9. The value of R6 is not critical and may be adjusted when tests are made to give the optimum H.T. voltage. The values of C8 and C9 are also not critical but should be at least 8μF. As the H.T. consumption is low, a small metal rectifier can conveniently be used and a contact-cooled type is ideal. The rectifier should be rated at about 30mA.

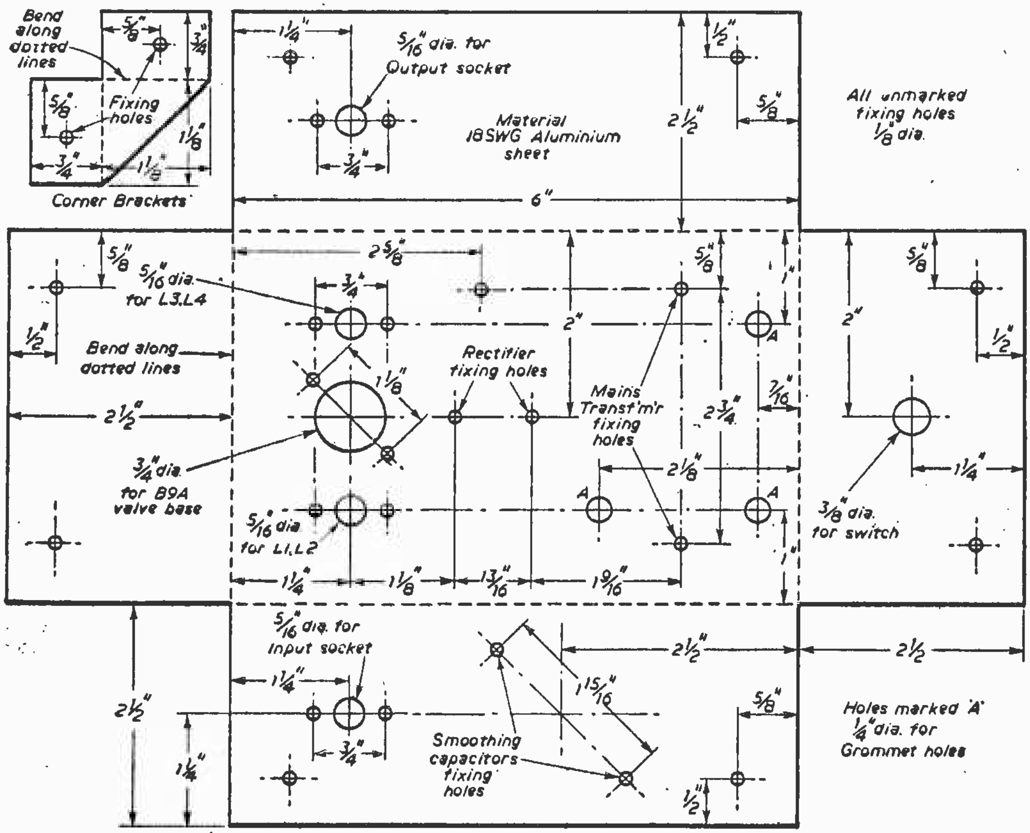

Fig. 3.—The drilling dimensions for the aluminium chassis (the details of the corner brackets are shown in the top left of the diagram).

Power Supply

The H.T. circuits of the power supply employ half-wave rectification for convenience. The transformer used is of the type commonly sold for use in the construction of television converters. A tapped primary is not essential provided the correct rating is obtained for the local mains voltage. The H.T. secondary winding should be rated at about 150-200V r.m.s. at 30mA. The heater winding should give 7·2V at 0·3A if the valve heater is to be run correctly. However if it is difficult to

Valve Connections

The input triode of the PCC89 has two cathode leads. Pin 7 should be wired, at the valveholder, to pin 8. This reduces the effect of the inductance of the cathode lead of the input triode and results in improved performance. It should be noted that the triode connected to pins 9, 6, 8 and 7 should be used for the input and the one connected to pins 3, 2 and 1 for the output as the valve was designed for this arrangement.

(To be continued)

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Crystal Controlled C.W. TRANSMITTERS

By G3OGR

THOUGH a variable frequency oscillator is often used to control the operating frequency of a transmitter, crystal control has the advantage of simplicity. The main disadvantage of crystal control lies in the fact that the transmitter is confined to one or more fixed frequencies, according to the type of circuit, and number of crystals. To some extent this limitation can be overcome by calling for contacts, instead of replying to calls from other transmitters. When answering a call from another station, it is usual to net the V.F.O. on that station's carrier, and reply on his frequency. With crystal control it is unlikely that a crystal will fall on the correct frequency. Therefore a call can be made, and an answering station can net on the crystal frequency. With this method of working, many satisfactory contacts can readily be made.

One-Valve Transmitter

A circuit suitable for a one-valve transmitter is shown in Fig. 1. This will operate successfully with almost any valve. For a fairly good output, a power valve such as a 6V6, 6L6, 6F6, 6BW6 or any similar type will be satisfactory. A 6L6 may easily be run at up to 15W input, which is a very useful level. If more output is required, a single 6146 can be run with an input of 50W or more. With a given valve, the maximum input will depend largely on the power supply. It is, of course, necessary to avoid over-running the valve, but on the other hand good outputs can be obtained with an H.T. voltage much lower than the maximum for the valve.

Such a transmitter is extremely easy to start working, and can be run from even a receiver type power pack, if necessary. It is thus excellent as a standby, or as a simple unit with which to begin working while a more elaborate transmitter is being constructed. It is unlikely that more than 50W input will be required, even for long distance working, and the 6146 R.F. power valve mentioned can then be run from an H.T. line of about 400V, with 10k for R1, and 47k for R2. With other valves, R1 and R2 may be modified to obtain a suitable screen grid voltage. Or a 50k or similar resistor, with a movable clip, can be used. The screen grid is then fed from the clip, which is adjusted to obtain a suitable voltage. When using a relatively low H.T. voltage the screen grid can be run directly from the H.T. line.

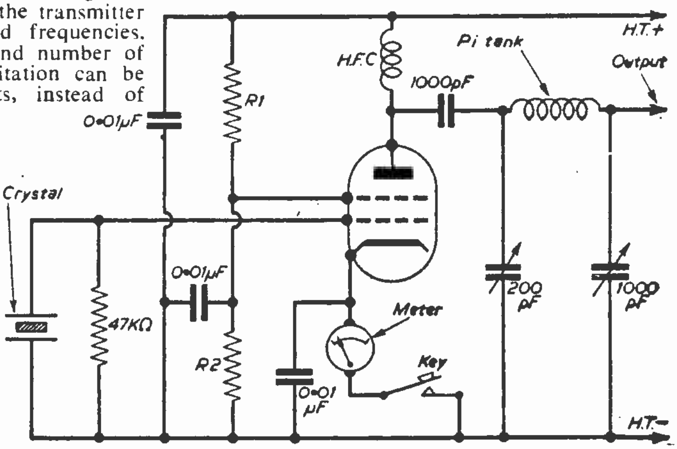

Fig. 1.—Crystal controlled one-valve transmitter.

For the 3·5Mc/s band, the π-tank can have about 36 turns of 18s.w.g. or similar wire, on a ribbed former about 1¼in. in diameter. For the 7Mc/s band, 16 turns will suffice. For other than small power, the 200pF condenser should be a transmitting type. The 1000pF condenser does not need to have widely spaced plates, and may conveniently be obtained by wiring the two sections of a 500pF

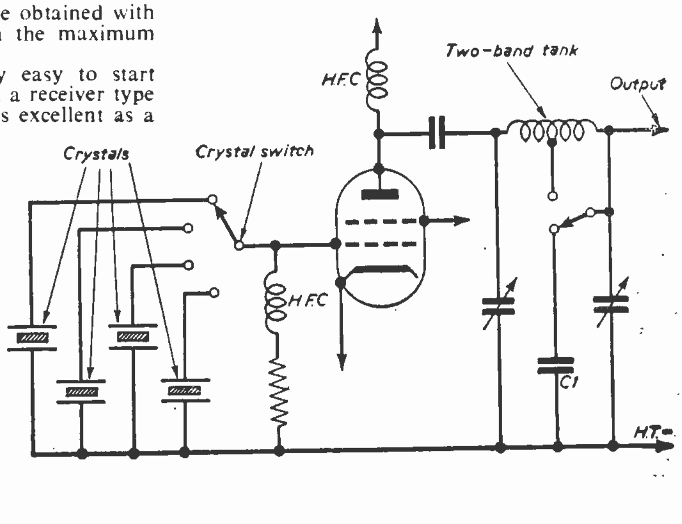

Fig. 2 (right).—Crystal and output tank switching.

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or similar 2-gang receiver tuning condenser in parallel.

For working on one band, a fixed coil can be used. For two or more bands, plug in coils may be provided, and changed while changing crystals. For working the various crystals in one band, the same tank coil is retained. The 200pF condenser is adjusted to obtain a current dip on the meter. If this dip indicates less input than required, the 1000pF condenser is adjusted to a lower value to increase loading, and the 200pF setting modified as necessary to restore the current dip, which will then be higher.

Crystal and Tank Switching

Though crystals can quite easily be changed in a holder, it is an added convenience to fit a switch, as shown in Fig. 2. Immediate operation upon any of the crystal frequencies is then possible, with only slight re-adjustment of the tank tuning condenser. A H.F. choke may also be included, as indicated, and can give a slight increase in efficiency.

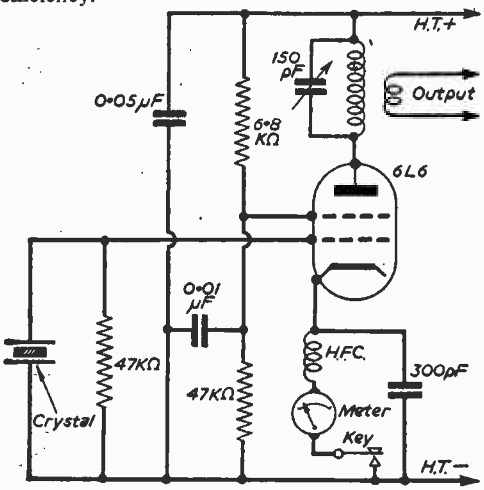

Fig. 3.—A regenerative oscillator.

For two-band working, a tapped coil may be fitted. This can have 36 turns as described, tapped at 16 turns. The whole coil will then provide 3·5Mc/s band working, with 7Mc/s band working when the switch is closed to short out the unrequired turns.

If a 2-way switch is used, as in Fig. 2, this can bring a fixed condenser C1 into circuit, for 3·5Mc/s band working. This is an advantage when the aerial loading condenser (1000pF in Fig. 1) is of insufficient capacity for the aerial. In these circumstances, C1 can be a high grade mica condenser of 100pF to 500pF, as required. The crystals may, of course, be for two bands, according to what is available.

Regenerative Oscillator

The radio frequency output from the stage may be increased by providing some regeneration. One method of doing this is shown in Fig. 3. The 300pF condenser may be modified in value, if necessary, to obtain a suitable effect. Actual results depend to some extent on crystal activity. Fig. 3 also shows values for a 6L6, which may be run to 12 to 15W input, if desired.

Another method of obtaining regeneration is to increase the 300pF condenser to about 500pF, and connect a 20pF or similar trimmer from grid to cathode. Regeneration can then be adjusted by means of the trimmer.

A π-tank, as in Fig. 1, may be used in Fig. 3. With the tank in Fig. 3, loading is adjusted by modifying the loop coupling. To feed a single wire aerial, the loop can be taken to an aerial tuner. For band changing, 4-pin plug-in coils may be used, each with its own loop. Windings may be as described, with two turns for the 7Mc/s loop, and 4 turns for the 3·5Mc/s loop, tightly coupled to the H.T. end of the coils.

Regeneration is also useful when the stage will be used to drive a doubler, to give 2-band working from one crystal. With any of the one-valve transmitter circuits, doubling is possible. However, R.F. output will fall off, and an aerial tuner should be added to reduce possible radiation of the fundamental. Regeneration is also desirable, with an active crystal, and adequate H.T. voltage.

A Push-pull Circuit

Similar valves may be employed in push-pull, to obtain increased output, and one circuit for this is shown in Fig. 4. This can give a powerful output, the actual maximum depending on the valves and H.T. voltage. The valves should be similar, but it is not necessary that 6L6's be used.

The screen grid supply may be obtained from a resistor with clip, as described, if preferred. For 250V receiver type power supply, the resistors may be omitted, as mentioned.

When adjusting any of the circuits, a 200/250V household lamp may be used as an R.F. indicator, for the smaller powers, a 25W lamp is suitable. If a 6146 is employed, a 60W lamp will be satisfactory. With π-tanks, connect the lamp from the output socket to chassis. With tank circuits like those in Figs 3 and 4, best loading will be obtained by connecting the lamp across some turns of the aerial tuner.

An "Automatic" Two-Band Circuit

In Fig. 5, the oscillator drives two output valves. The grids of these are operated in push-pull, but the anodes are in parallel. This provides a good output at twice the crystal frequency. When working in this way no neutralisation is needed, because of the frequency multiplication, and the high band coil L1 is in use.

For operation on the crystal frequency, the anode circuit is switched to L2. At the same time one output valve heater is switched off. The remaining valve then operates as a straight through amplifier, while the inter-electrode capacity of the unused valve provides neutralisation, due to the centre-tapped grid coil.

This circuit is particularly useful for the 1·8Mc/s and 3·5Mc/s bands. Here, regulations limit the input to 10W on the 1·8Mc/s band, so that the H.T. voltage or aerial loading can be adjusted until this figure is approached. When doubling into the 3·5Mc/s band the input will then be about 20W, as both valves will be in use. This provides extra useful power, as the 10W limit does not apply to this band.

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For operation in this way, the oscillator coil can have about 70 turns of 24s.w.g. or similar wire, on a 1¾in. or near diameter former. The coil is centre tapped. To maintain circuit balance, a split stator or butterfly type condenser is preferable for tuning this coil, but is not essential.

The screen grid resistors are selected as already explained. Three 6L6 valves will be satisfactory, but other valves are equally suitable. The screen grid resistors may be omitted for moderate voltages.

then be ensured that the normal grid drive is present, before switching in the output stage. With this method of operation, there will be no need to provide a separate bias supply for the output stage. It is in order to obtain safety bias for the output stage by using a cathode resistor. With a 6146, 2mA to 2·5mA grid current with a 27k grid resistor will be satisfactory. The output stage may otherwise be as shown for Fig. 1.

(To be continued)

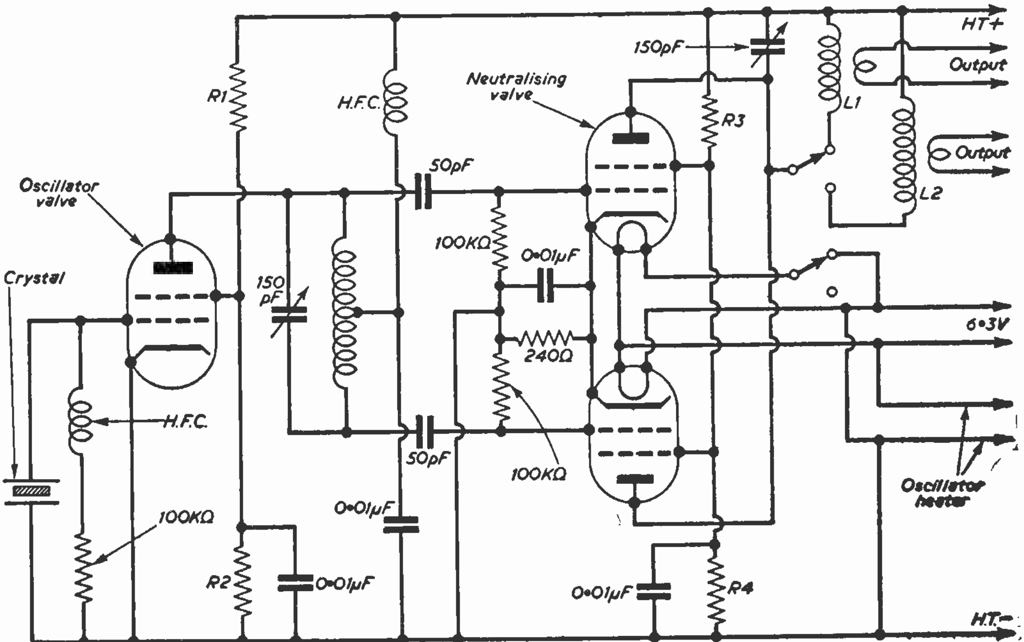

Fig. 5.—A circuit for two-band operation with one crystal.

Multiplier Stages

A simple method of obtaining frequency multiplication by the use of an extra stage. The anode circuit of the first stage is tunable to the crystal frequency, and the second stage is tuned to twice this frequency. The output then drives the grid of the valve or valves forming the output stage.

Normal screen grid voltages are provided. Bias for the second stage is obtained by grid rectification, so the circuit should not be left switched on without the first tuned circuit correctly adjusted. If preferred, a cathode resistor may be added to provide safety bias for the doubler. For efficient doubling, fairly high bias is required. Even with cathode bias, additional bias will be developed across the 100k grid resistor.

The output stage should have a grid current meter, so that grid current may be read before applying the anode and screen grid voltage. It should

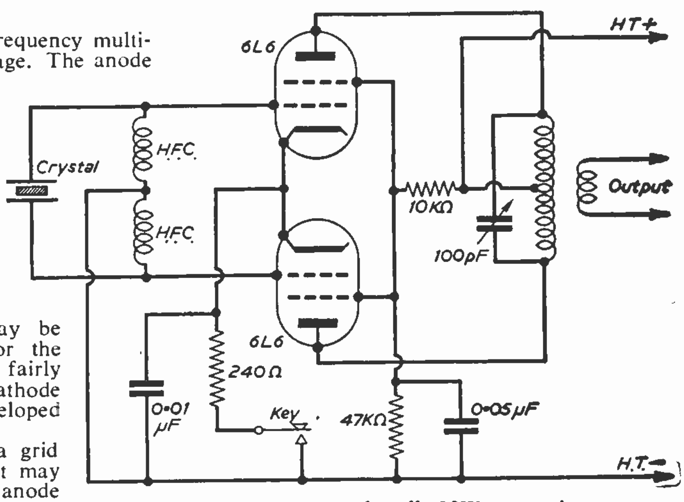

Fig. 4.—A push-pull 20W transmitter.

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COMBINED RADIO AND TABLE LAMP

USING A 40W LIGHT BULB INSTEAD OF A MAINS DROPPER

By M. J. Dunn

(Continued from page 805 of the January issue)

ALTHOUGH general wiring details were given last month, it must be borne in mind that the final form of the set may be altered to suit individual requirements. Most of the connections between and around the valve sockets and tag-strips can be made by soldering the components straight in from point to point. All grid and anode leads in the R.F. and detector stages should be kept very short and the coils mounted so as to achieve this. A few points will be mentioned later on with regard to the possibility of encountering R.F. instability, but at this stage careful attention to the "hot" leads and stray capacities in the circuits associated with the two coils will pay dividends later. Nearly all the information required can be derived from the circuit diagram of Fig. 4, but Fig. 1 showed a suggested form of layout which is in fact that adopted with success in the author's model. Figs. 2 and 3 gave all the switch connections.

two sections of which ("A" and "B") act as a normal wave change switch for the coils in positions 2 (L.W.) and 3 (M.W.). In position 1, Section C short circuits the heater chain so that the lamp is connected directly across the mains and section D disconnects the mains from the rectifier, so that in this position the apparatus works solely as a source of illumination. R2 (470k) is included connected across the H.T. supply to act as a bleeder and it discharges the smoothing capacitors when the set is switched off, or switched to "lamp only" position. The mains are switched on and off by SW1 ganged to the volume control and it is a wise policy to leave SW2 in position 1 when the set is not in use so that the lamp takes the initial surge when switching on. However, no ill effects have been noticed from switching on and off with the heaters in circuit and in practice the surge is so instantaneous that the brunt is almost entirely borne by the lamp which reaches incandescence so rapidly compared with the many seconds required for the heaters to warm up. The author strongly recommends the use of a three-pin mains plug—not necessarily for earthing the set, but to ensure that the polarity is such that the neutral lead goes to chassis. If the set is earthed through a three-pin plug, the inclusion of the two capacitors C11 and C12 is good for avoiding mains-borne

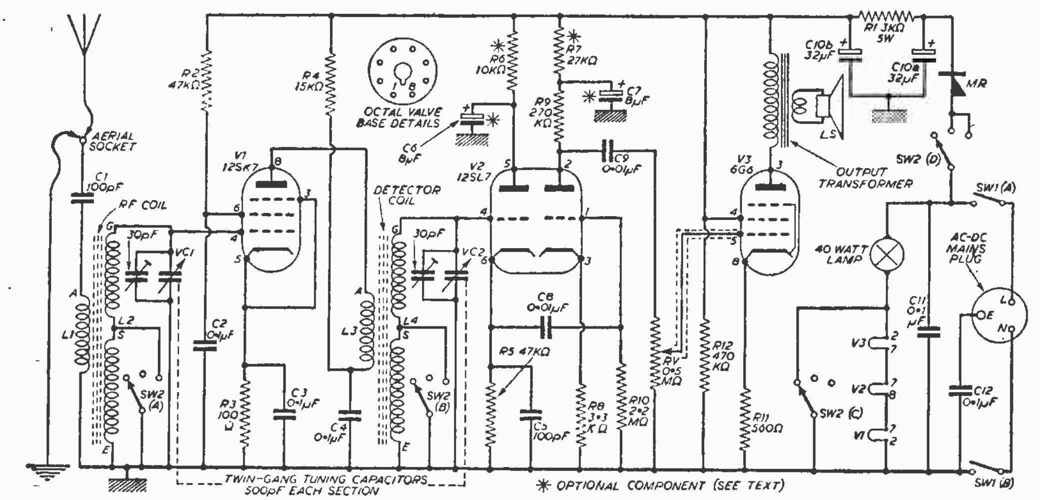

Fig. 4.—The circuit diagram.

The Power-Pack

After passing through the double-pole on/off switch, one limb of the mains goes direct to the chassis and the other to one of the lamp connections, the second of which returns to chassis via the valve heater chain. The "hot" mains lead also goes to the negative end of the H.T. rectifier via section "D" of SW2, the function of which can now be explained. This is a four-pole, three-way selector switch,

interference and modulation hum; however, the earth often gives excellent results as an aerial, in which case the arrangement in Fig. 6 can be adopted and the earth lead can terminate in a standard wander-plug to be placed in the aerial socket. All the usual precautions should be taken, of course, to see that in the finished article no part of the chassis, or anything connected with it, can be touched by the operator.

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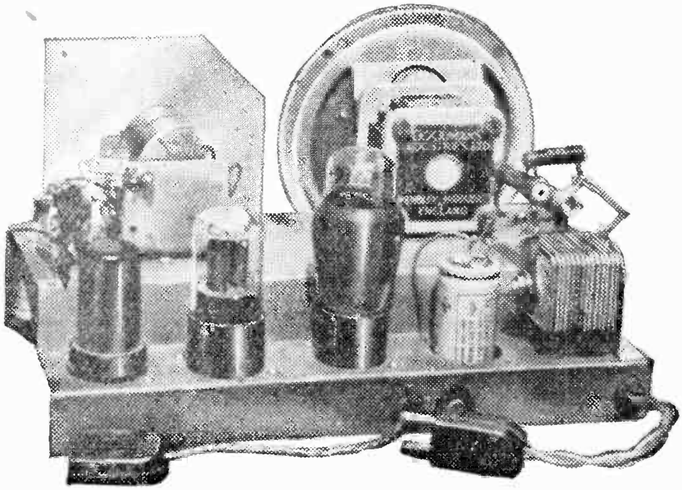
Final Setting-up, Aligning and Testing

After wiring up, the circuit should be thoroughly checked over and this is best done stage by stage. Particular attention should be paid to the mains, heater and power supplies. It is a wise procedure first to switch on with the H.T. disconnected and to check the voltages across the heaters, both individually and as a whole, unless this has been done as a separate operation during construction. Using a high resistance voltmeter, V1 and V2 should read 12·6V across each of their heaters and V3 should read 6·3V ± the 7 per cent allowed. If the heaters are found to be working within their tolerance limits the H.T. can be reconnected and the set lined up. To do this the standard procedure for lining up T.R.F. receivers is adopted. Insert the aerial and tune the dial to within a few degrees of the lower end to receive any readily available station. Adjust the trimmers for maximum reception. Then swing the tuning capacitors to the top end of the dial and on hearing a station, adjust the cores for maximum reception. Repeat this process at the lower and upper ends of the dial until a good compromise is obtained. Due to the excellent selectivity of this set, the trimmer of the first stage will probably require adjustment for different lengths of aerial so that initial setting should be done on the actual aerial to be used or one of similar characteristics. The above procedure applies, of course to the medium waveband (SW2, position 3). After this, switch to the L.W. position. If the Light Programme on 1500m needs any adjustment, this is best effected by a separate trimmer on one or other of the L.W. coils; this will, of course, be shorted out together with the coil, in the M.W. position of the switch. The important thing is to get the M.W. correct and probably no trouble will be experienced with the L.W. However, trouble may occur due to capacity effects of the wavechange wiring and switch.



The completed receiver prior to fixing in its cabinet.

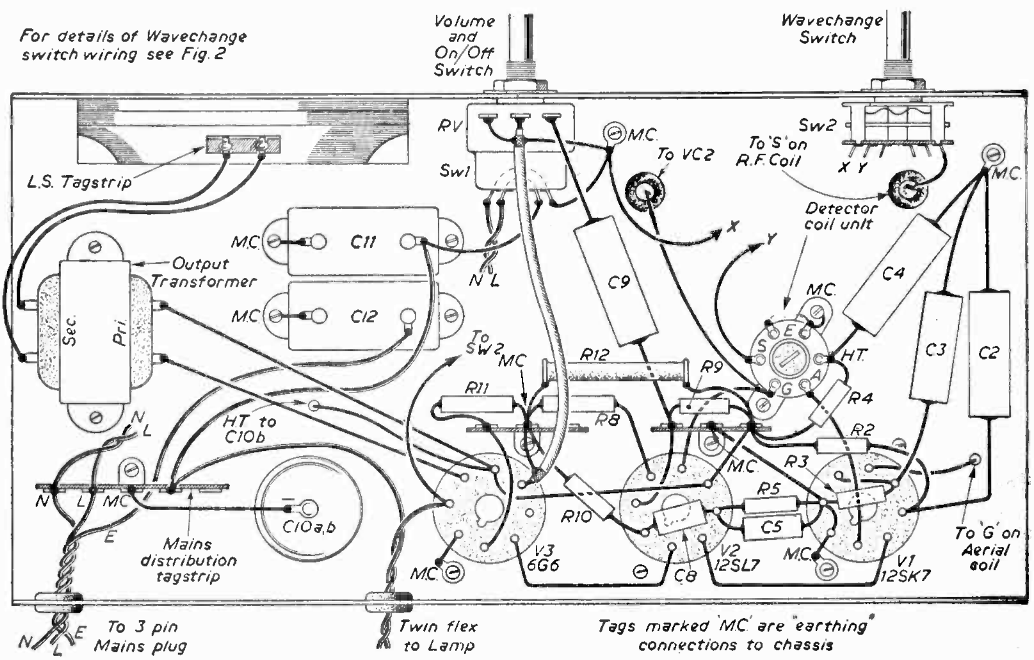


Fig. 5.—The underchassis component layout and wiring diagram.

Instability

The cathode follower detector imposes no load on its associated tuned circuit (L4) with the result that with a good coil a very high Q is obtainable with excellent selectivity and gain. Because of this, however, the circuit is rather prone to R.F. instability and this will arise if the anode to grid capacity of V1 is above a certain safety margin. There is, of course, an inherent capacity between these two electrodes in the valve itself, but apart from this extra will arise from the external wiring and possible coupling between the grid and anode coils. Although the latter are separated by being above and below chassis, one critical item is the leads from the coils to the wave-change switch, which although at chassis potential on M.W. are part of the tuned circuit on L.W. and unavoidably near each other. They should, therefore, be kept as far apart as possible throughout their course, and should be kept short and non-parallel. If the set howls on L.W. but not on M.W. this wiring should be suspect. Oscillation may occur over certain parts of the tuning range if the set is not properly lined up, so this matter should be attended to before condemning and making radical alterations to the wiring. If intractable oscillation is found to be present, apply the minimum necessary of "negative reaction". The specified pair of coils has an otherwise unused reaction winding on L3—4. One end should be connected to chassis and the other to the grid of V1 via the smallest possible capacity, making sure that the feedback is out-of-phase. Over-doing this will impair the high Q otherwise obtainable in the circuit and the procedure should be avoided if possible.

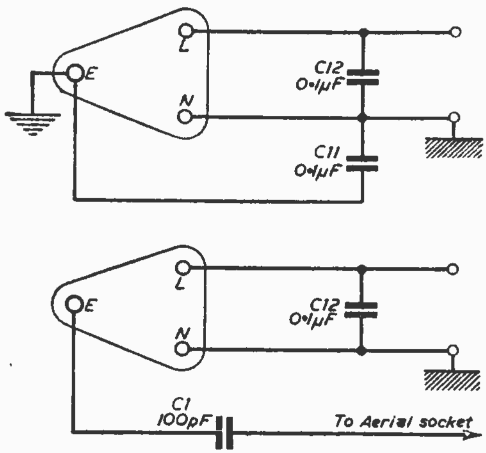


Fig 6.—This shows the mains connections for a 3-pin plug; in the lower diagram the earth pin is connected to the aerial socket.

COMPONENTS LIST

R1	3k, 5W
	all other resistors are ½W.
R2	47k
R3	100Ω, see text
R4	15k
R5	47k
R6	10k } see text
R7	27k } see text
R8	3·3k
R9	270k
R10	2·2M
R11	560Ω (6G6).
	390Ω (12A6).
	1k (12J5).
RV	0·5M with D.P. switch.
C1	100pF (500V).
C2, 3, 4	0·1μF.
C5	100pF.
C6, 7	8μF, see text.
C8, 9	0·01μF.
C10 a–b	32–32μF.
C11,12	0·1μF (500V).

Twin-gang tuning capacitors: 500pF.
with trimmers: 30pF.
Slow motion drive, pointer and dial.

V1	12SK7 (or 12K7, 12SJ7, 12J7).
V2	12SL7.
V3	6G6 (or 12A6, 12J5).

3 International Octal valve sockets.
Pair of matched T.R.F. dual range coils (Repanco).
Miniature O.P. Transformer. Loudspeaker.
Metal Rectifier: 250V, 50mA.
SW2 4-pole, 3-way rotary switch.
Electric light bulb—40W, 240V rating (see text).
(Holder, lampshade and support).

Transistorised, Stabilised D.C. Supply

THE type PP.2 is a heavy duty power supply designed for the engineer developing transistorised equipment, and provides a stabilised D.C. voltage over the range 0—50V at currents up to a maximum of 10A. The output voltage and current are monitored and the instrument is fully protected against overload conditions by an electronic circuit similar to that used on previous models. Four terminal output connections are provided to enable the connecting lead resistance to be effectively eliminated. The instrument is designed for bench use, or, alternatively, can be placed on a special trolley to enable the model to be conveyed around a laboratory more easily. This unit was designed by *Advance Components Ltd., Roebuck Road, Hainault, Ilford, Essex.*

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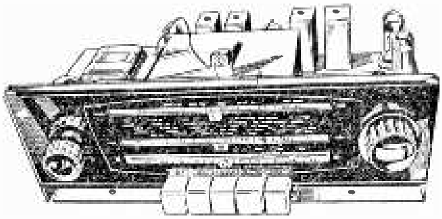

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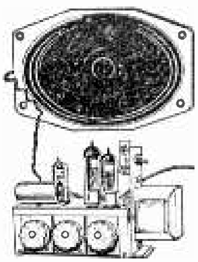

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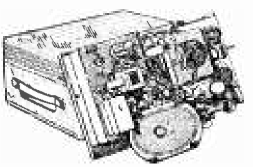

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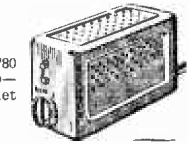

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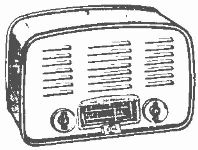

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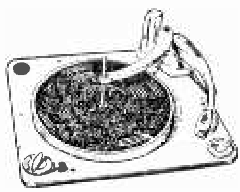

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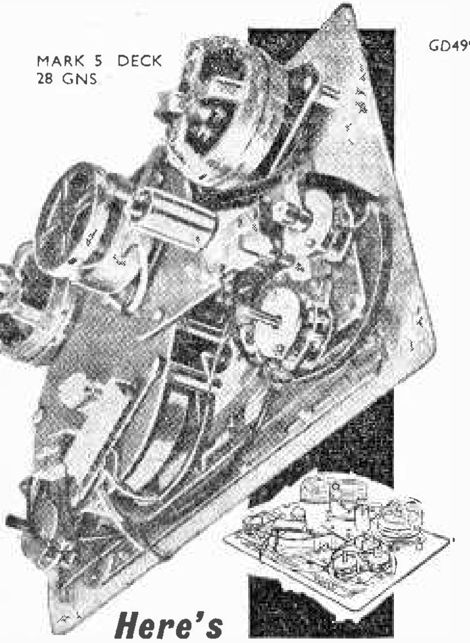

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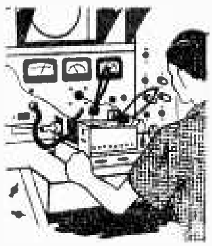

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CERAMIC SPEAKER CABINETS

INEXPENSIVE, HIGH QUALITY ENCLOSURES

By F. B. Burge

IN sound reproduction, the mounting of the speaker is of the utmost importance. Of the various methods that have been tried, none has the compactness and simplicity of a tuned reflex cabinet.

A reflex Cabinet

A reflex cabinet consists of an enclosure of between 1—27cu.ft. the larger the better. There is a small vent hole in the cabinet that makes it resonate at a low note. The smaller the hole the lower the note. A speaker is mounted in one wall or on the top of the cabinet, facing outwards. While the speaker projects the higher notes into the room, the cabinet builds up the bass notes which come out of the vent hole. The principles involved are that as the note from the speaker descends towards the resonant note of the cabinet the cabinet resonates louder, but at the same time the enclosed air reacts against the cone of the speaker, damping down the cone movement. These two factors give an even bass response.

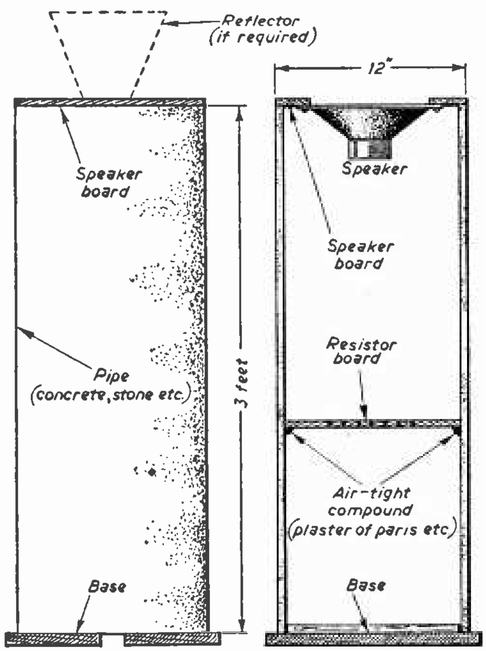

Fig. 1.—Plan and sectional views of the enclosure.

Making these cabinets out of wood and packing them with sand is a skilled job, for not only must they be solid and heavy, but no part of them must vibrate. Any vibration of a speaker cabinet destroys the purity of the tone and absorbs the energy of the speaker.

Expensive reflex cabinets 1ft square and 3ft high, fitted with full range 8in. speakers are becoming very popular as they are neat and well fitted to stereophonic reproduction.

The ideal cabinet would be one made of concrete, but these, of course, are not produced.

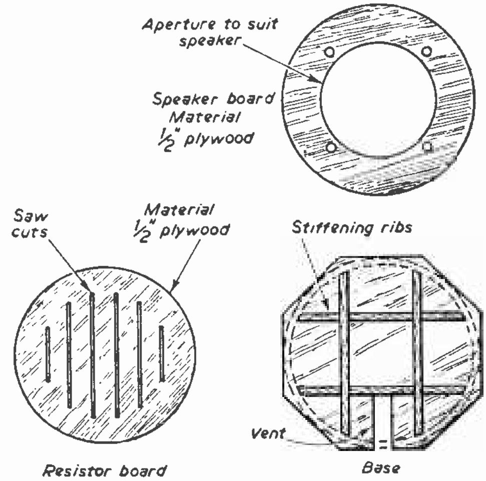

Fig. 2.—Plan views of the loudspeaker board, the acoustic resistor board and the base of the enclosure.

Fortunately the same effect can be obtained by using standard cheap objects made for other purposes.

Suitable Materials

Concrete sewer pipes, flue linings, chimney pots and drain pipes may be used and are cheap and can be made very presentable when painted. Speakers mounted in these give astonishing results even from ordinary wireless sets, tape recorders and record players. Chimney-pots tend to give slightly better results than the others as their tapered shape improves the tone.

The choice of design of the cabinet is entirely the constructor's as large ornamental chimney-pots give as good results as plain sewer pipes, etc. The recommended dimensions of the cabinet are 3ft (tall) x 12in. (diameter). For this size a speaker of not more than 8in. is suitable.

An Acoustic Resistance

An acoustic resistance must now be fitted one-third of the way up the pipe. The resistor consists of a piece of ½in. plywood cut to fit into the pipe. This board has parallel saw cuts in it, 1½ in. apart starting and finishing 2in. from the edge so that

(Continued on page 886)

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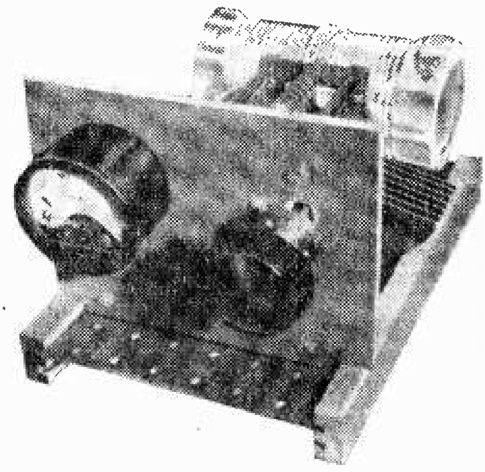
80-Metre Aerial Coupler

A COMPREHENSIVE MATCHING CIRCUIT

By G3OGR



ALTHOUGH coil details for the aerial coupler described here are for the 3·5Mc/s to 3·8Mc/s band, the coupler can be used on other bands merely by changing the number of turns on the coil. The coupler is intended as a matching device between transmitter and aerial, or as a coupler allowing a dipole to be fed from a π output network. It also provides a means of feeding a single wire aerial from a coupling link, and allows loading up of the transmitter with end-fed aerials which would not load sufficiently with a π output.

Former Winding

The circuit is shown in Fig. 1. For the 80m band a standard ribbed former approximately 2½in. in diameter and 5in. long will be satisfactory. The winding can consist of 26 turns of 18 or 20s.w.g. wire, occupying about 3¼in. winding length. With formers of other diameters, it is only necessary to change the number of turns until resonance can be obtained.

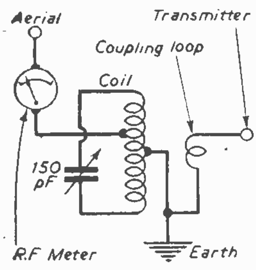


Fig. 1 (left). — The circuit for the coupler.

For coupling, three turns of adequately insulated wire, placed centrally round the coil as shown in Fig. 2, will usually be sufficient. This loop may be modified as described later, if necessary.

A radio-frequency type meter is included as shown in Fig. 1, so that aerial current may be read. This is a useful addition, as it immediately shows if the transmitter is providing its accustomed output. It also indicates how aerial current is modified by tuning, coupling adjustment, etc. Provided the aerial itself is not changed, the meter will give an increased reading, as the transmitter and coupling are adjusted for optimum performance.

For most moderately powered transmitters, an 0-350mA or 0-500mA R.F. meter will be satisfactory, when the aerial is end-fed. For powers in excess of 40W or so, a meter with a higher full scale reading can be employed, or the meter may be shunted with a piece of connecting wire.

When feeding a dipole, the meter is in one feeder only. As feeder currents will roughly balance, two meters are not essential. Since a dipole will normally be fed at a low impedance point, the current will be larger. However, the meter can easily be shunted, as mentioned, if necessary.

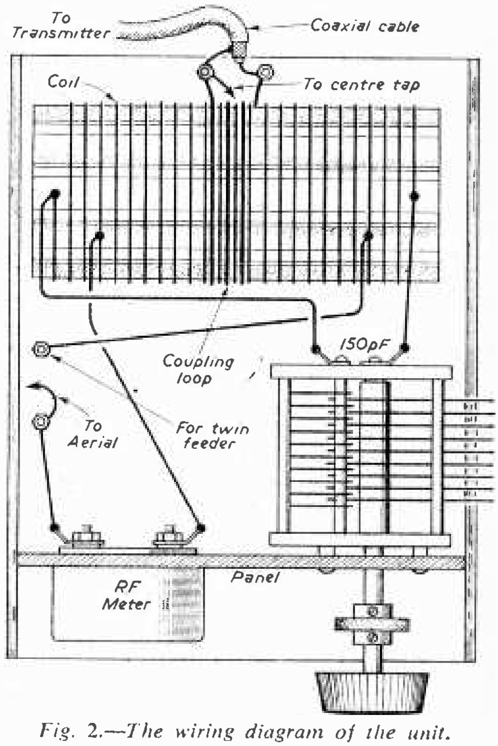


Fig. 2.—The wiring diagram of the unit.

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Coupler Construction

Fig. 2 shows a suitable layout. An insulated baseboard about 9in. x 6in. with a panel about 6in. x 5in. will be convenient. Strips 9in. long raise the base, to give clearance for the terminals.

The meter may be a flush or projecting type, either being equally satisfactory. The tuning condenser may be about 100pF to 200pF. For low powers, a receiver type condenser will do. But for larger power, wider spacing will be necessary. New and surplus condensers are available from many suppliers.

If the coil is wound as directed, leads from it may be permanently connected to the condenser. But if the coil is of different size, a check should first be made that resonance can be obtained throughout the band.

A short, insulated spindle is best used with the control knob, as the condenser spindle will be alive with R.F. when a centre tap is employed on the coil winding.

Feeding from π Output

A co-axial socket is usually provided with π output circuits, and a short piece of co-axial cable is then convenient between the transmitter and tuner. This method of connecting the unit is shown in Fig. 3. The cable can be of such a length that the tuner may be placed at a handy position, and near the aerial feeder.

When used with a π tank, the coupler allows high-impedance aerials to be matched to the transmitter. If the π tank is used alone with an end-fed aerial, it may be found that no adjustment of the π tuning controls will allow satisfactory loading. With an end-fed aerial, an excessively high impedance is likely.

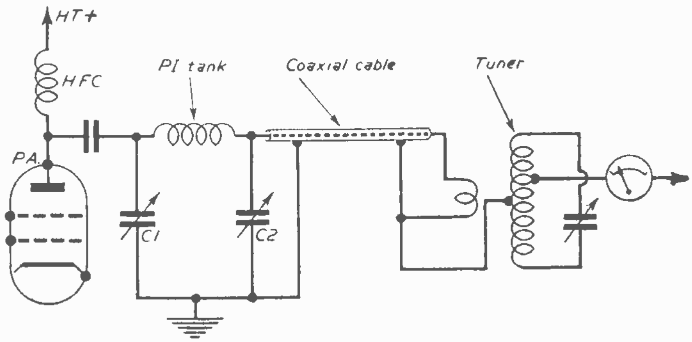


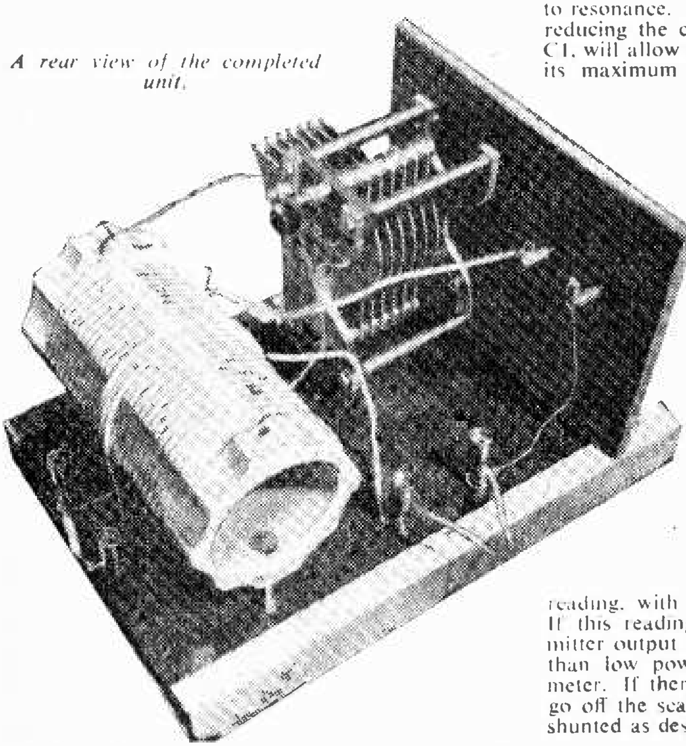
Fig. 3.—This shows the method of coupling to a π output.

When the tuner is connected, close C2 in the π tank in the usual way when commencing to load an aerial. Adjust C1 for the customary P.A. anode current dip. The aerial unit should then be tuned to resonance. It should then be found that slightly reducing the capacity of C2, and readjustment of C1, will allow the transmitter to be loaded to draw its maximum anode current. If not, the meter aerial tapping on the coil should be moved a turn or so towards the end of the coil.

A dipole cannot normally be fed from a π tank, except with a coupler, and the unit will allow this to be done. In this case, adjustments are as described for the end-fed aerial, except that the two feeders of the dipole are connected to the coil at equal distances from the centre tap. The meter will be in one feeder only, as mentioned. An additional terminal is provided for the second feeder, as shown in Fig. 2.

The impedance of a dipole fed in this way can be very low, so the tappings will usually need to be much nearer the centre of the coil. The aerial current will also be greater, due to the reduced impedance, so the meter should be shunted with a piece of connecting wire until it gives a convenient reading, with the transmitter operating normally. If this reading is noted, any reduction in transmitter output will be at once obvious. With other than low power, take care not to burn out the meter. If there is any tendency for the pointer to go off the scale, as loading is begun, it should be shunted as described.

A rear view of the completed unit.



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Link Coupling

When link coupling is used, a loop is connected as shown in Fig. 4. This loop should be similar to

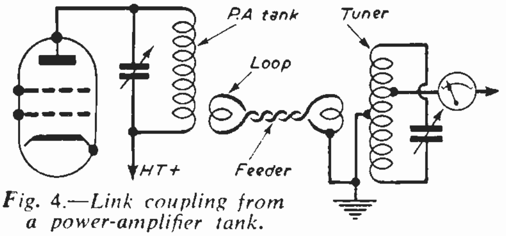

Fig. 4.—Link coupling from a power-amplifier tank.

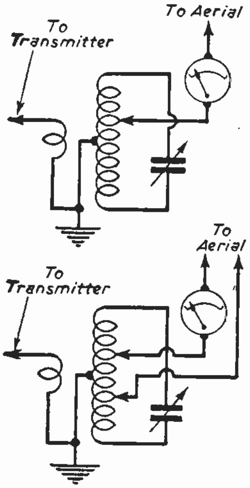

Fig. 5 (left).—The connections for end-fed and dipole aerials.

that in the tuner. That is, it can have the same number of turns, if of similar diameter. If smaller in diameter, an additional turn or so can be added. With a single-ended P.A. tank, the loop is situated as near as possible to the H.T. end of the coil. With push-pull output, the loop should be placed at the centre of the coil.

The feeder can be of twin flex, or any suitable twin lead tape. One side of the loop circuit is earthed, as this reduces harmonic radiation, in addition to the normal harmonic suppression furnished by the aerial tuner.

With link coupling, tune the aerial circuit to resonance, and adjust the loop until the P.A. draws its normal loaded anode current. Moving the aerial tapping on the tuner coil will also modify loading, so a suitable degree of coupling can be found without much difficulty.

End-fed and Dipole Aerials

When using an end-fed aerial better results are normally achieved if the centre of the coil is earthed, as in Fig. 5. With a co-axial input, this circuit may be completed through the sheath to the transmitter (Fig. 3.)

End-fed aerials will usually present an impedance of several hundred or thousand ohms, when approaching a half-wave in length. For this method of operation, the aerial current will not be very large for a given wattage. Reasonable results are obtainable with no earth, in these circumstances, and this is sometimes a convenient system.

When the end-fed aerial is near a quarter wave, it will be current-fed, as its impedance is lower. For a given wattage, the aerial current will then be very much larger. A really good earth is desirable, for maximum efficiency in these circumstances.

The usual dipole will be current-fed at the centre for the band for which it is cut when used with an untuned feeder. The feeder may be any twin conductor. Good results are obtainable without an earth, in these circumstances.

With a harmonically operated aerial, or aerial with a tuned feeder, current and voltage will be present at the tuner, in varying proportions, according to the aerial and feeder length.

In all cases, any of these aerials may be matched by tuning to resonance, then adjusting π or link coupling until the P.A. draws its maximum anode current on resonance.

If it should be found that the transmitter cannot be loaded with the tuner loop described, more turns should be added to the loop. When first adjusting the tuner, the aerial feed points should be modified a turn at a time. When suitable positions are found, connections should be soldered. After adjusting the tuner at the centre of the band (e.g. 3650kc/s, for the 80m band) no other modifications will be necessary.

CERAMIC SPEAKER CABINETS

(Continued from page 883)

the board is not made too weak. This limits the amount of air that can move in the pipe. When fixing the board it is easier to manage if a screw is inserted as a handle. It can then be wedged into position with another screw placed between the board and the pipe. The edges then can be made air-tight with plaster of Paris or similar compound.

The speaker (which must match the amplifiers) should have its face protected from dust by a covering of thin material, and then be bolted firmly on to a board. This board (½in. plywood) should have been shaped to fit on to the top of the pipe and can be firmly fixed with more plaster of Paris, etc. The speaker is now in the pipe facing upwards.

A base is now made for the pipe to stand on with a slit about 4in. x 1¼in. (for a 3ft by 12in. pipe) left open for the vent. If the bars that hold the base together fit the pipe exactly they will keep it centrally positioned on its base. A larger cabinet would have a proportionately larger vent hole.

(A reflector may be placed above the speaker to throw the higher notes into the room and gives improved results.)

When all is assembled it can be finished as the reader chooses.

Large ornamental chimney-pots look the best. 3ft tall 12in. flue linings are the neatest. But sewer pipes and drain pipes can be made to look quite neat. I recommend a 12in. pipe with a speaker not larger than 8in. Chimney-pots have the additional advantage of being tapered, which seems to improve their tone. The general rule is the bigger the better. A 9in. pipe seems to be the minimum size for good results. Large speakers find difficulty in moving fast enough for the high notes.

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A STEREO AMPLIFIER

8W WITH SINGLE-ENDED OUTPUT CIRCUITS

By R. Hindle

To put this amplifier into use it is necessary only to operate an H.T. switch and there is no delay awaiting the heaters. This switching could be dispensed with, depending on how the constructor wished to use the unit. Some kind of feeder unit will be required and this also could be quite simple, but this will generally carry all the operable controls, being fitted near the turntable. If the assembly is to be built into a cabinet for domestic use the main indicate that H.T. is switched on. These work with the switches, of course, but they could be provided even in the absence of the switches. The H.T. indicator, in fact, also acts as an H.T. fuse as will be seen when the circuit is reviewed.

Circuit

The circuit is shown in Fig. 1 and no doubt the exceptional simplicity will be noted. This is because of the absence of the usual cathode bypass capacitor.

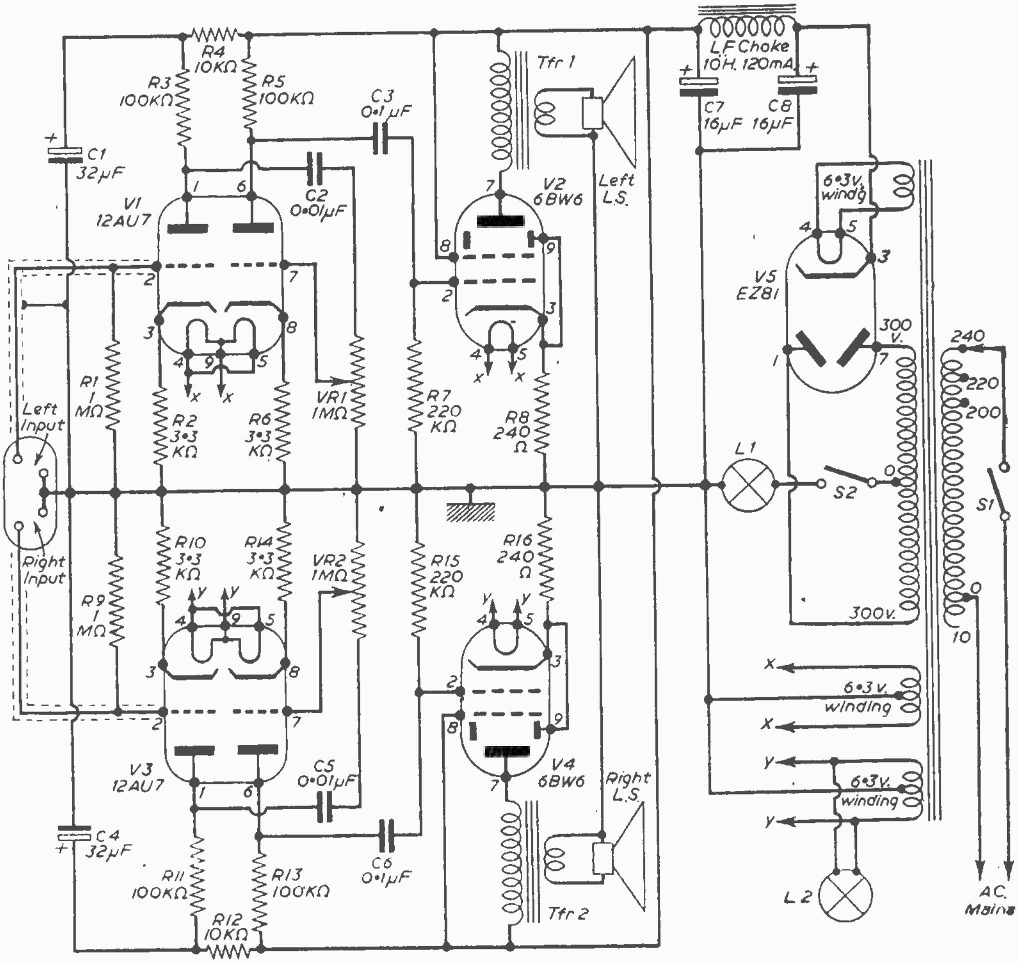

Fig. 1.—The circuit of the amplifier.

amplifier is then likely to be tucked away in an inaccessible position and there is no point in putting any controls on it. On the other hand if the amplifier is to be used on the bench the switches are an advantage.

Two dial lights are provided also, one to indicate that the mains are switched on and the other to

There is a very good case for avoiding reactive components wherever possible because inevitably they introduce a frequency discriminating element, and hence distortion, into the design. If they are made big enough their effect is not noticeable, but this necessitates electrolytic capacitors and these lose

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their capacitance with age so that distortion not present when new, might later find its way into the equipment. On the other hand omission of the cathode bypass capacitor causes negative feedback because any signal appearing across the cathode resistor is effectively in the input circuit. All depends on whether the effective gain reduction can be tolerated. In this design it was found that the loss could be accepted and so the capacitors were avoided. Certainly this was an advantage from the point of view of cost, because good electrolytics are not cheap, but there is another advantage arising from the omission of the capacitors. Constructors will know that there is some difficulty in finding room for all the components which normally have to be fitted close to the valve holder, and the comparatively bulky electrolytics are often the most difficult to fit, separate tagboards can be used, but these have the effect of lengthening the connections and in some positions this is undesirable. By eliminating the bypass capacitors such steps are unnecessary and construction is thereby simplified.

It is not a difficult matter to assess the order of loss of gain as a result of this simplification. Each half of the 12AU7 gives a gain of 12 times. This applies over a wide range of working conditions; a triode does not have the wide variation of gain with working conditions that is shown by an audio pentode such as the 6BR7. This gain takes place as between the input measured between grid and cathode and output in the load resistor which is measured between anode and cathode. In order to clarify the situation the appropriate part of Fig. 1 is modified in Fig. 2, the component numbers being those from Fig. 1 for the first half of V1, with the numbers of the equivalent components for the second half of V1 in brackets. The signal voltage in (Vin) produces an output signal current, i.e. it causes variations in the anode current of the valve. This anode current flows internally from cathode to anode and externally via R3, C1 and R2 back to the cathode. C1 is chosen to have a negligible reactance to audio frequencies and so can be looked upon as a short circuit to audio signals: effectively therefore the anode signal currents can be considered as flowing through R3 and R2 in series. By Ohm's Law the signal voltage produced by that current will be generated across these two resistors in proportion to the size of those resistors. In the present case the anode load is 100k and the cathode resistor is 3k. Thus 3 per cent of

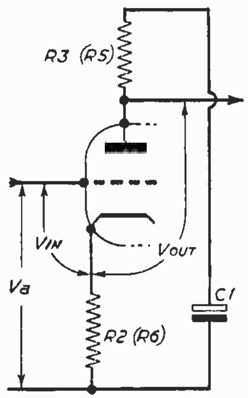

Fig. 2 (left).—The feedback circuit.

the output signal is lost in the cathode resistor and this is insignificant. The gain of the stage being 12 times, however, the cathode signal voltage will be 3 × 12, i.e. 36 per cent, or roughly a third of the input signal (Vin) and this opposes the signal from the previous stage (Va).

(Continued on page 902)

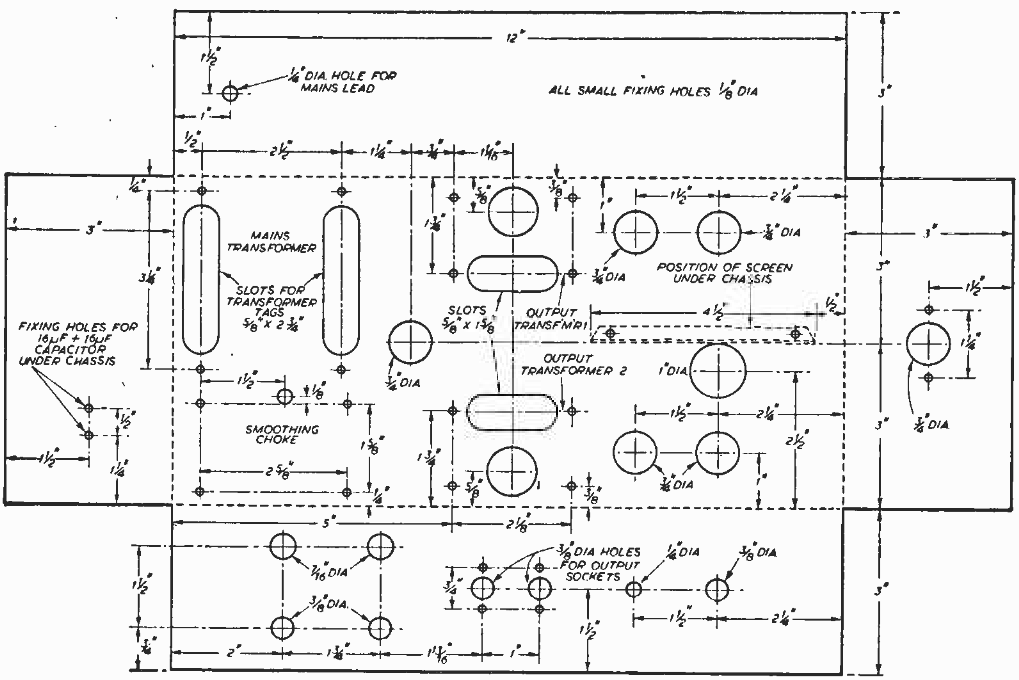

Fig. 3.—The drilling details for the chassis.

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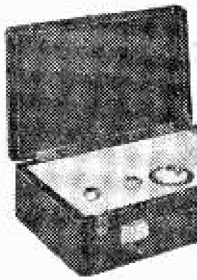

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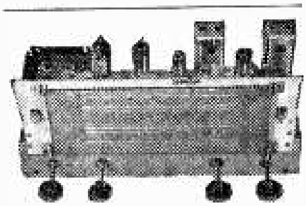

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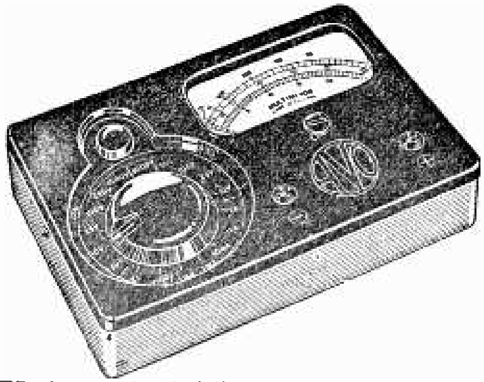

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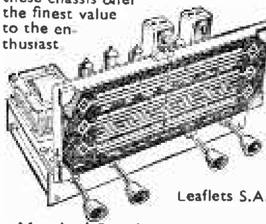

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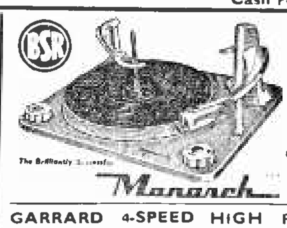

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3S4	7/6	6H6	3/6	12AU7	6/-	EBF80	10/-	EZ80	7/-	R[illegible]	[illegible]
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5Y3G	6/-	6J7G	6/6	12Q7GT	6/6	ECL80	10/-	HVR2A	6/-	UL41	[illegible]
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6AG5	5/-	6K7M	7/6	35Z4	6/6	EF41	[illegible]	[illegible]61	3/6	VP23	6/6
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6AM	4/-	6N7M	6/-	954	1/6	EF91	[illegible]	PCF8[illegible]	7/6	VR105 30	9/-
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35/-	UCH42 UF41 UBC41, UL41, UY41.
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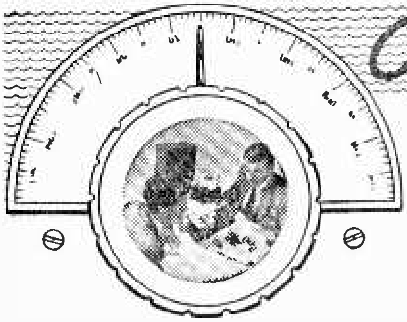

On Your Wavelength

BY THERMION

S.W. Receivers

I RECENTLY wrote about short-wave reception and in the course of my notes I mentioned that many years ago a set which I was using had proved better than a commercial (American) S.W. set, and that details of this set had been published in these pages. I have received dozens of letters since those notes appeared, asking if a copy of the issue or issues describing the set could be obtained, and in many of these letters readers suggested, if the information was no longer obtainable, that I might be in a position to recommend a modern set which would be ideal for short-wave listening. The details of the set in question are completely out of print (it was in a pre-war issue), and in any case it could not now be built as it incorporated certain components and parts which are no longer on the market. The circuit incorporated the superhet principle, with an "S" meter, and the main novelty was in the tuning circuits, where band-spreading was employed, but the band-setter consisted of the ganged main tuning condensers, and the small band-spreaders were ganged and taken to the main slow-motion tuning control fitted with a 300deg tuning dial which formed the main control. Therefore, if you are seeking a new set, look for some similar type of tuning system if this arrangement interests you and above all try and select one with an "S" meter. Although this means little from a point of view of reporting signal strengths (there is no basic measurement, remember, and it is purely an arbitrary reference) it does give the user of the receiver a direct reading which may be used for comparisons.

The "Best" Set

As for my recommending a set, this is a little difficult as personal preferences play such a large part in the choice of a set, not only from the point of view of operation, but also from the appearance. Some amateurs like to see a set full of dials and controls, even if half of them are more ornamental than useful, whilst others prefer an open breadboard type of construction which gives results—never mind the looks. I have tried many ex-government pieces of apparatus, but remember that these have in the main been designed to do a specific job, and as such price has not been spared. But whether they will fulfil a general purpose situation such as is needed in the amateur's den is another matter. The receiver which I kept longest in my active transmitting days was an AR88, and I had no fault to find with it. It had an "S" meter and stood up well to the work it had to do at an active amateur station, but I know it does not suit everybody.

Pocket Sets

I was recently loaned a pocket set of doubtful make and asked what I thought of it. I had not previously troubled about this type of apparatus, but was agreeably surprised by the quality and tone of reproduction in London. I had to make a journey and thought it would be a good idea to take the set with me. I am glad I did so, as I found that the performance of the set varied considerably from area to area. In fact at one place I could hear nothing at all on it, and it must be remembered that the small aerial which is fitted is very dependent upon signal strength in the area. I am sure that much of the disappointment which is expressed by readers in this type of apparatus is due to its use in unsuitable areas, or perhaps by the use of an unsuitable set in a bad area. If you happen to be one of those who perhaps have been disappointed, try a better type of set. Perhaps you tried a two transistor loudspeaker set and did not get much joy out of it, whereas a four transistor set might completely change your mind on this type of receiver.

Annoyance

Whilst on the subject of these little sets I would like to mention that a note appeared in a local paper recently deploring the introduction of them, as they annoy other people. The writer said he had visited a beach on the south coast and could not enjoy his stay as several portables were "blaring out" in the neighbourhood. After all, many people do go out into the country or to the seaside to get away from the noises of civilisation, and it can be very annoying to hear the radio following you—especially as in many cases the users of these sets seem to prefer modern jazz. I venture to think that if these little sets do become very popular and this type of outdoor use grows, the Noise Abatement Society will try and do something about it. I believe that in the London parks the L.C.C. have a by-law preventing the use of radios at a volume which can cause annoyance to members of the public.

Radio Speeds X-ray Servicing

All X-ray service engineers of Philips Electrical Ltd. working in the Home Counties now have their cars fitted with two-way radio. And after only two months working the scheme has already shown reductions in engineers' time and costs and an all-round increase of efficiency.

The control room is at the company's X-ray service H.Q., Balham. Signals are put out on 70Mc/s, the transmitting mast being situated at nearby Crystal Palace.

The longest distance over which a conversation has so far been held was between London and Winchester.

Engineers on the system call Balham whenever they have completed a job. They can then be sent to other calls which have since come in, or they can be recalled to base.

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Amplified D.C. Transistor Receiver

THIS RECEIVER MAY BE USED WITH EITHER AN AMPLIFIER OR AN EARPIECE

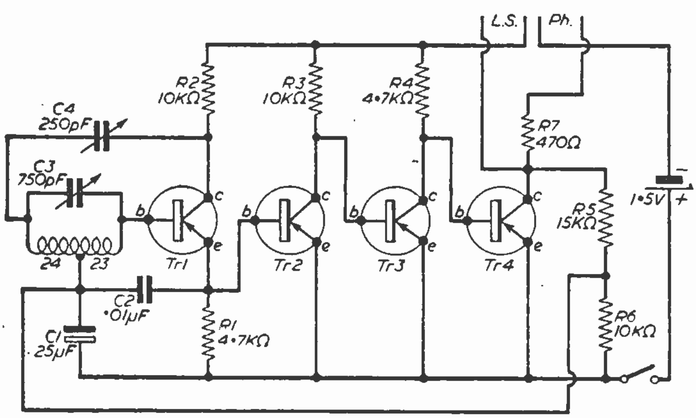
By E. J. Wotton

HAVING spent considerable time trying to produce a small radio receiver which could compete with the commercial sets now on the market, the following effort justifies the time and small outlay entailed. The complete arrangement consists of:—1 A receiver. 2 An earpiece. 3 An amplifier. The approximate cost is £6 10s. 0d., although most amateurs will find many of the components in their spares box. The receiver can be used with the deaf-aid earpiece as a pocket personal receiver using a small ferrite rod aerial. If on the other hand one wishes to share the radio with others, the earpiece is simply unplugged, complete with flex, and the amplifier plugged in and switched on. The mere act of removing the small home-made plug from the receiver switches it off. The amplifier can also be used as an intercom. using the earpiece as a microphone, and also as a gram amplifier. When used this way it would be necessary for a volume control to be introduced.

The completed receiver and its amplifier.

Receiver

It will be noticed that the circuit is the now well-known 4-transistor type, first published in the May issue of PRACTICAL WIRELESS. The only modification which seemed necessary was the aerial winding, this being some 2in. of ⅜in. ferrite rod with 47 turns of 33 s.w.g. enamelled copper wire wound on a Sellotape covering tapped at 23 turns. Transistor holders are used throughout. A U12 battery is also accommodated in the case, and, as only 2mA are consumed, it will be found to last many weeks.



The receiver circuit (the tapped coil is wound on a ferrite rod and constitutes the aerial).

Method of Assembly

The first procedure is to cut a stiff piece of cardboard about 2⅛in. x 3¼in. Then cover the ferrite rod with one or two layers of Sellotape and, starting about ½in. from one end, wind on 23 turns of approx. 33s.w.g. enamelled copper wire and twist a 3in. long loop, then continue with another 24 turns leaving a 3in. end. Cover with a layer of Sellotape. Clean and tin the ends and tap ready to solder in position. Carefully lay out the components on the cardboard making sure that there is enough room for the socket contacts (see Fig. 1), and battery. Mark the position of the transistor holders, battery, and sockets and pierce the cardboard each side of the transistor holders and secure them with thread. Make battery contacts from springy brass (see Fig. 2), and clip into the cardcoard allowing the battery to be a spring fit. The compression condensers can be temporarily secured by their nuts. The socket

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contacts are also made with springy brass and secured at a later stage. Proceed with the wiring.

Socket Contacts

The centre contact also acts as the switch, so be careful that the two pieces of brass do not come into contact with each other. This method of fixing the contacts to the card chassis is very satisfactory, it was found better if the brass was laid flat on to the card and ears marked before bending

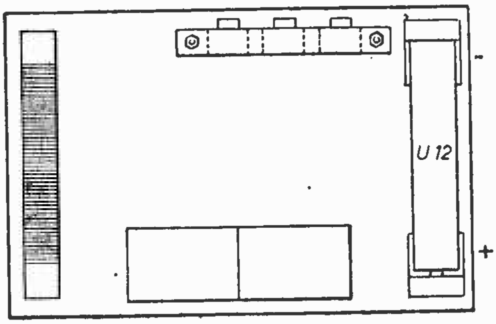

Fig. 1.—General layout of receiver.

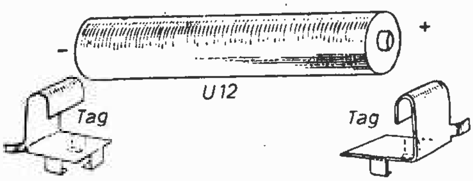

Fig. 2.—Receiver battery clips.

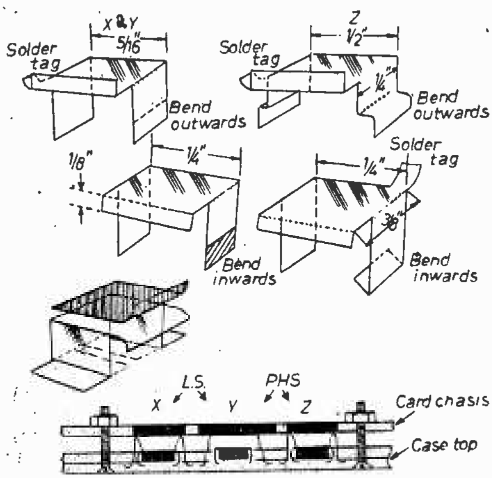

Fig. 3a.—Details of the construction of the socket contacts.

at right angles. The small slots were formed by using a small screwdriver. The indents in the one side of the plugs were cut out with a ¼in. chisel, being careful not to cut right through the plastic.

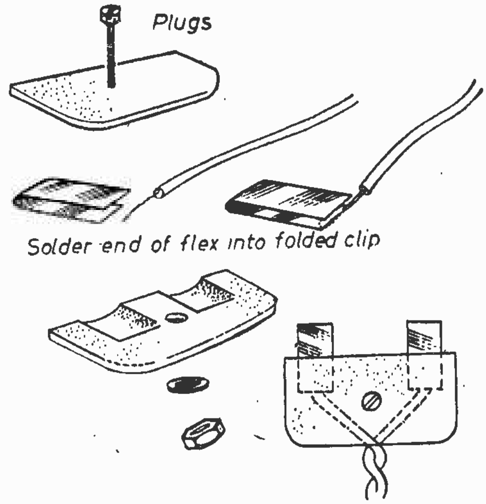

Fig. 3b.—Method of mounting the brass clips on the plastic.

It can be seen that it is not important to prevent the two halves of X and Z from touching. A small strip of plastic was bolted over the set of three contacts (Fig. 3). At this stage it is best to mount the whole assembly on the top of the case. Cut a piece of plastic, size 3¼in. x 2⅜in.

Carefully mark the position of the compression condensers making sure the chassis is ⅛in. smaller

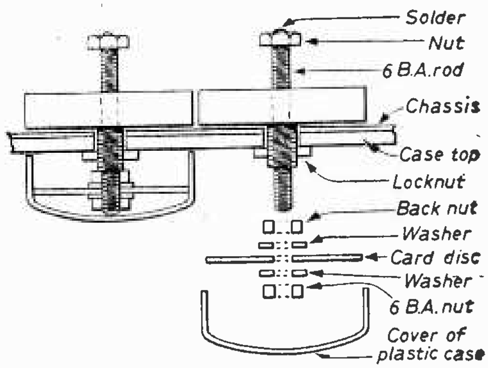

Fig. 4.—Removing the back nuts.

on all sides. drill two ¼in. holes for this. remove back nuts and bolt the chassis to the top with them (see Fig. 4). Now the plastic strip can be bolted right through the chassis and the top with two 8B.A. countersunk bolts (Fig. 3).

The Cabinet

The tuning knobs are quite easy to make and fix. Cut two pieces of 6B.A. threaded brass rod 1in. long and solder a nut on one end. Remove the adjusting screw supplied with the condensers and screw in the prepared spindles which should stand out about ⅜in. when screwed in tight. Obtain two plastic container covers about 1in. in diameter.

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COMPONENTS LIST

Receiver

R1—4·7k, R2—10k, R3—10k, R4—4·7k, R5—15k, R6—10k, R7—470Ω.
C1—25μF Sub min Elec. 6VW.
C2—0·01 Ceramic.
C3—750pF Comp Trimmer.
C4—250pF Comp. Trimmer.
T1—Coupling transformer; about 8½:1.
T2—Driver transformer; red spot; two XB104.
T3—Output transformer to match two XB104s to loudspeaker.
Ferrite Rod 2in. by ¾in.
About 3yd of 30 to 35s.w.g. covered copper wire.

Amplifier

R8—10k, R9—56k, R10—3.3k, R11—1·2k, R12—10k, R13—22k, R14—470Ω, R15—1·0k, R16—7·5k, R17—180Ω, R18—56k.

C5 6μF
C6 100μF
C7 12μF
C8 100μF
C9 100μF
C10 100μF
C11 0·1μF
} Miniature Electrolytic 6VW

Transistors

No. 1 White Spot R.F.
No. 2, 3, 4, 5, 6 Red Spot A.F.
No. 7, 8 XB104. Red Spot. Perdio 3in. loudspeaker. Offcut Warerite about 14in. by 6in. Medium Resistance Earpiece. 2yd small flex. Small switch. About 6sq.in. springy brass.

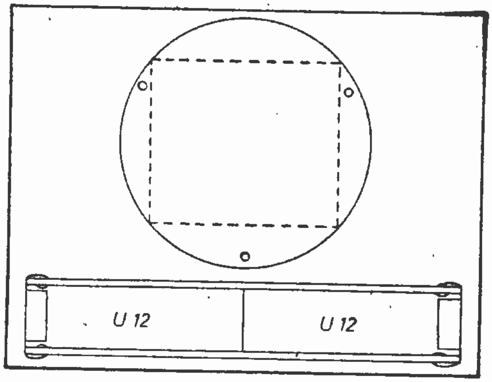

Fig. 5 (above right).—The layout for the amplifier.

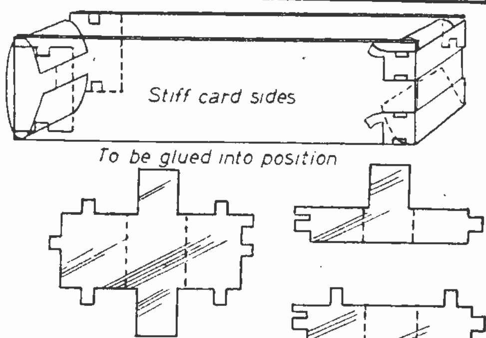

Fig. 6.—Construction of the battery container for the amplifier.

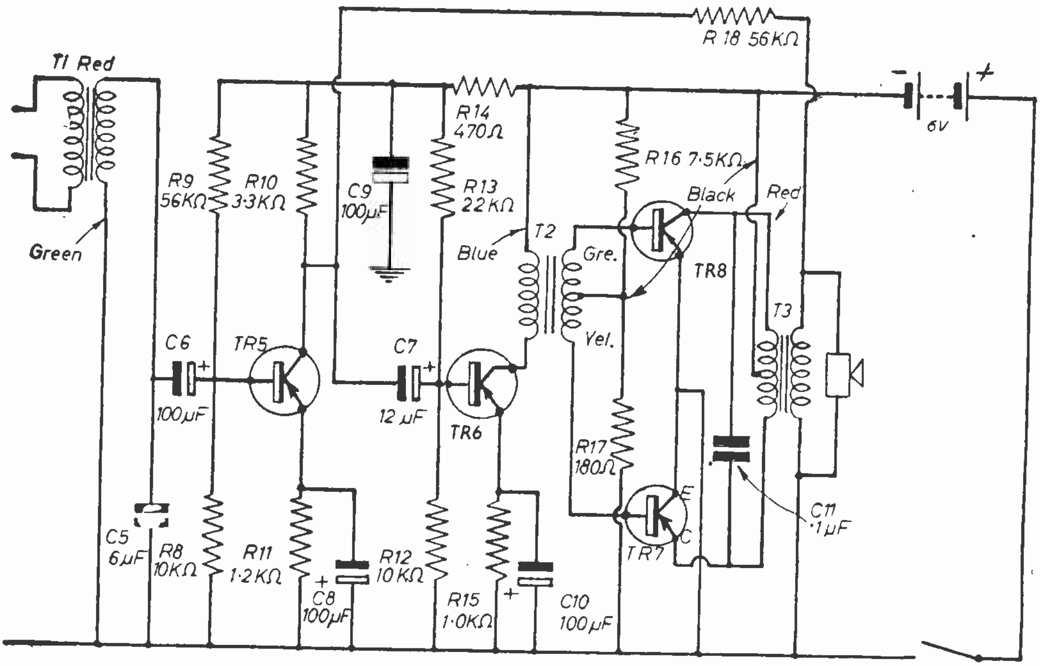

Fig. 7.—The amplifier circuit.

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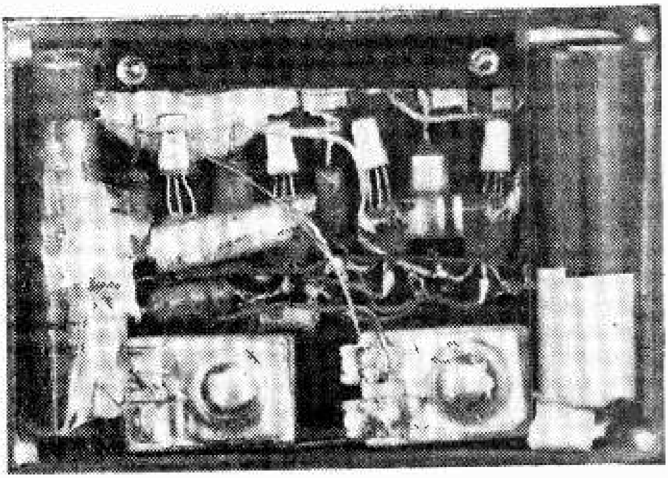
Mark two circles on stiff cardboard to fit tightly into the knobs and drill a hole in the centre to pass over the 6B.A. spindle. Secure in position with a nut and washer each side. Press the knobs over and secure with some adhesive. Turn the knobs clockwise until the trimmers are fully open, and leave to set (see Fig. 4). The case is then made by cutting the four sides from plastic or any material preferred by the reader. Three notches are cut in one side to correspond with the sockets, and four sides are glued to the top. When quite dry, a cover is cut to fit securely with four pieces of Sellotape, and carefully the corners are filed smooth. Remove the back and fit the battery and transistors and check that the polarity is correct. Replace the back and plug in the earpiece lead. It should be quite easy to obtain a strong signal when C4 is at the point of oscillation.



The lay-out of components in the completed receiver.

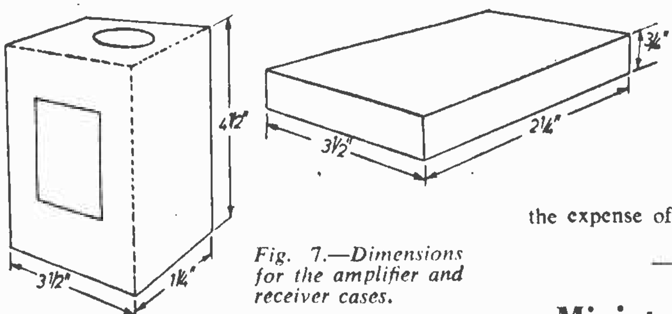


Fig. 7.—Dimensions for the amplifier and receiver cases.

Amplifier

Cut a piece of plastic size 3½in. x 4½in. Position the components on the back of this and mark the fixing holes. Drill these to take about size 6B.A. bolts. Cut a hole either square or round to correspond with the loudspeaker position (Fig. 5), it was found that a rectangular hole was quite adequate.

Before fixing the loudspeaker in position a piece of fine linen was glued over the apperture. Now that the loudspeaker and transformers are in position, carefully lay out the other components. Next proceed with the wiring from the loudspeaker end, working back to the input transformer, leaving enough space to slip the transistors into their holders. The batteries should be allowed plenty of space. When the wiring is complete, the sides can be fitted together. With the small switch it is as well to solder the connections to this before gluing into position on the sides. The best way to accommodate the batteries is to make a small cardboard frame with the contacts fixed in the usual manner (Fig. 6). In all cases when making the small brass contacts it is wise to leave a large nib which can be soldered to the wiring. The imput flex is soldered into position, knotted and passed out through a small hole in the side, after which the home-made plug can be attached. (See Fig. 4).

With the coil wound as before it is not possible to receive the Third Programme. If a 100pF is wired in parallel with C3 this station can be tuned in, but at the expense of losing Radio Luxembourg.

Miniature I.F. Transformers

A new range of miniature pass-band intermediate frequency transformers has been introduced by the Wireless Telephone Co. Ltd., one of the Plessey Group of companies. These are intended for portable transistorised receivers with intermediate frequencies within the range of 450-480kc/s. The chief feature of the new transformers is the parallel mounting of the coils which gives stable coupling and compact assembly. The ferrite cup cores are potted in an epoxy resin to give good mechanical rigidity with resistance to vibration. The can size has been reduced to 1 1/16in. x ¾in. x 11/16in.

Double tuned transformers are used in the first two stages, and a single tuned unit in the third stage, and I.F. alignment is carried out by adjustable dust cores. These are mounted in a novel way; in place of the normal threaded core a plain core is bonded to a polystyrene screw working in a threaded hole in the coil former. This provides a robust adjusting screw for operation by conventional metal-bladed screwdrivers, and this design allows the cores to be wax sealed after final trimming.

The transformer for the third stage has the diode R.F. by-pass capacitor mounted inside the shielding can. *Wireless Telephone Co. Ltd., Hallamgate Works, Crookes Road, Sheffield 10.*

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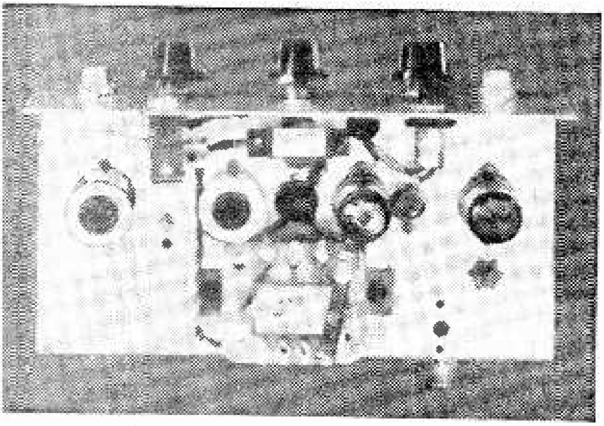
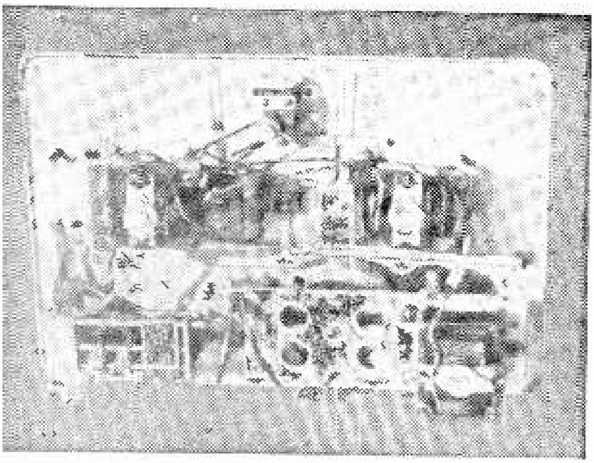
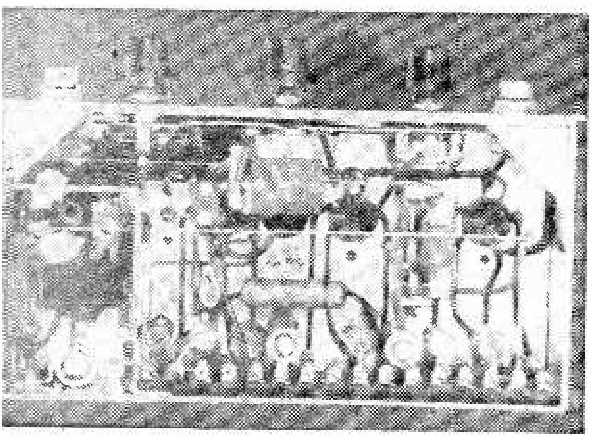


Above.—An above-chassis view of the amplifier.

Below.—The lower side of the tape-deck.





The underchassis view of the amplifier and its panel.

A Versatile TAPE REC

THIS tape-recorder uses a Motek K.9 tape-deck in conjunction with a home-built amplifier and cabinet. For convenience, the recorder can be divided into two sections. The tape transport mechanism and associated motors, together with the record/playback and erase heads, form one section; whilst the amplifier, power-supply, cabinet and loudspeaker form the other.

The Tape-Deck

From the start, it was decided to use a commercially built tape-deck, as previous efforts to build a satisfactory deck had not been successful. One of the main difficulties in constructing a tape-deck is to achieve a very steady tape transport mechanism together with a fast and efficient rewind. Although reasonably fair results were obtained, these were not of a high standard. The tape-deck finally chosen is easily built into a home-made cabinet, small in size although taking 7in. reels, and has simple, push-button controls. The layout of the mechanical parts of the deck is such that there is ample room for placing an amplifier, power-supply and loudspeaker underneath it, without any need to miniaturise or place components in positions likely to get overheated.

Positioning the Power Supply

Preliminary measurements on the deck gave an idea as to what room was available for the various pieces of equipment and also the best layout. One of the difficulties in magnetic recording is the susceptibility of the various parts of the apparatus to interact with each other and produce undesirable hum and noise. The power-supply is the chief offender, especially if placed close to the record/playback head. The best place for the power pack is as far away as possible from the head, yet in a space that will allow an uncramped layout and a small amount of movement, for even altering the position of the mains-transformer by $\frac{1}{4}$in. can greatly reduce hum.

Choice of the Loudspeaker

In order to obtain good results from the loudspeaker, it should be as large as possible and well mounted in the cabinet. The maximum size of loudspeaker that could be used without making the cabinet too bulky was found to be $8\frac{1}{2}$in. x $5\frac{1}{4}$in. An

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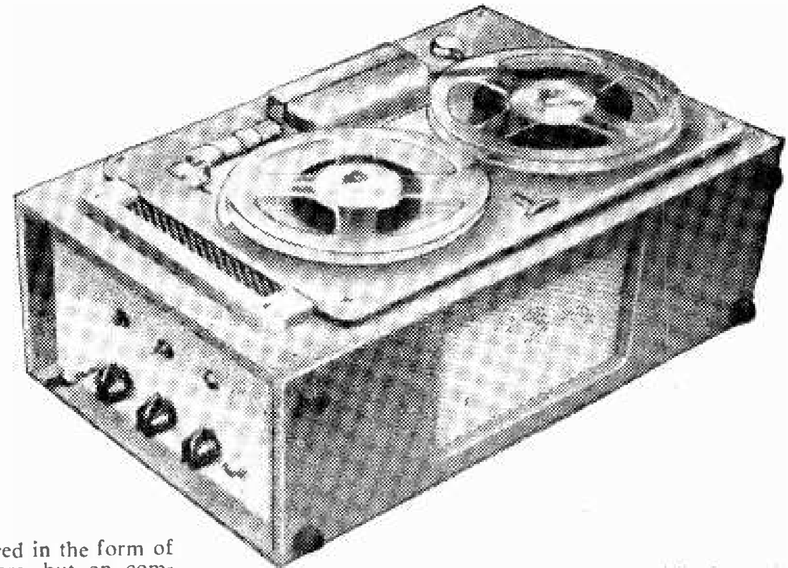

)RDER

A HOME-MADE AMPLIFIER AND CABINET WITH A COMMERCIAL TAPE-DECK

By D. L. Woolley

alternative was considered in the form of two smaller loudspeakers, but on comparing the results obtained from the two arrangements, the larger loudspeaker sounded more realistic, especially for music. Finally, a high-flux permanent-magnet loudspeaker was chosen.

The Amplifier

With a general idea as to the room available, the amplifier was considered next. It had already been decided as to what was expected of the amplifier and it was necessary to design one which would fit into the allotted space and yet would function as required.

For a recorder of this type, the amplifier has to serve both as a record and play-back amplifier; each function being determined by suitable switching. In addition, there are several aspects of such an amplifier which are very important. It must have sufficient gain to amplify signals from the microphone, or other source, to provide an adequate signal to energise the recording head in the record position, and a similar amount of gain to drive the loudspeaker from the small playback signal. As the average output from a combined record/playback head is only about 3mV, the gain has to be very high. In carrying out these functions, the hum and noise level should be kept as low as possible, or the signal to noise ratio will be greatly reduced. Another difficulty to be faced is that of providing the correct compensations for the non-linear record/playback process.

The graph (Fig. 1) shows the probable constant-current recording frequency response and the required playback compensation. At low frequencies—between 50c/s and 1,500c/s a compensation network, giving 6dB per octave boost, is required, but above about 1,500c/s another network is needed giving more than 6dB. A number of ways of doing this are described later, including the one chosen for this recorder.

In order to provide a high frequency signal for both erasing and biasing, an oscillator is needed, working at a frequency of about 60kc/s, but it is only required during the record process.

With these thoughts in mind, the circuit diagram (Figs. 2 and 3) was the one finally chosen. In all, only five valves are used, one being a full-wave rectifier, and of the other four, only three are used during playback.

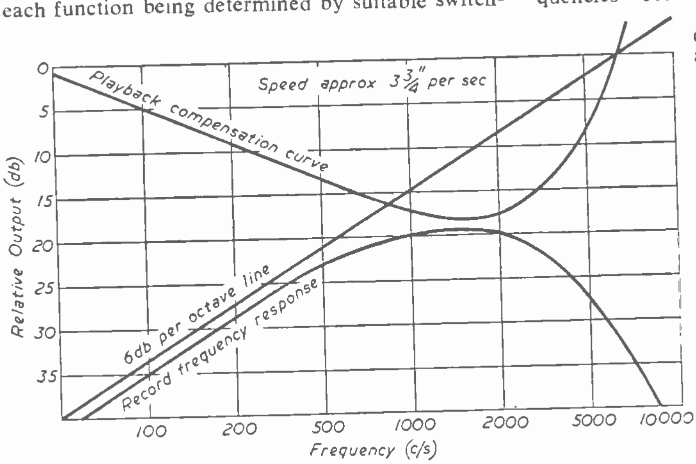

Fig. 1.—The graph of the relative output (dB) to frequency.

Record/Playback Switch

With amplifiers of this type, great care is needed when designing the switch that will convert the amplifier from the record to the playback position. In this case, the number of switched circuits has been kept down to a minimum without sacrificing

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any efficiency. There are only four sections of the switch, each being three-way. The second, or central, position of the switch is used to convert the amplifier into a general purpose one, so that it can be used without the tape-deck. Another important feature of the switch mechanism is that via C14 and R19 to SB1 where they are switched on to the high-impedance record head. The oscillator valve V4, is also switched on by SD1 and bias signals are applied via C17 and SC1 to the record head, whilst an erase signal is fed via C18 to the high-impedance erase head.

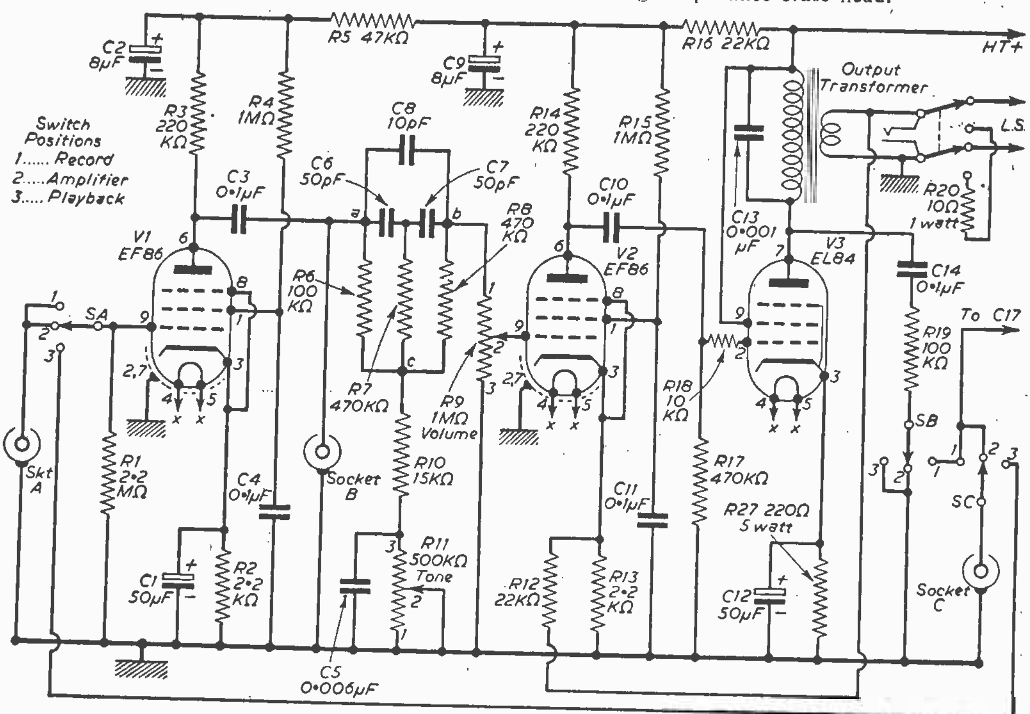

Fig. 2.—The circuit of the amplifier, excluding the bias oscillator and power supply.

on switching from record to amplifier, the bias voltage on the record head is made to die away slowly as C19 discharges. This prevents the record head from becoming magnetised by abruptly switching off the bias. A magnetised head will introduce a great deal of additional noise on playback.

Amplifier Theory

For recording, the grid of V1 is connected via SA1 to the high-gain input socket A. V1 acts as a high-gain voltage amplifier with screen grid and bias voltages supplied by R4 (decoupled by C4) and R2 (decoupled by C1) respectively. After amplification the signals are passed via C3 to a frequency-compensating network; which will be described in detail later, and on to the volume control R9. From here the signals are further amplified by V2 (acting in exactly the same way as V1) and passed on to the output valve via C10 and R18. After further amplification in V3 the signals can be heard via the output transformer and loudspeaker (or through headphones if it is desired to mute the loudspeaker when recording "live" from a microphone).

From the anode of V3 the signals are also passed

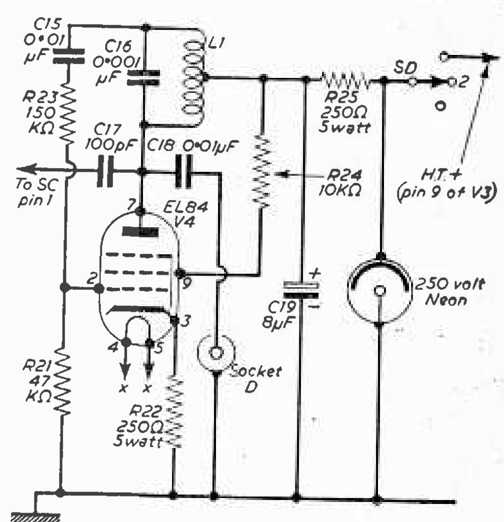

Fig. 3a.—The bias oscillator circuit.

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If a high input source is available (e.g. a radio-tuner or gramophone), this can be connected to the low-gain socket (B) and socket A shorted out with a shorting plug, or fed from a microphone with a built-in volume control. In this way, two signals can be mixed together at the volume control and then recorded.

Record-Level Indicator

One feature during recording is the record-level indicator. This is built as a separate unit in a small box and not into the recorder as is the general practice. If the source of sound is varying in intensity considerably, constant watch on the record-level indicator is required.

The recorder was used mainly with a small mixer unit, which controlled the signal being fed into the input socket (B), the volume control R9 being at maximum. With the indicator close at hand (being fed from the output transformer with the loudspeaker switched off), the recorder could be placed over 20ft or more away. The indicator can easily be built into the recorder if so required.

In the amplifier position, both input sockets A and B are used as before, but R19 is now earthed via SB2 and the bias oscillator switched off. The amplifier can now be used on its own for a good quality reproducer of radio or gramophone signals, at a maximum output of 5W. In all three positions of the switch, negative feedback is applied from the secondary of the output transformer to the cathode of V2. This greatly improves the quality of reproduction of the amplifier.

In the playback position, the grid of V1 is connected via SA3 and SC3 to the record/playback head; R19 remains earthed via SB3. Socket B can now be used to supply a larger amplifier with signals from the tape in order to obtain the very best reproduction, although the playback amplifier will be ample for normal purposes, especially if an extension loudspeaker in a large cabinet is used. If required, socket B can be used to mix another signal with that from the tape (e.g. background music for a play can be tried out this way without spoiling the tape).

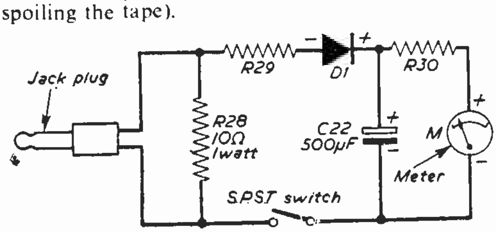

Fig. 3b.—The circuit of the record level indicator.

The Amplifier and Power Supply

The amplifier itself is built on to an aluminium chassis measuring 8in. x 4in. x 2½in. deep. Except for the bias oscillator and equaliser circuits, all small components are built onto one 16-way tag board. The equaliser circuit is itself built on to a smaller 5-way tag board which is mounted in such a way that it can be removed easily and an alternative equaliser circuit tried. A smaller aluminium chassis, 7in. x 3½in. x 1in. deep holds all the power supply components and has ½in. external flanges on the 3½in. sides in order to mount the power-pack on to the wall of the cabinet.

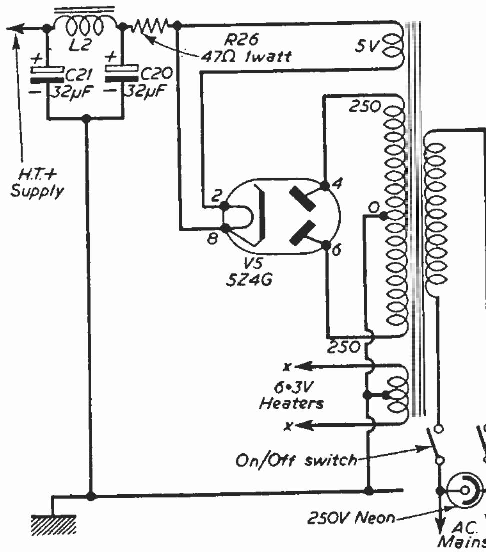

Fig. 3c.—The power supply circuit.

The Front Panel

An aluminium front panel is used with the amplifier chassis, the size of the panel can be altered slightly to suit requirements. It must, however, be 5½in. high, although the length can be from 9in. to over 11in. depending on the width of the recorder cabinet used.

First of all, the amplifier chassis is required. This can be home-made to the dimensions given in Fig. 4a, or a commercial chassis may be used. The four valve-holder holes should be cut first. A valve holder (B9A) should be placed in each hole in turn and two marks made indicating positions for holes to be drilled for fixing bolts. These holes should be ⅛in. in diameter. The other holes can now be drilled, care being taken to make sure that the socket, grommet or other component fits the hole made for it. Do not mount any components yet. A piece of 16s.w.g. aluminium is cut to size and drilled to form the screen that isolates the oscillator section. The three bends should be made carefully—a good idea is to score the metal heavily with a sharp tool on the inside of the bend. A sharp bend will then result. The screen can now be fitted into the chassis temporarily and tested for size and shape, its fixing holes being made to align with others drilled in the chassis. Now, remove the screen and put it carefully to one side.

It should have already been decided as to the make of tape-deck and size of cabinet to be used. In most cases, an external width of about 12in. is needed. (The length does not affect the size of the front panel used.)

(To be continued)

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A Tremolo Unit for an Electric Guitar

THIS PIECE OF EQUIPMENT MAY BE USED SEPARATELY OR IN AN AMPLIFIER

By F. C. Judd, A.Inst.E.

THE well-known Tremolo effect, which constitutes variations of either amplitude or frequency, has recently become popular with guitarists using the modern electric instrument and its associated amplifier.

Amplitude Variation

One of the problems with the amplitude variation method is that of preventing the harmonics of the low-frequency tremolo oscillation from being amplified, thus producing an objectionable thumping sound, especially when the amplifier chain is operated at full gain. The problem may be partly solved by injecting the tremolo oscillation at the final stages of the amplifier: for example, into the amplifier valve directly preceding the actual output stage. This is quite practicable if the main amplifier can be specially constructed with an incorporated slow-rate oscillator. However, for those who have an existing amplifier and do not wish to modify it, the only solution is to build an entirely separate but combined tremolo and pre-amplifier unit using the circuit of Fig. 1.

The pre-amplifier V1 has almost zero gain because of the negative feedback between the anode and grid. The valve is used primarily to obtain the necessary amplitude variation and is controlled by the low-frequency phase shift oscillator V2. The circuit also makes provision for a power supply, although there is no reason why the power should not be obtained from the main amplifier (250/350V D.C. and 6·3V A.C. are required).

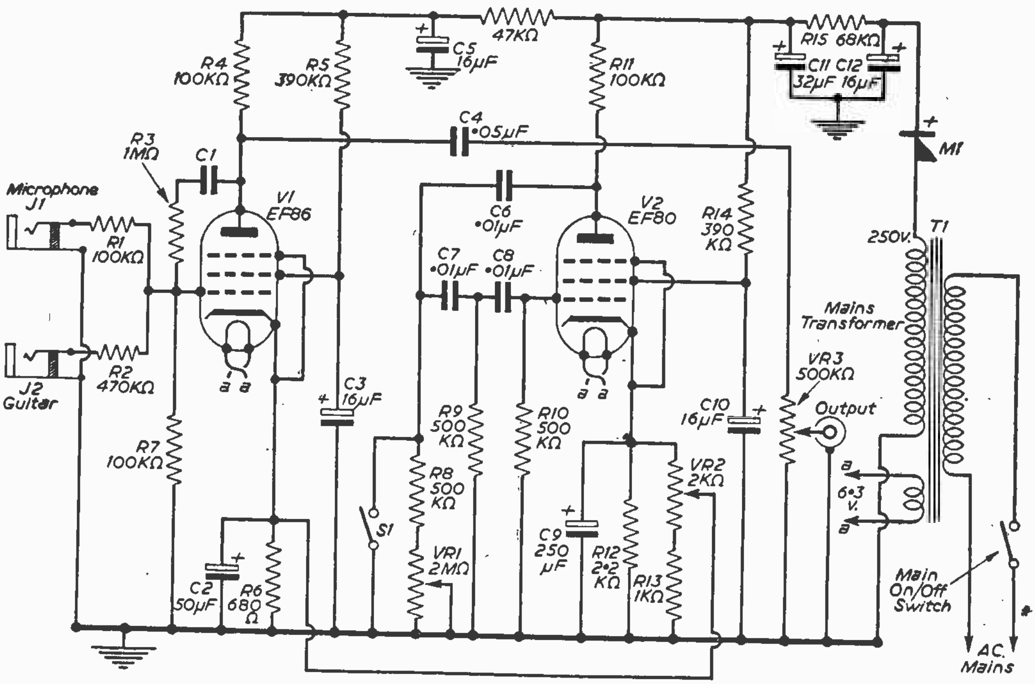

Fig. 1.—The circuit of the tremolo and pre-amp unit.

The output from the tremolo unit is taken from a 500k potentiometer, VR3, which provides full control over the output voltage so as not to overload the main amplifier first stage. The original design was contained in a case 11in. x 5in. x 4½in., which included the power supply transformer and components. Layout of the unit is not critical, and providing the usual rules for audio equipment are observed no trouble with hum or instability should be experienced.

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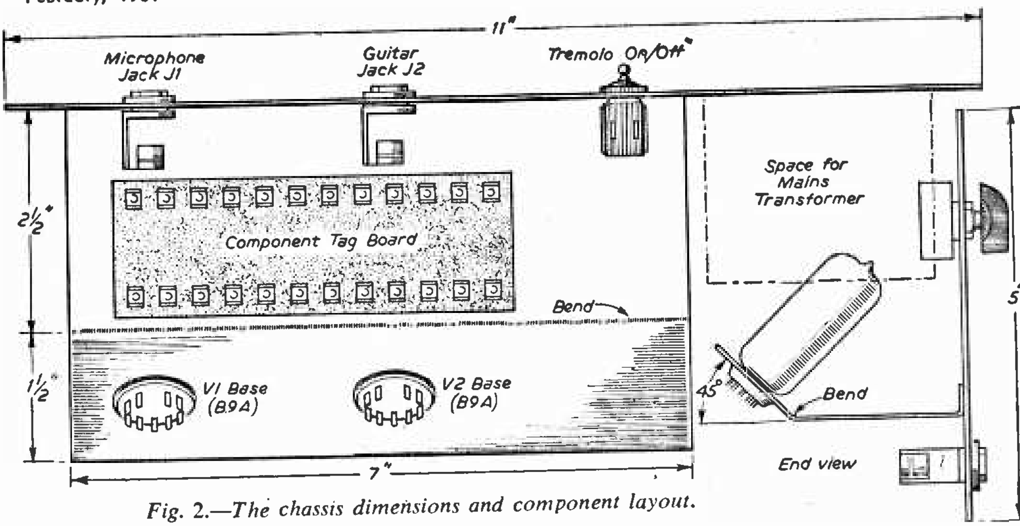

Fig. 2.—The chassis dimensions and component layout.

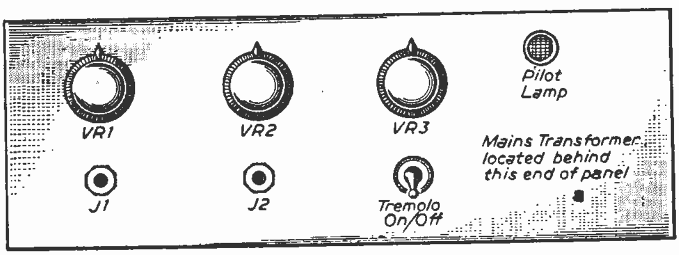

Fig. 3.—The control panel

Circuit Description

Two inputs are provided which may be used for guitar or microphone. The one marked "Microphone" requires only a low voltage input and may be found useful for guitars with low sensitivity pick-ups. The input marked "Guitar" is adjusted to comply with pick-ups of average sensitivity. Negative feedback prevents full gain from V1 whose cathode is taken via a potentiometer VR2 (tremolo amplitude) to the cathode of the phase shift oscillator V2. Note the very high capacity decoupling capacitors on V2 cathode. The use of a smaller value will result in harmonic thump from the main amplifier. Variation of the tremolo rate between 4·5 and 10c/s is provided by VR1 and the tremolo may be switched off by S1.

Adjustment of Tremolo Rate

The output from the tremolo unit is taken to the guitar input of the main amplifier which may be operated with nearly maximum gain, thus allowing the gain control on the tremolo unit to be used for normal gain control purposes. In this way overloading of the main amplifier input may be prevented, unless the guitarist wants a square-wave output—which incidentally is an effect sometimes deliberately introduced for single string solos.

To produce the best and most pleasing tremolo, adjust the amplitude control until a slight waver on a struck note is just noticeable, the most effective rate being about 6c/s. Too much amplitude and too fast a rate of oscillation will spoil the effect and is likely to introduce a certain amount of harmonic thump.

Constructional Details

The original design was produced for commercial application and a prototype was constructed in a mild steel (18s.w.g.) case, 11in. x 5in. x 4½in. Fig. 2 gives chassis and panel dimensions and shows the layout adopted with regard to the positions of the valves and the tagboard on which all

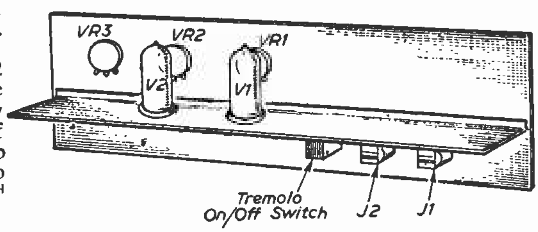

Fig. 4(a).—This unit can be mounted on an existing guitar amplifier.

the small components were mounted. The chassis is folded at an angle of 45deg to accommodate the valves within the case. There is ample space for the small mains transformer on the back of the panel within the area marked. Controls may be arranged side by side on the front panel above the chassis, and if small single-hole fixing microphone jacks are used they may be accommodated on the section of panel below the chassis (see Fig. 3). The tagboards (miniature 12 way) are mounted on the under side of the chassis, thus permitting short

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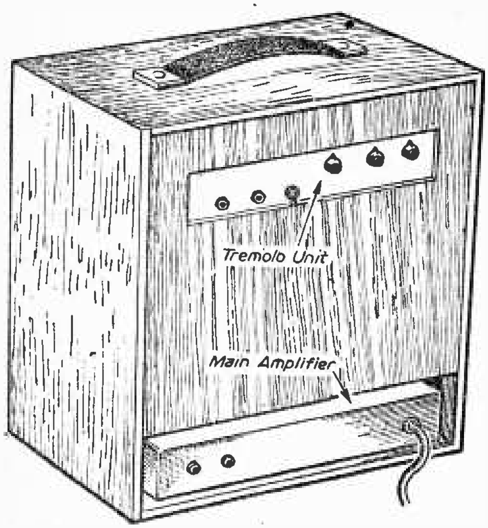

Fig. 4(b).—An amplifier with a tremolo unit fitted in the back.

leads to the valveholders. The order of components on the tagboard is not critical as there is no likelihood of instability or cross-talk; simply plan the layout for convenience of wiring and if an all-metal box is in use no leads need be screened. The output co-axial socket may be mounted at the rear of the case or on the front panel; whichever is more convenient.

Alternative Arrangement

Some may find it more practical to mount the unit in the guitar amplifier case. An alternative version was in fact assembled on a fairly long but narrow panel that could be mounted on the back cover at the top. Fig. 4 shows how this may be done and if this arrangement is used the chassis need be only 2in. or so wide but long enough to comfortably accommodate the two valves and the tagboard. Power may, of course, be obtained from the main amplifier H.T. and heater supplies as the unit consumes only a few milli-amps of H.T. current and 0·6A for the heaters.

COMPONENTS LIST.

V1 EF86.
V2 EF80.
Microphone Jacks.
Resistors all ½W.
C2, C3, C5, C9, C10, C11, C12 Electrolytic Capacitors.
Remaining of capacitors are tubular.
S1 On/Off type toggle switch.
M1 Metal Rectifier — Westinghouse type 16.R.C.-1-16-1.
T1 Mains transformer 220-250V pri. 250V single sec: H.T. 6·3V 1A.
VR3 and VR1 Standard size potentiometers.
VR2 Wire wound.
Standard type co-axial Output socket.
Valve Holders B9A Noval.

A Stereo Amplifier

(Continued from page 888)

The previous stage must provide a signal Va equal to Vin plus the signal voltage across R2.

Va must therefore be 4/3 of Vin, which is the same as saying that the stage gain is reduced to ¾ of what it was without feedback. The stage gain thus becomes 9, and for the two stages the overall gain is $9 \times 9 = 81$ times. An input of 150mV, will produce 12V of audio for the output valve which will thus be fully loaded. It follows from the above argument that the higher the anode load the less the loss through feedback, but the higher the cathode resistor the greater the feedback; unfortunately the higher the anode load the higher the cathode resistor has to be for a given bias voltage, and consequently the benefits of a larger anode load can be taken only in stages working at a low signal level in which a low bias voltage can be accepted.

In the present design the cathode bypass capacitor has been omitted in the output stage also. The effect on gain is noticeable but not serious whereas the feedback does clean up reproduction to any degree. If the constructor found the need for just a little extra gain he could try the effect of fitting a 25μF electrolytic across R8 and R16.

(To be continued)

COMPONENTS LIST

Resistors:

R1, 9	1M	½W
R2, 6, 10, 14	3·3k	½W
R4, 12	10k	½W
R7, 15	220k	½W

R3, 5, 11, 13 100k high stability ½W
R8, 16 240Ω wire wound 5W

Condensers:
C1, 4 32+32μF 350V electrolytic
C7, 8 16+16μF 350V electrolytic
C2, 5 0·01μF 400V
C3, 6 0·1μF 350V
VR1, 2 1M

Valves:
V1, 3 12AU7
V2, 4 6BW6
V5 EZ81

Other Parts:
S1, 2 Single pole toggle switch.
L1, 2 Indicator lamps in holder.
TFR1, 2 Output transformer (Parmeko P2641).
TFR3 Mains transformer 300-0-300V 120mA (Parmeko P2644). 2 x 6·3V CT, 6·3V
Choke 10H 120mA (Parmeko 549).
Output sockets.
Input socket—4 pin miniature.
Valve holders—5 off type B9A.

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1C5GT	9/9	6B7	9/6	6K7G	2/3	7B6	9/6	12SG7	6/-	54KU	8/9	DH76	5/6	ECF82	9/9	EY86	8/-	PCF80	7/6	U35	8/9	UL44	12/6
1H5	9/6	6B8G	3/6	6K7GT	5/-	7B7	7/3	12SJ7	5/6	618PT	11/-	DH77	7/-	ECH21	14/-	EZ35	6/-	PCF82	7/6	U37	26/6	UL46	9/9
1D6	9/9	6BA6	6/-	6K8	10/-	7C5	7/6	12SK7	5/6	75	8/-	DK32	11/9	ECH35	9/6	EZ40	6/9	PCL82	8/6	U43	8/9	UL84	7/9
1H5GT	9/9	6BE6	6/-	6K8G	5/6	7C6	7/3	12SN7GT	8/6	77	6/6	DK91	6/-	ECH42	8/6	EZ41	7/3	PCL83	11/6	U50	6/-	UM80	9/6
1L4	3/6	6BG6G	12/6	6K8GT	10/-	7E7	9/6	12Y4	9/6	78	7/6	DK92	8/6	ECH81	8/3	EZ80	6/3	PCL84	9/9	U52	5/-	UU6	12/6
1LD5	3/6	6BH6	6/-	6L1	12/6	7H7	7/6	14S7	14/9	80	8/6	DK96	7/9	ECL80	7/6	EZ81	7/-	PEN25	4/6	U76	5/6	UU7	9/6
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1S5	5/3	6BX6	5/3	6L18	9/-	7V7	7/9	20L1	13/6	723A	29/-	DL92	6/-	EF39	4/3	HL41DD	9/6	PL38	14/6	U301	14/-	UY85	6/9
1T4	4/-	6C4	3/6	6L19	12/6	7Y4	7/-	20P1	11/6	807A	5/-	DL94	7/-	EF40	13/6	HVR2	7/6	PL81	9/9	U309	12/6	VR105/30	7/-
2D21	4/6	6C5	5/6	6LD3	8/6	7Z4	7/6	20P3	12/6	807E	3/9	DL96	7/9	EF41	8/6	KL35	7/9	PL82	7/6	U329	12/6	VR150/30	5/6
3A4	5/6	6C6	4/9	6LD12	7/6	8D3	3/6	20P4	17/-	808	15/-	EA50	9d.	EF42	7/6	KT32	6/9	PL83	7/6	U339	11/-	W61M	11/-
3D6	4/6	6C9	9/6	6LD20	8/6	10C1	11/-	20P5	16/-	954	2/-	EABC80	7/6	EF50-BR	2/-	KT33C	6/6	PL84	11/-	U403	9/6	W76	5/6
3Q4	7/3	6CD6G	18/6	6N7	6/6	10C2	13/6	25A6G	8/-	955	3/9	EAC91	4/9	EF50-USA	2/6	KT36	9/-	PM80	9/9	U404	6/6	W77	4/9
3Q5GT	8/9	6CH6	3/9	6P1	14/-	10C14	9/-	25L6G	6/9	956	2/9	EAF42	8/6	EF54	3/3	KT44	9/6	PX25	16/-	U801	29/-	W81	5/9
3S4	6/-	6D1	9d.	6P25	9/-	10F1	6/9	25L6GT	9/-	5763	10/-	EB34	1/6	EF80	5/3	KT45	8/6	PY31	8/3	UABC80	8/9	X61M	12/6
3V4	7/-	6D2	3/9	6P28	12/6	10F9	10/3	25Y5G	9/-	9001	4/-	EB41	7/-	EF85	7/-	KT61	9/-	PY32	10/6	UAF42	9/-	X63	9/6
5R4G	9/6	6D3	12/6	6Q7G	6/9	10L14	8/-	25Z4G	7/3	9002	4/9	EB91	3/9	EF86	10/3	KT63	6/6	PY80	7/-	UB41	8/-	X65	11/-
5U4G	5/-	6D6	4/9	6Q7GT	9/3	10LD3	8/3	25Z5	8/-	9003	4/-	EBC3	9/-	EF89	8/-	KT66	12/6	PY81	6/6	UBC41	8/3	X66	11/-
5V4G	9/6	6F1	5/9	6R7G	7/6	10LD12	8/9	25Z6	9/-	ATP	2/9	EBC33	5/-	EF91	3/6	KT76	9/6	PY82	6/9	UBC81	10/-	X76M	9/6
5Y3G	6/-	6F6G	6/3	6SA7	5/9	10P13	9/6	27SU	16/-	AZ31	9/-	EBC41	8/6	EF92	4/9	KT81	14/-	PY83	8/-	UBF89	8/6	X78	14/(
5Y3GT	6/6	6F6M	7/-	6SG7	4/9	10P14	9/6	30C1	7/6	B36	3/6	EBC81	7/9	EF95	6/9	KTW61	5/6	PZ30	12/-	UBL21	14/6	X79	16/6
5Y4G	11/-	6F12	3/6	6SH7	4/6	10P18	8/-	30F5	7/-	B65	4/9	EBF80	8/6	EK32	7/9	KTW63	4/9	R18	12/6	UCC84	14/6	Y63	6/3
5Z4	11/-	6F13	6/9	6SJ5	5/-	12A6	5/3	30FL1	9/6	CBL31	21/-	EBF89	8/6	EL32	4/6	KTZ63	5/6	R19	12/6	UCC85	8/-	Z63	5/3
5Z4G	8/6	6F14	9/6	6SK7	5/3	12AH7	6/9	30F1	7/9	CCH35	7/6	EBL21	14/-	EL33	9/-	L63	2/9	SD6	9/-	UCF80	16/-	Z66	9/6
5Z4GT	11/-	6F15	9/6	6SL7GT	6/-	12AH8	9/9	30P4	12/6	CL33	18/-	EBL31	21/-	EL35	8/6	LN152	7/6	SP6	8/9	UCH21	14/6	Z77	8/6
6A7	10/-	6F16	8/6	6SN7GT	4/9	12AT6	7/9	30P12	8/-	CY31	9/9	EC52	3/9	EL37	11/6	LZ319	7/6	SP41	2/6	UCH42	7/9	Z152	5/3
6A8G	9/6	6F33	6/9	6SQ7	6/3	12AT7	5/9	30P18	7/9	D63	1/6	EC90	3/6	EL38	12/6	MU14	8/-	SP61	2/6	UCH81	8/6	Z719	5/3
6A8GT	13/6	6G6	3/-	6SS7	5/-	12AU7	6/6	30PL1	10/6	D77	3/9	EC91	4/6	EL41	8/6	N37	11/-	SU25	15/-	UCL81	11/3		
6AB8	8/3	6H6	2/-	6U4GT	10/6	12AX7	7/-	35L6GT	9/-	D152	6/6	ECC31	9/6	EL42	9/6	N78	15/-	SU2150A	4/6	UCL83	13/6		
6AC7	4/3	6J5	4/3	6U5G	6/3	12BA6	8/-	35W4	6/9	DA30	12/6	ECC32	4/-	EL84	7/-	N108	18/-	T41	7/6	UF41	8/6		
6AG5	4/3	6J5G	2/9	6V6G	5/6	12BE6	8/9	35Z4GT	5/6	DA90	2/6	ECC33	4/9	EL91	4/9	N152	10/6	TH30C	12/6	UF42	6/9		
6AG7	8/-	6J5GT	3/9	6V6GT	6/6	12BH7	10/6	35Z5GT	8/6	DAC32	9/9	ECC34	9/-	EM34	8/6	P41	4/6	U14	8/-	UF80	9/-		
6AK5	6/9	6J6	4/-	6X2	8/9	12C8	8/6	42	7/6	DAF91	5/3	ECC35	6/9	EM80	9/3	P61	2/3	U18	8/6	UF85	9/-		
6AL5	3/9	6J7	7/9	6X4	5/6	12E1	12/6	43	7/6	DAF96	7/9	ECC81	5/9	EM81	9/3	PABC80	11/-	U22	6/9				
6AM5	4/6	6J7G	5/6	6X5G	5/6	12J5GT	3/6	50C5	9/6	DF33	9/9	ECC82	6/6	EM84	9/9	PCC84	7/6	U24	15/-				
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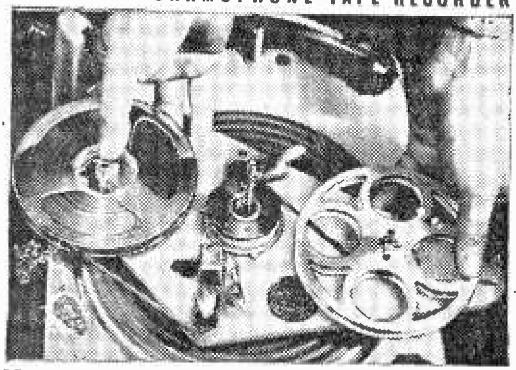

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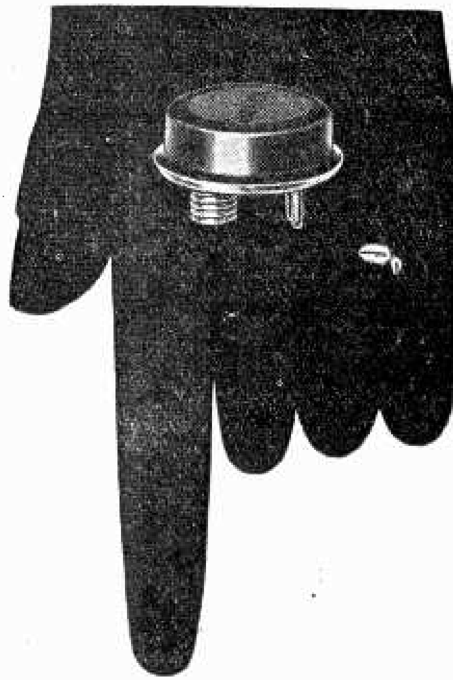

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An Efficient Mains Filter

ELIMINATING MAINS-BORNE INTERFERENCE

By M. D. Roberts

THIS filter was designed for use with mains radio receivers in areas where mains interference is troublesome. It consists simply of two chokes and four condensers, but the very nature of the construction makes it into an efficient filter network.

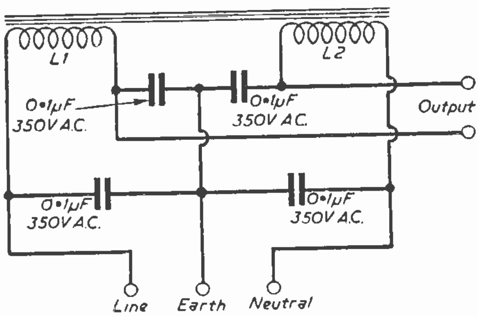
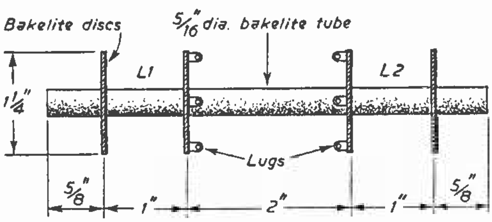


Fig. 1 (above).—The simple circuit.

Fig. 2 (below).—Details of the coil cheeks fitted on the bakelite tube.



Mains Input

The mains to the receiver is fed through L1 and L2, these two coils being wound on the same core to help limitation of interference in the filter. The addition of the four condensers make up a very efficient filter.

Construction

The first stage is to obtain a piece of 5/16in. diameter Bakelite tube, 5¼in. long, and four Bakelite discs 1¼in in diameter with a hole in the centre of each so that they just fit on to the tube. Fig. 2 shows these in position, but before they are glued down two of the discs must be modified slightly. From Fig. 2 it will be seen that there are some connecting lugs on two of the Bakelite discs. These lugs are at 90° to each other (Fig. 3). They consist of 8B.A. nuts and bolts with 8B.A. solder tags, and they must be as close to the edge as possible, as otherwise they get in the way of the coils when they are wound.

When two of the discs have been modified, assemble them as shown in Fig. 2 and cement them into place with some hard-setting glue.

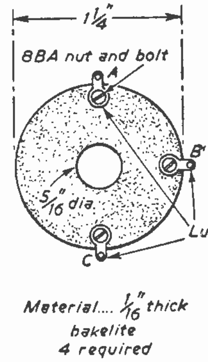


Fig. 3 (right).—The bakelite formers and the lugs set at 90° to one another.

Coil Winding

When the glue has set, pile-wind 140 turns of 18s.w.g., tinned copper wire for L1 and L2. Wind both coils in a clockwise direction, and about four layers of winding will be needed for each coil. Connect the ends of each coil to tags A and C on its respective disc. Next join the B lug on both discs together with a short piece of lead. Wire the earth of the mains input lead on to one of the B tags, and the live and neutral mains lead on one end of each choke. Take the mains output from the other end of each choke via a piece of mains lead.

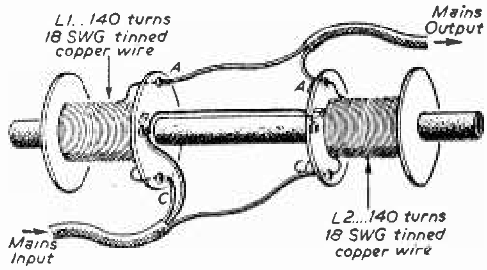


Fig. 4.—The unit complete without its case.

The unit should appear as it does in Fig. 4 at this stage, being completely wired except for the condensers. Take two condensers each to B1. Wire one side of the remaining two condensers to lug B. One of the condensers that has been wired to B must be wired on to A, and the other on B1 must be wired to C.

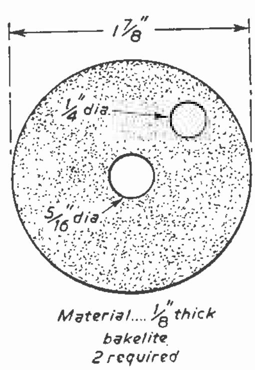


Fig. 5 (left).—Drilling details of the case ends.

(Continued on page 910)

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High Impedance Voltage Indicator

A USEFUL AID FOR ALIGNING VHF/F.M. RECEIVERS

By J. Willmott

THE constructor of VHF receivers is faced with one seemingly difficult problem, that of alignment of the completed unit. Here, there is a major difference between, say, the normal A.M. superhet receiver and a VHF/F.M. unit, the former can be aligned to a reasonable degree of accuracy without the use of instruments, provided that care and patience are taken over the procedure. When it comes to the alignment of F.M. tuner, a much higher degree of accuracy is required if satisfactory results are to be obtained, and the use of instruments is essential. Many of the firms retailing kits offer an alignment service for a very modest fee, and doubtless to many constructors this represents the easiest and most satisfactory solution, but for the radio enthusiast who neither wants to resort to these means nor to buy equipment such as wobbulators and oscilloscopes, necessary for any such operation, all is not lost, provided he is in possession of an ordinary A.M. signal generator, capable of covering the 10·7Mc/s I.F. of standard F.M. receivers, and a sensitive output indicator of some sort, either a voltmeter set to the 10V range and having a sensitivity of not less than 10,000Ω/V, or a valve voltmeter. Moving-coil meters of this sensitivity are expensive and somewhat delicate, and most constructors have to make do with a l[illegible] sensitive, multi-range meter [illegible] general testing needs, and so[illegible]e "Valve" voltmeter comes t[illegible] mind, which is an ideal instrument for the purpose in hand, as it draws virtually no current from the circuit to which it is connected.

Valve Voltmeters

There have been a number of designs for valve voltmeters featured in PRACTICAL WIRELESS from time to time, but these were of fairly elaborate design, having provision for measuring a large range of voltages with great accuracy. All that is required in the present instance is some indication of the presence and amplitude of voltages in the 0 to 10V range, the exact voltage represented by any particular meter deflection is of no importance. In other words all that is needed is an indication of rise or fall in voltage present at the selected high impedance test point. With these factors in mind, a simple indicator to which the normal multimeter can be connected to provide the comparative readings was designed, and has proved highly satisfactory. The indicator can be used with any meter possessing a basic movement of 2·5mA, or better still, 1mA. The cost of construction is extremely low, even if every component had to be purchased, but the majority of parts will be found in most "spares boxes". The prototype was constructed to operate from the standby bench power supply of 6·3V (heaters) and 250V (H.T.), but as it is obviously preferable to have a more self-contained instrument, a further design was developed, incorporating a fully isolated half-wave power supply unit, using a small mains transformer of the type designed for TV pre-amplifiers, etc. The impedance of the completed instrument is in the region of 10M, and will be found to give a useful deflection of the meter movement when connected to the AVC line of an F.M. tuner (or ordinary A.M. superhet receiver), or across the ratio detector network.

It is well known that the current passed in the anode circuit of a triode valve is dependent upon the applied H.T. voltage at the anode, and the negative "bias" voltage applied to the control grid, and that if the anode volts remain constant whilst the grid bias voltage is varied, the anode current will vary, a reduction in bias causing an increase in anode current. If it is arranged to monitor the anode current passed by the valve with a meter in the anode circuit, any change in voltage existing at the control grid will be reflected in the meter reading. The impedance of the grid circuit can be made so high (10M in the present case) that practically no disturbance is made to the voltage distribution of any circuit to which the test probes are connected. It is usual to arrange that under static conditions, i.e. when no external voltage is present at the test probes, the valve is so biased that anode current is exactly cut off, and the meter reads "zero". As soon as a positive voltage is applied, this will oppose (and therefore decrease) the standing negative bias, allow current to flow, and the meter to be deflected accordingly.

In practice, it is found desirable to have both the anode voltage and grid bias voltage variable within

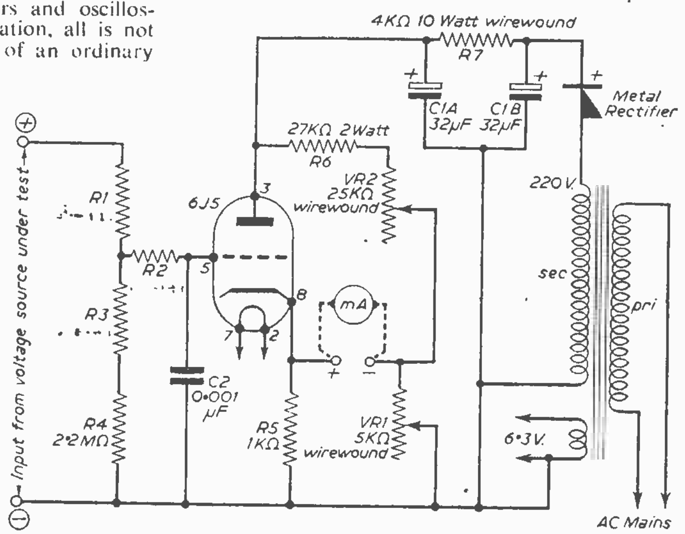

Fig. 1.—The theoretical circuit of the voltage indicator. (R1, R2 and R3 are 3·9M.)

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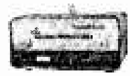
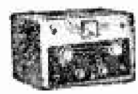
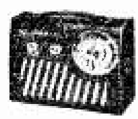
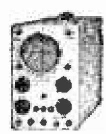

F. M. TUNER


S.33


S-88


DX-40


UXR-1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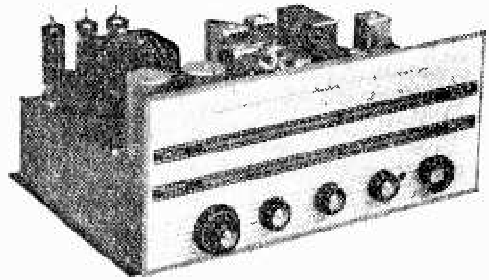

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limits, so that the exact point of "cut off" can be readily set up. Referring to Fig. 1, the theoretical diagram, it will be seen that the pre-set potentiometers VR1 and VR2 provide the necessary adjustments. It is convenient to fit a control knob to VR1, as this will require "resetting" to zero the meter accurately from time to time, as a simple instrument of this type invariably shows signs of thermal drift when in use.

Construction Details

Construction of the instrument is extremely simple, and apart from the need to keep the connections between the junction of R1, R2 and R3, and the valve control grid, as short as possible, the layout is in no way critical. A chassis of standard size, 7in. x 4in. x 2½in. is used, and drilling dimensions are given in detail in Fig. 2. Fig. 4 should make the layout of components perfectly clear. The mains supply leads enter through the ⅜in. grommetted hole in the rear chassis runner, and are anchored to the two insulated tags of a 3-way tagstrip mounted nearby. No on/off switch was provided in the original, although there is no reason why one should not be provided, and mounted at any convenient point on the rear or side chassis runners. The test leads,

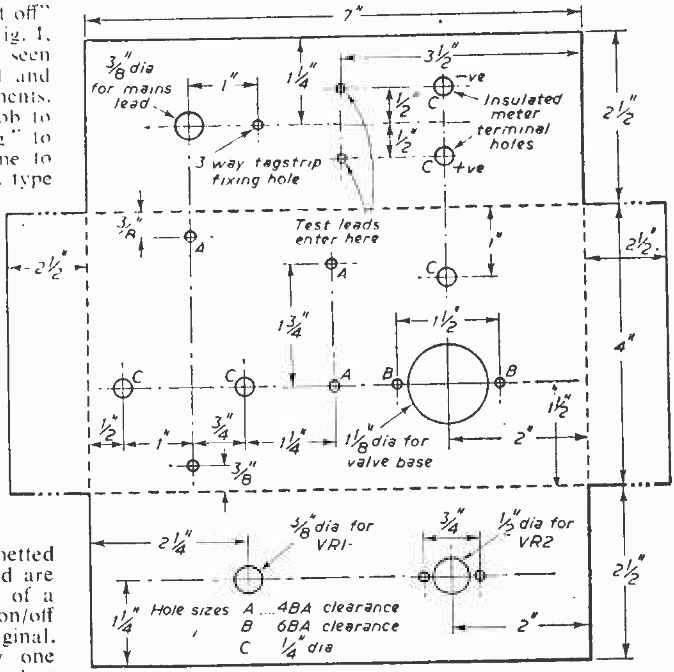

Fig. 2.—Drilling plan of the chassis.

COMPONENTS LIST

Resistors:	**R5—1k ½W.**
R1—3·9M ½W.	**R6—27k 2W.**
R2—3·9M ½W.	**R7—4 to 5k 5 or 10W W.W.**
R3—3·9M ½W.	
R4—2·2M ½W.	**C2—0·001μF.**

Chassis 7in. x 4in. x 2½in.
A small mains transformer, 6·3V and 220V 40mA.
A metal rectifier, 250V, 10mA or more.
32μF+32μF, 275V.W. electrolytic (C1A and C1B).
Fixing clip for above.
One I.O. Valveholder.
6J5 Valve.
Two insulated terminals.
One small knob (for VR1).
Mains lead and plug.
Red and black flexible test leads.
Two crocodile clips.
Four rubber grommets.
Nuts, bolts, solder tags, connecting wire, sleeving, etc.
"Multimeter" with basic movement 2·5mA or better.
VR1—5k W.W. potentiometer.
VR2—25k W.W. potentiometer.

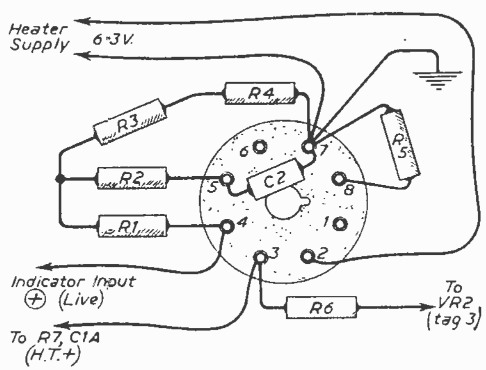

Fig. 3a.—Connections to the Octal valve-holder.

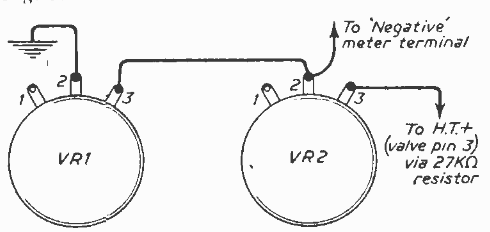

Fig. 3b.—The wiring of the balance potentiometers.

comprising red and black plastic-covered flexible wires (*not* twisted together, as this would introduce unwanted capacity), enter through the holes "B" in the rear runner, the black lead going to any convenient earth point and the red lead to pin 4 of the octal valveholder, which in the case of the 6J5 valve

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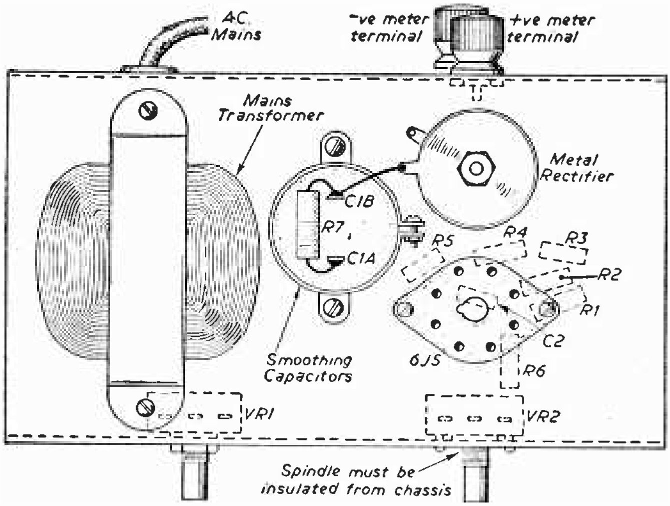

Fig. 4.—Plan view of the chassis.

range available, and the potentiometers VR1 and VR2 adjusted to bring the pointer to rest exactly at zero. VR1 should first be set with maximum resistance in circuit, and VR2 adjusted to obtain as near zero reading as possible, VR1 then being used as the "fine" control. Now connect a low voltage D.C. source to the test prods, e.g. a single or double cell torch battery, when the meter should immediately show a considerable deflection.

Alignment procedure

It is not proposed to relate in detail the procedure to be adopted in the alignment of F.M. receivers; if a proprietary kit has been purchased, full instructions will be given with the kit.

is a "spare" pin used for anchoring purposes. Two well-insulated terminals are mounted in the holes, ¼in. diameter, on the rear runner, and it is to these that the external meter is connected. The power supply requirements are 6·3V at 0·3A, and about 200V at about 5 to 10mA, so that any type of metal rectifier capable of withstanding an input voltage of 250V will be suitable.

Wiring the Instrument

Wiring is perfectly straightforward, and if the theoretical diagram is used in conjunction with Figs. 3 and 4 no difficulty should be experienced. It is recommended that the power supply components be wired into position first, followed by the heater and H.T. supply to the valveholder. The two potentiometers must be of the wirewound type, as they have to carry D.C.

The two test leads are terminated in crocodile clips, to facilitate easy connection to the external circuit under test. When connecting the "live" lead to a tuned circuit, such as the windings of an I.F. transformer, it is advisable to incorporate a 100k resistor at the point of connection to minimise the disturbance to the tuned circuit. It should also be remembered that when measuring the AVC voltage present at the limiter valve of an F.M. receiver, or on the AVC diode of an A.M. superhet, it is a negative voltage that is being measured, and in order to prevent the indicator meter movement from trying to record a reverse voltage, care should be taken to reverse the polarity of the meter connections to the terminals at the rear of the instrument.

Testing the Completed Unit

To test the completed instrument, when wiring has been finished and checked for any possible errors, connect a multimeter across the terminals, set to a fairly high current range (say 100mA), in order to avoid any danger of the pointer swinging hard over and causing damage. After two or three minutes warming-up period, the meter may be gradually switched (or plugged) down to the lowest current

AN EFFICIENT MAINS FILTER

(Continued from page 905)

Also one condenser wired on to B must go to A1, and the other to C1. This completes the wiring of the filter, and its wiring should be carefully checked against the circuit diagram (Fig. 1).

To complete the unit all that is needed is a case.

The Case

Obtain two Bakelite discs ¼in. x 1⅞in. diameter and drill a $\frac{5}{16}$in. diameter hole in the centre of each. Also drill a ¼in. diameter hole in both discs and fix one on each end of the mains filter. Feed the mains leads through the ¼in. holes. A piece of Bakelite tube with a 1⅞in. internal diameter, 5¼in. long is fixed over the whole filter assembly and glued into place. The $\frac{5}{16}$in. diameter tube should be packed with 5in. length of iron wire to form a core before the unit is finally glued.

Installation

This completes the unit and makes it ready for installation in the mains circuit of a radio receiver. This is simply a matter of fixing a plug on the input end of the filter to fit the mains socket, and feeding the other end into the receiver.

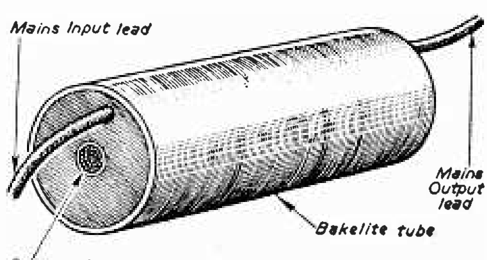

Fig. 6.—The case of the filter unit.

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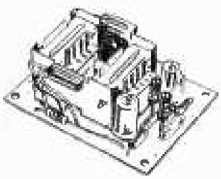

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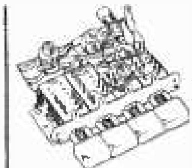

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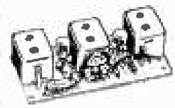

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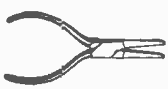
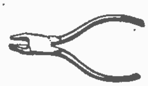


High-grade Sheffield tool steel hardened and tempered. 5in. flat long-nosed pliers, ideal for the radio constructor. Strong box joint. No. 23105. PRICE 9/6, post 6d.



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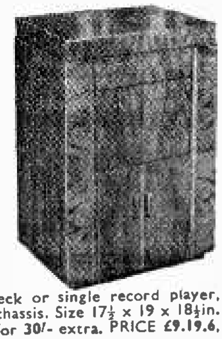

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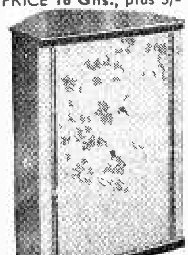
A handsome cabinet designed to take any size of tape deck or record player, as well as amplifier, pre-amp, and radio tuner. Storage space in lower section for 150 records. Doors fitted with patent magnetic catches. Size 36 x 24 x 18in. Polished walnut. PRICE 16 Gns., plus 5/- part carriage.



JUNIOR BASS REFLEX CORNER CONSOLE
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Will accommodate any make of tape deck or single record player, together with amplifier, tuner, or radio chassis. Size $17\frac{1}{2}$ x 19 x $18\frac{1}{2}$in. Set of 4 legs can be supplied if required for 30/- extra. PRICE £9.19.6, plus 5/- part carriage.

All these cabinets are beautifully made and finished, and are supplied packed flat. They can be completely assembled in a few minutes, using only a screwdriver. **Full range of WB Stentorian Hi-Fi Speakers and Tweeters in stock. Send 3d. stamp for illustrated leaflet. Specially recommended** to give real "Zing" to your reproduction, the Stentorian 8in. high-flux mid and upper frequency unit, Model T816. 15 ohms impedance and frequency response up to 17,000 cycles. PRICE £6.3.9, or complete in handsome walnut cabinet £10, post paid.

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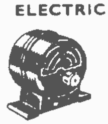

Model electric motor, ideal for toys, etc. Operates from dry battery $4\frac{1}{2}$ volts or transformer 3 to 8 volts. Brand new, boxed and supplied complete with pulley, driving band, and spare brushes. Realistic and wonderful value while stocks last. ONLY 4/6, plus 6d. post.

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LONG AND MEDIUM WAVE AERIAL—RA2W
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Medium wave in screening can. For 176pF tuning condenser 5/4

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Last stage transformer to feed diode detector. Size as P50/2 ... ... 6/-

DRIVER TRANSFORMER—LFDT2
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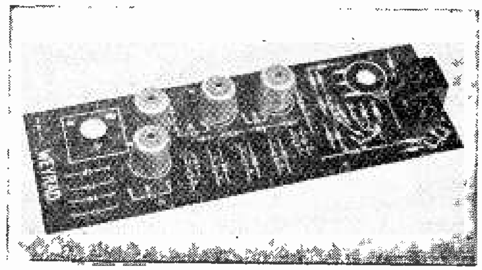

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Size, 2¾ in. x 8¼ in. Ready drilled and printed with component positions 9/6

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THE LINEAR L1/10

A 10-WATT HIGH FIDELITY ULTRA LINEAR AMPLIFIER WITH INTEGRAL PRE-AMP

Full advantage has been taken of latest component miniaturisation developments to produce a 10-watt Hi-Fi push-pull amplifier incorporating tone control preamplifier stages within the measurements of 9 x 7 x 5ins. **In addition two high impedance input sockets are provided for microphone and gram., etc. With selector switch and vol. control, five** B.V.A. valves are employed ECC83, ECC83, EL84, EL84, EZ81, H.T. and L.T. power supply point is included for a radio tuner.

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MAXIMUM POWER OUTPUT
in excess of 14 watts.

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L.P. 220 m.v. for 10 watts. 78 r.p.m. 220 m.v. for 10 watts. Radio/Microphone 40 m.v. for 10 watts.

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+ 10 d.b. to—22 d.b. at 12,000 c.p.

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Referred to maximum output and including integral pre-amp.—70 d.b.

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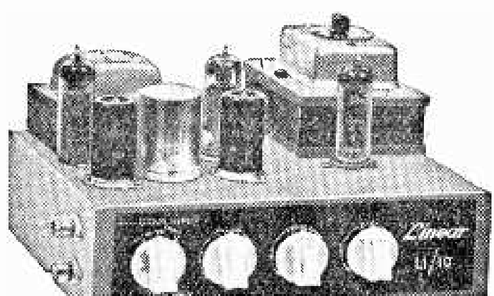
21 d.b. in main loop.



HARMONIC DISTORTION Less than 0.1% measured at 8 watts at 1000 c.p.s. Weight 10 lbs. Power consumption 90 watts. For 200-230-250 v. 50 c.p.s. A.C. mains. Outputs for 3- and 15-ohm speakers. Chassis finish stoved Gold hammer.

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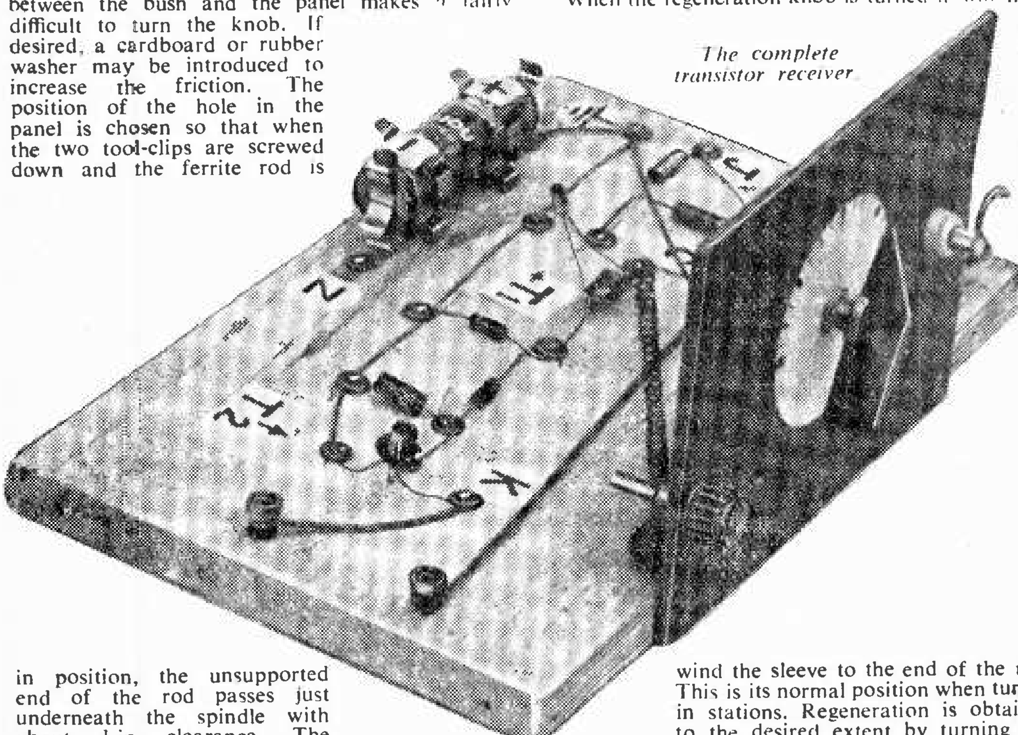
Radio Construction for the Beginner

No. 5—COMPLETING THE REGENERATIVE RECEIVER

By D. B. Kidd

THE two small tool-clips used to secure the small piece of ferrite rod in the last receiver described may be used to hold the long rod in this receiver. Both clips are placed on the rod on the side farthese from L2. One clip is slid towards the middle until it almost touches the fixed coil L1, the other remains near the end of the rod. The two clips are thus much less than half the rod-length apart.

Now the three "extra" parts mentioned can be fitted. The $\frac{1}{4}$in. brass spindle is fitted into the small knob and secured, the spindle passed through a $\frac{1}{4}$in. hole in the panel (near the bottom on the right) and the bush tightened on to the spindle so that the friction between the bush and the panel makes it fairly difficult to turn the knob. If desired, a cardboard or rubber washer may be introduced to increase the friction. The position of the hole in the panel is chosen so that when the two tool-clips are screwed down and the ferrite rod is in position, the unsupported end of the rod passes just underneath the spindle with about $\frac{1}{16}$in. clearance. The ferrite rod assembly is as close as possible to the panel without quite touching the bush.



The complete transistor receiver

A mark must now be made on the spindle just over the centre line of the rod and a very small diameter hole drilled through the spindle at this point. This will mean removing the bush and reassembling the arrangement when completed. The constructor will need to file a slight "flat" at the point marked before drilling, otherwise the drill point will slip. The spindle should be held in a vice while drilling.

The Regeneration Control

The end of a length of strong thread is passed through the hole in the spindle and secured by knotting. The movable coil is slid along the rod until it touches L1 then the thread is laid over it and bound on to L2 with Sellotape or other means. The thread is extended just beyond L1 then cut and tied to the end of a piece of rubber band. The far end of the rubber band is anchored to a nail, woodscrew, jug-hook, or any other convenient pillar on the extreme left of the board and exactly in line with the centre line of the rod.

The elastic cord need not be very strong; it is only required to overcome the friction between the sleeve and the ferrite rod. A single strand will probably be enough.

When the regeneration knob is turned it will now wind the sleeve to the end of the rod. This is its normal position when tuning in stations. Regeneration is obtained to the desired extent by turning the knob in the *opposite* direction when the elastic cord will cause L2 to approach L1. Although the arrangement is simple, and indeed almost crude, better and finer regeneration control is obtained by it than by more orthodox methods on expensive receivers. Figs. 3 and 4 gave the details. Note that the knob should be turned on so that the thread winds *under* the spindle.

The two leads of L2 should lastly be made spiral in form by releasing them from points "N" and "C" wrapping them tightly round a knitting needle then replacing. This keeps them tidy in spite of the movements of L2.

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Two experiments may be tried with the completed receiver. Firstly, the aerial and earth may be disconnected and reception attempted with the ferrite rod alone. This will require the regeneration control to be advanced much more, but under good conditions and especially after dark it is worth trying. The receiver will now be found to be very "directional", the whole apparatus needing to be turned for the best results from a given station.

Adding a Loudspeaker

If reception is very loud with an aerial and earth, the constructor may care to try connecting the two leads of a loudspeaker across the output terminals in place of the headphones. If faint reception is heard, then it is worth risking the expense of an output transformer which will greatly increase the volume of sound obtainable.

This should be bought as "suitable for *transistor* circuits" (valve-type transformers are almost useless for this job), and it should have a ratio of between 15 : 1 and 30 : 1. The two primary leads of the transformer go to the headphone terminals; its two secondary leads go to the loudspeaker terminals. The reader need not worry if the primary and secondary leads are not marked. Connecting the transformer each way in turn will soon settle the question, one way increasing the volume, the other greatly diminishing it. The largest diameter loudspeaker obtainable should be used; it will give the greatest volume and the best tone.

The receiver just described should give pleasing results if built and handled correctly. Regenerative receivers require a little skill to operate but this soon comes with practice, both controls being used in conjunction. When the station required is correctly tuned, it is usual to advance regeneration until oscillation just commences, then to reduce it slightly until normal undistorted reception is obtained with a slight final adjustment of the tuning.

The queer noises which the receiver produces whilst being tuned are quite normal to this type of set. They can, however, cause annoyance to other listeners if too long an aerial is employed. A modest aerial of a few yards only is therefore suggested for this receiver where other receivers are known to be fairly close.

This marks the end of the series to introduce beginners to the art and science of radio construction, completely without the use of solder.

There is, however, no substitute in the long run for the technique of soldering, and it is to be hoped that having gained some experience and confidence while constructing the three receivers in this series, the constructor will make an effort to learn the technique, and so move on to more ambitious projects.

Short-wave Listeners' Log—4

MANY USA transmitters beam English transmissions towards Europe, and these programmes can generally be received well in this country. Numerous frequencies are employed, so if propagation conditions make one band unsatisfactory, other bands will often give good reception. As many of the frequencies fall within the coverage of ordinary all-wave receivers, a special short wave set is not necessary.

Some of the "Voice of America" transmissions which may be tuned in, with times, frequencies, and wavelengths, are listed below. These are generally half-hour programmes, consisting of news followed by announced features. (Greenwich Mean Time is used throughout.)

16:00 (GMT): 21·5Mc/s., 13·95m., 15·27Mc/s., 19·65m., 15·205Mc/s., 19·73m., 11·76Mc/s., 25·51m.

17·00 (GMT): 21·505Mc/s., 13·95m., 15·205Mc/s., 19·73m., 11·76Mc/s., 25·51m., 9·635Mc/s., 31·14m., 9·620Mc/s., 31·19m., 9·520Mc/s., 31·51m., 6·185Mc/s., 48·5m.

18:00 (GMT): Generally similar to 17:00 (GMT).

Later in the day the lower frequencies, such as those in the 31 and 49m bands, will often be well received, while the higher frequencies, in the 13, 19 and 25m bands will generally give better reception earlier. News in "Special English" may be heard at 19:00 and 20:00 (GMT). This employs a limited vocabulary. "Radio Amateur's Notebook" may be heard at about 21:15 (GMT).

The 19, 25, and 31m bands, at least, will generally be within the tuning coverage of any all-wave receiver. Very good results can often be obtained on these bands.

Listeners who are just becoming interested in Amateur band reception may wish to know where the stations they tune in are situated. Many amateurs all over the world use English, and they have to announce their call signs frequently, when carrying out a contact. As a result, it is usually easy to log quite a number of countries in a short time. Lists of calls may be obtained, but some of the most generally heard calls, with the countries they indicate, are as follows:

DJ, DL and DM, Germany; EI, Ireland; F, France; G, England; GI, Northern Ireland; GM, Scotland; GW, Wales; I1, IT1, Italy; OZ, Denmark; VE, VO, Canada; K, W, USA.

Others, less frequently heard, include: CN8, CN9, Morocco; DU, Philippines; GC, Channel Islands; HB, Switzerland; HP, Panama; LA, Norway; OH, Finland; VK, Australia; ZS1 to ZS9, Africa.

When logging such stations, individual call numbers and letters follow the prefix showing the country. For example, G2XYZ, G3ABC, and G3XYZ, etc., would all be in England. Very many stations also give their locality during the course of the transmission and this is a further aid to logging new countries.

As most S.W. listeners will know, reception conditions on the various frequencies vary in approximately a 24-hour cycle, according to whether the transmission path between station and receiver is in daylight or darkness. For this reason it is wise to check over two or three bands when beginning a period of DX listening. Some frequencies which may have been giving good reception from one part of the world will cease to be usable for that direction, as darkness falls. But at the same time other frequencies will come into use, giving reception from other stations. When conditions are suitable for the band employed, transmissions may be heard over exceedingly great distances, even with the simplest type of receiver.

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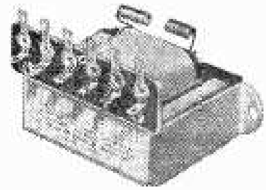
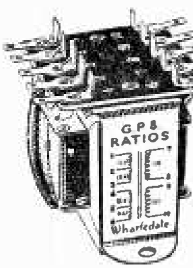
Wharfedale TRANSFORMERS

OP3 (3 *ratios*)
Small output transformer for battery and portable sets or mains sets up to 3 watts output. Ratios 30, 60 and 90 to 1. Max. D.C. 30mA. Inductance at 4v 50c/s. 26H with zero D.C. 3.8H with 30mA D.C. Width 2⅜in. by height 1⅞in. Weight 6 oz. Max. watts 3. Price 7/6

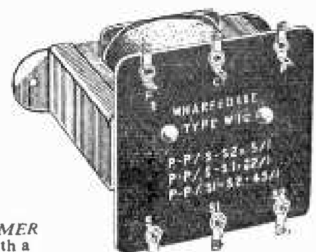
TYPE P (4 *ratios*)
The ideal replacement transformer for sets up to 5 watts output. Ratios 30, 45, 60 and 90 to 1 (90:1 centre tapped) Max. D.C. 50mA. Inductance at 4v 50c/s. 28H with zero D.C. 6.5H with 30mA D.C. 4.0H with 50mA D.C. Width 2¾in. Height 2in. Weight 12½ oz. Max. watts 5. Price 9/-



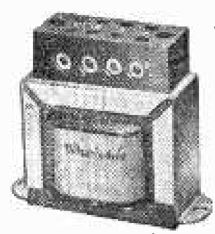


GP8 (8 *ratios*) General purpose output transformer with two centre-tapped primary windings and two secondaries. Matches practically all output conditions to speakers of 1 to 15 ohms impedance. Suitable for use up to 5 watts output. Ratios 12, 18, 24, 30, 36, 48, 60 and 72 to 1 (ratios 36, 48 and 72 to 1 are centre-tapped). Max. D.C. 50mA. Inductance at 10v 50c/s (each primary winding 22.5H with zero D.C. 5.0H with 30mA D.C. Width 2⅝in. Height 2¼in. Weight 12¾ oz. Max. watts 5. Price 12/6

W12 (3 *ratios—all centre tapped*)
A high quality transformer for undistorted output up to 10 watts with speakers up to 15 ohms impedance. Ratios: 15:1, 22:1, 45:1. D.C. resistance of primary 460 ohms. Max. D.C. 80mA. Inductance at 4v 50c/s. 61H with zero D.C. Leakage inductance 200mH Width 4⅝in. Height 3in. Weight 2 lb. Max. watts 10. Price 26/-
Special ratios to order 30/-



SM1 *STEREO MIXER TRANSFORMER*
Enables stereo systems to be operated with a single bass unit and two treble speakers. Can also be used to add a centre speaker to "fill in the middle" where existing speakers are too widely spaced. Existing full range speakers can also be converted to stereo using the SM1 and an additional treble unit. Size 4 x 2$\frac{5}{16}$ in. Weight 2 lb. Input 15 watts Max. Price 30/-



WMT1 *MATCHING TRANSFORMER*
Auto transformer for matching with 10-16 ohm or 7-9 ohm speakers to sets with 2-5 ohms output or vice versa. Frequency response within 1dB from 20c/s to 15kc/s. Power handling capacity 15 watts. Can be used to match loudspeakers of different impedances to cross over unit in high-quality two or three speaker systems. Width 2⅜in. Height 2¾in. Weight 12½ oz. Max. watts 15. Price 13/6

AIR CORED INDUCTORS
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At last a first grade multi-tester within the reach of everyone's pocket, and a necessity to all interested in Radio and TV. Reads A.C. and D.C. Volts up to 1,000 in 5 ranges, at 1,000 ohms per volt. D.C. current (3 ranges) to 500 mA. Resistance readings to 200 K ohms in 2 ranges. Basic movement 300μA sensitivity. Easily read open scale, beautifully made and fully guaranteed. Limited number available under import quota. Complete with leads, prods, and internal battery.

ONLY 59/6

COMMUNICATIONS RECEIVER R1155. The famous Bomber Command receiver known the world over to be supreme in its class. Covers 5 wave ranges 18.0 to 7.5 Mc/s, 7.5 to 3 Mc/s, 1,500 to 600 kc/s, 500 to 200 kc/s, and 200 to 75 kc/s, and is easily and simply adapted for normal mains use. Full details being supplied. All sets thoroughly tested and in perfect working order before dispatch, and on demonstration to callers. Fitted latest type super slow-motion tuning assembly. Have had some use but are in excellent condition. ONLY **£9.19.6.** **A.C. MAINS POWER PACK OUTPUT STAGE,** for the above in black crackle case to match receiver, enabling it to be operated immediately, but just plugging in, without any modification. With built-in 8in. speaker, **£6.10.0.** DEDUCT 10/- IF PURCHASING RECEIVER AND POWER PACK TOGETHER.
Send S.A.E. for illustrated leaflet, or 1/3 for 10-page booklet which gives technical information, circuits, etc., and is supplied free with each receiver. Add carriage 10/6 for Receiver, 5/- for Power Unit.

B.C. 342 RECEIVERS. A few only of these famous American sets covering 1.15—18.0 Mc/s in six bands. Internal 115 v. A.C. mains pack. Super receiver in first class condition, and perfect working order. ONLY **£25.** (carr. 15/-).

H.R.O. MAINS POWER UNITS A.C. input 115/230 v. output D.C. (fully smoothed) 230 v. 75 mA, and 6.3 v. 3.5A. Complete in black crackled case. ONLY **59/6.**

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AMERICAN HALLICRAFTERS 6 VOLT VIBRATOR-PACK. Output 300 volts D.C. at 170 mA. Designed to run Communications Receivers from 6 volt car battery. In grey metal case, size 6½in. H. x 6½in. W. x 7½in. D. Complete with 2 valves, 6X5, and instructions, in maker's cartons. BRAND NEW AND UNUSED. ONLY **29/6** (carr. 3/6).

POWER UNIT TYPE 3. Primary 200/250 volts A.C. 50 cycles. Outputs of 250 volts 100 mA, and 6.3 volts 4 amps. Fitted double smoothing, and 2 metres to read H.T. Current and Voltage. For normal rack mounting (or bench use) having grey front panel, size 19in. x 7... BRAND NEW. ONLY **79/6** (carriage 7/6).

10/- CONSTRUCTION PARCEL. 10 yards each of 6 colours wiring wire, solder, 24 each assorted Resistors and Condensers.

RESISTORS. 100 assorted values. NEW **10/-.**

CONDENSERS. 100 assorted mica and silvermica. NEW **12/6.**

SPRAGUE CONDENSERS. Metal cased, wire ends. New 0.01 mfd. 1,000 volt, and 0.1 mfd. 500 volt, **7/6** per dozen. Special quotes for quantities.

MINIATURE MOTORS. Ideal for models. Will operate on 3-6 v. D.C. Size 1¼ x 1 x 1³/₁₀in. plus ¼in. spindle. BRAND NEW only **7/6.**

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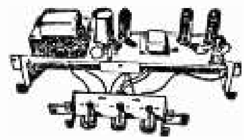
Gladstone Radio

PUSH-PULL AMPLIFIER £4.15.0 (3/- P. & P.)



Brand new 200-240 A.C. mains. Bass, treble and vol. controls on flying panel. Valves EZ80, ECC83 and 2-EL84 giving full 8 w. Chassis 12 x 3½ x 3¼in. With o.p. trans. for 2-3 ohm speaker. Suitable for Crystal Mike Input.

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State which Board—B.S.R. or COLLARO.

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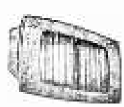
B.S.R. deck. Two-tone leatherette case. Acos crystal mike, 850ft. tape, extra spool. On/Off Tone and Vol. 7 x 4in. Speaker. 1½ hours playing time. Single speed 3¾in./sec. fast forward and reverse, mike and radio inputs, ext. speaker socket; cannot be accidentally erased, 13½ x 12 x 8in. Weight 20 lbs. 12 months' guarantee. Carr. 7/6 extra. **Terms: £6** down and 6 monthly payments of **50/-.**

B.S.R. "MONARDECK" for TAPE SINGLE SPEED. Our price only **£8.10.0** including 850 ft. 1st grade tape, carr. paid.

COLLARO STUDIO TAPE TRANSCRIPTOR. 3 MOTORS. 3 SPEED. Push Button Controls. **£12.10.0** (10/- carr.)

AMPLIFIER FOR STEREO WORK



Beautifully finished wood cabinet with "gold" and brown dividing strip and "gold" finished fabric front. Size 13 x 7⅞in. front to back 4½in. 5in. P.M. speaker. ECL82 valve with metal rectifier. Vol. tone, on-off. 82/6 (3/- p. & p.).

AMAZING OFFER!! BRAND NEW 6-12 VOLT D.C. REVERSIBLE MINIATURE MOTORS AT A FRACTION OF MAKER'S PRICE.

Weight 2.1 ozs. Motor dimensions 1⅞in. long, 1¼in. dia. Spindle 0.4in. long, 0.077in. dia. Consumption 0.72 watts off load. 7.68 watts on load. Speed 7,000 r.p.m. Switch. Centre off reverse by switching either side. General specification. These motors have a tremendous power-weight ratio, are extremely efficient. Can be used on 6 volts without great loss in power. Precision built in polythene housing. Self lubricating. With sintered bronze bearings. Easily mounted. Supplied Brand New and Guaranteed. 15/6, p.p. 1/6. Special price for quantities over 50.

FOR ADDRESSES SEE THE OTHER ADVERTISEMENT FOR GLADSTONE RADIO ON PAGE 881.

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A Simple R–C Bridge

THIS INSTRUMENT MEASURES COMPONENTS FROM 10Ω TO 10M, AND FROM 10pF TO 10μF.

By A. Guy

THIS unit is simple both in construction and operation, self-contained battery operated, uses only two resistance and two capacitance ranges giving wide coverage, reasonably accurate in use, and can readily be made portable if desired. No special components are required and, with the exception of the bridge standards, the instrument is constructed from parts found in most spares boxes, a choice of valve or transistor oscillator being described.

The Valve Oscillator

The oscillator shown in Fig. 1 follows conventional circuitry and utilizes a 3S4 valve only because this was to hand; a 1S4 or 1T4 would use less current and result in longer battery life. Providing that the oscillator is switched off when not in use (a warning light being included for this purpose), the battery will give nearly a year of satisfactory service with normal usage. A 67½/1½V battery is required to operate the unit.

The Transistor Oscillator

If a portable bridge is desired, a transistor oscillator provides the answer, and Fig. 2 shows that very few components are required. The transistor can be either one of the surplus "red spot" variety, or a OC71 or similar. The transformer is not critical and almost any interstage transformer will suffice, that used by the writer being a 3 : 1 type salvaged from an old battery amplifier. If midget construction is required a suitable transistor transformer should be obtained.

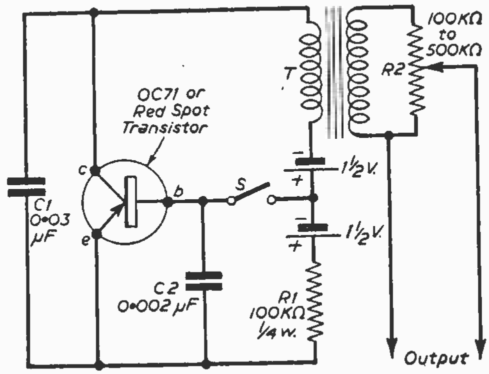
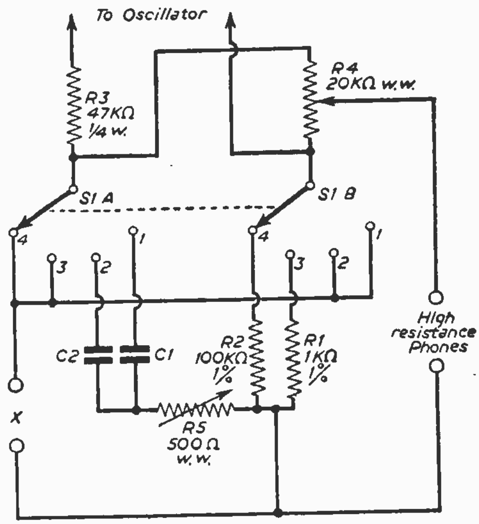


Fig. 2 (Above).—A transistor oscillator for portable use "T" is a 3:1 interstage transformer.

Fig. 3 (Below).—The two test terminals are marked "X" in this circuit diagram of the bridge. (C1 is 0·1μF and C2 0·001μF.)



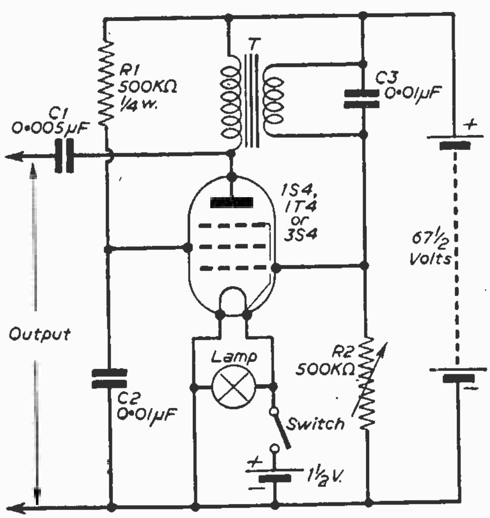


Fig. 1.—This shows a valve oscillator circuit. The valveholder used is a B7G type and "T" is a 3:1 interstage transformer.

The Bridge

Fig. 3 shows the extreme simplicity of the network, the only critical components being R1, R2, C1, and C2. The resistors are 1 per cent tolerance and the capacitors good quality paper types, all checked for accuracy against a bridge by an obliging dealer. The bridge balance potentiometer should not exceed about 50k, and in the prototype a 20k was used. It must however be of the linear wire-wound pattern as large as possible. The power factor potentiometer

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is also a linear wire-wound type of 500Ω. A 47k resistor feeds the bridge and is inserted to limit the load on the oscillator and prevent variations in frequency and amplitude.

The "null point" is detected on the original by a single earpiece which, when not in use, is hung on the side of the case by a small hook. This has one disadvantage in that it must be held when using the bridge, but normal headphones may be used if desired, this being entirely a matter of preference by the constructor. High resistance phones must however be used, and if not available, a suitable matching transformer will be necessary to feed low resistance types; a small loud speaker transformer will serve the purpose adequately.

The switch numbering shown in Fig. 3 indicates the bridge ranges as follows:

Range 1—10Ω to 100k.
Range 2—1, to 10M.
Range 3—10pF to 0·1μF.
Range 4—1000pF to 10μF.

If desired, and to avoid marking-out two separate scales, a chart to convert pF to μF can be affixed to the side of the case. A number of additional ranges could easily be added if required, but this was considered unnecessary, the ranges obtained having proved satisfactory for general checking purposes.

Switching is very simple and the changeover from resistance to capacitance ranges is effected in one movement.

Construction

The instrument can be constructed in any convenient form and the original was housed in a discarded multi-range meter case measuring 8in. x 4½in. x 2in. All components were mounted on the back of the panel and the battery fixed inside of the case. A circular piece of white card was used for the scale which, when calibrated was covered with thin perspex. The pointer was made from a small piece of thicker perspex having a narrow line scribed down its centre by a razor blade, and "blacked in" with pencil. This was screwed to the back of a large tuning knob. Panel lettering was done with a small artist's brush, but the finish of the instrument is left to the constructor.

Calibration

Calibration is simply a matter of balancing the bridge against a number of resistors and capacitors of known value, using series and parallel arrangements, a little thought showing that about ten components only are needed. If desired the scale can be marked in preferred values, with red or other coloured bands to indicate the limits for each value. The power factor control is calibrated quite simply as shown in Fig. 4, 0—250Ω indicating a high power factor, and 250—500Ω a low power factor.

Use

To check the value of any resistor or capacitor, connect the component under test to the terminals marked "X", switch to the appropriate range and turn the dial to the null point, when the value can be directly read. If difficulty is experienced in finding the null point, the power factor control should be rotated clockwise, a reading over the half-way mark indicating a low power factor. When testing resistors and capacitors it is important that they be disconnected at one end from their associated wiring, otherwise incorrect readings will be obtained. When a component measures out in the overlapping areas of any scale, it is worth taking a reading on both ranges, as the centre portions of each range are more accurate than the extremities.

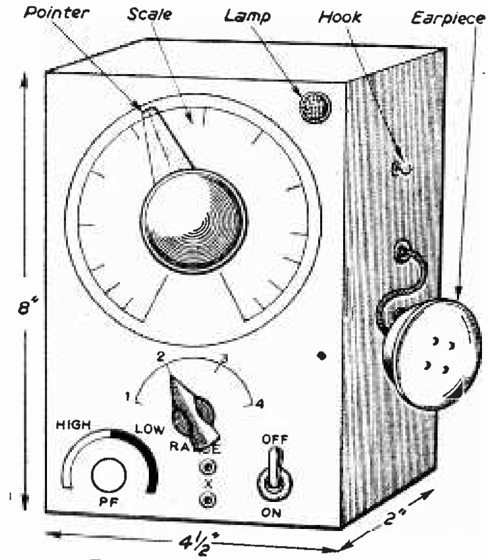

Fig. 4.—The completed bridge.

No originality is claimed for the design which follows standard circuitry, and providing leads are kept as short as possible, the layout is not in the least critical, any convenient cabinet being suitable. The original instrument using the valve oscillator has been in use for a period of approximately four years and has been invaluable in the workshop.

British Standard for Fixed Wire-wound Resistors

(B.S.2111: Part 1: 1960.)

The latest in a series dealing with components intended primarily for use in telecommunication and allied electronic equipment, this British Standard is divided into two parts, the first (now available) specifying requirements and tests, and the second (to be published later) comprising a list of standard sizes and ratings, for fixed wirewound resistors.

The specification applies to insulated and non-insulated fixed resistors consisting of a winding of resistance wire on a heat-resisting former, and having a dissipation of 70degC not exceeding 200W and a rated resistance value not greater than 200k. Precision wire-wound resistors are excluded from the standard.

Part 1 of the standard requires reference to B.S.2011, "Basic climatic and durability tests for components for radio and allied electronic equipment." The object of the tests is to establish, as far as is possible, in laboratory conditions, the components' suitability for use over stated ranges of temperature and humidity, their ability to withstand specified conditions of mechanical shock expected in transit or under operational conditions, and their ability to withstand normal assembly processes, such as soldering.

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

Wired printed circuit, power pack components, controls and knobs, etc. .. £5.15.0 p. & p. 2/6
Set of 5 valves, as above .. £2. 5.0 p. & p. 1/-
B.S.R. Monardeck Tape Unit £8.19.6 p. & p. 4/6
Bargain reduction for complete kit £16.10.0 carr. 5/-
Attractive two-tone Cabinet and 9 x 5in. speaker at special discount price .. £3.5.0 p. & p. 4/6
Illustrated Handbook with full details. 2/6 post free. Collaro Studio Tape Deck can be supplied with modified circuit as alternative for approx £5.10 extra

RECORD PLAYER BARGAINS

All brand new latest 4-speed Models.

SINGLE PLAYERS— B.S.R. (TU9) 90/-; Collaro Junior, 90/-; Garrard TA Mk.2 with GC8 Head. £7.19.6; Garrard 4HF Transcription Unit. £18. carr. 3/6.

AUTO CHANGERS—B.S.R. (UA8). £6.19.6; UA8 Stereo, £7.19.6; UA14, £7.19.6; Collaro Conquest, £7.19.6.

GARRARD RC210 4-speed Autochanger Model with latest features and GC8 Plug-in Head only 10 gns.. carr. 4/6.

Latest Garrard Transcription Autochanger Model "A" £18.19.6 with balanced P.U. Arm. Carr. 5/-.

E.M.I.—4-speed Single Player with Auto Stop-Start Dual Turnover Cartridge for Stereo and Monaural L.P. and 78—Bargain Buy at £6.19.6.

AUTO CHANGER RECORD PLAYER KIT

A.C. Supply 200-250 v.

Attractive 2-tone cabinet — famous B.S.R. Monarch 4-speed, full mixer, 10-record gram unit. Ful-fi xtal pick-up with dual stylii for std. L.P. recordings. 2-valve amplifier with quality neg. feedback circuit, volume and tone controls. Fully isolated from mains by double-wound transformer, NOT the live chassis type as often Offered in cheap commercial models.

A recommended buy while stocks last!

Ready-wired 2-valve Amplifier. complete with 6in. high flux speaker .. £3.19.6 p. & p. 2/6
Two-tone cabinet 18 x 13 x 8in. £3. 3.0 p. & p. 3/6
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Complete 3 unit kit. special Bargain price £12.19.6 carr. 7/6
Simple assembly a screwdriver only required.

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EMI 1st grade. Brand new sealed boxes.

Standard		Long Play	
3in., 175ft. ..	7/-	250ft. ..	9/-
5in., 600ft. ..	19/-	850ft. ..	25/-
$5\frac{3}{4}$in., 850ft. ..	25/-	1,200ft. ..	31/6
7in., 1,200ft. ..	31/6	1,800ft. ..	45/-

SPARE REELS: Emitape. new. boxed: 3in. 3/-. 5in. 3/8. $5\frac{3}{4}$in. 4/-, 7in. 4/6.

SPECIAL PURCHASE. Famous manufacturers 1st grade tape in sealed white boxes.

Standard		Long Play	
5in., 600ft. ..	15/-	850ft. ..	19/6
$5\frac{3}{4}$in., 850ft. ..	16/6	1,200ft. ..	22/6
7in., 1,200ft. ..	21/-	1,800ft. ..	32/6

Plastic Tape Reels, special offer. Manufacturers surplus. 3in. 2/9. 5in. 3/-. 3/3, 7in. $5\frac{3}{4}$in. 3/6.

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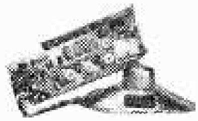

Famous manufactures 6 x 1 design based on Mullard and G.E.C. developments. Printed circuit, 6BVA 1st grade transistors, XA102, XA101 (2) OA70, XB103, XC101 (2) or equivalents. Quality components only supplied to ensure best results at attractive price.

Set of 6 BVA Transistor and Diode 70/- p. & p. 6d.
Printed Circuit, IF's (3), osc. coil, Driver Trans. Ferrite rod aerial .. .. 51/6 p. & p. 1/6
Resistors. Condensers, Twin Gang and Volume Control .. .. 37/6 p. & p. 1/6
7 x 4in. Quality 35 ohm matching Speaker .. .. 25/- p. & p. 1/6
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Complete Kit at special offer ONLY £8.19.6 post free
Handbook and Circuit details .. 2/- post free.

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1T4	6/-	ECH42	10/6	EZ80	7/6
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3S4, 3V4	7/6	ECL82	10/6	MU14	9/-
5Z4	9/6	EF80	8/-	PCC84	9/6
DAF96	9/-	EF86	12/6	PCF80	9/6
DF96	9/-	EF91	5/-	PCL83	12/6
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RE-GUNNED TV TUBES

New Reduced Prices

New Heater, Cathode and Gun Assembly fitted to all tubes. Reconditioned virtually as new. Now 12 months' guarantee to highest stands—as used by our own Service Dept.

12in. £5. 14in. £5.10.0. 17in. £6. etc.

Mullard and Mazda types ex-stock Carr. and Ins. 10/-10/- Part Exchange allowance on your old tube.

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STANDARD MODEL (FMT1) as previously extensively advertised. Complete Kit 5 gns. Set of 4 spec. valves now only 20/-.

MODEL (FMT2). Attractively presented shell mounting unit in enclosed Metal Cabinet with Built-in Power Supply. Complete Kit £7. Set of 5 spec. valves, 37/6. P. & P. 2/6.

LATEST MODEL—JTV2. Switched Band 1-2-3 AM/FM Unit with AFC. Kit £12.19.6. P. & P. 2/6.

NEW JASON COMPREHENSIVE FM HANDBOOK 2/6. 48 hr. Alignment Service. 7/6; P. & P. 2/6.

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XA101	14/6	OC70	9/6	GET114	9/6
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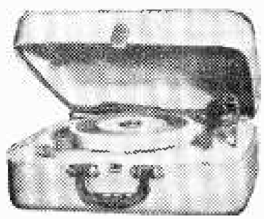
XB102	10/-	OC45	21/-	"Goldtop"	
XC101	10/6			V15/10P	15/-

Germanium Diodes, OA70 2/9, GEX34 4/-, OA81 3/6.

SPECIAL OFFER!



Superior type Art Leather covered Portable Case—well-known Manufacturer's Surplus—in attractive Tan and Fawn with non-tarnish gilt fitted with latest Collaro Junior 4-speed Record Player Unit with Turnover Xtal Cartridge and dual sapphire stylii for 78 and LP records. Ready mounted and wired complete with Mains Lead and detachable screened PU lead. A.C. Mains 200/250v. Size 15 x $11\frac{1}{2}$ x $5\frac{1}{2}$in. An ideal unit for Tape or Amplifier use.

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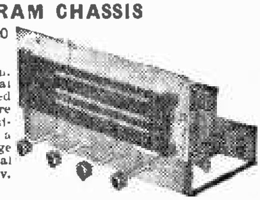

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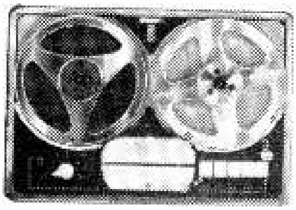

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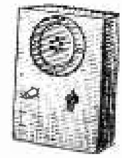

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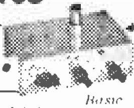

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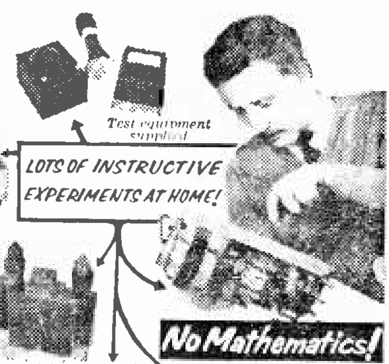

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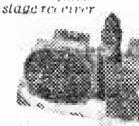
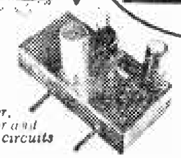


Servicing commercial receivers



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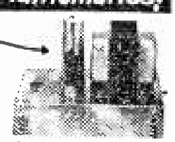

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Expanding Meter Ranges

USING ZENER DIODES WITH VOLTMETERS

By J. B. Dance

It is often necessary to measure a voltage fairly accurately over a limited range of values. Suppose, for example, that it is required to measure a voltage which varies between 100 and 120. The normal method would be to use a voltmeter with a full scale deflection of 120V or more but the part of the meter scale from 0 to 100V would then be wasted. In order to obtain the greatest possible accuracy, a meter which reads from 100 to 120V is required such that this range of voltage occupies the whole of the meter scale.

Alternative Methods

It would be possible to use a 100V battery in opposition to the voltage being measured so that the remaining voltage could be measured on a 0 to 20V meter. Such a method employing a large battery is not convenient and variations in battery voltage would render it very inaccurate. Special meters have been designed for limited ranges, but these would normally have to be specially ordered and would consequently be very expensive.

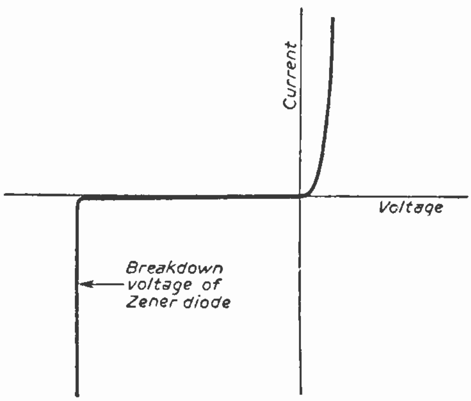

Fig. 1.—The current-voltage curve of a zener diode.

The zener diode provides an excellent means of removing the unwanted 100V so that a 0 to 20 voltmeter can be used to give a zero reading at 100V and a full scale deflection at 120V. The voltage-current curve of the zener diode is shown in Fig. 1, but when such a diode is employed for expanding meter ranges its properties that produce the reverse of the curve are used.

As the reverse voltage across a zener diode increases, the current remains at zero until quite suddenly, at the breakdown voltage, the current rises and the voltage remains constant.

Range of Diodes

The circuit used is as shown in Fig. 2. The meter and the resistor form a normal voltmeter, but the zener diode has a constant voltage across it irrespective of the current passing through it providing that the voltage is above the breakdown value. Zener diodes with a wide range of breakdown voltages are available and can therefore be used in circuits for the measurement of a few to many hundreds of volts. Several zener diodes can be connected in series, if desired, so as to obtain a higher breakdown voltage. On many types of diodes this is not usually quoted to an accuracy greater than about ±5per cent, therefore it is necessary to calibrate the circuit shown in Fig. 2 against a standard voltmeter. Nevertheless it is not necessary to do this if only the changes in voltage, and not the actual voltage must be known accurately.

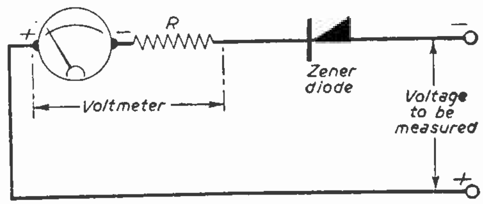

Fig. 2.—The simple circuit employing a zener diode.

Zener diodes have a maximum current rating which if exceeded causes a large amount of power to be dissipated in the diode which may subsequently be destroyed. This fact must be taken into account when the circuit values are being chosen. The meter used normally has a full scale deflection of between about 100μA and a few milliamps, but the optimum value depends on the voltage to be measured and the type of zener diode used. If several diodes are used in series, the maximum power dissipation becomes greater, but the largest permissible current is the same as that for a single diode.

The small size and long life of a zener diode make it a very convenient device for fitting inside the case of a meter.

FRIDAY, JANUARY 13th, 1961

A FILM SHOW

(in collaboration with Mullard Ltd.)

CAXTON HALL, WESTMINSTER

at 7-30 p.m.

A few tickets still remain and may be obtained from our offices. Mark your envelope "Caxton Hall" in the top left-hand corner and enclose a stamped addressed envelope (at least 3½in. x 6in.) for the tickets.

The films to be shown are "Conquest of the Atom", "The Invisible Force" and "Particles Count".

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Club News

REPORTS OF CURRENT ACTIVITIES

CHESTER AND DISTRICT RADIO SOCIETY
Hon. Sec.: A. Bagley, G3JJS, Oak Lea, Long Lane, Saughall, near Chester.

Future Events:
January 10th—Annual General Meeting.
January 17th—GW3HEU will give an account of his tour of Germany illustrated by transparencies.
January 24th—"My Tx" by G3OPT and G3MGK.
January 31st—"The Oscilloscope" by GW3HEU.
February 14th—Mr. C. Riche will give a talk on electric motors.
February 21st—Discussion on National Field Day.
February 28th—G3FWV will explain and exhibit a K.W. Vanguard.

All meetings will be held at the Y.M.C.A., The Old Bishop's Palace, Chester, at 8 p.m.

CHILTERN AMATEUR RADIO CLUB
Hon. Sec.: C. Simpson, 2 Mead Street, High Wycombe, Bucks.

The November meeting was a talk given by G2INZ and the December meeting, which was held on the 29th, was entitled "This or That". All interested in any aspect of radio are invited to join.

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

Meetings are held on Fridays and Wednesdays at 8 p.m. and on Sundays at 11.30 a.m. Morse Practice is held on Wednesdays.

On November 11th G3OAW introduced a quiz on various radio subjects. On December 2nd the club chairman, G3FVG, conducted a Junk Sale and on December 16th the annual constructional contest was held.

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

Future Events:
January 17th—Pea and Pie Supper at the Sportsman Inn, Ogden, at 7.30 p.m.
February 7th—Lecture on Transistors by Mr. E. C. Bell, lecturer at the Bradford Technical College.
February 21st—Ragchew Night.
March 7th—National Field Day arrangements.

Meetings are held on the first and third Tuesday of each month at the Sportsman Inn, Ogden.

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

The December meetings included a Film Show on the 6th, a talk by G3FBH on "Quartz Crystals" on the 13th, and a B.Y.O.B. (Bring Your Own Beer) night on the 20th.

MEDWAY AMATEUR RADIO SOCIETY
Hon. Sec.: S. W. Nutton, 42 Richmond Road, Gillingham, Kent.

The new headquarters is at Riverside Buildings, Gun Wharf, Chatham, Kent. and meetings are held on alternate Mondays at 7.30 p.m. The club will soon be back on the air with their old call G2FJA. Equipment installations are nearly ready at the club's new headquarters and a grand opening night in the near future is arousing great interest. The new headquarters provide plenty of room for aerial construction.

NORTHAMPTON SHORT WAVE RADIO CLUB
Hon. Sec.: S. F. Berridge, G3ITW, 20 Ethel Street, Northampton.

Meetings are held at Allen's Pram Works, 8 Duke Street, Northampton. On December 1st twenty members and guests visited the BBC transmitting station at Daventry and following a most interesting tour of inspection under the guidance of Mr. D. Pasfield, G5NH, the party was entertained by the BBC (Daventry) Amateur Radio Club, G5XX. Visits to other places of interest are being planned. Working demonstrations of equipment have included V.H.F./U.H.F. receivers, a receiver and its associated panoramic adaptor, teleprinter equipment and frequency meter. These demonstrations have been given by Mike Perry, G2ANS. The Club is operational under its call-sign G3GWB on two metres and "Top Band", and work is on hand to fill in the gaps between those two extremes. All senior officers are now licensed amateurs, the former "odd man out", treasurer Stan Haddon, having just received his licence, G3OOJ.

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

Meetings are held at 7.30 p.m. on Tuesdays at Virginia House Settlement, St. Andrew's Cross. The club may be heard on 80m and 160m under the call-sign G3JYB/A.

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

Recent meetings have been fairly well attended despite other attractions, and have included "Mobile Operations on Two Metres" by G2AHL and a taped lecture "Two Metres" by G2JU. The December meeting was held at Palmers Hall, West Street, Reading, on December 31st, at 7.30 p.m. and was devoted to the Short Wave Listeners and their queries.

All subscriptions are now due, and the treasurer will be glad to receive them.

Future Event:
January 28th—Election of officers for the coming year followed by a talk on "Low Power Equipment for 2m" by G3ASH and G2BRQ.

ROYAL NAVAL AMATEUR RADIO SOCIETY
Hon. Sec.: H. Matthews, G3JFF, H.M.S. Mercury, Leydene, Petersfield, Hants.

After just over three months since the Inaugural Meeting of the Society the membership totals 66 corporate members, 6 associate members and 3 junior members.

Membership of the society is open to all serving, or past members of the Royal Navy, Royal Marines, Women's Royal Naval Service, Reserves or Commonwealth Navies. Associate membership is open to civilians who are, or have been, connected with the above services in any way.

The Headquarters Amateur Radio Stations, G3BZU, is regularly on the air on 40m and the DX bands, and will welcome calls from "Naval Types". The Society has applied for affiliation to the Radio Society of Great Britain.

WEST KENT AMATEUR RADIO SOCIETY
Hon. Sec.: M. R. Richards.

Meetings are held at the Kent Education Committee's Adult Centre, Culverden House in Culverden Park Road, Tunbridge Wells. Meetings commence at 7.45 p.m.

Recent events have included "Getting Going on 2m", Part III; "Transmitters", by G2UJ; "Single Side Band", a talk and demonstration by B. Williams. An audio night was held on December 9th and the Christmas party on December 21st.

A morse tape is run from 7.15 to 7.45 p.m. before each meeting for the benefit of members learning the code.

COURSES OF INSTRUCTION

RISLEY EVENING INSTITUTE
Rowland Hill School. Lordship Lane, Tottenham, N.17. Head of Institute: R. Finch, A.F.T. com. Tottenham 2419.

A course entitled "Amateur Radio" is being held at the above institute on Monday evenings from 7.30 p.m. to 9.30 p.m. The Spring term commences on January 9th, 1961. The course is mainly intended to serve as an introduction to Amateur Radio and is not a course for the Radio Amateurs' Examination, although if enough interest is shown this later course will be started.

The main emphasis will be on the practical side and it is hoped to have an amateur radio station operating by the end of the spring term. The course is mainly intended for 14-17 age group, but naturally all will be welcomed. Inquiries should be made to J. D. Harris, G3LWM, 2 Lambton Avenue, Waltham Cross, Herts.

STREATHAM AND TOOTING EVENING INSTITUTE
H. N. Caley, 6 Farnan Road, Streatham, S.W.16.

Streatham and Tooting Evening Institute announce that Radio and TV classes for beginners will recommence on January 9th, 1961. There is room for a few more enrolments at each of the classes which take place on Mondays, Wednesdays and Fridays at Dunraven, Penwortham and Hillcroft schools respectively. The terms are the same as for other L.C.C. evening classes.

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By F. J. CAMM

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M.C. 24. Imported. crystal. attractive streamlined polished metal case. incorporates muting switch. List price **64/-**. OUR PRICE **42/-** only. 1/- P. & P.

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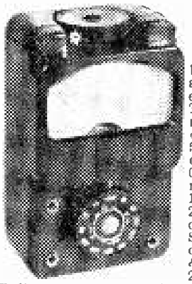

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Ideal for amateurs and service engineers. Incorporates 3in. rectangular meter. Ranges: A.C. & D.C. voltage. 0-10-50-250-500-1000 v. D.C. current 0-100-500 mA. 0-1 mA (used at 0-10v. range). Resistance 1-2000 ohms (centre 24 ohms). 100-200,000 ohms (centre 2.4 k.). Sensitivity 1000 ohms per volt A.C. & D.C. Size 5 x 3 x 2½in. Wt. 22 ozs. only. Fully guaranteed. Supplied complete and ready to use with test leads, at the very low price of ONLY **79/6.** P. & P. 3/6.
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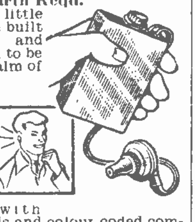

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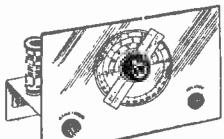
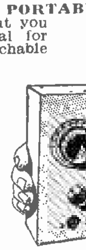
1 VALVE SHORT-WAVE RADIO

World-wide coverage at most reasonable cost.



Covers 40-100 metres with the coil supplied. Can be extended to cover 10-100 metres. Provision is also made for the addition of two extra valve stages. Employs the famous Acorn-type 954 valve. All necessary components can be supplied complete with full assembly instructions at **ONLY 35/-** plus 2/- p. & p. Send 2/- for point-to-point wiring diagram and price list.

SUPER PERSONAL PORTABLE



A wonderful little set that you can take anywhere. Ideal for camping, picnics, etc. Detachable aerial rod supplied. Covers Medium waveband 200-500 metres. Can be built in approx. 1 hour. All necessary components available at the following SPECIAL INCLUSIVE PRICES: 1-valve version **ONLY 35/-** plus 2/- P. & P. Super 2-valve version **ONLY 41/-** Plus 2/- P. & P. Send for point-to-point wiring diagram and parts price list 2/- post free. Extra for use with the above DLR5 balanced armature headphones. **7/6** pair.

PRINTED CIRCUIT CAR RADIO

(for Home Construction)

We are proud to be able to offer this New type Car Radio employing up-to-the-minute circuitry special 12 volt valves and transistorised output stage. The highest degree of sensitivity is assured by the incorporation of Permeability Tuning and a tuned R.F. Stage. Covers. Medium and Long Wavebands. NO VIBRATOR PACK IS REQUIRED. This is a really compact receiver that will fit any car. Comprehensive assembly instructions are provided with all necessary components, including valves and transistor at a Special New Low inclusive Price of Only **£11.19.6** plus 3/6 P. & P. Instruction booklet with itemised price list, full description dimensions. etc., available separately at 3/6 post free.

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Premier RADIO

23 TOTTENHAM COURT ROAD, LONDON W.1
and at 309 EDGWARE ROAD, LONDON W.2

TEL.: MUSEUM 3451/2
TEL.: PADdington 6963

"THE MID-FI" A NEW DESIGN 4½ WATT AMPLIFIER KIT

MAY BE BUILT FOR **95/-** plus 3/- p. & p.

A new circuit for the home constructor requiring a good quality medium powered Amplifier for reproduction of Records of F.M. Broadcasts. For use with Loudspeakers of 3 or 15 ohms impedance. Technical Specifications: separate bass and treble controls. Valve line-up EF86, EL84, EZ80. Voltage adjustment for A.C. mains from 200-250 volt. Negative feedback. Size 7 x S x 2in., overall height 5in. Silver hammered finish Chassis. Instruction Book 1/-.

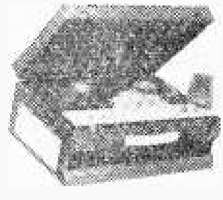
The "Petite" PORTABLE

MAY BE BUILT FOR

£7.7.0 Plus p. & p. 3/-

BATTERIES EXTRA.
H.T. 10/- (Type B126) or equivalent L.T. 1/6 (Type AD35) or equivalent.
★ Size only 8in. x 8in. x 4½in.
★ Instruction book 1/6.

THE PREMIER TR/2



Once again Premier is first with another magnificent offer. Introducing the "TR/2" the latest and cheapest addition to our range of popular Recorders.

Star features:
★ Latest BSR Tape Deck, with interlocking device to prevent accidental erasure.
★ Single speed 3¾in. per sec.
★ Playing time 5¾in. std. tape, 1½ hrs; L.P. tape, 2 hrs 8 mins.
★ Volume on/off and tone control.
★ Power output 3 watts.
★ Input sockets for Microphone, Radio/Gram.
★ Extension speaker socket. Size: 13½ x 9½ x 6in., weight 17 lb.

PRICE including Microphone, tape and spare spool **19 Gns.** Plus 15/- P. & P.

SPECIAL BARGAIN OFFER

THE PERFECT STEREO SYSTEM:

Two DL7-35 power amplifiers; One SP21 Stereo Control Unit- Original cost £91.0.0

Our Price 47 Gns.

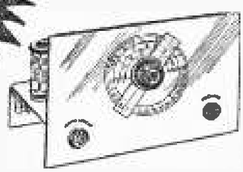
Brief Specifications:
SP21 Power requirements 6.3V at 1.3A A.C., 250V at 5mA D.C. Dimensions 14½ x 9 x 4in. ORIGINAL PRICE £28.10.0
DL735 Power output each amplifier, 54 watts peak. Valve line-up: GZ34, 2-EL34, ECC83, EF86. L.S. impedance 4, 8 or 16 ohms, switch selected. ORIGINAL PRICE 30 GNS.

ENSURE SUCCESS WITH R.C.S.

CONSTRUCTORS CORNER

Explore the world on short-wave radio (10-100m)

FOR ONLY **35/-**

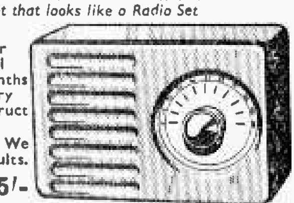


Construction price includes valve and one coil covering 40-100 m.
● Can be converted to 2v. or 3v.
● Receives speech and music clearly from all over the world.
Send 2/- for diagram and price list.

AN IDEAL PRESENT!

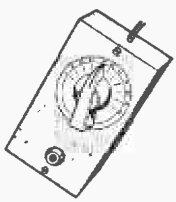
EASY TO BUILD TWO STAGE TRANSISTOR SET
The set that looks like a Radio Set

● Attractive Case
● Mini .0005 Tuner
● High Q Litz Coil
● Works for months off No. 8 Battery
● Simple to construct in 15 min.



You can't go wrong. We guarantee good results.
Total Building Costs. P.P 1/6 **25/-**
Components Price List. Layout Plans 1/6 free with order.

YOU CAN NOW BUILD THE R.C.S. TAPE TUNER



Will operate on all types of Recorder. Size 3¾ x 1¾ x 1in. High impedance output, variable med. wave tuning. Triple wound Super-Hi-Q coil. Easily constructed from full instruction data and Layout Diagrams. Chassis and components colour coded.

All parts to Build. Post 1/6. **30/-**

CRYSTAL RECEIVER

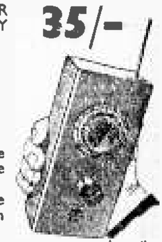
Covers M/W Band
All components including case for **12/6**
Ideal for the beginner

BUILD THIS AMAZING RADIO

POWERFUL PERSONAL PORTABLE

FOR ONLY **35/-**

★ Sturdy metal case.
★ No holes to drill.
★ Detachable rod aerial.
★ All batteries self-contained.
★ Can be built in 1 hour.
★ Covers medium waves.
★ Loud clear tone.
★ Selective tuning.
★ All parts are sold separately.



This delightful set is designed to give you a completely personal portable radio.
Bronze-finished case. Ideal for the beach, the bedroom, the office—in fact anywhere.
Send 2/- for wiring diagram and components price list

Post and packing: Under 10/- add 9d.; under 40/- add 1/6; over POST FREE

Trade Enquiries Welcomed **R.C.S. PRODUCTS (RADIO) LTD.** 11 OLIVER RD., LONDON, E.17 Mail Order Only

Trade News

NEW PRODUCTS AND DEVELOPMENTS

GENERAL COVERAGE RECEIVER

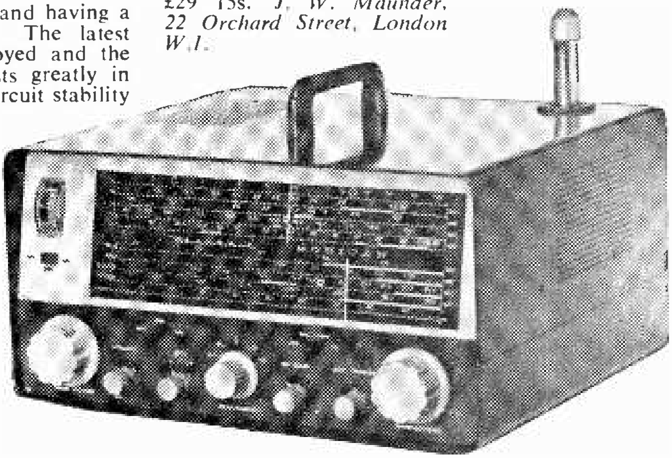
THE GC-1U is a portable or fixed station receiver for both the ham and the short-wave listener. It has been designed for good performance and some of its features are a ten transistor circuit, printed circuit board, internal dry battery power supply, telescopic whip antenna, tuning meter and a large slide-rule dial giving a total scale length of approximately 70in.

To overcome the problems of alignment etc., the R.F. "front-end" of the receiver is supplied as a pre-assembled, wired and aligned unit.

Continuous frequency coverage is provided from 550kc/s to 30Mc/s in five bands thus enabling world-wide reception. Electrical bandspread on five additional bands covers the amateur frequencies from 80 to 20m each, the band having a scale length of approximately 8in. The latest printed circuit techniques are employed and the use of a printed circuit board assists greatly in successful kit assembly and ensures circuit stability and consistent performance.

A 7in. x 4in. loudspeaker is mounted on a side panel within the cabinet and is automatically disconnected when the phone plug is inserted in the socket.

The GC-1U is housed within a strong steel cabinet finished in stove-enamelled green and it is powered by a 12V dry battery mounted internally. For static and mobile use a socket is provided for the connection of external power supplies. It is available from *Daystrom (Heathkit) Ltd., Gloucester, England.*



The Heathkit "Mohican" general coverage receiver.

STYLUS PRESSURE GAUGE

A STYLUS pressure gauge is being produced by Garrard Co. Ltd.

The gauge ensures optimum reproduction of all types of gramophone records by providing an accurate means of co--ecting the pressure of the stylus on the record. It accommodates all current pick-up arms and heads, and a swivelling balance lever ensures sensitivity. The gauge is freely adjustable and easy to operate. *The Garrard Engineering and Manufacturing Co. Ltd., Swindon, Wilts.*

MOVING COIL MICROPHONE

J. W. MAUNDER, U.K. agent for Shure Brothers Incorporated, announces the release of Model 545 "Unidyne III", a small cardioid dynamic microphone.

A slender moving-coil microphone only 1¼in. diameter x 6in. long, the "Unidyne III" provides wide-range reproduction of music and speech whilst the uni-directional characteristic largely overcomes problems of feedback and unwanted noise and ensures highly satisfactory performance under adverse acoustic conditions.

For a given feedback level the microphone can be placed at 75per cent greater distance from the performer than is possible with conventional models.

Of dual-impedance, the "Unidyne III" can be connected direct to a 50-250Ω line or high impedance input. It is supplied complete with 18ft of high quality shielded cable and plug and with an adjustable swivel adaptor which permits instant withdrawal for hand use.

Also available is the Model 544 Series, comprising the "Unidyne III" mounted on a flexible support for fitting to control desks and consoles.

The Model 545 "Unidyne III" Microphone, cost £29 15s. *J. W. Maunder, 22 Orchard Street, London W.1.*

HIGH TORQUE BATTERY MOTOR

DESIGNED primarily for professional tape recorders, this new EMI battery motor (part no. 98170D) is also suitable for television camera remote control, and for medical and other scientific uses. This high-grade precision motor is built for long life and exceptional speed regulation over a wide range of load and voltage. A multi-pole armature gives low electrical interference, long brush life and high efficiency and a ball race bearing is incorporated for handling heavy duty side loads. *The Gramophone Co. Ltd. (Components Division), Hayes, Middlesex.*

MONAURAL RECORD PLAYER

THIS new monaural record player is made by Magnavox and is selling at 19½ gns. (including purchase tax). The M.602 "Manhattan" record player incorporates features normally found in instruments selling in a higher price range.

Owing to advanced amplification technique, the "Manhattan" gives freedom from distortion at high volume. This is due to the first-class per-

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formance of the 7in. x 4in. elliptical wide range unit. The Magnavox standard auto-changer operates at $16\frac{2}{3}$, $33\frac{1}{3}$, 45 and 78 r.p.m.

There is a crystal turnover cartridge with a 1mil sapphire stylus for L.P. discs and a 3mil sapphire stylus for 78's. The cabinet features clean-cut contemporary styling. *Magnavox, 129 Mount Street, London W.1.*

A.M./VHF TRANSISTOR TABLE RADIO

A NEW 8-transistor A.M./VHF table radio, by Ekco (model BT359), makes everyday family listening independent of the mains supply without involving any undue extra running cost.

It is a full-size table model measuring $11\frac{1}{4}$in. high by $17\frac{1}{4}$in. wide by $6\frac{1}{2}$in. deep and a Class B push-pull output stage delivers up to 1W into a high-flux (10,000 line) 8in. by 5in. elliptical speaker. In addition to the usual ferrite rod aerial for medium waves, a double folding-rod dipole is provided for VHF reception.

This receiver can provide a standard of performance at least comparable with that of a typical better-class mains receiver while the absence of all external connections means that the receiver can be used wherever it is most convenient — without reference to the availability of a mains socket.

An attractive feature of this receiver is the clearly marked tuning scale which also carries the two concentric pairs of control knobs and extends to the full width of the cabinet. Controls include tuning, wavechange, volume on/off and tone. Waveranges are 185 to 570m and 85 to 100Mc/s.

In appearance, the receiver is of modern design, the cabinet is veneered in sapele mahogany and trimmed with silver-colour metal styling bars and a woven plastic speaker grille.

The price of the receiver is 27 gns. (£21 9s. 3d. plus tax £6 17s. 9d.) and the recommended battery costs 11/-.

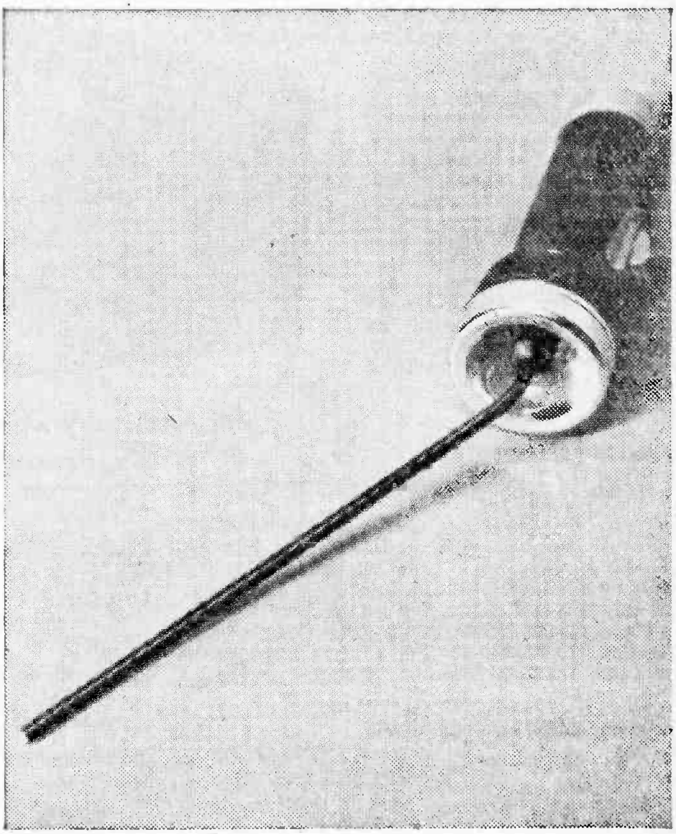
Technically, the receiver makes few concessions to tradition. There are four printed wiring panels, one for the R.F. tuner, one containing the audio frequency circuits, another containing the F.M. intermediate frequency and demodulator circuits and the fourth containing the A.M. frequency-changer, intermediate frequency and demodulator circuits. Between the two latter panels, a slide switch carries three transistors which are switched from one panel to the other by the wavechange switch. All three transistors serve as I.F. amplifiers when switched into the F.M. panel, only two of them serving as amplifiers when switched to the A.M. panel, the third then forming an oscillator/mixer. With ample space inside the cabinet, all the printed panels are easily accessible for servicing if required. *E. K. Cole Ltd., Southend-on-Sea, Essex.*

TORCH ATTACHMENT

THE "Clinton Prodlite" can be fitted to any two-cell electric torch in place of the standard miniature screw bulb.

The diameter of the stalk is only $\frac{1}{8}$in., or with an insulating sleeve, $\frac{5}{32}$in., and it contains a specially made ultra-miniature bulb incorporating a lens which directs an intense beam of light wherever required. As the bulb is sheathed within the hollow stalk, it is protected from damage and has a long working life.

For such purposes as inspecting the interior of radio apparatus, the practical value of this device is obvious. It can be obtained with a longer, or a specially shaped stalk, or with a flexible lead and switch. Incidentally, a 12V model for motorists and garage service will also be available. The price is 15/6. The Prodlite has been introduced by the *Clinton Laboratory, 43 Broomhall Place, Sheffield 10.*



The "Clinton Prodlite" torch accessory enables areas normally inaccessible to light to be illuminated.

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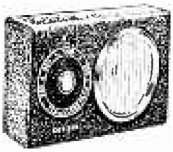
BUILD IT YOURSELF!



THE FAMOUS COSSOR

(Traveller's Friend) Transistorised

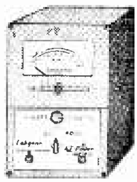
£7.19.6 P. & P. 2/-.

POCKET RECEIVER

in leatherette case

This set can be built for £7.19.6. Size 6 x 3⅞ x 1⅜in. Weight 17 oz. This set covers medium waveband 190/500 metres intermediate frequency. 470 kc/s using 4 transistors (Ediswan) and 2 diodes on a printed circuit board. plus a 2½in. moving coil speaker. Instruction book with point to point wiring diagram, 2/6 each. Batteries. PP4 (Ever Ready) 2/- each.

LABGEAR OUTPUT METER



£2.19.6 Complete Kit P. & P. 2/-

At last a Meter at the right price for the home constructor. An accurate Audio Power Output Meter. Two ranges 25mW to 1W and 1W to 10W. Accuracy 5% matched for 3. 15. 600 ohms with inst. and tech. data. New 3-in. 0-1mA meter.

NOT GOVERNMENT SURPLUS

FERGUSON VHF/FM TUNER

This F.M. adaptor is completely self-contained and can be fitted to any A.C. mains radio gram or radio with P.U. sockets. Valves 2-EF80's. FCF80. Input 200-250v. A.C. range 80-98 Mc/s.

Greatly Reduced **£13** P. & P. 2/-

LIST PRICE 18 gns.

YOUR EXISTING RADIOGRAM OR RECORD PLAYER CHANGED TO STEREO BY OUR STEREO ADAPTOR

Tech. Data 2 valves FF80 and EL84. Switch control for Stereo and Mono Dual volume and tone control. Output 3 ohms. suitable for use with Acos GC/71, GP/73 and Garrard GC/10. Complete with wiring diagram.

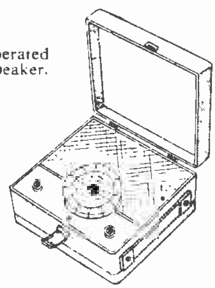
£2.19.6 P. & P. 2/6

COSSOR BATTERY PORTABLE

£7.7.0 P. & P. 3/6

This extremely sensitive battery operated set has a printed circuit and 5in. speaker. A frame aerial fitted in the lid gives high quality listening on L and M Bands.

LIST PRICE 13½ gns.



CARTRIDGES

Collaro Studio O	..	18/-
Collaro Studio P	..	18/-
B.S.R.	.. ..	18/-

RECORD CHANGERS

B.S.R. UA8 comp. with latest "ful-fi" cartridge	£6.19.6
Stereo	£7.19.6
Collaro Conquest, 4-speed auto. ..	£7.19.6
Garrard RC 120, 4-speed auto. ..	9 gns.
Collaro Junior, 4-speed Single Play Comp. with Arm and P.U.	£3.15.0

P. & P. 3/6

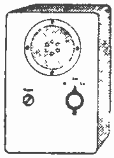
SPEAKERS

3½in. SPEAKER ..	17/6
5in. SPEAKER ..	15/-
6½in. SPEAKER ..	16/6
8in. SPEAKER ..	17/6
6 x 4in. SPEAKER ..	15/-
8 x 5in. SPEAKER ..	19/6
10 x 6in. SPEAKER	25/-
12in. SPEAKER ..	32/6

P. & P. 2/6.

"SUPER- THREE"

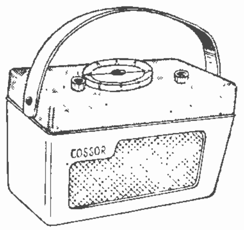
Transistor Pocket Radio



Printed circuit technique using 2 Surface Barrier type transistors, one A.F. Trans and one Diode. Ferrite aerial, fully tunable on LW and MW. Uses 2 U16 1½ volt batteries. And easily assembled by the beginner.

Kit of Parts Complete **39/6** P. & P. 1/6

COSSOR BATTERY PORTABLE SPECIAL



£6.19.6 P. & P. 3/6

LIST PRICE 12½ gns.

A printed circuit, 5in. speakers are features of this battery portable. An internal ferrite rod aerial for L and M Bands. A polythene wrapper provided to protect receiver. Width 10in., height 6½in., depth 5½in.

TAPE RECORDERS THE "MAGNAPHONE"

A first class tape recorder at a reasonable price. Separate Treble and Bass controls for replay, facilities for monitoring and mixing. 3-speed Collaro Studio deck. and many other refinements. Output 4 watts.

£32.0.0 21/- P. & P. & ins.

Complete with crystal microphone with lead and jack plug. 5¾in. reel of tape and spare reel and spare lead for recording from radio.

THE "VOGUE"

Another fine recorder fantastically cheap. It also uses the famous Collaro Studio 3-speed tape deck. Separate inputs for microphone and gram. recording tone control for replay. Output 3 watts. Complete with microphone. reel of tape and spare spool.

29 gns. 21/- P. & P. & ins.

RECORDING TAPE OFFER

FAMOUS MAKE P.V.C. BASE ON PLASTIC SPOOL

1800ft on 7in. spool ..	32/6	1200ft on 7in spool ..	21/-
1200ft on 5¾in. spool ..	22/6	850 ft on 5¾in. spool ..	16/6

THE LATEST MINIATURE EARPHONE FOR TRANSISTOR RADIOS

This lightweight superbly made instrument enables you to listen in to your radio wherever you are, ideal for all forms of travel. etc. Provides excellen reproduction and can be worn without any discomfort, complete with transparent earpiece, 3ft. of fine flex, plug and socket.

Crystal earpiece as illus. High Imp. Magnetic .. „ „ Low Imp. **10/-** Usual price £1.1.0 P. & P. 1/-.

SUB-MINIATURE TRANSISTOR PARTS

We can now supply all sub-miniature parts for the home constructor—transformers. coils. condensers, resistors—from our large stock of component parts.

SEND S.A.E. FOR FREE PRICE LIST OR PAY US A PERSONAL CALL

WIRECOMP ELECTRONICS

378 HARROW ROAD, LONDON, W.9

TEL: CUNNINGHAM 9530

Hours of business: 9 a.m. to 6 p.m. Open all day Saturday. Opposite Paddington General Hospital. Buses 18B and 36 pass the door.

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MAXI-Q REGD.

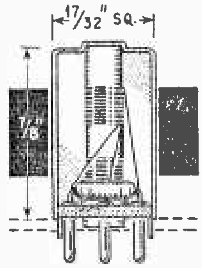
TRANSISTORIZED F.M. RATIO DISCRIMINATOR & I.F. TRANSFORMERS

FOR THE HOME CONSTRUCTOR . . .

I.F. TRANSFORMER, IFT.15

A 10.7 Mc/s double-tuned transformer with tapped secondary and primary windings. Wound on polystyrene former complete with irondust tuning cores and sub-miniature polystyrene foil capacitors. Completely enclosed in an aluminium screening can measuring 7/8in. high by 17/32in. square with two fixing clips. Termination is made to base mounted silver plated pins which are ideal for either printed circuit board or normal metal chassis mounting.

Bandwidth of single transformer at — 6 dbs is approx. 250 kc/s. Unloaded 'Q' of winding 70. **Price 10/6**



ACTUAL SIZE

RATIO DISCRIMINATOR TRANSFORMER, RDT.2

A sub-miniature 10.7 Mc/s transformer for use in ratio discriminator type circuits. Secondary winding is of bifilar construction. Dimensions as IFT.15. Peak Separation approximately 220 kc/s.

Connection diagram supplied with each coil. **Price 10/6**

GENERAL CATALOGUE covering full range of components send 1/4 in stamps.

PLEASE SEND S.A.E. WITH ALL ENQUIRIES

DENCO (CLACTON) LTD. (Dept. P.W.), 357/9 Old Road, Clacton-on-Sea, Essex

VALVES SAME DAY SERVICE

NEW! TESTED! GUARANTEED!

SETS 1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94 .. any 4 for 19/6
DAF96, DF96, DK96, DL96 .. .. 4 for 27/6
6K7G, 6K8G, 6Q7G, 6V6G, 6X5G, or 5Y3G .. .. 5 for 27/-

1A7GT	11/6	6K8GT	9/3	25L6GT	9/-	EBL21	13/6	EZ40	6/9	T41	9/6
1D5	8/-	6L1	14/-	25Z4G	7/6	EC92	11/-	EZ41	7/-	TH41	19/6
1H5GT	10/-	6L18	10/3	25Z6GT	9/6	ECC81	5/-	EZ80	6/3	U22	7/3
1N5GT	10/-	6LD20	8/-	35A5	9/6	ECC82	6/3	EZ81	7/-	U25	13/-
1R5	5/6	6P1	13/6	35L6GT	9/-	ECC83	7/-	FW4/500	8/-	U26	10/-
1S4	8/-	6P25	9/-	35Z4GT	6/-	ECC84	8/9	GZ30	8/6	U50	6/-
1S5	5/3	6Q7G	6/-	35Z5GT	8/6	ECC85	8/3	GZ32	9/6	U52	4/6
1T4	4/-	6Q7GT	9/6	50L6GT	8/9	ECF80	8/6	HBC90	7/-	U78	4/9
1U5	5/9	6SL7GT	6/3	AC/TH1	16/9	ECF82	8/6	KT33C	7/-	UABC80	7/9
3A5	9/-	6SN7GT	4/9	AZ31	9/6	ECH21	13/6	KT41	11/6	UAF42	9/-
3Q4	7/-	6U4GT	11/-	B36	8/9	ECH35	6/3	KT44	6/6	UBC41	7/9
3S4	6/-	6V6G	5/-	CL33	12/3	ECH42	8/9	KT61	10/-	UBF80	8/9
3V4	7/-	6V6GT	6/6	DAC32	10/-	ECH81	8/-	KT63	6/6	UBF89	8/-
5U4G	4/6	6X4	4/9	DAF91	5/3	ECL80	7/3	MU14	7/6	UC92	12/6
5V4G	8/-	6X5GT	5/-	DAF96	7/6	ECL82	9/6	MX40	9/6	UCC84	12/9
5Y3GT	6/-	7B6	9/-	DCC90	9/-	EF39	4/6	N18	7/-	UCC85	7/6
5Z4G	7/9	7B7	7/6	DF33	10/-	EF41	8/3	PCC84	7/6	UCF80	14/-
6AL5	3/9	7C5	7/6	DF91	4/-	EF42	9/6	PCC89	11/-	UCH21	13/6
6AM6	3/6	7C6	7/6	DF96	7/6	EF80	5/6	PCF80	7/6	UCH42	8/-
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Letters to the Editor

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

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

LOUDSPEAKER DESIGN

SIR.—Recent letters have given details of loudspeaker design and problems, but I have not so far seen any mention of some experiments which were carried out some time ago and according to the reports which I read, foretold great steps in development in the reproduction of sound. I believe that a flame was modulated in some way and that this gave reproduced sound of a very high quality. I have heard nothing further of this. Similarly, the flat plate type of reproducer was hailed as a wonderful new departure in loudspeakers, but also has faded away without any models incorporating it coming on the market. Can anyone tell me if there has been anything new in loudspeaker design in the period since the war? Apart from the fabric cone of certain models it seems to me that the modern loudspeaker is no different from those in use before the war.—F. R. ENDELL (Bristol).

WIDE-BAND S.W. TWO

SIR.—I recently finished the set described in the June issue but was very disappointed as it would not work. After some trouble I discovered a fault in the wiring in your Fig. 4 and when this was remedied the set responded well. I have had immense pleasure from this little set, and although it was built primarily to give to a young friend. I am keeping this for my own use and building another. I was terribly thrilled on the first night's listening by the large number of entertaining stations which could be picked up, and I think that I shall now have to build myself a really good aerial as the scope of this set seems endless—R. T. BURTON (Wembley).

[In Fig. 4 on page 128 of the June 1960 issue, the 270k screen resistor of V1 should be connected to H.T.+, as in the circuit diagram.—Ed.]

TRANSISTOR HOLDERS

SIR,—I have followed your articles and my main interest nowadays is in the transistor. I find, however, that after I have used a transistor three or four times it seems to have worn out. This prompted me to make some enquiries and I finally found that I had in fact more or less ruined the transistors by soldering them into the sets. I would have thought that after the time which these components have been on the market, some attempt would have been made to produce a transistor to plug in, just the same as the valve, and it looks to me as though the transistor manufacturer is cashing in on the fact that you have to solder them and therefore you will ruin them and have to buy another. Could not you publish an article on how to fit pins to the base (with a minimum risk of damage) and how to make sockets to take them. I am sure this would be welcomed by all, and could be done without making them any larger.—E. M. KRELL (Reading).

PLAYING A RECORD BACKWARDS

SIR.—During Christmas I saw a stunt carried out by a radio enthusiast which has me guessing. First of all he showed us how to play a gramophone record backwards, by putting it on a pencil and letting its edge rest against the edge of the turntable. Whilst we appreciated the "stunt" (it was quite good as a sort of party game to try and guess the artiste, and was really funny to listen to) he then astounded us by playing a tape recording backwards. I know a little about tape recording, but cannot see how he managed this, as it would not be sufficient just to turn the tape over. What has to be done so far as I can see it is to turn the tape "inside out backwards."—just turning it over will not give the same effect. Perhaps some ingenious reader has ideas on this and could let us have the "know-how".—F. KEATING (S.W.5).

TAG BOARDS

SIR.—The modern set is a masterpiece of "juggling", the many components having to be placed in awkward positions, and, the wiring made intricate, unless some special procedure is adopted. I some time ago took to using tag boards to simplify construction, making a drawing and mounting all the components required on the tag boards, which result in only the connecting wires from the edges of the boards to the valveholders having to be made to complete the set. I believe it is now possible to obtain valveholders in which a step further in this direction has been made in the U.S.A. and an extension of the valveholder base is made so that all the items associated with the valve may be mounted actually on the holder. Thus all the wiring to the valveholder may be made before it is mounted on the chassis, and this would surely greatly simplify construction, as well as making it much easier to ensure that there were no bad connections to a component which is very inaccessible when the same is completed. Does anyone know of this type of valveholder and whether it is available in this country? — H. NEVILLE (Bournemouth).

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MODULATION

SIR,—With reference to Mr J. R. Miller's letter printed in the January issue, concerning modulation at low power in the VFO, modulation in the oscillator stages is certainly practicable and was popular with amateurs in the early days of high-cost power valves when any economy not incurring too many disadvantages was given serious consideration.

The main fault with this method is that in modulating the oscillator on grid, screen or anode, a current change must occur and a corresponding voltage variation. Thus in turn reduces stability, frequency modulation occurring with consequent reduction of quality.

Now that cheap valves for power amplifier and modulator output stages are available e.g., the ubiquitous 807 type mentioned, it is surely worth the extra outlay to obtain the stability necessary for modern amateur operation on crowded bands such as 40m.

In reply to Mr. Miller's other query, it is possible to run 120W unmodulated R.F. from two 807's in parallel.

In the same issue Mr. E. Haines refers to Radio Luxembourg as having "hardly enough power to bridge the ether"! It would seem to me that the 350kW output radiates efficiently enough for I have heard the station with consistency whilst residing in Orkney. This was at a distance of roughly 800 miles and still S9+.—R. A. WHITE (Sevenoaks, Kent).

PUSH-PULL AMPLIFIER

SIR,—In reply to Mr. Haskell's request (January issue) for the value of separate cathode resistors for two EL84's in push-pull, I can inform him that the value will depend upon the loading of the output stages.

For normal loading, the value will be 270Ω for each resistor, and for low loading it will be 437Ω (i.e., 390Ω + 47Ω). The latter mode of operation will give a reduced distortion level, approximating the conditions of fixed bias, although the former arrangement also works admirably.—R. J. BURG (East Ham, E.16).

SHORT WAVE LISTENING

SIR,—With reference to Mr. F. N. H.'s letter that appeared in your December 1960 issue, I would also like to remark on such interesting reception. For, on the afternoon and early evening of November 27th I received on the 10 and 15m amateur bands large numbers of U.S. and Canadian amateurs as well as stations in Central America, Hawaii and Alaska. The receiver used was a 7 valve superhet and an R.F.24 pre-selector.—I. K. GURNEY (Chalfont St. Peter, Bucks.).

INTERFERENCE

SIR,—Reading the December 1960 issue of PRACTICAL WIRELESS, section "Letters to the Editor", I came across a sub-heading "Interference".

The explanation for this type of interference is commonly known as the Luxemburg effect. This phenomenon has been the object of much investigation, and an explanation of it was first given by two Australian physicists, Bailey and Martyn. They showed how a powerful low frequency station could affect the ionosphere in such a way that any other waves deflected from the affected region would acquire a modulation from the unwanted power station.

The only cure for this unfortunate mixing of transmissions would appear to be a reduction of a proportion of the skyline.

Under the action of a powerful electric field, such as a powerful transmitting station, the motion of the electrons does not follow a linear law. It is possible to make use of this non-linear characteristic, in the way which one does when employing grid modulation, by a process resembling the latter. The waves of the distant station passing through the area of the powerful electric field have a modulation from the latter impressed on them.—E. S. JACOBSON ZS6ATQ (Brakpan, South Africa).

CRYSTALS

SIR,—What has happened to the old-fashioned crystals which we used in earlier days as a detector? The various circuits which I have tried lately have not proved very thrilling, in spite of the exchange of silicon diodes and transistors, and I wanted to try a diode arrangement with a piece of the old Galena or Hertzite, but when I asked at the shop the dealer said he had never heard of them. Why not? I feel convinced that they are more sensitive than the modern components when once a suitable sensitive point has been found, and perhaps one of your readers knows a source of supply.—T. L. MENCE (N.W.).

A.C./D.C. EQUIPMENT

SIR,—I know there has been a long controversy about the merits and demerits of apparatus wired to what has become known as the A.C./D.C. technique, but there is one point which I do not think I have seen touched upon. What about hum? In a properly wired A.C. set, the heater wiring will be continuous on both pins, with the wires twisted tightly and run close to the chassis, thus ensuring that any A.C. field surrounding those wires will be so small as to be negligible, thereby avoiding the ejection of A.C. (hum) into other wires. In a set where the heaters are all wired in series, there is usually one single wire running all round the chassis, radiating, in my opinion, quite a considerable A.C. field which is bound to make its presence felt at one point or another. The purists may argue that the tranformer gives a larger field, but it is possible to obtain totally shrouded transformers, and I am convinced many of the troubles of the set wired "A.C./D.C." are due to the A.C. bearing wires. — H. FRANKS (Belmont).

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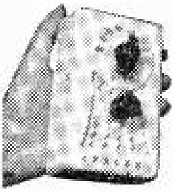

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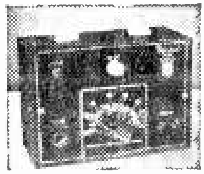

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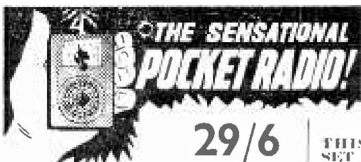

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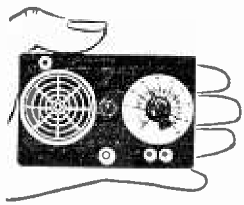

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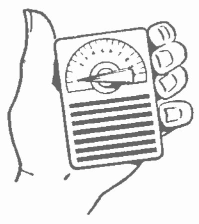

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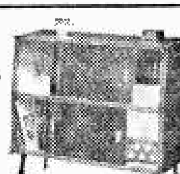

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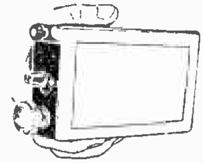

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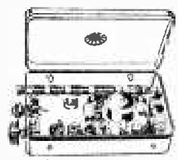

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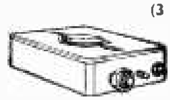

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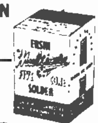

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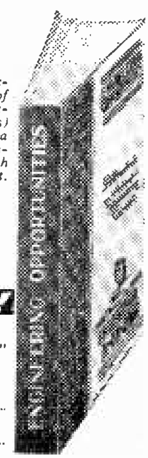

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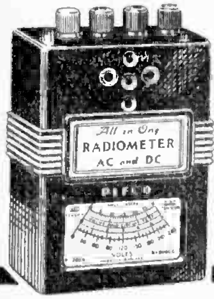

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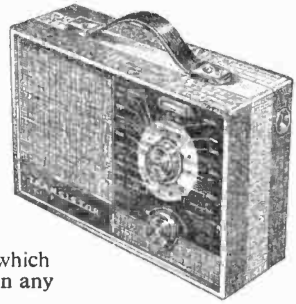

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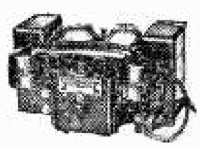

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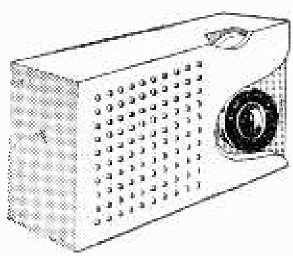

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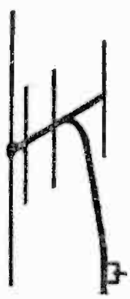

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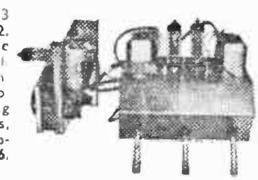

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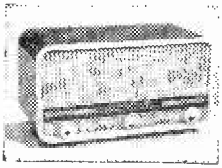

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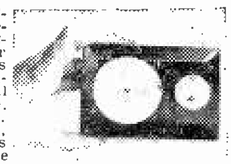

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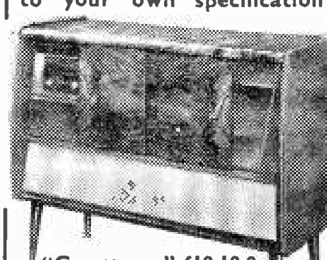

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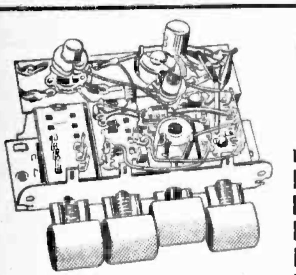
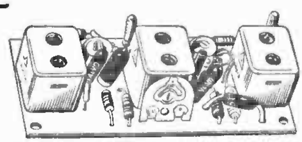
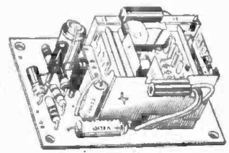

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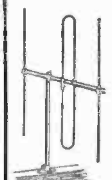

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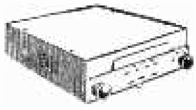

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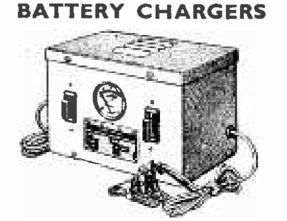

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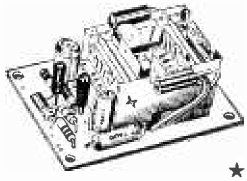

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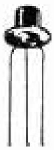

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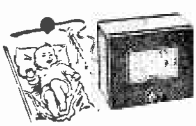

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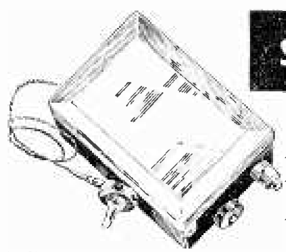

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Practical Wireless

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The index letters which precede the Blueprint Number indicate the periodical in which the description appeared. Thus PW refers to PRACTICAL WIRELESS; AW to *Amateur Wireless* and WM to *Wireless Magazine.*

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PRACTICAL WIRELESS, FEBRUARY, 1961.

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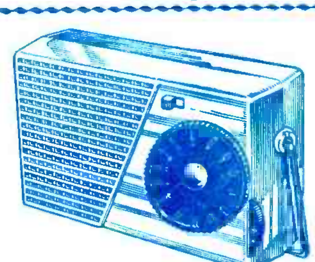

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