

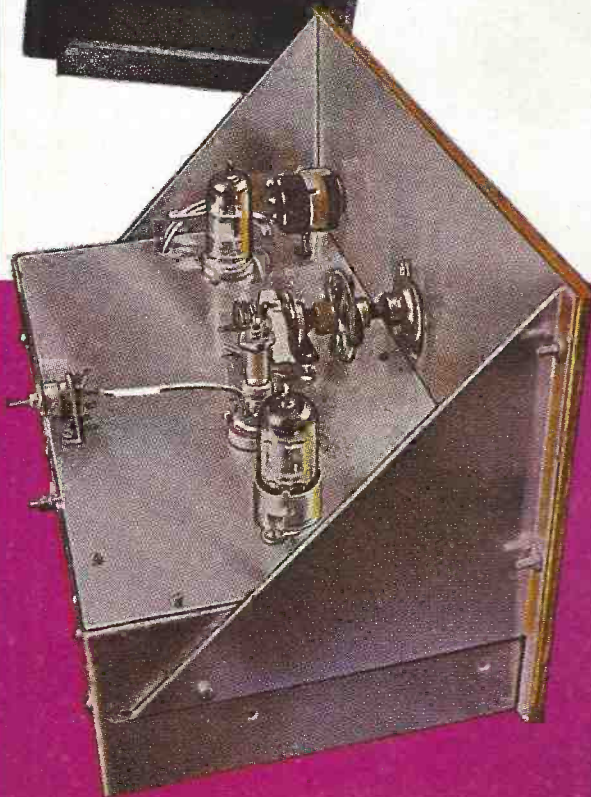
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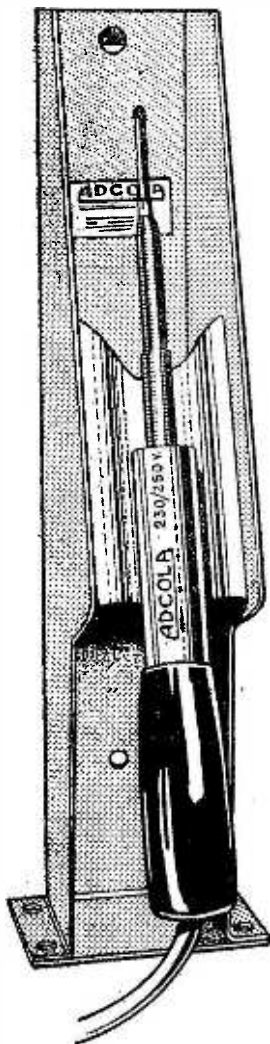
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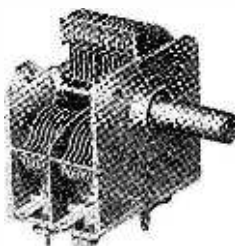
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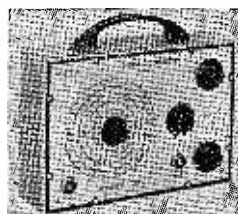
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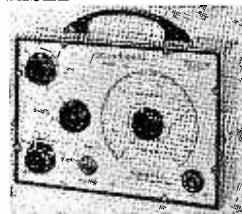
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Postage 1/- each.  
Post Free less 5% on three reels.  
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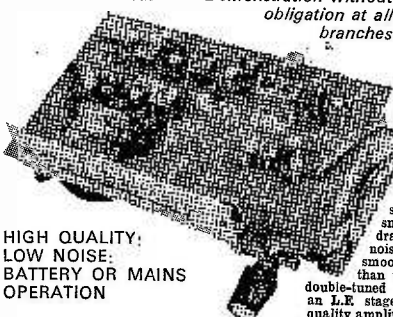
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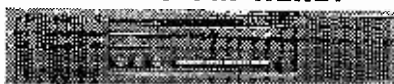
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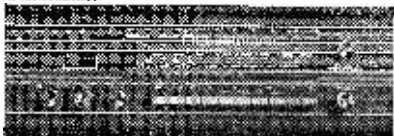
## THE NEILSEN 'ARENA' T1900H

All wave AF/FM stereo receiver amplifier, 5 wave bands 2 sinus pressure-chamber speakers, 8 watts, four channel. Fully transistorised, natural oiled teak cabinet, internal/external speaker, A.P.C. FM & AM tuning controls, internal or external aerials, tape recorder, gram inputs 200/250 v. A.C. operation tuning indicator base, treble volume controls. Size 29 1/2 in. x 5 1/2 in. x 8 1/2 in.

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6J7GT	9/6	20P9	9/6	EC082	5/6	EZ80	5/6	PY83	5/9	UY85	5/6
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6K8G	5/9	20P3	9/6	EC085	5/9	GZ82	9/6	PZ30	9/6	X66	7/9

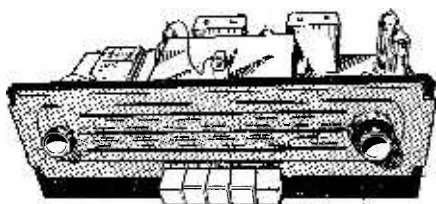
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AT £15.15.0 (Carriage Paid)**



Chassis size 15 x 6½ x 5½in. high. New manufacture. Dia 14½ x 4in. in 2 colours, predominantly cream. 200-250v. A.C. only. Pick-up Ext. Speaker. A.E. and Dipole Sockets. Five push-buttons—LW, MW, SW, FM and Gram. Aligned and tested. O.P. Transformer Tune control 1000-1900M; 200-550M; 88-95 Mc/s. 6-17 mc/s. EZ80 rect.; ECH81, EF89, EABC80, EL84. ECC85, 3-ohm speaker required.

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TAPE DECKS — 2 or 4 TRACK (4 TRACK 25/- EXTRA)**

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Valves ECC83, 2 x EL84, on printed circuit approx. 4 x 4in. Neg. feed back. Controls (vol. or tone) on separate panel, 6½ x 2in. Separate power pack with rect., double wound mains trans., connection socket etc. Supplied fully wired and tested with two O.P. transformers for 3-ohm speakers, only £4.15.0 (7/6 P. & P.). Two speakers, 8in. 3-ohm for 20/- each, post paid, if ordered with above Amp.

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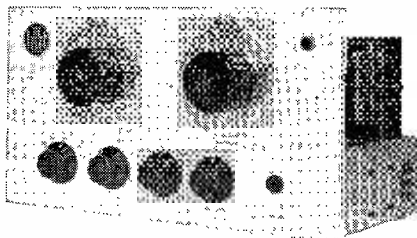
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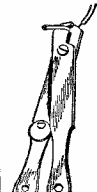
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Ideal for home constructors. Contains 102 ft. of 18 s.w.g. Ersin Multicore Savbit Alloy on a plastic reel. 15/- each (Also available in other sizes)

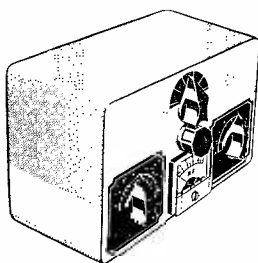


**BIB MODEL 3  
WIRE STRIPPER  
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Strips insulation without nicking the wire, cuts wire and splits plastic twin flex.  
**4/- each**

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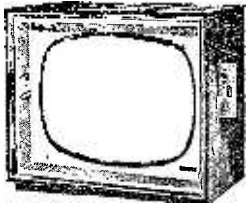


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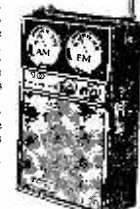


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The superb new streamlined desk console houses a remarkably powerful two-way telephone amplifier. Fits easily to any standard telephone in seconds and enables anyone in the room or office to hear the telephone conversation if required. Leaves both hands free for taking notes—always hear every word. LIMITED QUANTITY AVAILABLE. Only 750 left at 69/6 plus 5/6 p. & p. Full satisfaction or your money refunded in full.

This is truly a wonder purchase. Limited quantity only of FABULOUS EVERGOLD POCKET WATCHES Now at the lowest ever price. ONLY 25/- No More To Pay



Now offered at well below clearance price these remarkably reliable EVERGOLD pocket watches. Designed to withstand years of constant use with high resistant unbreakable glass. Luminous face markings—so easy to see the correct time at a glance. Fully guaranteed. DON'T MISS THIS ONCE IN A LIFETIME BARGAIN. Send only 25/- plus 3/6 p. & p. for 7 days' free home trial. Money back if not your best ever bargain.

CONCORD ELECTRONICS LIMITED (P.W.34) 87-89 TABERNACLE ST., LONDON, E.C.2. (Callers Welcome)





# R.S.C.

MAIL ORDERS TO:  
102 Henconner Lane  
Bramley, Leeds 13  
Hi-Fi CENTRES LTD.

Terms: C.V.O. or C.O.D. No C.O.D. under £1.  
Postage 3/6 extra under £2. 5/6 extra under £5.  
Trade Supplied. S.A.E. with all enquiries  
please. — Personal shoppers welcome at  
the following branches. Open all day Sats.

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**ALL LEADING MAKES OF HI-FI  
EQUIP. STOCKED Cash or Terms**

**15 watt HI-FI TRANSISTORISED  
AMPLIFIER TYPE A15**

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

**JASON VHF/FM TUNER £6.19.11**  
Complete Kit with valves  
Total cost of parts with detailed wiring diagrams and instructions. 12/- Gns.  
Or factory built 15/- Gns. Carr. 10/-  
Or in Teak finished cabinet Carr. 10/-  
as illustrated 19/- Gns. Terms: Deposit  
5/- and 9 mthly payments 39/- Total  
222.11.0.

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

**FULLY TRANSISTORISED** 200/250V. A.C. Mains.  
**OUTPUT 10 WATTS R.M.S.** cont. into 15 ohms.  
15 WATTS R.M.S. cont. into 3-4 ohms.  
Maximum instantaneous Peak power output 28 watts.  
**PRINTED CIRCUIT CONSTRUCTION.**  
**LATEST MULLARD TRANSISTORS.** AD149, AD149,  
OC127, OC81Z, OC44, OC44, OC81Z, OC44, AC107.  
**5 POSITION INPUT SELECTOR SWITCH.**  
**EQUALISATION** to Standard R.I.A.A. and C.C.I.R.  
Characteristics for Gram and Tape Heads.  
**FULL TAPE MONITORING FACILITIES.**  
**SENSITIVITIES:** Magnetic P.U. 4 mV. Crystal or  
Ceramic P.U. 400 mV. Microphone 4.5 mV. Tape Head  
2.5 mV. Radio/Aux or Ceramic P.U. 100 mV.  
**FREQUENCY RESPONSE:** +2dB 20-20,000 c.p.s.  
**TREBLE CONTROL:** +15dB to -14dB at 10 Kc/s.  
**BASS CONTROL:** +12dB to -15dB at 50 c/s. HUM LEVEL: -75dB.  
**HARMONIC DISTORTION** at 10 Watts R.M.S. 1,000 c.p.s. 0.3%.  
**NEGATIVE FEEDBACK:** 52dB.  
Complete Kit of parts with full constructional details and 10/-  
point to point wiring diagrams. 12/- Gns.  
Supplied factory built 14/- Gns. Or fitted in beautiful Walnut or Teak  
veneered cabinet as illustrated. 18/- Gns.  
Or Deposit 25.9.0 and 9 mthly pmts 40/6 (Total 221.13.0). Carr. 12/6.  
**ALL COMPONENTS ETC. ARE OF A HIGH STANDARD AND  
SUPPLIED BY LEADING BRITISH MANUFACTURERS.**

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New branches now open — see addresses

### HI-FI LOUDSPEAKER ENCLOSURES

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

**SE3.** For optimum performance with  
any Hi-Fi 8in. speaker. Carr. 10/-  
Size 22x15x7in. Carr. 7/6  
**SE10.** For 10in. Hi-Fi speaker with pro-  
vision for tweeter. Carr. 10/-  
Size 24 x 15 x 8in.

**SE12.** For outstanding performance with  
any 12in. Hi-Fi speaker. Cut for tweeter.  
Size 24 x 20 x 8in. Or Deposit 27/- and 9  
monthly payments of 18/2 (Total £9.10.6.)  
**FHE8.** Folded Horn type. Size 27 x 15 x 10in. Designed  
for high flux 8in. speaker with which  
exceptional quality can be obtained.  
Terms Deposit 21/- and 9 monthly pay-  
ments 21/- (Total 10 Gns.).

### AUDIOTRINE HI-FI 'SPEAKER SYSTEMS

Consisting of matched 12in. 12,000 line,  
15 ohm high quality speaker, crossover  
unit and Tweeter. Smooth response  
and extended frequency range ensure  
surprisingly realistic reproduction.  
Standard 10 watt rating. Or 5 Gns.  
Senior 20 watt inc. Pane Carr. 5/6  
12/10 speaker £6.19.2. Carr. 5/6  
7/6. Or Dep. 21/- and 9 mthly pmts of 15/4 (Ttl 27.19.0).

### AUDIOTRINE HIGH FIDELITY 'SPEAKERS

Heavy cast construction. Latest high efficiency  
ceramic magnets. Dual Cone for extended  
frequency range. Plastic treated  
surround giving low fundamental  
resonance. Response 30-20,000 c.p.s.  
Impedance 8 or 15 ohms. Carr. 5/6.  
**HF81D 8 in. 10 WATT 4 Gns.**  
**HF100D 10 in. 15 WATT 5.15.0**  
**HF121D 12 in. 20 WATT 6.15.0**  
**HF127D 12 in. 30 WATT 9 Gns.**

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

## HIGH FIDELITY LOUDSPEAKER UNITS

Cabinets of latest styling finished Satin Teak or Walnut, acoustically lined (and ported where appropriate.)

**MINI-8** 8 WATT rating. 3 or 15 ohm. Frequency  
response 60-13,000 c.p.s. Specially designed  
high flux 5in. speaker with low  
fundamental resonance. Handsome  
Teak veneered cabinet. Carr. 7/6  
Size 6 1/2 x 7in. **£6.19.11**

**THE 'PETITE'** Really astounding performance.  
Size only 10 1/2 x 6 1/2 x 7in.  
Rating 10 watts. Frequency range  
45-20,000 c.p.s. Fitted specially designed  
Heavy cast 5in. speaker with large pole pieces, extra  
large voice coil and rubber cone surround. Impedance  
3 ohms or 15 ohms. Or Deposit 26/- and 9  
monthly payments of 25/- (Total £13.1.0). **11 Gns.**

**The DORCHESTER** Size 24 x 15 x 8ins. Fitted  
Autodrine HF100D Speaker. Rating 15 watts.  
Impedance 15 ohms. Frequency Response 30-20,000  
c.p.s. Or Deposit 39/6 and 9 monthly  
payments 27/3 Total £14.4.9. Carr. 15/- **12 Gns.**

**The GLOUCESTER** Handsome "slimline" cabinet.  
Size 24 x 20 x 8in. 12 in. high flux 12,000 line  
speaker. Cross-over unit and Tweeter.  
Rating 10 watts. Smooth response  
40-20,000 c.p.s. Impedance 15 ohms.  
Or Deposit 36/- and 9 **11 Gns.**  
Monthly payments 25/- Carr. 15/-  
(Total £13.1.0).

**The BRONTE** Size 22 x 15 x 7 1/2in.  
Fitted Wharfedale Super 8 RSD  
Speaker, with Roll surround and dual cone. Rating  
6 watts. Impedance 15 ohms. Or Deposit 39/6 and  
9 monthly payments 27/3 (Total £14.4.9). Carr. 15/- **12 Gns.**

**AUDIOTRINE PLINTHS**  
For Record Playing units.  
Smooth finish cut for Garrard  
1000, 2000, 3000, AT6 Mk 2  
AT60, SP25 or Goldring GL68.  
Available with clear Perspex  
cover as illustrated 25.11.11  
complete **66/-**

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

A complete set of parts for the construction of a unit giving 5 watts high quality  
output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable  
all crystal or ceramic stereo heads. Ganged Bass and Treble Controls. Provision  
is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83,  
ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point to point wiring  
diagrams and instructions supplied. Send S.A.E. for leaflet. Or supplied factory  
assembled with 12 months' guarantee for 11 gns. Terms: Dep. 38/- and 9  
monthly payments 25/5 (Total £13.4.9). Carr. 11/6 **£8.15.0**

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

**PROVIDING 10/14 WATT ULTRA LINEAR PUSH-PULL OUTPUT ON  
EACH CHANNEL SUITABLE FOR "MIKE" FOR A.D.10 OR TAPE**  
Employing valves ECC83, ECC83, ECC83, ECC83, ECC83, ECC83, ECC83.  
Response: +2dB 30-20,000 c.p.s. Hum Level: 65dB down. Sensitivity: 5 millivolts  
maximum. Harmonic Distortion: (each channel): 0.2%. ★ Four-position tone  
compensation and Input Selector Switch. ★ Stereo/Mono switch.  
★ Will amplify direct from Tape Heads. ★ Neon panel indicator. ★ Handsome Perspex Frontplate.  
★ Separate Bass and "Cut" and "Lift" and "Cut" controls. Output transformers are high  
quality sectionally wound to required specification. Output matching for 3 and 15 ohm speakers on each  
channel. Complete set of parts with point-to-point wiring diagrams and instructions. Send 14 Gns.  
s.a.e. for leaflet. Carr. 12/6  
Or factory assembled, tested and supplied with our usual 12 months guarantee. Or Deposit 23/- and 9  
monthly payments 43/2 (Total £22.4.6). Carr. 12/6 **19 Gns.**

## R.S.C. TFM1 TRANSISTORISED VHF/FM RADIO TUNER

★ 200-250V. A.C. Mains operation. ★ Sharp A.M. Rejection. ★ High-sensitivity  
free reception. ★ Output ample for any amplifier (approx. 500 mV.).  
★ Simple alignment instructions. ★ Output available for feeding  
tuning meter. ★ Output for feeding Stereo Multi-plex. ★ Tuner  
head using Silicon Planar Transistors. ★ Designed for standard 80  
ohm co-axial input.  
Made to visually match our Super 15 and 30 amplifiers and of the same high  
standard of performance and reliability. The pre-wired tuning head facilitates  
speed and simplicity of construction. Printed circuitry. Only first  
grade transistors and components used. Our latest product giving you the  
best at half the cost of comparable units.

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

**TECHNICAL SPECIFICATIONS COMPARE MORE  
THAN FAVOURABLY WITH SIMILAR  
AMPLIFIERS AT TWICE THE COST**

**A DUAL CHANNEL VERSION OF THE SUPER**  
15. Employing Twin Printed Circuits. Close tolerance  
Ganged Pots. Matched Components.  
**CROSS TALK:** -52dB at 1,000 c.p.s.  
**CONTROLS:** 5 position Input Selector, Bass Control,  
Treble Control, Volume Control, Balance Control, Stereo/  
Mono Switch, Tape Monitor Switch, Mains Switch.  
**INPUT SOCKETS** (Matched Pairs). (1) Magnetic P.U. (2) Ceramic or Crystal P.U. (3) Radio/Aux. (4) Tape Head/  
Microphone.  
Operation of the Input Selector Switch assures appropriate  
equalisation.  
Rigid 18 s.w.g. Chassis. Size approx. 12in. Wide, 8in. High  
and 8in. Deep. Neon Panel Indicator. Attractive Facia  
Ganging and Balance Control, apply also to Super 15.  
**THESE UNITS ARE EMINENTLY SUITABLE FOR USE WITH  
ANY MAKE OF PICKUP OR MICROPHONE (Crystal, Ceramic,  
Magnetic, Moving Coil, Ribbon). CURRENTLY AVAILABLE  
SUPERB SOUND OUTPUT QUALITY CAN BE OBTAINED BY  
USING WITH FIRST RATE ANCILLARY EQUIPMENT. All  
required parts, point to point wiring diagrams and detailed  
instructions. Carr. 12/6  
Unit factory built 25 Gns. or deposit 81/- and 9 monthly payments 55/9  
(Total 229.2.9). Fitted cabinet as Super 15 29 Gns. Carr. 15/- or Deposit  
£4.12.0 and 9 mthly pmts 64/10 (Total £23.15.6). Send S.A.E. for leaflet.**

## AUDIOTRINE HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST. S.A.E. for  
CAN BE ASSEMBLED IN ONE HOUR. leads.  
ONLY 4 PAIRS OF SOLDERED JOINTS PLUS MAINS.  
Incorporating the latest Magnavox Tapedeck. The Audiocrine  
High Quality Tape Amplifier with switched equalisation for each  
of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel  
of Best Quality Tape and a handsome Portable Cabinet of latest  
styling finished dark grey leathercloth. Size 14 1/2 x 17 x 8 1/2 in. and  
circuit. Purchased separately would total approx. £34. Performance  
equal to units in the £50-£60 class. Deposit 26 1/2 Gns.  
4 gns. and 9 mthly payments 59/6 (Total 29 1/2 gns.)  
4 Track Model 3 gns. extra. Carr. 19/6



**LINEAR TAPE PRE-AMPLIFIER.** Type LP/1 Switched Equalisation. Positions for  
Recording at 1in., 3in., 7in. per sec., and Playback. EM84 Recording  
Level Indicator. Designed primarily as the link between a Magnavox  
Tape Deck and Hi-Fi amplifier suitable most Tape Decks. Terms available. 10 1/2 Gns.

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

A highly-sensitive 4-valve quality amplifier for the home, small  
club, etc. Suitable for all crystal or ceramic P.U. heads and practi-  
cally all "mikes". Separate Bass and Treble controls giving "lift"  
and "cut". Hum level 71dB down. Negative Feedback 15dB. Reserve  
power supply 300V 25 m.a., 6.3V 1.5 a. for Radio Tuner or Tape Pre-  
amp. Fo. A.C. mains 200-250V. Speaker output 3 ohms. Complete in every detail with  
fully punched enameled chassis, point-to-point wiring diagrams and  
instructions. Or assembled ready for use 6 gns. plus 5/6 carr. £4.17.9

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

Highly sensitive. Push-Pull high output, with Pre-amp./Tone Control  
Stages. Performance figures equal to most expensive amplifiers  
available. Hum level—70dB. Frequency response +3dB 30-20,000 c/s.  
Specially designed sectionally wound ultra linear output transformer  
with 307 output valves. All first grade components. Valves EF86,  
BF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls.  
Sensitivity 12 millivolts so that any kind of Microphone or  
Pick-up is suitable. Designed for Clubs, Schools, Theatres,  
Dance Halls or Outdoor Functions, etc. For use with Elec-  
tronic Organ, Guitar, String Bass, etc. Gram, Radio or Tape.  
Reserve L.T. and H.T. for Radio Tuner. Two inputs with associ-  
ated volume controls so that two separate inputs such as Gram and "Mike" can be mixed. 200-  
250V. 50 c/s A.C. mains. For 3 and 15 ohm speakers. Complete kit of parts 12 Gns. Carr. 12/6  
fully punched chassis, point to point wiring diagrams and instructions. If required  
perforated cover with carrying handles can be supplied for 21/-. Send s.a.e. for leaflet.  
TERMS: Deposit 48/- and 9 monthly payments of 33/7 (Total £17.10.3).

## R.S.C. A11 HIGH FIDELITY 12-14 WATT AMPLIFIER

**PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN"**  
**ONE TONE CONTROL PRE-AMP** Two input sockets with associ-  
ated controls allow mixing of "mike" and gram, etc. etc. High  
sensitivity. Valves ECC83, ECC83, EL84, EL84, EZ81. High quality  
sectionally wound output transformer specially designed for  
Ultra Linear operation and reliable small condensers of current  
manufacture. INDIVIDUAL CONTROLS FOR BASS AND  
TREBLE. Frequency response +3dB 30-20,000 c/s. Six negative  
feedback loops. Hum level—80dB. SENSITIVITY 23 millivolts.  
Suitable for Crystal or Ceramic P.U.s, all types "mikes". Com-  
parable with the very best designs. For Musical Instruments  
such as String Bass, Electronic Guitars, etc. Reserve Power provides 300V. 30mA, and  
6.3V. 1.5a. for Radio Tuner or Tape Pre-amp. Size approx. 12 x 9 x 7in. For A.C. mains 200-  
250V. 50 c.p.s. Output for 3 and 15 ohm speakers. Kit complete to last nut.  
Chassis fully punched. Full instructions and point-to-point wiring  
diagrams (or factory built £11.15.0). Metal covers with 2 carrying handles Carr. 11/6  
can be supplied for 21/-. **TERMS ON ASSEMBLED UNITS: Deposit 36/6 and 9 monthly**  
**payments of 25/9 (Total £13.8.3).** Send S.A.E. for leaflet of Cabinets, Speakers, Mikes, etc.

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

AN EXCEPTIONALLY POWERFUL HIGH QUALITY ALL-PURPOSE  
UNIT For lead, rhythm, bass guitar and all other musical instruments.  
For vocalists, gram, radio, tape and general public address  
★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION  
consisting of a FANE HIGH FLUX 15in. 30 watt unit PLUS  
a FANE 12in. 20 watt unit with extended frequency response. ★ 4 Jack Inputs  
and two Volume Controls for simultaneous use of up to 4 pick-ups or "mikes".  
★ Cabinets covered in two-tone Rexine/Vynair with gold trimming. Fitted carrying  
handles. Separate Bass and Treble Controls giving "lift" and "cut".  
49 1/2 Gns. Carr. 30/-  
Send S.A.E. for leaflet. Or call at one of our many branches and  
compare the Bass-Regent with units at three times the cost.  
Or deposit £7.16.6 and 9 monthly payments of £5.10.10. (Total 55 gns.)

## B20 MULTI-PURPOSE AMPLIFIER

especially suitable for Bass Guitar  
Incorporating massive 15in. high flux loud-  
speaker. Rating 25 watts. Individual bass and  
treble controls. Two jack inputs separately  
controlled. Substantial cabinet attractively  
finished in Rexine and Vynair. Size approx.  
24 x 21 x 11in. Send S.A.E. for leaflet. 29 1/2 Gns.  
Or Deposit £4.14.6 and 9 monthly  
payments of 66/- (Total £24.8.6). Carr. 17/6.

## G15 15 WATT AMPLIFIER for Lead or

Rhythm Guitar, Mike, Gram or Radio  
High-fidelity output. Separate bass and treble  
controls. Twin separately controlled inputs so  
that two instruments or "mike" and pick-ups  
can be used at the same time. Heavy Duty 12in.  
20 watt Speaker. Cabinet covered in attractive  
Rexine/Vynair. Size 18 x 18 x 8in. Deposit 3 gns.  
19 1/2 Gns. Carr. 15/-  
(Total £22.15.3). S.A.E. for leaflet.

## LINEAR TREMOLO PRE-AMP UNIT

Suitable for use with any of our Amplifiers. Controls are Speed  
(frequency of interruptions). Depth (for  
heavy or light effect). Volume and Switch. 4 1/2 Gns.

## POWER PACK KIT

Consisting of Mains Trans-  
former, Metal Rectifier, Electrolytics, smoothing  
choke, chassis and circuit. 200/250V. A.C. 22/11  
mains. Output 250V. 30mA, 6.3V. 2a supplied  
with case in lieu of chassis for 28/11.

## R.S.C. BATTERY/MAINS CONVERSION UNITS

Type BML. An all-dry battery  
eliminator. Size 5 1/4 x 4 1/2 x 2in. approx.  
Completely replaces batteries sup-  
plying 1.5V and 90V where A.C.  
mains 200/250V. 50 c/s is available.  
Complete kit with diagram 44/9 or  
ready for use 59/11.

## SELENIUM RECTIFIERS F.W. (Bridged)

All 612 v. D.C. output. Max A.C. input 18 v.  
1a. 3/11. 2a. 6/11. 3a. 9/9. 4a. 12/9. 6a. 15/9.

## FANE HEAVY DUTY

HI-FI SPEAKERS

12in. 20 watt. Type 122/10.

Post  
5/6.  
5 GNS.

R.S.C.  
HI-FI CENTRES LTD.

## R.S.C. COLUMN SPEAKERS

Covered in  
two-tone Rexine/Vynair. Ideal for vocalists  
and Public Address. 15 ohm matching.  
Type C28, 15-20 watts. Fitted five 8in. high flux  
speakers. Overall size approx. 18 1/2 x 12 1/2 x 12 1/2 in.  
42 x 10 x 5in. Or Deposit £2 and 12 1/2 Gns.  
9mthly pmts 28/- (Total £14.12.0) Carr. 10/-  
Type C412, 40 watts. Fitted four 12in. 12,000 line  
10 watt speakers. Overall size  
56 x 14 x 8in. approx. Carr. 15/- 19 1/2 Gns.  
Or Deposit 3 gns. and 9 monthly payments of  
43/7 (Total £22.15.3).

## 30 WATT HI-FI AMPLIFIER

for Guitar, Vocal or Instrumental Group

A Four Input, two volume control Hi-Fi unit  
with separate Bass and  
Treble "cut" and "boost"  
controls. Latest type  
valves. Housed in strong  
Rexine covered cabinet with twin  
carrying handles. Attractive  
black and gold perspex fascia plate.  
For 200-250V. A.C. mains. Output for  
3 or 15 ohm speak- 17 Gns. Carr.  
ers. Send S.A.E. for leaflet. Deposit  
£3 and 9 monthly payments of 37/5 (Total £19.16.3).

## 12in. HIGH QUALITY LOUDSPEAKERS

In walnut veneered cabinet. 10 Watt  
Model. Gauss 12,000 lines. £4.19.11  
Spec. Col. 3 or 15 ohms.  
Terms: Deposit 15/- and 9 Carr. 7/6  
monthly payments of 11/2 (Total £5.15.6)  
20 Watt Model. 15 ohm. Size 18x18x10in.  
Terms: Deposit 24/6 and 9 Carr. 10/6  
monthly payments of 17/3 (Total £8.19.3)  
30 Watt Model. 15 ohms. Or 10 Gns. Carr. 12/6  
Deposit 32/- and 9 monthly Carr. 12/6  
payments of 22/4 (Total £11.13.0). Any of above in extra  
heavy Rexine covered Cabinets, £1 extra.

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

## HIGH QUALITY 12in. 10 WATT SPEAKERS 59/11

Flux Density 12,000 lines. 3 or 15 ohms.

## TRANSISTOR SALE

Mullard OC71 2/11, OC45 3/11,  
OC44 3/11, OC72 2/11, OC75 7/9, OC81 2/11, OC171 5/9,  
AF117 6/9. Ediswan XA101 3/9, XA112 3/9, XC101A 3/9.  
Postage 6d. for up to 3 transistors.

## INTEREST CHARGES REFUNDED

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

## R.S.C. MAINS TRANSFORMERS

FULLY GUARANTEED. Interleaved and Im-  
pregnated. Primaries 200-250V. 50 c/s. Screened.  
MIDGET CLAMPED TYPE 2 1/2" x 2 1/2" x 2in. 14/11  
250V, 60mA, 6.3V. 2a. 15/11  
250V-250V. 60mA, 6.3V. 2a. 15/11  
FULLY SHROUDED UPRIGHT MOUNTING  
250V-250V. 60mA, 6.3V. 2a, 0-5-6.3V. 2a, 19/9  
2 1/2" x 3" x 3in.  
250V-250V. 100mA, 6.3V. 4a, 0-5-6.3V. 3a, 33/9  
350V-350V. 100mA, 6.3V. 4a, 0-5-6.3V. 3a, 33/9  
300V-300V. 130mA, 6.3V. 4a c.t., 6.3V. 1a.  
For Mullard 510 Amplifier 41/9  
350V-350V. 100mA, 6.3V. 4a, 0-5-6.3V. 3a, 33/9  
350V-350V. 150mA, 6.3V. 4a, 0-5-6.3V. 3a, 42/9  
450V-450V. 200mA, 6.3V. 4a, c.t., 5V. 3a, 67/9  
450V-450V. 200mA, 6.3V. 4a, c.t., 6.3V. 4a, 5V. 3a, 68/9  
450V-450V. 250mA, 6.3V. 4a, c.t., 5V. 3a, 79/9  
TOP SHROUDED DROP-THERMION TYPE  
250V-250V. 70mA, 6.3V. 2a, 0-5-6.3V. 2a, 19/9  
250V-250V. 100mA, 6.3V. 3.5a, 21/9  
250V-250V. 100mA, 6.3V. 2a, 6.3V. 1a, 22/9  
350V-350V. 80mA, 6.3V. 2a, 0-5-6.3V. 3a, 23/9  
250V-250V. 100mA, 6.3V. 4a, 0-5-6.3V. 3a, 23/9  
300V-300V. 100mA, 6.3V. 4a, 0-5-6.3V. 3a, 32/9  
300V-300V. 130mA, 6.3V. 4a, 0-5-6.3V. 1a.  
Suitable for Mullard 510 Amplifier 39/9  
350V-350V. 100mA, 6.3V. 4a, 0-5-6.3V. 3a, 32/9  
350V-350V. 150mA, 6.3V. 4a, 0-5-6.3V. 3a, 39/11  
FILAMENT or TRANSFORMER POWER FACT  
1.5V. 1.5A 6/9, 6.3V. 2V. 6.3V. 3A 8/9, 6.3V. 6A 12/9,  
12V. 1A 8/9, 12V. 3A or 24V. 1.5A 19/9, 0-25-35-42V. 2A  
27/9.  
CHARGER TRANSFORMERS 0-9-15V. 1 1/2A, 18/9,  
0-9-15V. 2 1/2A, 18/9, 0-9-15V. 3A, 18/9, 0-9-15V. 5A, 21/9,  
0-9-15V. 6A, 25/11, 0-9-15V. 8A, 31/9.  
AUTO (Step UP/Step DOWN) TRANSFORMERS  
0-110/120-200-230-250V.  
50-80 watts..... 14/9 250 watts .. 49/9  
100 watts ..... 29/11 500 watts .. 99/9  
OUTPUT TRANSFORMERS  
Standard Pentode 5,000Ω to 8Ω or 7,000Ω  
to 8Ω ..... 7/8  
Push-pull 8 watts EL84 to 3Ω or 15Ω ..... 11/9  
Push-pull 10-12 watts 6V6 to 3Ω or 15Ω ..... 19/9  
Push-pull 10-12 watts to match 6V6 to 3, 5, 8  
or 15Ω ..... 21/9  
Push-pull EL84 to 3 or 15Ω 10-12 watts ..... 19/9  
Push-pull Ultra Linear for Mullard 510, etc. 35/9  
Push-pull 11-18 watts sectionally wound 616,  
KT66, etc. for 3 or 15Ω ..... 22/9  
Push-pull 20 watt high quality sectionally  
wound, EL84, 6L6, KT66, etc. to 3 or  
15Ω fully shrouded ..... 55/9  
SMOOTHING CHOKES  
EL5 2500Ω 250V 12/9, 80mA, 10H, 350V 8/9,  
100mA, 10H, 200V 9/11, 80mA, 10H, 480V 4/11.





## HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT Type TA1

● Peak out-put in excess of 1½ watts.  
● All standard British components.  
● Built on printed circuit panel, size 6 x 3in.  
● Generous size Driver and Output Transformers.  
● Output transformer tapped for 3 ohm, 8 ohm, 16 ohm, 32 ohm, 64 ohm, 128 ohm, 256 ohm, 512 ohm, 1024 ohm, 2048 ohm, 4096 ohm, 8192 ohm, 16384 ohm, 32768 ohm, 65536 ohm, 131072 ohm, 262144 ohm, 524288 ohm, 1048576 ohm, 2097152 ohm, 4194304 ohm, 8388608 ohm, 16777216 ohm, 33554432 ohm, 67108864 ohm, 134217728 ohm, 268435456 ohm, 536870912 ohm, 1073741824 ohm, 2147483648 ohm, 4294967296 ohm, 8589934592 ohm, 17179869184 ohm, 34359738368 ohm, 68719476736 ohm, 137438953472 ohm, 274877906944 ohm, 549755813888 ohm, 1099511627776 ohm, 2199023255552 ohm, 4398046511104 ohm, 8796093022208 ohm, 17592186044416 ohm, 35184372088832 ohm, 70368744177664 ohm, 140737488355328 ohm, 281474976710656 ohm, 562949953421312 ohm, 1125899906842624 ohm, 2251799813685248 ohm, 4503599627370496 ohm, 9007199254740992 ohm, 18014398509481984 ohm, 36028797018963968 ohm, 72057594037927936 ohm, 144115188075855872 ohm, 288230376151711744 ohm, 576460752303423488 ohm, 1152921504606846976 ohm, 2305843009213693952 ohm, 4611686018427387904 ohm, 9223372036854775808 ohm, 18446744073709551616 ohm, 36893488147419103232 ohm, 73786976294838206464 ohm, 147573952589676412928 ohm, 295147905179352825856 ohm, 590295810358705651712 ohm, 1180591620717411303424 ohm, 2361183241434822606848 ohm, 4722366482869645213696 ohm, 9444732965739290427392 ohm, 18889465931478580854784 ohm, 37778931862957161709568 ohm, 75557863725914323419136 ohm, 151115727451828646838272 ohm, 302231454903657293676544 ohm, 604462909807314587353088 ohm, 1208925819614629174706176 ohm, 2417851639229258349412352 ohm, 4835703278458516698824704 ohm, 9671406556917033397649408 ohm, 19342813113834066795298816 ohm, 38685626227668133590597632 ohm, 77371252455336267181195264 ohm, 154742504910672534362390528 ohm, 309485009821345068724781056 ohm, 618970019642690137449562112 ohm, 1237940039285380274899124224 ohm, 2475880078570760549798248448 ohm, 4951760157141521099596496896 ohm, 9903520314283042199192993792 ohm, 19807040628566084398385987584 ohm, 39614081257132168796771975168 ohm, 79228162514264337593543950336 ohm, 158456325028528675187087900672 ohm, 316912650057057350374175801344 ohm, 633825300114114700748351602688 ohm, 1267650600228229401496703205376 ohm, 2535301200456458802993406410752 ohm, 5070602400912917605986812821504 ohm, 10141204801825835211973625643008 ohm, 20282409603651670423947251286016 ohm, 40564819207303340847894502572032 ohm, 81129638414606681695789005144064 ohm, 162259276829213363391578010288128 ohm, 324518553658426726783156020576256 ohm, 649037107316853453566312041152512 ohm, 1298074214633706907132624082305024 ohm, 2596148429267413814265248164610048 ohm, 5192296858534827628530496329220096 ohm, 10384593717069655257060992658440192 ohm, 20769187434139310514121985316880384 ohm, 41538374868278621028243970633760768 ohm, 83076749736557242056487941267521536 ohm, 166153499473114484112975882535043072 ohm, 332306998946228968225951765070086144 ohm, 664613997892457936451903530140172288 ohm, 1329227995784915872903807060280344576 ohm, 2658455991569831745807614120560689152 ohm, 5316911983139663491615228241121378304 ohm, 10633823966279326983230456482242756608 ohm, 21267647932558653966460912964485513216 ohm, 42535295865117307932921825928971026432 ohm, 85070591730234615865843651857942052864 ohm, 170141183460469231731687303715884105728 ohm, 340282366920938463463374607431768211456 ohm, 680564733841876926926749214863536422912 ohm, 1361129467683753853853498429727072845824 ohm, 2722258935367507707706996859454145691648 ohm, 5444517870735015415413993718908291383296 ohm, 10889035741470030830827987437816582766592 ohm, 21778071482940061661655974875633165533184 ohm, 43556142965880123323311949751266331066368 ohm, 87112285931760246646623899502532662132736 ohm, 17422457186352049329324779900506524426552 ohm, 34844914372704098658649559801013048853104 ohm, 69689828745408197317299119602026097706208 ohm, 139379657490816394634598239204052195412416 ohm, 278759314981632789269196478408104390824832 ohm, 557518629963265578538392956816208781649664 ohm, 1115037259926531157076785913632417363299328 ohm, 2230074519853062314153571827264834726598656 ohm, 4460149039706124628307143654529669453197312 ohm, 8920298079412249256614287309059338906394624 ohm, 17840596158824498513228574618118677812789248 ohm, 3568119231764899702645714923623735562557856 ohm, 7136238463529799405291429847247471125115712 ohm, 14272476927059598810582859694494942250231424 ohm, 28544953854119197621165719388989884500462848 ohm, 57089907708238395242331438777979769000925696 ohm, 114179815416476790484662877555959538001851392 ohm, 228359630832953580969325755111919076003702784 ohm, 456719261665907161938651510223838152007405568 ohm, 913438523331814323877303020447676304014811136 ohm, 182687704666362864775460604089535260802962272 ohm, 365375409332725729550921208179070521605924544 ohm, 730750818665451459101842416358141043211849088 ohm, 1461501637330902918203684832716282086423698176 ohm, 2923003274661805836407369665432564172847396352 ohm, 5846006549323611672814739330865128345694792704 ohm, 11692013098647223345629478661730256691389585408 ohm, 23384026197294446691258957323460513382779170816 ohm, 46768052394588893382517914646921026765558341632 ohm, 93536104789177786765035829293842053531116683264 ohm, 187072209578355573530071658587684107062233366528 ohm, 374144419156711147060143317175368214124466733056 ohm, 748288838313422294120286634350736428248933466112 ohm, 1496577676626844588240573268701472856497866932224 ohm, 2993155353253689176481146537402945712995733864448 ohm, 5986310706507378352962293074805891425991467728896 ohm, 11972621413014756705924586149611782851982935457792 ohm, 23945242826029513411849172299223565703965870915584 ohm, 47890485652059026823698344598447131407931741831168 ohm, 95780971304118053647396689196894262815863483662336 ohm, 191561942608236107294793378393788525631726967324672 ohm, 383123885216472214589586756787577051263453934649344 ohm, 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7770675568904392023203744391423349734336774539348156161689498469881895168 ohm, 155413511378087840464074887

# HI-FI AMPLIFIERS — TUNERS — RECORD PLAYERS

20+20  
STEREO  
AMP.  
AA-22U



GARRARD  
PLAYER  
AT-60



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

**20+20W TRANSISTOR STEREO AMPLIFIER. Model AA-22U.** Outstanding performance and appearance. 5 stereo inputs each channel, 20 transistor, 10 diode circuit. Kit £39.10.0 Assembled £57.10.0 (Cabinet £2.5.0 extra).

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

Many other Garrard models available, ask for Lists.

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

10W  
POWER  
AMP.  
MA-12



9+9W  
STEREO  
AMP.  
S-99



**HI-FI MONO AMPLIFIER. Model MA-12.** 10W output, wide freq. range, low distortion. Use with control units. Models UMC-1 (Mono) or USC-1 (Stereo). Kit £12.18.0 Assembled £16.18.0

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

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

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

**POWER SUPPLY UNIT. Model MGP-1.** Input 100/120V, 200/250V, 40-60 c/s. Output 6.3V, 2.5A A.C. 200, 250, 270V. 120mA max. D.C. Kit £5.12.6 Assembled £7.2.6



## Make the most of your leisure time..

### Hear the BBC Stereo FM Programmes on the TRANSISTOR STEREO FM TUNER

Elegantly designed to match the Stereo Amplifier, AA-22U



Many special features including:—

- ★ Pre-assembled and aligned RF tuning unit.
- ★ 4 stage IF amplifier, Automatic freq. control.
- ★ Printed circuit board, 14 transistor circuit.

Available in two units, sold separately, can be built for a **TOTAL PRICE KIT (STEREO) £24.18.0** incl. P.T. Kit (MONO) £20.19.0 incl. P.T. can be converted to stereo with adaptor, optional extra. Cabinet, optional extra £2.5.0. Send for details.

### TRANSISTOR RADIOS



Oxford



UXR-1

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

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

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

**HIGH PERFORMANCE CAR RADIO, CR-1.** Superb LW/MW entertainment, wherever you drive. For 12v pos. or neg. earth systems. Tastefully styled to match any car colour scheme. Many special features. Send for details. Kit (less speaker) £12.17.0., L/S £14.5 extra. Prices incl. P.T.

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### TEST INSTRUMENTS

Our wide range includes:

**3" LOW-PRICED SERVICE OSCILLOSCOPE. Model OS-2.** Compact size 5" x 7 7/8" x 12" deep. Wt. only 9 1/2 lb. "Y" bandwidth 2 c/s-3 Mc/s,  $\pm 3$  dB Sensitivity 100mV/cm. T/B 20 c/s-200 kc/s in four ranges, fitted mu-metal CRT Shield. Modern functional styling. Kit £23.18.0 Assembled £31.18.0

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

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

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

**VALVE VOLTMETER. Model V-7A.** 7 voltage ranges d.c. volts to 1,500. A.C. to 1,500 r.m.s. and 4,000 peak to peak. Resistance 0.1  $\Omega$  to 1,000M  $\Omega$  with internal battery. D.C. input resistance 11M  $\Omega$ . dB measurement, has centre-zero scale. Complete with test prods, leads and standardising battery. Kit £13.18.6 Assembled £19.18.6

**MULTIMETER. Model MM-1U.** Ranges 0-1.5V to 1,500V a.c. and d.c.; 150  $\mu$ A to 15A d.c.; 0.2  $\Omega$  to 20M  $\Omega$  4 1/2" 50  $\mu$ A meter. Kit £12.18.0 Assembled £18.11.6

**R.F. SIGNAL GENERATOR. Model RF-1U.** Up to 100 Mc/s fundamental and 200 Mc/s on harmonics. Up to 100mV output. Kit £13.18.0 Assembled £20.8.0

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

**TRANSISTOR POWER SUPPLY. Model IP-20U.** Up to 50V, 1.5A output. Ideal for Laboratory use. Compact size. Kit £35.8.0 Assembled £47.8.0

Prices and specifications subject to change without notice



OS-2



VVM, IM-13U



V-7A



RF-1U



1G-82U

# TAPE AMPLIFIERS — TAPE DECKS — CONTROL UNITS



FM  
TUNER  
FM-4U



STUDIO-  
MATIC  
DECK



TRUVOX  
DECK



AM/FM  
TUNER

**HI-FI FM TUNER. Model FM-4U.** Available in two units. R.F. tuning unit (£215.0 incl. P.T.) with I.F. output of 10.7 Mc/s and I.F. amplifier unit, with power supply and valves (£13.13.0). For free standing or cabinet mounting. Total Kit £16.8.0 (Multiplex adaptor available, as extra).

**STUDIOMATIC "363" TAPE DECK.** The finest buy in its price range. Operating speed:  $1\frac{1}{2}$ " 3 $\frac{3}{4}$ " and 7 $\frac{1}{2}$ " p.s. Two tracks, "wow" and "flutter" not greater than 0.15% at 7 $\frac{1}{2}$ " p.s. £13.10.0 With TA-1M Tape Pre-amplifier kit £31.5.6

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

**TRUVOX D-93 TAPE DECKS.** High quality stereo/mono tape decks. D93/2,  $\frac{1}{2}$  track, £36.15.0 D93/4,  $\frac{1}{2}$  track, £36.15.0

## TAPE RECORDING/PLAYBACK AMPLIFIER.

Mono Model TA-1M Kit £19.18.0 Assembled £28.18.0

Stereo Model TA-1S Kit £25.10.0 Assembled £35.18.0

**MULTIPLEX ADAPTOR KIT, SD-1.** Fully transistorised.

Self powered. Ideal for use with models FM-4U and AFM-1

Kit £8.10.0 Assembled £12.5.0

**MONO CONTROL UNIT. Model UMC-1.** Designed to work with the MA-12 or similar amplifier requiring 0.25V or less for full output. 5 inputs. Baxandall type controls. Kit £9.2.6 Assembled £14.2.6

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

## Enjoy building a Heathkit model



### SPEAKER SYSTEMS



SSU-1



Berkeley

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

The **BERKELEY SLIM-LINE SPEAKER SYSTEM**, fully finished walnut veneered cabinet for faster construction. Special 12" bass unit and 4" mid/high frequency unit. Range 30-17,000 c/s. Size 26" x 17" only 7 $\frac{3}{8}$ " deep. Modern attractive styling. Excellent value. Kit £19.10.0 Assembled £24.0.0

**COTSWOLD SPEAKER SYSTEMS.** Outstanding performance for price.

MFS: Size 36" x 16 $\frac{1}{2}$ " x 14" deep.

Kit £25.12.0 Assembled £33.17.0

STANDARD: Size 26" x 23" x 14 $\frac{1}{2}$ " deep.

Kit £25.12.0 Assembled £33.17.0

### HI-FI CABINETS

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

**GLOUCESTER.**

Kit £18.10.0 incl. P.T.

**MALVERN.** Kit £18.1.0 incl. P.T.

**CHEPSTOW.** Kit £11.18.6 incl. P.T.



Malvern

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FREE CATALOGUE**

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Prices quoted are Mail Order prices

**DAYSTROM LTD**

Dept. P.W.—12  
GLOUCESTER

### "AMATEUR" EQUIPMENT

**80-10m TRANSMITTER, DX-40U.** Power inputs 75W. C.W., 60W peak CC phone. Output 40W tp aerial. Provision for VFO.

Kit £29.19.0 Assembled £41.8.0

**SSB ADAPTOR, SB-10U**

Kit £39.5.0 Assembled £54.18.0

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

Kit £39.6.6 Assembled £52.10.0

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

Kit £81.10.0 Assembled £106.15.0

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

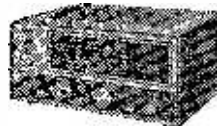
Kit £39.16.0 Assembled £53.0.0

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

Kit £8.10.0 Assembled £10.15.0



DX-40U



RA-1



HM-11U

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

#### FILTER TYPE SSB TRANSCEIVERS

Models for 80, 40 or 20 metre bands.

Model HW-12 (80M) £67.10.0 Kit.

Model HW-22 (40M) £66.0.0 each kit.

Model HW-32 (20M) } price inc. duty, etc.



80M Transceiver  
HW-12

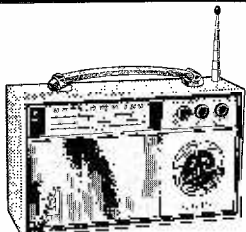
Without obligation please send me	(Tick here)
FREE BRITISH HEATHKIT CATALOGUE.....	<input type="checkbox"/>
FULL DETAILS OF MODEL(S).....	<input type="checkbox"/>
(Please write in BLOCK CAPITALS)	
NAME .....	
ADDRESS.....	
DEPT. P.W.12	

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# FOR THE FINEST VALUE AND TO HOME CONSTRUCTORS

## TRANSISTOR PORTABLES

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



**★ LONG WAVEBAND COVERAGE IS NOW AVAILABLE FOR THE SKYROVER**  
A simple additional circuit provides coverage of the 1100/1500M. band (including 1500M. Light programme). This is in addition to all existing Medium and Short wavebands. All necessary components with construction data.

Only **10/-** extra Post Free.  
This conversion is suitable for receivers that have already been constructed.  
Data 2/6 extra. Refunded if you purchase the parcel. Four U2 batteries 3/4 extra. All components available separately.

### THE SKYROVER De Luxe

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

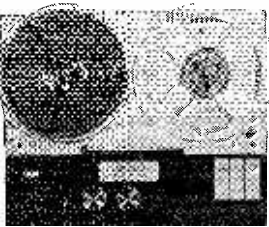
Can now be built for **£8.19.6** Post 5/- extra  
H.P. Terms: 45/- deposit and 11 monthly payments of 14/2. Total H.P.P. £10.0.10

## TAPE RECORDERS

### MAGNAVOX-COLLARO 363 TAPE DECKS

The very latest 2 speed model—1½, 3½, 7½ ips, available with either ½ track or 1 track head. Features include: pause control; digital counter; fast forward and rewind; new 4 pole fully screened induction motor, interlocking keys. Size of top plate 13½ x 11in. x 5½in. deep below unit plate. For 200/250v. A.C. mains, 50 cps operation. New, unused and fully guaranteed.

Lasky's Price ½ track model **£10.10.0**  
Lasky's Price 1 track model **£13.9.6**  
Carriage and Packing 7/6 extra.



### NEW MARTIN TAPE RECORD/REPLAY AMPS.

Now available from stock—for use with the Magnavox 363 Tape Deck.  
½ track model..... LASKY'S PRICE **£14.19.6** Carriage and  
1 track model..... LASKY'S PRICE **£15.19.6** Packing 4/6 extra.  
Optional extra: Control panel escutcheon to take deck and amplifier controls.  
LASKY'S PRICE 12/6 Post & Packing 2/6.

### INTERNATIONAL TAPE

Famous American Brand—Fully Guaranteed

3in. Message tape, 150ft.	2 6	5½in. Long play, 1200ft. Acetate	12 6
3in. Message tape, 225ft.	3 9	5½in. Standard play, 850ft. PVC	11 6
3in. Message tape, 300ft.	7 6	5½in. Long play, 1200ft. Mylar	15 0
3½in. Triple play, 600ft. Mylar	10 0	5½in. Triple play, 2400ft. Mylar	45 0
4in. Triple play, 900ft. Mylar	17 6	7in. Standard play, 1200ft. Acet.	12 6
5in. Double play, 1200ft. Mylar	15 0	7in. Standard play, 1200ft. Mylar	12 6
5in. Long play, 900ft. Acetate	10 0	7in. Long play, 1800ft. Mylar	19 6
5in. Standard play, 600ft. PVC	8 6	7in. Double play, 2400ft. Mylar	25 0
5in. Triple play, 1800ft. Mylar	35 0	7in. Long play, 1800ft. Acetate	15 0
5½in. Double play, 1800ft. Mylar	22 6	7in. Triple play, 3600ft. Mylar	50 0

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

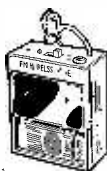
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### THE TTC MODEL B4002 FM WIRELESS MICROPHONE

Highly sensitive—suitable for either static or mobile use. Signals can be picked up by any FM radio or tuner which receives frequencies between 96–104 Mc/s over several hundred yards. Size only 3 x 2½ x 1½ in. (in leather case). Operates in one PP3 type battery. Complete with neck cord, clip on dynamic extension mike (½ x 3 x 6, ½ in.) and battery. LASKY'S PRICE 14 Gns. Post Free anywhere in world.  
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### SPECIAL PURCHASE—UHF/VHF TV TUNERS

Well known British makers surplus stocks. Now available for the first time to the Home Constructor. Add 2/6 Post and Packing on each.

#### TRANSISTORISED UHF MINIATURE MODEL

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

#### VALVE UHF MODEL (illustrated)

In metal case size 4 x 6 x 1½ in. Fully tunable—complete with PC86 and PC88 valves. LASKY'S PRICE 29/6 Without valves 12/6

#### TRANSISTORISED VHF MODEL 1

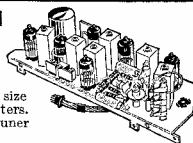
Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 4 x 2 x 3½ in. LASKY'S PRICE 29/6

#### TRANSISTORISED VHF MODEL 2

Sub-Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 3 x 1½ x 2½ in. LASKY'S PRICE 37/6

### MAKER'S SURPLUS TELEVISION IF AMPERES

95 Mc/s. Contains a large number of components, IF transformers, resistors, capacitors etc., and the following valves: 2 x PCF80, 1 x EB91, EF80, EF183 and EF184. Overall size 1½ x 8½ x 4in. deep. Ideal for servicemen and experimenters. This IF amp. when used with the valve model UHF tuner (above) provides a suitable conversion for BBC2.  
No circuit available. LASKY'S PRICE 39/6 Post 2/6



### SPECIAL PACKAGE BARGAIN OFFER!

Free standing table cabinet, size 19½ x 9 x 5½ in., finished in medium Mahogany. Seals marked 21 to 68 (UHF band). Designed to accept the above IF Amplifier with space for a Valve UHF Tuner.  
Special Package Offer: IF Amplifier, UHF Tuner with valves and Table Cabinet  
LASKY'S PACKAGE PRICE 89/6  
Post & Packing 6/-



### NEW—LASKY'S MINIATURE TRANSISTOR AMPLIFIER MODULES

Incorporating the very latest circuitry to provide high sensitivity and good quality in conjunction with extreme small size and compactness. High quality Newmarket transistors used throughout. All designed to operate on 9v. miniature battery.

Add 1/- on each for Post and Packing.

TYPE LRPC 1. 3 transistor. Input sens.

50mV, output 150mW, output imp. 40 Ω.

2 x 1 x 1½ in. PRICE 27/6

TYPE LRPC 2. 5 transistor. Input sens.

1mV, output 330mW, output imp. 15 Ω.

size 2½ x 1½ x 3½ in. PRICE 22/6

TYPE LRPC 3. 5 transistor. Input sens. 5mV, output 400mV, output imp. 15 Ω.

size 2½ x 1½ x 3½ in. PRICE 25/-

TYPE LRPC 4. 5 transistor. Input sens. 150mV, output 830mW, output imp. 15 Ω.

size 2½ x 1½ x 3½ in. PRICE 22/6

TYPE LRPC 5. 6 transistor. Input sens. 8mV, output 3V, output imp. 3 Ω.

size 5½ x 1½ x 1½ in. PRICE 59/6

#### FULLY ENCAPSULATED MODULES

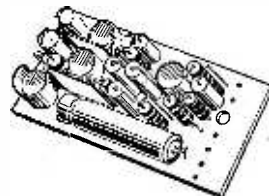
Special function modules—all one size 1½ x 1 x 1½ in. Complete with detailed function and installation instructions. Send S.A.E. for specification sheets.

TYPE PA-1. Public address amp. for use with carbon, crystal or Dynamic microphones. 3 Ω output imp. PRICE 30/-

TYPE GR-1. Gramophone amp.—provides sufficient power to fill average room. 3 Ω output imp. PRICE 30/-

TYPE CO-1. Morse code practice oscillator—for use with morse key and 3 Ω speaker. PRICE 20/-

TYPE MT-1. Metronome module—provides audible and visual beat from 30 to 240 beats per minute (for use with 3 Ω speaker or indicator lamp). PRICE 22/6



### GORLER UT 340 FM/VHF TUNING HEART

Permeability tuned—covering 87 to 108 Mc/s. For use with one ECC85 valve. In metal case, size 8 x 2½ x 1½ in. Circuit supplied.  
LASKY'S PRICE 15/11 Post 2/-. ECC85 valve 9/- extra.

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GET S1, GET S5, GET S6 2/6; 873A, 874P 3/6; OC45, OC71, OC81D 4/6; OC44, OC70, OC76, OC81 5/6; (match pair 10/6); AF117, OC200 6/6; OC42, OC43, OC73, OC82D 7/6; OC201, OC204 15/-; OC205, OC206 19/6; OC28 24/6; OC75 8/-.

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by BRUSH CRYSTAL CO., Available from stock.

TO—O1B 465 kc/s. ± 2 kc/s.

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TO—O2B 465 kc/s. ± 1 kc/s.

TO—O2D 470 kc/s. ± 1 kc/s.

TF—O1B 465 kc/s. ± 2 kc/s.

TF—O1D 470 kc/s. ± 2 kc/s.

9/6 each

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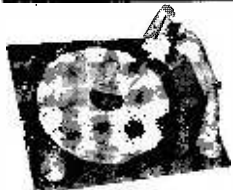
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# SERVICE IN GREAT BRITAIN AND HI-FI ENTHUSIASTS

# LASKY'S RADIO

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### B.S.R. AUTOCHANGERS

AT LOWEST EVER PRICES

Brand new and fully guaranteed—complete with cartridge and stylus.  
 UA14 4 speed mains model ..... £4. 9. 6  
 UA16 4 speed mains model ..... £4.19. 6  
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AT6 Mono	£3 19 6	SP25 Mono	£9 19 6
AT6 Stereo	£9 9 0	SP25 Stereo	£10 19 6
3000LM with stereo cartridge	£7 9 6	SRP12 with cartridge	£4 7 6
AT60 with stereo cartridge	£10 9 6	SRP10 Mains, with cartridge	£4 19 9
AT70 less cartridge	£19 9 0	SRP10 Battery, with cartridge	£4 19 6
A50 less cartridge	£9 14 6	GARRARD BASES	
A1000 with GCS cartridge	£5 6 0	WB1 £3 16 3	Clearview cover £3.10.0
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Postage and Packing on all above 5/-.

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33 $\frac{1}{3}$  and 45 r.p.m. 6v. Battery operated Comp. with pick-up and crystal cartridge.  
**LASKY'S PRICE 59/6** Post 2/6 Size 7 $\frac{1}{2}$  x 9in.

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### SINCLAIR SUPER MINIATURE KITS

Write for details of  
Package Deals

THE MICRO-6 miniature radio only 1 $\frac{1}{2}$ x 1 $\frac{3}{10}$ x 1 $\frac{1}{2}$ in.	£3 9 6
THE SLIMLINE 2-transistor pocket radio	£2 9 6
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THE X-20 20 watt P.W.M. amplifier	£7 19 6
Available ready built, tested and guaranteed	£9 19 6
THE Z-12 12 watt amp. and pre-amp., fully built	£4 9 6
STEREO 25 Pre-amplifier control unit, fully built	£9 19 6

### MARTIN HI-FI AUDIOKITS

Using specially developed circuits, the very latest transistors and printed circuits—these kits are all fully checked and tested before leaving the factory.

KIT 1. 5 stage Matching Input Selector Unit	LASKY'S PRICE £9/7/6
KIT 2. Pre-amplifier with volume control	LASKY'S PRICE £1/17/6
KIT 3. 3-Channel Mixer, with plug-in adaptors for individually matching each circuit. Adaptors 8/6 each	LASKY'S PRICE £3/19/6
KIT 4. Pre-amplifier with tone/volume control stages	LASKY'S PRICE £3/2/6
KIT 5. 10 and 5 watt Main Amplifier	LASKY'S PRICE £5/12/6
KIT 6. Power supply Converter Unit	LASKY'S PRICE £2/12/6
KIT 7. 15 ohm version of Kit 5	LASKY'S PRICE £2/12/6
KIT 8. Power supply for Kit 7	LASKY'S PRICE £2/15/6
UNIT 15. FM Head	LASKY'S PRICE £5/12/6
UNIT 16. IF Amplifier (FM)	LASKY'S PRICE £2/7/6
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### THE HARROW POWER PACK

Battery eliminator for portable radios, etc. Converts your Battery radio to A.C. mains. Replaces 4 $\frac{1}{2}$ v., 6v. and 9v. batts. Size only 3 x 2 x 2 $\frac{1}{2}$ in. State voltage required when ordering.

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CMP 5

## BSR MONARCH UA16 with FULL-FI HEAD

4-speed, plays 10 records, 12in., 10in. or 7in. at 16, 33, 45 or 78 r.p.m. Internixes 7in., 10in., and 12in. records of the same speed. Has manual play position: colour, brown. Dimensions: 12½ x 10½in. Space required above base board 4½in. below baseboard 2½in. Fitted with Full-Fi-turn-over crystal head.



£4.19.6

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



## POCKET MULTI-METER

Size 3½ x 2½ x 1½in. Meter size 2½ x 1½in. Sensitivity 1,000 O.P.V. on both A.C. and D.C. volts. 0.15, 0.150 0.1,000. D.C. current 0.150mA. Resistance 0.100kΩ. Complete with test leads, battery and full instructions, 42/6. P. & P 3/6. FREE GIFT for limited period only. 30 watt Electric Soldering Iron value 15/- to every purchaser of the Pocket Multi-Meter.

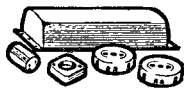


## "MAYFAIR" 5-Transistor TAPE RECORDER

Cassette-driven, battery operated 7½ and 3½ i.p.s. Precision made. Push-button controls. High quality 2½in. speaker. Push-pull circuit. Output 400mW. Frequency response: 200-7,000 k/s. Fast rewind. Up to 1 hour twin track playing time. Automatic erasing for re-recording. Dimensions: 8in. x 11in. x 3½in. Weighs only 7lb. Takes 5in. spools. plus 9/- P. & P.

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## 40W FLUORESCENT LIGHT KIT



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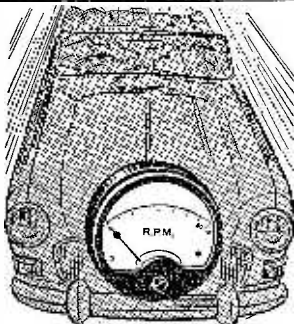
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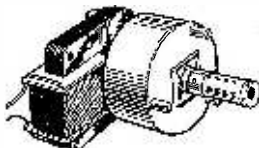
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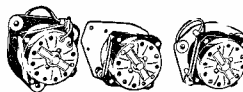


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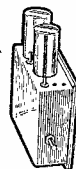


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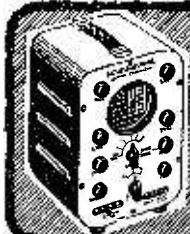
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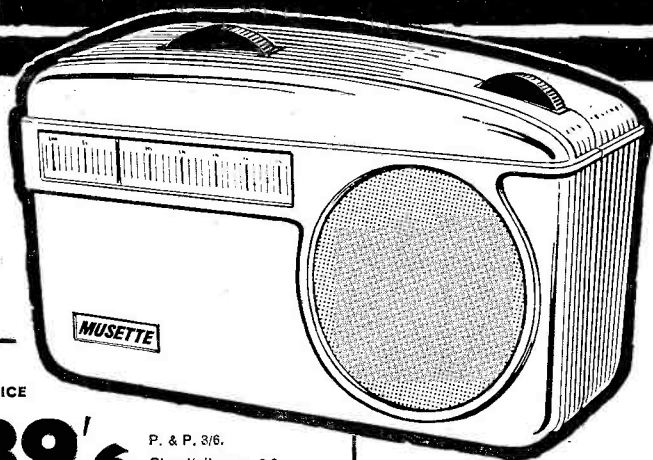
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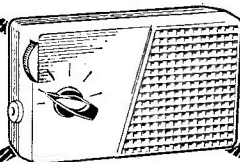
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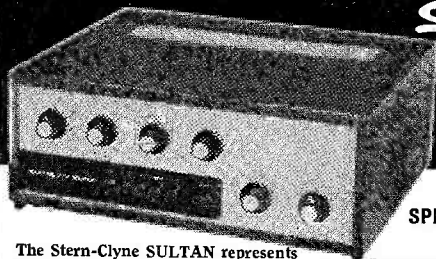
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Aux. 250mV, 490K ohms impedance	"
Aux. 250mV, 490K ohms impedance	"
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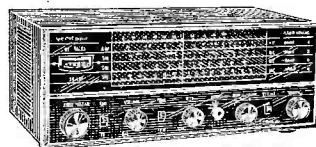
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7in.	1,200ft. Standard	..	..	12	6
7in.	1,800ft. Long Play	..	..	15	0

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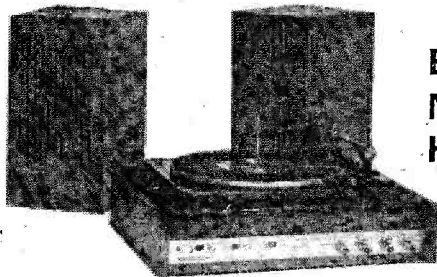


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**AMPLIFIERS** Identical, 5-watt, 7-transistor amplifiers designed round the latest, fully-proved semi-conductors. Each is independently constructed on a modular circuit board and subjected to searching inspection and precise matching at each stage of assembly.

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### SPECIFICATION

Power Supply	200/250 volts, 50 cycles AC (other standards to special order)
Output (Amplifiers)	5 watts per channel
Output Impedance	15 ohms (other speakers of 8 to 16 ohms may be used)
Frequency Response (Amplifiers)	30 c/s to 35 Kc/s flat (2 dB) at 1 watt, tone controls level
Harmonic Distortion	Less than 1%
Hum and Noise	—55 dB below full output, tone controls level
Gross talk between channels	45 dB at 1 Kc/s.
Bass Compensation	$\pm 15$ dB at 40 c/s.
Treble Compensation	$\pm 15$ dB at 14 Kc/s.

Balance Control Ganged potentiometer; either channel can be faded to zero without affecting the other.  
Tape Record Outlets 200 mV average, each channel  
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Loudspeakers 13 x 7 x 8 in. (each).

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# PRACTICAL WIRELESS

VOL 42 No 8

issue 718

DECEMBER 1966

## TOPIC OF THE MONTH

### *Who's for Hertz?*

**G**AD, Sir! Let's send a gunboat down the Rhine and subdue those followers of Heinrich Rudolph Hertz! How dare they threaten our homely c/s!

The term Hertz (Hz), used in Europe as the unit of frequency, has lately been promoted for more widespread acceptance. The situation at the moment, if you'll pardon the expression, is flux. The British technical press is divided, as is that of America, but the amateur radio movement and press appear to favour the older terminology.

There is little guidance from officialdom. The British Standards Institute have made no proclamation, nor have the ITU Radio Regulations been amended. No doubt future committees will sit and—as seems likely—declare for conversion to Hz.

Reasons for the change are (a) to tie in with Continental nomenclature and (b) to honour the name of Hertz. Standardisation is usually desirable in technical fields but with the prospect of decimal coinage, *mm* for inches, *gm* for those fine old English lbs, CCIR standards for u.h.f. TV, etc., some patriots feel that things have gone far enough. They wonder if, one day, the M1 will be renamed Autobahn 1, Scotland Yard becomes the Surette, "Practical Wireless" will cost 1½ Swiss francs and London is known as Londres, in the interests of unification.

As for perpetuating the name of Hertz, why stop there? Casting around in radio's past will land a healthy catch of other worthy but unsung heroes. Why not start again and concoct an entirely new set of technical units to satisfy all national honours? There are also many untapped areas for *new* units. Instead of expressing Wow, Flutter and Distortion as percentages we could devise a scale of units, to be called respectively, say, Dollys, Littlewoods and Beatles. The possibilities are boundless.

As for changing c/s to Hz, this seems to be utterly unnecessary. "Cycles per second" is an exact specification, whereas Hertz is meaningless without qualification. One might as well abolish the gramophone disc r.p.m. for "Berliners", i/s of tape speed for "Pfleumers" and m.p.h. for "Fords".

So for the moment we are sticking to old-fashioned c/s—at least until a change seems universally acceptable or until the Electricity Boards begin supplying 50Hz mains! W. N. STEVENS, Editor

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JANUARY ISSUE WILL BE PUBLISHED ON  
DECEMBER 8th

All correspondence intended for the Editor should be addressed to: The Editor, "Practical Wireless", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2. Phone: TEMple Bar 4363. Telegrams: Newnes Rand London. Subscription rates, including postage: 36s. per year to any part of the world. © George Newnes Ltd., 1966. Copyright in all drawings, photographs and articles published in "Practical Wireless" is specifically reserved throughout the countries signatory to the Berne Convention and the U.S.A. Reproductions or imitations of any of these are therefore expressly forbidden.

## Lafayette Receivers

I THINK your readers should be made aware how difficult it is to obtain spares for some of the American built receivers that are extensively advertised and sold in this country.

I purchased an H.E.30 communications receiver some time ago and recently wanted one or two parts which are special to the receiver. I have written twice to the Lafayette Radio Corporation, in New York, asking for the name of a spares supplier in this country, without success.

It is thus assumed that no spares facilities exist in this country (having not received a reply to either of my letters) and that one has to obtain them direct from the States. From my experience in trying to obtain a manual for this receiver (costing approximately 10s. plus 14s. for postage and insurance), it is obvious to me that the purchase of any foreign set is an uneconomical proposition.

My receiver remains silent.

H. C. Pryse. Weybridge, Surrey.

## Short Wave Receiver

BEING interested in S.W.L. for some time, I decided to build the "valve-base coil" short wave receiver (P.W. July 65) and found it necessary to have a twin gang 300 + 300 p.F. tuning capacitor using one gang as described in the text and the other gang with a coil of the same number of turns used in L1 across it with the aerial side of it going to pin 2 of V1.

I would like to hear from other readers who have built this set, and whether they had to do the same.

P. Blanchard.

8 Bircham View,  
Goosewell Hill,  
Eggbuckland,  
Plymouth.

## Converting the R1392

WITH reference to my article in the November issue page 502, I notice three errors.

Line 7 first paragraph should read  
$$f_{\text{xtal}} = \frac{f_{\text{signal}} - \text{I.F. Mc/s.}}{18}$$

In Fig. 2 the power supply lead marked "H.T.+ve to pin 9 . . ." etc., should read "H.T.-ve to pin . . ." etc., although anyone looking at the circuit will realise that the lower H.T.+ve should read H.T.-ve. Also in Fig. 2, R5 should be in series with V2 (OA2).

C. G. Elliott, G8ADP.

Devon.

# NEWS AND..

## NEW CORRESPONDENCE CENTRE

The Aldermaston Court Centre for Adult Education was officially opened recently by Sir Arnold Lindley, Chairman of the Engineering Training Board. This historic place now houses the modern and efficient machinery for providing correspondence courses varying from the ever popular G.C.E. "O" and "A" levels up to and including degree level. In fact 1,000 different courses are currently available.

The intake of the centre now tops twenty thousand a year, and over 2,000 letters and enquiries are answered every week. This is by no means restricted to Britain, and overseas lessons are shipped out at a rate of five tons per month.

This correspondence college embraces many of the well-known names: The British Institute of Engineering Technology; School of Careers; Press Art School, to name just a few.

There is no doubt that all these colleges, which come within the Cleaver-Hume Group, are extremely capable and well-organised. One room at the centre contains some three million lessons ready printed and our guide explained that these were "kept warm" to avoid any suspicion of paper deterioration.

The preparation of a course is a specialised business. First a panel of consultants is formed to prepare the syllabus. Once this is agreed, experts are approached to select text books, prepare lessons complete with test questions and model answers. The proposed course is then vetted and edited by experts in correspondence tuition. When the consultant panel is satisfied completely, the lessons and model answers are prepared for printing.

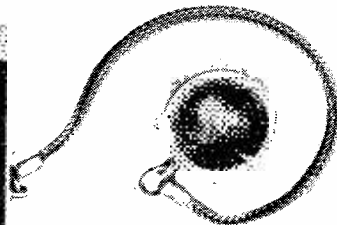
One of the courses examined at random was "Technical Mathematics", the subject—logarithms. The style and presentation was clear and lucid, but perhaps the most pleasing thing was the number of examples given; fifteen in fact. In the majority of text books only a couple of worked examples are included followed by numerous test questions.

## £1.1M AUTOMATIC WEATHER SYSTEM ORDER

The Marconi Company is to supply the Royal Swedish Air Force with an automatic meteorological system to process weather information received from ground stations, weather ships and weather satellites. The system is scheduled to be in operation by 1969.

## POCKET RADIO WITH INTEGRATED CIRCUIT

*This small Sony radio is of integrated design. In fact all the components (9 transistors 4 diodes 14 resistors and several inductors) are incorporated in a small silicon chip measuring 1.5mm. x 2.25mm. The overall dimensions of the receiver are: 1.25 x 2.3 x 0.7in.; weight is 105gm. Maximum audio output is quoted as 70mW. The address of Sony U.K. Sales is 70-72 Welbeck Street, London, W.1. (Tel. WELbeck 3546).*



*The integrated Circuit used in this receiver, has 9 transistors, 4 diodes, 14 resistors, and the size is 1.5 mm. x 2.25 mm.*

# ...COMMENT

## B.S.R. WINS GOLD MEDAL AT LEIPZIG FAIR:

B.S.R. Ltd. of Old Hill, Staffordshire, won a Gold Medal for the UA50 Mini-Changer which is claimed to be the smallest portable record changer in the world.

Altogether, 53 Gold Medals and Diplomas were awarded at this Fair. Nearly 300 firms from 25 countries submitted products for examination by scientific and technical experts.

## NEW MODELS FROM HEATHKIT

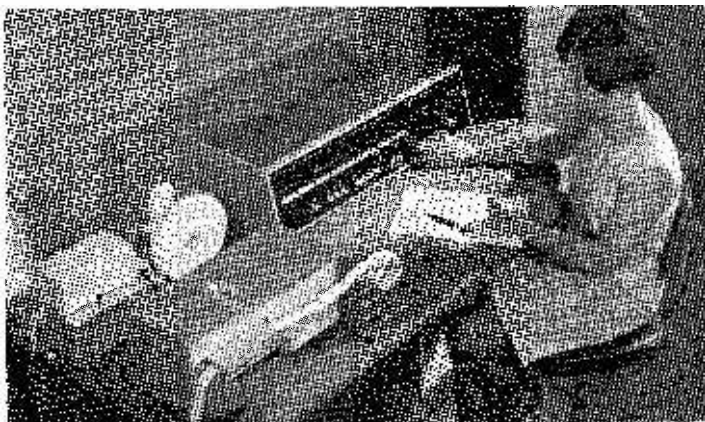
Two new kits are announced by Daystrom Ltd. in their Heathkit range. Model CR-1 is a high performance car radio covering m.w. and l.w. available as a kit for £12.17.0 (loudspeaker extra).

Model SD-1 is a welcome addition to the range. It is a transistor f.m. stereo decoder which although designed for use with the existing Heathkit tuners can also be used with most other f.m. tuners with facilities for multiplex output. The kit, complete with built-in power pack costs £8.10.0.

## SPIRALUX TOOLS

The new 48-page catalogue of Spiralux hand tools contains details of many items used by radio constructors. Copies may be obtained on application to Hollands & Blair Ltd., Bensham Grove, Thornton Heath, Surrey.

## MICROELECTRONIC COMPUTER



The photograph shows the new Marconi *Myriad II*, claimed to be one of the world's most powerful microminiature machines. It is a simpler version of the original *Myriad*, the first commercially available integrated circuit computer. Over 20 million orders per minute can be handled in this parallel computer which uses a 24-bit word and single address form order code.

## BBC ENTER DISC MARKET

The BBC is to market its own disc records under the label of BBC Radio Enterprises. The records will utilise the BBC archives for material and will probably be along the same lines as the records of BBC programmes issued by Pye, Decca and E.M.I., an arrangement which will continue. This is another venture designed to raise revenue for the BBC; its sister division, BBC Television Enterprises, has been bringing in between £1M-£2M annually.

## Regenerative Rejuvenation

FROM time to time letters are published in these columns criticising the super-regenerative receiver. This is a great pity, since properly built and operated super-regen's take a lot of beating.

I am also pleased to see that interest has been aroused in the v.h.f. and u.h.f. bands. Now perhaps we shall see more of these interesting receivers. It is true that they have rather a wide bandwidth, but this is obviously an advantage at v.h.f. and u.h.f.

As far as I can see, the f.m. detection of a super-regen is as good as found in commercial receivers, which require a sweep-generator for alignment if distortion is to be avoided. With the super-regenerative receiver, the operator is able to realign as he pleases with his single tuning control.

If really high quality is wanted with economy, then the quenching of the oscillator should be sinusoidal. This does mean that another valve or transistor is needed, plus a few resistors, capacitors, an r.f. choke and a quenching transformer. Even then, the total cost is well below a conventional f.m. receiver.

Recently, I had occasion to replace a complicated v.h.f. receiver I had built for satellite listening. I knocked-up a super-regen and was pleasantly surprised with the results. It was not so noisy as the superhet, yet was just as sensitive and a lot smaller.

I venture to predict, Sir, that we shall be seeing in the not too far distant future, a line-up something like this: grounded-grid (or base) r.f. amplifier-mixer, local oscillator, super-regenerative self-quenching detector (operating on the difference frequency), followed by the usual audio stages. For amateur use, the added complexity of automatic gain stabilization can be dispensed with.

**Hugh A. L. Wagner.** Kuala Lumpur.

## Surplus not Junk

I WAS rather surprised to read your Club Spot feature on the Luton & District Amateur Radio Club that the seller of the i.f. strips was termed a *junk dealer*.

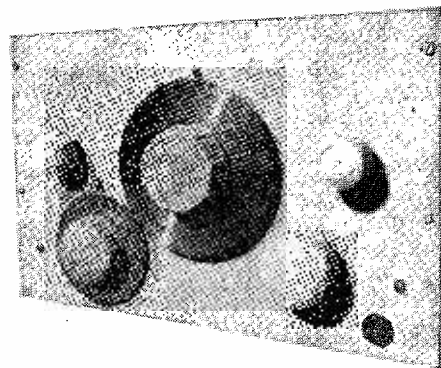
I would like to state that my Surplus Radio Components Business in Luton has a large selection of components, and that in the space of two years we have built up a reputation that we are very proud of.

**George Hannington.** Luton, Beds.

*More News and Comment on Page 588*

# 5 band TRF

F.G. RAYER  
G3OGR



FOR a t.r.f. receiver to be successful it must be possible to control reaction smoothly and efficiently. Tuning should also be easy, and the whole construction rigid. These points are satisfactory in the receiver described here, and very good results may be obtained.

Figure 1 on the blueprint shows the circuit. Ready-made Denco green type plug-in coils are used and the following ranges are available:

1	150—500kc/s	2000—750m.
2	515—1,545kc/s	580—194m.
3	1.67—5.3Mc/s	180—57m.
4	5.0—15Mc/s	60—20m.
5	10.5—31.5Mc/s	28—9.5m.

Ranges 2, 3 and 4 are the most suitable, giving coverage from 580—20 metres. VC2 is for medium wave tuning, or short wave bandsetting, while VC3, operated by a ball drive, is for s.w. tuning, or band-spreading. This arrangement is very helpful in the congested s.w. bands.

VR1 allows the screen grid voltage of V1 to be adjusted for best regeneration, which is controlled by the 15pF capacitor VC1. When long range reception is not achieved with a t.r.f. receiver, this is usually because regeneration is not properly controlled. A little care is necessary in this direction, but the presence of VR1 and the small size of VC1 does allow excellent reaction. The 6BR7 is a high gain, low microphony valve very suitable for detector.

The two sections of a 12AT7 are used as audio amplifier and output stages. Reception is often satisfactory with a loudspeaker, but 'phones are obviously more suitable for DX work. VR2 is the audio gain control. A small transformer T2 and

## BLUEPRINT SIDE ONE

a pair contact cooled rectifiers provide h.t., which is smoothed by C10/Ch/C9.

An attempt was made to measure sensitivity with a laboratory type signal generator, a difficult exercise with a t.r.f. receiver. Tests were made on 10Mc/s. With VC1 fully open and VR1 adjusted for maximum gain, an input of 200 $\mu$ V at the aerial terminal produced an output just audible in the loudspeaker. With VC1 rotated for maximum sensitivity, an input of 1 $\mu$ V produced an output just audible.

## Chassis and Panel

Dimensions of the chassis and positions of major components can be taken from Fig. 2 on the blueprint. A  $\frac{3}{4}$ in. diameter punch is most satisfactory for the valveholders and coil holder. These are fixed with 6BA bolts, with tags under the nuts. Trimmer T1 has its lugs through a strip of paxolin, supported by a bracket.

The panel used in the prototype was made of hardboard, painted, and backed by sheet aluminium, but aluminium alone would do. This and the side brackets can be purchased ready cut if preferred. The panel is bolted to the brackets and chassis.

A large hole is needed for the ball drive, and its lug is bolted to the panel. If the drive and VC3 are fitted carefully, the flexible coupling could be omitted. This coupling takes up any slight misalignment, but for smooth tuning VC3 should be as near in line with the drive as possible.

Leads from VR1 pass through an adjacent hole, and may be coloured for easy identification. This is also so with VR2; take separate well-insulated leads from the switch (VR2) through the chassis to the primary of T2, and mains.

A non-skirted holder is most suitable for the coils. The use of screening cans on V1 and V2 is optional.

## Under the Chassis

Figure 3 on the blueprint shows wiring and components under the chassis. Leads to VC1, VC2, VC3, V1 and the coil holder should be as short and direct as possible. All connections can be in 20 s.w.g. tinned copper wire, with insulated sleeving.

A tag strip near T2 anchors switch, mains and T2 primary leads. Tag 1 is a junction for switch and primary wires. Tag 2 holds the mains red (L) lead and the second switch connection. Tag 3 is a junction point for the mains black (N) lead and transformer primary.

When wiring is completed as in Fig. 3, the output transformer T1 can be bolted to the side runner. Its primary is connected to h.t. positive at R6 and tag 6 of V2. Leads from the secondary run to the panel jack socket.

The wires from C5, VR2 and R8 are close against the chassis. So are the 6.3V heater connections. C6 is directly from tag 1 to tag 7. If audio oscillation

begins with VR2 near maximum gain, this should be checked. Wiring should otherwise be perfectly straightforward, from Figs. 2 and 3.

## Notes on Components

Changes are possible with no loss of efficiency, and this may allow items on hand to be used. Any trimmer, small variable capacitor, or pre-set capacitor should do for TC1, though it must, of course, be insulated from the chassis.

Though VC1 and VC3 are 15pF, values from 10pF to 25pF will be found satisfactory. VC3 should not be too large or tuning will be less easy, but some plates can be taken off larger capacitors. VC2 can be 250pF, 300pF or similar. The smaller values will reduce the band coverage, especially for medium waves. Should some other type of drive be available, it can be fitted to VC3.

Resistor values are not very critical. R1 could be 68k $\Omega$  to 150k $\Omega$ . R3 and R6 may be about 200k $\Omega$  to 270k $\Omega$ . VR2 could be 500k $\Omega$ . The coupling and by-pass capacitors can also be changed somewhat in value without spoiling results.

The anode current of the output stage is small, and the type of speaker matching transformer originally intended for small battery operated pentodes will do well. The power output of this stage is similar to that of the output pentodes once used in battery portables (about 250mW).

If to hand, a larger transformer could be used for T2, but a bigger chassis, with the transformer on top, might be necessary. If the transformer is intended for use with a valve rectifier, and the valve is also to hand, it can replace R1 and R2. Provided an h.t. supply of around 250V is available, the actual components employed will not be important.

## Speaker/'Phones

The output jack is for a speaker, or headphones. There is some mismatch when using 'phones, but this is quite usual, and not too important. 'Phones of quite low impedance are most suitable.

If a high-impedance headset is to hand, a jack for this purpose can be connected to the receiver chassis. Take the second jack contact to a 0.01 $\mu$ F mica capacitor, wired to tag 6 of V2.

## Receiver Tuning

The results obtained depend very much on correct adjustment of VC1 and VR1. These are *not* volume controls and cannot be simply turned to maximum and left.

With an average aerial, T1 can probably be about half closed. Set VC1 about two-thirds closed, and rotate VR1 to increase V1 screen grid voltage from zero, until oscillation is heard when tuning through a transmission. If VR1 is not turned far enough, no reaction may be obtained. Turning VR1 too far will make reaction violent and difficult to adjust by means of VC1. With VR1 in a suitable position, a smooth build-up of sensitivity should be possible with VC1.

Adjust VC1 critically while tuning with VC3.

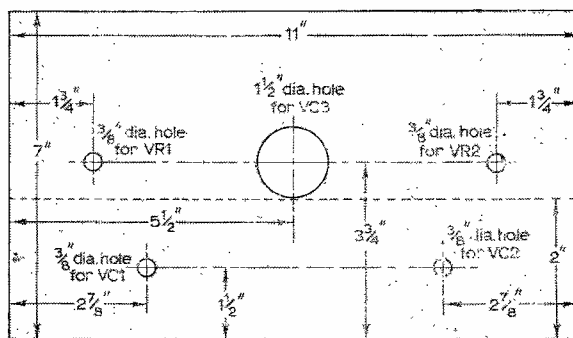


Fig. 4: Dimensional data for the front panel. If one does not have a cutter large enough to tackle the hole for VC3, drill a lot of smaller holes just inside its circumference, then break away the unwanted metal and finish the job off with a file.

After changing coils, or moving VC2, VR1 may have to be re-set. This is actually quite easy, but note that if VR1 is turned past a certain point, sensitivity begins to fall off, even if reaction can still be obtained.

VC2 is used to locate the required band, and this is tuned with VC3. Should T1 be set at too high a capacitance for the aerial used, reaction may be lost on some frequencies, especially with the smaller coils. VR2 is a conventional audio gain control.

If possible, provide an earth on the receiver. However, this depends on the location, and other factors. Mains current can be drawn from a plug fitted with the smallest available fuse, such as 1A.

If instability arises, especially at maximum audio gain, keep the aerial lead away from the receiver, and especially phone or speaker connections. Small capacitors (about 100pF) may be wired from tags 2 and 7 of V2 to chassis. Alternatively, stopper resistors of about 100k $\Omega$  each may be placed in the connections to tags 2 and 7, immediately at the holder. The possibility of such instability depends to some extent on actual wiring.

Band coverage with each coil depends somewhat on the position of the core, movement of which also has some influence on regeneration. Initially, the cores may be set with about 1/4 in. of brass thread clear, and this can be adjusted later if necessary. The cores are locked with 6BA nuts, to retain tuning calibration.

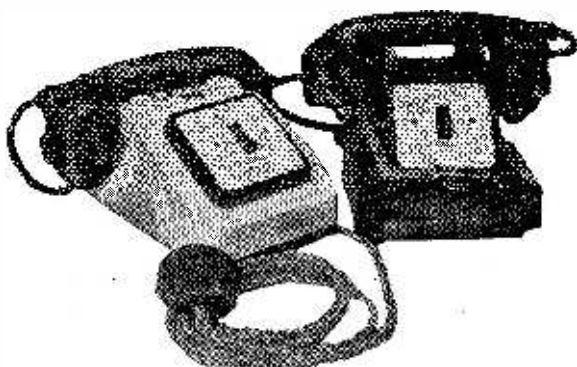
## Try 80 Metre Band

Many transmissions should be heard at any hour, but the most suitable bands depend on the time of day and other factors. If a start is being made in amateur band reception, then 80m will furnish many stations, especially at week-ends. The 20m band will usually be most suitable for long distance amateur signals. Very many broadcast stations will be heard around 19, 25, 31, 41 and 49 metres.

When maximum selectivity is required (as on the medium wave band) volume should be reduced as necessary by TC1 and VR2, so that regeneration can be increased. Good performance is then possible. ■

**SEE BLUEPRINT FOR OTHER DRAWINGS AND COMPONENTS LIST**





# HOME INTERCOM UNIT

By D.WILSON & J.W.ROBSON

**T**HIS unit uses sound-powered handsets, and embodies a small transistor amplifier at each station. Each amplifier may be built for less than five shillings, and the resulting power is at least as good as that available on the GPO system, without the tonal quality deteriorating.

Figure 1 (see Blueprint) shows the circuit diagram. The transmitter of the handset feeds via the blocking capacitor into the base of the transistor, which operates in the "common emitter" mode. The receiver of the handset acts as a collector load, and the audio output is fed via the line S" (which includes a 0.5 $\mu$ F capacitor to prevent the paralleling of the collectors of the two amplifiers), to the receiver of the other station, and thence via its battery to return along the "C" line. The power for the amplifier is taken from a 4.5V battery, which is used for calling.

## Amplifier

This is built around a cheap "red spot" transistor as advertised in "PW" at 1s. each which together with the base resistor and blocking capacitor is mounted on a piece of 1/16in. thick paxolin 1½ × 2½in. in such a way that an imitation printed-circuit results. Four flexible "tails" serve to connect the amplifier to the remainder of the equipment. Constructional details are shown in Fig. 2.

## Calling System

Calling is via a third line "R," the current returning via the line "C". Any small bell or buzzer of 3 volt rating will be satisfactory over lines of moderate loop-resistance (say not more than 15 $\Omega$ ) though in the author's case special arrangements had to be made, using relays to accommodate a loop resistance of 50 $\Omega$ .

## BLUEPRINT SIDE TWO

The pulsating nature of the current taken by a bell or buzzer will give rise to voltage pulses in the impedance of the "C" line, and as this impedance is common to the speech circuit, the pulses will produce a rasping sound in the caller's receiver to indicate that the bell at the other station is ringing. Since in the author's case the "C" line did not carry the bell current, it is not possible to state the loudness of this sound, but if it proves to be excessive it may be attenuated by shunting a large low-voltage electrolytic capacitor across each bell.

The "call" switch is of the single-pole change-over type, spring-biassed to one position. A neat switch may be cheaply made from a "VETO" flush two-way switch available from Woolworths, if the mechanism is modified so that the locating spring does not pass over dead centre. Access to the mechanism is obtained by first removing the two tapered square-headed screws securing the ceramic to the rear of the moulded front-plate. If the pinching screw is then removed from the centre terminal a small screw will be found inside, which if removed, will allow the mechanism to be withdrawn. By careful use of a miniature hacksaw the lug to which the locating spring is attached may be lengthened sufficiently to ensure that the line of the spring always remains to the front of the rocker fulcrum. No matter how the rocker is then moved it will always return to the one position upon release. Reassembly should be such that the lower portion of the rocker protrudes in the "free" condition. See Fig. 3.

## Case

This may be made from wood, plastic or metal in any shape or form to suit the individual constructor, provided that it will house the battery, amplifier and requisite terminal blocks. Externally there must be mounted the "call" switch, and a locating cradle for the handset, beneath which must be fitted a push-to-break switch (preferably a lever-operated micro-switch) to cause the amplifier to be switched off when the handset is on the cradle.

## Handset

As purchased, this will be fitted with a twin-core cabtyre-sheathed cable, which must be removed and replaced by a four-core cord. In some handsets a capacitor is connected in parallel with the transmitter, and it optional whether this is left in position or discarded. A neat four-core cord may be made by plaiting together two twin twisted flexibles (an idea of how to do this may be had from examining a handset cord on a pre-STD GPO instrument in some public call-boxes).

Flexibles, with transparent insulation are available with both tinned and untinned conductors, and it will assist in the final connecting up, as well as producing a pleasing appearance if different finishes of conductors are used respectively for transmitter and receiver. The action of plaiting will cause a loss of about 30% of the length of the individual twin-cores, so that due allowance must be made for this when purchasing. Care must also be taken to

see that the cords are clamped and anchored at each end to remove all stress from the terminals.

## Commissioning

Before the batteries are inserted it must be ascertained that the polarities are correct, and that the lines interconnecting the instruments are led to the correct terminals. A diagram, copied from Fig. 1, neatly drawn and pasted inside the battery-access panel of each instrument case will complete the project and afford it a professional appearance. On test, one of the author's instruments emitted a feedback whistle continuously whilst energised. A glance at Fig. 1 will show a similarity to the diagram of a blocking oscillator if a coupling could be arranged between receiver and transmitter. It was felt that the four-core cord could produce such a coupling, and the reversing of the cores to the receiver (or transmitter did in fact effect a cure.

## Authors' Prototype

The authors' prototype instruments, which have worked perfectly at Knaresborough for six months in spite of gardening damage to the lines were rather special in that certain local difficulties had to be overcome, although they embody the same principal components as the units described above.

Firstly, the line-wire which happened to be available was ex-army steel-conductor type with a resistance of about  $0.44\Omega/\text{yard}$ . Since the distance between the stations was 60 yards, the resulting loop-resistance of  $50\Omega$  prevented the use of direct-ringing bells or buzzers for calling. A relay was



*Note the 'S' line d.c. blocking capacitor on the right, and also how the cords were lashed so as to relieve the terminals of all stress.*

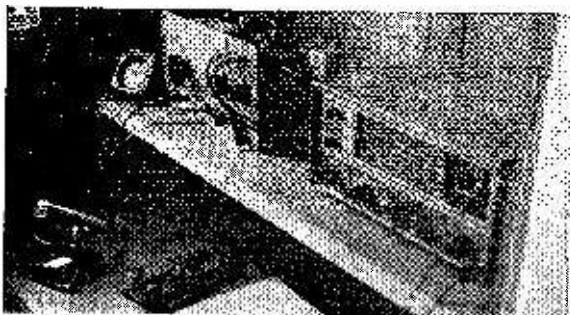


*This shows the cradle-switch and the call-detection relay. The modified dial mechanism can be seen in the background.*

therefore fitted at each end to detect the calling signal and ring the called station's bell from its local battery. The relay used had a coil resistance of  $60\Omega$  and with careful adjustment was made capable of working with a coil current of only  $30\text{mA}$  which makes adequate allowance for the falling voltage of an ageing battery.

Secondly, we were fortunate in being able to obtain a couple of scrap dial-type instruments, similar to GPO type, of which we were able to use the case, internal chassis, terminal block and handset cradle-switch. The dial, after modification (replacing the toothed pulsing cam by a toothless one so as to give one long "impulse" per operation) was retained as a call-switch. Removal of the "ringer," gongs, induction coil and capacitors gave sufficient room for the battery, amplifier, and call-detecting relay to be accommodated inside the instrument. The calling bell, of the cheap circular type, with its mechanism beneath the gong was simply affixed by screws to the rear of the instrument case. A disc, carefully lettered with calling instructions and fitted inside the dial gave the final professional touch to the instruments, which could stand unashamedly beside GPO counterparts.

Since the handle of the ex-Government sound-powered handset is wider than that of the GPO type carbon handset care must be taken to see that on being replaced after a conversation it depresses the cradle-switch plungers sufficiently to switch off the amplifier. If there is any uncertainty about this, it may be eliminated either by a bit of judicious filing, or by cementing a piece of  $\frac{1}{4}\text{in.}$  thick  $\frac{1}{4}\text{in.}$  wide plastic to the underside of the handset handle. ■



ALAN FORD G3UJV

## GETTING YOUR TICKET

**T**HIS magazine frequently receives letters from readers who ask, "How can I get a licence, and how much is it?", a question which can never be fully answered in a letter. Many of these inquiries are in connection with transistor walkie-talkie transceivers imported from Japan. Others refer to car radio-telephones. And the rest come from budding short-wave listeners, who have heard their first amateur contact on the short-wave band of the domestic set.

First, it should be made quite clear that **licences are not issued in this country for the use of transceivers on the Citizens' Band of 27Mc/s.** The Citizens' Band exists in America, and licences to operate such sets are relatively easy to obtain there. But the 27Mc/s band is allocated in the United Kingdom to model control, medical apparatus and industrial control systems.

There is in fact no Citizens' Band here, and the GPO will not under any circumstances, or for any fee, issue a licence. Although it is illegal to use such apparatus, and an offender may be fined and have the sets confiscated, it is not illegal to sell them. This is a fortunate paradox since, *provided an amateur licence is held*, these excellent little sets may be converted for the amateur 28Mc/s band and used very effectively.\*

Many of these sets have been bought by people who imagine that a licence is not required as they operate "under the three-mile limit." This is a complete misconception of the law. The three-mile limit refers only to the stretch of seawater round the coast of the United Kingdom, within which its laws and regulations may be enforced. Outside this limit, at present, some of these regulations may be broken with impunity, which is how the pirate broadcasting stations are able to exist. But the term has nothing at all to do with the actual range of transmitting apparatus, and it is therefore illegal to operate in this country even over a range of a few yards.

The wavebands allocated by the GPO for control of models only are 26.96–27.28Mc/s and 464–468Mc/s. The transmitter input must not exceed 5 watts. A licence for this purpose is quite straightforward to obtain, the fee being £1 for five years.

\* *Providing they are not of the super-regenerative type and do not create television and other interference!*—Editor.

The address to apply to is: *Radio Branch, Radio and Accommodations Dept., G.P.O. Headquarters, London E.C.1.*

Car radio-telephone systems may be considered in three classes. Firstly, official services like Fire, Police and Ambulance, which have their own spot frequencies specially allocated. Secondly, the GPO radio-telephone system, where subscribers in certain areas may rent instruments which are linked to the ordinary telephone system. The rental for this Post Office service is sufficiently high for its use to be mainly confined to business.

Thirdly, private systems, where a firm equips its own vehicles and sets up a base station. The apparatus is usually rented from a manufacturer and special wavebands have been set aside for this purpose.

We now come to amateur transmitting. Holders of these licences are able to operate morse, speech, teleprinter and even television transmitters. Many of them instal apparatus in their cars for which they need an additional permit.

Most beginners imagine that obtaining an amateur licence is largely a question of finance but this is not so. A fee of two pounds is required, but by the time the applicant arrives at this stage, the money seems very minor in comparison with the other requirements. The conditions to be met in order to be issued with an amateur transmitting licence are as follows:

1. Applicants must be over fourteen and be British subjects.
2. A pass must be obtained in the Radio Amateurs' Examination. This is a written examination paper somewhat of a cross between 'O' and 'A' level G.C.E. Physics, but with a more limited syllabus.
3. A pass must be obtained in the Post Office morse test, which is a test of receiving and sending in morse code at twelve words per minute, plain language and figures.
4. The fee of two pounds annually must be paid.

### THE EXAMINATION

The Radio Amateurs' Examination is held twice a year, usually in May and December, and is organised by the City and Guilds of London Institute. The work covered for this examination is considered as a subject of study in its own right, and is listed as subject No. 55.

By writing to the Institute at 76 Portland Place, London W.1, a booklet setting out the syllabus and copies of previous papers may be obtained. The papers will give the student a good guide to the type of question usually set.

Centres where the examination may be taken are widespread and it is not always necessary to travel to London. In most cases the local technical college can make arrangements for the examination to be sat, but in this case the applicant must ensure that the college concerned knows that he wishes to sit the examination there. This should be done at least two months before the examination day. The college will probably require a fee of about five shillings.

The examination syllabus and the questions are compiled by a committee which comprises representatives of the Post Office, Ministry of Education and the official amateur radio organisation—the Radio Society of Great Britain, among others. This means that the questions asked are fair and applicable to normal amateur practice.

The whole purpose of the examination is to make sure that a person is not allowed to operate transmitting apparatus if he does not have sufficient knowledge to do so safely and without inconvenience to amateur and other stations.

The two most important questions in the examination always relate to this aim. In the first question the applicant is merely required to write out more-or-less word for word parts of the conditions set out in the actual licence.

A specimen licence can be obtained from the GPO, and should be learnt by heart. This part of the examination should present no problem. The second question always deals with methods of avoiding or curing interference to other radio or television services.

The rest of the syllabus is as follows: elementary electricity and magnetism, elementary radio principles, thermionic valves and semiconductors, radio receivers, low-power transmitters, propagation of radio waves, aerials and measurements—particularly frequency measurements. This may seem a formidable amount of work, but as already stated the pattern of questions set remains within fairly narrow limits.

The authorities consider (whether rightly or wrongly is outside the scope of this article) that any person sufficiently keen and sufficiently intelligent not to be a nuisance or danger on the air, will be able, with reasonable application, to achieve a pass mark.

Quite obviously, though, it is no use the applicant sitting back until the examination comes along and then expecting to sit down and sail through. He must study, unless, of course, he already possesses a qualification which has taken him through a similar course of work.

There are three ways in which such a course of study may be tackled. Firstly, the books listed in the City of Guilds pamphlet may be bought or borrowed from a Public Library, and studied at home. Secondly, a correspondence course may be taken. Thirdly, the student may attend a course at evening school.

Many technical colleges run evening classes in this work. All that is needed is an inquiry. If there are enough applicants, a college not already offering such

a course will specially arrange one. The fee is very small—usually a guinea or two for the whole session.

## SHORT WAVE LISTENING

In addition to his studies, the intending applicant should spend a great deal of time *listening* on the amateur bands. These are as follows:

- 1.8—2.0 Mc/s (160 metres, or “Top Band”)
- 3.5—3.8 Mc/s (80 metre band)
- 7.0—7.1 Mc/s (40 metre band)
- 14.0—14.35 Mc/s (20 metre band)
- 21.0—21.45 Mc/s (15 metre band)
- 28.0—29.7 Mc/s (10 metre band)

plus the v.h.f. bands, which the beginner probably won't be able to receive at first.

By listening regularly, he will become familiar with amateur procedure and learn a great deal from listening to contacts. He may also hear pirates. Pirates are not welcome on the amateur bands, and they are usually caught in the end. An applicant for a licence is unlikely to secure it easily if he has been previously convicted for piracy, so it pays to be patient and wait for the “ticket.”

In the course of his listening, the Short Wave Listener, as he can now be termed, will come across a great deal of morse code. Learning to read this early on will add greatly to his enjoyment as well as pave the way for the Morse Test later.

## THE CODE

There has been much written on learning the code, but each generation of beginners seems to need the same advice just as urgently. Learning the code and learning to use it are two entirely different things, though obviously one will have to come before the other.

When first learning the alphabet, do not memorize dots and dashes, but learn each letter as a combination of “di” and “dah.” For instance, V is not dot-dot-dot-dash but didididah. Learning the alphabet in this way will ensure easy transition to the morse key. A morse operator does not think about dots and dashes. *He recognises the sound or rhythm.*

Here again, some technical colleges run a course in conjunction with the R.A.E. classes. Also most radio clubs run practice sessions, and there are scheduled slow morse transmissions run by the RSGB usually on 1.8—2.0 Mc/s. Finally, practices with a friend as frequently as possible are invaluable. All that is needed is a simple oscillator and morse key.

Mention of the RSGB slow morse and the Radio Club sessions prompts two further pieces of advice. Join your local radio club, where you will meet many to help you on your way to the ticket; and join the RSGB, which publishes a monthly bulletin entirely devoted to amateur radio. In the pages of their Bulletin details of slow morse transmissions appear regularly.

A course of study which includes the theory for the R.A.E. and practice for the morse test will normally take several months. Do not be tempted to let the work slip until a week before the examination and then try to cram. It just won't work, for most students anyway.

Most would-be amateurs wait to hear their results in the examination before taking the morse test. The

—continued on page 575

# This Martin Recordakit

*is designed specially for the MAGNAVOX 363*

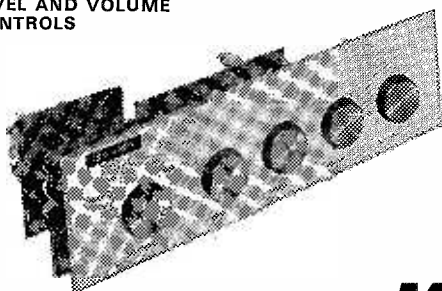
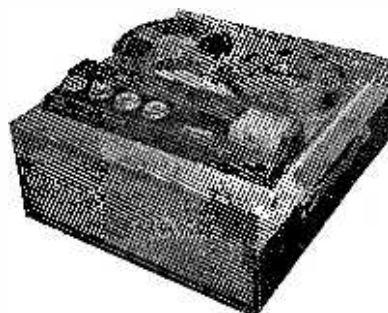
3 WATTS OUTPUT

3 SPEEDS: 7" REELS  
OUTLET FOR HI-FI AMP

SOLDERING NOT  
NECESSARY

SEPARATE RECORDING  
LEVEL AND VOLUME  
CONTROLS

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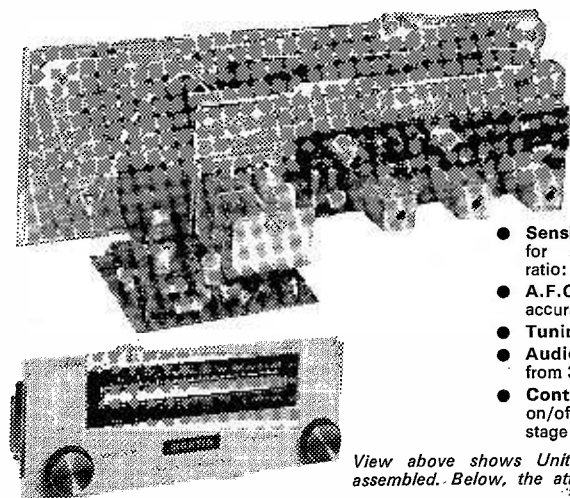
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## GETTING YOUR TICKET

—continued from page 572

reason for this is that the morse may be taken any time after the examination, but if the morse is taken first, and twelve months elapse before the examination is passed, then the morse has to be taken again. Thus if the student failed the examination he might find the morse test fee wasted!

The morse test may be taken at Head Post Offices in London, Birmingham, Cambridge, Derby and Manchester, and at certain coastal radio stations. Application should be made to: *Radio Services Department, Wireless Telegraphy Section, Union House, St. Martins-le-Grande, London, E.C.1.*

The applicant will be sent a form to fill in, and will have to pay the fee of ten shillings, in the form of a postage stamp. He will then be given ample warning of the date and time of his test, usually to suit him.

The official conducting the test is usually only too pleased to give a pass slip if he possibly can. The applicant will often be given a choice of keys and will have plenty of time to get the feel of the

key. The examiner will probably send a practice run first. So there is no reason for the student to fail through "nerves" provided he has practised beyond the required speed.

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In fact it is not a ticket, but a rather disappointing looking collection of typewritten duplicated sheets—but on it will be written a call sign, which will be the password to many happy years and to many good friends. Good luck! 73!

Further information on obtaining a license may be found in: "A Guide to Amateur Radio" (5s. 7d. post paid) and "Radio Amateurs' Examination Manual" (5s. 9d. post paid) from *Radio Society of Great Britain, 28 Little Russell Street, London, W.C.1*; also "How To Become a Radio Amateur," available free from *Radio Services Branch, G.P.O. Headquarters Building, St. Martins-le-Grande, London, E.C.1.* ■

## OBITUARY—Captain Henry Joseph Round

Captain Henry Joseph Round, M.C., A.R.C.Sc., one of the pioneers of broadcasting and a prolific inventor with 117 patent applications to his credit, died recently in Bognor Regis.

Captain Round, born on June 2nd, 1881, graduated from the Royal College of Science, London, with a first-class honours. In 1902 he joined The Marconi Company and was sent to the United States where he worked at the Company's training school for wireless operators, at Babylon, Long Island. Here, in his spare time, he investigated wireless propagation problems, experimented with dust-core tuning inductances and devised the elements of direction finding.

About this period, and again in his spare time, Round constructed one of the first arc radio telephones, which on his recall to England he demonstrated to Guglielmo Marconi. He became a personal assistant to Marconi and was conspicuous for his ability to rectify obscure faults in the apparatus of the period. In 1910-11 he greatly improved the performance of the Clifden (Ireland) high power trans-Atlantic transmitter and followed this in 1912 with a brilliant feat of engineering at two stations on the upper reaches of the River Amazon which were not achieving the contract guarantee by reason of heavy signal attenuation across the jungle. Round virtually redesigned the stations *in situ* to operate on 4000 metres by day and 2000 metres by night, a masterpiece of ingenuity since no parts were to hand. The occasion was historic in that it was the first time that deliberate use had been made of different wavelengths for day and night working.

At the outbreak of the Great War, Round was seconded to Military Intelligence with the task of building a network of "valved" direction-finding stations to cover the entire Western Front. These stations, which he had developed just prior to the onset of war, were so successful in pinpointing the location of enemy transmitters that he was recalled

to England to supervise the construction of a second network there.

Other war work included the co-design with Major Prince of the first telephony transmitters and receivers for airborne use, including the design of the valves. For his services to the country, Captain Round was awarded the Military Cross.

In 1919 he developed new types of transmitting valves and in March of that year directed the installation of a telephony transmitter at Ballybunion, Ireland, which became the first European station to span the Atlantic with telephony. Further experimental telephony work at Chelmsford followed which led, via the early broadcasts from the Marconi 2MT station at Writtle, to the establishment of the original London broadcasting station 2LO at Marconi House, for which Round designed the transmitting equipment. In parallel with all this work he also carried out another huge project, the redesigning of the Caernarvon high-power station from spark to valve transmission.

He was appointed chief of the newly formed Marconi Research Group in 1921. In addition to his work on short-wave telephony he was responsible for several other developments including the "Straight Eight" receiver.

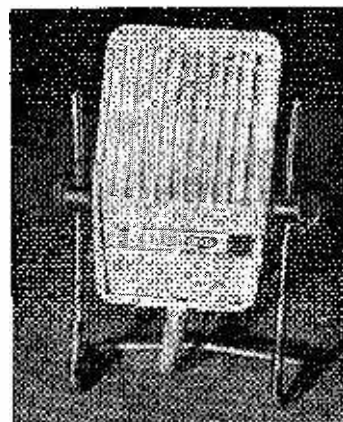
In 1931 he resigned from The Marconi Company to set up in private practice as a research consultant, returning to Marconi's in an advisory capacity in 1937 for work on echo sounding. During World War II he worked on ASDIC for the Admiralty, continuing with this until 1950. In 1952 he was presented with the prized Armstrong Medal by the Radio Club of America.

Captain Round has been working in close association with the Marconi organization almost to the time of his death. He was a truly great engineer, whose contributions to technology have helped in no small measure to shape the course of history.

# MICROPHONE STAND

## FOR THE GRUNDIG GDM

By A. D. Cardwell



SEVERAL of the microphones supplied with the popular range of Grundig tape recorders have no stands. In this article details are given for a simple stand which can be constructed in about an hour if you have the use of a sturdy vice.

The necessary materials should be easy to come by since all you need is a foot of  $\frac{1}{8}$  in. diameter brass rod (brazing wire from a garage will do), a small roll of "sticking plaster" and a couple of rubber grommets. Total cost to the author was 3s. 6d., getting the "sticking plaster" from a local chemist and the rubber grommets from the spares department of a Standard Triumph garage (type 605851).

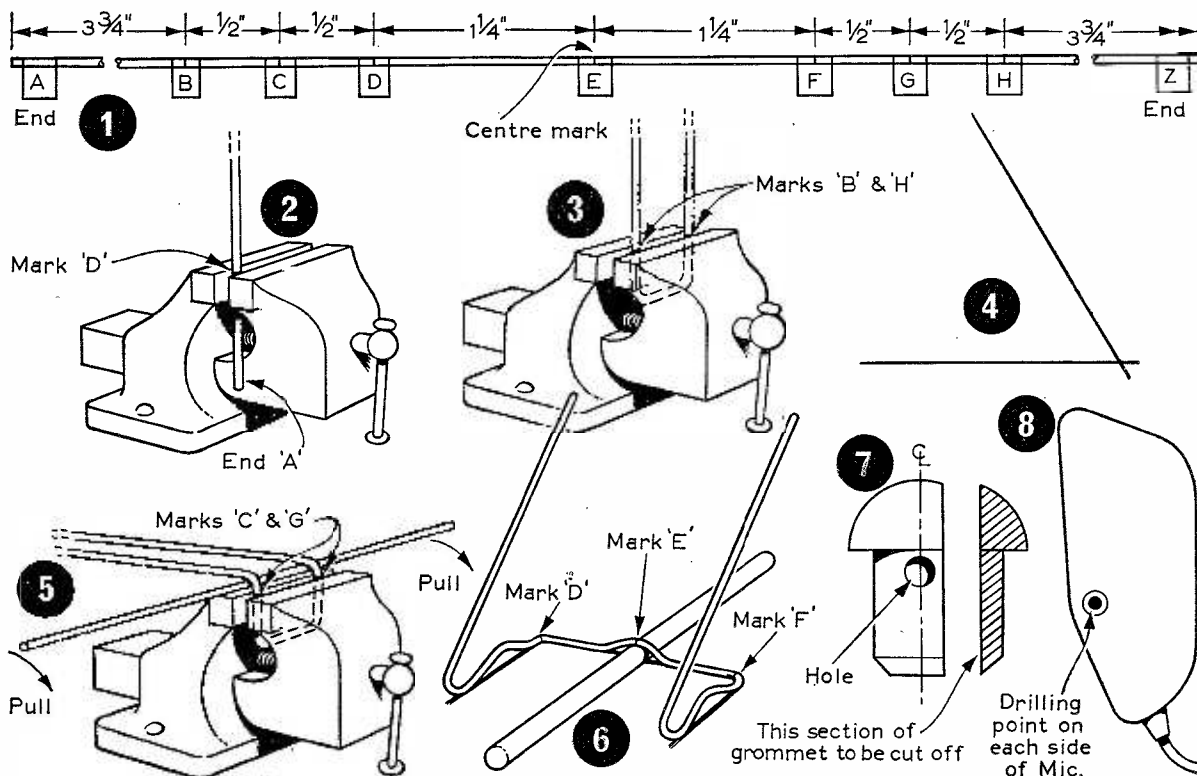
No difficulty should be experienced in constructing this stand if you first mark the brass rod (using the "sticking plaster") as shown in Fig. 1. Once this has been done, the bending process can be tackled. The first bend should be of 90° at position D. Then make a 90° bend at F to make the brass rod "U" shaped.

Now the base can be formed by bending the

metalwork at B and H as shown in Fig. 3 beyond the 90° point to match the angle in illustration 4. The next step is to round off this bend with a screwdriver or similar instrument as shown in Fig. 5 to get the side pieces looking like those illustrated in Fig. 6. The final step is to bend the rear section of the base for the microphone cable.

With this completed, one should cut part of each grommet away and drill as shown in Fig. 7. Be careful not to have an accident when cutting the grommet—a wet blade will reduce the risk of the knife slipping.

The best position for drilling the microphone case is shown in Fig. 8. One should, however, be careful not to allow the head of the drill to penetrate too far when drilling the microphone case as damage can be done to the microphone insert. Also be careful not to make the holes too large, otherwise it will be difficult to secure the grommets. ■



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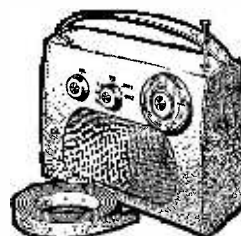
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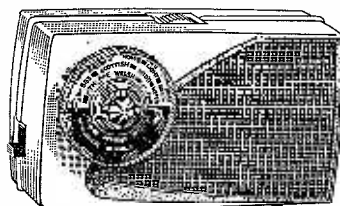
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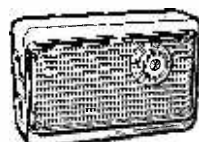
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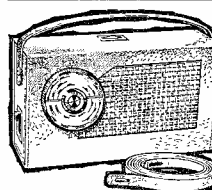
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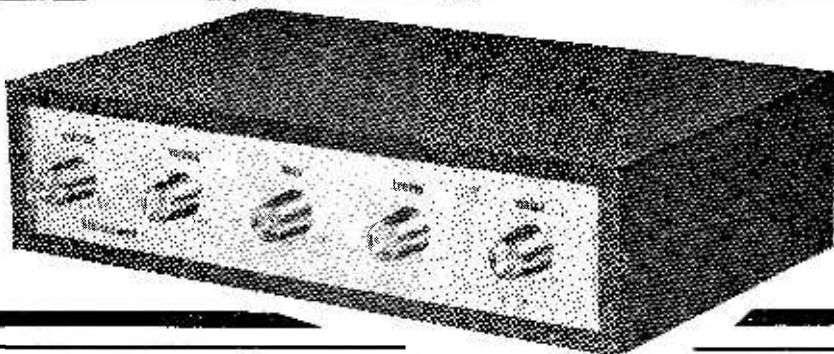
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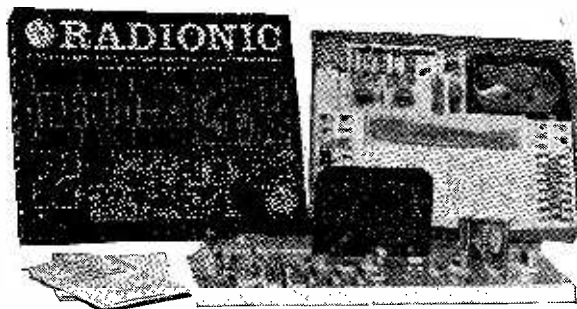
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# MAKING SUB-MINIATURE RELAYS

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Naturally, a circuit containing a relay is somewhat of a headache since the standard Post Office type of relay is rather a bulky device. Smaller relays are available (sometimes from the surplus market), but these can be rather expensive, hence the article on constructing sub-miniature relays. The one described here can be built at little cost in an evening. It is possible to deviate from the specification and from the materials used to suit individual requirements.

## Background

In simple terms, the relay is an electrically operated switch. Current passes through a solenoid which magnetically attracts the moving portion of a contact assembly to either make or break a circuit or circuits. There can be as many circuits as one likes, but additional circuits add to the weight of the contact assembly and thus require more power.

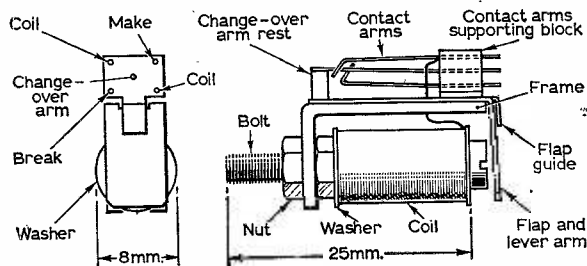
The relay described is a single changeover device with a common contact and a "make" and a "break" contact.

## CONSTRUCTION

Figure 1 shows the fully assembled relay, Table 1 its specification and Table 2 the materials used. Construction is not too difficult, and all dimensions are given in millimetres.

## Solenoid

The core of the solenoid must be capable of being magnetised, but not a material which can become a permanent magnet. Soft-iron is ideal, and it has been found that some bolts make perfect cores. If you are not sure of the suitability of a selected bolt, first check if it is attracted to an ordinary magnet, and secondly check if it can become a permanent magnet. To do this, stroke the selected bolt with a permanent magnet, twenty to thirty times as shown in Fig. 2. If the selected bolt has permanent magnet properties, you will now be able to pick up small metal items with it. If you can, throw it away and find another with which to make the core.



If one was to use a material with permanent magnet properties, the contacts would permanently remain in the energised position.

Once a core has been chosen, the next step is to make up a yoke to hold the windings. This is best done with nuts and washers, as shown in Fig. 3. Size is not critical; the author used 8 mm washers spaced 13 mm. apart on a 3 mm. bolt, which had an overall length of 25 mm.

The next step is to wind the coil. There are several methods one can use, from doing the job by hand, or by machine employing an old gram motor or an electric drill. The only thing one must remember is that the turns should be wound fairly tightly and layer upon layer. Probably the best way is to start from the left, wind to the right and then back again until you come up level with the washers. The author used 44 s.w.g. enamelled-copper wire, brought the two ends of the coil out at the "head end" of the bolt and wrapped the turns with tape to hold them in position.

If the coil has been wound tightly, the resistance should be around 200Ω. Before proceeding any further, it is worthwhile checking if the solenoid has the sufficient pulling power. This can be done by attaching the coil to a 1.5 volt battery and seeing if the solenoid

will lift small pieces of metal. If it will, in all probability, there will be sufficient power to move the completed contact assembly: remember, with a 1.5 V potential the current through the coil is less than 10mA.

## Frame

Constructional details for the frame are included in Fig. 4. A non-ferrous metal should be used (one that is not attracted by magnetic fields) such as aluminium, copper or brass. When completed, it should be bolted to the solenoid; see Fig. 1 for

TABLE 1

### SPECIFICATION

Size: 23mm. x 16mm. x 9mm. Working voltage: 9 to 24V d.c. Min. operating current: 45mA. Contacts: single changeover, common with make and break.

TABLE 2

### MATERIALS

One 3mm. bolt (25mm. long) with nuts and 8mm. washers.  
44 s.w.g. enamelled-copper wire.  
Small piece of tin.  
Small piece of thin metal.  
Small piece of 5mm. thick perspex.  
Short lengths of piano wire (38 s.w.g. or larger).  
Insulating tape.

Fig. 1: Front and side elevation of the completed relay.

positioning. No difficulty should be encountered in this operation, but one must be careful to ensure that the end of the frame is level with the bolt head. It should be filed to fit if necessary.

## Flap and Lever Arm

The flap and lever arm assembly is the chief moving part of the relay, the flap moving towards the solenoid, when energised, to change the position of the contacts. Thin metal, less than 1mm., which has the same properties as the core of the solenoid (being attracted to a magnet, but not having permanent magnet properties) should be used. A strip from an old tobacco tin is ideal. Fig. 5 shows the dimensions. The fold should be almost a right-angle, but not quite so that maximum contact is made with the bolt head when the solenoid is operated.

The rest arm for the lever assembly can be made from perspex and glued in position. Whilst this sets, the flap arm, which locates and positions the flap and lever arm, may be cut; see Fig. 6. Again this is bent just short of a right angle.

Lay the completed lever assembly on to the frame of the relay and position it so that a light depression on the flap will cause the end carrying the arm rest to lift a millimetre or so in the air. In this position the flap should lie flat on the head of the bolt. Fig. 7 shows the required overhang of the flap guide.

## Supporting Block for Contact Arms

A block of perspex is used to support the contact arms. This is cut to the dimensions specified in Fig. 8. The block itself is "T" shaped, the lower portion of the "T" resting on the flap guide and upper section projecting out above the arms of the flap and lever arm assembly; Fig. 10 shows this. The five holes in the block are to take the contacts and the terminating pins for the coil. If a very small drill is not to hand, it is possible to burn the holes through with the actual contact bars (38 gauge or thicker piano wire) and the terminals.

## Contacts

The contacts are made from piano wire and heated into the supporting block (see Fig. 9). The centre contact, the changeover arm, should be fitted before the other two contacts which, if possible, should be of thicker wire. The ends of these should be bent at

right-angles and positioned so that they are 1 to 2mm. away from the changeover arm rest. Also be careful to leave enough projecting through the other side of the supporting block for the solder connections.

The contact bar nearest the frame should just touch the centre contact bar and the upper one should be close but not actually touching the centre bar. A little adjustment will be needed here to get the lower arm to break away from the centre rod when the relay is operated.

The pins for the coil terminations may be made from almost anything, since they too can be heated into the perspex.

## Positioning Supporting Block

When fitting the supporting block to the frame of the relay it is important to make sure that the lever arm can move freely before glueing the block in position. Once set, the relay is ready for testing.

## Final Adjustment

In all probability it will be necessary to make some adjustment to the contacts before putting the relay into service. To do this, it is best to heat the contact bars and rotate them to the wanted position. As soon as heat is removed from the bars, the perspex hardens and will hold the contact bars in position.

Now is the time to put 12 volts across the relay. If it fails to operate, possibly the centre contact is under too much pressure. Check this by gently

—continued on page 583

2. Elliptical path to be taken with the magnet when stroking the bolt.

3. (a) 3mm. bolt; showing positioning of nuts and washers. (b) cross-sectional view of bolt after coil winding.

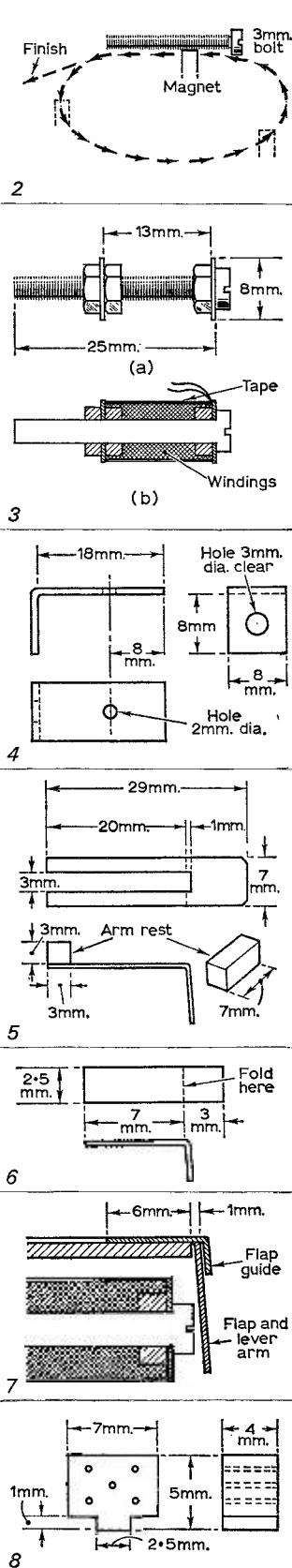
4. Frame assembly (about 1mm. thick).

5. Flap and lever arm assembly.

6. Flap guide.

7. Cross-sectional view showing overhang of flap guide.

8. Contact arms supporting block.



# Q MULTIPLIER

## FOR THE R1155

C. MOLLOY

THE R1155 is a 10-valve communications and direction finding receiver which, together with its associated T1154 transmitter, loop aerial and visual direction finding indicator, was used extensively in aircraft during the last war.

Although sensitivity is good, selectivity is not up to communication receiver standards owing to the absence of a crystal filter in the i.f. stages. The response curve of the i.f. amplifier indicates a bandwidth of 4.3kc/s at the 6dB points and several methods of improving this were considered. Fortunately, the direction finding part of the receiver is largely independent of the remainder and the three DF valves and the bulk of the DF components can be removed, leaving space for modifications and additions.

Mechanical filters of Japanese origin are now obtainable at moderate cost, but these, unfortunately, are only available for an i.f. of 455kc/s while the R1155 has an i.f. of 560kc/s. Construction of a crystal filter was thought to be impracticable and a regenerative i.f. stage was also rejected, since these can lead to a noisy background and instability. Finally, interest was aroused in the Q Multiplier. An experimental model was constructed using an outboard chassis, and was eventually incorporated within the R1155 itself, using the space occupied by the Jones plugs and sockets for the panel controls.

The Q Multiplier is essentially a parallel tuned circuit resonating at the i.f. frequency and connected between the frequency changer anode and chassis. A parallel tuned circuit offers a high impedance at its resonant frequency and can be regarded as a band stop filter or a rejector type wavetrap. When regeneration is applied to the parallel circuit the Q is

boosted to a high value, resulting in a sharp, narrow rejection notch.

When this circuit is connected to a frequency changer, frequencies outside the rejection notch are shunted through the low impedance of the parallel circuit and as a result they do not enter the i.f. amplifier. Frequencies within the rejection notch cannot pass through the tuned circuit and are applied to the i.f. input and amplified. The combined effect of the Q Multiplier and i.f. amplifier is to produce a sharp peak to the i.f. response, the width of the peak being controlled by the regeneration control. The position of the peak within the i.f. passband can be adjusted by the variable tuning capacitor.

The circuit derived after some trial and error is shown in Fig. 2. The inductor L1 together with C2 and C3 form a Colpitts oscillator, the frequency being adjustable over a small range by C5. The amount of feedback is controlled by VR1. Decoupling is provided by R3 and C6, the r.f. choke preventing leakage at the i.f. frequency. Coupling to the receiver is via C1, which also isolates the h.t. on the frequency changer from the Q Multiplier.

A small chassis 5 x 2½ x 2in. which was available was found to be adequate. It was thought advisable to mount L1 on the underside in order to avoid touching it while operating the controls. This inductor is pot cored, a hexagonal trimming tool being required to adjust the core. A suitable tool was obtained from the supplier of the coil. A screened r.f. choke is preferred and several are available among the redundant DF components in the R1155. The one chosen was taken from the screened compartment behind the b.f.o. valve (L2).

Care should be taken not to interfere with L25 which is situated near V8 and the third i.f. transformer (Fig. 1). This component is of a similar shape to the one specified but is of a different type (10C/2186). It is required in the communication part of the receiver and should not be removed. It

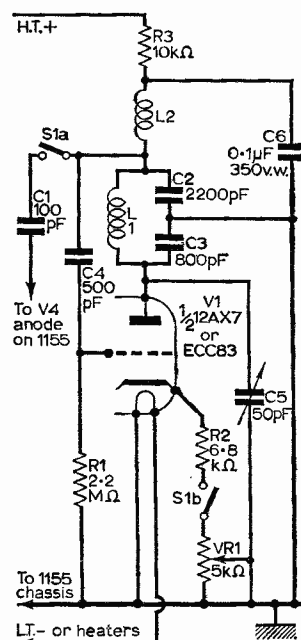


Fig. 2: Circuit diagram of the "Q" Multiplier.

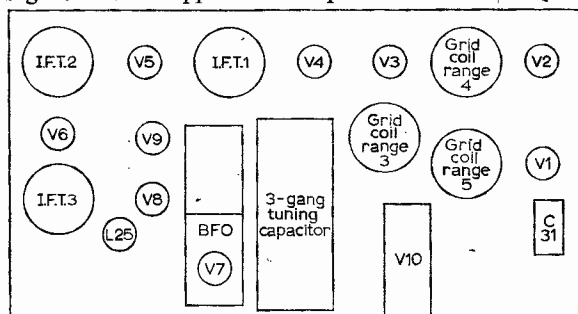


Fig. 1: Layout of the complete chassis. The valve positions are as follows: V1, V2 D.F. Switching (VR99 or X66); V3 R.F. Amplifier (VR100 or KTW62); V4 Frequency Changer (VR99 or X66); V5 1st I.F. Amplifier (VR100 or KTW62); V6 2nd I.F. Amplifier (VR100 or KTW62); V7 Beat Frequency Oscillator (VR101 or MHL6); V8 L.F. Amplifier (VR101 or MHL6); V9 D.F. Meter Switching (VR102 or BL63); V10 Tuning Indicator (VI103 or Y61).

is not essential to use the r.f. choke specified, several types were tried and the circuit would even work with a 47k $\Omega$  resistor in place of the choke.

Good quality co-axial cable is used between V4 anode and the Q Multiplier. The length of this cable is kept as short as possible as its capacitance will detune the first i.f. transformer. Re-alignment of the first i.f. stage will be necessary and the cores of the transformer will not be able to peak if the cable is longer than about 3 feet. The value of resistor R2 may have to be changed on account of differences in layout and supply voltages, details of how to do this are given in the setting up instructions.

Published circuits of Q Multipliers show the tuning capacitor C5 connected across L1, which means that both sides of C5 are at h.t. potential. Satisfactory operation was obtained with one side connected to chassis as shown, thus allowing a standard component to be used. In the interests of frequency stability close tolerance silver mica capacitors should be used for C2 and C3, though the actual values are not critical. The power drain of the Q Multiplier is small, the h.t. consumption is only 1mA. Both the h.t. and heater currents should be easily obtained from the R1155 without overloading its power supply.

## Setting up

With the Q Multiplier switch in the *off* position connect it to the receiver and re-align the i.f. stages, making sure that the a.v.c. is off. Tune the receiver to a steady signal such as a local medium wave transmitter and use the magic eye as a peaking indicator while the cores are being adjusted. After alignment is complete, switch on the Q Multiplier with C5 and VR1 set to mid position. Adjust the core of L1 until a signal is heard, using C5 as a fine tuner. If VR1 is advanced, oscillation will occur and the control should be set just short of the oscillation point to obtain maximum selectivity. It will probably be too sharp for other than c.w. reception and the control should be backed further until sufficient bandwidth is obtained. If oscillation does not occur when VR1 is advanced then R2 is of too high a value and must be reduced to 5.6k $\Omega$ . If oscillation occurs, irrespective of the position of the regeneration control, then R2 should be increased to 8.2k $\Omega$ . After a little practice with the controls it should be possible to obtain selectivity comparable to that given by a crystal filter. With VR1 set for maximum selectivity, speech becomes unintelligible and each sideband can be selected at will.

At this point the reader may think that an outboard Q Multiplier would be adequate for his needs. Commercial add-on units are available which use their own power supply or the receiver supply. Constructional details are not given here as the unit described was experimental and was subsequently dismantled and rebuilt as an integral part of the R1155. There is no reason why it could not be fitted into a small metal case and used permanently in this way. Operation on 465kc/s can be obtained by changing C3 to 1000pF, C2 to 3000pF and C5 to 100pF.

The remainder of the article describes how the Q Multiplier was fitted into the R1155. This should not be attempted by anyone who has not had

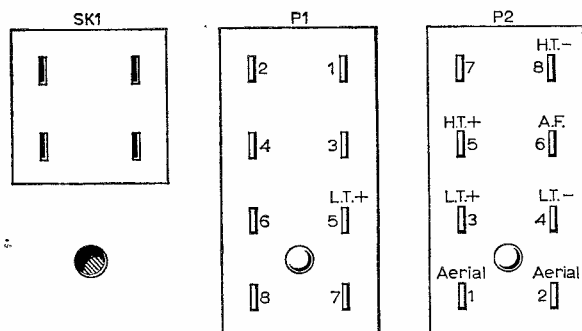
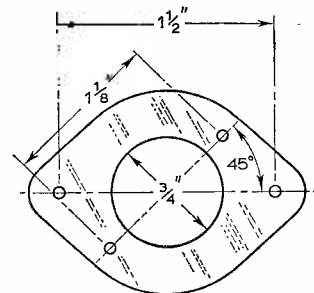


Fig. 3: Front view of the Jones plugs and sockets.

Fig. 4: Dimensions for the adaptor plate to convert Octal to B9A.



previous experience of wiring or receiver construction. A novice could very easily put his R1155 out of action permanently.

## Removal of Components

The following components should be removed from the receiver. In each case the associated wiring must be traced back to source and cut. Meter Balance Control; Meter Deflection Switch; Aural Sense switch and associated tagboard and resistors; Valveholders V1 and V2; Tagboard and components mounted beside V1 and V2 on the end of the coil compartment. The two large inductors and mounting plate situated behind the Jones plugs and sockets. The metal panel labels screwed to the top of the front plate.

## New Components

Fit a jack type socket in place of the Meter Balance control, the second terminal or body of the socket going to the chassis. This is the new high impedance phones socket.

A banana socket fitted in place of the Meter Deflection switch provides the new aerial input.

A 4-pin Painton socket (type 500467) or similar, replaces the Aural Sense switch. This will only be required if an external power supply for the receiver is in use. A square hole should be cut in the front panel to accommodate this.

A small metal adaptor plate mounting a B9A valveholder is now mounted in place of V1 to hold the Q Multiplier valve. A neat job can be made using an adaptor plate and details are shown in figure 4.

Before removal of the Jones sockets and plugs the aerial, phones and power wiring must be moved to their new location.

## Aerial Inputs

When the receiver was originally in use in an aircraft a fixed aerial was utilised for ranges 1 and 2

(18.5Mc/s to 3Mc/s) and a trailing aerial for ranges 3, 4 and 5 (1.5Mc/s to 75kc/s). P1 pin 1 is the fixed aerial input and P1 pin 2 the trailing aerial (Fig. 3). Unsolder from pins 1 and 2 the two wires coming from above the chassis, pull them back and connect each of them to the new aerial socket. This will provide a single aerial socket for all ranges. The two 2.2M $\Omega$  resistors connected from P1 pins 1 and 2 to earth are not required and should be removed.

## Phones Output

The connection from the output transformer comes via a grey wire from a tagboard mounted below the chassis at the front left-hand side of the receiver. This wire passes along a metal channel and terminates on P1 pin 6. Unsolder this wire from pin 6, pull it back through the channel and extend it to the new phone socket immediately above, at the top left hand corner of the front panel.

## Internal Power Wiring

Bolt a 4-way tagstrip to the underside of the chassis behind the Jones plugs and socket and transfer the internal power leads to it. The remaining wires connected to P1, P2 and SK1 are not required and should be unsoldered, traced back to their source and cut. The Jones plug and sockets can now be removed. *Note, HT is NOT connected direct to the chassis but passes through a bias resistor.*

If an internal power pack is in use, as in the writer's receiver, connection can be made to it from the tagblock. When an external power pack is used, run wires from the tagblock to the Painton socket. The wires from the power pack will have to be connected to the corresponding pins of a Painton 4-way plug (cat. 500207).

## Installation

A metal panel 4½ x 2½in. mounting VR1, C4, C5

## ★ components list

### Resistors:

R1 2.2M $\Omega$   
R2 6.8k $\Omega$   
R3 10k $\Omega$   
VR1 5k $\Omega$  potentiometer  
(Radiospares  
midget)

### Capacitors:

C1 100pF  
C2 2,200pF  
C3 800pF  
C4 500pF  
C5 50pF variable  
C6 0.1 $\mu$ F 350V

**Miscellaneous:** L1 Q Multiplier pot-cored coil type Q46 Electroniques. Bridge Road, Felixstowe, Suffolk.  
L2 r.f. choke type 10C/2019 see text, S1a/S1b  
4-pole 2-way midget rotary wavechange switch—only two poles used, V1, 12AX7 or ECC83—only one section used.

and the 2-pole switch is now fixed to the front panel in the space vacated by the Jones plugs and sockets. A length of co-axial cable runs from the panel to the anode of V4, the screen being connected to chassis. C4 is mounted on a spare contact of the switch. Two screened leads run to the remaining components which are located around the B9A valveholder. The space vacated by V2 is used above the chassis for the r.f. choke and L1 is mounted underneath. C31 is a 4 $\mu$ F paper capacitor connected between HT+ and chassis. This component, if still required, can be replaced by a small 350V working electrolytic and space then becomes available which can be used as an alternative location for the Q Multiplier coil, choke and associated components. This would shorten the leads required to the front panel controls. The writer was unable to do this as a mains transformer and smoothing choke had already been fitted here.

No difficulty was experienced operating the Q Multiplier in its new location. Setting up, as described earlier, including the adjustment of the 1st i.f. transformer cores was necessary on account of the new layout.

## MAKING SUB-MINIATURE RELAYS

—continued from page 580

lifting it up with a pair of tweezers and seeing if the arm pulls in when 12V is applied. If this is the case, the wire must be bent upwards to release the pressure; adjusting the other contacts accordingly.

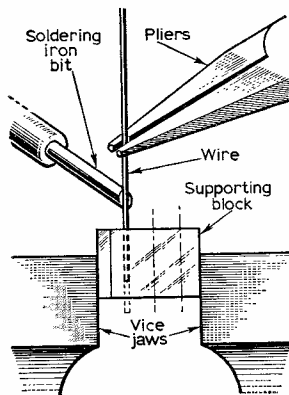
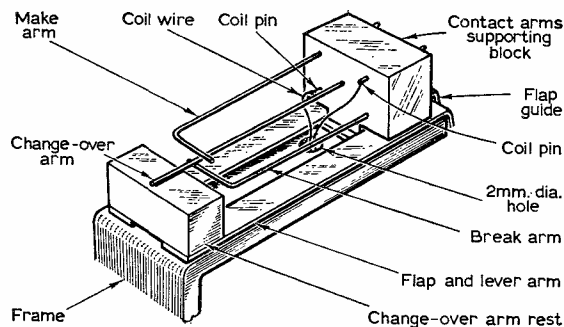


Fig. 9: (left) Method of locking wire contact arms in supporting block.

Fig. 10: (right) Contact arms and lever arm assembly.



If still unsuccessful, it is possible that the piano wire used is too heavy a gauge.

## Extra Poles

It is possible to add another changeover to the relay if required. It is best to place the extra one to the side of the existing one in preference to placing above it.



# receiving the . . . . . BBC STEREO PROGR

**N**OW that the BBC is at last transmitting regular two-channel stereo programmes, many readers are asking how it works and what extras are needed to receive the programmes and so forth. This article sets out to answer such questions, starting first at the transmitting end of the chain.

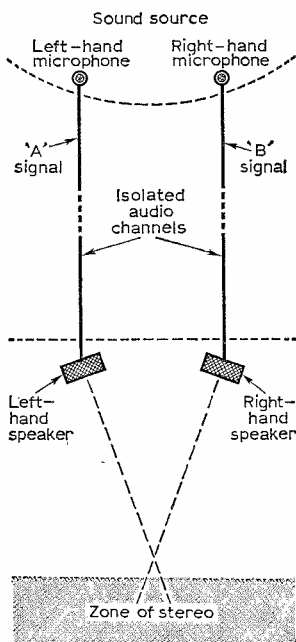
Stereo programmes are transmitted at v.h.f. in Band II, using frequency-modulation. The Wrotham and Dover stations are the first to carry the new signals, but within a year or so stereo will be extended to the Sutton Coldfield and Holme Moss transmitters. Public reaction to the system and prevailing economic factors will determine the subsequent rate of development and the nature of the stereo programmes transmitted. The first stereo broadcasts are in the Third Network Music Programmes (see *Radio Times*).

## How Stereo is Transmitted

Stereo reproduction demands two (or more) isolated audio channels from the sound source to the listeners' ears (Fig. 1). The requirements, therefore, are for two microphones, two isolated audio channels and two loudspeakers. On stereo tape the two channels are recorded separately side by side, while the channel isolation on disc records is achieved by the effective cutting of two modulation tracks at right-angles to each other.

It would be possible, of course, to maintain this two-channel isolation on radio by sending the information of the right-hand channel through one transmitter and that in the left-hand channel through a second transmitter. This system, which calls for two receivers, works quite well and readers may recall experiments along these lines being made by the BBC some time ago, with the v.h.f. set carrying one channel and the television sound section the second channel.

This is a very costly way of handling the problem since, apart from the need for two receivers, it holds the services of two transmitters. Far better methods have since been



**Fig. 1. Stereo reproduction requires the use of at least two isolated audio channels. The signal in the left-hand channel is called the A signal and that in the right-hand channel the B signal.**

evolved, requiring only one transmitter for the two channels of audio information and no more radio space than required for a single channel mono transmission.

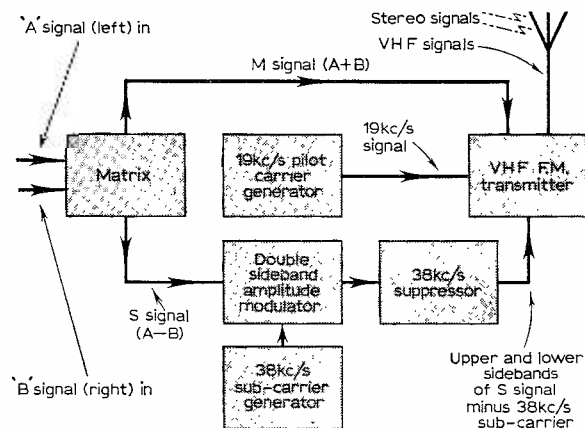
After examining the various methods put forward, Working Party S of the European Broadcasting Union proposed the Zenith-GE system for Europe. This is an American system, created jointly by the American General Electric Company and the Zenith Radio Corporation, and is, in fact, the system now in use by the BBC with the pre-emphasis changed from the American 75µS to the British 50µS.

## Compatibility

A stereo broadcasting system must be compatible. This means that a stereo transmission must produce correctly balanced mono when tuned in by any ordinary f.m. set or tuner. Incorrect balance would be obtained if the mono set responded only to one of the stereo channels or if the right and left-hand information failed to be correctly integrated.

The Zenith-GE system is, of course, compatible, and by tuning in a stereo transmission on any ordinary mono receiver a perfect mono reproduction is obtained. However, when that same transmission is tuned in by a stereo radio or tuner or one with a stereo decoder attached, then the signals in the right- and left-hand channels are adequately isolated and fed to their corresponding audio channels.

Now, from the original source of sound, the signal given by the left-hand microphone (see Fig. 1) is called the *A signal* and that from the right-hand microphone is called the *B signal*. Clearly, then,  $A+B$  signal is equal to correctly balanced mono signal. By the same token, therefore,  $A-B$  signal must equal the stereo information. The  $A+B$  signal is called the *M signal* (M for mono) and the  $A-B$  signal is called the



**Fig. 2. Block diagram of the essential features of the transmitting end of the Zenith-GE stereo system. The M or mono signal is  $A+B$  and the S or stereo signal is  $A-B$ .**

# AMMES

*S* signal (*S* for stereo).

The *M* signal is obtained at the transmitter by adding the *A* and *B* signals, while the *S* signal is derived from subtraction, these processes being handled by a so-called *matrix*. We shall see later that a matrix is also used in the decoder of a stereo receiver to produce the ultimate *A* and *B* signals.

At this juncture it would be best for us to take up the story by referring to the basic block diagram of a stereo transmitter (Fig. 2). So far we have seen that the *M* and *S* signals are obtained from the matrix due to *A* and *B* input signals. Now, the *M* signal is fed to the v.h.f. transmitter and thus modulates the v.h.f. carrier in the ordinary manner. The transmitter also receives a 19kc/s pilot carrier signal and upper and lower sidebands of the *S* signal. The v.h.f. carrier wave is, therefore, frequency-modulated by three separate signals, which are (i) the ordinary *M* signals, (ii) the 19kc/s pilot signal and (iii) the sidebands only of the *S* signal.

The first modulation signal provides ordinary mono receivers responding to the transmission with a mono signal (giving the system compatibility), while the second and third signals are concerned only with the stereo information. These signals are rejected by mono receivers and accepted only by stereo receivers, as we shall see later.

## Sidebands

The upper and lower sidebands of the *S* signal can only be obtained by first modulating the *S* signal onto a carrier wave. To keep the *S* sidebands within the channel spectrum, a frequency of 38kc/s is chosen for the sub-carrier, and this carrier signal along with the *S* signal (which is effective audio, of course) is applied to a double-sideband amplitude modulator.

## Suppressed Sub-Carrier

Between the output of this modulator and the

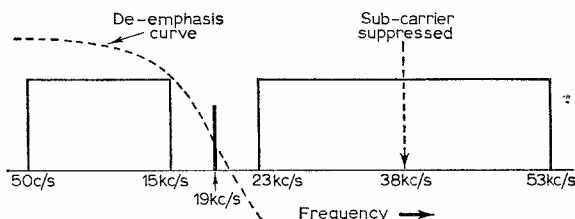
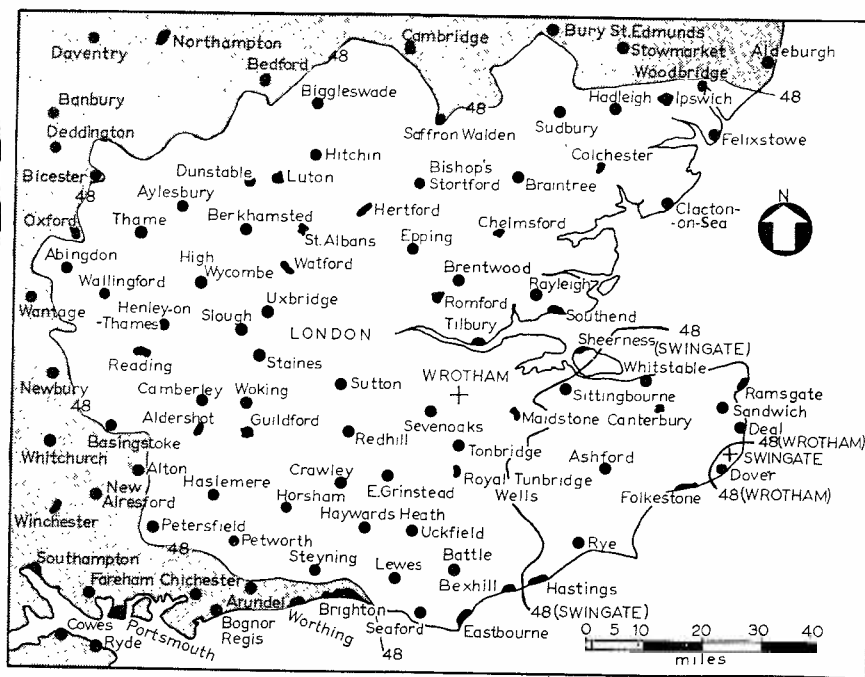


Fig. 3. Showing the frequency disposition of the various modulation signals.



Wrotham and Swingate are the only two BBC sound stations to radiate stereo. The contours on the map indicate field-strength in dB relative to  $1\mu\text{V/m}$  for a receiving aerial height of 30 ft.

modulation input of the v.h.f. f.m. transmitter is interposed a 38kc/s sub-carrier suppressing network, leaving only the upper and lower *S* signal sidebands for modulation. These sidebands fail to overlap the other modulation signals because they are spaced either side of 38kc/s on the modulation spectrum, as shown in Fig. 3.

It should be remembered that all these signals together frequency-modulate the v.h.f. carrier.

## Ratio Detector

Fig. 4 shows a typical balanced ratio detector circuit that may be found in a good quality f.m. tuner or receiver. Some sets may effectively employ a slightly different version of this circuit or a Foster-Seeley discriminator. A well designed balanced ratio detector is capable of good quality demodulation and has certain advantages with regard to stereo. But whatever type of detector is used, its response must be sufficiently wide to

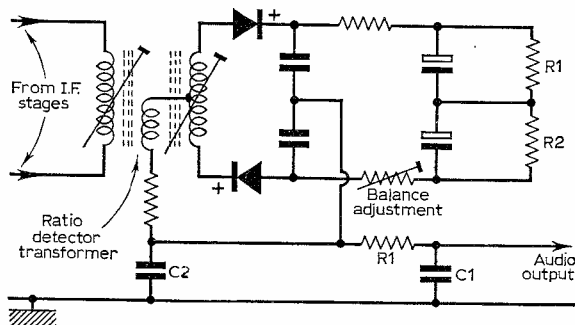


Fig. 4. The output circuit of a ratio detector used in many receivers and tuners. When feeding the signal into a stereo decoder either the de-emphasis components *R1* and *C1* should be removed or the output should be taken from the top of *R1*.

avoid cutting the higher order modulation components of the v.h.f. signal, and the same must apply to the i.f. channel which feeds the detector.

When the circuit in Fig. 4 receives a mono f.m. signal it develops across C2 the audio modulation of that signal. The audio is normally fed out through network C1, R1 for de-emphasis. This is necessary because pre-emphasis is given to the modulation signal at the transmitter to improve the system's signal/noise ratio.

Pre-emphasis means treble lift and de-emphasis treble cut. If the de-emphasis at the set end equals the pre-emphasis at the transmitting end, the result is a flat overall audio response. Improved signal/noise ratio occurs because the treble cut (de-emphasis) at the receiver reduces the worst of the high audio-frequency noise at the same time as correcting for the treble lift (pre-emphasis) at the transmitter.

It is important to bear this in mind because when a stereo decoder is fitted to a mono set or tuner the original de-emphasis circuit has to be disconnected. The reason for this is that the de-emphasis circuit effectively attenuates at the rate of 6dB/octave all the stereo information that is present on the transmission. Thus, with the de-emphasis circuit *connected*, the pilot carrier and upper and lower sidebands of the S signal are all suppressed and the receiver then behaves exactly the same on stereo transmissions as on mono ones.

Now let us suppose that we disconnect R1 and C1 in Fig. 4 and take the modulation output direct from across C2. We get the M signal as before, but in addition we get the pilot carrier and S signal sidebands. These are of no use to mono sets and tuners, but when a mono receiver is linked to a *decoder* it then becomes possible to reclaim the S signal, thereby making it possible to obtain the left and right-hand A and B signals.

## Basic Decoder

It is best to consider how this works from the block diagram given in Fig. 5. Here the modulation signal from the output of the receiver's detector (minus the de-emphasis) is applied to a signal amplifier in the decoder. The M signal from the output of this amplifier is taken direct to the matrix (which has the reciprocal action of that at the transmitter). For this matrix to deliver A and B signals it must receive the S signal as well as the M signal.

The S signal, however, cannot be obtained by detection without the 38kc/s sub-carrier (suppressed at the transmitter) first being re-inserted. This is where the 19kc/s pilot carrier signal comes in. This signal is passed through a filter, sometimes with extra amplification, and then into a frequency doubling stage, stepping up the frequency to 38kc/s.

The signal amplifier also passes the upper and lower sidebands to a synchronous detector, at which stage the

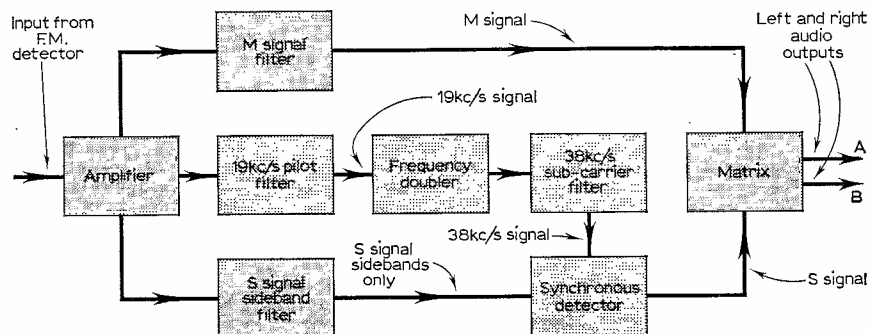


Fig. 5. Block diagram showing the stages of a stereo decoder.

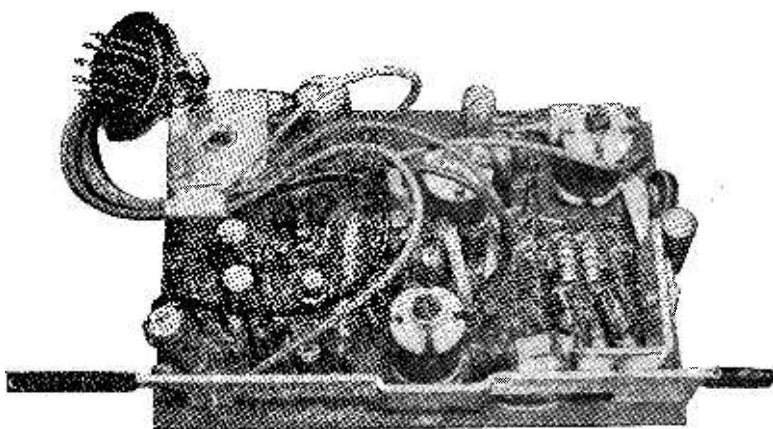


Fig. 6. Commercial stereo decoder unit designed for plugging into the Bang and Olufsen Beomaster 1000, integrated stereo tuner and hi-fi amplifier.

38kc/s sub-carrier is added, and amplitude demodulation produces the S signal, fed to the matrix.

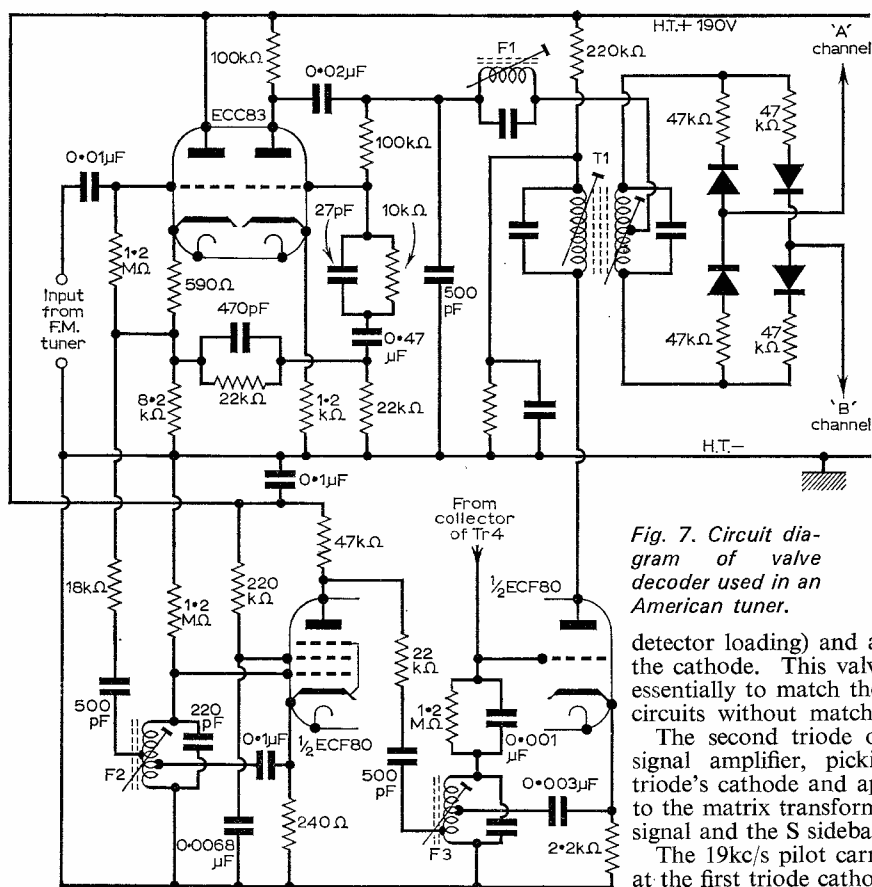
The matrix processes the M and S signals so that they yield the original A and B signals in the left and right-hand channels respectively. The matrix can be considered as a balanced bridge detector, arranged so that the combination of the 38kc/s sub-carrier and the S and M signals produces a modulation pattern, on one side of which is the left-hand channel and on the other side the right-hand channel envelope. Looking at it that way, each channel is then detected by the bridge; actuated synchronously by the 38kc/s signal.

The original A and B information is obtained because  $(A+B) + (A-B) = 2A$  and  $(A+B) - (A-B) = 2B$ , the matrix, in effect, giving rise to simple addition and subtraction, as intimated at the start of this article.

The A and B signals from the matrix are then fed to separate left and right-hand audio channels, via 50μS de-emphasis circuits, and thence to corresponding speakers.

## Deviation

The reason for suppressing the 38kc/s sub-carrier and then re-inserting it again in the decoder may not be apparent. It is concerned with modulation percentage or deviation. If the 38kc/s sub-carrier were retained, its depth of modulation on the main v.h.f. carrier would be such that the deviation of the audio signals (M and S signals) would have to be reduced to avoid over-modulation. Less modulation depth is produced by the 19kc/s pilot carrier owing to its reduced level in terms of v.h.f. modulation. In practice, the pilot carrier accounts for about 10 per cent of the total



circuit board sub-assembly. Separate decoders are also being made, self-powered or for powering from the parent set. Some of the latest f.m. tuners have plug-in provision for decoder sub-assemblies, such an assembly being depicted in Fig. 6 for the *Bang and Olufsen* Beomaster 1000, integrated f.m. tuner and stereo amplifier.

## Valve Decoder

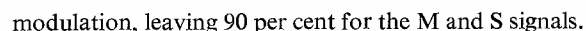
Fig. 7 shows a valve decoder designed by the American *Dyna Company*. This uses two valves, a double-triode ECC83 and a triode-pentode ECF80. The first triode of the ECC83 is arranged in a cathode-follower stage, having a high input impedance (to avoid f.m.

detector loading) and a medium output impedance at the cathode. This valve does not amplify, but serves essentially to match the f.m. detector to the decoding circuits without matching loss.

The second triode of the ECC83 is an M and S signal amplifier, picking up signal from the first triode's cathode and applying its output at the anode to the matrix transformer T1. Filter F1 passes the M signal and the S sidebands but rejects the pilot carrier.

The 19kc/s pilot carrier signal which is also present at the first triode cathode is fed to the first grid of the pentode of the ECF80, this section being arranged as pilot carrier amplifier. This signal is tuned by filter F2 at the input and filter F3 at the output. Frequency doubling is performed by the triode of the ECF80 and the 38kc/s sub-carrier is developed across the primary of T1.

—continued on page 590



Both these signals can separately modulate the v.h.f. carrier to a maximum of 90 per cent because they never rise together. When the modulation of, say, the M channel is rising it is falling on the S channel.

In stereo tuners and receivers the decoder circuit is integrated and often takes the form of a small printed

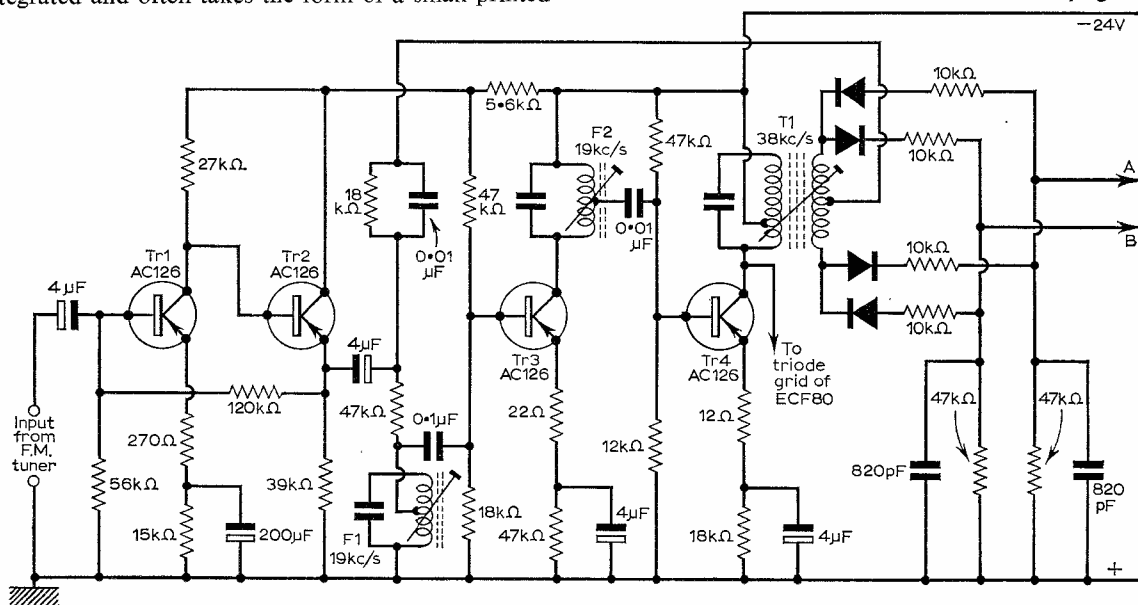


Fig. 8. Transistor decoder circuit, based on the B & O 1000.

## S.W. Broadcast Stations

I REFER to the letter on page 201, July issue, by Mr. N. D. Mugford.

Mr. Mugford has the advantage over a great majority of the people on this earth, that he lives in a free (relatively so) and democratic society. I do too. Therefore, Mr. Mugford immediately has no right to demand of you that you cease printing details of communist broadcasters, just because he doesn't like what they're doing!

However, away from the political side of it all, and assuming that Mr. Mugford simply objects to Radio Peking, Radio Sofia, RBI, Radio Moscow, etc., because they contravene the ITU and clutter up the bands, using non-broadcast-assigned frequencies, etc., then we find a strange omission in his listings . . . he forgot the BBC, poor chap! Here we have a prime example of how to sign the rules, then forget 'em . . . O! Granny BBC's got some strange frequencies hitched to her girdle, like 9410kc/s, 18150kc/s, 12095kc/s, and a few more!

So now, Mr. Editor, I must beseech you Sir, don't ever print any mention of the BBC until they drop all their naughty ways! And of course, they will take ever-so-much notice of the tremendous loss of listeners through your silence of their name!

Of course, Sir, you would then have to omit reference to any others so misusing the bands, which means nearly every international broadcaster worth his salt, and many who aren't.

**Robert Ronai,** New South Wales,  
Australian Radio DX Club. Australia.

## Valve Information: VX3188

MAY I correct the information given by your correspondent, W. Ritchie, on page 33 of the October issue?

The VX3188 is equivalent to the CV2277 and is a low-impedance pentode for use as an a.f. power amplifier and as a series valve in voltage stabilisers. The manufacturer's data sheet gives the following information:  $V_H$  26.5V,  $I_A$  90mA,  $I_H$  0.23A,  $V_{g1}$  -13V,  $V_A$  100V, gm 9.5 mA/V,  $V_{g2}$  100V,  $\mu A$  8500 $\Omega$ , Base: B9A.

Figures are also given for operation with  $V_A$  &  $V_{g2}$  = 26.5V.

**J. R. W. Murland.** Co. Down,  
N. Ireland.

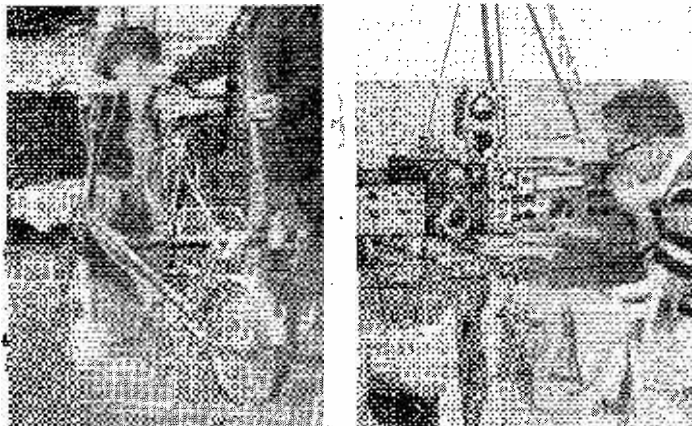
## Low Voltage Neon Indicator

I NOTE that several readers have been unable to obtain transistor types 2SO18 and XB121 as specified in my article "Low Voltage Neon Indicator" in the June 1966 issue. I have succeeded in obtaining a small stock of 2SO18's at 10s. each. Transistors type XB121 are available from Henry's Radio Ltd. at 10s. each.

**A. J. Bassett.** 28 Park Road,  
Chorley, Lancashire.

# NEWS AND..

## HARLOW MOBILE RALLY



On Sunday September 25th, a stream of traffic came in all shapes and sizes to Magdalen Laver. A family saloon with a base loaded whip on the front and a mini-halo on the back. A motor bike with a side car so full of gear it looked like a mobile Jodrell Bank. There was even a mobile on a bicycle, wobbling along the road with a huge whip towering upwards from the back of the saddle.

Without a doubt this is the friendliest rally your reporter has been to. The beaming face of Fred G3TLF on the front doorway and the eager handshakes from various people who five minutes past had been complete strangers all sum up the Harlow Rally.

The organisers covered everything; tea-and-cakes stall for the hungry; lucky dips and raffles for the gamblers; a make-up demonstration by a leading cosmetics house for the ladies; and a grand sale of the most glorious junk.

Then there were the kids; the dogs; the yarns of the DX that got away; and the groups of technical bods expounding pet theories.

Commercial gear was much in evidence but the antennae were ingenious. G3CZA/M had a very lofty whip with what appeared to be a midget basket-wound coil half way up. But perhaps the quaintest was a two foot length of 16 gauge which fed directly into an "S" meter clutched in the hand of an enthusiastic s.w.l. who promptly informed all when the talk-in station was on the air. G3RVV reminisced on receivers he built back in the old days, one of which was built bread-board style on a 9-foot plank of wood!

## REMOTE CONTROLLED TRANSMITTING STATION

Two 30kW, high frequency Marconi Self-Tuning radio transmitters are to be installed at Belgium's communications centre at Ruiselede. They are fully automatic, and will be remotely controlled over land lines from a centre three kilometres away.

In this installation, any one of 235,000 different frequencies at 100c/s steps in the range 4 to 27.5Mc/s can be selected from the control station without manual intervention at the transmitters.

This export order was awarded by the Belgian Posts and Telegraphs Department through SALT Electronics, Marconi's Belgian Associates.



# ...COMMENT

## TAYLOR ASSEMBLY SHOP



In order to meet increasing demands for their products, Taylor Electrical Instruments Ltd. put into operation a 3-point plan. A training school was set up on the factory premises, new jigs were designed and installed, and new assembly techniques devised. The result has been highly successful in that delivery times have been improved and production output increased by three times, without occupying additional floor space.

## ANTEX SOLDERING KIT

New from Antex Ltd., of Grosvenor House, Croydon, is a complete Soldering Kit consisting of a durable and rigid plastic "tool-box" with a lift-off "see-thro" cover, designed not only to keep everything to hand but also to serve as an iron stand whilst the iron is in use. Contained in this "tool-box" is an Antex Model CN 240 15W soldering iron, fitted with a  $\frac{3}{16}$ in. nickel plated bit. Two spare interchangeable bits ( $\frac{5}{32}$ in. and  $\frac{3}{32}$ in.) are also provided, with a reel of resin-cored solder, a cleaning pad, and a handy heat sink for soldering up transistors etc. A useful addition to the kit is a handy 36-page illustrated booklet on "How-to-solder". Price is 49s. 6d. complete.

## "THE ENGINEERS' DAY"

To encourage more young people to become engineers, the Government has sponsored "The Engineers' Day" exhibition at the Science Museum, South Kensington. Opening at 2 p.m. on November 18th, the exhibition will run to January 14th and will be open from 10 a.m. to 6 p.m. Mondays to Fridays and from 2.30 p.m. to 6 p.m. on Sundays. Graphic displays, with films and lectures, have been designed to promote an awareness of the importance and achievements of engineers and technologists.

Over 7,000 sq.ft. on the ground floor of the Science Museum have been given up to this exhibition. The installation at Goonhilly Down (Britain's ground satellite receiving station) will be featured.

## Ground Communications

I HAVE recently been conducting some research on ground communication which, I believe, will be of interest to many readers.

Although the transmitter and receiver earths should normally be orientated so that they face each other, I have discovered that, for good local communication, they should be beamed in order to obtain a good signal/noise ratio . . . the noise here being mains hum. The useful transmitting range for speech in my area, with transmitter earths 25 yd. apart and an output of 4W; is about 300 yd., although the soil conducts unusually well. Doubling the transmitter power increases the range by about 25%.

M. J. Walsh.

Portsmouth,  
Hampshire.

## Coil Formers for the Beginners' S.W.2

In relation to the Short Wave Receiver for the Beginner (PRACTICAL WIRELESS, July 1966 issue, page 182) Eddystone inform me that coil former type 538 specified for two of the three coils, is no longer available.

I have found that type B37 may be used for all three coils if a little patience is exercised.

A. White.

Oxton,  
Birkenhead.

## The R1155

WITH reference to the letter from John Tye inferring that enough has been written about the R1155 receiver, I would like to point out, we have not all been able to get back numbers of the magazines he mentions, which had articles on this receiver, i.e. noise limiter circuit. I endorse Mr. R. E. Robinson's cry for further articles on the R1155 or a reprint of "10 metre Converter" or "Noise Limiter" for this well tried set.

Perhaps Mr. Tye would be willing to loan his back numbers to people interested in this receiver?

I would be willing to get the pages copied.

A. R. Preston.

16 Millard House,  
Grove Street,  
Deptford,  
London, S.E.8.

## The "Ten-Five" Receiver

In the list of components for the modified "Ten-Five" Receiver appearing in the September issue of PRACTICAL WIRELESS the specification for T4 was omitted. T4 should be a miniature transistor-type transformer, Denco, Range 2 (Red).

the M and S signals after the carrier has been added and the signal demodulated. The matrix then delivers the audio signals in channels A and B, as already explained. It should be noted here that the matrix diodes have a d.c. return path through the resistors shunting the A and B amplifier inputs.

It is usual practice for the A and B outputs at the matrix to be fed to voltage amplifiers (another double-triode valve—one triode per channel—is commonly employed) before being applied to the input of the main stereo amplifier system, and it is in this early audio section that de-emphasis is often applied.

## Transistor Decoder

A transistor decoder circuit, based on the *Bang and Olufsen* Beomaster 1000, is given in Fig. 8. This has much in common with the valve circuit in terms of operation. Tr1 and Tr2, are signal amplifiers, the first in common-emitter mode and the second in common-collector mode, the equivalent of the valve cathode-follower. Stabilising feedback is applied between Tr2 emitter and Tr1 base, via the 120k $\Omega$  resistor.

The M signal and the sidebands of the S signal are passed to the tap on the secondary of the matrix transformer T1, via the RC filter (18k $\Omega$  in parallel with 0.01 $\mu$ F). The 19kc/s pilot carrier signal is tuned by filter F1 in the bass circuit of Tr3 and by F2 in the collector circuit. Tr4 acts as a frequency doubler, the 38kc/s sub-carrier signal being tuned by T1 primary in Tr4 collector circuit. The operation of the synchronous detector/matrix is the same as explained in the valve circuit.

## Critical Demands

To recapitulate; we have seen that any reasonable quality f.m. tuner can be coupled to a stereo decoder to provide A and B (left- and right-hand) stereo signals provided first the de-emphasis filter across the output of the f.m. detector is removed and that de-emphasis is inserted in each stereo channel subsequent to the decoding process.

It should be noted, though, that while some features of design or performance of the tuner may be acceptable for mono, there are certain critical demands for good quality stereo reception. For example, the tuner should be capable of maintaining a linear frequency response up to at least 240kc/s. In some cases it may be necessary to modify the f.m. detector a little to secure the best results. The total d.c. load of a ratio detector (i.e., R1 + R2 in Fig. 4) should not be much greater than 20k $\Omega$ , while the effective capacitance in parallel with the i.f. signal at the detector should not rise much above 250pF.

Poor overall frequency response or bad phase characteristics of the parent tuner can cause the output of the A channel to appear in the B channel, and vice versa (this is called crosstalk). The alignment of the discriminator transformer is also important from this

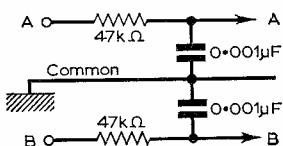


Fig. 10. A and B channel de-emphasis.

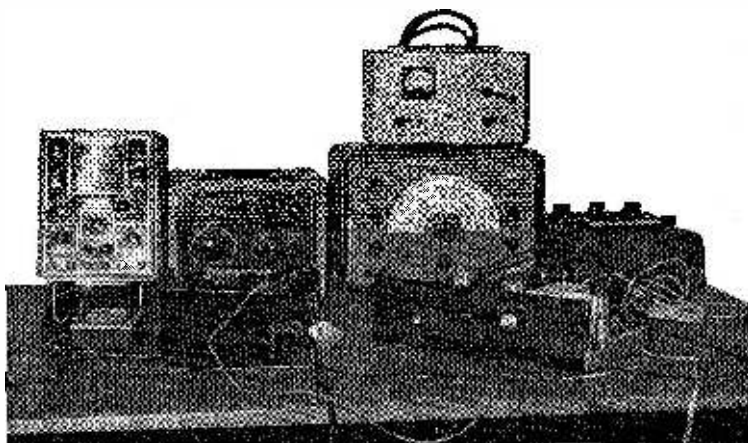


Fig. 9. Stereo tuner undergoing oscilloscope/wobbulator alignment.

aspect and to ensure that correct detector synchronisation occurs. If possible, alignment is best checked with an oscilloscope and wobbulator.

## Setting Up

Finally, a word about the setting up of a decoder. The output A and B channels usually need to feed through a triode or transistor amplifier to raise the signal levels sufficiently to work into, say, the radio inputs of a hi-fi stereo amplifier or into the audio section of a high quality radio or radiogram. The de-emphasis should also be remembered, and Fig. 10 shows a suitable twin-channel de-emphasis circuit for connection to the outputs of a decoder.

Incidentally, the 19kc/s or 38kc/s signal developed in the decoder when a stereo transmission is tuned in is often fed to some form of stereo indicating device. With a decoder having reverse compatibility, this then enables the user quickly to tune over Band II in search of a stereo transmission. The indicating device can be a moving-coil meter movement, a magic-eye tuning indicator or even a bulb.

The magic-eye tuning indicator is probably the easiest device to use, since the signal level at points marked 'A' in Figs. 7 and 8 is adequate to give full deflection of the shadow. To operate a meter the signal would have to be rectified and amplified in a valve or transistor to provide sufficient pointer deflection.

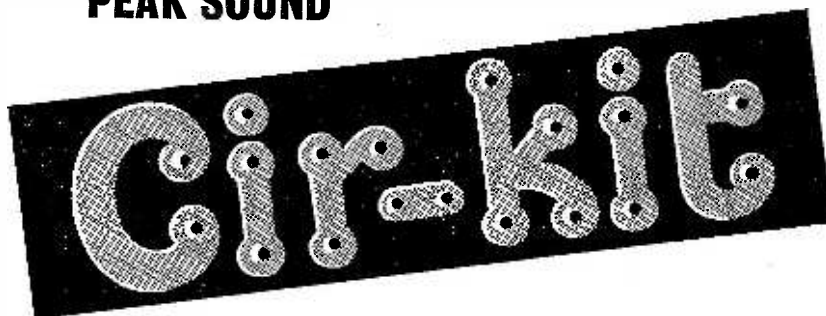
## Coil Winding

For readers wishing to experiment with decoders and construct their own models, the following information for the winding of 19kc/s and 38kc/s coils and transformers will be of assistance.

To secure sufficient inductance and Q, the coils should be wound on pot-type cores, such as the Mullard Vinkor LA2505 or equivalent. About 1,500 turns of 45 s.w.g. enamelled-covered wire will tune over 19kc/s with about 220pF in parallel. Tapping in to get the correct impedance coupling necessitates making a connection about 25 per cent from the 'cold' or earthy end of the winding.

To tune 38kc/s the primary of the matrix transformer should contain about 700 turns of 45 s.w.g. enamelled-covered wire tuned by 150pF, while the secondary to feed the diodes should contain about 100 turns. The exact tapping points will depend on the nature of the circuit, of course.

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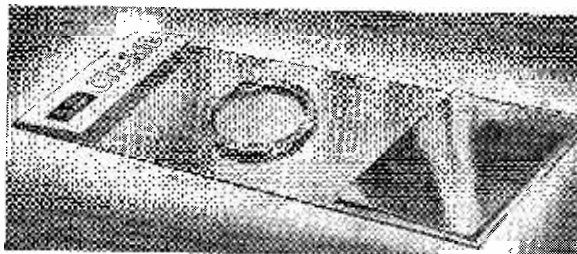
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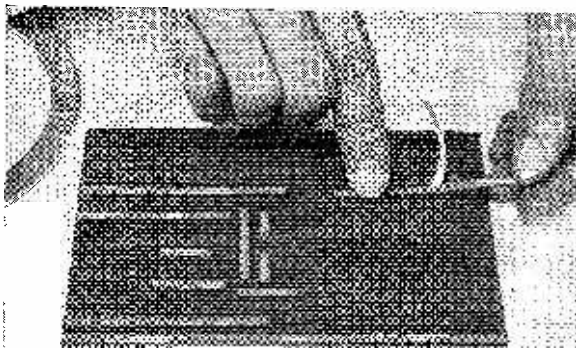
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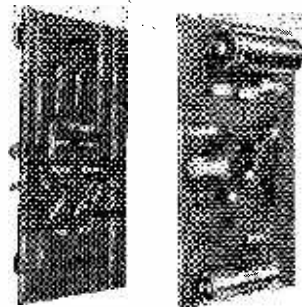


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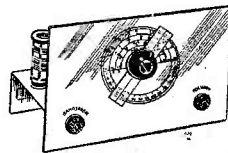
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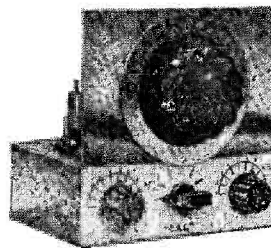
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# ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT  
Frequencies in kc/s

## THE BROADCAST BANDS

by JOHN GUTTRIDGE

**C**ONSIDERABLE increase in sunspot activity has been noted at times with complete blackout of h.f. channel on occasions. This means that better things are just around the corner as the higher frequency bands become more and more used. The move of the high-powered transmitters to these bands will considerably relieve overcrowding on the lower frequency bands and give the lower-powered stations a chance.

### SOUTH AMERICA

**Argentina:** *Radio Nacional* (Ayacucho 1556, Buenos Aires) is reported to be using LRA33, 15,345 until after 2300 in Spanish.

**Brazil:** *Radio Clube de Pernambuco* (Avenida Cruz Cabuga 394, Recife) often heard on 11,865 is now audible also at 2220 on 6,015. *Radio Jornal do Comercio* (Rua Marquez do Recife) now puts in a very strong signal on 15,145 after 0030.

*Radiodifusora Sao Paulo* (Casilla Postale 252, 4142, Sao Paulo) seems to be carrying the programme of *Radio Tupi* over 17,817. Strong heterodyne with *Radio Canado* on 17,820.

*Radio Clube Ribeirao Preto* (Casilla Postale 18, Ribeirao Preto) now putting in good signal after 2230 on 15,415. *Radio Sociedad de Bahia* (Rua Carlos Gomes, 57, Salvador) is back on 11,875. At 2300 there is interference from *Radio Moscow*.

**Chile:** *Radio President Balmaceda* (Casilla 13650, Santiago) is audible with frequent identification 2245-2301 when blotted out by Vladivostock relaying *Radio Moscow*.

**Colombia:** *Radio Nacional* (Apartado Nacional, 1824, Borgota) heard on the new frequency of 15,345 around 0100. Programmes in the main were transcription features of other stations.

**Ecuador:** *La Voz de los Andes* (Casilla 691 Quito) uses 15,325/17,880 to Europe 1830-2200 and 15,115/17,890 from 2330-2400.

**Venezuela:** *Radio Barquisimeto* (Apartmentado 576, Barquisimeto) gives a good signal from 0000 onwards on YVMQ 4,990. *Radio Tropical* (San Jacinto 9, Caracas) heard after 0025 over YVKP 4,870. Music, advertisements and news make up programme.

### EUROPE

**Albania:** *Radiodiffusion et Television Attanaise* (Rue Ismail Quemal, Tirana) now has a QSL card. Some reports say the 0630-0700 English transmission is aired over 7,090/7,265 whilst others give the frequencies as 7,265/9,390.

**Denmark:** *Radio Denmark* (Radiohouse, Rosenorssalle 22, Copenhagen V) has a special musical transmission 1800-1845 over long wave 245 (kc). There is English 1825-1830 and reports are wanted.

**France:** O.R.T.F. (Maison de l'O.R.T.F., 116 Avenue du President Kennedy, Paris 16) now has English at 1300-1330 over 15,245/17,740/21,580 and 1915-1930 over 15,130/17,740. The French inter programme is relayed on the following frequencies 6,175 1100-2200, 11,845/11,920, 1545-2000, 15,245 1100-1200, 17,765 1100-1230, 21,580 1100-1230, 1400-1700.

**German Federal Republic:** *Deutsche Welle* (Bruedertsrasse 1, Postfach 344, Skoln) has made changes in the following English transmissions 0300-0340 11,945/9,530; 0845-0940 11,925/15,275/17,845; 0600-0630 11,775/15,295; 1045-1055 9,765/11,905; 0130-0250 6,075/9,640; 0500-0540 15,140/9,735; 2050-2100 9,700/11,925/15,405.

*Deutsche Bundepest* (Funkamt Hamburg, Funkdienstburo, Hamburg 13, Schlüterstrasse 3) has a SSB point-to-point transmission over DGT46 19,460 at 1420. QSL verification is given.

**Great Britain:** BBC (C.E.X.B., Bush House, London, W.C.2) has been heard carrying its 2000-2100 Russian transmission in SSB over 12,185.

**Greece:** *National Hellenic Broadcasting Institute* (Mourouzi Street 16, Athens) can be heard (with patience) at 2200-2230 and 2300-2330 over 15,345/11,720.

**Holland:** *Radio Nederland Wereldomroep* (P.O. Box 22, Hilversum). The 2100-2150 English transmission is now aired over 11,730 and on frequency in the 31 m.b.—probably 9,590.

**Norway:** *Radio Norway* (Oslo) now transmits as follows: 0300-0430 9,550/9,610/11,850/1,578; 0745-0815 21,670/11,850/15,175/17,825/25,900; 1100-1230 7,240/21,670/15,175/17,825/25,900; 1300-1430, 1500-1630, 1700-1830 21,670/15,175/17,825/25,900; 1900-2030 11,850/15,175/17,825/21,670/21,730; 2100-2230 11,850/15,175/17,825; 2300-0030 11,850/9,550/9,610. The use of the 11 m.b. should be noted here.

**Portugal:** *Radio Portugal* (Rua du Quelhas 21, Lisboa) reported to be using 7,225/21,495 for its 2015-2100 English transmission to Europe although schedule says 41 and 49 m.b. are used.

★ ★ ★

Contributors this month were P. Charlton, A. B. Thompson, S. Shaw, M. C. Donnelly, D. Rye, D. Priestley, Swiss Broadcasting Corporation and Radio Nederland.



A VERITABLE deluge of logs, letters and reports have arrived from just about everywhere. The majority—7Mc/s. Some of the reports on forty are extremely good and as can be seen by the logs shown later—the DX is most definitely there for those who can be bothered to listen.

Very few tried 3.5Mc/s, and only two listened on 160 in spite of the fact that W's are active down the l.f. end.

From the h.f. end comes news of great activity. Both 14 and 21 Mc/s have been quite fantastic at times but reports are now growing on 28Mc/s. One particularly good opening on ten metres showed just a quick preview of things to come, things like Argentine, Canal Zone, South Africa, Israel, all on phone.

### Seven Meg. Souffle

No, you don't need a beam! **N. Henbrey** (Rye), 20-metre dipole and an EA12 logged CN8AW, UC2BF, VK2AVA, VP6KL, VS9ARV, VS9OC, WA4YQJ/P/4 (0557), 5A2TZ. **R. Adair** (Co. Down), R107, dipole, UW9AS, VK2AVA, VP3JR, VP6KL, VS9ARV, ZB2AJ, 4X4VL, 9M2OV.

**J. Fitzgerald** (Great Missenden) uses a Hitachi WH837 portable with another BC set as a b.f.o. This set up harvested the following: CN8AW, EL2A, JA1AEA, JA2BAY, LX1BB, MP4MAW, OD5BZ, PY's 1CAD, 1CLI, 1CNK, 2DL, 2EAD, 6WA, 7AOT, 7LAK (all between 2052 and 2395); UA1WW, UB5UW, UW9AF, VK2AVA, VP3JR, VP6KL, ZB2AJ, ZS1JA (2312), 5A2TR, 6O6BW, 9HIR, 9M2OV (2316). All s.s.b. Times for above three logs all between 1928—2143 except where stated otherwise.

**D. Allisett** (Gurnsey, C.I.), TCS receiver, 120ft. l.w., heard CT1LX, JA2BOI, OX3LP, PY4ND, VK2AVA, VK3VJ, ZB2AJ. **G. Morgan** (Tredgar), HA230 tuned to 7050kc/s, 45ft. end fed, all s.s.b.—CN8AW, HB9AHL, LA1K, OH5MW, PY's 1CLI, 2EAB, 6WA, 7APS, 8QQ; SL6BH, UW9AF, VK's 2EQ, 2AVA, 3MO, 7SM (Tasmania); VP3JR, VP3YG, VP6KL, VS9OC, 9HIR, 9R4VT, all on a loudspeaker, too!

### Twenty and Fifteen

If it's alive and it radiates, then you'll find it on one of these two bands. **R. Wells** (St. Albans) reports hordes of JA's romping in, and other s.w. I's quote similar instances of intense activity from distant climes.

**R. Dowdell** (Ewell), "52 rx. soon to be replaced with 130ft. end fed wire, running NW/SE." Cool! they must be coming in strong! 14Mc/s s.s.b.: CR6CN, EA8AH, EP2GF, ET3WH, HS1AK, KH6EN, KR6UA, LU5AES, PY2DSQ, VK3ZL, VS9OC, YA1DAN, YK1AA, YV5CIV, ZD9BE, ZS6AR, 5A2TS, 5A5TV, 5N2AAW, 5Z4IR, 9G1FF, 9J2MM, 9M2BO, 9M2DW, 9Q5HF, 9U5BB, 9X5MH.

**David Griffiths** (Cardiff), 640 plus 4 r.f. stages (why bother with the 640 OM?), 100ft. l.w., 14Mc/s s.s.b.: CR—6HF, 6IV, CR7—AP, FM, GW, EL2R, EP2PL, FH8KD, HS4AK, JA—1BN, 2BQE, 3RQ, 3UE, 5RG, 6AD, KG6CF, KG6ALW, KH6BX, KH6BJ, KL7—BTP, FCH, FEF, FIL, KM6CE, KR6HW, KR6QW, KS6BT, KZ5EX, K1VSD/AM, UH8DE, VE—2DZ, 8AA. VE1AED/SU, VE2BUJ/SU, VK3EUV, VK9VK, VP2VV, VP3HAG, VP5RB, VS9OC, VS9ARV, W0OTP, W0GTA/8F4, W6KXZ, YA1DAN, YV5BNW, ZC4JU, ZD9BE, ZL1CR, ZL4CH, ZP5OG, 4U1ITU, 4X4BL, 5A4TR, 9H1AB, 9M2LO, 9V1MY. An extremely good log, set out in alphabetical order with the date, time, RST, mode, band, etc. Interesting from this log to see that even the ZL's were 5 and 5.

**Philip Cooper** (Utttoxeter), CR45 t.r.f., 70ft. l.w., managed CN8CS, EP2AX, F9RY, HP9FC/MM, IIAUM/M1, K1HRV/MM, K1VKD/P/KG6, K6 JXS/MM, KR6KS, KR6UL, KV4CF, M1B, OD5BZ, PY2DFS, SV0WX, VE1AAH, VE2BUJ/P/SU, VE8AG, VK3—MO, TL, ZL, W7ALE/Fix. P/KG6, XW8AY, YV5CHO, ZL3MM, ZS6XL, 5A3TW, 5A5TB, 6O1AW, 7Q7LC.

**D. Harvey** (Salop), PCR3, ground-plane hunted 21Mc/s for—CN8FB, CR7FG, CT2AC, CX5AAM, CX0LE, EA8ES, HR1JKM, K1, 2, 3, 4, LU4LG, OD5EC, PY2GKD, PY9AI, SL7ZZS, SV1AC, VE2BUJ/MM/SU, VE3BIF, W1, 2, 3, 7, 8, 9, 0.

**Paul Baker** (Pontypool), HE30, 45ft. l.w. 21Mc/s—CE5MEO, dozens of CN's, CO8RA, CR7's, CT5JAS (ex G3SJ), CX5AAN, EA8CR, EA0AY, EL2AA, EP2RJ, HK4TA, many JA's, K6BNL, LU1DJO, MP4BEU, OA4DJ, OD5BZ, PX1MA, PY's, PZ1BE, SM3DJU/MM, VE2BUJ/SU, SU1IM, TL8JF, TN8BK, UA9TT, VE8BZ, VP7NA, VS9ASP, W6YAW, WA6LDG, WB6DLA, W7LUN, ZC4MO, ZE6JL, ZS1JQ, 4X4QA, 5A1TK, 5H3JL, 5N2AAW, 6W8DD, 6Y5RS, 7X0BB, 9G1FV, 9H1R, 9L1TL, 9M2FI (Penang Is.), 9Q5FV, 9V1MT.

### Sunspot Special

Were you disappointed with 28Mc/s this month or did you hear mumblings from distant mikes?

**Pat Longbone** and **John Singleton** use a modified S640, 20m. dipole—GM5ABN/KP4PRY, LA8WI, OE6UX, ZS6AJH. **John Farrer** (Bishop's Stortford), Mini - clipper, ground - plane—CT1PQ, DL8MM, DJ8OD, EA8EV (Canary Is.), EL8B, many G's, ZC4GB, ZE1AA, ZE8JJ, ZS4OI, ZS6—DK, DLW, IW, JK, IB, 5N2AAM, 9J2DT, 9J2MM.

**G. Owen** (Bristol), Mohican, Joystick, 28Mc/s a.m. CT1—OW, PT, QL, CR6EF, CX2CN, EA7DG, I1FAE, KV5VF, LU1AAB, OZ4FF, PY—1BAV, 3BSB, 4AB, 7EC, ZE2JA, ZE3JO, 5X5JK. On s.s.b. he claims CE3PR, CX—2AAJ, 2BD, 9CO, DJ1OJ, DJ7LY, DJ8LD, EL2R, H1IJMN, KP4AXC, KZ5KW, PY1CK, PY2PA, PY3BKT, PY4CT,

—continued on page 610

## DE LUXE PLAYERS

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Garrard LAB30 £24.19.6  
Garrard A40 £29.19.6  
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Garrard 4000 £5. 9.6  
Garrard AT60 with discast turntable £10.19.6

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1 1/2 in. 14/9 1 1/2 in. 18/- 2 in. 34/3  
1 1/2 in. 15/6 1 1/2 in. 18/6 2 1/2 in. 37/9  
1 1/2 in. 15/9 1 1/2 in. 20/- 2 1/2 in. 44/3  
1 in. 18/- 1 1/2 in. 20/6 1 in. sq. 37/6

**BARGAIN XTAL PICK-UP ARM** Complete with ACOS LP-78 Turnover Head and Styl 20/-; Stereo 30/-; SPEAKER FRET Tygan various colours, 52in. wide from 10/-; 26in. wide from 5/-; Samples S.A.E.  
**EXPANDED METAL** Gold or Silver 12 x 12in. 6/-  
**NEW GARRARD GRAM MOTORS** 100-130v. A.C. 15/- pair for 200/250v. (in series), or 10/- each (Post Free).

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6 or 12 v. outputs, 1 amp, 8/9; 2 a. 11/3; 4 a. 17/6.  
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OC71 6/-; OC72 7/8; OC81D 7/8; OC81 7/8; AF115 10/6; AF114 11/-; AF114 8/6; OC45 8/6; OC171 9/-; OC170 8/6; AF117 9/6. OC82 12/6; Transistor Holders 1/8.

**VALVE HOLDERS.** EA50 6d. MOULDED Int. Oct. 6d. Mazda Oct. 6d.; B7G, B8A, B8G, B9A, 9d.; B7G with can 1/6. B9A with can 1/9. Ceramic OCTAL, EF50, B7G, B8A, 1/-; Valve base pins B7G, B8A, Int. Oct., 2/8.

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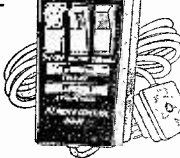
RASW 6 in. Ferrite Aerial with car aerial coil. 5/4  
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Long spindles. Midget Size 5 K. ohms to 2 meg. L.O.F. or L.I.N. L/S 8/-; D.F. 5/-; Stereo L/S 10/8; D.F. 14/6.  
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16/450 v. . . . . 3/-	8 + 8/450 v. . . . . 3/6	32 + 32/450 v. . . . . 6/-
32/450 v. . . . . 3/6	8 + 16/450 v. . . . . 3/6	50 + 50/350 v. . . . . 7/-
25/25 v. . . . . 1/9	16 + 16/450 v. . . . . 4/3	64 + 100/350 v. . . . . 11/6
100/50 v. . . . . 2/-	32 + 32/350 v. . . . . 4/6	100 + 200/275 v. . . . . 12/6

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350v.-0.1 9d., 0.51/9; 1 mfd. 3/-; 2 mfd. 150v. 3/-; 500v.-0.001 to 0.05 9d.; 0.1 1/-; 0.25 1/6; 0.5 3/-; 1.000v.-0.001, 0.0022, 0.0047, 0.01, 0.02, 1/6; 0.047, 0.1 2/6.

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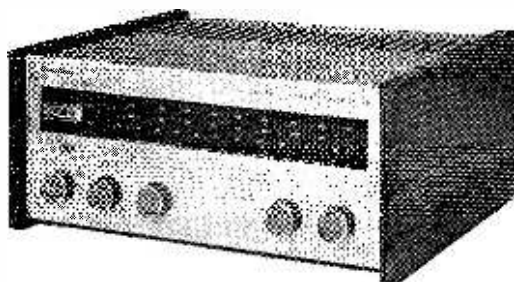
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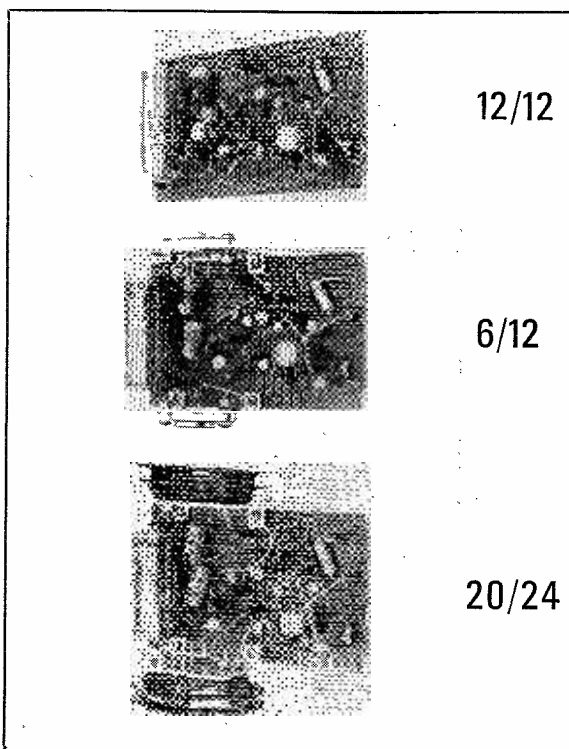
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# new books



**CIRCUITS FOR AUDIO AND TAPE RECORDING**  
By F. C. Judd, A.Inst.E., Haymarket Press Limited, London.  
80 pages. Size 10½ x 8in. Price 7s. 6d.

MANY of the circuits contained in this book have been published in earlier issues of the *Amateur Tape Recording* magazine. However this volume does contain a large number of very useful circuits covering most audio requirements. Component values are given for almost all the circuits and in some cases a layout diagram is also included.

Over forty circuits are shown including stereo amplifiers; microphone mixer units; hi-fi amplifiers; echo units; even circuitry for an electronic metronome and a simple transistorised electronic organ.

After looking through the pages several times your reviewer was lead to the inescapable conclusion that 7s. 6d. for this is excellent value for money.—DLG.

**AMATEUR RADIO ANTENNA HANDBOOK**  
By Harry D. Hooton, W6TYH. Published by Foulsham-Sams & Co. Ltd., Slough, Bucks. 160 pages. Size 8½in. x 5½in. Price 24s.

THIS book appears to offer both theoretical and practical aspects of aerials suitable for the radio amateur. To do this in 160 pages is a very tall order and to me this attempt has been a failure.

The eight chapters include Transmission Lines; Antenna Fundamentals; Practical H.F. Antennas; Impedance Matching Systems; Antenna Coupling Systems; and Practical Antenna Construction.

Some of the pages seem to be a waste of time to read. On page 151, for instance, there is a table of data for guying towers and information on the wind load. The smallest tower mentioned here is 120 ft. high, and one wonders how many amateurs

in this country could either erect or afford this sort of thing.

Perhaps the biggest gripe about this book is the price, when one considers the ARRL Antenna Handbook with some 300 pages for 19s. 6d. post free.—DLG.

**FUNDAMENTALS OF RELIABLE CIRCUIT DESIGN**  
Vols. 1 and 2. By Mel Xlander. Published by Iliffe Books Ltd., London.  
Vol. 1. 197 pages. Size 8½in. x 5½in. Price 30s. Vol. 2. 138 pages. Size 8½in. x 5½in. Price 27s. 6d.

THE preface begins "The purpose of this book which is published in two volumes, is to introduce the principles of basic circuit design and to provide practice in solving the type of problems that occur in industry."

How refreshing to find an accurate preface which sums up two volumes in a single sentence. For those who are interested in circuit design, these books should prove ideal; a very thorough treatment of the exact why and how of circuit design.

The style of the author is excellent and even the more obscure points are explained with the greatest clarity. Volume 1 covers Fundamentals of Linear Circuits; Inductance; Capacitance; General Equations; Voltage Extremes; Current Extremes; Voltage Divider Design; Threshold Circuits; and Power Dissipation.

Volume 2 continues with Diodes; Transistors, Analysis of Transistor Circuit Functions; Transistor Specifications; Transistor Circuit Design; and Circuit Specifications.

For students or indeed anyone wanting a clear explanation of these subjects then your reviewer has absolutely no hesitation in recommending both these volumes. Indeed these books would prove, in time, to be an investment rather than an expense.—LSA.

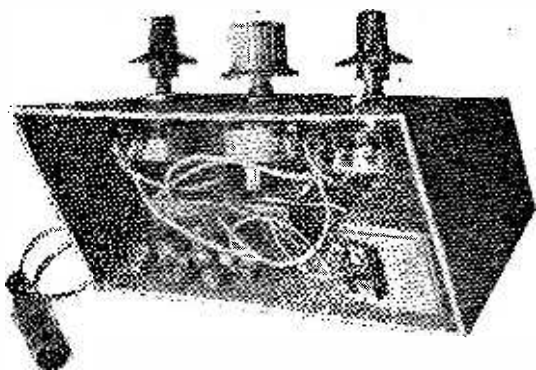
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*The magazine is also packed with other features including a valuable article on reactivating cathode ray tubes and valves.*

**DECEMBER PRACTICAL TELEVISION IS OUT ON NOVEMBER 24th — only 2s.**



**S**IMPLE audio mixers are a great utility with such diverse equipment as domestic tape recorders and electric guitars. The writer was therefore surprised when he found difficulty in obtaining one to suit his purposes in adapting a public address system for use in a small hall. An extensive collection of past issues of electronics magazines similarly failed to provide the answer so the unit to be described was developed. It had to provide a limited gain with at least three inputs, each individually controlled and matching either high or low impedance sources. It was decided to employ a transistor amplifier for each input, and mix the outputs. This procedure has the important advantage, as compared with a passive mixing network followed by a transistor pre-amplifier, that interaction between the various inputs is eliminated. Therefore increasing the volume of input 1 has no effect on the signal level of other inputs.

Figure 1 shows the circuit finally adopted. The signal is applied via a volume control and capacitor chosen to match the impedance of the source to a single transistor amplifier operating in the common-emitter mode. This system sets the desired signal level prior to mixing. The signals are mixed in a collector load common to all the transistors. The output develops a voltage across this resistor independent of any other signals present. This output signal feeds the input of the main amplifier whose volume and tone controls have their usual effect. Power for the mixer can be obtained (as in the prototype) from a battery, which due to the very small current drain has an extremely long life; of at least several months. It is also possible to use the heater line of the main amplifier, rectified by an OA 202 diode and smoothed by a 1,000 $\mu$ F, 12V capacitor, as the power supply to the mixer. It will be noticed that the base bias supply for each transistor is obtained by a potential divider from the collector, rather than as is usual,

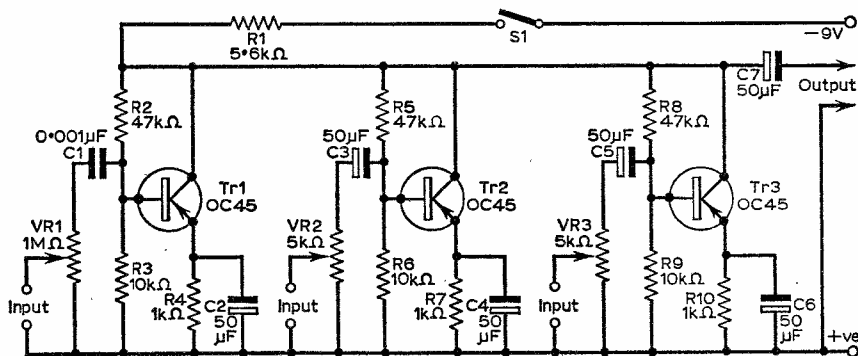
from the h.t. line. This introduces a measure of feedback to correct the matching of the amplified signals from each transistor to the impedance represented by the common load and the other transistors. Otherwise considerable attenuation would occur.

The actual construction of the device is evident from the illustrations. As can be seen the prototype is a three-input mixer, battery-powered through a switch on one of the volume controls and built into a small plywood cabinet. As mentioned above there are alternatives to this arrangement and due to the small size of the unit the ambitious constructor may even build it into his main amplifier. The heart of the unit is the printed circuit board shown in Fig. 2. It will be noted that it is of unitary construction, in that each mixer is a repetition of a standard layout. Therefore should a mixer with a larger number of inputs be desired the constructor need only use a longer piece of circuit board and repeat the pattern. If this process is carried beyond six stages, the common load may have to be reduced and with it the mixer gain. The circuit board is made up in the usual way by masking the copper of a laminate board with cellulose paint in accordance with Fig. 2, and etching off the unwanted remainder with  $\text{FeCl}_3$ . Adaptation of the circuit to assembly on veroboard or a blank paxolin panel with wired connections on the reverse side is a possibility should the reader wish to avoid chemicals.

Having assembled the circuit board, connections from the volume controls to their respective elements on the board may be made, and also connections to the input sockets. To avoid hum problems, special care should be taken with earth connections to sockets and controls; where leads of more than a few inches are involved, use of screened wire is advisable, and the output lead to the main amplifier is, of course, screened. In the proto-

—continued on page 601

**Fig. 1: Circuit diagram of the P.A. Preamplifier: Input 1 is suitable for high-impedance sources, while other inputs are suitable low impedance sources such as dynamic, moving-coil and magnetic microphones.**





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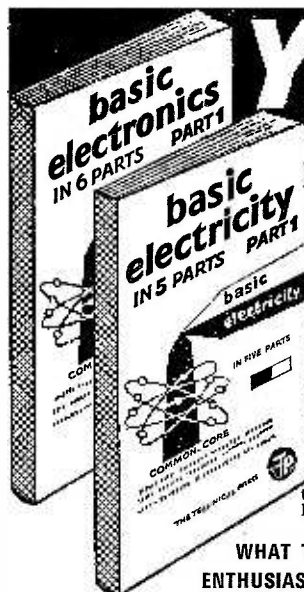
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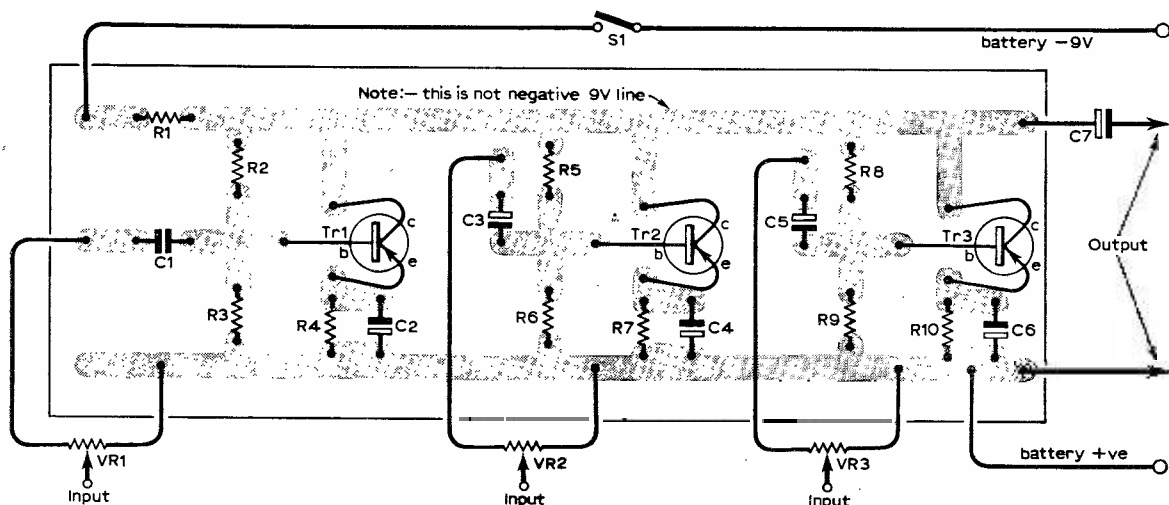


Fig. 2: Layout of the printed circuit board.

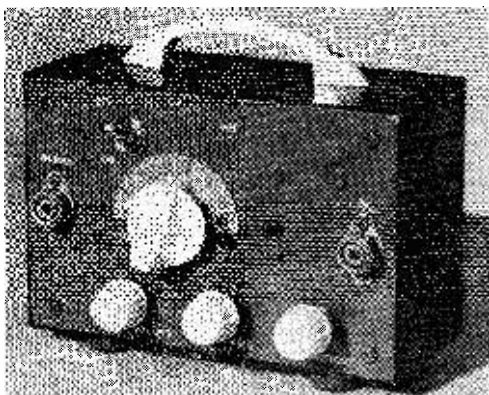
type, input 1 was designed for use with high-impedance sources, such as record decks or crystal microphones. The other inputs are low impedance, for use with dynamic, moving-coil or magnetic mikes.

Frequency response and distortion figures for the

prototype have not been measured, but it is in regular use and proving satisfactory, giving accurate speech reproduction and crisp performance on records. ■

## PRACTICAL WIRELESS

## NEXT MONTH'S FEATURES



### "Explorer" VHF Receiver

A four-transistor portable receiver/tuner for a.m. and f.m. reception on the v.h.f. bands. It covers 65-120Mc/s and 110-170Mc/s, which take in the 2m and 4m amateur bands, BBC Band II and many other transmissions.

### Power Supplies

This article examines mains power supplies in detail and draws attention to several fundamental requirements not always appreciated when designing a power supply to fulfil a particular role. The author discusses valve, metal rectifier and transistor circuitry.

### "Ten-Five" Transmitter

An attractive "pocket-size" 'phone transmitter covering 160 and 80m bands for use under fixed station, portable or mobile conditions. By the designer of the popular Ten-Five transistor communications receiver.

### Tape Recorder Monitoring

A unit to provide simultaneous record/monitor facilities, without the use of monitor headphones, where these are not incorporated in the tape recorder.

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# MW DX

The MW DX season is now in full swing. We are now riding high (or low?) on the sunspot minima and results should be excellent. Consequently, it will be possible to log the West Coast of America and Canada at times and to get interesting loggings from the Far East and South Africa.

Although DX is DX wherever you chase it, and certain basic principles for success apply on any band, searching for really long distant stations on the medium wave band requires a good deal more skill and patience than that necessary on the higher frequency short wave bands. Newcomers are referred to the two lead-in articles to the '66-67 Season published in the October and November issues. Readers with copies of the November 1965 issue will also find a good deal of information in a special article in that issue.

Opportunities should abound in the next few months for much interesting listening and we would like to hear from readers who have logged any unusual DX (with times and other relative information) or any new stations. We are particularly interested to hear of West Coast American and Canadian loggings—and the time to try for these is around dawn, or earlier.

The following personal DX log for late-October 1965 to late-April 1966 will show the range of DX possible. Although this may be used as a guide to newcomers, note that some of the stations may not be heard this season and some may have changed frequency. Some stations were heard frequently (almost nightly); others rarely only. Other listeners heard many more DX stations than those listed.

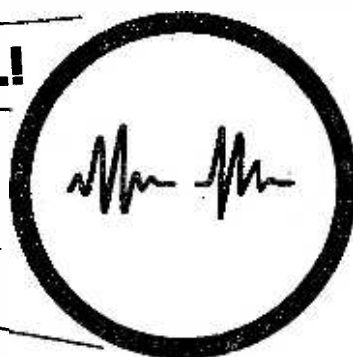
The receiver used was a GEC communications type with crystal filter. The aerial was a short "long-wire" into the TV antenna.—*Editor.*

kc/s	Call sign	Location	kc/s	Call sign	Location	kc/s	Call sign	Location
540	CBT	Grand Falls, Newfoundland	654	EAJ103	R. Sahara, El Aaiun	740	CBL	Toronto, Ontario
550	CFNB	Fredericton, N. Brunswick	655	YSS	R. Nacional, Salvador	746	CMKJ	Holguin, La Voz de Cuba
560	CKCN	Seven Sisters, P. Quebec	656	4XB47	Pyongyang, N. Korea	750	WSB	Aleppo, Syria
	LV1	R. Colon, San Juan			Ibadan, Nigeria		HJDX	Atlanta, Georgia
	YVLX	R. Rumbos, Caracas			Tel-Aviv		BED2	Antioquia, Columbia Rep.
	CHCM	Margstown, Newfoundland			New York			BBC, Taipei, Taiwan
570		Godthab, Greenland			Ottawa, P. Quebec	760	WJR	Radio Pakistan, Quetta
	WMCA	New York			All India Radio, Tiruchi		HJAJ	Detroit, Michigan
580	CFRA	Ottawa, P. Quebec	660	WNBC	Antigonish, Nova Scotia		ZFY	La Voz de Barranquilla, Col. Rep.
		All India Radio, Tiruchi		CB66	St. John's, Newfoundland		COA	Georgetown, Guyana
590	CJFX	Antigonish, Nova Scotia	665		R. Libertad, Bucaramanga			Sao Thome e Principe
600	VOCM	St. John's, Newfoundland	675	YND	Montreal, P. Quebec			VOA, Hue, Vietnam
	HJHJ	R. Libertad, Bucaramanga	677		Suwan, South Korea			All India Radio, Lucknow
	CFCF	Montreal, P. Quebec	680	WNAC	All India Radio, Ajmer	764		Radio Baghdad, Iraq
	HLSA	Suwan, South Korea		CJCN	R. Paramaribo, Surinam			Dakar, Senegal
		All India Radio, Ajmer	690	CBF	Abafon, Nigeria	770	WABC	New York
602		R. Paramaribo, Surinam		CMBC	Jeddah, Saudi Arabia			Pyongyang, N. Korea.
		Abafon, Nigeria			Grand Falls, Newfoundland	785		Damascus, Syria
604		Jeddah, Saudi Arabia	700	YVMH	R. Panamericana, Sao Paulo	786	WEAN	Providence, Rhode Island
620	CKCM	Grand Falls, Newfoundland		WLW	RNE, Santa Cruz, Canary Is.		WFUN	South Miami, Florida
	PRH7	R. Panamericana, Sao Paulo	701		Charlottetown, P.E.I.		CFDR	Dartmouth, Nova Scotia
		RNE, Santa Cruz, Canary Is.	705		Buenos Aires			?Peshawar, Pakistan?
625	TIRICA	San Jose, Costa Rica	710	WOR	Radio Pakistan, Lahore	795		?Black Rock, Barbados?
630	CFCY	Charlottetown, P.E.I.		CJOX	Havana, Cuba	800	PJB	Bonaire, Neth. Antilles
	LV14	Buenos Aires	720	WGN	China (Peking?)			Amman, Jordan
		Radio Pakistan, Lahore	730	CKAC	Chelyabinsk, USSR	810	WGY	Schenectady, N.Y.
640	CBN	St. John's, Newfoundland					WKVM	San Juan, Puerto Rico
	CMQ	Havana, Cuba				820	WBAP	Fort Worth, Texas
645	HOS22	R. Mia, Panama						
650	YVQO	Ondas Portenas, Puerto la Cruz						

—continued on page 605

# LOOK!

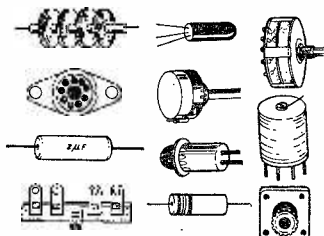
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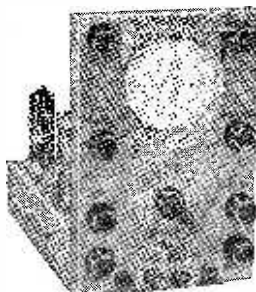
## 1 ▶ OWN and HANDLE a

complete range of present-day **ELECTRONIC PARTS** and **COMPONENTS**



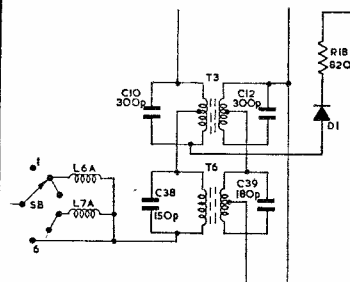
## 2 ▶ BUILD and USE

a modern and professional **CATHODE RAY OSCILLOSCOPE**



## 3 ▶ READ and DRAW and

**UNDERSTAND**  
**CIRCUIT DIAGRAMS**



## 4 ▶ CARRY OUT OVER 40 EXPERIMENTS ON BASIC ELECTRONIC CIRCUITS AND SEE HOW THEY WORK . . . INCLUDING . . .

- |                          |                          |                        |
|--------------------------|--------------------------|------------------------|
| ● VALVE EXPERIMENTS      | ● PHOTO ELECTRIC CIRCUIT | ● A.C. EXPERIMENTS     |
| ● TRANSISTOR EXPERIMENTS | ● COMPUTER CIRCUIT       | ● D.C. EXPERIMENTS     |
| ● AMPLIFIERS             | ● BASIC RADIO RECEIVER   | ● SIMPLE COUNTER       |
| ● OSCILLATORS            | ● ELECTRONIC SWITCH      | ● TIME DELAY CIRCUIT   |
| ● SIGNAL TRACER          | ● SIMPLE TRANSMITTER     | ● SERVICING PROCEDURES |

This new style course will enable anyone to really understand electronics by a modern, practical and visual method—no maths, and a minimum of theory—no previous knowledge required. It will also enable anyone to understand how to test, service and maintain all types of Electronic equipment, Radio and TV receivers, etc.

**FREE** POST NOW  
for  
**BROCHURE**

or write if you prefer not to cut page

To: **BRITISH NATIONAL RADIO SCHOOL, READING, BERKS.** Please send your free Brochure, without obligation, to: *we do not employ representatives*

NAME ..... BLOCK CAPS

ADDRESS ..... PLEASE PW12

## BARGAIN COLUMN

**25 AMP. ON/OFF SWITCH.** Mains heavy duty type amp. with control knob. 5/6 each.

**MAINS TRANSFORMER.** Upright mounting with primary tapped 200, 220, 240 v. H.T. secondary is 250-0-250 v. at 100 mA. and it has two L.T. secondaries of 6.3 v. 1 1/2 amp.—unused (removed from equipment), 15/- plus 3/6 post and insurance.

## HI-FI SPEAKER BARGAIN

12in. High fidelity loudspeaker. High flux permanent magnet type with either 2 or 15 ohm speech coil. Will handle up to 10 watts. Brand new by famous maker. Price 89/6, with built-in tweeter 35/-, plus 3/6 post and insurance.



## SPOT OR FOG LAMP

Made by Lucas, Flat or Pencil beam 36 watt. Suitable for car, boat, caravan, etc. Complete with 6v. or 12 v. bulb, flex cables and fixing bolt. Remarkable bargain 19/6, plus 3/6 post and insurance.



## LUMINOUS CORD SWITCH

This can hang on the end of a flex or it can be inserted into a flex. It has a built in neon which makes it luminous in the dark. Made for electric blankets but ideal in dark rooms, etc., normally 10/6, our price 6/6 each or £3 doz.



## FINE TUNERS

50 pf. with long spindle as illustrated, 1/6, or 12/- doz. Twin 50 pf. not quite such long spindle, 2/6, or 24/- doz.

## 12V INVERTER

Fully transistorised for operating a 20 watt fluorescent tube or other 20 watt mains device. Size 6ft. long by 1 1/4 x 1 1/4 in. £3.10.0, Post & Ins. 3/-.

## THOUSANDS OF TRANSISTORS at cut prices

(e.g. Silicon N.P.N. 5/-). Send 1/6 for latest list and equivalent chart, and circuits. S.C.R.'s. (Thyristors) 100v. 1 amp. 6/6; 3 amp. 7/6; 12 amp. 15/-; 400v. 1 amp. 15/-; 3 amp. 17/6; 5 amp. 22/6; 25 amp. £3; 50v. 1 amp. 6/6; 3 amp. 7/6; 10 amp. 10/-; 25 amp. 30/-.

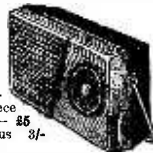
## DON'T MISS THIS it will save you \$100. 9v.

Nickel Cadmium Battery type FF3 (fits all popular pocket transistor sets). Can be recharged 800 times. Price with transformer type battery charger, only 58/6 p. & i. 3/-. Chargeable replacements also in stock for U7 12/6; U11 23/; U12 32/-.



## NO SOLDERING POCKET 3

Lots of fun to build and good results when finished — complete kit with detailed instructions and crystal splices. Batteries, 1/3d. extra — 25 value only 19/6, plus 3/- post. & ins.



## MISCELLANEOUS BARGAINS

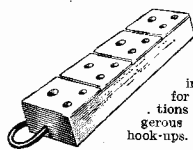
5 amp. car battery charger rectifier 10/6 (post. 3/6). Reed switch with magnet 6/6; 1 meg. pots. 6/- doz., ditto with d.p. sw. 10/- doz.; Silicon Rect. BY100, 350V, 250mA, 4/6 each; 3 for 12/-. Miniature pick-up with Cosmocond. Crystal cartridge and sapphire stylus 3/6; 4 transistor audio amplifier 19/6; turret tuner, less bottom cover and valves 7/6 each, Neoms (Midget) 1/6 each; valve type 10/6 doz., slide switch miniature 1/6; mains type 2/-, toggle switch 2/3, 30 amp relay for controlling heating 39/6, 80 watt fluorescent kit 17/6 (post 3/6), 4 pole change-over switch for series parallel working 4/6.

S.C.R. Light Dimmer. Can also be used to control the speed of Motors, drills and the heat from or to critical instrument circuit recently described in *Practical Electronics*. Mains operation this fits into 13 amps. socket outlet box. All the components including the silicon controlled rectifier. Available as a kit. Price £4.10.0. Plus 2/6 post. & ins.

Where postage is not definitely stated as an extra then orders over £3 are post free. Below £3 add 2/6.

## INFRA-RED HEATERS

Make up one of these latest type heaters. Ideal for bathroom, etc. They are simple to make from our easy-to-follow instructions—use silica enclosed elements designed for the correct infra-red wavelength (3 microns). Price for 750 watts element, all parts, metal casing as illustrated, 21/6, plus 3/6 post and ins. Pull switch 3/- extra.



## MULTI-MAINS BOX

These are 4 x 15 amp. sockets mounted on a metal box already for wiring to your power plug — intended for mounting on bench or wall — for use in workshops — laboratories — exhibitions — displays, etc. They avoid the use of dangerous bakelite multiplugs and adaptors and other hook-ups. Price only 19/6 plus 5/- post. and insurance.

## SQUARE D ADJUSTABLE TIMER

This is a fine American-made unit designed for precision. The time period is adjusted by a knurled screw. The delay period can be set anywhere from hours or seconds. The end of the delay operates a microswitch—and resetting can be remote controlled or manually reset. The unit is for wall mounting and is approx. 4in. x 7in. x 4in. Price 39/6 plus 3/6.



## FINE RECORD PLAYERS ARE 'GARRARDS'

and because they have been making record players for so long GARRARD are your best choice — big range always in stock. 7/6 for post and insurance.

1000	..	..	..	£5. 5.0	AT60	..	..	..	£11.11.0
2000	..	..	..	£6. 9.6	SP25	..	..	..	£10. 9.0
3000	..	..	..	£7.19.8	LAB80	..	..	..	£25. 0.0
	..	..	..	SP12	..	..	..	..	£2.8.6

Complete with service sheet and template.

## THIS MONTH'S SNIP

### ELECTRIC BLANKET OFFUIT

A thirteen yard, 70 watt waterproof element with temperature control by Thermal balance—and a double pole blanket switch in pastel blue bakelite—with enclosed neon ON/OFF indication—both items ideal for renovating a defunct or doubtful blanket—supplied complete with layout and other instructions only 12/6 plus 1/6 post and ins.

## FLUORESCENT SNIP

Your opportunity to instal non-flicker strip lighting at silly price—this month we offer the famous A.E.I. (Mazda) instant start lighting transformer suitable for one, 4ft. 40 watt tube or two, 2ft. 20 watt tubes. This transformer is listed at over £7, but this month you can buy the complete kit comprising instant start choke/transformer, two tube ends and two Terry clips to hold tube. Special snip price only 14/6 plus 3/6 post. and insurance—don't miss this tremendous bargain.

## See in the Dark INFRA-RED BINOCULARS

These infra red from a high voltage source will enable objects to be seen in the dark, providing the objects are in the rays of an infra-red beam. Each eye tube contains a complete optical lens system as well as the infra-red cell. These optical systems can be used as lenses for T.V. cameras—light cells, etc. (details supplied). The binoculars form part of the Army night driving (Tabby) equipment. They are unused and believed to be in good working order, but sold without a guarantee. Price £2.17.6, plus 10/- carriage and insurance. Handbook 2/6.



## FIELD TELEPHONE UNIT

Officially known as remote control unit No. 1, essentially these are telephones with additional facilities—each unit contains magnet type ringer and bell—as well as transformer—relay and switches. A pair of these will give you two way communication over distances up to five miles—unused and in good condition, 39/8 each plus 7/6 carriage and insurance.



## MAINS/TRANSISTOR POWER PACK

MAINS POWER PACK designed to operate transistor sets and amplifiers. Adjustable output 6 v.-3 to 12 v. for up to 500 mA. (class B working). Takes the place of any of the following batteries: PR1, PP3, PP4, PP6, PP7, PP9 and others. Kit comprises mains transformer-rectifier, smoothing and load resistor, 5,000 and 500 mfd. condenser. Zener diode and instructions. Real snip at only 14/8 plus 3/- post.

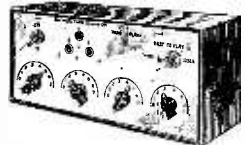
## SELF REPAIRING FUSES

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

## CONSTRUCTORS COLUMN

### Nim Computer

This computer will play games and do simple tricks and will provide endless amusement as well as education into computerisation. Kit comprises all the components, the printed front panel and full instructions. The box is not included but this can be made very simply from plywood. Price £4.17.6, plus 3/6 post. and ins.



Simple receiver for low voltage a TRF transistor set powered from the Sun or a 1 1/2 v. cell. Suitable for children or others who forget to switch off. 4 N.P.N. silicon transistors, diode and all other components necessary to build this circuit described in *Wireless World* Oct. are available as a kit price 30/- plus 3/6 post. & ins.

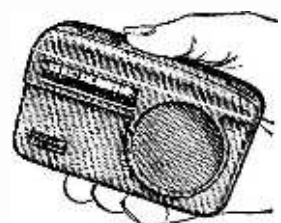
Electronic Controller for model locomotives. A device to overcome jerky stopping and starting is described in *Wireless World* Oct. All components including five transistors, 4 diodes, mains transformer, etc. to build this circuit is available as a kit price £4 post. & ins. 2/6.

Noughts & Crosses Machine. This machine described in Sept. (65) *Practical Electronics* is impossible to beat and will provide endless fun at home and considerable attraction (and profit) at charity do's and fetes, etc. It employs 19 switches and 8 bulbs and these and the other components necessary to make this are available. Price £4.10.0 post. and ins.

### MULTI PURPOSE NEON TEST UNIT

Robust, useful and instructive—test insulation—capacity—continuity—resistor—volume controls—also acts as signal injector and L.T. fault finder—kit comprises neon indicator, 4 way wafer switch, neon tubes, resistors, condensers, terminals, etc., with diag. only 8/6 plus 3/- post and insurance.

### STUPENDOUS OFFER—£11 for £2



Only recently sold for £10.9.6. Note these features: ● Long & Medium Wave ● Long dial ● Push pull output ● A.V.C. and feed back ● Ferrite aerial ● Six transistors ● Cabinet size 4 1/2 in. x 3 1/2 in. x 1 1/2 in. with carrying strap. You get everything you need and instructions. 39/6 plus 3/6 p. & p. or supplied with made up chassis 10/- extra. Battery 1/9 extra. Data separately 2/6.

### ENGINE REV. COUNTER

or direct reading frequency meter. Employing a special frequency discriminator the instrument is just right for many of the jobs you have wanted to do—it can be permanently installed as a rev counter or as a portable instrument it will do such jobs as measuring frequency of time base—pulse generator—dip-dop, etc., etc. Kit comprises: metal front panel all prepared and stove enamelled, moving coils meter, 4 specially tested transistor and diodes and all the necessary resistors and condensers and circuit diagram (separately 2/6) all for 49/6 plus 6/6 carr. and ins.

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

Solid State Ignition. Big things are claimed of Electronic ignition systems and if you would like to try for yourself a circuit as described in *Practical Electronics* (Sept. 1966). This requires a silicon controlled rectifier, four transistors and other components available as a kit, price £5.10.0 post free.

Rain Sensor. Here's a simple unit that will help you write. Rings a bell or flashes when it rains. All the components and data 39/6 post. 2/6.

### Be first this year SEED AND PLANT RAISING

Soil heating wire and transformer. Suitable for standard size garden frame 19/6 plus 3/6 post. & ins.



## ELECTRONICS (CROYDON) LIMITED

102/3 TAMWORTH ROAD, CROYDON, SURREY (Opp. West Croydon Station)



# MW DX LIST

—continued from page 602

kc/s	Callsign	Location	kc/s	Callsign	Location	kc/s	Callsign	Location
	WFAA	Dallas, Texas	910	WABI	Bangor, Maine			VOA, Sugarloaf, Florida
	HJED	La Voz de Rio Cauca, Cali.		CMBF	R. Musical Nacional, Havana		VUB	All India Radio, Bombay
	LU2	R. Nacional, Bahia Blanca		LR4	R. Splendid, Buenos Aires	1050	WHN	New York
830	WCCO	Minneapolis, Minn.		VUR	All India Radio, Rajkot		CHUM	Toronto, Ontario
	CMCA	Havana, Cuba		YVRQ	R. Aeropuerto, Maiguetia	1060	CJLR	Quebec City
	CR6R	Luanda, Angola	917		Lourenco Marques, Mozambique		CB106	Soc. Nac. de Minería, Santiago
	JOB8	Osaka, Japan	920	CJCH	Halifax, Nova Scotia		HLKX	Inchon, S. Korea
834		Belize, British Honduras	930	CJON	Shantung, China	1070	CBA	Sackville, N.B.
		Kiangsi, China	940	WINZ	St. John's, Newfoundland		LR1	Radio el Mundo, Buenos Aires
836		Beirut, Lebanon		YVQT	Miami, Florida		VUD	All India Radio, Delhi
840	WHAS	Louisville, Kentucky		PRF4	Montreal, P. Quebec		WMIA	Arecibo, Puerto Rico
		R. Ethiopia, Harrar			R. Carapuno, Venezuela	1075	TIFC	Voz de la Victor, San Jose
		R. Caribbean, St. Lucia			R. Jornal do Brazil, Rio de Janeiro	1080	WTIC	Hartford, Conn.
850	WHDH	All India Radio, Vijayawada			Kaduna, Nigeria		YVOJ	R. Barcelona, Venezuela
	WEAT	Boston, Mass.			All India Radio, Tiruchirapalli	1090	WBAL	Baltimore, Md.
	CKVL	West Palm Beach, Florida	950	WLOF	Anwei, China		HJBC	La Voz de Cucuta, Colombia Rep.
	YVLD	Verdum, P. Quebec		CKNB	Orlando, Florida		CX28	R. Impartial, Montevideo
	HJKC	R. Valencia, Venezuela	953	CHER	Cambletown, N.B.	1100	WKYC	Seattle, Washington
	CX16	Emisora Nuevo Mundo, Bogota	960	LR3	Sydney, Nova Scotia		PRG9	Cincinnati, Ohio
	VUA	R. Carve, Montevideo		CHNS	R. Belgrano, Buenos Aires	1110	WBT	R. Nacional, Sao Paulo
		All India Radio, Ahmedabad/Baroda		YVRB	Aleppo, Syria		CBD	Charlotte, N.C.
854	OAX4A	Pyongyang, N. Korea			Halifax, Nova Scotia	1115	YNC	St. John's, N.B.
860	CBH	R. Nacional, Lima	970	HCLA	R. Monogag, Maturin	1120	KMOX	Leon, Nicaragua
	CJBC	Halifax, Nova Scotia		CBZ	Omdurman, Sudan		TGRB	St. Louis, Mo.
	PRA3	Toronto, Ontario		PRE8	China (Peking ?)		YVMF	R. Reloj, Guatemala City
		R. Mundial, Rio de Janeiro	980	CBY	Suwan, S. Korea			Ondas del Lago, Maracaibo
		Kansu, China	985	WCFL	Fredricktown, N.B.	1125	TISRHB	Unid. Far Eastern Station
870	WWL	All India Radio, Sambalpur	990	CKBW	Kermanshah, Iran	1130	WNEW	R. Popular, San Jose
	WHOA	New Orleans, La.	1000	YVNM	Corner Brook, Newfoundland		HJAC	New York
	LRA	San Juan, Puerto Rico		XEOY	Chicago, Ill.		LU5	Emisora Riomar, Barranquilla
	JOLB	R. Nacional, Buenos Aires		KOMO	Bridgewater, Nova Scotia			R. Splendid, Neyquen
880	WCBS	Fukuoka, Japan	1005	HRVP	R. Moron, Venezuela	1140	CBI	Unid. Far Eastern (JOQR ?)
890	WLS	New York	1010	WINS	R. Mil, Mexico		CB114	Sydney, N.S.
	YVLW	Chicago, Ill.		CFRB	Seattle, Washington			R. Corporacion, Santiago, Chile
	PRA6	R. Valencia, Venezuela	1015	JONR	R. Norte, Honduras	1150	CHSJ	VOA, Poro, Phillipines
	CKDH	R. Gazeta, Sao Paulo	1020	HOU	Toronto, Ontario		CKTR	St. John's, N.B.
900	CJBR	Amherst, Nova Scotia		KDKA	Osaka, Japan		LU6	Three Rivers, P.Q.
	PJA6	Rimouski, P. Quebec	1025	YVNZ	La Voz de Baru, David, Panama			R. Atlantica, Mardel Plata
	YVMD	R. Victoria, Aruba, Neth. Ant.	1030	TICA	Pittsburg, Penn.		XEJP	Radio Pakistan, Rawalpindi
	XEW	R. Mara, Maracaibo	1035	WBZ	R. Calendario, Maracaibo	1157	WJJD	Mexico City
		Nexico City	1040	4VEF	R. Fides, San Jose, Costa Rica	1160		R. Americas, Swan Island
		?Shensi, China ?		WHO	Boston, Mass.		WJJD	Chicago, Ill.
				PRG2	Peking, China	1170	WWVA	Thailand
					Cap Haitien, Haiti	1178		Wheeling, W. Va.
					Des Moines, Iowa			VOA, Okinawa
					R. Cultura, Sao Paulo			

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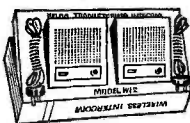
## MW DX LIST

—continued from page 605

kc/s	Callsign	Location	kc/s	Callsign	Location	kc/s	Callsign	Location
1180	WHAM	Rochester, N.Y.	1305	HJAK	La Voz la Patria, Barranquilla	1400	WOND	Pleasantville, N.J.
		VOA Marathon Key, Florida		ZP10	Emisora Paraguay, Asuncion		WIRA	Port Pierce, Florida
1190	PRE3	R. Globo, Rio de Janeiro	1310	CHGB	St. Annes, P.Q.	1403	—	Conakry, Guinea Rep.
	WOWO	Fort Wayne, Indiana		CKOY	Ottawa, Ontario	1410	WPOP	Hartford, Conn.
	JOQB	Niigata, Japan		—	REF, Martinique		—	Phnom Penh, Cambodia?
		China		—	Unid. China	1416	—	Bamako, Mali.
1200	WOAI	San Antonio, Texas	1315	HOL55	Chitre, Panama	1420	WOC	Davenport, Iowa
	YVOZ	La Voz de Avila, Caracas	1320	CKEC	New Glasgow, N.S.	1430	WENE	Endicott, N.Y.
	BED88	Taipei, Taiwan.		CJSO	Sorel, P.Q.		WNJR	Newark, N.J.
	PRE9	Fortaleza		WZOK	Jacksonville, Florida	1435	PJA5	R. Kelboom, Neth. Antilles
				WKAP	Allentown, Pa.	1440	CKPM	Ottawa, Ontario
1210	WCAU	San Antonio, Texas	1325	PJA10	Enugu, Nigeria		WAAB	Worcester, Mass.
	LV3	Philadelpia, Pa.		—	Aruba, Neth. Antilles	1450	CBG	Gander, Newfoundland
				—	Teheran, Iran	1460	WOKO	Albany, N.Y.
				—	New York		WHEC	Rochester, N.Y.
1220	WGAR	Cleveland, Ohio	1330	WPOW	Waltham, Mass.		CKRB	Ville de St. Georges, P.Q.
1230	—	Peking, China		WCRB	R. Haiti, Port-au-Prince		WLAM	Lewiston, Maine
1235	ZBM1	Hamilton, Bermuda		4VW	R. General Urquiza, Parana	1470	WMW	Meriden, Conn.
1240	LU10	R. de Sur, Bahia Blanca		LT14	All India Radio, Bikaner		CFOX	Pointe Claire, P.Q.
1250	CKBL	Matane, P.Q.		—	Hamilton, Bermuda		XESM	Mexico City
	WRYT	Pittsburg, Penn.	1340	ZBM2	Kuwait	1475	CSB90	Funchal, Madeira
	WTMA	Charleston, S.C.	1345	—	Portsmouth, Va.	1480	WHBC	Canton, Ohio
	—	All India Radio, Sangli	1350	WAVY	York, Pa.		WSAR	Fall River, Mass.
	—	Vladivostok, Siberia		WORK	Kentville, N.S.		WMDD	Fajardo, Puerto Rico
1260	WEZE	Boston, Mass.		CKEN	Belo Horizonte	1490	WPOR	Portland, Maine
	WAME	Miami, Florida	1360	PRH6	Bathurst, N.B.	1500	WTOP	Washington, D.C.
1268	CJCB	Thailand		CKBC	Hartford, Conn.		—	All India Radio, Vijayawada
1270	WTNT	Halifax, N.S.		WSAI	Cincinnati, Ohio	1510	WMEX	Boston, Mass.
	LS11	Tallahassee, Florida		ZYH25	R. Uirapuru, Fortaleza		WLAC	Nashville, Tennessee.
		R. Provincia, La Plata		KSBU	Okinawa, Ryuku Is.	1520	WKBW	Buffalo, N.Y.
		VUNC, Khangwa Is.	1370	WSAY	Rochester, N.Y.	1523	—	West China, Peking relay
		Montreal, P. Quebec		CFLV	Valleyfield, P.Q.	1530	WCKY	Cincinnati, Ohio
1280	CJMS	Quebec City		WIVW	Vieques, Puerto Rico	1540	WPTR	Albany, N.Y.
	CKCV	R. Centro, Arecibo, P. Rico	1375	—	Unid. Eastern station		ZNS	Nassau, Bahamas
	WCMN	New York	1380	CFDA	REF, St. Pierre et Miquelon	1550	WBSC	Bennettsville, S.C.
	WADO	R. Tupi, Rio de Janeiro		WLCY	Kingston, Ontario		CBE	Windsor, Ontario
	PRG3	Hopei, China		CBT38	St. Petersburg, Florida		WOKJ	Jackson, Missouri
	—	Keene, N.H.	1390	JOUF	R. Cruz del Sur, Santiago		HJZI	R. Fantasia, Bogota
1290	WKNE	China (Peking?)		—	Osaka, Japan	1560	WOXR	New York
	—	Omaha, Nebraska		WCSC	Charleston, S.C.		—	All India Radio, Siliguri
	KOIL	St. Maarten, Neth. Antilles.		WEGP	Presque Is., Maine	1570	CKLM	Montreal, P.Q.
1295	PJD2	Moncton, N.B.		—	All India Radio, Imphal		XERF	Villa Acuna, Mexico
1300	CBAF	Cleveland, Ohio	1394	LR11	Ahwaz, Iran	1580	CBJ	Chicotimi, P.Q.
	WERE	Baltimore, Md.		CSB80	R. Universidad, La Plata	1590	WAKR	Akron, Ohio
	WFBF		1395	HCVE4	Santa Maria, Azores		WSMN	Nashua, N.H.
					La Voz de Esmeraldas, Chimbo	1600	CJRN	Niagra Falls, Ontario

# RADIO • HI-FI • COMPONENTS • TEST EQUIPMENT

ALL ITEMS SENT POST FREE

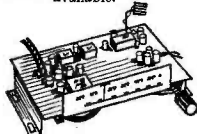


## WI-2. TRANSISTORISED WIRELESS INTERCOM

No wires, no installation needed, simply plug them into AC power point and talk. Units have press-to-talk lock switch and on-off volume control. Ideal Intercom or Baby Alarm for home, office, **£14.12.0** complete.

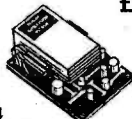
## DP303. DOOR PHONE INTERCOM

Ultra sensitive transistorised intercom designed so that you may answer the door from within for greater convenience and safety. **£4.12.6** other intercoms available.



## EAGLE FM141. FM TUNER

Sub-miniature 6 transistor 3 diode F.M. Tuner. Covers 88-108 Mc. Operates from 9-volt battery, micro miniature circuit giving brilliant FM reception. Ready to use, simply connect to your HI FI amplifier. Instructions supplied. **£8.10.0**



## EG304

Sub-miniature 3 watt transistorised push-pull radio amplifier on printed circuit. Ideal unit for Intercoms, Baby Alarms, Radio Tuners, etc. Complete with circuit and instructions. **£3.12.6**  
Also available EG104. **£3.2.6**  
One Watt and EC2004 250 mW **£2.5.0**

## SS.70.S. STEREO SELECTOR SWITCH



Seven position stereo switch for selecting all or seven different combinations for HI-FI Speaker systems. Will handle up to 60 watts of Audio power. Complete with instructions. **£1.10.0**

## TE190. SINE SQUARE WAVE AUDIO GENERATOR

SINE WAVE: 20-200,000 cps in four bands.  
SQUARE WAVE: 60-30,000 cps. Input impedance 0-5,000 ohms. Especially designed for HI-FI Radio and TV Service men who require a dependable instrument. **£21.19.6**

## K142. VACUUM TUBE VOLTMETER

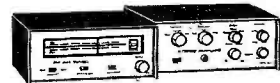
This high quality V.T.V.M. is an indispensable test instrument for the technician-engineer. It is a highly accurate D.C. Voltmeter, A.C. Voltmeter and Ohmmeter incorporating a 6in. full view meter. **£21.15.0**

Also a full range of other meters available.

## LATEST EAGLE PRODUCT TSA90 4X4 WATT ALL TRANSISTOR STEREO AMPLIFIER

Gram and radio inputs—output impedance 3-16 ohms. Silver anodised aluminium front panel complete with matching metal knobs. Only **10 gns.**

## EAGLE SA100. 10W INTEGRATED STEREO AMPLIFIER



A compact, versatile integrated unit for monaural or stereophonic reproduction from record player, tape recorder and tuner. Power output 5 watts per channel. Frequency response 40-20,000 c.p.s. **£18.0.0**

## EAGLE AFM100. AM-FM TUNER

Combines a host of advanced features that easily make it the finest AM-FM tuner in its class. A tuned RF stage on FM, AFC circuit and a heavy flywheel giving smooth but effortless tuning, built in AM Ferrite aerial: FM88-108Mc. **£29.0.0**  
AM 535-1605 K/s.

## MS80. 20W ROSEWOOD SPEAKER SYSTEM

The perfect answer for the music lover who wants full range fidelity in a compact system. Features an 8in. full range high compliance speaker with an output capacity of 20 watts RMS. Frequency response: 30-20,000 c.p.s. Resonant frequency: 30-40 c.p.s. Sensitivity: 97 db/w. Flux density: Over 12,000. Impedance: 16 ohm. Size 14in. high x 10 1/2 in. wide x 8in. deep. **£14.14.0**

As well as this beautifully designed speaker there are two other models MS65, 10 watts RMS at £12.12.0 and MS40 5 watts RMS £8.12.0.  
All three speakers are finished in magnificent rosewood and the entire cabinet filled with acoustic damping material.

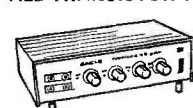
## EAGLE PRODUCTS

### MAGNETIC STEREO CARTRIDGES

<b>M1007G GOLD</b> Response: 20-20,000 cps Output: 5MV at 1Kc/ Scm/sec Stylus: 0.5 Mil diamond Tracking Pressure 1-2.5 grams.	<b>M1007F SILVER</b> Response: 20-18,000 cps Output: 10MV at 1Kc/ Scm/sec Stylus: 0.7 Mil diamond Tracking Pressure 2-4 grams.
<b>£6.12.6</b>	<b>£5.14.6</b>

Both feature singularly smooth reproduction and incisive separation of stereo channels

## ALL TRANSISTOR PUBLIC ADDRESS AMPLIFIERS



Two new models offering the last word in P.A. amplification. All transistorised circuit, negative feedback circuit reduces distortion to a minimum. Two mike inputs high and low with individual controls. Plus inputs for TAPE, TUNER and RECORD PLAYER.  
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Other P.A. models available.

## SC10F. RECTANGULAR REFLEX HORN SPEAKER

An outstanding combination of reflex horn and driver unit for car mounting to deliver wide angle high quality reproduction. Weatherproof, waterproof and shockproof. Output 10 watts. **£7.15.0**

Also available SC5F: 5 watts, £4.2.6 and SC15F: 15 watts £14.12.6.



## UD40H CARDIOD DYNAMIC MICROPHONE

Features a pop-proof diaphragm and superior anti-feedback properties, reduces feedback and room reverberation. O/p: -42 db. Response: 60-12,000 cps; 50K ohm impedance 26.6.



## DM31G. CARDIOD DYNAMIC MICROPHONE

Superb quality with ball head for distributed cardiod frontal pick-up. Output: -52db. Response: 40-13,000 cps. Impedance 50k ohm. **£7.7.0.**

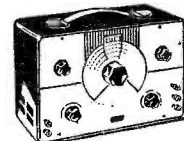
## DM24HL

A goose-neck dual impedance microphone 600 ohm - 50K ohm. Response: 50-11,000 cps. **£8.8.0.**

27 other microphones available.

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## TE-188. RF SIGNAL GENERATOR

A stable wide range signal generator with a range of 120 Kc/s-250Mc/s on 6 bands. Features a large 4in. vernier tuned, etched circular dial for easy accurate frequency adjustments. Complete with instructions. **£20.15.0**



## LA9P. AC ELIMINATOR

with a double wound step down transformer to operate 9v Radios, etc., from AC Mains. **£1.8.6**

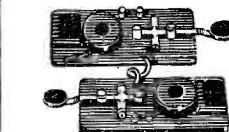


## FSW1. FOOT SWITCH

Snap action foot switch with acid proof rubber base pad. Plugs into your Tape Recorder remote control system but special adaptor supplied enables this to be used with all other 24/- Tape Recorders.

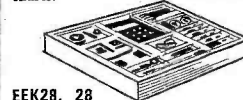


**CSK.10** Self-powered crystal set kit with private earphone. Supplied complete with instructions. **18/6**



## MCK.2. MORSE CODE KIT

Two station morse code kit supplied with instructions, 50ft. of connection wire and morse code charts. **£2.2.0**



## EEK28. 28 PROJECT CONSTRUCTIONAL KIT

This advanced educational kit is excellent for beginners as well as the more advanced experimenter. Not even a soldering iron is needed. Complete with 60 page booklet giving full details of suggested circuits. **£6.10.0**

## WIRELESS MICROPHONES

WM909 (as illustrated) Pocket FM Wireless transmitter complete with tie-pin microphone. Transmits clearly up to 100 yds. and is fully tunable over the entire FM band. Simply used with an FM radio or tuner. **£14.0.0**



Also available WM808 **£21.0.0**

Professional stick type FM Wireless Microphone.

These cannot be operated in U.K.

# REDA RADIO LTD

(Dept. P.W.12)

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ACJHL	4/6	DL510	8/6	EF81	6/6	KZ741	6/6
ACPA	4/6	DY86	7/6	EF85	4/6	KZ763	5/6
ACPEN5	5/6	EB0F	23/6	EF86	6/6	M8100	1/6
AL60	5/6	EB80C	12/6	EF89	5/6	M8141	12/6
ARP3	3/6	EB90C	10/6	EF91	9/6	M8142	12/6
AR312	4/6	EB95	14/6	EF92	5/6	MB4	5/6
ART24	3/6	EL1266	50/6	EP05	5/6	MLHD610	5/6
ARS	5/6	EL1415	30/6	EF183	6/6	ML6	6/6
ARTP1	6/6	EL1524	12/6	EF184	6/6	N78	15/6
ATP4	3/6	EL50	1/6	EH90	7/6	NE17	7/6
ATP7	5/6	EL73	7/6	BHT1	300/6	OA2	5/6
ATP8	5/6	EL8	BC08	EL92	9/6	OB4	7/6
AZ31	9/6	EA1	3/6	EL24	10/6	OB7	7/6
B6H	15/6	EA142	8/6	EL36	5/6	OC3	5/6
BD78	40/6	EB31	1/6	EL48	17/6	OD3	5/6
BL3	10/6	EB39	3/6	EL41	8/6	OZAA	5/6
B84	8/6	EB203	2/6	EL42	8/6	P21-35	14/6
B84	20/6	EB24	1/6	EL45	8/6	PC86	9/6
BD84	37/6	EB0C81	5/6	EL51	7/6	PC88	6/6
BL214	3/6	EBBF50	6/6	EL54	4/6	PC97	9/6
BT19	25/6	EBF83	7/6	EL55	7/6	PC99	12/6
BT35	25/6	EBBF89	5/6	EL91	4/6	PC854	5/6
BT45	150/6	EBL31	20/6	EL95	5/6	PC89	10/6
BT83	35/6	EC02	2/6	EL360	20/6	PC189	9/6
CB21	22/6	EC133	13/6	EL96	5/6	PCF60	6/6
CV23	10/6	EC70	4/6	EM81	7/6	PCF80	6/6
CV71	3/6	EC90	2/6	EM84	6/6	PCF84	6/6
CV77	5/6	EC01	3/6	EN31	10/6	PCF86	8/6
CV102	1/6	EC031	4/6	ESU74	80/6	PCF870	6/6
CV103	4/6	EC062	5/6	ESU208	6/6	PCF805	11/6
CV4004	7/6	EC08	5/6	ET81	5/6	PCL91	9/6
CV4005	7/6	EC085	6/6	EY86	6/6	PCL82	7/6
CV4015	7/6	EC088	9/6	EY91	3/6	PCL83	8/6
CV4025	10/6	EC088	9/6	EZ40	6/6	PCL84	8/6
CV4049	6/6	EC091	4/6	EZ41	6/6	PCL85	8/6
CY31	6/6	EC0189	9/6	EZ80	5/6	PCL86	8/6
D1	1/6	EC1	7/6	EZ81	5/6	PEN25	4/6
D1	6/6	ECF32	7/6	F0607	5/6	PEN25	4/6
D61	6/6	ECH42	9/6	F/6061	5/6	PEN46	3/6
D77	3/6	ECH81	5/6	F/6063	5/6	PEN200A3	6/6
DA30	12/6	ECH83	7/6	FW4/5006/8	6/6	PE200	6/6
DAF96	6/6	ECL80	7/6	FW4/5006/8	6/6	PL36	9/6
DD41	4/6	ECL82	6/6	G12500/6/8	6/6	PL37	18/6
DE73	8/6	ECL86	9/6	G12501/6	6/6	PL31	7/6
DET20	2/6	ECL86	9/6	J/370/1	20/6	PL82	6/6
DET33	15/6	EF36	3/6	G50/2G	4/6	PL83	6/6
EF78	5/6	EF37A	7/6	G180/2M15/5	5/6	PL84	6/6
DF91	3/6	EF40	8/6	G34	45/6	PL89	13/6
DF92	3/6	EF45	8/6	G233	10/6	PM2AA	4/6
DF93	6/6	EF42	3/6	G232	10/6	PT15	15/6
DH63	5/6	EF53	4/6	HK54	23/6	PT25H	7/6
DK92	8/6	EF55	8/6	HL2K	2/6	PT25M	7/6
DK96	6/6	EF71	7/6	HL23	6/6	PX4	14/6
DL92	4/6	EF72	5/6	HL23DD	5/6	PX5	18/6
DL93	4/6	EF73	5/6	HL41	4/6	PY33	6/6
DL94	7/6	EF74	5/6	HL42	4/6	PY80	5/6
DL95	7/6	EF80	5/6	K3A	60/6	PY81	5/6

[illegible]

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

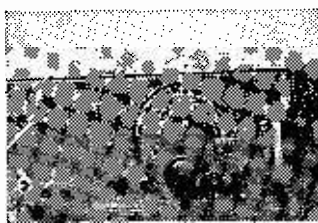
**2 KW ULTRASONIC GENERATOR** together with power supply unit for 200-250 v. A.C. Complete two chassis with interconnecting cables. Frequency 37 to 43 kc/s adjusted by fine control. Peak output 2 kw., average output 500 w. Completely new with valves and manual £65. carriage paid U.K.

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

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

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

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



**(Made by Pye).** 3 bands, 1:medium wave, 2:120-43m 3:43-13m. Overall sensitivity 1-2 $\mu$ V. S/Noise ratio 10 dB at 6 $\mu$ V. Circuit incorporates an RF stage, two I.F. stages, tone control, A.V.C. antenna trimmer. 6V6 output. Set in new condition together with headphones and speaker plug, **£9.5.6**. With vibratory supply unit, 12v, **£10.4.0**. With specially built-in P.S.U. for 210-250v. A.C., **£11.7.6**. Carriage either set 10/-

Ask for your needs from our huge selection.

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**PERSONAL CALLERS WELCOME**

**TR 50 XM TRANSMITTER/RECEIVER INSTALLATION**, for channel TX, provision for crystal or master oscillator. Frequency 1.5-12Mc/s. Output 50w. Complete with all accessories, alternatively Dynamator power unit for 12v. D.C. operation or P.S.U. 110/220v A.C. Full details and prices upon request.

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

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

(c) 260-350 v. stabilised, adjustable, approx. 45 m.

(g) 6.3 v. A.C., 4.5 amp. common earth.

**PHASE MONITOR ME-63/U.** Manufactured recently

displays on a panel meter the phase angle between two applied audio frequency signals within the range from 20-20 000 cps to an accuracy of  $\pm 1.0^\circ$ . Input

2 and 30v peak. In excellent condition together with handbook and necessary connector **£45**. Carriage 30/-.

KCS-30 MCS) with "S" meter and crystal filter in excellent, fully checked and tested condition together

**BACK MODEL** also available at the same price

**"S" METER** for H.R.O. Receivers. Brand New  
£2.10.0. Carriage paid U.K.  
**FRIGWAN SEALED RELAYS TYPE H 86 C**

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



# MODIFYING THE ELECTRONIC GATE

Described  
in the  
April Issue

ONE of our readers who has built two of the electronic gates, described in the April issue by H. T. Kitchen, for converting single-beam oscilloscopes into dual-trace machines, has modified the original circuit to make it more versatile. Briefly, he has made the gating oscillator free running—continually variable from 50c/s to 5kc/s—and improved the wave shape of the high frequency gating pulses.

## Variable Gating Speed

Two one-watt, wire-wound resistors (one fixed and one variable) are the only components necessary to carry out the fixed to free-running conversion. There are, however, a few circuit alterations; Fig. 1 shows the circuitry around V1 which has to be changed.

To effect the modification, proceed as follows: Disconnect the earthy end of R1 and R2. Connect one end of a fixed 120k $\Omega$  resistor to the 250+ h.t. rail; the other to one end of a 100k $\Omega$  potentiometer. The "free" end of the potentiometer has to be connected to the earth rail and the wiper to the "free" ends of R1 and R2.

With the wiper of the potentiometer at the earthy end, the fixed speeds will be as before, but they will increase as the wiper is moved towards the h.t. rail to give continuous coverage.

## "Squaring-up the Square Waves"

A prominent rounding of the leading edge of the square wave output of the gating oscillator takes place on the higher frequencies; 2kc/s and above, the higher the frequency the worse it gets. Although careful layout will improve matters, the stray capacity of the valve will cause some distortion. The result of this distortion is a spike on the signal across V2; the width being proportional to the percentage of the curve to the square on the waveform. If a careful study of the anode or output waveform is made it will be seen

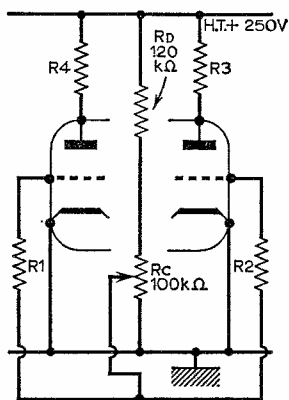


Fig. 1: Modifications to the gating oscillator V1 to give continuous coverage from 50c/s to 5kc/s.

that the curve usually starts about three-quarters of the way up the leading edge.

To overcome this problem the top portion of the square wave has been chopped. Instead of using a Zener diode (which would be expensive, since it would have to operate at about 160 volts), a pair of reversed diodes and a potential divider have been used. A circuit showing the alterations is given in Fig. 2. From this it can be seen that a potential divider,

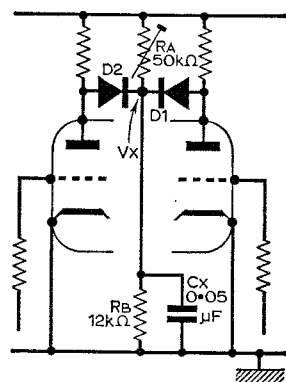


Fig. 2: Clipper modifications to improve the square wave output of the gating oscillator.

comprising a 50k $\Omega$  variable and a 12k $\Omega$  wire-wound, half-watt resistor, is inserted across the supply lines. The diodes, which must be capable of withstanding 300 p.i.v. and a forward current of 10mA, are connected to the centre point from the anodes of V1a and V1b. The diodes are thus reversed biased when the valve is conducting. When the anode voltage rises to the predetermined level, in this case 160V, the diode conducts and prevents any further increase in amplitude. This has the effect of clipping the waveform at the wanted voltage level and thus eliminates the distorted portion of the square wave. R<sub>A</sub> can, of course, be replaced with a fixed resistor once the optimum value has been selected. A small improvement may be found if a 0.05  $\mu$ F capacitor is put across R<sub>B</sub>.

When carrying out this modification, it is advisable to look at the signal on the anodes of V2. It should appear as a square wave, reducing to zero as VR1 (in the original circuit) is advanced to the mid position. Any distortion from the oscillator will appear as spikes, which VR1 will have no control over.

## Correction

The lead connections from Pin 2 and Pin 7 of V1 in the original circuit diagram of the trace doubler (page 1077) are incorrect. They should be transposed to give cross coupling.

## PRACTICAL ELECTRONICS

DECEMBER ISSUE

INTEGRATED STEREO AMPLIFIER  
MODEL TRAIN CONTROLLER

SPECIAL SERIES  
THE ELECTRONIC ORGAN

ON SALE NOVEMBER 10 2/6



**No. 12**

## **THE BRITISH AMATEUR ELECTRONICS CLUB**

**I**N November 1965 steps were taken to show the full series of Mullard technical films to all interested in electronics and who lived in the Cardiff area. Arrangements were made to show the films at the Penarth Secondary School, St. Cyres Road (where we still meet) and the organisation was called The St. Cyres Electronics Group. We had to borrow a projector, and these and other technical films were shown until March to very appreciative members. On May 16th we adopted a Constitution, elected a Committee, changed our name to The British Amateur Electronics Club, and we were off!

The first thing we did was to arrange for the public to play with an electronic shooting gallery during Penarth Holiday Week and we were allocated the shelter on the promenade. Having got the go-ahead from the Council we then had to design and make it! To cut a long and unbelievable story short we did, in fact, have a modified game ready just in time (well, two hours late!) and we raised £38 for the British Empire Cancer Campaign during the week.

In June we published our first Newsletter which contained details of the aims and policy of the B.A.E.C. and all prospective members were sent a copy. Much to the surprise of our members a second Newsletter was published in September, and apart from details of the electronic games played during the Holiday Week it gives details of our future programme of meetings.

The electronic games we make are designed to incorporate different types of electronic circuits (counters, and gates, S.C.R.'s, etc.) and during our

meetings we will be investigating the principles and operation of all types of electronic devices and circuits with the aid of electronic test equipment, and then incorporate them in the games. During Penarth Holiday Week next August we hope to have a few new games ready and do better than this year, particularly as we have more time in which to prepare.

Our membership fee is 10s. per year and out of this we pay for all electronic components used in the electronic games we make. The British Amateur Electronics Club is for all who are interested in electronics as a hobby, and it is hoped that more who live too far from Penarth to attend our meetings will join and exchange ideas through the Newsletter. To encourage this the B.A.E.C. has a scheme whereby electronic groups in other parts of the country can join as a whole, and if more than half their members are individual members of the B.A.E.C. then they can receive free electronic components up to 40% of their individual membership fee for any electronic project they plan which is approved by the committee of the B.A.E.C. This 40% would be the cost price plus postage, and as the B.A.E.C. can buy in bulk very cheaply indeed this idea could mean the difference between doing and not doing.

As has been shown in this summary we are a young club but very ambitious and full of ideas. To carry out our policy of catering for all who are interested in electronics as a hobby (and that includes radio) we need more members, so if you would like more details please write to the Hon. Secretary, Mr. R. E. Cullen, 4 Roseberry Road, Penarth, Glam., and he will, without hesitation, send you our first Newsletter!

### **THE AMATEUR BANDS**

*—continued from page 594*

SM5JW, SP5AKG, TI2LA, ZE1AN, ZE8SKI, ZP5KT, ZS4RI, 4X4GY, 5A2TI, 5N2AAF, 5Z4GS, 9J2—DT, DX, MM, VX, 9Q5BD, 9X5MH.

#### **News and Views**

Contests for November include: 12th—13th, 7Mc/s DX contest (c.w. section); 19th—20th, Topband contest (second); December 4th, Fourth 70Mc/s contest (c.w.).

What to look for and where? Well, try the 1.f. end of 1.8Mc/s for W's on c.w. Almost any time on 14 and 21Mc/s for DX. Don't forget 7Mc/s still provides a challenge if you find DX too easy on 14 and 21.

How about 80, very few reports these days for this band. Finally, every time you switch on the gear—a quick listen on 28Mc/s. You never know what you might hear these days.

PS—G3JDG is loose on topband with 10 watts into 140ft. end fed. You have been warned! Deadline for this month is 27th.

### **THE GIFT WITH JUST THE RIGHT FREQUENCY**

What better Christmas present could you give a radio enthusiast than a whole year's subscription to PRACTICAL WIRELESS? With every month of the coming year, he'll thank you for the help and interest this absorbing "practical" magazine brings him.

Simply send your friends' names and addresses, together with your own, and remittance to cover each subscription, to: The Subscription Manager (Z1), PRACTICAL WIRELESS, Tower House, Southampton Street, London, W.C.2. Your friends will receive a Christmas Greetings Card announcing each gift.

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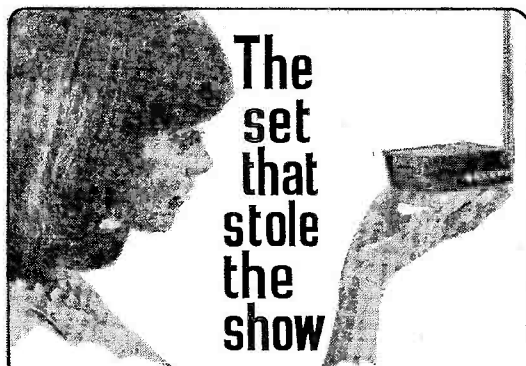
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# SINCLAIR STEREO 25

DE-LUXE PRE-AMPLIFIER AND CONTROL UNIT



## THE WORLD'S FIRST POCKET TV

THE SINCLAIR MICROVISION POCKET TV RECEIVER provided a world wide sensation when shown for the first time at the 1966 Radio and TV Exhibition. This fantastic British set tunes over 13 channels on bands 1 and 3, operates from six self-contained "Penlite" batteries and measures only 4in. x 2½in. x 2in. Despite the minute proportions of this 30 transistor receiver, quality from the exclusively designed tube and loudspeaker is superb. This amazing Sinclair triumph will be available early in 1967 at a cost of 49 gns.

**SINCLAIR MICROVISION**

Available early 1967

## A revelation in quality and economy

THE SINCLAIR STEREO 25 has been designed specially to ensure the highest possible standards of reproduction when used with two Z.12s or any other first class stereo power amplifier. Best possible components are used in the construction of this superb unit, whilst its appearance reflects the professional elegance characteristic of all Sinclair designs in hi-fi, radio and TV. The front panel of the Stereo 25 is in solid brushed and polished aluminium with beautifully styled solid aluminium control knobs. Mounting the unit is simple, and power is conveniently obtainable from the Sinclair PZ.3 which can also be used to supply two Z.12s to make a complete stereo assembly. Hi-fi enthusiasts seeking the ultimate in domestic listening will find all they want from this combination of Sinclair units. With a Micro FM for tuner, they will have an installation to compare favourably with anything costing from four to five times as much.

### IDEAL FOR USE WITH TWO Z.12s AMPLIFIER

### TECHNICAL SPECIFICATIONS

*Performance figures obtained with the Stereo 25 fed to two Z.12s and a PZ.3 mains power supply unit.*

■ **SENSITIVITY** for 10 watts into 15 ohms load per channel.  
Mic.—2 mV into 50K ohms.  
Pick-up—3 mV into 50K ohms.  
Radio—20 mV into 4.7K ohms.

■ **FREQUENCY RESPONSE** (Mic. and Radio)—25 c/s. to 30 kc/s.  $\pm 1$  dB extending to 100 kc/s  $\pm 3$  dB.

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Treble +12dB to -10dB at 10 kc/s.  
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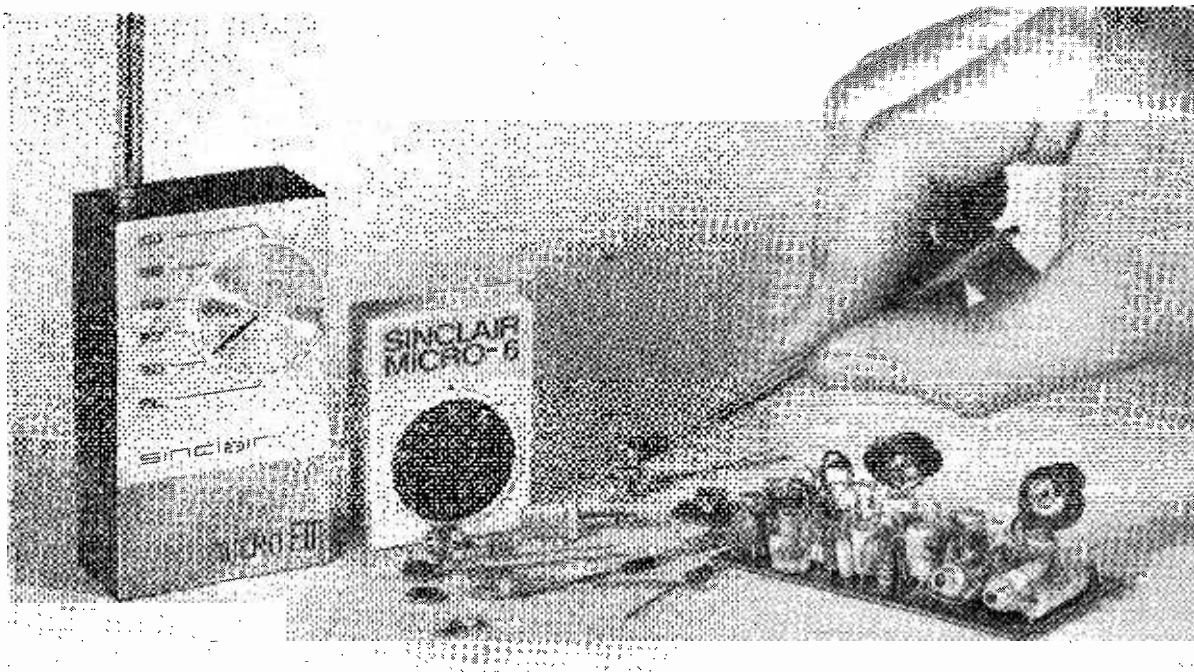
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"We have now completed installation of the Micro FM after being lost in admiration for the superb construction. Results are beyond praise. The quality is perfect. In fact I haven't done a stroke of work since we finished it. Please thank all for a first class job. We are thrilled with it."

C.E., Lowick, Berwick-on-Tweed.  
"I should like to express my very considerable satisfaction with the performance of the Micro FM. You have clearly designed a very efficient circuit with first rate overall performance. I am more than pleased."

L.E.H., Harrogate.

### MICRO-6

"A truly excellent kit. The finish and general quality is very good. It is fantastic that a radio can be so compact."  
N.R.C., Bishop's Stortford.  
"Reception and sound is superb. I found the instructions very easy to understand."

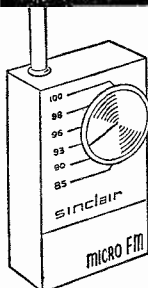
R.R., Spanish Town, Jamaica.

### Z.12

"The results are outstanding when used with a good quality speaker."

P.O.S., London, E.13.

## MICRO FM



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

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This unique, superbly engineered superhet FM set is completely professional in styling inside and out. Its performance is fantastic. It is the only set in the world which can be used both as an FM tuner and as an independent FM pocket receiver just whenever you wish. Problems of alignment which previously made it almost impossible for a constructor to complete an FM set for himself have been completely eliminated. This set is

### TECHNICAL DESCRIPTION

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

## 7 TRANSISTOR SUPERHET F.M. TUNER/RECEIVER

ready to use the moment you have built it. The pulse counting discriminator ensures best possible audio quality; sensitivity is such that the telescopic aerial included with the kit assures good reception in all but the very poorest reception areas. The Sinclair Micro FM give you all you want in FM reception and the satisfaction of building a unique design that will save you pounds.

- ★ Size:  $2\frac{1}{2} \times 1\frac{1}{4} \times \frac{3}{8}$  in.
- ★ Powerful A.F.C.
- ★ Pulse counting discriminator
- ★ Low I.F. completely eliminates alignment problems
- ★ Tunes from 88 to 108 Mc/s
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- ★ Signal to Noise Ratio: 30dB at 30 microvolts
- ★ Operates from standard 9V battery, self-contained
- ★ Plastic case with brushed and polished aluminium front and spun aluminium tuning dial

## MICRO-6



This is the set against which a matchbox looks enormous. Yet it is completely self-contained, including aerial and batteries and virtually plays anywhere. Its clever six-stage circuit (2 R.F., double diode detector, 3 A.F.) ensures all you want in a radio today—power, range, quality and selectivity. A.G.C. counteracts fading, bandspread brings in Luxembourg like a local station. There is great pleasure to be had in building the Micro-6, and it makes a highly acceptable gift with its white, gold and black case and amazing performance.

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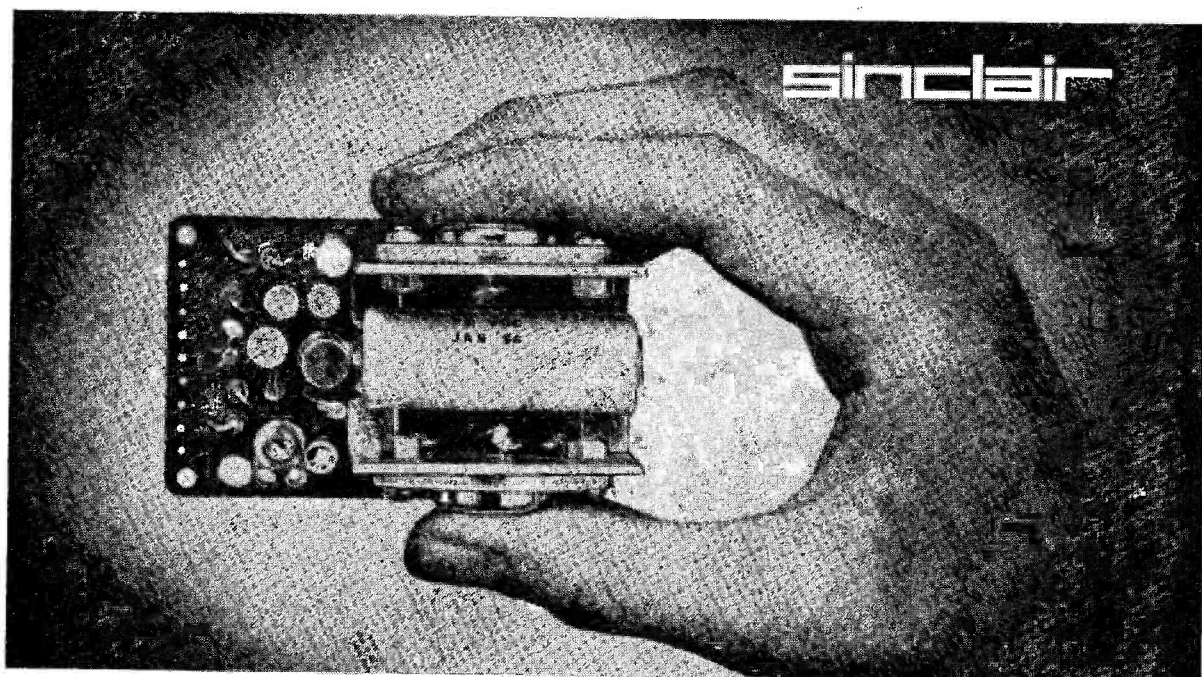
**59/6**

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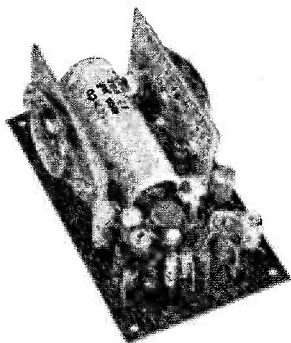
# SINCLAIR Z.12 COMBINED 12 WATT HIGH-FIDELITY AMPLIFIER AND PRE-AMP

**12 WATTS R.M.S. OUTPUT**

CONTINUOUS SINE WAVE (30W. PEAK)

**8 TRANSISTOR CIRCUIT WITH CLASS B ULTRALINEAR OUTPUT**

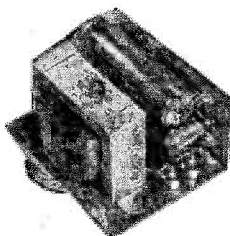
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## SINCLAIR PZ.3 POWER SUPPLY UNIT



This special power supply unit uses advanced transistorised circuitry to achieve exceptionally good smoothing. Ripple is a barely measurable 0.05 v. The PZ.3 will power two Z.12s and a Stereo 25 with ease.

**79/6**

## TECHNICAL SPECIFICATIONS

- Size 3 in. x 1½ in. x 1½ in.
- Class "B" ultralinear output
- RESPONSE 15–50,000 c/s  $\pm$  1 dB.
- Suitable for 3, 7.5 or 15Ω speakers. Two 3Ω speakers may be used in parallel
- INPUT—2mV into 2kΩ.
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**89/6**

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## Sinclair Stereo 25

DE-LUXE PRE-AMP. AND CONTROL UNIT  
PLEASE TURN TO PAGE 611

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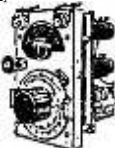
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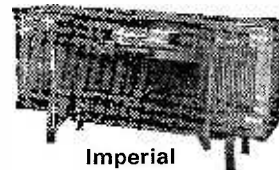
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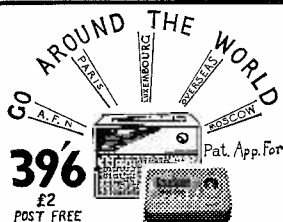
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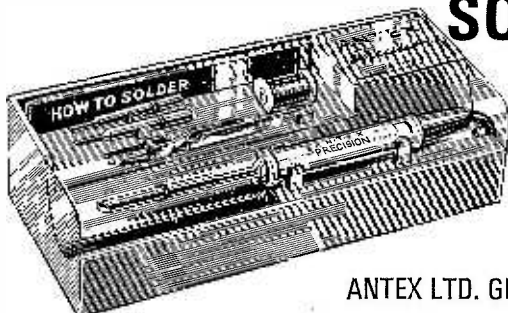
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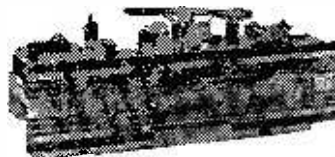
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Outstanding value. High-class 4 band receiver covering 550kc/s-31 Mc/s. Seven valves plus rectifier, RF stage, illuminated "S" meter, 1.5µV sensitivity. Electrical bandspread on 80/40/30/15 and 10 metre bands. Slide rule dial, aerial indicator, B.E.O., A.N.T., Output for phones or speaker, 115/230/240V. A.C. Brand new, guaranteed, with manual. 24 Gns, Carr. 10/-



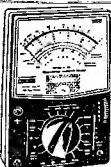
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MODEL 5050 MULTIMETER with meter protection. 20,000 ohm p.p. 0.1/0.5/5/50/250/1,000 V D.C. 0.02/0.1/1/250/1,000 V D.C. 0.05/0.5/5/50/250 mA. 0.05K/50K/500K/5 meg ohm. 0.001-.2 mfd -20/-200/-220. £15.9.6. P. & P. 3/-

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SRP12 Player mono £4.7.6; 1000 changer mono stereo £5.19.6; 2000 changer mono or stereo £6.6.0; A50 Changer mono or stereo £7.10.0; 3000 Changer stereo £7.19.6; A75 Mk II £8.19.6; SP25 Player mono or stereo £8.19.6; A750 Changer mono or stereo £9.19.6; A70 less cartridge £21.10.0; LAB 80 Stereo £25.0.0; 401 Transcription £30.0.0. Brand new and guaranteed. All plus post and packing 5/-.

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20 Amp ..... £22.10.0  
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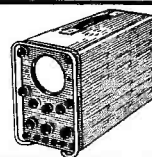
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150v. PIV. 25 amp ..... 15/6  
700v. PIV. 100 amp ..... 49/6  
Discounts for quantities. Post extra

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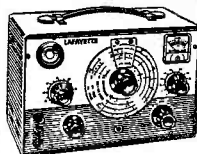
### PORTABLE OSCILLOSCOPE CT-52

A compact (9in. x 8in. x 16in) general purpose scope T/B 10c/s-40 kc/s. Band width 1 Mc/s. Multirad DG 7/5 24in. CRT. For operation on 200/230V. A.C. Supplied complete with metal transit case, strap, test leads, and visor hood. Brand new, £22.10.0. Carr. 10/- Supplied complete with instructions.



### OS/8B/U OSCILLOSCOPES

High quality Portable American Oscilloscope, 3in. c.r.t. T/B 2c/s-50kc/s X Amp: 0-500 kc/s Y Amp: 0.2 Mc/s. Power requirements 105-125V. A.C. Supplied in brand new condition. Fully tested. £25. Carr. 10/- Suitcase 230-115 v. Transformer, 15/6.



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



### TE-20 RF SIGNAL GENERATOR

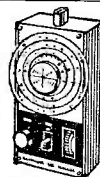
Accurate wide range signal generator covering 120 kc/s-240Mc/s on 6 bands. Directly calibrated. Variable R.F. attenuator. Operation 200/240V. A.C. Brand new with instructions. £12.10.0. P. & P. 7/8. S.A.E. for details.

### LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYSER

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

### LAFAYETTE NUVISTOR GRID DIP METER

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



### TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20 cps to 200 kc/s. on 4 hands. Square: 20 cps to 30 kc/s. Output impedance 5,000 ohms. 200/230V. A.C. operation. Supplied Brand New and Guaranteed with instruction manual and leads. £15 Carr. 7/6.

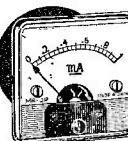


### NOMBREX EQUIPMENT

Transistorised Audio Generator 10-100,000 c/s. Sine or square wave. £16.15.0. Transistorised Signal Generator 150 kc/s. 350 Mc/s. £10.10.0. Transistorised resistance capacity bridge 1Ω-100 MegΩ. 1pF-100pF. £9.0.0. Transistorised Induction bridge, 1µN-100H. £18. Mains operated Transistor power supply unit, output 1-15v. up to 100mA. £6.10.0. All above post paid with battery.

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1mA ..... 22/6 750mA ..... 22/6 500V D.C. .... 22/6  
2mA ..... 22/6 1A D.C. .... 22/6 750V D.C. .... 22/6  
5mA ..... 22/6 2A D.C. .... 22/6 15V A.C. .... 22/6  
10mA ..... 22/6 5A D.C. .... 22/6 50V A.C. .... 22/6  
20mA ..... 22/6 10V D.C. .... 22/6 150V A.C. .... 22/6  
30mA ..... 22/6 10V D.C. .... 22/6 300V A.C. .... 22/6  
50µA ..... 25/6 100mA ..... 22/6 500V A.C. .... 22/6  
500µA ..... 25/6 150mA ..... 22/6 50V D.C. .... 22/6 'S' Meter 1mA 29/6  
50-0-500µA 29/6 POST EXTRA. Larger sizes available—send for lists.



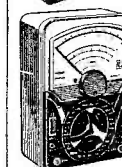
TE-51 NEW 20,000Ω/VOLT MULTIMETER  
0 / 10 / 60 / 120 / 1,200V. A.C.  
0 / 3 / 30 / 60 / 300 / 600/3,000V. D.C.  
0 / 60µA / 12 / 300 mA. D.C.  
0 / 60K / 6 Meg.Ω  
55/- P. & P. 2/6.



MODEL TE-12 20,000 O.P.V. 0.06/0.1/100/1,200/6,000/5,000V. D.C. 0/6/30/120/600/1,200 v. A.C. 0/60µA/6/60/600mA 0/6K/600K/6 Meg/60 Meg.Ω. P.F. -2 MFD. £5.19.6. P. & P. 3/6.

### MODEL PV-58 VALUE VOLTMETER

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



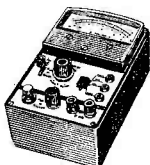
MODEL 500. 30,000 opv. 0.1/1.2/5/10/25 / 100 / 250 / 500 / 1,000 v. D.C. 0 / 2.5 / 10 / 25 / 100 / 250 / 500 / 1,000 v. A.C. 0 / 50µA / 5 / 50 / 500mA. 12 amp D.C. 0 / 60K / 6 Meg.Ω / 60 Meg.Ω. £8.17.6. Post paid.

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Open 9 a.m. to 6 p.m. every day Monday to Saturday. Trade supplied.

### ZQM TRANSISTOR CHECKER

It has the full-test capacity for checking on A, B and C. Equally adaptable for checking diodes, etc. S p e c . A : 0-70-9997. B : 5-200. Inc. 0-50 microamps, 0-5 mA. Resistance for diode 200Ω-1 MEG. Supplied complete with instructions, battery and leads. £6.19.6. P. & P. 2/6.



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Brand New Condition—Fully Tested and Checked before despatch. 3 Waveband with RF Stage—Wonderful value. 890-2080 metres 190-570 metres 3.6-16 Mc/s. with internal speaker £8.19.6. Carr. 10/6 with circuit. Plug in external power units. 230V A.C. 35/-, or 12V D.C. 19/6.

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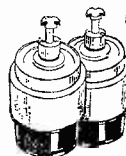
### MAGNAVOX-COLLARO 363 TAPE DECKS

The very latest 3 speed model—1 $\frac{1}{2}$ , 3 $\frac{1}{2}$ , 7 $\frac{1}{2}$  i.p.s. available with either  $\frac{1}{2}$  track or  $\frac{1}{4}$  track head. Features include: Pause control; digital counter; fast forward and rewind; new 4 pole fully screened induction motor; interlocking keys. Size of top plate 13 $\frac{1}{2}$  x 11 x 5 $\frac{1}{2}$  in. deep below unit plate. For 300/250 v. A.C. mains 50 c.p.s. operation. New unused and fully guaranteed.

### LIND-AIR PRICE

$\frac{1}{2}$  track model **£10.10.0** 3 track model **£13.9.6**

Carriage and Packing 7/6 extra.



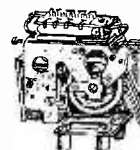
### 50V. SERVO SYSTEM

A unique offer of a pair of 50-volt, 50-cycle servos that enable remote indication of angular position to be made. These are ideal for monitoring Wind Directions in the comfort of the home, or the position of an aerial system for amateur broadcasting enthusiasts. The exact position of a roulette wheel could be "guessed" by a magician using our system.

It should be noted that 50 v. is readily obtainable, by using the 200-250-volt tap on any mains transformer.

Size of magnet motor 3 $\frac{1}{2}$  in. x 7 in.

Cost of pair, 75/-, plus 5/- P. & P.



### SELECTOR DRIVE

A very interesting item with numerous applications consisting of an electro-magnet and brass tooth wheel. A switch water and contacts are coupled to this and are arranged to be on for 10 pulses and off for the next 15. An auxiliary contact is normally on, but off for one in every 25 pulses; complete with suppressor resistors and a series contact to facilitate continuous operation. Absolutely ideal for window displays, switching lamps or models, 12 or 24 v. D.C. Brand New and Boxed, 12/6, inc. P. & P.

### SINCLAIR SUPER MINIATURES

Micro 6 miniature radio	£2 19 6
Micro-FM (tuner/receiver)	£5 19 6
PZ3 M.P.S. unit	£3 19 6
Z-12 12 watt amp and pre-amp, fully built	24 9 6
STEREO 25 pre-amp control unit, fully built	£9 19 6
P. & P. 3/6 each.	

### SYNCHRONOUS CLOCK MOTORS

Gearred for 40 revolutions per hour. 230 v. 50 cycles. With mounting flanges. 29/6. P. & P. 1/6.

### MODEL MAKER'S

Miniature D.C. Motor. Ideal for driving a gear system or can be used as a Tachometer. Speed 10,900 r.p.m. at 250 mA. 6.3 v. D.C. Housed in black ebonite case size 1 $\frac{1}{2}$  in. x 1 in. dia. Spindle 1 $\frac{1}{2}$  in. long x 3/16 in. dia. 9/6. P. & P. 2/6.



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Ideal for model makers, home repairs, electronics, radio, TV, etc. Unique features include interchangeable tips, extension barrels, comfortable grip with trigger control. "U" shaped 3 $\frac{1}{2}$  in. bit to minimise wear. Light beam is automatically directed onto end of bit when ON/OFF trigger is in use. 85 watt element with special ventilation. Complete with 2-pin, 5 amp. plug, 230-250 volts. Spares available. **49/6** +2/6 P.P.

### SUPER LIGHTWEIGHT PILOT'S HEADSET



**COMPLETE WITH BOOM MICROPHONE**  
Made to highest Ministry specifications as used by Airlines. High imp. Complete with 6ft. cable. 75/-, P. & P. 2/6.

### 'SMITH' 1/10th second RECORDING STOPWATCH



**UNREPEATABLE AT ONLY 77/6**  
Postage & packing 2/6.  
Time those sporting events, records, films, etc., yourself with this excellent ex-service timer, offered at rock bottom bargain price. Pattern 3189, manufactured to stringent government specifications. Jewelled movement, 1/10th sec. recorder, 0-15 min. register and functions with three pressures (start, stop and return) on crown. 14 Days! Approval for cash. 12 Months' Guarantee.

### FANTAVOX STEREO AMPLIFIER MODEL MG-333

The Stereo MG-333 is a compact and handsomely designed dual channel amplifier for use with stereo record players and AM or FM tuners. The amplifier operates from a power source of 105-125 (or 200-240) volts, 50/60 cycle AC, and is equipped with individual volume controls for each channel, a continuously variable tone control, and a stereo-monophonic mode switch. Price £8.19.6, P & P 6/6.

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C1001 20,000 $\Omega$ /volt	£3 12 6	P. & P. 3/6
B-14 1,000 $\Omega$ /volt	£2 2 0	P. & P. 3/6
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New AVO Meters from stock.		
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GET103 4/-	V15/20P 8/-	AF117 7/6
GET104 4/-	V60/201F8/-	ACY20 5/-
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OC81D 6/-		

(Postage and Packing 1/-)

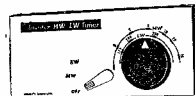
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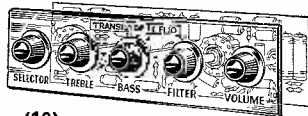




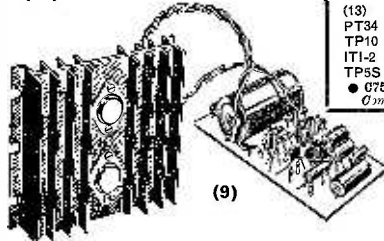
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### HENRY'S RADIO LTD.

303 EDGWARE RD., LONDON W.2.  
PADdington 1008/9 (STD: 01-723-1008)  
Open Mon. to Sat. 9-6, Thurs. 1 p.m.  
Open all day Saturday.

## 10 AND 20 WATT MONO AND STEREO TRANSISTOR AMPLIFIERS

(9) **POWER AMPLIFIERS.** 10 watts RMS output. 100mV input. 30 c/s to 20k/c/s  $\pm$  1dB. 6-Transistor Push-pull. Panel size 4 x 2½ x 1 in. H/S 4 x 4 in.  
**TPA10/3** 3-5 ohm spkr. £4.10.0, pp. 2/6.  
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### 25 WATT AMPLIFIER

8-Transistor design. Push-pull output for 7½ to 16 ohm speaker. 150mV input. 30c/s to 20k/c/s  $\pm$  1dB. For use with valve or transistor preamplifiers as item (10) above.

**PRICE BUILT AND TESTED £7.19.6 P.P. 3/-**  
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(13) **MULTI-METERS SCOPE**  
PT34 1kV 39/6 EP30k 30kV £8.10.0  
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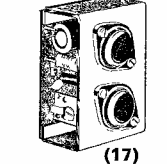
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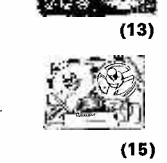
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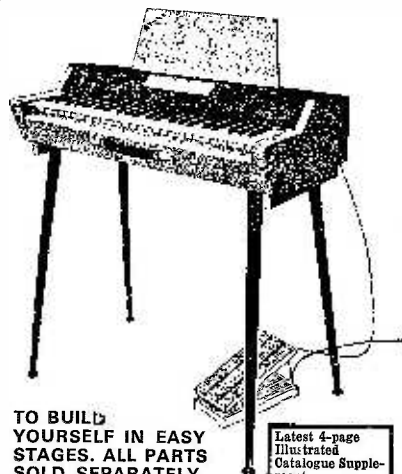
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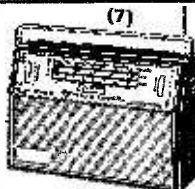
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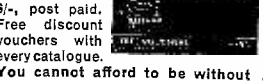
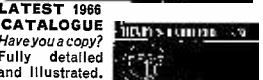
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