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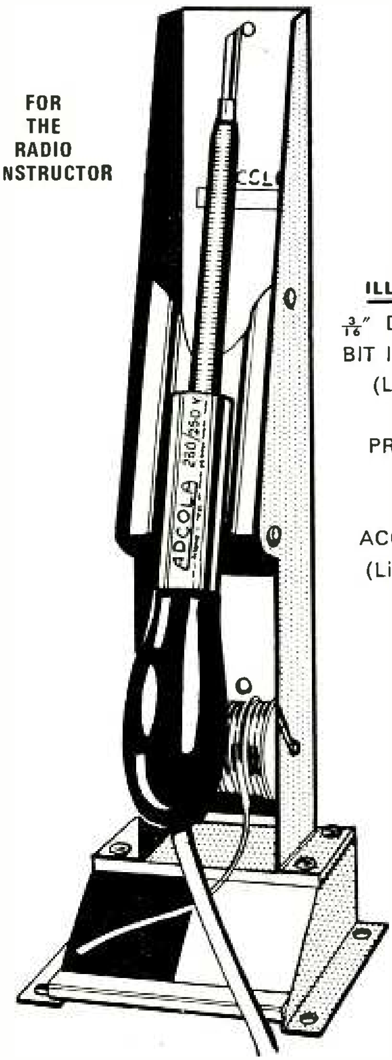

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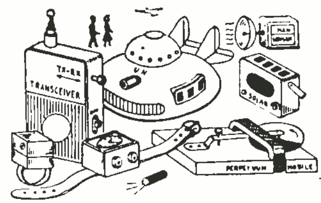

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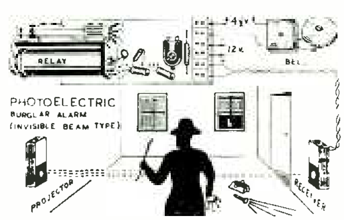

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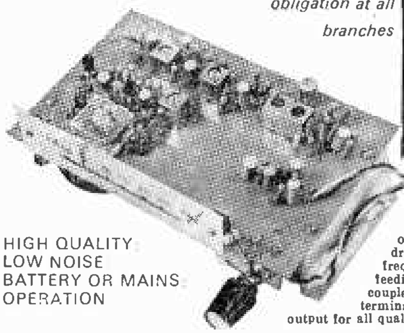

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6J7GT	9/6	14S7	14/6	EB91	2/9	EY51	7/6	PY32	9/6	UL84	6/8
6K7G	2/8	19AQ5	5/6	EBC33	7/6	EY86	7/6	PY33	7/6	UM80	9/6
6K7GT	5/9	20D1	8/9	EBC41	9/6	EY88	8/6	PY80	5/9	UY21	8/9
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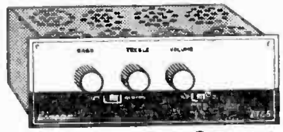

A High Fidelity unit providing excellent results at modest output levels.

Frequency Response 30-20,000 cps—2dB
Sensitivity 5 mv (max
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Output for 3-8-15 ohm Loudspeakers.
Input Sockets for "Mike," Gram and Radio Tuner/Tape Recorder.

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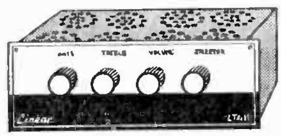
Controls (5) Volume, Bass, Treble, Mains Switch, Input Selector Switch.

LTA15 15 WATT AMPLIFIER



High Fidelity Output switched inputs for Gram, "Mike," Tape, and Radio.

Frequency Response 10-40,000 cps—3dB
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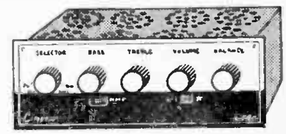
Recommended Retail price 16 gns
Size 9¼ × 3⅜ × 5¼in.
Output for 3-8-15 ohm Loudspeakers.

LT66 12 WATT STEREO AMPLIFIER



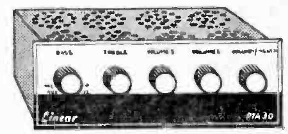
A twin channel version of the LT55 providing up to 6 watts High Fidelity output on each channel.

Switched Input Facilities Socket (1) Tape or crystal PU (2) Radio Tuner (3) Ceramic PU Microphone
Controls (6) Volume, Bass, Treble, Balance, Mains Switch, Input Selector Switch. Stereo/Mono Switch.

Recommended Retail price 15 gns
Size 12 × 3½ × 6in.

Facia Plate Rigid Perspex with black/silver background and matching black edged knobs with spun silver centres.

PTA30 HI-FI PUBLIC ADDRESS AMPLIFIER



A successor to our popular Concord 30 watt unit.

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- ★ Output 30 watts.
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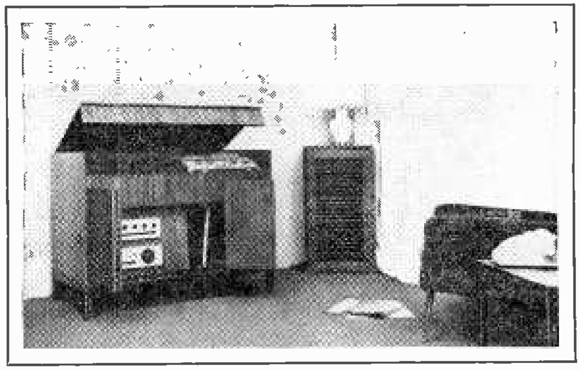

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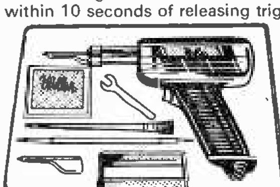

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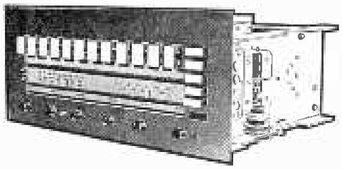

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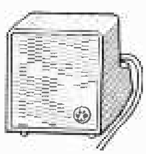

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4in. Triple play, 900ft. Mylar	17	6	7in. Standard play, 1200ft. Acet.	12	6
5in. Double play, 1200ft. Mylar	15	0	7in. Standard play, 1200ft. Mylar	12	6
5in. Long play, 900ft. Acetate	10	0	7in. Long play, 1800ft. Mylar ..	19	6
5in. Standard play, 600ft. PVC	8	6	7in. Double play, 2400ft. Mylar	26	0
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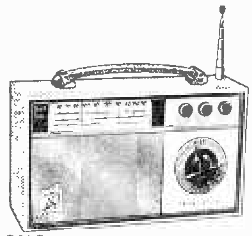

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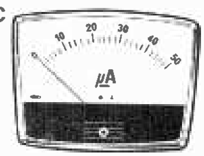

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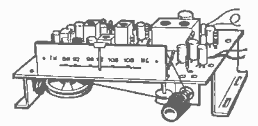
300 V DC	25/-	300 V DC	35/-
500µA	25/-	500µA	39/6
1 mA S Meter	35/-	1 mA S Meter	37/6

TRANSISTOR FM TUNER CHASSIS



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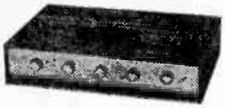
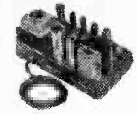
HI-FI AMPLIFIERS — TUNERS — RECORD PLAYERS

20+20 STEREO AMP. AA-22U

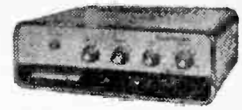


GARRARD PLAYER AT-60

10W POWER AMP. MA-12



9+9W STEREO AMP. S-99



TRANSISTOR MIXER. MODEL TM-1. Four channels. Battery operated. Kit **£11.16.6.** Assembled **£16.17.6**

TRANSISTOR STEREO AMPLIFIER. Model **AA-22U.** 20 + 20W ± 1dB over 15 to 30,000 c/s into 8Ω. 5 stereo inputs each channel. Versatile controls. 20 transistor, 10 diode circuit. Modern low silhouette styling . . . matches AFM-1, AFM-2 Tuners. **Kit £39.10.0. Assembled £57.10.0** (Cabinet £2.5.0 extra).

GARRARD AUTO/RECORD PLAYER. Model **AT-60,** less cartridge **£14.12.10.** With Decca Deram pick-up **£19.7.4** incl. P.T.

LOW-COST MONO AMPLIFIER. Model **MA-5.** 5W. Built in pre-amp. Inputs for Gram, Radio. Separate bass, treble, volume controls. Easy printed circuit construction. Modern functional appearance. **Kit £11.9.6. Assembled £15.15.0**

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

CONTROL UNITS. Mono, UMC-1. Kit **£9.2.6.** Assembled **£14.2.6.** Stereo, USC-1. Kit **£19.19.0.** Assembled **£27.5.0.**

DE LUXE STEREO AMPLIFIER. Model **S-33H.** 3 + 3W output. Three stereo inputs . . . ceramic/crystal pickup, radio tuner and aux. Separate bass, treble, volume and balance controls. Easy printed circuit construction. Attractive styling. 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. Matches FM-4U and AFM-1 tuners in styling. Kit **£28.9.6** Assembled **£38.9.6**

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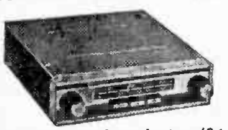
HIGH PERFORMANCE CAR RADIO CR-1



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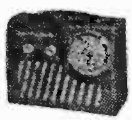
RADIOS

Oxford

"OXFORD" LUXURY PORTABLE Model **UXR-2.** 7 transistor, 3 diode circuit. 7″ x 4″ LS. Push button LW/LM and Tone. Specially designed for use as a domestic or personal portable receiver. Many features, including solid leather case. Kit **£14.18.0** incl. P.T.



UXR-1

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

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

TRANSISTOR STEREO FM TUNER. Elegantly designed to match the Stereo Amplifier, model AA-22U seen above. Many special features include built-in power supply. Available in two units sold separately, can be built for a **TOTAL PRICE KIT (STEREO) £24.18.0** incl. P.T. Cabinet **£2.5.0** extra. **(MONO)** version **£20.19.0** Kit.

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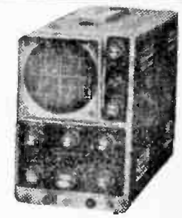
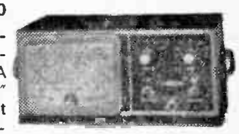


OS-2

3″ LOW-PRICED SERVICE OSCILLOSCOPE. Model **OS-2.** Compact size 5″ x 7⅞″ x 12″ deep. Wt. only 9¾lb. "Y" bandwidth 2 c/s-3 Mc/s ±3dB Sensitivity 100mV/cm. T/B 20 c/s-200 kc/s in four ranges, fitted mu-metal CRT Shield. Modern functional styling. Kit **£23.18.0** Assembled **£31.18.0**

5″ GEN.-PURPOSE OSCILLOSCOPE. Model **10-12U.** An outstanding model with professional specification and styling. "Y" band width 3c/s-4·5 Mc/s ± 3dB. T/B 10 c/s-500 kc/s. Kit **£35.17.6.** Assembled **£45.15.0**



VVM, 1M-13U

DE LUXE LARGE-SCALE VALVE VOLTMETER. Model **1M-13U.** Circuit and specification based on the well-known model V-7A but with many worth-while refinements, 6″ Ernest Turner meter. Unique gimbal bracket allows operation of instrument in many positions. Modern styling. Kit **£18.18.0** Assembled **£26.18.0**

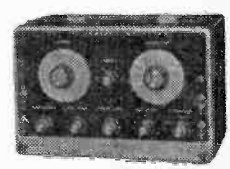
V-7A

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 0·1Ω to 1,000MΩ with internal battery. D.C. input resistance 11MΩ. dB measurement, has centre-zero scale. Complete with test prods, leads and standardising battery. Kit **£13.18.6** Assembled **£19.18.6**

MULTIMETER. Model **MM-1U.** Ranges 0–1·5V to 1,500V a.c. and d.c; 150μA to 15A d.c.; 0·2Ω to 20MΩ 4½″ 50μA meter. Kit **£12.18.0** Assembled **£18.11.6**

RF-1U

R.F. SIGNAL GENERATOR. Model **RF-1U.** Up to 100 Mc/s fundamentals and 200 Mc/s on harmonics. Up to 100mV output. Large accurate, calibrated dial scales. Factory wired and aligned coil and band switch assemblies. Ideal for the service shop. Kit **£13.18.0.** Assembled **£20.8.0.**



HFW-1

TV ALIGNMENT GENERATOR. Model **HFW-1.** Covers 3·6 Mc/s—220 Mc/s with 0-42 Mc/s max. sweep width. Stable all-electronic sweep circuit. Built-in marker oscillators—5 Mc/s crystal and 20 to 60 Mc/s variable. AGC circuit. Positive action return trace blanking. Kit **£38.18.0.** Assembled **£49.15.0.**

TRANSISTOR POWER SUPPLY. Model **IP-20U.** Up to 50V, 1·5A output Ideal for Laboratory use. Compact size. Kit **£35.8.0** Assembled **£47.8.9**

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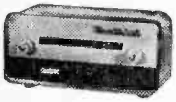
VALVE TUNERS



TUNERS
←FM
AM/FM→

★**HI-FI FM TUNER.** Model FM-4U. Covers 88-108 Mc/s. Flywheel tuning. Pre assembled and aligned. R.F. tuning unit (£2.15.0 incl. P.T.) with I.F. output of 10·7 Mc/s and I.F. amplifier unit, with power supply and valves (£13.13.0). For free standing or cabinet mounting. Total Kit £16.8.0

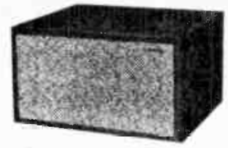
★**HI-FI AM/FM TUNER.** Model AFM-1. Covers AM 16 to 50 200-550 and 900-2000 metres FM 88-108 Mc/s. Pre-aligned Tuning Heart (AFM-T1—£4.13.6 incl. P.T.) and I.F. amplifier (AFM-A1—£22.11.6). Printed circuit board, 8 valves. Built-in power supply. Total Kit £27.5.0

★ Models available in two units for your convenience.

MULTIPLEX DECODER. Model SD.1. Convert above models to stereo at low cost. Transistorised circuit. Self powered. Compact, matching unit. Kit £8.10.0. Assembled £12.5.0.

LATEST MODELS

STEREO AMPLIFIER, TS-23



AVON SPEAKER

Low-priced 3 + 3 watt TRANSISTOR AMPLIFIER, TS-23
Breaks the price barrier in quality stereo amplifier cost. Incorporates all the essential features for good quality reproduction from gram, radio and other sources. 3W rms (15Ω) each channel. Good frequency response. Modern, compact, slim-line styling. Ganged controls. 6 position selector switch. 16 transistor, 4 diode circuit. Walnut veneered cabinet, optional extra. **Kit (Amplifier) £17.15.0 Cabinet £2.0.0** extra.

Good performance from a Mini speaker with the **'AVON' BOOKSHELF SPEAKER SYSTEM.** Occupies the minimum space consistent with first class reproduction. Only 7$\frac{3}{4}$" x 13$\frac{1}{4}$" x 8$\frac{5}{8}$" deep. Two special speakers 6$\frac{1}{2}$" BASS, 3$\frac{3}{8}$" HF unit and crossover network. Kit £4.18.0 incl. P.T. Walnut veneered, Fully finished cabinet, kit £8.18.0.
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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.
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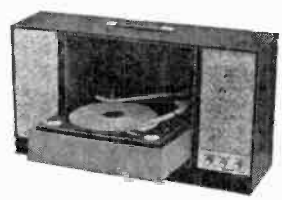
New! Portable Stereo Record Player, SRP-1



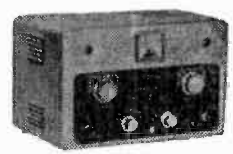
Automatic playing of 16, 33, 45 and 78 rpm records. All transistor—cool instant operation. Dual LP/78 stylus. Plays mono or stereo records. Suitcase portability. Detachable speaker enclosure for best stereo effect. Two 8in. x 5in. special loudspeakers. For 220-250v ac mains operation. Overall cabinet size 15$\frac{9}{16}$ x 3$\frac{7}{8}$ x 10$\frac{1}{4}$in.

Compact, economical stereo and mono record playing for the whole Family—plays anything from the Beatles to Bartok. All solid-state circuitry gives room filling volume.

KIT **£27.15.0** Assembled price on request.

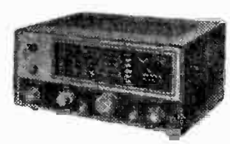
"AMATEUR" EQUIPMENT

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



DX-40U

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



RA-1

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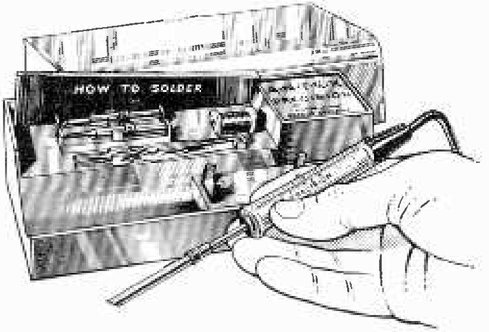

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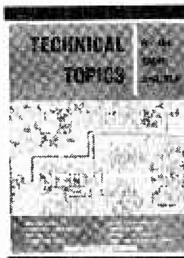

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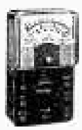
POCKET MULTI-METER



Size 3⅞ x 2½ x 1⅜in. Meter size 2½ x 1⅜in. Sensitivity 1000 O.P.V. on both A.C. and D.C. volts. 0·15, 0-150, 0-1000. D.C. current 0·150mA. Resistance 0·100kΩ. Complete with test prods, battery and full instructions, 42/6. P. & P. 3/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value 15/- to every purchaser of the Pocket Multi-Meter.

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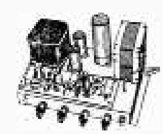
8-watt 4-valve PUSH-PULL AMPLIFIER & METAL RECTIFIER



Size: 9" x 6" x 1½". A.C. Mains, 200–250V, 4 valves. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Output 8 watts at 5 per cent of total distortion. Separate bass and treble lift control. Two inputs with controls for gram. and mike. Output transformer tapped for 3 and 15 ohm speech coils. Built and tested. **£4.4.0.** P. & P. 11/-, 8" x 5" speaker to suit price **14/6** plus 1/6 P. & P. Crystal mike to suit **12/6** plus 1/6 P. & P.

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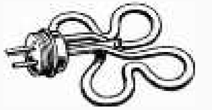

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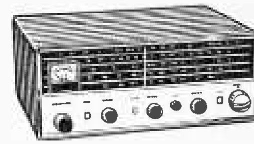

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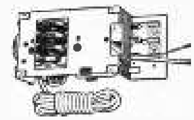

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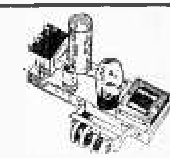

3-4 watt Amplifier built and tested. Chassis size 7 x 3¼ x 1in. Separate bass, treble and volume control. Double wound mains transformer, metal rectifier and output transformer for 3 ohms speaker. Valves ECC81 and 6V6. £2.5.0 plus 5/6 p. & p.
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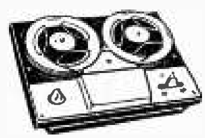

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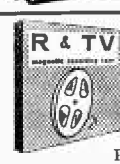

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3" L.P.	240ft.	4/–	5" T.P.	1800ft.	25/6
5¾" L.P.	1200ft.	11/6	5¾" T.P.	2400ft.	32/6
7" L.P.	1800ft.	18/6	7" T.P.	3600ft.	42/6
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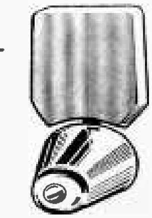

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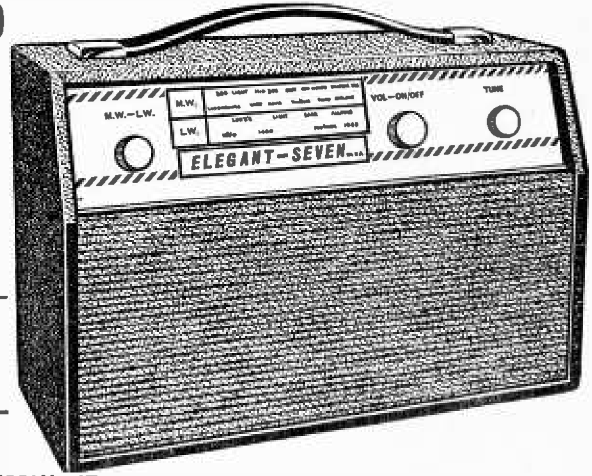

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2µF	..	150v	¾"×⅜"	W.E.	1	6
2µF	..	275v	⅞"×½"	W.E.	2	0
2µF	..	350v	1"×½"	W.E.	2	0
2µF	..	500v	1¼"×½"	W.E.	2	6
4µF	..	25v	1"×½"	W.E.	1	6
4µF	..	150v	¾"×⅜"	W.E.	1	6
4µF	..	275v	1"×½"	W.E.	2	0
4µF	..	350v	1"×½"	W.E.	2	6
4µF	..	500v	1¼"×⅝	W.E.	3	0
5µF Rev		20v	1½"×⅝"	W.E.	2	6
5µF	..	50v	¾"×⅜"	W.E.	1	6
5µF	..	70v	¾"×⅜"	W.E.	1	6
6µF Rev		50v	1½"×⅝"	W.E.	2	6
8µF Rev		20v	1¾"×¾"	W.E.	2	6
8µF	..	150v	1"×¼"	W.E.	1	6
8µF	..	275v	1⅛"×½"	W.E.	2	0
8µF	..	350v	1¼"×⅝"	W.E.	2	6
8µF	..	500v	1½"×⅝"	W.E.	3	0
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10µF	..	50v	¾"×⅜"	W.E.	1	6
10µF	..	150v	1"×½"	W.E.	1	9
10µF	..	300v	1¼"×½"	W.E.	2	0
16µF	..	250v	1½"×⅝"	W.E.	2	0
16µF	..	350v	1¾"×1"	W.E.	3	0
16µF	..	500v	1¾"×1"	W.E.	2	0
25µF	..	12v	¾"×½"	W.E.	1	6
25µF	..	25v	¾"×½"	W.E.	1	6
25µF	..	50v	1"×½"	W.E.	1	9
30µF	..	6v	¾"×⅜"	W.E.	1	6
30µF	..	10v	¾"×⅜"	W.E.	1	6
32µF	..	150v	1½"×⅝"	T.1.	2	6
32µF	..	350v	2"×1"	T.3	3	6
32µF	..	450v	1⅜"×1"	W.E.	4	6
32µF	..	500v	2"×1⅜"	T.2	4	6

					s.	d.
50µF	..	12v	⅜"×⅞"	W.E.	1	6
50µF	..	25v	1"×½"	W.E.	1	6
50µF	..	50v	1¼"×½"	W.E.	1	9
50µF	..	275v	1½"×1"	T.1	3	0
50µF	..	350v	2"×1"	T.1	3	6
64µF	..	450v	2"×1⅜"	T.1	4	6
100µF	..	15v	1"×⅜"	W.E.	1	6
100µF	..	25v	1"×½"	W.E.	1	6
100µF	..	50v	1¼"×⅝"	W.E.	2	6
100µF	..	100v	1¾"×¾"	T.1	4	0
100µF	..	250v	3"×1"	T.1	4	6
100µF	..	350v	3"×1"	T.2	5	0
100µF	..	450v	3"×1⅜"	T.2	7	6
125µF	..	500v	4"×1⅜"	T.2	9	0
200µF	..	275v	2"×1⅜"	T.2	6	0
200µF	..	350v	3"×1⅜"	T.2	7	6
250µF	..	12v	1"×⅜"	W.E.	2	6
250µF	..	18v	1"×½"	W.E.	2	6
250µF	..	25v	1¼"×⅝"	W.E.	3	0
250µF	..	50v	1¾"×¾"	W.E.	4	6
350µF	..	12v	1¼"×⅝"	W.E.	2	6
350µF	..	25v	1½"×¾"	T.1	3	0
400µF	..	15v	1½"×⅝"	W.E.	3	0
400µF	..	30v	1¾"×¾"	W.E.	3	6
400µF	..	50v	1¾"×1"	W.E.	4	0
400µF	..	275v	4"×1⅜"	T.2	9	0
500µF	..	6v	1¼"×½"	W.E.	1	6
500µF	..	15v	1¼"×⅝"	W.E.	2	6
500µF	..	25v	1½"×¾"	W.E.	3	6
1,000µF	..	15v	2"×¾"	W.E.	3	9
1,000µF	..	18v	1¼"×¾"	W.E.	3	9
1.000µF	..	25v	1¾"×1"	W.E.	4	6
1,000µF	..	50v	2"×1⅜"	T.2	7	6
1,500µF	..	25v	1½"×⅜"	W.E.	5	6
1.500µF	..	50v	3"×1"	W.E.	7	6
2,000µF	..	25v	3"×1"	T.2	6	0
2,000µF	..	50v	2½"×1⅜"	T.2	9	0

				s.	d
2,500µF ..	30v	3"×1⅜"	T.2	7	6
2,500µF ..	50v	4"×1⅜"	T.2	10	0
4,000µF ..	25v	3"×1⅜"	T.2	9	0
5,000µF ..	25v	3"×1⅜"	T.2	10	0
10,000µF	25v	4"×1¾"	T.2	27	6
30,000µF	30v	4½"×2½"	T.2	45	0
32×32µF	350v	2½"×1"	T.3	4	6
50×50µF	350v	2"×1⅜"	T.3	6	6
60×100µF	275v	2"×1⅜"	T.2	6	0
60×250µF	350v	4"×1⅜"	T.2	12	6
100×100µF	150v	3"×1"	T.3	4	6
100×200µF	275v	4"×1⅜"	T.2	9	6
150×200µF	350v	4"×1½"	T.2	12	6
250×250µF	325v	4½"×1½"	T.2	14	0

TERMINATION CODING

W.E. Wire Ended.
T.1 Tag each end of condenser
T.2 Single end tag termination
T.3 Single end tag termination
Twist prong fixing.

8×8µF ..	450v	1½"×1"	T.1	4	0
8×16µF	450v	2"×1"	T.1	4	6
16×16µF	275v	2"×¾"	T.1	4	0
16×16µF	450v	2"×1"	T.1	4	6
16×32µF	275v	1¾"×1"	T.1	4	0
32×32µF	275v	2"×1"	T.3	4	0
50×50µF	300v	2"×1⅜"	T.2	4	6
50×150µF	300v	3½"×1"	T.2	6	6
60×250µF	275v	4"×1⅜"	T.2	9	0
80×40µF	450v	4"×1⅜"	T.2	12	6
100×100µF	275v	3"×1⅜"	T.2	6	6
100×400µF	275v	4½"×1½"	T.2	13	6
200×200µF	300v	4"×1½"	T.2	12	6
300×300µF	300v	4"×1¾"	T.2	14	0

The above list represents just part of the extensive range of electrolytic condensers we carry in stock. All condensers are new and carry a twelve month guarantee. Please do not hesitate to contact us for quotations on bulk quantities. If you do not see the exact condenser you require please let us know your exact requirements.

Please send S.A.E. for Lists of Transformers, Transistors, Diodes, Rectifiers, Speakers and other components at Bargain Prices.

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VALVE LIST—Ex Equipment. 3 months' guarantee 10F1, EF80, EB91, ECL80, EF50, PY82, PZ30, 20P3. All at 10/- per doz. Post paid. Single valves, post 7d.

ARP12	1/6	EL38	5/–	PY81	1/6	U801	8/6	5U4G	4/–
EB91	9d.	EY86	5/–	PY82	1/6	10C2	5/–	6B8	1/8
EBF80	3/–	KT36	5/–	PZ30	5/–	10P13	2/6	6K7	1/9
ECC81	3/–	PCC84	2/–	U25	5/–	185BT	8/6	6K25	5/–
ECC82	3/–	PCF80	2/–	U191	5/–	20D1	3/–	6P25	5/–
ECC83	4/–	PCL82	4/–	U281	5/–	20L1	5/–	6U4	5/–
ECL80	1/6	PL36	5/–	U282	5/–	20P1	5/–	6V6	1/9
EF50	1/–	PL38	7/–	U301	5/–				
EF80	1/6	PL81	4/–	U329	5/–	20P3	2/6	6P28	5/–
EF91	9d.	PY33	5/–	U251	5/–	20P4	8/6	EY51	2/6

NEW VALVES EX UNITS

IT4, 2/-; 1L4, 2/-; IA3, 2/6; IS5, 2/6; 12AT7, 3/-; 3A4, 2/6; EF91, 2/-; EB91, 1/3; EL91, 2/-; UU8, 4/-; 6SN7, 2/6; 10P13, 4/-; box of 50 ARP12 Valves, 22/-, post paid.

New Boxed TV Tubes. 14in. MW36/44, 40/-. Carriage 10/-. 12 months' guarantee.

90 degree Tubes. Twelve months' guarantee. Slight glass fault, 30/- and 50/-. Carriage 10/-.

Special Offer. 19 Sets, Mark 3, in good clean condition. Parts removed, B section, 807 valve and TX section made US. Receiver Bench Tested, all you would need is a Power Pack. Price 35/-. Carriage 10/-.

19 Sets in fair condition as above and also removed is the meter and relay, 10/-. Carriage 10/-. Not tested.

Speakers, removed from TV sets, all 3 ohm PM. and perfect, 6 x 4in. and 6in. round, 3/-, post 2/9. 6 for 22/-, post paid. 7 x 4in., 5/-, post 2/9. 6 for 34/-, post paid. 8in. round, 6/6, post 3/6. 10 x 5in., 10/-, post 3/6. 8 x 5in., 6/6, post 3/6.

New 12in. Speakers with built in tweeter, 28/6, post paid.

Ex Equipment Ekco L.O.P.T. U25 type or U26, 17/6, post 2/-.

Silicon Rectifiers. 500mA 800 PIV, 2/6. 6 amps 400 PIV, 4/-.

Thyristors. 5 Amp 100 PIV, 6/6. 5 Amp 200 PIV, 8/-. 5 Amp. 300 PIV, 10/-. 5 Amp 400 PIV, 12/-, post paid.

Reclaimed Tubes. Six months' guarantee, AW43/80, 40/-. MW43/80, 30/-. MW43/69, 30/-. CRM172, 30/-. CRM142, 17/-. 12in. Tubes, 10/-. 17in. Tubes, perfect but without guarantee, 17/-. Carriage on any Tube in G.B., 10/-.

Ex Washing Machine Motors. Fully guaranteed. Single phase ¼ h.p., 26/-. Sixth h.p., 15/-. Plus carriage, 10/-.

Jap Personal Earpiece, small or large plug, 1/11. Post paid.

Top Grade Diodes, 3/6 per dozen. Post paid. No duds.

Top Grade Mylar Tapes, 7in. Standard, 11/6. L.P., 14/-. 7in. D.P., 19/6. 5in. Standard, 7/9. L.P., 10/-. Post 1/6 per tape.

New Test Set Type 5B. Complete with valves and 0–1 mA 3in. meter LESS crystal. 35/-. Carr. 10/-.

Special Offer. Good MW43/64 tubes 17in. 10/-. Carriage 10/-.

Small S.W. Chassis 6in. x 4in. Complete with Slow Motion Drives and Condensers. 3/9. Post 6/6.

88 Set RX TX, less Send–Receive Switch. Crystals and Valves. 3/3. Post 5/-.

U.S.A. tube unit B.C. 993A. Complete with 16 valves, tuning meter 3 inch tube type 3EP1. Used condition not guaranteed. 27/-, carriage 10/-.

U.S.A. tube unit, complete with two 5FP7 tubes 6H6 valves relay ECT 12/6, carriage 10/-. Used condition, not guaranteed.

Electronic Scrap, Half Cwt. 10/-. Carriage 20/-.

U.S.A. Battery Set Type 486–9 Mcs. Complete with six valves in clean condition. Not tested. 10/- and p/p 6/6.

Electric Clock Movement with train of Brass Gear Wheels. Tested 230–250 Volts A/C. 8/6 plus p/p 4/6.

Un-tested 13 Channel TV Sets 17 inch 50/-, 14 inch 30/-. Carriage 15/-.

Our new Walk Round Room is now open. Full of Surplus Bargains. Also our Special Department, nothing over sixpence.

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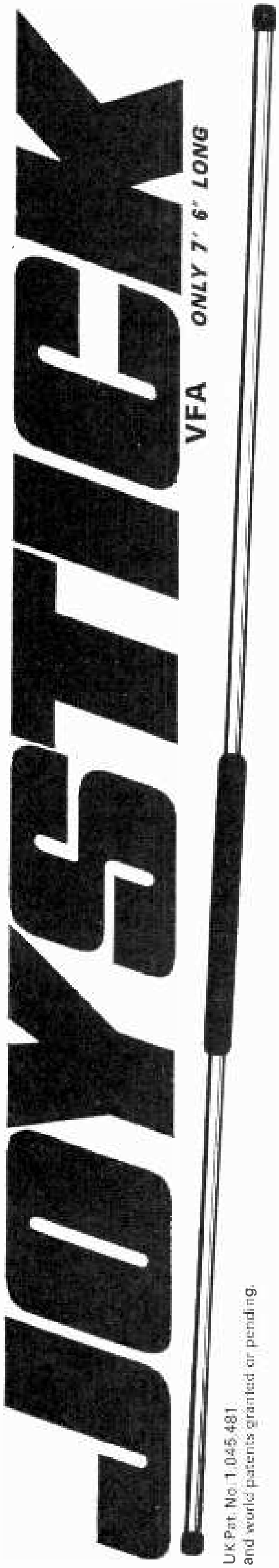
CMP 5



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and world patents granted or pending.

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EVERYONE KNOWS IT'S THE 'JET AGE' AERIAL!

BUT DO YOU KNOW SOMEONE ONCE ASKED

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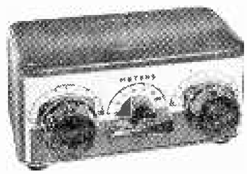
AND PRECIOUS FEW PEOPLE KNEW THE ANSWER

THAT'S PROGRESS!!

Bring **your** station right up-to-date with a Jet-age aerial!!

REMEMBER—THE PERFORMANCE OF THE JOYSTICK SYSTEM IS SUBSTANTIATED BY MASSES OF CUSTOMER TESTIMONIALS—ALSO BY THE FULL MONEY-BACK GUARANTEE—

WHAT'S YOUR PROBLEM?



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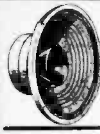
AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS



Heavy cast construction. Latest high efficiency ceramic magnets. Treated Cone surround giving low fundamental resonance. "D" indicates Tweeter Cone providing extended frequency range. Impedance 3 or 15 ohms. Response 40-18,000 c.p.s.

HF800D 8in. 8 watt	59/9	HF120 12in. 12 watt	69/9
HF811D 8in. 10 watt	£4.19.9	HF120D 12in. 12 watt	79/9
HF110D 10in. 8 watt	69/9	HF126 12in. 15 watt	89/9
HF101D 10in. 15 watt	£5.19.9	HF126D 12in. 15 watt	5 gns.
		HF127D 12in. 30 watt	9 gns.

R·S·C TA12 13 WATT STEREO AMPLIFIER

FULLY TRANSISTORISED, SOLID STATE CONSTRUCTION HIGH FIDELITY OUTPUT OF 6·5 WATTS PER CHANNEL.

Designed for optimum performance with any crystal or ceramic Gram P.U. cartridge. Radio Tuner. Tape Recorder, 'Mike' etc. ★ 3 separate switched input sockets on each channel ★ Separate Bass and Treble controls ★ Slide Switch for mono use ★ Speaker Output—3-15 ohms ★ For 200-250v. A.C. mains ★ Frequency Response 30-20,000 c.p.s. —2dB ★ Harmonic Distortion 0·3% at 1000 c.p.s. Hum and Noise —70dB ★ Sensitivities (1) 300mV (2) 100mV (3) 100mV (4) 2mV ★ Handsome brushed silver Facia and Knobs. Complete kit of parts with full wiring diagrams and instructions. Factory built with 12 mth gntee 14 Gns. Carr. 10/6 Teak finished cabinet as illustrated £3.13.6. ex. **11 GNS.**

RECORD PLAYING UNITS

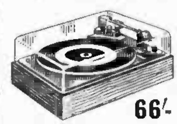
All types available on Credit Terms. Ready for plugging in to Amplifier or Tape Recorder.

RP2 Consisting of Garrard SP25 fitted Goldring CS90 high compliance ceramic Stereo/Mono ctrge with dmnd stylus. above. Only **19½ Gns.** plinth & cover. Normally £25. Carr. 15/-

RP3 As above but with Goldring Lenco GL68 Transcription unit and CS90 Cartridge **26½ Gns.** Normally over £33. Carr. 15/-. ONLY

RP3M with Pickering Magnetic Cartridge **34½ Gns.**

AUDIOTRINE PLINTHS



for Record Playing units. Teak finish cut for Garrard 1000, 2000, 3000. AT6 Mk 2, AT60, SP25 or Goldring GL68. **66/-** Available with clear Perspex cover as illustrated. *Complete* **£5.19.11**

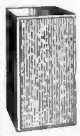
R·S·C·13 WATT HI-FI STEREO SYSTEM

Inc. Garrard SP25 Player Unit. Fitted Goldring CS90 high compliance ceramic cartridge with diamond stylus. TA 12 Stereo Amp. Plinth and Cover and Pair of Dorset Speaker Units. Total £56. Ready to use. **42 GNS.** Carr. 25/-.

HIGH FIDELITY LOUDSPEAKER UNITS

Cabinets of latest styling Satin Teak or Walnut, acoustically lined (and ported where appropriate). Credit terms available on all units.

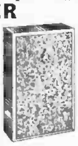
The FULTON Size 11 x 14 x 7in. Fitted Volume Control. Ideal as sensitive ext. unit for Tape Recorder etc. Incorporates Audiotrine HF810 8in. speaker with cast chassis and treated cone surround. Response 45-13,000 cps. Rating 8 watts. Imp. 3-8-15 ohms. Carr. 7/6 **£5.15.0**



The DORSET Size 20 x 11 x 8in. Response 45-18,000 c.p.s. Rating 10 watts. Fitted Audiotrine HF811D speaker. Impedance 3 or 15 ohms. Carr. 9/6 **£8.19.9**

The DORCHESTER Size 24 x 15 x 10in. Fitted Audiotrine HF101D Speaker Rating 12 watts. Impedance 3 or 15 ohms. Frequency Response 30-20,000 c.p.s. Carr. 15/- **12½ Gns.**

The GLOUCESTER Size 25 x 16 x 10in. 12in. High flux 12,000 line speaker. Cross-over unit and Tweeter. Rating 10 watts. Smooth response 40-20,000 c.p.s. Impedance 15 ohms. Carr. 15/-. **12½ Gns.**



The BRONTE Size 22 x 15 x 9in. Fitted Wharfedale Super 8 RSDD or Audiotrine HF 815D Speaker, with Roll surround and dual cone. Rating 6/10 watts. Impedance 3 or 15 ohms. Carr. 16/6. **13 Gns.**

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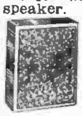
All types of pleasing modern design acoustically lined and ported and beautifully finished in light Teak or Walnut veneer. Credit terms available **JE8.** Size 20 x 11 x 8in. Gives pleasing results with any 8in. Hi-Fi speaker. Carr. 7/6 **£4.19.9**



SE8. For optimum performance with any Hi-Fi 8in. speaker. Size 22 x 15 x 9in. Carr. 7/6 **£5.19.9**

SE10. For outstanding results with 10in. Hi-Fi Speaker. Size 24 x 15 x 10in. Carr. 10/- **£6.19.9**

SE12. For outstanding performance with any 12in. Hi-Fi speaker. Cut for tweeter. Size 25x16x10½in. **8 Gns.** Carr. 10/-

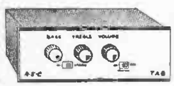
AUDIOTRINE HIGH FIDELITY SPEAKER SYSTEMS

Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit and Tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. Or **Senior 20 watt** inc. Fane. 122/10 speaker 7 Gns. Carr. 8/9. **5 Gns.** Carr. 6/9.

AUDIOTRINE HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST: CAN BE ASSEMBLED IN AN HOUR. ONLY 4 PAIRS OF SOLDERED JOINTS PLUS MAINS. S.A.E. for leaflet. Incorporating latest Magnavox Tapedeck. High Quality Tape Amplifier with switched equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, Reel of Best Quality Tape and handsome Portable Cabinet of latest styling, finished dark grey leathercloth. Size 14½ x 17 x 8½in. and circuit. Purchased separately would total approx. £34. Performance equal to units in the £50-£60 class. **Deposit 4 gns.** and 9 mthly paymts 59/6 (Total 29½ gns.) 4 Track Model 3 gns. extra. Carr. 19/6. **26½ Gns.**

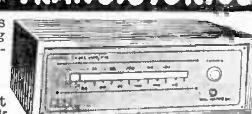
TA 6 WATT HIGH FIDELITY SOLID STATE AMPLIFIER



200-250v. AC mains operated Frequency Response 30-20,000 cps -2dB. Harmonic Distortion 0·3% at 1000 cps. Separate Bass and Treble 'lift' and 'cut' controls. 3 input sockets for Mike, Gram, Radio or Tape. Input Selector Switch. Output for 3-15 ohm speakers. Max. Sensitivity 5mV. Fully enclosed enamelled case. 9½ x 2½ x 5½ins. Attractive brushed silver facia plate 10½ x 3½ins. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. Carr. 7/6. Or factory built with 12 months guarantee £7.19.11. **6 Gns.**

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

Total cost of parts with detailed wiring diagrams & instructions. Carr. 10/- **12½ Gns.** Or factory built 15½ Gns. Or in Teak finished cabinet as illustrated 19½ Gns. Terms: Deposit £5 and 9 monthly payments 39/-. Total £22.11.0.



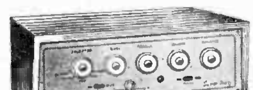
★High-sensitivity ★200-250v. A.C. Mains operation. ★Sharp A.M. Rejection. ★Drift-free reception. ★Output ample for any amplifier (approx. 500 m.v.). ★Simple alignment instructions. ★Output available for feeding tuning meter. ★Output for feeding Stereo Multiplexer. ★Tuner head using silicone Planar Transistors. ★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 perform'ce and reliability. The pre-wired tuning head facilitates speed and simplicity of constrctn. Printed circuitry. Only first grade transistors and componts used. Our latest product giving you the best at half the cost of comparable units. Stereo vrsn. Carr. 16/- **25½ GNS.**

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

SOLID STATE CONSTRUCTION

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.
LATEST MULLARD TRANSISTORS. AD149, AD149, OC127Z, OC81Z, 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 2.5mV. Radio/Aux or Ceramic P.U. 110 mV.
FREQUENCY RESPONSE: ±2dB 20-20,000 c.p.s.
TREBLE CONTROL: +15dB to —14dB at 10Kc/s. **NEG FEEDBACK:** 52dB.
BASS CONTROL: +12dB to —15dB at 50 c/s. **HUM LEVEL:** —75dB.
HARMONIC DISTORTION at 10 Watts 1,000 c.p.s. 0.25%.
Complete Kit of parts with full constructional details and point to point wiring diagrams. Carr. 12/6 **11½ Gns.**
Supplied factory built 15½ Gns. Carr. 12/6. Terms: Deposit 49/- and 9 monthly payments 35/- (Total £18.4.0). Or fitted in beautiful walnut or Teak veneered cabinet as illustrated. 4 Gns. extra.
ALL COMPONENTS ETC. ARE OF A HIGH STANDARD AND SUPPLIED BY LEADING BRITISH MANUFACTURERS.

SPECIFICATIONS COMPARABLE WITH UNITS AT ALMOST TWICE THE COST



R.S.C. SUPER 30 STEREO AMPLIFIER

A DUAL CHANNEL VERSION OF THE SUPER 15. Employing Twin Printed Circuits. Close tolerance Ganged Pots. Matched Components. **CROSS TALK:** —52dB at 1,000 c.p.s.
CONTROL: 5 position Input Selector. Bass Control. Treble Control. Volume Control. Balance Control. Stereo/Mono Switch. Tape Monitor Switch. Mains Switch. **INPUT SOCKETS** (Matched Pairs). (1) Magnetic P.U. (2) Ceramic or Crystal P.U. (3) Radio/Aux. (4) Tape Head/Microphone. Operation of the Input Selector Switch assures appropriate equalisation. Rigid 18 s.w.g. Chassis. Size approx. 12in. wide. 3in high and 8in. deep. Neon Panel indicator. Attractive Facia Plate and Spun Silver Matching Knobs. Above facilities, etc., except for Ganging and Balance Control, apply also to Super 15.
THESE UNITS ARE EMINENTLY SUITABLE FOR USE WITH ANY MAKE OF PICK-UP OR MICROPHONE (Crystal, Ceramic, Magnetic, Moving Coil, Ribbon). CURRENTLY AVAILABLE 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. 15/- **19 Gns.**
Unit factory built 26½ Gns. or deposit 83/9 and 9 monthly payments 59/3. (Total £30.17.0). Fitted cabinet as Super 15 30 Gns. Carr. 15/- or Deposit £4.15.6 and 9 monthly paymts 67/- (Total £34.18.6). *Send S.A.E. for leaflet*

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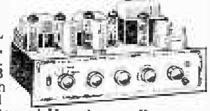
5 watts high quality output on each channel. Sensitivity 50 millivolts. Suitable all crystal or ceramic stereo heads. Ganged Bass and Treble Controls. Provision for use as straight (mono) 10 watt. Valves ECC83, ECC83, EL84, EL84, EZ81. For 2-3 ohm speakers. Complete kit with full wiring diagrams and instructions. Or supplied factory assembled with 12 months' guarantee for 11 gns. Carr. 11/6 **£8.15.0**
Terms: Dep. 36/- and 9 monthly payments 25/- (Total £13.4.9).

R.S.C. STEREO/20 HI-FI AMPLIFIER

PROVIDING 10/14 WATT ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL. SUITABLE FOR "MIKE", GRAM, RADIO OR TAPE. (7) valves ECC83, (2) ECL86, (4) EZ81. **Frequency Response**: +2dB 30-20,000 c.p.s. **Hum Level**: 65dB down. **Sensitivity**: 5 millivolts max. **Harmonic Distortion**: (each channel): 0·2%. ★**Four-position tone compensation and Input Selector Switch.** ★**Stereo/Mono switch.** ★**Neon panel indicator.** ★**Handsome Perspex Frontplate.** ★**Separate Bass "Lift" and "Cut" controls.** Output transformers are high-quality sectionally wound. Outputs for 3 and 15 ohm speakers. Complete set of parts, point-to-point wiring diagrams and instructions. Or factory assembled with our usual 12 months guarantee. Or Deposit £3 and 9 monthly payments 43/2 (Total £22.8.6). *Send S.A.E. for leaflet.* Carr. 12/6 **19 Gns.** **14 Gns.**

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

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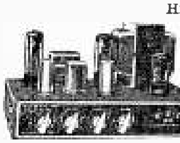
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TERMS: Deposit 48/- and 9 monthly payments of 33/7 (Total £17.10.3).

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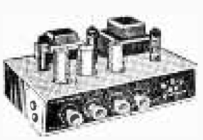
PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP Two input sockets with associated controls allow mixing of "mike" and gram. etc., etc. High sensitivity. Valves ECC83, ECC83, EL84, EL84, EZ81. High quality sectionally wound output transformer and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE. Frequency response +3dB 30-20.000c/s. Six negative feedback loops. Hum level —60dB. SENSITIVITY 23 millivolts. Suitable for Crystal or Ceramic P.U.s, all types "mikes". Comparable with the very best designs. For **Musical Instruments** such as **String Bass, Electronic Guitars,** etc. **Reserve Power** 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. Full instructions and point-to-point wiring diagrams (or factory built £11.15.0). **£8.15.0** Metal cover with 2 handles available for 21/-. **TERMS ON ASSEMBLED UNITS** Carr. 11/6 **Deposit** 36/6 and 9 monthly payments of **25/9** (Total £13.8.3). Send S.A.E. for leaflet.
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49½ Gns. 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.
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Consisting of Mains transformer. Metal Rectifier. Electrolytics, smoothing choke, chassis and circuit. 200/250v. A.C. mains. Output 250v. 60mA 6.3v. 2a. Supplied with case in lieu of chassis 26/11. Or assembled 39/11. **22/11**

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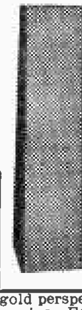
Covered in two-tone Rexine/Vynair, ideal for vocalists and Public Address. 15 ohm matching.
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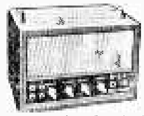
30 WATT HI-FI AMPLIFIER
for Guitar, Vocal or Instrumental Group

A 4 Input, 2 volume control Hi-Fi unit with Separate Bass and Treble controls. Latest valves. Strong Rexine covered cabinet with carrying handles. Attractive black/gold perspex facia. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet. **17 Gns.** Carr. 12/6 Deposit £3 and 9 monthly payments of 37/5 (Total £19.16.9).

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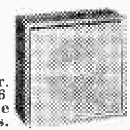
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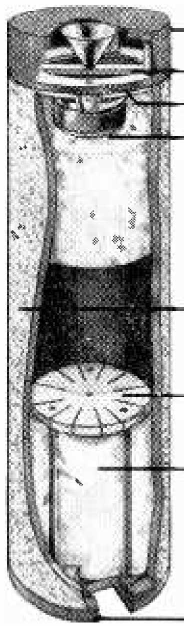

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Impedance 10/15 ohms. Pole size 1" diameter. Frequency range: 40–20,000 Hz. Aluminium voice coil. Roll surround and double diaphragm. Weight: 4½lb.
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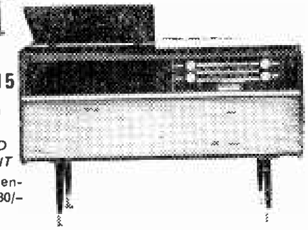

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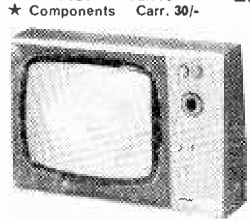

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6BG6G	15/-	30P4	12/-	ECC84	6/3	N78	14/9	R20	12/9	AF115	6/-
6BJ6	6/9	30P12	11/-	ECC85	5/6	N108	13/6	U25	11/6	AF116	6/6
6BW6	7/3	30P19	12/-	ECF80	7/-	PC86	8/-	U26	11/6	AF117	5/-
6C86	6/6	30PL1	14/6	ECF82	6/9	PC88	8/-	U47	13/6	AF118	8/6
6F1	7/9	30PL13	14/6	ECF86	9/-	PC97	5/9	U49	13/6	AF124	7/6
6F13	3/6	30PL14	14/6	ECH35	6/-	PC900	7/9	U52	4/6	AF125	7/6
6F14	9/-	35L6GT	7/6	ECH42	9/-	PCC84	5/6	U78	3/6	AF126	7/-
6F23	12/6	35W4	4/6	ECH81	5/3	PCC89	9/9	U191	11/6	AF127	7/-
6K7G	1/6	35Z4GT	4/6	ECH84	6/6	PCC189	8/6	U301	13/-	OC22	9/9
6K8G	4/3	6063	12/6	ECL80	6/-	PCF80	6/6	U801	18/-	OC25	9/6
6K8GT	7/6	AZ31	9/-	ECL82	6/3	PCF82	6/-	UC92	5/-	OC26	6/9
6L18	6/-	B36	4/9	ECL86	7/9	PCF86	9/-	UABC80	5/9	OC44	3/9
6V6G	3/6	B729	12/6	EF39	3/9	PCF800	10/6	UAF42	7/9	OC45	3/3
6V6GT	6/6	DAC32	7/3	EF41	9/6	PCF801	8/9	UB41	6/6	OC71	3/6
6X4	3/6	DAF91	3/9	EF80	4/9	PCF802	9/6	UBC41	6/9	OC72	4/9
6X5GT	5/9	DAF96	6/-	EF85	5/-	PCF805	11/9	UBF80	6/-	OC75	5/9
7B6	10/9	DCC90	7/-	EF86	6/3	PCF806	11/6	UBF89	5/9	OC81	3/6
7B7	7/-	DF33	7/9	EF89	5/-	PCF808	11/3	UBL21	9/-	OC81D	3/6
7C5	12/-	DF91	2/9	EF91	3/6	PCL82	6/9	UCC84	7/9	OC82	5/9
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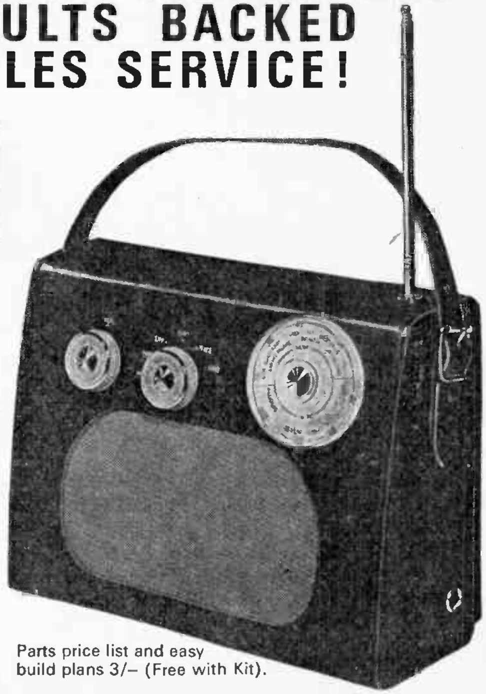

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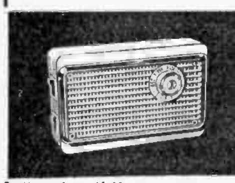
Parts price list and easy build plans 3/– (Free with Kit).

TRANSONA FIVE



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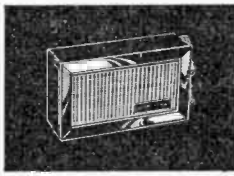
Attractive case with red speaker grille. Size 6¼ x 4¼ x 1½in. Fully tunable. 7 stages—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone super dynamic 3in. speaker, all first grade components. Easy build plans and parts price list 1/6. (FREE with kit).

Total building costs **42/6** P. & P. 3/6

POCKET FIVE



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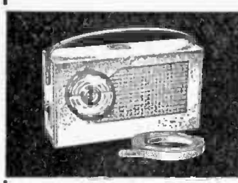
Attractive black and gold case. Size 5¼ x 1¼ x 3½in. Fully tunable over both Medium and Long Waves with extended M.W. band for easier tuning of Luxembourg, etc. All first grade components—7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone 3in. moving coil speaker etc. Easy build plans and parts price list. 1/6 (FREE with kit).

POCKET FIVE Medium and Long Wave version with miniature speaker ONLY 29/6. P. & P. 3/6.

Total building costs **42/6** P. & P. 3/6

MELODY SIX

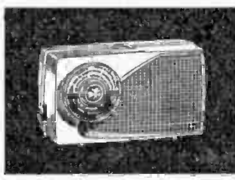


TWO WAVEBAND PORTABLE WITH 3in. SPEAKER

Handsome leather-look case size 6¾ x 3¼ x 1⅞in. with gilt trim and hand and shoulder straps. Fully tunable over both Medium and Long waves. Incorporates pre-tagged circuit board, 8 stages—6 transistors and 2 diodes, ferrite rod aerial, push-pull output, wave change slide switch, tuning condenser, volume control, 3in. moving coil speaker etc. Easy build plans and parts price list 2/-. (FREE with kit).

Total building costs **59/6** P. & P. 3/6

MELODY MAKER 6

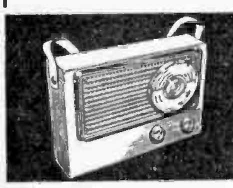


THREE WAVEBAND PORTABLE WITH 3in. SPEAKER

Smart pocket size case, 6¾ x 3¾ x 1¼in. with gilt fittings. Fully tunable over both Medium and Long Waves with extra M.W. band for easier tuning of Luxembourg, etc. 8 stages—6 transistors and 2 diodes, top grade 3in. speaker, 2 R.F. stages for extra boost, high "Q" ferrite rod aerial. Easy build plans and parts price list 2/- (FREE with kit).

Total building costs **69/6** P. & P. 3/6

ROAMER SIX

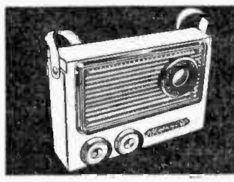


SIX WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case with gilt fittings, size 7½ x 5½ x 1¾in. World wide reception. Tunable on Medium and Long waves, two short waves, Trawler Band Plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short waves. All top grade components, 8 stages—6 transistors and 2 diodes including Philco Micro-Alloy R.F. Transistors etc. (Carrying strap 1/6 extra.) Easy build plans and parts price list 2/– (FREE with kit).

Total building costs **79/6** P. & P. 3/6

SUPER SEVEN



THREE WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case size 7½ x 5½ x 1¾in. wth gilt fittings and carrying strap. The ideal radio for home, car or outdoors. Covers Medium and Long Waves and Trawler Band. Special circuit incorporating 2 R.F. Stages, push pull output, ferrite rod aerial, 7 transistors and 2 diodes, 3in. speaker (will drive larger speaker) and all first grade components. Easy build plans and parts. Price list 2/- (FREE with kit).

Total building costs **79/6** P. & P. 3/6

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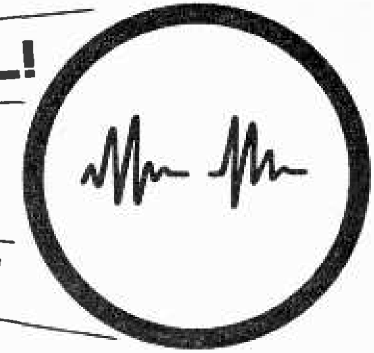

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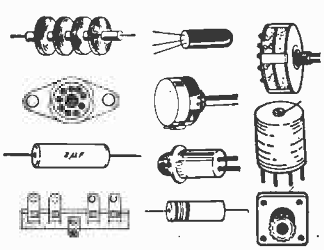

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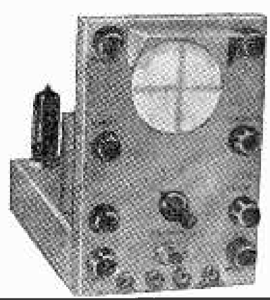

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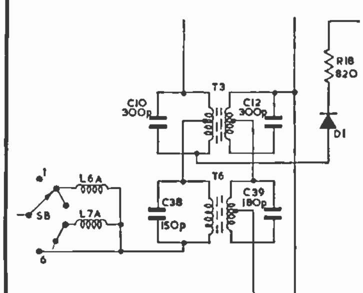

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PRACTICAL WIRELESS

VOL 43 No 7

issue 729

NOVEMBER 1967

TOPIC OF THE MONTH

Successful Servicing

WHEN we began the series "Repairing Radio Sets" in the April issue, we little realised how successful it would be. True we liked the material supplied by the joint authors, but long before the first half of the series ended in September it was clear that P.W. had come up with something of special interest. And this bore out the remark in the April leader that "inside most radio enthusiasts is a service engineer trying to break out"!

The second half of the series is due to start in the Spring and should be equally well received. And it has already been suggested that a further series, covering tape recorders, would be welcome. This can be arranged and if sufficient interest is shown we will make the necessary arrangements.

One reason we are so pleased at the response to Repairing Radio Sets is to see such an obviously keen interest in the actual subject matter. The repairing of faulty equipment, or the putting right of equipment which has never functioned properly, can be one of the most rewarding aspects of the hobby. Of course, it would be pleasant to have sets which never go wrong or constructional projects which work perfectly first time without even minor adjustments, but in that way many enthusiasts would learn little of what goes on behind the front panel.

There is nothing like having a sticky fault, and successfully diagnosing it, to provide a good understanding of what makes circuits work, or fail. The necessary probings, circuit tracing, testing, meter readings and brain searching should all help to expand both theoretical and practical knowledge.

Many beginners fail dismally in repairing sets because their basic approach is wrong. You might sometimes be lucky in finding the proverbial "loose screw" or disconnected wire, but little reliance can be placed on such fortuitous clues. Successful repair work needs not luck but a clear logical approach based on theory.

If our articles have only shown the way to get the mind thinking in a logical and progressive way when tackling faulty equipment then we are more than satisfied.

W. N. STEVENS—*Editor*

NEWS AND COMMENT

CONSTRUCTIONAL

OTHER FEATURES

DECEMBER ISSUE WILL BE PUBLISHED ON NOVEMBER 3rd

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 London, W.C.2. Subscription rates, including postage: 36s. per year to any part of the world.

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NEWS AND COMMENT...

G.B.—U.S. RESEARCH STATION

The Ministry of Defence and the United States Department of Defence are to collaborate in the construction and operation of a radio research station at Orfordness, Suffolk. The station will conduct joint research into problems of long-range propagation of radio signals.

The station will consist of a large aerial array and some associated buildings. Most of the technical equipment will be of American design and manufacture.

B.A.E.C. REDESIGN NEWSLETTER

The British Amateur Electronics Club have completely redesigned their sixth Newsletter. It now has a format measuring 8 x 10in. and contains, for the first time, letters written by members all over the British Isles.

The B.A.E.C. is starting a series of meetings at the Penarth Secondary School, St. Cyres Road (Off Redlands Road) Penarth, Glamorgan, every Thursday evening at 7 p.m. and further details can be obtained from Cyril Bogod, "Dickens", 26 Forrest Road, Penarth, Glamorgan.

TRIBUTE TO FARADAY

Michael Faraday from whose famous experiments at the Royal Institution in Albemarle Street so much of modern electrical technology stems died 100 years ago, on 25 August 1867.

The grave in which Faraday and his wife are buried, and which was entrusted to the care of the Institution of Electrical Engineers in 1937, is in Highgate Cemetery.

To mark this centenary of Faraday's death, wreaths were laid on the grave on 25 August 1967, by Sir Albert Mumford, K.B.E., Past-President of the Institution of Electrical Engineers and Lord Kings Norton of Wotton Underwood, Vice-President of the Royal Institution.

BBC WORLD SERVICE

Malcolm Nisbet, compere of the BBC World Service's Newest programme, "World Radio Club", holds aloft the target area of his programme and the Club card. To become a member of this programme for short wave enthusiasts, listeners simply write to: World Radio Club, BBC, Bush House, London, W.C.2.

Malcolm himself is a DXer and he gives DX news as well as tips to newcomers.

HEATHCRAFT MINI-DRILL

For people needing a small, efficient and versatile drill for those delicate jobs for which the big drill is far too clumsy, Heathcraft offer the *Mini-Drill.* Measuring only five inches long this midget powerhouse with its variety of miniature chucks and tools, will prove invaluable for a wide range of uses. There are three models—*Standard, Super* and *Deluxe,* all battery powered. The *Standard* operates from a 4·5 volt battery, while the *Super* and *Deluxe* models work from 9 volts. The latter two models will also operate from 12 volts.

Current consumption for the *Super* model, using a 9 volt supply is 900mA surge on switching on, falling almost at once to 480mA nominal. For 12 volt supplies consumption is 2 amps surge, 550mA nominal.

The *Super* model is supplied complete with three chucks and six tools which include a midget buffing wheel, a small grindstone and a drill which is just right for drilling a hole in printed circuit boards to allow the wire ends of resistors etc., to pass through. Using the grinding wheel on a piece of copper laminate board it is possible to grind away unwanted copper foil and thus "draw" a printed circuit.

Further details available from Heathcraft Metal Products Ltd., 54 Poland Street, London, W.1.

MOSAIC BREADBOARDING KIT

A "kit" of Mosaic breadboarding elements, comprising a range of devices from which prototype complex circuits may be built up, has been introduced by Semiconductor Division of the Plessey Components Group.

In the long term, it is anticipated that all equipment not requiring high-speed logic will utilise the MOS technique., The new kit, which is designated Mk100, offers two main advantages. It provides the customer with a comprehensive range of devices, and it costs considerably less than the same number of elements bought individually.

The Mk100 kit, which is the first of a projected range, contains 50 devices.

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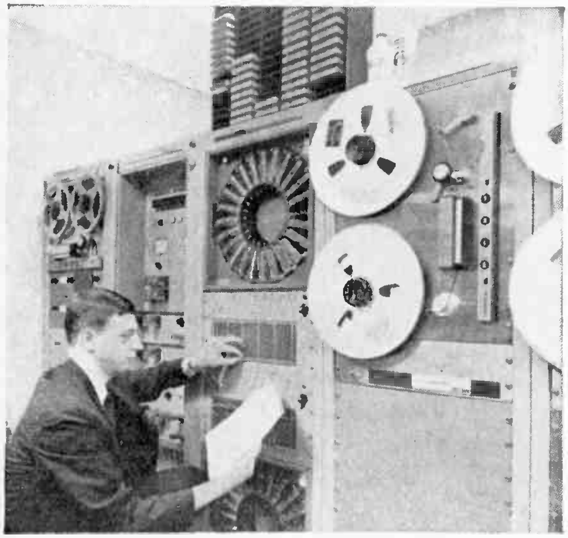
NEWS AND COMMENT...

R.N.W.W. TRANSMITTER



Steve Grayson, host of Radio New York Worldwide's special weekly programme for international radio enthusiasts ... DXing Worldwide which is broadcast on Saturdays at 1735GMT, and on Sundays at 1935GMT (beamed to the British Isles, Western Europe and all of Latin America), is shown programming Radio New York Worldwide's "local" New York City stereo f.m. outlet, WRFM. The equipment displayed is essentially a completely automatic radio station which could run for as long as 15 hours unattended!

ELECTRONICS AID THE POLICE

The new headquarters for the Dunbartonshire Constabulary is equipped with the latest electronic devices to aid the police in their fight against crime.

The bulk of this equipment is in the Information Room where there are separate compartments for the telephone switchboard and teleprinters and a glass-fronted booth containing a single console occupied by a radio operator where he has access to the radio circuits, the headquarters telephone system, the 999 emergency telephone system and the message recording system.

There is a three position radiotelephone control system using three Pye 5 station control units. Each unit is equipped to control five stations but, at the moment, only terminates two stations—one being the county v.h.f. system for communication with mobiles and the other regional inter-force link. Therefore, further expansion can be obtained by the addition of up to three more stations.

OVER THE CANAL

Emergency plans by B.S.R. Ltd. to beat the Suez canal closure have halved the time taken to make deliveries to Japan. Record changers are air freighted from London airport to San Francisco and from there proceed by ship to Tokyo. Time taken is 2½ weeks compared with 5 weeks for shipping via Suez.

PROBING FOR AURORAL SECRETS

New light on the origins of the spectacular Aurora Borealis (the Northern Lights) has come from an experiment mounted by the British Radio and Space Research Station on a rocket flight from Andoya in Norway.

Mullard channel electron multipliers, in an experiment, detected the particles causing the brilliant light patterns seen from Earth. The channel electron multipliers in the Nike-Apache rocket fired into the Aurora revealed that the flow of electrons in the Aurora pulsated. The fact that the waves of fast electrons arrived just half a second before the waves of slower electrons meant that the source producing the waves could be pinpointed to a position 35,000 miles above the equator. This is the first time that a source of particles causing the light fluctuations in an Aurora has been located; and it is the advent of the channel electron multiplier, which enables very low energy electrons at a rate of below one every second to be detected.

The channel electron multiplier is essentially a tube of special glass formed into a spiral. When an electrical potential is applied between the ends of the tube in a vacuum, electrons entering the low-voltage end initiate a cascade of secondary electrons which emerge from the high-voltage end. Because the multiplier operates in the environmental vacuum of space, the electrons enter the device without having to penetrate any "window". Thus the device will detect particles with energies down to only a few electron volts.

C.R. TEST BRIDGE

From Nombrex Ltd., Exmouth, Devon, comes Model 32.

This transistorised Capacitance-Resistance Bridge Model 32 is a re-designed version of their previous C-R bridge. Using the same unique basic circuitry, this model incorporates additional features and new bridge characteristics resulting in improved performance, increased accuracy of measurement and scale discrimination.

The measurement facilities cover a wide range of Resistance and Capacitance, together with provision for indication of leakage and Power Factor in the larger values of capacitors. The design includes new modern styling of case and controls, easy rear access to battery and provision for alternative operation from external battery or mains supply unit. Price is £10 10s.

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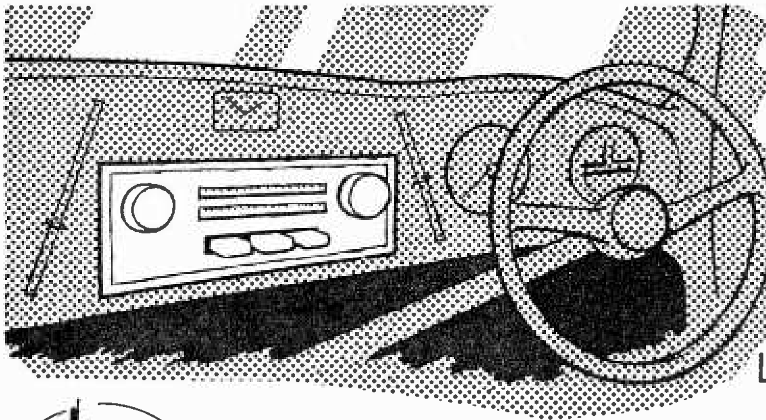

TRANSISTOR CAR RADIO

L. McNamara B.Sc.

COVER SUBJECT

READERS will realise that few, if any, kit manufacturers provide for the needs of those who must operate their car radios on a 6-volt system, such as is found in the Volkswagen and a few other Continental cars. Since a completely new design had to be evolved, it was decided to incorporate transfilters.

Two types of transfilter are used. One is a two-terminal device which works as a capacitor at the resonant frequency, but at other frequencies there is no interaction between the crystal and the applied field, so that it is equivalent to an open circuit. The resulting negative feedback attenuates any amplification at off-resonant frequencies.

The other type of transfilter is a three-terminal unit which performs the matching function of a transformer. This follows from the fact that the amplitude of the mechanical oscillation depends on the voltage applied across the crystal, while the power absorbed, which is a measure of the current, depends on the area of the electrodes. Therefore, the dot or input terminal of the transfilter, presents a high impedance to the preceding stage, since there is a large displacement in the crystal at that point, while the contact area is small. The output or ring terminal on the other hand, provides the low impedance drive to the base of the following transistor, corresponding as it does to a small amplitude of oscillation over a large area. The disadvantage of the slightly higher price of the transfilters is more than balanced by the reliability and convenience in operation, which is assured on the long term by the manufacturer's tests, which indicate that the resonance point of a unit will vary by less than 0·2% in ten years, and by less than 0·1% between —20 deg. C and +60 deg. C.

STABILITY

This question of stability with temperature is especially important in a car radio, since it will be required to operate under conditions ranging from below freezing after a night in the open in midwinter to perhaps 40 deg. C. if the car has been standing in direct sunshine for a few hours in midsummer. It was therefore decided to use silicon transistors except for Tr6, since they have a much greater tolerance of high temperatures than the more conventional germanium types. These were the obvious choice for the mixer and i.f. amplifier stages. They are n-p-n devices and the polarity will be the opposite of that to which many constructors are accustomed.

The fact that n-p-n i.f. transistors are to be used leads to a rearrangement of the decoupling components between the audio and i.f. stages. The negative line must be regarded as "quiet" and the positive line decoupled with respect to this. The decision to employ transfilters results in the relevant transistors needing collector load resistors, since there is no ohmic conduction through the crystals of the transfilters as there is in the windings of a tuned transformer. The resistors cope with the d.c. element in the collector current, while the transfilter deals only with the superimposed i.f. signal.

A.V.C.

The same considerations apply to the design of the a.v.c. system. The i.f. and audio components developed across the diode must be removed in order to provide a constant control potential on the a.v.c. line. The i.f. component is suppressed by the 0·01μF capacitor across the volume control, but whereas the electrolytic to suppress the audio can be taken to the chassis at the end of the a.v.c. line when a transformer is used, such procedure would short the i.f. signal in a transfilter set; the a.v.c. line must therefore be smoothed first, and the i.f. signal voltage developed across a resistive load forming part of the base potential divider for Tr2. This is the purpose of the two 3·3kΩ resistors, R7 and R10. It will be further noted that the diode is reversed when compared to the orthodox p-n-p arrangement. This again results from the fact that the n-p-n circuit must be a complete reversal, so that the a.v.c. line must be negative-going with increasing signal in order to bias back the first i.f. amplifier transistor and reduce its gain.

The a.f. section, too, is unconventional, and consists of a 3-transistor complementary amplifier, with two p-n-p transistors and one n-p-n, all direct coupled and transformerless. The normal transistor portable utilises a pair of transistors in class B push-pull, but the adoption of this arrangement in a set designed for 6-volt operation would either limit power, since each transistor would have a collector-to-emitter potential of only 3 volts, or involve two transformers if each was to get 6 volts. On the other hand the drain of even a 2 or 3 watt output stage using a single power transistor in class A is very small for a car battery, even if it is not feasible

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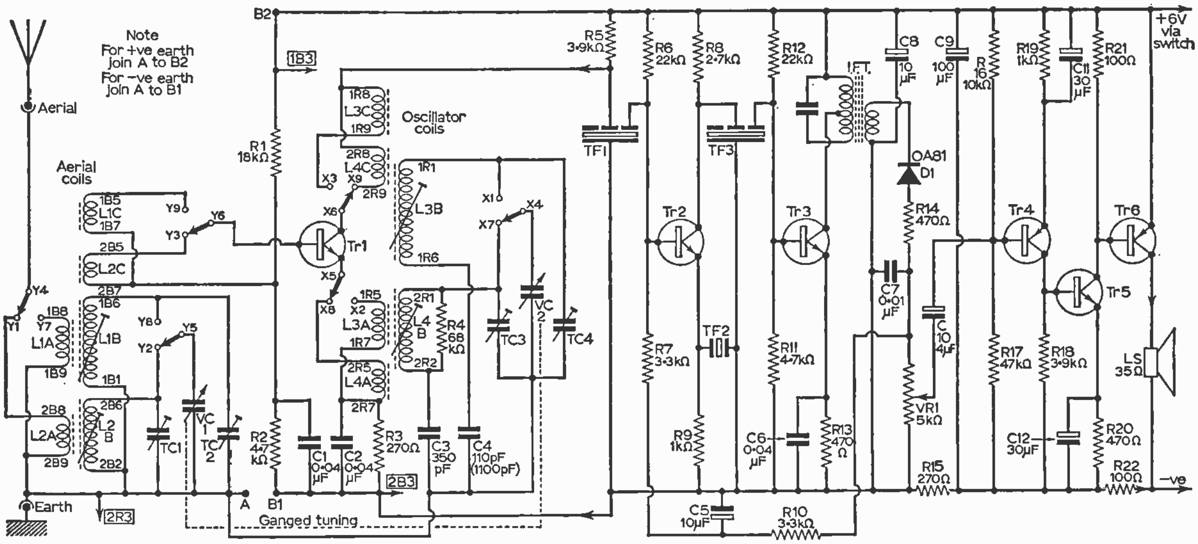

Fig. 1: ▲ *Theoretical circuit diagram of the car radio. The numbering around the coils is to assist wiring. (See Table 1.)*

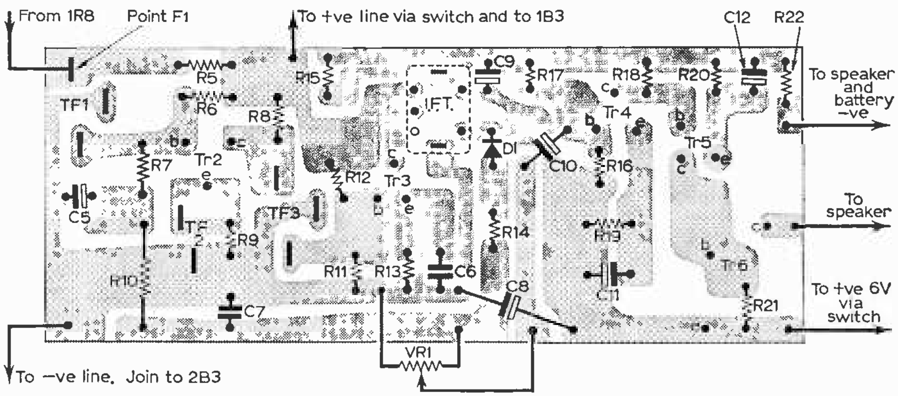

Fig. 2: ▶ *Printed circuit board and layout of components as used in the prototype. Alternatively "Cir-kit" adhesive copper foil strip could be used modifying the layout accordingly.*

for economy reasons in a portable. Further, the output impedance of a power transistor so driven will not be a serious mismatch to an ordinary loudspeaker, and in fact PRACTICAL WIRELESS published an amplifier along these lines as long ago as November 1959. Now, as then, it is more economical and convenient to use a p-n-p power transistor, but the current model differs from that of eight years ago in that direct coupling from an n-p-n driver is now possible.

By a similar complementary reversal this n-p-n driver follows a p-n-p preamplifier transistor. The audio n-p-n is again a silicon type, but germanium had to be employed for the p-n-p types. However, the output transistor is kept at a reasonable temperature since it uses the case of the radio as a heat sink, and both it and the preamplifier transistor are operated well within their allowed dissipations. There is therefore no danger of their destruction from thermal runaway. A second decoupling network is incorporated between the driver and output stages. The result is a powerful and sensitive audio amplifier using the absolute minimum of components consistent with quality.

Denco transistor coils are used in the aerial circuit because the ferrite type of aerial usually found in transistor sets would not be able to pick up any signal since the whole set is closely screened in its metal case. Neither would it be more effective in matching the signal received at the car aerial into the mixer transistor. In fact, a ferrite aerial would merely increase the noise level due to engine interference etc., without the smallest compensating advantage. This aerial coil demands a 300pF tuning capacitor, so that oscillator coils from the same range to match this gang must be used. In practice a definite advantage accrued from the use of these coils, since, due to the close tolerance to which they were manufactured, alignment was easy, and simplified further by the fact that the i.f. circuits were already almost perfectly aligned. There is also the advantage that any constructor who is not interested in the Droitwich transmissions on the long wave, but would prefer the 160 metre amateur band and marine reception, can obtain this simply by using range 3 coils (180—57 metres) instead of range 1 (2000—750 metres) and changing the value of C4 from 110pF to 1,100pF. This would be especially useful in a boat.

EARTHING

Design procedure for the circuit allowed for either positive or negative earths. The prototype was so assembled that the positive and negative lines in the set were insulated from the chassis, so that when the set is installed, either can be earthed, and the other taken through a fuse to the battery. The case of the output transistor must, of course, be insulated anyway, as it is carrying the output to the loudspeaker.

The tuning capacitor must be bolted to the chassis

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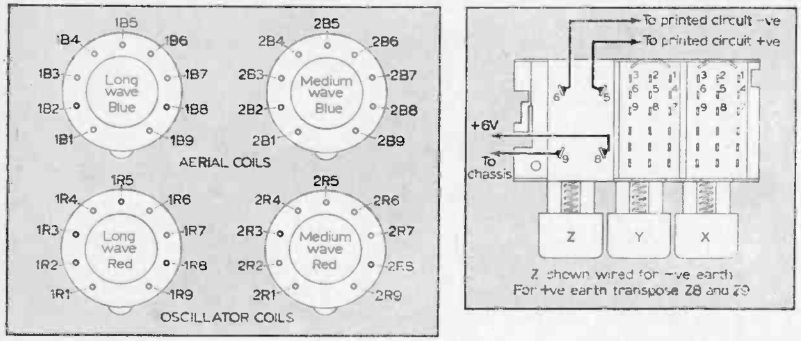
of the set, so the tuned and coupling windings on all the aerial and oscillator coils must be returned to the chassis earth, and *not* to the receiver positive or negative. It is most important that these be distinguished from the windings working into the emitter, base and collector of Tr1 which are referred to the potentials of the receiver circuitry. This procedure does not interfere with the operation of the circuits of the receiver, since there can be no potential difference at signal frequency between the chassis and the positive or negative lines. In any case, the practical details involved in this arrangement, as also in regard to the output transistor, are fully covered in the construction information.

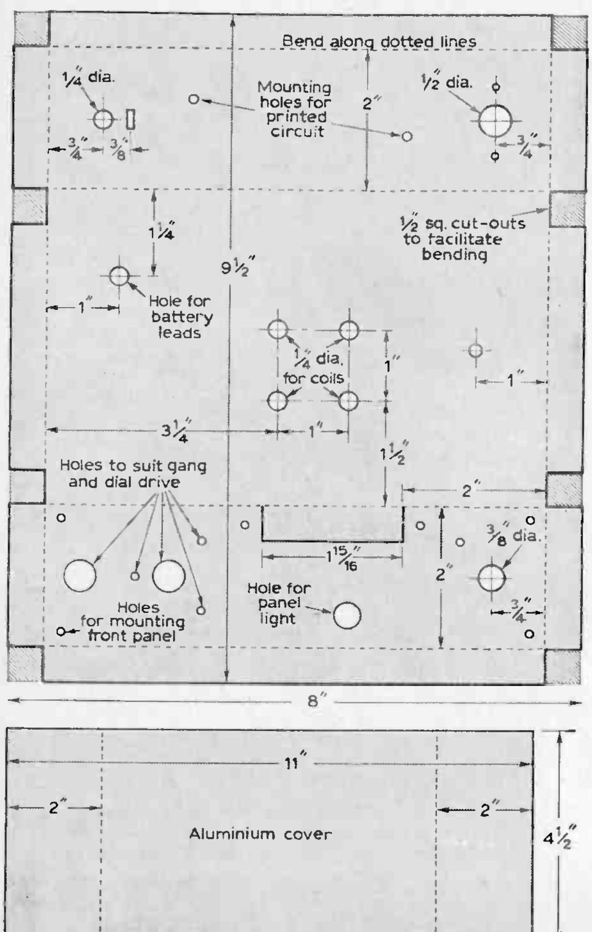
Building the car radio begins with the preparation of the etched circuit for the i.f. and audio amplifier panel. The experienced constructor will find little difficulty in marking the copper laminate for component locations in accordance with the diagram, painting the conductor pattern, and removing the unwanted copper with ferric chloride solution. The alternative of the "Cir-kit" adhesive system of assembling a copper foil circuit board, although not employed by the writer, would probably be equally satisfactory, and avoid the use of chemicals.

Only the locations of the pins of the i.f. transformer and of the transfilters are critical; some leeway is allowable with the resistors and transistors. Drilling component mounting holes and connecting the parts into the circuit follow standard procedure. Flying leads about 6 inches long are inserted for the connections to be made later to the volume control, on/off switch, power transistor and tuning circuits.



▲ *Fig. 3: Details of the numbering on the coils together with pin identification on the push-button switch bank. (See Table 1.)*

▼ *Fig. 4: Layout and drilling dimensions of the chassis-cum-case.*



METAL WORK

The metal work is fully illustrated in Fig. 4. The chassis is of 16 gauge aluminium and two pieces are required, 9½ x 8in. for the chassis itself, and 11 x 4½in. for a cover. The chassis is cut to size and drilled with the holes marked while still flat; this task is more difficult if an attempt is made to bend it to shape first. The shaded areas represent waste material and should be removed with a fine hacksaw or fretsaw with metal-cutting blade. On the front panel there are holes to suit the tuning capacitor, the volume control and tuning control spindles; also cut-outs for the switch-block and in the corners to permit folding of the flanges; finally, mounting holes for the gang and the plastic dial will also be required. The bottom of the chassis carries the tuning coils, the board with the trimmers, and a grommet for the leads to the battery and the loudspeaker. Again, there are cut-outs to provide for the later folding. The rear panel must be prepared to receive the amplifier circuit board, power transistor, and the aerial socket. When prepared, the sheet is bent carefully to channel section, with a flange along each edge to receive the self-tapping screws which will secure the cover.

MOUNTING COMPONENTS

It is now possible to mount the components on the chassis. It will probably be simpler to insert the i.f. and audio board first with stand-off spacers to prevent the soldered side from making contact with the chassis. The output power transistor is mounted beside it, also insulated by the manufacturer's kit of a mica disc which fits over the pins and a shaped washer to go over the collector bolt after this has passed through the mounting hole, to prevent any metal-to-metal contact between the chassis and the bolt or its nut. On the other side of the circuit board the aerial socket is fitted. The tuning capacitor,

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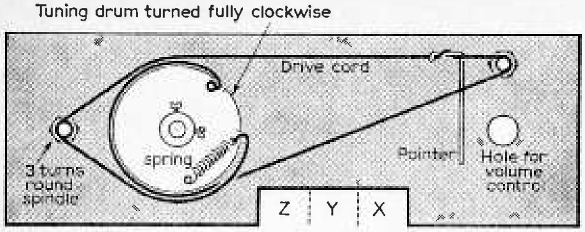

Fig. 5: Details of the positioning of the dial drive for the tuning capacitor.

coils and switch blocks are next added remembering the maker's warning that the coil fixing nuts should be no more than finger-tight.

The trimmers are mounted on a small piece of plain paxolin, wired underneath, and fixed to the chassis by a long bolt passing through stand-off spacers. Leads about 4 inches long are left from each trimmer, with one of similar length to carry the earth connection to all four. The volume control fits on the front panel, with a bolt carrying a pulley beside it. The tuning spindle mounts beside the gang, but the fitting of the drive cord in accordance with Fig. 1 is better left until later. Provision for a dial bulb is made on the front panel.

F.C. WIRING

It is now possible to begin wiring the frequency changer stage. The coils used have formers fitted with nine pins and intended for plug-in-use. As only six pins are needed for the windings of each coil, there are three blank pins available for use as terminals for mounting other components. It is therefore unnecessary to prepare an r.f. circuit board. The point of separate earths for the tuned and coupling windings applies to the wiring of this stage, and this complicates the task. Therefore the instructions for this wiring operation are given in the form of a programme routine, Table 1. For easier trouble-shooting, should it be required later, the switch is arranged so that all oscillator wiring is to one wafer, and all aerial connections to the other. It is advised that the programme should be followed carefully, as this is the heart of the set; each point should be cancelled by a pencil mark on the programme as it is completed to avoid any possible confusion. The positive, negative and signal leads to the i.f. and audio strip are included in the programme, as are the trimmer connections. Wiring should be as short as possible to avoid stray capacitance.

If there is a positive earth in the car, the switch is in the negative line, and vice versa. The positive and negative lines from the printed circuit are both brought to the on/off wafer of the switch, and one

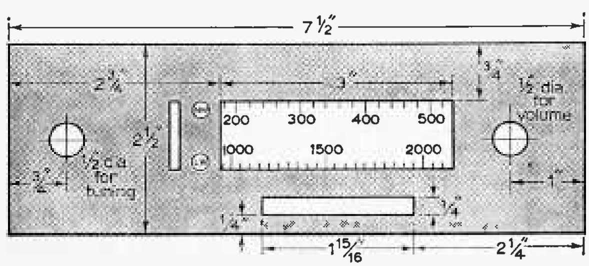

Fig. 6: Layout and drilling details for the front panel.

★ components list

Resistors:

R1	18kΩ	R12	22kΩ
R2	4·7kΩ	R13	470Ω
R3	270Ω	R14	470Ω
R4	68kΩ	R15	270Ω
R5	3·9kΩ	R16	10kΩ
R6	22kΩ	R17	47kΩ
R7	3·3kΩ	R18	3·9kΩ
R8	2·7kΩ	R19	1kΩ
R9	1kΩ	R20	470Ω
R10	3·3kΩ	R21	100Ω
R11	4·7kΩ	R22	100Ω
VR1	5kΩ		

Capacitors:

C1	0·04μF	C7	0·01μF
C2	0·04μF	C8	10μF
C3	350pF ±2%	C9	100μF
C4	110pf ±2% see text	C10	4μF
C5	10μF	C11	30μF
C6	0·04μF	C12	30μF

TC1, TC2, TC3, TC4: 3–30pF Trimmers (miniature) compression type)
VC1, VC2: 2 gang 300pF

Electrolytics not less than 6V working.

Semiconductors:

Tr1	2N708, 2N2368, BSY25 etc.
Tr2	2N708, 2N2368, BSY25 etc.
Tr3	2N708, 2N2368, BSY25 etc.
Tr4	2S303
Tr5	2S017
Tr6	V60/30P, OC16 etc.
D1	OA81

Transfilters:

TF1 TO-02D, TF2 TF-01D, TF3 TO-02D (Brush Clevite)

Coils:

L1A, L1B, L1C: Blue range one
L2A, L2B, L2C: Blue range two
L3A, L3B, L3C: Red range one
L4A, L4B, L4C: Red range two

These coils are Denco miniature transistor dual purpose coils

Miscellaneous:

Aerial socket; dial bulb and M.E.S. socket—6·3V; dial drum 1½in.; pulley for dial drive; knobs; aluminium sheet; perspex for dial; printed circuit board; paxolin panel for trimmers; nuts; bolts; self-tapping screws; push-button switch unit (Henry's Radio type 41); 35Ω loudspeaker.

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of them earthed by a short wire, while the other, as indicated, goes through the switch and the usual type of in-line auto fuseholder to the car battery.

Construction is now complete, and alignment may begin. However, it is a wise precaution to meter the current drawn by the set when first switched on; this gives an immediate check on any really obvious mistakes in the power supply wiring. A current of about 40mA is quite normal. The medium wave should be aligned first. With the aerial plugged in, the local station should be audible, since it is a very sensitive circuit and the i.f. stage is already practically aligned, thanks to the transfilters. A few turns of the core of the i.f.t. will complete this section.

In the mixer stage, the core of the m.w. oscillator coil will first be set to tune a station at the low frequency (or longer wavelength) end of the band at the appropriate section of the travel of the tuning capacitor. This is then peaked with the aerial coil core. The oscillator and aerial trimmers are then used in that order to tune a station at the high frequency (Luxembourg) end of the medium waveband. If necessary, the low frequency adjustment on the cores may be repeated, until there is no further improvement, and then the long (or trawler) band is treated in the same fashion.

It only remains to provide a smooth professional finish to the project. The cover is fixed to the flange of the chassis by a series of self-tapping screws, and a coat of paint applied to the metal. The cord drive is installed, and a dial prepared. In the prototype a sheet of perspex was used. It was shaped to permit the controls to protrude, and holes were drilled for fixing to the front of the chassis. The writer used four tapped spacing pieces; these were screwed to the chassis so as to accept screws through the holes in the dial. The dial itself was made slightly larger than the fascia aperture into which the set had to fit; the edges were bevelled with a file, and the resulting appearance was quite pleasing. The painting of the dial is best done from the reverse side, so that the outside retains its smooth finish.

Lettering on the prototype was typed and set on the reverse side before the painting; a masking tape was placed in the position of the aperture for viewing the sliding index of the tuning scale, and the paint applied. When two coats are dry, the masking tape is removed by cutting the paint layer with a razor blade and carefully peeling it off, while the typed lettering is securely fixed below the paint layer.

The set was installed in the car from the rear of the fascia, and secured to the bodywork with a strong metal strap and self-tapping screws. The dial is then attached from the front with the screws in the tapped spacers already referred to. Two knobs complete a project that the successful constructor can be proud of, as a really up-to-date and reliable addition for his motoring pleasure. The details of the car aerial fitting and any interference suppression that may be needed will not be dealt with; these are standard procedures more appropriate to strictly motoring magazines. ■

Table 1.

Coding. 1=long wave; 2=medium wave; R=red (oscillator); B=blue (aerial). The pin number is designated counting clockwise from the pip looking directly at the base of the former. For example 1B3= long wave aerial coil, pin 3 and 2R6 would be medium wave oscillator coil pin 6.

1. 1B1, 1B9, 2B1, 2B9 2R3 to chassis.
2. 1B3 to +ve line on P.C. board, and via R1 to 1B7.
3. 1B5 to Y9 on switch.
4. 1B6 to Y8.
5. 1B7 to 2B7, also via R2/C1 to 2B3
6. 1B8 to Y7.
7. 2B3 to -ve line on P.C. board.
8. 2B5 to Y3.
9. 2B6 to Y2.
10. 2B8 to Y1.
11. 1R1 to X1.
12. 1R5 to X2.
13. 1R6 via 110pF to 2R3.
14. 1R7 to 2R7.
15. 1R8 to 2R8, and to F1 on P.C. board.
16. 1R9 to X3.
17. 2R1 to X7, and via R4 to 2R2.
18. 2R2 via 3C to 2R3.
19. 2R5 to X8.
20. 2R7 via R3/C2 to 2B3.
21. 2R9 to X9.
22. X4 to VC2.
23. X5 to emitter Tr1.
24. X6 to collector Tr1.
25. Y4 to aerial socket.
26. Y5 to VC1.
27. Y6 to base Tr1.
28. Trimmer between X1, X7, Y2, Y8 and chassis.

If the trawler band is required instead of long wave, read 1R3 for 1R6, and use 1100pF instead of 110pF for C4.

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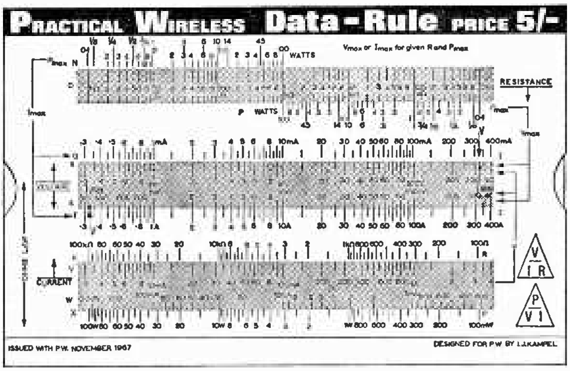

described by I. J. KAMPEL

SPECIFICATIONS

Reciprocals

Component tolerance limits.

Maximum current or voltage for given power dissipation in given resistance, giving absolute values (fixed decimal point).

Ohm's Law scales giving voltage-current-resistance and power-voltage-current relationships in absolute values over the most useful ranges. PLUS normal division and multiplication facilities of a mathematical slide-rule where, as is usual, the decimal point is fixed by inspection.

Decibel power, voltage or current ratios with matching or different impedances.

Preferred resistor values table.

Preferred parallel resistor (or series capacitor) chart.

Resistor colour code table.

Log x

Capacitance/inductance combinations for resonance for 30kc/s—300Mc/s. i.e. covering: LF; MF; HF; VHF; UHF, and giving absolute capacitance inductance values.

Direct conversion with fixed decimal point between the following units:

Newtons—Kgm.f.	B.T.U's—kW.hrs
Decibels—Nepers	x—x
kW—H.P.	kW.hrs—Joules
Degrees—Radians	Ft/lbs—kW.hrs
ft/lb f/s—H.P.	Ft/lbs—H.P. hrs
lbs—Dynes	Foules—Ft.lb.f
inches—Metres	Gilberts—Amp-turns
Coulombs—Amp/hrs	Lux—Ft. candles

THE following explanation should be sufficient for a person already familiar with the slide rule and the ABAC to use the Data-Rule immediately. A short series of articles will follow explaining in greater detail how to use the calculator to its fullest extent.

UNITS CONVERSION

To avoid confusion, the units on the rule are either electrical or electronic or, like the lux-foot-candle conversion, closely related. The latter conversion would be useful when considering photo-devices for example. To convert between units shown on the slider, adjust the slider to expose the desired units in windows I and J. Note that these windows are duplicated on either side of the rule, and which of these windows will be used will be dependent on the individual conversion. Quite simply, use the most convenient window initially, and if it is found that the required section of the scale is not exposed in the window, then re-adjust the units in the opposite window. Window I relates to the upper of the two lower scales, namely scale L, whilst window J refers to scale M. For accurate conversion, ensure that the arrow in the window J is accurately aligned with the arrow on the envelope of the rule.

Taking scale L as the magnitude indicated (1–10), to convert from the units in window I (scale L) to the units in window J (scale M), multiply the indicated magnitude on scale M (1–10) by the multiplication factor that will appear in either the bottom left, or bottom right corner of the rule. This conversion factor will set the correct magnitude of the answer. Only one of the conversion factor windows will show a factor at any given setting, and this will always be the window on the same side of the rule as the initial units setting in windows I and J. If it is necessary to multiply the indicated magnitude in scale L by some factor, the conversion answer should be also multiplied by this same factor.

Note that when the factor appears as say: $\times 10^{\bar{7}}$, this corresponds to $\times 10^{-7}$, the bar being employed to indicate a negative index for reasons of space. Naturally, a factor of $\times 10^{3}$ would represent $\times 1{,}000$, and $\times 10^{\bar{1}}$ would represent $\times 0{\cdot}1$. Note also that $\times 10^{0}$ indicates $\times 1$.

E.g. Convert 72×10^{6} joules into kW.hrs.

Firstly convert to standard form. Thus 72×10^{6} joules becomes $7{\cdot}2 \times 10^{7}$ joules. Now set the slider so that JOULES appears in window I and kW.hr. in window J, using the left-hand window. Read off the answer 2, on scale M, opposite 7·2 on scale L. Thus the complete answer is 2 multiplied by the original factor, multiplied by the indicated conversion factor, namely $\times 10^{\bar{6}}$, and is given by: $2 \times 10^{7} \times 10^{\bar{6}} = 20$ kW.hr.

Note that had we set the units in the right-hand I-J window, then the required figure on scale L, that is 7·2, is out of the window, thus indicating that the slider should be re-set with the units conversion in the opposite I-J window. To apply the reverse conversion, that is converting the units in window J to those in window I, then the procedure is simply reversed.

E.g. Convert 60° into radians.

Since conversion into the units in scale M requires the M quantity to be *multiplied* by the conversion factor, the reverse conversion requires the M quantity to be *divided* by the conversion factor, the resultant answer is L being again multiplied by the factor of the original M

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quantity. Thus, converting 60° to the standard form, this is $6{\cdot}0 \times 10^1$. With RADIANS-DEGREES conversion in the right-hand window, read off 1·05 in scale L opposite 6·0 in scale M. Thus the final result is:

$$\frac{1{\cdot}05}{\text{conv. factor}} \times \text{original multiple} = \frac{1{\cdot}05 \times 10}{10} = 1{\cdot}05 \text{ radians.}$$

To decide whether the conversion factor is divided or multiplied, an easy method is provided on either side of the rule just above the conversion factor boxes. The boxed "SIGN" indicates that in "downwards" units conversion, i.e. converting units in window I to those in window J, then the sign is unchanged, i.e. multiply the converted figure by the indicated factor. If the conversion is "upwards" however, the sign must be changed i.e. *multiply* the converted figure by the indicated factor, but changing the *index* sign.

In the previous two examples, JOULES to kW.hr. is a "downward" conversion, the index is unchanged, and so the indicated multiplication conversion factor is unchanged, i.e. 10^{-6}. In the second example, degrees to radians is an "upward" conversion, and the conversion factor's index sign is changed, and we proceed as follows: Converting $6{\cdot}0 \times 10^1$ degrees to radians, read off 1·05 as before, multiply by the original factor, 10^1, then multiply by the conversion factor, *index sign changed,* giving 10^{-1}, and the result: $1{\cdot}05 \times 10^1 \times 10^{-1} =$ 1·05 radians.

DECIBEL EQUIVALENTS

(*Assuming input and output impedances equal*)

To find the decibel equivalent of a power ratio, where:

$$\text{N dB} = 10 \log_{10} \frac{P_{out}}{P_{in}}$$

locate the power ratio in scale L, placing the ratio opposite 1 on scale M. If the ratio is between 1 and 10, the decibel equivalent is given directly above in window H, using the upper half since this is a *power* ratio. If the ratio is greater than 10, then add 10dB for every factor of 10, as indicated on the immediate right of the window.

E.g. To find the decibel equivalent of power ratio 30

Place 3 on scale L opposite 1 on scale M. Since the absolute value is really 3×10^1 there is a single factor of 10 involved in the answer, and thus 10dB must be added to the indicated answer. In window H, on the upper scale we read off 4·8 (actually 4·77), and adding 10dB, we have: $4{\cdot}8 + 10 = 14{\cdot}8$dB (actual answer 14·77dB). Since this is an anologue device, the difference between actual value and read value depends on reading accuracy. Working in the reverse direction, say we wish to complete the following example:

E.g. Convert 35dB into a power ratio.

Firstly we must determine the whole number of tens in this value. Thus, taking the nearest multiple of 10 below the value, we obtain 30, indicating that 10dB has been added three times to represent a $\times 10^3$ power ratio factor. Now bearing this in mind, take the remaining dB figure, i.e. $35 - 30 = 5$dB, and place this in the upper section of window H. The value 3·16 is then read in scale L opposite 1 on scale M. Thus the final power ratio will be $3{\cdot}16 \times 10^3$.

To find either the current or voltage ratio decibel equivalent, where: $\text{N dB} = 20 \log_{10} \frac{V_{out}}{V_{in}}$

proceed exactly as before, only now, as indicated by window H, the lower scale is used in the window for current and voltage ratio conversions.

E.g. Find the decibel equivalent of voltage (or current) ratio 7·08.

The only difference that could occur in this conversion is that where the ratio is over 10, 20dB are added per factor of 10, instead of the previous 10dB, as indicated to the right of window H. In this example the ratio is between 1 and 10 and this does not, therefore, arise. Place 7·08 opposite the appropriate point in scale M, and read off the final answer 17dB opposite the lower arrow in window H.

E.g. Convert 25dB to a current ratio.

Determine the number of multiples of 20dB in the quantity, i.e. only a single 20dB, leaving 5dB. The 20dB indicates a ratio factor of $\times 10$, and by placing 5dB in window H opposite the lower arrow, we may read of the ratio 1·78 in scale L, giving the final result $1{\cdot}78 \times 10$ or simply 17·8.

(*When input and output impedances differ*)

In this case proceed as before when converting from ratio to decibel equivalent, and then continue as indicated: Having obtained the basic dB figure, correction is made for the differing impedance by adding to this the figure obtained from: $x\text{dB} = 10 \log_{10} \frac{\text{input impedance}}{\text{output impedance}}$

Having determined the indicated impedance ratio, this figure of xdB is determined by setting the ratio in L and reading off 'x' in the upper portion of window H. Simply then add to two dB figures obtained.

LOG x

Convert the value to standard form. Place the number in scale L opposite 10 in scale M, and read the decimal portion of the logarithm opposite the arrow in window K. Place in front of this the index of the multiple to obtain the full logarithm, using a bar sign for a negative index.

E.g. Find log_{10} 27.

Firstly convert to form: $2{\cdot}7 \times 10^1$ giving the whole number portion of the logarithm as the index 1. Place 2·7 in L opposite 10 in M. In window K read of the decimal portion of the log, namely ·43, thus giving the complete log as 1·43 (actual value 1·4314).

E.g. Find antilog $\bar{2}{\cdot}2041$ (or the number whose log is $\bar{2}{\cdot}2041$).

The whole number portion of the log gives us the multiple 10^{-2}. Set 2·041 (significant figures 204 in practice) in window K, and read 1·6 in scale L opposite 10 in M. Thus the number is $1{\cdot}6 \times 10^{-2}$, or 0·016.

RESONANCE

Resonance for an inductance and capacitance in a parallel circuit may be computed from the ABAC provided. The full formula for the parallel circuit is:

$$f_{res} = \frac{\sqrt{L/C - R^2}}{2\pi L}$$

In radio circuits, however, in most cases R can be assumed negligible compared with $2\pi fL$, and therefore

$$C \simeq \frac{1}{(2\pi f)^2 L}$$

and the frequency expression may be simplified to

$$f_{res} = \frac{1}{2\pi\sqrt{LC}}$$

The ABAC scales are based upon this latter expression. Given values for two of the scales, the straight line through these two points will intersect the third scale at the other value for resonance. Adjusting the slider for the appropriate frequency range in window A will automatically set absolute values to the ABAC scales by means of windows B to G.

E.g. A capacitor is measured at 3·76pF. What inductance is required for the circuit to resonate at 150 Mc/s?

Adjust the slider for the appropriate frequency range,

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V.H.F., in window A. Place a straight edge across the scales to intersect 150Mc/s on the f scale, and 3·76pF on the C scale. This is seen to intersect the L scale at 0·3μH, the correct value of inductance.

RECIPROCALS

The decimal point should be placed by inspection in this conversion, however this is a relatively simple matter. To find the reciprocal of a number, set the significant figures of the number opposite either the 1 or the 10 of scale M, in scale L. The reciprocal significant figures may then be read off at the point on scale Y directly above.

E.g. Find the reciprocal of 6.

Place the 6 in scale L opposite the 1 of scale M, and read off 1·67 in scale Z opposite the end scale mark of Y. Since the reciprocal is 1/6, this must be less than 1, and 1/6 may be approximated to 0·1 mentally. Thus the true result is 0·167.

COMPONENT TOLERANCE

Suppose we have a nominal value of 500 for a component value. This could be ohms, microfarads, or any system of units. If we wished to know the allowable deviation in say a $\pm 5\%$ tolerance, then proceed as follows. Adjust the slider to place the 5 in scale Z opposite the central arrow section of the component tolerance scale, combined in scale Y. We may now read off that an increase of 5% would take us up to the value 550, whilst a decrease of 5% would take us down to 450. The values assume the same magnitude as the original number, or to be more explicit, in absolute values, the original value set on scale Z was 5×10^2, therefore the other tolerance values are as read off, times the same multiple, i.e. $5{\cdot}5 \times 10^2$ and $4{\cdot}5 \times 10^2$.

For example, if we calculate a resistance value of 80Ω is required, and estimate a $\pm 5\%$ tolerance is acceptable, by setting 8 in scale Z opposite the tolerance arrow, and referring to the preferred resistor values in the table at the upper right-hand corner of the calculator, we see that the value of 82Ω is within the $\pm 5\%$ tolerance, whilst the nearest value below, 68Ω, is seen to be well outside the required tolerance. The indicated tolerances are the usual resistor tolerances, neglecting 1% which may be estimated.

V_{max} OR I_{max} FOR GIVEN R AND P_{max}

Turn to the reverse side of the rule for these scales, the three-windowed side of the envelope.

On this side of the rule, as indicated by the coloured symbol to the left of the central scale, the central window, a voltage scale, is used in conjunction with both the upper and the lower windows. The upper window is used in conjunction with the middle scale, as is the lower window, but they are not used in conjunction with each other. For the values of V_{max} and I_{max} in a given resistance, at a specified power, the upper two windows are employed.

If we set a resistance and a power, and require to know the maximum current which can then be drawn by the resistance to keep within that power rating, set the resistance value of scale O opposite the appropriate power dissipation in scale N. The value of I_{max} is then read off on either scale Q or scale T, opposite the I_{max} mark to be seen in the central window. There are two I_{max} marks, but only one will indicate a value, the other being off the slide (the exception being when the slide is practically centrally situated, in which case both marks will indicate the answer). The actual arithmetic process involved is

$$I_{max} = \sqrt{\frac{P_{max}}{R}}$$

but the calculator performs this calculation automatically. E.g. Say we wish to know the maximum current that may be drawn through a 3W rating resistor of value 40Ω. Place 40Ω on scale O opposite 3W in scale N. Read off the value for I_{max} on scale Q, opposite the I_{max} arrow in the central window as 274mA.

Had we instead, with the same resistor, wished to know the maximum voltage which may be applied, then we would proceed as follows. Place the 40Ω on scale O opposite 3W on scape P, giving the answer of 11V on scale R opposite the arrow marked in colour V on scale Q. The answer of V_{max} could have appeared alternatively opposite V on scale T had the slider passed out of the left-hand side of the sleeve.

In this latter operation, the calculator automatically evaluates the arithmetic process of $V_{max} = \sqrt{P_{max} \cdot R}$. The choice of either scale N or scale P for the power is simply made since the I_{max} at the left of the calculator indicates, with a coloured line, the upper scale, N, and the V_{max} at the right of the calculator indicates the lower scale, P with a coloured line. The real purpose of these scales is for resistor ratings, and potentiometer ratings, in circuit design.

OHM'S LAW CALCULATIONS

The above processes could be done in two stages by the Ohm's Law scales, the lower two scales, however these are best employed for direct V = IR and P = VI relationships. Since these scales must be limited somewhere, the most useful ranges have been covered. Should any particular calculation require values out of the bounds of these lower scales, then the calculation may be done conventionally with the normal slide rule scales L and M.

VIR Relationships.

The upper right-hand triangular symbol indicates that the middle window is here used in conjunction with the upper lower window scales, U and V. For any voltage V, set opposite one of the V arrows on the central window, the current resistance values are found adjacent in scales U and V.

E.g. What current will flow in 2kΩ with a voltage of 20V?

Set 20V in scale R opposite the coloured V mark in scale Q, and read off the answer, 10mA, in scale V, opposite 2kΩ in scale U.

E.g. What voltage will 3mA develop across 40kΩ?

Set 3mA in scale V opposite 40kΩ in scale U and read the voltage, 120V, opposite the V arrow in scale R.

PVI Relationships.

The lower right-hand triangular symbol indicates that the middle scale is used in conjunction with the lower scales of the lower window, W and X. Proceed as before.

E.g. What power will be dissipated if the voltage across a load is 5V, and the current is 80mA?

Set 5V in scale R opposite the coloured V mark in scale Q, and read off the answer 400mW in scale X opposite 80mA in scale W.

USE AS SLIDE RULE

There is the limitation with this calculator that no cursor is possible, and therefore use as a slide rule is limited, but nevertheless useful when the rule is at hand and a slide rule is not.

Multiplication

Place either the 1 or the 10 of scale L opposite one of

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practically wireless commentary by HENRY

No. 38

"Why Can't They?"

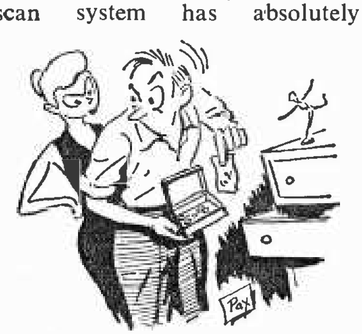
ONE of our contemporaries has lately been beating its illustrious head against the high blank wall of the "ideal" in searching for their readers' notion of a perfect tape recorder.

One reader wants at least three heads on every machine; another asks for variable bias; another wants provision for multi-track sound-on-sound.

Fair enough, but why, if they wanted these desirable features, did they not pay a little extra and procure them in the first place?

Henry was hauled over the coals a while ago for saying: *"You gets what you pays for, mate!"* In so far as electronic equipment is concerned, the axiom holds good. Our correspondence on kits showed very clearly that blind faith and an open purse were no guarantees of satisfaction. One needs to shop around with some knowledge of the goods, before parting with hard-earned cash.

Keeping to the subject of recording, remember the Wesgrove fiasco? Telcan had a good pioneering idea of a linear scan video tape recorder years ago, and poor marketing led to disappointment. Wesgrove took over the idea and brought out a kit which a number of our readers have since, frustratedly, tried to complete and operate. Now that commercial video tape recorders are genuinely with us, at prices that clubs, pubs, local authorities and businesses can afford, the helical scan system has absolutely usurped the linear scan.



Digging into the savings

Unfortunately, like Baird battling on with his rotating mirrors, our readers have attempted betterment, and found the cost of improving a dead-end system to be quite exorbitant. Recording heads, which wear quickly when tape rushes past them at a high rate of knots, are virtually unobtainable. Whereas the originals were listed at three or four pounds, replacements have been quoted at twenty pounds or more.

Why? Quite simply because head manufacturers, no ostriches, have developed far better manufacturing techniques. Materials are more rigorously specified. Limits are closer. Standards have changed. The current heads are that much better, and will, inevitably, cost more.

It is futile, and foolish, to cry: *"Why don't they make a radio/ amplifier/tape recorder/transmitter/computer/etc., exactly as I require?"* There is always a reason for a particular product to be marketed the way it is. And usually the reason is economic.

Of course it would be nice if the five-quid transistor radio you bought for the beach had another waveband. But by adding that little extra the price would have been nearer those shiny Jap models you thought twice about buying.

And if you had dug a little deeper into your savings, you could have toyed with the idea of the type that sported a larger speaker, or tape outlet and personal listening features. Or, with the knowledge that this magazine had given you, the better class set with battery economy circuits and then anti-fading front ends. And what about f.m.? and while we are about it, might as well go the whole hog and prepare for stereo broadcasting.

Before we know where we are, the covetous eye is glinting at magic boxes that cost two hundred guineas or more—even without leopard skin coats.

The covetous eye is glinting

"Why don't they?" Indeed! I'll tell you why. Because the makers are in business to make a profit, and gear their production to a carefully studied market.

Why not buy basic, buy with care and buy quality, then modify the best to suit your own requirements? There must be a dozen ideas per issue that can be usefully adapted.

Example: some while back there appeared a few articles on automatic recording control systems. Soon afterwards, L. McNamara came up with an excellent in-line audio control unit, employing straightforward transistor circuitry. From this, it needs little ingenuity to add auto-control to your tape recorder. Yet there were letters for months that asked for chapter and verse on specific mods to particular machines that would afford the same facility.

O.K. So you haven't the time to experiment; nor the bottomless spares box that some of our contributors assume. So let's kick the ideas around a bit. Let's discuss a few of those modifications, adaptations and just plain improvements to commercial equipment and see what can be done.

Don't ask "Why don't they . . . ?" Say "Why can't we . . . ?" Any ideas worth passing on are welcome, and will not be ignored. What about it lads?

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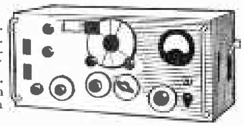

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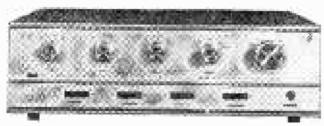

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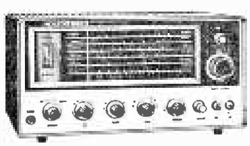

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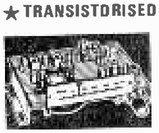

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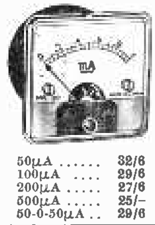

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		1mA	22/6	750mA	22/6	500V D.C.	22/6
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		5mA	22/6	2A D.C.	22/6	15V A.C.	22/6
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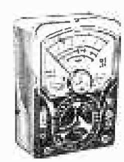

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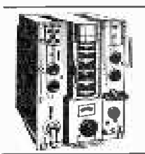

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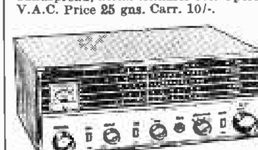

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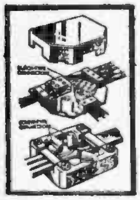

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R.V. ASKEY

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Circuit Description

The voltage amplifier is designed around a double diode triode valve—the EBC90. In this application, the diodes are not used and so are strapped together and earthed; thus the valve acts as a straightforward triode pre-amp. C1 serves to decouple and smooth the anode supply to V1, keeping hum and distortion negligible. The omission of a cathode bypass capacitor on V1, introduced some negative feedback and helped to keep distortion to the barest minimum. If more volume is required then R10 could be omitted, but this should be done only if really necessary as some distortion may occur. VR1 is the volume control which is fed into an effective potential-divider tone control arrangement—VR2.

A progressive "top cut" or "bass lift" occurs as the slider of the tone control is turned towards the capacitor end of the control. From the tone control, the signal is fed into the output stage, consisting of a high slope output pentode—the Mullard EL84—this valve delivers approximately 4 watts of undistorted output to 3 ohm speaker via a multi-ratio output transformer. C8 serves as further tone correction while C4 is a decoupling capacitor for the screen voltage on the output valve.

Power Supply

This provides approximately 260V at C6, being rectified by an EZ80 full wave rectifier. R7 acts as smoothing resistor.

Construction and Layout

A wiring diagram is given, as the author considered it was a necessity for the beginner. Layout of components is by no means critical and most components can be wired direct to the valveholders. Care should be taken to use screened wire on all grid leads and to use twin flex tightly twisted for valve heaters. These wires should be kept close to chassis to minimise a.c. mains hum which could be picked up and induced into the first stage.

Negative Feedback

When connecting the negative feedback leads from chassis and C5 to the output transformer secondary, there should be a decrease in volume compared to that obtainable when C5 is returned to chassis direct.

If even more volume is required, the negative feedback could be omitted and C5 connected direct to chassis. No distortion should occur although the overall frequency response may not be so good. If when connecting the feedback, there is an increase in volume with possibly some instability, this points to positive feedback and is an incorrect mode of operation.

★ components list

Resistors

R1	220kΩ	R8	100Ω
R2	4·7kΩ	R9	100Ω
R3	33kΩ	R10	15kΩ
R4	47kΩ	Rx	500kΩ
R5	5·6kΩ	VR1	2MΩ log
R6	180Ω $\frac{1}{2}$W 5%	VR2	1MΩ lin (or log)
R7	250Ω 5W		

(All $\frac{1}{4}$ or $\frac{1}{2}$W 10% unless otherwise stated)

Capacitors

C1, C4	16+16μF elec. cond. 450V
C2	0·02μF 350V
C3	150pF 150V
C5	50μF 50V
C6, C7	32+32μF elec. 450V
C8	2,000pF 350V

Valves

V1	EBC90	V3	EZ80
V2	EL84		

Mains Transformer T1
Primary: 200–220–240V.
Secondaries: 250–0–250V, 80mA, 6·3V, 3A.

Output Transformer T2
Elstone MR/T Multi-Ratio for 3/4 watts

Miscellaneous
Two B9A valveholders. One B7G valveholder. S1 double pole on/off switch on VR1. SK1 coax socket. Chassis to suit, screened lead, wire solder, bolts, pilot lamp (if required), etc.

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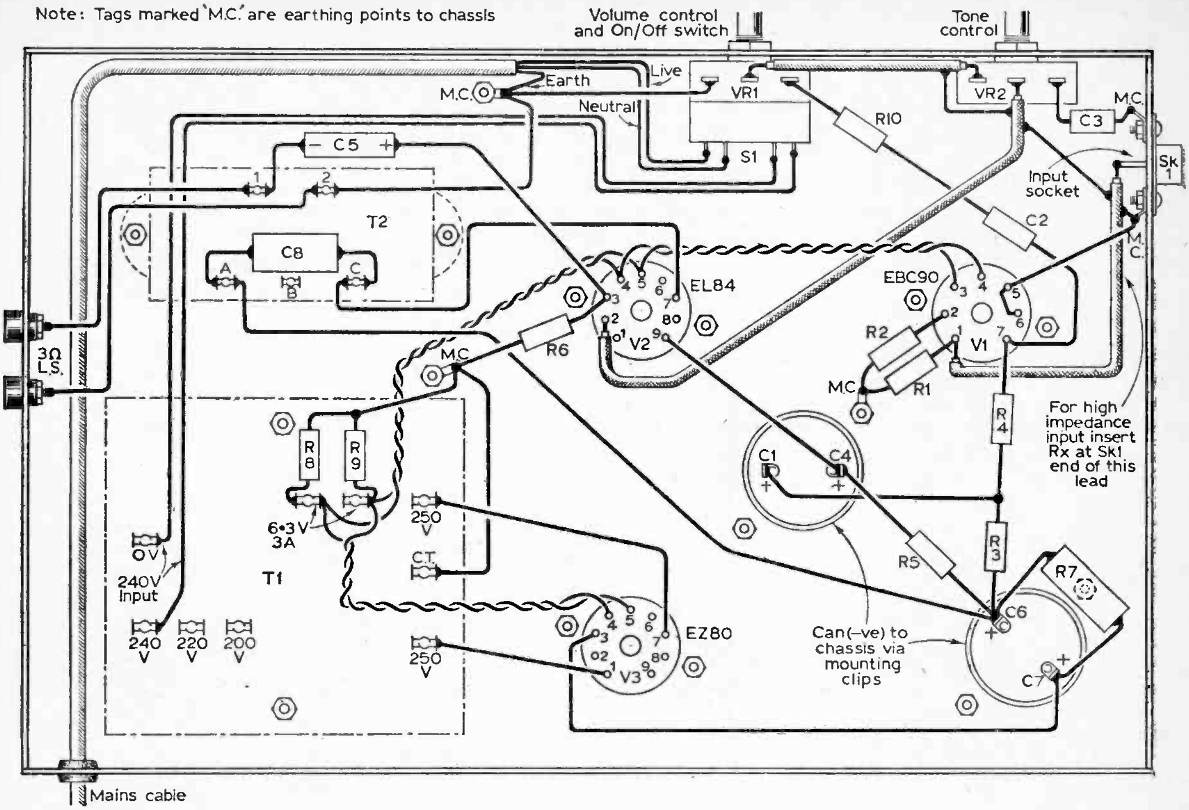

Fig. 2: Underside wiring and layout of the complete amplifier. Note that T1 and T2 are mounted above the chassis.

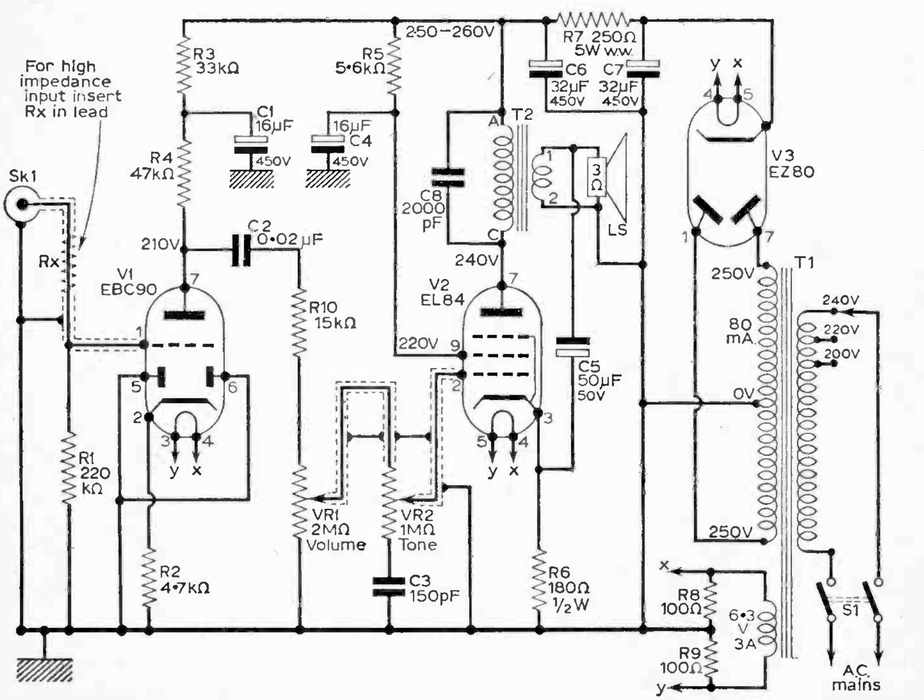

Fig. 1: Circuit diagram of the record amplifier. All screening to be connected to chassis.

Correct operating conditions will be given by reversing the feedback connections to the transformer secondary.

Conclusion

The constructor will find this two-stage amplifier far more satisfactory than those amplifiers using, for example, an ECL82 or UL84, which are found in some record players.

The author constructed the prototype in a portable cabinet, using a 7 x 4in. elliptical speaker with exceptional results. The recommended cartridge is the Ronnette TX88, using a low input circuit or the Garrard GC8. For a high input circuit, the Acos GP67-2 is recommended.

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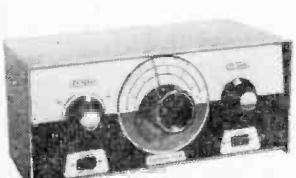

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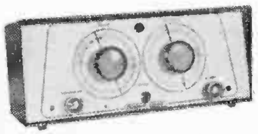

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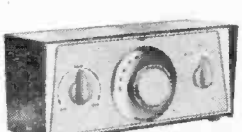

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Circuit diagram, construction details and parts list (free with kit) 1/6 (S.A.E.)

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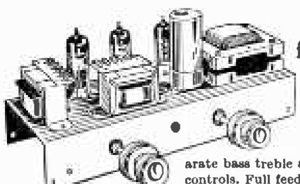

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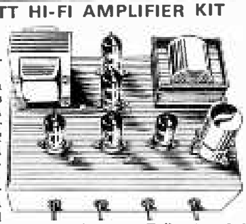

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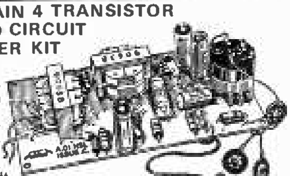

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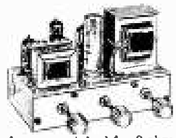

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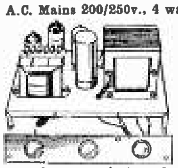

● Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss. ● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar, microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● Chassis size only 7½in. wide x 4in. deep. Overall height 4½in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves output transformer (3 ohms only), screened lead, wire, nuts, bolts, solder, etc. (No extras to buy). **PRICE 79/6.** P. & P. 6/-.

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This kit although similar in appearance to HA34 employs entirely different and advanced circuitry.

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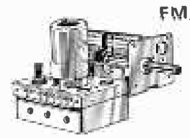

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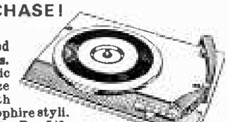

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new books

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BUILDING YOUR AMATEUR NOVICE STATION
By Howard Pyle, W7OE. Published by Foulsham-Sams.
115 pages, 11 x 8¾in. Price 28s.

THIS is a book originally intended for the American market. To offer it for sale in this country is, in my opinion, a mistake, particularly in view of the fact that it is intended for the newly licensed amateur.

The first four pages are taken up with informing the novice about disregarding this or that; that the transformer quoted might not be available; that anode resistor values can be chosen to drop the anode voltage to any required figure for the valve used. So our poor novice cannot look at the circuit and components list and decide what he needs, but must check through and then go back to the first four pages to find out that the transformer *might* not be obtainable, that certain electrolytic values *might* need changing and so on.

The actual c.w. "station" described has to be seen to be believed. It stands over three feet tall and eleven inches square—and contains three valves—one in the receiver, one in the transmitter and the other in an amplifier for the receiver!

One wonders how many of these novice monstrosities adorn the homes of American Hams. One shrinks to imagine the reaction of the British housewife at the introduction of such a hilarious piece of furniture into her house. Regrettably, it is not possible to recommend this book other than for amusement only.—*DLG*

TRANSISTORS FOR TECHNICAL COLLEGES
By L. Barnes, M.Sc.Tech., A.M.I.E.E. Published by Iliffe Books Ltd. 194 pages, 8½ x 5¾in. Price 42s.

THIS book will suit a number of people with a common interest in transistors. It should prove particularly useful to students taking telecomms and would serve as an introduction in elementary design work for those engineers who have neglected to study semiconductors.

It is presented with great clarity and the chapters follow a sensible order. It was particularly pleasing to find three pages at the beginning of the book devoted to symbols and definitions, thus avoiding any possibility of confusion. Indeed the only confusing thing in the entire book was the drawing which shows a transistor with two collectors and one presumes that the bottom collector is in fact the emitter.

Commencing with a description of the crystal diode and fundamentals of transistor action the book carries on through Transistors in Practice; Approximate Design of Linear Circuits; Parameters and Equivalent Circuits for Low Frequencies; Frequency Effects; Switching Circuits and finishes with a conducted tour of a number of practical and useful experiments. Taken at a steady pace the book makes interesting and very informative reading and is unhesitatingly recommended.—*DLG*

UNDERSTANDING AMPLITUDE MODULATION
By Irving M. Gottlieb. Published by Foulsham-Sams.
160 pages, 8½ x 5¾in. Price 25s.

FOR those interested in amplitude modulation this book will be of great interest and will prove a useful addition to the bookshelf. Starting with fundamentals, it covers a wide field, from high-level to low-level amplitude modulation. There is a very interesting chapter at the end describing techniques for improving the performance of amplitude modulators.

It was most gratifying to observe that Mr. Gottlieb had not forsaken transistors, and the book covers both these devices and valves. Another point in its favour is the marked absence of frightening higher mathematics. Although maths. does enter into the subject, the text is written in such a way that an advanced understanding is not required and where maths. is shown the text covers the same story in words.

Those who read this book and transmit on a.m. will doubtless have second thoughts on what is happening in their own equipment. The author caters for the s.s.b. enthusiasts, too, and even bearing in mind the somewhat narrow interest of the subject, it is still recommended.—*HRO*

ELECTRONICS FOR YOUNG EXPERIMENTERS
By W. E. Pearce, B.Sc. Published by G. Bell and Sons Ltd.
159 pages, 5¼ x 8in. Price 18s. 6d.

THIS book is intended to provide an understanding of electronics together with an enjoyment of the subject. It is primarily intended for the young experimenter and gives some seventy experiments designed to be carried out at home without any need for elaborate or expensive equipment. Most of the apparatus, in fact, is built during the course of the experiments.

The book opens with details of making and experimenting with electroscopes and electrical machines. From this, the reader is guided through to making electromagnetic devices and then to the construction and conversion of various types of meter, a relay, d.c. and a.c. motors, a magnetic brake, a device for the testing of one's reactions and generating a.c. current using a torch battery.

There is a chapter on inductance which leads on to the setting up of an oscillating circuit and the making of a simple form of oscilloscope.

Finally, there is a chapter on transistors, transistor circuitry and photo-transistors, with the construction of a simple telephone circuit, transistor radio, and a toy electric organ.

Summing up, I think this book would be a valuable asset to those lads who have attained their first or second years in a senior school and who want to study physics, for they could obtain the theoretical knowledge from their science master and gain the practical experience from doing the experiments that are described in this book.—*CRR*

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SHOWTIME '67 ★

★ A REVIEW OF NEW MODELS AND TRENDS AT THE SERIES OF TRADE EXHIBITIONS IN LONDON FROM AUGUST 20–25th.

★ Players and Grams

This year, the accent as far as radiograms go, was once again on the Scandinavian-type wood design although one or two manufacturers had veered away from this and adopted Regency-style cabinets and small radiogram-type units on plinths that needed external speakers.

Record players this year seemed to cater, as always, for the mass market, designs seeming not vastly different from previous years. We did think, however, that customers will get "higher fi" for their money this year.

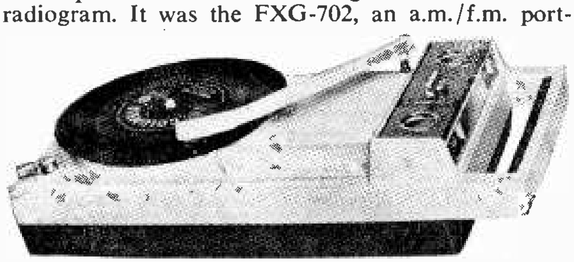
A new entrant to the market this year is S.S.C. Luxor from Sweden, who assemble their equipment in Denmark then export it to the U.K. One of the

GEC G988 8W stereogram with long, medium, short and v.h.f. bands.

most significant developments in the radiogram market is the continuation of the audio units (Philips' *Audio Plan,* Ferguson's *Unit Audio* and Dynatron's *Audio Separates*). Philco are also introducing this style of presentation.

A good idea came from Monogram who introduced their *Custom Decorator,* an a.m./f.m. set with stereo radio which can be mounted on the wall, thus saving floor space.

Sharp claimed to be exhibiting the smallest stereo radiogram. It was the FXG-702, an a.m./f.m. portable, which can play 12in. records, weighs 3lbs. and sells at £30 17s. 5d. Another compact radiogram was the Alba 3000, measuring 14½ x 7½ x 3½in. and with an output of about 600mW—price of this one was 18½ guineas.



Alba 3000 portable gram with 2-speed player and m.w./l.w. radio.

Decca introduced their SRG747 radiograms styled in the Regency vogue. The Regency costs 219 guineas and the Queen Anne, 228 guineas—very nice, but you have to have the right decor for these two!

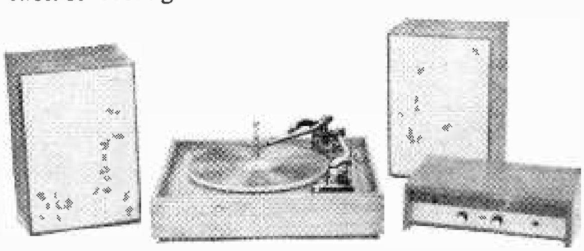
We thought that this year modules (pre-assembled units for i.f., a.f., etc.) would definitely be "in", owing to the fantastic ease of servicing, but it seems as though K-B are still the only people jumping on this band-wagon with their KG041 and KG042 radiograms. Both these units also incorporated flywheel tuning which was an extremely useful feature. The KG042, by the way, was finished in a new wood finish on show for the first time this year—canaletto walnut.

As far as record players were concerned, compatibility was definitely the keynote, for most makers exhibited mono models fitted with the kind of cartridge that would play both stereo and mono records. This move means that eventually, only stereo records will be stocked in the shops and mono will be completely "out".

Newcomers to the market this year are Van der Molen, Wyndsor and B.M.B. Van der Molen entered the field with their *Sonic Four* record player—a 4-speed autochange unit with the amplifier mounted in a central plinth with a transparent perspex lid. It has two separate speaker enclosures and all three units are styled in teak. The stereo amplifier has outputs of 4W per channel and the recommended list price is 39½ guineas. Wyndsor exhibited three models, one of which was housed in a speaker cabinet.

K-B use modular construction in their record players KP036 and KP034. The KP034 having a stereo adaptor costing 13½ guineas which contains the same amplifier as its parent unit and gives stereo output of 7W per channel.

Stereo consolettes on show included Pye's successor to the *Black Box*—the *Stereo Princess* in teak cabinet costing £55. HMV have 1967 versions of



B.M.B.'s stereo unit with 6W per channel and using Garrard 3000LM deck. Price? Under £50!

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their *Stereomaster* which can include v.h.f. radio with multiplexer decoding.

Mono consolettes include the Alba 338 which has novel styling. It has a shelf which extends out of one side of the player stand with a record storage rack. It is fully transistorised, has teak cabinet and costs 28½ guineas.

Dansette's introductions can be used with their "cruciform" stand and models on show included the *Bermuda Mk. 2* which had a rather colourful interior design, and the *Regina*, in black with a lid made of rosewood. Also seen was the *Prince*, an attractive unit with sides of teak and an 8in. reproducer. Both the *Regina* and *Prince* are adaptable for stereo with matching units similar to K-B model KP034.

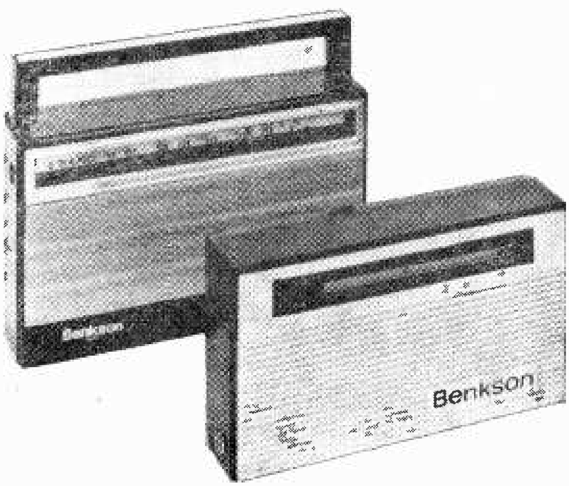
Winter Trading were exhibiting some very reasonably priced units. Their *Gold Crest* PH333 for 7¼in. 45 r.p.m. records only, retailing at 5½ guineas. They also had the *Taya* PHD105 for 45's and 33⅓ discs, which costs 9½ guineas and a stereo version at 16½ guineas.

★ Radio Receivers

THE display of radio sets this year was disappointing, most manufacturers showing only a small handful and usually accounting for only a very small space in their exhibitions, but one or two interesting trends became evident.

Styling seems to adhere rigidly to the "black and chrome" line, particularly in portables, but for the larger table models the "brown" look continues. Although there were individual variations in shapes, handles, etc., the trends here still followed the same familiar patterns mentioned above.

But although first impressions were that there was nothing really new, closer observation proved different. Portables are now commonly offering a choice of third waveband; i.e., Long and Medium wave plus f.m.—nearly all with a.f.c. Those with-

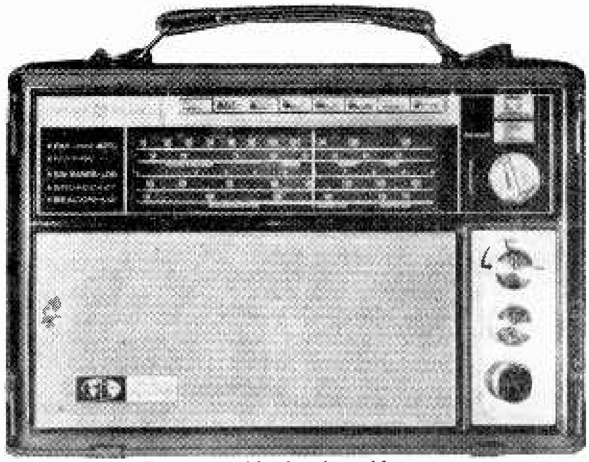


Benkson's models 202 (left) and 101 right).

out f.m. offered Shortwave coverage far in excess of the usual 6 to 15Mc/s.

The Hacker *Helmsman*, for instance, gave Long and Medium wave coverage plus Short waves from 1·58 to 30·64Mc/s which should be of interest to the Shortwave types. Sensitivity at 30Mc/s is quoted as 2μV for 50mW output. The set also has a bandspread tuning control and boasts separate ferrite rod aerials for Medium, Long and Marine bands, with provision for an external aerial. Full output is rated at 750mW and the set also has a tone control. Price should be around £33.

An interesting feature of the Hacker range was the use of plug-in modules which should help servicing considerably and is an advantage from the production point of view since the modules are used in various sets. The waveband switch



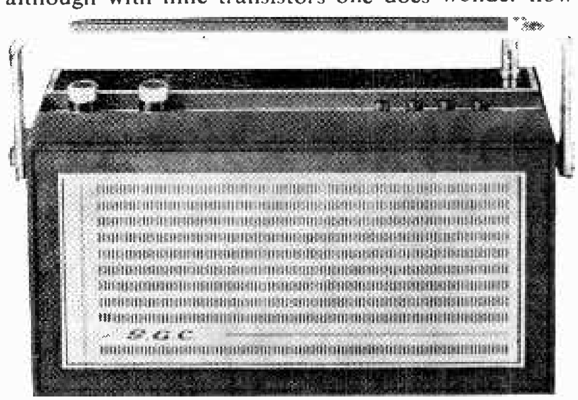
The World Monitor from Monogram.

brings in a separate oscillator for each range to avoid complicated and "lossy" coil switching.

It was surprising to see how many portables are including the Marine band now. The *World Monitor* by Monogram is an example. This one has broadcast band, Marine band from 1·8 to 5·0Mc/s, Beacon Long wave from 170—370kc/s, six bandspread Shortwave bands—16, 19, 25, 31, 41 and 49 metres, and rounds off with f.m. from 88—108Mc/s. It has two telescopic rod aerials and a tuning meter.

The Grundig *Satellit* at 119 guineas is quite something to see and, as you might guess, is offered for the connoisseur. It even has built-in protection in case lightning strikes the aerial while you are listening!

In the cheaper price range there were many portables to choose from. Binatone offered their *Crossworld* m.w./l.w. 9-transistor set for £3 19s. 6d., although with nine transistors one does wonder how



GEC G834 10 transistor a.m./f.m. portable with separate car input circuit.

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long the battery will last. Benkson also offered radios in the lower price bracket, model 202 m.w./l.w. at £4 19s. 6d. being typical in this range.

In the low price brackets were many imported sets, some with gimmicks, like the Hitachi *Hi-Phonic*, which has a small bezel which illuminates when a station is tuned in. Of interest here too was the Shortwave converter for a standard car radio suitable for both 6 and 12-volt positive or negative earth.

Not too much stereo in evidence this year and those which did put in an appearance were mostly tuners with a predominance of wood styling as was the trend at the Audio Fair earlier in the year.

All-in-all there was nothing really new or startling. Some makers were "with it" and had changed the tuning dials to cater for the new wording for the Home, Light, etc., to BBC1, BBC2, etc. Portables are still available quite cheaply but the trend is for them to grow more sophisticated and complex with added amenities like increased Shortwave coverage, bandspread, f.m. with a.f.c. After everything is considered, it boils down to the most obvious conclusion: you get what you pay for.

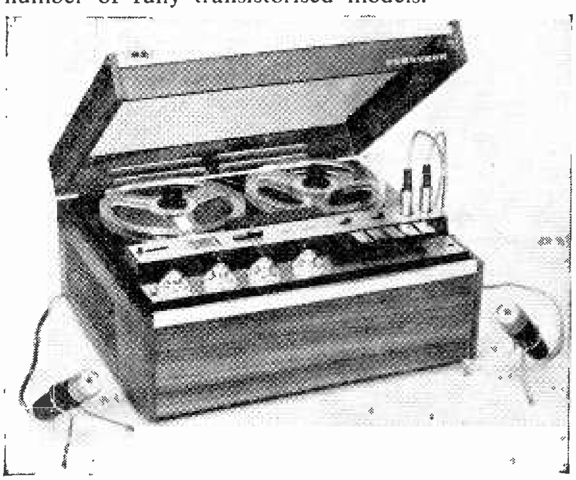
★ Tape Recorders

THE most notable feature in the tape recorder field was the substantial increase in the number of cassette models now on the market for use with C60 or C90 cassettes and for the reproduction of the *Musicassettes* introduced by Philips and E.M.I. last October. Cassette models have now been introduced in the Acme, Alba, Dansette, Eagle, Elizabethan, Elpico, Ferguson, H.M.V., National, Philco, Philips, Stella and Van Der Molen ranges.

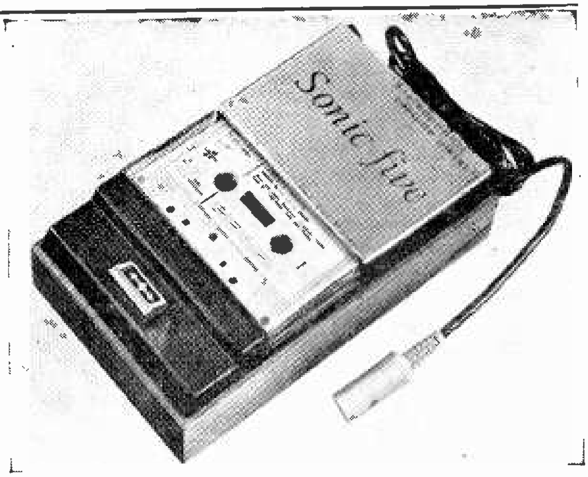
Most of these machines are "compact" portable models weighing 3—4 lb. Stereo cassette models were featured by Eagle and Van Der Molen. The Van Der Molen *Sonic Five* is a mains-operated model intended for plugging into radiograms, high fidelity amplifiers, audio plan units or piped music systems, and produces a stereo output of approximately 750mV per channel. The Eagle mains/battery stereo cassette tape recorder Model TP1004 comes with clip-on speakers. Also in this range is a cassette model (TP718) for car use. Other cassette models for use in cars were shown by Philips and Elpico.

New from Philips is a cassette model (RL673) with built-in a.m./f.m. radio. Elizabethan showed two larger cassette models, the LZ613 *Compette*, a mains-operated model with 3W output, and the LZ612 which, at 45 guineas, provides an output of $5\frac{1}{2}$W to a built-in 10in. speaker and may be operated from mains, battery or a car supply.

Other features of the tape recorder market are an increase in the number of stereo machines available, an increase in the number of models incorporating automatic level control, and an increasing number of fully transistorised models.

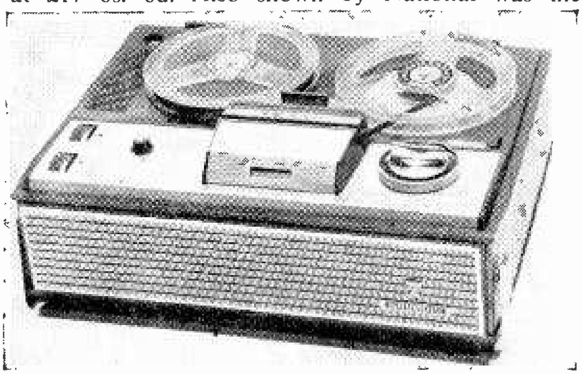


Ferguson model 3232 transistorised stereo or mono tape recorder.



Van Der Molen Sonic Five stereo cassette player.

Automatic level control is featured in the fully-transistorised Standard Models SR500 and SR550 and National Models RQ113S and RQ401S, the RQ113S being a two-speed portable model selling at £17 6s. 6d. Also shown by National was the



New from Grundig, the model TK145 featuring auto level control.

all-transistor mains/battery portable Model RQ102S and a combined radio and tape Model RQ120S.

New from Grundig is the four-track Model TK145, which closely follows the design of its sister machine, the TK140. The new model incorporates automatic recording level control which may be switched out to enable the machine to be manually controlled. The TK145 sells at $47\frac{1}{2}$ guineas. Also new from Grundig is the TM340, a version of the TK340 for use in an existing Hi-Fi installation.

The fully transistorised Ferguson Model 3232 provides stereo or mono recording and reproduction at 69 guineas, and is styled to match the Ferguson *Unit Audio* range. It provides 5W per channel.

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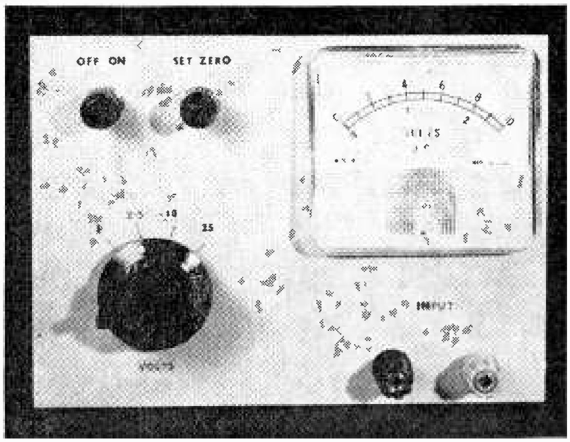

two voltmeters

FOR THE WORKSHOP

GRAEME LYNN

PART 2: D.C. VOLTMETER

THE comparatively recent introduction of silicon devices into most types of electronic circuitry has brought possibly one of the most simple measurement problems into the foreground.

Germanium transistors, with their relatively high leakage currents, raised little objection to being presented with the 20kΩ per volt load that one expects from a quality, static voltage measuring instrument. Collector currents in the order of 1mA were considered a practical minimum for consistently stable operating points and the 100μA or so drawn by the external measuring equipment did not radically obscure, for all practical purposes, the voltage under measurement.

For most of us the change over to silicon transistors was a gradual process of exchange whereby silicon transistors in their early expensive days were used only where vitally necessary, usually for their low leakage qualities alone. Under these circumstances they still tended to be run at collector currents in the order of 1mA, so that measurement techniques remained much the same. However as the economics of silicon semiconductor technology reached levels at which silicon devices could compete in price with other devices, original design thoughts to take advantage of the low collector current operating feature of silicon transistors, resulting in increased voltage gain due to higher collector loads and the resultant higher input impedances, suggested circuits with collector currents in the order of 100μA or less. To measure relatively accurately these lower current sources in terms of the voltage present at the emitter, base and collector, the measuring instruments had to draw 10μA or less current.

The simple, yet effective d.c. voltmeter described here has an input resistance in the order of 0·5MΩ for a full scale deflection of 1V, thus drawing only 2μA from the circuit under test.

The circuit is shown in Fig. 6. Transistors Tr1 and Tr2 are connected in the long-tailed pair configuration and act as a differential amplifier, with the input applied between the two bases. With this arrangement in-phase input signals are effectively cancelled out and only push-pull (i.e. anti-phase) input signals are indicated upon the meter. This mode of operation minimises the effect of V_{be} changes with temperature, and the problem of leakage current at this type of sensitivity may be neglected over the range of 5°C to 55°C due to the inherently low leakage current of the BC108 silicon transistors used. The switch S1a, b and c provides a coverage of 0—25V in four steps 0—1V, 0—2·5V, 0—10V, and 0—25V. On the 2·5V range the input resistance is in excess of 1MΩ, so that the meter draws only 1μA from the circuit under measurement. The circuit of Fig. 7, from which the final voltmeter was evolved, has a basic input sensitivity of 30mV but unfortunately the input resistance was too low to be of any practical

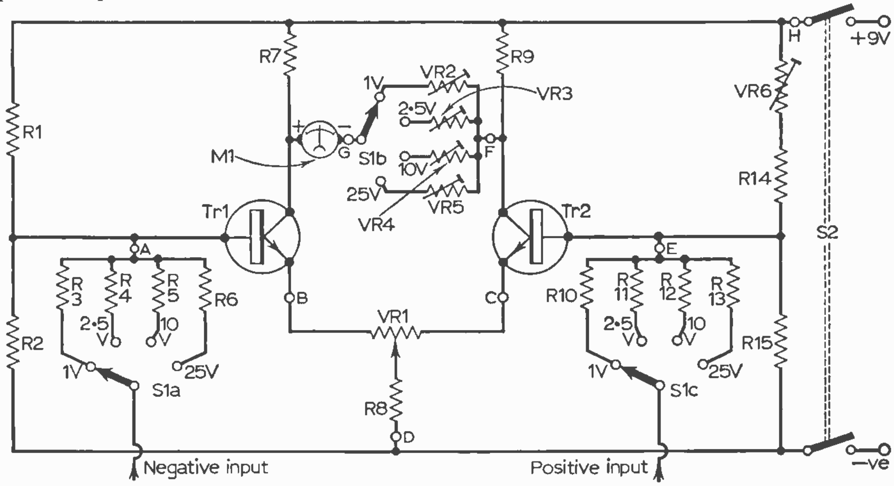

Fig. 6: Circuit diagram of the d.c. voltmeter.

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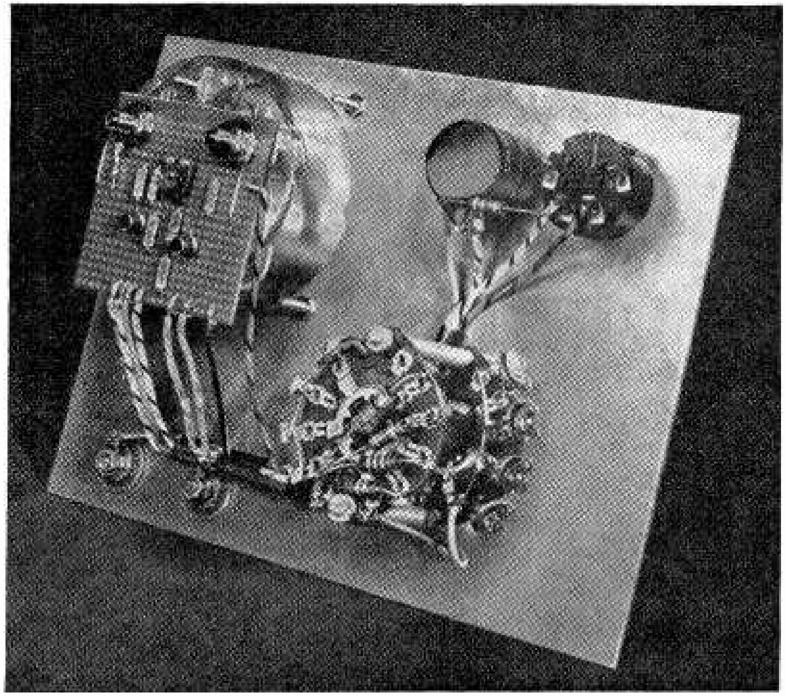
use: hence the inclusion of the series resistors connected to S1 in the final design. A further advantage of the series resistors lies in the ability to measure sources of widely varying resistance without upsetting the d.c. characteristics of the voltmeter.



Rear view of the completed unit.

Circuit

The input voltage, isolated from the common line of the voltmeter, is applied to the bases of Tr1 and Tr2, the positive side to Tr2 base and the negative side to Tr1 base. This input voltage causes the collector voltage of Tr1 to go more positive and the collector voltage of Tr2 to go more negative. The combined voltage change at the collectors applies a voltage differential to the meter thus giving rise to a flow of current through the meter which is suitably calibrated to interpret this change as a reading of voltage. The resistors R3 to R6 and R10 to R13 inclusive provide the necessary reduction in the input voltage so that the transistors are not over-driven as the voltage increases, the variable resistors VR2 to VR5 being introduced to provide a means of making a final accurate setting of the voltage reading on each individual range. VR1 set zero control provides a means of setting the zero reading should the occasion arise but has been kept as small as possible to obviate the introduction of too much unbalanced feedback. The value chosen gives a zero variation of about half scale which is more than adequate for the purpose. VR6 is adjusted so that when the set zero control is in the mid-position the reading on the meter is about zero with the input terminals open circuit, and is included to overcome the out of balance due to h_{fe} variation between transistors. The circuit is compensated quite adequately against temperature variation. The collectors of Tr1 and Tr2 sit at approximately 7·5V in the quiescent condition, drawing about 680µA each, this current being determined by the biasing resistors R1, R2 and VR6, R14, R15.

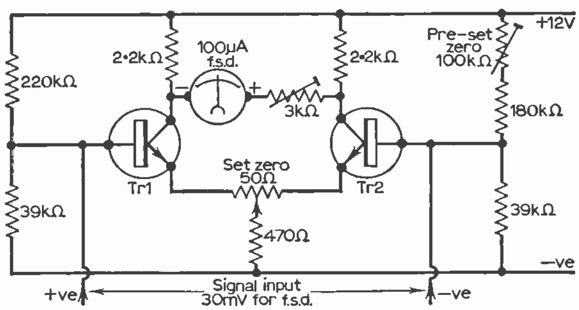


Fig. 7: Circuit from which the final design was evolved.

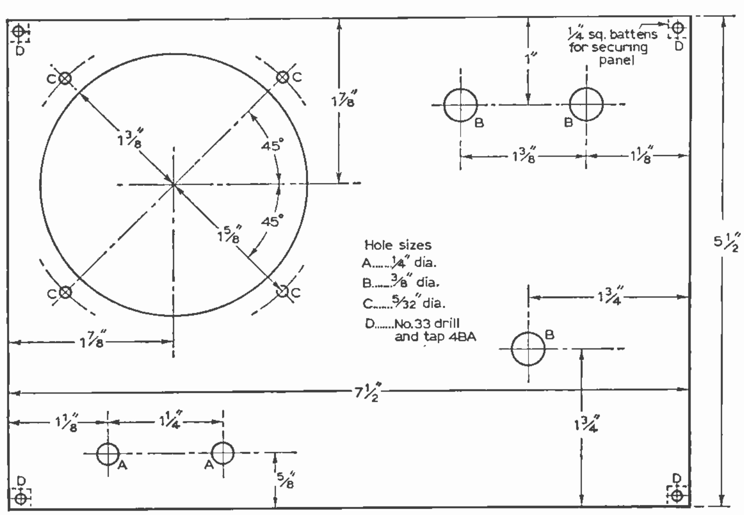


Fig. 8: Front panel drilling details as seen from back of panel.

Construction

The circuit layout is not at all critical so that the arrangement shown in Fig. 9 need not be adhered to. The board itself was cut from a piece of perforated board having a hole grid of 0·1 in., and 20s.w.g. tinned copper wire was used to form the connections between any components with short leads. The front panel was made from a piece of 18s.w.g. aluminium drilled at the required points (see Fig. 8). The meter was used as the

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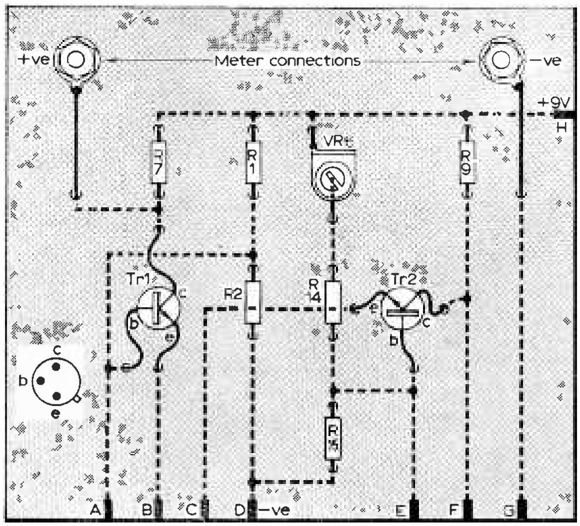

Fig. 9: Layout of the components on the board.

anchoring point for the circuit board, dispensing with the necessity to drill any further holes in the front panel. After all the required holes have been drilled in the front panel the finish was obtained by spraying with one of the many aerosol lacquers available in most hardware stores. When the lacquer was thoroughly dry the lettering was added by the now normal method of dry transfer. It is advisable to coat the lettering with the scratch proof varnish that may be obtained from the manufacturers of the transfers. As the unit is so simple there is no necessity to give any order of construction, all the parts being easily accessible no matter the stage of the construction.

Having ensured that the wiring is correct, switch on without applying any input voltage to the input terminals. The set zero control should be adjusted to approximately mid-way and then VR6 should be carefully adjusted until the meter reads zero. If the set zero control is now rotated in either direction the meter needle should swing alternately to either side of the meter zero. If this does not occur, check the circuit wiring again. After switching the function switch S1 to 25V a known d.c. signal of 25V should be applied to the input terminals in the correct polarity and VR5 adjusted so that the meter reads full scale deflection. This instruction can then be repeated for all the ranges by applying the appropriate full scale voltages to the input terminals and adjusting the related preset potentiometers. ■

★ components list

Resistors:

R1	220kΩ	R9	2·2kΩ
R2	39kΩ	R10	270kΩ
R3	270kΩ	R11	560kΩ
R4	560kΩ	R12	2·7MΩ
R5	2·7MΩ	R13	5·6MΩ
R6	5·6MΩ	R14	180kΩ
R7	2·2kΩ	R15	39kΩ
R8	470Ω		

All 5% high stability

Potentiometers:

VR1 50Ω w.w.
VR2–5 All 3kΩ carbon
VR6 100kΩ carbon

Transistors:

Tr1 and Tr2 Both type BC108

Miscellaneous:

M1 100μA meter
S1 3-pole 4-way rotary switch
S2 2-pole changeover

EASILY-MODULATED, INFRA-RED RADIATION

Two new gallium arsenide diodes now available from Mullard emit near infra-red radiation when subjected to a voltage of about 1·5V. The radiation from the diodes, type CAY12 and 101CAY, is coherent and can be easily modulated simply by varying the diode current.

Maximum radiation from the diodes occurs at a wavelength of 0·9μm which is also near the peak of the response curve of the phototransistor type BPX25. Hence, one of the diodes and the phototransistor can be used in a very simple compact communications system, as shown in the diagram. A range of 100ft. can be easily achieved and this can be extended by improving the lens system.

This communication system could be used on noisy building sites to form a link between the cabins of tall cranes and the ground. The equipment could also be useful in crowded places where rapid, secret communication free of interference is needed between two points.

The high-frequency performance and high switching speed of these diodes make them suitable for use in a.m. or pulsed communication links. Because the emitted radiation is coherent, the diodes can also be used to start laser actions in other devices.

NEW MOULDED ADAPTABLE BOXES

Egatube Ltd., now have a range of P.V.C. Moulded Adaptable Boxes including sizes 3 x 3in., 4 x 4in., 6 x 4in. and 6 x 6in. in various depths. These boxes provide excellent instrument cases, etc., and can be supplied with flush or overlapping lids.

Special prices are quoted for large quantities. For details of M.A.B. Range, write to Egatube Ltd., St. Asaph, Flintshire.

FRANCE and CANADA AGREE

Never mind the rumpus between the Canadian and French Governments. Both countries are in perfect agreement about the usefulness of participating in the 1968 Electrical Engineers Exhibition at Earls Court, London, taking place from 27th March to 3rd April.

The French Government has decided to participate in the International Exhibition and has taken up 300 square metres of floor space. This is the first time France has decided to take part in the Exhibition.

Canada, too, has now taken up about 300 square metres.

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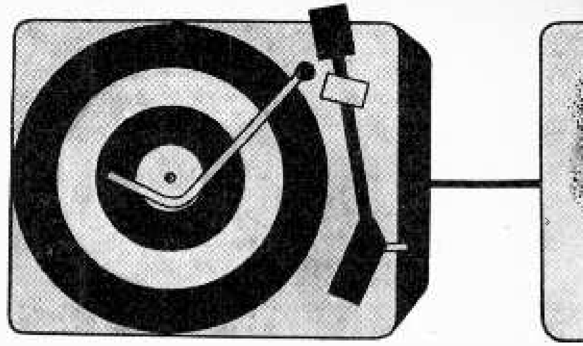
Semiconductor AUDIO

R.LEYLAND



MOST transistor amplifiers, until comparatively recently, included transformers as an integral part of their output stages. An amplifier that does not incorporate transformers is more compact and can have an improved performance. Loudspeaker transformers were the first to show signs of being displaced. Finding a substitute for a driver transformer is more of a problem, and has resulted in circuits that depart considerably from those of earlier amplifiers. There is usually direct coupling, with feedback loops, and often complementary transistor arrangements. The overall action can be understood by considering each of the circuit details in turn.

Power transistors are able to supply large currents, and the power outputs required can be developed in loudspeakers of the usual range of impedance values without any need of a step-down transformer. There is no impedance-matching, and the loudspeaker impedance is chosen according to the power output, and the voltage of the amplifier supply. Providing that the permissible dissipation of the output transistors is not exceeded, by using too low an impedance, a different value of loudspeaker could be used, with little increase of distortion. Too high an impedance will reduce the output available, but this will also depend upon the sensitivity of the loudspeaker.

It is preferable to keep large direct currents out of the loudspeaker, to prevent a continuous displacement of the voice-coil, and this has led to the single-ended type of push-pull output stage (Fig. 2). A direct coupled loudspeaker would connect on its other side to a centre-tap on the amplifier d.c. supply, but it has become more common to couple it capacitively as shown, and to earth the other side to the supply line. A capacitor value upwards of 200μF is usually necessary, depending on the impedance of the loudspeaker, and over 1,000μF when it is practicable to extend the low-frequency response.

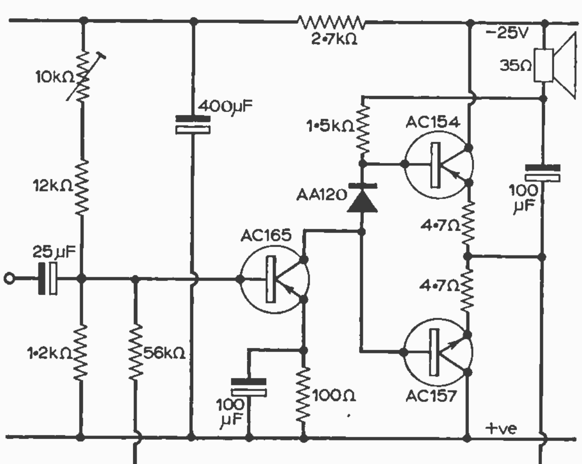


Fig. 1: Transformerless 1-watt amplifier driver and output stages (LP17 transistor package). The output transistors are mounted on a heat sink.

The large surge of current that occurs in the loudspeaker when the amplifier is switched on can be avoided if two electrolytic capacitors are used instead of one. These in series across the d.c. supply provide at their junction point the equivalent of a centre-tap.

The single-ended output stage consists of a pair of transistors in series across the supply, biased usually so that the transistors amplify in turn on alternate half-cycles. This mode of working, designated Class B, gives a higher efficiency, and has been necessary because of the limited power capability of transistors, and also to conserve battery current in portable equipment. The complete signal waveform is reproduced at the mid-point between the transistors which feed the loudspeaker. Current is drawn from the amplifier d.c. supply.

On one half-cycle of the signal current is drawn from the amplifier d.c. supply through the upper transistor in series with the loudspeaker and capacitor. On the other half-cycle, the capacitor, like a floating battery, supplies a reverse current through the loudspeaker, and this current passes through the lower transistor.

Under no-signal conditions a small direct current flows through the two transistors in series, and their mid-point is stabilised at a voltage about half-way between the positive and negative of the supply. The small quiescent current is needed to produce a smooth transition at the cross-over point, i.e. with Class A conditions for small amplitudes of signal.

At maximum drive, the output potential can swing upward and downward to within about a volt of the supply lines. This saturation or knee voltage is lower for germanium than with silicon transistors, a factor of importance with low-voltage supplies. Silicon transistors also require a slightly higher drive voltage, but have the advantage of being able to function at much higher temperatures.

At maximum drive, the peak voltage across the loudspeaker will thus be about a volt less than half the supply voltage. Dividing the peak voltage by the loudspeaker impedance gives the peak current, and the peak voltage and current multiplied together give

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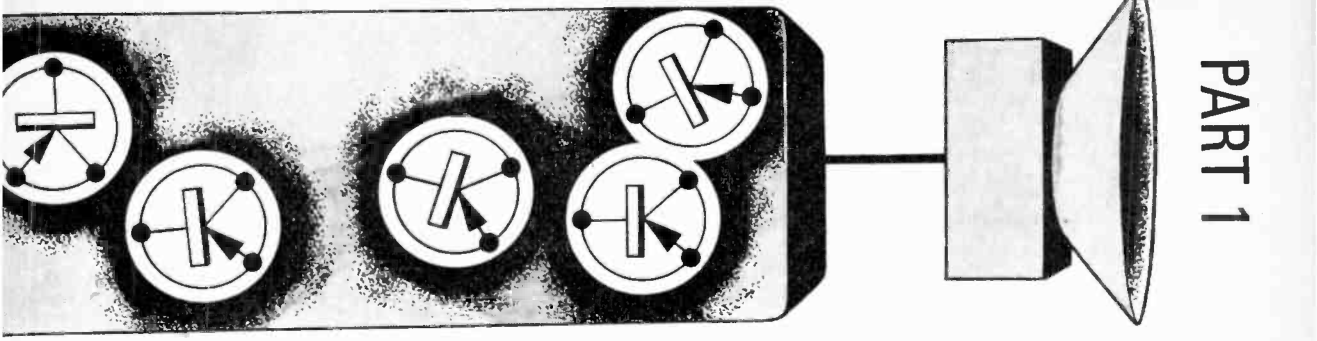

the instantaneous peak power. The average power is half of this peak power (for a sinewave) and is the nominal output on continuous sinewave. The average loudspeaker current is the peak current multiplied by $2/\pi$ or 0·636, and the d.c. required by the output stage is half of this.

In a more accurate assessment, the small voltage drop in the emitter resistors, and in the series resistance (often negligible) of the coupling capacitor, can be allowed for: also the quiescent current.

Some confusion can arise from an amplifier being given a music power rating that may be 20% or more higher than the continuous sinewave rating. The average current consumption on music is only about a third of that with maximum sinewave drive. Thus the voltage drop in the internal resistance of the amplifier d.c. supply is reduced, and a larger peak output can be obtained. Assuming an impedance of several ohms for an unstabilised supply, different ratings will therefore be obtained.

The original single-ended push-pull stage, Fig. 2(a), consisted of a matched pair of transistors of identical type, and required two separate inputs in antiphase, at different direct-voltage levels. For larger output powers, these two transistors may be preceded by others connected as emitter-followers to reduce the drive currents necessary.

It is possible to obtain the antiphase inputs from phase-splitters of types familiar in thermionic valve circuits, and a number of transformerless amplifiers have been developed on these lines. Direct coupling is only partially used in these amplifiers to avoid interdependence of the adjustments for quiescent current and voltage. It will be noticed that the quiescent voltage depends on the upper transistor of the output stage, and the quiescent current on the lower transistor.

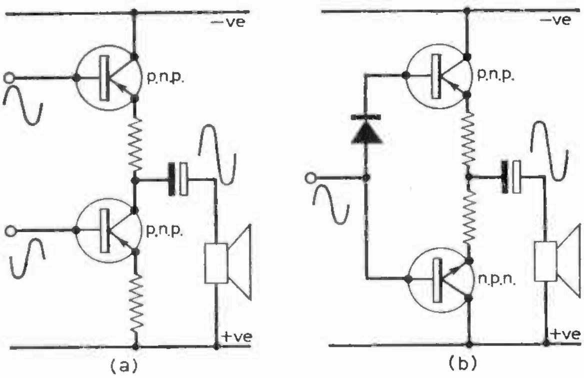

Fig. 2: Transformerless output stages. (a) Single-ended with two pnp transistors, requiring two anti-phase inputs. (b) Complementary pnp-npn circuit requiring one input only.

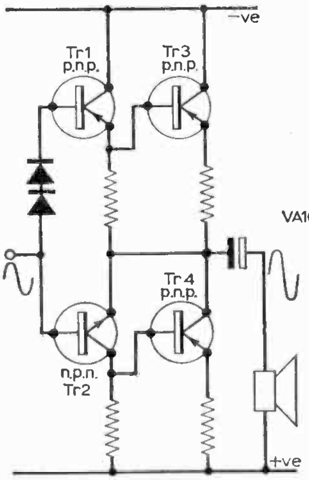

Fig. 3: Complementary driver stage feeding two pnp transistors Tr3 and Tr4 in the output stage.

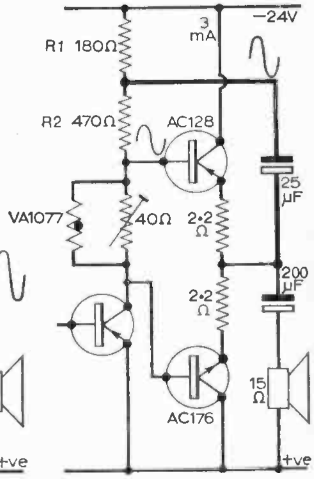

Fig. 4: Complementary output stage driven by a bootstrapped single transistor driver stage. Heavy line is bootstrap connection.

A complementary output stage, Fig. 2(b), consisting of a matched pair of transistors, an npn with a pnp one, is more convenient in that it only requires a single input. The existence of these two types of transistor, with opposite polarities, makes this possible, because an input half-cycle that produces conduction in the pnp transistor will cut off current in the npn transistor and vice versa.

It is however easier to match power transistors when both are of identical type. Returning to the original single-ended output stage, Fig. 2(a): for large output powers, the two transistors can be preceded by others to provide the drive currents necessary. These can be complementary transistors, enabling the circuit to work from a single input. The combined circuit, Fig. 3, is "quasi-complementary": the upper and lower sections look different, but have a performance on alternate half-cycles like the complementary matched pair of transistors in Fig. 2(b). Tr1 and Tr2 function as previously described. The output pair Tr3 and Tr4, however, both being pnp types, require input drive signals of the same polarity. For this reason Tr3 input is taken from the emitter circuit of Tr1 while Tr4 input is from Tr2 collector circuit.

—continued on page 526

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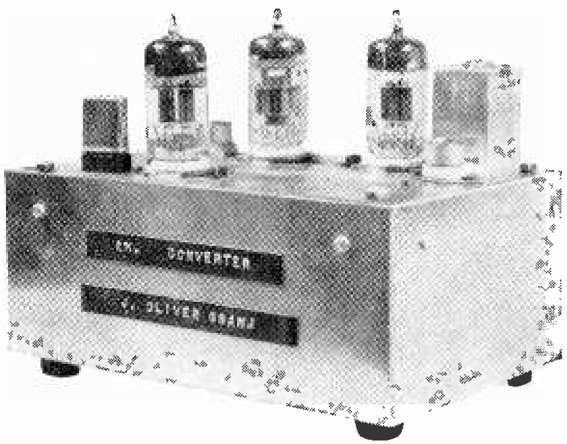
simple TWO-METRE CONVERTER

J. OLIVER G8ANJ



THIS unit was conceived as an introduction to v.h.f. practice, but it was so successful that it has become a permanent part of the station. The circuit is a collection of well tried and reliable elements and no originality is claimed except in the design of the unit as a whole. The entire device may be built for as little as £2 10s, although some constructors may have to purchase a new crystal which will increase the price to between £3 and £4. All these features make it an ideal constructional project for the beginner at v.h.f.

The entire circuit is designed around three double triodes. V1 contains the crystal oscillator and multiplier, V2 a cascode r.f. amplifier and V3 the mixer and, if required, a cathode follower.

The crystal oscillator is of the Squier type, and uses a 46·7Mc/s 3rd overtone crystal. This crystal was used because it was to hand, but a fundamental type crystal with a frequency of 15·56Mc/s should work equally well, although the tapping point on L1 may have to be adjusted and the value of R1 reduced slightly. The oscillator signal is coupled via C2 to the grid of V1B which is a trebler stage giving an output in the region of 140Mc/s.

The output from V1B is inductively coupled via a link winding (L3, L4), to the tuned circuit in the anode of the r.f. amplifier, thence via C8 to the grid of the mixer V3A. The mixer itself is of the low noise starved triode type, using half an ECC81, the 4·6Mc/s i.f. signal being developed across the tuned circuit L8, C10. The i.f. output is link coupled to Sk2 by means of L9 overwound on L8.

The r.f. amplifier is a conventional neutralised cascode stage using an E88CC v.h.f. double triode. The aerial signal is coupled from Sk1 to L7 which is self resonant with the input capacity of V2A at 145Mc/s. The output of V2A is coupled directly to the driver grounded grid amplifier V2B, L6 serving as a neutralising coil. The output from V2B is coupled via the self-resonant tuned circuit L5 to the mixer by means of C8.

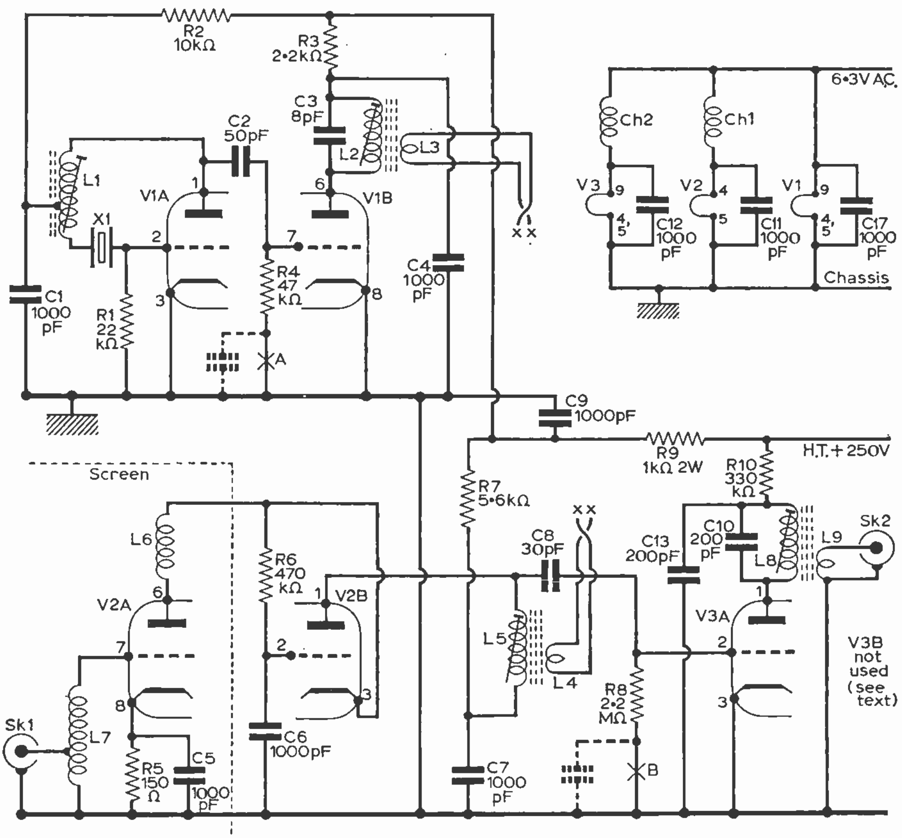


Fig. 1: Complete circuit diagram of the converter. Note that only half of V3 is used in this circuit.

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The entire converter is constructed on a single 18 s.w.g. brass plate of size 6 x 4in. This is mounted on a standard 6 x 4 x 2½in. aluminium chassis which is inverted and fitted with 4 small rubber feet. This makes for an attractive unit which is easily dismantled in the event of failure. Brass is preferable to aluminium for chassis work at v.h.f. as soldering directly to earth is possible, but, if brass is not available, copper or tinplate would do equally well.

All holes should just be drilled in the chassis plate (Fig. 4) and the screen fabricated from the same material as the chassis. It should be noted that if different types of coil formers are used for L1, L2, L5, L8, the chassis plan may have to be modified accordingly.

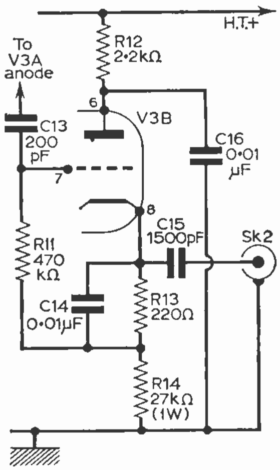

Fig. 2: A suitable cathode-follower circuit utilising the other triode in V3

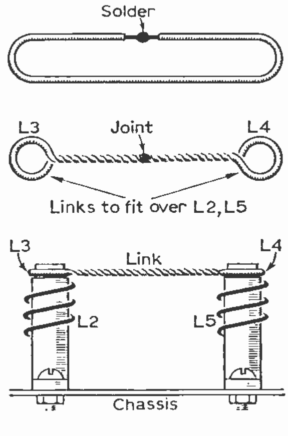

Fig. 3: Winding details and positioning of L3 and L4, and their coupling to L2/L5.

Construction

Construction should proceed logically, starting by soldering the screen to the chassis, then mounting the valve holders, coaxial sockets and the coil formers for L2 and L5 as these coils are easier to wind *in situ*. The remaining coils should then be wound and mounted in their respective locations. The remaining wiring may then proceed, starting with the heater circuit, followed by the signal circuits and finishing with the h.t. supplies. Care should be taken to ensure that the layout follows the original closely and that all r.f. leads are short and direct, as this will help to prevent instability. All soldered joints should be made with a hot iron and checked carefully afterwards as a bad connection will cause noise and/or spurious oscillations. Most of the wiring is self-supporting, but use should be made of a tag-strip to anchor all h.t. connections firmly.

Feed through ceramic 1000pF capacitors could be used with advantage in place of the ceramic tubular by-passing capacitors as they exhibit a much lower impedance to r.f. and make for much greater stability in the final design.

When construction is complete, the circuit should be carefully checked for short circuits, dry joints, etc. When you are satisfied that no mistakes have been made, the valves should be plugged in and the heater voltage only applied; if all the heaters light up, V2 and V3 should be removed and h.t. applied to V1 only. A 1mA meter should be inserted at point A and a 1000pF capacitor wired across from the bottom of R4 to earth. The slug of L1 should be screwed *into* the coil until the meter reads a maximum. The slug should then be backed off half a turn and sealed with Durofix. The grid current in V1B should be between 300 and 600μA, if it is greater, the tapping on L1 should be reduced by one turn and the procedure repeated. V3 should then be inserted in its holder and the meter inserted at point B in a similar fashion and the slug of L2 adjusted for maximum current through R8.

Now plug in V2 and feed the converter output into a suitable communications receiver. The receiver should be tuned to 5·0Mc/s and a signal from a signal generator or grid dip meter loosely coupled to the input of the converter. The signal source should be tuned about on 144—146Mc/s until a signal is heard in the receiver. L8 should be peaked for maximum output, then peak the slug of L5 and finally adjust the spacing of the turns of L7 for maximum signal. The tuning of L7 will be very broad and it may seem that it has no effect on signal strength at all. If this is the case try adjusting the number of turns or shunting it with a capacitor between 1 and 5pF. No alignment of L6 is necessary unless the constructor has noise generating and measuring equipment that he can use to adjust the

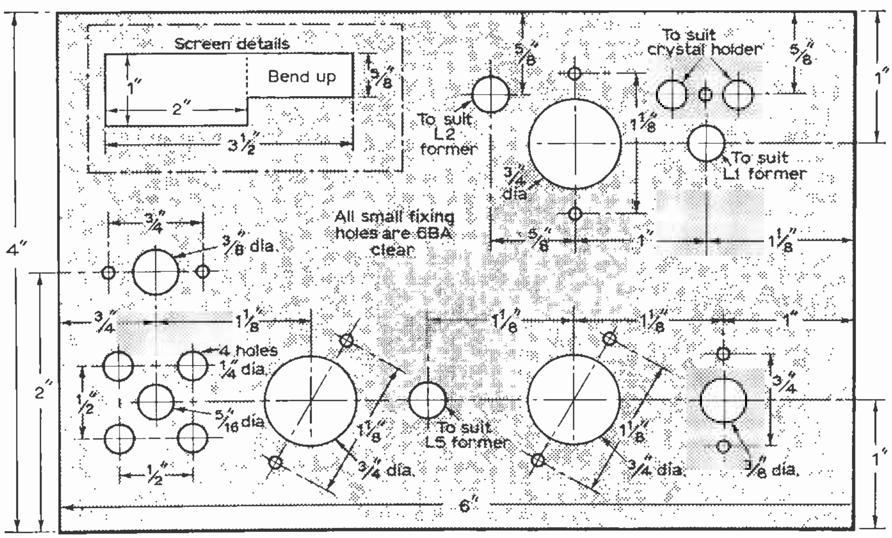

Fig. 4: Sizes and drilling dimensions for the chassis. Details of the screen shown in the top left-hand corner.

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inductance of L6 for lowest noise.

The response curve of the prototype was checked on a Rhode and Shwartz polyscope type S.W.O.B., and the following figures might be of interest to constructors.

Gain	20dB
Bandwidth	1·8Mc/s at 3dB
2nd Channel Rejection ..	17dB

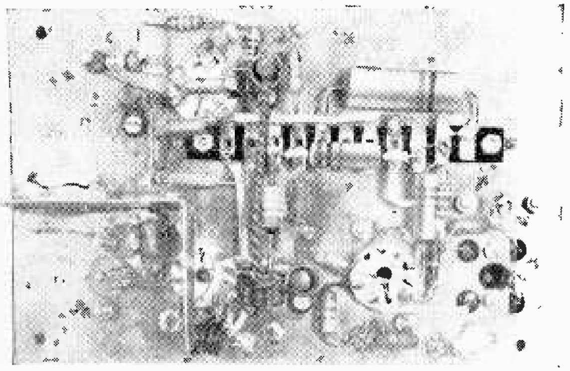
The noise figure of the converter has not been measured, but the background noise on a weak signal, although appreciable, is not objectionable and the converter performs well when compared with more complicated devices. If no signal source is available for the alignment of the signal stages, there is an alternative method which, if carefully followed, should produce equally good results. The core of L8 should be peaked on noise with the receiver tuned to 5Mc/s, and then L5 should be peaked in a similar fashion, making sure that it is tuned to the h.f. side of the oscillator. The converter should then have an aerial (dipole or halo) plugged into Sk1 and the local beacon searched for (alternatively a local station may be used), and, when found, the signals may be re-peaked in the manner described previously.

The tuning of the i.f. coil may be found too sharp; if this is the case, try shunting the tuned circuit with resistors between 10kΩ and 47kΩ retuning in each case. This was not found necessary in the prototype, but some constructors may prefer the flatter response obtained.

Improving the converter

Although the circuit described above performs adequately, some simple improvements can improve its performance considerably. The first such improvement is the inclusion of a cathode follower output stage, utilising the unused triode portion of V3. Figure 2 shows the circuit of such a stage, which, as can be seen, is quite simple, and provided care is taken in the layout no problems should be encountered. The advantage of the cathode follower output is that the whole of the i.f. signal developed at V3A anode is transferred to the input of the main receiver, instead of being stepped down to provide the correct impedance match.

The second, and simpler, improvement consists merely in adjusting the value of R10 until the voltage at V3A anode is approximately 60V with no signal present. At this voltage the noise from the mixer when compared with the gain of the stage is optimum, i.e. if the voltage is reduced, the noise will be reduced slightly, but the gain will fall more rapidly. If the h.t. is increased the noise will increase out of all proportion to the gain.



Photograph of the under-chassis wiring on the prototype. Note positioning of components to ensure very short leads. This is very important at the frequencies involved and should be observed.

★ components list

Resistors:

R1	22kΩ
R2	10kΩ
R3	2·2kΩ
R4	47kΩ
R5	150Ω
R6	470kΩ
R7	5·6kΩ
R8	2·2MΩ
R9	1kΩ 2W
R10	330kΩ

Capacitors:

C1	1000pF ceramic
C2	50pF silver mica
C3	8pF ceramic
C4	1000pF ceramic
C5	1000pF ceramic
C6	1000pF ceramic
C7	1000pF ceramic
C8	30pF silver mica
C9	1000pF ceramic
C10	200pF silver mica
C11	1000pF ceramic
C12	1000pF ceramic
C13	200pF ceramic
C17	1000pF ceramic

Valves:

V1	ECC81
V2	E88CC
V3	ECC81

Crystal:

X1 46·7Mc/s 3rd overtone HC6/U

Coils:

L1	13 turns 38 s.w.g. enam. $\frac{1}{4}$in. dia. former close wound tapped at 4 turns.
L2	3 turns 22 s.w.g. enam. $\frac{1}{4}$in. dia. former $\frac{3}{8}$in. long.
L3, L4	1 turn 22 s.w.g. plastic covered wire on each end of twisted pair of wires. See Fig. 3.
L5	3 turns 22 s.w.g. enam. $\frac{1}{4}$in. dia. former $\frac{3}{8}$in. long.
L6	5 turns 18 s.w.g. enam. $\frac{1}{4}$in. dia. close wound self supporting.
L7	4 turns 18 s.w.g. enam. $\frac{1}{4}$in. dia. close wound self supporting tapped at $1\frac{1}{2}$ turns.
L8	30 turns 38 s.w.g. enam. $\frac{3}{8}$in. dia. former close wound.
L9	4 turns 28 s.w.g. enam. overwound on cold end of L8.
Ch1, Ch2	10 turns 32 s.w.g. enam. wound on a 4·7kΩ $\frac{1}{2}$W resistor.

Table of values for Fig. 2

Resistors:

R11	470kΩ
R12	2·2kΩ
R13	220Ω
R14	27kΩ 1W

Capacitors:

C13	200pF silver mica
C14	0·01μF ceramic
C15	1500pF ceramic
C16	0·01μF ceramic

Miscellaneous:

Three B9A valve holders; coil formers; wire; metal for screen, chassis etc.; tagstrip; crystal holder; nuts, bolts etc.; two co-ax sockets.

Conclusions

When this converter was used together with an AR88D receiver, a transistor preamplifier and a simple dipole aerial located in a downstairs room, results have been quite satisfactory, stations over most of southern England have been heard. Any power supply is suitable that will provide 250V at 35mA and 6·3V at 1A.

It should be noted that if trouble with i.f. breakthrough is experienced, the chassis of the converter should be earthed to the receiver chassis with a piece of copper braid not more than 6in. long. ■

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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

AFRICA

Algeria: *Radiodiffusion Television Algerienne* (21 Boulevard des Martyrs, Algiers) is now using 11,715 to carry the French service. Clear identification is given at 1600. This programme has also been heard around 1800 on 11,835. Fair reception of the Arabic service is possible in the evening on 11,735

Liberia: *Voice of America* relay at Monrovia (Washington D.C. 20547, USA) has a special programme of news items in Swahili, Arabic and English for East and Central Africa from 1530-1600 on 21,560. This station can also be heard at fair strength at 1830 in French on 11,960.

Nigeria: *Nigerian Broadcasting Corporation* (Broadcasting House, Lagos) seems to be experimenting with different frequencies and now uses 15,330 for its 1700-1900 English Tx.

South Africa: *Radio South Africa* (P.O. Box 4559, Johannesburg) now transmits in English as follows: Mondays to Saturdays 0415-0427 15,220/11,900; 0430-0442 17,805/15,220; 0500-0512 11,900/9,525; 0515-0527 21,535/17,805; 0645-0657 17,805/15,220; daily 1000-1455 21,535/17,805/15,270/11,900; 1600-1655 15,220/11,900; 1700-1755, 1800-1855 and 2100-2155 21,535/17,805; 1900-1955 (UK Tx) 21,500/17,790; 2330-0325 11,875/9,705.

MIDDLE EAST

Saudi Arabia: *Saudi Arabian Broadcasting* (Ministry of Information, Airport Road, Jeddah) has an English by Radio transmission at 1900-1930 on 9,670/11,855/15,150.

Syria: *Radio Damascus* (Ommayad Square, Damascus) has Arabic from 1500-2200 on 17,860. From 1800 15,165 is used also. Between 2230 and 0100 both channels are used for Spanish, Portuguese and Arabic transmissions to South America.

ASIA

India: *All India Radio* (P.O. Box 500, New Delhi) now uses 15,080 from 1745-2045 for English to Africa. Other frequencies are 9,690/2045.

NORTH AMERICA

Canada: *Canadian Broadcasting Corporation* (P.O. Box 6000, Montreal) appears to have moved from 15,320 to 15,325 for its afternoon transmission to Europe. Reception is fair as it is on 21,595 and 17,820. The other frequencies used. Interference from Radio Moscow spoils the 17,820 signal.

USA: *Radio New York Worldwide* (485 Madison Avenue, New York, N.Y., 10022) now transmits in English from 1600-2200 on 21,530/17,845/15,440; 1600-1900 17,730; 1900-2200 17,760; 2000-2200 11,970.

Voice of America (United States Information Agency, Washington, D.C., 20547) now has English to Europe 0300-0730 on 3,980/5,965/5,995/7,200/7,270/9,540/9,635/9,740; 0500-0730 6,040/1,196; 0600-0730 11,705; 0300-0600 11,790; 0400-0730 11,835; 1400-2330 (2345 Sundays) 3,980/5,965/15,290; 1400-2000 11,770; 1400-2215 15,205; 1400-1800 17,855/17,890; 1400-1600 21,455; 1400-2015 21,600; 1600-1800 and 2100-2330 (2345 Sundays) 1,196.

EUROPE

Austria: *Osterreichischen Reudfunk* (P.O. Box 700A, 1040 Vienna) gives fair reception on 11,900 at 1230-1300. Frequent identification in German, French, English and Arabic. Interference comes from Radio Moscow's home service.

Bulgaria: *Radio Sofia* (4 Boulevard Dragen Tsankov, Sofia) excellent reception after 1030 in Turkish on 11,955. At 1100-1110 there is news in Bulgarian. Excellent reception of the Turkish programme is also given from 1000-1100 on 11,765.

Czechoslovakia: *Radio Prague* (Prague 2, Vinohradska 12) now using 15,285/17,840/21,735 for its 1530-1630 English transmission. 17,840 is now being used in addition to 5,930/7,345/11,990/15,345 for the 0330-0430 transmission.

Denmark: *Radio Denmark* (Radio House, Copenhagen V) now airs its Far East transmission on 15,165 half an hour later at 0730-0845. English is at 0815.

Finland: *Radio Finland* (Unioninkatu 16, Helsinki) now has an English news bulletin at 1815 on 9,555/11,805/15,185.

France: *O.R.T.F.* (Maison de l'O.R.T.F., 116 Avenue du President Kennedy, Paris 16) now transmits in English at 0015-0030 on 7,160/9,500/11,725B/15,445B; 0615-0630 11,725B/15,445B; 1100-1115 17,850/21,650; 1300-1330 15,445B/17,720/17,740/21,500B/21,525/21,580; 1915-1930 11,930B/15,190B/15,245/21,580 (B= Brazzaville relay).

Germany: *Deutsche Welle* (Bunderstrasse 1, Postfach 344, Koln) now transmits in English: 0845-0940 15,275/17,845/21,650; 2110-2200 7,275/9,675; 0300-0340 9,530/11,945; 1550-1620 15,275/17,880; 0600-0630 11,785/15,275/17,845; 1100-1115 11,930/15,275/17,875; 2145-2205 11,925/15,275; 0130-0250 9,640/11,945; 0445-0545 9,735/11,945; 1045-1055 11,905/15,315; 1900-1910 15,405/17,785.

Radio Free Europe (1 Englischer Garten, Munich) has been noted recently as follows: 21,720 Czech at 2000; 21,620 Polish 2030; 21,520 Czech 1800; 17,835 Czech 1500; 17,805 Polish 1545; 17,770 Hungarian 1045; 15,355 Hungarian 1700; 15,215 Romanian 1500; 15,170 Hungarian 1800; 15,145 Polish 2045; 15,115 Bulgarian 2030; 11,895 Polish 1530; 11,855 Romanian 1545; 11,815 Hungarian 1830.

Greece: *Radio Athens* (Mourouzi Street 16, Athens 138) now has English at 1340-1350 on 7,295/9,605.

Vatican: *Vatican Radio* (Vatican City) now has English to Europe at 1400 on 9,645/11,740/15,120/1,529.

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ANOTHER cool cool month for ten metres I'm afraid. Still the 1·97Mc/s of nothingness persists up there. Many people who sent in logs complained of hearing exactly the same nothing too, although some did confess that one or two Europeans and the occasional W did pop up now and again. Trouble is they popped down again just as quick. Any sunspot experts in the audience care to predict what will happen in the next few months?

FIFTEEN

Let's look at the band that has shown most improvement during the past month.

L. Rowland (Cheshire), Trio 9R—59, 150 ft. end-fed logged—CE6DC, CE8DV, CN8BV, CP1AR, CP6HB, CR6JW, CX9AAN, EL2DD, W6THY, WB6KOH, XW8EZ, YA1DAN, YS2CEN, YV1PP, YV4QG, ZC4MO, ZD8RB, ZS4PU, ZS5KF, ZS6BFI, 4U1ITU, 4X4IL, 5A1TV, 5Z4JW, 9G1BF, 9J2AB, 9L1GB, 9Q5FF, 9U5SK (Burundi), 9V1NP, 9X5AA (Rwanda). All these were on s.s.b.

D. Henbry (Sussex), has just acquired an HA-500 but says it's very fussy about antennas. On fifteen s.s.b. David heard—CE6FK, CEØAE, CX1AAC, CX7AP, HC1KS, HI8XHJ, HR1KAS, JA1CB, JA3COX, JH1BF, KV4FA, MP4BBA, VP2GAR, VP6WR, VS9MB, VU2BK, WA7BEV, YA1FV, YS1RTV, ZE2JE, ZS6AKC, 5N2AAN, 5U7AK, 6O1GB, 8R1C, 9G1GQ.

G. Richards (Isle of Wight), has a GEC 5-valve superhet with an indoor antenna—12 ft. of wire. He managed these on 15 a.m.—CP1LE, CT2AB, EP1LGM, I1BEG, K2ONO, K2VFB, K4YMJ, UB5FG, W2AFB, WA3GMN, W4DNY, W7NUA, W9RHZ.

M. Joyce (Birmingham) RA—1, 12 ft. whip sent in this log but didn't say what mode—CR6DA, CT1BH, DL, DJ, DM, EL9A, ET3WH, F, G, GM, GW, HB9ACG, HI6HJ, HI8XHJ, HP3MC, I, IT1QR, JA1LZP, JA1EBU, JA3EED, KA2VT, KP4AST, KV4CX, KZ5WL, LA, MP4BGE, MP4TBA, OA5HGL, OD5BZ, OE, OH, OZ, PY5IM, PZ1BO, SM, SV1CW, UB5FJ, VE2QS, VE3NB, VU2VKZ, W, YN4WD, ZB2AL, ZC4MO, 4X4KX, 5A1TV, 5Z4JW, 9G1BF, 9V1NV.

TWENTY

Back to the favourite, if you can't hear it on twenty retire to a monastery. Practically everywhere from Europe to the Pacific is on at one time or another.

L. Stockwell (Essex), BC342, 20 ft. wire in the bedroom heard—CP5SK, CT1NL, EA3HI, G4JG, HV3LJ, HB9LS, LX1BA, SV1CC, VE1EI/P, WB3OSW, W4AJP, W8BMK, 4X4FQ.

P. Ridley (Cheshire), H.R.O., 140 ft. long wire switched in his trusty b.f.o. and logged these on s.s.b., CE3ZN, CP1EE, CR6IV, EL2AC, EL3C, EP2BQ, ET3USA, F3CC/FC, HK4TA, HR2VFB, HR6EB, HS4AK, HV3SJ, I2LAG??, KL7MF, KP4AKB, KP4BCL, KR6MB, KR6USA, KV4EU, M1B (San Marino), OA4MX (Peru), PX1JS, PZ1BW, TF3EA, TI2ES, TI3TS, VK2WD, VK2AVA, VK3BM, VK3HA, VK3IP, VK3XO, VK5TJ, VK6GP, VP6WR, VP7EG, VQ9TC, YA1HD, ZL1KG, ZL3UY, ZL4BX, 4X4FQ, 4X4TP, 5Z4IW, 6Y5GG, 9V1NO, 9V1NQ, 9V1MT.

L. Bousher (a place in Wales I can't pronounce), R1155, 50 ft. long wire got these on s.s.b.—BY2PJ, CE3DM, CE4FY, CN8BV, CP5BQ, CP5AD, HI8LAL, HK4KL, HV3SJ, IS1SCB, JA1AEA, KP4AST, KP4LA, KZ5CZ, KZ5WI, KZ5HI, LU3MBQ, LU3FBT, LU8DKA, LU9DM, OA4XX, OA6AD, OA6BL, PJ2AQ, PY2DVR, PY3BXW, SVØWL, TI2PAS, TL8DL, TF3EA, UQ2KBH, VK3PG, VP1KL, VP2AA, VP6WR, VP8IU, VS9ALV, VU2BN, VU2WB, XW8AX, YV5AYB, YV5BPJ, YV7AV, ZC4AK, ZE1AE, 3A2CP, 3C1AE, 5Z4KN, 6O1GB, 8R1C, 8R1S, 9K2AB, 9G1TV, 9M2NF. Cor, how much do you want for that 1155 OM?

EIGHTY AND FORTY

Two brave r.f.-gathering warriors sent in their conquests this month. These are the bands where they separate the men from the boys—so I'm told.

C. Lewis (Devon), R1155A, 120 ft. long wire, heard this lot on a loudspeaker when tuning around 7Mc/s —CN8AW, CN8BV, DJ8SW, F5LA, I1KDB, IT1ZGY, PAØAB, SM4MI, UA9EU, VK2ABA (Wow!), ZD8RB, 9H1AM, 9M2DW. On 3·5Mc/s—DL6FU/M, F2WW, K2BXV, K4DPQ, ON4TT, PAØLM, VE2ED, VE2BF, W3EBK, W3FBB, W3KQY, W4FFO, W4UFO.

P. Baker (S. Wales), HE30, 100 ft., end fed sums up the bands by saying: 1·8—Full of G's, G mobiles (I heard that), GW, GM and EI4AN on s.s.b. 3·5—Full of QRN and QSB. 7·0—Some very good openings after dark. 14·0—S. America and the Carribean area very plentiful from 0700—0830. 21—Half the time dead as a doornail, the other half wide open. 28—Useless.

Paul listened on forty s.s.b. between 2200 and 2400 for—CN8AW, DJ8RR/M, EA6BH, EA8EZ, HI8XAL, LX1WR, OX3BS, OX3WX, PY1CWA, PY4ND, PY7AKQ, PZ1CF, VS9MB (Maldive Is.), ZB2AP, ZC4MO, ZD8RD, ZS5KY, 4X4BK, 9M2DW, 9V1VT.

CONTESTS

Eyes down, here comes the contest list for the keen types for October. If you are contest-minded then this month will drive you up the proverbial creek. Knee-deep in contests and some of them all on the same day too. October 7th/8th—1296Mc/s contest, RAEN contest, VK/ZL contest, WADM contest. On 14th/15th—RSGB 21/28Mc/s contest, hope ten is fully recovered by then, 14th—15th, 432Mc/s contest, VK/ZL contest phone section, 15th —D/F National Final. 21st/22nd—CQ WW DX contest, 28th/29th—RSGB 7Mc/s DX contest (phone section) good one to get your feet wet on forty.

That's the story for this month, deadline for logs is, as usual, the 20th.

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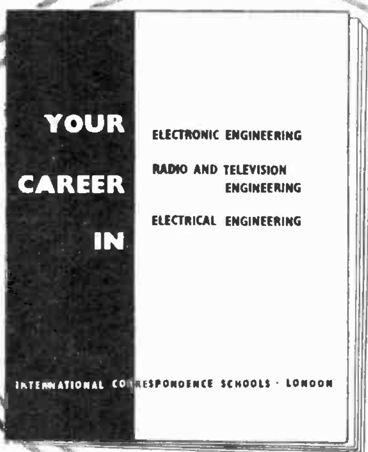

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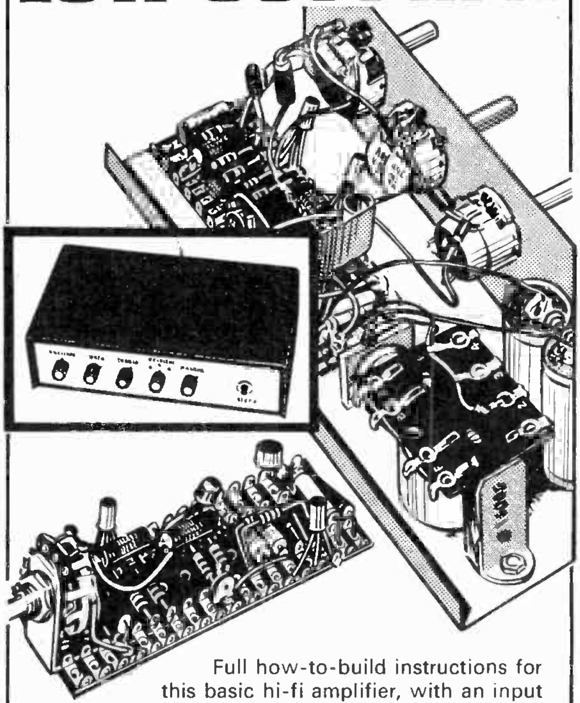

Full how-to-build instructions for this basic hi-fi amplifier, with an input sensitivity of 3mV and an output of 1 watt 30–50,000 c/s, are included in the November PRACTICAL WIRELESS. A suitable pre-amp and a companion power amplifier, giving 5 or 15 watts into 15 or 3 ohms respectively, are also detailed, and the feature includes power circuitry for all units.

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PRACTICAL WIRELESS

December issue on sale Nov. 3rd

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THE MW COLUMN

ONCE again the main m.w. DX season is with us, although signals may be weak for a while. But welcome to our old friends and to newcomers in this side of DX listening.

Conditions have been quite good throughout the summer with many "deep" South Americans—Uruguay, Paraguay and Ecuador are now coming through. As we get into darker months, conditions generally will improve but the South Americans may diminish somewhat. By now, Asia should be putting in an appearance (try afternoons from 1500 and evenings 2100-2330). From October they *may* be heard from as early as 1300 but at the time of writing I have had no luck with the Chinese stations which often peak around 2130. A few North Americans can be heard after the French stations sign off at 2300 and although they are very weak now, they should be getting much stronger by mid-October.

At the time of writing nothing very exciting has been logged, only run-of-the-mill items. The best signals have been *Radio Americas*, Swan Island (1157), China (1523), WCAU Philadelphia (1210), St. Pierre et Miquelon (1375), WBT Charlotte (1110), YVQJ Barcelona (1080), WHN N.Y. (1050), WBZ Boston (1030), KDKA Pittsburg (1020), CFRB and WINS (both 1010), CHNS Halifax (960), CKNB and CHER (both on 950), CMB Montreal (940), CJON St. Johns (930), WGY Schenectady (810), CFDR Dartmouth (790), WABC N.Y. (770), WAVY Portsmouth (1350), WLCY (1380), WNJR Newark (1430), WMEX Boston (1510), WKCY (1530), WHAM Rochester (1180), WNEW N.Y. (1130), CJCH Halifax (920), WWL New Orleans (880).

Conditions have not been very good during the last few nights before writing this column but they should start picking up by the time you read this. We ask readers to listen (particularly during October) for stations on the West Coast of North America which, if they appear, will come through between 0300-0600. Key stations are KING Seattle on 1090 and KOMO Seattle on 1000. When trying for KOMO you will experience QRM from WCFL Chicago and the Mexican station also on the same frequency. One technique on possible sessions is to stay tuned to WCFL and wait for it to fade down, when KOMO may appear. Dates, times, and general notes on *any* West Coast stations received will be greatly appreciated.

Many readers must have built the loop aerial described last season—at least I have sent out well over a hundred copies of the instructions. So we are expecting good support from you this year in sending along news of stations heard and other m.w. information. With the more unusual stations, times are very important as are signal reports and other notes. Let's make this year a bumper one for DX.

Alistair Woodland

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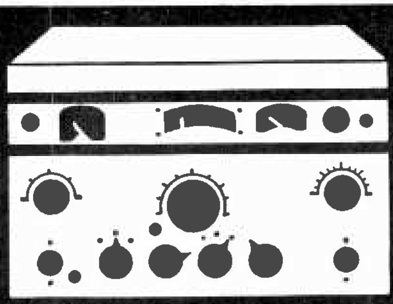


GUIDE TO SURPLUS COMMUNICATIONS RECEIVERS

K. ADKINS

PART 4

The PCR Series

The PCR was manufactured in fairly large numbers for the British Army by Pye and Philips. It was designed for the reception of broadcast stations, rather than for communications purposes, but has features which make it suitable for reception on the amateur bands.

Four versions exist: they have most features in common. The PCR is probably the cheapest, general coverage, ready-to-use communications receiver available. Unfortunately it does not have a b.f.o., and is therefore unsuitable for c.w. and s.s.b. reception.

The PCR has 6 octal valves, including an r.f. stage, two i.f. stages, and a 6V6 output stage. It has a 180 degree illuminated and calibrated dial, with flywheel tuning. Other panel controls are audio gain, aerial trimmer, tone control, and output sockets for headphones. It has an internal 5 inch loudspeaker, although certain versions do not. The overall sensitivity is from 1 to 2 μV. Signal to noise ratio is 10dB at 6 μV.

The frequency ranges are 850-2,000m, 200-500m and 6 to 18Mc/s. It has a black metal cabinet, size 17in. x 8in. x 10in. An external power unit is required, and must supply 250V d.c. and 12V. External power units are available for a.c. mains or for 12V car battery. In addition, some receivers were fitted with internal a.c. mains power units.

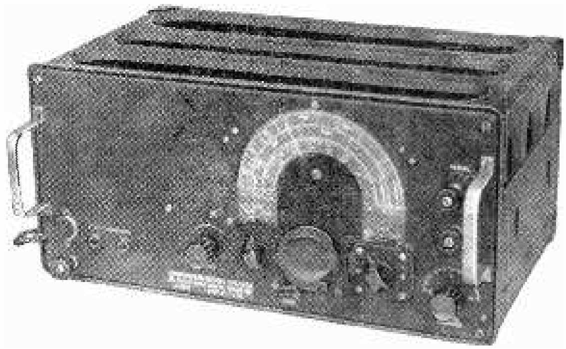
Modifications: The PCR operates perfectly satisfactorily without modification, However, the obvious modification is to add a b.f.o. An "S" meter would also be a worthwhile addition for the serious user.

Availability: PCR receivers first came on to the market in large quantities in late 1961, reconditioned by REME and in very good condition indeed. They were sold for a standard price of £6 19s. 6d., less power supply. Mains power supplies were an extra £2, and either the original external power unit was provided, or the receiver could be fitted with an internal mains supply for the same price. By late 1963 all the PCR's of the 1961 release had been sold. No manuals were issued.

PCR1

This version has a slightly different frequency range, as follows:— 860-2080m, 190-570m, 5·6 to 18Mc/s. It contains an internal speaker, like the PCR.

Availability: The PCR1 was not released with the PCR model in 1961. The first PCR1's came on to the market in the summer of 1966 at a price of £8 19s 6d., for grade 2 condition. Some have been available recently at a similar price. External power units were £2 for the a.c. version and 15s. 6d. for the 12V d.c. version. No PCR1 manuals have been issued.



Photograph by courtesy of G. W. Smith (Radio) Ltd.

PCR2

This is also similar to the PCR, but the frequency range is:— 850-2,000m, 200-550m and 6 to 23Mc/s. It does **not** have an internal speaker.

Availability: The PCR2 came on to the market at the same time as the PCR in a slightly inferior condition, although still in grade 2 category. They sold at between £5 and £7, without power units. Both external and internal power units were available on the same basis as for the PCR. The PCR2 was available until 1964, although it is believed that a very small number was released during late 1965. They are not available at the time of writing. PCR2 manuals are not obtainable.

PCR3

The PCR3, otherwise similar to the PCR, has a frequency range of 200-550m, 2·5-7Mc/s, 7-23Mc/s. It does **not** have an internal speaker *(photo above)*.

Availability: The PCR3 first appeared in 1963 in grade 2 condition, at about £8, without power supplies. Power supplies were available.

During the summer of 1966, a new batch of PCR3's were released in grade 1 condition, at £8 19s. 6d., without power supplies. Power supplies could be fitted internally for £2 extra. 12V d.c. power units were available at 19s. 6d. Some PCR3's have been available recently at a similar price. PCR3 manuals are not available.

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The R107

The R107 was first manufactured in large numbers during the last war for the British Army. It is popular with short wave listeners, being completely self contained. In fact, if one has a maximum of £15 to spend, the R107 is often the obvious choice. It performs very satisfactorily on the l.f. bands. The main drawback is its size and weight "built like a battleship and looks like one!" The receiver was built to withstand rough conditions and is very reliable.

The R107 covers 1·2 to 17Mc/s in three bands. It contains 9 valves, including one r.f. stage and two i.f. stages. Sensitivity is from 2 to 6μV. The internal power supplies are for either 100/250V a.c. or 12V d.c. There is also a built-in speaker. Outputs are available for headphones and line.

Bandwidth is switched for either 3kc/s or 7·5kc/s. There is also an audio filter. Provision is made for dipole or open wire antennae. R.F., i.f. and audio gains are provided. The a.g.c. is switched, and there is a b.f.o. control. A test panel is provided on the front panel for the checking of certain internal circuits.

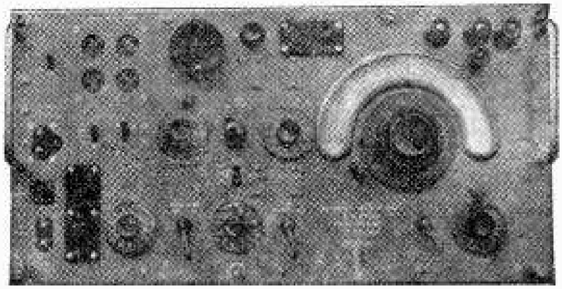
Inside the set, there are three main replaceable chassis units—r.f., i.f. and audio; and power. These units have been obtainable separately on the surplus market. The overall size of the receiver is 24in. x 13in. x 17in.

Modifications: The R107 operates perfectly satisfactorily without any modification at all. In fact, it is rather difficult to modify. Most amateurs would desire an "S" meter, and there exists a simple modification for fitting one.

Availability: R107 receivers have been quite easy to obtain, all in either brand new or very good used condition. They were more plentiful during 1960 to 1962, when they were selling at £12 to £15. Since 1963, they have been less easy to obtain, but grade 2 receivers can still be obtained occasionally for about £14. Those sold earlier can now be acquired on the secondhand market for about £10 or a little more.

During 1963, a quantity of replaceable chassis units, (the r.f. unit and the power unit) were placed on the market in brand new condition for about £2 each. These have not re-appeared since. Other spares, such as i.f. transformers, have been available in the past. The R107T, a superior version, was not made in large quantities but they can be obtained secondhand.

The R107 manual was not included with the receiver when sold brand new, but it has been possible to obtain them from the West End, and there are probably quite a large number in amateur hands.



Photograph by courtesy of Messrs. A. J Thompson.

The R109

The R109 was manufactured for the British Army and is little known, although it was made in fairly large numbers. Most of the R109's that exist were released several years ago, and the receiver is rather scarce nowadays. The main features are a frequency range of 2-8Mc/s, an internal 6V d.c. vibrator pack and an internal speaker. A variation, the R109A, has a frequency range of 2-12Mc/s.

Modifications: Faced with the lack of information on this receiver it is difficult to suggest modifications. However, from a general impression, it would seem that the receiver is not suitable for serious use on the amateur bands.

Availability: R109's were available before the period covered by this report in grade 2 condition until the middle of 1960 for about £4 and R109A's for about £5. It is believed that a few R109's in grade 3 condition were available for £2 10s. at the end of 1960.

Between the end of 1961 and the beginning of 1963, R109's were again placed on the market, presumably for the last time. R109's in grade 1 condition, with a set of spare valves, could be obtained for about £7; and the R109A, in similar condition, for about £8. None have been available since.

R109 manuals probably exist in small numbers, although they would be very difficult to obtain as the R109 itself is very rarely used by the amateur band listener.

to be continued

PRACTICAL TELEVISION

★ CO-CHANNEL INTERFERENCE: Because the number of TV channels is limited, it is necessary for more than one station to work on the same channel number and co-channel interference can be caused. This problem will become even more acute as further u.h.f. channels are exploited. In this article, methods of combating this type of interference are illustrated and brief details of a filter unit are given.

★ HELICAL AERIAL: Used on the continent for u.h.f. reception, this unusual design of aerial is primarily intended for indoors, but there is no reason why an outdoor version may not be constructed to improve reception.

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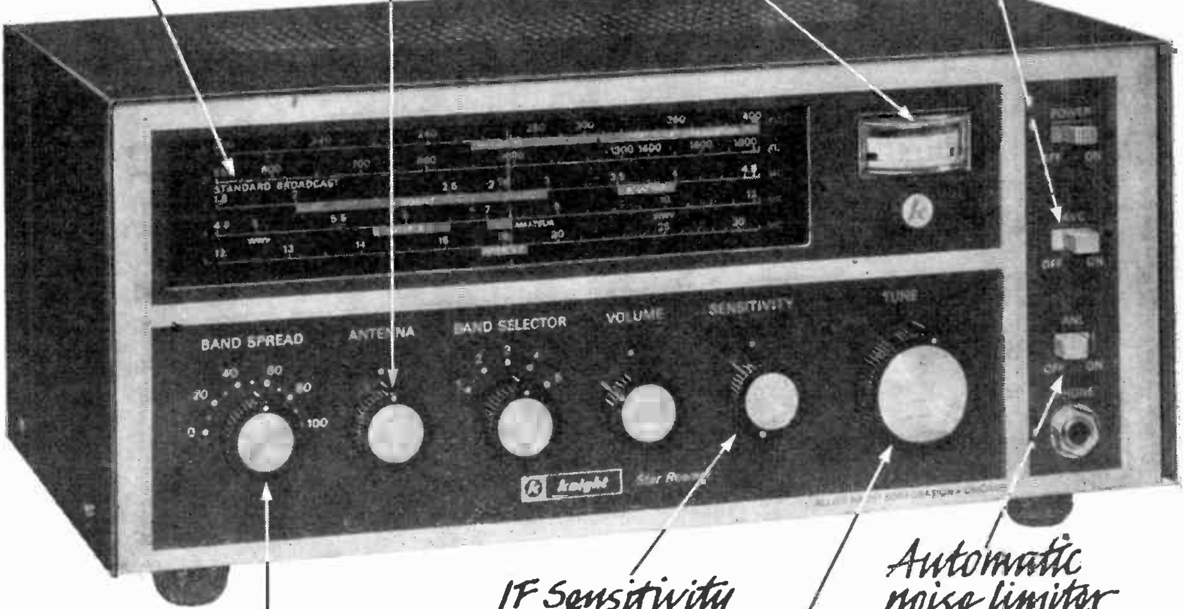

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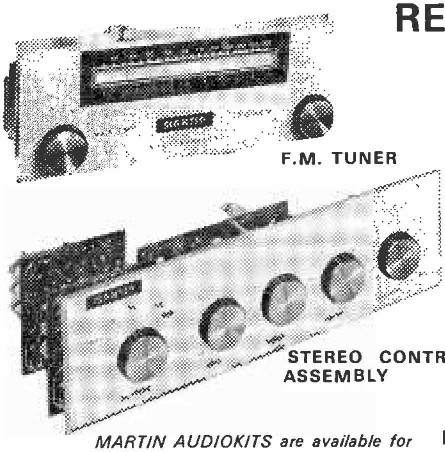

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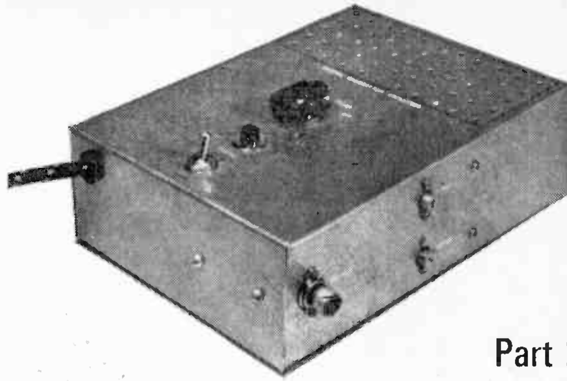
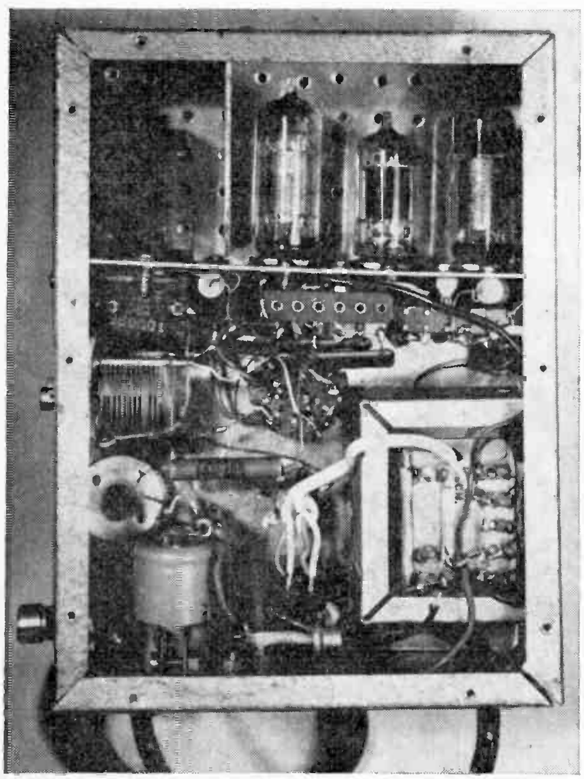


Part 2

FOR the sake of simplicity, the unit was built into a box consisting of the usual four-sided chassis with a baseplate fixed to flanges on the bottom with self-tapping screws. A chassis-panel mounted across the width carries the three valves, the crystals, the tag strips and the bulk of the minor components, the larger and heavier components (the mains transformer, electrolytic capacitors and trimmers) being mounted on the sides of the box.

Heat from the valves is kept away from the crystals by the use of a small screen.

The mains switch, function switch and the neon warning lamp—the controls of major interest—are mounted on the top of the box; the preset capacitors, the output socket and the grommet for the mains cable are mounted out of the way on the sides of the box.



Photograph of the completed unit with the baseplate removed.

CHASSIS DETAILS

The constructor who is fortunate enough to have a workshop set aside with a solid bench, a vice and the requisite tools, and who is reasonably competent at working with metal, may decide to undertake the metalwork himself. Those less fortunate and/or less able, however, are advised to buy the (blank) chassis, baseplate, chassis-panel and screen ready made. They can be obtained from: H. L. Smith & Co. Ltd., 287/289 Edgware Road, London W.2 at a cost, including postage and packing, of 17/-.

When ordering, ask for:

Chassis type N length 8 in.; width 6 in.; depth $2\frac{1}{2}$ in.; flange $\frac{3}{8}$ in.

Baseplate 8 in. x 6 in. to fit above.

Chassis-panel B to fit width of chassis.

Screen type A length $2\frac{3}{4}$ in.; width $2\frac{1}{4}$ in.; flange $\frac{3}{8}$ in. x $2\frac{1}{4}$ in.

All in 18 s.w.g. aluminium.

Figure 6 shows the positions of the controls, screws etc. on the box. This layout has been found to be perfectly satisfactory in the prototype.

Figures 6-8 give the dimensions of the box, baseplate, screen and chassis-panel respectively and show all the holes that have to be drilled. The exact location of some of the holes is not given because they will vary with the size of the components used. For the same reason, the sizes of the holes have not been given; the constructor should have no difficulty in determining these for himself. It is for this reason important for the constructor to have all the relevant components to hand before drilling any holes. Also if the transformer it is intended to use is taller than $2\frac{1}{8}$ in. or more than $2\frac{1}{2}$ in. from one side of the windings to the other, a larger box will be required. When all the holes have been drilled, a finish can be applied to the exterior of the unit. A coat of brush or spray-on crackle paint is easily applied, and will considerably enhance the appearance of the unit. The paint should be left until it has dried hard: the relevant components can then be mounted. Transfers may be mounted at this stage as indicated in Fig. 6. Rubber feet should be glued to the corners of the base so that the unit is lifted clear of the bench and ventilation thus improved.

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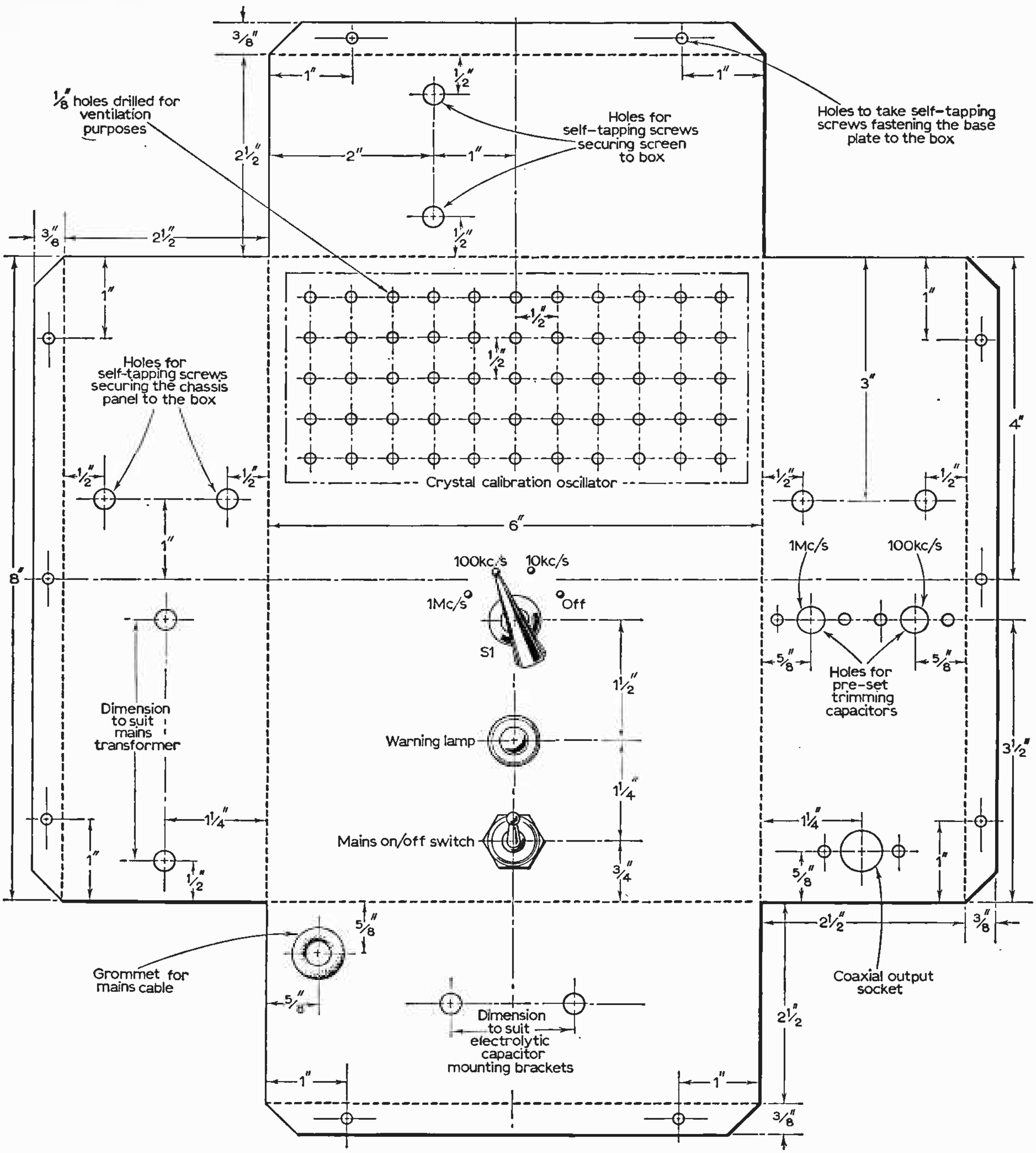

Fig. 6: Details of the chassis with positions of main controls and lettering indicated.

Details of the chassis-panel are shown in Fig. 8. Constructors who intend making the panel themselves should note that the length and breadth are $5\frac{7}{8}$ in. x $2\frac{3}{8}$ in. respectively when the inner dimensions of the box are being considered.

CONSTRUCTION

The electrical construction is best performed in three stages: (1) Wiring of components associated with the box (i.e. power supply unit, switch etc.). (2) Wiring of components on the chassis-panel. (3) Interconnections between (1) and (2).

Stages (1) and (2) should be performed with the chassis-panel removed from the box. For stage (3) the chassis-panel is placed *in situ* but parallel to the top of the box so that easy access may be had to all the tags, especially those of the valveholders.

Figures 9 and 10 give full details of the layout and wiring of the components, and the novice is advised to adhere to these.

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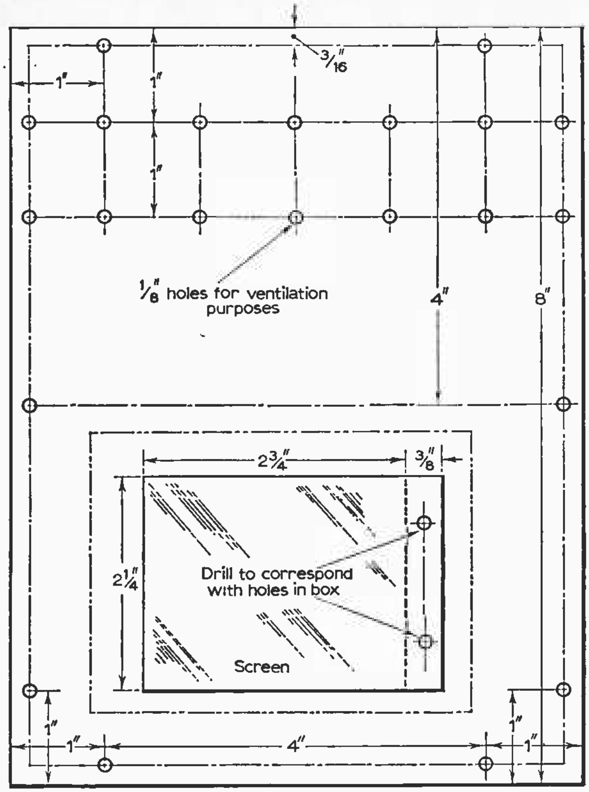

Fig. 7: Details of the baseplate and, lower insert, screen for crystals.

When the electrical construction is completed, a careful check must be made and, when the constructor is satisfied that all is well, the unit is ready for testing and making the necessary adjustments.

TESTING AND ADJUSTING

(1) Check with a multimeter on the resistance range that the h.t. line is in open-circuit with the chassis. If there is a short or low resistance, disconnect each stage from the h.t. in turn and check it individually.

(2) Wrap a piece of insulated wire round V1 pin 7 and place this near the aerial lead of a receiver tuned to, or to a low multiple of, 1Mc/s.

(3) Plug the unit into the mains and switch on; the neon lamp and the valves should glow.

(4) Check the h.t. voltage, which should have risen to about 350V on switching on gradually falling to about 250V as the valves start to draw anode current.

(5) With S1 in the 1Mc/s position a fairly loud hiss should be heard in the speaker. On switching to the 100kc/s crystal, another hiss should be heard though it will probably be slightly weaker than the other. If no hiss can be heard, then the oscillator is obviously failing to function and the wiring and components (including the valve) should be checked. If only one of the crystals fails to oscillate, then either that crystal or its associated circuitry is under suspicion.

The constructor should experience no difficulty in making even surplus crystals oscillate in this circuit, though should the crystal prove stubborn then the constructor should experiment with the position of the cathode tap by varying the value of C1 and/or C2.

(6) When the crystal oscillator is operating satisfactorily, the piece of wire can be removed from the anode of V1 and the output lead be plugged into the output socket. The clip (see Fig. 11) connected to the inner conductor of the output lead is clipped on to the aerial lead of the receiver and the clip connected to the outer to the chassis of the receiver (via an 0·01μF 250V capacitor in the case of an a.c./d.c. receiver). The original hisses should now be much stronger and furthermore harmonics should be audible well down into the s.w. spectrum.

(7) The receiver is now tuned to either an MSF transmission on 5·0Mc/s or 2·5Mc/s, or to the Light Programme on 200kc/s and, with the 100kc/s crystal in circuit, TC1 adjusted for zero beat.

The 1Mc/s crystal is then switched into circuit and made to zero beat with the MSF transmission on 5·0Mc/s by adjusting TC2.

CHECKING THE MULTIVIBRATOR

(8) The 10kc/s multivibrator can now be checked. Set the slider of VR1 so that it is near the centre of its travel. On moving S1 to the 10kc/s position, a very faint, high-pitched note should emanate from the multivibrator circuit. If the tuning control of the receiver is now moved, a number of swishes should be heard in the speaker. These swishes will become closer together as the frequency of the receiver is increased and farther apart as the frequency is decreased. It is thus easier to carry out adjustments to VR1 on the most l.f. range of the receiver.

(9) Note the position of two adjacent 100kc/s bars in this range. With the switch in the 10kc/s position, count the 10kc/s bars between the two points—there should be nine, or eleven including both 100kc/s points. If this is not so, adjust VR1 until it is.

Should it be found impossible to reduce the frequency to 10kc/s the probability is that Cx is too large so that too much sync is being applied. This state of affairs is unlikely by virtue of the nature of Cx. The remedy, however, is simply to unwrap the insulated wire until the frequency can be reduced to 10kc/s.

The unit has now been completed and constructors who have taken time and trouble over both

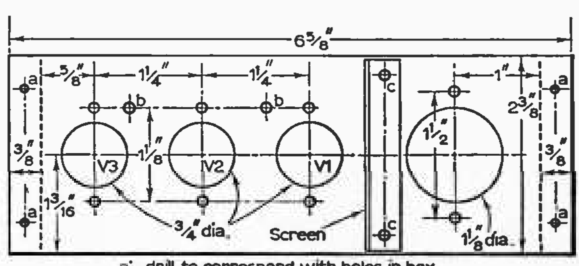

Fig. 8: Details of the chassis-panel.

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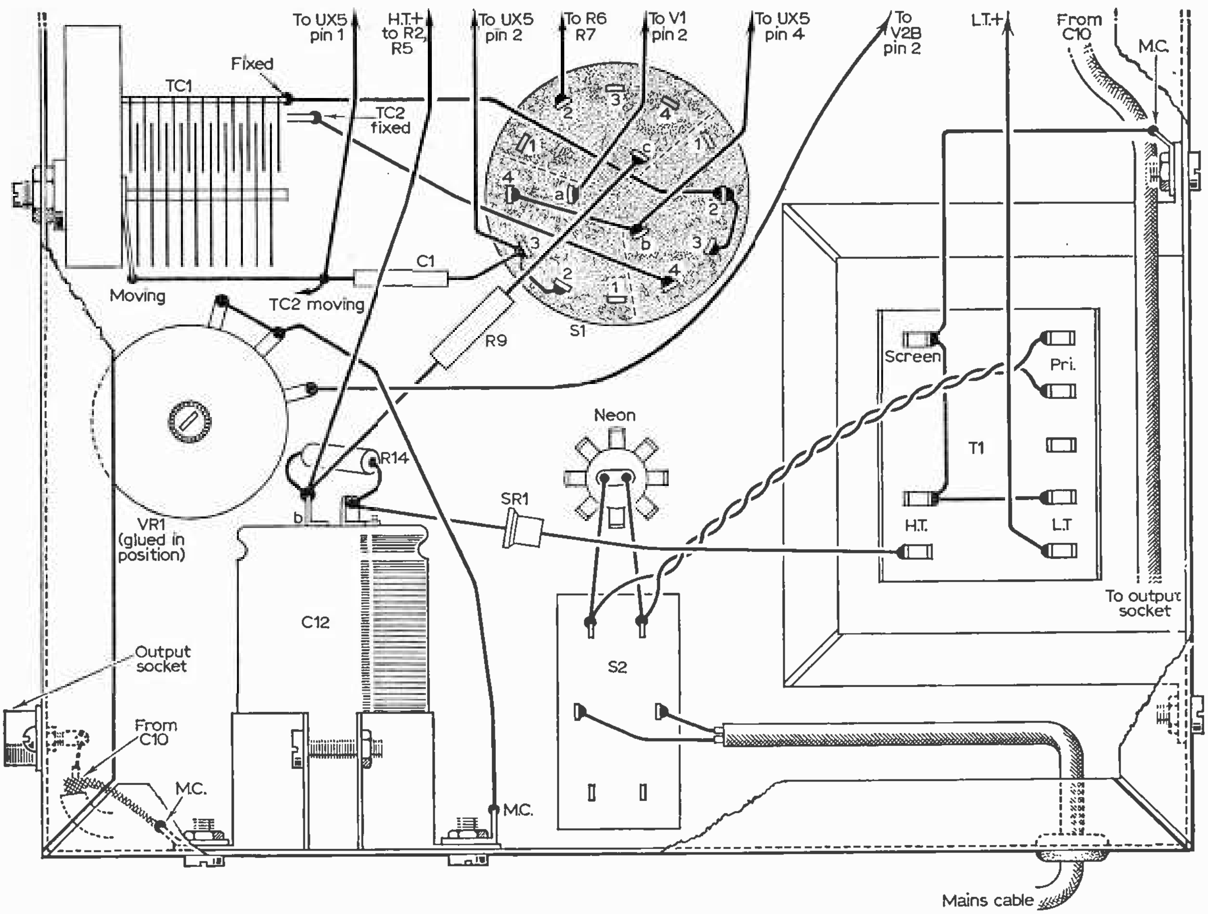

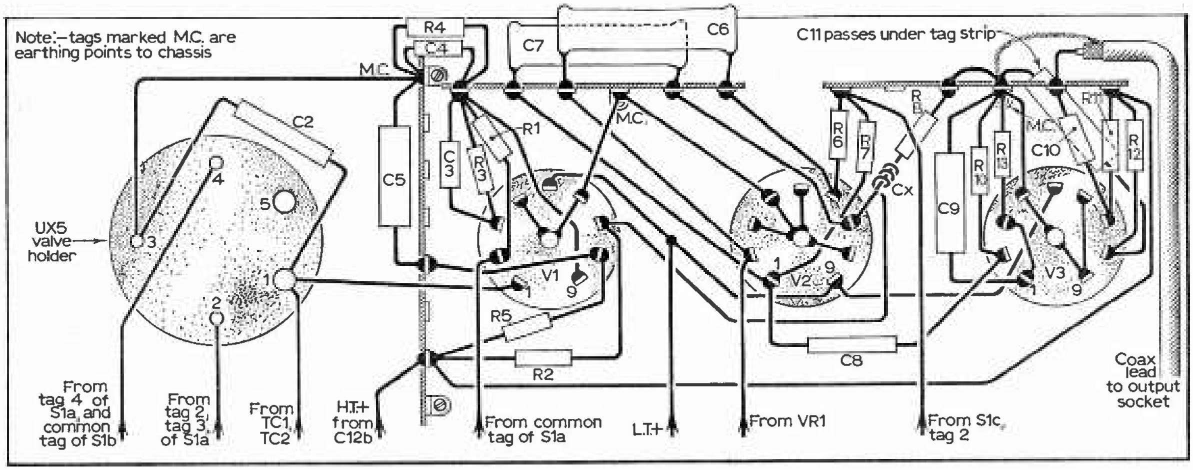

Fig. 9 (top): Wiring of the components mounted on the main chassis.

Fig. 10 (centre): Wiring of the components mounted on the chassis-panel.

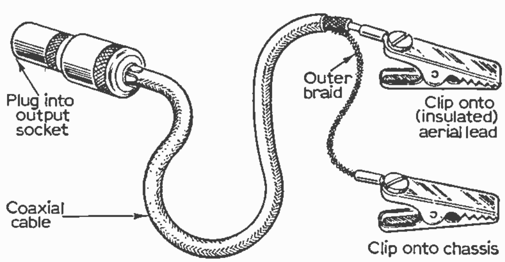

Fig. 11 (left): Output lead and clips.

sides of the construction will find that they have at their disposal a professional looking crystal calibration oscillator of high dependability, providing excellent facilities for calibrating to a very high degree of accuracy a great variety of equipment operating in the range 10—30,000kc/s. ■

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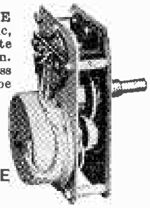
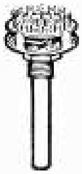
GEARED MOTOR



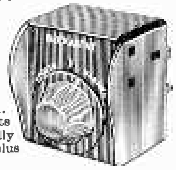
HALF REV. PER MINUTE
Made by famous Smith Electric, mains operated and quite powerful. Size 3½ x 2¼ x 1¼in. deep. Secondary use as process timer. Internal switch can be made to break circuit within a period up to 2 mins. 17/6 P. & P. 2/6 unless ordered with other goods.

MINIATURE WAFER SWITCHES



4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole, 6 way—1 pole, 12 way. All at 3/6 each 36/- dozen, your assortment.

BECKASTAT



An Instant Thermostat. Simply push it into 15A wall socket and plug your fire or other appliance into it. Knob setting. Will save its cost in a season. Normally £3. We offer at 19/6. plus 2/- post.

ALL PRICES GREATLY REDUCED

Type No.	Price	Type No.	Price	Type No.	Price
2N1727	15/-	OA5	5/-	OC75	3/-
2N1728	10/-	OA10	6/-	OC76	3/-
2N1742	25/-	OA47	3/-	OC77	7/-
2N1747	25/-	OA70	2/-	OC78	3/-
2N1748	10/-	OA79	2/6	OC78D	3/-
AC107	9/-	OA81	2/6	OC81	3/-
AC127	4/-	OA85	2/6	OC81D	3/-
ACY17	8/6	OA90	2/6	OC82	3/-
ACY18	5/6	OA91	2/6	OC82D	3/-
ACY19	6/6	OA200	3/3	OC83	4/-
ACY20	5/6	OA202	4/3	OC84	4/6
ACY21	6/-	OC20	12/6	OC139	8/6
ACY22	4/6	OC22	10/-	OC140	12/6
AF114	4/-	OC23	8/-	OC170	5/-
AF115	4/-	OC24	15/-	OC171	4/-
AF116	4/-	OC25	8/-	OC200	9/-
AF117	4/-	OC26	7/6	OC201	12/6
AF118	4/-	OC28	8/-	OC202	13/6
AF139	12/6	OC29	17/6	OC203	12/6
AF186	17/6	OC35	10/-	OCP71	15/-
AFZ12	15/-	OC36	15/-	ORP12	8/6
ASZ21	15/-	OC38	12/6	ORP60	10/-
BC107	14/6	OC42	6/6	SBO78	6/6
BY100	4/6	OC44	3/-	SB305	8/6
BYZ13	7/6	OC45	3/-	SB251	10/-
MAT100	7/9	OC46	3/-	ST140	3/-
MAT101	8/6	OC70	3/-	ST141	4/6
MAT120	7/9	OC71	3/-		
MAT121	8/6	OC72	3/-		

SCR's (THYRISTORS)

Piv	50V	100V	300V	400V
1 amp	6/6	7/6	8/6	9/6
3 amp	7/6	8/6	9/6	10/6
25 amp	30/-	35/-	47/6	60/-

SILICON RECTIFIERS

Tested and guaranteed.

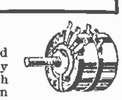
750mA	100v.	1/3	1 Amp.	100v.	3/-
	200v.	1/6		200v.	4/-
	400v.	3/6		400v.	6/-
3A	100v.	3/6			
	200v.	5/-	10 Amp.	100v.	9/6
	400v.	7/6		200v.	12/6
	600v.	9/6		400v.	14/6

Sub-miniature glass encased—only approx. ⅛in. long wire ended.
400mA, 50v. 1/6 100v. 2/6 200v 4/6

FLUORESCENT CONTROL KITS

Each kit comprises seven items—Choke. 2 tube ends, starter, starter holder and 2 tube clips, with wiring instructions. Suitable for normal fluorescent tubes or the new "Grolux" tubes for fish tanks and indoor plants. Chokes are super-silent, mostly resin filled. Kit A.—15-20 w. 19/6. Kit B—30-40 w. 17/6. Kit C—80 w. 17/6. Kit D—125 w. 22/-. Kit E—65 w. 19/6. Kit MF1 is for 6in., 9in. and 12in. miniature tubes 19/6. Postage on Kits A and B 4/6 for one or two kits then 4/6 for each two kits ordered. Kits C, D and E 4/6 on first kit then 3/6 for each kit ordered. Kit MFI 3/6 on first kit then 3/6 on each two kits ordered.

GANGED POTS



Standard type and size with good length of spindle—made by Morganite. List price is 10/- each but if you act quickly you can have them at 12/- doz. (or 1/6 each if less than doz.). Following valves in stock all "lin"—10K +10K—100K +100K—500K +500K all new and unused. Post 2/9 on 1st doz. then 1/- per doz. 6 doz. or more post free.

HURSEAL AUTOMATIC TIME SWITCH

12 hour. 15A to control heating, lighting, radio, immersion heaters, etc. Regular price £4.4.0. Limited quantity 39/6. P. & P. 3/-.

INFRA-RED HEATERS

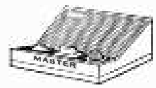
Make up one of these latest type heaters. Ideal for bathroom, etc. They are simple to make from our easy-to-follow instructions—uses silica enclosed elements designed for the correct infra-red wave length (3 microns). Price for 750 watts element, all parts, metal casing as illustrated, 19/6, plus 3/6 post and insurance. Pull switch 3/- extra.

DRILL CONTROLLER

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by fingertip control. Kit includes all parts, case, everything and full instructions. 19/6, plus 2/6 post and insurance. Or available made up 32/6.

THIS MONTH'S SNIP

FOUR STATION INTERCOM.

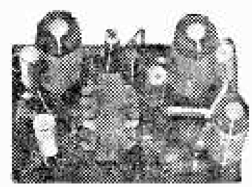


Will save time and improve efficiency. Ideal in home—office—shop—surgery, etc. Complete outfit comprises Master unit and three substations each of which can call the master and have full two-way working. No wiring problems as subs fitted with 60ft. twin flex and they plug into sockets. Also included is packet of staples—and battery. Nothing else to buy—£4.19.6, plus 4/6 post and insurance.

GARRARD AUTO RECORD PLAYER Model 2000

This is one of the latest products of the World's most experienced maker of fine record reproducers. Its superior features include—automatic playing of up to 8 mixed size records—stopping and starting without rejecting—manual playing—pick-up pivots to give low stylus pressure—large diameter turn-table for max. stability adjustments include pick-up height—pick-up dropping position and stylus pressure. Size is 13½ x 11⅝in. clearance 4¾in. above. 2½in. below—fitted with latest hi-compliance cartridge for stereo—and mono. L.P. and 78. Supplied complete with mounting template and service sheet. Offered this month at the Special Snip price of £6.19.6 plus 7/6 carriage and insurance.

750mW TRANSISTOR AMPLIFIER



4 transistors including two in push-pull input for crystal or magnetic microphone or pick-up—feed-back loops—sensitivity 5mV. Price 19/6. Post and insurance 2/6. Speakers: 3in. 12/6, 5in. 13/6, 6 x 4in. 14/6.

G.E.C. 13 amp. SWITCHED SOCKETS

An excellent opportunity to re-equip your house or workshop, or if you are a contractor to restock for future ring main jobs. We offer 12 GEC switch sockets, Brown Bakelite surface mounting. Latest ring main type listed at 6/6 each. You can have a box of 12 for 30/- only—thus showing you a saving of £2.8.0. Postage and insurance 4/6 extra.

CASSETTE LOADED DICTATING MACHINE

Battery operated and with all accessories. Really fantastic offer a British made £31 outfit for only £6.19.6 brilliantly designed for speed and efficiency—cassette takes normal spools drops in and out for easy loading—all normal functions—accessories include stethoscopic earpiece—crystal microphone has on/off switch telephone pick-up—tape reference pad—DON'T MISS THIS UNREPEATABLE OFFER—SEND TODAY. £6.19.6 plus 7/6 post and insurance. Footswitch 18/6 extra. Spare Cassettes at 7/6 each, three for £1.

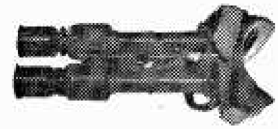
3 PUSH SWITCH

for test meter, hi-fi amp. etc. 1st button operates mains on/off switch, the other two operate change over switches. Knobs engraved on/off, bass, treble but engraving easily removed leaving clean surface for remarking. 2/9 each, 24/- doz.

BATTERY OPERATED TAPE DECK

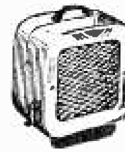
With Capstan control. This unit is extremely well made and measures approx. 6 x 5 x 2in. deep. Has three piano key type controls for Record, Playback and Rewind. Motor is a special heavy duty type intended for operation off 4/5 volts. Supplied complete with 2 spools ready to install. Record, Replay head is the sensitive M4 type intended for use with transistor amplifier. Price £4.15.0. Post and insurance 4/6.

See in the Dark INFRA-RED BINOCULARS



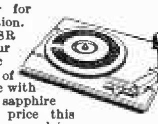
These infra-red binoculars when fed from a high voltage source will enable objects to be seen in the dark, providing the objects are in the rays of an infra-red beam. Each eye tube contains a complete optical lens system as well as the infra-red cell. These optical systems can be used as lenses for T.V. 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 £3.17.6, plus 10/- carr. and ins. Handbook 2/6.

2½ kW FAN HEATER

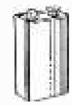


3 heat positions to suit changes in weather: 1kW, 1¼kW and 2½kW; also blows cold for summer, has thermostatic safety cut-out. Proper price £5.17.6. Yours for only £3.15.0, plus 7/6 post and insurance.

G.U.7 RECORD PLAYER



BSR Record Player for normal mains operation. This is the famous BSR Model G.U.7. Four speeds with automatic stop. Plays any size of record and is complete with crystal cartridge and sapphire stylus. Special snip price this month 67/6 plus postage and insurance 6/6.



PP3 Eliminator. Play your pocket radio from the mains! Save £s. Complete component kit comprises 4 rectifiers—mains dropper resistances, smoothing condenser and instructions. Only 6/6 plus 1/- post.

WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. 10/- post free.

9 VOLT PRECISION MOTOR

Intended for driving battery operated tape recorders and record players. Laminated, 6 Pole armature with Brush Gear and rapid start switch. Normally 25/-. Our price 7/6, plus post and insurance 1/6.

THERMOSTATS

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

Type "B" 15 amp. This is a 17in. long rod type made by the famous Sunvic Co. Spindle adjusts this from 50–550°F. Internal screw alters the setting so this could be adjustable over 30° to 1000°F. Suitable for controlling furnace, oven kiln, immersion heater or to make flame-start or fire alarm. 8/6 plus 2/6 post and insurance.

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

Type "E". This is standard refrigerator thermostat. Spindle adjustments cover normal refrigerator temperatures. 7/6 plus 1/- post.

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

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA. (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer rectifier, smoothing and load resistor. 5,000 and 500 mfd. condensers. Zener diode and instructions. Real snip at only 14/6, plus 3/6 postage.

Where postage is not definitely stated as an extra then orders over £3 are post free. Below £3 add 2/9. Semi-conductors add 1/- post. Over £1 post free. SAE with enquiries please.

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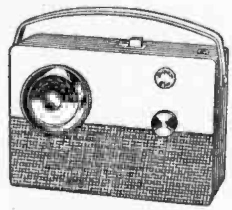
8 WATT, PUSH-PULL OUTPUT AMPLIFIER, 200-250 Volts A.C. EZ80, ECC83, 2—EL84. Bass, treble, vol/on-off. £5.15.0 (7/6 P. & P.) Size 12 x 8½ x 5in. high.

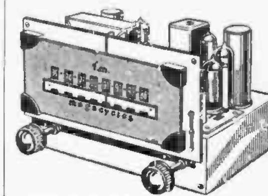
20 ELEMENT MAST CLIPPING BBC-2 OUTDOOR AERIAL. State Station required 55/- (7/6 carr.). **BBC-2 Coax Cable 1/6 yd.**



6 TRANSISTOR "SUPER SIX". M.W. and L.W. kit, £4 (5/- P. & P.). Wooden cabinet 11 x 7½ x 3½in. All parts may be purchased separately.
3⅜in. 10,000 line speaker, or 7 x 4in. 6000 line.

TESTED AND ASSEMBLED I.F. TRANSISTOR STRIP. 3 IFs (double tuned), osc., diode, 3—AF117, P.C. board 4½ x 2½in., 470KHZ, 25/- (2/6 P. & P.).

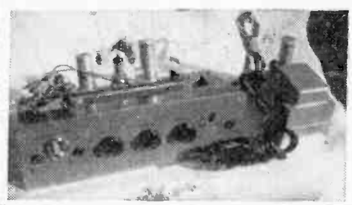
9-12 VOLT TRANSISTOR AMPLIFIERS (1) 200mW for 3 ohm speaker 30/-. (2) 350mW with switch, vol. control, for 3 ohm speaker 40/-. (3) 1 w. for 8 or 15 ohm speaker, 52/6. (4) 3 w. for 8 or 15 ohm speaker 67/6 (2/6 P. & P. each type). Type (1) can be supplied in metal box 3½ x 3½ x 1½in. high with vol./on-off. Internal PP3 battery or larger externally. Socket for input and output only 40/-. Post paid.



VHF/FM TUNER. 88–102MHz. Self-powered. Valves ECC85, EF89, 6BW7, ECC82, two diodes and metal rect. 8 x 6 x 5½in. high. Full instruction book, circuit diagrams etc. 2/6; free with chassis. With front panel and brackets £7.19.6 tax paid and carr. paid. Can be supplied built for £8.17.6.

TRANSISTORISED F.M. TUNER. Size 6 x 4 x 2½in. Model A1005. Requires 9v. 10mA, 88–108MHz printed circuit. Cap. tuned; 3 I.F. stages; double tuned disc.; 10mV output with 10 microv. input. Transistors 2SA235 x 2; 2SA350 x 3; SB75 and diodes 1N34, 1N60 (2). Only £7.5.0 (4/6 P. & P.). Compare this price before purchasing elsewhere.

2 x 4 WATT STEREO AMPLIFIER. Printed circuit. Separate power pack. Metal rectifier, ECC83 and 2—EL84. Negative feedback. Vol., base, treble each channel. Muting switch and on/off. £5.10.0 (7/6 P. & P.).



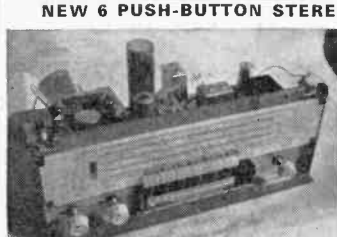
TAPE AMPLIFIER FOR MAGNAVOX TAPE DECKS — 2 or 4 TRACK

Chassis 12½ x 5½ x 4½in. high. Plastic front panel "gold" finish—12½ x 4½in. 200-250 A.C. Record/Playback amp. switch; Off/On-Tone; Vol./Mic.; Vol./Gram; Mic. Input; Gram. Input; Monitor; Speaker Socket. Valves 6BR7; 12AX7; EM84; EL84; 6X4. Separate power pack. Complete amp. and power pack, £8.17.6. (6/- P. & P.). Rexine covered cabinet (tan) 15½ x 17 x 9½in. high with sloping front for amp; complete with two tweeter speakers, and special adapting brackets for Magnavox Deck 85/- (8/- carr.) 3 speed Magnavox 2 track tape deck £10.17.6; 4-track £12.15.0. Complete Recorders (with speed compensation) 2-track £29; 4-track £32 (carr. 25/-). Worth £10 more on normal retail prices.

SALE OF VALVES (NEW)
Unrepeatable after Stocks Cleared

1/- ea. ARP35; 1/6 ea. CC3L, EB34, 6B8G, 7475, 1F2, 2/6 ea. DF92. EC31, EY91, 3/- ea. DL93, E2124, EC70, EF70, EL32, F6063, 2X2A, 6F32, 6J6, 6K7G, 6K8G, 3/6 ea. DAF91, DL92, 4/- ea. AC/P4, DL73, DM70, E2221, EL35, OD3, S6F17, TT11, VR150/30, 1N21B, 2D21, 5A/173G, 6X5G, 6X5GT, 5/- ea. DF96, EBC33, EN91, FVD7, HL133DD, KT55, L63, M8079, ME41, ML4, OA2, OB2, PY31, PZ30, R17, UBC41, V2053, VU71, VU/33A, Z66, 1D13, 1H5G, 2B35, 5U4G, 6AG7, 6AK7, 6AS6, 6BW6, 6CH6, 6K6, 6K6GT/G, 6K7, 6K8, 6L6G, 6N7G, 6SA7, 6SG7, 6SL7, 11E2, 85A2, 95A1, 354V, 6057, 6/- ea. E2134, EL36, EL41, GZ30, GZ37, 5726, 7/6 ea. QVO4-7, 807, 1834, 10/- ea. EM34, M8142, S130P, VX3193, VX9192, XB1, 75C1, 150B2; 12/6 ea. EL37, EL38, G18/2M, 6B4G, 15/- ea. A18340, ECC34, 6CD6G, 12E1, 20/- ea. 85A1, Z759, 30/- ea. 5B/254M. 5P/225M, 50/-. VX5029 60/-, 4X150A, TD1-100A; add 1/6 per order P. & P.

NEW 6 PUSH-BUTTON STEREOGRAM CHASSIS



M.W.; S.W.1; S.W.2; V.H.F.; Gram; Stereo Gram. Two separate channels for Stereogram with balance control. Also operates with two speakers on Radio. Chassis size: 15 x 7 x 6½in. high. Dial cream and red. 15 x 3in. 190-550M; 18-51M; 60-187M; VHF 86-100 Mc/s. Valves: ECC85, ECH81, EF89, 2 x ECL86, EM84 and Rect. Price £19.19.0, carr. paid or £6.13.0 deposit and 5 monthly payments of 56/6. Total H.P. price £20.15.6. Cream moulded escutcheon included.

BATTERY ELIMINATOR

90V H.T. and 1·4V L.T. Size 5 x 3 x 3in. State valve line-up. Fully built. 125mA L.T. or 250mA L.T. "Open" type for mounting inside set. 50/- post paid.

GLADSTONE RADIO

66 ELMS ROAD, ALDERSHOT, Hants.

(2 mins. from Station and Buses). FULL GUARANTEE Aldershot 22240
CLOSED WEDNESDAY AFTERNOON CATALOGUE 6d.

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LETTERS...

To all 19 set swl's

I HAVE modified two sets as from March—April 1966 P.W. (Mr. S. Simpson modifications). He does say in his notes that the b.f.o. het. tone control is slight in shift operation. I found by earthing the centre pin of the het. tone control pot, it works perfectly on c/w and s.s.b. signals with no trouble at all. Hoping it may be of use.—**C. Skinner** *(Blackpool).*

Burndept line-up

With reference to the letter from W. M. MacKenzie, Gosport, Hants., in the September issue requesting information re the valve line-up of a Burndept 285.

The following is an extract from the Mullard Valve Replacement Guide 1950: VP4B, TH4B. VP4B, 2D4A, 2D4A, AC/SP1 (Mazda), 6B5 (Brimar), IW4/350. —**G. Roberts** *(Holyhead, Anglesey).*

[*We would like to thank the many readers who wrote to us offering to help Mr. MacKenzie. It is very gratifying to note that so many readers believe in the true spirit of amateur radio.*]—Editor.

Offer of components

I have in my possession certain components that I would like to offer to P.W. readers. The components include valves, resistors, transistors, capacitors, etc.

I would like to hear from any reader who is interested.—**S. G. Deane** *(40 Thackeray Avenue, Tottenham, London, N.17).*

Tarnished halo?

I agree with your view expressed in the September editorial, that it is difficult to provide articles which will please everyone. Your magazine carries articles on a wide variety of topics, and so it doesn't grow stale.

Nevertheless you regularly commit two sins. (Perhaps your halo is a bit tarnished!) First, some of your advertisements come in the middle of features or constructional articles. In this position they make the articles more difficult to read.

Second, there are often errors in the illustrations, the components list or the text of your constructional articles. This should *never* be allowed to happen. The less well-educated constructor or the man with little or no test equipment has to wait two months before the errors are corrected. If every reader were able to correct these errors on sight, there would be no point in having constructional articles at all. — **A. G. Pope** *(Reading, Berks.).*

Vintage portable

I have, complete though in very "tatty" condition, what I would think ranks amongst one of the first portable radios, viz. McMichael Duplex Four Type "S.M.C." together with Installation and Operating Instructions, though I did have ideas of renovating same time will just not allow, so if any readers are interested please get in touch with me.—**R. A. Thomas** *(6 Hamble House Gardens, Hamble, Southampton).*

More science fiction?

With reference to Mr. J. Perry's letter (P.W. July), I would draw his attention to one of many misleading statements directed at the layman, i.e.:

ELECTRICITY
EXTRAORDINARY

"An all-in-the-ear hearing aid the size of a man's thumbnail and weighing only half an ounce . . . A wrist-watch that runs for years without winding . . . A radio receiver that fits behind the badge of a policeman's helmet . . . These are not dreams of the future: they are already here, made possible by the development of the transistor—the miniature electric battery which experts say will soon provide the power for all our radios, clocks and household appliances."

This amazing insight into modern electronic science was given to the readers of *Readers Digest* in November 1957.

Perhaps in the last ten years we have forgotten the true function of the transistor, or is it that our transistor research boffins don't read enough American science fiction magazines.—**T. Jones** *(Oldham, Lancs.)*

Goodbye, Mr Dodd!

With reference to the Topic of the Month in the September issue of PRACTICAL WIRELESS.

W. N. Stevens has proved somewhat hypocritical in his observations and appears to confuse his own warped opinions with the contrasting actual facts. He states that ". . . it matters not only what you say but how you say it". True Sir, quite true but to imply, quite erroneously, that the Editorial team is a "bunch of mutinous dogs" is clearly not etiquette nor polite, and certainly not becoming to a gentleman.

We find in other Topics of the Month suggestions like sending gunboats down the Rhine. Quite clearly the writer of these idioms is bent on a facetious tack, coupled with the dastardly attack on his own kith and kin, the very team who produce this splendid magazine. With such a one at the helm how true to say don't let us get complacent.—**W. E. Dodd & Associates** *(London, W.C.2).*

[*Readers, please note that Mr. Dodd is in fact one of the mutinous dogs referred to and is suffering from a stricken conscience. We are glad he is not complacent as he stands in grave peril of redeployment as from now. Gad, sir—what is this younger generation coming to!*]—Editor.

A bit of fluff

No doubt a lot of readers frequently have trouble with fluff and dust accumulations on stylus tips. I find that a toothbrush head, chopped down and mounted appropriately on the deck, suffices to clean the tip as the pick-up returns to its resting position as each record drops. This is only an amateurish modification of course, but on my own set, I haven't had record slip for quite a while.—**S. A. Gough** *(Burnley, Lancs.).*

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the numbers to be multiplied in scale M. The product may then be read off in scale M opposite the other number in scale L. If this is off the scale, use the opposite end of scale L in setting against the original number.

For example only one calculation is really necessary. *E.g.* $270 \times 4 \cdot 5$.

Place the 1 of scale L opposite the 2·7 of scale M, then look for 4·5 on scale L. This is seen to be outside the window. Thus reset the 10 of scale L opposite the 2·7 of scale M, and read off the answer, as 1·22 (actually 1·215) opposite 4·5 on scale L. This is not yet corrected in terms of the decimal point, and this is done by approximation, mentally multiplying say $300 \times 5 = 1{,}500$, thus signifying the answer as 1,220 within reading accuracies (actually 1,215).

Division is best explained by a direct example. *E.g.* $445 \div 20$.

Set 20 in scale L opposite 445 in scale M (actually setting 2·0 and 4·45 of course) and read the answer, 22·25 in scale M opposite the 1 of scale L.

OTHER DATA

Other useful data is provided on the rule, such as the preferred resistor values, a useful thing to have in mind when designing circuitry. Also the resistor colour code is tabulated for quick reference. Finally the preferred resistors in parallel to give a more exact non-standard resistance, may be determined from the chart provided.

Using this chart, magnitudes are selected by inspection. For example, say we calculate that we exactly require a resistance of 41kΩ. We see from the preferred resistors table this is not a standard resistance, and could check say the nearest value, 43kΩ with the tolerance scale, and possibly also 30kΩ, seeing these are outside our required tolerance, perhaps ±2%. The chart is employed to get the values of two standard resistances in parallel to give the required value. Look for 41kΩ in the right-hand scale of the chart, where of course we assume the scale is 0–100kΩ. Look across the line estimated to be 41, and find the nearest point of intersection of two coloured lines to this value. These are seen to be 56 and 150. Now since two resistors in parallel must give a resistance lower than the lowest of these resistors, and also remembering the other useful rule of thumb that two resistors of the same value in parallel give a resistance of half their value, we know that both resistors must be greater than 41kΩ, and we realise that the required parallel values are 56kΩ and 150kΩ.

Compare this with trial and error using values in the formula

$$\frac{R_1 \times R_2}{R_1 + R_2}$$

We may further determine approximately the tolerance we are within by using the formula with the two resistance values thus found, giving a resistance of approximately 40·8kΩ. The tolerance scale then tells us the tolerance, but remember to make allowance for say the ±1% tolerance of the parallel resistors. Unless these are measured to a greater accuracy than ±1% *in this example,* not much is to be gained from using the parallel combination.

CQ! CQ! CQ! CQ! CQ! CQ!

CORRESPONDENTS WANTED

. . . anyone interested in the field of radio—especially in the Commonwealth or Japan. I am 26 years old.—Corrigan Lupasha, P.O. Box 85, Chingola, Zambia.

. . . anyone interested in electronics and who will willingly send circuit diagrams for the latest communication receivers and the like. In exchange, Indian gifts will be sent. I am an electronics engineer.—V. K. K. Royan, The Royan Electronic Centre, Malayaninthankudy, Puthalam, p.o., (Kanyakumari District) Madras State, South India.

. . . anyone of my own age (13 years old) who is interested in short wave listening.—B. Mellor, 47 Back Green, Churwell, Nr. Leeds, Yorkshire.

. . . anyone of my own age (17 years old) living in Great Britain who has an interest in short wave, sport and Blue music. My call sign is HA3ME.—Buzsaki Gyorgy, Pecs II, Liszt F.u.2., Hungary.

. . . anyone of my own age (13 years old) interested in radio. I have a 19A set and I am on the look-out for a 1154.—Andrew Downes, 43 Banchory Place, Tullibody, Alloa, Clacks, Scotland.

INFORMATION WANTED

. . . official handbook or a circuit diagram and any information on the ex-Army wireless set 31, assembly cat. No. ZA44765 Mark 2.—K. M. Jiwa, 199b Sentul Pasar, Kuala Lumpur, Malaysia.

. . . technical details of the Grunther c.r.t. tester.—R. Gascoyne, 20 River Close, Stoke Canon, Exeter.

. . . any service manuals or service sheets that readers do not require, as I am a rehabilitate of St. Loyes and would find these very useful.—D. Marchant, St. Loye's College for the Training and Rehabilitation of the Disabled, Exeter.

. . . information on the correct pin and voltage connections for the 78 receiver.—J. E. Warr, 40 Palmeira Road, Bexleyheath, Kent.

. . . information on the ex-U.S. Navy crystal controlled calibrator type LR1.—G. V. Haylock, G2DHV, 28 Longlands Road, Sidcup, Kent.

. . . details of a machine that prints Morse code as it comes through on a receiver.—G. M. Breckin, 161 Longsite Road, Holcombe Brook, Bury, Lancashire.

. . . AR77E handbook or circuit, to buy or loan.—A. D. Besford, 49 Blake Road, Great Yarmouth, Norfolk.

. . . manual on the 46 set.—A. Giles, 20 Fieldway, Dagenham, Essex.

. . . the circuit of the W.S. 19 Mk. 3 'B' set and the issues of P.W. dealing with Versatile Double Trace Oscilloscope.—P. Mellor, 219 Allerton Road, Liverpool 18.

. . . an old German transceiver in a wooden case, range 3–6 Mc/s. The only markings on it are Type Ha5 K 39c 12V = 100–220V. F.Nr. 1711/brd 1942. The valves are of an unusual side-contact type.—R. Edger, Adenac, 148 Freshfield Road, Brighton 7.

. . . details of the S-meter circuitry in the R.C.A. AR88LF receiver.—A. J. Jenkins, 2 Dunvegan Close, West Molesey, Surrey.

. . . circuit or manual on receivers BC779, MCR1, Hammarlund 'Super Pro'. In return, can help on service sheets 1925–65 and back issues of various magazines etc.—W. Pryce, 34 Heol Padell, Swansea Road Est., Merthyr Tydfil, Glamorgan.

. . . information as to the whereabouts of a tuning indicator which fits in at the side of and behind the tuning scale of a 1935 Telsen receiver. I want to replace this component. The model number of the Telsen receiver *may* be D5852.—W. Wright, Muirpark House, Tranent, East Lothian, Scotland.

. . . information on the conversion of general coverage to bandspread coils (on amateur bands) for the H.R.O. receiver.—N. Page, 39 Stanley Road, Wellingborough, Northamptonshire.

. . . circuit and any information at all on G.M. Compass Mk. 4 amplifier type A, having an A.M. ref. No. 6B/2036. It is made by Sperry Gyroscope Co. The unit contains 3 x CV136, CV138, CV135. On front panel is one 6-pin socket. On the side under the heading modifications are the numbers B39, B57, B79, B111, B120 and B159 and a serial number SE/R/10/56.—M. Hardisty, Gleneagle, Carlton, Carlisle.

. . . information, diagram or even notes on the R1475.—T. R. Smith, 36 Homestall, Park Barn, Guildford, Surrey.

TAPESPONDENTS WANTED

Sir,—I would like to tapespond with . . .

. . . any female enthusiast of my own age (18) 7½, 3¾, and 1⅞ i.p.s., 7in. reels and Collaro Studio Deck.—Peter J. Russell, 71 Bray's Road, Sheldon, Birmingham, 26.

. . . anyone from Australia, New Zealand and South Africa. I am 16 years old and my interests are Hi-Fi, stereo reproduction and radio. My recorder is a Ferrograph 2 track 3¾ and 7½ i.p.s. and spool size is up to 7in.—Robert Fisher, 26 Grange Road, Plympton, Devon.

WANTED

. . . I have assembled the Signal Generator from page 703 of the December 1961 issue of P.W. and would like to know if any reader could help me with data for winding my own coils as they are not available on the Indian Market.—D. P. De, C.P.C. Office, P.O. Durgachak, Dist, Midnapore, West Bengal, India.

SWITCHED F.M. TUNER

by W. Groome

AUGUST/SEPTEMBER 1967 "PRACTICAL WIRELESS"

The value of **R21** is quoted as 220Ω—this is incorrect and should read **220kΩ.**

In Fig. 2, page 251, the jumper wire from hole Q21 should lead to V33, to which R10 is also connected. Hole V32 should be a conductor break.

Referring to Fig. 4, page 252, two rows of lettering are given for the leads of Tr1 (OC171) which conflict with each other—only the *upper* row is correct.

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DE LUXE PLAYERS

4-Speed Mono Players 2-tone Cabinets 17×15×8½in. High flux loudspeaker and High Quality Amplifiers ready built. Quality output. Volume and Bass controls. Special instructions enable assembly in 30 minutes, only 5 wires to join. 12 months' guarantee.

TO BUILD YOURSELF

Post 2/6 per item.

PORTABLE CABINET As illustrated. To fit standard player or autochanger. **69/6**

RCS AMPLIFIER 3 WATT. Ready made and tested with UCL82 triode pentode valve and loudspeaker. **59/6**

SUPERIOR AMPLIFIER. Ready made and tested. Guaranteed better sound! Fully isolated AC Mains Transformer 4 watt output. ECL86 triode pentode valve. Volume and tone controls with knobs. Quality Loudspeaker. **89/6**

SINGLE PLAY MONO		AUTOCHANGE MONO	
BSR GU7	£4.19.6	BSR Superslim	£5.19.6
Garrard SRP12	£4.19.6	Garrard 1000	£5.19.6
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Philips AG1016	£12. 9.6	Garrard 3000	£8. 9.6
Garrard A.70	£19.19.6	Garrard AT60 Mk. II	
Garrard LAB80	£24.19.6		
Garrard 401	£29.19.6	diecast turntable	£12.19.6

All with mono cartridge (Stereo 12/6 extra)

GARRARD TEAKWOOD BASE WB.1. Ready cut for mounting 1000, 2000, 3000, SP25, AT60. **75/-**
GARRARD PERSPEX COVER SPC.1 for WB.1 58/-

A.18 TRANSCRIPTION TONE ARM with tracking template and two plug-in shells. Original price £13.19.6. OUR PRICE **90/-**
Decca Deram Stereo Diamond Cartridge £4.10.0 extra.

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Complete: a die, a punch, an Allen screw and key
⅜in. 14/6 ⅝in. 15/9 1⅛in. 18/- 1⅜in. 20/6 2 3/32in. 37/9
½in. 14/9 1in. 18/- 1¼in. 18/6 1½in. 22/6 2¼in. 44/3
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ACOS XTAL GP67 PICK-UP ARM Complete, 15/-.
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SPEAKER FRET Tygan various colours. 52in. wide, from 10/- ft.; 26in. wide from 5/- ft. SAMPLES S.A.E.
EXPANDED METAL Gold or Silver 12×12in. 6/-.

FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12 v. outputs, 1½ amp., 8/9; 2 a. 11/3; 4 a., 17/6.
CHARGER TRANSFORMERS. P. & P. 2/6. Input 200/250 v. for 6 or 12 v., 1½ amps. ..17/6: 2 amps.. 21/-; 4 amps., 25/-.

MOVING COIL MULTIMETER TK 25. 0-1,000v. A.C./D.C., ohms 0 to 100k. etc., **47/6**
MOVING COIL MULTIMETER EP10K. 0-1,000v. A.C./D.C., ohms 0 to 3 meg. etc., **79/6**
MOVING COIL MULTIMETER EP20K. 0-2,500v. D.C. 20,000 ohms per volt. 0-1,000v. A.C. Ohms 0 to 6 meg. 50 Microamps full scale. **99/6**

NEW MULLARD TRANSISTORS

OC71 6/-; OC72 7/6; OC81D 6/-; OC81 6/-; AF115 8/-; AF114 8/6; OC44 8/-; OC45 8/-; OC171 9/-; OC170 8/6; AF117 7/-. OC26 12/6; AD140 15/-; OC35 15/-. Holders 1/3.

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D3035, 7.3 CT: 1 Push Pull to 3 ohms for OC72, OC81 .. 11/-
D3034, 1.75: 1 CT. Push Pull Driver for OC72, OC81 .. 11/-
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TRANSISTOR MAINS ELIMINATORS. FAMOUS "POWER MITE". 9 VOLT. SAME SIZE AS PP9 BATTERY. FULLY SMOOTHED. 150mA. FULL WAVE CIRCUIT. **45/-**
SPECIAL 9 VOLT 500mA POWER PACK........ 49/6

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RA2W 6 in. Ferrite Aerial with car aerial coil	12/6	Spare Cores	6d.
Osc. P50/1AC	5/4	Driver Trans. LFDT4	9/6
I.F. P50/2CC 470 kc/s	5/7	Printed Circuit, PCA1.	9/6
3rd I.F. P50/3CC	6/-	J.B. Tuning Gang	10/6
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VOLUME CONTROLS
Long spindles. Midget Size 5 K. ohms to 2 Meg. LOG or LIN. L/S 3/-. D.P. 5/-. STEREO L/S 10/6. D.P. 14/6.

80 Ohm Coax 6d. yd.
Semi-air spaced Cable 100 yd. drum 50/- post free. FRINGE LOW LOSS Ideal 625 lines yd. **1/6**

COAXIAL PLUG 1/-. PANEL SOCKETS 1/-. LINE SOCKETS 2/-. OUTLET BOXES, SURFACE OR FLUSH 4/6. BALANCED TWIN FEEDERS 1/- yd., 80 or 300 ohms. TELESCOPIC CHROME AERIALS. 6in. extends to 23in. 6/6 each. CAR AERIAL PLUGS 1/6. Sockets 1/3.

SPECIAL PURCHASE!
B.S.R. GU7
9 volt Battery Operated Record Player Decks

4 speeds, automatic stop. Plays any size record. Complete with mono LP/78 xtal and sapphire stylus. (With stereo cartridge 12/6 extra). ONLY **69/6** P. & P. 5/6

THE E.A.R. RECORD PLAYER CABINET

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NEW TUBULAR ELECTROLYTICS				CAN TYPES	
2/350 v.	2/3	100/25 v.	2/-	8/600 v.	9/6
4/350 v.	2/3	250/25 v.	2/6	16/600 v.	12/6
8/450 v.	2/3	500/25 v.	4/-	16+16/500 v.	7/6
16/450 v.	3/-	8+8/450 v.	3/6	32+32/450 v.	6/-
32/450 v.	3/9	8+16/450 v.	3/9	50+50/350 v.	7/-
25/25 v.	1/9	16+16/450 v.	4/3	60+100/350 v.	11/6
50/50 v.	2/-	32+32/350 v.	4/6	100+200/275 v.	12/6

SUB-MIN. ELECTROLYTICS. 1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 250 mfd. 15v. 2/6; 500, 1000 mfd. 12v. 3/6; 2000 mfd. 25v. 9/6.
CERAMIC. 500 v. 1 pF. to 0.01 mfd., 9d. Discs 1/-.

PAPER TUBULARS
350v.-0.1 9d., 0.5 2/6; 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.
E.H.T. CONDENSERS. 0.001 mfd., 7kV., 6/6; 20kV., 10/6.

SILVER MICA. Close tolerance (plus or minus ½ pF.), 5 to 47 pF., 1/-; ditto 1% 50 to 800 pF., 1/-; 1,000 to 5,000 pF., 2/-.
TWIN GANG. "0-0" 208 pF. +176 pF., 10/6; 365 pF. miniature 10/-; 500 pF standard with trimmers, 9/6; 500pF. midget less trimmers, 7/6; 500 pF. slow motion, standard 9/-; small 3-gang 500 pF. 18/9. Single "0" 365 pF. 7/6. Twin 10/-.
SHORT WAVE. Single 10 pF., 25 pF., 50 pF., 75 pF., 100 pF., 160 pF., 5/6 each. Can be ganged. Couplers 9d. each.
TUNING. Solid dielectric. 100 pF., 300 pF., 500 pF., 3/6 each.
TRIMMERS. Compression ceramic 30, 50, 70 pF., 9d.; 100 pF., 150 pF., 1/3; 250 pF., 1/6; 600 pF., 750 pF., 1/9.

250v. **RECTIFIERS.** Selenium ½ wave 100mA 5/-; BY100 10/-.
CONTACT COOLED ½ wave 60mA 7/6; 85mA 9/6.
Full wave 75mA 10/-; 150mA 19/6; T.V. rects. from 10/-.

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7 in. L.P. 1,800 ft. 45/-; 7 in. D.P. 2,400 ft. 70/-
60 min. Cassette C60 (For Philips, etc.) 17/6
Spare Spools 2/6. Tape Splicer 5/-. Leader Tape 4/6.
Tape Heads: Collaro 2 track 28/6 pair. B.S.R. 4 track 99/6.

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Post 2/6 each

250-0-250 80mA. 6.3 v. 3.5 a, 6.3 v. 1 a, or 5 v. 2 a.	25/-
350-0-350 80 mA. 6.3 v. 3.5 a. 6.3 v. 1 a, or 5 v. 2a.	29/6
MT. 510/300-0-300v. 120 mA., 6.3 v. 4 a.	29/6
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MIDGET 220 v. 45 mA., 6.3 v. 2 a.	15/6
SMALL 250-0-250 50 mA. 6.3 v. 2 a.	19/6
HEATER TRANS. 6.3 v. 1½ a., 8/6; 6.3 v. 4 a.	10/6
Ditto tapped sec. 1.4 v., 2, 3, 4, 5, 6.3 v. 1½ amp.	10/6
GENERAL PURPOSE LOW VOLTAGE. Outputs 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. at 2 a.	25/-
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AUTO TRANSFORMERS 0-115-230 v. Input/Output, 60w. 18/6; 150w. 25/-; 500w. 92/6; 1000w. 175/-.	

CRYSTAL MIKE INSERTS
1½ × ⅝in. 6/6; BM3 1 × ⅜in. 7/6; ACOS 1½ × ⅜in. 8/6
MOVING COIL MIKE with Remote Control Switch..19/6

ALL PURPOSE HEADPHONES
MOVING COIL HEADPHONES 100 ohms (ex. Govt.) 12/6
H.R. HEADPHONES 2000 ohms..12/6, 4000 ohms..15/-
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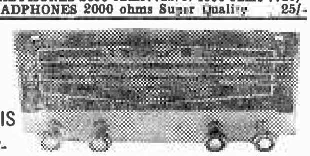
1967 GRAM CHASSIS



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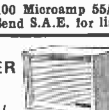

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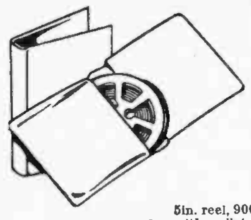

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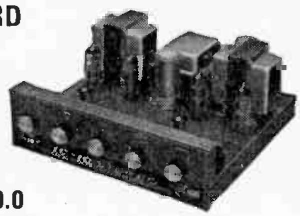

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Size
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(28 x 16·5 x 6·4 cm.).
Weight
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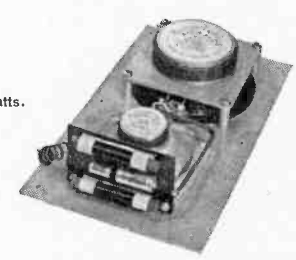

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WIRELESS INTERCOM

P. J. SMITH

IN order to make a portable intercom system which did not need long wires to join the units, the author decided to make use of the mains wiring in the house to carry the signal from one unit to the other. After much experimenting, this design was produced, bearing in mind two main considerations: simplicity and low cost.

Circuit Description

The audio signal is carried over the mains from one unit to the next by an r.f. carrier wave. Each unit, therefore, consists of an r.f. oscillator and a receiver. It was found that if a high enough r.f. was used, the ordinary "tank" circuit would quite well enough eliminate the mains frequency from the input to the receiver. In fact, in the prototype model, the mains voltage appearing across the coil L1 was of the order of a few microvolts.

A circuit diagram of the unit is given in Fig. 1. All units are the same. The r.f. oscillator just consists of a one-transistor Hartley oscillator circuit which provides enough power for the purpose. The oscillator transistor is Tr2. The receiver circuit, L1, D1, Tr1, Tr3, was chosen for its simplicity and low quiescent current (with good transistors it is in the order of 30μA). This means that the units may be left in the receive position for stand-by, and attention may be called by sending out a buzz along the mains which will be received and amplified and delivered through the earphone. This buzz may be produced by pressing S3, which makes the oscillator "howl". This produces a loud enough noise to attract attention in a normal room. If, however, this method is not found to be satisfactory, then S3 can be removed and R3 replaced by a relay operating at about 5mA. The contacts of the relay are connected into a buzzer circuit as in Fig. 2. The input signal raises the current in the receiver to about 10mA.

When in operation, bias for Tr1 is provided by the d.c. component from D1 in rectifying the r.f. signal. It *must*, therefore, be connected in the sense shown. Tr1 draws its current from B2 via the base-emitter of Tr3, and in doing so biases Tr3. The gain of the circuit is quite high, and it provides ample amplification to drive the earphone, or a small loudspeaker if matched by a transformer put in place of R3. However, in order to save money, it was decided to use one earphone for both microphone and earphone. This has proved to be very successful.

The necessary switching (send-receive) is carried out by S1, which also switches the oscillator and receiver power supply from B1, and the live side of the mains to the oscillator output or receiver input. **Great care must be taken at all times while the unit is not guarded. Lethal shocks can easily result from carelessness.**

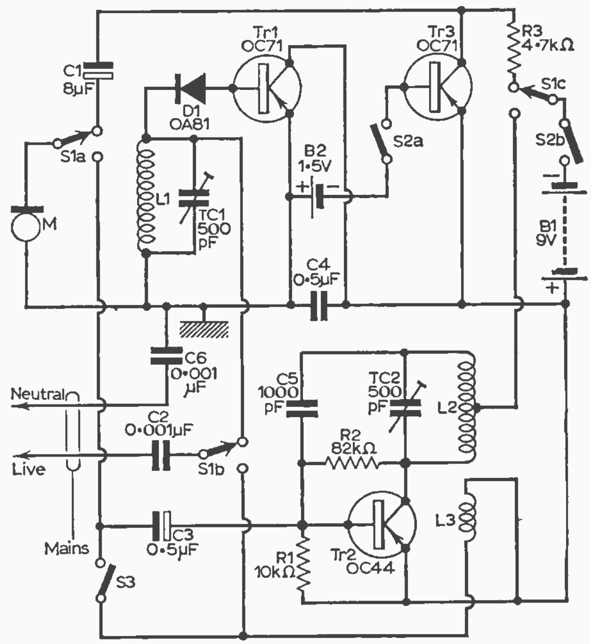

Fig. 1: Complete circuit of the wireless intercom.

S2 is the master on/off switch. This switches off the intercom unit, but does **not** disconnect the mains supply. No attempt must be made to replace B2 by tapping B1. The life of B2 is quite long since Tr1 only draws 10μA when in use. Also, the emitters of Tr1 and Tr3 *must* be separate as regards d.c. The return path for a.c. is provided by C4.

Construction

No great care need be taken in the layout of components except that ideally L1 should be screened from L2. In the author's model, each unit was mounted in a 6 x 6 x 3in. junction box divided down the centre by an aluminium screen. The

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★ components list

Capacitors:

C1	8μF electrolytic 15V	
C2	0·001μF 750V	
C3	0·5μF electrolytic 15V	
C4	0·5μF 250V	
C5	1000pF	
C6	0·001μF 750V	
TC1	500pF trimmer	
TC2	500pF trimmer	

Resistors:

R1	10kΩ
R2	82kΩ
R3	4·7kΩ
all ¼W 10%	

Switches:

S1	3-pole 2-way
S2	2-pole 2-way
S3	1-pole 2-way

Semiconductors

Tr1	OC71
Tr2	OC44
Tr3	OC71
D1	OA81

Coils:

L1	90 turns 30 s.w.g. on 1½in. former
L2	90 turns 30 s.w.g. on 1½in. former tapped at 45 turns
L3	12 turns 30 s.w.g. wound on top of L2, 6 turns either side of the centre tap

Miscellaneous:

High impedance earphone (2000Ω), 9V battery, 1·5V battery.

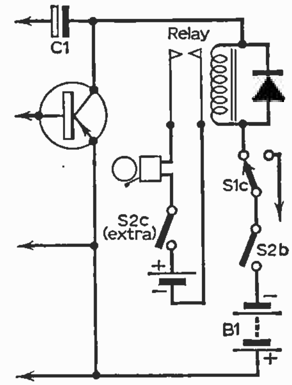

Fig. 2: Circuit showing alternative arrangement giving bell or buzzer operation to provide more positive calling.

receiver and batteries were put on one side, and the oscillator and switches on the other. Both the oscillator and receiver components were mounted upon tag boards.

While this design is ideal for use around the house, or from house to garage etc., in the author's case, it cannot be used between houses. Other constructors may find that limited house to house communication may be obtained—depending on what mains filtering exists, i.e. in the electricity meter, etc.

Note: The author is at present working on an audio phase-shift oscillator "call" system details of which will be included in an early issue. ■

SEMICONDUCTOR AUDIO

—continued from page 501

The voltage gain can be closer to unity than for the simple complementary output stage, and the four transistors together constitute a push-pull current amplifier that lowers the impedance level at the input to the loudspeaker, like a single emitter-follower (grounded-collector) stage, but with more power and a higher efficiency.

In the absence of a driver transformer, conditions in the single-transistor driver stage are considerably altered, and greater demands are made upon it. Since the output stage is basically the equivalent of an emitter-follower (see Fig. 4) with a voltage gain less than unity, the driver stage has to develop rather more than the loudspeaker voltage, and its quiescent voltage will be close to that of the mid-point of the output transistors, in order to accommodate the maximum signal swing between the positive and negative supply lines. Direct coupling is used between the driver and the complementary output (or driver) transistors, one reason being that there is no polarising voltage available at this point for an electrolytic capacitor.

The problem in a transformerless driver stage is therefore to produce sufficient drive for full output without incurring distortion. Under maximum signal conditions, the collector current moves towards zero on one peak, and the amplification will decrease. On the other peak, the collector voltage approaches its minimum. These opposite extremes on alternate half-cycles, added sometimes to the effect of unsymmetrical arrangements in the output stage, will tend to make the half-cycles unequal, introducing even-harmonic distortion.

A bootstrapped driver can provide the large amount of drive required with less distortion. The principle, as shown in Fig. 4, is to make an a.c. connection from the output of the output stage to the upper end of the driver load resistance R2 (470Ω). The smaller 180Ω resistance, R1, comes effectively in parallel with the load R_L of the output stage, and its only effect is slightly to reduce the value of the load R_L.

The bootstrap connection reduces the shunting effect of R2 across the driver output and increases the effective load impedance of the stage. The voltage amplification is therefore increased, typically three or four times.

If the output impedance of the driver transistor is high, bootstrapping will cause most of the local negative feedback of an emitter-follower type of output stage to be lost, thus converting it into what is virtually a grounded-emitter stage. This implies an increase of distortion in the output stage, but the loss of local negative feedback can be more than made up by overall negative feedback.

An important point to observe is that the bootstrap capacitor, which is charged to about half the supply voltage, will carry the top end of the driver load resistance, R2, to a potential above the upper supply line on one half cycle at maximum output. The effective supply voltage is therefore increased for the driver stage, enabling the required voltage swing to be produced with a smaller change of current. This allows a larger output voltage to be obtained than would otherwise be possible without a driver transformer, and the two peaks are more nearly equalised, even before negative feedback is applied.

In low-power amplifiers, the coupling capacitor to the loudspeaker also serves as the bootstrap capacitor (see Fig. 1). The loudspeaker is then returned to the upper supply line and carries the current of the driver stage. A separate and much smaller bootstrap capacitor, 20 or 25μF, is used in fidelity and high power amplifiers, and the loudspeaker can then be earthed to the lower supply line.

To be continued

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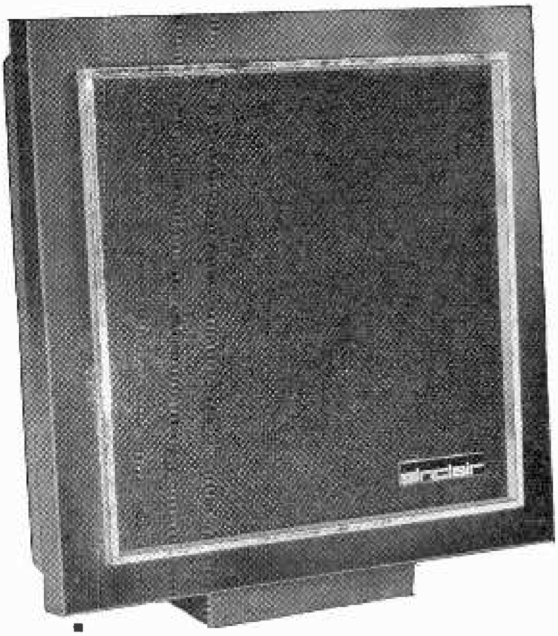
SINCLAIR Q.14



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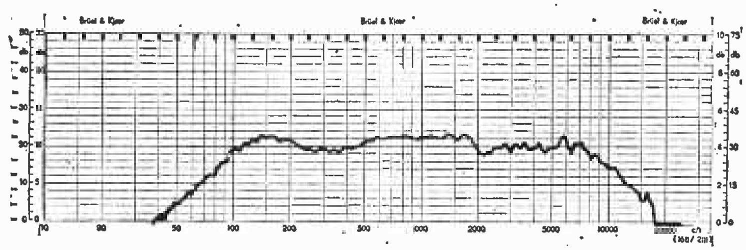

INDEPENDENT TEST REPORT

The above curve was taken by an independent testing laboratory and shows clearly why the Sinclair Q.14 achieves such remarkable standards of reproduction. Level response is maintained to assure the user of the finest possible results from the equipment to which the speaker is coupled.

Note—curve taken against vertical 0–25 dB range and plotted on a log. scale.

CONSTRUCTION
The seamless sound, or pressure chamber and mounting baffle are of special high-density ultra-low resonance materials made possible by modern bonding and processing techniques to ensure freedom from spurious coloration.

LOADING
The Sinclair Q.14 has an input impedance of 15 ohms and will comfortably accept loading in excess of 28 watts music power, far greater than that required for average listening requirements.

FREQUENCY RESPONSE
As the independently made test curve shows, remarkably smooth response is maintained between 60 and 15,000 c/s.

DRIVER UNIT
This is a specially designed unit having exceptionally high compliance due to the method of cone suspension employed. It has a massive ceramic magnet of 11,000 gauss and aluminium speech coil, with the cone treated to ensure brilliant transient response.

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The shape of the sealed sound chamber has been determined mathematically to ensure forward sounding presence and freedom from directional effect. Connections at rear are marked for correct phasing.

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The Sinclair Q.14 measures 9¾in. square on its front face by 4¾in. deep from front to back. A separate base for free standing position is provided as well as a template for wall or flush mounting. A neat solid aluminium bar inset is used to embellish the front.

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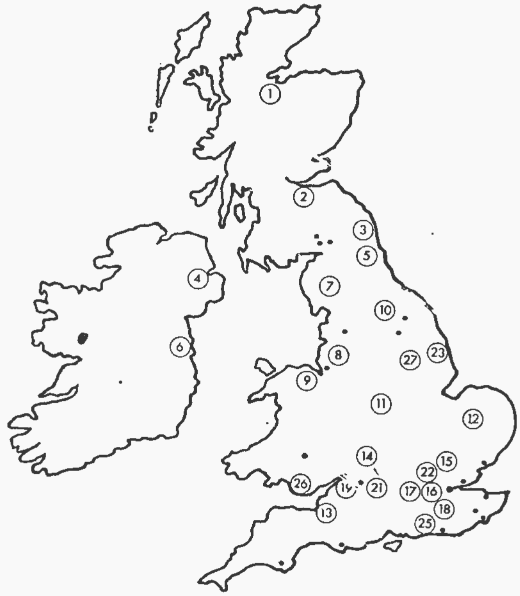
SINCLAIR MICROMATIC



The world's smallest radio

Actual Size

- $1\frac{4}{5}'' \times 1\frac{3}{10}'' \times \frac{1}{2}''$
- **SLOW MOTION TUNING OVER MEDIUM WAVEBAND**
- **FANTASTIC SELECTIVITY AND POWER**
- **A.G.C. AND BANDSPREAD**

Complete kit of parts in fitted pack, with earpiece, solder, and instructions. **59/6**

Built, tested and guaranteed 79/6

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Until you use a Micromatic for yourself, you will never know how fantastically efficient the world's smallest radio is. We have received thousands of letters testifying to the staggering performance of this six-stage transistor set, be it for quality, range, selectivity, sensitivity, long battery life or just playing in difficult places. We have letters galore to prove the excellency of this Sinclair design. That is why it is so fully guaranteed. You can build the Micromatic—or buy it complete, ready for immediate use. The thing is to have one and prove for yourself how good this British product is.

USERS FROM ALL OVER THE COUNTRY WRITE

From North, South, East and West enthusiasts for the world's smallest radio tell us of the wonderful results they get.

1 I was pleasantly surprised to find I was able to have it working in a few hours. W.J., Inverness

2 I would like to express my delight in the splendid sensitivity and quality. D.G.S., Edinburgh

3 I find it excellent in every way. W.A.S., Sunderland

4 We are very pleased with it. J.D.W., Belfast

5 Satisfactory results . . . good compared to any other transistor of any size. L.W.S., Stockton-on-Tees

6 I have found reception is quite satisfactory. S.C., Dublin

7 I am very pleased with its performance. B.M.H., Cumberland

8 I am very satisfied with the kit. J.H., St. Helens

9 A fabulous little performer in every respect. D.C.M., Mold, Flint

10 A thoroughly reliable receiver. Performance is wonderful. H.S.M., Ripon, Yorks

11 Very pleased with the results. D.T., Kenilworth

12 Lost for words . . . one of the most amazing inventions I have ever known. L.L., Norwich

13 Very pleased. J.M.H., Burnham on Sea

14 Amazed at such reception in these parts. K.T.R., Gloucester

15 The finish and quality is very good. N.P.C., Bishops Stortford.

16 Completed, and working extremely well. C.W., Harrow

17 Very pleased indeed with the Micromatic. D.M., Slough

18 Took only 5 hours to build and worked immediately. P.D., Reigate

19 The light programme came in better than a set costing £15. D.A.C., Bristol

21 Worked a treat. F.W., Banbury

22 Thank you for such a brilliantly designed little set. E.B.D., Epping.

23 Fantastic reception from the Continent. T.G.S., Grimsby

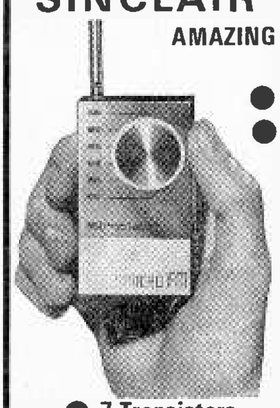
25 Stations come in marvellously for such a difficult area. P.G.H., Brighton

26 A marvellous set to build and listen with. E.K.J., Swansea

27 Better than anything I could ever have imagined. W.T., Sheffield

SINCLAIR MICRO FM

AMAZING DUAL PURPOSE FM TUNER/RECEIVER



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- **Needs no aligning when built**

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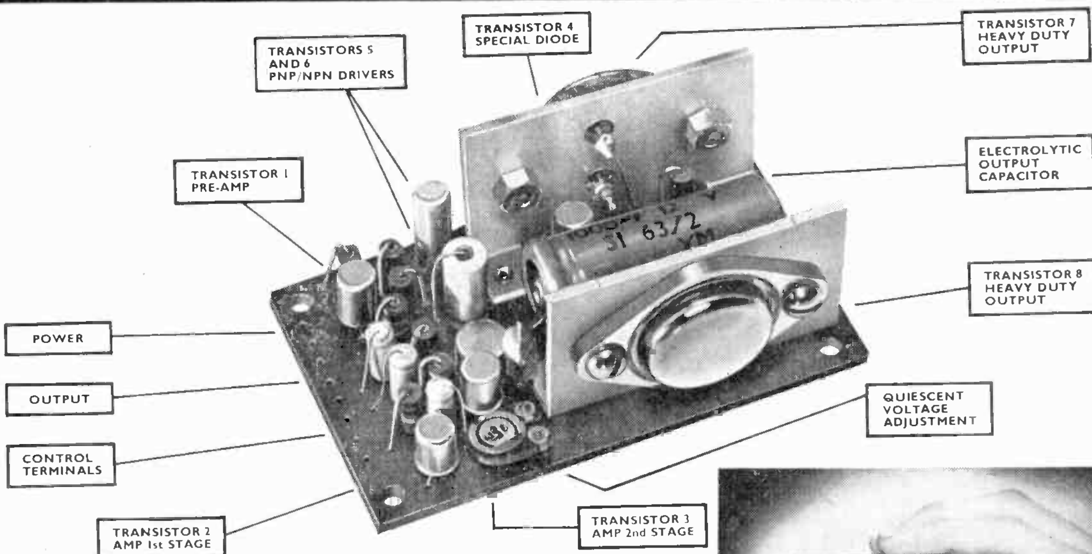
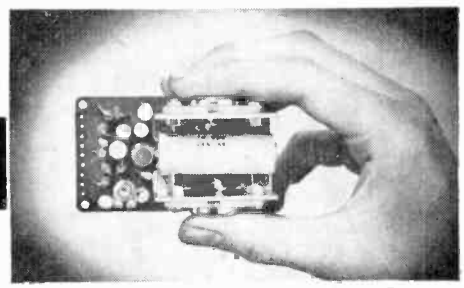


SINCLAIR Z.12



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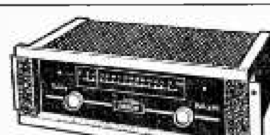

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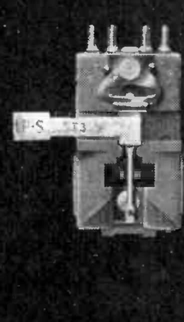

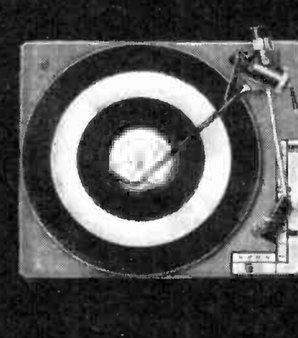

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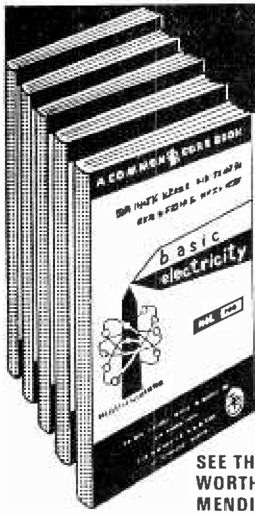

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S.A.E. with all enquiries please.
Postage rates apply to U.K. only.
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DEPT. PW, TALBOT HOUSE, 28 TALBOT GARDENS, LEEDS 8

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SERVICE SHEETS. RADIO. TV. 5,000 Models. List 1/6. S.A.E. Enquiries. TELRAY, Maudling Bk., Preston.

SERVICE SHEETS (75,000) 4/- each: please add loose 4d. stamp: callers welcome: always open. THOMAS BOWER, 5 South Street, Oakenshaw, Bradford.

SERVICE SHEETS for all makes, Radio, TV., Tape Recorders, 1925–1967. Prices from 1/-, Catalogue 6,000 models 2/6d. Free fault-finding guide with all Sheets. Please send stamped addressed envelope with all orders/enquiries. HAMILTON RADIO, 54 London Road, Bexhill, Sussex.

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Please supply Service Sheets for the following

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I require the new **1967** List of Service Sheets at 1/6 each plus postage.
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I enclose remittance of..................
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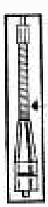
240 VOLT ELECTRIC POWER FROM YOUR 12 volt or 6 volt CAR BATTERY

Run your mains AC/DC equipment direct from your car battery with this compact low battery consumption dynamotor. Size only 5in. x 3in. Sturdy construction. Converts a 12 volt input to a 240 volt output. Huge purchase enables us to offer them at only 39/6 each, post and packing 6/-. 6 volt input model only 35/-, p.p. 6/-. Thousands already sold.



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fully adjustable highly efficient whip aerial. Made to exacting specifications. Copper plated sections. Brass base. An ideal aerial for TX/RX use. Easily adaptable for cars, scooters, walkie talkies etc. Brand new in maker's boxes. Only 17/6 each, post and packing 2/6. Two aerials for 30/-, post free.
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S. & R. SUPPLIES,
14 CLIFTON GROVE, LEEDS 9

TAPE RECORDERS, TAPES, Etc.

TAPES TO DISC—using finest professional equipment 45 rpm—18/-. S.A.E. leaflet. DEROY, High Bank, Hawk Street, Carnforth, Lancs.

GEE'S Recording Tape and Audio Accessories cost less! Send 1/- for illustrated catalogue. Gee Bros. Radio, 15 Little Newport Street, London, W.C.2. Gerrard 6794.

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WE BUY New Valves and Transistors. State price. A.D.A. MANUFACTURING CO., 116 Alfreton Road, Nottingham.

WE BUY New Valves, Transistors and clean new components, large or small quantities, all details, quotation by return. WALTON'S WIRELESS STORES, 55 Worcester Street, Wolverhampton.

WANTED: Popular Brand New Valves. R.H.S. Stamford House, 538 Great Horton Road, Bradford 7.

PRACTICAL WIRELESS for June 1957 and any others pre-1967 wanted. E. GEORGE, Box 170; 25 Navarino Road, London E.8.

WANTED: New valves, transistors etc.; state price. E.A.V. Factors, 202 Mansfield Road, Nottingham.

WANTED *NEW* VALVES ONLY
Must be new and boxed
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SPECIAL VALUE. 9 transistor 5 diode AM/FM superhet measuring 6¼ x 3½ x 1½. This is not a kit but a high quality radio with excellent reproduction on both medium and VHF wave bands. Costs less than the majority of FM tuners. Only £7.7.0 post free from DIRECT SALES. 79 Vicarage Lane, London E15, with money back guarantee.

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All complete with carrying case, personal earphone and batteries.	
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FOR SALE
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2½oz. tins **3/9.** ¼ pint **8/-**, 1 pint **16/-**. Carr. orders up to 5/-, 9d; up to 10/-, 1/9; over 10/-, 3/-. Colours: blue, silver, black, bronze. No primer needed. Panels transfers, fire-proof spray thinners. **List Free.**
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AMAZING RESULTS . JUST TRY IT!

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YUKAN SELF-SPRAY SO PROFESSIONAL THE YUKAN AEROSOL WAY—
Get these AIR DRYING GREY **HAMMER** or BLACK **WRINKLE (CRACKLE)** Finishes

Yukan Aerosol spraykit contains 16 ozs fine quality durable easy instant spray. No stove baking required. Hammers available in grey, blue, gold, bronze. Modern Eggshell Black Wrinkle (Crackle) all at 14/11 at our counter or 15/11, carriage paid, per push-button self-spray can. Also Durable, heat and water resistant Black Matt finish (12 ozs self spray cans only) 13/11 carriage paid.
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Open all day Saturday. Closed Thursday afternoons

Dept. PW/11

CURSONS TRANSISTORS
ALL GUARANTEED

1/- each, BAY31, BAY50, DK10, OA70, OA81, OA10, OA200, OA90, OA91, OA259.

2/- each. XA101, XA102, OC71, OC72, OC81, OC81D, OC44, OC45, GET16, FST3/1, ACY22.

3/- each. OC139, OC140, 2N706, 2N708, 2N2894, BY100, RAS310AF, 2N914, 2N914, BSY25, BSY26, BSY27, BSY95A, AFZ12, BFY18, BFY19, BFY26, BFY36.

7/6 each. RAS308AF, CRS3/40, BLY10, BLY11, BUY10, BUY11, ADY22, ADY23, ADY24, 2N2234, 2N2235, OC22, OC26, OC28, OC35.

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3·9v to 26v, ¼w **3/-** each, 1·5w **4/-**, 7w **5/-** each.

SAE, full new list:—

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FOR SALE
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FACT NOT FICTION. If you start **RIGHT** you will be reading amateur and commercial Morse within a month. (Normal progress to be expected.)
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G3CHS/P. 45 GREEN LANE, PURLEY, SURREY

MISCELLANEOUS

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Then how about making yourself an electric organ? Constructional data available—full circuits, drawings and notes! It has 5 octaves, 2 manuals and pedals with 24 stops—uses 41 valves. With its variable attack you can play Classics and Swing.

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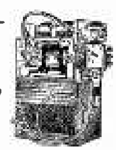

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BARGAIN PARCELS! 120 (minimum) radio parts, etc., mostly new 12/6. G. HART, Lings Lane, Chelmondiston, Ipswich, Suffolk.

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A limited quantity of low powered "export" VHF transmitters, tunable over 80–110 Mc/s are available. The units are completely self-contained in a plastic case and need no external aerial. These units may be used for a wide variety of purposes and contain a jack point for crystal microphone, pick-up, etc.

Size 3¼ x 2¼ x ⅞in.; powered by RM675H mercury cells; consumption 5mA; range in excess of 150 yds. in open space. Price **£5.5.0.** (without batteries).
Cash with order to
Carman-Waghorn Ltd., 1 Larch Grove, CHELMSFORD, Essex. Money refunded if not satisfied with purchase.

150 NEW ASSORTED Capacitors, Resistors, Silvered Mica, Ceramic, etc. Carbon, Hystab, Vitreous, ½-20 watt, 12/6 Post Free. WHITSAM ELECTRICAL, 18 Woodrow Close, Perivale, Middlesex.

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(continued)

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AC107	4/-	BC107	5/6	BF180	10/-	OC71	3/-
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AF117	3/6	BC109	5/6	BSX20	6/-	OC81	3/
AF239	12/6	BCY39	4/9	BSY95	6/-	OC81D	2/6
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12—Ge diodes like OA95—100% tested 3/-
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If you must use valves—see October PW or send SAE.
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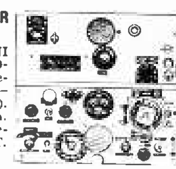
CANADIAN MARCONI RECEIVER No. 52. 10-valve 3 switched wavebands covering 1·75–16Mc/s (19–170 metres). Size 15 x 14 x 12in. Fully tested. Power requirements 150v. H.T. 60mA, 12v, 3A.
£9.19.6. Carr. 20/-.

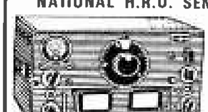


MURPHY B40 NAVAL RECEIVERS
5 bands 650Kc/s–30Mc/s. 10 valves. Built in speaker, phones output. 2 R.F. and 3 I.F. stages, xtal bandpass filter, noise limiter etc. etc. 150/230v A.C. Size 19½ x 13¼ x 16in. Cost well over £500. Supplied tested, working with circuit diagram **£22.10.0.** Carr. 30/-. Also B41, L.F. version **£15.** Carr. 30/-.

SPECIAL OFFER: Both above receivers **£30.** Carr £3.

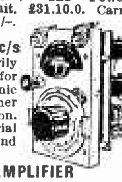
32ft. TELESCOPIC AERIAL MASTS
Comprising 20ft. 4 section tubular steel telescopic mast and 12ft. folding whip; can be erected in less than 5 minutes. Closes to 5ft. 9in. Weight 21lbs. Must have cost well over £20. Price **70/-.** Carr. 10/-.

NATIONAL H.R.O. SENIOR RECEIVERS 5T MODEL



In excellent tested condition. Complete with 9 coils 50Kc/s-30Mc/s and Power Unit. £31.10.0. Carr. 30/-.

REJECTOR UNITS 1.2-10Mc/s



Switched, 4 ranges. Primarily designed as station rejector for R.C. Suitable for harmonic suppression and many other uses with slight alteration. Tuning dial with lock. Aerial in and out sockets. Brand new **25/-.** P. & P. 5/-.

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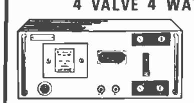

"C" Core transformers A.C. Mains 110/230 volts 600 ohms of high impedance input. Output 3 or 600 ohms (state choice). Controls: On/Off switch. Gain control. Indicator light. Valve inspection panel. 19 x 7 x 7in. Brand new in maker's carton. **79/6.** Carr. 10/-.

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R.F. ANTENNA TUNER (A.T.U.)
Calibrated scale, ideal 160/80/40 metres. Limited number only. Brand new with instructions, **17/6.** P. & P. 7/6.

ALL 19 SETS AND PARTS AVAILABLE
S.A.E. ALL ENQUIRIES—LIST 1/-

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RECEIVERS & COMPONENTS
(continued)

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2/- each AC126, 127, 128, OC75, 819T (OC83).
2/6 each OC44, 45, 81D, 81, 82D, 82.
3/- each OC71, 72, 170, 84, AF118, AF119.
3/6 each AF115, 116, 117, 125, 127.
4/- each AF114, OC171, 172.
7/- each OC22, 23, 25, 26, 28, 30, 200.
11/6 each AD140, 149, OC35, 36, 38.
Resistors ½ watt, 5% 10 Ω to 10M Ω **4/6** doz.
Caps 15V 8, 10, 30, 50, 100 mfd. **1/-** each.
Mylars ·001, ·002, ·005, ·02, ·05 **5/-** doz.
Lists 6d. P. & P. 6d. per order.
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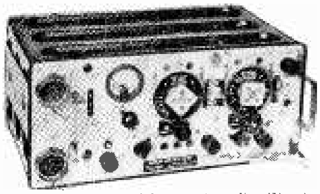
JOHN'S RADIO (Dept. B)

OLD CO-OP, WHITEHALL ROAD, DRIGHLINGTON, BRADFORD

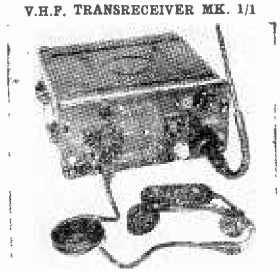
FAMOUS ARMY SHORT-WAVE TRANSRECEIVER MK. III



This set is made up of 3 separate units: (1) a two valve amplifier using a 6V6 output valve; (2) (some only, not built in the very latest models) a V.H.F. transreceiver covering 229–241 Mc/s using 4 valves; (3) the main short wave transmitter/receiver covering in two switched bands, just below 2 Mc/s–4½ Mc/s, and 4½ Mc/s–8 Mc/s (approx. 160–37·5 metres) using 9 valves. For R.T., C.W. and M.C.W. The receiver is superheterodyne having 1 R.F. stage, frequency changer, two I.F. (465 Kc/s) signal detector, A.V.C. and output stage. A B.F.O. included for C.W. or single side-band reception. T.X. output valve 807, other valves octal bases. Many extras, e.g. netting switch, quick flick dial settings, squelch etc. Power requirements LT 12 volts, HT receiver 275 volts D.C. HT transmitter 500 volts D.C., size approx. 17½ x 7½ x 11ins. Every set supplied in new or as new condition in carton with book including circuits, only **£4.10.0d.**, or Grade 2 slightly used **50/-** carriage both 15/-.

A FULL KIT of brand new attachments for this set including all connectors, control box, headphones and mike, aerial tuning unit, co-axial lead etc. at only **45/-** carriage 5/-. WE MAKE A MAINS 200/250 VOLT POWER UNIT in louvred metal case to plug direct into set power socket to run (1) receiver, **70/-** post 5/-. (2) TX and RX, **£6.10.0** post 7/6d. (3) 12 Volt DC P.U. for receiver, **50/-** carriage 5/-. A charge of 10/- to unpack and test the receiver of these sets is made only if requested.

V.H.F. TRANSRECEIVER MK. 1/1



This is a modern self contained tunable V.H.F. low powered frequency modulated transreceiver for R.T. communication up to 8–10 miles. Made for the Ministry of Supply at an extremely high cost by well known British makers, using 15 midget B.G. 7 valves, receiver incorporating R.F. amplifier. Double superhet and A.F.C. Slow motion tuning with the dial calibrated in 41 channels each 200 Kc/s apart. The frequency covered is 39 mc/s–48 mc/s. Also has built-in Crystal calibrator which gives pips to coincide with marks on the tuning dial. Power required LT 4½ volts, HT 150 volts, tapped at 90 volts for receiver. Every set supplied complete with valves and crystals. New in carton, complete with adjustable whip aerial, and circuit. Price **£4.10.0** carriage 10/-. Headset or hand telephone **30/-**. Internal power unit stabilised for 200/250 volts AC input **£6.10.0** extra.

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Tests Transistors in or out of set — Tests both P.N.P. and N.P.N.
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300 m/W AMPLIFIER KITS

Comprising: Full instruction manual — Transformers — Printed circuit — Transistors — Resistors — Electrolytics — Potentiometer — Flex — Copper wire — and solder etc.
Price 35/- post free.

9-VOLT POWER PACK KITS

Comprising: Full instruction manual — Resistors — Transformer — Electrolytics — Mains lead — Flex — Printed circuit — Screws and nuts etc.
Price 27/6. Post Free.

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695/697 SEVEN SISTERS ROAD, LONDON N.15
(50 yds. from Wards Corner).

R & R RADIO

(Proprietor: B. Green)

51 Burnley Road, Rawtenstall
Rossendale, Lancs.
Tel: Rossendale 3152

Boxed Valves				Fully Guaranteed	
EF80	4/-	PCC84	5/-	PY33	7/6
ECC82	4/-	PCF80	5/3	30P19	7/6
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EB91	2/-	PY81	5/-	U191	7/6
EF85	5/-	PY800	5/-	U310	7/6
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Radio chassis, modern valve type in clean condition. Less valves, **25/-** post paid.
Fireball tuners complete with valves, **£1** post paid.
Tuners less cover cans and valves, **9/-** post paid.
Your selected tuner, if available, **25/-** post paid.
Postage, one valve 9d. extra, two valves 6d. each extra, three or more 2d. per valve extra.
Stamped addressed envelope with all enquiries please

VALVES

... salvaged but tested and guaranteed for 3 months. Our assortment **12/-** doz., selected to your requirements **5/-** each, if unable to supply immediate cash refund.

Large bags of capacitors and resistors, **5/-** per bag.

HURRY, HURRY. Stocks good but selling fast.

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280 Lake Road
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HIGH QUALITY AERIALS AT A NEW LOW PRICE

UHF outdoor or loft, 7 element, **29/6.** 11 element **38/-.** 18 element **52/-.** Combined loft BBC/ITV with mountings V plus 5 45/-. Chimney H plus 5 70/-. Dipole plus 5 50/-. Low loss coax 1/5 yard. All types aerials, mounts and brackets on request. P. & P. 5/- on all above items.

TIMM'S ELECTRONICS
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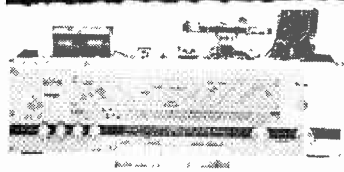
½ PRICE SPECIAL RADIO CHASSIS OFFERS

HI-FI KUBA ROYAL STEREOPHONIC TUNER AMPLIFIER



High Fidelity stereo/tuner amplifier. A four wave band tuner unit integrated with a powerful 16 watt high fidelity push-pull stereo amplifier. The most advanced comprehensive chassis yet designed.
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Separate bass and treble controls.
Full tape recording and play back facilities.
Complete with a 4 speaker system (2-4in. tweeters, 2-10in. bass speakers) plus BSR 4 speed record changer. Model UA70 with ceramic cartridge and diamond stylus.
Fully guaranteed for one year including all valves.
Special Package offer only £74.5.0. (Chassis only 49½ Gns.)
Terms
£24.15.0 deposit followed by 24 Monthly Payments of £2.11.7 (total H.P. £86.13.0)+17/6 P. & P. Send £25.12.6 NOW.
For other stereophonic equipment see page 542.

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- Each Lewis Radio Cabinet is carefully made by British Craftsmen and soundly constructed from the best materials available.
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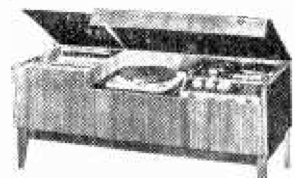

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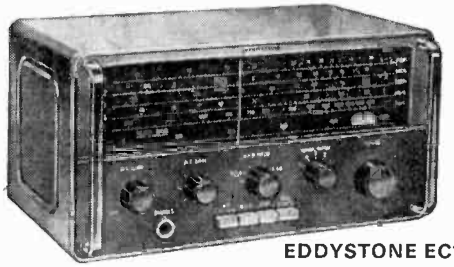

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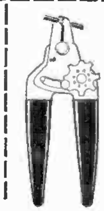

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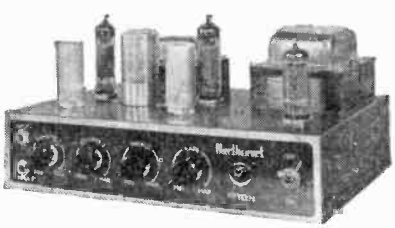

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1µF	50V.	5µF	25V.	20µF	15V.	150µF	25V.
1·25µF	16V.	5µF	50V.	25µF	6V.	200µF	3V.
2µF	3V.	5µF	70V.	25µF	12V.	200µF	4V.
2µF	9V.	6µF	12V.	25µF	15V.	200µF	12V.
2µF	15V.	6µF	15V.	25µF	25V.	200µF	16V.
2µF	50V.	6·4µF	40V.	25µF	30V.	200µF	18V.
2µF	70V.	8µF	3V.	30µF	6V.	250µF	2·5V.
2µF	150V.	8µF	6V.	30µF	10V.	250µF	9V.
2·5µF	16V.	8µF	50V.	30µF	15V.	320µF	2·5V.
2·5µF	25V.	8µF	275V.	32µF	1·5V.	350µF	9V.
3µF	3V.	10µF	6V.	40µF	3V.	350µF	12V.
3µF	12V.	10µF	10V.	40µF	6·4V.	500µF	4V.
3µF	25V.	10µF	12V.	50µF	6V.	500µF	6V.
3·2µF	6V.	10µF	25V.	50µF	9V.	640µF	2·5V.
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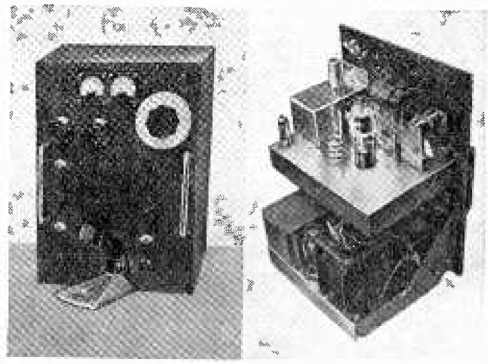

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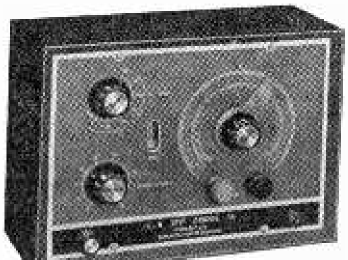

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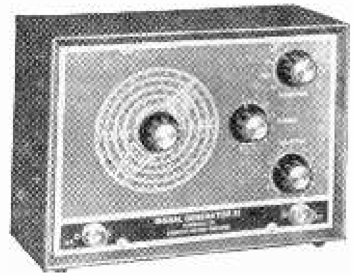

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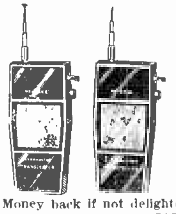

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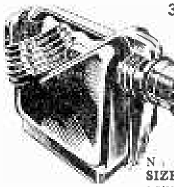

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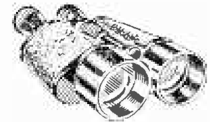

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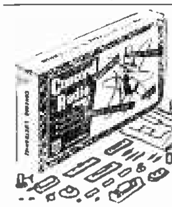

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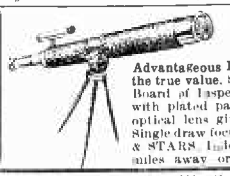

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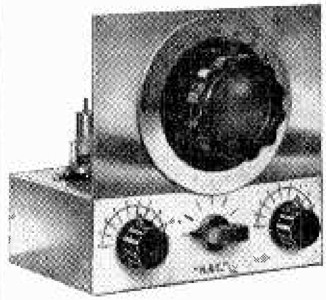

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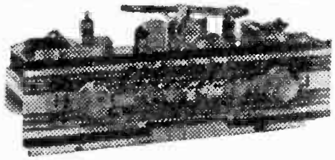

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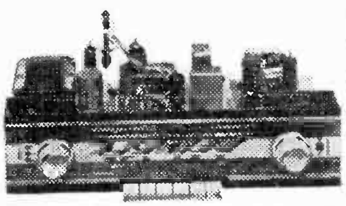

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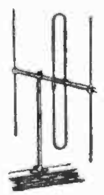

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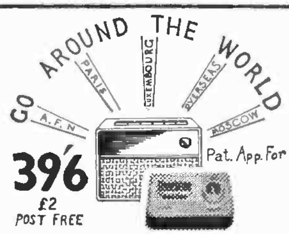

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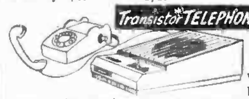

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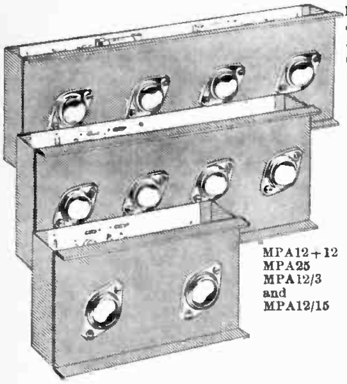

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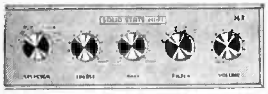
MPA25
MPA12/3
and
MPA12/15



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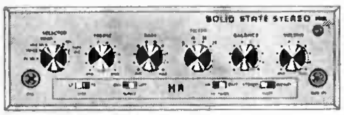

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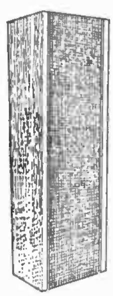

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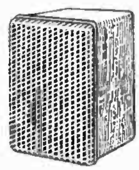
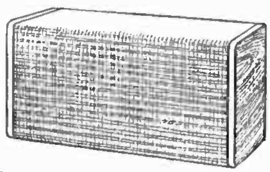
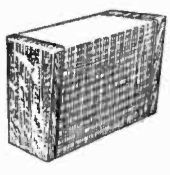


THE MILTON. A Hi-Fi Bookcase Cabinet. Size 9 x 5 x 6in. with 5in. speaker. Finished in Teak cloth with bold silk front. 30/-. P. & P. 3/6.

THE STEREO. A superior extension cabinet fitted with two 7 x 4in. speakers. Size 16 x 9 x 8½in. Finished in fawn Vynair with natural teak ends. £3. P. & P. 5/-





THE IMP. Extension Speaker Cabinet. Wedge shaped size 7½ x 6½in. fitted with 7 x 4in. speaker. Covered with attractive walnut with fawn Vynair front. Keyhole slot in back. Only 25/6. Post 2/6.
Note: All cabinets new and made with ½in. chipboard. All speakers ex TV reconditioned hi flux magnet. All carefully tested before despatch.

HAYDON SPEAKER SYSTEM. Size 16½ x 15 x 7½in., fitted 12in. Speaker and volume control. Fabric covered. £4.17.6. P. & P. 10/-.

SPEAKER ENCLOSURES
Tony Corner Cabinet 20 x 10 x 7in. takes 10 x 6in. speaker covered in Rexine and Vynair, 45/-. P. & P. 5/-.
Blake Cabinet size 18 x 24½ x 9½in., fabric covered £4.10.0. P. & P. 10/-.
Haydon, 16½ x 15 x 7½in. fabric covered suitable for 12in. speaker, 45/-. P. & P. 7/6.
Hi-Fi Bookshelf speaker enclosure foam lined, cabinet size 10½ x 5½ x 7½in. Teak finish, £3.0.0. P. & P. 3/6
Woofer for above £3.0.0. P. & P. 2/6. Tweeter 12/6. P. & P. 1/6. Condenser for crossover 2/6. Terminals 2/6 pair. P. & P. 1/-.
PLINTH Teak finish to match above Hi-Fi speaker size 17½ x 14 x 4in. for Garrard 1000, 2000, 3000, AT60, SP25, £2.17.6. P. & P. 4/6.

SPEAKERS:
Elac Heavy duty Ceramic Magnets 11,000 line, 10in. round 10 x 6in. 3 ohm or 15 ohm, 42/6. P. & P. 3/6. 8in. round 15 or 3 ohm, 38/6. P. & P. 3/6. E.M.I. 13½ x 8in. 15 or 3 ohm, 42/6. P. & P. 3/6. E.M.I. Tweeter, 12/6. P. & P. 1/6. R.T.C. 12in. 20 watt 15 ohm Ceramic magnet £5.5.0. P. & P. 3/6. 8 x 4in. Elliptical 30 ohm 30/-. P. & P. 3/6. All other speakers supplied—Goodmans, Bakers, W.B., Wharfedale, Eagle, Tripletone.

EARPIECES WITH CORD AND 3.5 mm. plug. 8 ohm magnetic, 3/-. 250 ohm 4/-. 180 ohm with clip, 6/6. Xtal 4/-. P. & P. 6d.
TRANSISTOR SPEAKERS 8 ohm 2in. 8/6; 3in. 10/6; 3½in. 12/6. P. & P. 1/-.
PANEL LIGHTS. 6v Red, Blue, Green, Yellow, White (uses Lilliput bulbs) 3/- each. P. & P. 1/-.
NEON PANEL LIGHTS 200-250v 3/- each. P. & P. 1/-.
ROTARY SWITCHES:
2 pole Mains Switch 3/-. 1 pole 12 way, 2 pole 2 way, 3 pole 3 way, 3 pole 4 way, 4 pole 3 way, 3/6 each. P. & P. 1/-.
PIANO KEY BUSH BUTTON SWITCHES. 7 button, including mains on/off. 6 banks of 6 P.C.O. 8/6. P. & P. 1/-.
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EY83	9/-	PCL81	9/-	U12/14	8/-	UU8	7/-
EY84	9/6	PCL82	7/-	U18/20	10/-	UU9	7/6
EY86	6/6	PCL83	8/6	U20	10/-	UU10	8/-
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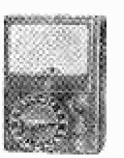
OC81D	3/-	AF114	6/6	GET113	4/-	2S006	20/-
OC83	5/-	AF115	6/-	GET114	4/-	2S012	140/-
OC84	5/-	AF116	6/6	GET115	8/6	2S018	60/-
OC122	12/6	AF117	5/-	GET116	10/-	2S103	25/-
OC139	7/6	AF118	10/-	GET872	6/-	2S104	15/-
OC140	9/6	AF124	7/6	GET875	6/-		
OC141	12/6						

MULTIMETERS



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A.C. and D.C. voltage ranges: 0-10-50-250-500-1000V.
D.C. current ranges: 500µA-10-100mA.
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1.0W 5%: 2.4V Z2A24CF; 2.7V Z2A27CF; 3.0V Z2A30CF; 3.6V Z2A36CF; 3.9V Z2A39CF; 16.0V Z2A160CF; all at 5/6.
1.5W 5%: 3.0V Z3B30CF; 27.0V Z3B270CF; 30.0V Z3B300CF; 33.0V Z3B330CF: all at 6/6.
2.25W 10%: 4.25V VR425B; 4.75V VR475B: all at 6/6.
5.25W 10%: 4.25V VR425A; 5.75V VR575BA; 7.0V VR7A; 11.0V VR11A; 13V VR13A: all at 8/-.
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3/40, 400 p.i.v. 3 amp, stud mounted, Gate voltage 3·0v. at 20mA max. 7/6

BLUE SPOT, 200 p.i.v. 5amp, stud mounted. Gate voltage 3·25v. at 120mA max. 12/6

GREEN SPOT, 400 p.i.v. 5 amp, stud mounted. Gate voltage 3·25v. at 120mA max. 17/6

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200–250 watt exceptionally well made lightweight soldering irons with polished wooden handles and chromium plated body. Angle bit of sufficient length for long life. No breakable plastics used in construction. PRICE 16/- (P.P. 2/-). Spare bits 1/9. Spare elements 3/6.

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Type RA8508AF, 960 p.i.v. at 6 amps. max., stud mounted 10/6

TEXAS SILICON FULL-WAVE BRIDGE RECTIFIERS

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PRACTICAL WIRELESS, NOVEMBER 1967

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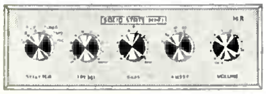

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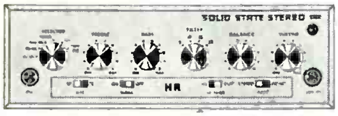

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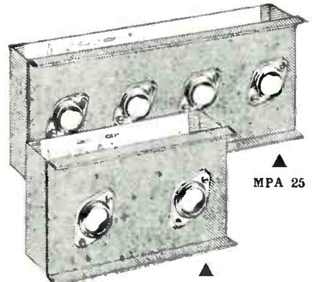

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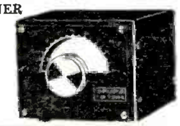

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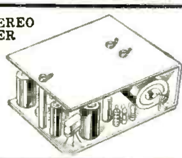

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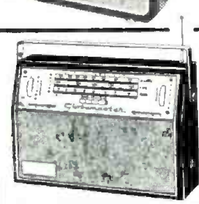

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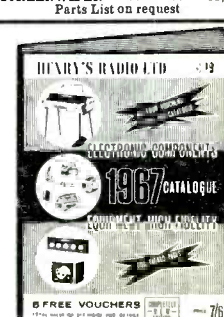

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