PRACTICAL WIRELESS

MARCH 1968

2'6

CONSTRUCTING THE

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TAPE RECORDER

* ALSO INSIDE

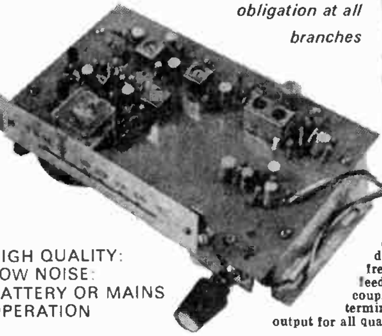
PORTABLE TEST UNIT

COILS FOR TRANSISTOR CIRCUITS

Transistorised FM Tuner

CALLERS WELCOME

Demonstration without obligation at all branches



HIGH QUALITY:
LOW NOISE:
BATTERY OR MAINS
OPERATION

This beautifully compact 6 transistor machine (size 6 x 4 x 2½in.) will give quieter, more interference free reception. Months of use from a standard 9 volt battery or its small power requirements can be drawn from any amplifier. Low noise freq. changer. Smooth 2 gang tuning feeding no less than three I.F. stages coupled to a double-tuned discriminator terminating in an L.F. stage giving ample output for all quality amplifiers.

REDUCED PRICE DUE TO HUGE SALES **£6.10.0** (3 FOR £18)

LATEST GARRARD (Post 5/-)

SRP12	£3.19.0
SP25 (*Mk. II die cast*)	£10.19.0
AT5	£5.10.0
Model 1,000	£6.5.0
Model 2,000	£6.10.0
Model 3,000	£8.10.0
AT60 Mk. II	£12.10.0
A70	£18.10.0
LAB80 Mk. II	£24.19.0
401	£27.10.0
Mono dual cartridges	12/6
Stereo ceramic cartridges	19/6

PLINTHS

Universal fitting de luxe Teak for SP25, 1,000, 2,000, 3,000, AT60 — 59/-

Ditto Perspex Clear View Cover, Complete — £5.15.0

LAB80, 401, Superb Teak/Perspex top finish plinth Normally £12.10. — £9.19.0

TRANSISTORS

GUARANTEED TOP QUALITY

Mullard Matched Output Kits OC18D and 2-OC81 — 12/6

R.F. Kits OC44, OC45 (2) 3 transistors. — 11/-

AF114	6/6	OC26	7/6	OC81	5/-
AF115	6/-	OC35	9/-	OC81D	4/6
AF116	6/-	OC44	5/-	OC170	6/-
AF117	5/6	OC45	4/6	OC171	6/-
AF127	5/6	OC72	5/-		

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General Purpose miniature detector or 6/6 doz. — 8d.

Gold Bonded Top Grade (9/6 doz.). — 1/-

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

100mA (3 for 6/6) 2/9 — 500mA (3 for 12/6) 5/-

BARGAIN PARCELS

Including variable condensers, i.f. coils, loudspeaker plug/sockets, knobs, pots, condensers, resistors, nuts, bolts, cabinet fittings, switches, transformer choke, rectifier, transistors at a small fraction of list value. Due to heavy demand we now pack them in several sizes—be amazed—try one now.

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14 lbs. (post 6/–)	29/-

100 HIGH-STABS 9/-

1% to 5% 100Ω to 5mΩ.
CO-AX, low loss, 6d. yd., 25 yds. 11/6; 50 yds. 22/-; 100 yds. 42/6. Plugs 1/3.

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SIZES—¼—3 watt.
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100 CONDENSERS 9/6

Miniature Ceramic, Silver, Mica etc., 3pF to 5μF. LIST VALUE OVER £4.

PLEASE NOTE. *A wide range of cabinets to callers at all branches.*

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SRP 110/230V (De Luxe Heavy Turntable). 59/-

Mono first-grade Cartridges. . 12/6

Stereo Ceramic Cartridges. . . . 19/- extra

EMI 4-speed heavy turntable player 200/250V with lightweight pick-up (dual cartridges 10/- extra) 49/-

Jason KITS

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

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3in.	150ft.	2/3	3in.	225ft.	2/9
4in.	300ft.	4/6	4in.	450ft.	5/6
5in.	600ft.	7/6	5in.	900ft.	10/6
5¾in.	900ft.	10/6	5¾in.	1,200ft.	13/-
7in.	1,200ft.	12/6	7in.	1,800ft.	18/6
Double Play			**Triple Play**		
3in.	300ft.	4/-	4in.	900ft.	13/-
4in.	600ft.	8/-	5in.	1,800ft.	25/-
5in.	1,200ft.	15/-	5¾in.	2,400ft.	34/-
5¾in.	1,800ft.	19/6	7in.	3,600ft.	44/-
7in.	2,400ft.	27/-	**Quadruple Play**		
			3in.	600ft.	8/6

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Post Free less 5% on three reels.
Quantity and Trade enquiries invited.
NOTE. *Large tape stocks at all branches*

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7 TRANSISTOR RADIOS

Superhet, full medium wave coverage amazing volume, clarity and sensitivity from built-in PM speaker. Solid leather pocket wallet. Supplied with rechargeable cadmium cells (2 sets) and 230 VAC charger with 5 amp. plug. Fabulous present. Huge purchase enables us to offer the complete outfit at a fraction of market value. (If not amazed by the value and performance your money will be refunded if returned within 14 days). 49/-

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Satisfaction or Money Back Guarantee on goods if returned unused within 14 days ALL VALVES ARE NEW UNLESS OTHERWISE INFORMED. FREE TRANSIT INSURANCE. POSTAGE 1 valve 9d. 2-11 6d. per valve. Free over 12

1L4	2/3	6P25	13/-	20P3	9/6	EBF80	8/9	EZ41	9/6	PY88	9/6
1S4	5/9	6P28	9/6	20P4	18/9	EBF89	8/-	EZ80	6/6	PY800	8/-
2D21	5/6	6Q7G	8/-	25L6GT	7/-	EBL21	12/-	EZ81	7/-	PY801	8/-
3Q4	6/3	6Q7GT	9/9	25Z4G	8/-	ECC40	10/6	FC4	8/6	PZ30	9/6
5U4G	7/-	6SJ7GT	6/-	30C15	12/6	ECC81	5/9	GZ32	10/6	SP61	3/9
5Y3GT	7/6	6SL7GT	7/9	30C17	11/6	ECC82	5/6	GZ34	11/6	TDD4	8/6
5Z4G	7/9	6SN7GT	6/9	30F5	10/-	ECC83	7/-	KT61	13/-	U14/18	8/-
5Z4GT	10/6	6U4GT	10/6	30FL1	10/9	ECC84	8/-	KT63	5/6	U25	10/6
6/30L2	10/6	6V6G	4/9	30L15	12/6	ECC85	6/9	KT66	20/6	U26	10/6
6A8G	7/6	6V6GT	7/9	30L17	12/6	ECC88	10/6	KTW61	6/9	U35	18/6
6AK5	5/9	6X4	5/6	30P4	12/6	ECF80	8/9	KTW63	6/-	U191	13/6
6AQ5	5/-	6X5G	5/-	30P12	10/-	ECF82	8/6	KTZ63	7/-	U281	9/6
6AT6	6/-	6X5GT	7/9	30PL1	12/-	ECH42	11/6	MU14	8/-	U282	16/-
6AU6	7/-	7B6	12/6	35A5	9/6	ECH81	7/9	N37	10/6	U801	20/-
6BA6	6/6	7B7	7/6	35L6GT	9/6	ECL80	5/9	N78	14/-	UABC80	7/6
6BE6	6/6	7C5	10/6	35W4	7/6	ECL82	8/6	N108	14/-	UAF42	8/9
6BH6	7/6	7C6	7/6	35Z4GT	6/9	ECL83	11/6	PC86	10/6	UB41	6/6
6BJ6	8/-	7H7	7/6	35L6GT	9/6	ECL86	10/6	PC97	8/6	UBC41	9/9
6BR7	10/6	7S7	15/6	42	6/6	EF36	5/9	PCC84	6/5	UBC81	7/9
6BW6	8/6	7Y4	8/-	80	8/6	EF39	8/-	PCC85	7/6	UBF80	8/6
6BW7	6/-	10C1	12/-	185BTA	20/6	EF40	11/-	PCC88	12/9	UBF89	8/9
6C4	4/-	10C2	13/6	807	10/6	EF41	10/-	PCC89	12/-	UBL21	11/3
6C6	4/-	10F1	7/6	955	3/6	EF42	7/9	PCC189	10/9	UCC85	8/6
6C9	12/-	10LD11	15/6	956	3/-	EF50	3/3	PCF80	6/9	UCF80	9/9
6CD6G	18/-	10P13	9/6	AZ31	9/6	EF80	5/3	PCF82	6/9	UCH21	11/6
6D6	4/-	10P14	9/6	DAF91	4/9	EF85	7/3	PCF86	9/3	UCH42	9/6
6F1	6/6	12AT6	7/6	DAF96	8/3	EF86	8/6	PCL82	7/9	UCH81	8/-
6F6G	6/-	12AT7	5/9	DF91	3/-	EF89	7/6	PCL83	10/6	UCL82	9/-
6F13	4/6	12AU6	6/-	DF96	8/3	EF91	3/6	PCL84	10/-	UCL83	11/6
6F14	7/6	12AU7	5/6	DK91	5/6	EF183	9/-	PCL85	10/6	UF41	10/-
6F15	9/6	12AX7	7/-	DK92	9/6	EF184	9/-	PCL86	10/6	UF42	6/9
6F23	9/-	12BA6	8/-	DK96	8/3	EL32	5/-	PL33	8/6	UF85	8/6
6J5G	4/-	12BE6	7/6	DL92	7/-	EL33	13/-	PL36	12/-	UF89	7/9
6J5GT	7/6	12J7GT	10/-	DL94	7/6	EL34	12/6	PL81	8/9	UL41	11/-
6J6	4/3	12K7GT	6/-	DL96	8/3	EL41	10/9	PL82	5/9	UL44	15/-
6J7G	5/6	12K8GT	10/6	DY86	6/-	EL42	9/9	PL83	6/-	UL46	11/6
6J7GT	10/6	12Q7GT	7/6	DY87	6/-	EL84	7/6	PL84	8/-	UL84	7/8
6K7G	2/8	12SJ7	5/6	EABC80	7/9	EM80	8/-	PY31	7/6	UM80	10/6
6K7GT	6/9	14S7	15/6	EAF42	9/-	EM81	8/6	PY32	10/6	UY21	9/9
6K8GT	10/6	19AQ5	6/6	EB41	4/6	EM84	8/9	PY33	8/6	UY41	8/-
6L1	10/6	20D1	9/9	EB91	2/9	EY51	8/6	PY80	6/9	UY85	6/6
6L6G	9/6	20F2	9/6	EBC33	8/6	EY86	8/6	PY81	5/9	VR105	6/-
6L18	7/9	20L1	17/-	EBC41	10/6	EY88	9/6	PY82	5/6	VR150	6/-
6LD20	9/6	20P1	9/6	EBC91	7/9	EZ40	8/6	PY83	6/9	X66	7/9

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HI-FI AMPLIFIERS

TS-23

AA-22U

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 Ready-to-Use £57.10.0** (Cabinet £2.5.0 extra).

Low-priced 3+3 watt TRANSISTOR AMPLIFIER, TS-23
Breaks the price barrier in quality stereo amplifer 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. Ready-to-Use price on request.

New! STEREO TAPE RECORDER, STR-1

Fully portable—own speakers

Kit £45.18.0

Ready-to-Use £59.15.0

FOR THIS SPECIFICATION

● $\frac{1}{4}$ track stereo or mono record and playback at $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ ips ● Sound-on-sound and sound-with-sound capabilities ● Stereo record, stereo playback, mono record and playback on either channel ● 18 transistor circuit for cool, instant and dependable operation ● Moving coil record level indicator ● Digital counter with thumb-wheel zero reset ● Stereo microphone and auxiliary inputs and controls, speaker/headphone and external amplifier outputs . . . front panel mounted for easy access ● Push-button controls for operational modes ● Built-in stereo power amplifier giving 4 watts rms per channel ● Two high efficiency 8" × 5" speakers. ● Operates on 230V a.c. supply.

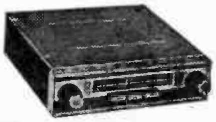
Versatile recording facilities. So easy to build—so easy to use.

FULL SPECIFICATION SHEET AVAILABLE

Heathkit DAYSTROM ENJOY YOURSELF & SAVE MONEY

Finished models provide years of superlative performance

HIGH PERFORMANCE CAR RADIO CR-1



Superb long and medium wave entertainment wherever you drive. Complete your motoring pleasure with this compact outstanding unit.

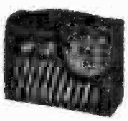
● 8 Latest semi-conductors (6 transistors, 2 diodes) ● For 12 volt positive or 12 volt negative earth systems ● Powerful output (4 watts) ● Pre-assembled and aligned tuning unit ● Push-button tone and wave change controls ● Positive manual tuning ● Easy circuit board assembly ● Instant operation, no warm-up time ● Tastefully styled to harmonise with any car colour scheme ● High quality output stage will operate two loudspeakers if desired. Can be built for a total price.

Kit (less spkr.) £12.17.0 incl. P.T. (6" x 4" LS £1.4.5 extra).

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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GLOUCESTER—Bristol Road.

TEST INSTRUMENTS

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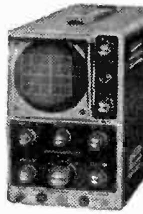
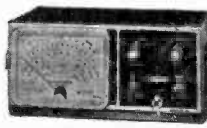


OS-2

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

5" GEN.-PURPOSE OSCILLOSCOPE. Model 10-12U. An outstanding model with professional specification and styling. "Y" band width 3 c/s-4·5 Mc/s ±3dB. T/B 10 c/s-500 kc/s. Kit **£35.17.6.** Ready-to-Use **£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-74 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.** Ready-to-Use **£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.** Ready-to-Use **£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 $4\frac{1}{2}$" 50μA meter.
Kit **£12.18.0.** Ready-to-Use **£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.** Ready-to-Use **£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.** Ready-to-Use **£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.** Ready-to-Use **£47.8.9**

Prices and specifications subject to change without notice

New! STEREO AMPLIFIER, TSA-12

12 × 12 watts output.

Kit £30.10.0 *less cabinet*

Ready-to-Use £42.10.0

Cabinet £2.5.0 extra

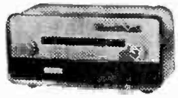
FOR THIS SPECIFICATION

● 17 transistors, 6 diode circuit ● ±1dB, 16 to 50,000 c/s at 12 watts per channel into 8 ohms ● Output suitable for 8 or 15 ohm loudspeakers ● 3 stereo inputs for Gram, Radio and Aux. ● Modern low silhouette styling ● Attractive aluminium, golden anodised front panel ● Handsome assembled and finished walnut veneered cabinet available ● Matches Heathkit models TFM-1 and AFM-2 transistor tuners.

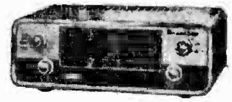
Full range power . . . over extremely wide frequency range. Special transformerless output circuitry. Adequately heat-sinked power transistors for cool operation—long life, 6 position source switch.

FULL SPECIFICATION SHEET AVAILABLE

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.** Ready-to-Use **£12.5.0**

Build Britain's Best Electronic Kits

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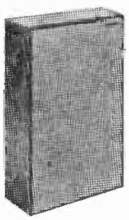
No special kit-building skills or Electronic knowledge required

SPEAKER SYSTEMS

SSU-1



Berkeley

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

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

COTSWOLD SPEAKER SYSTEMS. Outstanding performance for price.
MFS: Size 36" x 16½" x 14" deep.
Kit **£25.12.0.** Assembled **£33.4.0**
STANDARD: Size 26" x 23" x 14½" deep.
Kit **£25.12.0.** Ready-to-Use **£33.4.0**

- Deferred terms available in UK over £10.
- Extended terms over £75 (UK only).
- Full specification sheet of any model available upon request
- Prices quoted are Mail Order, retail prices in general slightly higher.

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36 pages, many models in colour . . . Hi-Fi Audio, Radio . . . Amateur gear, Britains largest selection of top quality, electronic kits.

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New! Portable Stereo Record Player, SRP-1

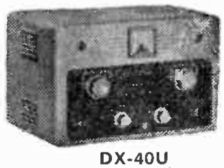
Automatic playing of 16, 33, 45 and 78 rpm records. All transistor—cool instant operation. Dual LP/78 stylus. Plays mono or stereo records. Suitcase portability. Detachable speaker enclosure for best stereo effect. Two 8in. x 5in. special loudspeakers. For 220-250v ac mains operation. Overall cabinet size 15 9/16 x 3⅞ x 10¼in.

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** incl. P.T. Ready-to-Use price on request.

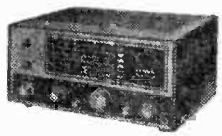
"AMATEUR" EQUIPMENT

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.** Ready-to-Use **£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.** Ready-to-Use **£52.10.0**

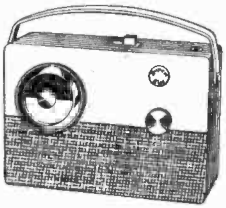


RA-1

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

To **DAYSTROM LTD. Gloucester.** Tel. Glos. 20217.
Please send me FREE CATALOGUE YES/NO
Further details of model(s) ....
....
NAME ....
ADDRESS ....
.... DEPT. P.W.3

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 3½ x 5in. high.

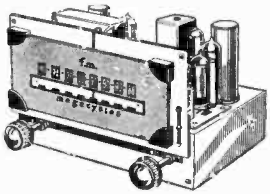


6 TRANSISTOR "SUPER SIX". M.W. and L.W. kit, £4 (5/- P. & P.). Wooden cabinet 11 x 7½ x 3¼in. All parts may be purchased separately.
3⅜in. 10,000 line speaker, or 7 x 4in. 6000 line.

12-WAY CABLE, each way 7/0048in. and P.V.C. covered. 5/16in. overall, P.V.C. covered. 2/6 yard, plus 1/6 post any quantity.
100 yard REEL, £11 post paid.

9 CORE 14/0048 1/6 yd.; 14/0048 twin 4d. yd.
6 CORE + 1 screened 14/0048 2/- yd
18 CORE 14/0048 2/- yd
Please add postage

SPECIAL OFFER SPEAKERS. Ellipt. Goodman 8 x 5in. 3-ohm post paid 30/- (57/6 pair). Baker's 12in. circular heavy cast frame 20W. 3 or 15-ohm £5 post paid or £9.10 pair. Goodman 3½in. square 15-ohm 12/- post paid or 20/- pair.



VHF/FM TUNER. 88–102MHz. Self-powered. Valves ECC85, EF89, 6BW7, ECC82, two diodes and metal rect. 8 x 6 x 5¼in. 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.).

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.).

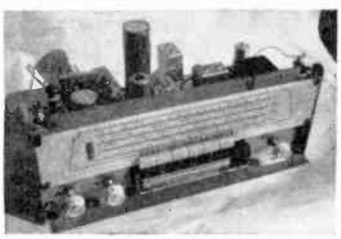
TAPE AMPLIFIER FOR MAGNAVOX TAPE DECKS — 2 or 4 TRACK

Chassis 12½ x 5½ x 4¼in. high. Plastic front panel "gold" finish—12½ x 4¼in. 200-250 A.C. Record/Playback amp. switch; Off/On-Tone; Vol./Mc.; 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.

STEREO AMPLIFIER 2 x 3 watt

200-250v. A.C. Mains. EZ80 and 2 x ECL86. Vol., Tone, Balance controls. With o.p. Trans for 3 ohms. 9 x 3½in. (plus trans. 2in. extra) x 3½in. high. £6.17.6 (P. & P. 7/6 extra).
Three tone grey record player cabinet (by well known manufacturer) taking above amplifier, complete with two 6½in. speakers (one speaker in removable lid). Size 17½ x 15½ x 7½in. high. Takes Garrard 1000, 2000, 3000 autochangers. £4.17.6 (plus 7/6 carr.).
Complete Stereo Record Player using above equipment 18gns. carriage paid.

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.

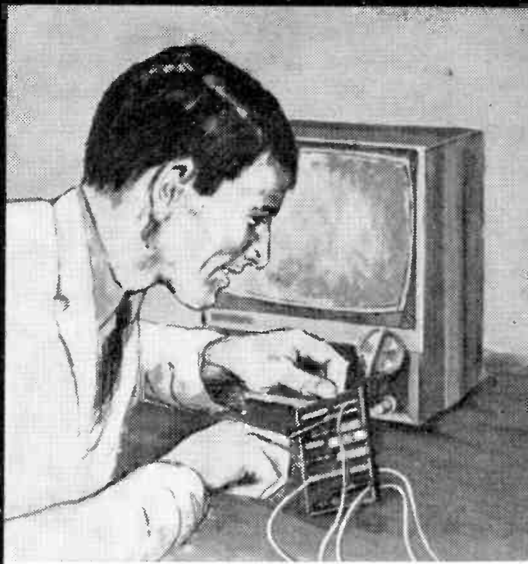
COPPER CLAD BOARD 7¾ x 14½ x ⅛in. 5/- plus 1/6 p.p. on 1; 4/6 on 2 or more.

Mains trans. 230-250V in; Sec. 250V. 40mA, 6·3V. 1A drop thru. resin impreg. 14/- post pd. (6 for £3) Gardners 250V.in: 5V. or 4V. 1A, 4V. 6A 15/- post pd. Choke (Gardners) 120H 10mA. 5KV WKG. 20/- post pd.

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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The next full time 16 month College Diploma Course which gives a thorough fundamental training for radio and television engineers, starts on 24th April 1968.

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Please send, without obligation, details of the Full-time Course in Radio and Television.

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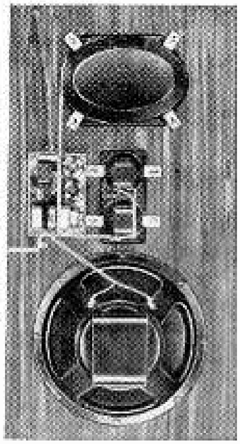
Peerless

HI-FI BAFFLE SPEAKER SYSTEMS FOR MONO OR STEREO

The new Peerless systems are engineered to the high quality standards that have made Peerless pre-eminent in high-fidelity design over the past years. Our experience, together with the most careful selection of materials and strictest manufacturing controls, assure performance of highest quality.

All the speaker systems are mounted and wired on a front board covered with plastic fabric grille and ready for cabinet mounting.

Available in 4Ω, 8Ω or 16Ω impedance.



4-30 PABS

4-30 PABS (also available as KIT, see below).
Is a 3-way speaker system consisting of 4 speakers and crossover network.
Max. Power Input: 30 Watts.
Frequency Range: 30-18000 c.p.s. in 50 litres (1.75 cu. ft.) cabinet.
Speakers: Woofer D 120 W special. Mid Range O 570 MRC.
Tweeters 2 × MT 25 HFC.
Crossover Frequencies: 500 and 3500 c.p.s.
Dimensions (inside) for 50 litres cabinet: Approximately $24\frac{13}{16} \times 13\frac{3}{8} \times 9\frac{1}{4}$in. (630 × 340 × 234 mm).
Brown coloured plastic fabric grille.

2-8 PABS (also available as KIT, see below).
is a 2-way speaker system consisting of 2 speakers and crossover network.
Max. Power Input: 8 Watts.
Frequency Range: 50-18000 c.p.s. in 16 litres (0.57 cu. ft.) cabinet.
Speakers: Woofer B 65 W. Tweeter MT 25 HFC.
Crossover Frequency: 4000 c.p.s.
Dimensions (inside) for 16 litres cabinet: Approximately $15\frac{9}{16} \times 9\frac{5}{8} \times 6\frac{1}{2}$in. (395 × 245 × 165 mm).
Specify grey or golden coloured plastic fabric grille.

2-10 PABS (not available as KIT).
is a 2-way speaker system consisting of 2 speakers and crossover network.
Max. Power Input: 10 Watts.
Frequency Range: 50-18000 c.p.s. in 6.5 litres (0.23 cu. ft.) cabinet.
Speakers: Woofer O 525 WL. Tweeter MT 20 HFC.
Crossover Frequency: 3500 c.p.s.
Dimensions (inside) for $6\frac{1}{2}$ litres cabinet: Approximately $9\frac{15}{16} \times 6\frac{1}{4} \times 6\frac{9}{16}$in. (252 × 158 × 167 mm).
Dark coloured plastic fabric grille.

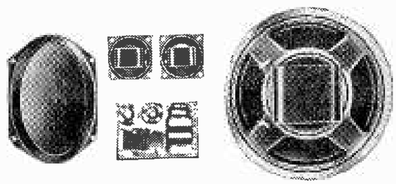
3-15 PABS (also available as KIT, see below).
Is a 3-way speaker system consisting of 3 speakers and crossover network.
Max. Power Input: 15 Watts.
Frequency Range: 45-18000 c.p.s. in 30 litres (1.06 cu. ft.) cabinet.
Speakers: Woofer P 825 W. Mid Range GT 50 MRC. Tweeter MT 20 HFC.
Crossover Frequencies: 750 and 4000 c.p.s.
Dimensions (inside) for 30 litres cabinet: Approximately $20\frac{3}{8} \times 8\frac{5}{8} \times 10\frac{1}{2}$in. (515 × 218 × 270 mm).
Specify grey or golden coloured plastic fabric grille.

3-25 PABS (also available as KIT, see below).
Is a 3-way speaker system consisting of 3 speakers and crossover network.
Max. Power Input: 25 Watts.
Frequency Range: 40-18000 c.p.s. in 100 litres (3.5 cu. ft.) cabinet.
Speakers: Woofer CM 120 W. Mid Range G 50 MRC. Tweeter MT 20 HFC.
Crossover Frequencies: 750 and 4000 c.p.s.
Dimensions (inside) for 100 litres cabinet: Approximately $25 \times 15 \times 16\frac{1}{4}$in. (635 × 380 × 412 mm).
Specify grey or golden coloured plastic fabric grille.

Peerless

LOUDSPEAKER SYSTEMS IN KITS FOR MONO AND STEREO

If you want to spend a little extra time to establish your high-fidelity sound system and at the same time save money, you can get four of our PABS systems in KITS. A KIT system consists of speakers, crossover network, drawing of cabinet as well as mounting instruction, but without baffle.
Available in 4Ω, 8Ω or 16Ω impedance.

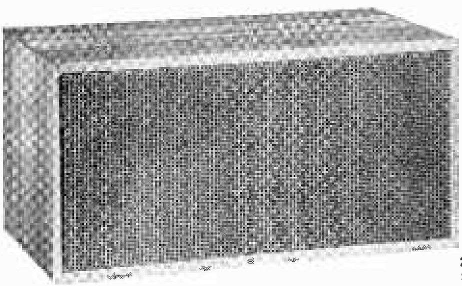


4-30 KIT

Peerless

HI-FI CABINET SPEAKERS FOR MONO AND STEREO

A trio of 2-way and 3-way compact speaker systems in oiled teak cabinets of bookshelf type. Danish design and technique at its very best.
Available in 4Ω, 8Ω or 16Ω impedance.



2-10A MEDIUM SIZE SYSTEM

2-10 COMPACT SYSTEM

is a 2-way speaker system in cabinet with dark coloured plastic fabric grille Combines one special woofer ($5\frac{1}{4}$in.), one closed-back tweeter (2in.) and a crossover network. Crossover Frequency: 3500 c.p.s. Frequency Range: 50-18000 c.p.s. Power Capacity: 10 Watts. Cabinet Size: $10\frac{1}{4} \times 6\frac{3}{16} \times 8\frac{3}{8}$in. (260 × 156 × 213 mm).

2-10A MEDIUM SIZE SYSTEM

is a 2-way speaker system in cabinet with brown coloured plastic fabric grille. Combines one special woofer ($6\frac{1}{2} \times 10\frac{1}{4}$in. elliptical), one closed-back tweeter ($2\frac{1}{8}$in.) and a crossover network. Crossover Frequency: 3500 c.p.s. Frequency Range: 40-18000 c.p.s. Power Capacity: 10 Watts. Cabinet Size: $19\frac{3}{4} \times 9\frac{7}{8} \times 10\frac{5}{8}$in. (500 × 250 × 270 mm).

4-30 MONITOR SYSTEM

is a 3-way speaker system in cabinet with brown coloured plastic fabric grille. Combines one special woofer (12in.). one special mid range (5 × 7in. elliptical), two closed-back tweeters ($2\frac{1}{2}$in.) and a crossover network. Crossover Frequencies: 500 and 3500 c.p.s. Frequency Range: 30-18000 c.p.s. Power Capacity: 30 Watts. Cabinet Size: $25\frac{9}{16} \times 14\frac{3}{16} \times 11\frac{7}{8}$in. (650 × 360 × 300 mm).

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PEERLESS FABRIKKERNE A/S

COPENHAGEN . DENMARK

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C. E. Hammond & Co. Limited — 90 High Street.
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Please send me details of Peerless
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March/PW/1968

Lasky's Radio

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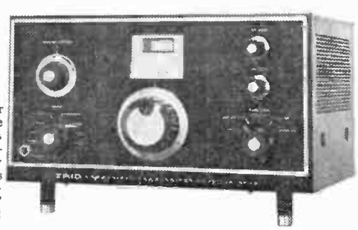
Just send your name, address and a 6d. stamp for postage.

A MUST FOR EVERY ELECTRONICS HOBBYIST AND HI-FI ENTHUSIAST!

COMMUNICATION RECEIVERS

NOW AVAILABLE FOR THE FIRST TIME IN GREAT BRITAIN—TWO NEW

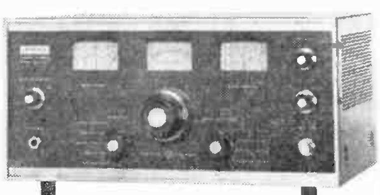
TRIO RECEIVERS



MODEL JR-500SE

This high performance receiver is made especially to cover the amateur bands and utilises a crystal controlled double heterodyne circuit for extra sensitivity and stability. Brief spec.: Covers all the amateur bands in 7 separate ranges between 3·5 and 29·7 Mc/s. Circuit uses 7 valves, 2 transistors and 5 diodes plus 8 crystals; output 8 and 500 ohm and 500 ohm phone jack. Special features: Crystal controlled oscillator ● Variable BFO ● VFO ● AVC ● ANL ● S meter ● SSB-CW ● Stand-by switch ● Special double gear dial drive with direct reading down to 1 kHz ● Remote control socket for connection to a transmitter. Audio output 1 watt. For use on 115/250 V A.C. Mains. Superb modern styling and control layout—finished in dark grey. Cabinet size 7 × 13 × 10 in. Weight 18 lbs. Fully guaranteed, complete with instruction manual and service data.

LASKY'S PRICE £61.19.0 Carriage and Packing 12/6



MODEL 9R-59DE

Brief spec.: 4 band receiver covering 550 Kc/s to 30 Mc/s continuous and electrical band spread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. Special features: SSB-CW ● ANL ● Variable BFO ● S meter ● Sep. band spread dial ● IF frequency 455 Kc/s ● Audio output 1·5 W ● Variable RF and AF gain controls. For use on 115/250 V A.C. Mains. Beautifully designed control layout finished in light grey with dark grey case, size: 7 × 15 × 10in. Weight 19 lbs. Fully guaranteed, complete with instruction manual and service data.

LASKY'S PRICE £36.15.0 Carriage and Packing 12/6.

JOYSTICK VARIABLE FREQUENCY ANTENNA

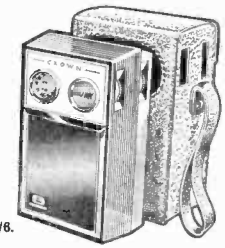
Revolutionary variable frequency antenna for transmission and reception. With a variable matching unit these antennae perform as a high 'Q' device at any selected Medium or Short waveband. Send for S.A.E. for descriptive leaflet.

AERIALS (7' 6" Long)		Matching units	
VFA Standard	£4 15 0	A.T.V. 3A	£3 12 6
VFA De Luxe	£5 19 6	A.T.V. 4	£4 4 0
		A.T.V. 4/RF	£6 6 0

HUGE PURCHASE OFFER

CROWN MODEL TRF-6

SUPER COMPACT AM/FM 9 TRANSISTOR POCKET RADIO



Unbelievably small for an AM/FM receiver—the Crown is only 4½in. x 2⅜in. x 1⅜in. Super sensitive 9 transistor superhet circuit with directionless stabilised reception. AM cover; MW 335–1605 Kc/s. FM cover; 88–108 Mc/s. Superb tone reproduction 2¼in. PM speaker. Precision tuning. 6 section (14¾ in.) telescopic aerial—clips into side when not in use. Output 280 mW max. Beautifully styled and finished cabinet in black plastic with silver metal trim. Operates on one 9V battery. Complete with leather purse, ear-piece and battery. List Price 13½ Gns.

SCOOP Price £7.19.6 Post 2/6.

IDEAL FOR USE WITH THE "TOMMY" WIRELESS MICROPHONE — SEE BELOW

THE LATEST

MARVELS IN TRANSISTOR MINIATURISATION

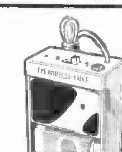
The TOMMY MODEL WO-11 WIRELESS MICROPHONE

This brand new wireless mic. combines sensitivity with miraculous miniature size. only 0·72 x 0·62 x 2·24in. Easily concealed with many uses—ideal for parties, games, or as a baby alarm, etc. Ideal for use with the Crown AM/FM radio and model A1004 FM Tuner. Brief Spec.: Short Range transmitting; frequency 9–107 Mc/s FM. External Antenna. Battery; Mercury 1·3V (Mallory 675 R). Weight 0·65oz. Complete with battery and trimmer for tuning and instruction booklet.

Lasky's Price £5.19.6 Post Free

SPECIAL PACKAGE PRICE if bought with the Crown TRF 6 AM/FM RADIO. See above £12.19.6 Post Free

TCC B4002 EXPORT FM WIRELESS MICROPHONE



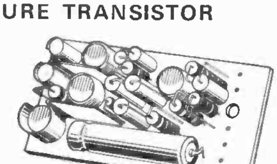
Highly sensitive—for static or mobile use, Signal can be picked up by any FM radio or tuner which receives frequencies between 96–104 Mc/s over several hundred yards. Size only 3in. x 2½in. x 1in. (in leather case). Operates on one PP3 type battery. Complete with clip-on dynamic ext. mike (¾in. x ⅝in. x 5/16in.!) and battery. List Price 16 Gns.

Lasky's Price £6.19.6 Post free anywhere in the world.

These cannot be operated in the U.K. owing to G.P.O. regulations.

SPECIAL INTEREST ITEMS!

NEW—LASKY'S MINIATURE TRANSISTOR AMPLIFIER MODULES



Incorporating the very latest circuitry to provide high sensitivity and good quality in conjunction with extreme small size and compactness. High quality Newmarket transistors used throughout. All designed to operate on 9v. miniature battery.
Add 1/- on each for Post and Packing.

TYPE LRPC 1. 3 transistor. Input sens. 50mV. Output 150mW. Output imp. 40 Ω. Size 2 × 1 × ¾in. ...... PRICE 27/6

TYPE LRPC 4. 5 transistor. Input sens. 150mV output 330mW output imp. 15 Ω. Size 2½ × 1½ × ¾in. ...... PRICE 18/–

TYPE LRPC 5. 6 transistor. Input sens. 8mV output 3W output imp. 3 Ω. Size 5½ × 1¾ × 1in. ...... PRICE 59/6

LRPC 9. High to Low input matching pre-amplifier. Input imp. 1 meg ohm output imp. 2 k/ohms. Size 1½ × 1¼ × ¾in. ...... PRICE 10/6

LRPC 10. Magnetic tape replay preamp. designed so that a 450 mH head can be matched into any of the audio amp. modules listed above. Sizes 2½ × 1½ × ¾in. .... PRICE 10/6

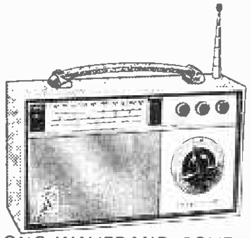
Note the LRPC 9 and 10 are ideal for use with the LRPC 1, 4 or 5 and are available at the reduced price of 7/6 if bought with the LRPC 4.

LASKY'S FOR SPEEDY MAIL ORDER SERVICE

Lasky's Radio

CONSTRUCTORS BARGAINS

THE SKYROVER De Luxe



7 transistor plus 2 diode superhet, 6 waveband portable receiver covering the full Medium Waveband and Short Waveband 31–94M and also 4 separate switched bandspread ranges, 13M., 16M., 19M. and 25M., with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. Superhet, 470 Kc/s. All Mullard Transistors and Diodes. Uses 4 U2 batteries. 5in. Ceramic Magnet P.M. Speaker. 500 mW Output. Telescopic and Ferrite Rod Aerial. Tone Control. Volume Control. Tuning Control and Waveband Selector. In wood cabinet, size 11½ × 6¼ × 3in. covered with washable material, plastic trim and carrying handle. Car aerial socket fitted.

Can now be built for **£8.19.6** Post 5/- extra

H.P. Terms: 60/- deposit and 11 monthly payments of 12/9. Total H.P.P. £10.0.3.

Four U2 batteries 3/4 extra.

Data 2/6 extra: refunded if you purchase the parcel. All components available separately.

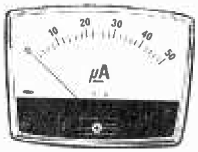
LONG WAVEBAND COVER FOR THE SKYROVER

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

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

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

LASKY'S CLEAR PLASTIC PANEL METERS



Precision made in Japan by HIOKI. Each meter boxed and fully guaranteed with all fixing nuts and washers. Sizes are of front panel. Add 1/6 Post on each.

Type KR-52 3 × 2¾in. (illustrated)

1mA DC	32/6	100μA	47/6
5mA DC	32/6	500μA	37/6
300 V DC	32/6	1mA S Meter	39/6
50μA	56/-		

Type MK-38A 1⅝in. square

1 mA DC	22/6
5 mA DC	22/6
300V DC	22/6
50μA	36/-
100μA	29/6
500μA	27/6
1 mA S Meter	29/6

Type MK-45A 2in. square

1 mA DC	25/-
5 mA DC	25/-
300V DC	25/-
500μA	25/-
1 mA S Meter	35/-

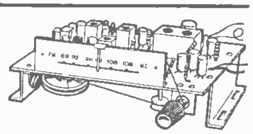
Type KR-65 3¾ × 3in.

1 mA DC	36/-
5 mA DC	35/-
300 V DC	35/-
50μA	59/6
100μA	49/6
500μA	42/6
1 mA S Meter	39/6

Type MK-65A 3in. square

1 mA DC	36/-
5 mA DC	35/-
300 V DC	35/-
500μA	39/6
1 mA S Meter	37/6

TRANSISTOR FM TUNER CHASSIS



Fully tunable—range 88 to 108 Mc/s. Completely wired on printed circuit. 10·3 Mc/s. IF. 6 transistors and 3 diodes. Slow motion tuning drive. Size 6¾ × 4 × 2¼in. Operates from any 9v. D.C. source. Full data and circuit supplied.

LASKY'S PRICE **£6.10.0** Post 5/- extra.

MULTIPLEX ADAPTOR MODEL

Now you can enjoy stereo sound with the model FM Tuner above. Brief spec.: MPX input sensitivity 100mV. Output 150mV. Self powered by a 9v. battery. 4 transistor and 6 diode circuit. Size 5¼ × 2 × ⅞in. Also suitable for use with other FM tuners with MPX input.

LASKY'S PRICE **99/6** Post 5/-

PACKAGE PRICE IF BOUGHT TOGETHER **£11** Post 5/-

SPECIAL PURCHASE—VALVE UHF TV TUNERS

Well-known British makers surplus stocks. Now available for the first time to the Home Constructors. **Add 2/6 Post and Packing on each.** In metal case size 4 × 6 × 1½in. Fully tunable—complete with PC86 and PC88 valves.

LASKY'S PRICE **29/6** Without valves **7/6**

TRANSISTORS — ALL BRAND NEW AND GUARANTEED

GET 81, GET 85, GET 86 2/6; 873A, 874P 3/6; OC45, OC71, OC81D 4/6; OC44, OC70, OC76, OC81 5/6; (match pair 10/6); AF117, OC200 6/6; OC42, OC43, OC73, OC82D 7/6, OC201, OC204 15/-; OC205, PC206 19/6; OC28 24/6; OC75 8/-.

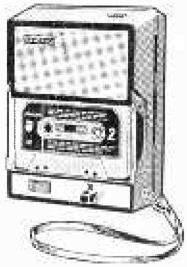
TRANSFILTERS by BRUSH CRYSTAL CO. Available from stock.

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

9/6 each Post 6d.

SPECIAL INTEREST ITEMS!

JUST ARRIVED — FANTAVOX TAPE CASSETTE PLAYER

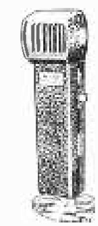


This machine is the first of its type and is designed specifically to replay pre-recorded tape cassettes made for the PHILIPS and other cassette systems. The cassette is simply slipped into the machine and is immediately ready to play. Each cassette gives over 40 minutes play (twin track), no loss of time if rewinding—simply turn cassette over. Constant tape speed 1⅞ i.p.s. Only two controls off/play and vol. Fully transistorised, powerful vol., built in speaker, socket for personal earpiece. Operates on 6 penlight batteries. Very attractively styled shockproof plastic cabinet size 6¼ × 4¼ × 2in. with wrist strap. Complete with earpiece and batteries. There are now over 200 musicassette titles available: jazz, pop, shows and classics. This machine allows you to play the music of your choice anywhere—anytime.

LASKY'S PRICE **£9.19.6** Post 5/-

NEW VOICE ACTUATED MICROPHONE

MODEL B 5001



This new voice actuated microphone is designed for use with tape recorders with facilities for remote control. The microphone is fitted with a three position switch allowing normal hand remote control, voice sensitivity action and off. The degree of voice or sound level required to operate the recorder can be adjusted. The microphone is self powered by one 9V (PP3 type) battery giving 6 to 10 hrs. operating time. Super sensitive 6 transistor circuit. Strong black plastic case. Length 7¼in. Designed for hand held use or lying flat. Fitted with 2·5 and 3·5 mm. plugs for fitting polarised sockets.

LASKY'S PRICE **£6.19.6** Post 3/6

TWO BAND TRANSISTOR CAR RADIO BARGAIN!

THE ROYAL CR-62

A new high quality imported all transistor superhet car radio that really breaks the quality/price barrier. A unique feature of this set are the four M/W band station preselection button which you yourself set to your own four favourite stations—this is in addition to full M/W band cover over 535–1605 Kc/s and full L/W band cover over 150–300 Kc/s (IF frequency 455 Kc/s.). Externally adjustable aerial trimmers ensure maximum output. Six transistor (including one drift type) and one diode circuit provides powerful 2W output. The set is adjustable for use on either positive or negative ground 12V systems (external line fuse fitted). Standard mounting size 6¾ × 5¼ × 2in.—front panel ⅛in. larger all round—finished in anodised aluminium with black push buttons. Complete with mounting brackets, full installation instructions and 2 baffle boards (for round or elliptical speaker). Fully guaranteed.

LASKY'S PRICE **£9.19.6** Post 5/–

6 × 4in. elliptical 8Ω dynamic speaker 17/6 extra—Post FREE.

SPECIAL OFFER—LOCKING CAR AERIAL Model 83003 five section 402 extension heavy chrome telescopic wing mounting type with unique locking device to protect the antenna when closed. Complete with mounting bracket, lead and plug and two "keys". **LASKY'S SPECIAL PRICE 39/6** Post Free with the Royal CR-62. Post Sep. 2/6.

MUSICASSETTES

There are now over 200 Musicassette titles available—jazz—pop—shows—classics—on Philips, Mercury, Fontana, C.B.S., Pye, Reprise, Chess, W.B., Kama Sutra, Page 1. *Send S.A.E. for full list.*

NEW INTERNATIONAL TAPE

FAMOUS AMERICAN MADE BRAND TAPE AT RECORD LOW PRICES

Size	Tape	s.	d.
3in.	Message tape, 150ft.	2	6
3in.	Message tape, 225ft.	3	9
3in.	Message tape, 300ft.	7	6
3¼in.	Triple play, 600ft. Mylar	10	0
4in.	Triple play, 900ft. Mylar	17	6
5in.	Double play, 1200ft. Mylar	15	0
5in.	Long play, 900ft. Acetate	10	0
5in.	Standard play, 600ft. PVC	8	6
5in.	Triple play, 1800ft. Mylar	35	0
5¾in.	Double play, 1800ft. Mylar	22	6
5¾in.	Long play, 1200ft. Acetate	12	6
5¾in.	Standard play, 850ft. PVC	11	6
5¾in.	Long play, 1200ft. Mylar	15	0
5¾in.	Triple play, 2400ft. Mylar	45	0
7in.	Standard play, 1200ft. Acetate	12	6
7in.	Standard play, 1200ft. Mylar	12	6
7in.	Long play, 1800ft. Mylar	19	6
7in.	Double play, 2400ft. Mylar	26	0
7in.	Long play, 1800ft. Acetate	15	0
7in.	Triple play, 3600ft. Mylar	50	0

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

Branches

207 EDGWARE ROAD, LONDON, W.2 Tel.: 01-723 3271
Open all day Saturday, early closing 1 p.m. Thursday

33 TOTTENHAM CT. RD., LONDON, W.1 Tel.: 01-636 2605
Open all day, 9 a.m.—6 p.m. Monday to Saturday

152/3 FLEET STREET, LONDON, E.C.4 Tel.: FLEet St. 2833
Open all day Thursday, early closing 1 p.m. Saturday

High Fidelity Audio Centres

42 TOTTENHAM CT. RD., LONDON, W.1 Tel.: 01-580 2573
Open all day Thursday, early closing 1 p.m. Saturday

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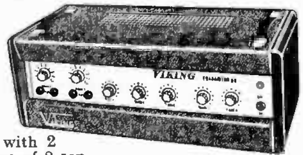
ALL MAIL ORDERS AND CORRESPONDENCE TO: 3-15 CAVELL ST., TOWER HAMLETS, LONDON, E.1 Tel.: 01-790 4821

VIKING AMPLIFIER

50 WATT AMPLIFIER



An extremely reliable general purpose valve amplifier. Its rugged construction yet space age styling and design makes it by far the best value for money.

TECHNICAL SPECIFICATIONS
4 electronically mixed channels, with 2 inputs per channel, enables the use of 8 separate instruments at the same time. The volume controls for each channel are located directly above the corresponding input sockets.

SENSITIVITIES AND INPUT IMPEDANCES

Channel 1	4mV at 470K	These 2 channels (4 inputs) are suitable for microphone or guitars.
Channel 2	4mV at 470K	
Channel 3	200mV at 1m	Suitable for most high output instruments (gram, tuner, organ etc.).
Channel 4	200mV at 1m	

Input sensitivity relative to 10w output.

TONE CONTROLS ARE COMMON TO ALL INPUTS
Bass Boost +12dB at 60 Hz/s. **Bass Cut** −13dB at 60 Hz/s.
Treble Boost +11dB at 15 KHz/s. **Treble Cut** −12dB at 15 KHz/s.
With bass and treble controls central −3dB points are 30 Hz/s and 20 KHz/s.

POWER OUTPUT
For speech and music 50 watts rms. 100 watts peak.
For sustained music 45 watts rms. 90 watts peak.
For sine wave 38·5 watts rms. Nearly 80 watts peak.
Total distortion at rated output 3·2% } at 1KHz/s
Total distortion at 20 watts 0·15% }
Output to match into 8 or 15 ohms speaker system.

NEGATIVE FEED BACK 20dB at 1KHz/s.
SIGNAL TO NOISE RATIO 60dB.

MAINS VOLTAGES
Adjustable from 200–250v A.C. 50–60 Hz/s.
A protective fuse is located at the rear of unit.

VALVE LINE UP
Double purpose ECC83 x 3, EL34 x 2 and GZ34.

Price
27 gns
P & P 20/-

FOUR *PLUS* FOUR *Stereo Amplifier*

A superb high quality, yet inexpensive stereo amplifier. Due to the great demand we are now able to offer this precision made instrument at a fantastically low price. The high quality, reliability and styling has been maintained in spite of its low price.

SPECIFICATIONS
Elegant styled cabinet (sizes 16″ wide 5″ high 8½″ deep) in black rexine and woodgrained sides. Brushed aluminium front panel with contrasting black / silver knobs.

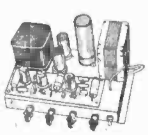
CONTROLS
Stereo/Mono switch. Gram/Aux switch. Volume left. Volume right. Treble (cut and lift). Bass (cut and lift). Separate on/off switch. Neon pilot indicator.

INPUTS AND OUTPUTS
(per channel)
Gram, aux, tape out and speaker out. A switched mains socket is also provided at the rear of unit. Employs Mullard valves throughout. ECC83 and 2 x ECL 86 with a metal bridge rectification.

TECHNICAL SPECIFICATIONS
Gram sensitivity 40mV at 1 KHz. Aux sensitivity 50mV at 1 KHz. (Sensitivities are given for rated output). 4 watts r.m.s. (8 watts r.m.s. in monoral position). Output matches into standard 3 ohms speaker system. Suitable 10″ x 6″ speakers are available at 29/6 each, plus 5/- p. & p. Bass control at 100 Hz lift + 9dB cut − 10dB. Treble control at 10 KHz lift + 8dB cut − 13dB. Total harmonic distortion 0·35% at 3 watts and 2% for rated output at 1 KHz. Negative feedback 13dB at 1 KHz. Mains supply 220–250V A.C. 50–60 Hz.

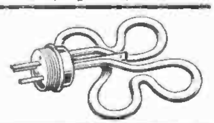
Price
13 gns
P & P 15/-

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.

GEC KETTLE ELEMENT



3,000W WITH AUTOMATIC EJECTION
200/240v. Size of hole required 1⅛″
List Price 32/-. Our PRICE
15/-. P. & P. 1/6.

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All enquiries Stamped Addressed Envelope

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STAR SR 150 COMMUNICATION RECEIVER

Frequency range: 535Kc/s–30Mc/s. 4 wavebands. 5 valve superhet. Incorporates BFO, bandspread tuning, "S" meter, external telescopic aerial and ferrite aerial. Built-in 4in. speaker. Easy-to-read dial. For 240V A.C. operation. Complete, brand new, with full instruction manual. **15** gns., P. & P. 10/-.

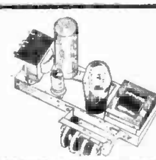
POCKET MULTI-METER

Size 3⅞ x 2½ x 1⅜in Meter size 2¼ x 1⅝in 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.

ANTI-THIEF CAR BURGLAR ALARM

The Melguard Safermatic consists of an electrical device housed in small metal box 4″ x 2″ x 1½″, which has been designed and developed to provide protection required by the average motorist at an economic cost. Using this system, an alarm and the immobilised condition is set automatically as soon as you park the car. Should you leave the key in the ignition, no one but you can drive the car away. Upon entering the vehicle the method of starting the car is by switching on the ignition, depressing two hidden switches, and simultaneously operating the starter. Location of the switches is known only to you. Should the alarm be set off it can be stopped by following the normal starting procedure. For 12V operation. List price 79/6, our price **29/6** plus 2/6 P. & P. Full easy-to-follow instructions supplied.

3 to 4 Watt AMPLIFIER



3–4 watt Amplifier built and tested. Chassis size 7 x 3½ 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.

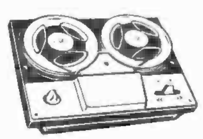
600 mW SOLID STATE
4-TRANSISTOR AMPLIFIER

Features NPN and PNP Complementary Symmetrical Output Stage. The elimination of transformers ensures maximum efficiency and frequency response. Automatic heat compensation. Combined AC/DC feed back. Class B output stage. i.e. output power is proportional to total current consumption, this ensures long battery life. Under no signal condition (1Q) current drain is approx. 12mA at 9 volts (4mA in the output pair). Printed circuit construction, size 2¼″ x ⅞″ x ⅞″. Speaker output impedance 12 ohms. Output power 600mW at 5% distortion, 400mW at 2·5% distortion, 750mW at 10% distortion. Supply 9 volts. Total current consumption at a reasonable listening level approx. 35–40mA at full power (speech and music), average 65mA. Sensitivity for 50mW output is 10mW. Frequency response —3dB points 90c/s and 12Kc/s. Price **15/-**, plus 1/- P. & P. 7″ x 4″ speaker to suit, **13/6** plus 2/- P. & P.

NEW TRANSISTORISED SIGNAL GENERATOR

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

BSR TAPE DECKS



200/250V A.C. mains

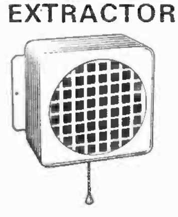
Type **TD2** Tape speed 3¾ twin track, **£6.19.6.**
Type TD10 2-track, 3 speed, plus rev. counter—**£7.19.6.**
Type TD10 4-track, 3 speed, plus rev. counter—**£9.5.0.** P. & P. on each 7/6.

FIRST QUALITY P.V.C. TAPE

5¾″	Std.	850ft.	9/-	5″	L.P.	850ft.	10/6
7″	Std.	1200ft.	11/6	3″	T.P.	600ft.	10/6
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
5¾″	D.P.	1800ft.	18/6	4″	T.P.	900ft.	15/-

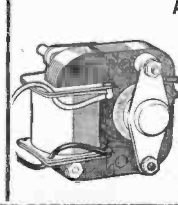
P. & P. on each 1/6, 4 or more post free.

EXTRACTOR FAN



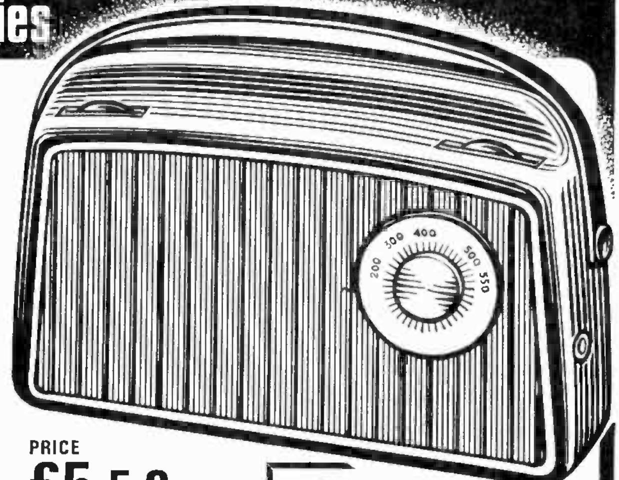
AC Mains 230/250 v. complete with pull switch. Size 6″ x 6″ x 4″. Price 27/6 plus 5/- P. & P.

AC MAINS MOTOR



1400 R.P.M.
230/250v
PRICE
9/6
P. & P. 3/-

NEW! The *Dorset* Transistor Portable Radio
with BABY ALARM facilities



600 milliwatt solid state 7 transistor plus diode and thermistor. Completely modulised high quality portable radio featuring complementary NPN and PNP output stage. The comprehensive easy-to-follow drawings supplied make this the easiest-ever transistor radio set of parts, with the following features:

- Simple connections to only 6 tags on the R.F./I.F. module, 3 I.F. stages, osc. coil and 3 transistors which with their associated components are completely wired.
- Only 4 connections on the A.F. module to complete the 4 transistor 600 milliwatt solid state amplifier.
- Pre-aligned R.F./I.F. module built and tested.
- A.F. module built and tested.
- Fully tunable over M.W. and L.W. bands. M.W. 540–1640 Kc/s (557–183 metres). L.W. 150–275 Kc/s (2000–1100 metres).
- Intermediate Frequency 470 Kc/s.
- Sensitivity: M.W. at 1 Mc/s 10 microvolts plus or minus 3dB. L.W. at 200 Kc/s 40 microvolt plus or minus 4dB.
- High Q internal ferrite rod aerial on both wavebands.
- Class 'B' modulised output stage with thermistor controlled heat stabilisation. Class 'B' output stage ensures long battery life. Current drain is proportional to the output level. Total current drain of the receiver under no signal conditions is 10–12 mA. At reasonable listening level 20–30 mA.
- Extension sockets for car aerial input, tape recorder output (Independent of volume control) and External Speaker.

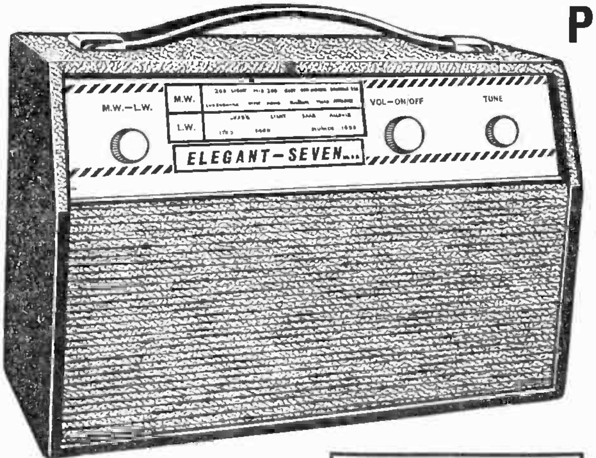
PRICE
£5.5.0
plus 7/6 postage & packing

CAN BE USED AS BABY ALARM

Circuit and parts list 2/6 free with parts.

- All components (except speaker) mount on the printed circuit board. Easy-to-follow instructions. Size of cabinet 12in. long, 8in. high and 3in. deep.
- Finger-tip controls.

Elegant Seven *Mk III* COMBINED PORTABLE *and* CAR RADIO



SPECIAL OFFER

Buy yourself an easy to build 7 transistor radio and save at least £10.0.0. Now you can build this superb transistor superhet radio for under £4.10.0. No one else can offer such a fantastic radio with so many de luxe star features.

★ De luxe wooden cabinet size 12¼" x 8½" x 3½".
★ Horizontal easy to read tuning scale printed grey with black letters, size 11½" x 2".
★ High 'Q' ferrite rod aerial.
★ I.F. neutralization on each separate stage.
★ D.C. coupled push pull output stage with separate A.C. negative feedback.
★ Room filling output 300mW.
★ Ready etched and drilled printed circuit board back printed for foolproof construction.
★ Fully comprehensive instructions and point-to-point wiring diagrams.
★ Car aerial socket.
★ Fully tunable over medium and long wave. 168–535 metres and 1250–2000 metres.
★ All components ferrite rod and tuning assembly mount on printed board.
★ 5" P.M. speaker.
★ Parts list and circuit diagram 2/6, free with parts.

POWER SUPPLY KIT
To purchasers of 'Elegant Seven' parts, incorporating mains transformer, rectifier and smoothing condenser. A.C. mains 200/250 volts. Output 9v 100mA. 9/6 extra.

ONLY £4.4.0
Plus 7/6 P. & P. Parts List and circuit diagram 2/6 FREE with parts.

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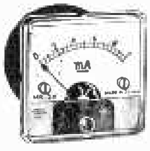
We are proud to introduce our first comprehensive catalogue of Electronic Components and equipment. Over 150 pages fully illustrated, listing thousands of items, many at bargain prices. Free discount coupons with every catalogue. Everyone in electronics should have a copy.

CLEAR PLASTIC METERS



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

50μA	37/6	100-0-100μA	32/6	200mA	25/-	100V D.C.	25/-
100μA	35/-	500-0-500μA	25/-	300mA	25/-	150V D.C.	25/-
200μA	32/6	1-0-1mA	25/-	500mA	25/-	300V D.C.	25/-
500μA	27/6	1mA	25/-	750mA	25/-	500V D.C.	25/-
50-0-50μA	35/-	2mA	25/-	1A D.C.	25/-	750V D.C.	25/-
		5mA	25/-	2A D.C.	25/-	15V A.C.	25/-
		10mA	25/-	5A D.C.	25/-	50V A.C.	25/-
		20mA	25/-	3V D.C.	25/-	150V A.C.	25/-
		50mA	25/-	10V D.C.	25/-	300V A.C.	25/-
		100mA	25/-	20V D.C.	25/-	500V A.C.	25/-
		150mA	25/-	50V D.C.	25/-	'S' Meter 1mA	29/6

POST EXTRA. Larger sizes available—send for lists.

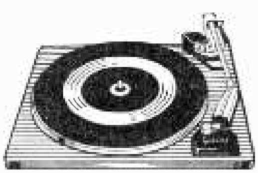
ADMIRALTY B.40 RECEIVERS

Just released by the Ministry. High quality 10 valve receiver manufactured by Murphy. Coverage in 5 bands 650 Kc/s-30 Mc/s. I/F. 500 Kc/s. Incorporates 2 R.F. and 3 I.F. stages, bandpass filter, noise limiter, crystal controlled B.F.O., calibrator I/F, output, etc. Built-in speaker, output for phones. Operation 150/230 volt A.C. Size 19½ x 13½ x 16in. Weight 114 lbs. Offered in good working condition, £22.10.0. Carr. 30/-. With circuit diagrams. Also available B.41 L.F. version of above. 15 Kc/s.-700 Kc/s. £17.10.0. Carr. 30/-.

UNR-30. 4 BAND COMMUNICATION RECEIVER

Covering 550 Kc/s – 30 Mc/s. Incorporates variable BFO for CW SSB reception. Built in speaker and phone jack. Metal cabinet. Operation 220/240v. A.C. Supplied brand new, guaranteed with instructions. Carr. 7/6. **£12.10.0**

GARRARD DECKS



SRP12	player mono or stereo	£4	4	0
1000	changer mono or stereo	£5	15	6
2000	changer mono or stereo	£6	19	6
A50	mono or stereo	£7	17	6
3000	changer mono or stereo	£7	19	6
3000	Sonotone stereo	£8	19	6
AT6	Mk II mono or stereo	£8	19	6
A70	Mk. II	£12	12	0
A70	Mk. II Sonotone stereo	£14	14	0
LAB80	Mk. II changer less cart.	£24	0	0
401	transcription deck	£27	0	0

All plus 5/- P. & P.

AMERICAN TAPE

First grade quality American tapes. Brand new. Discount or quantities.

3in., 225ft. L.P. acetate	4/-
3¼in. 600ft. T.P. mylar	10/-
5in. 600ft. std. plastic	8/6
5in. 900ft. L.P. acetate	10/-
5in. 1,200ft. D.P. mylar	15/-
5in. 1,800ft. T.P. mylar	35/-
5¾in. 1,200ft. L.P. acetate	12/6
5¾in. 1,800ft. D.P. mylar	22/6
5¾in. 2,400ft. T.P. mylar	45/-
7in. 1,200ft. std. acetate	12/6
7in. 1,800ft. L.P. acetate	15/-
7in. 1,800ft. L.P. mylar	20/-
7in. 2,400ft. D.P. mylar	25/-
7in. 3,600ft. T.P. mylar	58/6

Postage 2/-. Over £3 post paid.

NOMBREX TRANSISTORISED EQUIPMENT.

All Post Paid with Battery

Model 22 P.S.U. 0–15v. D.C. £14. Model 30 Audio Generator 10 c/s–100 Kc/s £19.10.0. Model 31 R.F. Generator 150 Kc/s.–350 Mc/s. £12.10.0. Model 27 Signal Generator 150 Kc/s.–350 Mc/s. £10.10.0. Model 62 C.R. Bridge £9. Model 66 Inductance Bridge £18. Model 61 P.S.U. 0·5–15v. D.C. £6.10.0.

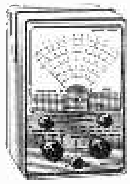
MODEL ZQM TRANSISTOR CHECKER

It has the fullest capacity for checking on A, B and Ico. Equally adaptable for checking diodes, etc. Spec A: 0·7–0·9967. B: 5–200. Ico: 0·50 microamps 0–5mA. Resistance for diode 200 Ω–1 Meg. Supplied complete with instructions, battery and leads. £5.19.6. P. & P. 2/6.

TE-20RF SIGNAL GENERATOR

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

TE-65 VALVE VOLTMETER

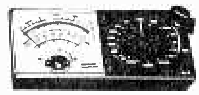


High quality instrument with 28 ranges. D.C. volts 1·5–1,500v. A.C. volts 1·5–1,500v. Resistance up to 1,000 megohms. 220/240v. A.C. operation. Complete with probe and instructions. £15. P. & P. 6/-. Additional Probes available: R.F. 35/-. H.V. 42/6.

MAGNAVOX 363 TAPE DECKS

3 speed. 1⅞-3¾-7½ ips. Carr. paid. 2-track £10/10/-; 4-track £13/10/-; 2-track Stereo £13/10/-.

PROFESSIONAL 20.000 o.p.v. LAB. TYPE MULTITESTER



With automatic overload protection, mirror scale. Ranges: 1/10/50/250/500/1,000 volts, D.C. and A.C. 0–500μA, 10mA, 250mA. Current: 0/20K, 200K, 2 megohm. Decibels: —20 to +22dB. £5.10.0. P. & P. 2/6.

ARF-100 COMBINED AF-RF SIGNAL GENERATOR

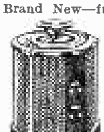
AF. SINE WAVE 20–200,000 c/s. Square wave 20–30,000 c/s. O/P. HIGH IMP. 21V. P/P 600 Ω 3·8V P/P. TF. 100 kc/s–300 Mc/s. Variable R.F. attenuation int/ext. modulation Incorporates dual purpose meter to monitor AF. output and % mod. on R.F. 220/240V a.c. £27.10.0. Carr. 7/6.

TF144G STANDARD SIGNAL GENERATORS

85 Kc/s–25 Mc/s. £25. Carr. 30/-.

VARIABLE VOLTAGE TRANSFORMERS

Brand New—fully Shrouded. Input 230v. 50/60c/s. Output 0·260 Volts.



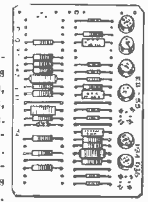
1 Amp	£4.10.0
2·5 Amp	£5.17.6
5 Amp.	£9.0.0
8 Amp.	£13.10.0
10 Amp.	£17.0.0
12 Amp.	£19.10.0
20 Amp.	£32.10.0

Post extra.

NEW MODEL 500

30,000 o.p.v. With overload protection, mirror scale. 0/·5/1/2·5/10/25/100/250/500/1,000v. D.C. 0/2·5/10/25/100/250/500/1,000v. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60K/6 Meg./60 Meg. Ω. £8.17.6. Post Paid.

PRINTED CIRCUITS



Five assorted printed circuit boards with transistors, diodes, resistors, condensers, etc. Guaranteed minimum 20 transistors. Ideal for experimenters. 5 boards for 10/-. P. & P. 2/-.

2-WAY RADIOS

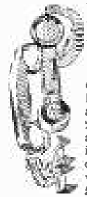
Super quality. Brand new and guaranteed.

3 transistor	£6.15.0 pr.
4 transistor	£6.19.6 pr.
5 transistor	£7.10.0 pr.
6 transistor	£8.12.6 pr.
6 transistor De Luxe	£12.10.0 pr.
10 transistor	£22.10.0 pr.
13 transistor 500 MW	£31.10.0 pr.
13 Trans. 1W	£35.0.0 pr.

Post extra.

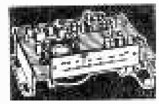
These cannot be operated in U.K.

TRANSISTORISED TWO-WAY TELEPHONE INTERCOM



Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets. £5.19.6. P. & P. 3/6.

★ TRANSISTORISED FM TUNER ★



6 TRANSISTOR HIGH QUALITY TUNER, SIZE ONLY 6 × 4 × 2½in 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9 volt battery. Coverage 88–108 Mc/s. Ready built ready for use. Fantastic value for money. £6.10.0. P. & P. 2/6

STEREO MULTIPLEX ADAPTORS 5 Gns.

SINCLAIR EQUIPMENT

Z12 12 watt amplifier, 89/6.
PZ4 Power Supply Unit 99/6
Stereo 25 Preamp., £9.19.6
Q14 Speakers, £6.19.6
Micromatic Radio Kit, 49/6. Built 59/6
Micro FM Radio Kit £5.19.6
ALL POST PAID

SPECIAL OFFER
2 Z12 Amps., PZ4 Power Supply, Stereo 25 Preamplifier, £22.

AVOMETERS

Supplied in excellent condition, fully tested and checked. Complete with prods, leads and instructions.
Model 47A £9.19.6
Model 7 £13.10.0
Model 8 £18.
Model 9 £20.
P. & P. 7/6 each.

LAYFAYETTE HI-FI STEREO HEADPHONES

★ Air cushioned headband. ★ Soft rubber ear pads. ★ Frequency response, 25 to 15,000 cycles. ★ High sensitivity. Impedance 8 ohms per phone. Supplied complete with all cables, wires, overload junction box and 3-connection plug. 79/6. P. & P. 2/6.

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3-34 LISLE STREET, LONDON, W.C.2

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. Exceptional performance at low cost.

HF510	5"	8W	49/9	HF120	12"	15W	69/9
HF800D	8"	8W	59/9	HF120D	12"	15W	79/9
HF811D	8"	10W	£4.19.9	HF126	12"	15W	89/9
HF101D	10"	15W	£5.19.9	HF126D	12"	15W	5 gns.

RECORD PLAYING UNITS

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

RP2 Consisting of Garrard SP25 Mk II (with heavy turntable) fitted Goldring CS90 high compliance ceramic Stereo/Mono cartridge with diamond stylus, plinth and cover. Normally approx. £26. Carr. 15/- **22 Gns.**

RP3 As above but with Goldring Lenco GL68 Transcription unit and CS90 Cartridge **27½ Gns.** Normally approx. 32 gns. Carr. 15/-. ONLY

HIGH FIDELITY LOUDSPEAKER UNITS

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

DORSET Size 16 x 11 x 9in. Response 45–18,000 c.p.s. Rating 8–10 watts. Fitted Audiotrine HF810D speaker. Impedance 3 or 15 ohms. **£8.19.9**

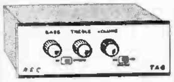
STANTON III Size 18 x 11 x 10in. Rating 10 watts. Incorporating Audiotrine HF 815 speaker with roll rubber surround and 15000 line magnet. High flux tweeter. Handsome Scandinavian design cabinet. Response 30–20,000 c.p.s. Impdnce 3 or 15 ohms. Gives smooth realistic sound output. **15 Gns.**

DORCHESTER Size 24 x 15 x 10in. Fitted Audiotrine HF101D speaker. Rating 15 watts. Impedance 3 or 15 ohms. Response 30–20,000 c.p.s. Provides really pleasing sound quality. **12½ Gns.**

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. **12½ Gns.**

LINEAR TAPE PRE-AMPLIFIER. Type LP/1 Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier suitable most Tape Decks. Terms available. **10½ Gns.**

R.S.C. TA6 6 Watt HIGH FIDELITY SOLID STATE AMPLIFIER



200-250v. AC mains operated Frequency Response 30–20,000 c.p.s. —2dB. Harmonic Distortion 0·3% at 1,000 c.p.s. 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, 9¼ x 2¾ x 5¼in. Attractive brushed silver finish facia plate 10¼ x 3¼in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. Carr. 7/6 **6 Gns.** Or factory built with 12 months guarantee. Post Paid 8 **Gns.**

SENSATIONAL VALUE IN HIGH FIDELITY STEREO SYSTEMS

SUPERB 30 WATT SYSTEM

Consisting of (1) Garrard Mk II SP25 4-speed Turntable with Pick-up. Heavy 12in. turntable, hydraulic lowering device and many other features inc. Plug in P.U. head. Fitted CS90 P.U. Cartridge Ready wired on plinth (baseboard). Fitted plugs for instant use. (2) Super 30 Amplifier fully wired and fitted in cabinet above. (3) Pair of Stanton III Loudspeaker Units. Performance comparable with equipment at twice the cost and saving approx. £16 on above units. Extremely attractive cabinets finished Satin Teak Veneer, tinted Perspex 'hinged' lid. Special inclusive Price **69 Gns.** Carr. 35/- Terms: Deposit **£18.10.0** and 12 monthly payments of **£5.** Total **£78.10.0.** Send S.A.E. for leaflet. Supplied less Stanton Loudspeakers at 49½ gns. or Deposit £7.17.6 and 9 monthly paymts £5.10.10 (total 55 gns.).

R·S·C·13 WATT HI-FI STEREO SYSTEM

Inc. Garrard SP25 MkII Player Unit (with heavy cast turntable) on plinth, ready wired, with plugs and fitted Goldring CS90 high compliance ceramic cartridge with diamond stylus. Assembled TA12 Stereo Amp. in cabinet and Pair of Dorset Speaker Units. Total for above saving **£11.** Terms available. Carr. 25/-. Special Price **46 Gns.** Perspex cover 59/9 extra with above.

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 finish Facia and Knobs. Complete kit of parts with full wiring diagrams and instructions. Factory built with 12 mth gntee **£14.19.9.** Or Deposit **£3.13.0** and 9 mthly pymts. 29/- (Total **£16.14.0**). **11 GNS.** Carr. 7/9

Teak finish cabinet as above 73/6 or as in stereo system 86/6.

AUDIOTRINE PLINTHS

for Record Playing units. Teak finish cut for Garrard 1000, 2000, 3000, AT6, AT60, SP25 or Goldring GL68. Available with clear Perspex cover as ill. Carr. 7/6 **66/-** **£5.19.11** Or deeper type cut for TA12, Super 15 or 30 **86/6** or with cover **£6.19.11.** Perspex cover sold separately at 3 gns. Limited number slightly damaged but repaired by Manufacturer. 39/9 to clear.

AUDIOTRINE HI-FI SPEAKER SYSTEMS

Consisting of matched 12in. 12,000 line 10 watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **5 Gns.** Carr. 5/9 Or **Senior 15 watt** inc. HF 126 15,000 line Speaker **6 Gns.** Carr. 6/6.

FR3 3-SPEAKER SYSTEM Inc. Audiotrine HF126 12in. Bass unit, with 15,000 line magnet. 5in. 10 watt, 11,000 line mid-range speaker HF510M. High flux 4in. Tweeter, Crossover units for mid and high frequencies and circuit. In suitable cabinet will provide quality comparable with very expensive units. Rating 15 watts. Impedance 15 ohms. Carr. 7/6. **9 Gns.**

HI-FI 'SPEAKER ENCLOSURES

Teak veneer finish. Modern design. Acoustically lined and ported.

JE8 Size 20 x 11 x 8in. Gives pleasing results with any 8in. Hi-Fi 'speaker. **4 Gns.**

SE8 For optimum performance with any 8in. Hi-Fi 'speaker. Size 22 x 15 x 9in. **5 Gns.**

SE10 For outstanding results with 10in Hi-Fi 'spkr. Size 24 x 15 x 10in. **6 Gns.**

SE12 For excellent performance with 12in Hi-Fi 'spkr and Tweeter. Size 25 x 16 x 10in. **7 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 **19 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 performance and reliability. The pre-wired tuning head facilitates speed and simplicity of construction. Printed circuitry. Only first grade transistors and components used. A quality product at half the cost of comparable units. Stereo version, all parts **19½ gns.** Assembled **25½ gns.** Carr. 10/-.

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

SOLID STATE CONSTRUCTION

SPECIFICATIONS COMPARABLE WITH UNITS AT ALMOST TWICE THE COST

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, OC44, OC81Z, OC44, AC107. **5 POSITION INPUT SELECTOR SWITCH EQUALISATION** to Standard R.I.A.A. and C.C.I.R. Characteristics for Gram and Tape Heads. **FULL TAPE MONITORING FACILITIES. SENSITIVITIES:** Magnetic P.U. 4 mV. Crystal or Ceramic P.U. 400 mV. Microphone 4.5 mV. Tape Head 2·5 mV. Radio/Aux or Ceramic P.U. 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 **4 Gns.** and 9 monthly payments **31/1** (Total **£18.3.9**). 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.

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 Fascia 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 **£6.2.0** and 9 monthly payments **50/-.** (Total **£30.17.0**). Fitted cabinet as Super 15 **30 Gns.** Carr. 15/- or Deposit **£6.2.6** and 9 monthly paymts **64/-** (Total **£34.18.6**). *Send S.A.E. for leaflet*

R·S·C HI-FI CENTRES LTD.

BRADFORD 10 North Parade. (Half-day Wed.) Tel. 25349
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MAIL ORDERS TO: 102 Henconner Lane, Bramley, Leeds 13. No C.O.D. under £1. Terms C.W.O. or C.O.D. Postage 4/6 extra under £2. 5/9 extra under £5. Trade supplied. S.A.E. with enquiries please. Hi-Fi Catalogue 4/6.

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MIDDLESBROUGH 106 Newport Rd (Half-day Wed) Tel. 47096
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SHEFFIELD 13 Exchange Street (Castle Market Bldgs.) (Half-day Thursday) Tel. 20716

PRACTICAL WIRELESS

VOL 43 No 11
issue 733

MARCH 1968

TOPIC OF THE MONTH

QRS!

THE quickness of the hand deceives the eye, sometimes—and if that hand grasps a morse key it sometimes appears to deceive the ear, too. That is, if we correctly understand the latest piece of petty niggling by the GPO.

The Radio Services Department of that august body has lately been mailing letters of complaint to licensed amateurs who are sending their callsigns faster than the specified 12 w.p.m. (it used to be 20 w.p.m.). Why it should suddenly become necessary to throw the book at operators is beyond understanding, unless the GPO monitors have so declined that they can only copy dead slow morse. It comes to something when the professionals ask the amateurs to slow down!

We would suggest that the GPO tries listening on the bands during one of the major DX contests, where a complete "QSO" flashes by in about ten seconds flat. A contestant dawdling at 12 w.p.m. would consider himself fortunate if he made any contacts at all!

But if the GPO really want to transform the amateur licence into a kind of Radio Highway Code, why stop at tut-tutting about c.w. operators exceeding the speed limit? How about some new rules such as—"Do not overtake a DX signal when he is in QSO", "Do not park your carrier on a crowded band", "Keep to the right lane" (for the v.f.o.-swishers), and some new (key) hand signals: QQQU ("I expect to drift upband—please follow my chirp"), QQQH ("Halt! When I asked what the weather was like, I didn't want a Met. report"), QQQD ("Danger! I'm operating mobile on a camel with no rear lights") QQQB ("Help!—my Super-Duper All-Band DX Ranger has gone berserk. Send breakdown van").

Of course to be really effective, we should have an itinerant band of inspectors armed with breathalysers—"This man was found drunk in charge of his log-book"—and traffic wardens to stop the parking of S9 signals on restricted frequencies.

Perhaps, however, it would be better for the GPO to run a course of Morse tuition. Or to transfer their attack on the a.m. and s.s.b. boys—many of whom we suspect of speaking faster than 12 words per minute!

W. N. STEVENS—*Editor.*

NEWS AND COMMENT

CONSTRUCTIONAL

OTHER FEATURES

APRIL ISSUE WILL BE PUBLISHED ON MARCH 8th

NEWS AND COMMENT...

CRAY VALLEY CELEBRATES ITS TWENTY-FIRST

Here we can see Arthur O. Milne, G2MI, president; Stan Coursey, G3JJC, chairman; Alan Swindon, G3ANK; Deryck Buckley, G3VLX, secretary; W. (Bill) Jardine, G2AQB; Norman Kemsley, G3WJK and T. I. Lundergaard, G3GJW.

The Cray Valley Radio Society was founded in 1946 and has therefore attained its majority—signified, naturally enough, by the addition of a morse key to the masthead of QUA, the Society's newsletter.

The occasion was marked by a special meeting in December last when the high spot of the evening was cutting the cake by G2MI, the Society's president. The birthday cake was home-baked by the XYL of the secretary G3VLX and expertly iced by his 15-year-old son. The cake decoration was a miniature replica of G2MI's h.f. beam.

There were two short talks by members. G3VLX (licensed in 1966) spoke on "My first 12 months" on the air and gave the newcomer's impression of Amateur Radio. Although so far confined to Top Band he recounted some interesting experiences and some amusing stories. G3ANK then outlined the earlier days of the Society and showed documents and cuttings from the days when many materials and foods were rationed.

The Society began as the Cray Valley Transmitting Club with members, as now, drawn from an area in North-west Kent comprising Eltham, Sidcup, Bromley, Orpington and the Crays. For the first five years interest in the club was so strong among local amateurs that it was possible to insist upon holding a licence as a condition of membership but later wider views prevailed and short wave listeners were admitted—today they are positively welcomed!

The Society's station—G3RCV—was on the air at the 21st meeting and several locals were worked on 4 metres. The rig (home-brew) was kindly supplied and operated by one of the members, G3TAA.

START OF VHF RADIO SERVICE FROM BBC'S BALLACHULISH RELAY STATION

The v.h.f. radio service from the BBC's relay station to serve Ballachulish, Argyllshire, started on 6 January, on the following frequencies: Radio 2 (Light programme) 88·1Mc/s, Radio 3 (Third Network) 90·3Mc/s, Radio 4 (Scottish Home Service) 92·5Mc/s.

RADIO 2 TRANSMITTERS IN SCOTLAND

Following the start of Radio 1 on 247 metres (1214kc/s), the wavelength previously used to supplement Radio 2, the BBC, has been investigating means of helping listeners in parts of Scotland who are having difficulty in receiving Radio 2 on 1500 metres long-wave and who do not have receivers for receiving this programme on v.h.f.

The shortage of wavelengths in the medium-wave band presents a serious problem but tests have shown that some local reinforcement of the Radio 2 service is possible by making use of the International Common Wavelength of 202 metres (1484kc/s).

Following the Postmaster-General's approval announced recently, low-power relay stations operating on 202 metres were brought into service in Glasgow on Wednesday, 20 December, and in Edinburgh on Thursday, 21 December.

The power of stations using the International Common Wavelength (202m) is restricted by international regulations so that the effective range of the stations is only a few miles. The range is further limited at night-time by interference from other European broadcasting stations, some 150 of which share this wavelength. The Glasgow and Edinburgh Radio 2 relay stations on 202 metres however, provide an alternative means of receiving Radio 2 in these two cities.

A PORTABLE DISCOTHEQUE

A new package deal in high fidelity discotheque equipment is now on sale to disc jockeys and users of professional record playing equipment.

The Rush D.J. is a suitcase size twin-turntable record playing console, complete with its own 30 watts solid state amplifier and control unit. Also included are a pre-fade listen switch for left- and right-hand channels feeding headphones for cueing-in each disc; separate volume controls for left- and right-hand grams; separate bass and treble controls for gram channels. Mike input with its own volume, bass and treble controls. Foot-operated mike on/off switch with music level reduction. Two Garrard SP25 Mk. II 4-speed single players are employed with turnover heads fitted with double L.P. styli instead of normal L.P./78 styli.

It is built into a leatherette covered case, which measures only 12in. high, 19in. deep by 36in. wide and weighs approximately 40 lb. It has a removable lid and is finished with anodised brass trims and locks.

Versions giving 60, 90, or 120 watts RMS output are also available at extra cost.

Further details regarding marketing, distribution, etc., may be obtained from Keith Pittman Limited, 42/44 Hanway Street, London, W.1.

NEWS AND COMMENT...

SERT MEETINGS THIS MONTH

The Society of Electronic and Radio Technicians announce that their meetings for February are as follows:

HORNCHURCH. Tuesday, 20th February. 7.00 p.m. at Havering Technical College, 42 Ardleigh Green Road, Hornchurch, Essex. Automatic Landing Systems: F. J. Sullings (B.O.A.C.).

CHESTERFIELD. Monday, 5th February. 6.30 p.m. at Chesterfield College of Technology, Infirmary Road, Chesterfield. U.H.F. Reception: B. M. Goodwin (A.B. Metal Products).

NEWCASTLE-UPON-TYNE. Wednesday, 7th February. 7.15 p.m. at Charles Trevelyan Technical College, Maple Terrace, Newcastle-upon-Tyne. Interference: T. Boast (G.P.O.).

STOKE ON TRENT. Friday, 16th February. 7.30 p.m. at Room C7, North Staffs College of Technology, College Road, Stoke on Trent. Sony Video Tape Recorders.

OLDHAM. Thursday, 8th February. 8.00 p.m. at Oldham Technical College, Oldham, Lancs. Stereo Broadcasting: (B.B.C.).

LINCOLN. Tuesday, 6th February. 7.30 p.m. at Lincoln Technical College, Cathedral Street, Lincoln. U.H.F. Reception: B. M. Goodwin (A.B. Metal Products.)

GREENOCK. Friday, 2nd February. 7.30 p.m. at Watt Memorial College, Greenock, Renfrewshire. Colour Television: J. McMaster.

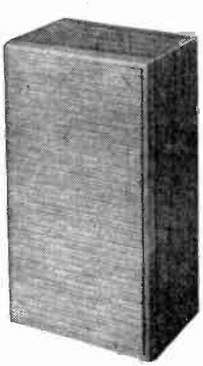
EDINBURGH. Friday, 23rd February. 7.30 p.m. at Room B44, Napier Technical College, Colinton Road, Edinburgh. Colour Television: J. C. Allen (Napier Technical College).

CARDIFF. Friday, 9th February. 7.30 p.m. at Llandaff Technical College, Western Avenue, Cardiff. Field Effect Transistors: E. F. Munroe (Texas Instruments).

LEWIS RADIO'S NEW RANGE

Lewis Radio, 100 Chase Side, Southgate, London, N.14, announce that the range of equipment they advertised in the February issue of "Practical Wireless" is now exhausted. The equipment advertised in this issue, however, is current and if readers require full details, they should contact Lewis Radio at the abovementioned address.

NEW SPEAKER FROM ROGERS



The "Standard" Speaker System introduced last year with the Ravensbourne Stereo Amplifier has now been joined by a "Compact" version employing the same basic design principles but using an 8in. main drive unit instead of the 12in. unit found in the "Standard" model.

The "Compact" has a frequency response of 50–14,000c/s, an impedance matching of 8–16Ω, power capacity of 10–15W and overall dimensions of 22 x 11½ x 8⅝in. (see photograph).

The "Compact" model costs £25 with £4 13s. 10d. purchase tax.

Rogers Developments (Electronics) Ltd., Rodevco Works, 4/14 Barmeston Road, Catford, London S.E.6.

DE-SOLDERING KIT

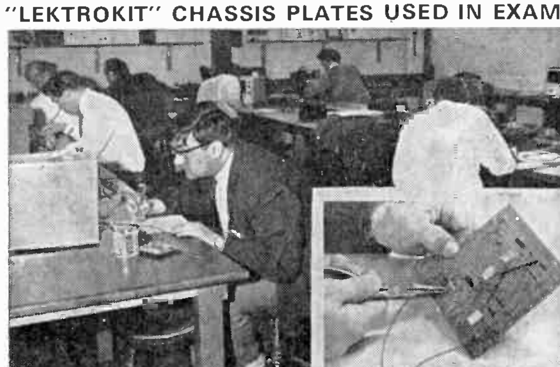
This new De-Soldering Kit from Antex contains a footpump with patented moulded cylinder and a synthetic cup washer. Lubrication and condensation problems are eliminated, weight is reduced to 3 lb. and exceptionally high pressure is obtained immediately on starting the stroke. The Model ESS De-Soldering Tool is now obtainable for 12, 24, 50, 110, 220 or 240 volts. This model can also be supplied on request with the smaller bit (2·4mm. –3/32in.) normally fitted to the smaller model GSS. The net trade price of £4 19s. 6d. for the complete outfit remains unaltered.

NORTHERN RADIO SOCIETIES' CONVENTION

The Northern Radio Societies' Association will again be holding their Annual Convention in the Kent Suite, at the Belle Vue Zoological and Exhibition Gardens, Manchester, on Sunday May 19th, 1968.

As readers may know, the Association comprises a number of radio societies from the North of England, who will be exhibiting, along with a number of commercial enterprises, at the Convention. The Convention will consist of a number of active displays and items of topical interest.

"LEKTROKIT" CHASSIS PLATES USED IN EXAMS



More than 170 students successfully passed their finals in the first national examinations in electronics servicing held by the Radio Trades Examination Board this year.

In conjunction with the City and Guilds Institute, the R.T.E.B. final radio and television servicing and the final electronics servicing certificates are achieved after five years' part time study. These certificates ensure that successful candidates are competent to maintain on the one hand, domestic radio and television equipment and, on the other, "professional" and industrial electronic equipment.

The Final Electronic Servicing Certificate examination consisted of two 3-hour written papers, one 2-hour fault diagnosis paper and a 2-hour practical test. For the practical exam (see illustration) students were required to construct and test a transistorised multivibrator circuit and Lektrokit No. 4 chassis plates, made by A.P.T. Electronic Industries Ltd. were chosen by the Board for this.

THE RHODIAN TAPE RECORDER

JULIAN ANDERSON

THE Rhodian tape recorder is the result of much trial and experiment using different decks and choices of amplifier. The aim was to achieve the best possible results using the minimum of components. Obviously in any design of this sort a compromise has to be reached between quality on the one hand and simplicity on the other, and the final design, although not claimed to be hi-fi, has a quality which matches or betters most of the popular range of tape recorders on the market. The total cost in parts, including cabinet, tape deck and speaker was under £12.

To the beginner to construction or to the occasional dabbler a tape recorder circuit may seem way beyond their capacity; the complicated-looking circuitry, the warnings of careful component placing and a fearsome looking "function switch" immediately seem beyond them. Actually in operation a tape recorder amplifier is less complicated than a superhet radio or a push-pull amplifier. If the circuit is shorn of its switches etc. and only the functional components are shown it looks like Fig. 1 on record and as in Fig. 2 on playback.

Basically on record the signals from the microphone are amplified by three triodes and fed via a high-value resistor to the record head. This resistor is needed because the record head is an impedance and has a higher resistance at the higher frequencies. By having a resistance in series the current flowing will depend on the total resistance and not only on that of the head. This means that roughly the same current will flow through the head whatever the frequency.

Since on record the tape will need to be wiped clean a form of erase is necessary. This is provided by the pentode valve, arranged as an oscillator, the secondary of the oscillator coil feeding the erase head. The only complicated part which needs brief explanation is the recording bias. This consists of a tiny part of the high frequency erase current fed via a capacitor to the record head along with the signal. There is no reason why this should be fully understood by the constructor; adequate explanations have been given in previous issues of this magazine. Basically it is necessary because of the nonlinear characteristic of the recording tape, the high frequency bias signal overcoming this nonlinearity. It is absolutely necessary in the recording process although it involves only a small capacitor.

On playback the circuit is far simpler. Those who have made a valve amplifier will see that it is completely straightforward apart from the high gain involved.

On record one must have some method of seeing how much signal is being fed to the tape. If too little is fed to it the playback will be noisy, if too much heavy distortion will result. In the final circuit the record-level indicator also serves to show if the recorder is on playback or record.

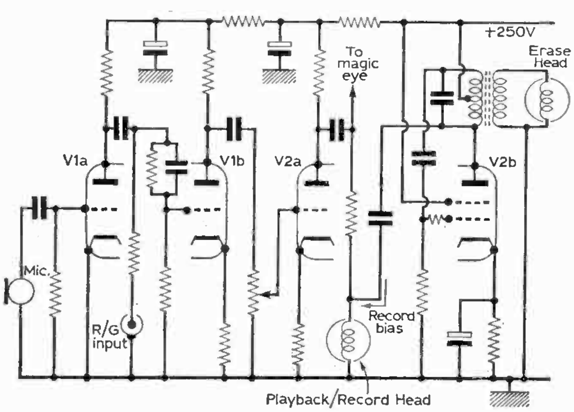


Fig. 1: Effective circuit on record.

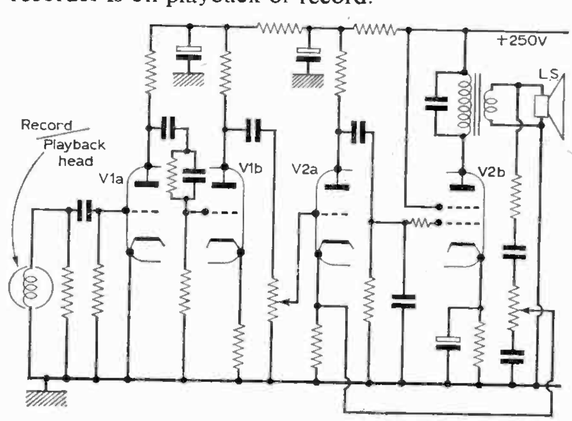


Fig. 2: Effective circuit on playback.

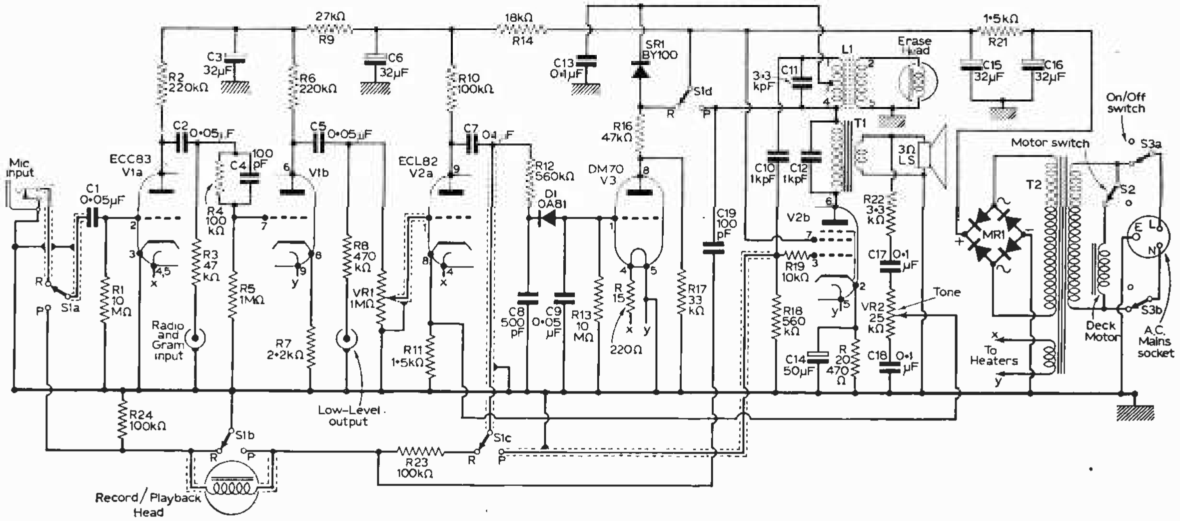


Fig. 3: Complete circuit of the Rhodian tape recorder

The complete circuit, shown in Fig. 3, is not very original. When the minimum number of components are used similarity between designs is bound to result. It is not dissimilar to many commercial designs available, but unlike these it uses readily available components which are completely standard, and also keeps the number of switchings to the minimum (four). The amplifier is even built on a standard chassis size available from advertisers in this magazine.

The recorder is built around the BSR TD2 deck which is available for about £5 10s. There is no reason why other decks should not be used, and the amplifier will need no amendments for any deck using a high-impedance record/playback head and a low-impedance erase head (most decks use this arrangement).

It was decided at the start to use a home-made cabinet. The disadvantage with most of the ones on sale is that, while very attractive, they are designed around a specially made chassis. The author's cabinet cost 10s. and was completed in under two hours. It is a very simple one and no doubt readers who are more accomplished at carpentry than the author would be able to improve on it.

It was decided to mount the loudspeaker forward facing. The simplicity of the deck and the amplifier may limit fidelity, but there is no reason to limit this further by using a tiny speaker tucked away on the side. The author's final design incorporated an 8 x 5 inch speaker. Another decision was to use a single chassis, with no flying leads, the only interconnecting leads going to the deck, and also for the amplifier to be capable of being worked upon while in the cabinet, thus making testing very much easier.

Amplifier switching is one of the features of a tape recorder, and on the deck of the BSR TD2 this is on the left. The deck is not normally supplied with a wafer, but this can be readily obtained. By using the switch provided, accidental erasure is impossible and allows the less technical members of the family to use the machine. The amplifier is sited on the left of the deck so that the interconnecting leads can be kept short.

General layout is more important in a recorder than on most equipment because of the high gains and high impedances involved. For those wishing to use a different layout the following should be observed: (1) Keep the low-signal and high-signal sections well apart. (2) Keep the mains transformer well away from the tape heads. (3) Screen wires liberally and especially all those carrying signal to the deck.

Basic design

As the main features of the recorder are cost and simplicity, the valves chosen were an ECC83 (a high-gain double triode) and an ECL82 (a triode pentode). Together these give more than adequate gain and a final output of about 2½W. A contact-cooled metal rectifier was chosen since it is smaller than its valve counterpart and needs no heater current. A full-wave rectifier was chosen since a ripple of 100c/s is easier to smooth.

The magic eye chosen was a DM70. This is really intended for battery operation, but has the advantages that it uses little heater or h.t. current, and more important it is small and easily mounted. In the earlier stages of development the author used an EM81, but without special escutcheons it is very hard to mount it attractively.

Under no circumstances should a tape recorder have a live chassis. This is acceptable in a radio or TV set where all metal parts can be shielded, but on a tape recorder the deck and even the microphone can be live and only those with a death wish should avoid using a mains isolating transformer.

The BSR deck has no motor switch, and for those wishing to use the amplifier other than for the tape recorder a switch is included. This can also be used as a kind of pause control. The author uses his a lot when medium wave DXing and it is very useful to be able to start and stop the machine by just throwing a switch.

Circuit description

On record, the microphone signal is switched to the grid of V1a by S1a. This is the first part of the ECC83 and as mentioned is a high-gain amplifier. It is arranged for very high input impedance and is especially good for use with crystal microphones, giving a good bass response. The signal then passes via a frequency-discriminating network (C4, R4) giving a treble boost to the signal (treble boost is needed on record to overcome head and tape losses). If a high signal source is used this is fed into the radio/gram input socket just before the network, the first stage being automatically shorted at the microphone socket.

The signal is further amplified by V1b. No cathode bypass capacitor is used since adequate gain is available and thus a measure of negative feedback can be introduced to improve linearity. The signal from this stage is controlled by the record-level control, VR1, and is then further amplified by V2a, finally being applied via R23 to the record head, the other side of which is connected to earth by S1b. The signal for the magic-eye record-level indicator is tapped off via R12, rectified by the OA81, smoothed and fed to the grid of the DM70 (V3). As mentioned earlier, the DM70 is intended for operation with an h.t. of about 90V and its anode is thus fed from a potential divider (R16 and R17). The low heater current required is achieved by the inclusion of R15 in the heater circuit.

V2b is arranged as an oscillator on record. The anode receives h.t. via S1d, rectifier SR1, the oscillator coil L1 and the output transformer T1. Part of the signal from the oscillator coil is fed back to the grid via C10. The frequency of oscillation is determined by C11 and should be in the order of 60kc/s. The secondary of the oscillator coil is connected directly to the erase head. (If a high-impedance erase head is to be used the signal should be taken via an 0·1μF capacitor from the anode side of the coil.) It will be noticed that the output transformer T1 is connected throughout, but the high impedance of its primary blocks the passage of oscillations thus making it inoperative on record, the high frequency signals being bypassed through C12. The tone control operates on the negative feedback circuit from the secondary of the output transformer and is thus also inoperative during record.

Bias is fed to the record head via C19 from the effective anode of V2b. It should be noted that there is 250V across this through the record head and if it is shorted for even a millisecond unpleasant things may happen to the head (the author was not willing to find out exactly what!).

The power supply is standard, being smoothed by R21, C15 and C16. Adequate decoupling between stages is used, being provided by R9, R14, C3 and C6.

On playback the output from the record/playback head is switched to the grid of V1a by S1a, the other side of the head being switched to earth by S1b. The amplifier output is switched to the grid of V2b by S1c and h.t. is switched directly to the top of the output transformer by S1d.

In this condition the amplifier acts as follows. The playback head (which is the same as the record head on this and most decks) is paralleled with a 100kΩ resistor (R24). This lowers the input impedance of the first stage. The signal is amplified as before, still receiving treble boost. A low-level output suitable for a feed to another tape recorder or amplifier is taken from the anode of the next stage. This time the record-level control becomes the volume control, and the output from V2a is this time fed via S1c to the grid of the output stage V2b. R19 in the grid lead helps to stop parasitic oscillations in this stage. Signal is still fed to the magic-eye V3, but because this time the h.t. is switched by S1d to the top of the output transformer T1 rectifier SR1 prevents the h.t. reaching V3 so that it does not glow, in this way providing a visual guide as to whether the recorder is switched to playback or record. (For those not wanting this facility the rectifier can be left out.)

★ components list

Resistors:

R1	10MΩ	R13	10MΩ
R2	220kΩ	R14	18kΩ
R3	47kΩ	R15	220Ω
R4	100kΩ	R16	47kΩ
R5	1MΩ	R17	33kΩ
R6	220kΩ	R18	560kΩ
R7	2·2kΩ	R19	10kΩ
R8	470kΩ	R20	470Ω 5W
R9	27kΩ	R21	1·5kΩ 5W
R10	100kΩ	R22	3·3kΩ
R11	1·5kΩ	R23	100kΩ
R12	560kΩ	R24	100kΩ

All 10% $\frac{1}{4}$W unless otherwise stated

Variable resistors:

VR1	1MΩ log with d.p. switch
VR2	25kΩ lin

Capacitors:

C1	0·05μF
C2	0·05μF 350V
C3	32μF 350V electrolytic
C4	100pF
C5	0·05μF 350V
C6	32μF 350V electrolytic
C7	0·1μF 350V
C8	500pF
C9	0·05μF
C10	1,000pF 350V
C11	3,300pF 350V
C12	1,000pF 350V
C13	0·1μF 350V
C14	50μF 50V electrolytic
C15	32μF 350V electrolytic
C16	32μF 350V electrolytic
C17	0·1μF
C18	0·1μF
C19	100pF 500V

Valves and rectifiers:

V1	ECC83	MR1	250V, 75mA contact-cooled bridge metal rectifier
V2	ECL82		
V3	DM70		
		SR1	250V, 50mA. BY100 is suitable
D1	OA81		

Miscellaneous:

L1	Denco TDO2 osc. coil
T1	To suit ECL82
T2	250V, 60mA double-wound mains with 6·3V, 2A heater winding
S1	BSR TD2 switch wafer
S2	Rotary on/off switch
S3	With VR1

Also 2 B9A bases, one screened; audio jacks, 2 normal and one shorting; tagboards, screened lead; grommets; capacitor clips, etc.

C13 acts as a tiny h.t. reservoir and, when the record / playback switch is altered, it will allow oscillations to die away rather than cut off thus preventing the head from becoming magnetised. (A magnetised head leads to noisy playback.)

C12, which on record bypassed the output transformer for oscillation, now acts as a treble cut to neutralise the unwanted top boost given earlier in the circuit. C10 now goes from V2b control grid to effective a.c. earth (the h.t. line) and cuts the top further. These two capacitors give the top cut necessary to equalise the signal on playback. The output transformer is now in use and negative feedback is applied to the cathode of V2a. The arrangement used gives a wide range of control from very mellow to very bright and has been found to be very satisfactory in this and other circuits.

TO BE CONTINUED

Modification to the GENERAL PURPOSE P.S.U.

(December 1967, page 570)

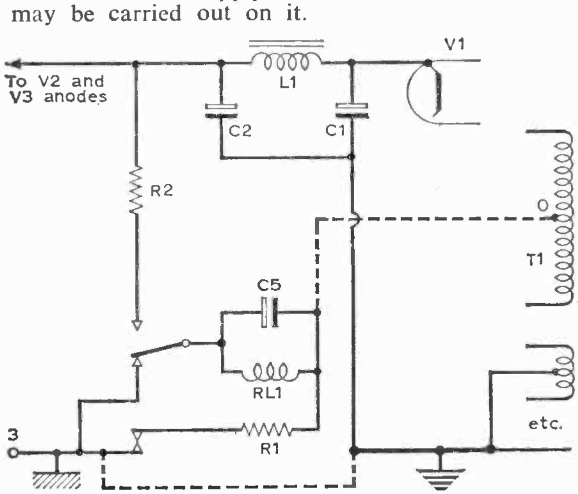
In order to eliminate the risk of an electric shock when this device has been overloaded (or short-circuited) the following modification must be carried out.

In Fig. 1 the common connection of C5, RL1, and R1 is removed completely from the earth connection (heavy black line) and wired directly to the centre tap (marked O) of the h.t. secondary of the mains transformer T1, as shown below. The existing connection from this point to earth is removed.

The negative sides of capacitors C1 and C2 are still returned to the earth connection (heavy black line), and the negative bus-bar connected to output terminal 3 may now be joined directly to earth.

This simple modification ensures that the chassis is always at earth potential, even during overloads.

It must also be stressed that, during an overload, when the relay is energised, high voltages still exist in the circuit and the device must be disconnected from the mains supply in order that servicing, etc., may be carried out on it.



Wiring shown thus ------ is modified wiring

Modified circuit.

YOUR ? QUESTIONS ANSWERED

F.M. DISTORTION

I have recently purchased an a.m./f.m. stereo radio chassis incorporating a Gorler tuning heart. Sound on f.m., however, is accompanied by a definite distortion which cannot be tuned out.

I have replaced the ECC85, also provided a loft aerial with 300Ω twin feeder but this has made no improvement. Before I adjust any trimmers or screws (there appears to be one beneath and three on top) could you advise how this distortion may be removed.—D. Spencer (Oldbury, Birmingham).

It is doubtful (though possible) that the distortion you mention is caused by incorrect alignment of the tuner unit in your f.m. radio. It is more likely that the trouble is due to incorrect alignment of the f.m. i.f. transformers, especially the one feeding the f.m. detector. We therefore suggest that you realign the f.m. i.f. circuits; alternatively, ask a local service engineer to do it for you. We advise you not to tamper with the tuner unit until all other possibilities have been eliminated. Before realigning, however, check the aerial orientation since the distortion could be caused by multipath reception.

LONG MIC LEAD

I wish to use a long microphone lead (about 25 yards) with my tape recorder. I have made several experiments with different types of microphone but find in all cases that the quality is poor and is accompanied by loud hum.—H. Wilson (Birmingham).

It is not possible to use a long lead on your microphone unless you add a preamplifier between the microphone and the long lead. The preamp would be arranged to have a low output impedance (by the use of a cathode follower valve stage, or an emitter follower transistor stage).

OHMS LAW

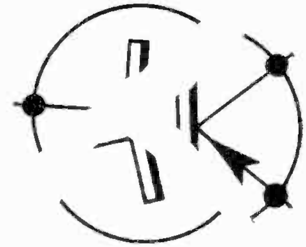
I have a three-transistor i.f. amplifier designed to work from a 9V supply. My supply voltage is 12V. Could you state what value of resistance I should use to drop the 3V and where in the unit it should be connected ?—R. Riddle (Edinburgh, 11).

In order to calculate what value of resistance you need to feed your i.f. amplifier, you will need to measure the current it takes when connected to the correct 9V supply. Suppose that the current is I milliamps. Then, the value of the necessary resistance (in ohms) is given by dividing 3,000 by the current I. Thus, if the current was 6 milliamps, a resistor of 500Ω would be needed.

LEAGUE OR CLUB

We apologise for the error under the heading "Short Wave Club" published last month. The correct address of the International Short Wave Club is **100 Adams Gardens Estate, London, S.E.16** and the Secretary is **Arthur E. Bear.** The address we gave last month is that of the International Short Wave League. Will all concerned kindly accept our apologies for any inconvenience this may have caused.

RECLAIMING FAULTY TRANSISTORS



M. K. TITMAN B. SC.

PART 2

Last month we discovered how to reclaim faulty or dud transistors, for use as diodes or zener diodes. Now let us look at a few of the many circuits in which we can use the reclaimed junctions.

Power supplies are perhaps the most important application for our reclaimed zener diodes. By using the test set described last month, we can measure the zener voltage and dynamic resistance (R_z). We can see that the voltage change with current is small, which indicates that it would be useful as a reference voltage in power supplies, or as a means of obtaining low voltage supply lines.

Figure 3 illustrates a method of providing a low voltage line from an existing power supply. This is often useful for supplying add-on units such as tuners, pre-amps., mixers etc., where only a low power and additional smoothing are required. It is also useful when we are experimenting with low voltage circuits where the only supply is in an existing equipment.

We can design the low voltage rail by first selecting a reclaimed zener diode of the correct voltage and then calculating R from the following equation;

$$R = \frac{V_{IN} - V_z}{I_{LM} + I_z}$$

where V_{IN} is the existing voltage
V_z is the zener voltage measured on the test set
I_{LM} is the maximum current from the low voltage line
I_z is the minimum current for zener stability (1–5mA).

In order not to destroy the zener diode under open-circuit conditions, we must limit the zener power $[V_z(I_{LM} + I_z)]$ to less than 200mW for a small transistor. Similarly the power rating of the resistor is V_{IN}^2/R for short-circuit conditions. Thus we have designed a low voltage rail for our tuner or pre-amp., which will not be damaged by open or short circuits. The voltage versus current for the supply is given by Fig. 4 and is virtually constant, as the output resistance is R_z (zener dynamic resistance) up to a maximum current of I_{LM}. For greater currents the zener has no effect, as all the current has been diverted from it, to the load. Commonly, a small transistor yields a 200mW zener diode which will deliver 30mA at 6V, or 20mA at 9V.

One of the advantages of this method is that additional smoothing is achieved since any ripple on V_{IN} is reduced by R and C in parallel with R_z. This is especially useful for tuners and pre-amps. However, its limitation is that for high voltage zeners, say 20V, the maximum current for a small zener is approximately 10mA. In this case, however, we can use the circuit of Fig. 5.

The maximum current is again determined by the power of the zener, thus for a 10V difference between the input and output voltages, the maximum current is 20mA.

The output voltage is given by $V_{OUT} = V_{IN} - V_z$ and R is given by $R = \frac{V_{OUT}}{I_z}$.

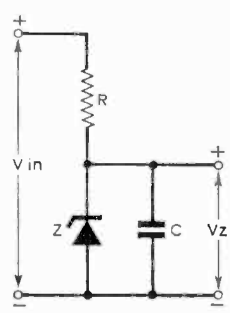
In this case the power in the zener diode for an open-circuit is small ($V_z I_z$), whilst a short-circuit would destroy the zener. The voltage-current characteristic is shown in Fig. 6. The disadvantages are that ripple on V_{IN} is transferred directly to the low voltage rail and the output resistance is the sum of the source resistance and R_z.

Stabilisation and Rectification

Where an increased power is required the stabiliser circuit of Fig. 7 may be designed. The design follows that of Fig. 3 except that the maximum load current is hFE I_{LM} (or α' I_{LM}) or the maximum transistor current, whichever is the lower. The output voltage is ($V_z - V_{bel}$) where V_{bel} is 0·7V for silicon and 0·3V for germanium. The power rating of Vr1 is [($V_{IN} - V_{OUT}$) hFE I_{LM}] and the transistor will generally require a heat sink. As hFE is rarely less than 10 the current output for a 6V zener would be at least 300mA.

Reclaimed collector-base junctions, particularly of power transistors, are useful as rectifiers. The circuit of Fig. 8 shows a 6V 20mA supply for a tuner or pre-amp. using a spare 6·3V winding on a valve equipment. Here four reclaimed diodes and a 6V zener are used.

Reclaimed diodes may be used for temperature compensation. Silicon junctions have a negative temperature co-efficient and the voltage decreases by 2·4mV per °C. Now a 6·8V zener diode has a similar positive temperature co-efficient. Hence a forward biased diode in series with a 6·8V zener would give almost zero drift with temperature and an output voltage of (V_z + 0·7)V, whilst maintaining the low output impedance.



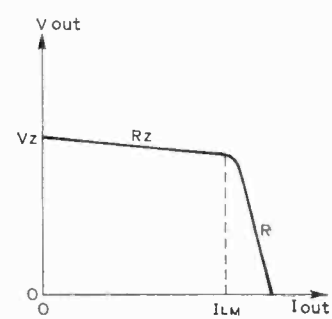
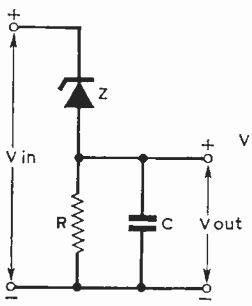


Fig. 3 (left): Zener power line.
Fig. 4 (right): Output voltage characteristic.

For zeners below 6·2V this cannot be used, since they have negative co-efficients. Above 7·2V more than one diode can be used for compensation.



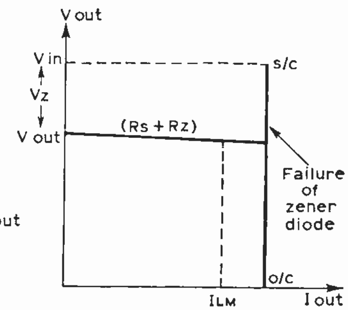


Fig. 5 (left): Zener power line.
Fig. 6 (right): Output voltage characteristic.

Where the voltage in a circuit must not exceed a certain value, then a reclaimed transistor used as a zener diode may be used for protection. Thus a second zener diode of slightly higher voltage may be placed across the primary zener diode to give protection should the primary zener diode fail.

Similarly they may be used back to back across a high impedance path transformer, as in Fig. 9, to clip a signal. The maximum peak-to-peak signal would then be limited to $2(V_z + 0{\cdot}7)$V. This cannot be used for power transformers since the current is not limited.

A power supply protection circuit using a thyristor is shown in Fig. 10. Here, if the voltage exceeds approximately $(V_z + 1)$ volts, the thyristor will fire and blow the fuse. Thus expensive circuitry may be saved, and since the overload current of a small thyristor is greater than 15A, this can be used on high current supply lines.

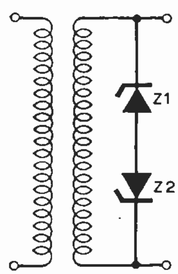
Where a moving coil meter is used as a universal meter, the movement may be protected by silicon diodes across the meter as shown in Fig. 11. Provided the product $I_M R_M$ is less than 250mV the diodes will have a negligible effect on the readings and yet prevent damage through overload.

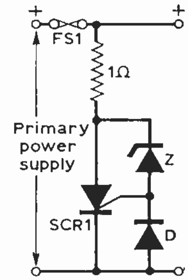
For example, if the product $I_M R_M$ is 200mV then the diodes will conduct for approximately 600mV and the overload current is limited to three times the normal current. As a meter movement is usually capable of this value of overload no damage will be sustained.

Pulse and gate circuits

High-speed diodes are often used in pulse circuits and the reclaimed junctions of high-frequency transistors are very suitable. Figure 12 illustrates a differentiating trigger circuit used for triggering bistables, monostables, etc. Figure 13 illustrates a peak detection circuit. This form of circuit is used at the detector stage of radios for which purpose the reclaimed diodes are very suitable.

Logic gate circuits have a very large number of applications though they are used only rarely in experimental equipment. The circuit in Fig. 14 is a gate circuit and operates as follows. Ignoring R1 to R3 at present, if A *OR* B *OR* C is connected to the positive supply, then Vr1 will conduct heavily and the relay will operate. This then is an OR gate and can be used for a number of applications, such as safety or alarm circuits. One example is in a tape-recorder. If A is made to be positive when there is no tape and B when the bias is absent and C when the level is too high, then the





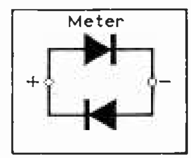
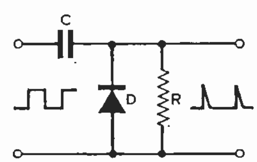


Fig. 9 (left): Audio clipping circuit
Fig. 10 (centre): Excess voltage protection circuit.
Fig. 11 (right): Meter protection.



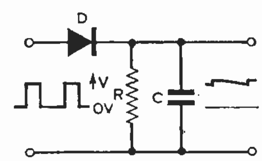


Fig. 12 (left): Trigger circuit.
Fig. 13 (right): Peak detector.

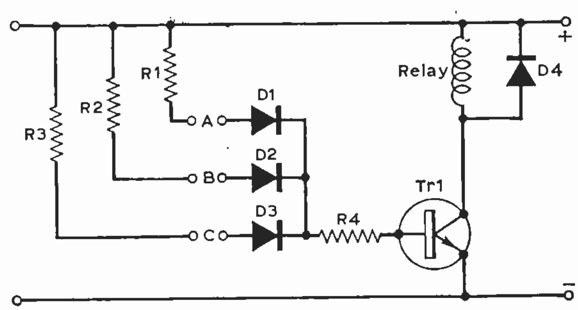


Fig. 14: Logic gate circuit.

relay could operate an alarm light which indicated a fault, if any of these conditions were present.

If R1, R2, R3 are connected to A, B and C respectively, then the circuit would behave as follows. Only when A *AND* B *AND* C were connected to OV would the relay switch off. This then is the AND gate condi-

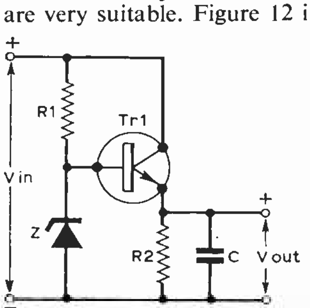


Fig. 7: Stabiliser circuit.

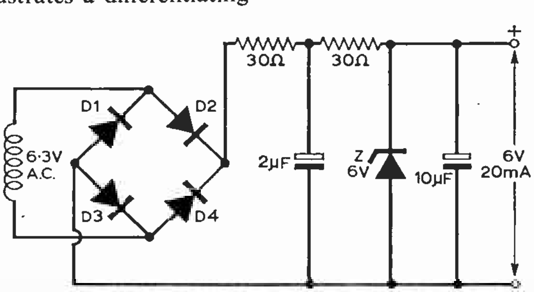


Fig. 8: 6 volt power supply using a heater winding.

—*continued on page 866*

THE 'CLUBMAN'

J. THORNTON-LAWRENCE GW3JGA

continued from the February issue

WHILST the Clubman Mk 1[1] performs satisfactorily and is ideal for the beginner, it must, due to its simplicity, be somewhat limited in its selectivity and sensitivity. To improve the selectivity it is necessary to increase the number of tuned circuits in the i.f. amplifier. This normally requires extra i.f. transformers and the addition of an extra transistor i.f. amplifier stage. This incidentally also improves the sensitivity. With higher sensitivity it becomes more difficult to use a reflex circuit without encountering instability and so this feature has to be abandoned.

In the Clubman Mk II receiver, the existing Veroboard panel containing the reflex i.f., demodulator and a.f. stages is replaced by a new Veroboard panel comprising a conventional[2] two stage i.f. amplifier using AF117 transistors and having automatic volume control, a demodulator stage and two a.f. stages. The biasing and gain control of the a.f. stages is similar to those used in the Clubman Mk I but with the i.f. components omitted. A new feature is the inclusion of a beat frequency oscillator for c.w. and s.s.b. reception. This is housed in a small screening box to prevent unwanted radiations to the earlier stages of the receiver.

The circuit of the Mk II version is shown in Fig. 19. The original frequency changer stage remains unchanged and the operation of this circuit has been described previously[1].

I.F. Amplifier Stages

Intermediate frequency signals (470kc/s) at the collector of Tr1 are accepted by the i.f. transformer i.f.t.1 and passed to the base of Tr4. D.C. biasing of Tr4 base is provided by the potential divider R12 and R13. The emitter stabilising resistor is R15. Decoupling for the base circuit is provided by C13, for the emitter by C14 and for the collector circuit by C12. Amplified i.f. signals appearing at the collector of Tr4 are accepted by i.f.t.2 and passed to

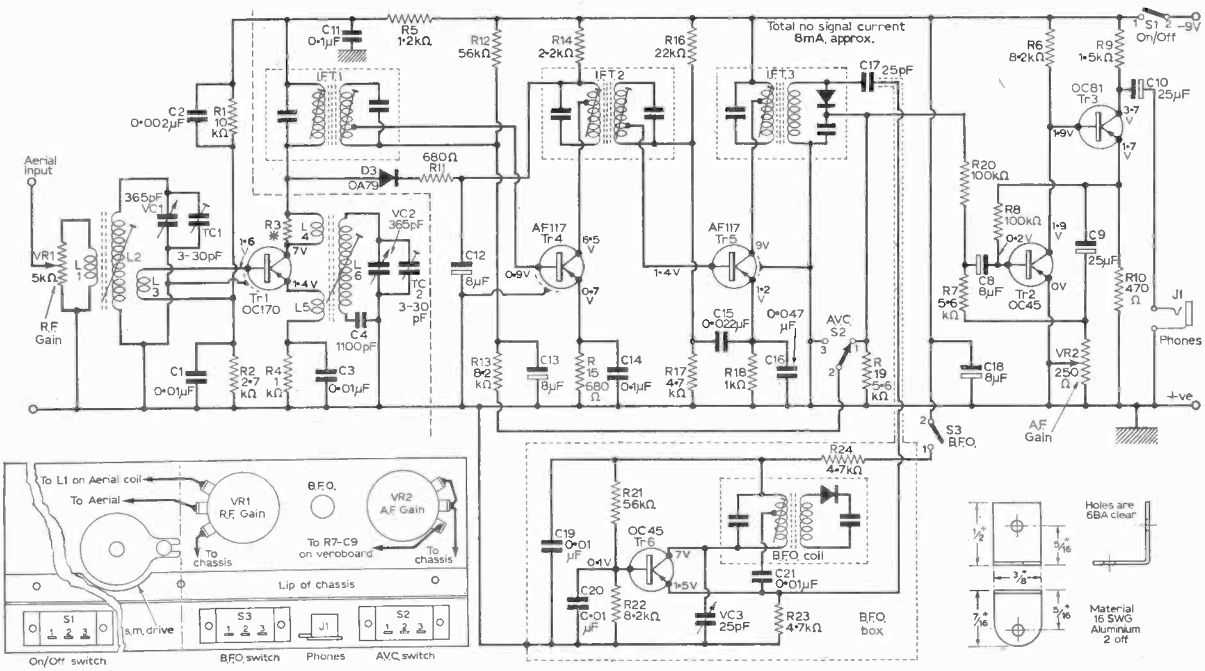


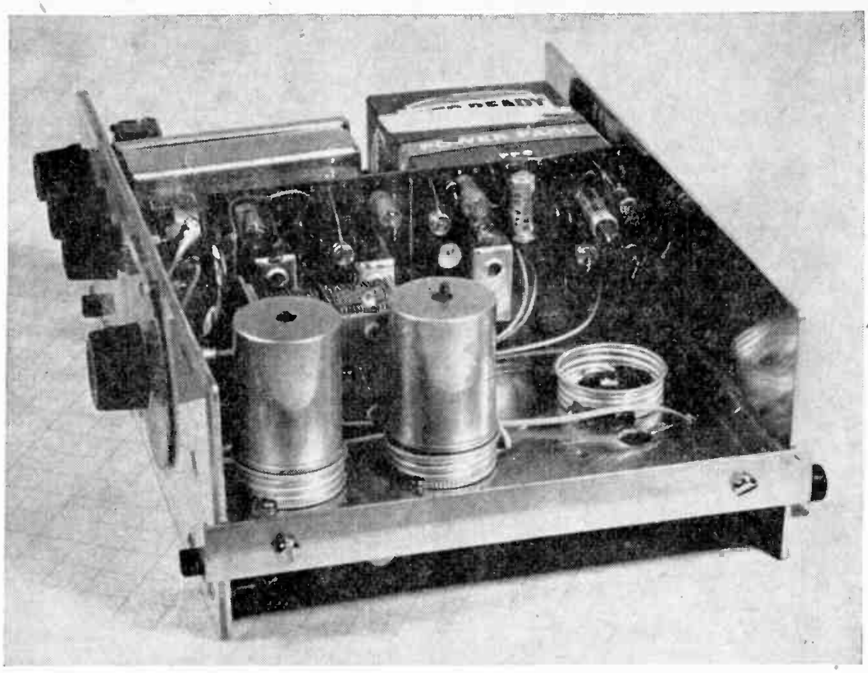
Fig. 18: Wiring of the Mk II front panel. Fig. 19: Complete circuit of the Mk II Clubman. Fig. 20: B.F.O. box mounting brackets.

the base of TR5. Base biasing for TR5 is provided by R16 and R17 and the emitter stabilising resistor is R18. Decoupling for the base circuit is provided by C15 and for the emitter by C16. Amplified i.f. signals at TR5 collector are accepted by i.f.t.3 which also contains the demodulator diode circuit. In the presence of a signal a positive voltage is developed across the diode load resistor R19. The d.c. component of this signal is used for a.v.c. purposes and superimposed on this voltage is the a.f. signal which is passed to the a.f. stages via R20.

The positive a.v.c. voltage present across R19 is passed through S2 and R13 to the base of TR4, reducing the current through TR4 and thus reducing the gain of this stage. Filtering of this voltage is provided by R13 and C13. There is a limit to the amount of control which can be obtained by this method and so an additional method[3] of gain control is employed. This is effected by D3 and R11. For small input signals, little or no positive voltage appears at the bottom end of R13 and the d.c. through TR4 causes a voltage drop across R14. The voltage at the bottom end of R14 being approximately −6·5 volts. The voltage at the collector of Tr1 is approximately −7 volts and it will be seen that the voltage across D3 results in it being reverse biased and having negligible effect on the operation of i.f.t.1. If, however, a strong signal is being received, the positive a.v.c. voltage appearing at R13 will cause the current through Tr4 and R14 to decrease. The reduced voltage drop across R14 results in an increase in the voltage at the junction of R11 and C12. When this voltage becomes more negative than that at the collector of Tr1, D3 becomes conductive and connects the damping resistor R11 across the primary of i.f.t.1, thus reducing the gain of this stage. C12 provides a low impedance path for i.f. signals through D3 and R11 to chassis.

The a.v.c switch S2 is provided to disconnect the a.v.c. voltage so that the i.f. stages may operate at fixed gain for c.w. and s.s.b. reception.

The operation of the a.f. stages has been described previously[1] and is similar to those in the Clubman Mk I but with the i.f. components omitted.



Inside view of Mk II Clubman. The i.f./a.f. panel can be seen mounted vertically, between the tuning gang and b.f.o. box.

Beat Frequency Oscillator

A separate b.f.o. coil is not available in the range of Weymouth i.f. transformers used, so a final i.f. transformer type T41/3T is employed as a b.f.o. coil[4], the secondary winding being unused.

The b.f.o. is a Hartley circuit which operates at a nominal frequency of 470kc/s. VC3 provides a tuning range of about ±5kc/s. Tr6 operates in common base mode with the tuned circuit in the collector, feedback is taken from a tapping on the coil to the emitter via C21. Base biasing for Tr6 is provided by R21 and R22, the emitter stabilising resistor is R23. The base decoupling capacitor is C20 and decoupling for the collector circuit is provided by C19 and R24.

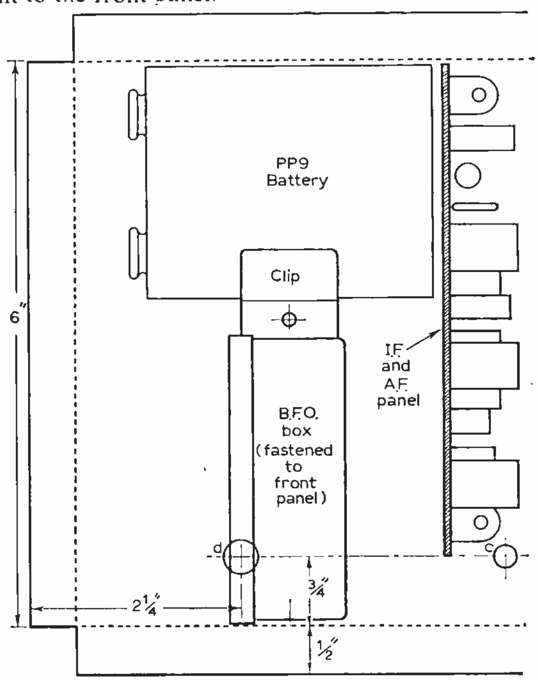
The i.f. output from the emitter is coupled to the demodulator circuit by C17. S3 is the b.f.o. switch and it controls the d.c. supply to the b.f.o. circuit.

Construction

The Mk II i.f. and a.f. panel consists of Veroboard with a 0·2 x 0·2in. hole matrix, size $5\frac{1}{4}$ x $2\frac{3}{16}$in. The mounting positions for the various components and the drillings to remove the copper strip are shown in Fig. 23. The hints given previously[1] to assist in marking out and working on the Veroboard panel are even more important with this more complicated layout if errors are to be avoided.

The i.f. transformers do not fit exactly into the Veroboard drillings and it is necessary to elongate the holes and open them out slightly to suit the soldering spills on the i.f. transformers. This can conveniently be done using a mousetail file or Abrafile, working downwards with the copper strip side of the panel uppermost so as not to tear off the copper strip. The transformer i.f.t.1 used in the Mk I version can be reused. Some difficulty may be experienced in removing this transformer from the Veroboard panel if a desoldering tool is not available. A useful alternative method is to clamp the old panel in a vice and whilst heating one tag with a soldering iron, brush away molten solder using a stiff-bristled brush. A cut down suède brush with metal bristles is ideal. This process is repeated for each tag and the transformer may then be extracted from the panel. Avoid excess heat for long periods as this may damage the transformer internally. The i.f. transformers are colour coded at one end and the position of this coloured dot is shown in Fig. 23. Make sure that the transformers are orientated correctly[4]. The i.f.t. cans have two earthing tags, the one at the end with the colour code is cut short and the other tag is connected to the Veroboard as shown.

The b.f.o. unit consists of a small Veroboard panel, complete with the circuit components, which is mounted in a small aluminium box along with the b.f.o. tuning capacitor VC3. The Veroboard panel is fastened into the box by two 6BA screws and nuts and is spaced away from the side by two full nuts which are run on to the screws before the panel is fitted. The tuning capacitor VC3 is fastened through the ⅜in. diameter hole at the end of the b.f.o. box. One fitting nut is used to lock the tuning capacitor in position and the protruding spindle bush is passed through the front panel hole and a further nut fitted on from the front of the panel. This nut, when tightened, locks the complete b.f.o. unit to the front panel.



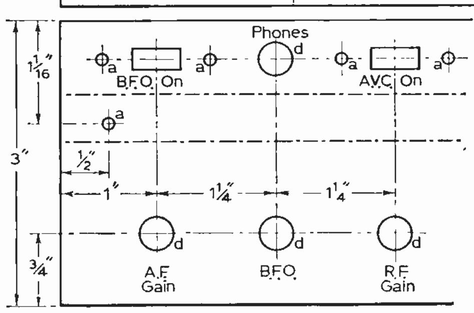


Fig. 21 (upper): Positions of the i.f./a.f. panel and b.f.o. box respectively.
Fig. 22 (lower): Showing extra holes required in front panel for b.f.o. and a.v.c. controls.

★ components list

Resistors:

All 10% ¼W carbon

*R1	10kΩ	R13	8·2kΩ
*R2	2·7kΩ	R14	2·2kΩ
*R3	see text on Mk1 receiver	R15	680Ω
*R4	1kΩ	R16	22kΩ
*R5	1·2kΩ	R17	4·7kΩ
*R6	8·2kΩ	R18	1kΩ
*R7	5·6kΩ	R19	5·6kΩ
*R8	100kΩ	R20	100kΩ
*R9	1·5kΩ	R21	56kΩ
*R10	470Ω	R22	8·2kΩ
R11	680Ω	R23	4·7kΩ
R12	56kΩ	R24	4·7kΩ

Capacitors:

*C1 0·01μF 20V disc ceramic
*C2 0·002μF Hi-K ceramic
*C3 0·01μF 20V disc ceramic
*C4 1,100pF (1,000 and 100pF in parallel) mica
*C8 8μF 15V electrolytic
*C9 25μF 15V electrolytic
*C10 25μF 15V electrolytic
C11 0·1μF 20V disc ceramic
C12 8μF 15V electrolytic
C13 8μF 15V electrolytic
C14 0·1μF 20V disc ceramic
C15 0·022μF 20V disc ceramic
C16 0·047μF 20V disc ceramic
C17 25pF ceramic
C18 8μF 15V electrolytic
C19 0·01μF 20V disc ceramic
C20 0·01μF 20V disc ceramic
C21 0·01μF 20V disc ceramic
*TC1 3-30pF concentric trimmers
*TC2 3-30pF concentric trimmers
*VC1/VC2 365pF 2 gang type 0-2 Jackson Bros.
VC3 25pF C804 Jackson Bros.

Semiconductors:

*Tr1	OC170	Tr4	AF117
*Tr2	OC45	Tr5	AF117
*Tr3	OC81	Tr6	OC45
D3	OA79		

Miscellaneous:

*IFT1 470kc/s double tuned T41/1E Weymouth
IFT2 470kc/s double tuned T41/2E Weymouth
IFT3 470kc/s single tuned T41/3T Weymouth
BFO Coil 470kc/s single tuned T41/3T Weymouth
*L1, L2, L3, aerial coil 3T Blue Denco
*L4, L5, L6, Oscillator Coil 3T Red Denco
*S1, 2, 3 miniature slide switch
*Slow motion drive, Jackson Bros.
*Knobs *VR1 5kΩ *VR2 250Ω
*Valveholders, terminals, solder tags, battery connectors, nuts and screws etc.
*Cabinet and chassis, H. L. Smith & Co.

*Used in Clubman Mk I.

The wiring and drilling of the Veroboard panel is shown in Fig. 24 and the construction of the b.f.o. box in Fig. 25.

A screened cable passes through a ¼in. diameter hole in the box and carries the b.f.o. signal to the connection point on the i.f./a.f. panel.

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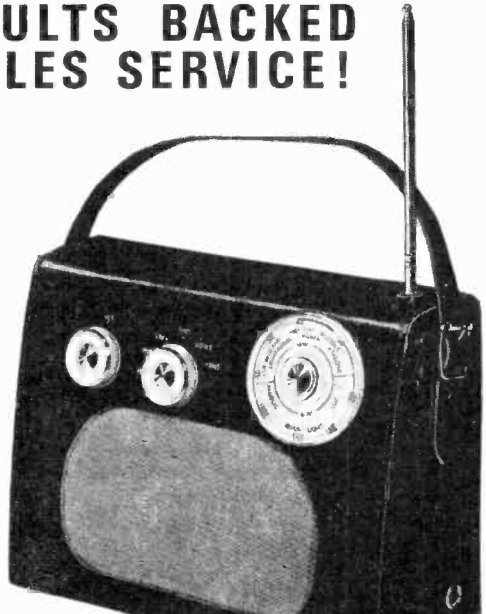

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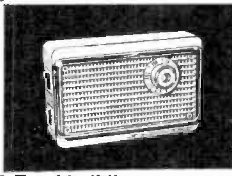

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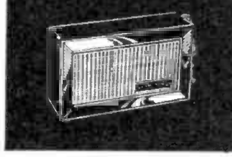

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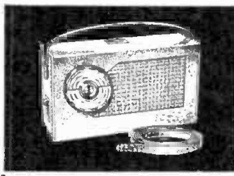

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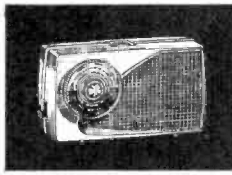

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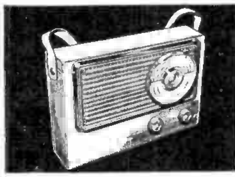

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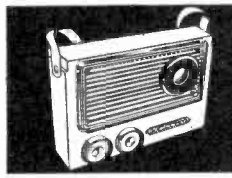

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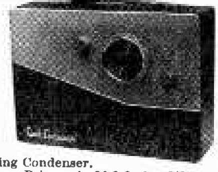

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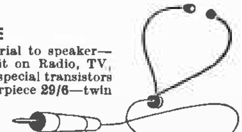

Easiest way to fault find—traces signal from aerial to speaker—when signal stops you've found the fault. Use it on Radio, TV, amplifier, anything—complete kit comprises two special transistors and all parts including probe tube and crystal earpiece **29/6**—twin stetoset instead of earpiece 7/6 extra—post and ins. 2/9.

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Piv	50V	100V	300V	400V
1 amp	3/6	4/-	6/6	7/6
3 amp	4/-	4/6	7/6	8/6
25 amp	30/-	35/-	47/6	60/-

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TYX-FL and TYX-F. Both popular types fitted to many cookers. Suitable for 230/240v. up to 15 amps. Handy device to have around the workshop. **12/6** each.

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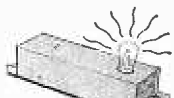
750mA. 100v. 1/3	1 Amp. 100v. 3/-	3 Amp. 100v. 3/6	10 Amp. 100v. 9/6
200v. 1/6	200v. 4/-	200v. 5/-	200v. 12/6
400v. 3/6	400v. 6/-	400v. 7/6	400v. 14/6
		600v. 9/6	

Sub-miniature glass encased—only approx. ⅜in. long, wire ended. 400mA. 50v. 1/6; 100v. 2/6; 200v. 4/6

OZONE AIR CONDITIONER



For removing smells and generally improving oppressive atmosphere. In neat hammer finish box. Uses Philips ozone lamp and mains unit. Lamp easily replaceable. Only **39/6** plus 6/6 carr. and ins.

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Suitable for ring mains etc. Surface mounting type, takes the modern fused plug. 30/- doz. plus 4/6 post.

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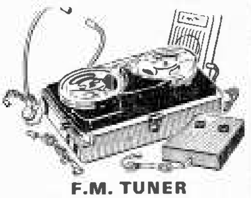

Battery operated and with all accessories. Really fantastic offer a British made £31 outfit for only **£6 19.6** brilliantly designed for speed and efficiency—cassette takes normal spools drops in and out for easy loading—all normal functions—accessories include:—stethoscopic earpiece—crystal microphone 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**.

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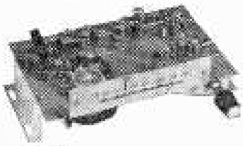

of exceptional quality, giving really fantastic results with virtually no noise. Suitable for mains or battery operation, 6 transistors—three IF stages—double tuned discriminator. Complete, new, and built up all ready to work on chassis. Size 6 x 4 x 2in. with tuning scale and slow motion drive. A £12.12.0 tuner for only **£6.19.6.**

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Remote Controller for Philips, Stella and Cossor TV sets but adaptable to most others, and to model control. Comprises three rock switches, two variable resistances and component including Mullard OA81—Knobs—10 way plug—11ft. 7 way cable, etc.

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Want to open your garage door with a toot? Or close your curtains with a whistle? Or make anything obey your command? Then first you need an Audio Switch. We offer complete kit, including 5 transistors, Veroboard panel, all the resistors and condensers and the relay with diagrams, etc., for making. **48/6** plus 2/6 post and insurance.

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1. Planes everything smooth. **2.** Planes convex and concave. **3.** Planes in all corners. **4.** Scrapes everything clean. Complete with 5 blades

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1H5GT	7/3	10F1	9/9	DH81	12/6	EF184	5/9	PENA4	6/9	UCH42	9/9
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6/30L2	11/9	30C15	11/6	EAF42	8/6	EY51	7/-	PY80	5/3	VP1321	21/-
6AL5	2/3	30C17	12/6	EB91	2/3	EY86	6/3	PY81	5/3	Z77	3/6
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6AQ5	4/9	30F5	12/-	EBC41	8/-	EZ41	6/9	PY83	5/9	AC107	10/-
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6AU6	5/6	30FL14	12/6	EBF89	5/9	EZ81	4/9	PY800	6/-	AD140	15/6
6BA6	4/6	30L15	14/-	ECC81	3/9	KT61	8/9	PY801	6/-	AF102	18/-
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6BR7	7/9	30P19	12/-	ECC85	4/9	PC88	9/6	U25	11/6	AF118	8/6
6C86	6/6	30PL1	12/6	ECF80	7/-	PC97	5/6	U26	11/6	AF124	7/6
6F1	7/9	30PL13	14/6	ECF82	6/9	PC900	7/9	U47	13/6	AF125	7/6
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6L18	6/-	B36	4/9	ECL82	6/3	PCF800	11/6	UABC80	6/3	OC45	3/3
6V6G	3/6	B729	12/6	ECL86	7/9	PCF801	7/9	UAF42	7/9	OC71	3/6
6V6GT	6/6	CCH35	9/-	EF39	3/9	PCF802	9/6	UB41	6/6	OC72	4/9
6X4	3/6	DAC32	7/3	EF41	9/6	PCF805	11/9	UBC41	6/9	OC75	5/9
6X5GT	5/9	DAF91	3/9	EF80	4/9	PCF806	11/6	UBF80	6/-	OC81	3/6
7B6	10/9	DAF96	6/-	EF85	5/-	PCF808	12/6	UBF89	6/9	OC81D	3/6
7B7	7/-	DCC90	8/6	EF86	6/3	PCL82	6/9	UBL21	9/-	OC82	5/9
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Postage on 1 valve 9d. extra. On 2 valves or more, postage 6d. per valve extra. Any Parcel Insured against Damaged in Transit 6d. extra.

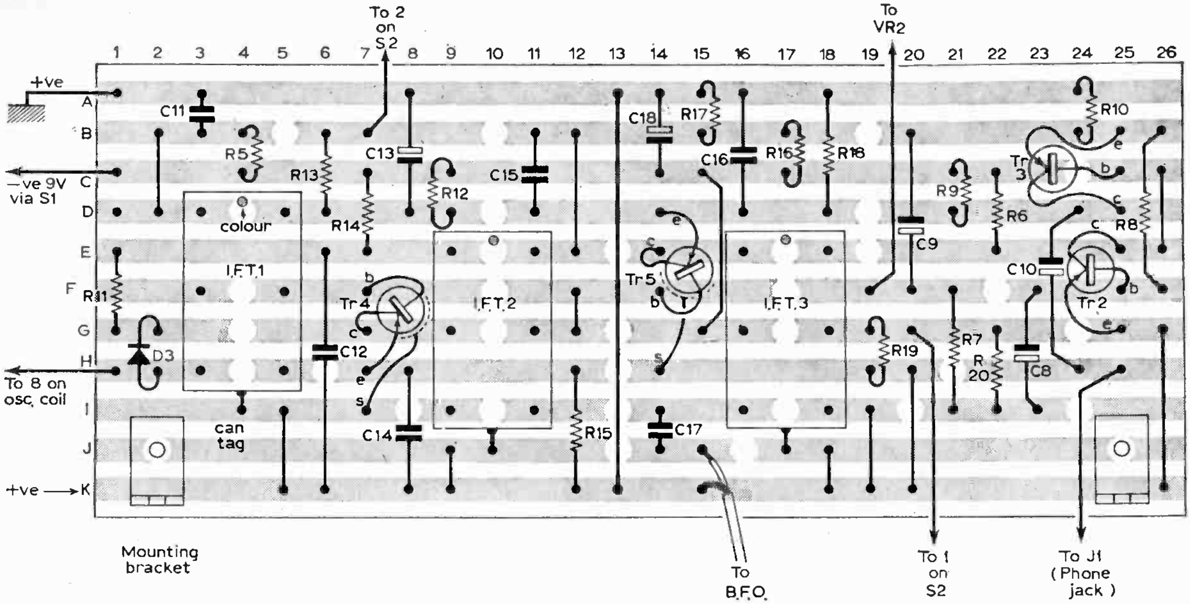

Fig. 23: Layout and wiring of the complete i.f./a.f. panel.

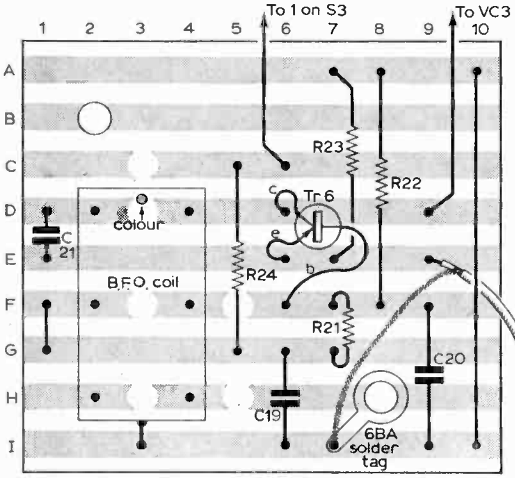

Fig. 24: Layout and wiring of the b.f.o. panel.

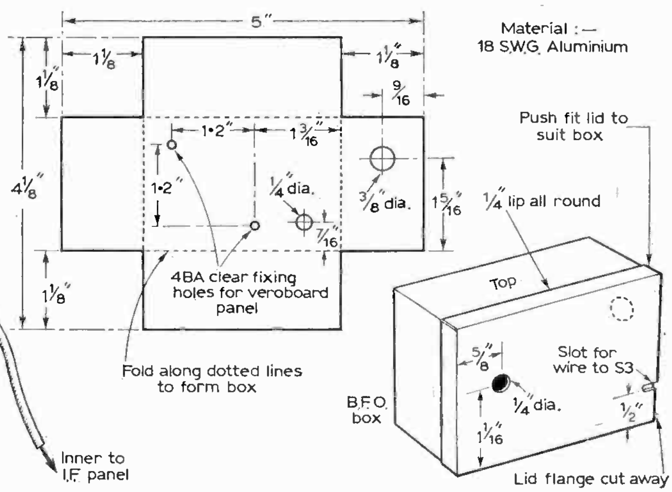

Fig. 25: Constructional details of the b.f.o. box.

The lid of the b.f.o. box has the flange removed at one corner is shown in Fig. 25, to clear the edge of the chassis. A hole is drilled in the lid to allow access to the tuning core of the b.f.o. coil when the lid is in place. The completed i.f. and a.f. panel is mounted in position shown in Fig. 21, by using two small right-angle brackets. Details of these are given in Fig. 20. The position of the b.f.o. box is also shown in Fig. 21 and to facilitate the mounting of the b.f.o. box, the b.f.o. switch and the a.v.c. switch, it is necessary to provide extra holes in the front panel as detailed in Fig. 22.

The i.f./a.f. panel and the b.f.o. unit are then wired to the various controls and other parts of the chassis, keeping the wiring tidy and close to the chassis wherever possible. After a check of all components, connections and wiring, the receiver is ready for testing.

Alignment

A signal generator with facilities for internal amplitude modulation is required and alignment may be carried out, in the usual way, as follows.

1—Set the receiver controls as given below:

ON/OFF	ON
B.F.O.	OFF
A.V.C.	OFF
TUNING	1·6Mc/s
A.F. GAIN	max.
R.F. GAIN	max.

2—Set the signal generator to 470kc/s with the modulation "on".

3—Inject the signal between chassis and Tr5 base. The connection to the base should be via a suitable (0·01μF) coupling capacitor.

—*continued on page 858*

practically wireless commentary by HENRY

No. 42

That Devilish Dealer

ACCORDING to one of those gay ladies, whose re-hashed diffusions appear regularly in the dailies around Salestime: *"Bargains can be found in the most unlikely corners if you plan your buying campaign."*

Some of these seem to reach the service counter of the radio dealer just about now. Lulled by the thought that the "slack season" is coming up and every little extra penny (Sorry, Mr. Wilson, "cent") helps stave off the shadow of the bailiff's bowler hat, he accepts the repair job. Inevitably, he will regret it.

You know the sort of equipment. Sold at giveaway prices, or advertised as foolproof kits, it sports such equivocal names as *"Super-10"* or *"High-Gain Special"* with no hint of manufacturer or indeed, of country of origin. The dealer draws upon his experience, relates the design to something similar in the more legitimate trade, and tries to order spares.

This is usually where the fun begins. The transistors will be coded unintelligibly, or have no known equivalents. No circuit will be available, and attempts to trace something from printed circuit and short, brittle, illogically-coloured wires generally end up looking like a cast-off from Ronald Searle or Topolski.

Stave off the bailiff's bowler.

So the bargain turns out to be a flop, and the dealer's five-minute job will make him a loss unless he has the sense to swallow his chagrin and hand it regretfully back to the owner. Then, bang goes another reputation! *"He couldn't do a straightforward repair,"* howls the disappointed customer.

Rubbing salt into the wound, the ubiquitous "chap round the corner" gets the thing going after a fashion. It is too often overlooked that he gives no sort of guarantee, may have "fiddled" the equipment, and can charge peanuts because of his minimal overheads and the fact that he does it out of a genuine interest, not costing his hours as he would have to in a commercial business.

Does that sound like sour grapes? Henry is a practising serviceman—has been for what seems a chunk off eternity—and feels pretty strongly about business ethics. He knows, as do most responsible dealers and service managers, that time is the biggest cost factor of all. Some jobs are inevitably timewasters. Experience provides the best short-cuts, and experience should be paid for. More important, the finished job should be up to some sort of reliable standard—even if the original specification cannot be attained. Henry and his mates are putting their stamp of approval on the repair; sticking their necks out.

This was rubbed in lately when a reader blew up about the refusal of a service agent for a well-known manufacturer to put his ageing tape recorder back to rights. *"Use your influence to shake up the manufacturers,"* he told the Editor, *"all it wants is a spring."*

Further investigation showed that the agents had *not* refused service, but had advised him it would hardly be economical. In view of the age of the machine, and their experience of the prevalence of certain faults, plus the time it would take to check the relays, switches and solenoid-operated mechanism to obviate future breakdowns, they had to estimate a sum that was certainly more than the trade-in value!

Shake up the manufacturers.

Experienced readers would order the missing part and tackle the job themselves.

The alternative—have the job done properly, up to some stated level of reliability, with a guarantee of the work done, and be prepared to pay for the repair.

As a footnote—not every "simple" job is quite so straightforward as it seems. Just this week we had a tiny transistor radio handed to us with the laconic note on the worksheet: "Change batteries." First reaction was: *"Why didn't the customer change them himself?"*

This became obvious when we tried to take off the battery compartment cover. It was glued tight with a horrible chemical mess of burst cells that had spread all over the printed circuit and even jammed the wave-change switch. It took three and a half hours to clean out that set, trace the short-circuit in the output stage, change the transistor and its emitter resistor and finally —fit new batteries.

Well, what would you have charged, Joe?

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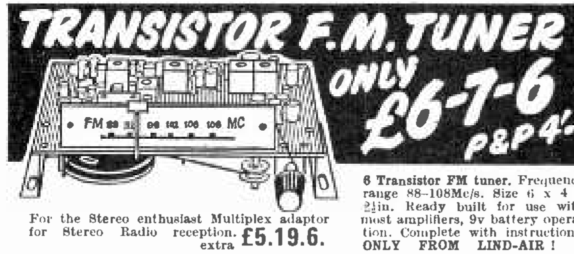
3 Transistor AM Tuner covering full medium wave. Size 4½ x 2¾ x 2¾in. Ready built. 9v. battery operation. Complete with instructions.



For the Stereo enthusiast Multiplex adaptor for Stereo Radio reception. extra **£5.19.6.**

6 Transistor FM tuner. Frequency range 88–108Mc/s. Size 6 x 4 x 2½in. Ready built for use with most amplifiers, 9v battery operation. Complete with instructions. ONLY FROM LIND-AIR !

SPECIAL OFFER OF GARRARD DECKS

Model 3000 with Sonoton 9TAHC Stereo Cartridge	**£8.19.6**
AT60 Mk. I less cartridge	**£9.19.6**
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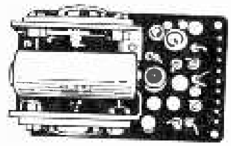
SP25 Mk. II less cartridge	**£10.19.6**
LAB80 Mk. II less cartridge	**£24.19.6**

Mono Cartridge 17/6 extra.
Stereo Cartridge 22/6 extra.

TEAK FINISH PLINTHS with perspex cover **6 gns.** (For LAB80 8 gns.). P. & P. 5/-. Agents for Thorens, Dual, Goldring. Prices on request.

SINCLAIR PRODUCTS



MICROMATIC RADIO. KIT ONLY **49/6.** P. & P. 2/6
MICROMATIC RADIO BUILT. ONLY **59/6.** P. & P. 2/6.
MICRO FM. KIT—**£5.19.6** complete. P. & P. 2/6
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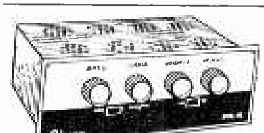
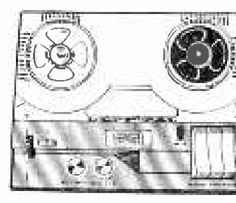
PZ4. Mains Power Supply Unit **£4.19.6.** P. & P. 2/6

LINEAR AMPLIFIERS



Latest A.C. Mains Models offering highest quality at modest cost.
LT66. All Transistor 12 watts Stereo. Inputs for Tuner, Gram, Mike. Separate Bass, Treble, Balance and Volume Controls. **£15.15.0.** Carr. 7/6. **Teak case £3.10.0 extra.**
PTA 15 (as illus.). All Transistor, 15 watts Mono. Inputs for Tuner, Gram, Mike, Guitar, Bass, Treble and two volume controls, **£15.15.0.** Carr. 7/6. Teak case **£3.10.0** extra. **LT45.** 2 Valve 5 watts Mono. Inputs for Tuner, Gram, Bass, Treble and volume controls, **£6.19.6.** Carr. 5/6. Metal cover 15/- extra. **Full details sent on request.**

MAGNAVOX-COLLARO 363 TAPE DECKS

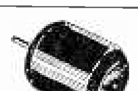


The very latest 3-speed model—1⅞, 3¾, 7½ i.p.s. available with either 2 track or 4 track head. Features include: Pause control; digital counter; fast forward and rewind; new 4-pole, fully screened induction motor; interlocking keys. Size of top plate 13½ x 11 x 5¼in. deep below unit plate. For 200/250v. A.C. mains, 50 c.p.s. operation. New, unused and fully guaranteed.
2 track model **£10.10.0** 4 track model **£13.19.6**
Carriage and Packing 7/6 extra.

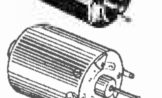
MARTIN TAPE AMPLIFIERS

FOR USE WITH ABOVE DECKS. 2 track model **£14.19.6;** 4 track model **£15.19.6.** Carriage and Packing 7/6.

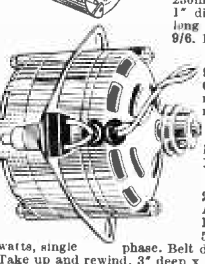
MOTOR BARGAINS



Ideal for model makers, record payers, tape decks, etc.



6.3 D. C.Motor. 10,900 r.p.m. at 230mA. 1⅜in. x 1" dia. Shaft ⅛" long x 3/64" dia. **9/6.** P. & P. 2/6.



9v. D.C. Gram deck replacement motor. 2" x 1¼" dia. Shaft ⅛" long x 3/32". **17/6** P.P. 2/-.

200/250v. A.C. Tape Deck Motor. 50c/s. 50/- watts, single phase. Belt drive pulley. Take up and rewind. 3" deep x 3" dia. Two are used together with capstan motor. Easy mounting. **27/6.** P. & P. 5/6.

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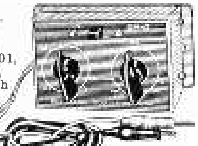

OM.B. 9 Capitance ranges ·0001, ·0010 ·0022, ·0047, ·01, ·022, ·047, ·1, ·22, mfd. With leads and clips. **29/6** P. & P. 2/-.
O.M.G. Two Resistance ranges. Low: 15 ohm to 10 K ohm (1 watt resistors). High: 15 K ohm to 10 meg. ohm. (½ watt resistors). Selects 24 separate resistances. With leads and clips **42/6.** P. & P. 2/-.

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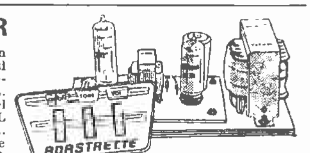
Vantena Table Top V Aerial BBC/ITV, **25/-. Cresta** Room Aerial Bd I/II/III. Cream or black **25/-. Veemaster** Table Top VHF/UHF tunable aerial. Chrome or Grey **70/-. YAG1** All channel table top aerial BBC1/2/ITV/. VHF. **65/-. HL535 Loft Aerial.** Hilo V +5 for vertical. Band I/III. With mounting arm and bracket. **49/-. New Major,** 10 element BBC2 aerial for loft or outdoor fixing. With roller bracket for up to 2in. dia. mast **42/6 H1. Hunter.** 13 element BBC2 aerial as above, **53/-. E1. Explorer** 18 element BBC2 aerial as above **64/6. Loft Six.** 6 element BBC2 aerial for loft or outdoor fixing. With arm and bracket, **34/6. YAG1,** 4 element outdoor Band II VHF/FM stereo aerial. With mast, **44/-.** Please add postage.

2-3 WATT AMPLIFIER

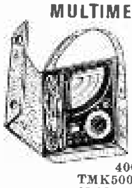


An ideal basis for building your own portable record player. Just add speaker and turntable and you will have an above-average model for a mere fraction of the cost. 2–3 watt printed circuit with control panel on flying lead. ON, OFF, TONE CONTROL AND VOLUME, colourful escutcheon. Brimar valves: EZ80, ECL82 and composite installation booklet Price **£3.17.6** P. & P. 3/6.

PROFESSIONAL ELECTRIC INSTANT HEAT SOLDER GUN

Ideal for model makers, home repairs, electronics, radio, TV, etc. Unique features include interchangeable tips, extension barrels, comfortable grip with trigger control. "U" shaped 3½in. bit to minimise wear. Light beam is automatically directed on to end of bit when ON/OFF trigger is in use, 85 watt element with special ventilation. Complete with 2-pin, 5 amp. plug. 230-250 volts Spares available. **49/6** +2/6 P.P.

MULTIMETERS



TTC1001 (as illus.) 20,000 opv **£3.19.6.**
C1000. 1,000 opv **£2.2.0**
Caby NH 200 20,000 opv **£6.10.0**
Caby B40 4000 opv **£6.10.0**
TMK500 30,000 opv **£9.19.6.**
TTC Model 1030 50,000 opv **£9.19.6**
TTCModel1031 100,000opv **£12.19.6**
Also stockists of Avo, Nombrex, Eagle etc. Test equipment. P.P. 3/6

AUTO TRANSFORMERS

Input 0–200, 220 240 v. Output 110 v.

50w.	£1 7 6	600w.	£6 9 6
75w.	£1 17 0	1,000w.	£9 9 0
100w.	£2 5 0	1,500w.	£15 15 0
150w.	£2 15 0	2,000w.	£18 10 0
200w.	£3 5 0	3,000w.	£25 10 0
300w.	£4 5 0	4,000w.	£34 18 0
400w.	£4 19 6	0·30v. 1 amp	£1 10 0
500w.	£5 9 6	0.30v. ½ amp.	17 9
		0·30v. 2 amp.	£1 17 6
		0·30v. 3 amp.	£2 2 0

MAINS TRANSFORMERS

Input 200–250v. 50 c/s.

24v. 3 amp.	£2 12 6	24v. 8 amp.	£5 5 0
24v. 5 amp.	£3 15 0	24v. 12 amp.	£5 15 0

Post extra.
Mains and Output Transformer Lists available on request.

TRANSISTORS

OC3	6/-	OCP71	19/6
OC16	20/-	ST721	15/-
OC23	15/-	ST723	10/-
OC28	12/6	ST140	4/-
OC22	10/-	ST141	6/-
OC24	17/6	V62R	6/-
OC25	9/6	V64R	6/6
OC29	15/-	V68R	7/-
OC35	12/6	V1050A	6/-
OC36	12/6	V1520P	10/-
OC41	6/-	V1530P	10/-
OC42	5/-	V1302P	8/-
OC44	5/-	V60201P	8/-
OC45	2/6	V6030	10/-
OC66	19/6	BFY50	8/6
OC70	4/-	BFY51	7/-
OC71	4/-	BFY52	6/-
OC72	5/-	BYZ12	10/-
OC73	6/6	BYZ13	10/-
OC75	6/-	BCY33	7/6
OC76	5/-	BCY34	8/6
OC77	7/-	BCY10	7/6
OC78	5/-	BCY38	9/6
OC78D	5/-	BCY39	12/6
OC81	5/-	BCY12	5/6
OC81D	5/-	AC107	14/6
OC82	6/-	AC127	9/-
OC123	11/6	ACY17	8/6
OC139	8/-	ACY19	6/6
OC140	10/-	ACY20	5/6
OC170	6/-	ACY21	6/-
OC171	7/-	ACY22	4/6
OC200	7/6	AF102	18/-
OC201	12/6	AF114	7/-
OC202	13/6	AF115	6/6
OC203	10/6	AF116	7/-
OC205	15/-	AF117	5/-
OC206	19/6	AF118	17/6

AF124	10/-
AF125	10/-
AF126	10/-
AF127	9/6
AF139	10/-
AF186	17/6
AFZ11	17/-
AFZ12	12/6
ASY26	6/6
MAT100	7/9
MAT101	8/6
MAT120	7/9
MAT121	8/6

VALVES

EL84	6/6
EF86	9/6
EY86	9/6
DY87	9/6
ECC83	6/6
ECC81	5/6
EABC80	8/6
UL84	8/6
UF41	10/6
UY41	7/6
EZ80	6/6
EZ81	6/6
PCC84	7/6
PCL85	9/6
PCL82	8/6
PCL86	9/6
KT66	25/-
KT88	27/6
DY86	9/6
EBC33	8/6
DK96	6/6
DAF96	6/6
DL96	7/6
DF96	7/6
PY81	6/6
PL81	10/6
PY33	13/6
PL36	11/6

DIODES

OA5	4/6	OA9	4/6
OA3	3/-	OA10	3/-
OA71	3/6	OA47	3/-
OA81	2/6	OA70	2/-
OA95	1/9	OA79	2/6
OA200	3/3	IN91	3/-
OA202	4/3	IN253	7/-
OA203	4/-	IN254	4/-
OA210	7/6	IN255	6/6
		IN537	6/6
		IN647	5/-
		IN2373	5/6
		IN2374	15/-
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		IN58	3/6
		INU59	3/6

GEX44	2/6
GEX54	2/-

PGT Power Mounting Kits 3/9

We have a complete range of new and old types of valves, transistors and diodes. List available on application.

DE LUXE PLAYERS

4-Speed Mono Players 2-tone Cabinets 17×15×8¼in. 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 4/6 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

BSR TU9	£3.7.6
Garrard SRP22	£5.9.6
Garrard SP25	£12.19.6
Philips AG1016	£12. 9.6
Garrard A.70	£14.19.6
Garrard LAB80	£24.19.6
Garrard 401	£29.19.6

AUTOCHANGE MONO

BSR UA70 Transcription Changer	£10.19.6
BSR Superslim	£5.19.6
Garrard 1000	£6.19.6
AT60 Mk II	£12.19.6

All with mono LP/78 cartridge. (Stereo 20/- 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 template and two plug-in shells. OUR PRICE **90/-**
Decca Deram Stereo Diamond Cartridge £4.10.0 extra or Stereo Moving Coil Diamond 20-18,000 cps £5.5.0. extra.

Q MAX CHASSIS CUTTER

Complete: a die, a punch, an Allen screw and key
½in. 14/6 ⅝in. 15/9 1⅛in. 18/- 1½in. 20/6 2³/₃₂in. 37/9
¾in. 14/9 1in. 18/- 1¼in. 18/6 1¾in. 22/6 2¼in. 44/3
⅞in. 15/6 1¹/₁₆in. 18/- 1⅜in. 20/- 2in. 34/3 1in. sq. 31/6

PICK-UP ARM Complete with ACOS LP-78 Turnover Head and Stylii 20/-; ACOS GP67. 15/-; B.S.R. TC8 25/-.
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 × 12 in. 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., **49/6**
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NEW MULLARD TRANSISTORS

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

REPANCO TRANSISTOR TRANSFORMERS

TT45. Push Pull Driver. 9:1 CT. .. 6/-
TT46. Push Pull Output. CT 8:1. .. 6/-
TT49. Interstage etc. 4·5:1 5/- TT52. Output 3 ohms. 20:1 5/-

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

WEYRAD P50 — Transistor Coils

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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Telescopic Chrome Aerials 6in. extends to 23in. 5/-.

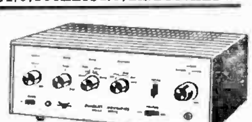
VOLUME CONTROLS

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 40 yd. 20/-; 60 yd. 30/-.
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. CAR AERIAL PLUGS 1/6; SOCKETS 1/3; LINE SOCKET 2/-

EAGLE SA200 INTEGRATED STEREO AMPLIFIER



7½ watts per channel. Inputs for gram, tape, tuner, mike, aux. tape output socket. Separate volume controls for each channel. Separate bass and treble controls. Stereo/Mono selector. Stereo headphone socket. Impedance. 4, 8 or 16 ohms.
STILL ONLY **£25** POST FREE

THE E.A.R. RECORD PLAYER CABINET

Strongly built wooden cabinet covered in Blue and Grey leathercloth. Size 15×17×8in. Motor Board 14½×12½in. ready cut out for B.S.R. Monarch UA12/14/15/16/25 decks. Gilt fittings, strong carrying handle. Amplifier space size 14×7×3in. is completely enclosed. The baffle board is cut out for a 6½in. dia. speaker. Post 5/6. **59/6**

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/-; 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/-.

'SONOCOLOR' CINE RECORDING TAPE

Superior quality. 5" reel. 900' LP with strobe markings also cine light deflector-mirror. Suitable all tape recorders and cine projectors. List 28/- OUR PRICE 14/- each. Post 2/6.

NEW B.A.S.F. LIBRARY BOXED TAPE
7 in. L.P. 1,800 ft. 45/-; 7 in. O.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.
Reuter Tape Heads for Collaro models 2 track 21/- pair.

MAINS TRANSFORMERS

Post 5/- each

250-0-250 80mA. 6.3 v. 3.5 a, 6.3 v. 1 a, or 5 v. 2 a.	30/-
350-0-350 80 mA. 0.3 v. 3.5 a. 6.3 v. 1 a, or 5 v. 2a.	35/-
MT. 510/300-0-300v. 120 mA., 6.3 v. 4 a.	29/6
MINIATURE 200 v. 20 mA., 6.3 v. 1 a.	12/6
MIDGET 220 v. 45 mA., 6.3 v. 2 a.	17/6
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.	12/6
Ditto tapped sec. 1.4 v.. 2. 3, 4, 5, 6.3 v. 1½ amp. ..	12/6
GENERAL PURPOSE LOW VOLTAGE. Outputs 3. 4. 5. 6. 8. 9, 10, 12, 15, 18, 24 and 30 v. at 2 a.	30/-
1 amp.. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48. 60.	35/-

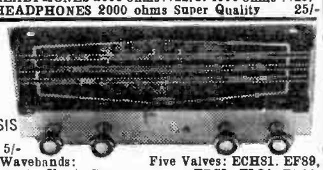
AUTO TRANSFORMERS 0-115-230 v. Input/Output. 60w. 18/6; 150w. 30/-; 500w. 92/6; 1000w. 175/-.

CRYSTAL MIKE INSERTS

1½ × ⅝in. 6/6; ACOS 1⅜ × ⅜in. 8/6. ACOS 39. 1in. dia. 12/6
MOVING COIL MIKE with Remote Control Switch. .19/6

ALL PURPOSE HEADPHONES

LOW RESISTANCE HEADPHONES, 3-5 ohms. 25/-
H.R. HEADPHONES 2000 ohms ..12/6. 4000 ohms ..15/-
H.R. HEADPHONES 2000 ohms Super Quality 25/-



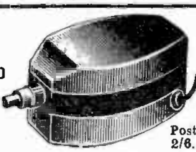
1968 GRAM CHASSIS

Post 5/-
Three Wavebands: Long., Med. Short, Gram. Five Valves: ECH81. EF89, EBC8, EL84, EZ80. 12-month guarantee. A.C. 200-250 v. Ferrite Aerial 5 watts 3 ohm. Chassis 13½in. × 7in. × 5in. dial size 13in. × 4in. Two pilot Lamps. Four Knobs. Aligned calibrated. Chassis isolated from mains **£10.19**
DE LUXE STEREO GRAM CHASSIS V.H.F., MW. SW 19-50m. SW 60-180m. Magic eye. push buttons, 6 valve plus rect. Size 15 x 7½ x 6in. high. **£19.19**

TAPE DECK AMPLIFIERS FOR B.S.R. T.D.2 ETC. With Pre Amplifier, Oscillator, all valves. "magic eye" tuning indicator, 3 watt 3 stage amplifier especially built for B.S.R. T.D.2 Tape Deck. Bolts directly to tape deck chassis. Inputs for mike and radio/gram. Output 3-5 ohms. A.C. 200/250v. Ready built. PRICE £7.19.6. Carriage and Insurance 5/6.

BLANK ALUMINIUM CHASSIS. 18 s.w.g. 2½in. sides, 7×4in., 5/6; 9×7in., 6/6; 11×3in., 6/6; 11×7in., 7/6; 13×9in., 9/6; 14×11in., 12/6; 15×14in., 15/-.
ALUMINIUM PANELS 18 s.w.g. 12×12in., 5/6; 14×9in., 4/6; 12×8in.. 3/6; 10×7in., 2/9; 8×6in., 2/- 6×4in. 1/6.

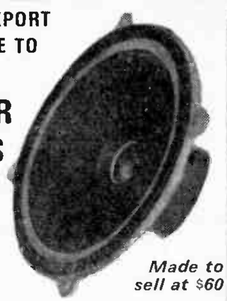
THE INSTANT BULK TAPE ERASER AND RECORDING HEAD DEMAGNETISER



200/250 v. A.C. Leaflet S.A.E. Post 2/6. **35/-**

CANCELLED EXPORT SHIPMENT DUE TO DOCK STRIKE!

15" BAKER WOOFERS



20-10,000 cps. Bass Resonance 18-25 cps. Massive Ceramic Ferrobar Magnet. Flux density 15,000 lines. Rated 20 watts. 15 ohms. Overall depth only 6½in. Weight 15lb.

Made to sell at $60

OUR PRICE **£11.19.6** Carriage, packing and Insurance 10/6.

'Group 25'	'Group 35'	'Group 50'
12in. 25w. **5 gns.**	12in. 35w. **8½ gns.**	15in. 50w. **18 gns.**

"BONDACOUST" Wadding 18in. wide. 2/6ft.

E.M.I. Cone Tweeter 3½" square, 3-20kc/s, 10w. 17/6.
Quality Horn Tweeters 2-18kc/s. 10w. 29/6. Crossover 16/6
LOUDSPEAKERS P.M. 3 OHMS. 2¾in., 3in. 4in.. 5in. 7in. × 4in., 15/6 each 8in. 22/6; 6½in. 18/6; 10in. 30/-; 12in. Double cone 3 or 15 ohm 35/-; 10×6in. 30/-; 8×5in 21/-; E.M.I. Double Cone 13½×8in.. 3 or 15 ohm models, 45/-
SPECIAL OFFER! 8 ohm. 2¼in., 5in.; 80 ohm. 2¼in.. 2¾in. 25 ohm, 5in., 6×4in.. 35 ohm, 3in.. 7×4in. EACH TYPE. 15 ohm, 3in., 7×5in., 10×2½in. **15/6**
JACK SOCKET Std. open-circuit 2/6, closed circuit 4/6; Chrome Lead Socket 7/6. DIN 3-pin 1/3, 5-pin 1/6; Lead 3/6. Phono Plugs 1/-. Socket 1/-. JACK PLUGS Std. Chrome 3/-; 2.5mm.; 3.5mm. 1/9; DIN 3-pin 3/6; 5-pin 5/-.
WAVE-CHANGE SWITCHES WITH LONG SPINDLES.
2 p. 2-way, or 2 p. 6-way, or 3 p. 4-way 3/6 each.
1 p. 12-way, or 4 p. 2-way, or 4 p. 3-way, 3/6 each.
Wavechange "MAKITS" 1 p. 12-way, 2 p. 6-way, 3 p. 4-way, 4 p. 3-way, 6 p. 2-way. Prices include click spindles, adjustable stops, spaces, etc., 1 wafer, 10/6; 2 wafer, 15/-; 3 wafer. 19/6.
TOGGLE SWITCHES, sp. 2/-; sp. dt. 3/6; dp. 3/6; dp. dt. 4/-.

ALL EAGLE PRODUCTS

Catalogue 5/-

EAGLE DE LUXE TAPE SPLICER. Cuts, trims joins for editing and repairs. With 3 blades. **17/6**

EAGLE 4 CHANNEL TRANSISTOR MIXER. Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. **59/6**

EAGLE DYNAMIC MICROPHONE. Impdnce. 600 ohm/50k Universal Mtg. 70-12,000 cps. **£6.6.0**

EAGLE FM TUNER 88-108 Mc/s Six Transistor. Ready built. Printed Circuit. Calibrated slide dial tuning. Size 6 × 4 × 2½ in. **£8.10.0**

EAGLE 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control **69/6**

★ RADIO BOOKS ★ (Postage 9d.)

High Fidelity Speaker Enclosures and Plans........	5/-
Transistor Superhet Commercial Receivers..........	7/6
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Radio Valve Guide. Books 1, 2, 3 or 5..........	5/- each
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Wireless World Radio Valve Data	9/6
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RESISTORS. Preferred values, 10 ohms to 10 meg. ¼ w., ½ w., 1 w., 20% 3d.; 1½ w. 8d.; 2 w. 1/-; ½ w. 10% 6d.
HIGH STABILITY. ½ w. 1% 10 ohms to 10 meg., 2/-. Ditto 5%. Preferred values 10 ohms to 22 meg.. 9d.

5 watt	0.5 to 8.2 ohm 3 w.	1/6
10 watt	WIRE-WOUND RESISTORS	1/9
15 watt	10 ohms to 6,800 ohms	2/-

10K, 15K, 20K, 25K, 68K. 10W. 3/-
MAINS DROPPERS. Midget. With sliders. 0.3 a.. 1 K., 0.2 a., 1.2 K., 0.15 a., 1.5 K., 6/- each.

WIRE-WOUND 3-WATT POTS. T.V. Type. Values 10 ohms to 30 K., 3/3, Carbon 30 K, to 2 meg., 3/-.

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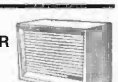

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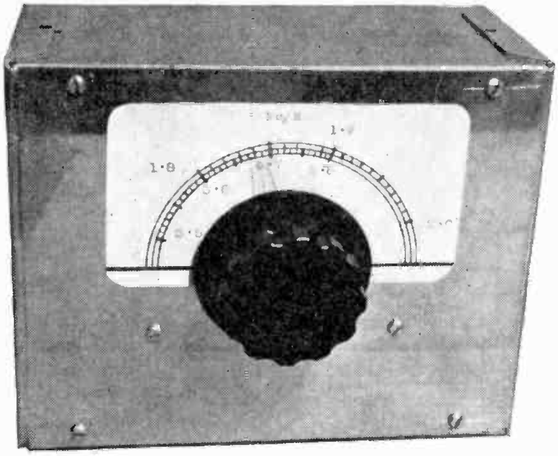


V.F.O.

FOR THE MINIATURE PHONE TRANSMITTER

F. G. RAYER G3OGR

THIS v.f.o. is intended for use with the "Miniature Phone Transmitter" described last month but could be employed to drive other transmitters. The v.f.o. is constructed in an aluminium case matching the transmitter described.

The circuit (Fig. 1) is capable of very good results. Changes in the inter-electrode capacity in the valve due to heating etc., are largely swamped by C2 and C3. The oscillator circuitry is effectively isolated from the output (anode) circuit, thus changes in loading and the effects of modulation are minimised. The h.t. supply is stabilised by V2, the anode jumper connection being used so that the unit will not function if the regulator is removed.

COVERAGE

On 3·5Mc/s the v.f.o. covers 1·75—1·9Mc/s, the first stage of the transmitter acting as a doubler. The coverage may be adjusted to 1·8—2·0Mc/s for topband only, or 1·75—2·0Mc/s for two-band working.

Coil L1 has an inductance of 75μH and consists of 95 turns of 34s.w.g. enamelled wire close wound on a $\frac{1}{2}$in. diameter cored former. Smear the former thinly with clear Bostik or similar adhesive before winding. Medium wave oscillator coils intended for use with a 465kc/s i.f. and having adjustable cores

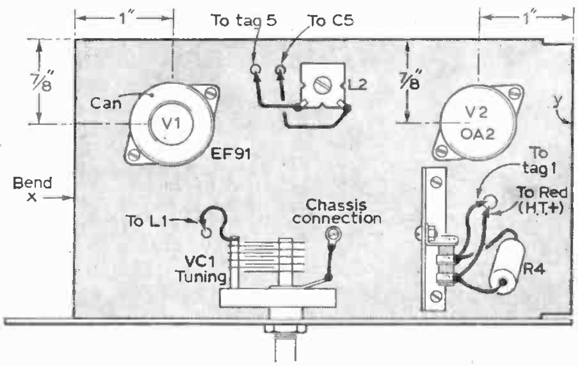


Fig. 2: Layout of the main components above the chassis

can usually be set to this inductance. Unused windings should be removed. Adjustment of the coil core and TC1 will allow variation in frequency and bandspread afforded by VC1.

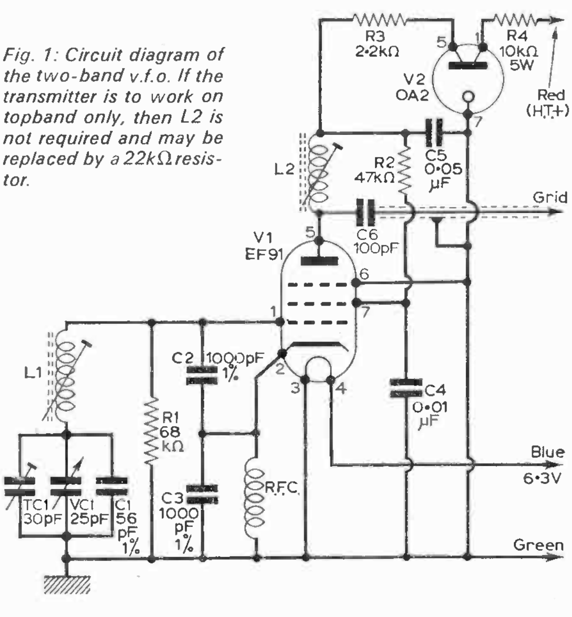


Fig. 1: Circuit diagram of the two-band v.f.o. If the transmitter is to work on topband only, then L2 is not required and may be replaced by a 22kΩ resistor.

CONSTRUCTION

Take the 7 x 3in. runner and draw a line across it $1\frac{3}{4}$in. from one end. Cut a 90deg. piece out of each flange opposite this line and bend at point X (Fig. 2) to obtain a chassis top $5\frac{1}{4}$ x 3in. with a side $1\frac{3}{4}$ x 3in. Punch two holes for the valve holders. The chassis is bolted to the panel in such a position that when the box is assembled the flange **Y** (Fig. 2) bolts to one side. Cut away the corners adjacent to Y to enable the end of the chassis to slip between the flanges on the side of the case.

Above chassis the coil L2 is fitted to the chassis with its securing clip. It is broadly resonant at the middle of the 80 metre band. No slow motion drive is used on VC1 as this was felt unnecessary, however there is sufficient room to fit one if desired. It is advisable to punch a hole in the bottom of the case directly opposite TC1.

The power supply and output connections terminate at a small tagstrip. A suitable multi-pin plug might prove preferable.

Apply power to the unit, or plug the v.f.o. into the companion transmitter and switch to Net. The original crystal oscillator will now act as a doubler and output will be heard between 3·5 and 4·0Mc/s.

For 80 metre operation only, put VC1 at half-mesh and adjust TC1 until the doubler output is heard on 3·65Mc/s. For top band only, adjust TC1 for output on 1·9M/cs with VC1 at half-mesh. For two-band working, adjust coverage to 1·75—2·0Mc/s.

To adjust L2, tune to about the centre of the band (say 3·65Mc/s) and rotate the core for maximum grid current in the 5763, as explained last month for testing the crystal oscillator. Grid current should be approximately 3mA falling slightly at band edges. The unit should now be calibrated and a suitable dial provided and marked accordingly.

★ components list

Resistors:

R1	68kΩ	½ watt
R2	47kΩ	½ watt
R3	2·2kΩ	½ watt
R4	10kΩ	10 watt

Capacitors:

C1	56pF 1% s.m.
C2	1,000pF 1% s.m.
C3	1,000pF 1% s.m.
C4	0·01μF 250V
C5	0·05μF 250V
C6	100pF s.m.
VC1	25pF variable
TC1	30pF trimmer

Inductors:

L1	see text
L2	QHF5 (Osmor)
L3	R.F.C.

Valves:

V1	EF91
V2	OA2

Miscellaneous:

Universal chassis 5 x 6 x 3in. for case, and universal chassis runner 7 x 3 both from Home Radio, Mitcham; two B7G valve holders, one skirted; one B7G valve can; knob; dial; wire; etc.

Capacitor VC1 is a standard value which results in a little unused rotation. For 80 metre use only, it might be preferred to spread the scale. This can be achieved by removing a plate or two from the back of the capacitor, but band edges should be reached before the capacitor is completely open or closed.

If the original transmitter is used for 160 metre operation only, then L2 is not required in the v.f.o. and may be replaced with a 22kΩ resistor. The 5763 grid current should run at 2—3mA with all stages working straight through on 160. ■

THE MW COLUMN

CONSIDERING the period of the sunspot cycle, conditions have been, very good, particularly with regard to East Coast North Americans and these have been coming through from at least 2230 and have also been well received in the period around dawn, together with various Latin Americans.

My own log this month includes: VOCM St. Johns (590kc/s). WNBC New York (660), WABC New York (770), XEW Mexico City (very good on 900 at 0500), PRF4 *Radio Journal do Brasil* (good at 2205 on 940), CHER Sydney (0455), WFCL Chicago (very good at 0105 on 1000), WINS (regular on 1010), WHN New York (also regular, on 1050), HJCT *La Voz de Costa*, Barranquilla (very good at 0500 on 1190), *Radio Puerto Cabezas* (good at 0125 on 1290), WCAU Philadelphia (1210), WINZ Miami (940), WBT Charlotte (1110, regular), WZOK Jacksonville (fair on 1320), WLCY St. Petersburg (fair on 1380), WSCS Charleston (very good on 1390), WOND Pleasantville (1400), WPOP Hartford (very good on 1410), WENE Endicott (fair on 1430), WOKO Albany (1460), WSAR Fall River (1480), WCKY Cincinnatti (fair on 1530), WQXR (regular on 1560), WSB Atlanta (good on 750), WJR Detroit (poor at 0300 on 760), CFDR Dartmouth (790), WHDH (good at 2350 on 850), WCBS (good at 2350 on 880), WBAL Baltimore (regular on 1090), YVOZ *Radio Tiempo* (fair on 1200), WWL New Orleans (good on 870).

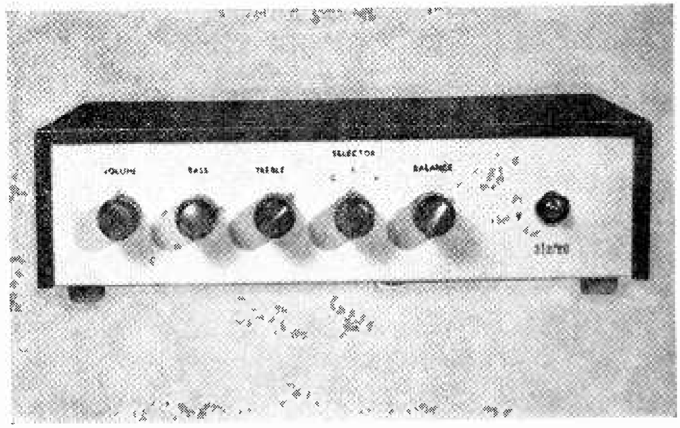
Others heard here recently are: Surinam on 725; Georgetown, Guyana (760); HJED Cali (820); CX16 *Radio Carve*, Uruguay (850); YVRQ *Radio Aeropuerto* (910); Anhwei, China (heard evenings on 940); a tentative KOMO Seattle (fair but QRM from XEOY and WCFL, 1000); YVQT *Radio Carupano* (very good, 1110); St. Pierre et Miquelon (good on 1375).

Here are a few new ones to look for. *Emisorra Official*, Angola, has been heard testing on 1088, which with the 1367 channel should now be operating with 100kW. The Broadcasting Corporation of Biafra is now using 620 and 953; *Radio Biafra* is on 1320 and 1397. *Kinshasa*, Congo, has been testing on 836 with 5kW.

There is a new station in Madeira *(Emisora Naçional)* using 1kW. It signs off at 2300, on 1331kc/s. *Radio El Aiun*, Spanish Sahara, now seems to have moved from around 656 (variable) to 998. A new station in Saudi Arabia was scheduled to go into operation at the end of last year using 1250kW; this would be the most powerful station in Europe. Near East and Africa. Has anyone heard it? Addis Ababa, heard here last season on 840 is reported to have moved to 855. Anyone heard it?

The early hours of the morning should now be producing good signals from India. When looking for these note that several new ones are now reported to be in use: Aijul (920), Colmbatore (1010), Gulbarga (1110), Agartala (1270), Bhagulpur (1470), Mathura (1530) Hyderabad B (1060), Udaipur (1170). Although most are low powered you never know. We also hear that 1000kW stations are planned for Bombay and Calcutta. **ALISTAIR WOODLAND**

ADAPTABLE LOW COST hi-fi SYSTEM



W. CAMERON **PART 4**

USING TWO OF THE CHANNELS DESCRIBED LAST MONTH TO GIVE A HIGH POWER STEREO AMPLIFIER

TWO of the high power circuits described last month can be combined to give a stereo unit, using ganged controls for the volume and tone control functions and adding a balance control.

Earth returns in the stereo unit obviously become of greater importance and Fig. 14 shows the system adopted to avoid troubles associated with feedback caused by high currents in the chassis. Not shown are the earth returns from the volume controls; these are taken to the earth line in the respective driver amplifiers.

The fuses in each of the supply leads must be of the ordinary quick-blow type and not anti-surge fuses, which apart from their undesirable (as far as transistors are concerned) delay have sufficient resistance to cause noticeable distortion and intermodulation.

The inputs as shown have series resistors which are suitable for, on gram, pickups with an output of 100 to 250mV/cm/S (the actual maximum r.m.s. output is several times this value) and, on radio, 100mV nominal. With higher outputs the resistor values should be increased proportionally. The auxiliary input is suitable for direct connection to a dynamic microphone or other device with an impedance of up to 30kΩ and output of 10 to 30mV. For higher impedances or outputs a series resistor must be included as discussed previously.

The wafer switch used for the selector is a Radiospares four-pole three-way one. Only two sections are used so some of the spare sections can be linked together to provide an anchor for the earthed braided outers of the screened leads.

BALANCE CONTROL

The balance control is simple and effective. It serves, with the series resistors, as a potential divider. Moving the slider toward the right-hand channel reduces the gain of that channel whilst the

SELECTOR SWITCH

Figure 15a shows the switching arrangement when stereo is required only on gram. Figure 15b gives an idea of the wiring between the "phono" type input sockets, switch and balance control. Mono recordings can of course be used with this arrangement, and the inclusion of a stereo-mono switch is not necessary.

Figure 16 shows the arrangement when either stereo or mono is required on all inputs. A slide or toggle switch should be mounted adjacent, and wired to, the balance control to effect stereo-mono changeover.

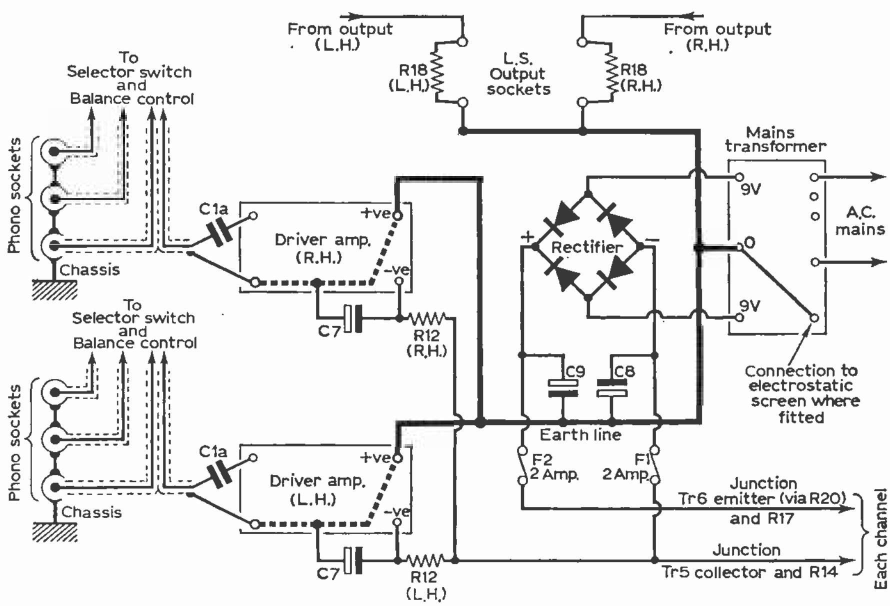


Fig. 14: Simplified schematic of wiring system used to avoid troublesome earth loops. No earth returns are made to chassis other than at the input. The most important return is from the speakers: this is taken direct.

gain of the left-hand channel increases, and vice versa. Note that the slider earth connection is made via the screened leads and not to chassis.

ANCILLARY EQUIPMENT

An amplifier, however good, will not make good deficiences in the signal source or speaker systems. For best results it is recommended that the speakers should have a flux density of not less than 10,000 gauss and a minimum frequency response of 50c/s to 15kc/s.

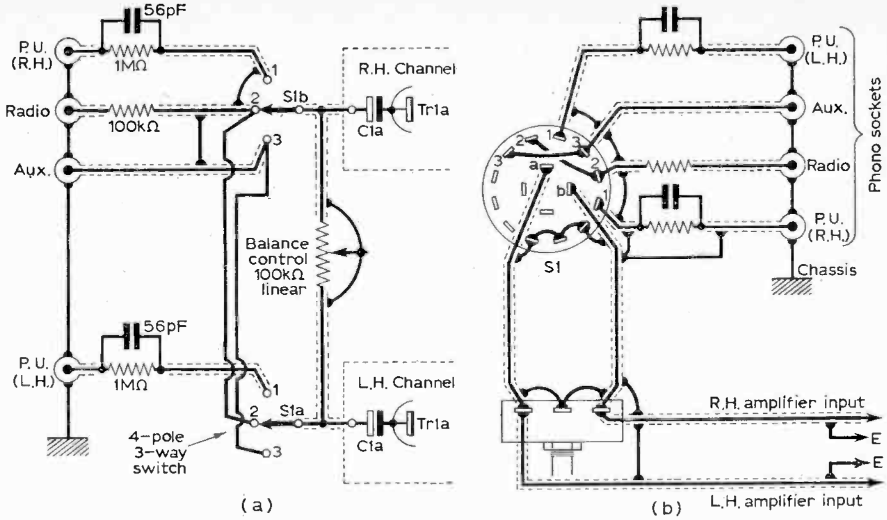


Fig. 15: (a) Input switching when stereo is required only on gram. (b) Wiring to the switch and balance control. The braided outers of the screened leads may be soldered to unused switch tags linked together.

The gram input is designed for a medium output crystal or ceramic pickup cartridge. One which gives excellent results is the Sonotone type 9TA/HC. It is particularly suitable with the popular Garrard 3000 changer. The radio input should be from a v.h.f./f.m. tuner.

CHASSIS

The complete amplifier chassis was made from a single piece of 18s.w.g. aluminium, size 12 x 13in., bent into a U section to provide a chassis 12 x 7 x 3in. This will accommodate all the parts for either a single mono amplifier or a complete integrated stereo unit. These notes will deal with the stereo arrangement, but obviously apply also to the mono version. Most constructors concerned only with mono at this stage will no doubt wish to add the second channel later.

The chassis size allows for a mains transformer of the clamp construction type, with fixing centres of up to $3\frac{1}{2}$in. The group panels on which the driver amplifiers have been constructed are each secured with two 6BA bolts, a couple of 6BA nuts on each serving as distance pieces to hold the boards clear of the chassis.

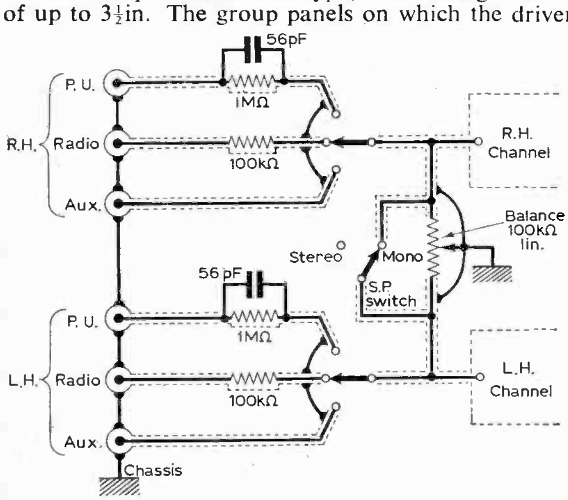


Fig. 16: Switching arrangement when mono or stereo selection is required on all inputs.

MOUNTING POWER TRANSISTORS

The power transistors are insulated from the chassis with the special bushes and mica insulators made for this purpose. A mica insulator is used as a template for marking the positions of the holes. Before mounting the transistors, it is essential that no burrs remain, as these will puncture the mica and render the insulation useless. It is good policy to rub down and polish the chassis area where the holes have been drilled prior to mounting the transistors, and finally to check the insulation with an ohmmeter.

A short piece of sleeving is pushed over the base and emitter connectors to prevent accidental short circuits to chassis. The transistors are spaced so that the securing 6BA bolts will also accommodate a length of Radiospares tag strip. The connections so made provide the collector connection to each transistor. The remaining tags serve to mount bias components etc. The edges of the mica insulators are trimmed slightly so that they do not overlap, and thereby allow close thermal contact with the chassis.

CONSTRUCTIONAL NOTES

Moulded feet are screwed to each corner of the chassis base. These apart from their normal function also serve to give clearance for the output transistors mounted under the chassis, and provide the necessary ventilation.

The twin fuse-holder can be cemented to the top of the mains transformer if this has a flat surface, or else bolted to a strip of aluminium held under the clamp holding the smoothing capacitors, taking care that no sharp edges are left to cut through the insulating sleeve on the capacitors.

Most mains transformers are rated to give their specified voltage at maximum current, and with some transformers the voltage output under quiescent conditions may be unduly high. This tendency can be curbed if necessary by connecting a thermistor, type CZ1 or CZ6, in series with the mains input.

MODIFICATION

It has been found that with some makes of capacitor used in position C3a (25μF) some low frequency instability may be present. This problem can be overcome by using a 100μF capacitor in this position instead.

DETERMINING OUTPUT POWER

From an audio amplifier the power output is V^2/R where V is the r.m.s output volts and R is the load impedance. Thus if an a.c. voltmeter is connected across the terminals of a 16Ω load and indicates an output of 4V, then the power output would be $4^2/16$ or 1 watt.

Although an a.c. voltmeter can be used to check power output in this way it is not a reliable method of checking maximum sine wave output as will be seen.

The output from push-pull transistor amplifiers, whether using complementary pairs or matched pairs in transformerless output circuits, can be explained from the circuits in Fig. 17. When the transistor Tr1 is conducting, its resistance is lowered and the voltage at the centre point (the junction of the emitter resistors R1 and R2) will rise towards h.t. negative. Similarly when the lower transistor Tr2 is conducting, its resistance is lowered and the voltage at the centre point will fall towards the positive rail.

So it will be seen that the voltage at the centre point can move between negative and positive to a degree depending on how hard the appropriate transistor is conducting (Fig. 18a). If it were possible for the output transistors to swing the full h.t. then the output in the case of 12V h.t. would be 6V (peak) $\times$ 0·707=4·242V r.m.s. (Fig. 18a). However,

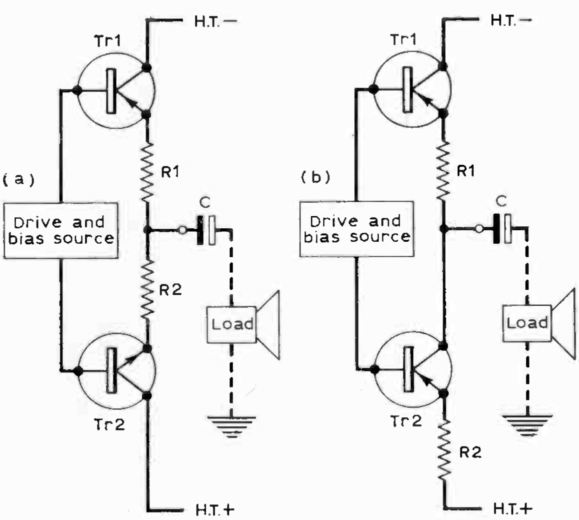
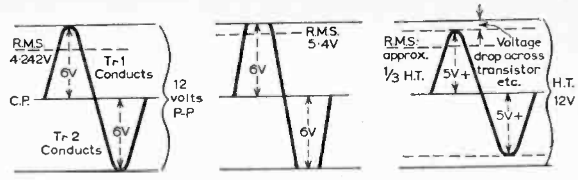


Fig. 17: Basic output circuits using (a) a complementary pnp-npn pair of output transistors and (b) a matched pair of pnp transistors. Capacitor C isolates the load from d.c.



(a) (b) (c)

Fig. 18: (a) Peak output 6V, r.m.s. output is peak x 0·707. C.P. is the centre point or connection to the load. (b) Effect of clipping on r.m.s. at r.m.s. of 0·9. (c) The maximum r.m.s. output from a typical amplifier is about one-third of the supply voltage.

the resistance of the transistors and their emitter resistors represent loss (Fig. 18c).

In a high efficiency output stage this loss should be small, and for a quick calculation of power output, it can be taken that the r.m.s. volts out is about one-third of the h.t. Hence from a 12V supply the r.m.s. out will be about 4V. Therefore the power developed in a 16Ω load will be near enough V^2/R or $4^2/16=1$ watt. Into 4Ω it would be $4^2/4$ or 4 watts, but it should be remembered that because of the higher current requirements imposed by a lower impedance load, the voltage losses will be greater, and therefore the available r.m.s. out will be less. Typically the power output into 4Ω would be expected to be in the order of 3 watts but this really would depend on the type of output transistors used and also the method and amount of audio drive into them. One could not expect low power transistors as used in the small basic amplifier described earlier to feed into speaker loads of 3 or 4Ω. They would simply blow up!

R.M.S. MEASUREMENTS

It is difficult to measure the maximum r.m.s. voltage output accurately with an a.c. voltmeter, unless the output waveform is also monitored on an oscilloscope, as only then is it possible to see when peak clipping commences (when the amplifier is driven beyond the capabilities of the h.t. supply voltage). The true maximum power output is the maximum sine wave output. When peak clipping commences, the r.m.s. output voltage will rise, and will continue to rise as the clipping becomes more severe. Thus the r.m.s. out will be much greater than peak $\times$ 0·707 and may be as much as peak $\times$ 0·9 (Fig. 18b). So it is apparent that the maximum output is much greater than the maximum sine wave output.

CLIPPING

One may have concluded from this that an amplifier delivering speech or music at an average level near maximum output must be making excursions into the clipping region on peaks. This is true and is permissible. A small amount of clipping does not cause objectionable distortion, particularly when the peaks of signal are of short duration as occurs in speech and music. Summing up, an a.c. voltmeter will give a reasonable if not always accurate indication of power output. When used with an oscilloscope it will give a very accurate indication as the commencement of peak clipping is observed.

The other method, of taking the r.m.s. out to be one-third of the h.t. supply, is useful for checking claims made concerning power output from amplifiers of this type. ■

A TRIPLE FUNCTION T

TRANSISTOR TESTER
SIGNAL INJECTOR
MULTIMETER

THIS unit was designed to be a completely portable testing device, suitable for rapidly locating faults in a wide variety of radio and electronic equipment. Being self-powered it is ideal for servicing transistorised equipment and, above all, it is inexpensive and quite easy to construct. The unit can be built for just under £3 although many of the components may be found in the spares box. The specifications on the unit are as follows

Voltage ranges: 0—15; 0—60; 0—150; 0—1,500.

Current ranges: 0—600μA; 0—15mA; 0—150mA.

Resistance range: 0—500kΩ.

Signal Injector: Square wave generator at approximately 2kc/s with harmonics into the i.f./r.f. region.

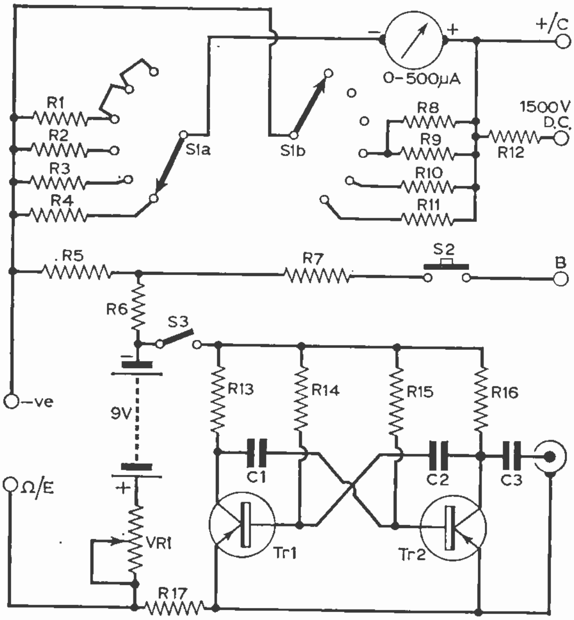
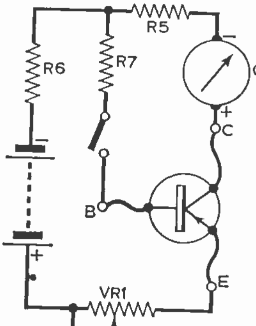
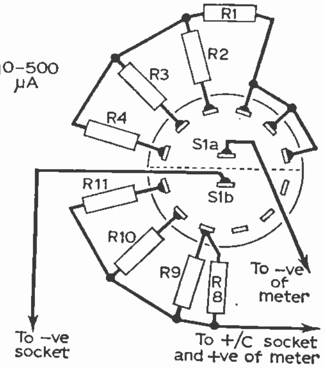


Fig. 1 (Above): Complete circuit of the tester.
Fig. 2 (Below—left): Conventional circuitry of a transistor tester.
Fig. 3 (Below—right): Wiring diagram of the selector switch.





Transistor Tester: Suitable for p-n-p types. Will measure the leakage I′co and the approximate gain of the device under test.

CIRCUIT DESCRIPTION

The circuit of Fig. 1 consists of a simple multimeter combined with a signal injector and transistor tester. The multimeter and transistor tester are built around the well-known Ex-19 set 500μA meter movement which is available from many of the advertisers in this magazine for only a few shillings. This meter has two scales marked 0—15 volts and 0—600 volts respectively, making it ideal for this unit. Shunts are switched in series with the meter for voltage ranges and in parallel with the meter for current ranges, this is done by the six-way two-pole selector switch S1. All shunts should be 5% high stability types although 10% types may be used if an ohmmeter is available to check their accuracy.

The internal resistance of the meter used in the prototype was 500Ω, if a different meter is used this may be different. The important point is to ensure that the total resistance of R1 plus the internal resistance is 2kΩ. The resistance range (0—500kΩ) uses an internal 9 volt battery which is also utilised by the transistor tester and signal injector.

The transistor tester, which is an integral part of the unit, is a modified ohmmeter circuit. The circuit in a more conventional form is shown in

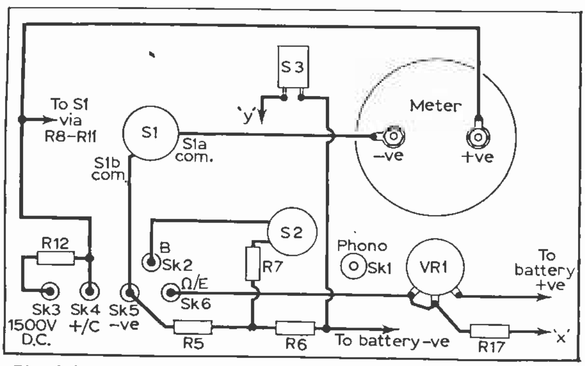


Fig. 4: Layout of the main components and wiring diagram of the front panel.

ESTER

ANDREW DICKS

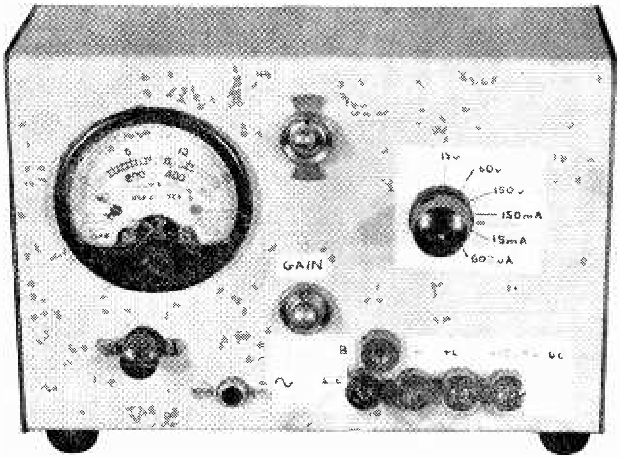


Fig. 2. This will measure collector leakage current I'co and the current gain in the common emitter configuration, α′ . It will be apparent that it is only suitable for p-n-p transistors; the extra wiring that would have been necessary to enable n-p-n transitors to be tested was not thought worthwhile in this unit.

The signal injector takes the form of the well-known flip-flop or multivibrator circuit, this is powered by the 9 volt battery, the output voltage is controlled by VR1. This gives a square wave output having a fundamental of about 2kc/s although this varies within a few c/s as VR1 is adjusted. The signal may be injected into any section of a radio receiver as the harmonics extend into i.f. and r.f. frequencies. The transistors used can be any general purpose r.f. types.

CONSTRUCTION

The prototype was constructed in a ready-made cabinet although a suitable one could be made from plywood. The outside dimensions are 6½ x 4½ x 2½in., this being about the smallest size that would allow easy wiring and fitting.

The selector switch S1 should be wired up first as outlined in Fig. 3, this can then be assembled into the cabinet together with all of the switches and sockets. Layout is not critical but it is advisable to keep the leads as short as possible and Fig. 4 will show how the front panel should be arranged. The meter may have a bracket or flange on it,

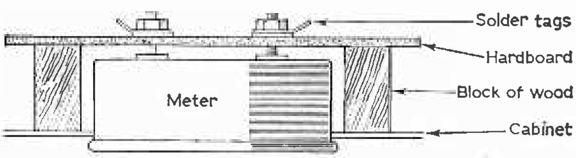


Fig. 5: Simple bracket for mounting the meter

★ components list

Resistors: all ¼ watt.

R1	1·5kΩ	5%	R10	68Ω	5%
R2	300kΩ	5%	R11	10kΩ	5%
R3	120kΩ	5%	R12	2·7MΩ	5%
R4	30kΩ	5%	R13	22kΩ	10%
R5	560Ω	10%	R14	150kΩ	10%
R6	3·3kΩ	10%	R15	270kΩ	10%
R7	220kΩ	10%	R16	22kΩ	10%
R8	10Ω	5%	R17	12kΩ	10%
R9	20Ω	5%	R18	50kΩ Lin. preset	

Capacitors:

C1 1,000pF
C2 0·01µF
C3 0·01µF

Switches:

S1A, S1B 6 way 2 pole
S2 Press-button on/off
S3 Toggle. SPST.

Transistors:

Tr1, Tr2 R.F. types OC44 or similar.

Miscellaneous:

Wander plugs, sockets, phono plug and socket, PP3 battery or equiv., battery clips, Veroboard 1¼ x 2½in., wire, sleeving, hardware, cabinet, solder, etc.

alternatively a simple bracket may be made from hardboard as shown in Fig. 5. Insulated wander plug sockets are mounted on the front panel, the wires and components may be soldered directly to these so that no tag strips are necessary.

The signal injector is constructed on a piece of Veroboard which is then secured into the cabinet with a small metal bracket. The wiring of this board is straightforward and is shown in Fig. 6. When all of the other wiring has been completed, the Veroboard may be fastened in the cabinet and connected to the rest of the unit. A suitable bracket for mounting the board can be made from an old capacitor clip by bending it to form a right-angle, this should be secured with a nut and bolt to the bottom of the cabinet.

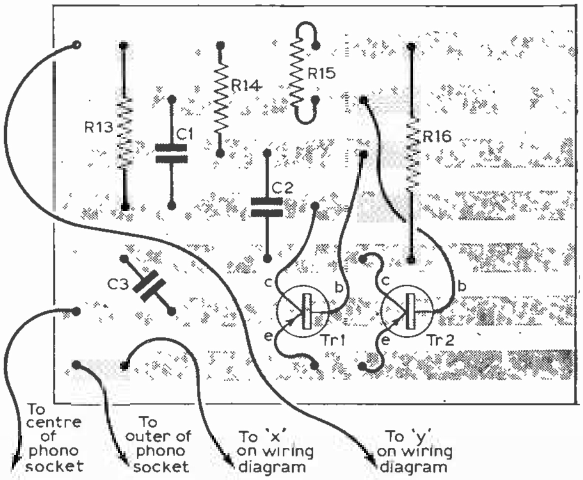


Fig. 6: Wiring diagram of the Veroboard and associated components.

The battery used is a 9 volt PP3 type and if no clips are available a substitute can be obtained by carefully dissecting a used PP3 battery. It will be found that the terminals can be removed quite easily without damaging the plastic that they are mounted on, and they will connect directly to another battery. Care should be taken to ensure that the correct polarity is observed when wiring the battery. The battery itself may be secured in the cabinet with judiciously placed blocks of wood, alternatively the outer part of a standard matchbox will hold it in place.

When the unit has been completed it should be thoroughly tested by making every conceivable measurement with it. If necessary the accuracy may be compared with a standard multimeter.

VOLTS/mA

To measure volts and milliamps, probes should be inserted into sockets marked — and +/C. The selector switch is then adjusted to the required range (always working from the high ranges down to the low ones) and the value read off on the appropriate meter scale, the other controls should have no effect on these measurements. All of the voltage ranges are d.c. and to measure high voltages up to 1,500 volts the positive probe should be plugged into the appropriate socket and the selector switch set to the 150 volt range.

RESISTANCE

To measure Ohms the selector switch should be turned to the 600μA range and probes inserted in the Ω/E and +/C sockets. With the probes touching, the meter is adjusted to give full-scale deflection with the potentiometer. Since the meter is not calibrated directly in Ohms, if quantitative measurements are to be made, the meter reading (0·15 volt scale) is noted and the value of the resistance under test read off from the scale of Fig. 7.

TRANSISTOR TESTS

To test p-n-p transistors, three probes should be inserted in the sockets marked +/C, B, and Ω/E, these connect to the collector, base and emitter of the transistor respectively. The selector switch should then be set to 600μA and the potentiometer turned fully clockwise, the leakage I'co should now be indicated (0—600μA scale) and for a general purpose a.f. transistor this should not be greater than 200μA at 20deg. C.

GAIN

To measure gain, the press-button marked GAIN is depressed (S2) and the increase in meter reading noted. This increase divided by 10 gives an approximate value for the current gain α'. The value of α' cannot be determined accurately by this method as it is not necessarily a constant under these circumstances. It may be necessary, when the leakage has been found, to turn the potentiometer slightly anti-clockwise before the gain is found.

SIGNAL INJECTOR

The signal injector is used as follows. The probe illustrated in Fig. 8 is inserted into the output socket and the injector switched on by the toggle switch. The wander lead is clipped to the + battery line of transistorised equipment or the chassis (— line of valve equipment) then in the case of, for example, a radio, the probe is applied to the slider of the volume control turned to full volume and with the set switched on. The output amplitude of the injector can be varied by adjusting the potentiometer. If a note is heard in the headphone or speaker then the fault in the receiver lies in the r.f. or i.f. stages.

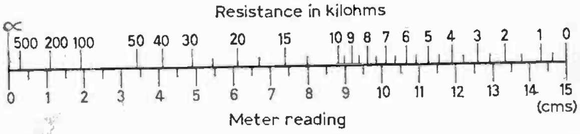


Fig. 7: Calibration of the meter for measuring resistance can be either a graph, or drawn along a single horizontal axis as shown.

If no note is heard then the fault lies in the a.f. stages, i.e. between the loudspeaker and volume control. If, for example, the latter fault existed then the probe should then be applied to the output transformer secondary and primary windings, base of output transistors and so on, working back from the loudspeaker to volume control. The injection should proceed until a point is found where the signal is not heard when the probe is applied. The fault then lies between the point found and the one previously checked when the signal was heard.

FURTHER TESTS

A similar procedure should be followed if the fault lies in the r.f. or i.f. stages, starting by injecting the signal at the diode, then the bases of the i.f. transistors and so on back to the aerial. It should be pointed out that a transistor may for some reason lose its gain but still pass a signal. This method of fault finding would not reveal this fault, which, fortunately, is seldom encountered.

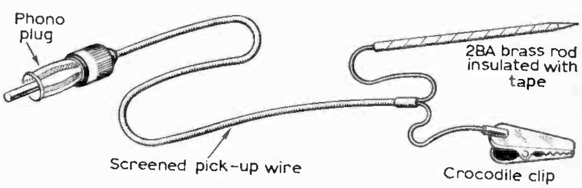


Fig. 8: Details of the injector probe. The crocodile clip is attached to the screening and the brass rod to the centre conductor.

A good test in transistorised equipment is to measure the voltage across the emitter resistor of each transistor (if there are any!). The voltages measured should be within 10% of the values given in the service sheet or manual. If this is not the case there is most likely a fault in that particular stage.

For those who wish to make the Ohms range calibration accurately the following should help. If M is the meter reading (0—15), then resistance R under test is given by: $R = 225/M - 15$, answer in kΩ. For example, when $M = 7{\cdot}5$, $R = 225/7{\cdot}5 - 15 = 15k\Omega$.

CONCLUSION

In conclusion, while the test unit may be used confidently for most routine checks its limitations should be realised and should not be used too ambitiously. It should be used with care when dealing with valve equipment and the signal injector should not be used to fault-find in the a.c./d.c. type of radio or television receivers. ■

LETTERS...

Please play the game chaps

Thank you very much for publishing my letter regarding the disposal of back numbers of P.W. I received more than 50 requests for these and had cleared them all within about a week.

One feature stands out, however. I received about a dozen requests for copies as gifts, and without exception none of these were accompanied by a stamped addressed envelope. It cost me several shillings to reply to these. Could you please ask your readers to observe this elementary courtesy?—**R. J. Morris** *(Melton Mowbray, Leicestershire).*

[*We must emphasise that if readers do write to people who offer issues or information, they must enclose a s.a.e. We make this ruling ourselves with our Query Service. No s.a.e. or Query Coupon, and no reply!*]—Editor.

Instant Silence

Instant silence is the greatest unsatisfied need of the age in which we live. Any manufacturer who produced a comfortable headset which would completely shut out sounds of conversation or other noises, when not in use for wireless reception, I think has a ready-made national market.

I have been looking, without success, for an Army No. 19 Set headset for five years, so that I can use it as an aid to concentration in chess matches.

The instant silence set would also be useful in parks or on long-distance trains, to shut out the sounds of "yappers", when one just wants to think or relax. —**S. G. Hill** *(London, E.C.1).*

No auto transformer

In the "Your Questions Answered" section of Practical Wireless you advised Mr. J. Macfarlane to use an auto transformer to drop 220V to 110V at 75 watts. A much cheaper and just as reliable way is to use a 75 watt bulb in series with the iron. I have been using this system for some time now and I have found it completely satisfactory. —**A. Jefford** *(Devon).*

Radio Alarm

The idea that Mr. H. S. Barker mentions in his letter on page 690 of the January 1968 issue, is in fact, in use by most electricity boards (in the South at least) in the control of "off peak loads", "night metering", some "street lighting", etc, etc, and this idea is used in the time switches used to control above. This allows for correct time to be maintained even during a supply failure up to about 30 hours; on resumption of supply, spring reserve will be left fully wound. The saving in man hours to reset clocks is obvious when you realise the many, many thousands in use.

So, Mr. Barker, do not think your idea outdated because even now an experimental 2-dial and 3-dial meter to register units on selected dials Low High Normal at Low High Normal prices per unit during selected periods is in fact controlled by a similar time switch.

The idea of course is to try and shift peak use from peak periods by offering cheaper electricity at selected times.—**H. A. Blunden** *(Guildford).*

Any old gear?

The Peterborough Amateur Radio Society, of which I am Hon. Secretary, will be holding an exhibition of "Wireless in the Twenties" at their Mobile Rally at Peterborough on August Bank Holiday.

If any reader has a very old wireless set, ancient valve, or old radio book or magazine, would they please drop me a line? Thank you.

Later, it is hoped to form a Radio Museum and so keep this ancient equipment for the benefit of future generations. — **Douglas Byrne, G3KPO** *(Jersey House, Eye, nr. Peterborough, Northants.).*

Electronic metronome

With reference to the Electronic Metronome, August 1967 issue, I would like to point out that the correct value for R3 is 100 ohms and not 100kΩ as the circuit diagram indicates.—**A. Jay** *(Limerick, Eire).*

Not always true

One of your correspondents has said, referring to Mail Order, "you get what you pay for" but I am afraid this is not always the case.

An interesting article on a crystal calibrator set me off and as the source of the crystals was mentioned I wrote asking for the price of certain crystals together with sockets and after 10 days received just a price list and an order form.

I ordered two crystal units and sockets to match, the price list did not make clear the price of sockets so I included 1s. 3d. for each. I may add that there is a handling charge of 2s. 6d. for each order.

Almost by return I received the crystals but no sockets. There was a delivery note but no mention as to why the sockets were not sent.

I immediately wrote pointing out that I had ordered and paid for two sockets and 11 days later I received a short note saying "with reference to sockets recently ordered—credit note enclosed"; a credit note for 1s. 3d. was enclosed—note 1s. 3d. not 2s. 6d.

If they could not supply sockets they should have said so in the first place and I contend that they should refund the amount paid and not send credit notes.

I suppose I shall have to think myself lucky that the item in question was only shillings and not pounds.—**R. Haworth** *(Manchester, 21).*

A simpler method

With reference to the letter from Mr. J. Macfarlane in "Your Questions Answered" in the January 1968 issue, I would like to point out that it is not necessary for him to purchase an auto-transformer for his soldering iron. A BY100 or equivalent in series with either mains lead would be equally effective and certainly cheaper and more compact. It is of course essential that the diode be insulated in order to avoid contact by the operator. Polarity is of no importance. —**M. Francis** *(Cheltenham).*

COILS FOR TRANSISTOR CIRCUITS

D. V. DEBBAGE

UNDOUBTEDLY more and more amateur constructors are now using semiconductors in preference to valves. This being the case, there must be many who have complete sets of coils which have, in the past, been used with valve circuits but which now seem likely to be relegated to the darkest corners of the junk box.

Some time ago, a general coverage multi-waveband shortwave receiver using semiconductors was decided upon by the writer, but the expense of purchasing a set of brand new coils as well as a set of i.f. transformers and the like led to this idea for a project being temporarily shelved.

Recently, however, a number of experimental circuits were made up to see if it would be at all practicable for coils designed and intended for valve circuits to achieve any measure of success when utilised in semiconductor circuitry. The main problem appeared to be one of matching impedances, since a coil possessing a particular inductance would not alter its value merely because a semiconductor was used in place of a valve. The basic consideration boiled down to matching a high impedance tuned circuit meant for valves, to a low impedance input required by a transistor.

Circuitry

Figure 1a shows the generally accepted method of matching the low impedance base input of the transistor to the high impedance presented by the tuned circuit. The coil L1 is the aerial coupling coil, while L2 together with the tuning capacitor forms the first selective circuit in the receiver. Coil L3 is a low impedance winding inductively coupled to the other two, which will pass on the signal to the base of the transistor. In Fig. 1b this latter low impedance winding is not required because the high impedance of the tuned circuit can be fed directly to the high impedance input of the valve.

The first logical method of adaptation appeared to be the addition of a third low impedance winding to each coil in order to feed the base. However, when it was realised that a four-waveband superhet receiver complete with r.f. stage contains a minimum of twelve coils, it became apparent that the whole procedure would be both tedious and time-consuming, not to mention the physical difficulties of the correct degree of coupling, etc.

Impedance Matching

Recalling the early days of semiconductors when there were very few associated coils and other suitable components available to the home constructor, the problem of matching the base input impedance to the input circuit was very often overcome by using a capacitive tap. This method is depicted in Fig. 1c, where the two capacitors, C1 and C2, form the tap. By altering the respective values of these two capacitors, it is possible to alter the impedance "seen" at the tapping point. By making their values low (low in pF's), we can avoid their affecting the tuning of the parallel circuit formed by L2 and the variable capacitor. Although the two capacitors are in parallel with the tuned circuit, they will not detune it to any great degree. This is because (a) although capacitances in parallel add, thus the capacitance of C1 and C2 will add to the value of the tuning capacitor, (b) the two capacitors (C1/C2) are themselves in series and thus their effective capacitance is less than the value of the smaller of the two. Thus by keeping these two capacitors to the low value, the capacitance added to the circuit will be very slight and can be offset by slight adjustment of the core in the tuning coil.

Applications

The initial circuit used to experiment along these lines is shown in Fig. 2. This is a straightforward t.r.f. type of circuit without the complication of frills and gimmicks. The transistor, Tr1, functions as a tuned r.f. amplifier with an inductive collector load L3. Coil L4 is the secondary winding on this load and feeds the amplified r.f. signal to the diode, the audio being developed across the resistor R4 and fed for subsequent a.f. amplification via capacitor C8. The capacitive tap for base matching is formed by C1 and C2. For the OC170 the values shown proved optimum. The coils in this circuit are the Wearite PA2 for L1/L2, and PHF2 for L3/L4. Considering the simplicity of the circuit, selectivity was reasonably good.

The Superhet

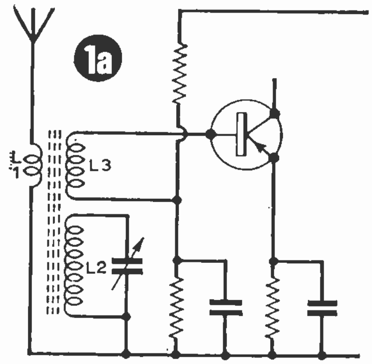
Encouraged by the results obtained from Fig. 2, a superhet mixer was built along the lines indicated in Fig. 3. The coils in this instance were the well-known Denco types, range three being chosen because this embraces the two lower amateur bands plus trawlers etc.

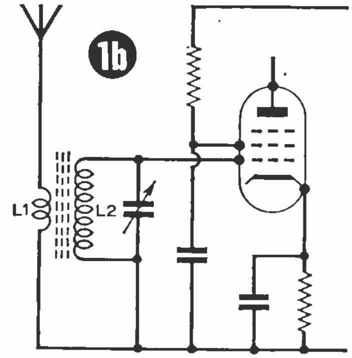
The white coded coil was used in the oscillator position, and the i.f. output at 1·6Mc/s was then fed from the 1·6Mc/s i.f.t.1., into a domestic superhet tuned to the highest frequency of the medium waveband. After aligning in the usual manner this single transistor converter gave a very lively account of itself, therefore, the next step was to precede this mixer by a transistor r.f. amplifier.

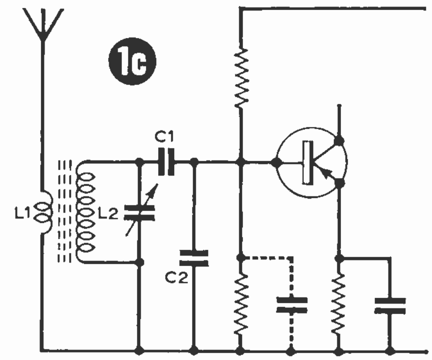
The final circuit of this two-stage converter is shown in Fig. 4. When it was aligned and fed into the superhet already referred to, the unit performed extremely well and fully justified the effort in making it.

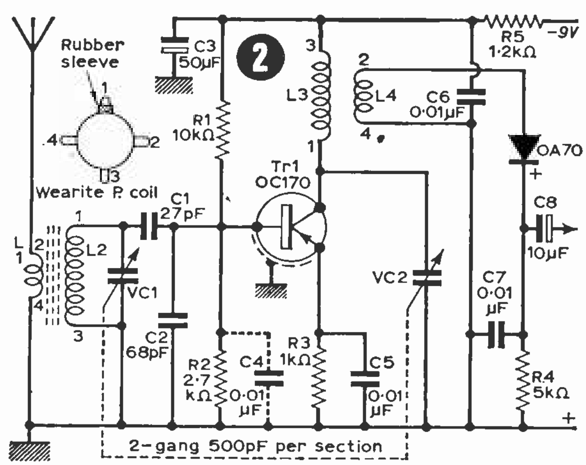
Certainly if a receiver using semiconductor circuitry is to be built from scratch, the proper transistor coils should be obtained.

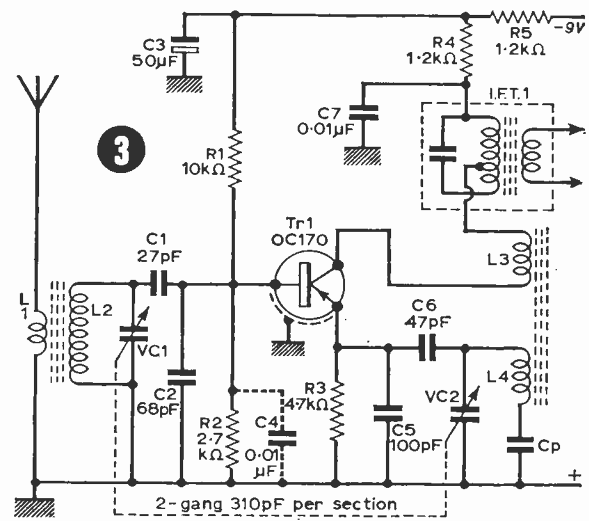
Note. The capacitors shown in dotted lines should be omitted from the circuit. These capacitors form standard circuitry but must not be used in these circuits as they will upset the tuning.











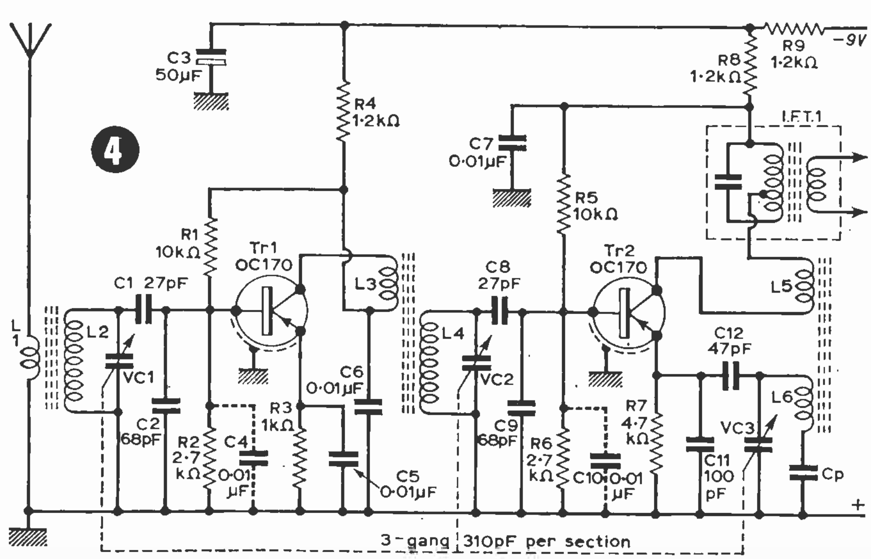


Fig. 1a: Method of matching the base of a transistor.

Fig. 1b: Tuned circuit connected in valve circuitry.

Fig. 1c: Using a capacitive tap for matching.

Fig. 2: A simple t.r.f. circuit.

Fig. 3: Mixer stage using valve-type coils.

Fig. 4: Two-stage converter using valve-type coils, and capacitive taps for matching.

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1D5	7/-	6BR7	8/6	6K7GT	4/6	10C1	12/6	25A6	5/9	85A2	7/3	DK92	8/-	ECH42	11/-	EY51	7/6	PCF82	6/-	SP61	3/6	UU6	13/6
1H5	7/-	6BR8	5/6	6K8M	8/6	10C2	12/6	25L6GT	5/6	150B2	9/6	DK96	7/9	ECH81	5/9	EY86	7/-	PCF84	8/-	STV280/80		UU7	13/6
1LD5	5/-	6BS7	16/9	6K8G	3/-	10F1	9/-	25Y5	6/-	150C4	7/6	DL66	15/-	ECH83	8/-	EZ35	4/6	PCF86	9/-		90/-	UU9	8/-
1N5GT	8/-	6BW6	14/-	6K8GT	7/-	10F3	8/-	25Z4	6/3	801	6/-	DL92	4/9	ECL80	7/-	EZ40	8/-	PCF801	10/-	SU25	19/6	UY21	9/6
1R5	5/6	6BW7	14/-	6K25	20/-	10F9	9/9	25Z5	7/-	807	7/-	DL93	3/6	ECL82	7/-	EZ41	10/-	PCF802	10/-	SU2150	12/6	UY41	7/-
1S4	5/-	6C4	2/9	6L1	9/6	10F18	9/-	25Z6	8/6	811	30/-	DL94	5/9	ECL83	10/3	EZ80	5/6	PCF805	13/6	T41	15/-	UY85	6/6
1S5	4/-	6C5G	4/-	6L6G	7/6	10L1	8/-	28D7	5/-	813	75/-	DL95	6/6	ECL86	9/-	EZ81	5/6	PCF806	13/6	TDD4	10/-	VMP4G	17/-
1T4	3/-	6C6	3/9	6L18	5/-	10LD11	15/-	30C1	6/3	866A	13/6	DL96	7/6	ECLL800		GZ30	10/-	PCF808	11/6	U10	7/6	VP4B	25/-
3A4	3/6	6C8G	6/-	6Q7G	6/-	10P13	16/3	30C15	13/6	954	4/6	DM70	5/-		30/-	GZ32	9/6	PCL82	7/9	U14	7/6	VR105/30	
3Q4	6/6	6CD6G	22/-	6Q7GT	8/6	11E3	42/-	30C17	15/6	1625	5/6	DY86	6/-	EF9	20/-	GZ34	11/-	PCL83	9/3	U19	35/-		5/-
3Q5	6/6	6CH6	5/9	6SA7M	7/-	12AT6	4/6	30C18	13/6	4022AR	50/-	DY87	6/-	EF37A	7/-	KT36	17/6	PCL84	7/9	U25	13/6	VR150/30	
3S4	4/9	6CW4	12/-	6SC7	7/-	12AT7	3/9	30F5	15/6	5763	10/-	E88CC	12/-	EF39	6/-	KT61	12/6	PCL85	9/3	U26	13/6		5/-
3V4	5/9	6D6	2/9	6SG7	5/-	12AU6	5/9	30FL1	16/-	7193	2/-	EA50	2/-	EF41	10/-	KT66	16/-	PCL86	9/-	U78	3/6	VT25	15/-
5R4GY	8/9	6E5	7/6	6SH7	3/3	12AU7	4/9	30FL12	16/-	7475	4/-	EABC80	7/-	EF50	2/6	KT81	35/-	PENA4	20/-	U191	13/6	VT31	80/-
5U4G	4/-	6F1	9/-	6SJ7	5/-	12AX7	6/3	30FL14	13/6	ATP4	2/3	EAF42	10/-	EF80	5/-	KT81 (7C5)		PENB4	20/-	U251	12/6	VU111	7/6
5V4G	8/-	6F5G	8/-	6SK7GT	4/9	12BA6	6/-	30L15	15/3	ATP5	7/-	EB41	4/6	EF85	6/6		15/-	PEN45	7/-	U301	16/3	VU120	12/6
5Y3GT	5/6	6F6G	4/-	6SL7GT	4/9	12BE6	5/9	30L17	14/3	ATP7	5/6	EB91	3/-	EF86	6/9	KT88	27/6	PEN46	2/9	U403	6/6	VU508	35/-
5Z4G	6/9	6F8G	4/6	6SN7GT	4/6	12C8GT	4/6	30P12	13/6	AU2	80/-	EBC33	7/-	EF89	5/-	KTW61	10/-	PL36	10/-	U404	11/9	W81M	6/-
6/30L2	13/-	6F11	7/-	6SQ7	6/-	12E1	17/6	30P19	13/-	AU5	7/6	EBC41	9/9	EF91	3/6	KTZ41	6/-	PL81	8/-	U801	23/6	X79	41/-
6A7	15/-	6F13	5/-	6U4GT	12/-	12J5GT	2/6	30PL1	15/-	AZ1	8/-	EBC90	4/6	EF92	2/6	ML4	17/6	PL82	7/3	UABC80	6/-	XH1-5	5/-
6A8G	12/6	6F14	12/6	6U5G	7/6	12J7GT	7/-	30PL13	17/-	AZ31	9/6	EBF80	7/-	EF98	10/-	ML6	6/-	PL83	6/-	UAF42	10/3	XP1-5	5/-
6AC7	3/-	6F23	13/6	6V6M	8/-	12K7GT	6/-	30PL14	16/3	CBL31	15/-	EBF83	8/3	EF183	6/6	M8P4	10/-	PL84	6/9	UBC41	8/6	XSG1-5	10/-
6AK5	4/6	6F24	13/-	6V6G	4/6	12K8GT	8/-	35A5	12/6	CCH35	21/-	EBF89	6/6	EF184	6/6	MU14	7/6	PL500	15/-	UBC81	8/3	Y63	7/6
6AL5	3/-	6F25	12/-	6V6GT	6/6	12Q7GT	4/6	35L6	5/9	CL33	20/-	EBL1	14/-	EL32	3/6	MX40	12/6	PX4	14/-	UBF80	6/9	Tubes	
6AM5	2/6	6F28	11/6	6X4	3/6	12SA7	6/6	35W4	4/6	CY31	10/-	EBL21	11/-	EL33	12/6	N37	17/6	PY33	9/6	UBF89	7/3	3EG1	50/-
6AM6	3/6	6G6	2/6	6X5G	4/6	12SG7	4/3	35Z3	10/-	DAC32	7/-	EBL31	27/6	EL34	10/6	N78	15/-	PY81	6/6	UCC84	8/6	3FP7	19/-
6AQ5	6/-	6H6	2/-	6X5GT	6/-	12SH7	3/-	35Z4GT	5/6	DAF91	4/-	EC90	2/9	EL41	10/-	N108	15/-	PY82	6/-	UCC85	7/-	5CP1	35/-
6AS7G	15/-	6J5M	6/6	7B6	11/6	12SJ7	3/9	35Z5	5/6	DAF96	6/9	ECC81	3/9	EL42	10/-	NGT1	3/6	PY83	6/6	UCF80	8/6	CV1526	40/-
6AT6	4/6	6J5G	2/6	7B7	7/6	12SK7	4/9	37	5/-	DCC90	7/-	ECC82	4/9	EL84	4/9	NGT7	55/-	PY800	10/-	UCH42	10/6	ACR13	100/-
6AU6	6/-	6J5GT	4/6	7C5	15/-	12SR7	5/-	42	6/-	DF33	8/-	ECC83	6/3	EL90	6/-	OZ4	4/6	PY801	10/-	UCH81	6/9	VCR97	35/-
6B8G	2/-	6J6	3/-	7C6	6/6	14H7	9/-	50B5	6/6	DF70	7/-	ECC84	6/-	EL95	5/6	PC86	11/6	R2	7/6	UCL82	8/-	VCR517B	
6B4G	15/-	6J7M	7/6	7D5	8/-	19AQ5	5/-	50C5	6/3	DF91	3/-	ECC85	5/-	ELL80	20/-	PC88	11/6	R19	7/9	UCL83	10/-		46/-
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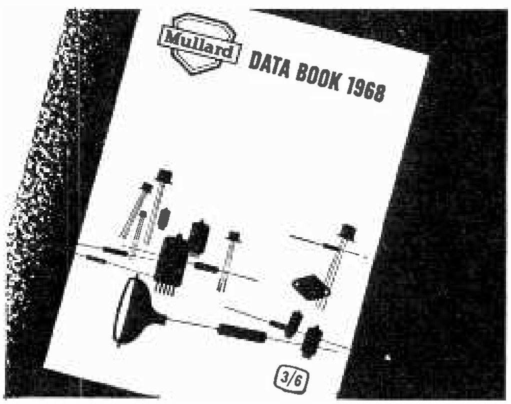

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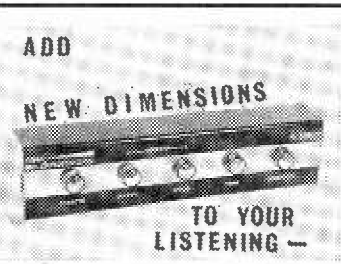

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ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times GMT
Frequencies in kc/s

THE BROADCAST BANDS by CHRISTOPHER DANPURE

FROM this issue on in the Broadcast Band column we will take a look at propagation conditions in the different broadcast bands.

During the winter months here in the northern hemisphere as the days are shorter the ionosphere will not reflect the higher frequencies of 25, 21, 17 and 15Mc/s the greater part of evenings here in Europe. 25Mc/s is dead by 1700 GMT, 21Mc/s by 1830 GMT, 17 Mc/s by 2030 GMT and 15Mc/s by 2200 GMT. But some nights these bands stay open later, this is due to a sunspot disturbance, and the next day the band will be disturbed and close a lot earlier than usual. Also, during the winter evenings there is a greater "skip" distance, signals from the UK transmitted on 6Mc/s will bounce right into Central Europe, whereas in the summer 6Mc/s would reach Holland on the first hop.

In February as the days lengthen in the northern hemisphere the higher frequency bands will stay "open" later in the evenings, and the "skip" in Europe will start a little later in the evening. So again reception of Holland on 6Mc/s will be possible in the early evening and Switzerland will give steadier, stronger signals on 6Mc/s.

On the 2nd and 3rd March operating schedules of most overseas broadcasting shortwave stations will change over to spring in the northern hemisphere and autumn in the southern hemisphere schedules. So most of the information in this column will be liable to change on that weekend. But in the April issue we will list as many of the new schedules as possible. Also, note that on 18th February Great Britain goes on to British Standard Time so please add 1 hour to all times shown. Now on to this month's DX-tips.

AFRICA

Congo Republic: *O.R.T.F.* Brazzaville has a daily English transmission at 1915–1930 GMT on 15,190.

Rwanda: *Deutsche Welle Relay* station at Kingali is now on the following schedule: 0300–0330, 0345–0530 GMT on 9,565; 0545–0745 on 11,905; 1045–1145 on 11,785; 1200–1400 on 17,765; 1415–1445 on 15,245; 1500–1730 on 9,735; 1745–2015 on 17,765; and 2030–2325 on 15,380.

South Africa: *Radio R.S.A.* now transmits its English service to the UK and Eire from 1900 to 1950 GMT on 17,790 and 11,875. The North American transmissions are now as follows: 2362–0020 17,805, 15,220; 0026–0220 15,220, 11,875; 0226–0320 11,875 9,705.

ASIA

Afghanistan: Now transmits to Europe in German and English from 1730–1830 on 25mb, has been heard on 11,770, but is trying to find a clear channel in the 25mb, heard regularly on 9,545.

Israel: *Kol Israel* transmits two English programmés daily 2015–2030 on 9,725 and 9,625 to Europe, 9,009 to S. Africa, 2115–2130 to Europe on 9,725, 9,625and 9,009.

Philippines: The only transmission beamed to Europe from Far East Broadcasting Co., Manila, is the Russian programme from 1615 to 1730 and English closing announcements 1730–1738, beamed to Europe on 11,850 and 9,545, to Eastern Siberia on 11,890 and to Asian USSR on 7,230 and 6,030; 11,850 does not start until 1631.

AUSTRALASIA

Australia: *Radio Australia* is now transmitting as follows: English to S.E. Asia 2214–0100 15,220; 2245–0930 17,870; 0100–0800 21,540; 0830–1500 11,880; 0830–0930 15,320; 0930–1500 9,570. English to South Asia 1400–1430 11,880 and 9,570; 1430–1500 11,880, 9,570 and 9,540; 1500–1730 11,740, 9,540. Indonesian to S.E. Asia 2230–0030 15,320 and 11,780; 0630–0830 17,820, 15,320; 1000–1130 11,740, 7,220; 1430–1500 11,740, 7,220. Mandarin and Cantonese to S.E. Asia 1130–1430 11,740, 7,220. Vietnamese and Thai to S.E. Asia 1230–1430 11,790, 9,540. French to S.E. Asia 2315–0015 17,715. English to N.E. Asia 2100–2300 17,715, 15,240; 2300–0015 15,240; 0859–1000 15,390, 11,810; 1000–1100 15,390; 1100–1215 15,390, 11,810, 9,580; 1215–1400 15,390. Japanese to N.E. Asia and Japan 1000–1100 11,810, 9,580. English to Mid-Pacific 1800–2115 11,840; 0030–0645 15,240; 0700–1215 7,190. French to Mid-Pacific 0015–0115 15,180; 0515–0615 15,220. English to South Pacific 1800–2115 11,810; 0645–0915 11,710, 9,560. English to North America 0100–0300 17,840, 15,320; 1214–1315 11,710. English to Africa 0330–0515 17,820, 15,320. French to Africa 0515–0615 17,820, 15,320. English to Europe 0814–0915 11,710, 9,560 up to 18th Feb. 0645–0745 11,710, 9,560 18th Feb. onwards.

Radio New Zealand transmits as follows: to Pacific Isles in English 1700–1945 11,780, 9,520; 2000–0545 15,110. 0600–0800 also in Samoan, Rarotongan and Niuean as well as English on 11,780, 9,520. English weekdays 0800–0845 11,780, 9,520. English Sundays 0800–0845 11,780. To Australia in English 2000–0545 17,770; 0900–1145 11,705, 9,520. To Antarctica in English (Sundays only) 0815–0845 9,520.

NORTH AMERICA

Radio Canada, Montreal has made some changes to its evening services to Africa and Europe now as follows: 1832–1958 English and French to Africa 17,820, 15,320, 11,720; 2001–2150 French and English to Europe 15,320, 11,720, 9,610.

EUROPE

Monaco: *Trans-World Radio*, Monte Carlo English transmission on Sunday afternoons is now on 7,230 from 1515 to 1630. On Saturdays from 0710–0725 there is the DX-special on 7,295.

We would like to thank the Sweden Calling DX'ers Bulletin for information supplied.

THE AMATEUR BANDS by DAVID GIBSON, G3JDG

YO Ho Ho and a bottle of 1968 rum, wonder what this brand New Year will bring on the Amateur bands? For a start, I hope that it will bring lots of lovely DX reverberating down my aged eartrumpets. According to all the Gipsy Rose Lees of the Ham world the ten-metre band should give us plenty of signals from exotic parts in 1968. However, at the other end of the scale, topband is still producing some very good contacts so it could well be a bumper year for all r.f.-loving hounds.

The six bands from 1·8—30Mc/s are going through a bit of a patchy period at present, especially the three h.f. segments. This explains why one person will listen and hear nothing, while another s.w.l. with roughly the same gear will hear half the world.

G. Haslip (no address on the letter—probably working portable in Hyde Park), has a 3-valve t.r.f. and heard these on ten metres a.m.—UA2KAA, UC2AOL, UC2DZ, UP2NX, UD5DUD, W3IAC, WØYOP, YO3AID, and CN8FW. Yet the other day when I listened for a spell on ten I didn't hear a thing.

Chris Kirby (Oxon), says that nothing much on topband seems to arrive at his QTH, he reckons the best band this month is eighty where he logged VQ9JW and weirdy—6E1AEP. By the way, Zambia has decided to issue 9I3 callsigns.

Rummaging around in my personal postbag this month, the following dispatches were received.

BELOW 7Mc/s

J. Bradley (Co. Donegal), R1224A, 50ft. end fed, has been listening on eighty metres for about six weeks in the Emerald Isle. On s.s.b. after 2200hrs he logged—CN8AW, CT1PQ, LA3XI, ON4UN, OZ6PG, PAØDDT, SM7ABO, SP6AAT, SP8AVB, TF5TP, UP2OV, UR2IV, VE1AOZ, VE1WA, VE2TJ, W1FRR, W1WQC, W2GO, YU2RAZ, ZB2BC. A point to remember when listening on eighty is that the American stations are licensed to transmit from 3·5 to 4·0Mc/s whereas the British amateur is limited to 3·5 to 3·8Mc/s.

D. M. Clark (Bucks.), P.W. progressive superhet with b.f.o. and S-meter, 60ft. end fed running NW/SE says that twenty is very good at present. He heard things like ZS, W, VE, 8R, PZ, 5Z4 and one he queries—7P8AR. Mr. Clark sent in a model log for eighty. Among those listed on s.s.b. were—DL5MA, K1YIW, LA3ZH, OE3SBW, OF1AF, OK1BY, OZ1BQ, PAØGHB, SL3ZV, VE1IE, VO1FX, W1IMM/P, W1ZFF, W2FZJ, YU2NFJ, 3A2MJC.

D. V. Goadby (Leics.), HA700, 140ft. tapped at 44ft. (VS1AA) or multi-band Windom aerial (see R.S.G.B. handbook), logged these on 80 s.s.b.—DJ3VI, DJ6WX, DL5CG, DU1AS (Philippine Islands), F9DH, I1BLU, K1YIW, K1BCK, K2ADY/P, LA3XI, ON4XJ, OZ9FI, PAØHRP, SL3ZZN, SM4CTF, UA2WJ, WA4ZE, W3OV, WB1IA, W1WQC, YU2RC, 9H1R, 9J2BC.

Sad to say nobody reported hearing the famous DX station G3JDG on topband this month. It's no good, I'll just have to use an aerial like the rest.

ABOVE 7Mc/s

David Henbry apologies for not having had much time to listen because of end-of-term exams, and then proceeds to send a list of the most gorgeous DX including all those I didn't hear. David lays in wait for the DX with an HA500 receiver and then harpoons it as it passes with a 7ft. copper rod at thirty feet. He hopes Santa will bring a Joystick, but meanwhile the 7ft. rod managed to skewer—CR6IV, DU1FH, HK4BFQ, HR1JAP, JT1KAA (Mongolia), KG6AQG (Guam), KG6SA (Saipan), OA4CV, PJ2CT (Curaçao), PZ1CI, TU2BA, TY2KG, VP1LL (British Honduras), VP2AA (Antigua), VP2LA (St. Lucia), VP8DJ, VP8HZ (Saunders Island in the Falkland group), VP8IE (South Georgia), VP8IU (Argentine Is.), VP8JD (Signy Island in the South Orkneys), YJ8BW, ZD8RH, 9X5PB, 9Y4AR. All this gang on twenty metres s.s.b. Notice all the VP8 callsigns. I mentioned the actvity in the VP8's last month.

G. Richards (Isle of Wight), five-valve domestic receiver, bent long wire (80ft.), draped his ears on the fifteen metre band to detect this bunch on a.m. phone—CT1JN, CT1VA, DK1PG, EA4IA, ET2FJ, G3CXJ, G3UXM, I1AMS, I1SRO, K1GUP, K2UTC, K4GLY, K5PMZ, LA7KK, OE3MJW, OH3LS, OZ5ND, SM3AT, SPØPZM, UA2KUP, UQ2AH, VE1GD, VE3UKL, W1CNX, W1RF, W2CDY/P1 (on s.s.b.), W3BVP, WA4PDY, WA8GYU, YO2BV, YU2EQ, YU1OW, which is pretty good for an ordinary domestic receiver. Quick—into the living room and fire-up the gramophone.

N. Edwards (Southampton—SO1 2HNO) (Funny callsign!), is fourteen years old (congratulations Sir!) and is a member of the Southampton Radio Society. His "tools of the trade" are an 840C receiver and a 100ft. V aerial running East/West. Alone in the ten-metre wilderness, Nicholas observed a.m. coming from—IT1SMO, K4ZYU, SM3DMM, UA1IB, UA3JQC, UA3KHD, UA3MRH, UB5CDV, UB5DUS, UB5FGC, UC2APW, UL7AWD, UP2YNC, UV3ABA, UV3ABW, VE1AOG.

LEG PULLING

A word about sending in logs for those uninitiated and just "dunno". First and foremost—only genuine logs please. Some of the lists I get, if genuine, would qualify for the eighth wonder of the world. As an example, a recent log of quite fantastic DX was received from a listener who claimed that I was right—ten metres was really humming. His receiver (he claimed) was a one transistor (admitted he did claim to have regeneration) followed by a three-transistor amplifier. The bit that hurt was that the line-up was an OC45 into three OC81's. Just for the record, the OC45 has an f_T of 6Mc/s, so on ten metres the set amounted to a crystal detector and an a.f. amplifier. So please slaves—only what you hear and not a grand pulling of '3JDG's hoof.

CONTESTS

Examination of my little black book shows four contests coming up soon. These are—February 11th, First 70Mc/s contest; 17—18th, First 1·8Mc/s contest (c.w.). Early March contests include—March 2nd—3rd, RTTY contest for the teleprinter enthusiasts; 3rd—4th, Third 144Mc/s contest.

Deadline for logs this month is the 20th.

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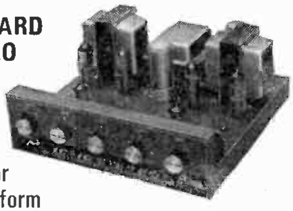

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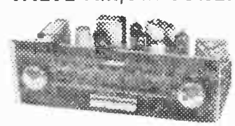

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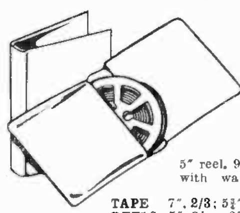

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PART 2:

H.T. KITCHEN

THE power supply is provided by two 6V batteries arranged in series. Since the equipment was designed for 9V operation a potentiometer VR8 is inserted in series with the supply and can therefore be used to set the supply voltage. It has the disadvantage that VR8 is in series with the intrinsic impedance of the power supply with the result that a path exists for unwanted signals to flow between the oscillator and the frequency meter. Normally, with both units working, if S3 is switched to EXT with no input, the meter should not read if S4 is turned to Monitor (Set) Freq. Due to the high impedance however sufficient oscillator voltage is passed to the frequency meter via the power supply to make the meter respond to the internal oscillator irrespective of the position of S3. Decoupling both sections by high value electrolytics C11 C22 cures this effect, and the use of a two pole switch for S3 is desirable.

CONSTRUCTION

With solid state equipment the use of some form of circuit board is almost mandatory. Consequently a means was sought which would be reasonably inexpensive and easy to fabricate, and capable of easy modification, if this became necessary. Such a means is provided by turret tags which are inserted into holes drilled in a suitable piece of bakelite or paxolin and then riveted over.

The boards on which the oscillator and frequency meter are constructed are of $\frac{1}{16}$in. paxolin and measure 8 x 3in. Figures 7 and 8 show the wired and assembled circuit boards. The thermistor which is comparatively fragile, should be fitted with care. In the prototype, it was held on the circuit board (with a piece of felt between them) by means of an elastic band passing through two small holes drilled in the paxolin in either side of the transistor and then tied together on the reverse side of the board. All interconnecting wiring on each panel is carried out on its reverse side.

PRELIMINARY TESTING

Upon completing the circuit boards, it is advisable to establish if they are functioning correctly before wiring them together on the front panel, as mistakes or faulty components can be located and rectified more easily at this stage. Flying leads should be soldered to the respective tags of VR1 a, b and the other ends soldered to the appropriate points on the tag board. Any pair of capacitors out of C1—C4 and C5—C8 should be wired into circuit and leads should be soldered to connect VR2 and VR3 to their respective points on the circuit board and after a final check to ensure that everything is correctly connected. The power supplies can be applied with VR8 set to maximum resistance. This acts in the manner of a safety device by limiting the maximum current the circuit can draw in the event of a fault being present. An oscilloscope or high resistance headphones connected between C13 and chassis (+ve side of the supply) will indicate the presence or absence of oscillations. VR2 should vary the output between zero and maximum, determined by the setting of VR3, which affects the amplitude and waveform of the output signal. The maximum output is in the region of 1,500mV (1·5V) and when the signal is reduced to 1,000mV it should be free from all apparent distortion. This concludes the preliminary tests on the oscillator panel.

The frequency meter is checked by soldering into the circuit the differentiating capacitor (C18—C21) corresponding to the frequency range of the oscillator panel. C14 should be connected to the junction of C9 and R9 and one

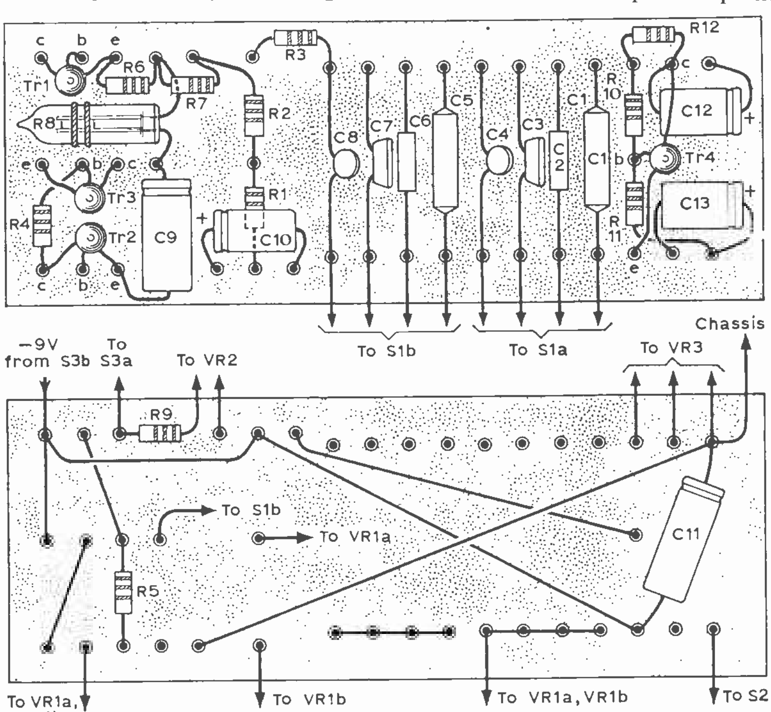
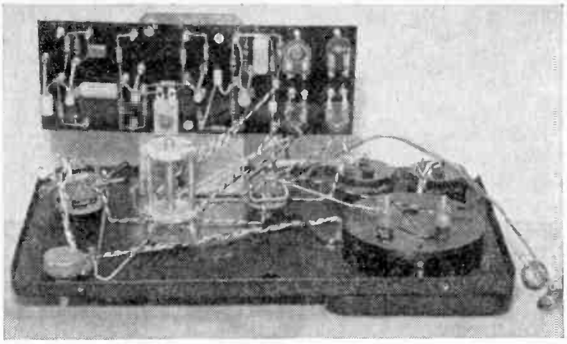
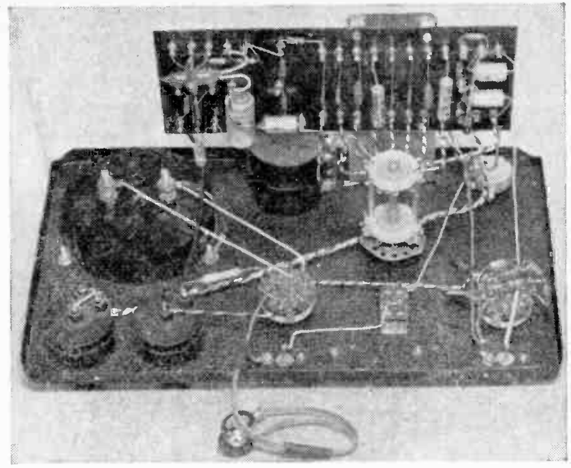


Fig. 7: Wiring details of the oscillator panel.



Above: Back view of the unit shown with the frequency meter board of Fig. 8 wired and in position.



Right: Back view of the unit showing the oscillator board of Fig. 7 wired and in position.

of the pre-set potentiometers VR4 to VR7 should be temporarily connected into circuit. The oscillator frequency is next determined by comparing it to the 50c/s a.c. mains supply by means of Lissajous figures and the pre-set pot is adjusted to make the meter read this frequency. The scale linearity can be checked by adjusting the oscillator frequency and seeing if the meter readings correspond. Any deviation can be corrected by altering R34 though this should not normally prove necessary. Although leads terminated in crocodile clips such as used by the author are very convenient it is probably safer to solder all flying leads into circuit.

Once it has been established that both units are functioning correctly they can be bolted on to the front panel and the remainder of the wiring completed.

COMPONENTS

The working voltages of all capacitors with the exception of C14, need not exceed 15V and in fact one capacitor will have to be limited to 6V working, if it is to be incorporated on the circuit board. This is C9 (500μF) which is on the bulky side even at 6V. C14 which may be connected to varying voltages of differing polarities should preferably be a reversible electrolytic with a working voltage at least equal to, and preferably higher than, the highest voltage it is likely to encounter. Unfortunately paper capacitors of equivalent capacity are almost always on the large side and it may prove easier to use two 16μF electrolytics back to back in place of C14.

It may prove desirable to include a series isolating capacitor between the output socket and S4 if the oscillator is to be fed into a point of high d.c. potential, as for example, the anode of a valve. Without such a capacitor, the attenuator resistors could suffer damage. Due to the low characteristic impedance of the attenuator, such a capacitor would have to be made as high in capacity as possible, in order to minimise low frequency losses. Again, the working voltage must be adequate.

Although a two gang 10kΩ wirewound potentiometer was used as the fine frequency control in the experimental stages of the prototype, it was found to suffer from two major disadvantages which made it desirable to replace it with the component specified. A wirewound potentiometer can be regarded as being composed of a large number of individual resistors in series, with its wiper corresponding to the wiper of a multi-way rotary switch. Whilst this may not prove to be a disadvantage in some applications it has the disadvantage, in the present application, of causing the frequency to alter in small increments instead of smoothly, making the selection of a precise frequency often difficult if not altogether impossible.

The second disadvantage is that being wirewound it possesses a certain amount of self-inductance

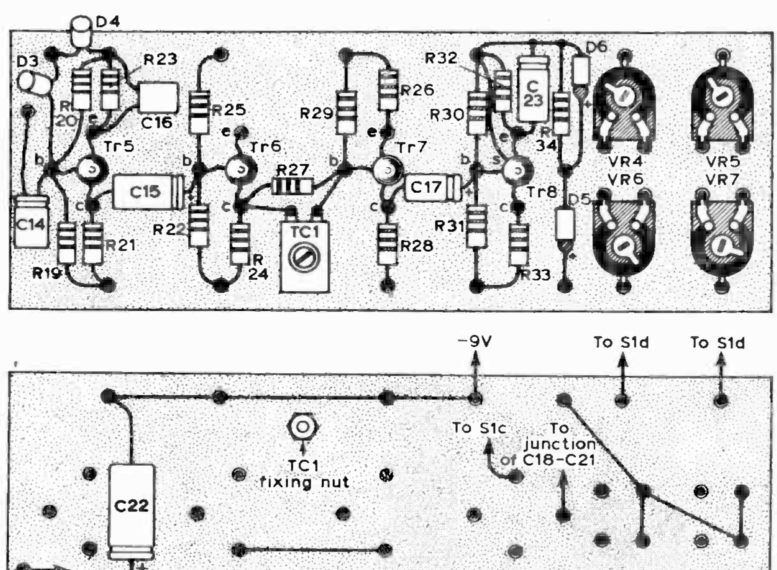


Fig. 8: Wiring details of the frequency meter panel

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6BW7	5/6
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6C5GT	6/-
6C6	3/9
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7H7	5/-
7R7	12/6
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10D2	11/8
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12AT7	4/-
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12AU7	4/6
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12AY7	9/9
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12BE6	5/3
12BH7	6/-
12E1	17/6
12J5GT	2/6
12J7GT	6/6
12K5	8/-
12K7GT	3/6
12K8GT	7/9
12Q7GT	3/6
12SA7GT	6/9
12SC7	4/-
12SH7	3/-
12SJ7	5/-
12SK7	3/-
12SQ7GT	8/-
12SR7	5/-
12Y4	2/-
13D1	5/-
13D3	9/-
14H7	9/6
14S7	19/6
18	12/6
19	10/6
19AQ5	5/-
20D1	13/-
20D4	20/5
20F2	11/6
20L1	15/6
20P1	17/6
20P3	17/-
20P4	17/6
20P5	17/-
25A6G	7/6
25L6G	4/9
25Y5	6/-
25Y5G	8/6
25Z4G	6/3
25Z5	7/-
25Z6G	8/6
30C1	7/-
30C15	12/-
30C17	13/-
30C18	9/6
30F5	11/6
30FL1	15/-
30FL12	15/-
30FL14	12/6
30L1	6/-
30L15	14/-
30L17	13/-
30P4	11/6
30P4MR	13/-
30P12	11/-
30P19	11/-
30PL1	15/-
30PL13	15/-
30PL14	15/-
30PL15	15/-
35A5	15/-
35L6GT	6/3
35W4	4/6
35Z3	10/-
35Z4GT	4/6
35Z5GT	5/6
42	5/-
43	10/-
50A5	21/10
50B5	6/3
50C5	5/9
50CD6G	40/9
50L6GT	6/-
52KU	14/6
53KU	14/6
72	6/6
77	5/-
78	4/9
80	5/3
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PCL85	8/3
PCL86	8/3
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UY21	9/-
UY41	6/6
UY85	5/6
U10	9/-
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U16	15/-
U17	5/-
U18/20	6/6
U19	40/-
U22	5/9
U25	12/6
U26	11/-
U31	6/3
U33	13/6
U35	16/6
U37	34/11
U45	15/6
U50	5/-
U52	4/9
U76	4/6
U78	3/6
U107	17/6
U191	12/-
U251	12/6
U281	8/9
U282	12/3
U301	12/6
U329	12/6
U403	6/6
U404	7/6
U801	18/-
U4020	6/-
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VP41	5/-
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X66	7/6
X76M	7/9
X79	40/9
X81M	29/1
X101	29/1
X109	26/-
Y63	5/-
Y65	5/-
Z63	4/9
Z66	7/3
Z77	3/3
Z329	11/6
Z729	6/3
Z759	23/-
Transistors and diodes	
2G225	10/6
2N404	6/-
2N2297	4/6
AA120	3/-
AA129	3/-
AAZ13	3/6
AC107	3/6
AC113	5/-
AC114	8/-
AC126	2/-
AC127	2/-
AC128	2/-
AC154	5/-
AC155	6/6
AC156	4/-
AC157	5/-
AC165	5/-
AC166	5/-
AC167	12/-
AC168	7/6
AC169	6/6
AC176	11/-
AC177	5/6
ACY17	3/4
ACY18	5/3
ACY19	6/3
ACY20	4/9
ACY21	5/9
ACY22	3/6
ACY28	4/3
AD140	8/-
AD149	8/-
AF102	18/-
AF114	4/-
AF115	3/-
AF116	3/-
AF117	3/4
AF118	3/-
AF119	3/-
AF124	7/6
AF125	3/6
AF126	7/-
AF127	3/6
AF139	11/-
AF178	10/-
AF179	13/6
AF180	9/6
AF181	14/-
AF186	10/-
AFZ12	5/-
ASY27	10/-
ASY28	7/6
ASY29	10/-
AY100	26/-
BA115	2/8
BA116	9/-
BA129	2/6
BA130	2/-
BCY10	5/-
BCY12	5/-
BCY33	5/-
BCY34	5/-
BCY38	5/-
BCY39	5/-
BCZ11	3/6
BC107	4/-
BC108	3/9
BC109	4/6
BC113	5/-
BC115	3/-
BC116	5/-
BC118	4/6
BD119	9/-
BFY50	5/-
BFY51	4/6
BFY52	5/-
BF115	2/6
BF154	5/-
BF159	5/-
BF163	4/-
BF167	2/6
BF173	2/6
BF180	12/-
BF184	2/-
BF185	8/-
BY100	3/6
BY101	11/6
BY105	10/6
BY114	8/-
BY234	4/-
BY236	4/-
BY238	4/-
BYZ12	5/-
BYZ13	5/-
CG12E	4/-
CG64H	4/-
GD3	6/6
GD4	6/6
GD5	5/6
GD6	5/6
GD8	4/-
GD9	4/-
GD10	4/-
GD11	4/-
GD12	4/-
GD14	10/-
GD15	8/-
GD16	4/-
GET102	4/9
GET103	4/-
GET105	18/-
GET111	15/6
GET113	4/-
GET114	4/6
GET115	17/-
GET116	7/6
GET118	4/6
GET119	4/6
GET573	8/6
GET587	8/6
GET872	10/-
GET873	4/-
GET874	23/6
GET882	10/-
GET887	4/6
GET889	4/6
GET890	4/6
GET896	4/6
GET897	4/6
GET898	4/6
GEX13	3/6
GEX35	4/6
GEX36	10/-
GEX45/1	7/-
GEX55/1	15/-
GEX64	11/6
GEX66	15/-
GT3	5/-
M1	2/10
M3	2/10
OA5	1/9
OA9	2/6
OA10	6/6
OA47	2/-
OA70	3/-
OA73	3/-
OA79	1/9
OA81	1/9
OA85	1/6
OA86	4/-
OA90	2/6
OA91	1/9
OA95	1/9
OA182	2/-
OA200	1/-
OA202	2/-
OA210	9/6
OA211	13/6
OAZ200	12/-
OAZ201	10/6
OAZ202	9/-
OAZ203	9/6
OAZ204	9/-
OAZ205	9/-
OAZ206	9/-
OAZ207	10/6
OAZ210	7/-
OAZ213	7/-
OAZ224	13/-
OC19	25/-
OC22	5/-
OC23	7/-
OC24	14/6
OC25	5/-
OC26	5/-
OC28	5/-
OC29	16/6
OC30	7/-
OC35	10/-
OC36	7/6
OC38	11/6
OC41	10/-
OC42	6/9
OC43	12/6
OC44	2/-
OC44PM	8/3
OC45	1/9
OC45M	8/-
OC46	3/-
OC65	22/6
OC66	25/-
OC70	2/3
OC71	2/-
OC72	2/-
OC73	16/-
OC74	8/-
OC75	2/-
OC76	3/-
OC77	3/4
OC78	3/-
OC78D	3/-
OC79	8/-
OC81	2/-
OC81D	2/-
OC81M	5/-
OC81Z per pair	5/6
OC82	2/3
OC82D	2/6
OC83	2/-
OC84	3/-
OC123	4/6
OC139	12/-
OC140	19/-
OC169	3/9
OC170	2/6
OC171	3/4
OC172	4/-
OC200	5/-
OC201	23/-
OC202	5/6
OC203	5/6
OC204	10/6
OC205	7/6
OC206	10/6
OC812	8/-
OCP71	27/6
ORP12	15/-
TS2	12/6
TS3	15/-
V10/15A	12/-
XA102	19/6
XA103	15/-
MAT100	7/9
MAT101	8/6
MAT120	7/9
MAT121	8/6
P346A	2/-
ZE12V7	1/9

MATCHED TRANSISTOR SETS 1—OC44 and 2—OC45 8/6; 1—OC81D and 2-OC81 7/6; 1 OC82D and 2-OC82 8/6; Set of three-OC83 (GET118/119) 8/6; 1—GET874P sleeved yellow, 1—GET873P sleeved white (1st I.F.) 1—GET873P sleeved blue (2nd I.F.) 8/6; LP15 package (AC113, AC154, AC157, AA120) 12/6; Postage 6d. per set.
S.T.C. 1 watt Zener diodes. 2·4v: 2·7v: 3·0v: 3·6v: 4·3v: 13v: 16v: 18v: 30v. All 3/6d. each.

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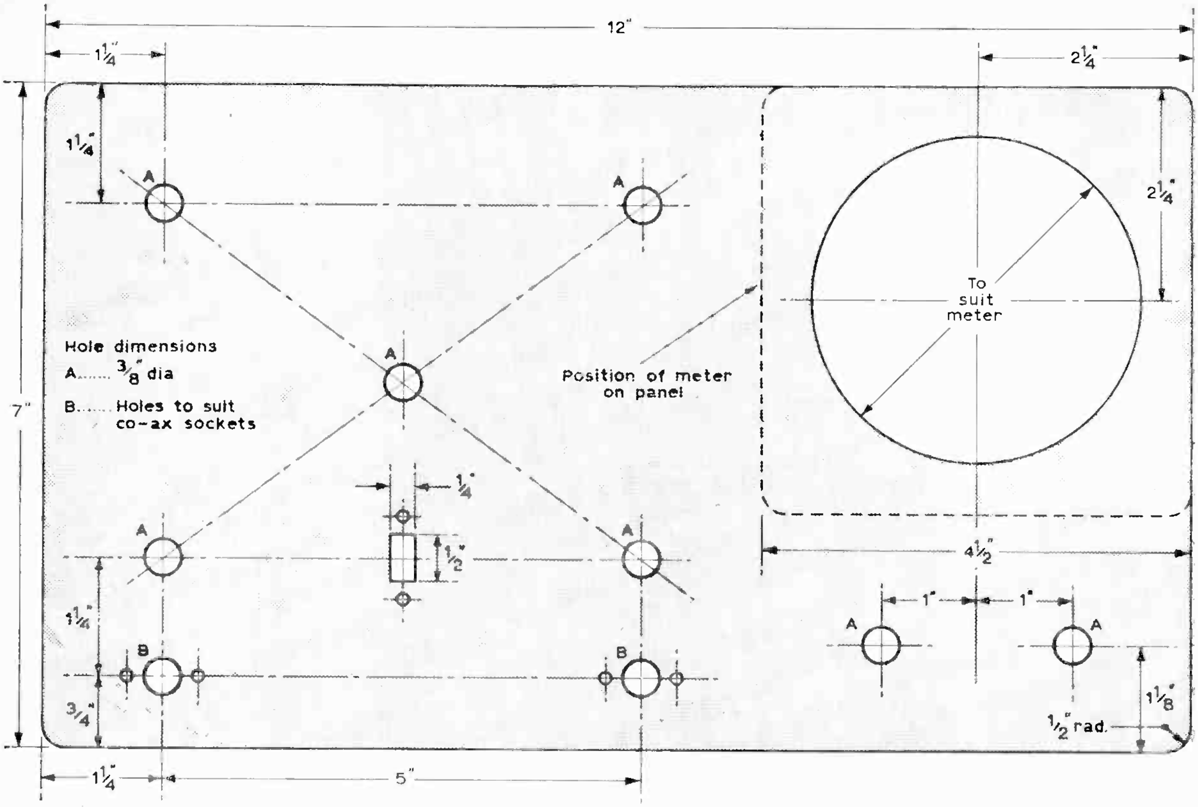


Fig. 9: Dimensions and details of the drilling for the front panel of the unit, viewed from the front.

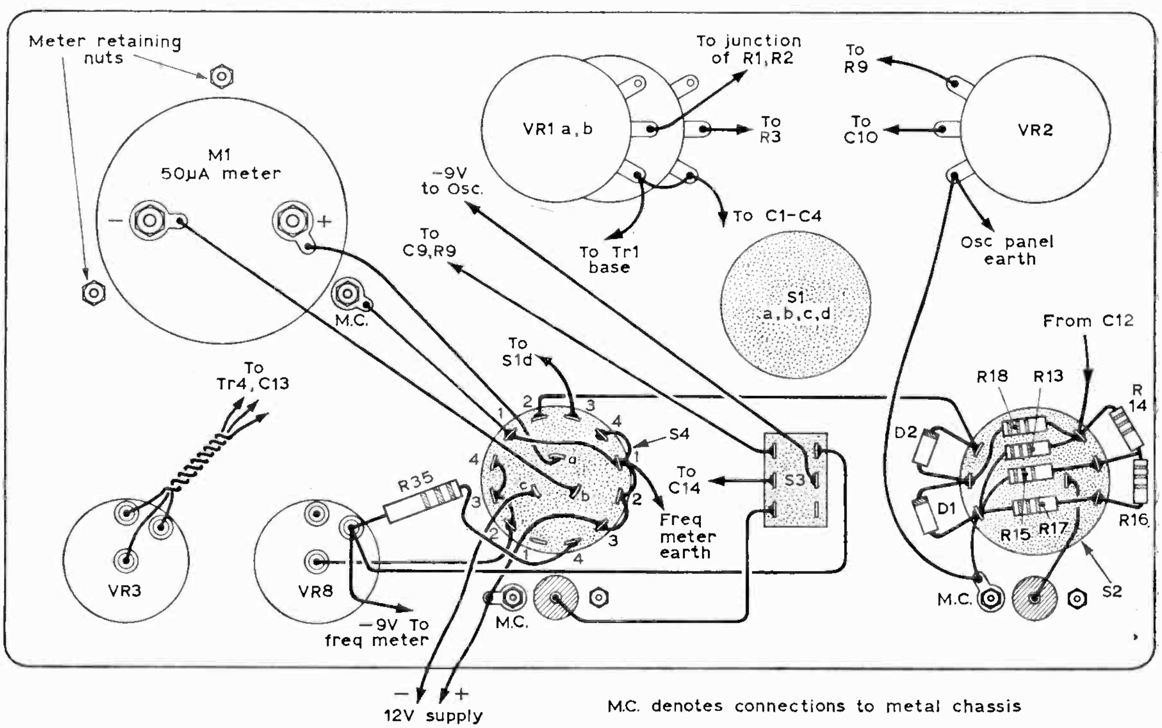


Fig. 10: Sketch showing the wiring of components mounted on the inside of the front panel. All other wiring is contained in the two circuit boards of Figs. 7 and 8.

which becomes noticeable at the higher frequencies by causing the output voltage to fall well below its mid band (1kc/s) level. The reason for this is not hard to find if we remember that one section of the potentiometer is in series with the oscillation producing positive feedback, with the result that its inductive reactance increases with increasing frequency and thereby reduces the feedback, which in turn reduces the output voltage. Although the thermistor can compensate for this to a certain extent, it is unable to restore the output to its 1kc/s level. The measured drop using the wirewound potentiometer was −4dB at 150kc/s relative to the 1kc level (measured across VR2).

Where resistor leads are short, it is advisable to use a heat shunt to avoid excessive overheating which often causes an appreciable resistance change.

The meter is the most expensive single item and it is desirable to acquire the best available, consistent with one's individual means, since the performance of the equipment as a whole is greatly dependent upon it. Apart from the desired sensitivity, it should have a clear open scale calibrated from 0—10 or 0—20. Some meters are calibrated expressly for use in a particular position and for use on a ferrous or non-ferrous panel. Any departure from the maker's recommendation can therefore lead to inaccurate meter readings.

The transistors used are freely and cheaply available. The use of alternative transistors has not been investigated.

We come now to the only component that may prove difficult to obtain, at least in provincial areas. The author, who ordered his thermistor through his local dealer, had to wait for some eight weeks even though he was told he could have a gross in a week!

The range switch (S1) is the only switch that is in any way critical, that used by the author had two three-pole four-way wafers, of which only two poles on each wafer are actually used. The two wafers should be as far apart as practicable, the wafer nearest the front panel being used for switching the frequency meter, and the other wafer used to switch the audio oscillator. The wiring to the switch should be kept short and direct. No interaction was noticed on the prototype between the two wafers and their associated wiring, but should it occur an aluminium screen, made as large as practicable and inserted between the two wafers should cure the trouble.

S2 and S4 are of the wavechange variety, S2 being a single-pole three-way switch and S4 a three-pole four-way switch. A two-pole three-way switch was used for S2 because it happened to be handy and the spare tags used to anchor R18 and D1 D2.

S3 is a miniature two-pole two-way slide switch and can if desired be replaced by a two-pole two-way rotary switch. The meter short-circuiting facility should not be omitted whatever changes are made to the rest of the switching.

next month—Calibration

THE CLUBMAN

—continued from page 831

4—With a suitable insulated trimming tool, adjust the tuning core of i.f.t.3 for maximum audio output, reducing the output from the signal generator as necessary, to avoid overloading the a.f. stages.
5—Disconnect the signal generator and connect to Tr4 base and chassis.
6—Adjust the primary and secondary cores of i.f.t.2 for maximum output, reducing the signal generator output as necessary.
7—Disconnect the signal generator and connect to Tr1 base and chassis.
8—Adjust the primary and secondary cores of i.f.t.1 for maximum output.
9—With the signal generator still connected to Tr1 base repeat the adjustments 4, 6, and 8.
This completes the i.f. alignment.
10—With the signal generator connected as in 9, switch the signal generator modulation "off".
11—Switch the receiver b.f.o. "on".
12—Adjust the b.f.o. tuning capacitor VC3 to half capacitance (90deg. from fully meshed).
13—Adjust the tuning core of the b.f.o. coil until the b.f.o. is heard to zero-beat with the 470kc/s signal from the signal generator.
14—Check that rotating the b.f.o. tuning control VC3 produces a beat note of approximately equal frequency at maximum and minimum capacitance.
This completes the b.f.o. adjustment.

The r.f. alignment is identical to that previously described for the Clubman Mk I.

The performance of the receiver when fully aligned is as follows:

Sensitivity	1·8Mc/s	5μV
	5·0Mc/s	3μV

(For 50μW output, 6dB s/n ratio, input signal modulated 30% at 400c/s)

Selectivity	3dB down	3kc/s
	20dB down	10kc/s

The controls of the Clubman Mk II are self-explanatory but the following points should be borne in mind.

1—For the reception of a.m. signals the a.v.c. is normally switched on. To obtain best results from the a.v.c. system, the r.f. gain should be set at maximum unless noticeable overloading occurs from very strong signals.

2—For the reception of c.w. signals, the a.v.c should be switched off and the c.w. signal tuned in. The b.f.o. should be switched on and the b.f.o. tuning adjusted to give a suitable beat note. The r.f. gain should be adjusted to avoid overloading of the i.f. stages to give the cleanest signal with respect to any interference that may be present.

3—For the reception of s.s.b. signals the r.f. gain should first be set to minimum and the a.f. gain to maximum. Increase the r.f. gain slightly and carefully adjust the s.s.b. signal. Switch the b.f.o. on and carefully adjust the b.f.o. tuning control until the s.s.b. signal is resolved. Slight adjustment of the r.f. gain may now improve the results. It is important to keep the a.f. gain near maximum and the r.f. gain at the minimum level for satisfactory results.

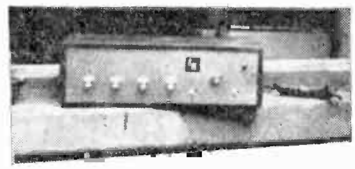
References

1. J. T. Lawrence. "Clubman Mk I Receiver" *Practical Wireless*. January/February 1968.
2. Denco (Clacton) Ltd. "Circuit for 465kc/s i.f. or 1·6Mc/s i.f. employing double tuned transformers". *Technical Bulletin DTB4*.
3. Mullard Ltd. "Reference Manual of Transistor Circuits" pp. 199-200.
4. Weymouth Radio Mfg. Co. Ltd. "I.F. Transformers—T41 Series". *Technical Data Sheet*.

TO BE CONTINUED

E.S.V. THE ONLY DISCOUNT STORE

Stereo amplifier Mk II



BARGAIN—A fully **Transistorised Amplifier** as illustrated—Stereo 5/5 Channel—Mono 10—Fully built in Black padded Leather Cabinet—Five controls — Disc-Radio-Tape/Bass/Treble/Balance/Volume. Mono-Stereo function — Indicator Neon on brushed silver fascia panel — Stereo Tape Recorders and High Sensitivity Stereo Pick-up may be fed directly to the Amplifier. List Price 26 gns. **Our Price 15 gns.** Brand new and guaranteed. P.P. 8/6.

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● **SCOOP—LOUD-SPEAKER ENCLOSURES** 16 gns.—our price 8 gns. p.p. 12/6.
As main distributors for Electra Hi-Fi Equipment we are prepared to offer this reduction to introduce this beautiful speaker. Enclosure fitted with superb 8 ohm custom-built unit handling 5 watts R.M.S. Teak finish. Superb T/men front, fully damped. Size approx. 3ft. by 1ft. 9in. deep by 1ft. 7in. wide.

● **SCOOP—JUST RELEASED—SCHAUBE CRYSTAL TUNER.** Completely wired and tested in beautiful cabinet with silver facia. Leads supplied for immediate connection to amplifier, tape recorder etc.
E.S.V. price—S.W.B. L or M. **£3.5.0.** only. P.P. 5/-.
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Transistor Stereo Amplifier	£15 15 0
Two Electra Hi-Fi Enclosures	£16 16 0
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Sonotone 9TA/H.C. S/S Cartridge	£1 10 0
Special X/A Plinth—Fully damped	£4 10 0
	£47 10 6

To introduce this superb equipment 44 **gns.** p.p. free. (Fully wired—with all leads ready to plug in).

● **SCOOP—W.B. 8in SPEAKERS** (Round) Golden finish, die-cast chassis—Power handling 5 watts—3 or 15 ohms. Fitted into very pleasing Vynair covered cabinet—ideal for Stereo units or superb extension speaker. Our price while stocks last 4 **gns. only.** P.P. 6/6—10 gns. value.

● **SCOOP—BAKER SELHURST SPEAKERS**—12in. round—15 watts —this custom built unit was made to sell at £12.10.0. Golden finish, die-cast chassis, micro suspension, 3-15 ohms, 12,000 lines. Brand new in makers sealed package. **Our Price 5 gns. only.** P.P. 6/6.

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● **SCOOP—RADIO CHASSIS By Famous Manufacturer** 15 gns. **Our price 9 gns** plus P.P. 6/-. 10 Transistor—L.W.-M.W.-S.W.—Ferrite Rod Aerial. A beautiful Chassis. Supplied with matching Speaker. 12 Month's Guarantee. Limited number. Cannot be repeated!

● **SCOOP—STEREO RADIO CHASSIS BY BRITISH NATIONAL MANUFACTURER.** A superb instrument (valve) giving 5 watts P/C. Long-Medium-Short wave bands. Ferrite rod on Long and Medium. Push Button Control. Vernier Dial with Log. Passivated Chassis. Supplied complete in every way. All knobs, leads, etc. **Usual Retail Price 21 gns—Our Price 16 gns.** P.P. 21/-. Twelve months' guarantee—and as special introductory offer — **FREE TWO 8in. ROUND SPEAKERS.**

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● **SCOOP—BARGAIN**—A Tape Amplifier—A.C. 230/240V. specially designed for easy mounting—completely built and ready to connect (5 connections only)—2 Valves—Rectifier—Magic eye—Output transformer—Tone control, etc. Product of National manufacturers. Our Price only **£6.** P.P. 7/6. (Brand new and guaranteed.) Over 10,000 of these units have been sold with complete satisfaction.

● **SCOOP—THE ELPICO 5-WATT STEREO AMPLIFIER.** Easily mounted Black/Silver escutcheon. Black/Silver matching controls. **Original Retail Price £17.1.5.** These units (which are brand new and boxed) while stocks last can be offered for **£6.10.0** only. P.P. 10/-.
This is the bargain of the month.

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● **SCOOP—E.S.V. 3-WATT AMPLIFIER UNIT**—75/-. **Our Price** 57/6 plus P.P. 3/6. Complete with Valves (U.C.L. 82 Output) Fully built. Tested. Mounted on Board. Complete with Speaker (5in. round)—Knobs supplied, all leads attached—ready for instant connection to your turntable. Fully guaranteed.

● **SCOOP—E.S.V. RECORD PLAYER CABINET**—75/-. **Our Price** 55/- plus P.P. 5/6. Strongly Built Wooden Cabinet. Two-tone. Complete with either B.S.R. or Garrards Cut-Out Board. Gilt Fittings. Strong Carrying Handle. Will suit any Gramophone Amplifier. Ample space for Speaker.

● **SCOOP—TRANSCRIPTION PICK-UP**—Brand new by famous manufacturer (was used by B.B.C.). Complete with mag. cartridge (but less stylii). Removable head shell, balanced arm weighted, needle mounted. **Our price** while stocks last **£3.10.0 only.** P.P. 7/6. A fraction of original price of £17.15.0.

● **SCOOP—CAR RADIO 12 gns.—Our price 8 gns. only.** P.P. 8/6. Well-known brand name on sale nationally. Fully tested before dispatch. In maker's own carton with maker's guarantee. L/W-M/W-fully transistorised—Speaker and fitting kit supplied at no extra cost, also instructions for fitting. 12 volt. Please state negative or positive earth.

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● **SCOOP—TAPE RECORDER**—9 gns. **Our Price 6 gns.** plus P.P. 6/-. Famous Manufacturer. Brand New and Boxed. Battery Operated. Six Transistor—Push Button Sytem. Remote Control Mic. Business. Pleasure. Education. A constant companion. Remote Control. Styling and quality found only in Higher Priced Recorders. High Fidelity allows for good pick-up of conversations at meetings and conferences. Record in Car. Train or Boat. Cannot be repeated.

● **SCOOP—BARGAIN—SLIMLINE TV RECEIVERS**—19in. in Mint condition. Complete, tested, working but less I.F. Strips. Make ideal Monitors. Various famous makes. Our Price only **£10.0.0.** I.F. strips if required 45/- only. P.P. 50/- (TV and Strip). Personal collection advised otherwise despatched at customer's risk.

● **SCOOP—DIODES**—over 1,000,000 in stock—ideal substitute O.A.81 vision detector.
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● **SCOOP — CARTRIDGES** — Cartridges — Cartridges. The lowest prices.

Sonotone 19/TI—Crystal Stereo	25/- only
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T.C.8H—Mono	25/- only
T.C.8M—Mono	25/- only
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P.W. DATA RULE

PART 5

by I. J. KAMPEL

In this final article concerning the Data Rule (still available at 5s. from the Blueprint Department), some practical applications will be considered.

CONSTANT-CURRENT GENERATOR DESIGN

THE generator that will be developed is intended for driving only low impedance loads, loads which will not develop more than about 3V. It is ideally suited for driving emitter-base currents in, for example, a transistor tester, and the value of constant-current can be programmed by switch positions. The useful range of the circuit is about 0·5μA to 50mA.

Figure 1 shows the basic circuit in which Tr1 and Tr2 form a long-tailed pair, the base of Tr1 being held constant at a set voltage. The emitter-base voltage of the transistors can be regarded as a constant, therefore the emitter of Tr1 must also be held constant. The emitter of Tr1 is linked to the emitter of Tr2, since they both draw their emitter currents through the same emitter load. Since Tr1 base is clamped, also effectively clamping its emitter, Tr2 emitter is also clamped, and an identical emitter-base voltage to Tr1 means that Tr2 base will be clamped at the same voltage as Tr1 base.

The emitter resistor Tr3 is thus totally influenced, in terms of current, by this clamping, since a constant voltage is maintained across this resistor. Because there is constant voltage across the resistor, there will be constant current driven through the Tr3 emitter. The BC109 is a very high gain device, and thus we can assume that the collector current is virtually all of the emitter current, and thus, in effect, constant current, programmed by the Tr3 emitter resistor, is driven through the collector load.

To allow accurate programming, since I = V/R, the voltage to be presented at Tr2 base should be adjusted in order that a preferred resistor value will provide the required constant-current/s. The circuit will be designed to produce currents of 1μA, 10μA, 100μA, 1mA and 10mA. As seen from the Preferred Resistors Table on the Data Rule, 6·8 is a preferred value. Since we want multiples of ten in terms of constant current, then the values of current can be produced by 6·8V across different resistors with multiples of 6·8Ω. Thus we must design for 6·8V at Tr1 base. The transistors in this circuit are all silicon, giving V_{BE}'s of about 0·5V, therefore the voltage across R4 must equal $V_B - V_{BE}$ of Tr1, i.e., 6·8V — 0·5V = 6·3V. As shown on the figure, we shall drive the transistors with 1mA emitter current apiece, therefore the current through R4 will be the sum of the two, namely 2mA, and therefore:

$$R4 = \frac{6 \cdot 3V}{2mA}\ \Omega$$

Adjust the rule slider to give 6·3V in scale R opposite the coloured "V" mark on the central window. Read off the value of R4 in scale U opposite 2mA in scale V, i.e., 3·15kΩ. Refer to the Preferred Resistors Table on the other side of the rule, and see that the nearest preferred value is 3·0kΩ, and therefore R4 = 3·0kΩ.

Now consider the bias chain for Tr1, and the zener diode, D1. Bearing in mind the possible spread of zener voltage, V_Z, R2 must be capable of adjusting to 6·8V. Consider the spec. for the OAZ203 zener diode given in the table on the following page.

If we run this diode at I_Z = 1mA, the maximum V_Z closely approaches the required 6·8V, but cannot exceed it. Now in the minimum case, V_Z = 5·8V, R2 must drop at least 6·8 — 5·8 = 1·0V. Since the zener current is 1mA, therefore $R2_{min} = \frac{1V}{1mA}$ Ω. The answer to this is obviously 1kΩ, however the rule could be employed as a further illustration. Set scale R to 1V, and read 1kΩ adjacent to 1mA in scale V. Thus, since this happens to be a preferred value for potentiometers, usually found to follow multiples of 1, 2 and 5, we shall make R2 a 1kΩ pot.

Now R1 has to drop the remaining voltage in the chain, which can be line voltage minus 1V across the pot, with a further 5·8V in the worst case, giving 5·2V.

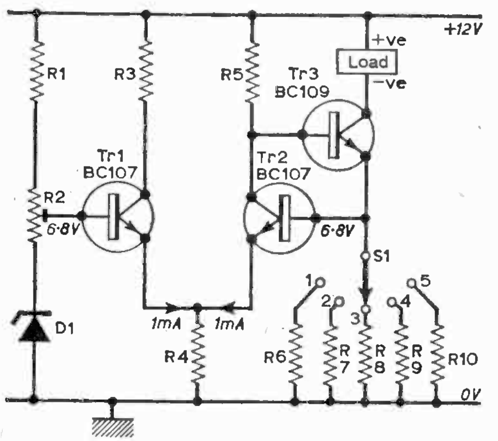

Fig. 14: Constant-current generator.

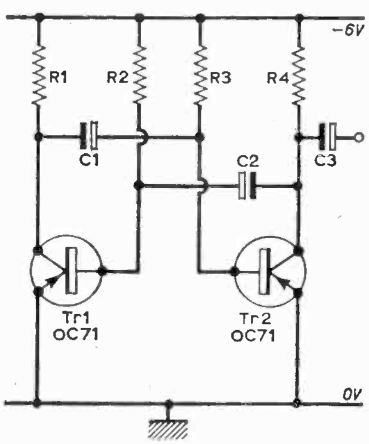

Fig. 15: A multivibrator design.

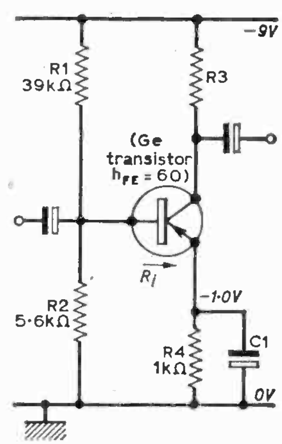

Fig. 16: Simple amplifier stage.

Now if V_z is its max., the voltage to be dropped by R1 reduces to 4·4V and the two resistance values could then be usefully computed. Set 5·2V on scale R and read the resistance 5·2kΩ opposite 1mA in scale V. Set 4·4V on scale R and read the resistance 4·4kΩ opposite 1mA in scale V. Thus the resistor R1 may be between 4·4kΩ and 5·2kΩ. Bearing in mind, from the data, that a slight increase in current will not greatly affect V_z, we will prefer a lower biased resistor, therefore, looking at the resistor chart, 4·7kΩ is seen to be a likely value, and we will therefore make R1 = 4·7kΩ.

For correct design, we should look at the curves for the BC107 transistor before selecting the collector resistances, however, assuming this is not available, we shall assume the typical value of V_{ce} = 3V, giving adequate collector bias, and still leaving a reasonable bias across R3 and R5. The long-tailed pair will be made symmetrical, therefore R3 = R5. If 6·3V are dropped

V_z spreads			
	voltage		
at I_z mA	min.	typ.	max.
0·1	5·0	5·6	6·4
1·0	5·8	6·2	6·6
5·0	6·1	6·3	6·8

The table shows the specifications for the OAZ203 zener diode referred to in the text.

across R4, and a further 3V across the transistor, the collector resistors must drop 12 — 6·3 — 3 = 2·7V. Remember that the 2mA in the common emitter load is now divided equally between Tr1 and Tr2, therefore we feed 2·7V and 1mA into the Data Rule. Select 2·7V on scale R and read off 2·7kΩ opposite 1mA in scale V. Note that the design of this circuit has led to a multiple of 10 making calculations easy, but the rule would be far more appreciated in cases where such manageable values are not attained. From the table, it is seen that 2·7kΩ is a preferred value, thus R3 = R5 = 2·7kΩ.

Switch position 1 programmes the load current for 1μA, and bearing in mind the clamped 6·8V across which ever of R6 — R10 is selected by S1, then the rule will give R6 if we calculate 6·8V and 1μA. Set the voltage in the middle window, and read 6·8kΩ opposite 1mA, since 1μA is not on the scale. Now, 1μA = 1mA x 10^{-3}, therefore R6 = 6·8kΩ x 10^3, i.e., 6·8MΩ.

The other resistors selected by S1 may be similarly found, and we already know that for 1mA, switch position 4, that R9 = 6·8kΩ. By inspection, however, it will be seen that since, from switch position 1, the current increases in factors of 10, the programming resistance will reduce by factors of 10, giving the following values of all components:—

R1 = 4·7kΩ	R7 = 680kΩ
R2 = 1kΩ preset pot.	R8 = 68kΩ
R3, R5 = 2·7kΩ	R9 = 6·8kΩ
R4 = 3kΩ	R10 = 680Ω
R6 = 6·8MΩ	

Circuitry Note: R2 is preset, and in the practical circuit, put a 10mA f.s.d. meter in as a load, and adjust R2 for exactly 10mA with S1 in position 5.

The circuit can be adapted to provide reliable low-level current for testing silicon planar transistors for gain at low levels, the circuit providing the programmed base-current drive. It can work down as low as 30nA programmed current, if a fourth transistor, another BC109, is added in Darlington configuration with Tr3. It is best to set the pre-set at a higher current, since as the programmed current reduces, and with it the output transistor's gain, the base current in this transistor assumes greater importance. In extreme cases, such as 30nA, it may be advisable, if the means to check the current is available, to adjust the programming resistor to allow for this reduction in collector current due to base current. With a Darlington configuration, currents above 100nA should give good accuracy, the accuracy being set almost solely by the tolerance of the programming resistors.

Finally to check on the power ratings of resistors necessary. Our highest current is 10mA through R10, therefore set the I_{max} arrow in the central window opposite 10mA in scale Q. It will be seen that the resistance value of R10, 680Ω, is way off the power scale, this resistance value in scale O seen to be less than 0·1W on scale N. Thus even a $\frac{1}{8}$W rating resistor will suffice. Move the slider to read 1mA in scale Q, and R9, 6·8kΩ, is again low. It will be seen that as we go down the switch positions, although we move one cycle higher on the resistance scale, we also move one larger division in the reduction of current scale, therefore $\frac{1}{8}$W is satisfactory for R6-10. Set to 2mA, and look for 3kΩ in scale O for R4 power dissipation. Again power is negligible. Similar checks on all other resistances show the same result: negligible power dissipation, and $\frac{1}{8}$W resistor ratings adequate throughout.

MULTIVIBRATOR DESIGN

Figure 2 shows the familiar multivibrator design, and space will not be taken up here on explanations of how this functions, since this has been explained a number of times previously in this magazine. We shall simply consider the circuit design. The period of time that each of the two sections of the circuit is on is given approximately by t = 0·7CR. A much more involved calculation is required to get a truly accurate answer, however 0·7CR is a reasonable approximation in practice, and will suffice for most applications. The CR terms refer to coupled base resistances and capacitances.

If the CR product is unequal for the two sides of the circuit, unequal switching times will occur, and this is quite acceptable if desired. We shall design for a symmetrical case, however.

Let us assume that a reasonably slow frequency is required, say 500c/s. The reciprocal of this gives the period of the waveform, and this can be worked out easily mentally, but by the rule, place 500 in scale L opposite the 1 of scale M, and read the significant figures of the reciprocal opposite the mark above, in scale Y, namely 2·00, and correcting for the true decimal place, this is 0·002 sec. This represents the full cycle, but to consider one transistor's function only, its period will be 0·001 sec.

We will firstly select a suitable value of base resistance, work out the appropriate capacitance, then take the nearest preferred capacitance value, working back to then modify the base resistance, since it is easier to alter the resistor than capacitor by a small amount to adjust to the required frequency.

Assuming I_c = 1mA in the first instance and that the OC71 has an h_{FE} of around 40 then I_B = $\frac{10^{-3}}{40}$ mA. This can be evaluated as a reciprocal on the ZL scales as 1/40mA, and is seen to give, when correcting the point by inspection, 25μA. Since germanium transistors are being used, in comparison with line voltage, V_{EB} can be neglected, and line voltage and the

calculated base current are fed into the scales on the rule to evaluate the resistances R2 and R3.

Set 6V in scale R, and read off the resistance 2·4kΩ opposite 2·5mA in scale V, since 25μA is off scale. 2·5mA = 25μA x 10^2 therefore R = 2·4kΩ x 10^2 which is 240kΩ. Thus: 1 x 10^{-3} sec = 0·7 x C x 240 x 10^3 ie.,

$$C = \frac{1 \times 10^{-3}}{0{\cdot}7 \times 240 \times 10^3} = \frac{10^{-6}}{0{\cdot}7 \times 240}.$$

Place the 7 in scale L opposite the 1 of scale M and read off the significant figures 143 as the reciprocal. It is now only necessary to divide this by 240. Place the 1·43 of scale M adjacent to the 2·40 of scale L to divide by 240 and read off 594 in scale M opposite the 10 of scale L. To place the decimal point do a rough calculation. In the denominator the 0·7 reduces the 240, and since we are rounding number off, we shall thus reduce this to 200, approaching the 70% value of 240 that is required anyway. This gives: $\frac{10^{-6}}{0{\cdot}2 \times 10^3}$ with a further simplification. Simplifying further: $\frac{1 \times 10^{-9}}{0{\cdot}2}$ = 5 x 10^{-9}, or 5,000 pF. Thus the true answer is seen to be 5,940pF. The nearest capacitor to this easily available is probably 5,000pF, therefore, assuming this, we shall now check the frequency that this would give, to see if this is acceptable without further modification: t = 0·7 x 5 x 10^{-9} x 240 x 10^3 = 3·5 x 240 x 10^{-6} (mentally readjusting).

Multiply this out with the L and M scales, giving 840 x 10^{-6}, or 2 x 840 x 10^{-6} the full period, giving 1·68 x 10^{-3}. Take the reciprocal of this from L and Z scales, giving 598c/s. Now, bearing in mind that the formula used is only an approximation, this may be considered close enough. We can check the percentage error, assuming the formula accurate, by placing 5 (representing 500c/s) opposite the component tolerance central mark, adjacent to the Z scale. From this we see that 598c/s represent nearly a 20% error, and we may wish to make this closer to 500c/s. To do this, take the previously used formula, but instead of C being the unknown, make R the unknown, putting C in as 5,000pF. This gives: 1 x 10^{-3} = 0·7 x 5 x 10^{-9} x R and

$$\text{thus } R = \frac{10^{-3}}{0{\cdot}7 \times 5 \times 10^{-9}} = \frac{10^6}{0{\cdot}7 \times 5} = \frac{10^6}{3{\cdot}5}.$$

Determine the reciprocal of 3·5, and correct, giving 0·286 x 10^6 or 286kΩ, as opposed to the original 240kΩ. Refer to the preferred resistor chart, and it is seen that 270kΩ is the nearest preferred value. Now if this is worked out for frequency, i.e., for 270kΩ and 5,000pF, the frequency is seen to be 529c/s. By checking with the component tolerance scale again, this is now found to be between 5 and 10%. To get even closer than this it would be necessary to use parallel resistors for the base resistance, and since the formula is only an approximation, this is pointless. Thus we shall use R2 = R3 = 270kΩ.

Now, I_B must be determined for the transistors, by setting 6V in scale R, and reading off 2·23mA opposite 2·7kΩ in scale U. Since 270kΩ = 2·7kΩ x 10^2, the base current is 2·23mA x 10^{-2} = 22·3μA. The collector current will thus be 22·3 x 40μA, which, multiplied on L and M scales, gives 0·892mA. Again, curves for the OC71 should then be consulted, but allowing, say, 4V across the transistor, this leaves 2V to drop across the collector loads. Select 4V in scale R and read off 448Ω in scale R against 8·92mA in scale V. Now this is one cycle too far to the right, so it is seen at once that the true value is 4·48kΩ. Looking at the preferred resistance value chart it is seen that 4·3kΩ is the nearest suitable value. Thus, R1 = R4 = 4·3kΩ. Thus, the calculated components for an approximate frequency of oscillation of 500c/s are: R1, R4 = 4·3kΩ; C1, C2 = 5,000pF; R2, R3 = 270kΩ.

The output may be taken from either collector through a capacitor, shown in the figure taken from Tr2. This capacitance should present low impedance to 500c/s, and should really consider the following circuit impedance, but generally speaking, since the capacitive reactance, $X_c = \frac{1}{2\pi fC}$ we can select a suitable capacitor from this, giving a low value X_c, say 100Ω for example. This value can be very loose indeed, in terms of accuracy, and hence π may be taken as 3 without any qualms. Thus the formula $X_c = \frac{1}{6fC}$ is quite adequate, and $C = \frac{0{\cdot}167}{fX_c}$ where the reciprocal of 6 has been worked out from the rule. Take 0·167 as 0·17, and divide by 100, the reactance, giving 1·7 x 10^{-3}. Now divide 1·7 by the frequency, 500, and obtain the significant figures of 340. A rough calculation is: $\frac{0{\cdot}2}{500 \times 100}$ = 4μF and thus the true value is 3·4μF. Increasing the capacitance decreases X_c, therefore the most convenient capacitor above 3·4μF would be very suitable, say 4 or 8μF, the value for C3.

AMPLIFIER STAGE CALCULATIONS

Figure 3 shows a typical amplifier stage, grounded or common-emitter. We shall not design the stage, but use the stage as shown to do a couple of calculations. Let us find the input impedance of the stage. R_{in} = R1// R2//R_i If the transistor is germanium, then V_{EB} is approximately 0·15V, therefore the voltage with respect to earth, must be — 1·15V. To calculate R_i then, the base current of the transistor must be known. The 1V across the emitter resistor, apart from indicating the base potential, also enables us to calculate emitter current. In scale R, 1V gives us 1mA opposite 1kΩ in scale U. Since I_c is approximately the same as I_E, take the base current as: $\frac{1\text{mA}}{60}$. From the L and M scales, or by reciprocal, the L and Z scales, this is found to give 16·7μA. Now, $R_i = \frac{V_B}{I_B} = \frac{1{\cdot}15\text{V}}{16{\cdot}7\mu\text{A}}$. Set 1·15V in scale R and read 690Ω opposite 1·67mA. Since 16·7μA = 1·67mA x 10^{-2}, then R_i = 690 x 10^2, i.e., 69kΩ. Thus, input resistance is 69kΩ in parallel with 39kΩ in parallel with 5·6kΩ, and is, of course, less than the lowest of these, 5·6kΩ.

Now there are two possible approaches on the rule to evaluating this, one, and that which will be considered first, considerably more cunning than the more conventional way, and giving a good approximation to the answer. The first method makes use of the parallel resistors chart. Let us consider the 69kΩ resistance in parallel with 39kΩ. Looking at the chart for the higher value, 69kΩ, we see the 68 the closest to the required 69. Below this the other required significant figures, 39, are seen. Trace the 69 and the 39 lines back until they intersect, and this is seen to occur at about 25 on the right-hand scale. This represents 25kΩ.

Note. When using this method, take care that when one of the numbers is multiplied by some factor 10^n to give the particular resistance, the other resistance must also be multiplied by the same factor, for a true reading, i.e., in the previous example, both 69 and 39 are x 10^3 in terms of absolute resistance. In this case you could not go wrong, but if the line for 390 had been shown, this intersecting 68, for example, would have given a wrong answer.

We must now consider 25kΩ in parallel with the remaining resistance 5·6kΩ. We must, to use the provided values, modify the 25kΩ to 22kΩ, and employing the factor x 10^2, 220 then represents 22kΩ, and 5·6kΩ is represented by 56. These intersect at 45, giving the value for R_i approximately equal to 4·5kΩ.

The more conventional method is to apply the formula: $R_T = \frac{R_a \times R_b}{R_a + R_b}$. Thus, considering 39k$\Omega$ in parallel with 5·6kΩ, we have: $\frac{39k\Omega \times 5{\cdot}6k\Omega}{44{\cdot}6k\Omega} = 4{\cdot}9k\Omega$.

Then we consider 4·9kΩ in parallel with 69kΩ, giving: $\frac{4{\cdot}9k\Omega \times 69k\Omega}{73{\cdot}9k\Omega} = 5{\cdot}58k\Omega$ where L and M scales are used to evaluate these expressions. Thus, with the approximate chart method, as can be confirmed from the tolerance scale, the approximation of 4·5kΩ is less than -2% error of the more accurate calculation giving 4·58kΩ.

Finally, let us select a suitable value for C1, assuming that the lowest frequency of operation of the amplifier is 100c/s. C1 should be made to have a reactance of about 1/10 the value of the resistor it decouples, to give good dynamic gain at low frequency. As frequency increases, the reactance decreases, and thus we need only worry about the low frequencies with the decoupling capacitor. Its object is to, relative to R4, provide an a.c. short-circuit to earth. Thus X_c should be about 100Ω maximum at 100c/s. Again there is no reason why we should not round off π to 3, hence, to obtain C, we obtain the following: $C = \frac{1}{6 \times 100 \times 100}$.

It is seen that the reciprocal of 6 gives us at once the significant figures required, and this is found to be, from the rule, 1·67. Now, a rough calculation gives us: $\frac{1}{60 \times 10^3} = 10\mu F$.

Thus 16·7μF is seen to be the actual value, and the nearest higher capacitance will be taken, namely either 20 or 25μF. A 16μF capacitor is available, if the physical dimensions of the larger capacitor are too great, and this is just acceptable, however better to reduce the reactance even further if possible, hence going to a higher capacitance.

In this article the rule has been shown in some of its uses. The circuit designer and constructor should find the rule of great use, and it is hoped that the information provided in this series will enable anyone to use the rule to its fullest. ■

RECLAIMING FAULTY TRANSISTORS

—*continued from page 825*

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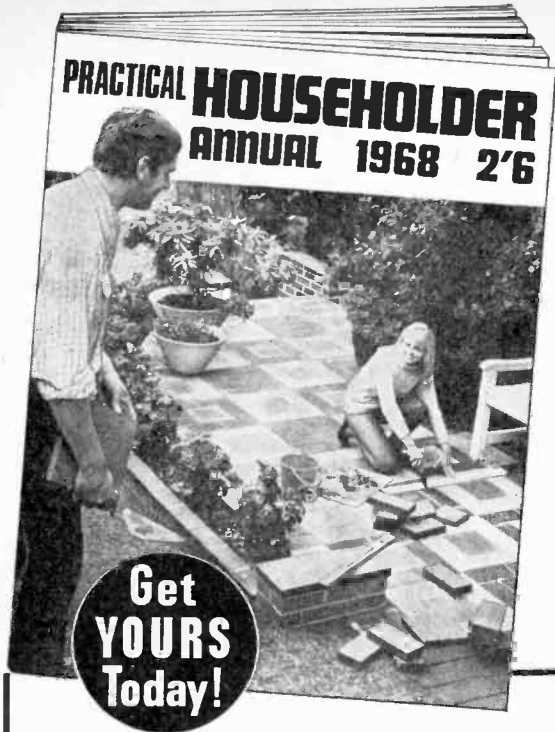

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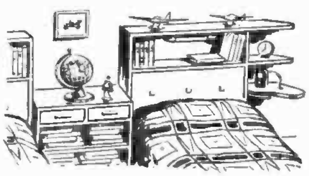

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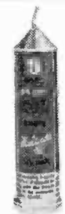

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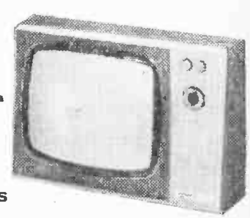

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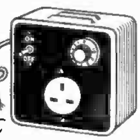

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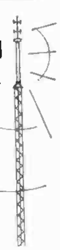

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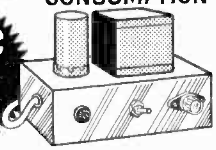

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12¼"	8⅞"	1	8	9	1	14	6	1	18	9
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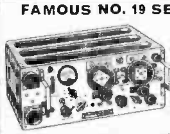

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16/16/16, 350v	2/2	100/100, 50v	3/2	250µF, 50v	10d.
50/50/50, 350v	2/7	10,000µF, 12v	4/6	12,500µF, 30v	16/-
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0·25µF	3 volt	5µF	50 volt	30µF	10 volt
1µF	6 volt	5µF	70 volt	32µF	1·5 volt
1µF	10 volt	6µF	3 volt	40µF	3 volt
1µF	15 volt	6µF	12 volt	40µF	6·4 volt
1µF	50 volt	6µF	15 volt	50µF	6 volt
1·25µF	16 volt	6µF	150 volt	50µF	9 volt
2µF	3 volt	8µF	3 volt	50µF	12 volt
2µF	9 volt	8µF	6 volt	64µF	2·5 volt
2µF	70 volt	8µF	25 volt	64µF	9 volt
2µF	150 volt	8µF	350 volt	100µF	3 volt
2µF	350 volt	8µF	50 volt	100µF	6 volt
1µF	350 volt	8µF	275 volt	100µF	9 volt
2·5µF	16 volt	10µF	6 volt	150µF	12 volt
2·5µF	25 volt	10µF	10 volt	150µF	25 volt
3µF	3 volt	10µF	12 volt	200µF	3 volt
3µF	12 volt	10µF	25 volt	200µF	4 volt
3µF	25 volt	12µF	3 volt	200µF	16 volt
8µF	450 volt	12µF	20 volt	250µF	2·5 volt
3·2µF	6 volt	16µF	30 volt	250µF	12 volt
3·2µF	6·4 volt	16µF	150 volt	250µF	9 volt
3·2µF	64 volt	20µF	3 volt	320µF	2·5 volt
4µF	4 volt	20µF	6 volt	350µF	9 volt
4µF	12 volt	20µF	9 volt	350µF	10 volt
4µF	25 volt	20µF	15 volt	400µF	2·5 volt
4µF	64 volt	25µF	6 volt	400µF	15 volt
4µF	100 volt	25µF	12 volt	500µF	4 volt
5µF	6 volt	25µF	15 volt	500µF	6 volt
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ECL86	7/4	PCF80	7/4	PL84	5/0
EF80	6/2	PCF86	8/9	PL500	10/10
EF85	6/2	PCL82	7/4	PY32	7/10
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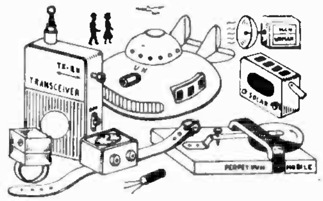

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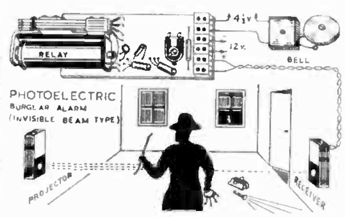

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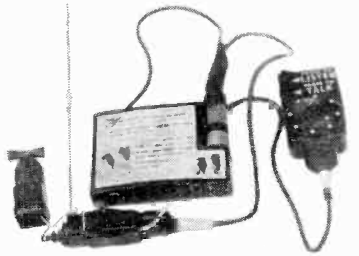

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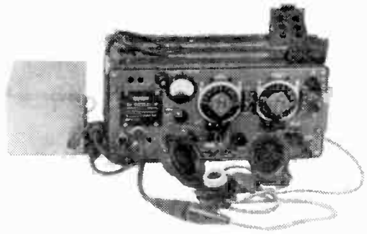
We have a few of these V.H.F. 12 valve transreceivers operating on 3 switched channels between 60Mc/s–95Mc/s complete with all 6 crystals, headphones, mike, mobile aerial and dipole aerial, all connectors plus alloy tripod for mounting the set on. Power input 12V D.C., TX output 3 watts, internal speaker (all valves BG7). All air **tested O.K.** Supplied in good grade 2 condition at **£10.0.0. each**, carr. 30/-. Also available in matched pairs **£25** per pair, carr. 30/- tested.



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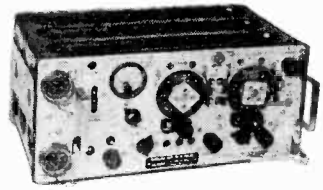
This is one of the latest releases by the govt. of an extremely recent R/T set covering 2–8Mc/s in two switched bands, containing 13 valves (3 EL32s in TX output) which can be used for morse CW or R/T. Also has netting trimmer, BFO, RF and AF controls, switched meter for checking all parts of set, size 17 x 8 x 12in. Power required LT 12V D.C., HT 325V D.C. **Supplied brand new** and boxed with **headphones and mike** also two spare valves and circuit of set. **Few only at £5.10.0.**, carr. 30/-. New plug in power supply made by us for either 12V D.C. input **£3.10.0** or 200/250V A.C. **£3.17.6.**



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 mainshort 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 superhetrodyne 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 **£4.10.0**, or Grade 2 slightly used **50/-** carriage both 15/-.

A KIT of brand new attachments for this set including all connectors, control box, headphones and mike, co-axial lead etc. at only **40/-** 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 7/6. (3) 12 volt D.C. 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.

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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 A.C. input **£6.10.0.** extra.

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AF115	3/-
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AF117	4/-
AF118	3/6
AF119	3/6
AF178	10/-
BSY95A	5/-
OC22	7/6
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OC26	5/-
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OC35	5/-
OC36	7/6
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OC42	2/6
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OB2	6/-
OB3	8/-
OC3	6/-
OD3	6/-
1A3	4/-
1A5GT	5/-
1A7GT	7/-
1AX2	10/-
1B3GT	8/-
1G4GT	8/-
1G6GT	6/-
1H5GT	6/6
1L4	2/6
1Q5GT	8/-
1R4	5/-
1R5	6/-
1S4	5/-
1S5	4/6
1T4	3/-
1T5GT	6/-
1U4	5/-
1U5	6/-
1V	8/-
1X2B	7/-
2C26A	7/-
2C51	8/-
2CW4	12/-
2D21	5/6
2E22	30/-
2E24	42/6
2E26	22/6
2X2	4/-
2X2A	8/-
3A3	11/-
3A5	10/-
3B28	40/-
3D6	3/-
3D21A	35/-
3E29	60/-
3Q4	7/-
3Q5GT	6/6
3V4	6/-
4B32	80/-
4X150A	100/-
5R4GY	9/-
5T8	8/-
5U4GB	6/6
5V4G	7/6
5Z3	7/6
5Z4G	7/-
5Z4GT	7/6
6/30L2	12/6
6A6	4/-
6A8G	5/6
6AB4	6/6
6AB7	4/-
6AF4A	9-
6AG5	2/6

6AG7	6/-
6AH6	10/-
6AK5	5/-
6AK6	10/-
6AL5	3/-
6AM6	4/-
6AQ5	5/6
6AQ6	10/-
6AR4	10/-
6AR5	6/-
6AR6	6/-
6AS5	5/-
6AS6	6/-
6AS7G	15/-
6AT6	4/6
6AU6	5/-
6AV6	5/-
6AW8A	12/6
6B4G	15/-
6B7	5/-
6B8	7/-
6B8G	2/6
6BA6	4/-
6BA7	15/-
6BE6	4/6
6BG6G	12/-
6BH6	7/6
6BJ6	7/6
6BK4	20/-
6BK7A	9/-
6BN6	7/6
6BQ7A	7/-
6BR7	15/-
6BR8	10/-
6BS7	25/-
6BW7	10/-
6C4	4/-
6C5GT	6/6
6C6	4/-
6C8G	8/-
6C9 (Sylvania)	15/-
6CB6	5/-
6CD6GA	20/-
6CG7	8/-
6CH6	8/-
6CL6	9/-
6CW4	12/-
6CY5	7/-
6CY7	11/-
6D6	3/-
6DK6	8/-
6DS4	15/-
6EA8	11/-
6F1	14/-
6F11	6/-
6F13	6/6
6F14	15/-
6F15	11/-
6F17	6/-

6F18	7/6
6F23	14/-
6F25	14/-
6F26	6/6
6F28	13/-
6F29	6/-
6F20	6/-
6F32	3/-
6F33	15/-
6H6	3/-
6J4	9/-
6J5GT	5/-
6J6	3/6
6J7	8/-
6J7G	5/-
6K6GT	8/-
6K7	6/-
6K7G	2/-
6K23	7/6
6L1	10/-
6L5G	6/-
6L6GC	8/-
6L7	5/6
6L12	5/-
6L13	5/6
6L16	5/6
6L18	6/-
6LD3	8/6
6LD12	6/6
6LD13	6/-
6LD20	5/-
6N7GT	6/6
6P1	11/-
6P5GT	8/-
6P25	17/-
6P28	12/-
6Q7	7/-
6R7G	6/-
6SA7	7/-
6SF5	8/-
6SF7	8/-
6SG7	6/-
6SH7	4/-
6SJ7	7/-
6SL7GT	6/-
6SN7GT	5/6
6SQ7	7/-
6SR7	7/-
6SS7	3/-
6T8	6/6
6U4GT	12/6
6U8	6//6
6V6GT	6/-
6X4	4/-
6X5GT	5/-
6Y6G	10/-
6Z4	5/-
7B6	11/-
7B7	7/-
7B8	8/-
7Y4	8/6

7Z4	6/-
9BW6	7/-
10D1	7/-
10F1	9/-
10F3	8/-
10F9	10/-
10F18	7/6
10L1	7/6
10L14	6/6
10LD3	7/-
10LD12	5/3
10LD13	8/-
10LD14	6/6
10P13	15/-
10P14	16/-
11D3	7/-
11D5	7/-
12AC6	8/-
12AD6	9/-
12AE6	7/6
12AH7GT	5/-
12AL5	7/-
12AQ5	7/-
12AT6	4/6
12AU6	5/-
12AU7	5/6
12AV6	5/6
12AV7	8/-
12AW6	20/-
12AX7	5/6
12AY7	10/-
12B4A	9/-
12BA6	6/-
12BE6	5/6
12BH7	6/-
12BY7	10/-
12E1	20/-
12H6	4/-
12J5GT	3/-
12K5	10/-
12K8	8/-
12Q7GT	5/6
12SA7	10/-
12SC7	4/-
12SF5	9/-
12SF7	7/-
12SG7	5/-
12SH7	4/-
12SJ7	4/-
12SK7	6/-
12SQ7	7/6
12SR7	5/-
14S7	15/-
20A3	5/6
20CV	62/6
20D1	9/-
29L1	13/-
20P1	12/-
20P3	12/-
20P4	19/-

20P5	19/-
25L6GT	6/6
25Z4G	8/-
25Z5	8/-
25Z6GT	11/-
30A5	7/-
30C1	6/3
30C15	13/6
30C17	14/6
30C18	14/-
30F5	14/-
30FL1	15/-
30FL12	17/-
30FL13	8/-
30FL14	14/-

90AV	46/-
90C1	12/-
90CG	25/-
90CV	25/-
150C2	6/-
807	9/-
811A	35/-
813	80/-
866A	14/-
872A	50/-
884	10/-
931A	65/-
955	3/-
991	7/-
5654	9/-

DAF96	6/6
DF96	6/6
DH81	12/6
DH101	7/6
DK32	7/-
DK40	10/-
DK92	7/6
DK96	7/6
DL66	20/-
DL91	5/-
DL94	6/-
DL95	7/-
DL96	7/-
DM70	5/6
DM71	6/-

ECC35	17/-
ECC40	9/6
ECC81	4/-
ECC82	5/6
ECC83	5/6
ECC84	5/6
ECC85	5/-
ECC86	7/-
ECC88	8/-
ECC91	3/6
ECC180	7/-
ECC189	11/-
ECC804	12/6
ECC807	13/6
ECF80	6/6

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30L1	5/6
30L15	15/-
30L17	15/-
30P16	7/-
30P18	6/-
30P19	14/-
30PL1	16/-
30PL13	16/-
30P14	16/-
35D5	12/-
35L6GT	8/-
35W4	4/6
35Z3	10/-
35Z4GT	8/6
35Z5GT	6/-
50C5	6/-
50CD6G	27/6
50L6GT	7/6
52KU	7/-
53KU	12/6
58CG	45/-
62BT	20/-
75C1	13/-
85A2	7/6
90AG	46/-

5670	10/-
6146	27/6
6360	25/-
6939	40/-
7199	15/-
7360	30/-
7586	22/6
7895	22/6
9002	5/6
9003	9/-
A2293	18/-
AR8	6/-
ARP12	4/6
ATS25	9/-
AZ11	7/6
AZ31	9/-
CBL1	15/-
CBL31	15/-
CCH35	9/-
CY1	8/-
CY31	7/-
DAC32	6/6
DAF40	10/-
DAF41	10/-
DAF91	4/6
DAF92	6/-

DM160	8/-
DY30	8/-
DY80	7/-
DY86	6/-
DY87	6/6
DY802	9/-
E88CC	12/6
E180F	17/6
EABC80	6/6
EAF42	8/6
EB91	3/-
EBC33	7/-
EBC41	8/7
EBC81	6/-
EBC90	4/6
EBC91	5/-
EBF80	7/6
EBF83	8/-
EBF89	6/6
EBL1	14/-
EBL31	22/6
EC86	11/6
EC88	10/-
EC92	6/6
ECC33	10/-
ECC34	8/-

ECF82	6/6
ECF83	12/-
ECF86	9/6
ECF200	13/-
ECF201	13/-
ECH21	9/6
ECH35	11/-
ECH42	10/-
ECH81	5/3
ECH83	7/6
ECH84	9/-
ECL80	7/-
ECL81	7/6
ECL82	6/-
ECL83	9/6
ECL84	11/-
ECL85	10/6
ECL86	8/-
ECLL80	17/-
EF9	8/-
EF36	5/-
EF37A	8/-
EF39	6/-
EF40	8/6
EF41	8/6
EF42	11/-

EF80	4/6
EF83	9/6
EF85	6/6
EF86	6/-
EF89	5/6
EF92	4/-
EF93	4/-
EF94	5/-
EF95	5/-
EF96	2/6
EF98	10/-
EF183	6/-
EF184	6/-
EF804	20/-
EF811	14/-
EF812	14/-
EH90	7/-
EL34	9/6
EL35	9/6
EL36	8/6
EL38	22/6
EL41	8/6
EL42	9/6
EL81	9/-
EL82	8/-
EL83	6/6
EL84	4/6
EL85	7/6
EL86	8/-
EL90	5/6
EL95	5/-
EL360	22/-
EL821	8/-
EL822	17/-
ELL80	13/-
EM34	13/-
EM71	12/6
EM80	7/-
EM81	6/9
EM84	7/-
EM85	11/-
EM87	10/-
EN91	5/6
EY51	7/-
EY70	10/-
EY80	8/-
EY81	7/-
EY83	9/-
EY84	9/6
EY86	6/6
EY87	8/-
EY88	8/6
EZ35	5/-
EZ40	7/6
EZ41	8/-
EZ80	5/-
EZ81	5/-
EZ90	4/-
FW4/500	10/-

FW4/800	10/-
GS10H	40/-
GTE175M	12/-
GZ30	7/-
GZ31	5/-
GZ32	10/-
GZ33	12/6
GZ34	10/-
GZ37	12/6
HABC80	8/-
HBC90	4/6
HBC91	5/6
HF93	6/-
HF94	5/-
HL42DD	8/-
HL92	6/-
HL94	7/-
KT66	19/-
KT88	27/6
PABC80	7/6
PC86	10/6
PC88	10/6
PC95	6/6
PC97	7/6
PC900	8/6
PCC84	5/6
PCC85	7/-
PCC88	11/-
PCC89	10/6
PCC189	11/-
PCC805	15/-
PCC806	15/-
PCE800	15/-
PCF80	6/3
PCF82	6/-
PCF84	8/-
PCF86	8/-
PCF87	14/6
PCF800	13/6
PCF801	9/-
PCF802	9/-
PCF805	14/-
PCF806	12/-
PCF808	13/-
PCH200	12/-
PCL80	15/-
PCL81	9/-
PCL82	7/-
PCL83	8/6
PCL84	7/6
PCL85	8/6
PCL86	8/-

PCL88	16/-
PCL800	16/-
PCL801	16/-
PEN4DD	6/-
PEN45	6/6
PEN45DD	12/-
PEN46	6/-
PEN220A	7/-
PEN383	9/-
PEN384	7/-
PEN453DD	10/-
PENDD4020	10/-
PF86	10/-
PF818	14/-
PFL200	13/6
PL36	9/-
PL81	7/-
PL82	7/-
PL83	6/6
PL84	6/-
PL302	14/-
PL500	13/6
PL504	14/-
PL801	13/-
PM84	8/-
PX4	20/-
PX25	15/-
PY31	5/-
PY32	8/6
PY80	5/6
PY81	5/6
PY82	5/-
PY83	5/6
PY88	7/6
PY301	14/-
PY800	9/-
PY801	9/-
PZ30	7/-
QQV02-6	40/-
QQV03-10	25/-
R17	8/-
R18	9/6
SD6	12/-
TH233	7/-
TH2321	7/-
TT21	35/-
U12/14	8/-
U18/20	10/-
U19	40/-
U20	10/-
U21	7/-
U22	6/-
U25	14/-

U26	14/-
U33	26/-
U76	4/-
U81	10/-
U191	14/-
U281	8/-
U282	8/-
U301	11/-
U404	5/-
U801	17/-
UABC80	5/3
UAF41	9/-
UAF42	9/-
UB41	10/-
UBC41	7/-
UBC81	8/-
UBF80	6/6
UBF89	7/-
UBL21	10/-
UC92	6/-
UCC84	9/-
UCC85	6/6
UCF80	9/6
UCH21	9/6
UCH42	9/-
UCH43	8/-
UCH81	6/3
UCL81	9/-
UCL82	7/3
UCL83	9/-
UF9	10/-
UF41	9/-
UF42	9/-
UF43	8/-
UF80	6/6
UF85	7/3
UF86	9/-
UF89	7/-
UL41	8/6
UL84	6/6
UM4	10/-
UM80	5/-
UU5	8/-
UU8	7/-
UU9	7/6
UU10	8/-
UY1N	9/-
UY21	9/-
UY41	6/6
UY82	9/6
UY85	6/-
VU39A	8/-
VU111	7/6
VU120	12/-
VU133	7/-
Z719	4/6
Z729	6/-
Z759	24/-
Z803U	15/-

TRANSISTORS

OC16	20/-	OC141	12/6	AF124	7/6	MAT101	8/6
OC23	12/6	OC170	5/-	AF125	6/6	MAT120	7/9
OC24	15/-	OC171	6/-	AF126	6/-	MAT121	8/6
OC25	7/6	OC200	7/6	AF127	6/-	V30/30P	20/-
OC26	6/-	OC201	10/-	AF178	12/6	2G309	5/-
OC28	12/6	OC202	13/-	AF186	17/6	2G371A	4/6
OC29	14/9	OC203	10/6	AFY19	22/6	2G381	5/-
OC35	13/-	OC204	12/6	AFZ11	17/-	2G403	8/6
OC36	12/6	OC205	15/-	AFZ12	10/-	2N410	3/6
OC42	5/-	OC206	22/6	ASY26	6/6	2N412	3/6
OC43	9/-	AC107	10/-	ASY28	6/6	2N696	7/-
OC44	4/-	AC125	6/6	ASZ20	7/6	2N697	7/6
OC45	3/6	AC126	6/6	ASZ21	12/6	2N706	3/4
OC58	12/6	AC127	7/6	BC107	7/6	2N753	6/6
OC70	4/-	AC128	6/6	BCY30	7/-	2N1132	37/-
OC71	3/6	AC176	7/6	BCY33	7/6	2N1304	6/-
OC72	5/-	ACY17	8/6	BCZ11	10/-	2N1756	15/-
OC73	7/6	ACY18	5/6	BFY50	8/6	2N2068	20/-
OC75	6/-	ACY19	6/6	BFY52	6/6	2N2926	5/6
OC76	5/-	ACY20	5/-	BSY26	5/-	2S002	20/-
OC77	8/-	ACY21	6/-	BSY28	5/-	2S003	20/-
OC78	5/-	ACY22	3/6	BSY65	5/-	2S004	15/-
OC78D	5/-	AD140	16/-	GET103	5/-	2S005	50/-
OC81	5/-	AD149	16/-	GET104	8/-	2S006	20/-
OC81D	3/-	AF102	18/-	GET113	4/-	2S012	140/-
OC83	5/-	AF114	6/6	GET114	4/-	2S018	60/-
OC84	5/-	AF115	6/-	GET115	8/6	2S103	25/-
OC122	12/6	AF116	6/6	GET116	10/-	2S104	15/-
OC139	7/6	AF117	5/-	GET872	6/-		
OC140	9/6	AF118	10/-	GET875	6/-		

COMPLEMENTARY PAIRS (PNP/NPN)
AC128/AC176 (Germanium) 13/-; 2N697/2N1132 (Silicon) 40/-; ASY26/ASY28 (Germanium) 12/-.

SPECIAL OFFER OF TRANSISTOR PACKS

All new current production germanium P-N-P Transistors for AM/FM and SW Receivers.
Two AF125 (Mixer and Oscillator); two AF126 (IF); one AC126 (Audio); two AC128 (push/pull output).
Price of a complete set of 7 transistors, 21/- post paid.

25 WATT SOLDERING IRONS

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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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. 5 amp, 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

AVALANCHE SILICON RECTIFIERS

Type RAS508AF, 960 p.i.v. at 6 amps. max., stud mounted 10/6

FOR P.W. CLUBMAN RECEIVER

One each OC170, OC45, OC71. Two OA81 and TC1, TC2 Trimmers (3-30pF Beehive), 19/-, post free.

DRY REED INSERTS

Glass dry reed inserts approx. ⅛in. dia. x 1in. long with axial leads. One "make" contact of 100mA capacity at 50V. Can be operated by permanent magnet or 30-50 Amp-turns relay coils. PRICE 18/- per doz. post free.

TEXAS SILICON FULL-WAVE BRIDGE RECTIFIERS
1B20K10 100 piv, 2 amps, dimensions 1·4 x1·4x·6in. 25/-
1B40K10 100 piv, 4 amps, dimensions 1·4x1·4x·6in. 30/-
1B100M10 100 piv, 10 amps, dimensions 2¼x2¼x1in. 85/-.
Postage 1/6 per rectifier.

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We announce the introduction of a range of first quality moving coil meters with 1.5% accuracy. Meters are available in 3in. round flange, and 3in. and 4½in. square flanges. Please write for illustrated leaflets.

SILICON POWER RECTIFIERS

BY100, 700 p.i.v., 450mA, W.E.	4/6
BYZ10, 800 p.i.v., 6 Amps, S.M.	9/-
BYZ12, 400 p.i.v., 6 Amps, S.M.	5/-
BYZ13, 200 p.i.v., 6 Amps., S.M.	7/6
BYZ19, as BYZ13 but stud negative	7/6
DD000, 50 p.i.v., 500mA, W.E.	3/-
DD006, 400 p.i.v., 500mA, W.E.	6/6
DD058, 800 p.w., 500mA, W.E.	7/6

Note: W.E.—Wire Ended; S.M.—Stud Mounted.

GERMANIUM POINT CONTACT DIODES

OA5, 100 piv/115 mA	3/-
OA6, 60 piv/115 mA Gold Bonded	4/-
OA79, 30 piv/35 mA, 40 mc/s	2/3
OA81, 115 piv/60mA, High Back Resistance	2/-
OA95, 90 piv/56 mA subminiature	2/-

25% discount for orders of 24 or more of each type.

Our new (1967/68) price list of Valves, Tubes and Semiconductors is now ready. In addition to listing prices of some 2,300 types it is a useful reference work giving: Valve and Tube Equivalents, Specification of Microwave Tubes, Cathode Ray Tubes and Semiconductors. Send S.A.E. (Quarto) now to get your copy free of charge.

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The following blueprints are available from stock. **Descriptive text is not available** *but the date of issue is shown for each blueprint. Send, preferably, a postal order to cover cost of the blueprint (stamps over 6d. unacceptable) to Blueprint Department, Practical Wireless, George Newnes Ltd., Tower House, Southampton Street, London, W.C.2.*

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The Berkeley Loudspeaker Enclosure; The Luxembourg Tuner	(Dec. 1962)	5/-
The PW Troubadour; The PW Everest Tuner	(June 1962)	7/6
The PW Britannic Two; The PW Mercury Six	(May 1962)	6/-
Beginner's Short Wave Two; S.W. Listener's Guide	(Nov. 1963)	5/-
PW "Sixteen" Multirange Meter; Test Meter Applications Chart	(Jan. 1964)	5/-
The Celeste 7-transistor Portable Radio; The Spinette Record Player	(June 1963)	5/-
Transistor Radio Mains Unit; 7 Mc/s Transceiver	(June 1964)	5/-
The Citizen	(December 1961)	5/-
The Mini-amp	(November 1961)	5/-
The Beginner's Short Wave Superhet	(Dec. 1964)	5/-
The Empire 7 Three-band Receiver	(May 1965)	5/-
Electronic Hawaiian Guitar	(June 1965)	5/-
Progressive SW Superhet	(February 1966)	5/-
Beginner's 5-Band Receiver; Home Intercom Unit	(Dec. 1966)	5/-

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The PW Query Service is designed primarily to answer queries on articles published in the magazine and to deal with problems which cannot easily be solved by reference to standard text books. In order to prevent unnecessary disappointment, prospective users of the service should note that:

(a) We cannot undertake to design equipment or to supply wiring diagrams or circuits, to individual requirements.

(b) We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuitry.

(c) It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.

(d) We regret we are unable to answer technical queries over the telephone.

(e) It helps us if queries are clear and concise.

***(f)* We cannot guarantee to answer any query not accompanied by the current query coupon and a stamped addressed envelope.**

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PRACTICAL WIRELESS, MARCH 1968

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