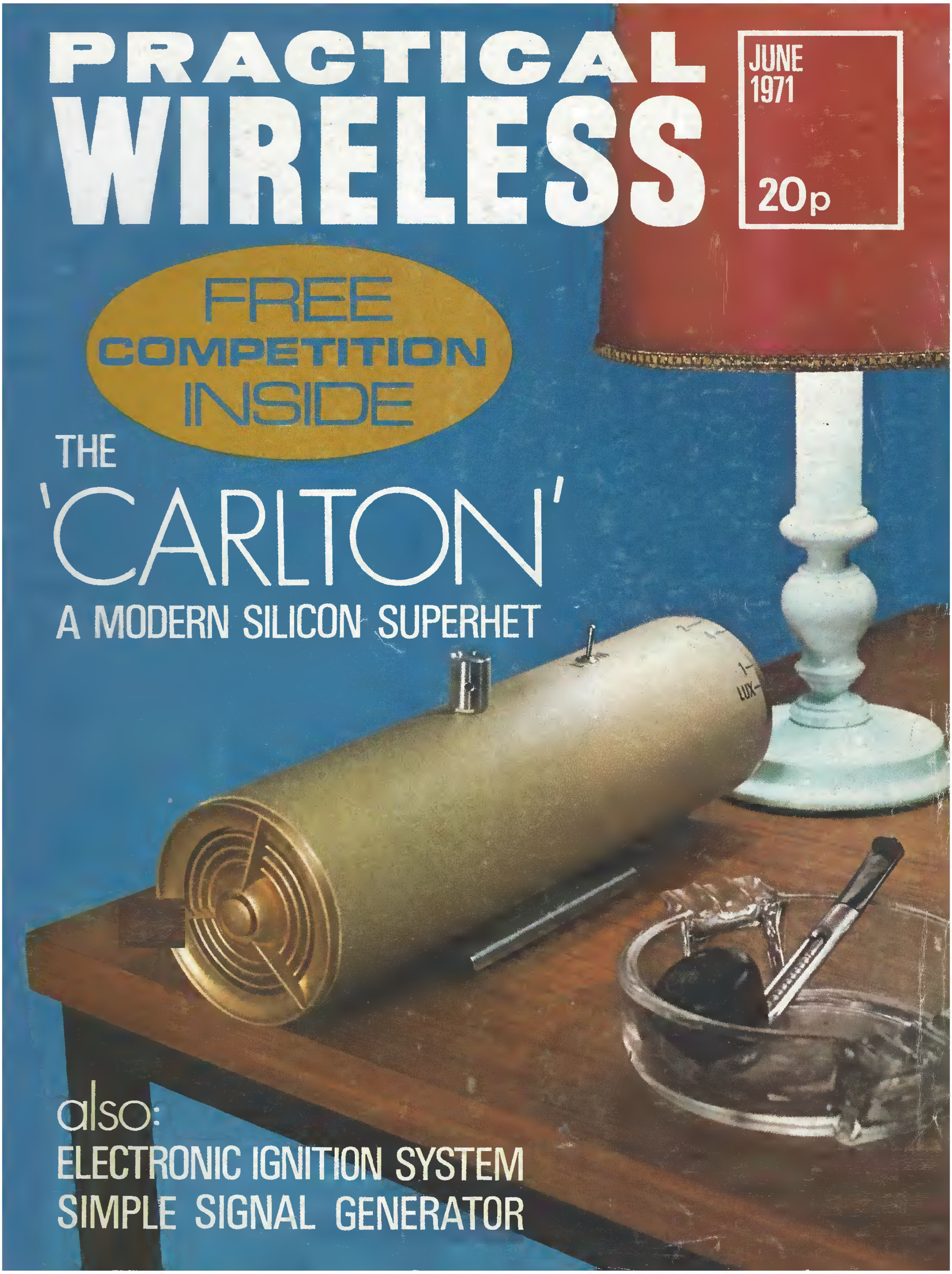

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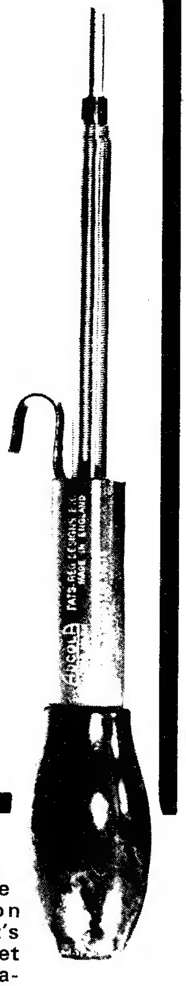

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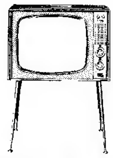

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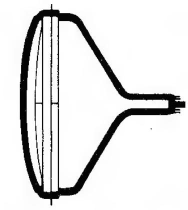

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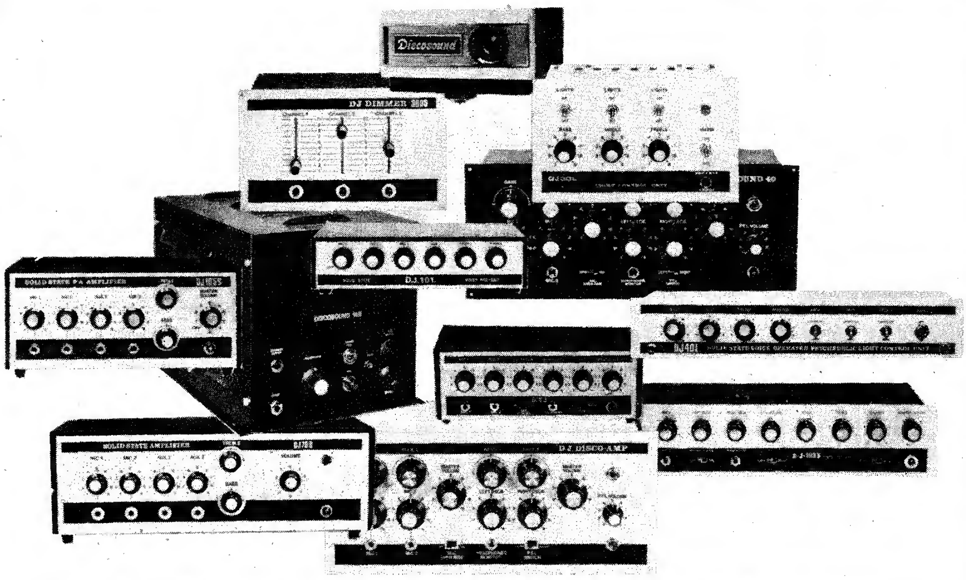

D.J. 102 Discotheque Mixer Pre-Amplifier
4 inputs each with its own volume control plus master volume control, PFL monitoring and mic override switches.
Size 10¼" x 4" x 4".
Suggested Retail Price £25·00

D.J. 105S P.A. Amplifier
4 channel mixing facilities each with separate inputs and volume controls 30 watts r.m.s. power output A.C. Mains 200/250v A.C. Size 11¾" x 5" x 6".
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D.J. 70S Integrated Mixer Amplifier
Power output 70 watts r.m.s. 4 channel mixer with separate inputs and volume controls, plus master volume and separate bass and treble controls.
Size 15½" x 5" x 6".
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Designed specifically for use with discotheques. Power output 100 watts r.m.s. Two mike inputs and two gram inputs, with independent volume controls plus bass and treble controls.
Incorporates many exclusive features.
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Front panel size 16½" x 7".
Suggested Retail Price £40·00

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Frequency response 20-20,000 Hz ± 3db.
Distortion less than 1% at 70 watts r.m.s. ± 1db.
Size 10½" x 8" x 7".
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D.J. 103S Stereo Pre-Amplifier
A high quality stereo discotheque pre-amp unit. Incorporating two microphone and two turntable inputs each with independent volume control, plus bass, treble, balance and master volume control Offers full mixing and monitoring facilities.
Front panel size 16½" x 3½".
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3 channel light unit enabling bass, middle and treble frequencies from the amplifier to be operated individually. Handles 1000 watts per channel.
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D.J. 40L Sound Operated 3 Channel Light Unit
Features built-in microphone which eliminates the need for connections to any amplifier or sound source.
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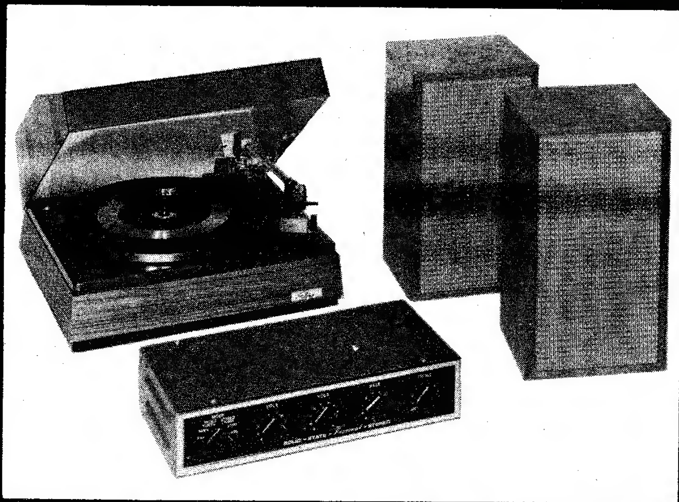
WITH VISCOUNT F.E.T.
FIELD EFFECT TRANSISTORS AMPLIFIER



This superb stereo system is a real price break through. It comprises the VISCOUNT F.E.T. Mk I amplifier on which full details are given below, the famous Garrard SP 25 Mk III (including teak veneer base and transparent cover) with diamond cartridge or 2025 TC and the very successful DUO type 2 speakers. Measuring 17½in x 10¾in x 6¾in, the Duo type 2 speakers are teak finished with matching Vynair grills. They incorporate a 3 ohm. 13in x 8in drive unit and Parasitic tweeter. Max. power handling 10 watts. Price £13·50 per pair plus p. & p. £1·50.

Complete stereo system £43 plus £2·50 p. & p. or with Mk II Amplifier and Magnetic Cartridge £48 & £2·50 p. & p.

The Viscount F.E.T. Mk I **£14·25** + 75p. p. & p.

High fidelity transistor stereo amplifier employing field effect transistors. With this feature and accompanying guaranteed specifications below, the Viscount F.E.T. vastly surpasses amplifiers costing far more.

Specification—Output per channel 10 watts r.m.s. into 3 ohms Frequency bandwidth 20 Hz to 20 kHz ± 1db at 1 watt. Total distortion at 1 kHz at 9 watts 0.5% Input sensitivities CER. P.U. 100mV into 3 meg ohms. Tuner 100mV into 100K ohms. Tape 100mV into 100K ohms. Overload Factor Better than 26db.

Signal to noise ratio—70db on all inputs (with vol. max). Controls—6 position selector switch (3 pos. stereo and 3 pos. mono). Separate volume controls for left and right channels. Bass ± 14db at 60 Hz. Treble (with D.P.S. on off) ± 12 db at 10 KHz. Tape recording output sockets on each channel. Size 12¼in. 6in. 2¾in. in simulated teak case. BUILT & TESTED.

MkII (MAG P.U.) £15·75 plus 75p. p. & p.

Specification same as Mk. 1, but with the following inputs. Mag. P.U. CER. P.U. Tuner. Spec. on Mag. P.U. 3mV at 1 kHz input impedance 47K. Fully equalised to within ±1db RIAA. Signal to noise ratio—65db (vol. max).

The £25 Stereo system

The Duetto is a good quality stereo amplifier, attractively styled and finished. It gives superb reproduction previously associated with amplifiers costing far more.

SPECIFICATION—
R.M.S. power output 3 watts per channel into 10 ohms speakers.

INPUT SENSITIVITY. Suitable for medium or high output crystal cartridges and tuners. Cross-talk better than 30dB at 1Kc/s.

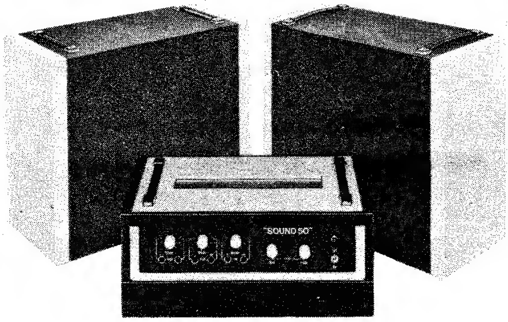
CONTROLS: 4-position selector switch (2 pos. mono and 2 pos stereo) dual ganged volume control.

TONE CONTROL Treble lift and cut Separate on off switch. A preset balance control.

Duetto integrated transistor stereo Amp.	£9.50	50p
Garrard Changer from	£7.97	50p
Cover and teak finish plinth	£4.75	50p
Duo Type I speakers (see opp. page)	£4.20	50p
The above items purchased together	£25.00	£2.00

SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



The Sound Fifty valve amplifier and speakers are sturdily constructed with smart housings and thoroughly tested electronics. They are designed to last—to withstand the knocks and bumps of life on the road. Built for the small and medium sized gig, they are easy to handle and quick to set up and can be relied upon to come over with all the quality and power you need.

Output Power: 45 watts R.M.S. (Sine wave drive). **Frequency response:** −3dB points 30Hz at 18KHz. **Total distortion:** less than 2% at rated output. **Signal to noise ratio:** better than 60dB.
Speaker Impedance: 3, 8 or 15 ohms. **Bass Control Range:** ± 13dB at 60Hz. **Treble Control Range:** ± 12dB at 10 KHz. **Inputs:** 4 inputs at 5mV into 470K. Each pair of inputs controlled by separate volume control. 2 inputs at 200mV into 470K.
To protect the output valves, the incorporated fail safe circuit will enable the amplifier to be used at half power.
SPEAKERS! Size 20″ × 20″ × 10″ incorporating 12″ heavy duty 25 watt high flux, quality loudspeaker with cast frame. Cabinets attractively finished in two tone colour scheme—Black and grey.

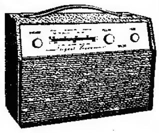
COMPLETE SYSTEM £50 Plus £4 P. & P.
Sound 50 amp and 2 speakers

or available separately.

Amplifier **£28.50** plus £1.50 P. & P.

Speakers **£12.50** each plus £1.75 P. & P.

The ELEGANT SEVEN Mk. III
(350mW Output)

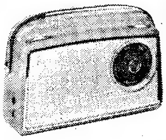


7 transistor fully-tunable M.W.—L.W. superhet portable. Set of parts. Complete with all components, including ready etched and drilled printed circuit board—back printed for foolproof construction.
MAINS POWER PACK KIT: 75p extra.

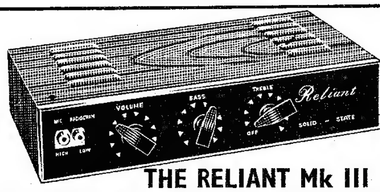
Price **£5.25** plus 50p. P. & P.
Circuit 13p FREE WITH PARTS.

The DORSET
(600mW Output)

Price **£5.25** plus 50p. P. & P.
Circuit 13p FREE WITH PARTS



7-transistor fully tunable M.W.—L.W. superhet portable—with baby alarm facility. Set of parts. The latest modulised and pre-alignment techniques makes this simple to build. Sizes: 12 x 8 x 3in.
MAINS POWER PACK KIT: 75p extra.



THE RELIANT Mk III
SOLID-STATE GENERAL PURPOSE AMPLIFIER

in simulated teak case **£7.25** plus P. & P. 50p

SPECIFICATIONS
Output 10 watts. Output impedance—3 to 4 ohms.
Inputs 1. -xtal mic 10mV Tone Controls—Treble control range ± 12dB at 10KHz. 2. -gram/radio 250mV. Bass control range ± 13dB at 100Hz.
Frequency Response—(with tone controls central) Minus 3dB points at 20Hz and 40KHz. Signal to Noise Ratio—better than −60dB. Transistors—4 silicon Planar type and 3 Germanium type. Mains input—220/250V. A.C. Size of chassis—10¾in. x 4¾in. x 2¼in. For use with Std. or L.P. records, musical instruments, all makes of pick-ups and mikes. Built and tested.

THE DUO SPEAKER SYSTEM

Similar in design to those on the previous page the 2-way speaker system is beautifully finished in polished teak veneer. It is ideal for wall or shelf mounting either upright or horizontally.
Type 1 SPECIFICATION :—
Impedance 8 or 10 ohms (please state requirement). It incorporates high flux 7in. x 3½in. speaker and 2½in. speaker. Teak finish 11½in. x 6in. x 5¾in. **£4.20** each. 50p P. & P.

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Beautifully designed to blend with the interiors of all cars. Permeability tuning and long wave loading coils ensure excellent tracking, sensitivity and selectivity on both wave bands. R.F. sensitivity at 1 MHz is better than 8 micro volts. Power output into 3 ohm speaker is 3 watts.
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Pre-aligned I.F. module and tuner together with comprehensive instructions guarantees success first time. 12 volts negative or positive earth. Size 7in x 2in x 4½in deep.

See top of previous page for address

SET OF PARTS
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- **The SA. 55 Amplifier**
- **Compact SC. 18-15 MkII System, illustrated above.**
- **The plinth units.**
- **The loudspeakers.**

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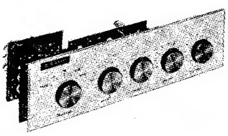
MARTIN AUDIOKITS were first to make modular unit construction available to the hi-fi enthusiast keen to save by building his own assembly. AUDIOKITS were first to feature "add-on-ability" by which a simple system could be expanded to high performance stereo equipment by the addition of easily added on units. Many who built with MARTIN AUDIOKITS years ago continue to enjoy unsurpassed quality and reliability from them to this day. **NOW YOU CAN BUY AUDIOKITS AGAIN** to allow you to build a high fidelity system to your personal choice and which will satisfy completely on performance, simplicity of assembly, robustness and reliability. These units are beautifully engineered and solidly built for a lifetime of trouble-free service. Each unit is complete in itself and requires nothing added; each is tested and checked before leaving factory.



- **Robust construction.**
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- **Simple to fit up.**
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1478E	Five stage matched input selector unit; controls and pre-amp; power amp. (10 watts RMS into 15 ohms) power supply; front escutcheon plate mono)	Total price £17·50
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All units are obtainable separately. *State pick-up when ordering.*

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PW6

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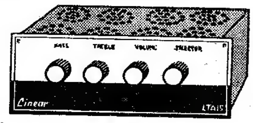
Employing only high grade components and transistors.

LTA 15 WATT AMPLIFIER



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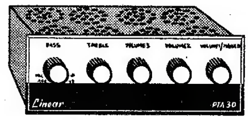
Recommended Retail Price **£19**
Size 9¼ x 3¾ x 5¼ in. approx.

PTA30 HI-FI PUBLIC ADDRESS AMPLIFIER



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If required an attractive wood cabinet with veneer finish can be supplied for any model. Prices from **£3.50**

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BAKER 12in. REGENT

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Maximum Power	15 watts
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Flux Density	12, 000 gauss
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Useful response	45–13,000 c.p.s.
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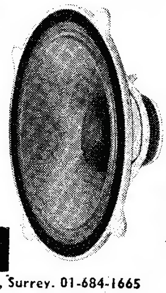
£7 POST FREE



GUITAR MODEL "GROUP 25" 25 watt rating £7

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Parts Price List and Easy Build Plans 25p (FREE with parts).

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Overseas P. & P. 90p

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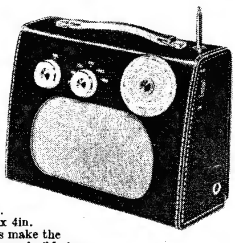

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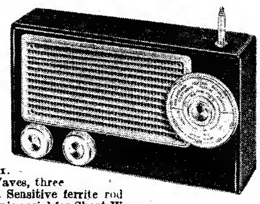
trans eight
SIX WAVEBAND PORTABLE WITH 3in. SPEAKER

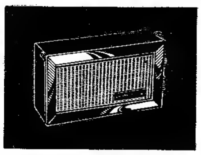


Attractive case in black with red grille and black knobs and dial with spun brass inserts. Size 9 x $5\frac{1}{4}$ x $2\frac{3}{8}$in. approx. Tunable on Medium and Long Waves, three Short Waves and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. Eight improved type transistors plus 3 diodes. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans 25p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra

Total building costs £4.48 Post, packing and insurance 31p.

Overseas P. & P. 70p

pocket five
MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE WITH SPEAKER



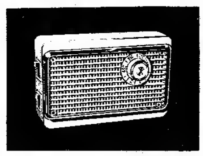
Attractive black and gold case. Size $5\frac{1}{2}$ x $1\frac{1}{2}$ x $3\frac{1}{2}$in. Tunable over both Medium and Long Waves with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Easy build plans and parts price list 8p (FREE with parts).

Earpiece with plug and switched socket for private listening 30p extra.

Total building costs £2.23 Overseas P. & P. 55p

Post, packing and insurance 21p.

transona five
MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE WITH SPEAKER



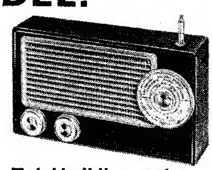
Attractive case with red speaker grille. Size $6\frac{1}{2}$ x $4\frac{1}{2}$ x $1\frac{1}{4}$in. 7 stage—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser volume control, fine tone moving coil speaker. Easy build plans and parts price list 8p (FREE with parts).

Earpiece with plug and switched socket for private listening 30p extra

Total building costs £2.38 Overseas P. & P. 55p

Post, packing and insurance 22p.

IMPROVED MODEL!
roamer six
SIX WAVEBAND PORTABLE WITH 3in. SPEAKER



Attractive black case with red grille and black knobs and dial with spun brass inserts. Size 9 + $5\frac{1}{4}$ + $2\frac{3}{8}$in. approx. Tunable on Medium and Long Waves, two Short Waves, Trawler Band plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and latest telescopic aerial for Short Waves. Improved circuit. 8 stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors, etc. Easy build plans and parts price list 10p (FREE with parts).

Earpiece with plug and switched socket for private listening 30p extra

Total building costs £3.98 Overseas P. & P. 70p

Post, packing and insurance 26p.

★ *Callers side entrance Barratts Shoe Shop*

★ *Open 10–1, 2.30–4.30 Mon.–Fri. 9–12 Sat.*

RADIO EXCHANGE CO

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ROAMER EIGHT	☐	ROAMER SEVEN	☐
TRANSONA FIVE	☐	TRANS EIGHT	☐
POCKET FIVE	☐	ROAMER SIX	☐

Parts price list and plans for ....

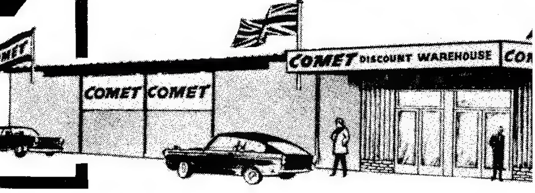
Name ....

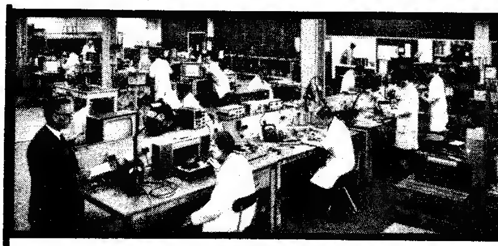
Address ....

.... PW.30

COMET HI-FI DISCOUNT WAREHOUSES

DRIVE-IN CAR PARK





COMET for after-sales service
THROUGHOUT THE U.K.

Pictured, Service Dept. at Clough Rd., Hull also at Leeds, Stockton, Goole, Wakefield, Doncaster, and Bridlington

STEREO AMPLIFIERS

	Rec. Retail Price	Comet Price
ALBA UA 700	34·50	26·00
ARMSTRONG 521	56·00	44·50
*DULCI 207	26·00	17·50
DULCI 207M	32·00	22·25
FERROGRAPH F307	59·00	48·00
GOODMANS Maxamp	54·00	38·00
LEAK Stereo 30 Plus	56·50	44·75
LEAK Stereo 30 Plus, in teak case	62·50	49·50
LEAK Stereo 70	69·00	55·00
LEAK Stereo 70, in teak case	75·00	59·50
*LINEAR LT 66	21·00	17·00
METROSOUND ST20	36·00	28·00
PHILIPS RH 591	79·00	61·50
PHILIPS RH 590	52·00	39·50
PHILIPS RH 580	29·00	23·00
PIONEER SA500	62·10	43·00
PIONEER SA700	98·00	70·00
PIONEER SA900	134·10	97·00
PIONEER Reverberation	45·50	33·00
ROGERS Ravensbourne	59·50	47·00
ROGERS Ravensbourne (cased)	64·00	50·00
ROGERS Ravensbrook Mk. II	47·50	38·00
ROGERS Ravensbrook (cased) Mk. II	52·50	42·00
SINCLAIR 2000	35·00	26·00
SINCLAIR PROJECT 60/2 X Z30/PZ5	23·90	17·00
SINCLAIR PROJECT 60/2 X Z50/PZ8/trans.	34·86	25·50
SINCLAIR AFU	5·95	4·95
SINCLAIR Neoteric	61·95	46·00
SINCLAIR 3000	45·00	36·00
TELETON SAQ 206 (new release)	29·00	20·00
VOLTEX 100w. Stereo Discotheque, 8 electronically mixed inputs	185·00	139·00

Starred items above take ceramic cartridges only. All others take both ceramic and magnetic cartridges.

TUNERS

	Rec. Retail Price	Comet Price
*ARMSTRONG 523 AM/FM	53·76	45·00
*ARMSTRONG 524 FM	41·89	35·00
ARMSTRONG M8 Decoder	9·50	8·00
*DULCI FMT.7 FM	28·00	22·00
DULCI FMT.7S Stereo	35·00	29·25
GOODMANS Stereomax	82·52	49·95
LEAK Stereofetic Chassis	66·50	52·00
LEAK Stereofetic in teak case	72·50	59·00
PHILIPS RH 690	47·00	38·00
PHILIPS RH 691	89·00	75·50
PIONEER TX500 AM/FM	77·94	64·00
PIONEER TX900 AM/FM	153·69	125·00
ROGERS Ravensbourne chassis	61·89	50·00
ROGERS Ravensbrook	45·01	40·00
ROGERS Ravensbrook (cased)	51·26	43·00
TELETON GT 101	45·50	34·00
TELETON 201X FM	36·00	30·00

All above Tuners are complete with MPX Stereo Decoder except where starred.

TUNER/AMPLIFIERS

	Rec. Retail Price	Comet Price
AKAI AA 8500	229·00	181·00
AKAI 6600	142·53	112·00
ARENA R500	82·00	67·00
ARENA 2400	90·30	72·00
ARENA 2700	105·00	85·00
ARENA T1500F	72·45	60·00
ARENA T9000	303·45	258·00
ARMSTRONG M8 Decoder	9·50	8·00
ARMSTRONG 525	91·89	77·00
ARMSTRONG 526	104·71	87·00
GOODMANS Module 80, 35w. R.M.S.	95·00	75·00
GOODMANS 3000	77·73	53·00
MIDLAND 19/542	49·56	37·50
PHILIPS RH 790	139·00	112·00
PIONEER SX770 AM/FM	160·43	126·00
PIONEER SX990 AM/FM	194·74	150·00
PIONEER 440	111·10	89·00
*TELETON F2000	51·50	32·00
TELETON 7 AT 20	105·00	80·00
TELETON 10AT1 150w. RMS	160·00	109·00
TELETON TFS50	82·50	56·00
TELETON TFS 50LA MW/LW/VHF	87·50	64·90
*TELETON R.8000 with Speakers	63·25	50·00
TELETON CR55	120·00	95·00
WHARFEDALE 100.1	149·00	119·00

Starred items above take ceramic cartridges only. All others take both ceramic and magnetic cartridges.

All the above Tuners and Tuner/Amplifiers include MPX Stereo Decoder with the exception of Armstrong where decoder is extra as listed.

PICKUP ARMS

	Rec. Retail Price	Comet Price
GOLDRING Lenco L75	12·33	10·50
GOLDRING Lenco L69	9·29	7·00
SME 3009 with S2 Shell	34·47	28·00
SME 3012 with S2 Shell	36·71	31·50

CARTRIDGES

	Rec. Retail Price	Comet Price
GOLDRING 800	13·00	7·50
GOLDRING 800H	10·69	8·00
GOLDRING 800E	18·86	12·25
GOLDRING 800 Super E	26·01	20·00
*GOLDRING CS90 Stereo	5·20	4·25
*GOLDRING CS91/E	7·81	6·25
GOLDRING G850	6·50	5·25
EMPIRE 100ZE/X	63·00	52·50
EMPIRE 999VE/X	44·50	36·00
EMPIRE 999TE/X	27·60	22·50
EMPIRE 999SE/X	21·00	17·50
EMPIRE 999E/X	16·50	13·00
EMPIRE 999/X	11·50	9·25
EMPIRE 909E/X	12·85	10·25
EMPIRE 909/X	9·00	7·50
EMPIRE 90EE/X	9·75	8·00
ORBIT Magnetic NM 22	Special Price	2·90
PICKERING V15 AC2	8·40	7·00
ORTOFON SL15E	29·65	23·75
ORTOFON 2X15K Transformer	7·00	5·25
SHURE M3DM	7·41	5·25
SHURE M31E	12·05	9·50
SHURE M32E	11·10	8·75
SHURE M32-3	10·20	8·00
SHURE M44-5	11·10	8·50
SHURE M44-7	10·20	8·00
SHURE M-44C	10·20	8·00
SHURE M44E	12·05	9·50
SHURE M55E	12·95	10·25
SHURE M75G	17·60	14·00
SHURE M75-6	16·70	13·00
SHURE M75EJ	19·45	16·00
SHURE M75E-95G	23·15	18·00
SHURE M75E	21·30	16·00
SHURE M75E/D19	23·15	19·00
SHURE V15-11	40·76	30·00
SHURE V15-11-7	38·90	29·00

Starred cartridges above are ceramic. All others are magnetic.

TURNTABLES

GARRARD AP76 turntable, complete with Goldring G.800 Cartridge base and cover. Special Price 30·95

GARRARD SP25, Mk III fully wired with Goldring G800 Magnetic Cartridge. Complete with base, plinth and cover— Special Price 21·98

GARRARD 2025 fully wired with Sonotone 9TA HC Cartridge complete with base and cover Special Price **15·50**

GOLDRING 705/P turntable, complete with Goldring G850 cartridge, base and cover 25·00 **15·95**

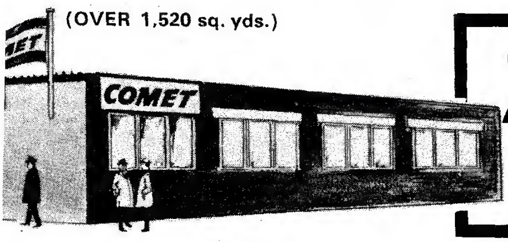
	Rec. Retail Price	Comet Price
DUAL 1219 transcription	60·40	50·00
DUAL 1209 transcription	42·62	35·00
GARRARD SP25 Mk III	16·45	11·90
GARRARD SL65 B	21·25	15·90
GARRARD SL75 B	39·20	29·50
GARRARD SL95 B	50·01	38·50
GARRARD 401	38·07	29·50
GARRARD SL72 B	33·11	27·90
GARRARD 3500, with GKS Cartridge	17·23	12·90
Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500	Special Price	4·00
GARRARD 40B	13·84	10·97
GARRARD AP 76	28·88	21·50
GOLDRING GL69 Mk. II	26·63	22·50
GOLDRING GL69 P Mk. II	35·14	29·50
GOLDRING GL75	36·41	33·90
GOLDRING GL75 P	46·94	41·90
GOLDRING Covers for 69P and 75P	4·21	3·50
GOLDRING C99—plinth and cover for G99	11·45	9·90
GOLDRING G99	26·00	23·90
GOODMANS 3025	37·74	26·90
McDONALD MP 60	15·75	12·95
McDONALD 610	20·00	16·50
Base and Cover for McDONALD MP 60 and 610	Special Price	4·50
PHILIPS 228	20·00	17·00
PHILIPS GA 146	31·50	25·00
PHILIPS 202 Electronic	69·00	57·50
PIONEER PL 12A with base & cover	49.93	37·95
THORENS TX 25 cover	8·85	7·00
THORENS TD125	79·04	64·95
THORENS TD150A Mk. II	46·16	35·95
THORENS TD125AB	120·20	100·00
THORENS TD150AB Mk. II	49·96	42·95
THORENS TX11 Cover	4·43	3·95

SPEAKERS

	Rec. Retail Price	Comet Price
ARENA HT 16	13·00	10·95
B & W Model 70	139·50	115·00
B & W DM3	63·00	53·00
B & W DM1	32·00	25·50
CELESTION Ditton 120	24·00	18·00
CELESTION Ditton 15	32·00	25·50
CELESTION Ditton 25	65·00	52·00
GOODMANS Minister	25·00	21·20
GOODMANS Magister	62·50	49·50
GOODMANS Maxim	20·39	16·75
GOODMANS Mezzo 3	34·00	26·50
GOODMANS Magnum K2	44·00	33·00
KEF Cresta	22·17	18·00
KELETRON KN 500 4 speaker system (pair)	23·00	17·95
KELETRON KN 700 4 speaker system (pair)	27·50	21·95
KELETRON KN 1000 4 speaker system	19·25	14·95
KELETRON KN 1500 4 speaker system	24·75	19·95
KELETRON KN 2000 4 speaker system	28·75	21·95
LEAK 200	24·95	18·90
LEAK 300	32·50	23·95
LEAK 600	49·50	36·90
LOWTHER Acousta (with PM6)	45·50	38·50
LOWTHER Acousta (with PM7)	53·00	46·00
LOWTHER Ideal Baffle	35·50	30·00
METROSOUND HFS 20 (pair)	39·00	25·95
METROSOUND HFS 10 (pair)	27·44	22·95
PHILIPS RH481	11·00	9·25
PHILIPS RH482	18·00	15·00
SINCLAIR Q16	8·98	8·00
STE-MA 275 3 speaker system	23·10	15·00
WHARFEDALE Speakers		
Airedale	69·50	56·00
Denton	19·95	15·90
Super Linton	24·95	20·50
Melton	32·50	25·50
Dovedale 3	42·50	32·50
Rosedale	65·00	52·50
Triton (pair)	59·90	46·90
Unit 3 Speaker Kit	13·00	10·50
Unit 4 Speaker Kit	18·00	14·25
Unit 5 Speaker Kit	26·00	20·50

CHASSIS SPEAKERS

	Rec. Retail Price	Comet Price
GOODMANS Axiette 8	8·10	6·50
GOODMANS Twinaxiette 8	9·17	7·50
GOODMANS Axiom 10	9·16	7·75
GOODMANS Axiom 80	28·31	23·75
GOODMANS Axiom 201	14·45	10·95



(OVER 1,520 sq. yds.)

OVER 1000 ITEMS ALWAYS IN STOCK

ALL FULLY GUARANTEED—WITH AFTER-SALES SERVICE

All items offered are brand new, latest models in manufacturers' sealed cartons

	Rec. Retail Price	Comet Price
GOODMANS Axiom 301	20·70	15·75
GOODMANS Audiom 8P	5·55	4·25
GOODMANS Audiom 10P	6·05	3·58
GOODMANS Audiom 51	13·05	9·75
GOODMANS Audiom 61	18·95	14·00
GOODMANS 12P	12·37	10·00
GOODMANS 15P	20·00	16·97
GOODMANS Audiom 18P	34·00	26·97
GOODMANS Twin Axiom 10	10·23	8·25
GOODMANS ARU 172	4·50	3·50
GOODMANS Trebax 100	8·60	6·00
GOODMANS Trebax 5K/20XL	9·70	7·50
GOODMANS Midax	12·95	9·00
GOODMANS Attenuator	3·55	2·50
GOODMANS Crossover Networks XO/950/5000	9·75	7·25
GOODMANS Crossover Networks XO/950	7·40	5·75
GOODMANS Crossover Networks XO/5000	2·65	2·00
WHARFEDALE 8 in. Bronze/RS/DD	5·00	4·00
WHARFEDALE Super 8/RS/DD	8·50	7·00
WHARFEDALE Super 10/RS/DD	14·00	11·50
WHARFEDALE WMT 1 Matching Transformer	0·84	0·75

HI-FI STEREO SYSTEMS (complete)

ARENA MR15	143·00	115·95
ALBA UA552	47·50	35·95
ALBA UA662	62·97	47·95
BUSH System 749/746/764	102·65	82·65
DECCA Sound 603	72·50	59·95
DECCA Sound 604	72·50	60·95
DECCA Sound 1203	97·50	79·95
DECCALIAN 5, complete with stand.	65·50	52·95
EKCO SRG 609	88·50	69·95
EKCO ZU5	165·00	135·00
FERGUSON 3422	87·85	69·95
FERGUSON 3423	118·25	94·95
FERGUSON 3424	123·15	99·95
FERGUSON 3425	145·10	114·00
FIDELITY Music Master UA2	46·00	35·95
FIDELITY Music Master UA1	98·00	82·95
GOODMANS 3000 Suite	140·45	92·95
H.M.V. 2416	129·70	104·95
H.M.V. 204/5/6	202·85	165·00
K.B. KA1250, complete with two 653 speakers	72·00	59·95
K.B. KA1250, complete with two 651 speakers	83·00	65·95
LEAK 30/GOLDRING/WHARFEDALE	182·65	142·95
LEAK 70/THORENS/WHARFEDALE	218·72	169·95
MARCONI Unit 4	77·45	66·95
MARCONI Unit 3	86·00	69·95
METROSOUND Stereo 1010	77·32	65·95
PHILIPS GF823	51·50	41·95
PHILIPS GF824	69·50	56·95
PHILIPS GF833	67·50	55·95
PHILIPS GF834	88·00	73·95
PHILIPS 882 (less L/S)	99·00	78·50
PHILIPS GF417	99·50	82·95
TELETON 2S60F, with Stereo Radio	75·00	55·95
TELETON CRIOT 2025/1003, with Stereo Radio	62·10	45·95
TOSHIBA SP8507	248·00	175·00
ULTRA 6405	79·75	66·95

TAPE RECORDERS AND TAPE DECKS

AKAI M10L	245·05	189·00
AKAI X200D	190·00	159·95
AKAI X5000 W/L	177·98	140·00
AKAI X330	342·57	269·00
AKAI X-330D	312·56	245 00
AKAI X-360	380·08	284 00

	Rec. Retail Price	Comet Price
AKAI X-360 D-deck	318·92	243·00
AKAI 1800SD	199·42	167·00
AKAI 1710L	89·85	65·95
AKAI CR80 8-track stereo recorder	115·03	99·95
AKAI CR80D 8-track stereo tape deck	95·00	79·95
AKAI 4000 4-track Stereo	124·90	99·95
AKAI 4000 D 4-track Stereo deck	89·95	69·95
BUSH TP 60 Cassette Tape Recorder	29·40	24·95
BUSH TP 70 Cassette Battery/Mains Tape Recorder	29·95	23·95
BUSH Discassette DC70	21·95	16·95
FERGUSON 3252	104·30	83·95
FERGUSON 3245 Twin track	38·00	29·95
FERGUSON 3246 4-track	44·10	34·95
FERGUSON 3247 4-track	49·65	39·95
FERGUSON 3248 4-track	55·65	43·95
FERROGRAPH 722	266·41	219·00
FERROGRAPH 724	266·41	219·00
FERROGRAPH 702 2 track tape deck	228·71	193·00
FERROGRAPH 704/W 4 track tape deck	228·71	193·00
GRUNDIG C200L Cassette	39·90	29·95
GRUNDIG TK 141 (4-track)	61·85	49·95
GRUNDIG TK 121 (Twin-track)	56·85	43·95
GRUNDIG TK 146 (4-track Auto)	68·14	53·95
GRUNDIG TK 149 4-track	57·63	47·95
MIDLAND TC 144 cassette	18·00	13·95
PHILIPS 2202 Cassette	29·90	23·95
PHILIPS 2205 Cassette	43·15	34·95
PHILIPS 2400 Stereo Cassette (Less L/S)	68·00	59·95
PHILIPS 4404 4-track stereo recorder	95·00	73·95
PHILIPS 4407 4-track stereo recorder	110·00	89·95
PHILIPS 4302 Twin Track Auto	39·00	32·00
PHILIPS 4500 4-Track Stereo Tape Deck	126·00	98·95
PHILIPS 4408 4-Track Stereo	139·00	109·00
PHILIPS 4307	49.50	38.95
PHILIPS 4308	60·50	46·50
PYE Cassette Recorder/Radio (Batt./Mains)	45·50	36·95
TELETON 511 Batt./mains cassette	29·50	17·50
TELETON FXB 510 D 4-track Stereo	67·50	52·00
TELETON TRC 130 cassette, with VHF/AM radio. Battery/mains twin motors	41·75	31·90
TELETON TC110 cassette, battery/mains	27·75	20·00
TOSHIBA GT 840 S	110·00	67·95
TOSHIBA GT 601v Twin Track	45·15	25·95
TOSHIBA 850 SA	94·00	59·95

BASES AND COVERS

GARRARD WB1 Base	3·86	3·25
GARRARD WB4 Base	5·69	4·75
GARRARD SPC 1 Cover	3·74	3·00
GARRARD SPC 4 Cover	4·44	3·75
Special offer of Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500	Special Price	4·00
GOLDRING Plinth 75	8·52	7·00
GOLDRING Plinth 69	8·52	7·00
GOLDRING Covers for 69P and 75P	4·21	3·50
THORENS TX25 (for TD125AB)	8·22	6·50
THORENS TX11 Cover	4·11	3·75
Base and Cover for TD 125	15·18	12·50
SME Plinth System 2000	39·20	31·25
MOTORBOARDS only	4·95	3·00

TEAK CASES

Leak 70/30 Amp. case	7·50	6·50
Leak Tuner case	7·50	6·50
Leak Double case for amp. & tuner	10·50	8·95

COMPLETE HI-FI SYSTEMS

Completely wired, mounted and ready for use

	Rec. Retail Price	Comet Price
GOODMANS AUDIO SUITE, Goodmans Maxamp stereo amplixer, Goodmans stereomax AM/FM Tuner with decoder. Pair of Goodmans Magnum K2 speakers, Garrard AP76 turntable in base, complete with cover and Goldring G800 Cartridge. Beautifully finished in walnut	257·13	169·95
METROSOUND 448 8-track stereo play-back unit complete with 2 HFS 10 Speakers	83·56	70·95
TELETON Stereo 8 track tape Audio system complete with speakers	54·75	48·00
GARRARD SP 25, Mk. III mounted in base, plinth and cover with GOLDRING G800 Cartridge. Teleton 203 or 206 Stereo Amplifier 12 watts RMS, and 2 KELETRON KN500 Speakers, each speaker is a 4 speaker system	88·33	58·95
PIONEER PL 12 turntable, Goodmans Maxamp, Shure M55E Cartridge, 2 Keletron KN 700 speakers (each speaker cabinet contains 4 speakers)	144.38	105·00
GARRARD AP76 turntable complete with Goldring G800 Cartridge, base and cover, Rogers Ravensbrook Amplifier in teak case and 2 Goodmans Minister Speakers	142·41	108·50
GOLDRING GL 75P mounted in teak base with hinged perspex cover complete with GOLDRING G800E Cartridge. Leak Stereo 30 Plus Amplifier in Teak case. 2 GOODMANS Mezzo 3 Speakers	200·50	154·20
THORENS TD 150AB Mk. II with TX11 dust cover, SHURE M55E Cartridge, LEAK Stereo 70 Amplifier in Teak case. 2 Wharfedale Dovedale 3 Speakers	226·87	175·00
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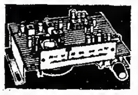

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Resistance 12 ohm to 120 mΩ
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Offered in perfect condition.
£55 each. Carr. 50p.

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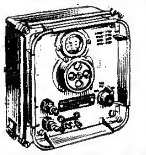

Small portable crystal controlled wavemeter. Size 7 × 7½ × 4in. Frequency range 500 Kc/s–10 Mc/s (up to 30 Mc/s on harmonics). Calibrated dial. Power requirements 300V. D.C. 15mA and 12V D.C. 0.3A. Excellent condition. **£4·47½**. Carr. 37½p.

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AVO CT.38 ELECTRONIC MULTIMETERS

High quality 97 range instrument which measures A.C. and D.C. Voltage. Current. Resistance and Power Output Ranges D.C. volts 250mV–10,000v. (10 meg Ω –11 0meg Ω input). D.C. current 10µA–25 amps. Ohms, 0–1,000 meg Ω A.C. volt 100mV.–250V (with R.F. measuring head up to 250 Mc/s) A.C. current 10µA–25 amps. Power output 50 micro-watts–5 watts. Operation 0/110/200/250V. A.C. Supplied in perfect condition complete with circuit lead and R.F. probe. **£25**. Carr. 75p.

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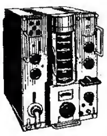

High quality 10 valve receiver manufactured by Murphy. Coverage in 5 bands 150-300 Kc/s, 560 Kc's–1.5Mc/s; 3.9–30.5 Mc/s I.F. 500/Kc/s. Incorporates 2 R.F. and 3 I.F. stages, bandpass filter, noise limiter, crystal controlled B.F.O. calibrator I.F. output, etc. Built-in speaker, output for phones. Operation 150/230 vol A.C. Size 19½ × 13½ × 16in. Weight 114lb. Offered in good working condition. **£22·50**. Carr. £1.50. With circuit diagrams. Also available B41 L.F. version of above, 15 Kc/s–700 Kc/s. **£17·50**. Carr. £1.50.

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3in. tube. Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps–1·5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0·9v. p-p/CM. Bandwidth 1.5 cps –800KHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps–300 KHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½ lb. 220/240V. A.C. Supplied brand new with handbook. **£37·50**. Carr. 50p.

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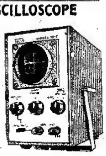
A general purpose low cost economy oscilloscope for everyday use. Y amp. Bandwidth 2 CPS–1 MHZ. Input imp. 2 meg Ω 25 P.F. Illuminated scale. 2in. tube. 115 × 180 × 230mm. Weight 8lb. 220/240 V a.c. Supplied brand new with handbook. **£22.50**. Carr. 50p.



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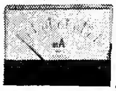
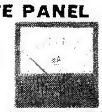


TYPE SW.100
100 x 80 mm.

		20V. D.C. ..	£2·97½
50µA	£3·47½	50V. D.C. ..	£2·97½
50–0–50µA	£3·37½	300V. D.C.	£2·97½
100µA	£3·37½	1 amp. D.C.	£2·97½
100–0–100µA	£3·25	5 amp. D.C.	£2·97½
500µA	£3·12½	300V. A.C.	£2·97½
1mA	£2·97½	VU Meter..	£3·75

BAKELITE PANEL METERS

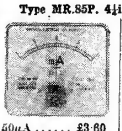
TYPE S-80
80 mm.
square fronts



50µA	£3·12½		
50–0–50µA	£2·97½	50V. D.C...	£2·47½
100µA	£2·97½	300V. D.C.	£2·47½
100–0–100µA	£2·87½	1 amp. D.C.	£2·47½
500µA	£2·62½	5 amp. D.C.	£2·47½
1mA	£2·47½	300V. A.C.	£2·62½
20V. D.C...	£2·47½	VU Meter..	£3·37½

"SEW" CLEAR PLASTIC METERS

Type MR.85P. 4½in. × 4¼in. fronts.



		50mA	£2·60
		100mA	£2·60
		500mA	£2·60
		1 amp.	£2·60
		5 amp.	£2·60
		15 amp.....	£2·60
		30 amp.....	£2·60
		20V. D.C...	£2·60
		50V. D.C...	£2·60
50µA	£3·60	150V. D.C.	£2·60
50–0–50µA	£3·10	300V. D.C.	£2·60
100µA	£3·10	15V. A.C. ..	£2·60
100–0–100µA	£3·10	300V. A.C.	£2·60
200µA	£2·87½	S Meter 1mA	£2·87½
500µA	£2·75	VU Meter..	£3·60
500–0–500µA	£2·60	1 amp. A.C.*	£2·60
1mA	£2·60	5 amp. A.C.*	£2·60
1–0–1mA ..	£2·60	10 amp. A.C.*	£2·60
5mA	£2·60	20 amp. A.C.*	£2·60
10mA	£2·60	30 amp. A.C.*	£2·60

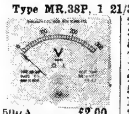
Type MR.52P. 2⅞in. square fronts.

50µA	£3·10	10V. D.C. ..	£2·00
50–0–50µA	£2·60	20V. D.C. ..	£2·00
100µA	£2·60	50V. D.C. ..	£2·00
100–0–100µA	£2·37½	300V. D.C.	£2·00
500µA	£2·25	15V. A.C. ..	£2·00
1mA	£2·00	300V. A.C.	£2·00
5mA	£2·00	S Meter 1mA	£2·10
10mA	£2·00	VU Meter ..	£3·10
50mA	£2·00	1 amp. A.C.*	£2·00
100mA	£2·00	5 amp. A.C.*	£2·00
500mA	£2·00	10 amp. A.C.*	£2·00
1 amp.	£2·00	20 amp. A.C.*	£2·00
5 amp.	£2·00	30 amp. A.C.*	£2·00

Type MR.65P. 3½in. × 3¼in. fronts.

50µA	3·37½	10V. D.C. ..	£2·10
50–0–50µA	£2·75	20V. D.C. ..	£2·10
100µA	£2·75	50V. D.C. ..	£2·10
100–0–100µA	£2·60	150V.D.C. ..	£2·10
200µA	£2·60	300V. D.C.	£2·10
500µA	£2·37½	15V. A.C...	£2·10
500–0–500µA	£2·10	50V. A.C...	£2·10
1mA	£2·10	150V. A.C.	£2·10
5mA	£2·10	300V. A.C.	£2·10
10mA	£2·10	500V. A.C.	£2·10
50mA	£2·10	S Meter 1mA	£2·37½
100mA	£2·10	VU Meter..	£3·37½
500mA	£2·10	50mA A.C.	*£2·10
1 amp.	£2·10	100mA A.C.*	£2·10
5 amp.	£2·10	200mA A.C.*	£2·10
10 amp.....	£2·10	500mA A.C.*	£2·10
15 amp. ..	£2·10	1 amp. A.C.*	£2·10
20 amp. ..	£2·10	5 amp. A.C.*	£2·10
30 amp. ..	£2·10	10 amp. A.C.*	£2·10
50 amp. ..	£2·37½	20 amp. A.C.*	£2·10
5V. D.C. ..	£2·10	30 amp. A.C.*	£2·10

Type MR.38P. 1 21/32in. square fronts.



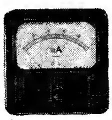
		200mA	£1·37½
		300mA	£1·37½
		500mA	£1·37½
		750mA	£1·37½
		1 amp.	£1·37½
		2 amp.	£1·37½
		5 amp.	£1·37½
		10 amp. ..	£1·37½
50µA	£2·00	3V. D.C. ..	£1·37½
50–0–50µA	£1·87½	10V. D.C. ..	£1·37½
100µA	£1·87½	15V. D.C...	£1·37½
100–0–100µA	£1·75	20V. D.C...	£1·37½
200µA	£1·75	100V. D.C.	£1·37½
500µA	£1·50	150V. D.C.	£1·37½
500–0–500µA	£1·37½	300V. D.C.	£1·37½
1mA	£1·37½	500V. D.C.	£1·37½
1–0–1mA ..	£1·37½	750V. D.C.	£1·37½
2mA	£1·37½	15V. A.C...	£1·37½
5mA	£1·37½	50V. A.C...	£1·37½
10mA	£1·37½	150V. A.C.	£1·37½
20mA	£1·37½	300V. A.C.	£1·37½
50mA	£1·37½	500V. A.C.	£1·37½
100mA	£1·37½	S Meter 1mA	£1·60
150mA	£1·37½	VU Meter..	£2·10

Type MR.45P. 2in. square fronts.

50µA	£2·25	5 amp.	£1·50
50–0–50µA	£2·10	10V. D.C. ..	£1·50
100µA	£2·10	20V. D.C. ..	£1·50
100–0–100µA	£1·87½	50V. D.C. ..	£1·50
200µA	£1·87½	300V. D.C.	£1·50
500µA	£1·60	15V. A.C. ..	£1·50
500–0–500µA	£1·50	300V. A.C.	£1·50
1mA	£1·50	S Meter 1mA	£1·87½
5mA	£1·50	VU Meter..	£2·25
10mA	£1·50	1 amp. A.C.*	£1·50
50mA	£1·50	5 amp. A.C.*	£1·50
100mA	£1·50	10 amp. A.C.*	£1·50
500mA	£1·50	20 amp. A.C.*	£1·50
1 amp	£1·50	30 amp. A.C.*	£1·50

"SEW" BAKELITE PANEL METERS

Type MR.65. 3½in. square fronts.



		500mA	£1·75
		1 amp.	£1·75
		5 amp.	£1·75
		15 amp.....	£1·75
		30 amp.....	£1·75
		50 amp.....	£1·75
		5V. D.C. ..	£1·75
		10V. D.C. ..	£1·75
		20V. D.C. ..	£1·75
		50V. D.C. ..	£1·75
		150V. D.C.	£1·75
		300V. D.C.	£1·75
25µA	£3·50	30V. A.C.*	£1·75
50µA	£2·37½	50V. A.C.*	£1·75
50–0–50µA	£2·25	150V. A.C.*	£1·75
100µA	£2·25	300V. A.C.*	£1·75
100–0–100µA	£2·25	500mA A.C.*	£1·75
500µA	£2·10	1 amp. A.C.*	£1·75
1mA	£1·75	5 amp. A.C.*	£1·75
1–0–1mA ..	£1·75	10 amp. A.C.*	£1·75
5mA	£1·75	20 amp. A.C.*	£1·75
10mA	£1·75	30 amp. A.C.*	£1·75
50mA	£1·75	50 amp. A.C.*	£1·75
100mA	£1·75	VU Meter ..	£3·10

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100µA	£4·25	50V d.c.	£3·97
1mA	£3·97	300V d.c.	£3·97
50-0-50µA ...	£4·25		
1-0-1mA.....	£3·97	Dual range	
1A d.c.	£3·97	500mA/5A d.c.	£4·25
5A d.c.	£3·97	5V/50V d.c...	£4·25
10V d.c.	£3·97		

EDGWISE METERS

Type PE.70. 3 17/32in. × 1 15/32in. × 2¾ in. deep.

50µA	£3·00	500µA	£2·60
50–0–50µA	£2·87½	1mA	£2·37½
100µA	£2·87½	300V. A.C.	£2·37½
100–0–100µA	£2·75	VU Meter..	£3·25
200µA	£2·75		

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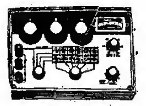

A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω–11·1 meg Ω 6 Ranges ±1% L.1 µ H - 111 HENRYS 6 Ranges –2% C. 10pF ±1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100µA. Meter indication. Attractive 2 tone metal case. Size 7⅝ × 5 × 2in. **£20**. P. & P. 25p

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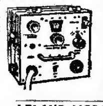

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Frequency 0–20 Kc/s. on 2 ranges. Output 500 Ω or 5k Ω. Operation 200/250V. A.C. Supplied in perfect order. **£12·50**. Carr. 50p.

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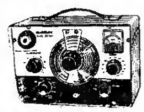
2 pF-2000 mFd 2 ohms 200 megohms. Also checks impedance, turns ratio, insulation, 200/250V. A.C. **Brand New £17·50.** Carr. 37½p.



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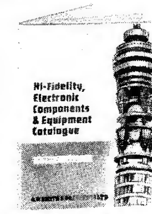

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2G308	80p	AF114	25p	NKT214	15p
2G309	30p	AF115	25p	NKT216	37p
2G371	22p	AF116	20p	NKT217	40p
2G374	27p	AF117	25p	NKT224	22p
2G381	25p	AF118	62p	NKT241	27p
2N696	17p	AF119	20p	NKT261	20p
2N697	17p	AF124	25p	NKT271	25p
2N698	42p	AF126	17p	NKT272	25p
2N706	10p	AF127	17p	NKT274	20p
2N706A	12p	AF139	30p	NKT275	25p
2N708	15p	AF178	47p	NKT278	25p
2N914	22p	AF180	52p	NKT281	27p
2N916	22p	AF181	42p	NKT403	75p
2N918	37p	AF186	40p	NKT404	62p
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2N930	25p	ASY26	25p	NKT773	25p
2N1131	30p	ASY27	32p	NKT10439	
2N1132	30p	ASY28	25p		37p
2N1302	20p	ASZ17	42p	OA5	20p
2N1303	22p	AUY10,	97p	OA10	25p
2N1304	25p	BAY31	7p	OA47	10p
2N1305	25p	BC107	12p	OA70	10p
2N1306	25p	BC108	12p	OA79	10p
2N1307	25p	BC109	12p	OA81	10p
2N1308	30p	BC113	25p	OA85	12p
2N1309	25p	BC116	40p	OA90	10p
2N1613	22p	BC125	55p	OA91	7p
2N1711	25p	BC126	55p	OA95	7p
2N1889	32p	BC147	17p	OA200	7p
2N1893	50p	BC148	12p	OA202	10p
2N2147	75p	BC149	20p	OA210	17p
2N2160	65p	BC167	15p	OC19	37p
2N2193	47p	BC172	17p	OC20	97p
2N2217	40p	BC177	25p	OC22	50p
2N2218	30p	BC186	25p	OC23	60p
2N2219	32p	BC182L	10p	OC24	60p
2N2368	17p	BC184L	12p	OC25	37p
2N2369	20p	BC212L	12p	OC26	25p
2N2369A	20p	BCY30	25p	OC28	62p
2N2484	35p	BCY31	30p	OC29	62p
2N2613	85p	BCY32	50p	OC35	50p
2N2646	50p	BCY33	25p	OC36	62p
2N2904	30p	BCY34	30p	OC41	25p
2N2923	17p	BCY38	40p	OC42	30p
2N2924	17p	BCY42	15p	OC44	17p
2N2925	17p	BCY43	20p	OC45	15p
2N2926G	12p	BCY71	30p	OC46	27p
2N2926Y	12p	BCY72	15p	OC70	12p
2N29260	12p	BCZ11	40p	OC71	15p
2N3053	25p	BD121	65p	OC72	25p
2N3054	50p	BD123	80p	OC73	30p
2N3055	75p	BD124	80p	OC74	30p
2N3391A	30p	BF115	25p	OC75	25p
2N3416	37p	BF117	47p	OC76	25p
2N3570	£1·25	BF167	25p	OC77	40p
2N3702	12p	BF173	30p	OC78	20p
2N3703	12p	BF180	37p	OC81	25p
2N3704	17p	BF181	37p	OC81D	20p
2N3705	15p	BF182	32p	OC83	25p
2N3706	22p	BF184	25p	OC84	25p
2N3707	15p	BF185	25p	OC139	25p
2N3708	17p	BF194	17p	OC140	37p
2N3709	12p	BF195	15p	OC169	20p
2N3710	12p	BF200	37p	OC170	25p
2N3711	12p	BF224	30p	OC171	30p
2N3819	35p	BF225	30p	OC200	40p
2N3903	25p	BF244	47p	OC201	60p
2N3904	25p	BFX12	22p	OC202	75p
2N3905	30p	BFX13	25p	OC203	40p
2N3906	30p	BFX29	30p	OC204	40p
2N4058	17p	BFX30	32p	OC205	62p
2N4059	25p	BFX44	37p	OC207	75p
2N4061	15p	BFX85	40p	OCP71	97p
2N4062	22p	BFX86	32p	ORP12	50p
2N4286	15p	BFX87	32p	ORP60	40p
2N4287	17p	BFX88	25p	P346A	25p
2N4288	15p	BFY18	25p	PL4001	14p
2N4289	17p	BFY20	62p	PL4002	15p
2N4290	15p	BFY50	22p	PL4003	16p
2N4291	15p	BFY51	20p	PL4004	17p
2N4292	15p	BFY52	22p	PL4005	19p
2N5354	27p	BFY90	67p	PL4006	20p
2N5355	27p	BSX19	17p	PL4007	24p
2S102	25p	BSX20	17p	TIS43	40p
2S103	37p	BSX21	37p	TIS44	12p
2S104	37p	BSX76	15p	TIS45	17p
40250	50p	BSY26	17p	TIS46	17p
40361	55p	BSY27	20p	BC107/8/9	
40362	60p	BSY28	17p	25+	10p
AC107	37p	BSY38	20p	100+	9p
AC126	25p	BSY39	22p	500+	7p
AC127	25p	BSY51	32p	2N3055	
AC128	25p	BSY56	90p	25+	62p
AC154	15p	BSY95A	15p	100+	50p
AC176	25p	BY100	15p		

THYRISTORS

PIV	50	100	200	300	350	400
1A	25p	27p	37p	40p	—	47p
3A	30p	37p	40p	45p	—	50p
5A	—	55p	65p	—	—	75p
7A	—	55p	65p	70p	—	97p

VALVES

OA2	38p	25Z4	30p	EL95	35p
OB2	45p	25Z5	42p	EM80	40p
OZ4	30p	25Z6	65p	EM81	50p
IL4	20p	30C15	80p	EM84	35p
IR5	35p	30C17	85p	EM85	£1·00
IS5	25p	30C18	75p	EM87	43p
IT4	25p	30F5	85p	EY51	40p
IU4	27p	30FL1	70p	EY86	40p
IU5	50p	30FL12	92p	EY87	42p
2D21	35p	30FL14	75p	EZ40	45p
3Q4	40p	30L15	85p	EZ41	45p
3S4	35p	30L17	80p	EZ80	25p
3V4	45p	30P12	80p	EZ81	28p
5R4	60p	30P19	80p	GZ32	48p
5U4	33p	30PL1	70p	GZ34	60p
5V4	42p	30PL13	93p	KT66	£1·70
5Y3	32p	30PL14	90p	KT88	£1·75
5Z4G	40p	35L6	50p	MU14	60p
6/30L2	75p	35W4	30p	PABC80	40p
6AC7	25p	35Z4	30p	PC86	60p
6AG7	40p	35Z5	40p	PC88	60p
6AK5	30p	50B5	45p	PC97	45p
6AK6	57p	50C5	40p	PC900	48p
6AL5	20p	80	50p	PCC84	40p
6AM6	33p	85A2	45p	PCC85	40p
6AQ5	35p	807	50p	PCC88	55p
6AS6	37p	1625	50p	PCC89	50p
6AT6	30p	5763	70p	PCC189	55p
6AU6	25p	6146	£1·50	PCF80	30p
6AV6	30p	AZ31	50p	PCF82	34p
6BA6	25p	CY31	35p	PCF84	50p
6BE6	30p	DAF91	25p	PCF86	60p
6BH6	45p	DAF96	42p	PCF800	80p
6BJ6	45p	DF91	25p	PCF801	50p
6BQ7A	40p	DF96	42p	PCF802	50p
6BR7	85p	DK91	35p	PCF805	75p
6BR8	65p	DK92	50p	PCF806	70p
6BW6	85p	DK96	42p	PCF808	75p
6BW7	70p	DL92	35p	PCL82	35p
6BZ6	35p	DL94	45p	PCL83	65p
6C4	33p	DL96	42p	PCL84	45p
6CD6	£1·15	DM70	32p	PCL85	40p
6CL6	50p	DY86	33p	PCL86	45p
6CW4	63p	DY87	35p	PFL200	70p
6F1	62p	E88CC	65p	PL36	55p
6F6G	30p	E180F	95p	PL81	50p
6F13	38p	EABC80	35p	PL82	45p
6F14	65p	EAF42	35p	PL83	45p
6F15	65p	EB91	20p	PL84	40p
6F18	45p	EBC41	55p	PL500	75p
6F23	80p	EBC81	30p	PL504	80p
6H6	20p	EBF80	40p	PY32	55p
6J4	50p	EBF83	40p	PY33	63p
6J5	20p	EBF89	32p	PY80	35p
6J5GT	30p	EBL21	60p	PY81	30p
6J6	20p	EC86	60p	PY82	30p
6J7	45p	EC88	60p	PY83	38p
6K8G	35p	ECC40	60p	PY88	40p
6L6GT	45p	ECC84	30p	PY800	50p
6LD20	40p	ECC85	60p	PY801	50p
6Q7	40p	ECC88	40p	U25	75p
6SA7	40p	ECF80	35p	U26	75p
6SG7	35p	ECF82	35p	U50	32p
6SJ7	40p	ECF86	65p	U52	33p
6SK7	35p	ECH21	57p	U191	75p
6SL7	35p	ECH35	60p	U281	40p
6SN7	35p	ECH42	70p	U282	40p
6SQ7	40p	ECH81	30p	U301	40p
6U4	60p	ECH83	40p	U801	£1·00
6V6G	25p	ECL80	40p	UABC80	35p
6V6GT	32p	ECL82	35p	UAF42	55p
6X4	30p	ECL83	65p	UBC41	50p
6X5G	30p	ECL86	40p	UBC81	40p
6X5GT	27p	EF37A	60p	UBF80	40p
10C2	50p	EF39	40p	UBF89	35p
10F1	90p	EF40	50p	UCC84	49p
10P13	55p	EF41	65p	UCC85	40p
10P14	£1·10	EF42	70p	UCF80	55p
12AT6	30p	EF80	25p	UCH21	60p
12AT7	30p	EF85	35p	UCH42	70p
12AU7	30p	EF86	30p	UCH81	35p
12AX7	30p	EF89	28p	UCL82	35p
12AV6	33p	EF91	33p	UCL83	60p
12BA6	35p	EF92	40p	UF41	60p
12BE6	35p	EF183	30p	UF80	35p
12BH7	40p	EF184	35p	UF85	40p
19AQ5	35p	EH90	40p	UF89	35p
20D1	45p	EL34	50p	UL41	65p
20F2	75p	EL33	£1·25	UL84	30p
20L1	£1·10	EL41	55p	UY41	45p
20P1	50p	EL42	58p	UY85	30p
20P3	60p	EL81	55p	VR105/30	38p
20P4	£1·10	EL84	25p	VR150/30	35p
20P5	£1·20	EL85	43p		
25L6	45p	EL91	32p		

SEND SAE FOR FULL LISTS!
DISCOUNTS 10% on 12+ any one type. 15% on 25+ any one type.
Large quantity discounts on application.
Postage: Semi-Conductors 8p; Valves 15p.

ZENER DIODES

200mw. (3.3 to 33v) **15p**; 1.5watt (2.4 to 400v) **20p**; 40 watt (3.9 to 100v) **25p**.

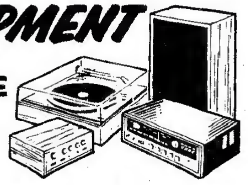
INTEGRATED CIRCUITS

L900 **40p**; L914 **40p**; L923 **60p**; IC-10 **£2·50**; SL403 **£2·25**; MC1303 **£2·62**; MC1304 **£2·75**; PA246 **£2·45**; CA3005 **£1·17**; CA3011 **74p**; CA3052 **£1·65**; FCH131 **50p**; FCH161 **50p**; FJH141 **25p**; FJH171 **25p**; FJH181 **25p**; FJH221 **25p**; FJH231 **25p**; FJH241 **25p**; FJH251 **25p**; FJJ121 **60p**; FJJ131 **60p**; FJJ211 **£1·25**; FJY101 **25p**

HI-FI EQUIPMENT

SAVE UP TO 33⅓% OR MORE

SEND S.A.E. FOR DISCOUNT PRICE LISTS AND PACKAGE OFFERS!



GARRARD

FULL CURRENT RANGE OFFERED BRAND NEW AT FANTASTIC SAVINGS

40 Mk II stereo	£8·40	SL72B	£26·97
2025T/C stereo	£9·87	AP76	£20·97
3000 stereo	£10·50	SL75B	£28·50
SP25 Mk III	£11·75	SL95B	£38·50
SL65B	£14·97	401	£29·50

Carriage 50p extra each item.

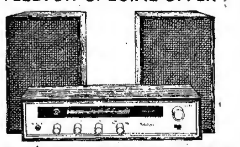
TEAK PLINTHS & PERSPEX COVERS
1. For SP25, SL65, SL55, 3000, 2025 T/C 2025, 1000. **£3·97½**.
2. For AP75, SL75, SL95. **£5·97½**.
3. For SP25 etc. to operate with lid in place **£5·97½**. Carriage 37½p extra each type. Full range of Garrard accessories available.

SPECIAL OFFERS!

Garrard SP25 MK III fitted Goldring G800 cartridge and wooden plinth and plastic cover. Ready wired. Total list price £35. OUR PRICE **£20.95** Carr. 50p

GOLDRING GL69/2 fitted Goldring G800 cartridge complete with deluxe base and cover. Total list price £50.80. OUR PRICE **£39** Carr. 50p

TELETON SPECIAL OFFER!



CR10T AM/FM STEREO TUNER AMPLIFIER WITH MATCHING PAIR SA1003 SPEAKER SYSTEMS. Output 4 watts per channel. Excellent reception, AFC, built-in MPX. Cer/XTAL Input. Total List **£50·25**. OUR PRICE **£29·95**. Carr. 62½p.

Also available with Garrard 2025T/C Record Changer, Plinth, cover and stereo cartridge. Ready wired **£45**. Carr. £1·00.

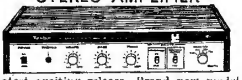
TAPE CASSETTES

Top quality in plastic library boxes.
C90 60 min **42½p**, 3 for **£1·22½**.
C60 90 min **62½p**, 3 for **£1·80**.
C120 120 min **75p**, 3 for **£2·17½**.
Cassette Head Cleaner **56p**. *Post Extra.*

HOSIDEN DHO4S 2-WAY STEREO HEADSETS

Each headphone contains a 2¼in. woofer and a ⅜in. tweeter. Built in individual level controls. 8 Ω imp. 25–18,000c/s with cable and stereo plug. **£5.97½** P. & P. **12½p**.

TELETON SAQ-206 STEREO AMPLIFIER



Latest exciting release. Brand new model. 6 + 6 watts rms. Inputs for mag, xtal, aux tape. **Volume, bass, treble, sliding balance,** scratch filter and loudness controls. Rec. List £29. OUR PRICE **£19·97** Carr. 37p.

AMERICAN TAPE

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

3in. 225ft. L.P. acetate	17½p
3¼in. 600ft. T.P. mylar	50p
5in. 600ft. std. plastic	42½p
5in. 900ft. L.P. acetate	50p
5in. 1,200ft. D.P. mylar	75p
5¾in. 1,200ft. L.P. acetate	62½p
5¾in. 1,200ft. L.P. mylar	80p
5¾in. 1,800ft. D.P. mylar	£1·12½
5¾in. 2,400ft. T.P. mylar	£1·97½
7in. 1,200ft. std. acetate	62½p
7in. 1,800ft. L.P. acetate	75p
7in. 1,800ft. L.P. mylar	£1·00
7in. 2,400ft. D.P. mylar	£1·25
7in. 3,600ft. T.P. mylar	£2·25

Postage 10p. Over £3 post paid.

B.S.R. McDONALD

MP60	£11·95	610	£15·95
510	£12·95	310	£10·95

Carriage 37½p extra each item

TEAK BASE AND PERSPEX COVER for above BSR range **£3·97½**. Carriage 37½p

TPDI SERIES with plinth and cover and ready wired.
MP60 **£19·50** 610 **£22·97**
510 **£20·97**
Carriage 50p extra each item

GOODMANS SPECIAL OFFERS!

MAXAMP 30 Stereo Amplifier 15+15 watt r.m.s. with matching STEREOMAX AM/FM Tuner. Total list price £136·52.
OUR PRICE **£89** THE PAIR Carriage £1

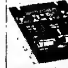
GOODMANS SPEAKERS!

MAXIMS
OUR PRICE **£32·60** pr. Carr. 50p.
MINISTERS
OUR PRICE **£39·97** pr. Carr. 50p.
MEZZO III,
OUR PRICE **£25.50** pr. Carr. 50p
MAGNUM K2, teak.
OUR PRICE **£33·00** each Carr. 50p
MAMBO, teak.
OUR PRICE **£32·50** pr. Carr. 50p
MARIMBA
OUR PRICE **£35·00** pr. Carr. 50p.
MAGISTER
OUR PRICE **£41·50** each. Carr. £1

TE-1035 STEREO HEADPHONES
Low cost high performance stereo headphones. Foam rubber ear cups. Adjustable head-band. 8 ohm impedance. 25-18,000 Hz. With lead and stereo jack plug. ONLY **£1·97½**. P. & P. 12½p.

SINCLAIR EQUIPMENT

Project 60. Package offers.
2 x Z30 amplifier, stereo 60 pre-amp, PZ5 power supply. **£16·75** Carr. 37½p. Or with PZ6 power supply **£18·85** Carr. 37½p. 2 x Z50 amplifier, stereo 60 pre-amp, PZ8 power supply. **£20·25**. Carr. 37½p.



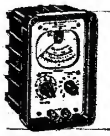
Transformer for PZ8. **£2·97½** extra.
Add to any of the above **£4·87½** for active filter unit and **£16** for a pair of Q16 speakers.
Project 60 FM Tuner **£20·97½**. Carr. 37½p.
All other Sinclair products in stock.
2000 Amplifier **£25·00** Carr. 37½p.
3000 Amplifier **£35**. Carr. 37½p.
Neoteric Amplifier **£45·97½** Carr. 37½p.

ECHO HS-606 STEREO HEADPHONES

Wonderfully comfortable. Lightweight adjustable vinyl headband. 6ft. cable and stereo jack plug. 25–17,000 cps. 8 ohm imp. **£3.37½** P. & P. 12½p.

RUSSIAN C1-16 DOUBLE BEAM OSCILLOSCOPES

5 MHz Pass Band. Separate Y1, Y2 amplifiers. Calibrated triggered sweep from ·2 sec to 100 milli sec/cm. Supplied complete with all accessories and instructions **£87.** Carr. paid.



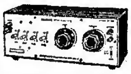
MARCONI T/44/TF956

AF Absorption Wattmeter

1 μ/watts to 6 watts.

£20. Carr. £1.

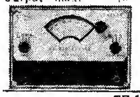
TE111. DECADE RESISTANCE ATTENUATOR



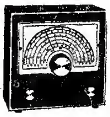
Variable range 0–111dB. Connections, Unbalanced T and Bridge T. Impedance 600 Ω range (0.1dB × 10) + (1dB × 10) + 10 + 20 + 30 + 40dB. Frequency: d.c. to 200kHz (−3dB). Accuracy: 0.05dB. +Indication dB × 0.01. Maximum input less than 4W (50V). Built in 600 Ω load resistance with internal/external switch. Brand new. **£27·50.** P. & P. 25p.

BELCO AF-5A SOLID STATE SINE SQUARE WAVE C.R. OSCILLATOR

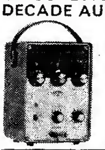
Sine 18—200,000 Hz: Square 18—50,000 Hz Output max. + 10 dB (10 K ohms) Operation internal batteries Attractive 2-tone case 7½" × 5" × 2". Price **£17·50.** Carr. 17½p.



TE-16A Transistorised Signal Generator. 5 ranges 400kHz—30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5¼ × 5¼ × 3½in. Complete with instructions and leads. **£7·97½.** P. & P. 20p.



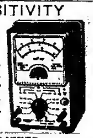
BELCO DA-20 SOLID STATE DECADE AUDIO OSCILLATOR



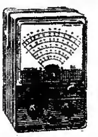
New high quality portable instrument. Sine 1 Hz to 100 KHz. Square 20 Hz to 20 KHz. Output max + 10 dB (10 K ohms). Operation 220/240v. A.C. Size 215mm x 150mm x 120mm. Price **£27·50.** Carr. 25p.

TE-40 HIGH SENSITIVITY A.C. VOLTMETER

10 meg. input 10 ranges: 01/·003/·1/·3/1/3/10/30/100 300V. R.M.S. 4cps.-1·2 Mc/s. Decibels −40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. **£17·50.** Carr. 25p.

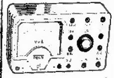


TE-65 VALVE VOLTMETER



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. 200/240v. A.C. operation. Complete with probe and instructions. **£17·50.** P. & P. 30p. Additional probes available: R.F. **£2·12½**; H.V. **£2·50.**

MULTIMETERS *for EVERY purpose!*

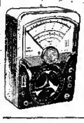


TECH PT-34. 1,000 O.P.V. 0/10/50/250/500/1,000V. A.C. and D.C. 0/1/100/500mA. D.C. 0/100K. **£1·97½.** P. & P. 12½p.

HONOR TE.10A. 20k Ω Volt 5/25/50/250/500/2,500 v. D.C. 10/50/100/500/1,000 v. A.C. 0/50uA/2.5mA/250mA D.C. 0/6K/6 meg. ohm. −20 to +22 dB. 10–0, 100 mfd. 0.100–0.1 mfd. **£3·47½.** P. & P. 15p.

MODEL TE-200 20,000 O.P.V. Mirror scale, overload protection. 0/5/25/125/1,000 V.D.C. 0/10/50/250/1,000 V.A.C. 0/50 uA/250 mA. 0/60K/6 megΩ. −20 to +62 db. **£3·75.** P. & P. 15p.

MODEL TE-300. 30,000 O.P.V. Mirror scale, overload protection 0/.6/3/15/60/300/1,200V. D.C. 0/6/30/120/600/1,200V. A.C. 0/30uA/6mA/60mA/300mA/600mA. 0/8K/80K/800K/8 meg. ohm −20 to +63 db. **£5·97½.** P. & P. 15p.



MODEL 500 30,000 O.P.V. with overload protection, mirror scale 0/·5/2·5/10/25/100/250/500/1,000v. D.C. 1/2·5/10/25/100/250/500/1,000v. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60K/6 Meg./60 Meg Ω. **£8·87½.** Post paid.

MODEL PL436 20kΩ/Volt D.C. 8kΩ/Volt A.C. Mirror scale. .6/3/12/30/120/600V D.C. 3/30/120/600V A.C. 50/600uA/60/600 mA. 10/100K/1 Meg/10 MegΩ. −20 to + 46db. **£6·97½** P & P 12½

MODEL TE-70. 30,000 O.P.V. 0/3/15/60/300/600/1,200v. D.C. 0/6/30/120/600/1,200v. A.C. 0/30uA/3/30/300mA. 0/16K/160K/1.6M/16 Meg Ω. **£5·50.** P. & P. 15p.

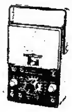
MODEL TE-90 50,000 O.P.V. Mirror scale, overload protection. 0/3/12/60/300/600/1,200 v. D.C. 0/6/30/120/300/1,200 v. D.C. .03/6/60/600mA. D.C. 16K/160K/1.6/16 MEGΩ. −20 to +63 db. **£7·50.** P. & P. 15p.

TMK MODEL TW-50K 46 ranges, mirror scale. 50K/Vol. D.C. 5K /Volt A.C. D.C. Volts .125, .25, 1.25, 2.5, 5, 10. 25, 50, 125, 250, 500, 1000V, A.C. Volts: 1.5, 3, 5, 10, 25. 50, 125, 250, 500, 1000V. D.C. Current: 25, 50uA, 2.5, 5, 25. 50, 250, 500mA, 5, 10 amp, Resistance: 10K, 100K, 1 MEG, 10 MEGΩ. Decibels: −20 to + 81·5 dB. **£8·87½.** P. & P. 17½p.

TMK MODEL TW-20CB FEATURES RESETTABLE OVERLOAD BUTTON. Sensitivity: 20K Ω/Volt D.C. 5K Ω/Volt A.C. D.C. Volts: 0–0.5, 2.5, 10, 50, 250, 1,000V. A.C. Volts: 0–2.5, 10, 50, 250, 1,000V. D.C. Currents: 0–0.05, 0.5, 5, 50, 500mA. Resistance: 0–5K, 50K, 0–500K. 5 MEGΩ. Decibels: −20 to +52 db. **£11·50.** P. & P. 17½p.

TE-900 20,000 Ω/VOLT GIANT MULTIMETER. Mirror scale and overload protection. 6in. full view meter. 2 colour scale. 0/2.5/10/250/1,000/5,000 v. A.C. 0/25/12.5/10/50/250/1,000/5,000 v. D.C. 0/50uA/110/100/500mA/10 amp. D.C. 02K/200K/20 MEG. OHM. **£15.** P. & P. 25p.

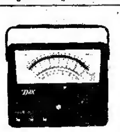
MODEL AS-100D. 100K Ω Volt. 5in., mirror scale. Built-in meter protection 0/3/12/60/120/300/600/1,200 v. D.C. 0/6/30/120/300/600 v. A.C. 0/10uA/6/60/300MA/12 Amp. 0/2K/200K/2M/200MΩ. −20 to +17 bB. **£12·50.** P. & P. 17½p.



MODEL 5025. 57 Ranges, Giant 5¼in. Meter, Polarity Reverse Switch. Sensitivity: 50K /Volt D.C. 5K /Volt A.C. D.C. Volts: .125, .25, 1.25, 5, 10, 25, 50, 125, 250, 500, 1,000V. A.C. Volts: 1.5, 3, 5, 10, 25, 50, 125, 250, 500, 1,000V. D.C. Current: 25, 50uA, 2.5, 5, 25, 50, 250, 500mA, 5, 10 amp. Resistance: 2 K, 10K, 100K, 1MEG, 10 MEGΩ. Decibels: −20 to +85 db. **£12·50.** P. & P. 17½p.

TMK LAB TESTER. 100.000 O.P.V. 6½in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K Ω/Volt A.C. D.C. Volts: .5, 2.5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 50, 50, 250, 500, 1,000V. D.C. Current: 10, 100uA, 10, 100, 500mA, 2.5, 10 amp. Resistance: 1K, 10K, 100K, 10MEG, 100 MEGΩ. Decibels: −10 to 49 db. Plastic Case with Carrying Handle. Size 7½in. x 6⅞in. x 3⅛in. **£18·90.** P. & P. 25p.

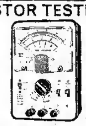
MODEL TE-12 20,000 O.P.V. 0/0.6/6/30/120/600/1,200/3,000/6,000v. D.C. 0/6/30/120/600/1,200v. A.C. 0/60μA/6/60/600mA. 0/6K/600K/6Meg./60 Meg. Ω 50pF, 0.2mFd. **£5·97½.** P. & P. 17½p.



SKYWOOD SW-500 50K Ω/Volt. Mirror scale DC Volts 0.6/3/12/30/300/600. DC Current 20uA/6/600mA Resistance 10K/100K/1 Meg/10 Meg. Decibels — 20 to +57 db. **£7·50.** P. & P. 15p.

FTC-401 TRANSISTOR TESTER

Full capabilities for measuring A, B and ICO. NPN or PNP. Equally adaptable for checking diodes. Supplied complete with instructions, battery and leads. **£6·97½.** P. & P. 15p.



270° WIDE ANGLE 1mA METERS

MW1-6 60mm square **£3·97½**

MW1-8 80mm square **£4·97½**

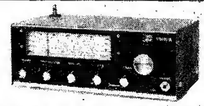
P. & P. extra

UNR-30 RECEIVER

4 Bands covering 550kc/s–30mc/s. B.F.O. Built-in Speaker 220/240v. A.C. Brand new with instructions. **£15·75.** Carr. 37½p.

WS62 TRANCEIVERS

Large quantity available for EXPORT! Excellent condition. Enquiries invited.



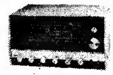
UR-1A SOLID STATE COMMUNICATION RECEIVER

4 Bands covering 550kc/s–30mc/s. FET, S Meter, Variable BFO for SSB, Built-in Speaker, Bandspread, Sensitivity Control. 220/240v. A.C. or 12v. D.C. 12¼" x 4½" x 7". Brand new with instructions. **£25.** Carr. 37½p.

LAFAYETTE HA-600 SOLID STATE RECREIVE

General coverage 150–400kc/s, 550 kc/s–30mc/s. FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter, S. Meter, Bandspread. RF Gain. 15" x 9¼" x 8½". 18 lbs. 220/240v. A.C. or 12v. D.C. Brand new with instructions. **£45.** Carr. 50p.

LAFAYETTE HA-800 SOLID STATE AMATEUR COMMUNICATION RECEIVER



3.5–4, 7–7.3, 14–14.35, 21–21.45, 28–29.7 50–54 mc/s. Dual conversion, 2 mech. filters, product detector, variable BFO, S Meter, 100kc/s calibrator. 220/240v. A.C. or 12v. D.C. 15" x 9¼" x 8¼". 18 lbs. Brand new with instructions. **£57·50.** Carr. Paid. (100kc/s Crystal **£1·97½** extra.)

FULL RANGE OF TRIO EQUIPMENT IN STOCK

EDDYSTONE VHF RECEIVERS Model 770R 19—165 Mc/s. Excellent condition. **£150**

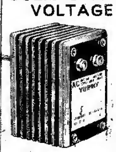
VOLTAGE STABILISER TRANSFORMERS 180—260v. input. Output 230v. Available 150w or 225w. **£12·50.** Carr. 25p.

AUTO TRANSFORMERS

0/115/230V. Step up or step down. Fully shrouded.

150 W.	£2·37½	P. & P. 17½p
300 W.	£3·25	P. & P. 22½p
500 W.	£4·97½	P. & P. 32½p
1000 W.	£7·25	P. & P. 37½p
1500 W.	£8·97½	P. & P. 42½p

SOLID STATE VARIABLE A.C VOLTAGE REGULATORS



Compact and panel mounting. Ideal for control of lamps, drills, electrical appliances etc. Input 230/240v. A.C. Output continuously variable from 20v—230v. Model MR 2305 5 amp 68 x 46 x 43mm **£8·37½.** Model MR 2310 10 amp 90 x 68 x 60mm **£11·97½.** Postage 12½p.

POWER RHEOSTATS

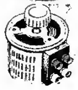
High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range available ex-stock. Single hole fixing, ¼in. dia. shafts. Bulk quantities available.

25 WATT. 10/25/50/100/250/500/1000/1500/2500 or 5000 ohms, **72½p.** P. & P. 7½p.
50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms, **£1·05** P. & P. 7½p.
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms, **£1·37½** P. & P. 7½p.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

Excellent quality . Low price . Immediate delivery

MODEL S-260 General Purpose Bench Mounting

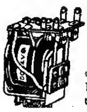


1 Amp	£5·50
2.5 Amp	£6·75
5 Amp	£9·75
8 Amp	£14·50
10 Amp	£18·50
12 Amp	£21·00
20 Amp	£37·00

MODEL S-260 B Panel Mounting

1 Amp	£5·50
2.5 Amp	£6·62½

Please add postage
ALL MODELS
INPUT 230 VOLTS,
50/60 CYCLES,
OUTPUT VARIABLE
0–260 VOLTS.
Special discounts for quantity



230 VOLT A.C. 50 CYCLES RELAYS Brand new. 3 sets of changeover contacts at 5 amp rating. **50p** each. P. & P. 10p (100 lots **£40**) Quantities available.

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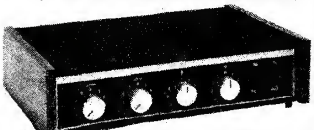
HARVERSONIC SUPER SOUND 10 + 10 STEREO AMPLIFIER KIT



NEW IMPROVED MODEL WITH HIGHER OUTPUT AND INCORPORATING HIGH QUALITY READY DRILLED PRINTED CIRCUIT BOARD FOR EASY CONSTRUCTION

A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors including Silicon Transistors in the first five stages on each channel resulting in even lower noise level with improved sensitivity. Integrated pre-amp with Bass, Treble and two Volume Controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 5 to 15 ohms. Compact design, all parts supplied including drilled metal work, high quality ready drilled printed circuit board, attractive front panel, knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of. Brief specification; Power output: 14 watts r.m.s. per channel into 5 ohms. Frequency response ±3dB 12–30,000 Hz Sensitivity: better than 80mV into 1MΩ. Full power bandwidth: ±3dB 12–15,000 Hz. Bass boost approx. to ±12dB. Treble cut approx. to −16dB. Negative feedback 18dB over main amp. Power requirements 35v. at 1.0 amp. Overall Size 12"w. x 8"d. x 2½"h.

Fully detailed 7 page construction manual and parts list free with kit or send 18p plus large S.A.E.

PRICES

AMPLIFIER KIT	**£10·50**	P. & P. 15p
POWER PACK KIT ..	**£3·00**	P. & P. 30p
CABINET	**£3·00**	P. & P. 30p

(Post Free if all units purchased at same time)
Full after sales service

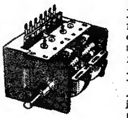
Also available ready built and tested **£20·50.** Post Free.

Note: The above amplifier is suitable for feeding two mono sources into inputs (e.g. mike, radio, twin record decks, etc.) and will then provide mixing and fading facilities for medium powered Hi Fi Discotheque use, etc.

FANTASTIC 'POLY PLANAR' WAFER-TYPE, WIDE RANGE ELECTRODYNAMIC SPEAKER

Size only 11¾" x 14 11/16" x 1 3/16" deep. Weight only 19 ozs. Can replace cone speakers in any application and is particularly useful for those with limited space. Extremely rugged and shockproof. Operating temperature —20°F to 175°F. Power handling 10 watts rms (20 watts peak). Impedance 8 ohm only. Response 40 Hz–20 KHz. Can be mounted on ceilings, walls, doors, under tables etc. and used with or without baffle. Send S.A.E. for full details. **ONLY £5.75** each. P. & P. 25p.

SPECIAL PURCHASE OF MANUFACTURERS SURPLUS! All Transistor F.M. tuner head with twin A.M. Gang incorporated. Beautifully engineered with precision geared reduction drive. F.M. Transistor oscillator/Mixer and first I.F. stage (10.7 Mc/s output) with optional AFC connection. Built on printed circuit panel and fully screened. Extremely stable over range 88–108Mc/s. Brand new and pre-aligned. Size 2¼"h x 1¾"w x 2½"d. For 6v D.C. at 2.8mA. A.M. Gang fitted with trimmers which can be connected to standard A.M. aerial and oscillator circuits if required. **LIMITED NUMBER.** Only **£2.25** post free. Connection details supplied.



HIGH GRADE COPPER LAMINATE BOARDS. 8 × 6 × 1/16in. FIVE for **50p.** P. & P. 13p.

PIANO KEY TYPE SWITCHES. 8 press buttons plus 1 cancel button. Each of the 8 sections contains 6 s.p.c.o. (total 48 s.p.c.o.). Brand new—limited quantity only. Original manufacturing cost £1·37½. **OUR PRICE 75p.** P. & P. 13p (3 or more post free).

HONEYWELL MICROSWITCHES. S/P. C/O. Push button action. Rating 250v. AC at 15 amps. Size approx. 1¼ × ¾ × ⅜in. **25p each.** P. & P. 5p (6 or more post free).

SPECIAL OFFER! PLESSEY TYPE 29 TWIN TUNING GANG. 400pF + 146pF. Fitted with trimmers and 5:1 integral slow motion. Suitable for nominal 470 k/sc I.F. Size appox. 2×1×1½. Only **43p** P. & P. 13p.

TELESCOPIC AERIALS WITH SWIVEL JOINT. Can be angled and rotated in any direction. 6 section Lacquered Brass. Extends from 6in. to 22½in. approx. Maximum diameter ¼in. **25p** each. P. & P. 5p.

BRAND NEW MULTI-RATIO MAINS TRANSFORMERS. Giving 13 alternatives. Primary: 0–210–240v. Secondary combinations 0–5–10–15–20–25–30–35–40–60v. half wave at 1 amp. or 10–0–10, 20–0–20, 30–0–30v. at 2 amps full wave. Size 3in. long × 3½in. wide × 3in. deep. Price **£1·75** P. & P. 30p.

MAINS TRANSFORMER. For transistor power supplies. Pri 200/240v. Sec. 9–0–9 at 500mA. **70p.** P. & P. 13p. Pri. 200/240v. Sec. 12–0–12 at 1 amp. **88p.** P. & P. 13p. Pri. 200/240v. Sec. 10–0–10 at 2 amp. **£1·38.** P. & P. 30p. Tapped Primary 200–220–240v. Sec. 21.5v. at 500mA. **63p.** P. & P. 13p.

SPECIAL OFFER !
HI-FI LOUDSPEAKER SYSTEMS

Beautifully made teak finish enclosure with most attractive Tygan-Uynair front. Size 16½" high x 10¼" wide x 5¼" deep. Fitted with E.M.I. Ceramic Magnet 13" x 8" bass unit, two H.F. tweeter units and crossover. Power handling 10 watts. Available 3 or 8 or 15 ohms impedance.

OUR PRICE £8.40 Carr. 65p

Also available in 8 ohms with EMI 13" x 8" bass speaker with parasitic tweeter **£6·50** Carr. 65p

LOUDSPEAKER BARGAINS

3" 4 ohm **50p,** P. & P. 8p. 5in. 3 ohm **80p,** P. & P. 15p. 7 × 4in. 3 ohm **£1·05,** P. & P. 20p, 10 × 6in. 3 or 15 ohm **£1·90,** P. & P. 30p, E.M.I. 8 × 5in. 3 ohm with high flux magnet **£1·62.** P. & P. 20p E.M.I. 13½ × 8in. 3 ohm with high flux ceramic magnet **£2·10** (15 ohm **£2·25**), P. & P. 30p. E.M.I. 13 × 8in. 3, 8 or 15 ohm with two inbuilt tweeters and crossover network **£4·20,** P. & P. 30p. E.M.I. 13" × 8" twin cone (parastatic tweeter) 8 ohm **£2.25** P & P **30p.**

BRAND NEW. 12in. 15w. H/D Speakers, 3 or 15 ohms. Current production b y well-known British maker. Now with Hiflux ceramic ferrobar magnet assembly **£5·50.** Guitar models: 25w. **£6·50,** 35w. **£8·50.** P. & P. 38p

E.M.I. 3½in. HEAVY DUTY TWEETERS. Powerful ceramic magnet. Available in 3 or 8 or 15 ohms **93p** each. P. & P. 13p.

12in. "RA" TWIN CONE LOUDSPEAKER. 10 watts peak handling, 3 or 15 ohm **£1·88,** P. & P. 30p.

35 ohm SPEAKERS 3in. only **63p** P. & P. 13p.

VYNAIR & REXINE SPEAKERS & CABINET FABRICS app. 54 in. wide. Usually £1·75 yd., our price **75p** yd. length. P. & P. 15p (min 1 yd.) S.A.E. for samples.

HI-FI STEREO HEADPHONES

Adjustable headband with comfortable flexifoam earmuffs. Wired and fitted with standard stereo ¼in jack plug. Frequency response 30–15.000Hz. Matching impedance 8–16 ohms. PRICE **£2·95.** P. & P. 15p.

SINGLE HEADPHONE. With aluminium headband. Approx. 200 ohm, **25p.** P. & P. 8p

CRYSTAL MIKES. High imp. for desk or hand use. High sensitivity, **93p,** P. & P. 8p

HIGH IMPEDANCE CRYSTAL STICK MIKES. OUR PRICE **£1·05,** P. & P. 8p

GENERAL PURPOSE HIGH STABILITY TRANSISTOR PRE-AMPLIFIER

For P.U. Tape, Mike, Guitar, etc. and suitable for use with valve or transistor equipment. 9–18v. battery or from H.T. line 200/300v. Frequency response 15Hz—25KHz. Gain 26dB. Solid encapsulation size 1¾" x 1¼" x ¾". Brand new complete with instructions. Price **88p.** P. & P. 13p.

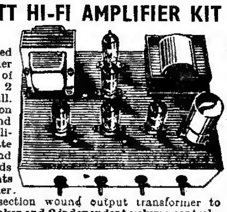
BRAND NEW E.M.I. LIGHTWEIGHT PICK-UP ARM WITH ARM REST, Fitted mono t/o stylus and cartridge for LP/78. ONLY **£1,** P. & P. 13p.

QUALITY RECORD PLAYER AMPLIFIER MK II A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, and rectifier. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. wide × 3in. deep × 6in. high. Ready built and tested. PRICE **£3·75** P. & P. 40p

ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE **£4·88** P. & P. 50p.

DELUXE QUALITY PORTABLE R/P CABINET MK II. Uncut motor board size 14½ × 12in. clearance 2in. below, 5½in. above. Will take above amplifier and any B.S.R. or GARRARD changer or Single Player (except AT60 and SP25). Size 18 × 15 × 8in. PRICE **£3·98.** P. & P. 50p.

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3–15 Ω speaker and 2 independent volume controls, and separate base and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 13p (Free with parts). **All parts sold separately.** ONLY **£7·97** P. & P. 55p. Also available ready built and tested complete with std. input sockets, **£9·97.** P. & P. 55p.

BRAND NEW TRANSISTOR BARGAINS. GET 15 (Matched pair) **75p;** V15/10p **50p;** OC71 **25p;** OC76 **30p;** AF117 **18p;** 2G339 (NPN) **15p.**

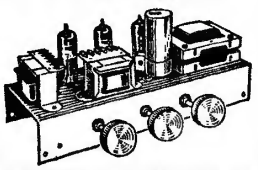
Set of Mullard 6 transistors OC44, 2—OC45, AC128D matched pair AC128 **£1·25;** ORP12 Cadmium Sulphide Cells **53p.** All post free.

SPECIAL PURCHASE!
SPEAKER CABINET FROM FAMOUS MAKER!

Beautifully made all wooden construction cabinet with medium walnut finish front, gold anodised expanded aluminium grille and dark sides. Approx. size overall 11½" high x 5" deep x 13½" wide at base. Easily removable baffle cut out for 8" speaker. Fibre board back. Could accommodate amplifier or radio together with speaker. An expensively made cabinet at a give away price.

LIMITED NUMBER ONLY £1·38 Post Free.

DE LUXE STEREO AMPLIFIER



A.C. mains 200-240 v. Using heavy duty fully isolated mains transformer with full wave rectification giving adequate smoothing with negligible hum. Valve line up:—2 × ECL86 Triode Pentodes. 1 × EZ80 as full wave rectifier. Two dual potentionmeters are provided for bass and treble control, giving bass and treble boost and cut. A dual volume control is used. Balance of the left and right hand channels can be adjusted by means of a separate 'Balance' control fitted at the rear of the chassis. Input sensitivity is approximately 300m/v for full peak output of 4 watts per channel (8 watts mono), into 3 ohm speakers. Full negative feedback in a carefully calculated circuit, allows high volume levels to be used with negligible distortion. Supplied complete with knobs, chassis size 11"w × 4"d. Overall height including valves 5". Ready built and tested to a high standard. **PRICE £8·92** P. & P. 45p.

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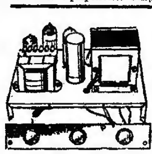

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PRACTICAL WIRELESS

VOL 47 NO 2
Issue 772

JUNE 1971

TOPIC OF THE MONTH

Not so Free!

THE long awaited White Paper on commercial local radio contained few real surprises but, for those viewing the advent of non-BBC local stations with concern, it carries some reassurances. The basic concept—given elsewhere in this issue in greater detail—is for the establishment of a 60-station network of stations under the aegis of the ITA (to be renamed the Independent Broadcasting Authority) in competition with 20 BBC local stations.

This, no doubt, disappointed the supporters of "free radio", the more extreme of which seemed to envisage a local station in every garden shed, a set-up not so much free as anarchistic. But the facts remain that if standards are to be preserved, the small local station serving up to 100,000 population would be lucky to break even.

The Minister of Posts and Telecommunications wasted little time in presenting his White Paper, following election pledges, but it is obvious that he saw clearly some of the dangers inherent in setting up local commercial radio. He therefore insists that local stations must offer a truly public service, that they must maintain high standards, not least in the provision of news and news commentary programmes, and that the programmes must maintain a wide appeal. It is obvious that he is aware of the lamentable standard of small budget stations in the USA. Consequently the first IBA stations will serve the large conurbations.

The matter of frequency allocation, however, strikes us as reeking of indecision. Transmissions will be on v.h.f./f.m. but with medium wave a.m. support. Ostensibly the reason for this is to permit as many listeners as possible to hear the new stations. Yet, in the White Paper itself, it is admitted that whereas m.w. coverage for the 60 stations would be 70% in daylight hours, this will drop to 25% at night! Therefore, for most people without v.h.f. receivers, their local radio station will vanish beneath the mush in the evenings. So, if they want to listen after dark they will *still* need to buy a v.h.f. receiver. This seems to be analagous to the situation with TV after the war when the decision was made to re-start on the outdated 405-line system instead of opting for a system more in keeping with the times—a change that *had* to be made, anyway, before many years.

Paragraph 9 in the White Paper, however, has its feet firmly on the ground. It points out that the IBA stations have a formidable challenge. They must bring in new listeners, yet they will not be able to provide for as broad a range of different audiences as can the BBC with its four national services and its local network. Formidable may be an understatement. We wish the IBA stations the best of luck. They will probably need it!

W. N. STEVENS—*Editor.*

NEWS AND COMMENT

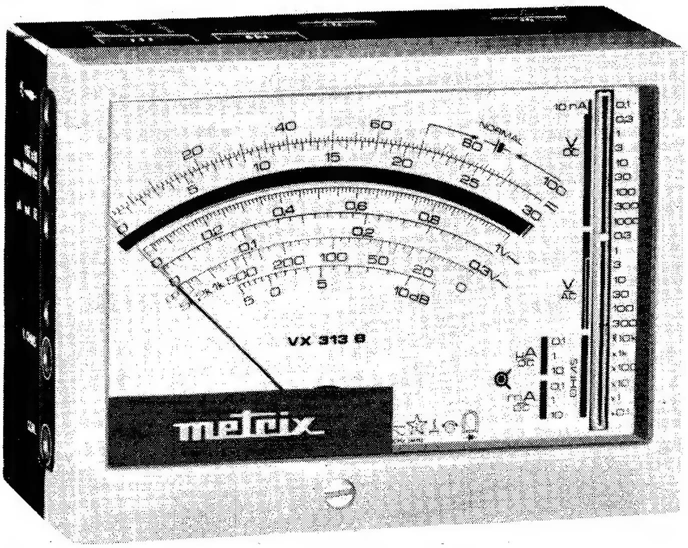
CONSTRUCTIONAL

OTHER FEATURES

JULY ISSUE WILL BE PUBLISHED ON JUNE 4th

NEWS... NEWS... NEWS...

ITT Electronic Voltmeter



The VX313B electronic voltohm-meter nanoammeter has been introduced by ITT Metrix and is available from ITT Components Group Europe. The instrument makes extensive use of solid-state circuitry to achieve a compact size.

The VX313B can be used for measuring a.c. voltages up to 300V from 30Hz to 1MHz, d.c. voltages up to 1000V, d.c. currents up to 10mA and resistances up to 50 megohm. Equipped with a shock-proof taut band suspension centre pole meter movement, the VX313B is very sensitive. With the exception of the 0·1 and 0·3V ranges (10 megohm input resistance) it features a constant 100 megohm input resistance on all d.c. ranges.

A full range of accessories is available including an r.f. probe for measurement of 0 to 30V, 10kHz to 50MHz a.c. voltages; crystal tees for measurements up to 1000MHz at 2V; and a 30kV e.h.t. d.c. probe. Current measurements from 5 to 150A can be made using 100mV and 300mV shunts, and 10 kilohm test probe leads are available for d.c. voltage measurements in r.f. circuits. *ITT Electronic Services, Edinburgh Way, Harlow, Essex.*

Horsham A.R.C.

The above club has recently been revived after a lapse of 32 years. Meetings are held on the 1st. Wednesday of each month at the "Swan" in West Street, Horsham, Sussex.

Morse instruction is given every Monday and Friday at G3VPO (Chairman) Horsham 60216.

The Hon. Sec., R. J. Polley, G3PYC, 81 Beech Road, Horsham, would welcome *ANY* news of the original club or its members.

Apollo Postcript

Is the interest in space exploration declining as it is generally believed? Viewing figures for Apollo 14 seem to challenge this. Intelsat, the international consortium whose satellites beamed the TV pictures of the flight around the world, say that an estimated 650 million looked in on the mission. In Britain alone, audiences ranging from 20 to 35 million saw highlights of the Apollo 14 Moon landing mission.

"Vintage" QSL Card

D. H. Adams, Lecturer in charge of the Electrical Department, Barry College of Further Education, recently sent us a special QSL card. It commemorates a unique Vintage Radio occasion—the first transmission over water conducted by Marconi and Kemp.

Kemp's diary and photographs of Post Office technicians together with Marconi and some of his equipment are included on the card.

The Barry College of Further Education Radio Society GW3VKL commemorate the event annually by establishing a special station, GB3FI on Flatholm Island. This year they will be on the Island on Sunday 23rd. May, operating on all h.f. bands (10-160m) and 2m v.h.f.

For our "Going Back" enthusiasts, in May 1897, Marconi and Kemp conducted experiments in radio communication from Flatholm Island in the Bristol Channel, Lavernock Point (Glamorgan, Wales) and Brean Down (Somerset, England). During these tests, radio signals were transmitted for the first time across water and between two countries.

The station at Lavernock Point will be GW3VKL/P. G3XZW/P (Taunton and District A.R.C.) will be operating from Brean Down.

H.A.C. Prices

H.A.C. Short Wave Products advise us that they have available a new price list, showing today's decimal prices for all products.

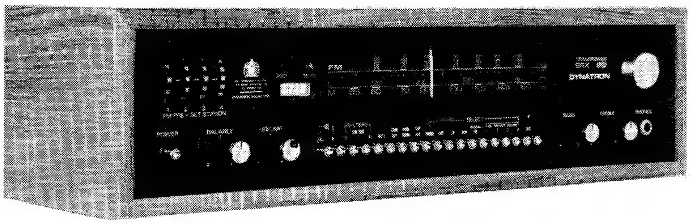
They are pleased to be able to assure readers, however, that they have made no increase whatsoever, and that their prices remain as previously. The two most popular kits, as advertised in our periodical are priced as follows: Model "DX" mark 2. ex works £3·30. Model "K" ex works £5·25.

Shining Light

If you're interested, the table lamp and shade on this month's cover can be obtained from *Gamages Ltd., High Holborn, London.*

NEWS... NEWS... NEWS...

USA Export Order for Dynatron



Dynatron have been in negotiation with Olson Electronics of Akron, Ohio, U.S.A., for some time past culminating with a recent visit to the Dynatron Factory at Maidenhead by Mr. Sidney L. Olson, President, and the signing of a contract to supply several hundred of '90' Series, Model STA90, Tuner/Amplifiers for sale in his branches across the U.S.A.

The demand in many overseas markets is for audio equipment far more powerful than that normally acceptable by the U.K. buyer, output powers of 40 Watts per channel and above are considered normal.

Dynatron '90' Series fulfils this requirement with its 45 x 45 Watts output RMS and highly sophisticated tuner specification designed with both home and overseas markets in mind.

L. H. (Laurie) Skeet, Export Sales Executive for Dynatron, advises that he will be delighted to receive enquiries for both Direct and Personal Export and will ensure these receive his personal attention; he can be contacted on Maidenhead (0628) 23331, Extension 53.

The photograph illustrates the Standard Model STA90 priced at £165.

A New I.C.

SGS announce the TBA651, a new linear circuit, which has been designed for use in high quality car radios and radio receivers. It combines the functions of an r.f. amplifier, oscillator, mixer and i.f. amplifier. As the device contains an internal voltage regulator, it can be operated with a supply voltage from $4\frac{1}{2}$-18 volts. The range of applications for the circuit is considerably increased by its ability to perform at a frequency up to 27MHz.

A typical S/N ratio of 26dB can be achieved for an input of 10μV.

This device is supplied in a 16 lead plastic split DIP Package. Technical Bulletin reference 108 is available covering this device. *SGS (United Kingdom) Limited, Planar House, Walton Street, Aylesbury, Bucks.*

Soldering Kit

Antex announce their "SK2" kit which includes the following: 240 volts—15 watt miniature soldering iron fitted with $\frac{3}{16}$in. bit, 2 spare bits $\frac{5}{32}$in. and $\frac{3}{32}$, coil of cored solder, heat sink, 1A fuse and the booklet "How to Solder."

The new kit is presented in a polystyrene pack, protected by a cardboard sleeve. The booklet "How to Solder" is now printed in three languages and the kit is also available in 220 volts, 115 volts or 100 volts for sale on the European, American and Japanese markets.

The recommended retail price in the U.K. is £2·40. *Anglo-Netherland Technical Exchange Ltd., Mayflower House, Plymouth, Devon.*

Bib's Latest

Two new additions to the BIB range of accessories are a stylus balance and cassette case.

The stylus balance, manufactured from non-magnetic alloy and fitted with a non-scratch base is calibrated to be accurate within $\frac{1}{4}$ gram from $\frac{1}{4}$ to 5 grams. Price is £1·80.

The cassette case is covered in hide-effect p.v.c. and holds 12 cassettes. The lid is held by a rotary fastener. Price is £1·50. *Bib Division, Multicore Solders Limited, Hemel Hempstead, Herts.*

Do You Fancy a Bit?

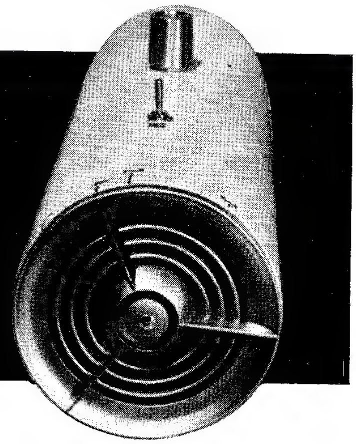
A new design service for special purpose soldering bits has been introduced by Adcola Products Ltd. A new division has been formed to design and manufacture soldering bits to meet customers' requirements. Special purpose soldering bits can be manufactured in copper and can be iron-plated to provide long working life.

The service is equally suitable for small or large quantities and is complementary to the range of 70 standard soldering bits—copper and iron plated—produced by Adcola.

THE 'CARLTON'

A MODERN SILICON SUPERHET RECEIVER

ERIC DOWDESWELL



IT is surprising what good quality the average small portable transistor radio can provide if the output is fed into a speaker a bit larger in size than that in the set. For some time the author has used one of the imported tubular extension speakers which are quite cheap and consist of a 3in. speaker in a decorative tube with a long lead and plug.

As it was a bit of a bother to carry around the house both the set and the speaker it seemed to be an obvious solution to build a set into the speaker tube itself. The tube can easily accommodate a circuit board, battery and ferrite rod aerial without using up too much of the enclosed space which gives the speaker its pleasant tonal qualities.

Basically the circular plastic grille furthest from the speaker is used as a tuning dial with a wave-change switch and a volume control/on-off switch brought through the top of the speaker tube.

The resulting complete radio set has proved very satisfactory, the quality usually provoking pleasant surprise from those that hear it.

THE CIRCUIT

The circuit is a hybrid one using discrete transistors and an integrated circuit. The superhet, Fig. 1, uses three 2N2926G n.p.n silicon transistors in the mixer/oscillator and i.f. stages, the output being detected and fed to an MFC4000P integrated circuit audio amplifier or "gain block."

The MFC4000P was described in "IC of the Month" (*PW*, Sept. 1970) to which article reference can be made for detailed description of its operation. Briefly it contains six transistors, three diodes and three resistors but its outstanding feature is its small size,

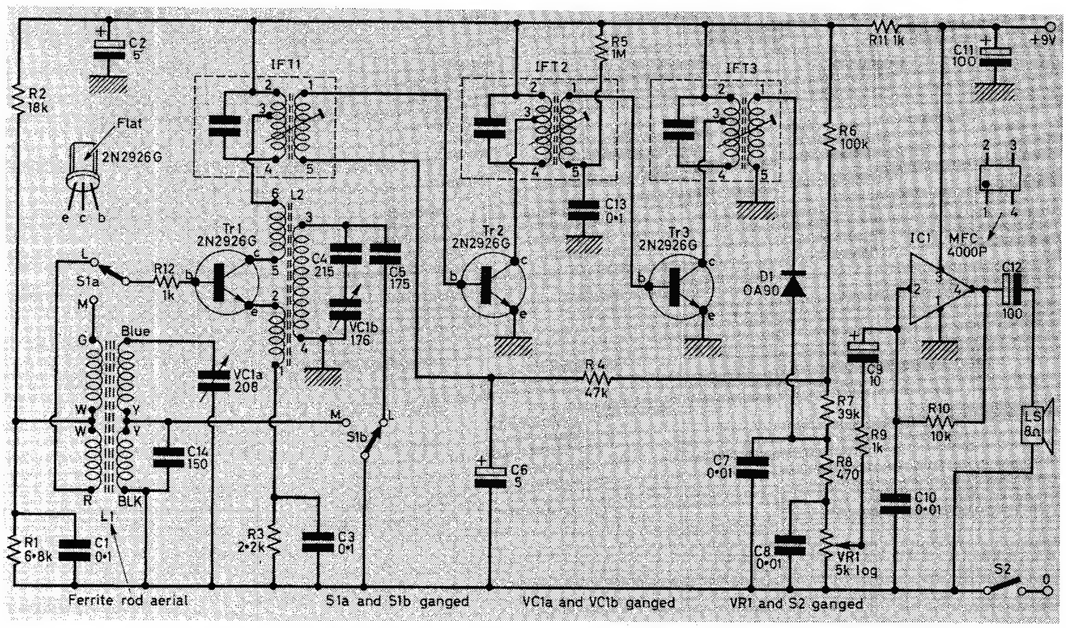


Fig. 1. Circuit diagram of the 'Carlton' receiver with lead-out connections of thet ransistors and integrated circuit.

being only approximately $\frac{1}{4}$ x $\frac{1}{4}$ x $\frac{1}{8}$in., with just four leadout wires.

A ferrite rod aerial L1 covers the medium and long wavebands the input and oscillator L2 circuits of Tr1 being tuned by the two-gang capacitor VC1a-b, the band being selected by S1a-b.

The output of the single-tuned i.f.t.1 is fed to the first i.f. amplifier Tr2 the gain of which is controlled by the voltage fed through R4 from the signal diode D1. Tr3 and i.f.t.3 form the second i.f. amplifying stage. Diode D1 has a small reverse bias applied to it to improve its efficiency at low signal levels. A further reference to this diode will be made later.

The low level audio signal from D1 goes to the volume control VR1 which feeds the integrated circuit IC1. R10 constitutes a feedback path which fixes the frequency response of the audio amplifier. The speaker is fed from the output of the i.c. via the blocking capacitor C12. It will be noticed that no audio transformers are required anywhere in this particular circuit.

THE CONSTRUCTION

A piece of Veroboard holds the majority of the components, only the wavechange switch and the volume control/on-off switch being mounted on the tube. These are connected to the board with flexible

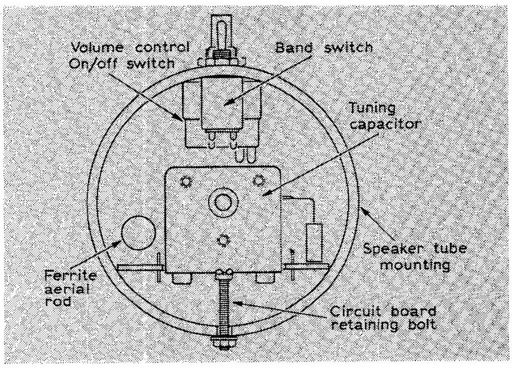


Fig. 2. Disposition of the circuit board and major components inside the speaker tube.

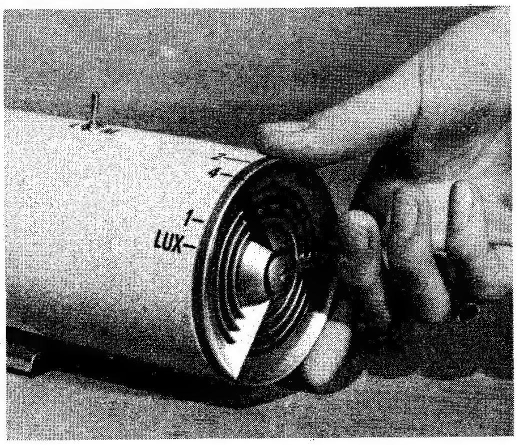
leads. The width of the board is fairly critical because when it is placed inside the tube the spindle of the tuning capacitor must be central in the tube since the end cap of the tube is used as the tuning dial, see Fig. 2.

The first step is to carefully remove the end cap from the speaker tube by easing it out slowly all round using the blade of a small screwdriver, avoiding any damage to the tube end. A hole $\frac{1}{4}$in. in diameter should be drilled in the centre of the cap to take the tuning capacitor spindle.

At this point it is a good idea to clean away any surplus glue or paper from around the inside edge of the tube using a round file and to check that the end cap is an easy fit inside the tube.

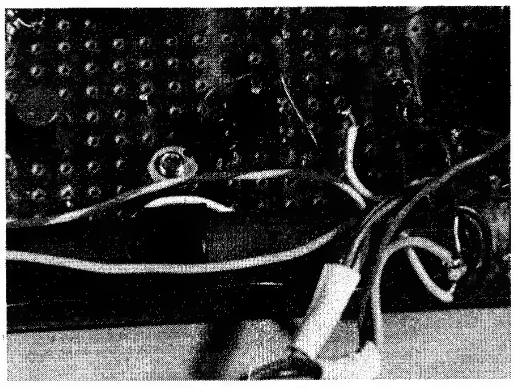
Cut a piece of plain Veroboard (0·15 x 0·15in. matrix) slightly wider than the dimensions given in Fig. 3, trim the corners as shown and cut out the rectangular portion to accommodate the tuning capacitor. Attach the capacitor to the board by soldering the two tags on the rear (oscillator) section to the two Veroboard pins C5 and M5, Fig. 3.

Place the board inside the tube so that the capacitor spindle is just projecting and then slide the end cap over the spindle. When the board is at the right height the end cap will just fit nicely into the tube. If the spindle is too high reduce the width of the board slightly until the cap fits in the tube as described. In practice, if the width given for the board is adhered to and the specified tuning capacitor used the height will be right first time.



The end cap of the extension speaker becomes the tuning dial with appropriate station markings.

The remainder of the Veroboard pins should now be inserted into the board using the proper insertion tool, supporting the board from the back to prevent it cracking, Fig. 3. The clearing holes for the i.f.t. and oscillator coil soldering lugs can be drilled easily, as they are just enlargements of existing holes, using a $\frac{1}{8}$in. diameter drill.



A close-up of the integrated circuit audio 'gain-block'. Its small size can be appreciated by comparing it with the 0·15 × 0·15in matrix Veroboard.

The i.f.t.'s and oscillator coil can be fitted by pushing the lugs through holes in the board and bending over the screening can tags flat against the board. Note that all six lugs are present on the oscillator coil L2 the identifying red spot being between lugs 1 and 6.

Veroboard pins are used to support the transistors and the i.c., these components being soldered to the pins only **after** all the wiring has been completed and checked.

Complete the wiring, Figs. 3 and 4, using bare 22 s.w.g. copper wire. The interconnections are so short and stiff that insulated wire is not necessary except in one or two places where wires cross close to each other. The connections to the ferrite rod aerial coils should be made with flexible wire, coloured as suggested, as it is necessary to move the coils along the rod during the alignment process.

Initially fix the coils at the ends of the rod with plastic tape.

The wires to the waveband switch and the volume control/on-off switch should be left long enough to enable these controls to be fitted to the top of the speaker tube, Fig. 5. Allow a couple of inches extra which can be trimmed off later.

Check and double check the wiring especially that to the bandswitch as the stage has now been reached when the transistors and the i.c. can be soldered into

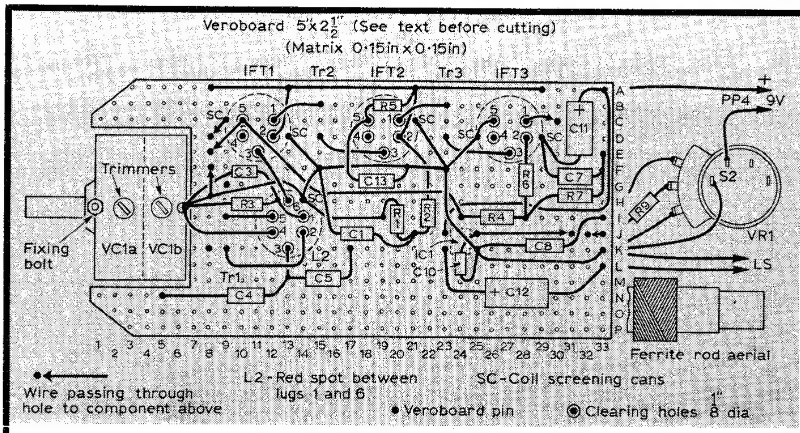
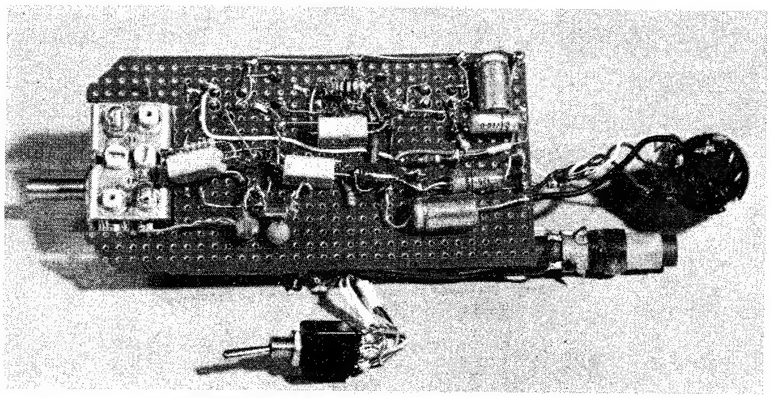


Fig. 3. Wiring diagram of the underneath of the circuit board with interconnections to the volume control/on-off switch and speaker. Compare this with the photograph below showing the completed board. Note that the tuning capacitor is fixed to the board by soldering the lugs of the two sections to pins in the Veroboard.



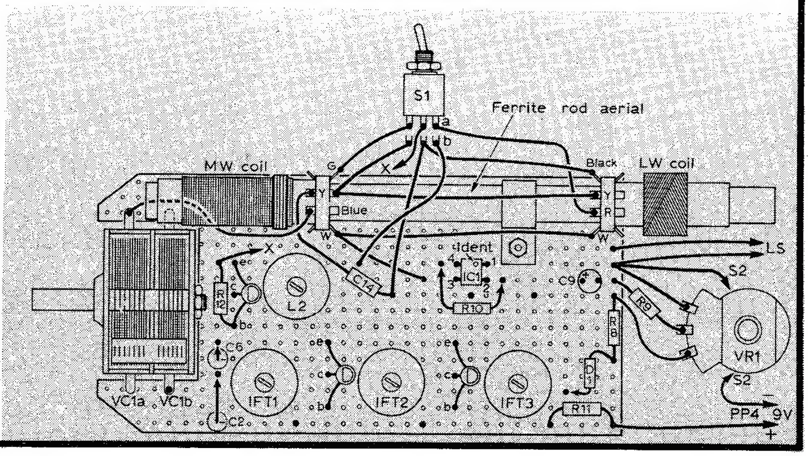


Fig. 4. Remainder of the wiring, on top of the circuit board. Connections to the ferrite aerial are made with flexible wire to permit the two coils to be moved along the rod for alignment purposes. The negative side of diode D1 goes to resistor R8. A photograph of this side of the circuit board appears on the next page.

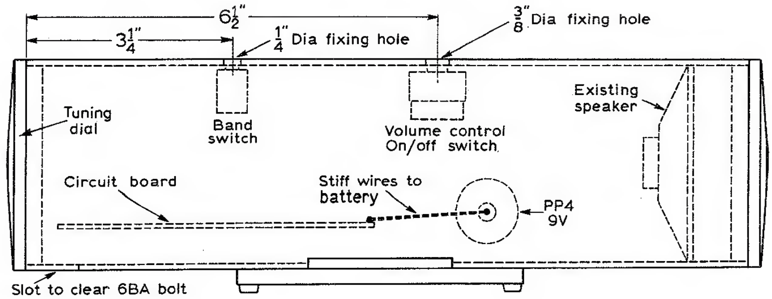


Fig. 5. This side view of the extension speaker shows the position of the volume control etc. in the prototype receiver. The flexible wires to the bandswitch should be kept as short as possible. The PP4 battery is not suspended in mid-air, as it would appear, but rests on the curved sides of the tube.

position. With the transistors, grip all three leads with a pair of long-nosed pliers, close to the body of the transistor, then tin the ends of the leads. While still gripping the leads solder the ends to the appropriate pins making absolutely sure that the connections are right. See Fig. 1 for the lead-out connections. A hot soldering iron and speed are the essence of this operation.

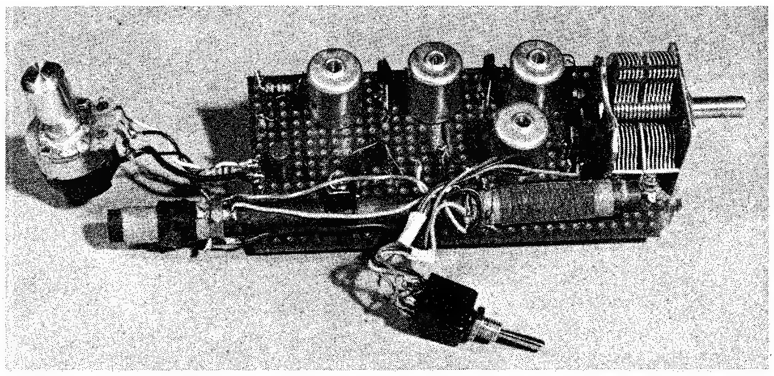
With the i.c., tin each lead-out wire as with the transistors, using the pliers as a heat sink, then solder all four to the correct pins. Note that pin 1 is the identifying pin, see Fig. 4.

A 6BA bolt, 1in. long, has a flat filed on its head and it is then soldered to the centre earth tag underneath the tuning capacitor, Fig. 2. This bolt

Switch to the m.w. band and adjust the two trimmers on VC1a and VC1b to their mid-way positions. Set the tuning to the dial position for the local BBC4 station and adjust the core of oscillator coil L2 until the station is heard. Having got a signal tune each of the i.f.t.'s, beginning with i.f.t.3 and working forward, for best signal strength. Use only the proper trimming tool for these cores or damage will result.

Find a station such as Radio 1 on 247m. at the low end of the dial and adjust the trimmer on VC1a for best volume. Tune to a station at the top end, such as Radio 3, moving the m.w. coil along the ferrite rod for maximum signal.

Return to the low end of the band and adjust the calibration against a station of known wavelength,



fits into a slot in the bottom edge of the speaker tube where, with nuts and washers it retains the circuit board in its correct position in the tube, Fig. 5. The holes for the volume control and the bandswitch are drilled in the top of the tube, using Fig. 5 as a guide.

THE ALIGNMENT

The existing long lead from the speaker is connected to the circuit board as shown in Fig. 4. Connect the battery terminal clips to the board with short stiff wires, the battery resting on the bottom of the tube, Fig. 5.

To assist in the alignment of the set a temporary dial drawn on stiff paper or card, Fig. 6, should be stuck to the front of the tuning capacitor and a pointer knob put on the spindle ensuring that minimum capacity coincides with left hand end of the dial markings.

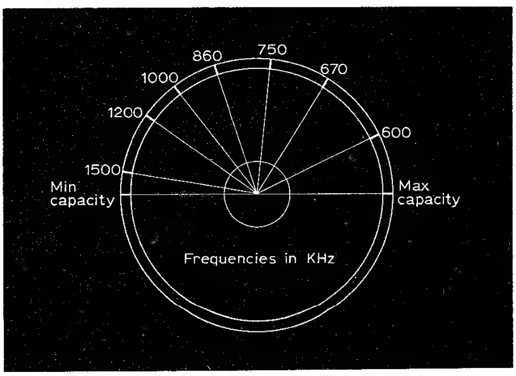


Fig. 6. Alignment of the finished receiver will be considerably facilitated by copying the above dial on to thin card and sticking it temporarily to the front of the tuning capacitor.

using the trimmer on VC1b.

Switch to the l.w. band and tune in Radio 2 on 1500m. and slide the l.w. coil along the ferrite rod for best results.

It is advisable to go over the alignment procedure once more after the set is working properly on both bands only this time use weak but steady signals for the alignment of the i.f. stages and the m.w. and l.w. coils on the ferrite rod. This will reduce any effect the a.g.c. may have on the apparent signal strength. In fact a voltmeter connected to the a.g.c. line will provide a much more precise means of alignment than the ear.

The set is now ready for final fitting to the tube. Remove the temporary dial and pointer. The circuit board can now be slid into the speaker tube, the control spindles manipulated into their respective holes and fitting the retaining nuts. The end grille, now the tuning dial, is fitted over the end of the tuning capacitor and into the end of the tube. The circuit board is adjusted until the end of the spindle is just flush with the dial. Tighten the nuts holding the 6BA bolt but do not overtighten as this will risk cracking the board. Remove the dial and put a small amount of Araldite or similar cement in the depression inside the dial, replace the dial on the spindle and leave overnight for the cement to set hard.

Turn the dial maximum anti-clockwise and mark a line across the edge of the dial and onto the tube to indicate the high frequency end of the tuning range. Tune in the various BBC stations on m.w. and mark the tube accordingly. Do the same for Radio 2 on l.w. The complete dial markings are shown in the photographs. There is no reason, of course, why the markings should not be in wavelength or frequency or both. The bandswitch is marked to indicate its position for the m.w. and l.w. bands.

NOTES

Although these tubular extension speakers are no longer imported there are many thousands in use and they can still be obtained in radio shops at around £1 each. The model used here is the TTC K3001 with plastic end caps but there is another model around that has pressed metal caps. If this model is used make quite sure that the end cap used for the dial is an easy rotating fit on the tube before glueing it to the tuning capacitor spindle.

Reference was made earlier to resistor R7, 39kΩ in the diode detector circuit. Its optimum value will depend upon the diode actually used. Once the set is working propertly, switch it off, remove R7 and fit a 50kΩ potentiometer in its place on temporary wires. Switch on and adjust the value of the pot. for best quality of sound. The actual position is quite critical making a significant difference to the overall results. Switch off and remove the pot. from the circuit and measure the resistance of that part which was in circuit. Choose and solder in a fixed resistor as near as possible to that value.

Don't forget that since the set uses a ferrite rod aerial it will be highly directional and should always be turned to provide maximum signal strength. ■

★ components list

Resistors

R1	6·8kΩ	R7	39kΩ*
R2	18kΩ	R8	470Ω
R3	2·2kΩ	R9	1kΩ
R4	47kΩ	R10	10kΩ
R5	1MΩ	R11	1kΩ
R6	100kΩ	R12	1kΩ

All ½W 10%. * See text

VR1/S2 5kΩ log pot. with switch

Capacitors

C1	0·1μF	C8	0·01μF
C2	5μF 12V	C9	10μF 12V
C3	0·1μF	C10	0·01μF
C4	215pF 5%	C11	100μF 12V
C5	175pF 5%	C12	100μF 12V
C6	5μF 12V	C13	0·1μF
C7	0·01μF	C14	150pF 5%

VC1a–b 208+176pF variable (Jackson Type 00)

Semi-conductors

Tr1	2N2926G	Tr3	2N2926G
Tr2	2N2926G	D1	OA90
IC1	MFC4000P		

Inductors

L1 Ferrite rod aerial m.w. and l.w. (Weyrad RA2W)
L2 Oscillator coil (Weyrad P50/1AC)
IFT1 IF Transformer (Weyrad P51/1)
IFT2 IF Transformer (Weyrad P51/2)
IFT3 IF Transformer (Weyrad P50/3V)

Miscellaneous

Tubular radio extension speaker, type TTC Model K3001 or similar.
Veroboard, plain, 5 × 2½in. (see text) matrix 0·15 × 0·15in.
Veroboard pins.
Battery 9V (PP4) and connectors.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Model E - 20 watts. Fitted $\frac{1}{4}$" bit. Spare bits $\frac{3}{32}$", $\frac{1}{8}$" and $\frac{3}{16}$" available. For 240, 220 or 110 volts. From £1·80
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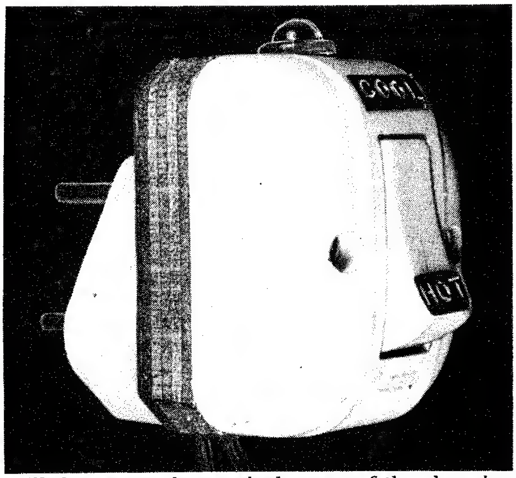
2 HEAT SOLDERING IRON

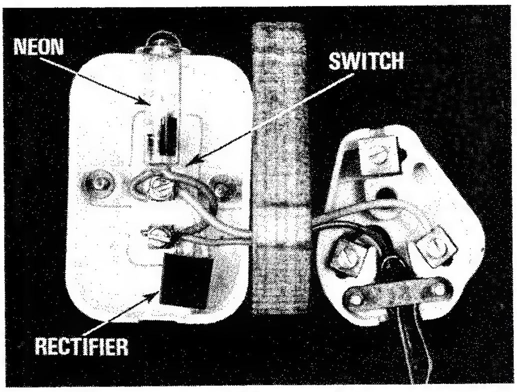
H.C.BENNETT-CLARK



MY soldering iron was a nuisance. It was either too hot or too cold. Too hot if it had been left on, unused, and too cold when I had only just turned it on.

The solution is to leave it on the whole time but to reduce the power when it is standing by; one friend has a Variac specially for this job but who wants to tie up five quids worth of useful Variac in this way?

My solution is to put a silicon rectifier in series with the soldering iron element (Fig. 1). As this cuts one half cycle, the power is halved when the switch is open and full power is produced by closing the switch. The mains neon shows when the iron is on at half power.



Since the rectifier does not get hot, it can be mounted inside a suitable switch screwed on the back of the soldering iron mains plug. The Bakelite top of the plug is replaced by a block of ½in. plywood drilled to recess the terminal screws of the plug pins. Two wires pass through the plywood block: one goes from the live pin to one side of the switch and the other from the live side of the element to the other side of the switch. The neutral wire of the element is connected to the neutral plug pin. The rectifier and mains neon are connected across the switch. The mains neon is held in a groove filed in the switch housing. The switch is screwed to the wooden block and the plug is screwed to the other side.

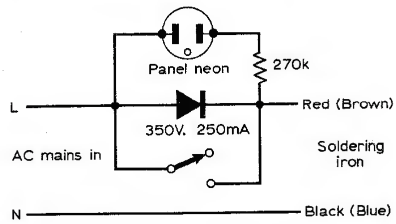


Fig. 1: The circuit of the two heat soldering iron.

When switched to "cool", the iron, a 25 watt Henley Solon, will melt solder and is ready for full scale soldering within about 10 seconds of switching to "Hot". The bit life, since the modification, has been much extended and the tip does not become covered in oxide.

The switch is a "VETO" from Woolworth's and, for the rectifier, any component with a 250mA 350V p.i.v. (or greater) rating that is small and cheap will do. A BY100 is ideal for this purpose.

Notice that I have not earthed my iron; this may not be strictly safe but I do not have disasters through soldering the "hot" end of a live circuit and, to me, this is worth the small risk. ■

PSSST! WANT TO BE AN AUTHOR?

A high proportion of the articles in Practical Wireless are submitted by readers who want their hobby to pay it's way (plus a good bit over). The Editor always welcomes articles from new authors; these should, if possible, be typewritten, double spaced and should conform generally, with regard to length and type, to existing articles. All circuits etc. are redrawn before publication but the originals should be as clear as possible. Photographs of the equipment are helpful but if this is difficult these can be done in our own studios.

All components used must be available with the source of unusual items given.

All published material is payed for at attractive rates. Further information is available from the Editor.

SERVICING

AN INTRODUCTION TO FAULT-FINDING

PART 2

G. J. KING

FOLLOWING THE INTRODUCTION OF THE SERIES BY H. W. HELLYER, CO-AUTHOR G. J. KING GUIDES THE READER THROUGH THE CIRCUITRY OF TYPICAL A.M. AND COMBINED A.M./F.M. RECEIVERS AS A NECESSARY PRELUDE TO ACTUAL SERVICING TECHNIQUES BEGINNING NEXT MONTH.

MY thanks to Mr. Hellyer for setting the stage, so to speak, allowing me to launch straight into basic circuitry and servicing techniques.

Radio receiver design has developed essentially into the following:

1. Relatively simple receiver
2. Radiogram
3. Hi-fi receiver or system.

COMMON FEATURES

All have the common features of (i) the front-end which includes the frequency changer and sometimes an r.f. amplifier in front, (ii) the i.f. channel which feeds into the second detector and (iii) the audio channel which feeds into the speaker. When considering any circuit in electronics it is always desirable to break it up into sections or 'blocks', and this, for the basic radio receiver, is done in Fig.1.

Even the simplest of receivers has this sort of section make-up, with the more expensive ones carrying greater section detail. For example, a cheap a.m. portable has the ferrite rod aerial signal coupled straight into the frequency changer stage, which is commonly a single transistor stage performing the dual functions of mixing and local oscillator generation, while a more expensive f.m. model would be expected to have at least one r.f. amplifier stage and possibly two transistors for frequency changing, one working as the mixer and the other as the local oscillator. Moreover, the r.f. amplifier and possibly the mixer would be designed round field effect transistors (f.e.t.'s) rather than the ordinary type of bipolar transistor, such devices yielding improved linearity over bipolars, with a consequent improvement in the rejection of intermodulation components and hence spurious signals.

FRONT-END BASICS

The front-end thus accepts the aerial signal and heterodynes this with the local oscillator signal to provide the required intermediate-frequency (i.f.) signal. The i.f. signal can be equal to the sum or difference between the local oscillator and the incoming signal.

The first makes the oscillator frequency higher than the incoming frequency by the i.f. and the second makes the oscillator frequency lower than the incoming frequency by the i.f. Either arrangement works equally well and both are found in practice, but the choice is sometimes based on the required tuning range and frequency band and the possibility of fundamental or harmonic radiation from the local oscillator affecting neighbouring radio and television receivers.

The simplest receiver, therefore, has two variably-tuned circuits at the front-end, one to tune the incoming signal and the other to tune the local oscillator so that over the tuning range this remains exactly out of step with the incoming signal tuning to yield the i.f. difference. This is where the front-end alignment comes in.

Receivers with one or more r.f. stages have an extra variably-tuned circuit for each stage. The number of front-end stages can thus be gleaned by counting the number of variable elements in the tuning gang. Simple sets have a two-gang capacitor, and more exotic models capacitors with three or, perhaps, four ganged sections. Sometimes there might be two r.f. stages tuned by a single gang (making three ganged sections in all). This is when the r.f. section consists of one tuned stage and one untuned stage. There are a few models with two r.f.

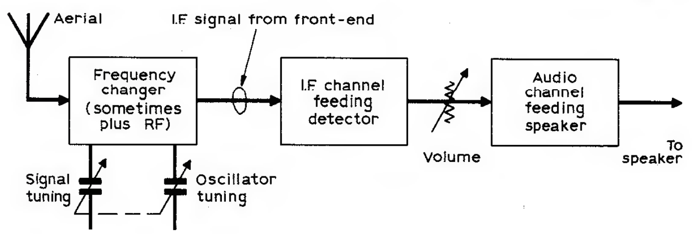
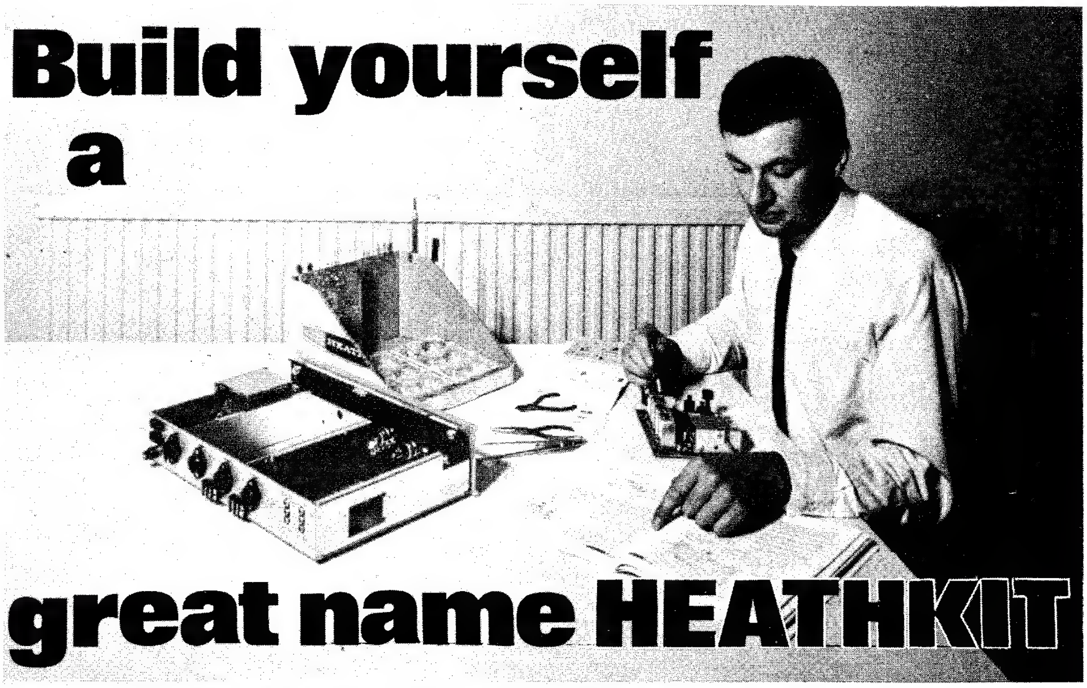


Fig. 1. The circuit of a basic superheterodyne receiver is broken up into blocks or sections to assist in the discussion of receiver circuitry.



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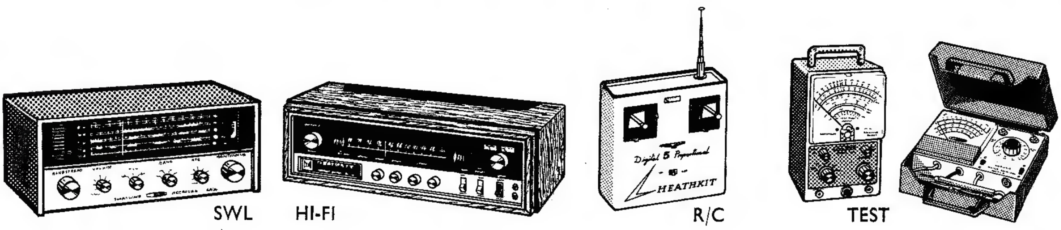

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transistors arranged in a cascode circuit which requires only one section of the tuning gang.

TUNING SYSTEMS

Sometimes the tuning is accomplished not by ordinary capacitor sections but by either variable inductors or varactor capacitors. For tuning, of course, we require a combination of inductance and capacitance and to change the tuned frequency we can alter either the capacitance or the inductance. When the inductance is altered dust-iron cores are arranged to move inside the formers, these being mechanically linked with the tuning system.

Varactor tuning is a recent innovation and it is based on the change in capicitance which occurs between the elements of a semi-conductor diode when the **reverse** bias across it is altered. When a diode is in forward conduction there is no electronic demarcation between the p and n zones. However, in reverse biasing, a 'barrier' develops at the zone junction and the width of this increases as the reverse bias is increased. This is reflected as an increase in capacitance as the reverse bias is **decreased,** going into a short-circuit when the biasing changes from reverse to forward. Of course, the design is such that the biasing never goes forward (not normally, anyway; a fault condition resulting in this would put the whole of the front-end out of action).

Each circuit to be tuned (r.f., mixer and local oscillator) has its own varactor, which is the name given to junction diodes designed specifically to exploit the capacitance feature as efficiently as possible, the variable biasing for tuning coming from a potentiometer geared to the tuning system.

Owing to the relatively small capacitance swing, varactor tuning is confined essentially to f.m. receivers, f.m. tuners and to the f.m. front-end of a.m./f.m. receivers. The a.m. section is almost always capacitively-tuned, even today.

Modern receivers commonly embody a v.h.f. (f.m.) front-end unit complete, which is often 'imported' in the form of a single unit. The a.m. section is then an integral part of the receiver design, using its own capacitors. To illustrate this, Fig. 2 shows a valve-type receiver with the tuning coupled to the gang on the left for a.m. and the screened unit adjacent, with its tuning mechanism also coupled to the main drive, for v.h.f. f.m.

A more advanced version is shown in Fig. 3, which is the Swedish Sonab R7000 receiver. This is all-transistor, f.m. only and uses varactors for tuning

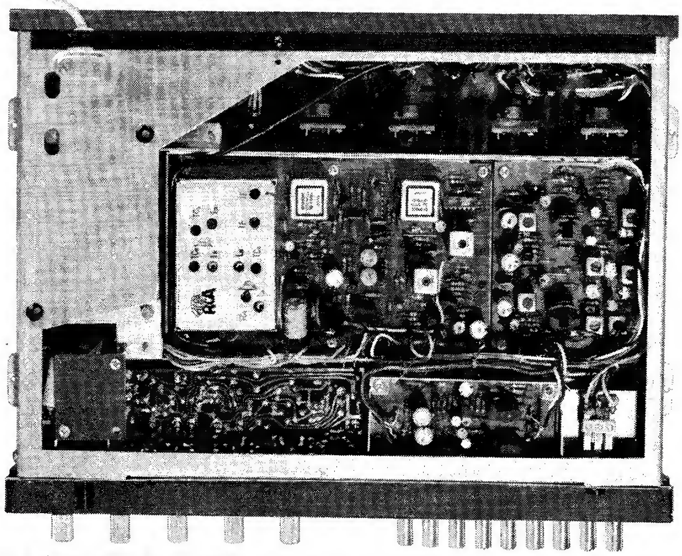
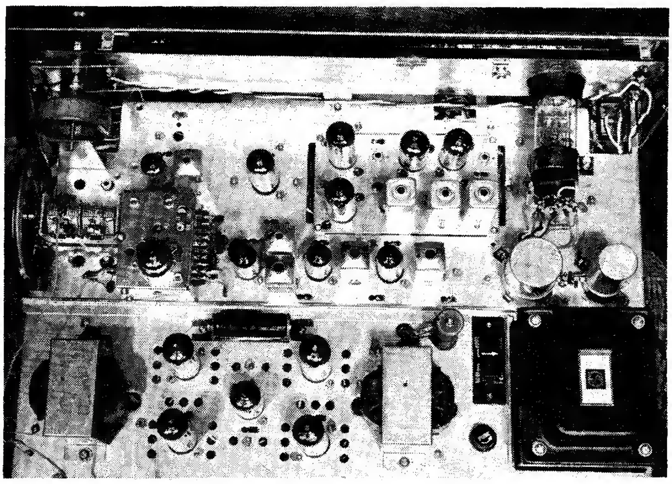
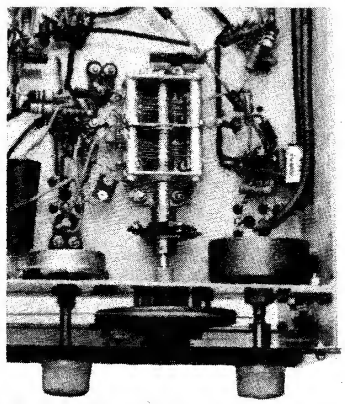


Fig. 3. A view of the Sonab R7000 receiver, for f.m. only. All tuning is by varacters, the complete tuning unit being contained in the large screened box at the left.





◀ Fig. 2. In this receiver the main f.m. tuning mechanism is coupled to the gang capacitor at the left, used in the a.m. channel. Fig. 4. (above) shows a simple two-gang capacitor in a home-made v.h.f. tuner.

which are biased simultaneously for the correct capacitance by a potentiometer. The self-contained v.h.f. f.m. section (with varactors) constitutes the screened unit on the left-hand side.

An earlier v.h.f. f.m. tuner is shown in Fig. 4. This home-made set is seen to employ capacitor tuning, one section being for the mixer input and the other for the local oscillator. Nowadays, however, the majority of f.m. receivers and tuners of any consequence carry a variably tuned r.f. stage. Inexpensive models and portables, though, might well have an untuned r.f. stage, these then showing a tuning capacitor with only two ganged sections. It is just as well to get all these factors sorted out, since successful servicing demands intimate knowledge of the receiver.

The trend is for more receivers, even cheap portables, to carry an f.m. section so that they can tune to the 'local' v.h.f. stations at least. To be up-to-date, therefore, a substantial part of this series is bound to delve into f.m. techniques and servicing problems quite extensively. Nevertheless, a.m. is still used either by itself or linked to f.m., the latter constituting the a.m./f.m. receiver.

Whether dual or single system, the i.f. on a.m. is almost exclusively 470kHz and on f.m. 10·7MHz. Such output from the appropriate front-end is then conveyed to the i.f. channel.

DESIGN VARIATIONS

This is where we can see some variation in detail. An a.m. only receiver has a relatively simple i.f. channel of, perhaps, only two transistor stages, depending on its price category. This would feed into a simple diode a.m. detector and thence, via the volume control, to the audio channel, which commonly carries three transistors.

The a.m./f.m. receiver might be similarly endowed so far as a.m. is concerned, but for f.m. would carry a separate i.f. channel feeding into the f.m. detector, thence via switching and the volume control to the audio channel, as shown in Fig. 5. This is the least complex type of dual receiver to service, for

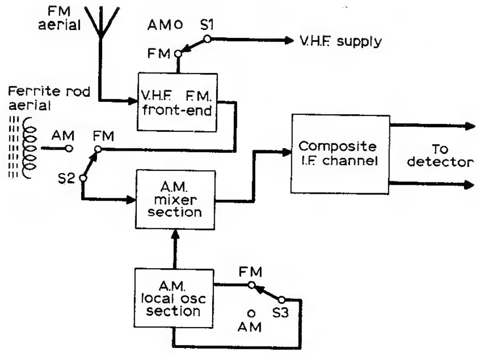
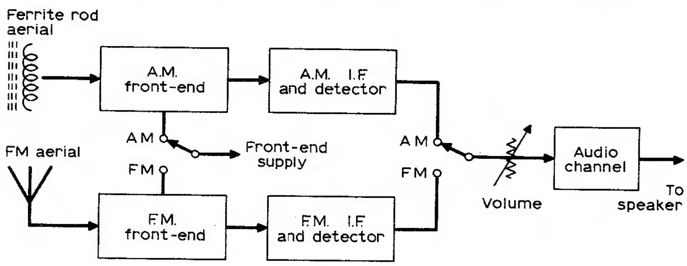


Fig. 7. This particular design variation helps to eliminate switching.

apart from the audio department, each standard runs its own way. Thus, failure of one standard only would mean at least that the audio channel is working and that the trouble must lie either in the affected front-end or i.f./detector channel (or, perhaps, in the a.m./f.m. switching). Similarly, failure of both standards would point strongly to audio channel or power supply trouble.

Receivers adopting this design philosophy are few; current practice favours the use of a combined a.m./f.m. i.f. channel. Indeed, this is a reflection from the early days of dual-system receivers. It is made possible because of the wide difference between the i.f.'s of a.m. and f.m. (470kHz and 10·7MHz). Each i.f. stage, therefore, can be loaded to respond to both the a.m. i.f. and to the f.m. i.f. without interaction. This merely means that two sets of i.f. transformers are located in the grid and anode or base and collector circuits, the i.f. signal then sent through from the selected tuner neatly getting to the appropriate detector without the need for elaborate switching. The final i.f. stage goes into two branches, via 470kHz and 10·7MHz transformers, to feed the a.m. and f.m. detectors. The idea is illustrated in Fig. 6, and this is the most important block diagram so far given. The a.m./f.m. switches are ganged, of course, and coupled to the band-change switch.

Deviations from this are found, a common one lies in the use of the a.m. mixer/oscillator (frequency changer) transistor as an extra i.f. amplifier on the f.m. standard. This enhances the f.m. i.f. gain which is desirable to ensure full 'limiting' on relatively weak signals over the f.m. i.f. passband, which needs to be significantly wider (up to 260kHz to the −6dB points) than that of a.m. to handle the multiple f.m. sidebands and also to accommodate the sub-channel information without distortion when the receiver carries a stereo decoder.



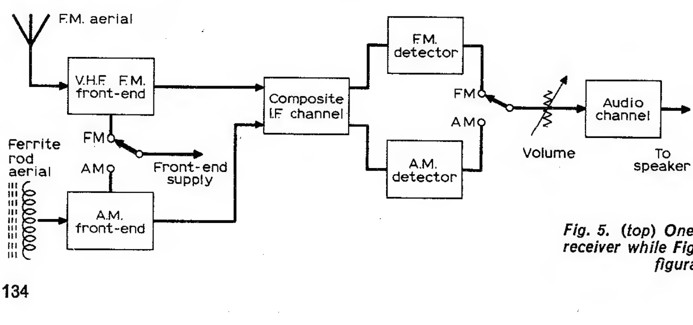


Fig. 5. (top) One possible arrangement for a combined a.m./f.m. receiver while Fig. 6. (bottom) illustrates the more common configuration using a composite i.f. channel.

The block diagram in Fig. 7 shows the deviation just explained. Switches S1, S2 and S3 tell the story. S1 energises the v.h.f. f.m. front-end on f.m. and removes the supply on a.m.; S2 switches the v.h.f. f.m. front-end i.f. to the a.m. mixer section on f.m., while disconnecting the ferrite rod aerial; and S3 mutes the a.m. local oscillator on f.m., restoring it on a.m. S2 switching implies that the a.m. mixer section must also be loaded with dual i.f. transformers (the primaries at the anode or collector at least) at 470kHz and 10·7MHz. This is, in fact, true, as we shall see later.

Block diagrams in Figs. 5, 6 and 7 show a ferrite rod aerial at the a.m. front-end. Almost all receivers, even very expensive hi-fi species, get their a.m. signals by way of such an aerial; and this applies also to inexpensive, small and large portables. The ferrite rod aerial is a highly efficient device and it can collect more signal with less interference (giving a good signal-to-interference ratio) than long-wire or rod-type outdoor aerials, when it is properly orientated. However, the efficiency diminishes with increasing frequency, so in the short-wave bands and certainly at v.h.f. a 'long-wire' or tuned dipole aerial is required (the tuned dipole certainly for v.h.f. f.m. reception).

Some receivers try to make do with a compressed v.h.f. dipole fitted into the wooden or plastic cabinet, while f.m. portables can provide sometimes fair results from local stations by way of a built-in telescopic aerial, but this is definitely not the best way of securing the potential attributes of the f.m. system of broadcasting! Pickup efficiency of such rods is likely to improve marginally with the new 'slant' plane of signal polarisation, but currently only one or two stations of the BBC are so engineered.

Unsuccessful attempts have been made to simulate at v.h.f. the convenience and efficiency of the ferrite rod aerial; but to date we still need a good v.h.f. f.m. aerial to obtain the best results from this service, especially when advantage is to be taken of the stereo information multiplexed on some v.h.f. f.m. signals.

The ferrite rod aerial is a tuned device and it takes the place of the aerial coil of earlier receivers. Two windings provide for long-wave and medium-wave tuning and sometimes there is a third winding for coupling to an external aerial when the receiver is operated under screened conditions, such as in a metal caravan or motor car.

AM RECEIVER

The circuit of a six transistor a.m. only receiver is given in Fig. 8. I have divided this into the three sections of the block diagram, Fig. 1. Thus VT1 is the frequency changer transistor whose base receives signals tuned by the ferrite rod aerial. Windings L2 and L4 are for medium and long wave respectively, while windings L3 and L5 couple the tuned signal to the transistor base, the appropriate winding being selected by wavechange switch sections S3m and S41.

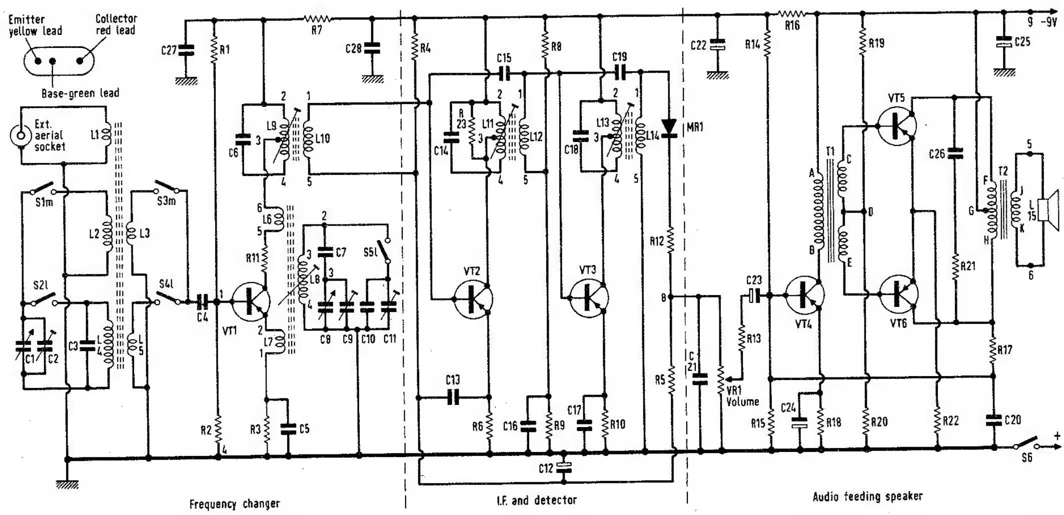
Aerial section of the tuning gang is C1 with trimmer C2 in parallel this combination being connected to L2 or L4 by S1m and S21, also wavechange switch sections. Winding L1 provides for external aerial coupling.

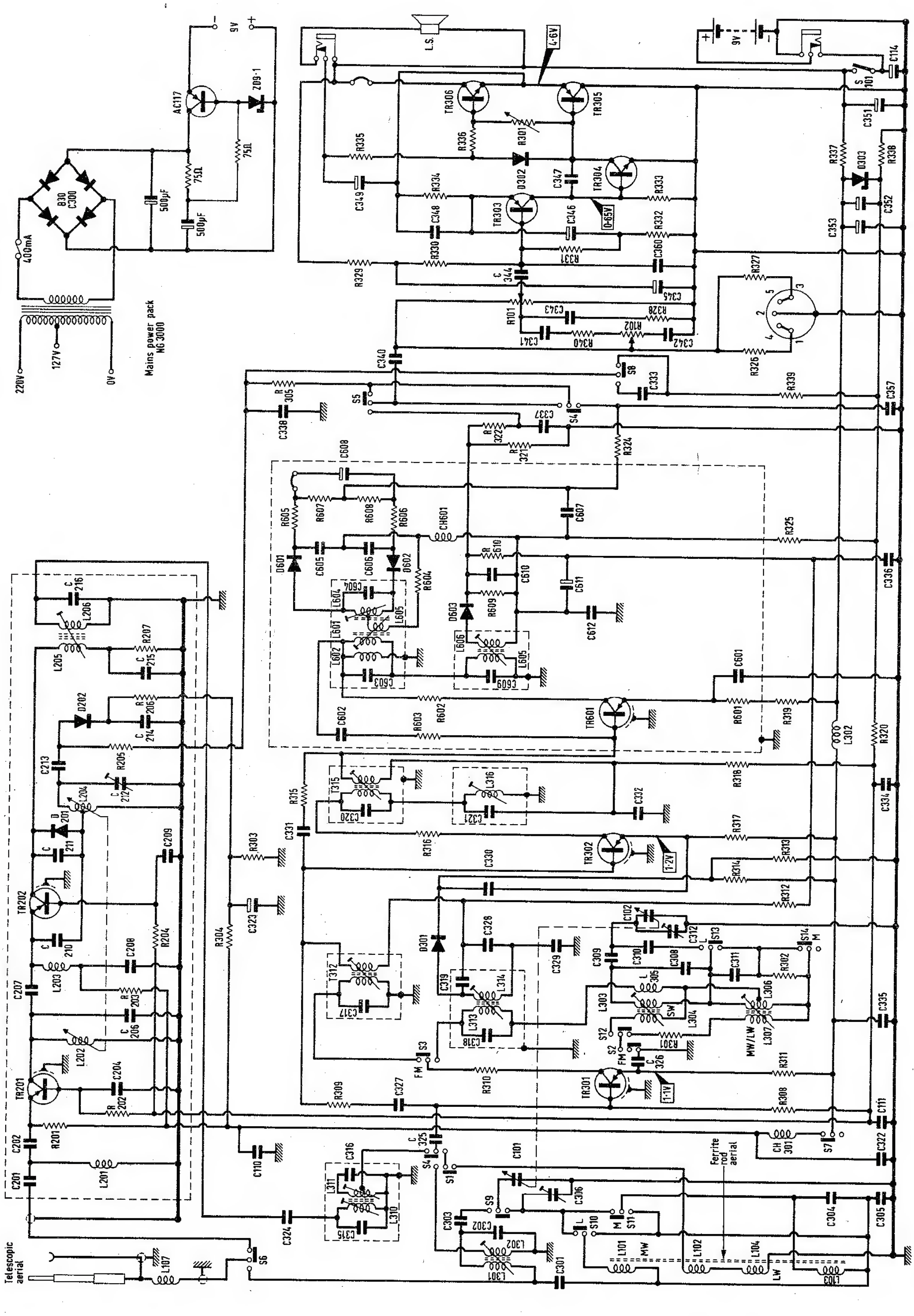
Local oscillator coils are L6, L7 and L8, with tuning provided by C8 section of the gang and C9 trimmer in parallel. Wavechange switch section S51 introduces extra parallel capacitance for long-wave operation. Part of this capacitance is in the form of l.w. trimmer C11, the remainder being provided by C10. Capacitor C7 in series with the oscillator tuning acts as a fixed padder to provide the correct signal/oscillator tracking (at the i.f. difference) over the bands. The trimmers mentioned and also the cores in the i.f. transformers determine the overall alignment. This subject will be dealt with fully by Mr. Hellyer later.

The i.f. signal is developed across the windings of the first i.f. transformer L9/10, the tapping on the primary providing the correct coupling impedance.

The i.f. channel features the two transistors VT2 and VT3, the second i.f. transformer L11/12 coupling one to the other and the third coupling VT3 to the second detector MR1, via windings L13/14. Primary taps are also provided on these i.f. transformers for impedance matching at the collector circuits. This is fairly common practice to avoid undue damping by

Fig. 8. The operation of this six transistor a.m. receiver is described in the text.




Mains power pack NG 3000
220V
127V
0V
400mA
B30 C300
500μF
500μF
75Ω
75Ω
AC117
ZD9·1
9V
L.S.
4·6V
Telescopic aerial
Ferrite rod aerial

the relatively low collector impedance.

Detector load consists of R12, R5 and R4 in series, but only R5 is concerned with the resulting audio signal. Residual i.f. signal is bypassed by C21, while C12 clamps the bottom of R5 to chassis so far as the audio signal is concerned. Thus the audio appearing across R5 is applied in parallel to the volume control and thence, via the slider, to the base of the first audio transistor VT4.

The d.c. component of the 'detected' i.f. signal modifies the static current in VT2 base feed resistor R4 in such a way that the gain of this i.f. transistor is caused to fall as the strength of the received signal rises, and vice versa. This provides automatic gain control (a.g.c.). What happens is that as the signal level rises, so the cathode of MR1 reflects a positive potential to VT2 base circuit, thereby making the base go less negative with respect to emitter. Since VT2 is a p-n-p device, this reducing negative base potential automatically reduces the emitter current and hence the gain of the stage. Capacitors C15 and C19 in the circuits of the second and third i.f. transformers provide a small amount of negative feedback to neutralise the intrinsic positive feedback via the transistors which could otherwise cause oscillation.

The audio channel is straightforward. VT4 is the driver transistor which feeds push-pull signals to the bases of the two output transistors VT5/VT6. This pair is biased towards class B working by the potential-divider resistors R19/20 in the base circuit, which means that the collector current is almost zero when there is no signal drive. True class B implies zero collector current, but it is necessary to bias for a small current to avoid discontinuity of the transfer characteristics of the output pair at the point of intersection. If the quiescent current is too small this discontinuity effect is revealed by an unpleasant type of distortion, called crossover distortion, which I shall have more to say about later when I shall be dealing with amplifier fault finding.

AM/FM RECEIVER

Fig. 9 gives the circuit of the ITT-KB KR612 a.m./f.m. receiver. The v.h.f. f.m. unit is at the top left-hand corner, containing two transistors, TR201 the r.f. amplifier and TR202 the self-oscillating mixer. Before I describe this, let us investigate the signal paths involved in this model.

I.F. output from the v.h.f. front-end comes from i.f. transformer L205/206 and is conveyed to a band-pass coupling L310/311 and from there to TR301 base when switch section S1 is in the f.m. position. TR301 is the a.m. frequency changer, which acts as an extra i.f. amplifier on f.m. (see Fig. 7). The a.m. oscillator circuit is muted on f.m. by switch section S2, while section S3 couples the primary of the f.m. i.f. transformer T312 to TR301 collector circuit. The top of the secondary conveys the signal to the base of the second i.f. transistor (on f.m.) TR302.

This transistor's collector is loaded into the second i.f. transformer T315, which is for f.m., in series with the a.m. i.f. filter L316, this responding only on a.m.

The signal from T315 secondary is passed to the base of TR601, and the collector of this transistor is also loaded into series-connected f.m. and a.m. transformers which feed the appropriate detectors. The top transformer, L601/604/605, feeds the f.m. ratio detector diodes D601/602, while that below, L605/606, feeds the a.m. detector diode D603.

RESISTORS		R331	82K	C209	1K8pF	C331	24pF
R201	750	R332	10	C210	10pF	C332	15pF
R202	2K2	R333	1K8	C211	39pF	C333	100pF
R203	1K	R334	2K2	C212	13pF	C334	47KpF
R204	5K1	R335	180	C213	10pF	C335	47KpF
R205	560K	R336	82	C214	1K8pF	C336	10KpF
R206	560K	R337	47	C215	22KpF	C337	4K7pF
R207	68	R338	1K5	C216	220pF	C338	100KpF
R301	12	R339	100K	C301	680pF	C340	100KpF
R302	150K	R340	4K7	C302	82pF	C341	1KpF
R303	51K	R601	1K2	C303	290pF	C342	22KpF
R304	6K8	R602	150	C304	68pF	C343	100KpF
R305	560K	R603	82	C305	2K2pF	C344	100KpF
R308	3K3	R604	180	C306	20pF	C345	50μF
R309	150	R605	1K8	C308	120pF	C346	250μF
R310	270	R606	680	C309	270pF	C347	680pF
R311	820	R607	15K	C310	40pF	C348	2K2pF
R312	3K3	R608	15K	C311	245pF	C349	1000μF
R313	22K	R609	10K	C312	10pF	C351	1000μF
R314	2K2	R610	10K	C315	43pF	C352	100μF
R315	180	R101	250K	C316	39pF	C353	1000μF
R316	560	R102	100K	C317	100pF	C357	100pF
R317	1K2			C318	1K8pF	C360	390pF
R318	3K3			C319	1K8pF	C601	47KpF
R319	820			C320	100pF	C602	18pF
R320	1K	CAPACITORS		C321	1K8pF	C603	51pF
R321	270K	C110	220pF	C322	47KpF	C604	43pF
R322	10K	C111	220pF	C323	10μF	C605	270pF
R324	2K2	C114	10μF	C324	12pF	C606	270pF
R325	10	C201	27pF	C325	10KpF	C607	2K2pF
R326	100K	C202	16pF	C326	22KpF	C608	2μF
R327	470K	C204	1KpF	C327	24pF	C609	1KpF
R328	4K7	C206	24pF	C328	22KpF	C610	3K9pF
R329	15K	C207	4·3pF	C329	47KpF	C611	5μF
R330	150K	C208	330pF	C330	47KpF	C612	4K7pF

Fig. 9. (facing page) is the circuit of the KB KR612 a.m./f.m. receiver whose operation is discussed in the text. The above table of component values for this circuit should prove helpful. (Note: 5K1 is 5·1 kΩ etc. 2K2pF is 2200pF etc.)

Output from the f.m. detector comes from C607 and gets to the volume control R101 through R324, switch sections S4/S5 and C340 (R102 is the tone control.)

The switch sections so far considered handle the a.m./f.m. changeover and we have explored the f.m. signal paths. Now, on a.m. S1 removes the v.h.f. tuner i.f. output and connects TR301 base to the ferrite rod aerial, S2 removes the a.m. oscillator muting and introduces the oscillator coils, S3 removes the f.m. i.f. transformer T312 and in place connects the a.m. i.f. transformer L313/314, while S4/S5 change over the detector outputs, the a.m. detector output then being fed to R101 volume control from R322, S5 and C340. Under this condition the receiver is of similar style to that of Fig. 8.

Now to get back to the v.h.f. front-end. This is tuned by variable inductors (permeability tuning); L202 tuning the r.f. transistor output and L204 the v.h.f. local oscillator. This tuning is ganged mechanically, in the same way as tuning capacitors (denoted by the dotted line between the two inductors).

R.f. transistor TR201 is in common base mode, meaning that the input signal is applied to the emitter, the base 'earthed' to signal by C204 and the tuned output being taken from the collector. Incidentally, switch section S6 supplies signal to the f.m. front-end from the telescopic aerial and transfers the aerial to the ferrite rod circuit on a.m., this giving enhanced signal pick-up under certain conditions.

The emitter circuit of TR201 is broadly tuned over Band II by the pi-network C201/C202 and L201, providing the input coupling. The transistors are p-n-p

Continued on page 153

TAKE 20

JULIAN ANDERSON

A series of simple transistor projects, each using less than twenty components and costing less than one pound to build.

No. 26
LIGHT FLASHER

IN Take 20 No.11 a "Novelty Light Flasher" was described, operated by a conventional multivibrator. At the time the article was presented mainly as a description of the operation of the multivibrator circuit. You may think that just over a year is rather a small gap to describe yet another light flashing circuit as there can be little demand for them but the circuit produced here has such advantages that I feel its inclusion is justified. It has a considerable number of advantages over other circuits I have seen and is cheaper to build than the previous circuit.

The light output is extremely high—far higher than you would expect from a torch operating with the same type of bulb; the reasons for this are given later.

Deaf people often make use of lights for receiving signals where those with normal hearing use a bell—telephones and door bells are the first cases that spring to mind. A flashing light is far, far more noticeable than one many times brighter that stays on continuously—ambulances, police cars and breakdown vans are cases in point.

Warning devices in electronic equipment are often arranged to complete a circuit to a bulb and this little simple circuit can be wired up so that the warning is a series of flashes. Car warning lights can readily be modified to use this circuit.

I use the circuit shown here, built into a simple wooden box and carry it with my car tools so that if there is a breakdown it can be set to flash away beside the car, warning other drivers of the dangers.

So, you can see that there are plenty of uses for such a circuit—no doubt the ingenious constructor will be able to think of many more.

The Circuit

The circuit makes use of a rather special version of the multivibrator and regular readers may notice a similarity with the rain alarm and the metronome projects described before in this series.

Only two transistors, one resistor and a capacitor are used although for versatility in being able to modify the flashing rate, the resistor is made up from one fixed and one variable.

The circuit produces a series of pulses which have the effect of turning Tr2 alternatively completely on and completely off so that pulses of very nearly 9V are applied across the bulb which is normally intended for 3V operation. The bulb is one of those usually used for torches, they are widely available and all Woolworth stores have them. They have 3·5V stamped on them just above the thread. Holders for these bulbs are also available and these are inexpensive and save soldering directly on to the base of the bulb, an operation which is not always easy.

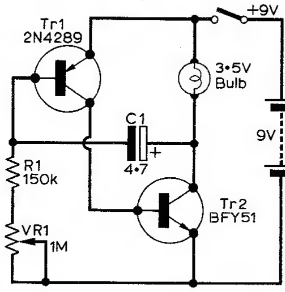


Fig. 1: Circuit of the 'Take 20' light flasher.

Although 9V is applied to the bulb, no harm has befallen those used in various prototypes. Light output is very much higher than for normal operation due to the high voltage applied and possibly reaches 10W though this is very hard to measure. However, it is operating not continuously but as a series of pulses and the filament has time to recover before blowing. The same applies to the battery which receives a real caning during the short periods but this, like the bulb, has time to recover before the next demand is made of it.

The larger layer batteries such as the PP9 are best but for operation inside a car, or near it, the 12V internal battery will be fine.

Neither of the transistors in the circuit are expensive. The BFY51 is a semi-power silicon type and N-P-N while the 2N4289 is one of the cheapest plastic silicon P-N-P types available.

The flashing rate is determined by VR1 and this will vary between several flashes a second to one every five or six seconds. For normal fixed operations R1 can be increased and selected for the required rate. The capacitor can of course be raised in value for longer delays but it's working voltage should be at least 12V.

Construction for a circuit of this simplicity does not of course matter and should present no problems. If VR1 is left out the wiring can even be done around the bulb holder. ■

PRACTICAL WIRELESS

PW 'partygram'

INCLUDING RADIO 1 AND 4

Those sounds you get from a one valve record player, straining to reach 2 watts, really won't do any more; so we are offering you the "Partygram"—a modern solid state design producing 10 watts of beautiful sound.

Separate treble and bass controls give you full control over the output and the dulcet tones are fed to a speaker that will make most commercial record players blush!

And there's more. An optional transistor m.w. tuner is featured and with this the press of a button converts the "Partygram" to receive Radio's 1 and 4.

Beautiful Beat, Blues or Beethoven is what we promise with the "Partygram": the full description is covered in P.W., starting in the next issue.

ALSO:

ENLARGER TIMER

No relays, high accuracy and wide range are the ideal features you expect in a good timing unit. This project has all these, and although specifically designed as an enlarger timer, it is also suitable for other uses. Timing accuracy is better than $\frac{1}{4}$ sec. per minute and timing period can be set between 1 second and 80 seconds. The controlling device is a TRIAC used with four other transistors.

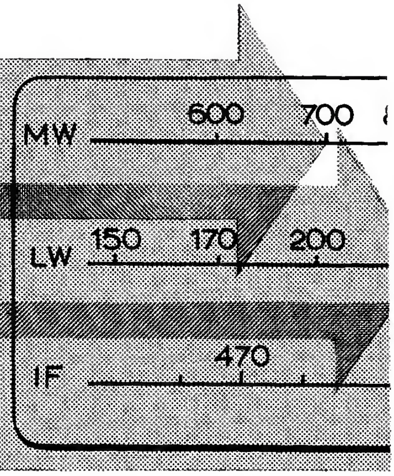
SIMPLE FET RECEIVER

You've read about f.e.t.'s—they're transistors that are a lot like valves—but we bet that many of you haven't tried them yet. Here is a golden opportunity to get in on the act with a simple project with great potential; three plug in coils give coverage of 20 metres to 580 metres and there are a lot of stations in this part of the spectrum. Low cost, simple construction, high performance and an excellent introduction to the f.e.t. is what we offer—full details in the July issue.

Plus all the regular features: *'Take 20'* for the beginner, *'I.C. of the Month'* for the experimenter, *'Going Back'* for the nostalgic and *'News'* to keep you up to date with developments. All this and more in the July Issue—on sale June 4th—Price 20p.

ALL FEATURED IN THE JULY ISSUE ON SALE JUNE 4th

SIMPLE SIGNAL GENERATOR



THIS is a transistor signal generator operating from an internal 9V battery, covering 150kHz to 30MHz in five bands. An audio output is also available, for the testing of a.f. circuits. The generator uses easily obtainable coils which considerably eases construction.

CIRCUIT

Fig. 1 is the circuit, Tr1 being an f.e.t. operating as an r.f. oscillator, with Tr2 as audio oscillator. The radio frequency signal produced by Tr1 is modulated by Tr2, so that it carries an audio tone which can be heard on a receiver.

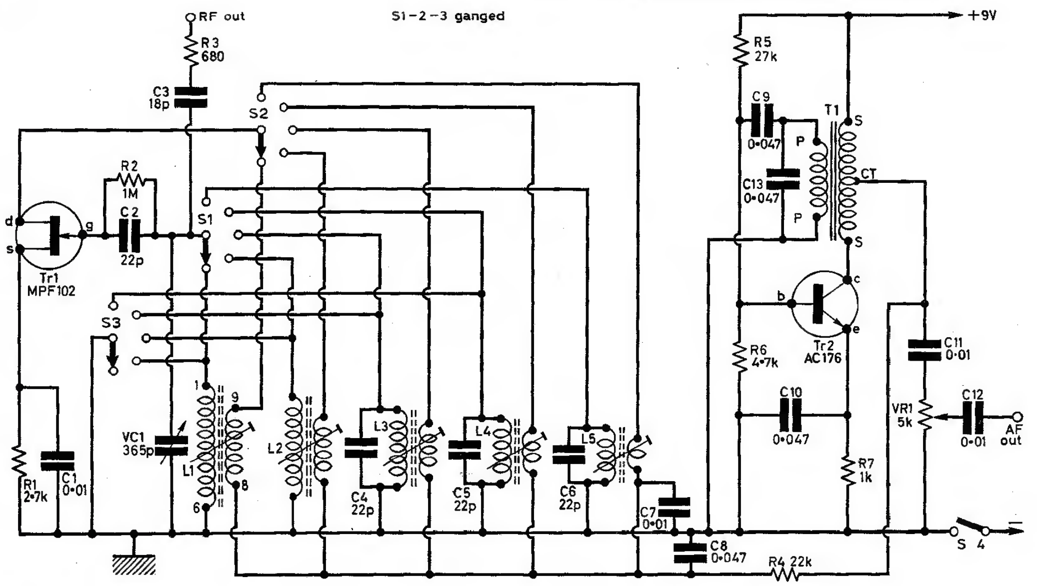
The band switch has three poles. S1 switches the gate circuit to L1, L2, L3, L4 or L5, which are tuned by VC1. The small fixed capacitors C4, C5 and C6 are to obtain suitable band coverage on the last three ranges.

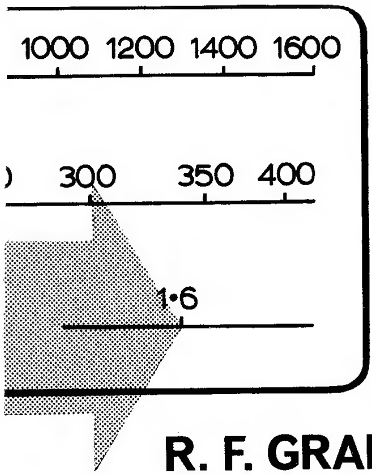
Section S2 switches the drain to the feedback windings, drain current being obtained through R4 and one half of the secondary of the audio transformer T1. C7 is an r.f. by-pass capacitor. S3 shorts out the next-larger inductor to the actual one in use, to avoid possible absorption effects due to the natural frequencies of coils not in circuit.

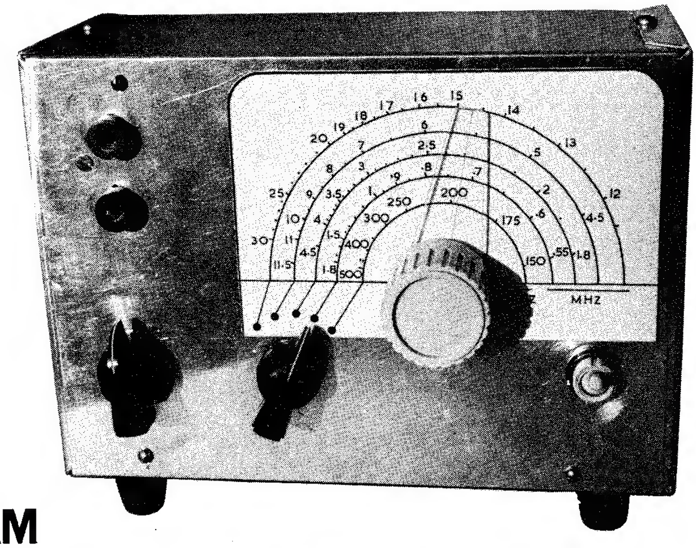
Tr2 obtains feedback from the transformer T1 generating an audio tone, taken to R4. C8 governs the depth of modulation.

Audio obtained through C11 is taken to VR1 and

Fig. 1. Complete circuit of the Simple Signal Generator.







R. F. GRAHAM

is available at the a.f. output socket with C12 isolating external d.c. circuits. VR1 controls audio output, as required when testing various stages in an a.f. amplifier or receiver.

RF output is taken through C3 and R3, to the r.f. output socket. It was decided not to switch VR1 into this circuit, because an ordinary small potentiometer does not perform very well as an attenuator at high frequencies. Instead, in those circumstances where a change in r.f. signal strength is required, the output leads can be moved or changed to alter coupling. For many purposes the output lead can be placed near the receiver aerial lead or ferrite aerial. Or the output lead can be twisted for an inch or so with an insulated wire, which is in turn taken to the aerial socket of the receiver, or r.f. or i.f. circuit points.

The r.f. output is modulated at all times by the audio tone, so can be tuned in on any type of ordinary receiver.

Inductors. The coils listed are of a type intended for valve equipment, and thus suit the high-impedance gate circuit of the f.e.t. Tr1. L4 and L5 are positioned for short leads to the switch. The ranges obtained are approximately as follows:—

Range 1	150-500kHz
Range 2	550-1800kHz
Range 3	1·8-4·5MHz
Range 4	4·5-11·5MHz
Range 5	11·5-30MHz

It was found that the highest-frequency coil L5 was manufactured with an interwound primary to give tighter coupling, and to obtain correct feedback on this range leads to tags 1 and 6 are reversed, compared with the other coils.

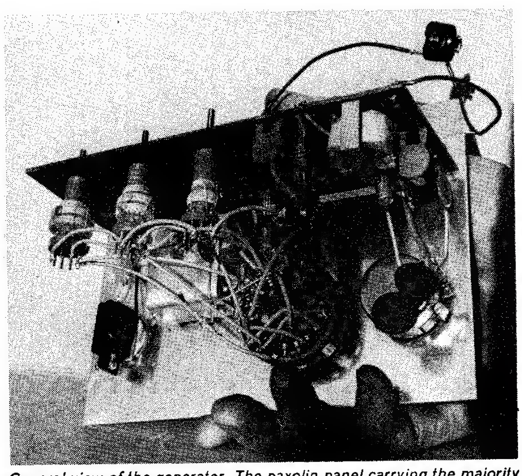
CONSTRUCTION

Most of the components are assembled on a paxolin panel $6\frac{5}{8} \times 2\frac{1}{2}$in, Fig. 2 which is later attached to the panel by two brackets. There should be about $\frac{1}{8}$in. clearance between board and panel, as shown, to take the flanges of the sides of the case.

Holes for the coils and other items are drilled as in Fig. 2. Most of the small parts are then wired in. When the board is fixed to the panel, it is about $1\frac{1}{2}$in. from the top edge of the panel.

Transistors. A transistor holder was employed for Tr1, which is inserted only after wiring is finished. The holder is a push-fit in a hole in the paxolin but adhesive can be used if necessary. Take care that Tr1 is so placed that drain, source and gate leads come as in Fig. 2. Tr2 is an n.p.n. audio transistor. Its leads are passed through small holes and soldered as shown.

Panel. This is 7×5in. and VC1 is fixed $2\frac{1}{2}$in. from the top edge by three short countersunk bolts. VR1, the bandswitch, and S4 are placed as shown. Two insulated sockets are provided for a.f. and r.f. output, a lead with plug being inserted in the required



General view of the generator. The paxolin panel carrying the majority of the components is mounted towards the top of the front panel.

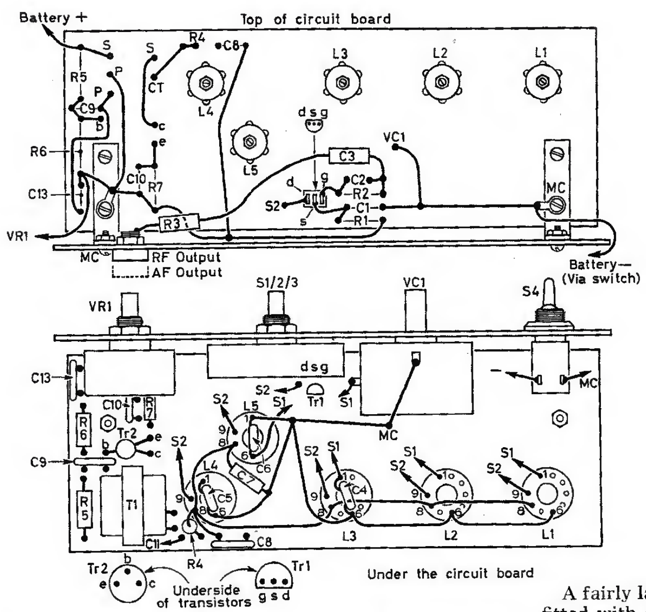


Fig. 2. Component layout and wiring of the circuit board from top and bottom. See text with reference to pins 1 and 6 on L5.

outlet. An earth terminal should also be fitted on the panel.

The circuit board and panel are fixed together with the brackets mentioned and wiring is then completed.

A stout lead from VC1 runs through the board, to the connection MC, Fig. 2. Short earth return leads also pass from VC1 directly to L4 and L5. C7 is soldered directly to tag 8 of L5, as shown.

Bandswitch. Tag connections are shown in Fig. 3. The type of rotary switch employed (Bulgin) has 6 positions, so adjacent tags were joined for L5, to avoid one "dead" position.

If there is any doubt about connections made internally by the switch, test for continuity with a meter. To avoid any possible errors here, it is probably easiest to fit and wire the coils as in Fig. 2, but to connect tags 1 and 9 of L1 only to the switch. Switch to the Band 1 position and test the signal generator by listening for its output with a receiver on the long wave band. If no results are obtained, look for a wiring or other fault, especially on the bandswitch. If results are satisfactory continue by wiring L2 to the switch, followed by L3 and the other coils.

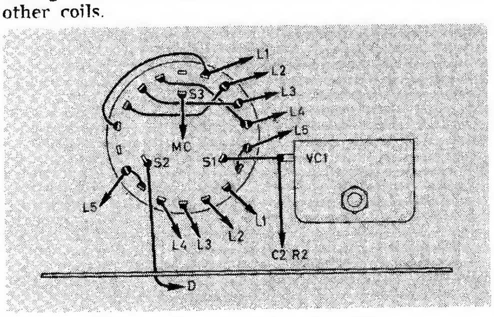


Fig. 3. Details of the band-switch wiring.

When wiring has been finished and operation and approximate band coverage has been checked, the case can be assembled. The flanged members are bolted together to form a box 5×7in. to which the panel is secured with self-tapping screws.

A clip to hold a PP3 9V battery is cut from metal strip and bolted to the bottom of the case. Positive and negative clips are soldered to the battery leads.

T1 is an audio driver type transformer. If it is found that the a.f. oscillator does not operate, reverse the leads to the primary. C13 governs the frequency of the tone produced and its value can be changed if necessary.

It is as well to leave the top off the case until adjustments have been made to the coil cores. These are then locked with 6BA nuts.

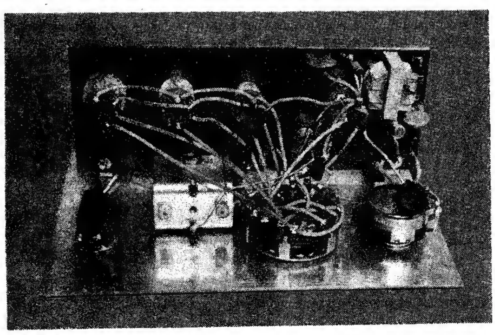
A fairly large knob is most suitable for tuning. It is fitted with a cursor with a hair line and frequencies are read on five semi-circular scales drawn on card. A check should be made that ranges overlap slightly, to give complete coverage. The case top is then fitted and four feet screwed to the case bottom.

CALIBRATION

If an accurately calibrated all-wave receiver is available, connect a short lead to the aerial socket and place a lead from the generator near this lead. Tune the receiver and generator together to various frequencies, marking these on the scales.

Should a 100kHz, 1MHz or other crystal marker be available, this will allow very accurate setting of the receiver.

If a calibrated signal generator can be borrowed, tune its signal in on a receiver, then tune the home-constructed generator to the same frequency and mark its scale.



A view underneath the circuit board; also showing the major components mounted on the panel.

When no other calibrated equipment is available, fit a 0-100 scale to the generator. Obtain several calibration points for each range, by tuning in known transmissions, or using harmonics. Mark these on a graph so that readings for 100kHz, 1MHz or other appropriate intervals can be taken from the graph and transferred to the appropriate scale.

★ components list

Resistors:

R1 2·7kΩ	R3 680Ω	R5 27kΩ
R2 1MΩ	R4 22kΩ	R6 4·7kΩ
	R7 1kΩ	

All ¼W 10%

VR1 5kΩ potentiometer, linear

Capacitors:

C1 0·01μF disc	C6 22pF SM	C11 0·01μF disc
C2 22pF SM	C7 0·01μF disc	C12 0·01μF 350V disc
C3 18pF SM	C8 0·047μF	C13 0·047μF
C4 22pF SM	C9 0·047μF	
C5 22pF SM	C10 0·047μF	

VC1 365pF air spaced variable (Jackson O)

Semiconductors:

Tr1 MPF102 Tr2 AC176

Inductors:

L1 Range 1 Blue	L4 Range 4 Blue
L2 Range 2 Blue	L5 Range 5 Blue
L3 Range 3 Blue	

All above for use with valves (Denco Ltd)

Cabinet:

Flanged plate, 2 off, CU147, 7 x 3in.
Flanged plate, 2 off, CU145, 5 x 3in.
Flanged plate, 2 off, CU168, 7 x 5in.
(Home Radio)

Miscellaneous:

On-off switch. 3 pole 5 way wafer switch.
Transistor holder (3-wire) for MPF102.
T1, audio driver transformer. Knobs. Feet.
Output Sockets (2).

Reversed connections to any feedback winding, tags 8 and 9, will prevent oscillation on that range. Should oscillation become weak towards the l.f. end of Range 5, the leads to tags 1 and 6 can be reversed as well as tags 8 and 9. This increases effective coupling and feedback.

The position of the coil cores also has some influence on oscillation, as well as band coverage. Should it prove necessary, the value of R4 can be changed, to adjust the drain voltage.

USES

To test a.f. circuits, work backwards from the output stage. When the faulty stage is passed, the signal will cease. The usual detailed tests then only need be made to this stage.

When aligning r.f. mixer or oscillator circuits, it is usually best to have the receiver volume control near maximum and to keep signal strength down by placing the generator lead to give suitable coupling to the ferrite aerial or aerial socket, or to a short wire in the socket.

Do not make any connection to any receiver or other equipment operated from the mains in which the chassis or other parts are connected directly to the mains. ■

Electronotes..

S. GINSBERG

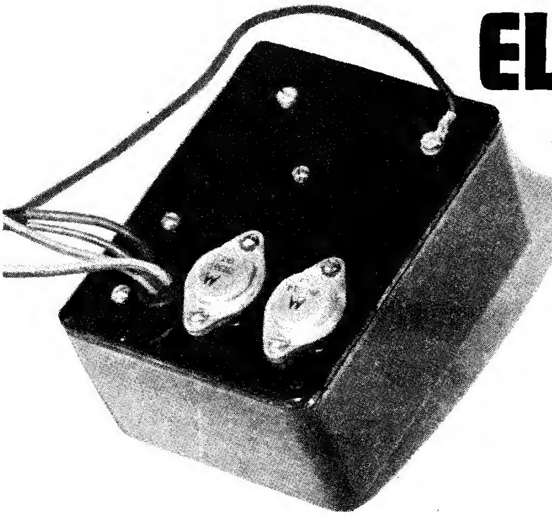
IT is a never-ending source of wonder that the makers of integrated circuits seem to be able to get more and more devices on smaller and smaller substrates. The very latest from this wonderland of semiconductorian Lilliput is an m.o.s. (metal oxide silicon) chip or substrate which performs all the digital functions required for a five-digit panel meter.

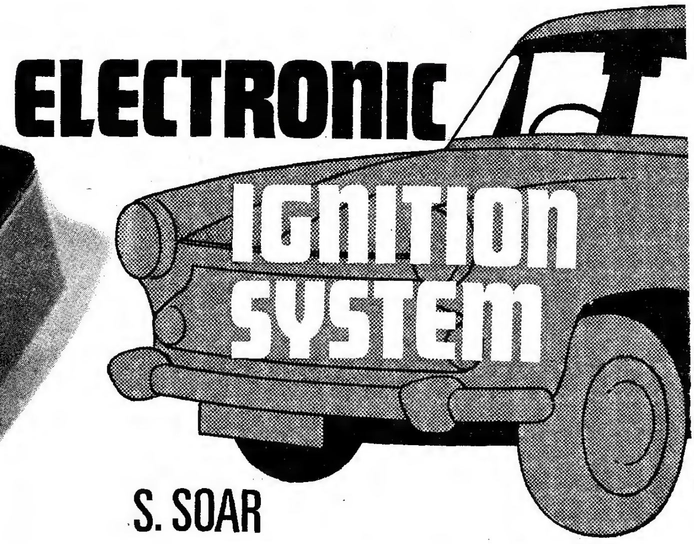
Packaging is a 30-lead dual in-line configuration which is hermetically sealed. This chip incorporates five decade counters, four further binary shift registers, 20 shift register stages acting as buffer storage, 13 further shift registers, 12 set-reset bistables and some 70 other gates of various complexities. There are over 1,000 m.o.s.t. devices on the chip which measures an amazing 0·137 inches by 0·117 inches.

Besides the counting logic and buffer storage, this chip also accommodates automatic over-range and under-range indication. Thus, if a meter is clipped onto a piece of equipment which provides, across the test points, say, 500V, then the auto-ranging circuitry will ensure that the meter is automatically set to the correct range to accommodate this.

To replace this chip with TTL devices, commonly housed in 16-pin dual in-line packages, you would need around 20 of them. If you now multiply 20 (the number of packages) by 16 (the number of leads which need to be mounted and soldered) you arrive at 320. In terms of production and number of individual joints, compare the 320 with the mere 30 required for the new chip and you will appreciate the advantages of the device.

Do you own a motor car? Where is it now? Are you sure? The safety of a motor car is often a very precarious thing. When you go into the cinema and leave your car outside, there is no real guarantee that it will be there when you come out. Supposing it were stolen or interfered with half way between Peyton Place and Coronation Street while you were watching the Tele. Now you can be sure and take steps to prevent your precious mobile being touched. A company in Britain is making an ingenious device which you can carry, unobtrusively, in your pocket. Directly any one switches on the ignition of your car, a bleeping alarm sounds to let you know. But don't panic. When the bleeping starts, all you have to do is to flick a switch on your receiver. This will immediately make the ignition system in your car inoperative. This could be a winner for preventing crime and shows another application of electronics. It's getting so's an honest crook can't make a decent living anymore.





ELECTRONIC IGNITION SYSTEM

S. SOAR

THE car ignition system is often neglected by the enthusiast who, whilst spending considerable effort to enhance his car's performance with the addition of special carburettors, manifolds, pistons, cam-shafts, etc., often writes off the electrics with perhaps the addition of a sports coil.

The unit described has many advantages over the usual coil ignition system, the principle being the now well-accepted 'capacitor-discharge' system. Although the advantages make this system of particular interest to the competition motorist, the average motorist might well consider its adoption for the advantages of less maintenance, reduced petrol consumption and easier starting in below-zero conditions.

Some of the advantages of capacitor discharge over the normal inductive discharge ignition can be listed as follows:—

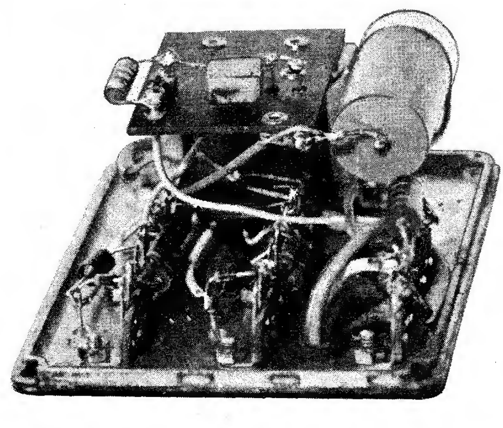
1. Easier starting especially in very cold or damp conditions.
2. Increased combustion efficiency resulting in improved performance and economy.
3. Ignition remains 'in tune' over a much wider range of contact breaker and plug gap settings.
4. Erosion of contact breaker and plug electrodes virtually eliminated, resulting in these components having a life of some 4 to 6 times normal expectancy.
5. Misfiring due to contact breaker bounce at high speed eliminated.
6. Rise time of the output high voltage pulse is typically 2 to 5 microseconds in comparison with 100 to 200 microseconds for inductive discharge systems. Leakage losses due to fouled spark plugs, moisture on leads and distributor cap, etc., are therefore much reduced and less energy is absorbed in these losses.
7. Voltage at the contact breaker is reduced from around 300 to 12 volts; failure due to breakdown of capacitor or insulation is therefore virtually eliminated.
8. Coil does not overheat if the ignition is inadvertently left switched on with the engine stopped.
9. The engine can be easily cranked or push-started by connecting a 6 volt dry battery in place of the accumulator.

Other less obvious advantages include longer battery life, less strain on dynamo and reduced wear on starter motor and gear brought about by easier starting especially in sub-zero conditions.

The system has been designed around the standard coil and contact breaker to facilitate easy interchange of the two systems.

DESIGN

Basically the unit consists of a convertor which generates around 450 volts and charges a storage capacitor. A silicon controlled rectifier is then triggered to discharge the stored energy into the ignition coil. Referring to Figs. 1 and 2, it can be seen that, with the s.c.r. triggered, C1 and the coil form an oscillatory circuit and as the current swings to zero,



This photograph, with the heading photograph, shows the general method of construction. Component layout is not critical.

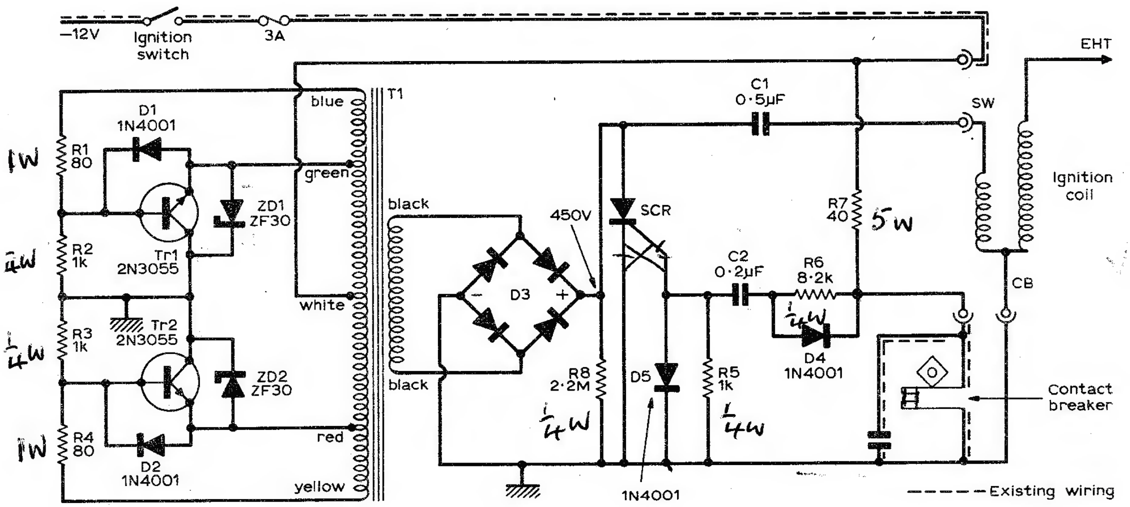
the s.c.r. turns off, current can no longer flow and energy remaining in the circuit is stored in C1. The convertor increases this charge and the cycle is complete.

The use of 'backswing' to partially recharge C1 increases the efficiency and a convertor capable of 30 to 40 watts is adequate for engines of up to twelve cylinders.

In designing the convertor it was decided that the following characteristics were desirable:—

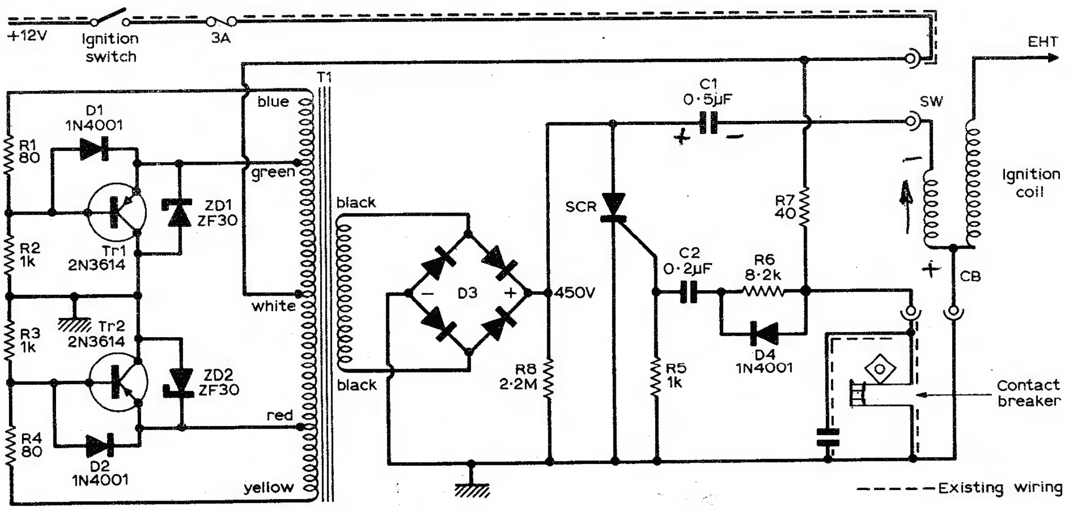
1. Overshoot should be controlled and utilised to charge C1 to a high value with engine speed low and decreased battery potential on starting.
2. Frequency of operation such that transformer is reasonably small and low priced.
3. Mechanical construction to be simplified by adopting a common collector circuit and mounting the power transistors directly into the case side, thus overcoming the complication of insulation and improving heat dissipation.
4. Because the s.c.r. imposes an intermittent short on the convertor, some form of protection is necessary. A transformer with moderate leakage reactance fulfills this requirement by causing the convertor to operate at a much higher frequency during short circuit conditions. It was noted that the change from short circuit to normal operation occurred instantly, thus overcoming the disadvantage of many inherently short circuit proof convertors which cease oscillating on short circuit and have a delay before restarting.

Zener diodes ZD1 and ZD2 were chosen to limit the overshoot voltage to a safe level. Omission of



▲ *Fig. 1: Circuit of the unit for use with cars having a* **positive** *earth system.*

▼ *Fig. 2: This circuit is intended for use with* **negative** *earth systems.*



these components would result in Tr1, Tr2, C1, D3 and the s.c.r. being subjected to excessive voltage. Diodes D1 and D2 protect Tr1 and Tr2 from being reverse biased.

THE TRIGGER CIRCUIT

A major feature of the trigger circuit is that misfiring due to contact breaker bounce is eliminated. Diode D4 transmits the trigger pulse via C2, C2 then discharges through R6 thus forming a delayed recovery. Fig. 3 shows output from contact breaker when bounce occurs and voltage available to trigger s.c.r.

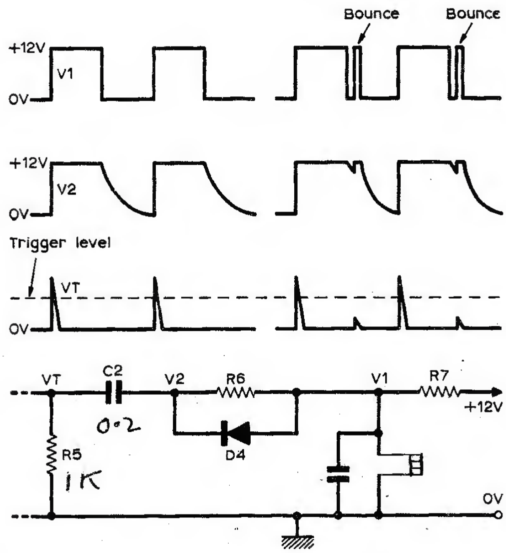


Fig. 3: The waveforms, upper right, show the spurious pulses due to contact breaker 'bounce' in conventional ignition systems. The waveforms, upper left, indicate the clean triggering pulse obtained with the capacitative-discharge system.

★ components list

Resistors

R1	80Ω 1W	R5	1kΩ ¼W
R2	1kΩ ¼W	R6	8·2kΩ ¼W
R3	1kΩ ¼W	R7	40Ω 5W
R4	80Ω 1W	R8	2·2MΩ ¼W

Capacitors

C1 0·5μF 600V — C2 0·2μF 100V

Semi-conductors

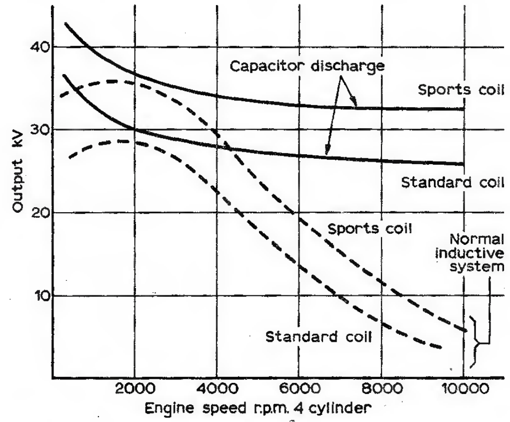
Tr1, Tr2 **Positive earth system:** 2N3055
Negative earth system: 2N3614
(Obtainable from Jermyn Industries, Sevenoaks, Kent.)
D1, 2, 4, 5 1N4001 D3 Bridge Rectifier (4 x BY100)
ZD1, 2 ZF30 (30V 400mW)
SCR CRS1/40 (400V p.i.v. 1A)

Transformer

T1 Type P1/6 (Available from Magtor Ltd., 68 Dale Street, Manchester. £1·50 inc. p/p.)

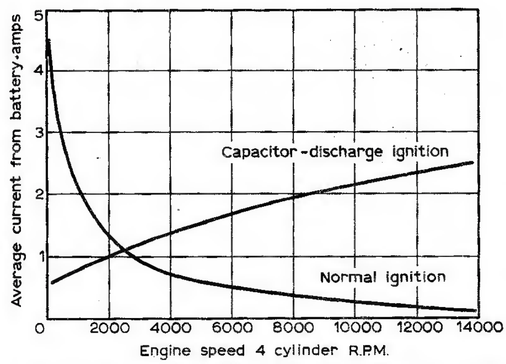
The prototype was bench tested with a conventional contact breaker, motor driven, and a 10cm diameter sphere gap used to compare maximum output voltage of capacitor discharge ignition and inductive discharge systems. Fig. 4 shows the result obtained with a battery potential of 14V. Output was measured at reduced battery potential, and at 7 volts (normal for starting in freezing conditions) spark voltages of approximately 30kV for c.d.i. and approximately 10kV for inductive discharge were recorded.

Since the engine requires some 10 to 15kV minimum on starting this latter figure demonstrates why many cars suffer from grinding paralysis in cold weather.



▲ *Fig. 4: Comparison of coil output against engine speed for standard and sports coils for both systems of ignition.*

▼ *Fig. 5: This graph illustrates the greatly reduced load on the battery with the c.d. ignition system.*



It can be seen from Fig. 5 that the demand on the battery with c.d.i. is very much less at starting. In fact, with c.d.i. the engine can be cranked or push-started with a 6V torch battery in place of the 12V accumulator, whereas the coil ignition system requires a supply capable of supplying a considerable current.

CONSTRUCTION

Construction can follow any number of variations, the prototype being constructed in a diecast case $4\frac{1}{2} \times 3\frac{1}{2} \times 2$in. Points worth noting are that part of the circuit is low voltage and part operates at up to 450V, so adequate insulation must therefore be used and care taken to appreciate the shock hazard if the unit is operated with cover removed.

A certain amount of heat is generated especially in the transformer core and it is therefore advisable to mount the completed system away from the exhaust manifold. The addition of cooling fins to the exterior of the case was found to be an advantage if the unit is used on 8 and 12 cylinder cars where the demand on the system is greater.

In use it was found to be advantageous to increase plug gap setting to around 0·050in. Starting is definitely improved, so, too, is acceleration and flexibility. The prototype has completed some 8,000 miles and approximately 500 hours of bench testing at a simulated engine speed of 9,000 r.p.m. (4 cylinder). ■

PROJECT Autumn

1971

This year we shall be sponsoring another Project Autumn competition. The rules have been amended so that the PW "Designer's Trophy 1971" will be awarded to the author of the best constructional article published in PW issues dated July 71 to March 72 inc. This allows submitted articles to be published as soon as possible and for authors to be paid without delay.

Full details and rules in the July issue of PW, on sale 4th June.

SUBMIT YOUR ARTICLES NOW

MAXWELL

by G8DSH

THE MW COLUMN

MAY to July is the season for receiving medium wave stations in East and South Africa. Listen from 0200hrs GMT until sunrise for Johannesburg 1286kHz and Bloemfontein 782kHz. Although never strong, Johannesburg is consistent throughout the summer and has been logged by a number of DXers in the UK. Lourenco Marques 917kHz in Mozambique is another regular. It broadcasts in English but can only be heard before 0300hrs when European interference starts to become troublesome. Further north in Zambia, Kitwe on 1070kHz has been heard signing on at 0255hrs. Others from this area that sign on at 0300hrs are Dar es Salaam, Tanzania on 656kHz; Nairobi, Kenya with 100kW on 746kHz and Mbali, Uganda 638kHz. The BBC Eastern Relay on 1410kHz is located on Masirah Island in the Arabian Sea to the south of Muscat and Oman. This station broadcasts for most of the night in Arabic, Persian or Urdu and is often heard in this country.

E. Cox of Downpatrick N. Ireland asks for details of books that cover MW DXing. The few on DXing that are available are concerned mainly with the short waves, though "How to Listen to the World," published by the World Radio and TV Handbook Co, Copenhagen, does devote some space to the MW's as well. Practical Wireless occasionally has articles on MW DXing; the most recent was in April 1970 while constructional details of the PW Medium Wave Loop appeared in November 1966. Back issues can usually be obtained by advertising in technical or club magazines. There are also a number of DX programmes that give news and information on the medium waves. The English version of "Sweden Calling DXers" is on 1178kHz at 2245hrs GMT every Tuesday and includes news about the MW's and events on international matters. "DX Juke Box," a weekly programme of Radio Nederland has a MW feature on the 4th Thursday of the month. Details are available from Postbus 222, Hilversum, Holland. Deutschlandfunk 1286kHz carries "DX Circle" at 1800hrs on alternate Wednesdays. This programme is presented by Alan Thompson, Secretary General of the European DX Council and it covers both medium and short waves.

Brazil is well represented on the medium waves during the summer, stations in Rio de Janerio and Sao Paulo being particularly prominent. Although they can be logged from midnight onwards they are at their best in the half hour before sunrise. Portuguese is the language and the majority are commercially owned, usually by local newspapers who give their name to the station. Callsigns are allocated but seldom used over the air. Look for PRA3 Radio Mundial on 860kHz; PRF4 Radio Journal on 940kHz; PRE8 R. Nacional 980kHz; PRE3 R. Globo 1180kHz; PRG3 R. Tupi 1280kHz; all in Rio. From Sao Paulo there are PRB9 R. Record 1000kHz which has been heard in English; PRG2 R. Tupi 1040kHz; PRG9 R. Nacional 1100kHz. Other cities heard include Belem with ZYE25 R. Dif. Liberal on 1330kHz and Belo Horizonte with PRH6 R. Guarani 1340kHz. PRH6 verifies readily with a QSL card and pennant.

Charles Molloy

COMMERCIAL RADIO...

IN about two years, if Government plans go through, the first commercial radio station on the British mainland will take to the air and the BBC monopoly in sound broadcasting will be no longer.

How these stations will develop, what their programming will consist of, and who will listen to them is a matter of conjecture but a mass of information from overseas is available and from this we can at least make a good guess as to what will happen.

The White Paper

The Government's White Paper—and remember that it is as yet only a proposal and not legislation—lays down plans for *'up to sixty'* local commercial radio stations financed entirely by spot advertising.

The paper makes it quite clear that these stations should be essentially local in character and that the programmes should be concentrated on local interest. Locally produced programmes will fill the majority of the schedule, though it is suggested that the stations could be linked for the networking of *'news, music and other programmes.'*

The overall authority over these stations will be vested in a revamped ITA which at present operates the transmitters and controls, to a certain degree, the ITV programme companies. This will be renamed the IBA (Independent Broadcasting Authority) and although other sections of the lay press seemed surprised at this, the original policy statement of the Government, while still in opposition (published in full in *Practical Wireless* May 1969) made it quite clear that this was planned.

The BBC loses a little by the proposals but on the other hand in certain aspects gains quite a lot. The BBC Radio 4 regional programmes in England would disappear on the medium waveband, being replaced by a single programme; Radio 1 on 1214kHz has set the pattern and shown that this can operate successfully. Three frequencies would be released for other uses by this, one of which will be allocated to the BBC Overseas Services.

On the other hand, medium wave frequencies would be allocated to all the twenty BBC Local Radio Stations so that, with the 60 proposed commercial ones, about 80 new stations will be fitted into the medium waves. In addition back-up channels on v.h.f. will be provided for the new stations and to this end the higher frequency end of Band II will be transferred from mobile services to broadcasting. This is the part of the band which at present is used by the police and other services.

IN BRITAIN

HALVOR MOORSHEAD

Programme contracts will be granted in much the same way as the present TV contracts. The IBA will select the company who *they* feel will best serve the particular area and will be responsible for vetting programme schedules and for the actual transmitters; for this the stations would pay a levy and presumably it would operate on the TV principle of charging a levy according to the station revenue, rather than on the cost of providing the service. Thus, small stations may well be provided with transmitter facilities below cost price, this being offset by heavy charges made on the larger stations.

Commercial stations would only be granted a franchise for a limited period and if they failed to live up to their promises, or another applicant appeared better, the franchise would not be renewed (as was the case in TV with TWW).

The stations would be introduced over a period, but, unlike the BBC Local Stations, the larger cities and conurbations would have the service first.

The Government White Paper also makes provisions limiting ownership of stations and suggests that local newspapers would have 'first refusal' for stations in their area, though outright ownership by local papers would not be allowed.

Massive profits, of the type that the commercial TV stations made in the early 1960's, are precluded in the White Paper.

Frequency Allocations

Until recently the Post Office and the BBC had denied that any frequencies at all could be found for further sound broadcasting stations in the medium waveband—this was of course the reason for shutting down the 'Pirates' rather than giving them frequencies. How is it then that 80 stations can be fitted in?

Two frequencies will be made available by the reorganisation of the Radio 4 wavelengths. In addition there are the two International Common Frequencies, 1484kHz and 1594kHz. Radio 3 would lose 1546kHz which is at present used for low power relay stations in certain parts of the country and be confined to 647kHz. Thus, before anything spectacular takes place, five new frequencies become available. In addition the Government intend to invoke Article 8 of the Copenhagen Convention (the international European agreement governing allocation of frequencies).

In simple language this allows member countries to broadcast on frequencies allocated to other countries as long as such transmissions do not cause interference and that the country using that frequency does not object. Far fewer frequencies are made available by this provision than may at first appear because of the chaotic conditions prevailing, but some frequencies at least can be found. Whatever happens, and however the stations are organised, it is certain that several stations will be sharing each frequency.

The White Paper suggests that major cities such as London will have more than one station and even puts forward the idea of London having two stations from the outset. 60 stations would allow for a coverage of 70% of the population of the United Kingdom and, roughly converted into siting, this would mean that most cities of 100,000 or more population would have a station.

By international standards this would make the local stations very large. In the USA there is a radio station for every 30,000 people, in Australia a commercial station for every 100,000 and 60 stations for Britain would mean one for every 900,000. These are only average figures but it does indicate that stations are not going to find it hard going and are unlikely to be run by the proverbial 'one man and a dog.' New York City alone supports nearly 60 stations and most of them make good profits so it can be seen that London, which is of a similar size, will have no trouble in supporting more than two stations.

Many areas will be served by several stations, even if there is only one station locally, as coverage is bound to overlap to such an extent that an average of three stations would be heard. This in itself is likely to damage the local identity of the stations. How will it be possible for a station in the Luton/Dunstable area (which will probably have a station) to be kept from aiming it's programmes at the Greater London Area where the audience might be twenty times that which they can obtain locally, enabling the station to charge vastly higher advertising rates? This is not covered in the White Paper and would be almost impossible to legislate against. This is a considerable weakness in the 'local' emphasis of the proposals.

Programmes

The critics of commercial radio say that the stations will be all "pop and ads", while the supporters say that first of all it doesn't matter and secondly that stations are bound to concentrate on local affairs.

Almost certainly some of the stations will concentrate on little else but pop music and hope to take away audience from Radio 1. They will probably be successful. To judge commercial stations on the "pirates" would be a mistake. Their very location made it almost impossible to put out anything but recorded music and of course the proposed stations will have no such limitations.

The second commercial station in any area may well find the potential audience for pop music very well catered for with Radios 1, 2 and other commercial stations and could well find the largest audience among the more traditional listeners. There is a strong tendency in the USA for stations to move out of the pop field and more and more are concentrating on news, talks and features. Those best at doing pop programmes are staying in the field but they no longer rule the airwaves as they once did. The BBC was very successful at combating ITV by changing their programme patterns and this will almost certainly apply to radio, making the competition for audiences even keener.

There is also the aspect of the BBC Local Stations. At present they are limited to an hour a day each of "needle time", that is the time that they are allowed to put out locally originated recorded music. The commercial stations will not be hampered by such restrictions (the White Paper makes this clear) and almost certainly the same rule will apply to BBC local stations—it would be unfair to expect them to be restricted by conditions not applicable to the new stations.

Local news and events do not seem to be popular features on radio (although the new stations may change this) and so it seems that we can expect almost anything in the way of programming. The audience that the BBC "Dales" programme attracted would be regarded with envious eyes by many commercial concerns. The audience for plays and news programmes is very high and commercial stations may well compete for this audience.

The field is wide open and although we can certainly expect a lot more broadcast music, there will be many other programmes catering for most sections of the community.

Finance

Commercial contractors will be responsible for selling time for spot commercials and naturally they will charge as much as they can for this. The amount of time that can be sold will probably be limited by the IBA to about six minutes an hour (the same as for TV).

A general guide is that for a 30 second spot, advertisers would be prepared to pay between 10p and 20p per thousand listeners (Manx Radio on the Isle of Man rates are about 15p per thousand). Thus stations in large conurbations may attract well over 100,000 listeners and could charge £10 to £20 per spot but if programmes were networked a programme attracting the audience that Tony Blackburn does at present could charge £500 for a 30 second spot (which is very cheap by TV comparison)!

From this it can be deduced that commercial radio will not be a place to sell your car or even for your local store to advertise it's bargains. The same money can be far better used in the local press.

Contrary to the general train of thought it is more likely that the advertisers would be mostly those who at present use TV or the provincial evening papers. Local papers generally rely on very local advertising—and to a large extent on classified ads—and these are not applicable to the much wider and less selective medium of radio.

There is little doubt that commercial radio, when it is fully developed, will be very big business and £30 million a year is the sort of figure we can expect.

Set Design

One can only hope that British industry rises to the occasion and meets the demand for new sets; for many people will have to get new sets. The fact that all the stations will broadcast on v.h.f. will, it can be hoped, give a fillip to this band. This is especially likely as reception after dark of the medium wave stations will be poor and the difference will become very much more apparent than it is at the moment. May we hope that this new market is met by decent and inexpensive v.h.f. sets made in *this* country rather than imports from the Far East.

All-in-all commercial radio will bring about major changes in many fields—from the nation's listening habits to the content of PW but we have still about two years to wait; the Government are thinking that the first stations will take to the air in the spring of 1973. Much may change in the meantime—Parliament has still to debate it and the Labour Party are opposed to the plans, but this is unlikely to stop it. We can only wait to see what happens. ■

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz • Times in GMT

THE postal dispute being over your reports are starting to get through again, the first one coming from new reporter **Howard Stephenson** of Newcastle-upon-Tyne. Howard does not mention what equipment he uses but he must have used more than his ears to hear:

4783 *Radio Mali* in French at 2145.
4800 *Radio Lara, Venezuela,* music at 2330.
4807 *St. Denis, Reunion,* ORTF relay at 2100.
4850 *R. Mauritania,* news in French followed by Arabic music, close at 2230.
4900 *Radio Juventud, Ven.,* pop music at 0000.
4910 *R. Conakry, Guinea,* 'La voix de la Revolution' news in French at 2300.
4940 *R. Abidjan, Ivory Coast* in French at 2250.
4995 *R. Brazil Central,* music and ads.
5015 *Windward Islands B.S.,* English at 2345.
5035 *R. Bangui, Central African Rep.,* English at 2045.
5047 *R. Lome, Togo* with African music at 2100.
15105 *R. Rural, Brazil,* Portuguese talk at 2100.
15225 *R. Cultura de Bahia, Brazil,* soccer, 2000.

Terry Gibbs of Swindon is a regular reporter to this page and this time his log includes:
4920 *R. Progresso, Honduras* at 0000.
9705 *Mexico* in English at 0015.
9655 *Thailand* using a new frequency and also on 11905.
11920 *Bucharest, Rumania* in English at 1500.
17820 *R. Ankara, Turkey* in Turkish every Sunday at 0605.

Nigel Milner of Sutton Coldfield has been tuning his Invicta, 5-valve superhet through the bands and has come up with the following stations:
9640 *R. Kuwait,* news in English at 1700.
9710 *R. Nederland, Bonaire* in English at 0800.
11720 *R. Trans Europe* in English at 1100.
11840 *R. Portugal* DX Club in English at 1900.
11880 *R. Mexico, XERH* with news at 2200.
15230 *BBC, Atlantic relay, Ascension Island,* 1700.
17885 *HCJB, Quito, Ecuador* in English at 2000.

J. Childs of Blackheath, London SE3 has had a Skyrover II receiver for one month; connected to a 100 foot long-wire it enabled him to hear:
6130 *HCJB, Quito, Ecuador,* Religious Service at 0800.
17705 *Radio Havana, Cuba* with news at 2015.
21590 *Radio Canada International* at 1835.
25790 *Radio South Africa* noted at 1000.

F. Wakeman of Basingstoke has a Philips 5-valve domestic superhet and a 100 foot long-wire brought him the following:

4990 *Radio Kiev, Ukraine* at 1930-2000.
5920 *Radio Kiev, Ukraine* at 1930-2000.
6095 *Radio Baghdad, Iraq* at 1800 and at 1930.
6130 *HCJB, Quito, Ecuador,* 0730-0830.
7120 *Radio Kiev, Ukraine* at 1930-2000.
7245 *Radio Austria* at 1000-1030.
9390 *Radio Tirana, Albania,* 1630-1700.
11755 *Radio Finland,* in Finnish at 2000-2030.

Graham Close of Diss in Norfolk is still using his "old GEC heap" but he has constructed an a.t.u. which has improved reception:

4823 *Hanoi, Vietnam,* announcements in English at 2225.
5058 *Radio Tirana, Albania* at 2100.
6540 *Pyongyang, N. Korea* in English at 1850.
7065 *Radio Tirana, Albania* at 1930.
9620 *Radio Cairo,* announcements at 1730.
9725 *Radio Haiti* at 1245.
9730 *Radio Australia* in English at 0800.
11735 *Radio Morocco,* music at 1500.
11740 *Radio Australia* in English at 1000.
11820 *Radio Trans Europe* at 1050.
11960 *AIR, Delhi* at 2030.
15250 *Radio RSA, South Africa* at 1755.
15300 *NHK, Japan* in English at 2130.
15345 *Radio Kuwait* at 1600.
15400 *Radio Kuwait* at 1600.
17885 *NHK, Japan,* Oriental music at 0700.
17890 *HCJB, Quito, Ecuador* at 2320.

Author's Note

The standard of reports sent to this page has been dropping noticeably over the last few months. I would, therefore, be grateful if all intending reporters bore the following points in mind:—

All reports should be in frequency order and the frequency should be given as accurately as possible. The full name of the station should be given together with the country from which it operates. The next item should either be details of the programme heard or the language used. The final item should be the time at which the broadcast was heard in **GMT.**

The equipment used is also of interest as it enables readers to make a comparison between their results and those of the reporter.

Reports should arrive by the **15th of the month** and be addressed to the author at **5 Ranelagh Gardens, Cranbrook, Ilford, Essex.**

ON THE SHORT WAVES

THE AMATEUR BANDS

David Gibson, G3JDG

Frequencies in kHz • Times in GMT

SUMMERTIME is aerial time, and, I hope, with the better weather, will come a renewed interest in that solitary slither of wire you claim to be the antenna. Funny things aerials, most of them are "suck-it-and-see" affairs, even the ones in the handbooks. A good thing about aerials is that it is seldom possible to do much damage to the receiver by trying out a different type.

How about spending a quiet evening to work out two different types of aerials to try this summer. Try and design your own. How about a short vertical loaded with a coil at the bottom. Try tapping the coil, tuning it in series with a capacitor and again in parallel with the same capacitor. See what difference the new aerial makes to reception. If you are really serious about aerials, and some amateurs make this fascinating field a favourite study, then you should number, amongst your treasured possessions, a grid dip oscillator and if possible, an antenna noise bridge.

One good way to begin is to measure yourself some electrical half wavelengths of coaxial cable at the particular frequencies of interest. Why half a wavelength? Because the impedance at one end of it will be repeated at one half wavelength further down the line. So, if you want to be sure that the impedance your cable sees up in the air at the antenna terminals is the same one your bridge is looking at on the ground, start slicing those halfwaves. Many circuits have appeared in *Practical Wireless* for grid dippers and both these and antenna noise bridges are sold commercially. Let me know how your wire wonders work.

From the Post

Letters received have given a few hints and tips on items picked up by the simple art of r.f. eavesdropping (Well done, spies). **Stephen Burrell** (Gosport) says that a new one to listen for on or around 14·25MHz is AX9YR located on Cocos Keeling Island. Daytime is apparently the best time to QRX. Note from **Gordon Mayer** (London), that it is not advisable to send a QSL card to TR8VW in Gabon unless it is enclosed in a sealed envelope with no mention of amateur radio or callsigns etc. on the envelope. Anyone hearing TR8VW and sending confirmation please observe this request.

Brian Gibson (Chelmsford—no relation), underlines an item mentioned in the R.S.G.B. publication Radio Communication in January. This concerns G3ZGO receiving permission to use slow scan television on 14MHz and 2 metres. A thought here for those who would like to try their hand at something different.

Two meters only had one pair of faithful earholes tuned to it judging from this month's postbag. **J. Roberts** (Wigan) Logged these around 144·41MHz on s.s.b.; G3BA, G3EHM, G3JWZ, G3PFR, G3UDA, G3UQH, GW3UCB/P, G3VNQ, G3VKV, G8ASG, G8BCG, G8CVB. Gear is homebrew using an f.e.t. converter and tunable i.f. Other gear includes equipment for 70cm. but the only station heard recently is GB3SC on 433·5MHz. How about a squirt of seventy cems from you licensed types?

Nicholas Hingley (Halesowen), uses a T28 and a Unica UNR-30. Antenna is 66ft. end-fed bagged; GD3GMH, GI3WFA, GM3YCM and GM3YRK on Topband all on s.s.b. Eighty metres produced; ON5DO/AP, K4ADY, MP4BLJ, PZ1CU, WA2HNO/TF, WA6EGL/TF, VE1BT, VE1HP, ZB2A, ZC4IK, ZM4KE, 6W8DY, 9H1BL. Nicholas is 15 years old and current plans include the building of a 144MHz receiver.

Who's bought themselves a 9R-59DS and finding it a "pleasure to operate"? Ten out of ten if you said **"Richard Mortimer"** (Cardiff). Previous receiver was an H.A.C. model DX. A Mortimer-type meander through the wilds of 3·5MHz revealed; CM2RX, DL8PC, EA3RF, HB9AVQ/MM, HR2GK, KZ4MU, LAØAD, ON5VT, VP7NS, W/SH, XE1KB, YN1HSM, ZL4KE, ZL4NH. Antenna is a quarter-wave inverted 'Vee' and the transmission mode, I suspect, was phone, probably s.s.b: *(Is there any other?—Ed).*

Stephen Kaye sends a drawing of his aerial as seen by an ailing wood pigeon. The configuration looks intriguing, somewhat reminiscent of a varicose vein on a Japanese beetroot. The AR88D gets the other end of this 250ft. affair shoved smartly up its aerial socket and as a result gave the following information of happenings on eighty metres; EA8GZ, MP4BHH, VE1EI, W5/LR/TF, ZB2A, 6W8DY.

The same set up was exposed to 14MHz (or vice versa) and the following stations heard; CR7IK, CT2AK, FG7XL, HR2WTA, KH6CF/TF, LU3DSS, M1B, PY1NBG, PZ2AC, TR8MC, VE1AIJ/M, VE3DBT, VE6AAV, VE8RCS, VP2VQ, VP7BJ, YV5CKR, ZE4JW, ZP5CF, ZS5XA, ZS6BLA, 4X4BL, 5Z4MO, 9H1CD, 9J2PV, 9Y4VV.

"By the time you receive this log I will have a 15 metre dipole", writes **Julian Iredale** (Llandudno). Meanwhile, back at the 132ft. long wire, the CR-70A and PR-30 responded to 14MHz s.s.b. signals from; CT3AN, EA6AL, JA1MIN, KL7HEU/P, SU1MA, VK5CI, VK6US, VP2MY, W6BH, W6JY, XE1PAY, ZL3FO, ZS4LF, 3A2FL, 4U1ITU.

S. Wainwright (St. Helens), 9R-59DS, PR-30, 100ft. long wire did an audio survey of fifteen metres. Results include; AP2KS, CR4BC, EA8GZ, EL9C, ET3USA, F9VN/P/FC, FG7XLI, HS1ABU, OD5BA, PJ9VR, TA1SK/P/4X, VQ9RK, W6MSM, 4Z4KM, 4X4VB, 5Z4GK, 5N2AAE, 7Q7BC, 9G1WW.

A lean time for contest types because the merry month of May doesn't seem to have a serious contest in it. Never mind, the break can be spent pliching up the receiver ready for National Field Day which takes place this year on June 5-6.

Logs, in alphabetical order please, to arrive by the 15th of the month to:
12, Gross Way, Harpenden, Herts.

PRIZE CROSSWORD

WIN A £10 VOUCHER

COMPETITION No. 2

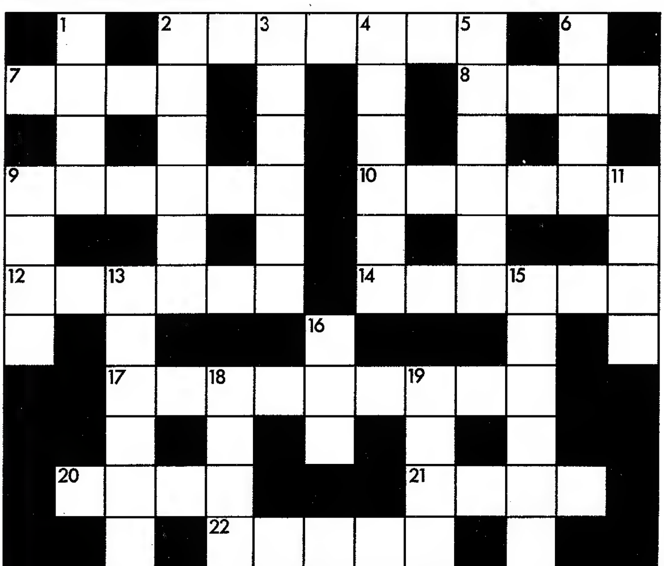
How to enter

COMPLETE the crossword below and you will have the opportunity to win one of **five** £10 vouchers, exchangeable with an advertiser in **Practical Wireless.** The prizes will be awarded for the first five correct solutions checked on the closing date.

Send the completed form, with your full name and address in block letters, and post it in a sealed envelope to: **PRACTICAL WIRELESS CROSSWORD COMPETITION, 1-2 Bear Alley, Farringdon Street, London EC4X 1AJ (Comp.)** to arrive not later than the closing date: **Tuesday 15th June, 1971.**

Rules

Entry is open to all readers in Great Britain, Northern Ireland and the Channel Isles, except employees (and their families) of IPC Magazines Ltd. and the printers of Practical Wireless. There is no entry fee, but each solution must be completed in ink or ballpoint pen on the proper printed coupon cut from Practical Wireless and bear the entrant's own full name and address. The Editor's decision in all matters is final and binding. No correspondence can be entered into. The winners will be notified and the result announced in the earliest possible issue of Practical Wireless.



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Full Address..

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Post to: PRACTICAL WIRELESS CROSSWORD COMPETITION
1-2 Bear Alley, Farringdon Street, London, EC4X 1AJ (Comp.).

Closing date: 15th June, 1971

Cut out along this line

Clues Across

2. What a nice girl and a common component do when under current pressures. (7)
7. Well, a penalty or is it's effect only marginal? (4)
8. This may well snare an unwanted frequency. (4)
9. A final one of these is not usually welcome. (6)
10. Old cable covering. (6)
12. Brings a change to it's senses. (6)
14. Put in an active microphone element. (6)
17. A midget's greeting at high frequency. (9)
20. None is disarranged to produce an inert gas (4)
21. Faraday's one was not designed to hold wild beasts. (4)
22. I suppose a transistor junction does this. (5)

Clues Down

1. A pure wave form familiar in trigonometry. (4)
2. Although they pass on they are still with us. (6)
3. He soldiers on but is left out to make a good join. (6)
4. Sounds very much like a style I used to play records.(6)
5. Instead of wandering off these capacities can be difficult to get rid of. (6)
6. This leads to two types of field. (4)
9. and 16. N (4,3)
11. A tax applied to spirits and tobacco and sometimes used with a cycle. (4)
13. Displayed by a numicator. (6)
15. Basic force. (6)
16. See 8 Down.
18. This part of the loudspeaker is often conically shaped. (4)
19. Spark paths. (4)

CROSSWORD No. 1
WINNERS and SOLUTION

The Practical Wireless Crossword Competition No. 1 (in the February issue) was badly affected by the postal strike. Because of this entries were accepted until a week after the postal strike had ended. The first five correct entries opened win a £10 voucher, exchangeable with any advertiser in Practical Wireless.

The winners of competition No. 1 were:

Mr. H. R. W. Thurlow
Gravesend, Kent

Mr. L. Reynolds
Bath, Somerset

Mr. W. Bamford
Hemel Hempstead, Herts.

Mrs. G. Rawling
Keighley, Yorkshire

Mr. S. Turner
Warrington, Lancs.

SOLUTION TO COMPETITION No.1

1C	■	2E	■	3M	■	■	■	4B	■	5S	■	6G
7R	A	D	I	O	S	■	8F	A	C	T	O	R
I	■	I	■	T	■	9D	■	F	■	O	■	E
10T	E	T	R	O	D	E	■	11F	O	R	C	E
I	■	O	■	R	■	C	■	L	■	M	■	N
12C	O	R	E	■	13R	E	G	E	N	■	■	■
S	■	S	■	14B	■	I	■	D	■	15L	■	16D
■	■	■	17V	A	L	V	E	■	18M	I	K	E
19S	■	20P	■	S	■	E	■	21S	■	M	■	T
22C	E	L	L	S	■	23R	E	C	E	I	V	E
O	■	A	■	C	■	S	■	O	■	T	■	C
24O	U	T	P	U	T	■	25E	F	F	E	C	T
P	■	E	■	T	■	■	■	F	■	R	■	S

Servicing—Part 2 *continued from page 137*

type, which means that the emitters must be returned to a positive source, and this occurs through R201 for TR201 and R203 for TR202. The collectors are returned to negative chassis potential.

Automatic gain control (a.g.c.) is applied to the base of each transistor, via R202 to TR201 and R204 to TR202. The potential for this is picked up from the ratio detector.

AUTOMATIC FREQUENCY CONTROL

Diode D202 is a varactor for automatic frequency control (a.f.c.). It shunts the v.h.f. oscillator inductor L204, in parallel with the trimmer C212. Reverse bias is obtained from zener diode D303 (bottom right of diagram) and applied through resistive circuits.

The ratio detector is returned to zener cathode through R325, while the varactor cathode is returned to the zener anode through R206, choke CH301, S7 and CH302. Static reverse biasing of the varactor is completed by its anode going to the zener cathode through S8 and R339.

The ratio detector (R606/R608 junction) is also connected to the varactor anode through R205, R305, S4 and R324.

Now, the two sides of the ratio detector mentioned represent 'points of balance,' so that when a station is tuned correctly the potential between the two sides is essentially zero. However, should the tuning tend to drift or be in initial error, then a positive or negative potential (depending on whether the tuning error is high or low) develops between the two points. This modifies the reverse biasing of the varactor in such a manner as to change its capacitance, providing tuning correction, (a.f.c.).

On a.m. a.f.c. is not required, of course, but a.g.c. is applied to TR302 from the a.m. detector, via R610 and R312. De-emphasis is given to the f.m. audio by R324 and C357, these components being out of circuit on a.m.

Switch sections S9, S10 and S11 are concerned with wavechange (long and medium) switching of the ferrite rod aerial, while S12, S13 and S14 change the wavebands of the a.m. local oscillator. This style of receiver thus contains two primary switching modes, for switching over a.m. and f.m. and for switching the a.m. wavebands. Some receivers have short-wave bands in addition to long and medium waves.

The audio section in Fig. 9 differs from that in Fig. 8 in that an n-p-n transistor TR304 is used to drive, from its collector, a pair of complementary output transistors, TR305/TR306. To get push-pull drive the bases of the pair need to be driven in the same polarity. This is because one is p-n-p (TR305) and the other n-p-n—hence the term complementary. The first audio transistor is TR303 and the set of four are d.c. coupled, with feedback (to reduce distortion and enhance frequency response) from the emitters of the output pair (where the speaker is connected) to the emitter of TR303. I shall be having more to say later in the series about negative feedback and about audio stages in general.

The Fig. 9 receiver is essentially for 9V battery operation, but the inset at the top right shows the circuit of a power unit for mains operation. This has a mains transformer with fully isolated primary and secondary windings (essential for safety), a bridge rectifier with a 500μF reservoir capacitor and a series regulator transistor with a base reference potential stabilised by a zener diode.

END OF PART TWO

practically wireless commentary by HENRY

No. 80

Durability

I WONDER what the world of five thousand years hence will think when they open the time capsule in Osaka Castle Park.

This was a collection of bits and pieces representative of 1970, including a photomask made by IC technology, a microbook and a plutonium timepiece, buried by Matsushita as part of their contribution to EXPO 70, in Japan.

If the whole exhibition, which covered a site of 815 acres near Osaka, gave contemporary visitors a feeling that H. G. Wells had been actively engaged on the overall design, and that the intention was to afford a glimpse of 'things to come', then future historians will scan the records and think us a very peculiar bunch.

One of our peculiarities is the economic value we put on electronic goods. Built-in obsolescence is a taboo phrase. Yet the logic of disposability is inescapable. With all our sophisticated techniques of mass production, it should be possible to make a cheaper version, though less rugged, of practically any piece of radio or electrical equipment. When it breaks, chuck it!

It should be—probably is: but we are not yet, as a society, ready for such techniques. We want our gear to last and last and last . . .

Henry was tickled to see an interview of Michael Holroyd a while ago in the S*ND*Y T*M*S.

Exploded in a photographer's face.

Philip Oakes had asked this eminent biographer about his electronic aids. Mr. Holroyd admitted that he could not get on with them.

'I have the sort of memory that tells me, eventually, that what I want is in the fourteenth drawer on the left-hand side.'

He was hesitant about photocopying. Someone had once told him that the ink faded in time. '. . . imagine that! Archives of blank sheets . . .' What if the timebomb explodes in Osaka Castle Park to reveal that the microdot has been overexposed to the plutonium clock and is now a mass of magnified squiggles? What *will* they think of us?

But the bit that got Henry was the reference to Mr. Holroyd's brief venture into tape recording. '. . . one exploded in a photographer's face and he was almost choked by the escaping tape.'

That wouldn't have happened with a Ferrograph. I've known them smoke a bit—but explode, never!

Some little while ago there was a flurry of panic amid the radio service fraternity, when one manufacturer, bringing out his range of 'packaged circuits', foretold the end of the diagnostic wizard. Armed with his AVO-meter (another item that seems to go on for ever, I may say) and extensive knowledge of the problems likely to beset wireless equipment, he happily pulled it to pieces on the kitchen table, waved his magic wand (25-watt Solon, not even a Weller, thermostatically controlled!) and departed to the strains of happy music.

In my business, I've had numerous requests to service such disposable items as Philips Popmaster radios, built around their printed circuit, designed neither to be treated roughly nor repaired. They are first-generation disposable items. Some of the IC designs we are seeing now follow along similar lines. You don't try and mend them.

What did Mrs. Henry donate to the jumble sale?

The irony is that many items we would like to see disposable—or, at least, dispensable—linger on forever, as unwearoutable as one's old Harris Tweed gardening jacket.*

To quote a *Daily Mail* leader of last Christmas, 'In spite of Biblical injunctions against possessions, there are some adjuncts to living we grow ridiculously fond of.'

Like a Williamson amplifier, for instance, the 'Premier' TV that actually worked first time, old jazz records, or an F.G. Rayer Shortwave Three. '. . . there is a range of household goods, the detritus of modern living, which annoys because we'd like to get rid of it but can't.'

Like my old wind-up gramophone, the mains-energised speakers that 'just may come in handy one day' and a few blocks of paper capacitors with screw terminals that would at least add mass to the loudspeaker cabinet if I eventually decided to use them as part of a crossover unit.

I'd dispose of them, sure; like I'd dispose of the Ferro 4A if someone decided to get rid of their Series Seven at a knockdown price. *That's* what Henry means by disposability.

*That reminds me. What *did* Mrs. Henry donate to the jumble sale last week?

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CARRIAGE £1·75

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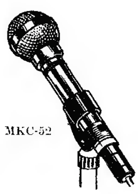
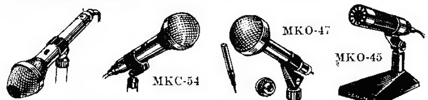
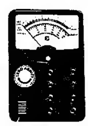
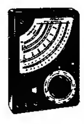
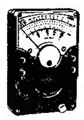
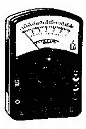
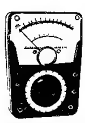


MKC-52



MKC-55 MKC-54 MKO-47 MKO-45

METER BARGAINS

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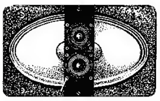

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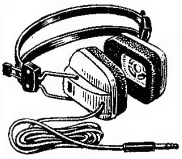

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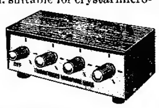

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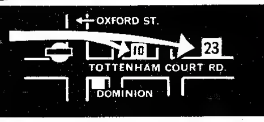


CRYSTAL BAND-EDGE MARKER

A.S. CARPENTER G3TYJ

ALTHOUGH many receivers in use at amateur and s.w.l. locations are fitted with a band-edge marker, many are not, and in these cases it becomes very difficult to locate any amateur band precisely. This is especially true if the receiver in use is of the general-coverage type. Ex-services receivers such as the CR100 for example fulfil the listening needs of many and, although some excellent specimens of this type are in use, their 'drifty' nature offers a further hazard to band-edge finding and retention.

In more sophisticated receivers designed especially for the amateur bands the problem is simplified by incorporating a built-in 'Marker' whilst a further refinement may be provision of limited panel control of the local oscillator frequency. Some receivers fitted with a marker are the Heath RA-1, Eddystone 888A and EA12 and the Star SR550. In the SR550 receiver, for example, one merely selects the desired amateur band, places the scale pointer at the l.f. band end and switches in the built-in calibrator—which uses a 3·5MHz crystal. The local oscillator is then made to fall into step with the marker signal by means of a panel-fitted 'Set' control.

The facility for accurate amateur l.f. band edge location, although useful to s.w.l's, is even more important to the c.w. transmitting fraternity and since the amateur c.w. segments are always low of those used for a.m. or s.s.b., precise location of l.f. band ends is essential.

Where no calibrator or marker is in existence, it is an easy matter to provide a self-contained unit that will enable the user to locate all amateur bands '80' through to '10' quickly and reliably. A pocket-sized, self-powered crystal controlled l.f. band edge marker can in fact be constructed in a single evening and will cost but £2 approximately after allowing inclusion of a new crystal of accuracy 0·005%.

Since the author usually finds it a chore connecting and disconnecting 'outboard' items it is a good plan to arrange for the Marker to be left permanently in position close to the receiver with which it is to be used. This is easily done and Fig. 1 shows how

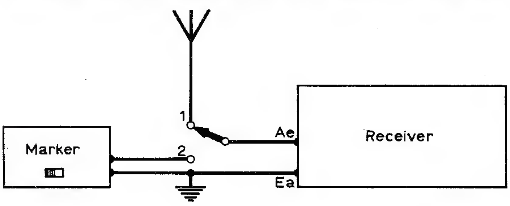


Fig. 1.

simple switchery can be employed to select either the aerial *or* the Marker at the same time permitting no Marker signals to reach the aerial direct. If a further switch section is added the d.c. power supply required by the marker can also be controlled. With these considerations in mind the simple Marker shown in Fig. 2 was evolved, the end product being found completely satisfactory for the purposes required of it. The device should not of course be confused with a Crystal Calibrator which is a more sophisticated item with extended facilities.

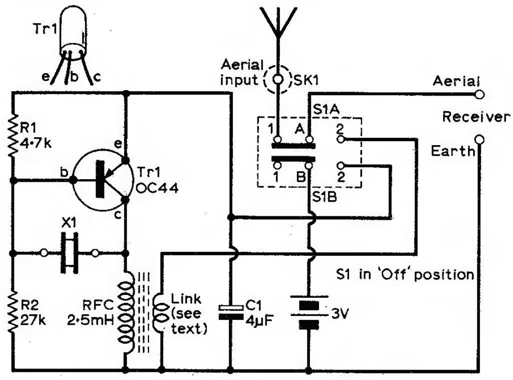


Fig. 2: The circuit of the band-edge marker.

CIRCUIT

Looking at Fig. 2 it is noted that oscillations are produced at the crystal frequency due to X1 being connected between base and collector of Tr1, output being developed across choke R.F.C. and thereafter inductively coupled for connection to the receiver. Depending upon the potential applied and the type of transistor used the current drain demanded is of the order of 2mA when the circuit is functioning from 3V. Prohibitively high current will flow if the circuit is in a non-oscillating state so this enables one to make a post-construction test using a test-meter set to read say 0-50mA initially.

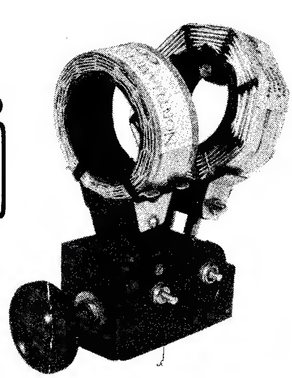
Switch S1 enables the user to leave the Marker in position near the receiver at all times. When S1 is in the position indicated, the aerial is fed direct through to the receiver and the Marker is 'dead'. Moving the slide switch to its alternative position disconnects the aerial and connects the receiver aerial socket to the Marker outlet at the same time applying battery power to the Marker. In this position a very strong marker signal will be received if the receiver is tuned to 3·5MHz whilst additional 'harmonic markers' will be tuneable at 7, 10·5, 14, 17·5, 21, 24·5, 28MHz and so on. The markers grow less strong as the receiver is tuned towards higher frequencies but detection is still easy even at 28MHz and higher. To aid recognition, the receiver b.f.o. and 'S' meter can be made use of temporarily.

Some of the harmonic markers available, viz: those at 10·5, 17·5 and 24·5MHz may be of little practical use to those interested purely in amateur band location and can be disregarded.

—*continued on page 161*

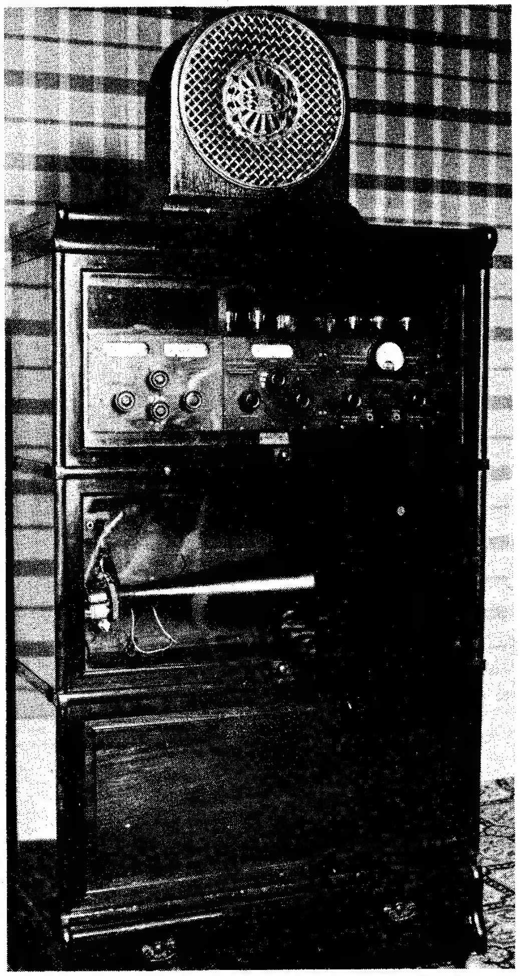
GOING BACK...

1970 60 50 40 30 20



COLIN RICHES
ARTHUR DOW

EDWARD Harrison of Rochdale, Lancashire, writes to tell us that the set in the photograph was manufactured by the Radio Communication Co., 34/35 Norfolk Street, London, W.C.2—their general range of sets being "Polar" Radiophones. Its type is RA33, 34, 35 and has seven valves. There were *originally* bright emitters—5 "R" or "ORA" and two "PA3" or "LS3". The present valves are PMX5X (Mullard) R5V, PM5X and two PM6's. The extension speaker on top is an Amplion brass fret and re-entrant horn. The three sections of the receiver can clearly be seen. They are h.f., i.f. and a.f. amplifiers. The three white slots shown are three interchangeable coils. The small plate on the bottom is engraved: "Supplied and fitted by Harry Crompton, Radio Engineer, 61 Cateaton Street, Bury". The next lowest compartment shows the Amplion 2kΩ loudspeaker unit with a slender horn reaching into the mahogany slatted sound box. The third and lower compartment contains the 6V accumulator—an Exide charger—a Philips h.t. only unit with valve rectifier and six h.t. tappings.



The last licence Mr. Harrison has knowledge of was in 1943 but after all these years with new accumulator, external wiring renewed, cleaning of tarnished contacts and terminals, the set works very well. It has, of course, the 9V grid bias battery.

It is interesting to note, he says, that The Radio Communication Co. was one of the original firms that formed the British Broadcasting Company Limited in 1923. This set must therefore be prior to 1927.

A few foreign stations can be tuned in after dark with the limited aerial (from window side to guttering).

He only has one complete set of coils—these cover 350-500m and means that he is at the moment limited to Radio 1. Also, Mr. Harrison is looking for two sets of coils—either Range 4A (1200-1800m) or Range 3 (1000-20000m). Can anyone help him?

W. E. Audio Amp.

We recently heard from Mr. Alan Douglas (the electric organ expert) that he was interested in the old Western Electric audio amplifier shown in the February "Going Back" article. He informs us that he has had several of these units from time to time.

Alan states that he had one of the first amateur stations in this country in 1912 and did a lot of experimental work on speech modulation of arc transmitters. He was also the designer of the first self-contained commercial portable radio set.

Alan goes on to say, "The Western Electric amplifier shown in the March issue reminds me of several interesting details. This audio circuit was designed

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2N1303	22p
2N1304	25p
2N1305	25p
2N1306	25p
2N1307	25p
2N1308	30p
2N1309	25p
2N1613	22p
2N1711	25p
2N2147	75p
2N2160	65p
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2N2219	32p
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2N2222A	37p
2N2369	20p
2N2484	35p
2N2646	50p
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2N3820	60p
2N4058	17p
2N4061	15p
2N5457	35p
2N5458	37p
2N5459	50p
2S301	50p
2S302	50p
2S303	60p
2S304	75p
40250	50p
40361	55p
40362	60p
AAY30	10p
AAY42	15p
AAZ13	12p
AAZ17	10p
AC107	37p
AC126	25p
AC127	25p
AC128	25p
AC176	25p
AC187	30p
AC188	30p
ACY17	30p
ACY18	25p
ACY19	25p
ACY20	22p
ACY21	22p
ACY22	17p
ACY39	50p
ACY40	15p
AD140	50p
AD149	50p
AD161	37p
AD162	37p
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AF116	25p
AF117	25p
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AF124	25p
AF125	20p
AF126	17p
AF127	17p
AF139	30p
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AF180	52p
AF181	42p
AF186	40p
AF239	42p
ASY26	25p
ASY27	32p
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ASY29	30p
ASY67	47p
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BC149	20p
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BC178	25p
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BCY30	25p
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BCY33	25p
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BCY43	20p
BCY58	25p
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BF197	15p
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BFW87	25p
BFW88	23p
BFW89	20p
BFW90	22p
BFW91	20p
BFX13	25p
BFX29	30p
BFX30	32p
BFX37	32p
BFX84	30p
BFX85	40p
BFX86	32p
BFX87	32p
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OA73	10p
OA79	10p
OA81	10p
OA85	12p
OA90	10p
OA91	7p
OA95	7p
OA200	7p
OA202	10p
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4004	400	4 amps	80p	75p	70p	65p
6004	600	4 amps	90p	80p	75p	70p
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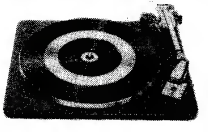

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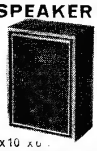

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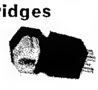

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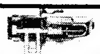

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to drive the Western Electric balanced armature 750 ohm loudspeaker, which appeared in two forms; one to stand on a table with a vertical ebonite horn; and the circular "Kone" instrument, which remained in use for many years. The balanced armature movement operated a circular varnished linen corrugated diaphragm only 2in. in diameter but it was so efficient that ten of these units, connected to square section wooden horns, covered the whole of the Wembley Exhibition in 1924.

Incidentally the gain of the Western Electric amplifier was varied by tappings on the secondary of the input transformer, and the thoriated ribbon filaments of the 216A valves, though glowing like indirectly heated cathodes, were in fact extremely low temperature "bright emitter" valves. The vacuum in these was so good that up to 800 volts could be applied, and they were often used as transmitting valves.

I wonder how many readers can recall other audio curiosities *before* the time of valve amplifiers? Can anyone remember the Brown Frenophone? A slowly rotating metal cylinder was partly encircled by a cord on one end of which was a Brown "A" type earpiece; the other end was attached to a carbon microphone capsule. The idea was that the signals from the "A" type reed pulled the cord, but the friction from the cylinder caused the stretch to be amplified and this made the carbon button give out an enhanced replica of the signal. Much distortion, and not so good as the original Brown microphone amplifier, in which a larger version of the "A" type reed drove two microphone buttons in push-pull, the output being combined in a transformer. Incredible though it may seem, this device was actually used in aircraft as a speech amplifier in the earlier days of the 1914/18 war. The differential carbon button microphone was later extensively developed by the Western Electric Co., many being used by the BBC. I gave my first broadcasts on these from the Glasgow station 5SC in 1923/4.

Mention of the Cambridge experiments with G9BIB and the earth rods reminds me of the power buzzer, used in the first war. The object of this was to create so much interference that no enemy trench radio set could operate. This it certainly did! The device weighed some 8lbs and rapidly exhausted any accumulator fated to energise it. Two massive pole-pieces carried windings after the style of an induction coil but capable of giving heavy currents at many hundreds of volts. Two bayonets were inserted into the ground to form a V about 50/60ft. in length, then connected by telephone wire to the buzzer. An immense interference field was set up in this primitive directional array. Interference was in fact the order of the day at that time, some observation aircraft actually having spark transmitters.

Other curios I have had from that period included a Newton airship rotary converter, 12V to 1200V; one of the beautiful Newton propeller-driven 300Hz aircraft alternators; and the 6 valve RAF Mk. 10 receiver with remote control."

Crystal Band-Edge Marker *—continued from page 157*

The prototype Marker is completely self-contained and is built into a tobacco tin. Since it uses a HC6U type crystal there is adequate space but if a FT243 based type or if a different battery is preferred a larger tin is recommended.

The oscillator proper is accommodated on a piece of 0·1in matrix Veroboard which requires no preparation whatever; it should have a total of six conductor strips each possessing seven holes. The crystal holder is soldered direct to two of the strips at one end over two holes; leadouts emanate from the end opposite.

The layout used is shown clearly in Fig. 3 together with all wiring. It is important when soldering items in position to take sufficient care to bend over slightly various lead-outs on the conductor side; simple 'spot-joints' will eventually prove unsatisfactory.

Miniature items are used throughout and in order that the lid can be fitted on completion the transistor 'shell' is carefully laid on its side. Resistor R1 is initially mounted vertically as shown inset then later bent slightly to one side so as not to foul the lid.

The only item to be modified is the R.F. choke and on to this some six turns of fine d.s.c. copper wire (stranded wire is not suitable), as is to be found on some discarded tuning coils, is wound centrally; the ends are fed to the holes indicated.

The completed Veroboard assembly can be secured to the tin interior either by glueing the crystal holder to it with Araldite or by using a stiff copper wire soldered to it from the conductor strip nearest the battery. A piece of stiff card should also be glued to the tin interior to lie directly underneath the Veroboard assembly to act as a simple insulator in case of accidents. The locations of the battery, aerial socket, switch and outlet grommet are clearly indicated.

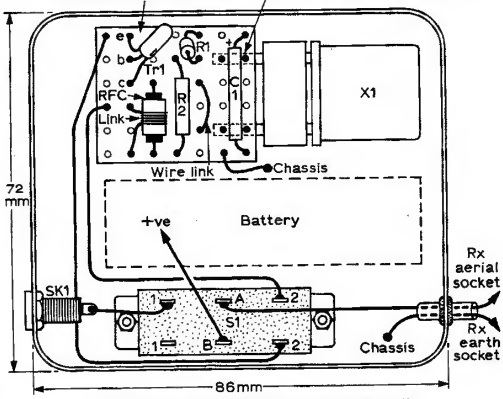

Fig. 3: Suggested layout inside a tobacco tin.

TESTING

Initially a meter should be inserted in a series with the battery and the current drain checked as was mentioned earlier and/or the output may be coupled to a suitable oscilloscope if available. If all is well the aerial may be removed from the receiver and applied to the Marker socket SK1, the leads from the Marker being connected to the receiver aerial and earth sockets.

When the Marker switch is placed at position '2' strong signals should be locatable on the receiver at the frequency points listed earlier. Moving the Marker switch back to position '1' will reconnect the aerial to the receiver which will then function as normal. ■

CONCLUDING the

STATION FOCUS SIX

F. G. RAYER

Ferrite Aerial

THAT listed has two mounts which clip to the rod, and these are bolted as in Fig. 2. The winding L1 is for medium wave tuning, and L2 consists of six turns of 26 s.w.g. cotton covered or similar insulated wire, wound on top of L1, as in Fig. 2. L1 has wire ends, which are ready tinned and being of Litz wire are best left full length.

Wind excess wire at end 1 round the paxolin former, in the same direction as the winding L1, and secure with tape or adhesive, with a little slack to reach VC3. Wind end 2 in the same way, leaving about ½in. free. L2 is then wound on in the same direction as L1, and secured with tape or adhesive. Connect L2 to end 2 as in Fig. 2, and take a connection to the positive line at the frame of VC1/2. Place sleeving over the other end of L2 (lead 3) and take this to C3.

The bandswitch is 2-pole 2-way with two contacts unused. When it is in the 200kHz position, A and B close, Figs. 1 and 2, so that TC1 with C2 in parallel is placed across VC1 and L1. In this position C and D also close, so that TC2 is across L3 and VC2.

Alignment

Before first switching on, set R16 to near minimum resistance. Place a meter in one battery lead. Note the current taken, which may be around 6-8mA. With no signal carefully move the slider of R16 to increase resistance, until current has risen by about 4mA.

If no meter is available, tune in a signal and slowly move the slider of R16 until reproduction is clear and normal volume is obtained.

Bringing too much of R16 into circuit will increase the current taken by the output pair. With good volume, current peaks will be 30mA or higher.

When first testing the receiver, leave the collector end of R18 disconnected. With a signal tuned in, bring the free end of R18 into contact with the collector circuit, as in Fig. 3. If volume falls, and quality of reproduction improves, this is the correct phase, and the lead is soldered on.

Should volume increase, or oscillation or distorted reproduction begin when this connection is made, feedback is positive. To correct this, take the free end of R18 to the other collector of the output pair of transistors.

IF Alignment. IFT1 and i.f.t.2 each have two cores, while i.f.t.3 has a single core. These are best adjusted with a proper tool, or with a slip of paxolin carefully shaped to fit. A metal screwdriver is unsuitable, and in any case a wedge-shaped blade may break the cores.

To adjust by ear, tune in a weak signal, with VR1 at maximum volume, and rotate each core for best volume.

A high resistance voltmeter may be clipped across VR1, and the cores can be adjusted for maximum a.g.c. voltage.

Oscillator and Aerial. To adjust medium wave band coverage, set TC3 about half closed, nearly close VC1/2 and adjust the core of L3 to bring in 550kHz from a signal generator. Open VC1/2, and adjust TC3 for 1600kHz.

If no signal generator is available, adjust the core and TC3 until tuning in known stations shows that coverage is suitable.

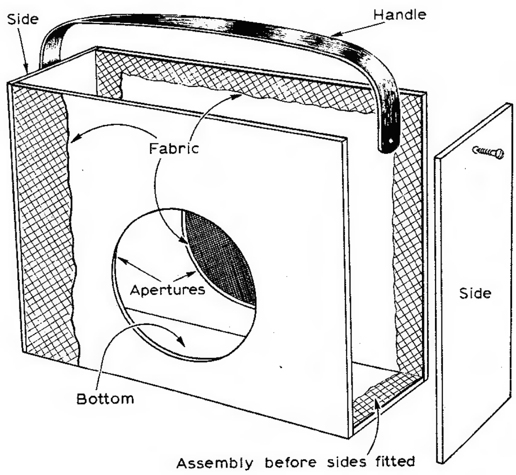

Fig. 4. Constructional details of the cabinet.

Tune in a signal with VC1/2 nearly full open, and peak signals with VC3. Then find a transmission with VC1/2 almost closed, and slide L1 along the ferrite rod for best results.

Check that VC3 can be rotated to peak signals on any frequency, with the aerial closed or extended. VC3 should not need to be fully open, or fully closed. If it is, adjust TC3 and the position of L1 until VC3 never needs to be at either minimum or maximum capacitance.

Switch to 200kHz and set VC1/2 about half-closed. Rotate TC2 to tune in the BBC on this frequency, and peak the aerial circuit with TC1. VC1/2 will then tune a narrow band around 200kHz.

Cabinet Construction

The cabinet is made in the form of an open-topped case, into which the receiver is lowered, Fig. 4. Internal dimensions must be a little oversize, so that

continued on page 166

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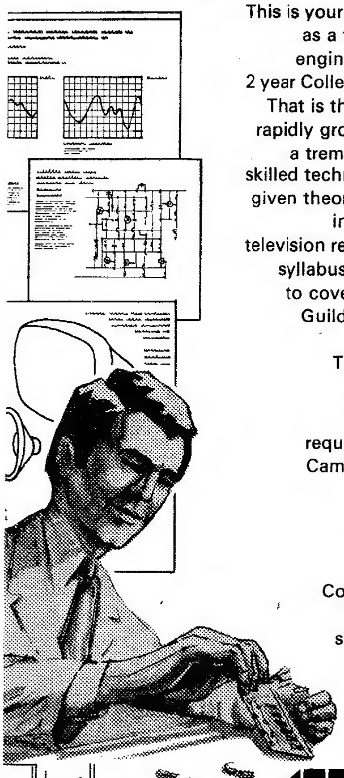

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I.C. OF THE MONTH

L.A.J. IRELAND

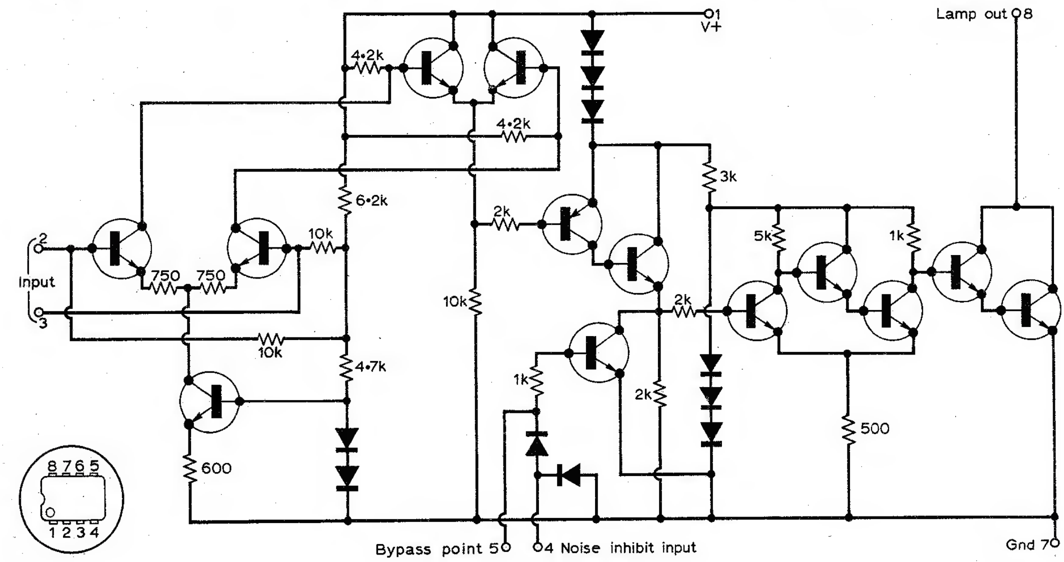
Number 20 The Motorola MC 1335P FM/TV Tuning Indicator

TUNING indictors for standard a.m. radios are very simple; the receiver generally incorporates an automatic gain control system, which monitors the mean amplitude of the incoming signal and by means of a voltage bias adjusts the gain of the i.f. stages to avoid overloading the detector. Any device which indicates visually the presence of this a.g.c. bias voltage is an effective tuning indictor. In the old days with valve radios, one simply applied the a.g.c. voltage to the grid of a miniature cathode ray tube; transistor sets may employ a buffer transistor driving an "S" meter or a lamp. A tuning indicator is more useful, but less simple with f.m. systems, such as that used in v.h.f. broadcasting or for the sound channel of 625 line TV, where the difficulty of accurate tuning should by now be evident to every viewer. It is precisely to cope with this problem that Motorola have introduced the MC1335P integrated circuit.

First, an examination of the principle of operation of the unit. It is intended to function in a ratio detector circuit, which demodulates an f.m. signal by producing a voltage output dependent on the deviation of the applied frequency at any instant from the resonant frequency of the circuit. Since the frequency swings above and below the carrier frequency, it follows that when the circuit is correctly tuned to an incoming signal, the voltage produced by the ratio detector averages to zero, while any detuning produces a standing d.c. potential, whether positive or negative. It follows that a circuit which identifies a null voltage will prove an acceptable f.m. tuning indicator.

The circuitry on the MC1335P chip is illustrated in Fig. 1. It is evidently based on the differential amplifier principle, familiar by now from a number of examples already examined in this series of i.c. notes. It is followed by a Schmitt trigger, a circuit in which the output transistor is either saturated or cut off depending on the input conditions. At any time when the input is zero, the trigger is saturated, and a lamp in the collector circuit of the final transistor pair will light. The potential produced across the ratio detector by even a slight detuning will switch the trigger circuit, cutting off the collector current to the lamp. It must further be remembered that there is another condition in which the ratio detector will produce a null output, and that is when no signal is

Fig. 1. With the transistors encircled, this circuit should help in following the operation of the MC1335P.



being received. Some may prefer to operate the indicator in this mode, in which the lamp is extinguished as a station is approached, lighting again as perfect tuning is achieved. However, the designer of the circuit added a refinement which permits the extinguishing of the lamp under "no signal" conditions also. When no station is tuned in, the 'front end" of the tuner and the i.f. amplifier stages will produce their own device noise, together with the inevitable random aerial noise. Since these effects are random, the effect on the ratio detector must result in a d.c. null output, but an r.m.s. a.c. value can still be applied to the noise level. If applied to pin 4 of the i.c., this a.c. will be rectified by the integral diodes and smoothed by the capacitance at pin 5, to produce a d.c. bias on the associated transistor. The trigger will be cut off and the lamp extinguished. In many cases, particularly in TV applications, the '"no signal" noise level will be sufficiently high to operate the inhibit circuit directly; higher quality audio systems will require a noise amplifier as shown in the practical circuit of Fig. 2. Again, individual experiments may be necessary to determine how elaborate a noise amplifier is required; a single transistor stage may suffice, or alternatively one of the many general purpose integrated amplifiers for small signal applications previously treated in these columns.

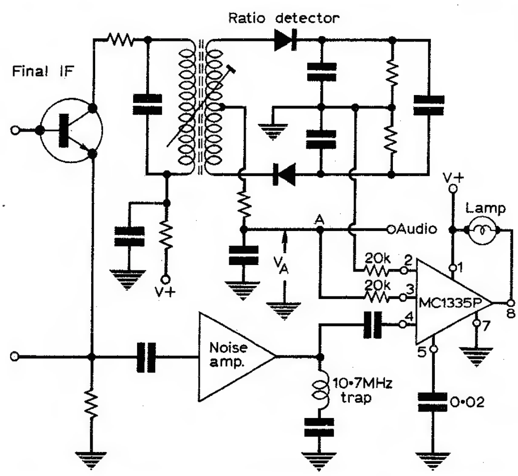


Fig. 2. A practical application of the MC1335P tuning indicator.

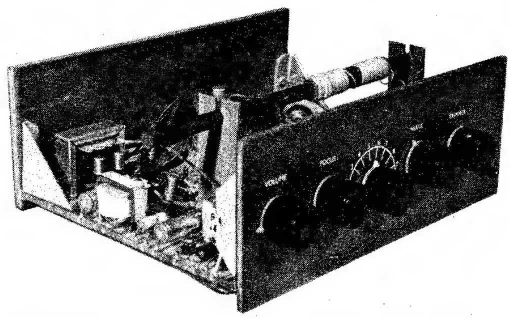
The circuit will operate on h.t. supplies of up to 20 volts, and the lamp should be chosen to draw a maximum of 40Ma at the applied d.c. voltage. This is because the saturated condition results in a collector voltage of under 1 volt at pin 8 of the i.c. For operation on battery supplies it is advisable to choose a lamp rated at about the battery voltage but with only that current rating which renders it effectively visible under operating conditions; when the lamp is extinguished the standby current drawn by the circuit is approximately 5·5Ma. Finally, it may be noted that teachers and others interested in instrumentation may find the device a useful null indicator for bridges and other experimental systems. The device is presented in a minature 8-pin dual in-line plastic package, pin 1 being identified by an index mark. The device is available from Jermyn Industries, Vestry Estate, Sevenoaks, Kent; or other Motorola stockists.

Station Focus Six—*continued from page 162*

the receiver can be fitted in.

Front and back are hardboard, approximately 8 x $6\frac{5}{8}$in. With apertures about $3\frac{1}{4}$in. in diameter cut in each piece, about $\frac{3}{4}$in. clear of the bottom. The bottom is three-ply about 8 x 3in. with sides, also three-ply, $6\frac{5}{8}$ x $3\frac{1}{2}$in. All the pieces should be sand-papered smooth, and the edges checked. Dust them off before fixing them together.

The meeting edges of front, back and bottom are smeared with a quick-setting adhesive and these pieces fixed together with a few small panel pins. When the adhesive is dry, a single piece of fabric about 10in. wide and 20in. long is glued on, so as to cover the outer surfaces, and overlap inside. Adhesive should be applied to the edges of the front, bottom and sides. The fabric is cut to suit at the corners, folded over inside, and glued here also.



This view shows the mounting arrangements of the ferrite rod aerial.

The sides are varnished and allowed to dry before fitting them. The edges of the parts already assembled are spread with adhesive and the case placed on one end, with the sides in position, and left with a weight on top until the adhesive is hard. The carrying handle is a simple loop, fixed with screws.

It is a good idea to check that the cabinet dimensions are correct before the final glueing together. Tack the sides and bottom together with panel pins as suggested but do not drive them right in. The completed set can be lowered into the framework and any adjustments made to ensure a good fit.

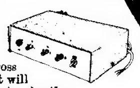
Notes

It was found that the brass rod of L3 projected at the front (Fig. 3 side), so a portion was cut off to clear the cabinet. The rod, with core, is completely unscrewed to do this, then replaced and locked with a nut.

The receiver can be operated from a $7\frac{1}{2}$V battery such as the RD38, or a 9V supply from a PP9. The AD38 battery takes a non-reversible two-pin plug, and the PP9 requires battery clips. If lamp batteries are ever used they must never be connected with the wrong polarity.

In use, it will be found that the "station focus" control is very helpful with m.w. tuning, especially at the h.f. end of this band, where many transmissions can be heard after dark. This control has virtually no effect on 200kHz, where tuning with VC1/2 is easy. ■

CHROMOSONIC SOUND OPERATED LIGHT DISPLAY



This compact unit (size $8\frac{1}{4}$" × $5\frac{1}{4}$" × 3" high) is connected directly across the speaker output of an amplifier, it will then convert audio signals into a spectacular three colour light display (500 watts light output each colour) Send S.A.E. for further details.

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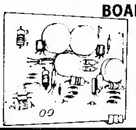

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10 watts **£3.50**	cone **£2.50**
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CHROME TV STAND

28 × $8\frac{1}{2}$ × 16in. high. This modern design TV Stand would make an ideal base for a coffee table and is a bargain at **163p.** Post 25p

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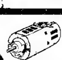

Rated up to 11·5 volt 400mA. Size $1\frac{3}{8}$" long, $\frac{7}{8}$" dia. Shaft $\frac{5}{16}$" long $\frac{1}{16}$" dia.

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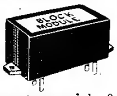
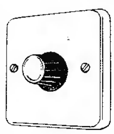
SOLID STATE BLOCK MODULES



Phono pre-amp E1311 input 100k: gain 28dB max out 3 volt: max input 50mV. Tape pre-amp as above E1313. Power amp E1314 input 1,000 ohms gain 20dB 300mW. Organ tone osc E1315 tone freq. 200-1k, Hz output 80mW. All above modules 9 volt. Dual flasher E1318 flash time 1-4 secs power 6 volt. Lamp 6v 150mA. All at **£1.25** P. & P. 10p

LIGHT DIMMER



The unit comes complete with MK Ivory Front Plate and Control Knob, when used in place of Light Switch it will control your room lighting from, off to full brightness. Power— up to 300 watts inteference suppressed

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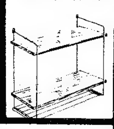
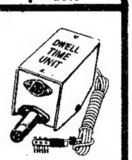
SHELF UNIT



Two teak finish shelves on a black frame (overall size 28" × 25" × 12" deep). This unit is wall mounting. **250p.** Postage Free

DWELL TIME UNIT



These small units contain the following components: 700 ohm DPDT relay with base, 1μF 250v. paper, 0·01μF 400v. paper, 50μF 35v. electrolytic, 3 diodes OC200 transistor, a 2N2926 type transistor unmarked, a skeleton pre-set pot, 4 pin din plug & skt., 4 foot of 4 core screen. All housed in a small neat metal box. Can be made into many timing devices.

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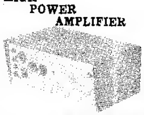

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- Full power — four ohms
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1S5	.22	6J6	.18	12AU7	.23	30P19/		DW4/		ECH84	.38	EY86/7	.33
1U4	.29	6J7G	.24	12AV6	.28	30P4	.28	350	.38	ECL80	.35	EY88	.43
1U5	.48	6J7GT	.38	12AX7	.23	30PL1	.69	DW4/		ECL82	.33	EY91	.53
2D21	.35	6K7G	.10	12BA6	.30	30PL12	.37	500	.38	ECL83	.52	EZ40	.40
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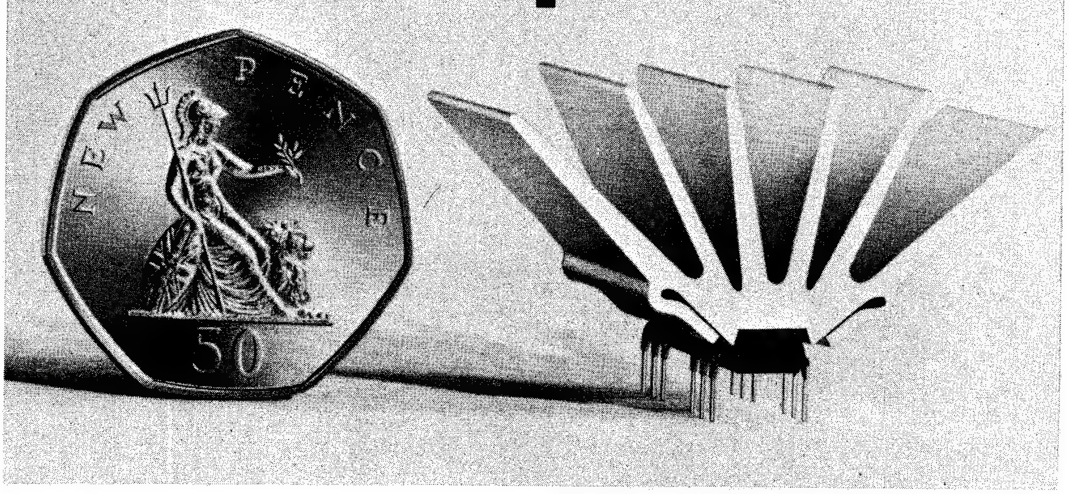
5Z4G	.35	6Q7	.43	12SA7GT		50L6GT	.45	E1148	.53	EF40	.50	GZ32	.45
6/30L2	.58	6Q7G	.30		.40	72	.33	EA50	.15	EF41	.50	GZ33	.70
6A8G	.33	6R7	.55	12SC7	.35	85A2	.43	EA76	.88	EF42	.33	GZ34	.53
6AC7	.15	6R7G	.55	12SG7	.23	807	.59	EABC80	.33	EF54	.98	GZ37	.75
6AG5	.25	6SA7GT	.38	12SH7	.15	5763	.50	EAC91	.38	EF73	.33	HABC80	.45
6AK5	.25	6SA7M	.35	12SJ7	.33	AC2/PEN		EAF42	.50	EF80	.23	HL23DD	.40
6AL5	.12	6SC7GT	.33	12SK7	.24		.98	EB34	.20	EF83	.48	HL41DD	.98
6AQ5	.28	6SG7	.33	12SQ7GT		AC2/PEN/		EB91	.12	EF85	.29	HL42DD	.50
6AT6	.20	6SH7	.53		.50	DD	.98	EBC41	.48	EF86	.32	HN309	1·40
6AU6	.25	6SJ7	.35	14S7	1.15	AC6PEN	.38	EBC81	.33	EF89	.25	HVR2	.53
6AV6	.30	6SK7GT	.23	19AQ5	.24	AC/PEN(7)		EBC91	.30	EF91	.17	HVR2A	.53
6B8G	.13	6SQ7GT	.38	20F2	.70		.98	EBF80	.34	EF92	.13	KT2	.25
6BA6	.23	6V6G	.18	20L1	.98	AC/TH1	.50	EBF83	.40	EF97	.55	KT8	1.75
6BE6	.24	6V6GT	.33	20P1	.88	AC/TP	.98	EBF89	.32	EF98	.65	KT44	1.00
6BH6	.43	6X4	.22	20P3	.90	AL60	.78	EBL21	.60	EF183	.30	KT66	.83
6BJ6	.43	6X5GT	.25	20P4	.93	ATP4	.12	EC86	.63	EF184	.30	KT88	1.70
6BQ7A	.38	7B6	.58	20P5	1.00	AZ1	.40	EC88	.60	EH90	.38	KTW61	.63
6BR7	.79	7B7	.35	25A6G	.29	AZ31	.48	EC92	.35	EL32	.18	KTW62	.63
6BR8	.63	7C6	.30	25L6G	.29	AZ41	.53	ECC33	1.58	EL34	.53	KTW63	.50
6BW6	.72	7H7	.38	25Y5	.38	B36	.33	ECC40	.60	EL37	.87	MHLD6	.75
6BW7	.65	7R7	.65	25Y5G	.43	CY1C	.53	ECC81	.19	EL41	.55	N78	2.05
6BZ6	.33	9D7	.78	25Z4G	.30	CY31	.38	ECC82	.23	EL42	.53	N308	.98
6C9	.73	10C1	1.25	25Z5	.40	DAC32	.35	ECC83	.23	EL81	.50		
6CD6G	1.15	10C2	.50	25Z6G	.43	DAF91	.22	ECC84	.30	EL83	.38		
6CH6	.38	10F1	.75	30C1	.30	DAF96	.35	ECC85	.28	EL84	.24		
6CL6	.43	10F9	.45	30C15	.65	DF33	.39	ECC86	.40	EL85	.40		
6CW4	.63	10F18	.35	30C17	.80	DF91	.14	ECC88	.35	EL86	.40		
6F1	.63	10LD11	.53	30C18	.64	DF96	.35	ECC189	.48	EL91	.23		
6F6	.63	10P13	.65	30F5	.80	DF97	.63	ECC804	.58	EL95	.35		
6F6G	.25	10P14	1.10	30FL1	.64	DH63	.30	ECC8071	.35	EM34	.90		

N339	1.25	PL302	.60	UF80	.35	AC157	.25	BF180	.30	OA202	.10
P61	.50	PL500	.68	UF85	.34	AC166	.25	BF181	.40	OC22	.38
PABC80	.35	PL504	.68	UF86	.63	AC168	.38	BF185	.40	OC23	.38
PC86	.52	PL505	1.44	UF89	.34	AC176	.55	BFY50	.23	OC24	.38
PC88	.52	PL508	1.40	UL41	.59	AC177	.28	BFY51	.19	OC25	.38
PC95	.53	PL509	1.44	UL84	.33	ACY17	.25	BFY52	.20	OC26	.25
PC97	.40	PL802	.75	UM80	.33	ACY18	.20	BY100	.18	OC28	.60
PC900	.38	PM84	.39	UY1N	.50	ACY19	.19	BY105	.18	OC29	.63
PCC84	.32	PX4	1.18	UY21	.55	ACY20	.18	BY114	.18	OC35	.32
PCC85	.33	PX25	1.13	UY41	.38	ACY21	.19	BY126	.15	OC36	.43
PCC88	.49	PY32/3	.50	UY85	.30	ACY22	.15	BY127	.18	OC42	.63
PCC89	.48	PY80	.33	U10	.45	ACY28	.18	BYY23	1.00	OC43	1.18
PCC189	.49	PY81	.27	U12/14	.38	AD140	.38	BYZ10	.25	OC44	.10
PCC805	.64	PY82	.27	U18/20	.75	AD149	.50	BYZ11	.25	OC45	.13
PCF80	.30	PY83	.29	U19	1.73	AD161	.45	BYZ12	.25	OC46	.15
PCF82	.33	PY88	.34	U22	.30	AD162	.45	BYZ13	.25	OC70	.13
PCF84	.40	PY500	1.08	U25	.65	ADT140	.63	CG12E	.20	OC71	.13
PCF86	.50	PY800	.38	U26	.59	AF102	.90	FSY11A	.23	OC72	.13
PCF200	.67	PY801	.34	U45	.78	AF106	.50	GD9	.20	OC74	.23
PCF801	.35	PZ30	.48	U191	.63	AF114	.25	GET113	.20	OC75	.13
PCF802	.45	QQV03/10		U251	.73	AF115	.15	GET116	.40	OC76	.15
PCF805	.64		1.20	U281	.40	AF117	.20	GET118	.20	OC77	.27
PCF806	.64	QV04/7	.63	U282	.40	AF121	.30	GET119	.20	OC78	.15
PCF808	.73	R10	.75	U301	.53	AF124	.25	GET573	.38	OC78D	.15
PCH200	.62	R11	.98	U403	.33	AF126	.18	GET587	.43	OC81	.13
PCL82	.37	R16	1.75	U404	.38	AF139	.65	GET873	.15	OC81D	.13
PCL83	.50	R17	.88	U801	.95	AF178	.68	GET887	.23	OC82	.13
PCL84	.38	R19	.33	U4020	.38	AF180	.48	GET897	.23	OC82D	.15
PCL805/85		SP42	.75	VP23	.40	AF186	.55	GET898	.23	OC83	.20
	.45	SP61	.33	VP41	.38	AF239	.38	M1	.15	OC84	.24
PCL86	.43	TH4B	.50	VR105	.33	B1181	.50	M3	.15	OC123	.23
PCL88	.75	TH233	.98	VT61A	.35	BA102	.45	MAT100	.39	OC139	.23
PD500	1.44	TP2620	.98	VU111	.44	BA115	.14	MAT101	.43	OC140	.95
PEN4DD		UABC80	.33	VU120	.60	BA116	.25	MAT120	.39	OC169	.23
	1.38	UAF42	.52	VU120A	.60	BA129	.13	MAT121	.43	OC172	.35
PEN36C	.75	UBC41	.45	VU133	.35	BA130	.10	OA5	.28	OC200	.22
PEN45	.35	UBC81	.40	W76	.34	BC107	.13	OA9	.13	OC201	.38
PEN45DD		UBF80	.29	W107	.50	BC108	.13	OA10	.43	OC202	.43
	.75	UBF89	.34	W729	.60	BC113	.15	OA47	.10	OC203	.30
PEN46	.20	UBL21	.55	X41	.50	BC115	.15	OA70	.13	OC204	.30
PEN453DD		UC92	.35	X65	.50	BC116	.25	OA73	.15	OC205	.43
	.98	UCC84	.40	2S323	.50	BC118	.23	OA79	.09	ORP12	.53
PENDD-		UCC85	.37	AA119	.15	BCY10	.45	OA81	.09		
4020	.88	UCF80	.42	AA120	.15	BCY12	.50	OA85	.08		
PFL200	.59	UCH21	.60	AA129	.15	BCY33	.20	OA90	.13		
PL36	.48	UCH42	.63	AAZ13	.18	BCY38	.23	OA91	.09		
PL81	.48	UCH81	.33	AC107	.15	BCZ11	.38	OA95	.09		
PL81A	.63	UCL82	.35	AC113	.25	BD119	.45	OA200	.09		
PL82	.33	UCL83	.50	AC127	.20	BF159	.25				
PL83	.33	UF41	.50	AC128	.20	BF163	.20				
PL84	.33	UF42	.60	AC156	.20	BF173	.38				

All valves are unused, boxed, and subject to the standard 90 day guarantee. Terms of business — Cash or cheque with order only. Post/packing 0.03 per item, subject to a minimum of 0.09. Orders over £5.00 post/packing free. Same day despatch by first class mail. Any parcel insured against damage in transit for only 0.03 extra per order. Complete catalogue with conditions of sale price 0.07 post paid. Business hours Mon.-Fri. 9–5.30 p.m. Sats. 9–1 p.m.
We do not handle seconds nor rejects, which are often described as "New and Tested" but have a limited and unreliable life. No enquiries answered unless S.A.E. is enclosed for reply.

new

Super IC-12



High fidelity Monolithic Integrated Circuit Amplifier

Two years ago Sinclair Radionics announced the World's first monolithic integrated circuit Hi-Fi amplifier, the IC.10. Now we are delighted to be able to introduce its successor the Super IC.12. This 22 transistor unit has all the virtues of the original IC.10 plus the following advantages:

1. Higher power.
2. Fewer external components.
3. Lower quiescent consumption.
4. Compatible with Project 60 modules.
5. Specially designed built-in heat sink. No other heat sink needed.
6. Full output into 3, 4, 5 or 8 ohms.
7. Works on any voltage from 6 to 28 volts without adjustment.
8. NEW 22 transistor circuit.

Output power 6 watts RMS continuous (12 watts peak).
Frequency Response 5 Hz to 100KHz $\pm$ 1dB.
Total Harmonic Distortion Less than 1%. (Typical 0.1%) at all output powers and all frequencies in the audio band.
Load Impedance 3 to 15 ohms.
Power Gain 90dB (1,000,000,000 times) after feedback.
Supply Voltage 6 to 28 volts (Sinclair PZ-5 or PZ-6 power supplies ideal).
Size 22 x 45 x 28 mm including pins and heat sink.
Input Impedance 250 Kohms nominal.
Quiescent current 8mA at 28 volts.
Price: including FREE printed circuit board for mounting. **£2.98** Post free

With the addition of only a very few external resistors and capacitors the Super IC.12 makes a complete high fidelity audio amplifier suitable for use with pick-up, F.M. tuner etc. Alternatively, for more elaborate systems, modules in the Project 60 range such as the Stereo 60 and A.F.U. may be added. The comprehensive manual supplied with each unit gives full circuit and wiring diagrams for a large number of applications in addition to high fidelity. These include car radios, oscillators etc. The very low quiescent consumption makes the Super IC.12 ideal for battery operation.

Sinclair Radionics Ltd., London Rd, St. Ives
Huntingdonshire PE17 4HJ
Telephone St Ives (048 06) 4311

sinclair

Sinclair Project 60

the world's most advanced high fidelity modules

Sinclair Project 60 presents high fidelity in such a way that it meets every requirement of performance, design, quality and value and now that the remarkable phase lock loop stereo FM tuner is available, it becomes the most versatile of high fidelity systems. With Project 60, it is possible to start with a modest mono record reproducer and expand it to a sophisticated stereophonic radio and record reproducing system of fantastically good quality to hold its own with any other equipment, no matter how expensive. Project 60 is a unique high fidelity module system where compactness and ease of assembly are combined with circuitry that is far in advance of any other manufacturer in the world. Thus it is extraordinarily easy to assemble any combination of modules using nothing more complicated than the simplest of tools, and you certainly do not have to be experienced to build with complete confidence. The 48 page manual free with Project 60 equipment makes everything easy and you can house your assembly in an existing cabinet, motor plinth, free standing cabinet or virtually any arrangement you wish. Once you have completed your assembly you will have superlatively good equipment to give you years of service and enjoyment. You will have obtained superb value for money because Project 60 is the best selling modular system in Europe and can therefore be produced at extremely competitive prices and with excellent quality control.

	System	The Units to use	together with	Cost of Units
A	Simple battery record player	**Z.30**	Crystal P.U., 12V battery volume control	**£4.48**
B	Mains powered record player	**Z.30, PZ.5**	Crystal or ceramic P.U. volume control etc.	**£9.45**
C	20+20 W. R.M.S. stereo amplifier for most needs	**2 x Z.30s, Stereo 60, PZ.5**	Crystal, ceramic or mag. P.U., most dynamic speakers, F.M. tuner etc.	**£23.90**
D	20+20 W. R.M.S. stereo amplifier with high performance spkrs.	**2 x Z.30s, Stereo 60, PZ.6**	High quality ceramic or magnetic P.U., F.M. Tuner, Tape Deck, etc.	**£26.90**
E	40+40W. R.M.S. de-luxe stereo amplifier	**2 x Z.50s, Stereo 60 PZ.8, mains trsfrmr**	As for D	**£34.88**
F	Outdoor P.A. system	**Z.50**	Mic., up to 4 P.A. speakers controls, etc.	**£5.48**
G	Indoor P.A.	**Z.50, PZ.8, mains transformer**	Mic., guitar, speakers, etc., controls	**£19.43**
H	High pass and low pass filters	**A.F.U.**	C, D or E	**£5.98**
J	Radio	**Stereo F.M. Tuner**	C, D or E	**£25.00**

Sinclair Radionics Ltd., London Road, St. Ives, Huntingdonshire PE17 4HJ.
Tel: St. Ives (048 06) 4311

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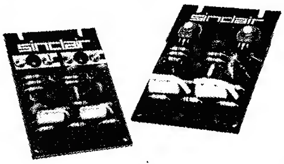
Sinclair Project 60

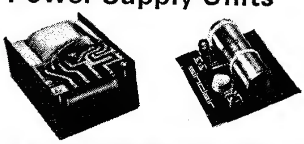
Z.30 & Z.50 power amplifiers



The Z.30 and Z.50 are of advanced design using silicon epitaxial planar transistors to achieve unsurpassed standards of performance. Total harmonic distortion is an incredibly low 0.02% at full output and all lower outputs. Whether you use Z.30 or Z.50 amplifiers in your Project 60 system will depend on personal preference, but they are the same size and may be used with other units in the Project 60 range equally well.

SPECIFICATIONS ***(Z50 units are interchangeable with Z.30s in all applications).***
Power Outputs
Z.30 15 watts R.M.S. into 8 ohms using 35 volts: 20 watts R.M S. into 3 ohms using 30 volts.
Z.50 40 watts R.M S. into 3 ohms using 40 volts: 30 watts R.M.S. into 8 ohms, using 50 volts.
Frequency response: 30 to 300 000 Hz ±1dB.
Distortion: 0.02% into 8 ohms.
Signal to noise ratio: better than 70dB unweighted.
Input sensitivity: 250mV into 100 Kohms.
For speakers from 3 to 15 ohms impedance.
Size $3\frac{1}{2} \times 2\frac{1}{4} \times \frac{1}{2}$ in.
Z.30
Built tested and guaranteed with circuits and instructions manual **£4.48**
Z.50
Built, tested and guaranteed with circuits and instructions manual. **£5.48**

Power Supply Units

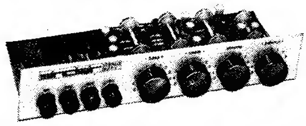


Designed specially for use with the Project 60 system of your choice.
Illustration shows PZ.5 to left and PZ.8 (for use with Z.50s) to the right. Use PZ.5 for normal Z.30 assemblies and PZ.6 where a stablised supply is essential.
PZ-5 *30 volts unstabilised* **£4.98**
PZ-6 *35 volts stabilised* **£7.98**
PZ-8 *45 volts stabilised*
(less mains transformer) **£7.98**
PZ-8 *mains transformer* **£5.98**

Guarantee

If within 3 months of purchasing Project 60 modules directly from us, you are dissatisfied with them, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail. Air-mail charged at cost.

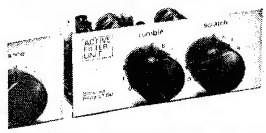
Stereo 60 pre-amp/control unit



Designed for the Project 60 range but suitable for use with any high quality power amplifier. Again silicon epitaxial planar transistors are used throughout, achieving a really high signal-to-noise ratio and excellent tracking between channels. Input selection is by means of push buttons and accurate equalisation is provided for all the usual inputs.

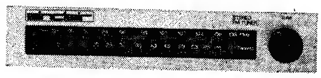
SPECIFICATIONS
Input sensitivities: Radio–up to 3mV. Mag. p.u. 3mV: correct to R.I.A.A. curve ± 1dB: 20 to 25,000 Hz. Ceramic p.u.–up to 3mV: Aux–up to 3mV.
Output: 250mV
Signal-to-noise ratio: better than 70dB.
Channel matching: within 1dB.
Tone controls: TREBLE + 15 to —15dB at 10KHz: BASS + 15 to—15dB at 100Hz.
Front panel: brushed aluminium with black knobs and controls.
Size: $8\frac{1}{4} \times 1\frac{1}{2} \times 4$ ins.
Built, tested and guaranteed. **£9.98**

Active Filter Unit



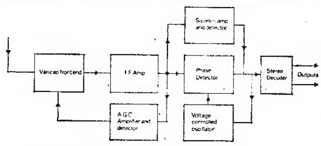
For use between Stereo 60 unit and two Z.30s or Z.50s, and is easily mounted. It is unique in that the cut-off frequencies are continuously variable, and as attenuation in the rejected band is rapid (12dB/octave), there is less loss of the wanted signal than has previously been possible. Amplitude and phase distortion are negligible. The A.F.U. is suitable for use with any other amplifier system. Two stages of filtering are incorporated – rumble (high pass) and scratch (low pass). Supply voltage – 15 to 35V. Current – 3mA. H.F. cut-off (–3dB) variable from 28kHz to 5kHz. L.F cut-off (–3dB) variable from 25Hz to 100Hz. Distortion at 1kHz (35V. supply) 0.02% at rated output.
Built, tested and guaranteed **£5.98**

Stereo FM Tuner



first in the world to use the phase lock loop principle
Before production of this tuner, the phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio over other systems. Now, for the first time, the principle has been applied to an FM tuner with fantastically good results. Other original features include varicap diode tuning, printed circuit coils, an I.C. in the specially designed stereo decoder and squelch circuit for silent tuning between stations. Sensitivity is such that good reception becomes possible in difficult areas. Foreign stations can be tuned in suitable conditions and often a few inches of wire are enough for an aerial. In terms of a high fidelity this tuner has a lower level of distortion than any other tuner we know. Stereo broadcasts are received automatically as the tuning control is rotated, a panel indicator lighting up as the stereo signal is tuned in. This tuner can also be used to advantage with any other high fidelity system.

SPECIFICATIONS:
Number of transistors: 16 plus 20 in I.C.
Tuning range: 87.5 to 108 MHz
Capture ratio: 1.5dB
Sensitivity: $2\mu V$ for 30dB quieting: $7\mu V$ for full limiting.
Squelch level: $20\mu V$.
A.F.C. range: ±200 KHz
Signal to noise ratio: >65dB
Audio frequency response: 10Hz—15KHz (±1dB)
Total harmonic distortion: 0.15% for 30% modulation
Stereo decoder operating level: $2\mu V$
Pilot tone suppression: 30dB
Cross talk: 40dB
I.F. frequency: 10.7 MHz
Output voltage: 2 x 150mV R.M.S.
Aerial Impedance: 75 Ohms
Indicators: Mains on: Stereo on; tuning indicator
Operating voltage: 25-30 VDC
Size: 3.6 x 1.6 x 8.15 inches: 91.5 x 40 x 207 mm



Price: £25 built and tested. Post free

To: SINCLAIR RADIONICS LTD LONDON ROAD ST. IVES HUNTINGDONSHIRE PE17 4HJ

Please send ______

for which I enclose cash/cheque/money order.

Name ______

Address ______

Sinclair Q16/Micromatic

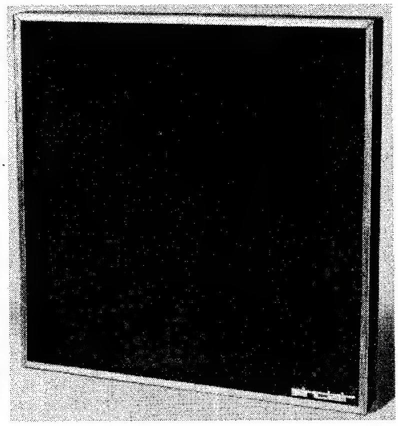
Q16 High fidelity loudspeaker

The Q16 employs the well proven acoustic principles specially developed by Sinclair in which a special driver assembly is meticulously matched to the characteristics of the uniquely designed cabinet. In reviewing this exclusive Sinclair design, technical journals have justly compared the Q16 with much more expensive loudspeakers. Its shape enables the Q16 to be positioned and matched to its environment to much better effect than is the case with conventionally styled enclosures. A solid teak surround with a special all-over cellular foam front is used as much for appearance as its ability to pass all audio frequencies without loss.

This elegantly designed shelf mounting speaker brings genuine high fidelity within reach of every music lover.

Specifications:

Construction: Special sealed seamless sound or pressure chamber with internal baffle.
Loading: up to 14 watts RMS.
Input Impedance: 8 ohms.
Frequency response: From 60 to 16,000 Hz. confirmed by independently plotted B and K curve.
Driver unit: Special high compliance unit having massive ceramic magnet of 11,000 gauss, aluminium speech coil and special cone suspension for excellent transient response.
Size and styling: $9\frac{3}{4}$ in. square on face x $4\frac{3}{4}$ in. deep with neat pedestal base. Black all over cellular foam front with natural solid teak surround.
Price £8.98.



Britain's smallest radio

Considerably smaller than an ordinary box of matches, this is a multi-stage AM receiver brilliantly designed to provide remarkable standards of selectivity, power and quality for its size. Powerful AGC counteracts fading from distant stations; bandspread at higher frequencies makes reception of Radio 1 easy. The plug-in magnetic earpiece provided, matches the Micromatic's output to give wonderful standards of reproduction. Everything including the special ferrite rod aerial and batteries is contained within the minute attractively designed case. Whether you build a Micromatic kit or buy this amazing receiver ready built and tested, you will find it as easy to take with you as your wrist watch, and dependable under the severest listening conditions.

Specifications:

Size: 36 x 33 x 13 mm (1.8 x 1.3 x 0.5 in.)
Weight: including batteries, 28.4 gm (1 oz.)
Case: Black plastic with anodised aluminium front panel and spun aluminium dial.
Tuning: medium wave band with bandspread at higher frequencies (550 to 1,600 KHz).
Earpiece: Magnetic type.
On/off switching: By inserting and withdrawing earpiece plug.
Kit in pack with earpiece, case, instructions and solder **£2.48.**
Ready built, tested and guaranteed, with earpiece **£2.98.**
Two Mallory Mercury batteries type RM675 required from radio shops, chemists, etc.

To: SINCLAIR RADIONICS LTD LONDON ROAD ST. IVES HUNTINGDONSHIRE PE17 4HJ

Please send ____________________

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____

for which I enclose cash/cheque/money order

Name ____________________

Address ____________________

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PW671

Sinclair Radionics Ltd., London Rd, St. Ives
Huntingdonshire PE17 4HJ.
Telephone St. Ives (048 06) 4311

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STEPHENS

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P.O. BOX 26,
AYLESBURY, BUCKS.

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AZ31	50p	ECF80/2	47½p	EL803	85p	PCC85	42½p	PY83	50p	UL41	57½p	6AR5	33½p	6EJ7	35p	6SK7	32½p	12BE6	32½p	30PL1	77½p
AZ50	60p	ECF86	55p	EL821	55p	PCC88	70p	PY88	41p	UL84	55p	6AR6	32½p	6EW6	60p	6SL7GT	32½p	12BH7	32½p	30PL13	90p
CBLI	80p	ECH35	67½p	ELL80	75p	PCC89	61p	PY500	£1·00	UM80/4	45p	6AS5	35p	6F1	70p	6SN7GT	30p	12BY7	50p	30PL14	85p
CBL31	85p	ECH42	66p	EM34	80p	PCC189	61p	PZ30	80p	UY41	40p	6AS7G	80p	6FS	40p	6SQ7	40p	12K5	50p	35A3	50p
CY31	35p	ECH81	51p	EM71	62½p	PCF80	51p	QQU02-6	£2·10	UY85	34p	6AT6	45p	6F6G	25p	6SR7	37½p	12K7GT	35p	35A5	55p
DAF91	41p	ECH83	40p	EM80	40p	PCF82	52½p	QQUO3-10		U25	75p	6AU6	29p	6F11	32½p	6T8	32½p	12Q7G	25p	35B5	65p
DAF96	41p	ECH84	47½p	EM81	42½p	PCF84	47½p		£1·25	U36	75p	6AU6	30p	6F12	22½p	6U4GT	62½p	12SC7	25p	35C5	35p
DF91	45p	ECL80	40p	EM84	37½p	PCF86	61p	QVO3-12	65p	U191	72½p	6BA6	47½p	6F13	35p	6U8	35p	12SG7	35p	35D5	65p
DF96	45p	ECL82	49p	EM87	55p	PCF200/1	81p	R19	65p	U193	41p	6BE6	60p	6F14	60p	6V6GT	32½p	12SH7	25p	35L6GT	47½p
DK91	57½p	ECL83	57½p	EN91	32½p	PCF801	61p	R20	75p	U301	85p	6BH6	42½p	6F15	55p	6X4	25p	12SJ7	25p	35W4	25p
DK96	57½p	ECL86	49p	EY51	40p	PCF802	61p	SU2150A	75p	W729	55p	6BJ6	42½p	6F18	40p	6X5GT	27½p	12SK7	40p	35Z3	55p
DL92	37½p	ECLL800		EY80	45p	PCF805	65p	TT21	£2·40	Z759	£1·22½	6BK7A	50p	6F22	33½p	6X8	55p	12SL7GT	40p	35Z4G	25p
DL94	37½p		£1·50	EY81	40p	PCF806	61p	TT22	£2·50	OA2	32½p	6BL8	35p	6F23	77½p	6Y6G	60p	12SN7GT	40p	35Z5GT	37½p
DL96	46p	EF39	52½p	EY83	55p	PCF808	67½p	U18/20	67½p	OA3	45p	6BN5	42½p	6F24	67½p	7Y4	60p	12SQ7	40p	50A5	65p
DM70	32½p	EF80	40p	EY86	40p	PCH200	70p	U20	67½p	OB2	32½p	6BN6	40p	6F25	75p	9BW6	42½p	12SR7	32½p	50B5	35p
DY86/7	40p	EF83	50p	EY87	42½p	PCL82	51p	U25	75p	OB3	50p	6BQ5	25p	6F26	35p	10C2	50p	14S7	80p	50C5	35p
DY802	42½p	EF85	41p	EY88	42½p	PCL83	61p	U26	75p	OC3	35p	6BR7	75p	6F28	70p	10D1	40p	20D1	45p	50L6GT	40p
E55L	£2·75	EF86	66p	EZ35	27½p	PCL84	51p	U31	45p	OD3	32½p	6BR8	95p	6F29	32½p	10D2	40p	20LI	£1·00	83A1	90p
E88CC	40p	EF89	40p	EZ40	45p	PCL85	52½	U37	£1·50	3Q4	40p	6BW6	82½p	6F30	35p	10F1	90p	20P1	50p	85A2	37½p
E130L	£4·50	EF91	42½p	EZ41	45p	PCL86	51p	U50	30p	3S4..	35p	6BW7	69p	6J4	47½p	10F9	50p	20P3	60p	90AU	£2·40
E180F	95p	EF92	50p	EZ80	27½p	PD500	£1·52½	U52	30p	3V4	40p	6BX6	25p	6J5GT	30p	10F18	40p	20P4	£1·00	90C1	60p
EABC80	52½p	EF93	47½p	EZ81	27½p	PFL200	74p	U76	25p	5R4GY	55p	6BZ6	32½p	6J7	42½p	10L1	40p	20P5	£1·00	90CU	£1·25
EAF42	50p	EF94	77½p	EZ90	25p	PL36	64p	U78	25p	5U4G	30p	6C4	30p	6K6GT	50p	10LD11	55p	25C5	45p	807	47½p
EBC33	55p	EF95	62½p	GS10C	£5·00	PL38	90p	U191	75p	5U4GB	37½p	6C5GT	35p	6K7	32½p	10P13	55p	25L6GT	37½p	811A	£1·50
EBC41	47½p	EF183	56p	GY501	80p	PL81	51p	U201	35p	5V4G	40p	6CD6G	£1·40	6K8G	30p	10P14	£1·00	2524G	30p	612A	£3·25
EBC81	32½p	EF184	35p	GZ30	37½p	PL81A	62½p	U281	40p	5Y3GT	30p	6CA4	27½p	6K23	50p	12AB5	50p	25Z6GT	50p	813	£3·75
EBC90	47½p	E280F	£2·10	GZ31	30p	PL82	36p	U282	40p	5Z3	45p	6CA7	52½p	6K25	75p	12AC6	37½p	30A5	40p	866A	70p
EBF80	40p	EF800	£1·00	GZ32	47½p	PL83	51p	U301	57½p	524GT	40p	6CBC	27½p	646GT	45p	12AD6	37½p	30AE3	40p	5642	60p
EBF83	40p	EF804	£1·00	GZ33	80p	PL84	41p	U403	50p	6/30L2	75p	6CD6GA	£1·15	6L7	32½p	12A15	40p	30C15	75p	6080	£1·37½
EBF89	40p	EF811	75p	GZ34	55p	PL500	82½p	U404	37½p	6AB4	32½p	6GG7	45p	6L18	30p	12AQ5	40p	30C17	80p	6146	£1·50
EB91	26p	EL34	52½p	HK90	32½p	PL504	85p	U801	£1·00	6AF4A	47½p	6CH6	55p	6LD20	32½p	12AT6	25p	30C18	75p	6146B	£2·37½
EC53	50p	EL36	47½p	HL92	35p	PL505	£1·45	UABC80	52½p	6AG7	37½p	6CL6	50p	6N7GT	35p	12AU6	75p	30F5	85p	6267	32½p
EC86	60p	EL41	55p	HL94	40p	PL508	£1·00	UBF89	40p	6AH6	50p	6CW4	62½p	6P1	60p	12AV6	30p	30FL1	75p	6360	£1·25
EC88	60p	EL42	57½p	KT66	£1·37½	PL509	£1·54	UBC41	49p	6A18	29p	6CY5	40p	6P25	£1·05	12AV7	45p	30FL2	92½p	6939	£2·10
EC90	30p	EL81	50p	KT88	£1·66	PL802	86p	UCC85	46p	6AK5	30p	6CY7	60p	6P28	62½p	12AX7	30p	30FL13	50p	7199	75p
EC92	32½p	EL83	41p	N78	£1·05	PL805	86p	UCH42	69p	6AK6	57½p	6D3	40p	6Q7	37½p	12AY7	67½p	30FL14	77½p	7360	£1·80
EC93	47½p	EL85	42½p	PABC80	40p	PY33	62½p	UCH81	54p	6AL3	42½p	6DC6	67½p	6R7G	35p	12B4A	50p	30L1	45p	7586	£1·25
ECC81	40p	EL86	42½p	PC86/8	51p	PY80	32½p	UCL82	51p	6AL5	16p	6DK6	42½p	6S2	40p	12BA6	32½p	30L15	85p	9002	32½p
ECC82/3	42½p	EL90	32½p	PC95	38p	PY81	41p	UCL83	61p	6AM5	25p	6DQ6B	60p	6S4A	55p	12BA7	32½p	30L17	85p	9003	50p
ECC84/5	42½p	EL91	25p	PC97	41p	PY800	41p	UF41/2	55p	6AM6	22½p	6DS4	75p	6SA7	37½p			30P12	80p		
ECC88	55p	EL95	35p	PCC84	46p	PY801	41p	UF80/5	37½p	6AQ5	32½p	6EA8	55p	6SG7	32½p			30P18	35p		
E88CC	62½p	EL360	£1·15			PY82	35p	UF89	41p	6AQ6	50p	6EH7	32½p	6SJ7	37½p			30P19	75p		

CATHODE RAY TUBES

New and Budget tubes made by the leading manufacturers. Guaranteed for 2 years. In the event of failure under guarantee, replacement is made without the usual time wasting forms.

Type		New £	Budget £
MW36-20			£4·50
MW36-21			£4·50
MW43-69Z	CRM171		
	CRM172	£6·60	£4·62½
MW43-80Z	CRM173	£6·60	£4·62½
AW43-80Z	CME1702	£6·60	£4·62½
	CME1703	£6·60	£4·62½
	CME1706	£6·60	£4·62½
	C17AA	£6·60	£4·62½
	C17AF	£6·60	£4·62½
AW43-88	CME1705	£6·60	£4·62½
AW47-90			
AW47-91	A47 14W	£5·95	£4·87
A47 14W	CME1901	£5·95	£4·87
	CME1902	£5·95	£4·87
	CME1903	£5·95	£4·87
	C19AH	£5·95	£4·87
147 13W	CME1906	£10·27½	£8·50
A47-11W	CME1905	£8·86½	£7·00
A47-26W	CME1905	£8·86½	£7·75
A47-26W/R	CME1913R	£9·33½	

Type		New £	Budget £
A50-120W/R	CME2013	£10·85	
AW53-80		£8·93½	£6·25
AW53-88	CME2101	£8·93½	£6·25
AW59-90			
AW59-91	CME2303	£9·58½	£7·20
A59-15W	CME2301		
	CME2302		
	CME2303	£9·58½	£7·20
A59-11W	CME2305		
A59-13W	CME2306	£13·65	£10·97½
A59-16W	CME2306	£13·65	£10·97½
A59-23W	CME2305	£12·60	£10·50
A59-23W/R		£12·60	£10·50
A61-120W/R	CME2413	£13·50	£11·50
A65-11W	CME2501	£16·50	£14·50
COLOUR TUBES			
A49-191X	19 inch	£52·50	
A56-120X	22 inch	£57·50	
A63-11X	25 inch	£62·50	
PORTABLE SET TUBES			
TSD217		£11·50	
TSD282		£11·50	
A28-14W		£9·16½	Not supplied
CME1601			£7·75
CME1602			£8·00

A discount of 10% is also given for the purchase of 3 or more tubes at any one time.
All types of tubes in stock. Carriage and insurance 75p anywhere in Britain.

TRANSISTORISED UHF TUNER UNITS NEW AND GUARANTEED FOR 3 MONTHS

Complete with Aerial Socket and wires for Radio and Allied TV sets but can be used for most makes.
Continuous Tuning, **£4·50**; Push Button, **£5·00**.

SERVICE AIDS

Switch Cleaner, **55p**; Switch Cleaner with Lubricant, **55p**; Freeza **62½p**, p. & p. 7½p per item.

PLUGS

Jack Plugs and Sockets		Co-Axial Plugs	
Standard Plugs	19p	Belling Lee (or similar type)	6½p
Standard Sockets	12½p	Add 2p per doz. p. & p.	

LINE OUTPUT TRANSFORMERS

G.E.C.	BT454	£4·75	G.E.C.	2028	£4·75
G.E.C.	BT456	£4·75	G.E.C.	2041	£4·75
G.E.C.	2010	£4·75	G.E.C.	2000 Series	
G.E.C.	2013	£4·75	Philips	19TG	£4·75
G.E.C.	2014	£4·75	Pye	Mod. 36	£4·75
G.E.C.	2018	£4·75	Pye	Mod. 40	£4·75
G.E.C.	2043	£4·75	Thorn	800–850	£4·75
G.E.C.	2048	£4·75			

STYLII—BRITISH MANUFACTURED

All types in stock.

Single Tip "S"	13p	Double Tip "S"	33p
Single Tip "D"	37p	Double Tip "D"	47p

"S"=Sapphire "D"=Diamond

CARTRIDGES

ACOS		Inc. P.T. each
GP79		£0·63
GP91-1Sc	1	£1·05
GP91-2Sc		£1·05
GP91-3Sc		£1·05
Suitable to replace TC8		
GP92		£1·32
GP93-1		£1·24
GP94-1		£1·55
GP94-5		£1·80
GP95		£1·24
GP96		£1·57
ACOS		
104	1–10	£2·09

B.S.R.		Inc. P.T. each
X3M	S/S	£1·39
X3H	S/S	£1·39
X5M	S/S	£1·39
X5H	S/S	£1·39
SX5M	S/S	£1·81½
SX5H	S/S	£1·81½
SX5M	D/S	£1·99½
SX5H	D/S	£1·99½
X4N	D/S	£1·36½
GOLDRING		
850		£5·25
G800		£7·35
G800E		£15·00
G800 Super E		£19·50

RONETTE		Inc. P.T. each
105	S/S	99p
106	S/S	99p
DC400	S/S	70p
DC400SC	S/S	70p
105	D/S	£1·11½
106	D/S	£1·11½
DC400	D/S	84p
DC400SC	D/S	84p
SONOTONE		
8TA	D/S	£1·25
9TA	D/S	£1·79
9TAHC	D/S	£1·79

SEMICONDUCTORS BRAND NEW MANUFACTURERS MARKINGS NO REMARKED DEVICES

2N388A	63p	SN3704	23p	AF116	25p	BC118	33p	BF115	25p	T1S43	40p
SN697	20p	SN3705	20p	AF117	25p	BC134	58p	BF117	48p		
2N698	25p	SN4061	23p	AF118	60p	BC135	P/A	BF163	35p	**DIODES &**	
SN706	13p	SN4062	23p	AF124	13p	BC136	P/A	BF167	25p	**RECTIFIERS**	
SN706A	13p	SN4286	18p	AF125	20p	BC137	P/A	BF173	33p		
SN930	28p	SN4291	18p	AF126	20p	BC138	P/A	BF178	35p	1N914	8p
SN1132	33p	RCA		AF127	18p	BC142	30p	BF179	73p	AA119	10p
SN1303	18p	40253	P/A	AF139	38p	BC143	P/A	BF180	35p	BA102	23p
SN1305	23p	40398	P/A	AF178	45p	BC147	18p	BF181	33p	BA115	8p
SN1306	25p	40458	P/A	AF179	45p	BC148	15p	BF184	25p	BA114	13p
SN1307	25p	AC107	30p	AF180	53p	BC149	18p	BF191	23p	BY100	23p
SN2614	30p	AC117	60p	AF181	43p	BC152	18p	BF195	28p	BY126	20p
SN3826	30p	AC126	20p	AF186	67p	BC158	18p	BF196	43p	BY127	23p
SN4905	P/A	AC127	25p	AF239	43p	BC169B	14p	BF197	32p	BZY88	
SN4914	P/A	AC128	20p	ASY28	28p	BC169C	15p	BF200	37p	(Series)	33p
SN1711	25p	AC176	25p	BA144	P/A	BC171	18p	BF224	30p	OA5	13p
SN2147	73p	AC187	63p	BA145	P/A	BC175	28p	BF225	30p	OA47	8p
SN2160	58p	AC188	38p	BA148	23p	BC183	23p	BF257	47p	OA70	8p
SN2646	58p	ACY17	28p	BA155	P/A	BC184	23p	BFX29	35p	OA79	9p
SN2905	40p	ACY20	25p	BA156	P/A	BC187	29p	BF161	P/A	OA71	8p
SN2926		AD140	40p	BC107	15p	BC213L	27p	BF162	P/A	OA90	8p
Green	14p	AD142	58p	BC108	15p	BCY32	38p	BF163	25p	OA91	8p
Yellow	13p	AD149	58p	BC109	15p	BCY58	23p	BFY19	23p	OA202	10p
Orange	13p	AD161	38p	BC113	28p	BCY70	20p	BFY50	23p		
SN3053	28p	AD162	38p	BC114	38p	BD121	65p	BFY51	23p		
SN3055	75p	AF102	58p	BC115	33p	BD123	83p	BFY52	23p		
SN3392	20p	AF114	25p	BC116	63p	BD124	63p	BSX21	38p		
SN3702	18p	AF115	25p	BC116A	38p	BD131	98p	P346A	25p		

P/A—price on application.

ADD 3p PER ITEM FOR POST AND PACKING FOR ORDERS UNDER 24 PIECES

TERMS, CASH WITH ORDER ONLY, POST AND PACKING PAYABLE ON ORDERS UP TO £6.00, AFTER THAT FREE EXCEPT C.R.T.'s.

DISCOTHEQUE EQUIPMENT PACKAGE OFFERS

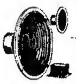
F.A.L. PHASE 50 MK.II AMPLIFIER £33.50
PR. R.S.O. L12/25 25W L/S in cabinets £19.00
Terms: Deposit £9 and 9 monthly payments of £5 (Total £54) £52.50
PACKAGE PRICE **£48** carr. £1

F.A.L. PHASE 50 MK.II AMPLIFIER £33.50
PR. FANE POP 50 L/SPEAKERS £21
Terms: Deposit £10.50 and 9 monthly payments of £5 (Total £55.50) £54.50
PACKAGE PRICE **£49.50** carr. £1

F.A.L. PHASE 100 AMPLIFIER £62.95
PR. L125 50W L/S in cabinets £59.80
Terms: Deposit £22 and 9 monthly payments of £11 (Total £121) £122.75
PACKAGE PRICE **£110** carr. £1.50

F.A.L. PHASE 100 AMPLIFIER £62.95
4 FANE POP 50 L/SPEAKERS £42
Terms: Deposit £14 and 9 monthly payments of £10 (Total £104) £104.95
PACKAGE PRICE **£94** carr. £1.50

AUDIOTRINE HI-FI SPEAKER SYSTEMS



Consisting of matched 12in. 11,000 line 15 Watt 15 ohm high quality speaker, cross-over unit and tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. **£5.75**

OR SENIOR 15 WATT INC. HF126 15,000 LINE SPEAKER carr. 35p **£6.75** Carr. 30p

AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS

Heavy construction. Latest high efficiency ceramic magnets. Treated Cone surround. "D" indicates Tweeter Cone providing extended frequency range up to 15,000 c.p.s. Impedance 3 or 8–15 ohms. Please state choice. Exceptional performance at low cost.

HF801D	8"	8W	£2.71	HF120D	12"	15W	£4.49
HF102D	10"	10W	£3.40	HF126	12"	15W	£5.25
HF120	12"	15W	£3.99	HF126D	12"	15W	£5.75

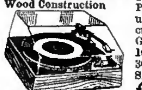
FANE 807 HIGH FIDELITY LOUDSPEAKER

A full range 8in. 10 watt unit for excellent sound quality, in suitable enclosure. Cast chassis Roll P.V.C. cone surround and long throw voice coil to achieve very low fundamental resonance of 30 c.p.s. Tweeter cone is fitted to extend high note response. Frequency range 25 Hz to 15 KHz. Impedance 3 or 8-15 Ω. Gauss 10,000. Remarkable value. **£3.50**

HI-FI SPEAKER ENCLOSURES

Modern design. Teak veneer finish. Acoustically lined. All sizes approx. Carr. 25p. per enclosure
JE8 Size 16 x 11 x 9in. Pressurised. Gives pleasing results with any 8in. Hi-Fi 'speaker. **£4·75**
SE8 For optimum performance with any 8in. Hi-Fi 'speaker. Size 22 x 15 x 9in. Ported **£5·75**
SE10 For outstanding results with 10in. Hi-Fi 'spkr Size 24x15x10in. P'td. **£5.99**
SE12 For exclnt prfmnce with 12in. Hi-Fi speaker and Tweeter. Size 25 x 16 x 10½in. **£6.99**

R.S.C. PLINTHS



Superior Solid Natural Wood Construction for Record Playing units, cut for Garrard 1025, 2025, 3000, AT60, SP25 etc.
£3.15
WITH TRANSPARENT PLASTIC COVER **£6.30**

LEADING MAKES HI-FI EQUIPMENT AT CLEARANCE PRICES AVAILABLE AT BRANCHES ONLY

R.S.C. BATTERY/MAINS CONVERSION UNITS

TYPE BM1

An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries supplying 1·5v. and 90v. where A.C. mains 200/250v. 50c/s is available. Complete kit with diagram £3 or assembled ready for use £3.50

RECORD PLAYING UNITS

Moneysaving units. Mounted on Plinth. Supplied with transparent plastic cover. Ready to plug into Amp. or Tape recorder.

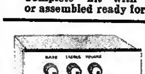
RP1C GARRARD 3000 4-speed Auto-change Unit with Sonotone 9TA/HC Ceramic Stereo Cartridge. **£19.45** Carr. 50p.

RP23C GARRARD SP25 Mk III fitted Goldring CS90 high compliance ceramic Stereo/Mono cartridge with diamond stylus. **£26.09** Carr. 50p.

RPC6 GARRARD 5200 Auto Unit fitted Stereo Cartridge Plinth & Cover as RP23C. **£15** Carr. 50p.

Other types available with Magnetic cartridges and with alternative design plinths.

R.S.C. TA6 6 Watt HI-FI 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 spkrs. Max. sensitivity 5mV. Output rating I.H.F.M. Fully enclosed enamelled case, 9¼ × 2¾ × 5¼in. Attractive brushed silver finish facia plate 10½ × 3¼in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£7.50** Carr. 40p
OR FACTORY BUILT WITH 12 MONTHS' GUARANTEE **£9·45**

R.S.C. A11 HI-FI 12-14 WATT AMPLIFIER

PUSH-PULL OUTPUT. Two input sockets with sep. vol. controls for mixing. High sensitivity, 5 valves. Bass and treble controls. Response ± 3dB 30-20,000 c/s. Hum level –60dB. Sensitivity 40 millivolts. For Crystal or Ceramic PUs. High Impedance "mikes". For Musical Instruments etc. Std. AC mains. For 3 & 15 ohm spkrs. Complete kit. Full instructions and point-to-point wiring diagrams. Carr. 60p SAE for leaflet. Twin handled metal cover £1.75 **£10.50**
Factory built £14.75 or Dep. £3 and 9 mthly pymnts of £1.60 (Total £17.40.)

R.S.C. COLUMN SPEAKERS

IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

R·S·C HI-FI CENTRES LTD.

All types 15 Ohms covered in Rexine Vynair
TYPE C4100 IS ALSO SUITABLE FOR BASS GUITAR OR ELECTRONIC ORGAN

TYPE C48S 25-30 WATTS
Fitted four 8" high flux 8 watt speakers. Overall size approx 48 x 10 x 5 in. Carr 50p
Terms: Dep £3 and 9 monthly payments £2 (Total £21) **£17.75**

TYPE C412S 50 WATTS
Fitted four 12" 11,000 line 15 watt speakers: Overall size approx 56 x 14 x 9 in. Carr 75p
Terms: Dep. £4 and 9 monthly payments £3 (Total £31) **£27.50**

TYPE C4100 100 WATTS inc. four 12" 50 watt speakers for conservative rating. Extra heavy construction. Size approx 58 × 16 × 10" Acoustically filled and pressurised. Terms: Dep. £7·50 and 9 mthly. pyts. £5·45 (Total £56·55). Carr. £1 **£50.50**

30 WATT HI-FI AMPLIFIER FOR GUITAR, VOCAL OR INSTRUMENTAL GROUP.

A 2 or 4 input, 2 vol. control Hi-Fi unit with Separate Bass and Treble controls. Current valves. Peak output rating. Strong Rexine covered cabinet with handles. Attractive black/gold P.V.C. facia. Neon indicator. For 200-250v. A.C. mains. For 3 or 15 ohm speakers. Send S.A.E. for leaflet.
Terms: Deposit £3.70 and 9 monthly payments of £2.10 (Total £22.60) **£19.95** Carr. 65p

HIGH QUALITY LOUDSPEAKER UNITS

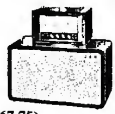
IN TEAK VENEERED CABINETS

L13 13" × 8" 10 Watt 10,000 lines 3 or 15 ohms. State impedance required. **£5.25** carr. 40p

L12 12" 25 WATT 10,000 lines 15 ohms. **£9.50** carr. 45p

L12/25 50 WATT Two tone Rexine and vynair finish. Fitted pair of 12" 50 watt high flux speakers for conservative rating. Impedance 8-15 ohms. Carr. 75p **£29.50**

R.S.C. BASS REGENT 50 WATT AMPLIFIER



A powerful high quality all-purpose unit for lead, rhythm, bass guitar, vocalists, gram, radio, tape. Peak Output rating. Loudspeaker unit optional horizontal or vertical mounting. **£60**
★ Two extra heavy duty 12in. Loudspeakers.
★ Four Jack inputs and two Volume Controls for simultaneous use of up to four pick-ups or "mikes". Carr. £1.50
Bass and Treble controls. Send S.A.E. for leaflet.
Credit Terms Deposit £16 and 9 monthly payments of £5.75 (Total £67.75)

FAL PHASE 50 MkII AMPLIFIER 50W

Solid state 4 Separately controlled inputs. Plus master vol. control. Ind. Bass and Treble Controls. Protective circuit to guard against damage from accidental shorts. Output for Speaker/s 3-30 ohms. Size 17" × 7" × 7½" 200-250v. A.C. mains. I.H.F.M. Output rating.
Or deposit £6 & 9 monthly payments £3·50. Total £37·50. **£33.50** Carr. 65p

FAL PHASE 100 AMPLIFIER 100W

Solid State. 4 Separately controlled inputs Plus master volume control. Ind. Bass and Treble Controls. Protective circuit to guard against damage from accidental shorts. Output for speaker/s 3·30 ohms. I.H.F.M. Output rating.
Or deposit £12 & 9 monthly payments £6·25. Total £68·25. **£61.95** Carr. 75p
Send S.A.E. for leaflets.

FANE ULTRA HIGH POWER LOUDSPEAKERS

All power ratings are R.M.S. continuous. 2 years' guarantee. High flux ceramic magnets. Heavy cast chassis. All carr. free.

'POP' 100
18" 100 Watt 14,000 gauss 8/15Ω
£22.05
Dep: £6 and 9 monthly payments £2·10 (Total £24·90)

'POP' 60
15" 60 Watt 14,000 gauss 8/15Ω
£12.90
Dep. £3.30 and 9 monthly payments. £1.30 (Total £15).

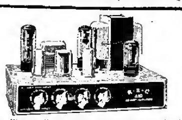
'POP' 50
12" 50 Watt 13,000 gauss 15Ω **£10.50**
Dep £2 and 9 monthly payments £1.15 (Total £12.35) Pair suitable all purposes

FOR BASS GUITAR, ELECT. ORGAN, ETC.

FANE LOUDSPEAKERS 'POP' 25/2

12in. 25 WATT
Dual Cone 15 Ω (for uses other than Bass Guitar or Electronic Organ).
£6.75 Carr. free
or Dep. £1 and 9 mthly payments 75p (Total £7.75).

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



Highly sensitive. Push-Pull high output, Hum level—70dB. Response ±3dB 30-20,000 c/s. All high grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Sensitivity 36 millivolts. For High Impedance microphones. For Clubs, Schools, Theatres. Dance Halls Outdoor Functions, etc. For Electronic Organ, Guitar, String Bass, etc. Gram, Radio or Tape. Two separate inputs with vol. controls permit such as "mike" and Pick-up etc. to be used for mixing purposes, 200-250 v. 50 c/s A.C mains. For 3 and 15 ohm speakers. Complete Kit of parts with wiring diagram and instructions. Twin-handled perforated cover £1.75 Or factory built with EL34 output valves and 12 months' guarantee for £19.75 **£15.75** Carr. 65p
TERMS: Deposit £4 and 9 monthly payments of £2·10 (Total £22·90). Send S.A.E. for leaflet.

RSC TRANSFORMERS, L.F. CHOKES & RECTIFIERS

FULLY GUARANTEED. Impregnated and Interleaved where necessary

Primaries 200-250v. 50c/s. Screened

MIDGET CLAMPED TYPE 2⅝ × 2⅝ × 2¼in.

250v., 60mA, 6.3v. 2a	90p
250-0-250v., 60mA 6.3v 2a	95p

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1.25
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£1.99
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£1.99
300-0-300v. 130mA, 6.3v. 4a., c.t., 6.3v. 1a. For Mullard 510 Amplifier	£2.40
350-0-350v. 100mA, 6.3v. 4a., 0.5-6.3v. 3a.	£1.99
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.40
425-0-425v. 200mA, 6.3v. 4a., c.t., 5v. 3a.	£4.49
425-0-425v. 200mA, 6.3v. 4a., 6.3v. 3a., 5v. 3a	£4.69
450-0-450v. 250mA, 6.3v. 4a., c.t., 5v. 3a.	£4.99

TOP SHROUDED DROP-THRO' TYPE

250-0-250v. 70mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1.20
250-0-250v. 100mA, 6.3v. 3.5a.	£1.40
250-0-250v. 100mA, 6.3v. 2a., 6.3v. 1a.	£1.45
350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a.	£1.50
250-0-250v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£1.99
300-0-300v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£1.99
300-0-300v. 130mA, 6.3v. 4a., 0-5-6.3v. 1a. Suitable for Mullard 510 Amplifier	£2.35
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a.	£1.99
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	£2.35

FILAMENT or TRANSISTOR POWER PACK Types 6.3v. 1.5a. 45p; 6.3v. 2a. 49p; 6.3v. 3a. 69p; 6.3v. 6a. £1.15; 12v. 1a. 50p; 12v. 3a. or 24v. 1.5a £1.20; 0.9-18v. 1¼a. 99p; 0-12-25-42v. 2a. £1.60

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2N930	29p	2N3055	65p	AC128	20p	BC158	11p	BSX20	16p
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2N1132	40p	2N3703	13p	AC176	16p	BC167	11p	MC140	25p
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2N1303	19p	2N3705	13p	ACY22	16p	BC169	11p	MPS6534	30p
2N1304	23p	2N3706	13p	AD140	56p	BC177	14p	NKT211	25p
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2N1306	33p	2N3708	13p	AD149	60p	BC179	14p	NKT214	23p
2N1307	36p	2N3709	13p	AD161	33p	BC182L	10p	NKT274	18p
2N1308	36p	2N3710	13p	AD162	36p	BC183L	10p	NKT403	65p
2N1309	36p	2N3711	13p	AF114	30p	BC184L	11p	NKT405	79p
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2N1711	26p	2N3819	35p	AF117	28p	BC213L	16p	OC81	25p
2N1893	54p	2N3906	35p	AF124	30p	BC214L	16p	OC83	20p
2N2147	95p	2N4058	13p	AF127	28p	BCY70	19p	ZTX300	17p
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2N2219	38p	2N4061	11p	ASY26	27p	BF115	23p	ZTX303	22p
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2N2905	44p	2N4292	15p						

RESISTORS

Code	Power	Tolerance	Range	Values available	1 to 9	10 to 99 (see note below)	100 up
C	1/20W	5%	82 Ω–220K Ω	E12	9	8	7·5
C	1/8W	5%	4·7 Ω–330K Ω	E24	1	0·8	0·7
C	1/4W	10%	4·7 Ω–10M Ω	E12	1	0·8	0·7
C	1/2W	5%	4·7 Ω–10M Ω	E24	1·2	1	0·9
C	1W	10%	4·7 Ω–10M Ω	E12	2·5	2	1·8
MO	1/2W	2%	10 Ω–1M Ω	E24	4	3·5	3
WW	1W	10% ± 1/20 Ω	0·22 Ω–3·9 Ω	E12	7	7	6
WW	3W	5%	12 Ω–10K Ω	E12	7	7	6
WW	7W	5%	12 Ω–10K Ω	E12	9	9	8

Codes: C = carbon film high stability low noise
MO = metal oxide Electrosil TR5 ultra low noise
WW = wire wound Plessey.

Prices are in pence each for same ohmic value and power rating, NOT mixed values. (Ignore fractions of 1p. on total value of resistor order)

Values:
E12 denotes series: 10, 12, 15, 18, 22, 27, 33, 39, 47, 56, 68, 82 and their decades.
E24 denotes series: as E12 plus 11, 13, 16, 20, 24, 30, 36, 43, 51, 62, 75, 91 and their decades.

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Dual gang log	4·7K Ω to 2·2M Ω	42p
Log/antilog	10K, 47K, 1M Ω only	42p
Any type with ½A D.P. mains switch, extra		12p

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MULLARD SUB-MIN ELECTROLYTIC

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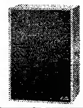

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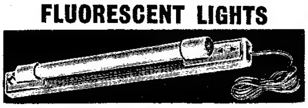

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6″ × 3″	33p	10″ × 7″	51p	14″ × 3″	44p
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COMPLETE RANGE of receivers by Trio, Lafayette, Hallicrafters, etc. Chassis, panels, cabinets. S.A.E. for lists. **Stephens-James Ltd., 70 Priory Road, Liverpool 4. Tel. 051-263 7829.**

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17″ Semi Slim (90 degree tube) **£2**
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All TVs sold complete but unserviced, 12 channel tuners, reasonable cabinets, plus carriage **£1.**

PERFECT SPEAKERS EX TV

PM 3 ohm (minimum order two) 5″ round, 8″ by 2″ rectangular—12½p each. Add 7½p per speaker postage and packaging.

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EB91	**5p**	EY86	**17½p**	PCF80	**7½p**	PY81	**15p**
EBF89	**12½p**	30PL13	**20p**	PCC89	**12½p**	PY800	**15p**
ECC82	**12½p**	630LZ	**12½p**	PCL85	**22½p**	PY82	**7½p**
EC180	**7½p**	30L15	**12½p**	PCL84	**17½p**	PY33	**22½p**
EF80	**12½p**	30P4	**12½p**	PCL82	**17½p**	U191	**17½p**
EF85	**12½p**	PC97	**17½p**	PCL86	**17½p**	6F23	**17½p**
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On two valves or more 5p postage and packaging.

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To suit Ferguson 850 900 Chassis **£2·50p** P. & P. 50p

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Push Button Switch, Type 14 D.M.G. A very fine switch made by Honeywell. The switch is intended for mounting on panel through oblong hole. No screws required for fixing, its sprung clips secure it quite firmly. The operating button is approximately 1 in. dia. round and dished for ease of operation. Has 2 sets of 10 amp c/o contacts. Sprung loaded, returns to normal when pressure released. Ideal for instrument or quality gear. Price **40p. £4** per dozen.

12v. Fluorescent Light. This uses 12 in. 8 watt tube, is energised by transistor inverter thus gives maximum light for minimum battery drain. Ideal for caravan, boat or van interior light. Not a kit, but made up on aluminium body and ready to install. Complete with tube **£4.** Post 20p.

Sew-tric Pump Motor. Very powerful series wound so easily controllable from speed point of view, size 3½ in. x 3 in. approx. For mains working. Price **£1·75** plus 30p post and insurance.

Mains Operated Solenoids Model TT2. A small one but has a powerful pull, size approx. 1½ in. x 1½ in. x 1¼ in. ⅝ in. pull Mains operated, **65p**—model 400/1 medium size 2 in. x 2 in. x ⅞ in. approx. ⅝ in. pull —**80p.** plus 20p post.

TT10. A very powerful solenoid with 1½ in. long pull, as fitted to many automatic washing machines etc. Size 3 in. x 2½ in. x 2½ in. Mains operated **£1·80** plus 25p post and ins.

Cold Room or Air-Conditioning Thermostat. This is calibrated from 30 to 60 F. and operates in the reverse way to normal thermostats, i.e. switches on with a rising temperature. In a neat wall mounting case, size 2½in. x 1½in. x 1½in. Made by famous Teddington company. Limited quantity, **£1·75** each.

110 R.P.M. Geared Motors. This is a powerful 2-pole mains operated induction motor similar construction and size as that used in record players, but much more powerful (⅞ in. stack). Gear box is sealed and the final drive shaft is 1 in. long x ¼ in. diameter. **£1·75.** Postage and insurance 25p.

Hearing Aid Amplifiers. 3 transistors and associated condensers and resistors on a little printed circuit board, the whole thing only about half as big as an Oxo cube. If you are making miniature equipment then these may well be just what you are looking for. **£1·75** each.

Mains Solenoid Operated Water Valve. Normally closed opens when activated. Nylon body as used in many automatic washing machines. The mains solenoid is completely embedded in a resin jacket thus making it absolutely waterproof. Many uses include automatic control of plant watering. Model 1 for 2 small hose connectors, Model 2 for one small and one large hose connector. Price **95p. £10** dozen.

Mains Solenoid Operated Water Valve. Normally open, closes when activated. This is made by Asco their type No. 8030 A2. This is a heavier and somewhat superior water valve with an all-metal body suitable for connecting in line with ½ in. pipe. The solenoid is not waterproofed but is enclosed in a metal casing with ½ in. conduit entry. To facilitate electrical connection the solenoid casing may be rotated through 360 degs. Well made, should give years of trouble free service. Price **£1·75,** post and insurance 30p.

Amplifier Mains Transformer, 50v 1½ amp. Upright mounting with fixing brackets and metal shrouds to contain magnetic field, 50 c/s primary, tapped 110v, 117v, 210v, 230v and 250v. 2 secondaries, one 50v, 1½ amp, other 6v 1 amp for pilot light etc. **£2·50,** postage 30p.

Mains Transformer, 25-0-25v 2 amps, 50 c.p.s. primary tapped 200/250v, in 10v steps, separate screen, 2 secondaries, one 25-0-25v, at 2 amps and the other 110v, at 10 MA. Open construction with mounting feet. **£2·25p,** post 30p.

Multi-Range Test Meter. Handy slip-in-your-pocket size, but angled movement gives wide easily read scale, 8 ranges, D.C. volts 0-15-150-1000 AC volts 0-15-150-1000 OC current 0-150MA. Resistance 0-100k. A very well made tester, 100-o.p.v. ideal for most jobs. Japanese made, of course, and very robust. Buy one of these and save your expensive instruments for precision jobs. Price **£2.** Post and insurance 20p.

Air Spaced Tuning Condenser. 2 gang with slow motion spindle (standard ¼ size). Exact capacity not known, but estimated at approximately 300 p.f., and 250 p.f. **45p. £5** doz.

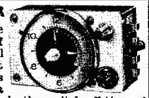
Micro Switch, reference RW18. An ultra sensitive switch operated by spring lever only slightest pressure needed to operate. Contacts rated at 10 amps. Price **20p.**

500K. Edgewise Control Pot-Meter. Morganite, approximately 1½ in. dia. useful size and standard replacement in many T.V. sets. **12p. £1·20** per dozen.

Pre-Set Pot Meters. With integral bakelite control knob, all by Morganite, Welwyn or similar quality makers. Standard size (approximately 1 in. dia.) suitable for pre-set or variable circuits. Low values are wire wound. The following values are in stock. 22ohm, 33ohm, 300ohm, 1K, 5K, 50K, 100K. **10p.** each. **£1** per dozen.

1 Watt Transistor Amplifier. Japanese made, very good quality. Panel size approx. 5½ in. x 2 in. 5 transistors, 3-8 ohm output, operated from 9v battery or from mains with 12v transformer. **£1·25p.**

20 AMP ELECTRICAL, PROGRAMMER



Learn in your sleep: Have Radio playing and kettle boiling as you awake—switch-on lights to ward off intruders—have warm house to come home to. All these and many other things you can do if you invest in an Electrical Programmer. Made by the famous Smiths Instrument Company. This is essentially a 230/240 volt mains operated Clock and a 20 amp Switch, the switch-off time of which can be delayed up to 12 hours (continuously variable not stepped). Similarly the switch-on time can be delayed. This is a beautiful unit, size 5¾ × 3¾ × 2½in. deep. Metal encased, glass fronted with chrome surround. Offered at **£2.40** plus 23p postage and insurance.

INSTRUMENT SWITCHES

Miniature ¾" dia wafers. Silver plated 5 amp std. ¼" spindle.

No. of Poles	2 way	3 way	4 way	5 way	6 way	8 way	9 way	10 way	12 way
1 pole	60p	60p	60p	60p	60p	33p	33p	33p	33p
2 poles	60p	60p	60p	60p	60p	33p	33p	55p	55p
3 poles	60p	60p	60p	60p	£1	55p	55p	75p	75p
4 poles	60p	60p	60p	£1	£1	55p	55p	95p	95p
5 poles	60p	60p	£1	£1	£1·40	75p	75p	£1·15	£1·15
6 poles	60p	£1	£1	£1	£1·40	75p	75p	£1·35	£1·35
7 poles	60p	£1	£1	£1·40	£1·80	95p	95p		
8 poles	£1	£1	£1	£1·40	£1·80	95p	95p		
9 poles	£1	£1	£1·40	£1·40	£2·20	£1·15	£1·15		
10 poles	£1	£1	£1·40	£1·80	£2·20	£1·15	£1·15		
11 poles	£1	£1·40	£1·40	£1·80	£2·60	£1·35	£1·35		
12 poles	£1	£1·40	£1·40	£1·80	£2·60	£1·35	£1·35		

AUTO—ELECTRIC CAR AERIAL

with dashboard control switch—fully extendable to 40in. or fully retractable. Suitable for 12v positive or negative earth. Supplied complete with fitting instructions and ready wired dashboard switch. **£6** plus 25p post and ins.

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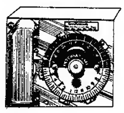
A parcel of integrated circuits made by the famous Plessey Company. A once-in-a-lifetime offer of Micro-electronic devices well below cost of manufacture. The parcel contains 5 ICs all new and perfect, first-grade device, definitely not sub-standard or seconds. 4 of the ICs are single silicon chip GP amplifiers. The 5th is a monolithic NPN matched pair. Regular price of parcel well over **£5.** Full circuit details of the ICs are included and in addition you will receive a list of many different ICs available at bargain prices 5/- upwards with circuits and technical data of each. Complete parcel only **£1** post paid. *DON'T MISS THIS TERRIFIC BARGAIN.*

24-HOUR TIME SWITCH



Made by Smiths, these are AC mains operated, NOT CLOCKWORK. Ideal for mounting on rack or shelf or can be built into box with 13A socket. 2 completely adjustable time periods per 24 hours, 5 amp changeover contacts will switch circuit on or off during these periods. **£2·50** post and ins. 23p. Additional time contacts **50p** pair

DISTRIBUTION PANELS

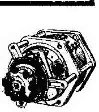
Just what you need for work bench or lab. 4 × 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Suppled complete with 7 feet of heavy cable. Wired up ready to work, **£2** less plug **£2·25** with fitted 13 amp plug; **£2·40** with fitted 15 amp plug, plus **23p** P. & I.

BARGAIN OF THE YEAR

MICROSONIC KEYCHAIN RADIO

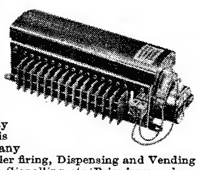
7 transistor Keychain Radio in very pretty case, size 2⅜ x 2⅛ x 1⅛in.—complete with soft leather zipped bag. Specification:— Circuit: 7 transistor superheterodyne. Frequency range: 530 to 1600 Kc/s. Sensitivity: 5 mv/m. Intermediate frequency: 465 Kc/s or 455 Kc/s. Power output: 40mW. Antenna: ferrite rod. Loudspeaker: Permanent magnet type.
In transit from the East these sets suffered slight corrosion as the batteries were left in them but when this corrosion is cleared away they should work perfectly—offered without guarantee except that they are new. Price only **£1·25** less batteries plus **13p.** post 6 for **£7** post free. Pair of rechargeable batteries and charger **85p.**

4 AMP VARIAC CONTROLLERS



With this you can vary the voltage applied to your circuit from zero to full mains without generating undue heat. One obvious application therefore is to dim lighting. Ex equipment but little used—as good as new offered at approx. half price. **£5** plus 75p. post and ins.

HONEYWELL PROGRAMMER



This is a drum type timing device, the drum being calibrated in equal divisions for switch setting purposes with trips which are infinitely adjustable for position. They are also arranged to allow 2 operations per switch per rotation. There are 15 changeover micro switches each of 10 amp type operated by the trips thus 15 circuits may be changed per revolution. Drive motor is mains operated 5 revs per min. Some of the many uses of this timer are Machinery control, Boiler firing, Dispensing and Vending machines, Display lighting animated and signs, Signalling, etc. Price from makers probably over £10 each. Special snip price **£5.75** plus 25p post and insurance. Don't miss this terrific bargain.

DRILL CONTROLLER

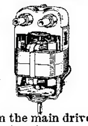
Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. **£1·50** plus 13p post and insurance. Made up model also available, **£1·90** plus 13p post & p.

NEW 1KW MODEL

BALANCED ARMATURE UNIT

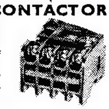
500 ohm, operates speaker or microphone, so useful in intercom or similar circuits. 6/6 ea., £3.10.0 doz.

MULTI-SPEED MOTOR



Replacement in many well known food mixers. Six speeds are available. 500, 850 and 1100 r.p.m. from either or both of the nylon sockets (Where the beaters of the food mixers normally go) and 8,000, 12,000 and 15,000 r.p.m. (ideal polishing speeds) from the main drive shaft. Very powerful and useful motor size approx. 2in. diameter, 5in. long. Price **90p** plus 23p, p. & ins. 12 or more post free.

MAINS OPERATED CONTACTOR

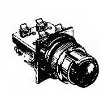


220/240v. 50 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10 amps. Extremely well made by a German Electrical Company. Overall size 2½ × 2 × 2in. **£1** each.

COMPUTER TAPE

2,400 ft. of the best magnetic tape money can buy. Made by E.M.I., 1in. wide almost unbreakable and on a 10½in metal computer spool. Users have claimed successful results with video as well as sound recordings **£1** plus 33p post. Cassette to hold spool 50p extra.

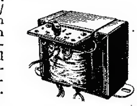
EMERGENCY SWITCH



A heavy duty switch, ideal as an emergency stop switch machine flow-line, etc. To operate the switch you simply push the centre, but this is protected against accidental switching by an extended metal flange. 2 pair contacts one pair open other pair close as switch pressed. **65p.**

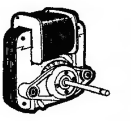
MAINS TRANSFORMER

Output variable 24/38v.



50 c.p.d. primary 230/240v. Voltage from secondary depends upon the setting of a plug connector and may be varied from 24v to 38v approximately in 4 stops. Secondary rated at 40 watts. Price **95p.** Post 20p.

MAINS MOTOR



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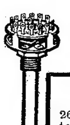

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at **18p** each, **£1·80** dozen, your assortment.

WATERPROOF HEATING ELEMENT
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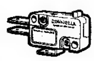
MICRO SWITCH



5 amp. changeover contacts, **9p** each, **£1** doz. 15 amp. Model **10p** each or **£1·05** doz.

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OB2	0.35	6AR6	0.40	6F6G	0.30	10D1	0.50
OB3	0.60	6AR11	1.25	6F11	0.38	10D2	0.40
OC3	0.38	6AS5	0.35	6F13	0.38	10F1	0.90
OD3	0.35	6AS7G	0.80	6F14	0.65	10F9	0.50
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1CP31	6.00	6AU6	0.25	6F18	0.45	10L1	0.45
1L4	0.20	6AV6	0.30	6F23	0.80	10LD11	0.60
1R4	0.35	6AW8A	0.55	6F24	0.75	10P13	0.55
1R5	0.35	6BA6	0.25	6F25	0.75	10P14	1.10
1S4	0.27	6BE6	0.30	6F26	0.35	12AB5	0.60
1S5	0.25	6BF5	0.80	6F28	0.60	12AC6	0.40
1T4	0.25	6BF6	0.50	6J4	0.50	12AL5	0.45
1U4	0.27	6BH6	0.45	6J5GT	0.30	12AQ5	0.43
1U5	0.50	6BJ6	0.45	6J7	0.45	12AT6	0.30
1V2	0.45	6BK7A	0.55	6K6GT	0.55	12AT7	0.33
1X2B	0.40	6BN5	0.43	6K7	0.35	12AU6	0.30
2D21	0.35	6BN6	0.40	6K8G	0.35	12AU7	0.30
3A4	0.35	6BQ5	0.25	6K25	0.75	12AV6	0.33
3B28	2.15	6BR8	0.65	6L6GT	0.45	12AV7	0.50
3BP1	2.75	6BS7	1.30	6L7	0.40	12AX7	0.30
3Q4	0.40	6BW6	0.85	6L18	0.45	12AY7	0.70
3S4	0.35	6BW7	0.70	6LD20	0.40	12B44A	0.55
3V4	0.45	6BX6	0.25	6N7GT	0.40	12BA6	0.35
5R4GY	0.60	6BZ6	0.35	6P1	0.60	12BA7	0.35
5U4G	0.33	6C4	0.33	6P25	1.25	12BE6	0.35
5U4GB	0.42	6C5GT	0.40	6P28	0.65	12BH7	0.40
5V4G	0.42	6CB6	0.30	6Q7	0.40	12BY7	0.55
5Y3GT	0.32	6CD6GA	1.15	6SA7	0.40	12K5	0.55
5Z3	0.50	6CG7	0.50	6SG7	0.35	12K7GT	0.35
5Z4G	0.40	6CH6	0.55	6SK7	0.35	12Q7G	0.30
6/30L2	0.75	6CL6	0.50	6SL7GT	0.35	12SR7	0.35
6AB4	0.35	6CW4	0.63	6SN7GT	0.35	1487	0.80
6AF4A	0.50	6CY5	0.43	6SQ7	0.40	20D1	0.45
6AG7	0.40	6CY7	0.65	6SR7	0.40	20L1	1.10
6AH6	0.50	6D3	0.45	6T8	0.35	20P1	0.50
6AJ8	0.30	6DC6	0.75	6U4GT	0.60	20P4	1.10
6AK5	0.30	6DK6	0.48	6U8A	0.40	20P5	1.20
6AK6	0.57	6DQ6B	0.63	6V6GT	0.38	25C5	0.50
6AL3	0.43	6DS4	0.75	6X4	0.30	25L6GT	0.45
6AL5	0.20	6EA8	0.58	6X5GT	0.35	25Z4G	0.30
6AM5	0.32	6EH7	0.30	6X8	0.55	25Z6GT	0.65
6AM6	0.33	6EJ7	0.35	6Y6G	0.65	30A5	0.45
6AQ5	0.35	6EW6	0.65	7Y4	0.60	30AE3	0.40

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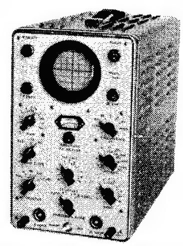
30C1	0.30	50L6GT	0.50	DK40	0.55	ECC83	0.30
30C15	0.80	85A2	0.40	DK92	0.50	ECC84	0.30
30C17	0.85	90AG	2.40	DK96	0.42	ECC85	0.40
30C18	0.75	90AV	2.50	DL96	0.42	ECC88	0.40
30F5	0.85	90C1	0.60	DM160	0.65	ECC89	0.50
30FL1	0.70	90CV	1.25	DY86	0.38	ECC91	0.20
30FL12	0.93	807	0.50	DY87	0.35	ECC189	0.60
30FL14	0.75	812A	3.50	DY802	0.50	ECF80	0.35
30L1	0.40	813	3.75	E88CC	0.65	ECF82	0.35
30L15	0.85	866A	0.75	E180F	0.95	ECF86	0.65
30L17	0.80	5642	0.65	E810F	2.90	ECF804	1.50
30P12	0.80	6080	1.50	EABC80	0.35	ECH42	0.70
30P19	0.80	6146	1.50	EAF42	0.55	ECH81	0.30
30PL1	0.70	6146B	2.50	EBC33	0.50	ECH83	0.40
30PL13	0.93	6360	1.25	EBC41	0.55	ECH84	0.45
30PL14	0.90	6870	2.50	EBC81	0.30	ECL80	0.40
35A3	0.55	6939	2.15	EBF80	0.40	ECL81	0.45
35A5	0.75	7199	0.75	EBF83	0.40	ECL82	0.35
35B5	0.65	7360	1.80	EBF89	0.30	ECL83	0.65
35C5	0.40	7586	1.25	EC53	0.50	ECL84	0.55
35D5	0.70	7895	1.25	EC86	0.60	ECL85	0.55
35L6GT	0.50	9002	0.35	EC88	0.60	ECL86	0.40
35W4	0.30	9003	0.50	EC90	0.33	ECLL800	
35Z3	0.60	AZ1	0.48	EC91	0.50		1.50
35Z4G	0.30	AZ31	0.55	EC92	0.35	EF37A	0.60
35Z5GT	0.40	CBL1	0.80	EC93	0.50	EF39	0.40
50A5	0.70	CBL31	0.90	EC8010	2.25	EF40	0.50
50B5	0.45	CY31	0.35	ECC40	0.60	EF41	0.65
50C5	0.40	DAF96	0.42	ECC81	0.33	EF42	0.70
50CD6G	1.65	DF96	0.42	ECC82	0.30	EF80	0.25

EF83	0.55	EY88	0.43	PCL88	0.90	U78	0.30
EF85	0.35	EZ40	0.45	PCL800	0.93	U191	0.75
EF86	0.30	EZ41	0.45	PCL801	0.70	U201	0.35
EF89	0.28	EZ80	0.25	PD500	1.50	U281	0.40
EF91	0.33	EZ81	0.28	PF86	0.60	U282	0.40
EF92	0.40	GY501	0.80	PF818	0.85	U301	0.40
EF95	0.30	GZ30	0.40	PFL200	0.70	U403	0.50
EF97	0.65	GZ31	0.33	PL33	0.35	U404	0.40
EP98	0.65	GZ32	0.48	PL36	0.55	U801	1.00
EF183	0.30	GZ33	0.70	PL81	0.50	UABC80	
EF184	0.35	GZ34	0.60	PL82	0.45		0.35
EF800	1.00	HABC80	0.45	PL83	0.45	UAF41	0.50
EF804	1.25	HK90	0.35	PL84	0.40	UAF42	0.55
EK90	0.30	KT66	2.05	PL302	0.80	UBC41	0.50
EL33	1.25	KT88	2.00	PL504	0.80	UBC81	0.40
EL34	0.50	N78	1.45	PL508	0.90	UBF80	0.40
EL36	0.50	PABC80	0.40	PL509	1.30	UBF89	0.35
EL37	1.25	PC86	0.60	PL509	1·30	UBL1	0.50
EL41	0.55	PC88	0.60	PL801	0.80	UBL21	0.60
EL42	0.58	PC97	0.50	PM84	0.50	UC92	0.35
EL81	0.55	PC900	0.48	PY31	0.30	UCC85	0.40
EL83	0.42	PCC84	0.40	PY33	0.63	UCF80	0.55
EL84	0.25	PCC85	0.40	PY80	0.35	UCH21	0.60
EL85	0.43	PCC88	0.55	PY81	0.30	UCH42	0.70
EL86	0.40	PCC89	0.50	PY82	0.30	UCH43	0.75
EL90	0.35	PCC189	0.55	PY83	0.38	UCH81	0.35
EL95	0.35	PCC805	0.85	PY88	0.40	UCL81	0.60
EL803	1.00	PCC806	0.80	PY500	1.00	UCL82	0.35
EL821	0.55	PCF80	0.30	PY800	0.50	UCL83	0.60
EL822	0.90	PCF82	0.35	PY801	0.50	UF41	0.60
ELL80	0.75	PCF84	0.50	PZ30	0.35	UF42	0.60
EM34	0.90	PCF86	0.60	QQV2-6	2.15	UF43	0.60
EM71	0.75	PCF87	0.85	QQVO3-10		UF80	0.35
EM80	0.40	PCF801	0.50		1.25	UF85	0.40
EM81	0.60	PCF802	0.50	QQV03-20A		UF89	0.35
EM84	0.35	PCF805	0.75		5.25	UL41	0.65
EM85	1.00	PCF806	0.70	TT21	2.65	UL84	0.30
EM87	0.55	PCF808	0.75	TT22	2.80	UM84	0.20
EN91	0.35	PCH200	0.70	U18/20	0.75	UY1N	0.50
EY51	0.40	PCL81	0.50	U25	0.75	UY11	0.65
EY80	0.45	PCL82	0.35	U26	0.75	UY41	0.45
EY81	0.40	PCL83	0.65	U31	0.45	UY82	0.50
EY83	0.55	PCL84	0.45	U37	1.50	UY85	0.30
EY86	0.40	PCL85	0.40	U52	0.33	W729	0.60
EY87	0.43	PCL86	0.45	U76	0.30	Z803U	0.90

TRANSISTORS

2N404	0.17	2S102	0.40	BC175	0.25
2N444A	0.25	2S104	0.50	BCY30	0.35
2N696	0.20	2S701	0.50	BCY33	0.25
2N697	0.23	2S702	0.50	BCY34	0.30
2N698	0.40	2S746	0.30	BCY72	0.20
2N705	0.70	AC113	0.15	BCZ11	0.40
2N706	0.15	AC125	0.30	BD121	0.80
2N708	0.20	AC126	0.25	BD123	0.95
2N753	0.25	AC127	0.20	BF115	0.20
2N929	0.30	AC128	0.20	BF167	0.25
2N930	0.35	AC132	0.35	BF173	0.30
2N987	0.35	AC153	0.25	BF181	0.25
2N1131	0.40	AC154	0.15	BF184	0.25
2N1132	0.45	AC156	0.23	BF185	0.20
2N1184	1.25	AC157	0.20	BF194	0.20
2N1301	0.40	AC169	0.10	BF195	0.15
2N1302	0.25	AC176	0.25	BF196	0.20
2N1304	0.25	AC187	0.30	BF197	0.20
2N1305	0.25	AC188	0.30	BFW87	0.30
2N1306	0.25	ACY17	0.30	BFW88	0.25
2N1307	0.30	ACY18	0.20	BFW89	0.23
2N1308	0.40	ACY19	0.25	BFW91	0.20
2N1309	0.35	ACY20	0.20	BFX88	0.25
2N1613	0.25	ACY21	0.20	BFY17	0.40
2N1711	0.30	ACY22	0.15	BFY19	0.60
2N1756	0.75	AD140	0.80	BFY50	0.25
2N2147	0.75	AD149	0.50	BFY51	0.20
2N2160	1.25	AD161	0.35	BFY52	0.25
2N2217	0.30	AD162	0.35	BSY26	0.25
2N2218	0.40	AF114	0.30	BSY27	0.30
2N2219	0.45	AF115	0.30	BSY28	0.30
2N2369A	0.25	AF116	0.25	BSY65	0.20
2N2477	0.65	AF117	0.20	BSY95A	0.20
2N2646	0.60	AF118	0.45	OC16	0.75
2N2905	0.50	AF125	0.20	OC22	0.65
2N2923	0.15	AF127	0.25	OC23	0.60
2N2924	0.15	AF178	0.40	OC24	0.60
2N2926	0.15	AF180	0.35	OC25	0.40
9N3053	0.30	AF181	0.35	OC26	0.30
2N3055	0.75	AF186	0.50	OC28	0.60
2N3133	0.35	AF239	0.40	OC29	0.65
2N3134	0.50	AFZ11	0.45	OC30	0.75
2N3391	0.20	ASY26	0.25	OC35	0.50
2N3392	0.15	ASY27	0.30	OC36	0.60
2N3393	0.15	ASY28	0.30	OC42	0.30
2N3394	0.15	ASY29	0.30	OC44	0.20
2N3395	0.20	ASY54	0.25	OC45	0.20
2N3402	0.15	ASY74	0.50	OC70	0.20
2N3403	0.15	ASY77	0.35	OC71	0.15
2N3404	0.35	ASY82	0.20	OC72	0.25
2N3414	0.20	ASY86	0.20	OC73	0.40
2N3415	0.15	ASZ16	0.70	OC75	0.25
2N3416	0.25	ASZ17	0.75	OC76	0.25
2N3417	0.25	ASZ18	0.75	OC78	0.25
2N3702	0.15	ASZ21	0.50	OC78D	0.20
2N3703	0.15	BC107	0.15	OC81	0.25
2N3704	0.20	BC108	0.15	OC81D	0.15
2N3707	0.20	BC109	0.20	OC83	0.20
2N3709	0.15	BC113	0.40	OC139	0.35
2N3710	0.15	BC118	0.30	OC140	0.40
2N3819	0.35	BC134	0.30	OC141	0.60
2N3906	0.30	BC147	0.20	OC170	0.25
2S002	1.00	BC148	0.15	OC171	0.25
2S004	1.00	BC149	0.15		
2S034	1.00	BC152	0.15		

SYNCHROSCOPE TYPE C1-5



3-in tube fitted with telescopic viewing hood, giving bright display in full daylight.
Bandwidth 10 c/s—10 mc/s. Triggered sweep pre-set at 1-2-5-10-30-100-300-1000-3000 μsec per stroke. Free-running time base 20 c/s to 2000kc/s with built-in crystal calibrator providing timing marks at .05-.2-1-5-20-100 μ sec + 5%.
Amptitude calibrator directly calibrated in volts.
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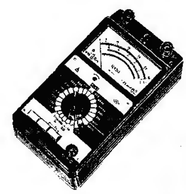

Type U4312
U4313
with AC current ranges

Type U4312—Low sensitivity instrument (667 o.p.v.) 1% accuracy on DC and 1·5% on AC. 9 current ranges on DC (300μA to 6A) and 8 current ranges on AC (1·5mA to 6A). 9 voltage ranges 0·3 to 900V AC/DC. Resistance 0·2 to 30k Ω. Mirror scale.

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Type U4313—20,000 o.p.v. DC and 2,000 o.p.v. on AC. 8 DC current ranges 60μA to 1·5A. 6 AC current ranges 0·6 to 1·5A. 9 DC and AC voltage ranges 1·5-500V. Resistance ranges 0·5-500k Ω. Accuracy 1·5% DC and 2·5% AC. Mirror scale.
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5% tolerance 22-27-33-39-47-56-68-82-100-120-150-180-220-270-330-390-470-560-680-820-1000pF
All at **20np** per twenty.
+50%-20% tolerance 1500-2200-3300-4700-6800-10,000-15,000 pF—All at **23np** per twenty.
+80%-20% tolerance 0.022-0.033-0.047 μF.
All at **23np** per twenty.
Minimum orders 20 of one size.

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BY101	50 p.i.v.	1 Amp	**10np**
IN4002	100 p.i.v.	1 Amp	**10np**
BY125	200 p.i.v.	425mA	**13np**
IN4004	400 p.i.v.	1 Amp	**12np**
BY130	450 p.i.v.	800 mA	**10np**
BY127	600 p.i.v.	1 Amp	**15np**
IN4006	800 p.i.v.	1 Amp	**15np**
BY105	800 p.i.v.	1·1 Amp	**20np**

INTEGRATED MONOLITHIC DUAL OPERATIONAL AMPLIFIER MC1435P

Two identical amplifiers in 14-pin dual-in-line epoxy package. 400mW dissipation. Typical open loop voltage gain 7000. Max. differential input ± 5V. Power supplies 6 to 9V. Max. frequency 1 mc/s. **£2.00.**

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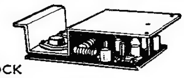
TRANSISTOR AMPLIFIERS



NEW RANGES NOW IN STOCK
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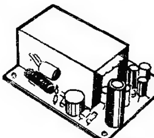

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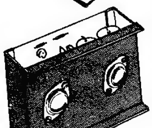

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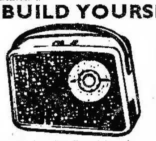

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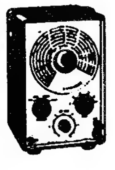

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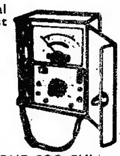

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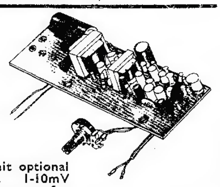

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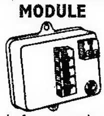

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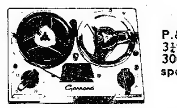

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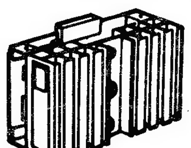

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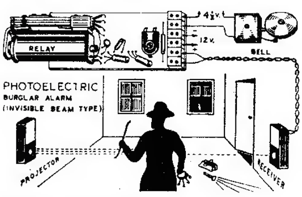

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