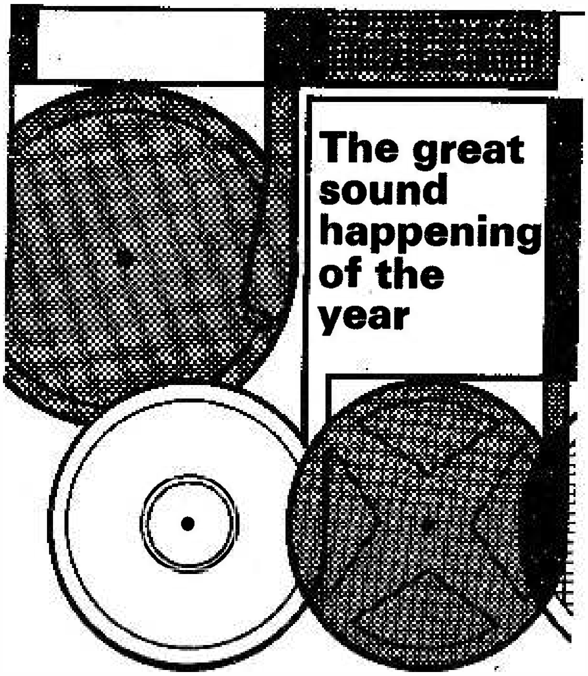
PRACTICAL WIRELESS

NOVEMBER 1971
20p

BUILD THIS 2-Octave Miniature Organ

What to look for at the AUDIO FAIR

Also:
Basic Signal Generator
Comprehensive Multi-Band Receiver



THE 1971 INTERNATIONAL AUDIO FESTIVAL AND FAIR

October 26-30

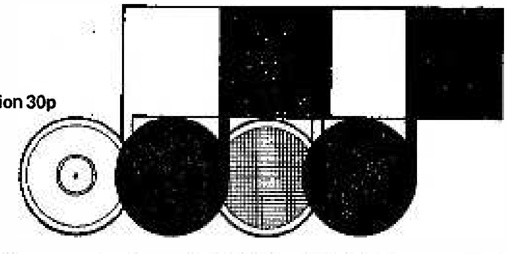
You must see and hear the most comprehensive demonstration of Hi-Fi ever staged in Europe. Come to Olympia and see the big names of the Sound Industry displaying the latest reproduction equipment. Tape recorders, Cassette Players and Cassettes, Loudspeakers and Earphones, VHF radios, Stereo Multiplier Receivers, Tapes and Discs — you can hear them all in action in 100 specially constructed Audio Studios.

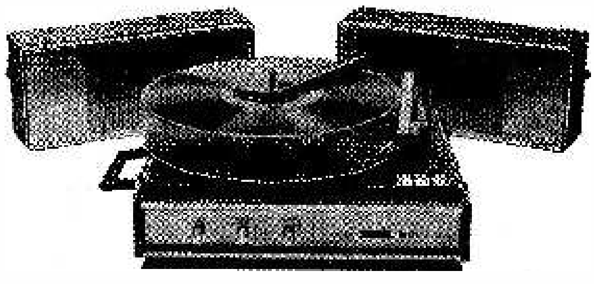
And you can relax in the comfortable Hi-Fi Theatre with daily presentations, lectures and discussions by the industry's top names. Everyone interested in Hi-Fi must come. This is the greatest event in the history of sound techniques.

OLYMPIA

Tuesday to Saturday 10 - 9 daily **LONDON**

Admission 30p





A super stereo for £40·50

£5 Gift Voucher FREE when you buy the Boots Auto Stereo

This popular Boots Auto Stereo is great value at £40·50 (including transparent cover) but now we're giving away a £5 Gift Voucher with every auto player sold! This voucher can be exchanged at any branch of Boots or Timothy Whites — just think of all the many things you can get there with £5, especially in the gift buying season.

And you can be sure that you're getting a really superb stereo player. The Auto Stereo is specially made for Boots by Philips, and is acclaimed by the press; "What a player" said the Daily Express; "Hi-Fi connoisseurs were full of admiration" said the Observer.

The range of Boots audio equipment is expanding rapidly—stereo headphones, low noise cassettes—but why not come and see for yourself.

This Boots Voucher/Stereo offer is available at all BOOTS or TIMOTHY WHITES Record and Audio Departments — but hurry the offer ends on November 6th.

Boots

VALVES

SAME DAY SERVICE
NEW! TESTED! GUARANTEED!

SETS 1R5, 1S5, 1T4, 3S4, 3V4, DAF91, DF91, DK91, DL92, DL94. Set of 4 for £1·02. DAF96, DF96, DK96, DL96, 4 for £1·48.

1R5	·28	30C1	·28	DY87	·25	EL500	·62	PCL82	·32	UABC80	·32
1S5	·22	30C15	·58	DY802	·35	EM80	·41	PCL83	·57	UAF42	·51
1T4	·16	30C17	·79	EABC80	·32	EM81	·41	PCL84	·34	UBC41	·52
3S4	·26	30C18	·61	EAF42	·50	EM84	·32	PCL85	·38	UBF80	·34
3V4	·37	30F5	·69	EB41	·40	EM87	·36	PCL86	·40	UBF89	·32
5U4G	·26	30FL1	·61	EB91	·11	EY51	·38	PCL88	·65	UCC84	·38
5V4G	·35	30FL12	·70	EBC33	·40	EY86	·29	PCL800	·75	UCC85	·35
5Y3GT	·26	30FL14	·68	EBC41	·54	EZ40	·43	PENA4	·77	UCF80	·33
5Z4G	·35	30L1	·29	EBC90	·22	EZ41	·43	PEN36C	·70	UCH42	·58
6/30L2	·54	30L15	·57	EBF80	·32	EZ80	·22	PFL200	·53	UCH81	·33
6AL5	·11	30L17	·71	EBF89	·29	EZ81	·23	PL36	·49	UCL82	·32
6AM6	·13	30P4	·65	ECC81	·17	GZ30	·35	PL81	·44	UCL83	·55
6AQ5	·22	30P12	·72	ECC82	·20	GZ32	·40	PL81A	·49	UF41	·56
6AT6	.20	30P19	·57	ECC83	·35	GZ34	·48	PL82	·31	UF89	·30
6AU6	·20	30PL1	·63	ECC85	·26	KT41	·77	PL83	·33	UL41	·57
6BA6	·20	30PL13	·75	ECC804	·56	KT61	·55	PL84	·30	UL44	£1·00
6BE6	·21	30PL14	·65	ECF80	·27	KT66	·78	PL500	·63	UL84	·30
6BJ6	·41	30PL15	·90	ECF82	·26	LN319	·63	PL504	·63	UM84	·22
6BW7	·52	35L6GT	·45	ECH35	.30	LN329	·72	PM84	·35	UY41	·42
6CD6G	£1·07	35W4	·25	ECH42	·61	LN339	·63	PX25	£1·00	UY85	·25
6F14	·42	35Z4GT	·25	ECH81	·29	N78	·87	PY32	·55	VP4B	·77
6F23	·68	807	·45	ECH83	·40	P61	·45	PY33	·55	Z77	·22
6F25	·57	6063	·62	ECH84	·36	PABC80	·34	PY81	·25	**Transistors**	
6K7G	·12	AC/VP2	·77	ECL80	·30	PC86	·47	PY82	·25	AC107	·17
6K8G	·17	B349	·65	ECL82	·31	PC88	·47	PY83	·28	AC127	·18
6Q7G	·27	B729	·62	ECL86	·36	PC96	·42	PY88	·33	AD140	·37
6SN7GT	·30	CCH35	·67	EF39	·38	PC97	·39	PY800	·34	AF115	·20
6V6G	·23	CY31	·30	EF41	·60	PC900	·33	PY801	·34	AF116	·20
6V6GT	·31	DAF91	·22	EF80	·23	PCC84	·29	R19	·30	AF117	·20
6X4	·23	DAF96	·36	EF85	·28	PCC85	·27	R20	·58	AF118	·48
6X5GT	·28	DF33	·38	EF86	·31	PCC88	·42	U25	·64	AF125	·17
7B7	·33	DF91	·16	EF89	·26	PCC89	·46	U26	·56	AF127	·17
10P13	·58	DF96	·36	EF91	·13	PCC189	·48	U47	·65	OC26	·25
12AT7	·17	DH77	·20	EF98	·65	PCC805	·56	U49	·58	OC44	·12
12AU6	·20	DK32	·33	EF183	·28	PCF80	·28	U50	·26	OC45	·12
12AU7	·20	DK91	·28	EF184	·31	PCF82	·31	U52	·31	OC71	·12
12AX7	·22	DK92	·38	EH90	·37	PCF86	·45	U78	·24	OC72	·12
19BG6G	·87	DK96	·38	EL33	·55	PCF800	·58	U191	·59	OC75	·12
20F2	·67	DL35	·40	EL34	·45	PCF801	·30	U193	·42	OC81	·12
20P3	·80	DL92	·26	EL41	·54	PCF802	·44	U251	·66	OC81D	·12
20P4	·92	DL94	·37	EL84	·23	PCF805	·61	U301	·38	OC82	·12
25L6GT	·20	DL96	·38	EL90	·26	PCF806	·56	U329	·66	OC82D	·12
25U4GT	·57	DY86	·25	EL95	·33	PCF808	·68	U801	·98	OC170	·22

READERS RADIO

85 TORQUAY GARDENS, REDBRIDGE, ILFORD, ESSEX. Tel. 01-550 7441.

Postage on 1 valve 5p, on 2 or more valves 3p per valve extra. Any parcel insured against damage in transit 3p extra.

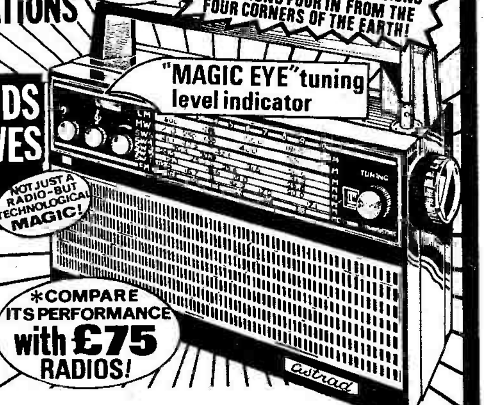
ADVANCE 1972 model —SO FAR AHEAD OF ITS TIME IT WILL STILL BE MAKING SOME LOOK OUT OF DATE IN 1984!

RUSSIA HERALDS THE DAWN OF A NEW ERA IN RADIO TECHNOLOGY!

THE FABULOUS **ASTRAD (VEF) 17** PORTABLE RADIO & COMMUNICATIONS RECEIVER

THIS OFFER ONLY FROM US!

WORLD WIDE RECEPTION
THOUSANDS OF TRANSMISSIONS & STATIONS POUR IN FROM THE FOUR CORNERS OF THE EARTH!



28 TRANSISTORS AND DIODES!

Plus 5 SHORT WAVEBANDS
Plus ULTRA SHORT WAVES (V.H.F. AM. FM. MW. LW. USW.)

WAVEBANDS: STANDARD LONG and MEDIUM

BATTERY MODEL **£19·75** BOX POST ETC. 50p
MAINS/BATTERY ELIMINATOR £1·38 extra

WE COULDN'T EVEN MAKE THEM FOR THIS PRICE!

*COMPARE ITS PERFORMANCE with £75 RADIOS!

IT'S ALMOST UNBELIEVABLE! Just think of the year 1984 and the "perfect radio" that might be produced then, with all the advanced qualities it could possibly have—now place the fantastic ASTRAD (VEF) 17 in front of you and switch on, and you'll see for yourself that the incredible Russians have done it all HERE AND NOW! It's the radio perfectionist's dream come true! THIS ONE SUPERSEDES ALL EARLIER MODELS! It will probably make your present radio seem like a "crystal set"! Complete with optional battery eliminator for both battery and mains use! We're almost giving them away at only £19·75—a mere fraction of even today's Russian miracle price! In fact we challenge you to compare the performance and value with that of £75 radios! ★You just can't lose, we'll refund your money instantly if you are not astounded! Purer and sweeter tone than ever! Much wider band spread than hitherto, for absolute "pin-point" station selection! Plus "MAGIC EYE" tuning level indicator for ultra perfect tuning sensitivity! Yes, the Russians have really surpassed themselves this time, proving once again their fantastic ability in the field of electronics and brilliantly reflecting their advanced micro-circuitry techniques in the field of spaceship and satellite communications. YOU GET THIS AMAZING SET FROM US AT A PRICE THAT BEARS NO RELATION TO ITS TRUE VALUE! Yes, EVERY WAVEBAND instantly at your fingertips including Standard Long, Medium, Short and Ultra Short Waves to cover the four corners of the earth 24 hours a day, including all normal transmissions VHF, AM, FM, MW, LW, USW plus local and new stations not yet operational, Ships at Sea etc., short mobile transmissions and messages from all over the world—truly nothing is secret! (Even getting "Private transmissions" is a piece of cake!) Unique side control waveband selection unit gives incredible ease of station tuning! Superb sweet tone—controlled from a whisper to a roar that will fill a hall! Genuine push-pull output! ON/OFF volume and separate Treble and Bass tone controls for complete and utter perfection of reproduction and tone! Press-button dial illumination! Take it anywhere—runs economically on standard batteries (obtainable everywhere) or direct through battery eliminator from 220/240v AC mains supply. Internal ferrite rod aerial plus built-in "rotatable" telescopic aerial extending to 39ins approx. It's also a fabulous CAR RADIO. Elegant Black and Chrome finish case. SIZE 12¾ins. x 9¼ins. x 4¼ins. overall approx. Magnificently designed and made to give years of perfect service (U.K. service facilities and spares available for years and years to come, if ever necessary!) Complete with WRITTEN GUARANTEE, manual with simple operating instructions and circuit diagram. ONLY £19·75 (with mains/battery eliminator £1·38 extra). BOX, POST ETC. 50p. Standard 'longlife' batteries plus ultra sensitive earphone for personal listening 25p extra. Can also be used through extension amplifier, tape recorder or public address system. (Sorry—we cannot change these new radios for any earlier mode already purchased). HURRY! Send today or call at either store. SHOPPERTUNITES FOR BARGAINS!

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*WHY PAY £40 OR MORE? ADVANCED 1972 MODEL! COMPLETE PORTABLE HIGH FIDELITY COMMUNICATIONS & RADIO RECEIVER

VHF AM FM AFC WITH SPECIAL AIRCRAFT WAVEBAND

AC/DC MAINS and BATTERY

AND... wait for it... BUILT-IN MAINS BATTERY BOOSTER!

MIRACLE PRICE — REDUCED TO **£9·99** POST ETC. 38p

CONTROL TO AIRCRAFT, SHIPS, POP PIRATES, TAXIS, AMBULANCES, LOCAL AND CONTINENTAL STATIONS, ALL B.B.C. VHF AND MANY MORE, including public service transmissions we are not allowed to mention! Far more than an ordinary radio! Bring a new dimension to your world of sound! Range: MW 540–1600 KHz, FM 88–108 MHz, Air 108–145 MHz, Intermediate, Frequency: AM 455 KHz, FM 10·7 MHz, Air 10·7 MHz. 18 SEMI-CONDUCTORS: Transistors 11, Diodes 6 + Thermister! Automatic frequency control 'locks-in,' eliminating drift. Pinpoint selection! Built-in 8-section aerial extending to over 30" approx. Strong leather grained finish case with handle. 10¼in. x 6¼in. x 4in. overall approx. Written guarantee. Only £9·99. post 38p. Runs off mains—AC 230/250 volts—or off standard batteries. That's not all! It's got a built-in Battery Booster too! Just plug in to mains whenever you wish! ★Compare it with sets costing £40 or more. Refund if not delighted. BONUS: Shoulder Strap, earphone for personal listening and dry batteries, all for 31p extra.

MAKE NO MISTAKE

fabulous 1971 model **SAVE £13·98 NOW!** FIRST CLASS MAKER'S DE LUXE MODEL

BRAND NEW Cassette TAPE RECORDER and PLAYER

RECOMMENDED LIST PRICE £26·97 OUR PRICE **£12·99** POST ETC. 30p

WITH REMOTE CONTROL MICROPHONE

This is the expensive model with "piano keyboard" control panel and "Magic Eye" automatic recording level. SAVE £13·98! Due to price we cannot mention famous maker's name—but rest assured you're getting one of the BEST! 1971 cassette model—no fiddling with awkward tape & reels, just "slap in" a cassette and off you go! (Takes 30, 60 or 90 minute standard Philips cassette tapes obtainable everywhere.) Amazing performance ensures perfect tapings and superb reproduction! Remote control microphone. Separate volume control! Rapid rewind! Beautiful tone from a whisper to a roar! Completely self-contained—record anywhere. Separate jacks for remote control microphone, etc. Size 9" x 4¾" x 2¼" overall approx. Case design can vary slightly. With carry handle or strap. WRITTEN GUARANTEE and instructions. Only £12·99, post 30p. Refund guarantee. BONUS one per customer: Cassette tape, set of standard batteries AND microphone stand all for 51p extra if required. A visit to Shopertunities will save you £££s

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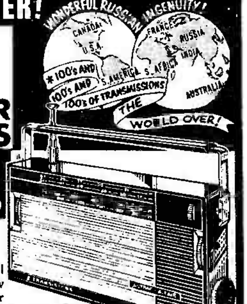
MULTI WAVES TO CONQUER SPACE—ONE SIDE OF THE WORLD TO THE OTHER!

AMAZING RUSSIAN **8** 'VARIABLE WAVEBANDS' TRANSISTOR PORTABLE RADIOS

OUR 'NEVER AGAIN' PRICE **£7·97** POST ETC 33p



*Compare its performance with **£30** RADIOS

EXTRA TUNER FOR FINE STATION SEPARATION!

Never before nationally advertised to the general public in this Country. These amazing brand new Russian Multi-Wave Portable Radios designed for inter-continental reception are truly fantastic — and brilliantly reflect advanced Russian micro-circuitry developments in space communications. We've acquired one gigantic parcel (don't ask us how) and we're almost giving them away at only £7·97 — a mere fraction of even today's Russian miracle price! In fact, we challenge you to compare their performance with that of £30 radios! ★You just can't lose, we'll refund your money instantly if you are not astounded at the value and performance! Superb design and technical specification, incorporating amazing 8 transistor (plus diodes) micro-circuitry techniques. Multi waveband selector with standard long, medium and short wavebands to 'conquer' space. Internal ferrite rod plus 30" approx. extending telescopic aerial. Pick up hundreds of transmissions day and night; yes, even including ships at sea and messages from all over the world. Despite the fantastic range of stations you get pin-point interference-free selectivity with superb extra fine tuner and special Bass/Treble tone controls. Going abroad anywhere? Keep in touch! It's also a 'SUPER' car radio that requires no additional aerial—unique! Quality of tone and volume comparable with that of expensive console models—yet all this performance and power packed into a superbly designed attractive Black and White portable case measuring only 8¼" x 6¼" x 2" overall approx., including carry handle. Plus additional aerial and tape-recorder sockets. Only £7·97, post, etc. 33p, complete with written g'tee. BONUS OFFER miniture earphone for personal listening AND set of batteries 37p extra!

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Both stores open from MONDAY to SATURDAY from 9 till 6.

JUST BEGINNING?

Then try out

8-Watt, 10-Transistor Stereo Amplifier R.137

ROC price £10.50

Separate tone and volume controls for each channel, inputs for turntable (ceramic cartridge), tuner and tape. Attractive black crackle finish with brushed aluminium front. Frequency response: 70-20,000 Hz ±3dB. Output: 4 watts per channel @ 8 ohms. Inputs: Phono 80mV; tuner/aux 80mV.

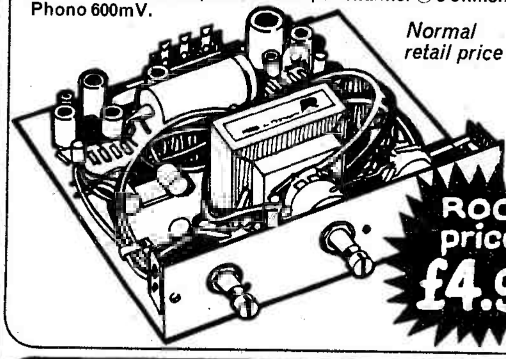
Normal retail price: £14·70

FIRST STEP TO STEREO!

5-Watt Transistor Stereo Amplifier Chassis R.123

Completely self-contained, fully transistorised, mains-powered (240vAC) amplifier, needing only cabinet and knobs. Ideal for adapting mono players to stereo. Frequency response: 40-17,000 Hz ±3dB. Output: 2·5 watts per channel @ 8 ohms. Input: Phono 600mV.

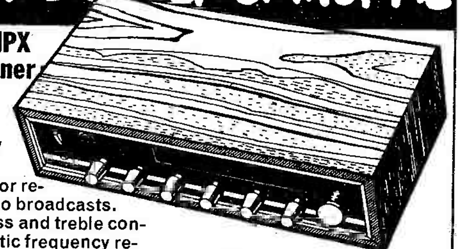
Normal retail price: £7·30



ROC price £4.95

SOUNDS SENSATIONAL

AM/FM/MPX Stereo Tuner Amplifier R.124



A top quality amplifier with facility for receiving stereo broadcasts. Separate bass and treble controls, automatic frequency response, stereo headphone socket, output power: 8 watts. FM frequency range 88-108 M Hz; AM frequency range 535-1605 K Hz. Inputs for turntable (ceramic cartridge) and tape. Frequency response: 50-10,000 Hz ±3dB. Output: 4 watts per channel @ 8 ohms. Inputs: Phono 200mV, tape 100mV. FM: Sensitivity 20µV, stereo separation 26dB, image rejection 55dB. AM: Sensitivity 300µV.

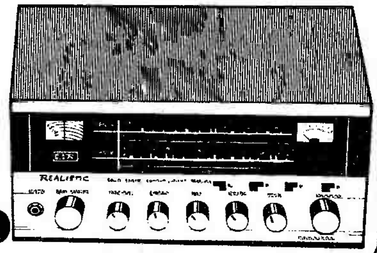
Normal retail price: £42·00 **ROC price: £29.95**

World wide reception

Professional Solid-state, Four-band Communications Receiver R.135

Fully transistorised with continuous coverage from 555K Hz to 30 M Hz in four bands (with illuminated bandspread for 160-10 metres). Incorporates internal speaker, automatic noise limiter, SSB/AM/CW switch, AVC switch, S Meter, Receive and Standby switch, external socket for headphone or speaker, bandspread control, BFO control, on/off/AF gain, band selector, antenna trimmer and RF gain. Runs off 240 v AC, batteries or any 12 v DC negative ground source. Frequency ranges (in mHz): Band A, 535-1·6; B, 1·55-4·5; C, 4·5-13; D, 13-30. Sensitivity: 0·5µV @ 30mHz. Bandspread: 10-160 metres.

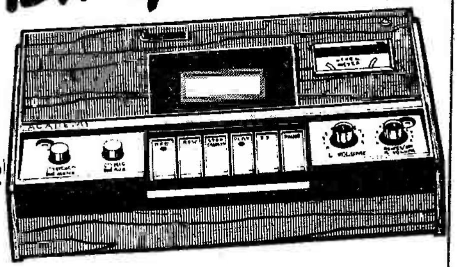
Normal retail price: £65·00



ROC price: £45.00

AMAZING OFFER!

Stereo Cassette Tape Unit R.142



Complete stereo record and playback unit with line and microphone inputs. Fitted with tape counter, separate pause control, recording level metres for each channel, pop-up cassette ejection. Supplied complete with two pencil microphones. Wow & flutter better than 0·3%, frequency response 100-10,000 Hz. Tape speed: 1⅞ IPS, 4·75 CMS. Rewind time: Better than 60 sec (C.60 cassette).

Normal retail price: £65·00

ROC Price £49.50

We don't want you to

Every piece of electronic or audio-equipment we sell is built to our specifications. It comes complete with a Guarantee. And it's tested before it leaves us.

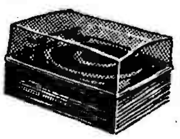
We bend over backwards in our advertising to make sure everything we say is factually accurate. But, buying mail-order, even though you're buying from us, we accept you could still end up with a piece of equipment that's not exactly what you wanted. And we think that's unfair.

FAMOUS TELETON—AM/FM

Stereo Tuner Amplifier R8000

SAVE ££s ANOTHER PSP SUPER SCOOP

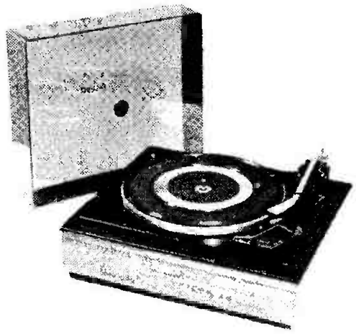
Supplied complete with 2 speakers. Total 12 watts RMS. Specification MPX Beacon, AFC Connections for Tape Recorder, Stereo Headphone Socket, etc.
Mfgs. Rec. Price £63·50
P.S.P. FANTASTIC OFFER only £39.95



Plus GARRARD DECK 2025. Fitted in Famous 'Thorpe Grenville' Plinth & Cover with patented moulded motor board. Fitted with **superb** Sonotone 9TAHCO cartridge. P.S.P. offer

ONLY IF YOU BUY THE ABOVE only £15.40

All orders C.W.O. Special Securicor fast delivery £3.



SUPERB 'THORPE-GRENVILLE' PLINTHS
with Tinted Perspex Covers incorporating the Patented Moulded Motor Board. **Our Price £4·50** p.p 35p.

Suggested System.
SAQ 206 Amplifier, SP25 III Plinth and Cover, G800 cartridge, pair large 3-way speaker system. Also available with EMI 13 × 8 speaker system **£63·95.** Would normally cost £85 complete. **Our price £59·95.**

TELETON SAQ 206 STEREO AMPLIFIER
Latest release, beautifully styled in walnut case, 6+6 watts r.m.s. Switched inputs for magnetic Xtal, aux. Tape. Incorporates volume, bass, treble and, slide balance control, scratch filter and loudness control. Rec. £32·50.
Our price £19·95.

Also available standard perspex cover, **£3·25** p.p 35p.

Also available complete ready wired using above Plinths GARRARD 2025 with Sonotone 9TAHC-Diamond, **£15·40** p.p 35p.

GARRARD SP25111 with G800 fitted in above superb Plinths. **£20·95** p.p 35p.

PERSONAL SHOPPERS PLAN LTD.
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Also a very special bargain only available to customers buying the R8000 and Garrard Deck. TELETON SUPER HI-FI STEREO HEADPHONES RETAILING AT £5·00 — ONLY £1·95

The BATTERIES That Won't Let You Down! RECHARGEABLE

Cells in U2, U11 and Penlite U7 sizes Kestral Battery Charging Unit

Uses :
Tape recorders, Portable radio and TV, Radio controlled model aircraft and boats, Cine cameras, Flashguns, Cordless shavers and other battery appliances.

Whenever you *must* have utterly dependable battery power—then these new Alkaline-Manganese rechargeable cells will provide it. The cells can be recharged many times, a simple job with the Kestrel Charging Unit which has been specially designed for these new type batteries.

PRICES
Batteries U2 equiv. £1·25
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Charging unit £3·99 with one battery holder

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4-STATION INTERCOM

£7.25

Solve your communication problems with this **4-Station Transistor Intercom system (1 master and 3 Subs)**, in de-luxe plastic cabinets for desk or wall mounting. Call/talk/listen from Master to Subs and Subs to Master. Ideally suitable for Business, Surgery, Schools, Hospital, Office and Home. Operates on one 9V battery. On/off switch. Volume control. Complete with 3 connecting wires each 66ft. and other accessories. P. & P. £0.40.

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No batteries—no wires. Just plug in the mains for instant two-way, loud and clear communication. On off switch and volume control. Price £14.40 P. & P. £0.45

INTERCOM/BABY ALARM

OUR PRICE ONLY **£3.35**

Same as 4-Station Intercom for two-way instant communication. Ideal as Baby Alarm and Door Phone. Complete with 66ft. connecting wire. Battery 14p. P. & P. £0.25.

Transistor TELEPHONE AMPLIFIER

£2.99

Why not boost business efficiency with this incredible De-luxe **Telephone Amplifier.** Take down long telephone messages or converse without holding the handset. A useful office aid. On/off switch. Volume Control. Battery 14p. extra. P. & P. 22p. Full price refunded if not satisfied in 7 days.

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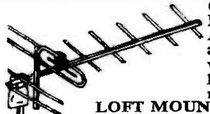
U.H.F. T.V. AERIALS

SUITABLE FOR COLOUR AND MONOCHROME RECEPTION



All U.H.F. aerials now fitted with tilting bracket and 4 element reflector.

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Built in Ferrite Rod Aerial for MW/LW. Retractable, chrome plated 7 section Telescopic Aerial, can be angled and rotated for peak short wave and VHF listening. Push Pull output using 600mw Transistors. Car Aerial and Tape Record Sockets. Switched Earpiece Socket complete with Earpiece. 10 Transistors plus 3 Diodes. 7in × 4in Speaker. Air Spaced ganged Tuning Condenser with VHF section. Volume on/off, Wave Change and Tone Control. Attractive Case in black with silver blocking. Size 9" × 7" × 4". Easy to follow instructions and diagrams. Parts price list and easy build plans 30p (FREE with parts).

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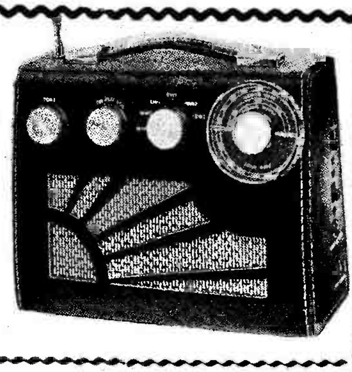

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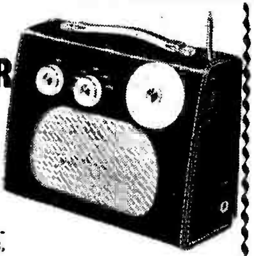

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for MW and LW. Retractable 4 section 24in. chrome plated telescopic aerial for SW. Socket for Car Aerial. Powerful push-pull output. 7 transistors and 2 diodes, including Micro-Alloy R.F. Transistors. 7 × 4in. P.M. speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with carrying handle. Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts price list and easy build plans 15p (FREE with parts). Earpiece with plug and switched socket for private listening, 30p extra.

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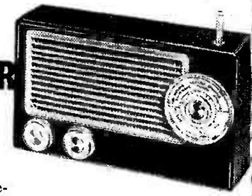

6 Tunable Wavebands: MW, LW, SW1, SW2, Trawler band plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes including Micro-Alloy R.F. Transistors, etc. Attractive black case with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2½in. approx. Easy build plans and parts price list 15p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

Total building costs £3·98 P. P. & Ins. 26p
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POCKET FIVE

3 Tunable Wavebands: MW, LW, Trawler Band 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. Attractive black and gold case. Size 5½ × 1¼ × 3½in. Easy build plans and parts price list 10p (FREE with parts). Earpiece with plug and switched socket for private listening 30p extra.

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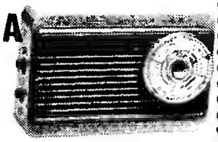
TRANSONA FIVE



NOW WITH 3in SPEAKER

3 Tunable Wavebands: MW, LW and Trawler Band. 7 stage—5 transistors and 2 diodes, ferrite rod aerial. tuning condenser volume control, fine tone 3in. moving coil speaker. Attractive case with red speaker grille. Size 6½ × 4½ × 1½in. 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 £2·50 P. P. & Ins. 22p
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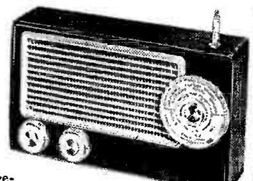

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 × 5½ × 2½in. approx. 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.

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COMPONENTS INCLUDE:
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Introducing R.S.C. MkIII SUPER 30 HI-FI STEREO AMPLIFIER

A COMPLETELY NEW DESIGN FURTHER IMPROVED IN BOTH APPEARANCE and PERFORMANCE. REPRESENTING VALUE FAR HIGHER THAN THE PRICES SUGGEST.
Only high grade components by leading manufacturers.
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WE RECOMMEND USE WITH THE BEST ANCILLARY EQUIPMENT THAT CAN BE AFFORDED.

Or **FACTORY BUILT** with 12 months guarantee **£33·75**
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PRINTED CIRCUITRY, TWENTY SILICON TRANSISTORS.
FOUR DIODES, FOUR RECTIFIERS.
TECHNICAL DETAILS (Applying to each channel where appropriate)
CONTROLS: PUSH-BUTTON SELECTOR (1) Disc (2) Radio (3) Tape (4) Mono L (5) Mono R (6) SPEAKER DIS. (7) Mains on/off. Bass, Treble, and Balance. Plus Ceramic Mag P.U. Switch.

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HUM & NOISE—75dB Min. Vol.—65dB Full Vol. **HARMONIC DISTORTION** 0·1% at 1000 Hz 10 Watts
FREQUENCY RESPONSE: —3dB 7Hz to 70KHz
TREBLE CONTROL: +16dB to —12dB at 14KHz
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SENSITIVITIES: Disc Mag. 2·5mV. Ceramic 35mV. Radio 120mV. Tape 120mV.
REAR PANEL SOCKETS ARE FOR 3 PAIRS OF INPUTS (1) P.U. (2) Radio. (3) Tape Amp. Plus pair for tape recorder signal take off and 2 pairs for speaker connections.

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Four fully wired units ready to 'plug in.'
★ SUPER 30 AMPLIFIER (15 + 15 watt) in veneered housing
★ GARRARD SP25 MKIII Turntable on Plinth with cover
★ GOLDRING CS90 Ceramic Pick up Cartridge with diamond stylus
★ PAIR OF STANWAY II Speaker Units
Special Total Price **£79·80** Carr. £1·50
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Trans. Plastic Cover £3·15 extra.

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Impedance 15 ohms
COMPLETE KIT **£22** Carr. 63p
★ **Performance comparable with units costing considerably more.**
Consists of (1) 12in. 15 watt Bass unit with cast chassis. Roll rubber cone surround for ultra low resonance, and ceramic magnet. (2) 3-way quarter section series cross-over system (3) 8 × 5in. high flux middle range speaker. (4) High efficiency tweeter. (5) Appropriate quantity acoustic damping material. (6) Handsome Teak veneered cabinet. (7) Circuit and full instructions. Terms: Dep. £4·50 and 9 monthly payments £2·25 (Total £24·75).
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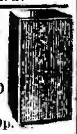

Cabinets latest style Satin Teak veneer. Acoustically lined or filled acoustic damping. Ported where appropriate. Credit terms available.
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Individual Ganged Controls: Bass, Treble, Volume and Balance. Printed circuit construction employing 10 Transistors plus Diodes. Output rating I.H.F.M. Frequency range 20–20,000 c.p.s. Bass Control ±12db. Treble Control ±13db. Selector switch for P.U. or Tape/Radio. For loudspeaker output impedances of 3 to 15 ohms. For standard 200–250v A.C. mains operation. Attractive Black and Silver finished metal facia plate and matching control knobs.

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HIGH FIDELITY OUTPUT OF 6.5 WATTS PER CHANNEL

Designed for optimum performance with any crystal or ceramic Gram. P.U. cartridge. Radio tuner, Tape recorder etc. ★ 3 separate switched input sockets on each channel ★ Separate Bass and Treble controls ★ Slide Switch for mono use ★ Speaker Output 3-15 ohms ★ For 200-250v. A.C. mains ★ Frequency Response 20-20,000 c.p.s. —2dB ★ Harmonic Distortion 0.3% at 1,000 c.p.s. Hum and Noise — 70dB ★ Sensitivities (1) 50mV (2) 400mV (3) 100mV. Output rating I.H.F.M. ★ Handsome finish Facia plate & Knobs.
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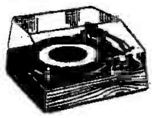

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1 pr Wharfedale Super Linton Speakers, 1 F.A.L. Phase 32 15 + 15 watt Stereo Amplifier
Total Rec. Retail Price £87·70
PACKAGE PRICE £66·50
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TANDBERG 62X TAPE RECORDER (Stereo) £88
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WHARFEDALE SUPER LINTONS £36.75 PAIR Carr. Free

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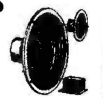
DISCOTHEQUE EQUIPMENT PACKAGE OFFERS

F.A.L. PHASE 50 MK.II AMPLIFIER PR. FANE POP 25/2 25W L/SPEAKERS Terms: Deposit £5.50 and 9 monthly payments of £4.72 (Total £47.98)	£33.50 £13.50 £47.00	PACKAGE PRICE **£44** carr. £1
F.A.L. PHASE 50 MK.II AMPLIFIER PR. FANE POP 50 L/SPEAKERS Terms: Deposit £10.50 and 9 monthly payments of £5 (Total £55.50)	£33.50 £21 £54.50	PACKAGE PRICE **£49·50** carr. £1
F.A.L. PHASE 100 AMPLIFIER PR. L195 50W L/S in cabinets Terms: Deposit £22 and 9 monthly payments of £11.62 (Total £129.58)	£61.95 £59.80 £121.75	PACKAGE PRICE **£118** carr. £1.50
F.A.L. PHASE 100 AMPLIFIER 4 FANE POP 50 L/SPEAKERS Terms: Deposit £15 and 9 monthly payments of £10.52 (Total £109.50)	£61.95 £42 £103.95	PACKAGE PRICE **£99** carr. £1.50

F.A.L. DISCOTHEQUE CONSOLE

Incorporating twin Garrard SP25 Mk.III turntables and Goldring CS90 Ceramic Cartridges with diamond stylii. Separate Vol. controls for each turntable. Also MONITORING FACILITIES, plus Treble and Bass Controls. Black Rexine covered Cabinet with lid. **£65** Carr. £1·25
Terms: Deposit £11 and 9 monthly payments of £6·70 (Total £71·30)

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**
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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.

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HF120	12"	15W	£4.25	HF126D	12"	15W	£5.90

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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. Gauss 10,000. Impedance 3 or 8-15 Ω. STATE WHEN ORDERING **£3·50**

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SE10 For outstanding results with 10in. Hi-Fi 'spkr Size 24x15x10in. P'td. **£6·74**
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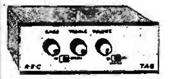
R.S.C. TA6 6 Watt HI-FI SOLID STATE AMPLIFIER



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, 9½ × 2½ × 5½in. Attractive brushed silver finish facia plate 10½ × 3½in. and matching knobs. Complete kit of parts with full wiring diagrams and instructions. **£7·50** Carr. 40p
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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.
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R.S.C. COLUMN SPEAKERS

IDEAL FOR VOCALISTS AND PUBLIC ADDRESS

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

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TYPE C412S 50 WATTS Fitted four 12" 11,000 line 15 watt speakers: Overall size approx 56 x 14 x 9 in. Terms: Dep. £4 and 9 monthly payments £3 (Total £31) **£27·50** Carr 75p

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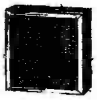
HIGH QUALITY LOUDSPEAKER UNITS IN TEAK VENEERED CABINETS



L13 13" × 8" 10 Watt 10,000 lines 3 or 15 ohms. State impedance required. **£5·25** carr. 40p

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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
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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. Output 60 watts music rating **£33·50**
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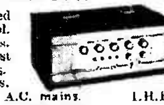

FAL PHASE 100 AMPLIFIER 100W

Solid State. 4 Separately controlled inputs Plus master volume control. Ind. Bass and Treble Controls. Output for speaker/s 3·30 ohms. Protective circuit to guard against damage from accidental shorts. I.H.F.M. Output rating. **£61·95** Carr. 75p
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All power ratings are R.M.S. continuous. 2 YEARS' GUARANTEE High flux ceramic magnets. Heavy cast chassis. All carr. free.

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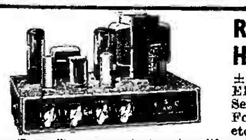
Dual Cone 15 Ω (for uses other than Bass Guitar or Electronic Organ). **£6·75** Carr. free
or Dep. £1 and 9 mthly payments 75p (Total £7.75).

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
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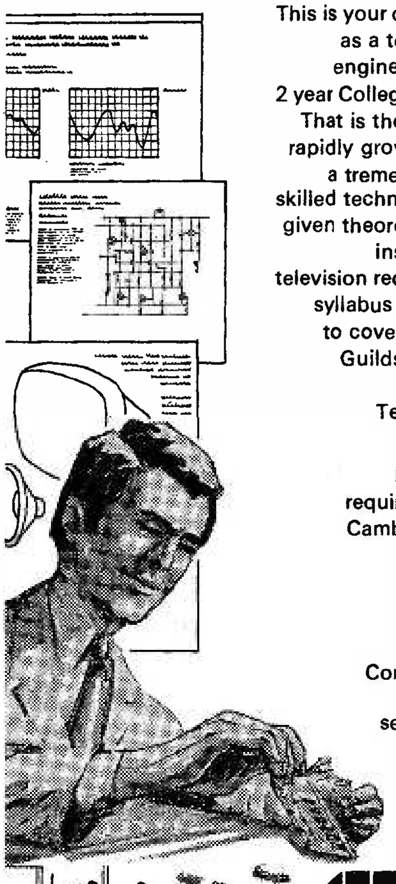

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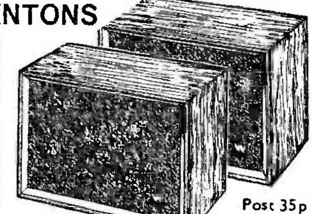
SUPER SPEAKER BARGAINS

WHARFEDALE DENTONS

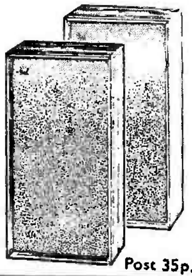


A compact system sold in matched pairs for a perfectly balanced stereo system. Each Denton contains an 8in. bass unit with 3in. pressure unit, coupled by a Wharfedale crossover network. Rated input: 15 watts maximum. Frequency response: 65–17,000Hz. Impedance: 4/8 ohms. Cabinet 9¾in. x 14in. x 8¾in. These most attractive units are available in oiled teak, white or matt walnut and are small enough to blend in with most surroundings.

Post 35p

LIST PRICE £39·90 **£27·00** Teak

WHARFEDALE TRITONS



A new and exciting addition to the Wharfedale range, this three speaker system will satisfy the most ardent Hi-Fi enthusiast. Shelf or floor standing—hand finished in oiled teak or polished walnut. Frequency response 55–22,000Hz. C.A.B. Dome pressure unit. Bass unit 8in. Mid-range unit 5in. Treble unit 2in. Impedance 8 ohms. Size 21¾in. x 9¾in. x 9in.

LIST PRICE £59·90

LASKY'S PRICE **£36·00** Teak

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BSR McDONALD MP60

High precision low-mass counterbalanced pick-up arm, heavy balanced turntable, simple to operate controls, viscous cueing device, slide in cartridge carrier, 4 pole motor.

LASKY'S PRICE **£12·50** Post 35p

BSR McDONALD UNITS & PACKAGES

A. Chassis only. **B.** Complete with Lasky's plinth and cover. **C.** Complete with Lasky's plinth, cover and AD76K cartridge. **D.** Comp. wired on BSR plinth with cover. **E.** As D plus AD76K cartridge.

MODEL	A	B	B	D	E
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HT.70	15·90	20·00	23·50	24·50	27·00
610	14·50	18·57	22·00	23·00	25·50
510	12·10	16·50	19·85	20·00	22·85
310	9·75	14·00	17·25	17·90	20·25
210					9·95
MP.60 TPD2 Styrene base				18·00	21·00

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Four speed autochanger

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Now available ZERO 100S £49.95, post 35p.

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LASKY'S NEW LOW NOISE CASSETTES FROM THE USA

Type	Singles	5	10	20
C·60	32p	£1·52	£2·96	£5·60
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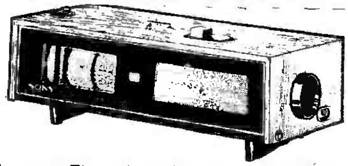
Post Each 5p. 5-20p. 10-25. 20-50p.

SONY 8FC 59WA SCOOP

DIGITAL AM/FM CLOCK RADIO



Digital Alarm Clock Radio. The digital clock shows you the time minute by minute with matchless accuracy and once set the Digimatic will wake you up at the same time every morning without having to be re-set. The radio section features Sony's unique sleep button, you fall gently to sleep lulled by the sweet tone of the radio, which switches itself off at a predetermined time. Available in either black or white. Frequency range 530-1,605KHz (AM); 87-108MHz (FM). Uses 8 transistors and 8 semi-conductors, built-in ferrite aerial and 3¼in loudspeaker. Power requirements: 230V AC 50Hz. Dimensions: 12¼in x 3¾in. x 5¼in.

LIST PRICE £30·00

LASKY'S PRICE **£16·75** Post 35p

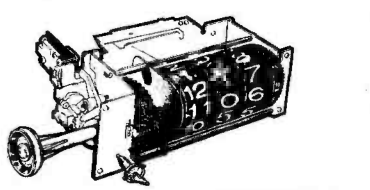
KATONE AM/AIRCRAFT PORTABLE RADIO

BATTERY/MAINS

A combined battery and mains portable of exceptionally attractive design. Housed in a leatherette covered case, size 8½in. x 5¼in. x 3½in., fitted with an 8-section external telescopic aerial for FM and internal ferrite rod for MW wave bands, and clear easy-to-read dial with logging scale. Wave band coverage is FM 88-108MHz, AM 535-1,600KHz. A highly selective circuit using 9 transistors and 9 semi-conductors operating from either 4 x 1·5 volt torch batteries or direct from 230 volts 50Hz AC house mains, from a built-in mains unit. A socket is fitted for a personal earphone. Easy-to-use silver colour knobs, with "woodgrain" panel enhances the appearance of this fine radio.

LASKY'S PRICE **£9·95** Post 15p

DIGITAL CLOCK SCOOP



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SPECIAL QUOTES FOR QUANTITES

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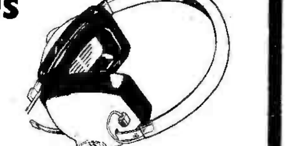
for you to mount into any housing. The clock measures 4¾ W x 1¾ H x 3¾ D (overall from front of drum to back of switch). SPEC.: 210/240V a.c., 50Hz operation; switch rating 250V, 3A. Complete with instructions. **HUNDREDS OF APPLICATIONS. COMPLETE WITH KNOBS.**

LASKY'S PRICE **£6·50** Post 20p

TRIO HS.1 & HS.2 STEREO HEADPHONE BARGAINS



Models HS-1 and HS-2. Both these sets by TRIO offer really superb stereo reproduction in a lightweight, fully adjustable headset designed for optimum comfort. Listening fatigue is unknown with TRIO headphones. Brief spec. both models: Input imp. 8Ω nominal (matching 4 to 8Ω); max. input 0·5W; frequency response 20–19 kHz; output sensitivity at 1mW input: HS-1 118 dB, HS-2 111 dB; weight 0·66lbs. Identical in appearance—both models are finished in ivory with contrasting foam filled ear pads and head band.

LIST PRICE £8·40 LIST PRICE £6·75

HS.1 £5 HS.2 £4 Post 18p

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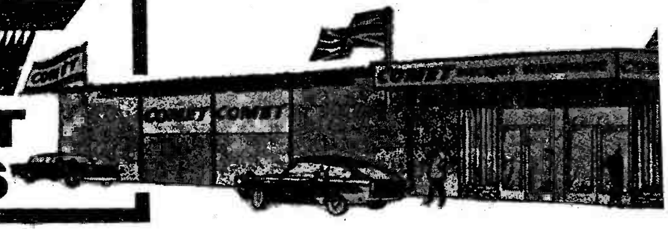

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ALBA UA 700	34·50	26·00
AMSTRAD Stereo 8000	25·95	16·95
ARMSTRONG 521	56·00	41·75
DULCI 207M	32·00	19·95
FERROGRAPH F307 Mk. II (Cased)	64·00	45·95
FERROGRAPH F307 Mk. 11	60·00	45·95
GOODMANS Maxamp	54·00	37·95
LEAK Stereo 30 Plus	56·50	40·95
LEAK Stereo 30 Plus, in teak case	62·50	45·95
LEAK Stereo 70 Chassis	69·00	49·50
LEAK Stereo 70 cased	75·00	54·50
METROSOUND ST20E	39·50	27·95
PHILIPS RH 591	79·00	54·95
PHILIPS RH 590	52·00	36·95
PHILIPS RH 580	29·00	18·50
PIONEER SA500	62·10	39·25
PIONEER SA700	98·00	67·95
PIONEER SA900	134·10	94·45
PIONEER Reverberation	45·50	31·95
RANK Rotel 310	45·00	32·95
RANK Rotel 610	69·00	49·95
ROGERS Ravensbourne	59·50	42·95
ROGERS Ravensbourne (cased)	64·00	47·95
ROGERS Ravensbrook Mk. II	47·50	34·95
ROGERS Ravensbrook (cased) Mk. II	52·50	38·95
SINCLAIR 2000	35·00	23·75
SINCLAIR Project 60/2 x Z30/PZ5	23·90	15·95
SINCLAIR PROJECT 60/2 x Z50/PZ8/trans	34·86	23·25
SINCLAIR AFU	5·95	4·45
SINCLAIR Neoteric	61·95	43·95
SINCLAIR 3000	45·00	31·50
TELETON SAQ 206	32·50	17·50
TELETON GA101	37·50	28·50
VOLTEX 100w. Stereo Discotheque, 8 electronically mixed inputs	185·00	139·00

All the above take both ceramic and magnetic cartridges.

	Rec. Retail Price	Comet Price
TUNER/AMPLIFIERS		
AKAI AA 8500	221·85	175·00
AKAI 6600	137·34	108·00
AKAI 6300	128·85	99·95
ARENA R500	82·00	67·00
ARENA 2400	90·30	72·00
ARENA 2600	111·30	69·95
ARENA 2700	88·63	73·95
ARENA T9000	303·45	285·00
ARMSTRONG M8 Decoder	9·50	7·70
ARMSTRONG 525	88·55	69·95
ARMSTRONG 526	100·90	79·95
GOODMANS Mod. 80, 35w. R.M.S.	91·59	68·95
MIDLAND 19/542	49·56	37·50
PHILIPS 882	96·50	76·95
PHILIPS RH 790	134·00	98·95
PIONEER SX770 AM/FM	159·79	125·95
PIONEER SX990 AM/FM	192·61	148·95
PIONEER 440	119·62	95·00
TANDBERG 1171 comp. with decoder	110·00	94·00
*TELETON F2000	51·50	28·95
TELETON 7AT20	119·75	69·95
TELETON 10AT1 150w. RMS	160·00	94·00
TELETON TFS50	79·65	52·95
TELETON TFS 50LA MW/LW/VHF	86·64	60·95
*TELETON R.8000 with Speakers	63·25	37·50
TELETON CR55	125·26	74·95
WHARFEDALE 100-1	139·00	89·95

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.

	Rec. Retail Price	Comet Price
CARTRIDGES		
GOLDRING 800	12·55	6·75
GOLDRING 800E	18·16	10·50
GOLDRING 800 Super E	25·10	15·95
*GOLDRING CS90 Stereo	5·02	4·10
*GOLDRING CS91/E	7·53	6·00
GOLDRING G850	6·27	3·95
EMPIRE 1000ZE/X	60·34	51·25
EMPIRE 999VE/X	43·00	34·95
EMPIRE 999TE/X	25·09	21·00
EMPIRE 999SE/X	20·31	16·95
EMPIRE 999E/X	15·89	12·50
EMPIRE 999/X	12·55	10·25
EMPIRE 909E/X	12·37	9·95
EMPIRE 909/X	9·26	7·75
EMPIRE 90EE/X	9·56	7·95
ORBIT Magnetic NM 22	Special Price	2·95
ORTOFON SL15E	28·62	22·95
ORTOFON 2X15K Transformer	7·00	4·95
SHURE M3DM	7·16	4·50
SHURE M31E	11·63	8·70
SHURE M32E	10·73	8·05
SHURE M32-3	9·84	7·80
SHURE M44-5	10·73	7·19
SHURE M44-7	9·84	7·15
SHURE M-44C	9·84	7·15
SHURE M44E	11·63	7·50
SHURE M55E	12·52	8·95
SHURE M75G	16·99	13·75
SHURE M75-6	16·10	12·45
SHURE M75EJ	18·78	14·95
SHURE M75E	20·57	12·95
SHURE V15-11	39·35	27·95
SHURE V15-11-7	37·56	27·95

Starred cartridges above are ceramic. All others are magnetic.

	Rec. Retail Price	Comet Price
PICKUP ARMS		
GOLDRING Lenco L75	13·98	0·50
GOLDRING Lenco L69	10·04	6·50
SME 3009 with S2 Shell	33·26	24·95
SME 3012 with S2 Shell	35·42	26·45

TURNTABLES

The following Turntables are complete with base, plinth, perspex cover and cartridge. Fully wired and ready for use. All at special prices.

GARRARD SP25 Mk 111 with Goldring G.800 Special Price £19·95

GARRARD SP25 Mk 111 with Shure M.44/7 Special Price £22·95

GARRARD SP25 Mk 111 with Shure M.55E Special Price £23·95

GARRARD AP76 with Goldring G800 Special Price £30·95

GARRARD AP76 with Shure M55E Special Price £32·95

GARRARD AP76 with Shure M75E Special Price £36·95

GARRARD 2025 with Sonotone 9TAHC Special Price £14·50

GOLDRING 705/P with G850 Special Price £15·95

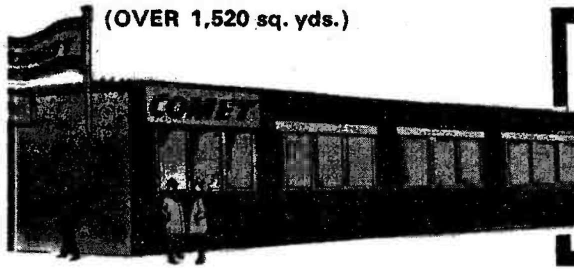
GOLDRING GL75 with G800 Special £39·95

GOODMANS 3025 with G800 Special Price £26·90

	Rec. Retail Price	Comet Price
DUAL 1219 transcription	60·40	50·00
DUAL 1209 transcription	42·62	35·00
GARRARD SP25 Mk III	15·85	10·50
GARRARD SL65 B	20·48	13·45
GARRARD SL75 B	39·20	26·50
GARRARD SL95 B	49·23	32·95
GARRARD 401	39·26	27·45
GARRARD SL72 B	31·93	23·95
GARRARD 3500, with GKS Cart.	15·25	10·95
Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500	Special Price	3·50
GARRARD 40B	13·34	10·49
GARRARD AP76	27·85	18·90
GOLDRING GL69 Mk. II	27·60	19·50
GOLDRING GL69P Mk. II	36·21	26·95
GOLDRING GL75	40·15	28·95
GOLDRING GL75P	48·76	35·95
GOLDRING Covers for 69P and 75P	4·48	3·30
GOLDRING C99—plinth and cover for G99	11·05	9·75
GOLDRING G99	26·89	19·95
GOODMANS 3025	37·74	21·95
McDONALD MP 60	15·20	10·95
McDONALD 610	19·28	14·50
McDONALD HT 70	21·22	17·50
McDONALD HT 70 inc. Plinth and Cover	30·68	24·95
Base and Cover for McDONALD MP 60 and 610	Special Price	4·25
PHILIPS GA146	30·35	23·95
PHILIPS 202 Electronic	66·50	49·95
PHILIPS 308 transcription unit complete with base and cover	37·60	29·95
PIONEER PL12A with base & cover	48.34	36·95
THORENS TX25 cover	8·52	6·95
THORENS TD125	78·03	58·95
THORENS TD125AB	115·57	94·50
THORENS TD150A Mk. II	44·40	34·50
THORENS TD150AB Mk. II	48·05	40·25
THORENS TX11 Cover	4·26	3·50

	Rec. Retail Price	Comet Price
SPEAKERS		
B & W Model 70	159·50	114·95
B & W DM3	63·00	48·40
B & W DM1	38·47	31·95
CELESTION Ditton 120	28·85	22·95
CELESTION Ditton 15	38·47	31·95
CELESTION Ditton 25	65·00	46·95
GOODMANS Minister	24·10	17·45
GOODMANS Magister	62·50	41·95
GOODMANS Maxim	19·66	14·95
GOODMANS Mezzo 3	34·00	22·95
GOODMANS Magnum K2	44·00	29·95
J & S Model SXMT (pair)	26·95	14·95
KEF Cresta	22·17	18·00
KELETRON Speakers		
KN500 4 speaker system (pair)	23·00	15·50
KN700 4 speaker system (pair)	27·50	18·25
KN1000 4 speaker system	19·25	13·95
KN1500 4 speaker system	24·75	18·95
KN2000 4 speaker system	28·75	19·95
LEAK 200	30·19	16·45
LEAK 300	39·33	21·95
LEAK 600	49·50	34·95
LOWTHER Acousta (with PM6)	52·50	45·50
LOWTHER Acousta (with PM7)	65·00	54·00
LOWTHER Ideal Baffle	37·50	32·00
METROSOUND HFS103 (pair)	30·05	19·95
METROSOUND 202	21·50	15·95
METROSOUND HFS20	23·59	17·95
METROSOUND HFS10 (pair)	26·65	21·95
PHILIPS RH481	10·60	8·45
PHILIPS RH482	17·35	14·45
SINCLAIR Q16	8·95	6·20
STE-MA 400	24·00	16·95
TANDBERG TAN 7	28·00	23·95
TANDBERG TAN 11	19·00	16·25
TANDBERG TAN 15	45·00	35·95
WHARFEDALE Speakers		
Denton	19·23	14·70
Super Linton	24·05	18·45
Melton	32·50	21·95
Dovedale 3	45·00	26·95
Rosedale	65·00	48·50
Triton (pair)	72·16	39·95
Unit 3 Speaker Kit	12·53	9·70
Unit 4 Speaker Kit	18·00	12·50
Unit 5 Speaker Kit	26·00	18·50

	Rec. Retail Price	Comet Price
CHASSIS SPEAKERS		
GOODMANS Axiette 8	7·81	6·25
GOODMANS Twin-axiette 8	8·84	6·95
GOODMANS Axiom 10	9·26	7·50
GOODMANS Axiom 80	27·29	22·75
GOODMANS Axiom 201	14·45	10·45
GOODMANS Axiom 401	17·86	13·95
GOODMANS Twin Axiom 10	9·86	7·50
GOODMANS Audiom 8P	5·35	4·05
GOODMANS Audiom 10P	5·83	3·25
GOODMANS Audiom 51	13·05	9·50
GOODMANS Audiom 61	18·95	13·50
GOODMANS Audiom 12P	12·37	9·50
GOODMANS Audiom 15P	20·00	16·50
GOODMANS Audiom 18P	34·00	25·95
GOODMANS ARU172	4·50	3·25
GOODMANS Trebax 100	8·60	5·50
GOODMANS Trebax 5K/20XL	9·70	7·25
GOODMANS Midax 650	12·95	8·50



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GOODMANS Crossover Networks XO/950	7·40	5·50
GOODMANS Crossover Networks XO/5000	2·65	1·80
WHARFEDALE 8in.Bronze/RS/DD	4·82	3·50
WHARFEDALE Super 8/RS/DD	8·19	6·75
WHARFEDALE Super 10/RS/DD	11·20	9·50
WHARFEDALE WMT1 Matching Transformer	0·84	0·70

HI-FI STEREO SYSTEMS COMPLETE

	Rec. Retail Price	Comet Price
ALBA UA552	45·86	35·50
ALBA UA662	60·32	46·95
DECCA Sound 613	70·14	57·95
DECCA Sound 614	66·55	54·95
DECCA Sound 1204	89·44	72·95
DECCA Compact 3	119·56	103·95
ECKO SRG 609 with radio	85·44	49·95
ECKO ZU5 with radio	159·29	99·00
FERGUSON 3422	84·80	65·95
FERGUSON 3423	114·15	89·95
FERGUSON 3425 with radio	140·10	108·00
FERGUSON 3450 with radio	72·40	59·95
FIDELITY UA2 Music Master	44·41	31·95
FIDELITY UA1 Music Master with radio	103·29	79·95
SPECIAL OFFER GOODMANS Max-amp Stereo Amplifier, Goodmans Stereo-max AM/FM Tuner with Decoder. Pair of Goodmans Magnum K2 Speakers. Garrard A.P. 76 Turntable in base, complete with cover and Goldring G.800 Cartridge. Beautifully finished in Walnut	257·13	169·95
H.M.V. 204/5/6 with radio	198·00	155·95
HMV 2452	65·65	53·95
HMV 2450 with stereo radio	134·20	109·00
KB KA1250 complete with two 653 speakers	71·55	58·50
KB KA1250 complete with two 651 speakers	80·25	64·95
KB 2010 with radio and two 653 speakers	94·70	76·95
LEAK 30/Goldring/Wharfedale	182·65	142·95
LEAK 70/Thorens/Wharfedale	226·87	175·00
MARCONI Unit 3	84·80	64·95
MARCONI 4450 with radio	72·40	55·50
MARCONI 4452	76·00	55·95
METROSOUND Stereo 1010 complete with speakers	79·34	55·95
PHILIPS 580/481/105	71·00	55·95
PHILIPS GF 823	47·80	36·95
PHILIPS GF 824	67·10	52·95
PHILIPS RF 833	67·10	52·95
PHILIPS GF 834	86·40	65·95
PHILIPS GF 417	96·06	69·95
TELETON 2S60F with radio	72·40	53·95
TELETON STP 8-track Stereo System	54·75	48·00
TOSHIBA SP8507	248·00	175·00
ULTRA 6405	77·00	64·95

TAPE RECORDERS AND TAPE DECKS

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AKAI 1720L 4-track Stereo	83·73	65·95
AKAI 4000 D 4-track stereo deck	89·95	65·95
AKAI CR 80D 8-track stereo tape deck	91·56	76·95
AKAI CR80 8-track stereo recorder	110·83	96·95
AKAI X200D	145·95	115·00
AKAI 1800SD	153·00	119·00
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BUSH Discassette DC70	21·19	16·95
BUSH TP60 Cassette tape recorder	28 38	23 95
BUSH TP70 Cassette, battery/mains tape recorder	28·91	23·50
FERGUSON 3245 Twin track	36·70	27·95
FERGUSON 3246 4-track	42·55	32·95
FERGUSON 3247 4-track	47·95	37·95
FERGUSON 3248 4-track	53·75	41·95
FERGUSON 3252 4-track	100·52	80·95
FERROGRAPH 702 2-track tape deck	220·22	185·00
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FERROGRAPH 722	256·52	209·00
FERROGRAPH 702 Dolby	272·25	229·00
FERROGRAPH 724	256·52	209·00
FERROGRAPH 722 Dolby	308·55	262·00
GRUNDIG C200 De Luxe Cassette	38·45	28·95
GRUNDIG TK 121 twin track	55·30	41·95
GRUNDIG TK 141 4-track	61·55	47·95
GRUNDIG TK 146 4-track Auto	67·25	51·95
GRUNDIG 222 stereo cassette	57·70	47·95
GRUNDIG TK 147 4-track Auto	93·35	74·95
MIDLAND TC 144 cassette	18·00	11·95
PHILIPS 2202 cassette	26·90	19·95
PHILIPS 2204 cassette, battery/mains	32·30	23·95
PHILIPS 2205 cassette tape recorder	41·60	33·50
PHILIPS 3302 cassette	23·05	17·50
PHILIPS 4303 new release	40·55	32·50
PHILIPS 4307 4-track	47·80	35·95
PHILIPS 4308 De luxe 4-track	58·40	43·50
PHILIPS 4404 2-track stereo recorder	91·70	69·95
PHILIPS 4407 4-track stereo recorder	106·20	85·95
PHILIPS 4500 4-track stereo tape deck	121·65	94·95
PHILIPS 4408 4-track stereo	134·20	104·50
PHILIPS 2503 Cassette Stereo tape deck	52·05	41·95
PHILIPS 2400 stereo cassette less L/S	65·55	56·45
PYE Cassette Recorder/Radio 9000 battery/mains	43·86	35·95
TANDBERG 1841 4-track stereo tape deck	68·00	58·95
TANDBERG 3021X twin track stereo	107·00	91·00
TANDBERG 3041X 4-track stereo	107·00	91·00
TANDBERG 4021X twin track stereo	174·00	145·00
TANDBERG 4041X 4-track stereo	174·00	145·00
TANDBERG 6041X 4-track stereo	188·00	158·00
TANDBERG 6021X twin track stereo	188·00	158·00
TELETON 8110 cassette	26·75	14·95
TELETON TC110 cassette battery/mains	26·79	18·95
TELETON TRC130 cassette with VHF/AM Radio, Batt./Mains, twin motors	40·31	27·95
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WHARFEDALE Dolby DC9 cassette stereo tape deck	110·84	94·50

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	Rec. Retail Price	Comet Price
GARRARD WB1 Base	3·71	3·25
GARRARD WB4 Base	5·49	4·75
GARRARD SPC 1 Cover	3·60	2·95
GARRARD SPC 4 Cover	4·27	3·75
Special offer of Base and Cover to fit GARRARD SP25, SL55, SL65B and 3500	Special Price	4·00
GOLDRING Plinth 75	8·60	7·00
GOLDRING Plinth 69	8·60	7·00
GOLDRING Covers for 69P and 75P	4·48	3·75
THORENS TX25 (for TD125AB)	8·52	6·95
THORENS TX11 Cover	4·26	3·75
Base and Cover for TD 125	15·04	12·45
SME Plinth System 2000	41·36	30·50
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GOLDRING 705P turntable complete with G850 Cartridge, Midland Tuner/Amp., pair of Metrosound 103 Speakers	99·56	69·95
GOODMANS Module 80 Tuner/Amplifier, Garrard AP76 Turntable with Goldring G800 Cartridge and 2 Goodmans Minister Speakers	199·00	139·00
METROSOUND 448 8-track stereo play-back unit complete with 2 HFS 10 Speakers	83·56	70·95
GOLDRING 705P turntable complete with G850 Cartridge, Teleton 206 Amplifier, pair of Keletron KN500 Speakers	77·00	49·95
TELETON STP 801 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 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	142·51	108·50
LEAK 30/THORENS/WHARFEDALE	182·65	142·95
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
THORENS TD 125AB Electronic Turntable complete with cover. SHURE V15-11 Cartridge, GOODMANS Maxamp, GOODMANS Stereomax AM/FM Tuner. 2 GOODMANS Magister Speakers	422·48	309·00
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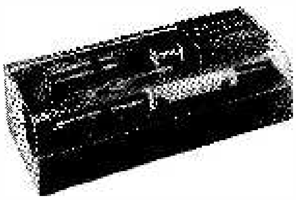

SK1 SOLDERING KIT

In rigid plastic "tool box" containing Model CN - 15 watts - 240 volts miniature iron fitted $\frac{3}{16}$" bit. Spare bits $\frac{5}{32}$" and $\frac{3}{32}$". Reel of resin-cored solder, heat sink, cleaning pad, stand and booklet "How to Solder".

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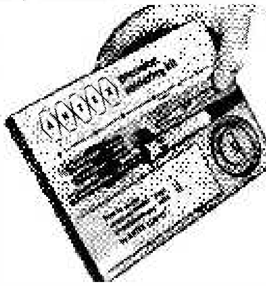

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In polystyrene pack, containing 15 watt miniature soldering iron, 240 volts fitted with $\frac{3}{16}$" bit, 2 spare bits $\frac{5}{32}$" and $\frac{3}{32}$". Coil of resin-cored solder, heat sink, 1A fuse and booklet "How to Solder".

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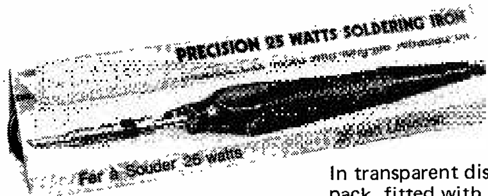

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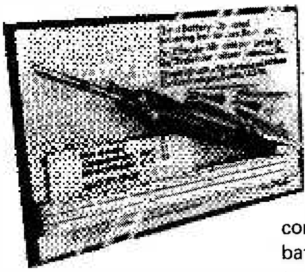

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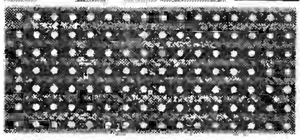

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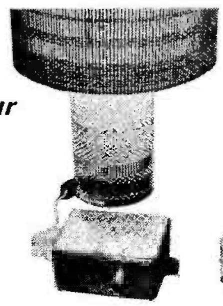

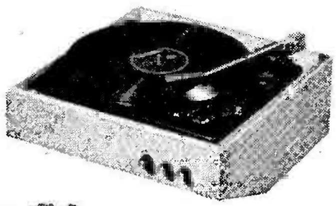

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SPECIFICATION R101
14 watts per channel into 3 to 4 ohms. Total distortion @ 10W @ 1kHz 0·1%. *P.U.1* (for ceramic cartridges) 150mV into 3 Meg. *P.U.2* (for magnetic cartridges) 4mV @ 1kHz into 47K. equalised within ± 1dB R.I.A.A. *Radio* 150mV into 220K. (Sensitivities given at full power). Tape out facilities; headphone socket, power out 250mW per channel. *Tone controls and filter characteristics*. Bass: +12dB to −17dB @ 60Hz. Bass filter: 6dB per octave cut. Treble control: treble +12dB to −12dB @ 15kHz. Treble filter: 12dB per octave. *Signal to noise ratio*: (all controls at max) R101—P.U.1 and radio—65dB. P.U.2. −58dB. **R100** same as R101 but P.U.2 (for crystal cartridges) 450mV into 3 Meg. *Cross talk* better than −35dB on all inputs. *Overload characteristics* better than 26dB on all inputs. Size approx 13¾″ x 9″ x 3¾″.

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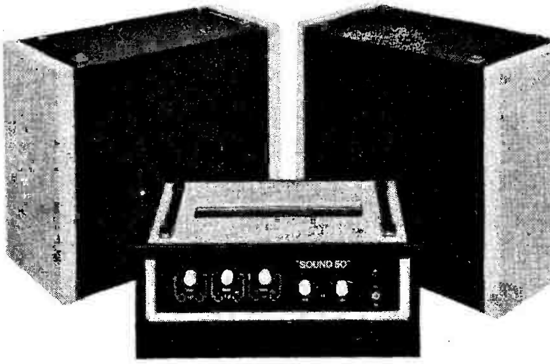
SOUND 50

50 WATT AMPLIFIER & SPEAKER SYSTEM



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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.

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Sound 50 amp and 2 speakers

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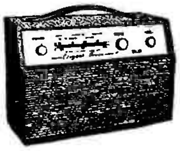
THE ELEGANT SEVEN Mk. III

(350mW Output)



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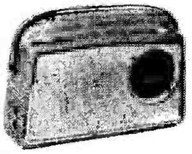

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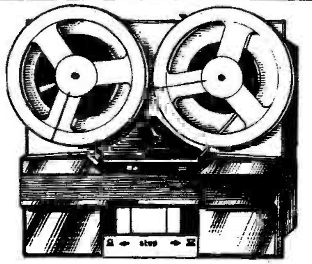

with high impedance heads

R.C. 74 tape deck. Three speeds—7½, 3¾ and 1⅞ ips.
4-track record/playback head. Plus 4-track erase head. Positive pressure pad system. Takes any tape spool up to and including 7″. The R.C. 74 is driven by a powerful 200/250V 50-cycle A.C. motor. A heavy, accurately balanced, flywheel brings wow and flutter levels down to approx. 0.3% total at 3¾ and 7½ ips. Fast rewind in both directions.
Controls couldn't be simpler! Just five push buttons that interlock to cut out accidental tape damage. Efficient servo-action type braking. Easy drop-in tape loading.
The R.C. 74 comes with an attractive moulded deck cover, which has positions for tone and volume controls. The unit is built into a rigid die-cast frame, and overall size of the whole unit is 12⅞ × 11⅛ × 6 inches. Every single deck fully tested before dispatch. Spools not supplied.

Price complete **£15·00.** Plus 75p P. & P.

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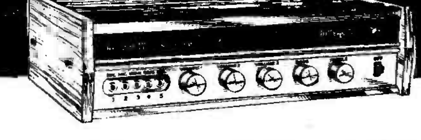

Provides a high standard of sound reproduction, with full mixing facilities. It's versatility makes it suitable for: Discotheque, P.A., Home Entertainment Applications, etc.

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£9.50 plus P. & P. 60p.

INPUTS:—1. Crystal Mic or Guitar 9mV. 2. Moving coil Mic or Guitar 8mV. Inputs 3, 4 & 5 are suitable for a wide range of medium output equipment (Gram. Tuner, Monitor, Organ, etc.). All 250mV sensitivity.
CONTROLS:—3 Volume controls. Bass control range: 13db @ 60 Hz. Treble control range ±12db @ 15KHz. Separate ON/OFF Switch. Neon Indicator.
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SIGNAL/NOISE:—Better than —60db on inputs 3, 4 and 5 & —50db on 1 & 2
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MARK 3

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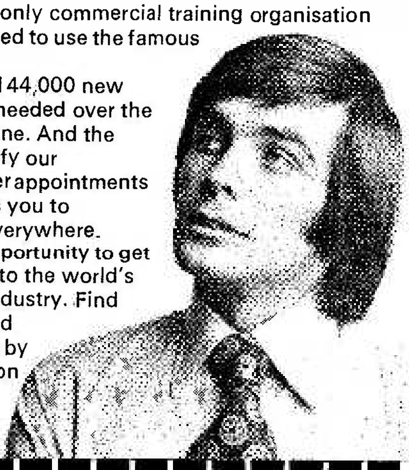

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Best quality. Width 36". Under half price at 55p per yd. Black with gold fleck, will blend with any room setting. End of stock line, yds and yds must go.

Plugs, Sockets and Leads.
Phono plugs; 3p each **30p** per dozen.
2 pin Din spkr. plugs **10p** each.
3 pin Din plugs. **15p** each
5 pin Din plugs. **13p** each.
5 pin Din sockets (chassis) **7p** each.
Stereo Jack Sockets c/cct. **13p** each.
Phono sockets (chassis) 2 way **3p**; 3 way **4p**; 4 way **5p**.
6ft. stereo lead 5 pin Din to open end. **45p**
6ft. stereo lead 2 phono to open end. **37p**
12ft. spkr. lead 2 pin Din to open end. **40p.**
Please add P & P5p.

100 Mixed Resistors
½ watt 10% all best quality (no ex government) **40p.**

Pots
100K x 100K lins & Logs. stereo. **35p** inc. post.
100K DP switch stereo, log. **45p** inc. post.
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PRACTICAL WIRELESS

VOL 47 NO 7
Issue 777

NOVEMBER 1971

Evolution of Audio

IT has been a long haul since the days when a pair of PX4's in push-pull represented the last word in "quality". Although the search for greater realism continues, and is reflected in the steady flow of improved products, the industry itself and its approach to marketing is undergoing fundamental changes.

For some years, hi-fi has revolved around a kind of cottage industry, the highest quality products coming from small, highly specialised companies. More recently, however, the big boys have been getting into the act. Generally speaking they had previously been unable to compete because mass production is incompatible with the "luxury trade" associated with products for the connoisseur.

Things, however, are changing. In the first place, the minnows are being swallowed by the whales so that high specification equipment can still be made but with the backing and resources of the bigger parent company. Secondly, hi-fi is now no longer the sole province of the more affluent and this has led to a huge market in so-called mid-fi—not the equipment for the more fastidious but representing a very fair sound at a reasonable price. And, thirdly, developing techniques and new devices such as ICs are making it more feasible to produce equipment of quality in greater quantity and within narrower tolerances.

But although there is now a vast selection of audio products to suit all pockets, there is a potential danger. The phenomenal boom in hi-fi is probably past its peak, although the industry as a whole continues to grow, and a slowing down seems to be inevitable. This will again put the pressure on reducing costs as the market cools down.

Largs of Holborn, a paradise for audio types, with a large auditorium and their famous £5,000 comparator, is already a casualty. David A. Larg says that a combination of overheads and competition from undercutting competitors "who offer neither the listening and demonstration facilities nor the installation advice and after sales service of Largs" have forced the company to close down.

The specialist dealer offering the kind of service and facilities expected by the discerning enthusiast is, of course, at a disadvantage when facing dealers offering discounted goods albeit with little service. But this is the trend and if manufacturers are also forced to keep their eyes more on the ledgers than the quality then customers are in for a leaner time.

Let us hope, therefore, that in its evolution, audio will not retreat from its present pinnacle and degenerate into the cheap-and-nasty take-it-or-leave it standards which have been the fate of other modern industries.

W. N. STEVENS—*Editor.*

NEWS AND COMMENT

CONSTRUCTIONAL

OTHER FEATURES

SPECIAL FEATURE

DECEMBER ISSUE WILL BE PUBLISHED ON NOVEMBER 5th

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

Project 605

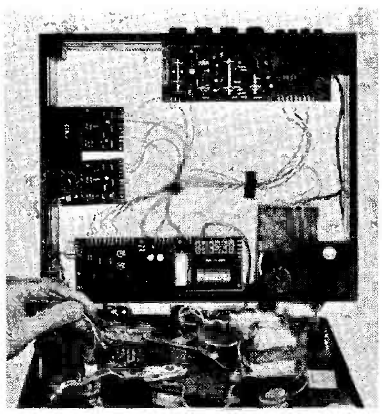
Sinclair Radionics Limited, announce the introduction of Project 605, a stereo system designed for the do-it-yourself enthusiast who does not have any special audio or electrical knowledge.

Based on four of the Sinclair Project 60 modules, Project 605 has an additional unit—Masterlink—through which all internal connections are routed by means of push-on tags already fitted to wires of the correct length—soldering is completely eliminated.

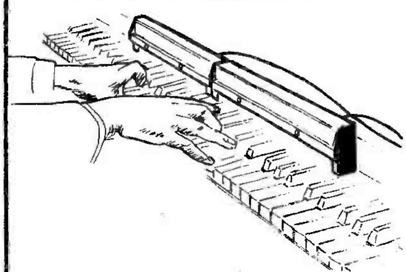
In the very comprehensive and extensively illustrated twelve page instruction book which is included in every Project 605 pack there are full details of tested installations in plinths of some of the major manufacturers of record players.

The Project 605 pack contains: —two Z.30 power amplifiers; one Stereo 60 pre-amplifier and control unit; one PZ5 power supply; one Masterlink connector unit with all necessary inter-connecting wires tagged at each end; twelve page Instruction Book. The suggested retail price is £29·95.

Project 605 and all other Sinclair products are available from retailers in all parts of the Country or direct from the Company. The guarantee which extends over two years is direct with Sinclair who perform all service and repair work in their own large Service Department. *Sinclair Radionics Limited, London Road, St. Ives, Huntingdonshire, PE17 4HJ.*



The PianoMate



This device transforms any piano, whatever its age or condition into four octaves of blending electronic chords.

There are two double octave units that are simply placed onto the back of the piano keyboard *without any permanent fixing.*

These keyboard units (A) are then plugged into the 'Master control Unit' (B) which in turn is plugged into a power socket.

A Tone Selector Switch provides three different tone colours which include a 'Flute' sound which is ideal for standard tunes or ballads. A second tone is that of a Church Organ, the third has a 'Jazz Band' sound which is suitable for Latin American or Pop Music.

A two speed Vibrato Control provides a further variation of tone colours.

There is a Level Control giving predominance to either the Bass or Treble keyboard unit.

An Input Socket is also provided for those wishing to plug in a microphone or other instrument, or to amplify the piano itself.

A further socket is provided for a foot volume or Waa Waa pedal.

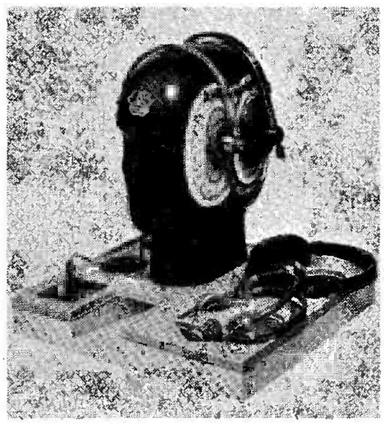
The PianoMate is completely tuneable via a single control for pianos which may be out of pitch by as much as a semi-tone.

It is possible to play the PianoMate without a piano at all. One would do this by using a dummy or practice keyboard. This would provide all the electronic variations, without of course the blending qualities of the piano.

The price of the PianoMate complete with Foot Volume Control will be £69·00, and it will be in production January 1972. *Dubreq Studios Limited, 249/289 Cricklewood Broadway, London NW2 6NX Tel : 01-450 5475.*

A.K.G. Superhead

A.K.G. announce the introduction of their 'Superhead'. This is a novel demonstration unit which will be found at many A.K.G. retail stockists. It comprises a large life size black robot-like head with two faces, mounted on an orange coloured base. On this 'Superhead' unit are three or four different types of A.K.G. headphones which can be listened to instantly and judged for personal preference. This most unusual yet very helpful device will be found at dealers displaying an orange and black poster announcing that they have an A.K.G. 'Superhead' on demonstration inside.



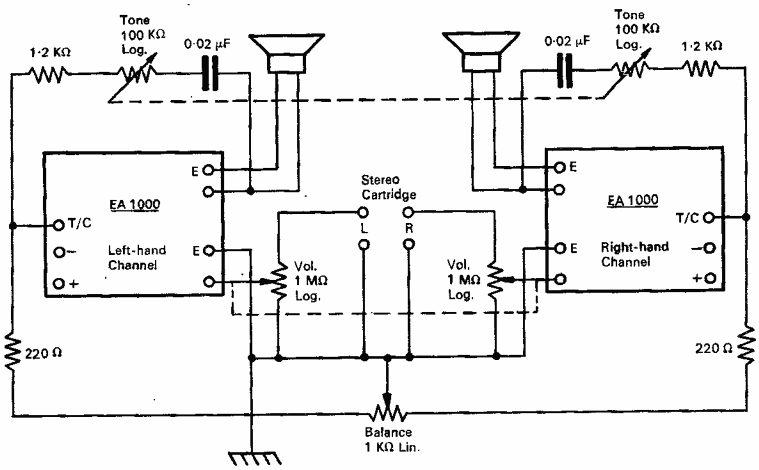
NEWS... NEWS... NEWS...

SGS Module

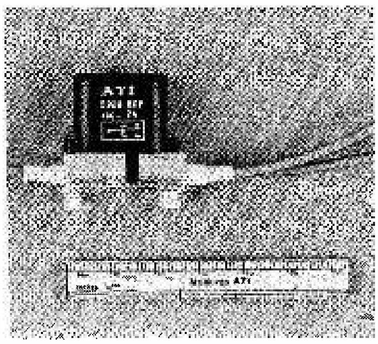
SGS have entered the module market for the first time with their EA1000 unit. A compact solid - state audio amplifier assembled on a printed-circuit board, it is capable of delivering a minimum output power of 3W into a 16Ω load from a 24V supply.

The amplifier has been designed around the proven TAA621 monolithic silicon integrated circuit which contains all the active stages. The careful choice of associated components and of layout has given the unit considerable flexibility making it suitable for a wide range of applications at various supply voltages, load impedances and power outputs. Provision has also been made to alter the negative feedback and to vary the frequency response.

As a guide to obtaining the highest possible standards of performance from the EA1000 module, a 12 page handbook has been prepared which includes detailed information on its function, characteristics, and a number of applications. It includes a scheme for a stereophonic record player complete with volume, tone and balance controls. This publication is immediately available, price 10p. *SGS (United Kingdom) Ltd, Planar House, Walton Street, Aylesbury, Bucks.*



A typical application of the EA1000 in a stereophonic record player.



Co-Axial Relays

McMurdo are extending their range of components, marketed under arrangement with Alliance Technique Industrielle of France, by the introduction of a miniature co-axial relay.

For frequencies up to 500MHz there are versions for PCB or chassis mounting. Three types are available—Type R has fixings, inputs and outputs on a 2·5 mm grid for PCB mounting. In Type RC the fixings and supply are PCB mounted whilst the h.f. circuits are fed via a co-axial cable.

For the chassis mounted version Type RCP (illustrated) the supply connections are by solder tags and those to the h.f. circuits by co-axial cable.

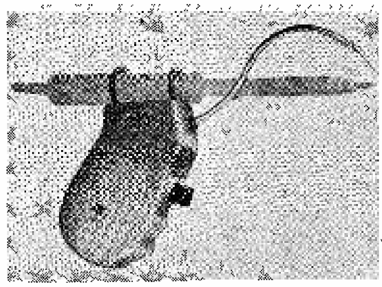
Supply voltage is either 12 or 24V d.c. at 1 Watt. The impedance is 50 ohms, VSWR is less than 1·15 and the cross talk at 300MHz is 45dB. Dimensions are length 26·8 mm (1·06in), height 24·8 mm (0·98in), width 10 mm (0·39 in). Further information from: *McMurdo, Rodney Road, Portsmouth, PO4 8SG.*

Solder Feed

Leaving one hand free to hold the job, Anextra Solder Feed fits the majority of soldering irons and carries up to 4oz. reels of flux cored solder. Saves time on soldering in production, construction and repairs.

Injection moulded in tough, high impact polystyrene, with a life tested simple mechanism, easily reloaded, light weight, with comfort grip, suitable for right or left hand users, the Anextra provides an adjustable solder feed, for 22 to 18s.w.g. solder, which is fed onto the job.

Designed and made in England, the Anextra Solder Feed, with initial 1oz. reel of 60/40 cored 22s.w.g. solder, and detailed instructions is obtainable direct from the makers at £4·25, spare 1oz. reels at £0·25, post free, c.w.o. S.a.e. for leaflet, *Anextra Ltd., Chiltern Works, Rear of 77/78 Chiltern View Road, Uxbridge, Middlesex, England.*



International Audio Festival & Fair 1971

Come and visit us on stand 3 at Olympia, London, from October 26th to 30th.

What to look for at the AUDIO FAIR

DONALD ALDOUS

MENTION of the title to this feature to a rather jaded audio trade friend evoked the reply "find the exit or the nearest bar!" Having been associated with audio fairs and like jamborees before there were any—if that isn't too paradoxical—I know what my friend meant. Tired feet allied to noise do not make for the best appreciation of high fidelity sound reproduction, which is presumably what such gatherings of the hi-fi clans should be all about.

Having made that point, I must go on to say that audiophiles with discerning eyes and ears can glean a lot of useful information about products to come, the latest technical developments in hi-fi, and by a discriminating choice of demonstrations to attend, gain a very helpful overall impression of what's happening in the home electronics entertainment world. Then after your visit to the 1971 International Audio Festival and Fair, Olympia, October 26 to 30th inclusive, 10 a.m. to 9.0 p.m. daily, admission 30p, go along to your local hi-fi dealer and have another session there or, if he will co-operate, have the equipment on test in your home. Reputable and well-organized hi-fi stores, many of which are members of the High Fidelity Dealers' Association—look for the HFDA sign—have demonstration showrooms or theatres, and facilities for A-B direct comparisons of systems or components.

At the last count, which may well have been increased by the time you visit Olympia, 66 exhibitors have stands at this year's exhibition, excluding the consumer and trade papers' stands. And, of course, these exhibits cover many brand names of products manufactured, imported and distributed, so a representative cross section of the world's hi-fi equipment and accessories is on display and demonstration.

This is not all you get for your admission fee, as four times a day for five days, an impressive lecture/recital programme is presented in the specially built theatre. Speakers taking part include H. W. Hellyer (Tape Troubles), Professor Tristram Cary (Musical Value of Synthesizers), J. L. Linsley Hood (Amplifiers), Loudspeakers (Dr. A. Bailey), W. Woyda (Tape Cassettes/Cartridges), A. C. Griffith (Record Rejuvenation), R. Auger (Multi-Channel Sound), Howard Souther (Headphones), and two panel sessions, one on 'Women and Hi-Fi', and under the title 'Feed-Back-Chat' a number of well known audio personalities will tackle technical questions from the floor. This occasion will be recorded on the spot by BBC Radio London, and broadcast in November on their 'Sounds Good' programme.

Under the umbrella title 'home electronics entertainment media'—this is the new term at present in vogue—audiovisual recording systems are coming more and more into prominence, with applications extending into many areas from education to industry. At least five systems are now being promoted—VCR (video-cassette), EVR (electronic video recording), VTR (videotape recording), Super-8 film, and the Teldec *bildplatte* (picture-disc) from AEG-Telefunken-Decca. A colour version of this last disc technique was recently demonstrated in Berlin, at the big international radio and TV show.

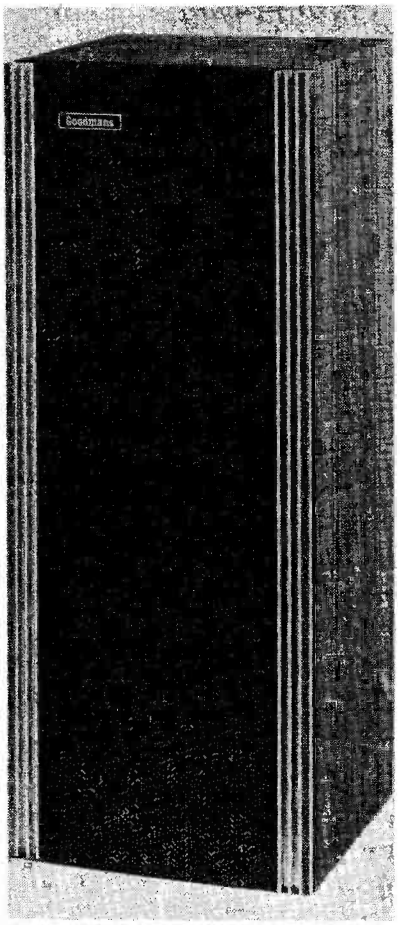
Whilst a few of the firms participating in the audio exhibition at Olympia have one or other of these systems, they are not really eligible for presentation at a strictly audio assembly.

So let's turn our attention to techniques and products that immediately concern the audio enthusiast. Topics that are the talking points for engineers and the knowledgeable public are quadraphonic sound systems, noise reduction methods, cassette and cartridge tape recorders, headphones, and that hardy perennial—loudspeakers.

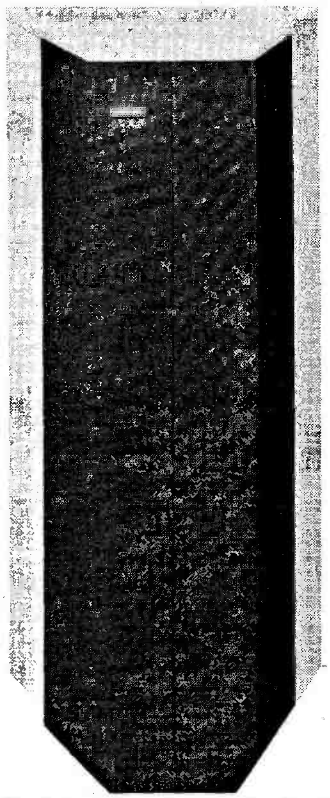
Starting with loudspeakers, the hundreds of models available in all shapes and sizes and prices do present a problem for the potential purchaser. The perfect loundspeaker does not exist and, although some families of transducers do have a 'household' sound —in most instances each system sounds a little different from the next and, so, ultimately, you must make your final choice by listening. The more experienced your ear is the better, naturally, and most audio purists would agree that regular ear purification by listening to 'live' music at concert halls is necessary to serve as a reference standard. A few audiophiles do exist still who tolerate the music to hear the equipment, but for the music lover-audiophile 'natural sound' is the goal for his domestic listening.

Home constructors will find several examples of D-I-Y loudspeaker enclosure kits at the show, ranging from Heathkit models to the latest Units 3, 4 and 5 from **Wharfedale. Goodmans** have now entered this field with their DIN 20 kit, as well as launching several new loudspeaker designs at Olympia.

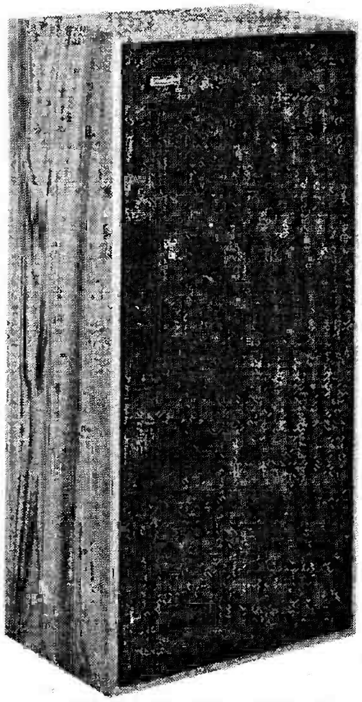
The two new bookcase models from Goodmans are both three-way systems, but here the similarity ceases. The DoubleMaxim is intended for those with limited space. The bass and middle registers are shared between two small cone l.f. units and an h.f. dome unit handles the higher frequencies. The system will accept up to 30 watts (DIN). By employing three drive units—a bass model, a new mid-range and an h.f. dome radiator—Goodmans' engineers claim the division of the frequency range in the Havant model ensures a balanced natural sound. The DoubleMaxim is an IB design and the Havant is a reflex, and both models meet the DIN standards



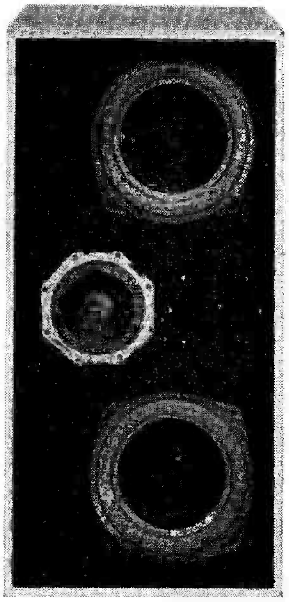
Goodmans Double Maxim speaker system.



Goodmans Dimension 8 bi-directional speakers.

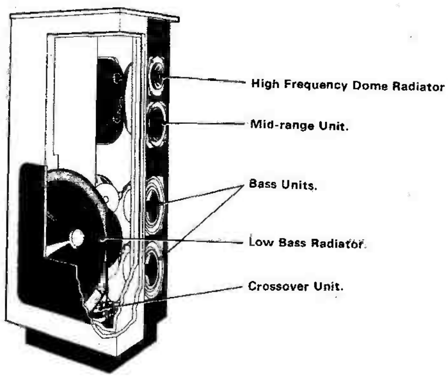


Rola Celestion Ditton 44 Monitor

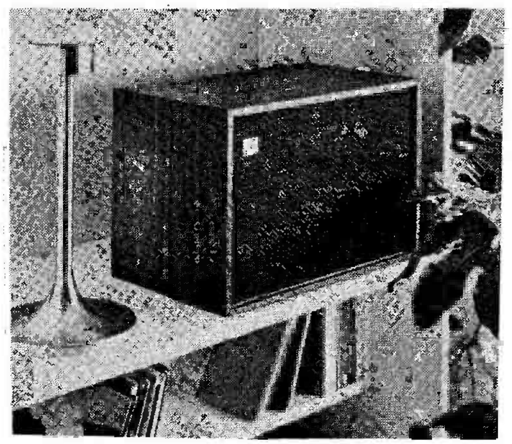


(right) B & O Beovox 4700 speaker enclosure.

(below) Wharfedale Unit 5 home-assembly Hi-Fi 3-unit Loudspeaker kit.



(above) Units and functions in a Dimension 8 enclosure.



(right) Wharfedale Denton 2 speaker for bookshelf mounting.

45:500 and 45:573.

The outstanding product in the new Goodmans' range is undoubtedly the Dimension-8 loudspeaker system. Described as bi-directional, to distinguish it from the traditional uni-directional and omni-directional systems, the designers believe it to be the first system planned to meet the twin requirements for ideal stereo—namely, radiating direct sound over a large listening area for accurate stereo placing and providing a controlled amount of indirect sound for natural stereo ambience (reflection and reverberation).

This effect is achieved by having one set of four drive units vertically arranged on each side of the cabinet so that the inward facing drive units (of a stereo pair) radiate direct sound over an appreciable listening area, whilst the outward facing units give indirect sound reflected off the side walls of the room.

The design philosophy of the Dimension-8 embraces the 'small cone concept' with a number of units which are carefully selected to match and so complement each other's output. The 'small cone' approach simply means using small diameter units working within their range, so avoiding cone break-up distortion. Four bass units handle the considerable rated input power of 60 watts nominal, or 35 watts r.m.s. Two new mid-range units, two dome h.f. radiators, and a 12in. 'sympathetic' low bass resonator complete the assembly. The output of these nine units is integrated by a crossover network using eight close tolerance components. The interior volume is 40 litres and its weight is 44lbs. The crossover frequencies are 80,800 and 4,000Hz. Its frequency response covers 30 to 22,000Hz within ±5dB. Physical dimensions: $30\frac{3}{8} \times 14 \times 12\frac{1}{2}$ins.

After a short period of listening to the Dimension-8s at the recent Berlin Radio and TV exhibition, I was impressed by their spacious and smooth sounding performance, so don't miss this demonstration at Olympia.

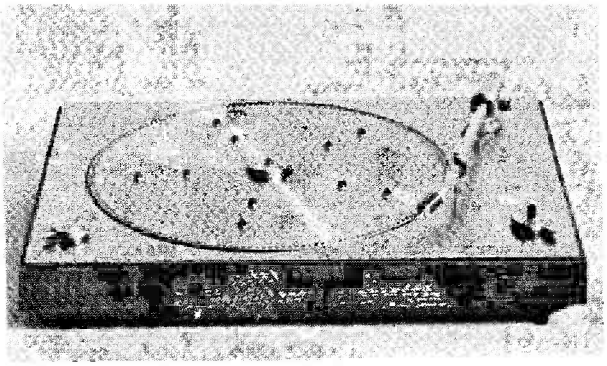
The radiation characteristics of loudspeakers are attracting interest lately, with the upsurge of enthusiasm by some designers—notably Stig Carlsson of Sweden—for an omni-directional pattern. The **Sonab** loudspeaker of this type disperses the sound in all directions so that all reflecting surfaces of a listening room are integrated, and the listening position for stereo sources is not critical, although room dependent to some extent. Yet another realisation of this concept are the omni-radial speakers from Sony. These have six acoustic-suspension drivers, and an individual dispersion dome over each cone distributes the highest frequencies evenly throughout a full 360° and from floor to ceiling. These speakers are housed in a barrel-shaped compound curved cabinet. Lastly, in this category of multi-directional loudspeakers, Arthur Radford, well known for his amplifier and other loudspeaker designs, has created an unusual loudspeaker of special dispersion characteristics, which will be released shortly, I understand, by **Radford Audio Ltd.** of Bristol.

At this point, it must be mentioned that neither Sonab nor Radford is exhibiting at the Olympia audio exhibition, and Sony may not be showing their Omni-Radials, which have only lately come on to the market in Japan and in the USA. Sonab, however, did demonstrate their OA speaker range at the Northern Audio show in Harrogate in September. But enthusiasts will wish to know what developments are afoot in this controversial area of electro-acoustic transducer design.

Mention of kits, reminds me that **Sinclair Radionics** will show for the first time their new Project 605 at the Audio Fair, Olympia. Using modules, it is a novel extension of their popular Project 60 and sells for £29·95. The complete system can be assembled by any handyman without any soldering at all, as the printed circuit boards, etc. are all interconnected to inputs, outputs, through leads with push-fit tags. A fully illustrated instruction manual is supplied with the Project 605 system, which is certainly good value for outlay. The modules supplied include two Z.30 (15 watts r.m.s. per channel) power amplifiers, a pre-amp/control unit, and the PZ-5 power supply unit. (See "News . . . .")

Audio fairs throughout the world seem to be using headsets as a practical means of reducing the bedlam of such conclaves and providing the audiophiles with a personal intimate sound demonstration. The latest designs of stereo headsets will be displayed and available for listening on the stands of such firms as **AKG** (75 on first floor), **Dynatron Radio** (47, first floor), **Grundig** (62, first floor), **Sony** (51 and 93), **T. M. Distributors (Koss)** on 68, first floor, and **Wilmex (Stax)**, 24 on ground floor, where six pairs of 'phones will be fed from disc/tape signals.

Many other manufacturers will have earphones on show, and my advice is not to miss the demonstrations of the latest Koss electrostatic ESP-9 studio monitor headset, and the Japanese Stax SR-3 so-called Ear Speakers. The ESP-9 model costs £69 and the Stax headset, with its SRD-5 adaptor, retails at £45·40. Once you have become used to listening via a headset, which fits comfortably and is non-fatiguing even after an hour or so's wearing, the experience can only be described as a sonic delight. Fed from a good source, the sound quality is clinically clean and undistorted. If you consider solo listening is anti-social in the home, Koss and other manufacturers produce connector boxes to permit attaching two or more pairs of headphones! Koss also offer among their collection of accessories, a stereo/mono adaptor cable, which simply switches from stereo to mono reproduction, as required, on the particular headphones. By the way, highly acceptable performance



B & O Beogram 1200 turntable on plinth.

New Sony PSE 4000 turntable.

(below) Akai X2000 SD which accepts open reel, 8-track cartridge and Philips' type cassettes.

Goodmans Model 80 fitted with Goldring Lenco G800E and Module 80 stereo f.m. tuner/amplifier.

Philips N4450 recorder/amplifier with auto reverse.

Beocord 1600 4-track recorder.

headphones are available for far less than the prices quoted of these 'state of the art' designs.

Peter Merrick, of Wilmex, tells me that there is a good chance that he will be able to show the latest Stax UA-7 pick-up arm, a sophisticated design, but it depends whether the samples from Japan reach our shores in time. Don't miss it, if it is on display. Before leaving headphones, we have just been told of the stereophonic 2-way, 4-speaker headphones, type DD1 from Wharfedale. These have dynamic elements, with separate bass and treble units, plus a crossover network, and a frequency response specified as from 16Hz to 22,000Hz but no tolerances given. Distortion less than 1 per cent and sensitivity (at 600Hz) is 100dB for 1mW input. Price: £11.

Wharfedale are showing, in addition to their well known Super 10/RS/DD, Super 8/RS/DD and 8in Bronze RS/DD units, their Dovedale 3 and Rosedale loudspeakers (both 3-unit systems) and the three Unit kits referred to earlier, will also introduce the Linton stereo amplifier (15+15 watts into 8 ohms) at 0·1 per cent distortion at all power levels up to 10 watts each channel driven at 1kHz into 8 ohm speakers, at £60. Another innovation from Wharfedale is the Linton 4-speed disc turtable, fitted with **Shure** M44-7 cartridge, and selling for £35, including PT. Rumble is quoted as better than 35dB and wow better than 0·2 per cent, with flutter down to less than 0·06 per cent.

One wag has observed that the cassette revolution is not red but fully coloured these days. However, we are not dealing with video-cassette systems here, but the audio cassette revolution does concern us. In about six years, the fuss-free cassette has made tape recording more popular than ever, with modest recorders available at reasonable prices and **Philips** report that since the launch of the portable cassette recorder some five years ago, more than 6 million units have been sold in Western Europe.

Philips are marketing their new Cassettophone battery model, type N2000, styled in green polystyrene and weighing only 2lbs. It has one central control for playing, rewinding and fast forward, plus sockets for the addition of a mains supply unit and an earphone. Price is £13. A mains stereo cassette deck, N2503, is also now released from Philips. This design has one neat sliding control for setting the recording level and a 3-digit counter to give tape position. Another feature is that the motor stops automatically at the end of each cassette. This model sells for £52·05.

What might be called the 'home studio class' has been catered for in another new model from the Philips organization. Known as Model N4450, it is a 3-speed quarter-track recorder for vertical or horizontal operation with automatic and manual reverse. This facility means that the direction of the tape transport can be reversed at will or at the end of the tape, when it will automatically play in the other direction. The machine can accept up to 10½in reels and the built-in stereo amplifier develops 2×25 watts, and can be employed as a straight amplifier, with the motors and transport switched off.

Features in this advanced design include six heads, levers for cueing during fast forward and rewind, a tape tension comparator for constant winding torque, and a synchronous clock with built-in timing device for starting and stopping the recorder at any predetermined time. Following a trend, the volume, balance and treble/bass tone controls are sliding potentiometers. Having played with an advance model of this N4450 I can vouch for its flexibility, and so don't miss examining this machine. It costs £280, including PT and will not be available till November.

We learn that Philips are engaged in producing hi-fi cassette machines, due for release in 1972, and this vast organization will take the initiative in proposing standards for this category of hi-fi cassette machine, but the standards will be reached—so they say—that the advantages of compact cassette systems, namely compatability and ease of operation, will not be affected. Be it noted, however, that the prices of these models will be higher than existing equipment! These developments have been made possible by the release of tapes with high coercivity and improved magnetic heads on commercial recorders.

If you are a tape recordist, you will make special visits to the stands of **Agfa-Gevaert, BASF, 3Ms (Scotch)** to find out about the latest chrome-dioxide tapes now manufactured by these companies. These are low noise tapes and the BASF cassettes have a new form of internal construction for even more reliable foolproof operation.

It will be evident now that this preview is highly selective, and, of course, cassette tape models (including new radio-recorders, with built-in radio tuners) incorporating various refinements can be seen on stands other than those mentioned. For example, Sony have several outstanding designs, as has Sanyo, Grundig, Akai, Sharp, National Panasonic, not forgetting the **Revox** open-reel tape machines.

Uher (Bosch) have a real innovation for them in their latest Compact Report Stereo 124 model, a mono-stereo cassette machine, which will accept Philips' type cassettes, work from all power sources, and has a built-in capacitor microphone, auto-reverse, remote controls and a power output of 1·3 watts r.m.s. per channel.

So we come to the noise bugaboo. Reams have been written about the brilliantly conceived Dolby noise reduction system, which in its professional A-type is widely used by all the major recording companies of the world, resulting in quieter surface commercial pressings. A simplified B-type Dolby system designed for home tape recorders is now available and used by more than 30 manufacturers of hi-fi equipment. Hundreds of cassettes processed for domestic playback with units having the Dolby system are already available from such firms as **Columbia (USA), RCA (UK), Decca/London, Ampex Stereo Tapes (USA), Pye Precision Tapes,** and others.

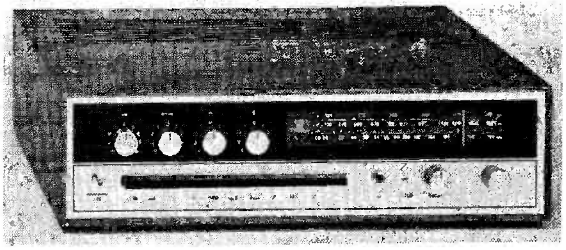
The Dolby technique works in two stages. During recording, the Dolby circuit automatically analyses the sounds of the music and makes appropriate changes in the level of the programme. The same circuit, operating in reverse, removes these changes during replay, and with them most of the intrusive noise produced by the tape. For the first time Ferrograph, that much respected name in the tape recorder world, has launched one of their machines incorporating Dolby B circuitry, which must not be overlooked at the show. Cassette machines fitted with Dolby noise-reduction circuit include **Harman-Kardon** (Highgate Acoustics), a **Rank-Wharfedale** model, and **Bell & Howell** also market such a unit.

Although it will not be seen in a production model, so far as I know, at Olympia, Philips have developed

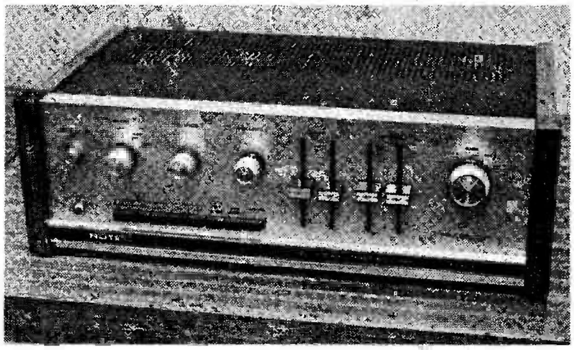
—continued on page 589

WHAT TO LOOK FOR AT THE AUDIO FAIR

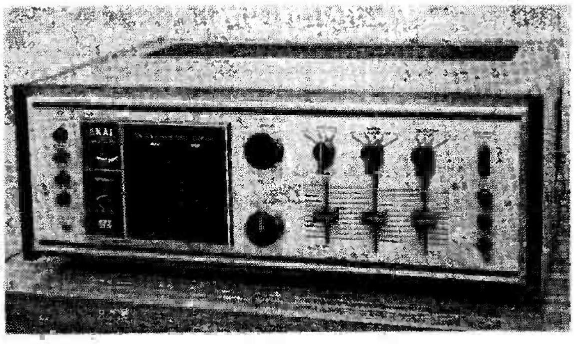
—continued from page 586



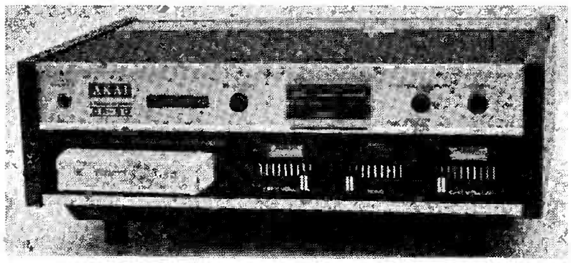
Armstrong 526 a.m./f.m. stereo tuner/amplifier.



Rotel RA 610 stereo amplifier with slider controls.

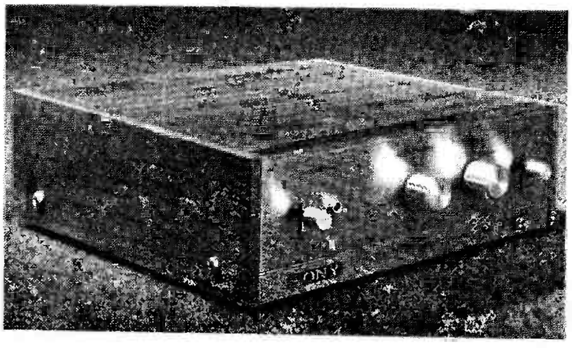


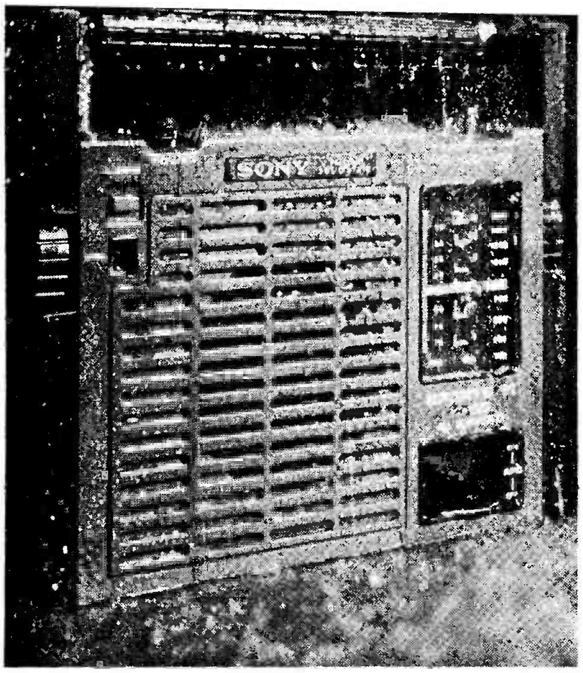
Akai a.m./f.m. solid state stereo receiver AA 8500.



Akai CR 80 8-track cartridge record and player.

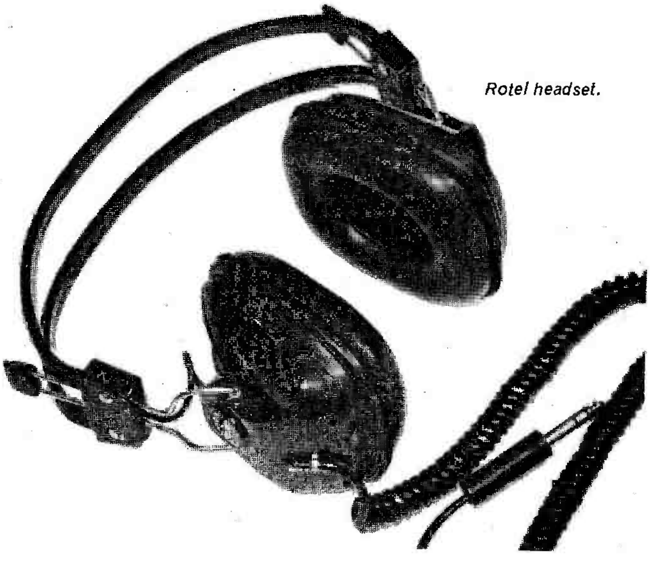
(below) Sony SQD—1000 Quadphonic Decoder.





Sony Sports 11 waterproof portable.

Stax electrostatic headset SR3/SRD5 "ear speakers".



Rotel headset.

their DNL circuitry (which means Dynamic Noise Limiter) as an alternative system to the Dolby method. It operates as a steep low-pass filter in the absence of high signal frequencies, and it is tripped by high frequencies only, in such a way that the presence of high frequency signals above a certain level will by pass the filter action. It is claimed that unweighted measurements show an S/N ratio improvement of more than 10dB at 6kHz and 20dB at 10kHz. A prototype Philips cassette recorder with the DNL circuit incorporated was shown at Berlin, which has push buttons ready for all types of tape, from the newer chrome grades to standard hi-fi formulations. Perhaps next year production models will be available, but the news of this development indicates the importance attached to noise reduction systems for upgrading domestic sound recorders.

Denham & Morley's stand 65 (on first floor) will display and demonstrate **JVC-Nivico** equipment, and among this range is their ANRS circuit, meaning Automatic Noise Reduction System, another technique that seems to bear some resemblance to the Dolby method.

A lot of money and effort is being spent developing and promoting spatial sound systems, which are being given such names as quadraphonic, quadrasonic, surround sound, tetrahedral sound, even multisound, and some of the competing 4-channel systems for the home environment include **Sansui, E-V** (Electro-voice), JVC-Nivico, **Dyna** (Hafler) and the **CBS**.SQ technique. In the last instance, **Sony** is manufacturing the hardware for reproducing these SQ (meaning stereo quadraphonic) discs. Benjamin Bauer (Vice President, CBS Laboratories), who led the team responsible for the system, has given some most impressive demonstrations of the method on the Continent and in London, at a recent Audio Engineering Society meeting. A specially prepared sampler LP, with David Frost as narrator, was used for this purpose, and it is promised that about 50 SQ processed discs will be produced in the coming months, so providing the needed software.

At the time of writing, no details are available of any company participating in the Audio Fair here that will be demonstrating a 4-channel disc system, although multi-channel tape systems will undoubtedly be heard. Propagandists for quadraphonic sound which recreates sound from four different source points, permitting a 360° sound perception, regard the technique as the most important advance in hi-fi sound recording since the advent of the stereo disc. This is not a universally held viewpoint, and some critics consider it rather gimmicky at this stage, offering all-round sound at the price of maximum fidelity for a given outlay. No standards exist yet, and only time will show which system will win, if at all in the UK, where the extra cost of decoder, amplifier and loudspeakers, linked to limited room size and problems of siting additional loudspeakers, may weigh more heavily than technical advances.

Lastly, **BSR** will show their attractive transcription hi-fi record playing deck, BSR McDonald 810 with many refinements, including push button control, and I hear that our old faithful Quad electrostatic loudspeaker will now be available in black finish, as an alternative to the long familiar bronze. **Leak,** too, have a new series of Delta equipment, including amplifiers, speakers, turntables, and a.m. f.m. tuner.

Electronotes..

S. GINSBERG

POWER supplies have long followed fairly standard rules. In the days of the valve, it resolved itself to a mains transformer, rectifier(s) and some form of smoothing, usually comparatively high value capacitors and a fairly hefty iron-cored choke.

With the advent of the transistor, much the same rules applied, except that whereas before it was a case of high voltage and low current the reverse was true. This was particularly so in the case of industrial applications such as computers. In many forms of instrumentation today, many logic chips are employed, all requiring some 5V and, since there can be many, needing quite a few amps of current.

An improvement came with active regulation, the use of large transistors as series regulators with some form of feedback sensing circuit to control variations in the final supply to within certain limits.

A snag is that the power supply has become, in many instances, the largest part of the equipment—and the heaviest. The two major offenders in space and weight considerations are the mains transformer and the series regulator heat sinks. In a series regulator, the total current passes through the device which also has a voltage dropped across it. This means heat, mainly because of inefficiency, and thus the heat sinks become vital to get rid of the heat and prevent the regulators from overheatinig and becoming ruined.

A new technique has now been launched which gets rid of both the big 50Hz mains transformer and the heat sinks all in one go. It uses switching techniques. The mains is taken and rectified. It is then applied to an inverter which is a form of oscillator using semiconductors. The oscillator has a working frequency of between 20 and 40kHz. The output is fed to a small ferrite torroid transformer and the output rectified by Schottky barrier diodes in a full wave rectifier circuit. The Schottky diodes have barely one third the voltage drop across them compared to conventional high-speed silicon rectifiers and they do not have the problems of reverse recovery. This means very much smaller heat sinks.

A 5V 20A unit, using these techniques, is so small it can be easily stood on the palm of one's hand. The power packing density, just for the mathematicians, works out at around $0 \cdot 75 \text{in.}^3/\text{W}$. Using conventional techniques to build a similarly rated unit would mean that the 50Hz mains transformer alone would be both bigger and heavier, than the whole power supply using switching techniques. Because the switching frequency is high (compared to 50Hz) and because it is effectively doubled by using full wave rectification, the smoothing components can be made extremely small.

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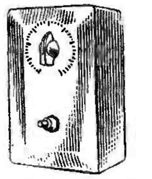

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CUTS OUT NOISE POLLUTION—SOOTHES YOUR NERVES! Don't underestimate the uses of this fantastic new design—the **RELAXATRON** is basically a pink noise generator based on avalanche operated transistors. Besides being able to mask out extraneous unwanted sounds, it has other very interesting properties. For instance, many people find a rainstorm mysteriously relaxing, a large part of this feeling of well-being can be directly traced to the sound of falling raindrops!—a well known type of pink noise. *A group of Dentists have experimented on patients with this pink noise*—**NO ANESTHETICS WERE USED!** The noise ostensibly created a most definite reaction on these patients' nervous systems with the results that their pain systems were blocked. **IF YOU WORK IN NOISY OR DISTRACTING SURROUNDINGS, IF YOU HAVE TROUBLE CONCENTRATING, IF YOU FEEL TENSED, UNABLE TO RELAX—** then build this fantastic Relaxatron. Once used you will never want to be without it—use this **amazing** pink noise generator whenever you feel uneasy, can't relax or wish to concentrate. **TAKE IT ANYWHERE,** pocket sized. Uses standard PP3 batteries (current used so small that battery life is almost shelf-life) **CAN BE EASILY BUILT BY ANYONE OVER 12 YEARS OF AGE** using our unique, step-by-step, fully illustated plans. No soldering necessary. All parts including case, a pair of crystal phones, Components, Nuts, Screws, Wire, etc. etc. no soldering. Send only **£2·25 + 25p (45/- + 5/-)** p. & p. parts available separately.)

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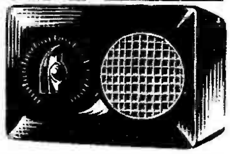

CAN'T SLEEP AT NIGHTS? DO YOU WAKE UP IN THE NIGHT AND CAN'T GET OFF TO SLEEP AGAIN? WOULD YOU LIKE TO BE GENTLY SOOTHED OFF TO SATISFYING SLEEP EVERY NIGHT? Then build this ingenious electronic sleep inducer. *It even stops by itself so you don't have to worry about it being on all night!* The loudspeaker produces soothing audio-frequency sounds, continuously repeated—but as time goes on the sounds gradually become less and less—until they eventually cease altogether, *the effect it has on people is amazingly very similar to hypnosis.* A control is provided for adjusting the length of times etc., all transistor, can be built by anyone over 12 years of age in about two hours. No knowledge of electronics or radio needed. Extremely simple, easy-to-follow, step-by-step, fully illustrated instructions included. *No soldering necessary.* Works off standard batteries—extremely economical. Size only 3" x 4¾" x 1¾"—take it anywhere. All parts including case, loudspeaker, components, nuts, wire, screws, etc. etc. **THERE WILL BE A GREAT DEMAND FOR THIS UNIQUE NEW DESIGN—SEND NOW £2·75 + 25p (55/- + 5/-)** p. & p. (parts available separately).

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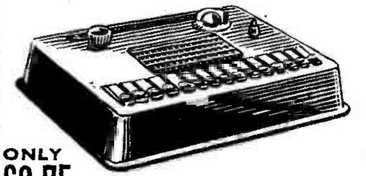

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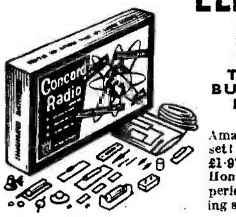

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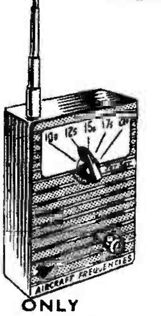

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2-Octave Miniature Organ

COVER PROJECT

F. C. JUDD

PART 1

As a "one off" project, the simple electronic organ described here is not a difficult one and actually involves more carpentry than electronics. Moreover, a half scale version of the real thing has tremendous appeal to young children and if you have junior members in the family, there could be a large demand for a project of this type. The prototype, shown on the front cover, was in fact patterned on a full size electronic organ and is approximately a half scale version.

The circuit employs only four transistors and it comprises a multi-vibrator tone generator, a vibrato oscillator and an amplifier stage providing quite a reasonable output. The organ has a two octave keyboard with a range from F at 174·6Hz to F at 698·4Hz. The vibrato can be switched on or off and there is a choice of two 'voices', one being slightly reedy and the other a softer flute-like sound. There is also an "expression" pedal which, although mechanical, provides the young player with some control over loudness. The organ uses a standard 9V battery from which the total current drain is about 20mA.

THE ELECTRONICS

The circuit for the tone generator, vibrato oscillator and amplifier is shown in Fig. 1. Tr1 is a phase shift oscillator and runs at about 6 to 8Hz, the output from the junction of C2/R1 being taken to the base of Tr2 which is one half of the multi-vibrator tone generator. The output from Tr2/Tr3 is a typical multi-vibrator waveform and the frequency range is governed by the series connected 10kΩ preset potentiometers marked F1, F♯2, G3 etc., between the base of Tr3 and the negative supply rail. The 50kΩ pre-set, PR1, is for adjustment of initial pitch. The output from Tr2/Tr3 is taken directly to the amplifier-cum-tone forming circuit, Tr4, and with a 25-40Ω small loudspeaker the nominal output is about 0·5W. The voicing is a very simple arrangement by means of

★ components list

Resistors

R1	8·2kΩ	R8	3·9kΩ
R2	8·2kΩ	R9	4·7kΩ
R3	8·2kΩ	R10	18kΩ
R4	1·5kΩ	R11	6·8kΩ
R5	5·6kΩ	R12	56Ω
R6	2·7kΩ	R13	68kΩ
R7	47kΩ		

All ¼ or ⅛W, 10% types

Capacitors

C1	250μF	C6	0·05μF
C2	1·5μF	C7	0·01μF
C3	1·5μF	C8	10μF
C4	1·5μF	C9	0·1μF
C5	100μF	C10	0·47μF

All electrolytics at least 10V working

Semiconductors

Tr1	OC71 or NKT213	Tr3	OC71 or NKT213
Tr2	OC71 or NKT213	Tr4	OC81

Miscellaneous

25-offΩ 01k preset skeleton pots, miniature type; 1-off 50kΩ preset skeleton pot, miniature type; small loudspeaker, round or elliptical, 25-40Ω; 2-off switches, press on/off types; on-off toggle switch.

★ materials list

Plywood and hardboard to sizes in diagrams.
¼ x ½in planed batten for keys, approx. 9ft.
Felt or foam plastic ¼ to ½in wide approx. 20in.
¾ x ¾ aluminium angle, 10in.
16s.w.g. aluminium for brackets.
Thin countersunk head woodscrews for key springs and contact guides. 75 off. (these should not be more than ½in long).
Material for main front panel (speaker grill material).
Sundry screws and glue.
Tagstrip, 9in long.
Gold clad wire (organ contact wire) 6ft (Henry's Radio Limited).
Light tension springs approx. ¾in long. 25 off.

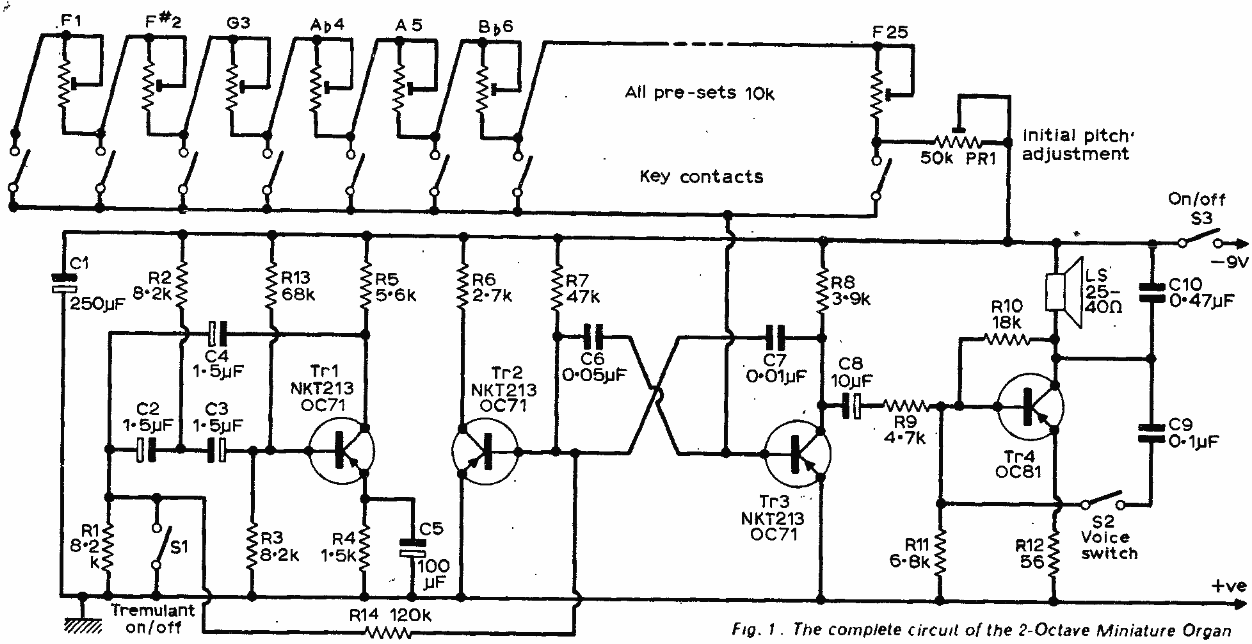

Fig. 1. The complete circuit of the 2-Octave Miniature Organ

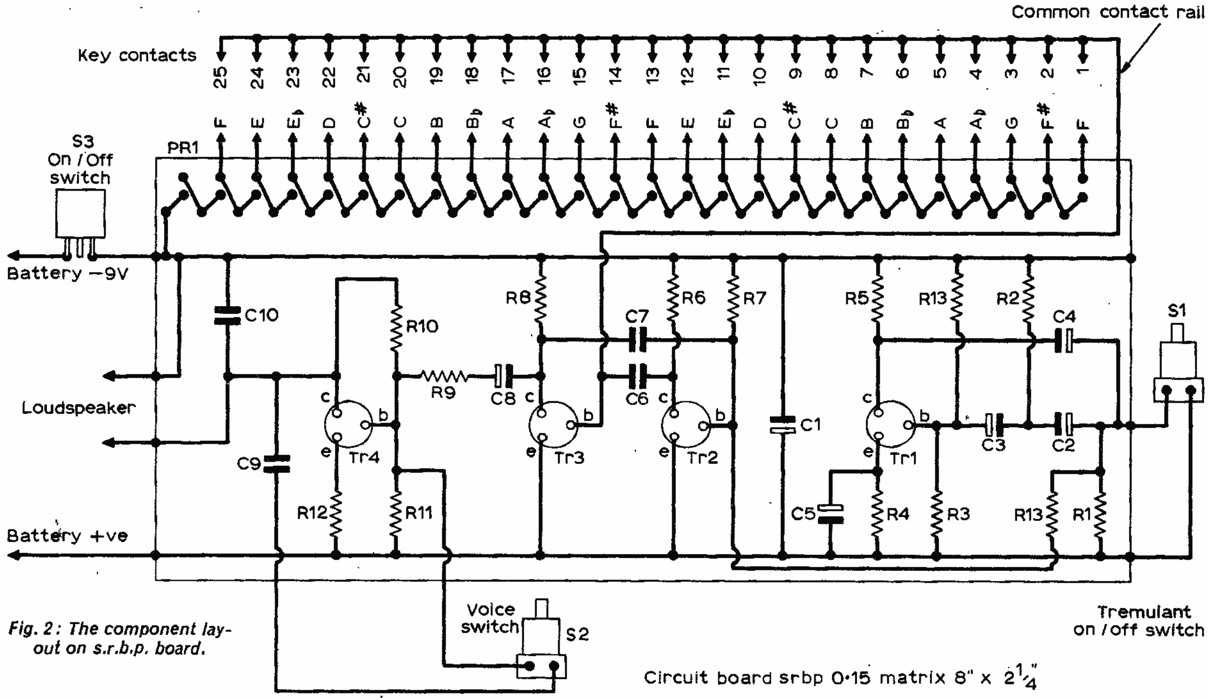

Fig. 2: The component layout on s.r.b.p. board.

negative feedback and gives two voices, one with a 'reed' sound and the other a 'flute' sound.

All the components, including the 25 miniature pre-sets, can be mounted on a piece of plain Veroboard 8 x $2\frac{1}{4}$in. which is secured to the key baseboard with a short strip of $\frac{3}{8}$ x $\frac{3}{8}$in. aluminium angle or a small bracket either end. The component layout and wiring for the circuit board is shown in Fig. 2.

CONSTRUCTION

The various diagrams show the dimensions used for the original, but these can be varied so long as similar space is provided for the keyboard and the electronics. A supply of assorted sizes of woodscrews and some glue are required for assembly and these, together with the pieces of plywood, hardboard and planed batten etc., should be readily available from timber merchants or d.i.y. shops.

The main case should be built first, as shown in Fig. 3 and assembled complete with the inside shelf (for the keyboard etc.) and the rail at the rear on which the lid is hinged. The batten under the front edge of the inside shelf is used to support the upper front panel. An inside speaker baffle is necessary if the expression pedal feature is to be incorporated, otherwise the speaker can be mounted directly on the main front panel. In this case the speaker opening will be appropriate to the loudspeaker used and the cut out for the expression pedal will not be required.

The expression pedal is a simple mechanical

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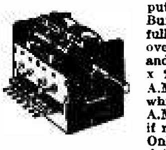

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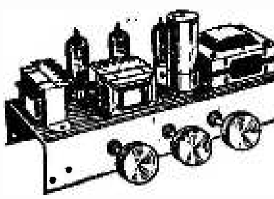

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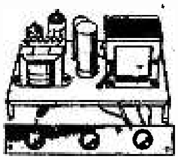

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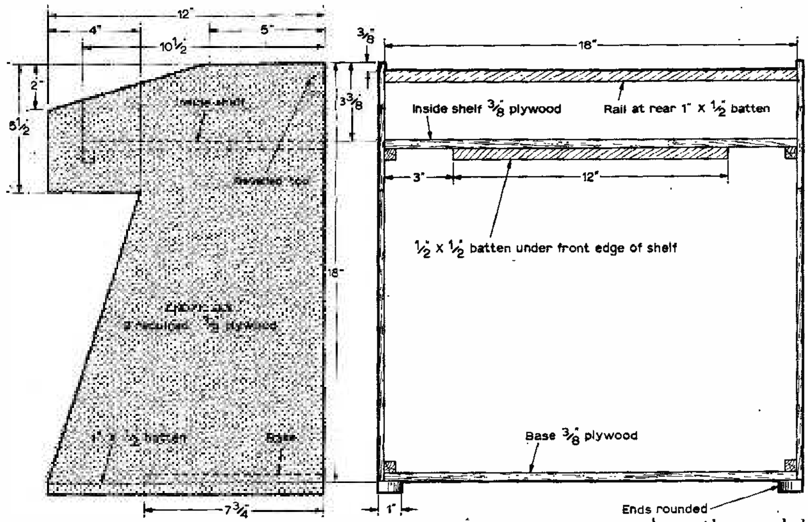


Fig. 3: Cutting dimensions for the main cabinet.

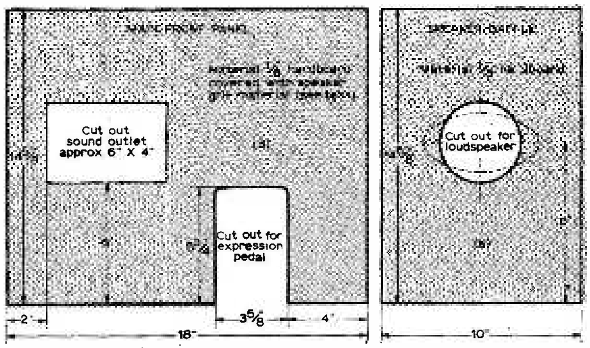


Fig. 4: Cutting details of the main front panel and speaker baffle.

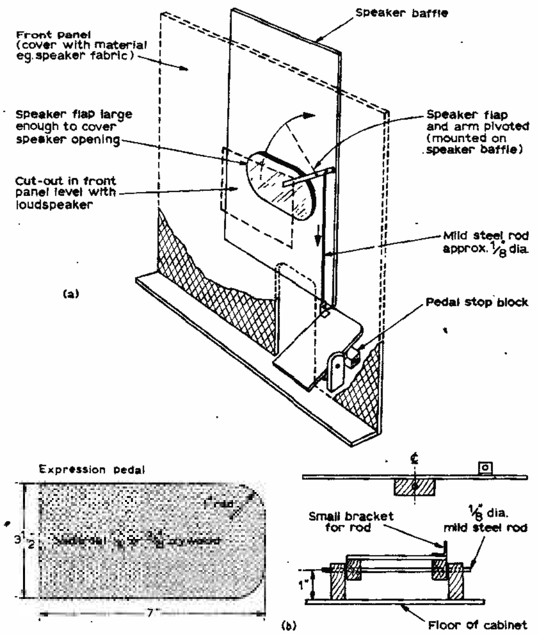
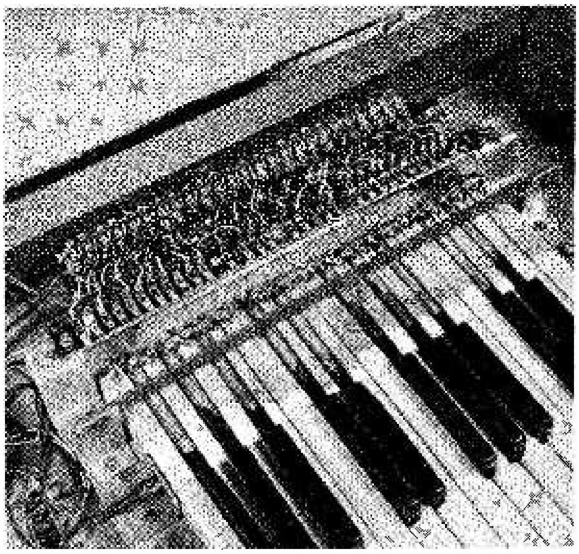


Fig. 5: Arrangement of the expression pedal.

arrangement that lifts a flap over the loudspeaker when the pedal is pressed downward. Although this only provides a small degree of change in loudness it is worthwhile including as it does at least simulate the use of an expression pedal. The general mechanical arrangement used for the prototype is shown in Fig. 5a. As the size of the speaker flap and the length of the arm attached to it may depend somewhat on the shape and size of the loudspeaker, no detailed dimensions have been given. All that is necessary however, is to ensure that the flap over the loudspeaker moves upward and clear of the speaker opening in the direction shown when the pedal is pressed downward. The arm on the flap, the position of the pivot and the length of the operating rod should be adjusted so that the flap just covers the speaker opening when the pedal is lifted. The position of the pedal stop block will help facilitate the correct amount of pedal movement.

THE KEYBOARD

This is the most difficult part because normally piano keyboards are cut from one piece so that they fit together precisely when reassembled on the frame. The keys for the children's electronic organ are slightly larger than half scale and are made separately. The general layout of the keyboard and the size of the white and black keys is shown in Fig. 6. The base is made from $\frac{3}{8}$in. thick plywood and the 'frame' consists of two end brackets and a length of $\frac{3}{16}$in. dia. mild steel rod. The best procedure is first to make the baseboard and the two end brackets (see Fig. 7b) and secure the left hand bracket in position as in Fig. 6. The spacers between each key are single turns of 22 s.w.g. wire, or if you



The completed keyboard of the prototype. The contact wires and the presets can be seen.

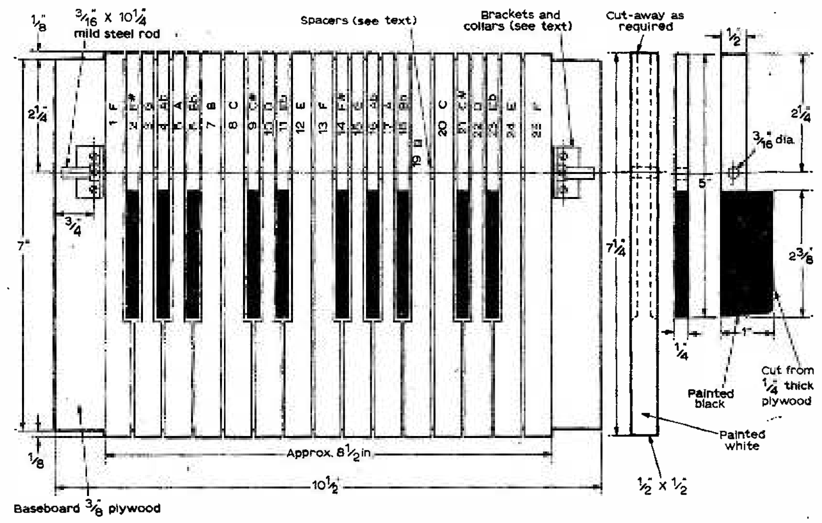


Fig. 6: Plan view of the keyboard with key dimensions given on the right.

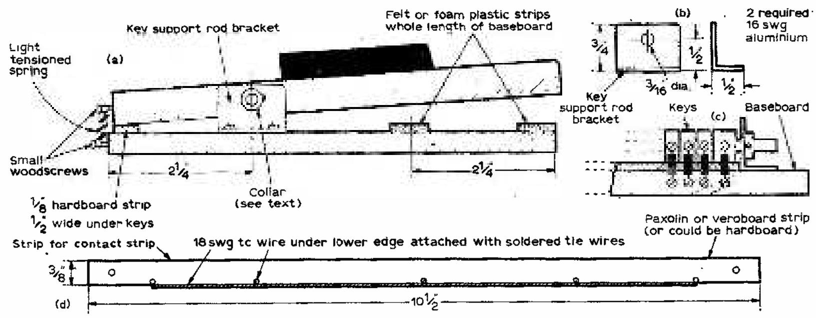


Fig. 7: Details of the keyboard construction.

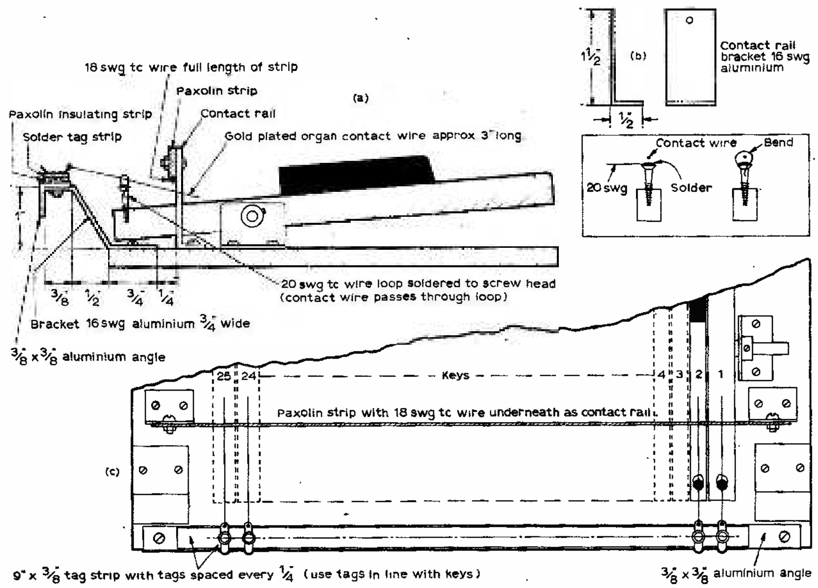


Fig. 8: Arrangement of the keying contacts—see text for explanation.

can get them, $^3{}_{16}$in. washers of similar thickness e.g. $^1{}_{32}$in. It will be seen from Fig. 6 that the cut-away portions on each of the white keys varies according to its position. For instance, key No. 1 is cut-away only on one side to fit with the black key No. 2. Key No. 3 and also keys 5, 10, 15, 17 and 22 have cut-aways on both sides. Keys No. 8, 13 and 20 are similar to No. 1 with the right hand side only cut-away whilst keys No. 7, 12, 19 and 24 have only the left-hand side cut-away. The remaining key No. 25 has no cut-away.

First the $10^1{}_4$in. long mild steel rod should be ready to take the keys. Then make up the first half dozen keys, black and white, from No. 1 to No. 6. Cut and file the cut-away portions of the white keys until each fits snugly with its associated black key. Then proceed on the same lines until all the keys are made and fitted and, most important, numbered and marked as in Fig. 6.

Temporarily fit the remaining end bracket and ensure that the keys move up and down freely on the rod. They can now be removed and painted. Before re-fitting the keys secure the strip of hardboard along the rear of the key baseboard and the strips of felt under the keys as shown in Fig. 7a. When the keys have been re-assembled the rod can be secured with small brass collars each end as in Fig. 6 and 7a. *Meccano* collars were used originally but could be made quite easily from $^3{}_8$in. dia. brass rod. Before fitting the tension springs as in Fig. 7a, make sure that each key moves freely up and down. The springs, which must not be too highly tensioned, are secured by small woodscrews as shown in Fig. 7c. When the springs have been fitted, make sure that each key moves freely downward with a light touch and returns to its upward position.

KEYING CONTACTS

The keying contact system is a simple but effective one and the general assembly details for this are given in Fig. 8. The main contact rail as shown in Fig. 7d consists of a strip of insulating material such as paxolin (or hardboard would do) to which is secured a length of 18 s.w.g. tinned copper wire. This strip is fitted over the keys as in Fig. 8a by means of two brackets (Fig. 8b). The gold wire contacts, one for each key, are fitted as shown in Fig. 8 to a solder tag strip mounted on a length of $^3{}_8$in. aluminium angle which is secured on two brackets projecting over the end of the baseboard as in Fig. 8a. Before fitting this assembly to the baseboard, small countersunk woodscrews are fitted one to each key and about

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2N696	17p	2N2924	20p	AC107	46p	BC153	19p	BFY50	23p
2N697	18p	2N2925	22p	AC126	20p	BC154	20p	BFY51	20p
2N706	12p	2N2926	11p	AC127	20p	BC157	12p	BFY52	23p
2N930	29p	2N3053	27p	AC128	20p	BC158	11p	BSX20	16p
2N1131	29p	2N3055	60p	AC153K	22p	BC159	12p	C407	17p
2N132	29p	2N3702	13p	AC176	16p	BC167	11p	MC140	25p
2N1302	19p	2N3703	13p	ACY20	20p	BC168	10p	MPS6531	35p
2N1303	19p	2N3704	13p	ACY22	16p	BC169	11p	MPS6534	30p
2N1304	26p	2N3705	13p	AD140	63p	BC177	14p	NKT211	25p
2N1305	26p	2N3706	13p	AD142	50p	BC178	13p	NKT212	25p
2N1306	33p	2N3707	13p	AD149	58p	BC179	14p	NKT214	23p
2N1307	33p	2N3708	10p	AD161	33p	BC182L	11p	NKT274	18p
2N1308	36p	2N3709	11p	AD162	36p	BC183L	10p	NKT403	65p
2N1309	36p	2N3710	13p	AF114	24p	BC184L	11p	NKT405	79p
2N1613	23p	2N3711	13p	AF115	24p	BC212L	16p	OC71	38p
2N1711	26p	2N3819	23p	AF117	22p	BC213L	16p	OC81	25p
2N1893	54p	2N3904	35p	AF124	24p	BC214L	16p	OC81D	25p
2N2147	95p	2N3906	35p	AF127	22p	BCY70	18p	ZTX300	14p
2N2218	34p	2N4058	13p	AF139	33p	BCY71	33p	ZTX301	16p
2N2218A	44p	2N4059	10p	AF239	36p	BCY72	15p	ZTX302	22p
2N2219	38p	2N4060	11p	ASY26	27p	BF115	23p	ZTX303	22p
2N2219A	53p	2N4061	11p	ASY28	27p	BF167	18p	ZTX304	27p
2N2270	62p	2N4062	12p	BC107	12p	BF173	19p	ZTX500	18p
2N2369A	19p	2N4124	18p	BC108	11p	BF194	14p	ZTX501	21p
2N2483	35p	2N4126	27p	BC109	12p	BF195	15p	ZTX502	25p
2N2484	42p	2N4284	15p	BC125	15p	BFX29	31p	ZTX503	22p
2N2646	47p	2N4286	15p	BC126	22p	BFX84	25p	ZTX504	52p
2N2904A	42p	2N4289	15p	BC147	10p	BFX85	32p		

RESISTORS 10% — 5% — 2%

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
C	1/8W	5%	4·7 Ω–470K 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	1·9
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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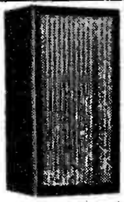

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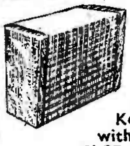

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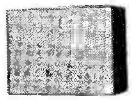

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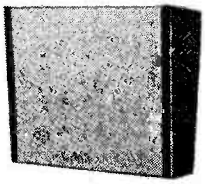

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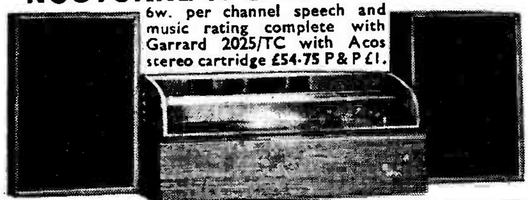

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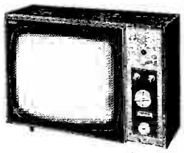

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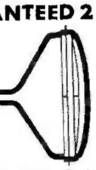

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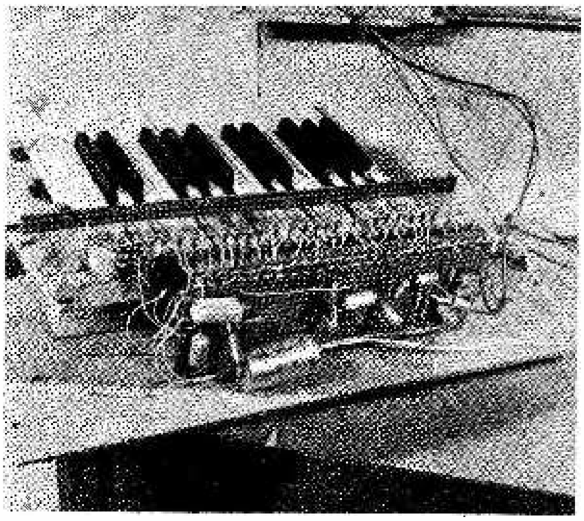
$\frac{3}{8}$in. back from the rear end of the key. Solder about $\frac{1}{2}$in. to $\frac{3}{4}$in. of 20 to 22 s.w.g. tinned copper wire to each screw head as in the inset in Fig. 8. These wires are wrapped loosely around the gold contact wires when the contact frame is finally placed in position.

The final stage of the keying assembly is to ensure that when the keys are at rest, the gold contact



A rear view of the keyboard showing the component board fixed in place.

wires are each about $\frac{1}{8}$in. clear of the main contact rail but do not touch the keys themselves. Check each contact with a continuity meter. The finished keyboard is shown in the photograph.

TO BE CONTINUED

CHARLES MOLLOY

THE Medium Wave Column

RAMADAM starts on the 21st October this year and lasts until the 19th November. During this period Arabic speaking stations will be on extended schedule, many remaining on the air all night. From 2200hrs GMT onwards, listen for Algiers on 980kHz and 890kHz; Tunis on 962kHz and 629kHz; Libya with El Beida on 1123kHz and Tripoli on 1250kHz; Tangiers on 1232kHz; Batra Egypt on 620kHz. Among the less conspicuous are Riyadh, Saudi Arabia, 588kHz; Aleppo, Syria, 647; Bagdad, 760 (also on 908 after BBC4 closes down); Beirut, Lebanon, 876; Omdurman, Sudan, 960; Diyabakir, Turkey, 1061; Tel Aviv, Israel, (in Arabic) 1286; Teheran, Iran, 1325; Kuwait, 1345; Ahwaz, Iran, 1390.

M. Noctor of South Norwood has had difficulty using his MW loop aerial with a transistor portable. A loop should not be connected to a receiver that has an interial aerial as the latter will mask the 'null' of the loop. **Dr. H. S. Brodribb** of St Leonards-on-Sea has solved this problem by mounting the receiver *inside* the loop so that the two rotate together. Coupling is between the turns of the loop and the windings on the ferrite rod inside the receiver and care should be taken that the nulls of both the loop and receiver are pointing in the same direction.

Medium Wave DXers will welcome the return of GMT this winter. Many European stations will close down at 2300hrs, clearing the band for North American DX before midnight. Paris 1070kHz signs off at 2300hrs GMT and, if the North American path is open, the 50kW Canadian at Moncton, New Brunswick, also on 1070kHz, should be audible after the Paris carrier is switched off. This station is a main outlet of the Canadian Broadcasting Corporation; it belongs to the "CBC Radio Network" and identifies on the hour and the half hour with the call letters CBA. Other Canadians that can be heard before midnight are CHER in Sydney, Nova Scotia, on 950kHz and CJON, St. John's, Newfoundland, on 930kHz. As midnight approaches look for WINS, 1010kHz, the all-news station in New York City; WNEW, 1130kHz, also in NYC; WBZ 1030kHz in Boston and WHN 1050kHz, NYC (After BBC4 signs off).

Newcomers to the medium waves are sometimes disappointed if North America is not heard at the first attempt. Propagation on this path is variable, with occasional fadeouts that last several days, so if you are unsuccessful the first time, try again a few days later. On a good night, many trans-atlantic stations peak-up by 0100hrs GMT. They can be logged on any communications receiver that covers the medium waves (the writer uses a CR100).

All reports and information concerning Medium Wave DXing should be sent to me at 132 Segars Lane, Southport PR8 3JG.

TREASURE TRACED

AT the end of the article describing the P.W. Treasure Tracer, we offered a small prize for the reader who sent in the most interesting letter mentioning items that had been found using the project.

Well, this article seems to have hit the jackpot. We know that several thousands have been built, so many in fact that for several weeks some components which were specified were in very short supply; we hope this did not put off some potential constructors.

The prize for the most interesting letter goes to 13-year-old Mark Read of Benfleet, Essex, who, on his first trip, found a ·38 Smith and Wesson revolver in some nearby woods. Young Mark made the front page of his local evening newspaper with his find after he had done the sensible thing and handed it over to the police.

Mark admits to having had a little help with the building but he is a keen constructor and is tackling further P.W. projects by himself. His skill in using the Treasure Tracer must be very high as other finds include a .303 bullet and an iron axe head.

Competition for the most interesting finds was fierce. Mr. Peter Hope of West London found a total of £3 4s $3\frac{1}{2}$d in his first week after building the project, enough he says to cover the cost of the Treasure Tracer—with a bit over.

Another reader found several transistors on the beach; how they got there we will probably never know but one has to admit that it is unusual.

Several letters mentioned sums of money that have been found and the total of all of them is nearly £20.

One point must be emphasised again and again. A lot of people complained that their results were poor compared to ours; when asked if they had spent much time trying, in nearly all cases they had done very little practice and were expecting good results immediately. **You will not become good with the Treasure Tracer without considerable practice.** One or two of those politely asked to put in more practice actually contacted us again saying that all was now fine and finds had been made.

Correspondence on the Treasure Tracer has been considerable but the points raised have all been very similar and answers are given below to the most common queries.

There are no mistakes in the article which will affect the operation, suspect your construction as a likely cause. Any type of 2N2926 transistor will do though the G (or green) may be better in the audio stages. Many readers felt that the volume was a little low and want to fit a louder amplifier. Any transistor amplifier capable of being run from a PP3 battery can be used instead of the amplifier of the prototype. Connections for this should be taken from the junction of D1 and C6, C5 may not be necessary. Experimenting with the value of R6 may help in some cases.

Mark Read with his Treasure Tracer and the revolver he found.

A lot of readers mentioned a Faraday shield, since these are fitted to most commercial types. The amount of information on metal locators is not very extensive. Experiments have shown that a Faraday shield is only useful or necessary if the frequency is a lot higher. The ground capacity effect on the Treasure Tracer is very small indeed and fitting a Faraday shield made no difference. However, another design was tried working on 700kHz; on this frequency the ground capacity effect was marked even **with** a Faraday shield.

There is room for experimenting with different coils. A larger diameter with fewer turns to obtain the same inductance will find large objects much deeper in the ground **but** it will not pick up small items, even on the surface; the size of the prototype seems to be the best operational size for general use.

Recent experiments have been carried out on encapsulating the coil in epoxy resin to hold the windings rigid. This works well and is an improvement but it does increase the weight of the head to an uncomfortable degree. Lacquering the search coil with a coil cement definitely helps.

And please, many letters were from readers who had not read the article through, they could have saved themselves a lot of trouble and time by reading the text as we had already anticipated their queries.

We hope that the above will help some readers and answer their queries. We regret that no back numbers are available at all. ■

IN NEXT MONTH'S

PRACTICAL WIRELESS

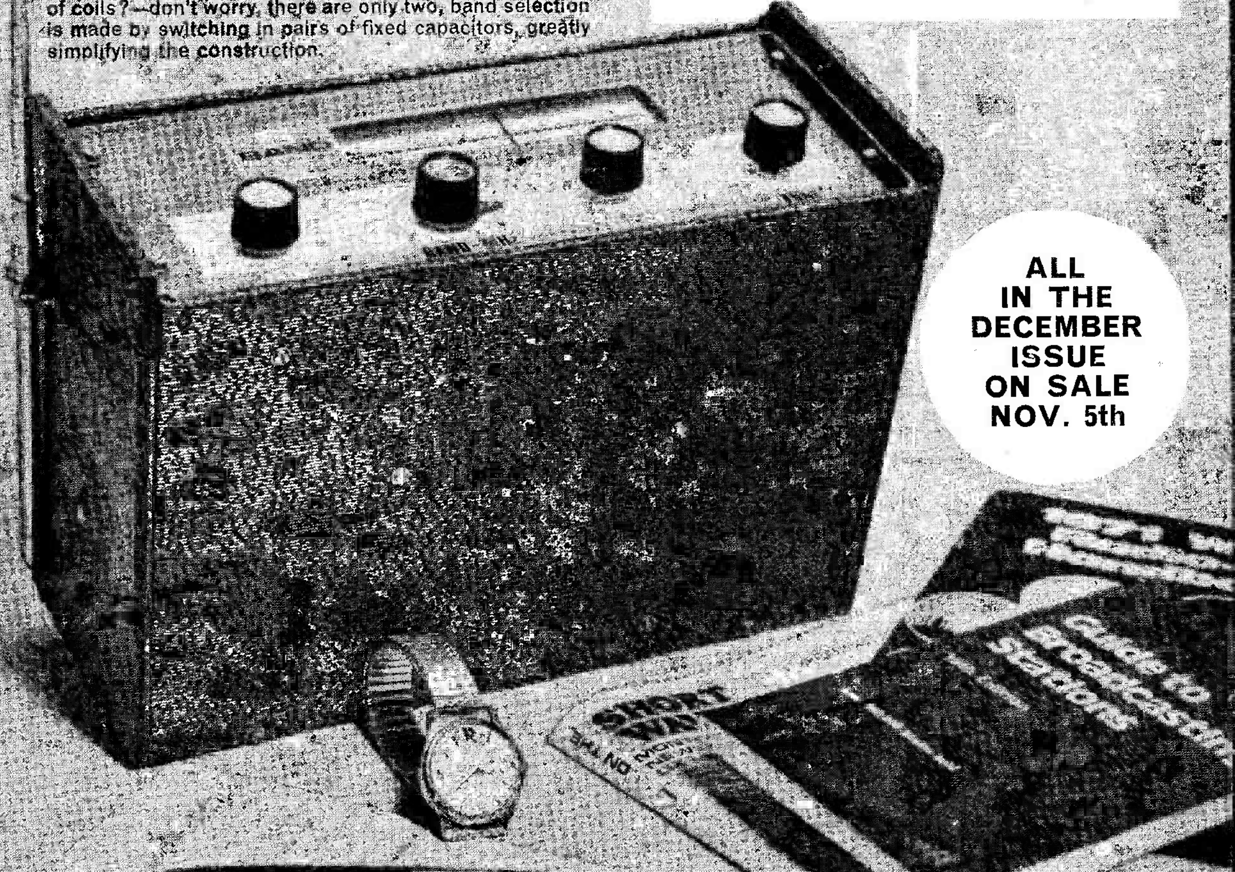
9-Band Short Wave Radio

"The world at your finger-tips" has become almost a cliché when advertising short wave receivers—but it's certainly true with this project. The nine bands means no dial cramping, enabling you to tune into stations with ease in the range 3·6 to 15 MHz. Worried by visions of lots of coils?—don't worry, there are only two, band selection is made by switching in pairs of fixed capacitors, greatly simplifying the construction.

EXTRA

COMPONENTS DICTIONARY SUPPLEMENT

Aerials to Zeners—that's the field covered in this extra supplement featured in the December issue. A detailed explanation is given of most of the important components used in today's electronics.



ALL IN THE DECEMBER ISSUE ON SALE NOV. 5th

ALSO

4-20V REGULATED POWER UNIT • TRANSISTOR TAPE RECORDER

Fed up with using a whole variety of batteries for your experiments? You'll be able to throw them away if you build our stabilised power supply covering 4V to 20V. The whole unit builds up into a smart, compact unit.

Earlier this year we promised you a mono tape recorder project. Well, it's in the December issue. Six transistors are used in this 4W circuit which combines both record and playback facilities. Constructional details and layout are given in full.

COMPREHENSIVE MULTI-BAND RECEIVER

PART 1

F. G. RAYER G3OGR

THIS receiver, intended for use in the 550kHz to 30MHz range, has electrical bandspread for all frequencies and is capable of very good general short wave reception. For the builder who is particularly interested in the amateur bands a crystal filter is incorporated and a product detector for the reception of single-sideband. For calibration purposes a harmonic crystal marker is included.

The circuit has the advantage that the receiver can be started in much simplified form, the crystal filter, carrier oscillator and other features being added later, as required. In any case, it will be found convenient to proceed in this way rather than to build the complete circuit before anything can be used or tested.

Miniature plug-in coils are used which enormously simplifies wiring and construction. These coils have to be changed by hand, but in practice this is often not so much of a disadvantage as may be supposed. For example, if most interest is in the h.f. amateur bands, 14, 21 and 28MHz, all these fall in the range of one set of coils. Again, both the l.f. amateur bands (1·8 and 3·5MHz) are tuned with another set of coils while for general s.w. listening, the range which falls between these will cover many of the useful broadcast frequencies.

Approximate coverage of the four ranges is as follows:

Range 2. 550-1550kHz.
Range 3. 1·5-4·8MHz.
Range 4. 4·8-12·0MHz.
Range 5. 12·0-30MHz.

These ranges are the maker's coil numbers. Range 1 is for long waves and may be employed if a high-performance receiver is wanted for these low frequencies.

DESIGN

Fig. 1 shows the receiver stages in block diagram form. (1) is the r.f. amplifier, with r.f. gain control and panel aerial trimmer, allowing best results with any aerial. (2) is the frequency changer stage. (3) is the crystal filter and (4) the 1st i.f. amplifier. As selectivity with the filter adjusted for maximum sharpness is much too narrow for a.m. reception a selectivity switch is incorporated, together with a phasing control which allows a rejection notch to be moved across the i.f. passband.

(5) is the 2nd i.f. amplifier and (6) a diode, for a.m. detection and a.g.c. (7) is the carrier oscillator, used for s.s.b. and as a beat frequency oscillator for c.w. reception, in conjunction with the double-triode product detector (8). (9) is a triode-pentode, for a.f. amplification and output, feeding the speaker. (10) is the crystal marker, a 1MHz crystal giving calibration points up to 30MHz.

For the beginner in particular, it is recommended that the receiver is built in the following order:

Stages (2), (5), (6) and (9). This is a straightforward superhet with three valves and one diode, capable of good results on any band.

The r.f. stage (1) is then added, improving sensitivity, and giving much more freedom from second channel interference on the h.f. ranges.

Stages (7) and (8) may then be added, allowing reception of s.s.b. and c.w. signals. The crystal filter (3) and its extra i.f. amplifier (4) can then be incorporated which are primarily intended to bring about the increased selectivity which proves so useful with crowded amateur and other bands.

The marker (10) plays no part in actual reception, but is a convenience for accurate calibration and accurate setting of the bandset ganged capacitor, when it is necessary to read frequencies from the bandspread dial.

It is, of course, not necessary that the extra or optional stages are added in the order given, as this depends to some extent on the requirements of the user.

It is recommended that the "basic circuit" is built first, for the following reasons:

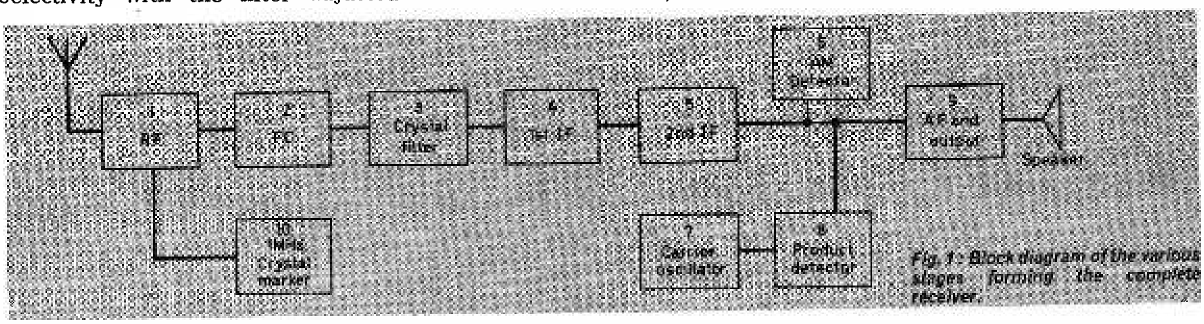
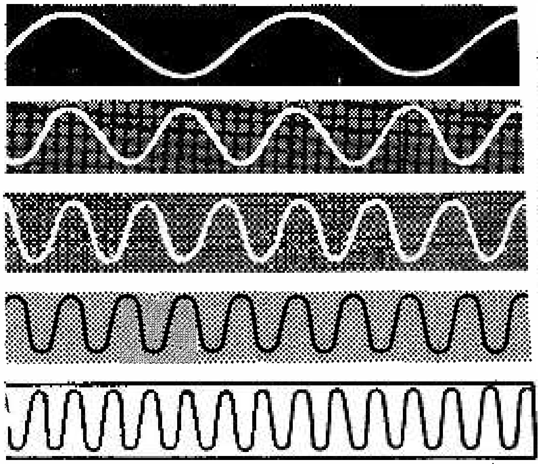
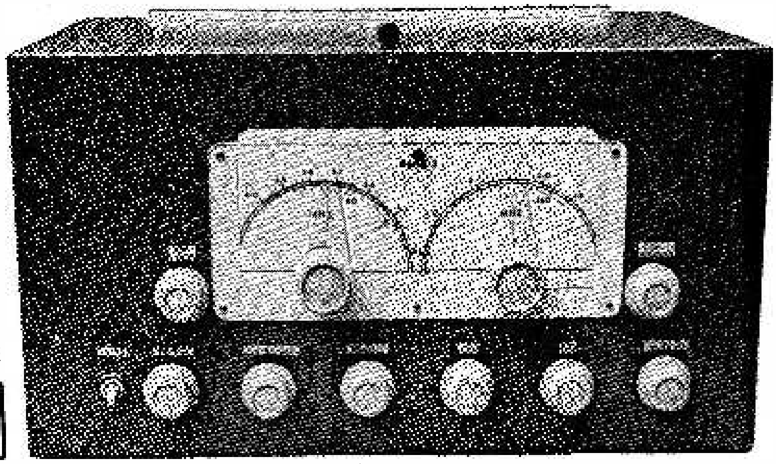


Fig. 1: Block diagram of the various stages forming the complete receiver.





(1) This consists only of stages 2, 5, 6 and 9, Fig. 1, so there is less chance of wiring or other errors.
(2) The "building time" until a useful receiver is produced is much smaller.
(3) If a fault should be present at this stage it will be much easier to locate.
(4) The whole construction can be spread over a period, without the feeling that it will never be finished.
(5) In some cases a simpler receiver will be adequate, so that some stages need not be built.

METHOD OF CONSTRUCTION

The carrier oscillator, crystal frequency marker, and crystal filter (with i.f. stage and phasing capacitor) are built as three separate units on boxes readily made from "universal chassis" flanged members. When wired, they are bolted on to the main chassis, and connected to the receiver circuit.

The main chassis is 13×8in. To allow experimentation, and the easy changing of some parts of the circuit, the chassis was made from five "universal chassis" members, bolted together by the flanges to form one assembly 13×8in. To the left, the power supply and a.f. amplifier occupy a 8×4in member, with space near the front for the carrier oscillator box, when required.

To the right, a 8×3in member takes the mixer section, with space for the crystal filter, when added. Between these, two 5×3in members accommodate the bandspread and bandset capacitors, and aerial coil.

At the back, a 6×3in member forms the i.f. and product detector strip. All make a chassis by bolting on a 13×2in member at the back and 8×2in sides.

If this method of construction is employed, place the five flanged members together with their flanges upwards, and mark and drill the flanges for two 6BA bolts between each member and those adjacent. Also drill and fit the back and sides. It is then possible to remove the bolts and take out any section, without much disturbance to other members.

If this method of construction is not favoured, it is in order to use a conventional chassis 13×8in. This would simplify preparation and metalwork to some extent.

The completed receiver is enclosed in a ready-made metal cabinet, the speaker being an external

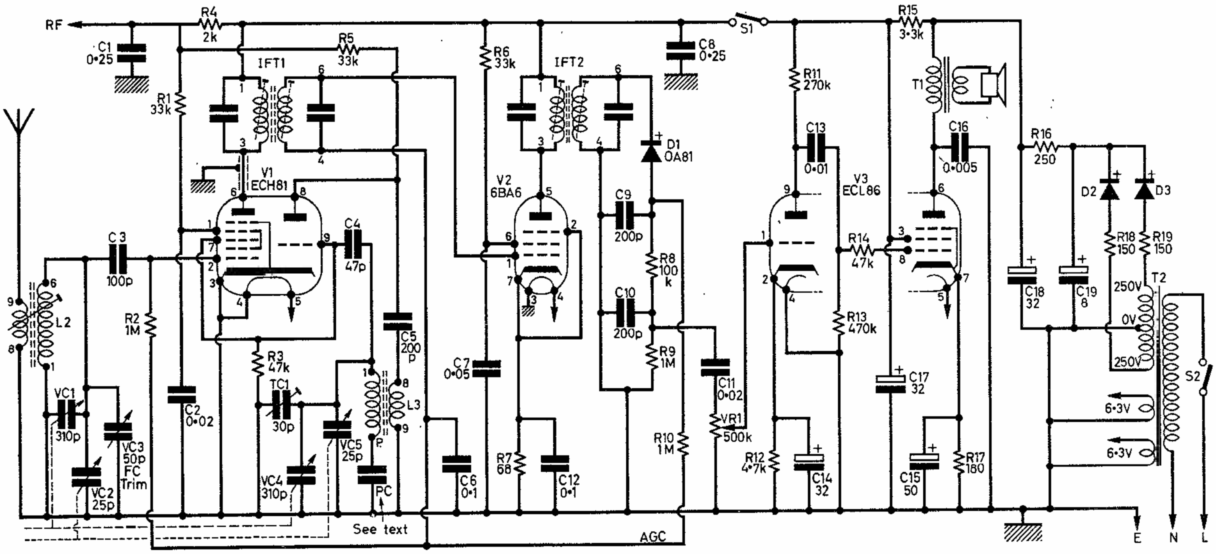


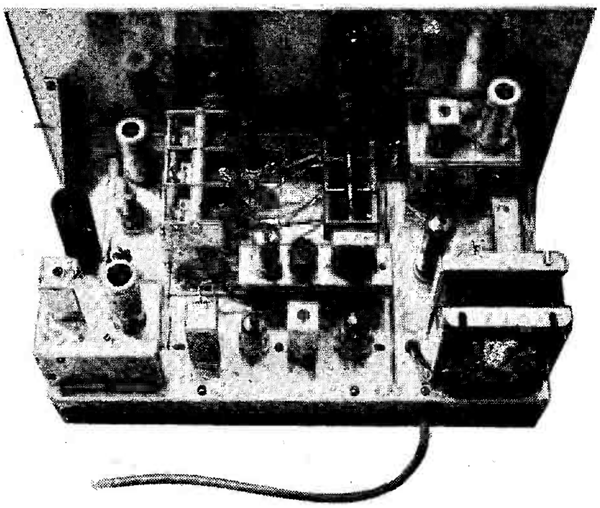
Fig. 2: Circuit diagram of the 3-valve basic receiver. The unused sections of the two 3-gang capacitors will be used for the r.f. stage added later.

unit. No reasonably-priced cabinet with a lifting lid could be obtained, so the top was sawn and hinged to allow access to the interior and changing of plug-in coils. If the receiver is later modified to include band-switching, this is still a useful feature.

BASIC RECEIVER

Fig. 2 is the circuit of the basic receiver. The miniature plug-in coils are "Blue" for the aerial circuit, "Yellow" for the mixer grid (L2 in Fig. 2) and "Red" for the oscillator circuit (L3 in Fig. 2). With Fig. 2, it is necessary to have a pair of coils, one Blue and one Red, for each waveband. When the r.f. stage is included, a set of three coils is necessary for each waveband—Blue for aerial, Yellow for mixer, and Red for oscillator. Yellow coils will thus be placed in the L2 holder, Fig. 2, when this stage is reached.

Padder capacitors PC are of separate value for each Red coil, using a different pin for this purpose on each range. So all the padders are permanently wired to the holder and the correct value is automatically in circuit for any coil which is inserted. PC is 350pF to tag 2 for Range 2, 1000pF to tag 3 for Range 3, and 3000pF to tag 4 for Range 4. Range 5 has no padder and tag 6 must be connected to the chassis.



VC1/VC4 is the ganged tuning or bandsetting capacitor, and a 3-gang unit is fitted to allow tuning the r.f. stage when fitted. VC2/VC5 is of low value, so that its full movement covers only a narrow range of frequencies, for bandspreading (easy and more accurate short wave tuning). This unit is also 3-gang. Both variable ganged capacitors have ball drives.

The oscillator trimmer TC1 is left at the same setting for all coils, and VC3 is a panel aerial trimmer for peaking up signals.

V2 is the i.f. amplifier, and the two transformers IFT1 and IFT2 give a good degree of selectivity. When the crystal i.f. filter and extra i.f. stage are added, these come between V1 and IFT1. D1 is the a.m. detector which also gives automatic gain control voltage. When the product detector is provided, D1 is retained for a.g.c. and a function switch selects the appropriate mode of operation for a.m. or c.w./s.s.b. reception.

V3 is a 2-stage a.f. amplifier giving adequate output into a loudspeaker. Additional h.t. smoothing is

★ components list

BASIC RECEIVER:

Resistors:

R1 33kΩ 1W	R8 100kΩ ½W	R15 3·3kΩ 3W
R2 1MΩ ½W	R9 1MΩ ½W	R16 250Ω 3W
R3 47kΩ ¼W	R10 1MΩ ¼W	R17 180Ω 1W
R4 2kΩ 1W	R11 270kΩ ½W	R18 150Ω 1W
R5 33kΩ 1W	R12 4·7kΩ ½W	R19 150Ω 1W
R6 33kΩ 1W	R13 470kΩ ½W	
R7 68Ω ½W	R14 47kΩ ¼W	All 10% tolerance

VR1 500kΩ potentiometer, log. with switch (S1)

Capacitors:

C1 0·25μF 350V	C11 [illegible] 150V
C2 0·02μF 350V	C12 0·1μF 150V
C3 100pF SM	C13 0·01μF 250V
C4 47pF SM	C14 [illegible] 6V
C5 200pF SM	C15 50μF 25V
C6 0·1μF 150V	C16 0·005μF 500V
C7 [illegible] 250V	C17 32μF 450V
C8 0·25μF [illegible]	C18 32μF 450V
C9 200pF	C19 8μF 450V
C10 200pF	

VC1–VC4–VC6 3×310pF (Jackson Type E3 3 gang)
VC2–VC5–VC7 3×25pF
(VC6–VC7 are used in RF stage added later)
VC3 50pF Variable (Jackson [illegible])
TC1 50pF Trimmer (beehive style)

PC Silver mica padding capacitors:—
Range 2 350pF to pin 2
Range 3 1000pF to pin 3
Range 4 3000pF to pin 4

On Range 5 pin 6 is connected to chassis

Valves and Diodes:

V1 ECH81	D1 OA81
V2 6BA6 (EF93)	D2 BY100
V3 ECL82	D3 BY100

Inductors:

IFT1/IFT2 IFT11/465 (Denco)
L2 Miniature plug-in coils (Denco 'Blue' Ranges 2, 3, 4 and 5)
L3 Miniature plug-in coils (Denco 'Red' Ranges 2, 3, 4 and 5)

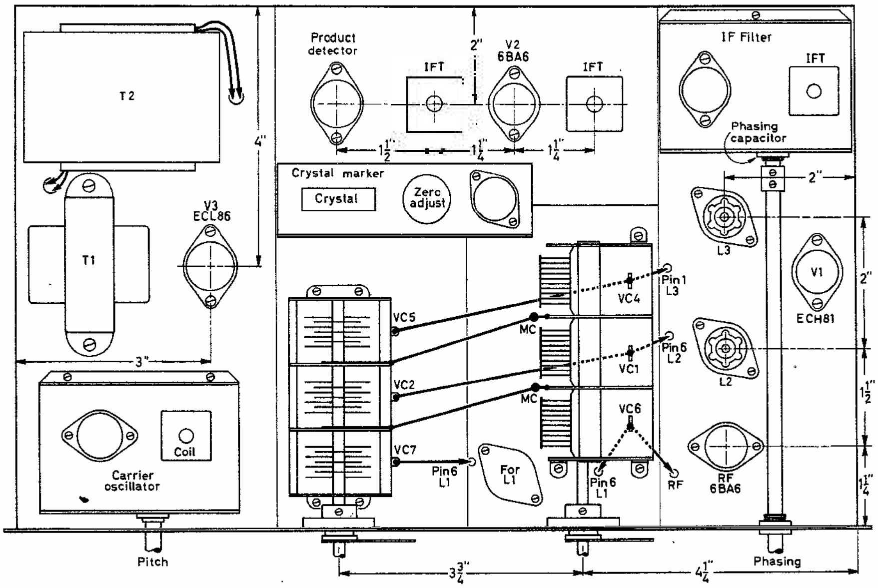
Miscellaneous:

T1 Output transformer (Home Radio TO46)
T2 Mains transformer (Home Radio TM11)
Valveholders, B7G with screen (1), B9A (4) with one screen. S1, on/off toggle switch. Ball drives (2) (Home Radio DL50A) and pointers (2) (Home Radio DL69). Brackets 4×4in (2). Knobs, feet (4), twin socket strips (Aerial/Earth, Speaker) tag strips. Cabinet, 15×9×8in with panel (H.L. Smith Type W). Chassis, 13×8in aluminium plate with 13×[illegible] (2) and 8×2in (2) flanged members (Home Radio).

provided for early stages by R15 and C17. S1 is a "Standby" switch, leaving heaters on but h.t. on V3 only. This allows immediate on/off switching, as may be required when using the receiver with a transmitter.

CONSTRUCTION

Fig. 3 shows the layout of the completed receiver, but the i.f. filter, carrier oscillator, marker, product detector and r.f. stage are added later in the way described. Punch chassis holes for the r.f. stage, aerial coil holder L1, and product detector holder, as this is awkward later if sections are not removable



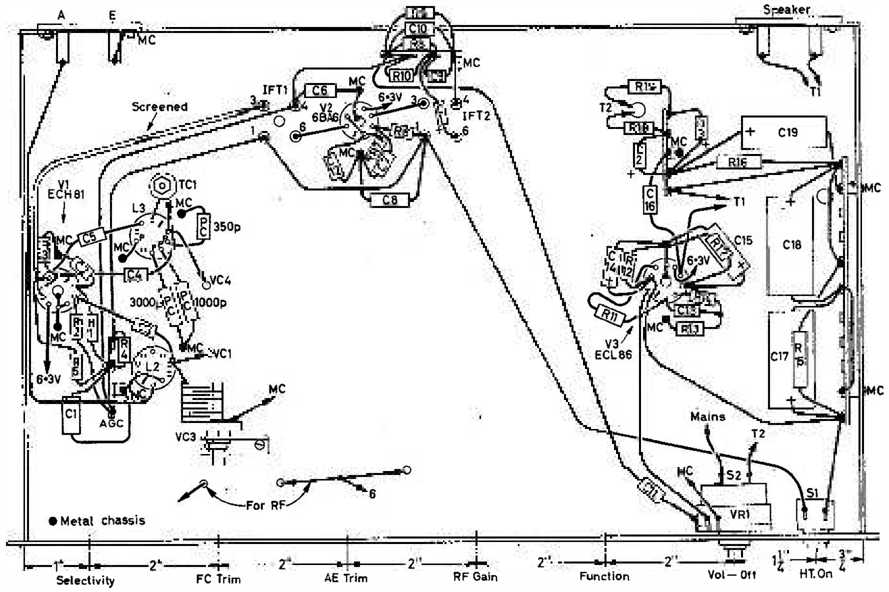


Fig. 3: (left) shows the disposition of the major components and units on top of the chassis while Fig. 4: (below) illustrates the wiring beneath.

in the way explained.

Punch holes in the front 13×2in runner as in Fig. 4. Place this on the panel with ½in of the panel projecting below, and punch matching holes in the panel. The panel is held to the chassis by component bushes and a vertical bracket each side.

Mount the variable capacitors with their spindles at the same height, so that the ball drives fit in clearance holes, with the drive lugs bolted to the panel. Take insulated leads from the lower tags of the bandsetting capacitor, down through holes as in Fig. 3. Connect the bandspread capacitor with stout leads clear of the chassis. The rotor tags are wired to tags bolted to the chassis.

Fig. 4 shows connections and components under the chassis to assemble the circuit in Fig. 2. The absence of bandswitching simplifies this part of the work.

Anchor the mains cord at a tag strip. Leads from the transformers T1 and T2 pass down through rubber grommets. Smoothing capacitors and other items are anchored by tagstrips.

Later, h.t. for the r.f. stage is taken from the tag holding C1, while the "a.g.c." tag supporting R2 is the a.g.c. connection for the r.f. stage.

Leads carrying r.f. are stout and run clear of the chassis. AF circuits, such as to C11, are run against the chassis, as are heater and h.t. connections.

VC3 is mounted on a bracket near the holder for L2, as in Fig. 4, and its spindle is extended through the panel. This allows short leads and separation of r.f. and mixer circuits.

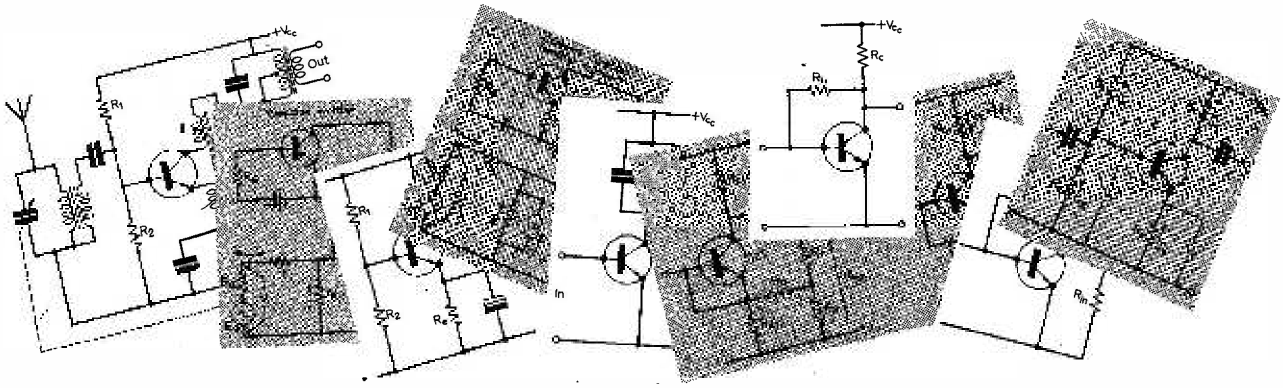
ALIGNMENT

With the circuit of the basic receiver completed, insert a correct pair of coils, such as those for Range 2. Clip a test-meter, set for 10mA, across R7 with negative to chassis. Tune in any local BBC or other stable transmission.

The four cores of the two i.f.t.'s are then adjusted, with the correct type of core tool, for minimum meter reading. Each core should have quite a definite peak.

TC1 is set at about half capacitance and rotating VC3 with any pair of coils in use, and the bandset capacitor nearly fully open, should peak up signals. The receiver is then tuned towards the low-frequency end of the band, and if coverage is unsuitable, the core of L3 is adjusted to correct this. The core of L2 is then adjusted for best results (minimum meter reading). Set the core of L2 so that when tuning from the h.f. end of the band, to the l.f. end, the minimum re-adjustment of VC3 is required. Deal with each pair of coils separately, and lock the cores with 6BA nuts.

PART 2 NEXT MONTH WILL CONTAIN FULL DETAILS OF THE ADD-ON UNITS TO COMPLETE THE RECEIVER



TRANSISTOR CIRCUITRY for beginners

PART 2

H.W.HELLYER

Properties of Germanium and Silicon

The silicon diode has a more sharply defined 'knee' in the reverse characteristic than the germanium type. At a certain point, as the reverse voltage is increased, the current suddenly increases very rapidly. At the breakdown point the current can suddenly increase from a few microamps to many milliamps, and even amperes in some specially constructed devices. Advantage is taken of this characteristic which all semiconductors exhibit to some extent, in the development and application of a Zener diode.

History of the Transistor

Although it was as recently as 1947 that Bardeen and Brattain of the Bell Telephone Laboratories earned themselves a Nobel prize with the development of the transistor from the types of semiconductor devices we have been discussing, it should not be imagined that the whole family of semiconductors has so short a history. The main research impetus, it is true, came during World War II, but as long ago as 1835 the rectifying properties of certain substances had been noted by Rosenshold. F. Braun revived interest in 1874 and Willoughby Smith Co. testing underwater telegraph lines, had already noted a variation of resistance according to the amount of light shining on the material some un-named technical assistant was using—which happened to be selenium. In Victorian times, the selenium cell, in rather primitive form, was a scientific curiosity, and its rectifying property was observed in 1876.

Even as Fleming was experimenting with his thermionic diode in 1904, J. C. Bose patented a semiconductor crystal diode, and in the early years of broadcasting, the crystal detector was much used. A silicon detector was invented in 1906 by Pickard—familiar to early experimenters under the name of the 'Perikon detector'. A patent for the improved version of this device was taken out in 1909.

Earlier devices—until 1941, anyway—were point-contact. Then a junction diode was brought out. Six years later came the first transistor. Bardeen and Brattain developed a 'crystal diode' and the name 'Transistor' came from '**Trans**fer- re**sistor**'.

There is nothing new under the sun. Many years before, the diode had been used as an oscillator, and in 1924, *Wireless World* carried an article by Victor Gabel, which dealt with the Russian Lossev's experiments with crystals as generators and amplifiers. To undermine our easy belief in progress yet further, we note that Eccles used a crystal diode as an oscillator way back in 1909!

The original work on point contact devices at Bell Telephone Laboratories brought the first transistors. Shockley was a leader among those, who, realising the limitations—high noise factor, relatively high production costs, lack of durability and the difficulty of manufacture—researched the junction device and eventually came up with a 'junction transistor'. This is the basis of most modern semiconductor devices.

A variety of techniques has developed: grown junction, alloying, surface barrier, alloy-diffused, diffused mesa, epitaxial diffused mesa, planar, epitaxial planer, diffused field effect, etc. Let's take a look at the more important among them.

Development

It was during an investigation into the rectifying properties of surface potentials around a point contact that the scientists at Bell Telephone Laboratories used a second contact to prove the field. At spacings between the two probes of less than a couple of thousandths of an inch they noted a change in current in the main contact influenced the current flow in the other. From this, the germanium point contact transistor was developed.

Two springy wires with pointed ends about a thousandth of an inch apart, pressed on a flat piece of germanium, each having rectifying characteristics. The emitter has a forward bias and thus a low resistance while the collector is reverse biased, giving it a high resistance. A change in forward current through the emitter contact produces a change in the collector contact, and because of the difference in the resistances, power amplification takes place.

This is the important, noteworthy, fact about

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the unassuming Frenchman who accomplished the amazing first flight of the English Channel.

GREAT GOD THIS IS AN AWFUL PLACE–
the harrowing account of Scott's nightmare return from the Antarctic which ended in he and his comrades dying in a grave of snow.

THE KILLER DOCTOR–
hung for the gruesome and depraved crime of slaughtering and dismembering his wife and maid.

EDWARD VIII–
torn between his duty to the nation and personal happiness–he relinquished his Crown for the woman he loved.

THE BOLSHEVIK BUTCHER–
that was Beria–Head of Russia's Secret Police and responsible for the callous murder of thousands of 'anti-communists'.

ROCKY MARCIANO–
the heavyweight champion with the iron punch that no man on earth could withstand.

THE MURDER FACTORY–
that was the name given to the factory in Crawley where John Haigh destroyed the 6 bodies of his victims in a tank of acid !

THESE AND OTHER GREAT FRONT-PAGE STORIES OF THE TWENTIETH CENTURY ARE ALL IN NO. 2 ISSUE

the transistor, that it is essentially a current-operated device. However, it is the difference in input and output **resistance** that is the vital means of securing amplification. Hence the name—the process being basically one of transferring a current from a low to a high resistance, using a solid-state device. The advantage is reduced size and weight and no need for a heater supply as with a thermionic valve.

As development goes on, some of the disadvantages, power handling limitation, frequency characteristics, etc., will be overcome. Solid-state devices have almost completely ousted valves from portable equipment, have invaded the domestic entertainment field for table radios and record players, and most tape recorders, are already into high fidelity amplifiers and are now used for nearly all stereo radiograms, while television circuitry has been the subject of much experiment with transistors taking the place of valves in almost every stage. Transistor television receivers have been marketed and are gaining in popularity as prices level off.

In the commercial and industrial field, solid-state devices are imperative for many applications, where the number of switch-gates and amplifiers in a unit would militate against valves on the grounds of space alone, even if power consumption and heat dissipation were not important considerations. Transistors, allied to micro-electronics, modules, integrated circuits and other developments, have led to the production of computers with a wide range of facilities, yet no larger than an old-style adding machine.

Operation

In considering the operation of the junction transistor, we must revert to the properties of the p-n junction. If two of these junctions are formed, back to back, in a single piece of semiconductor, and lead wires taken from the p and n sections, a transistor is formed. This formation can be either p.n.p. or n.p.n., with roughly opposite characteristics, as we shall observe. The first p region, called the emitter, emits holes into the base, the centre n region. The second p region, the collector, collects holes from the base and is negatively biased. This is the p.n.p. transistor, which we shall now consider.

Fig. 7 shows the p.n.p. transistor connected as an amplifier, with appropriate supply voltages. In passing through the base region, the emitter current I_E decreases slightly by some holes recombining with electrons. To take the place of these 'lost' electrons, more flow in from the base contact, the current thus produced being equal to the difference between the emitter current and the collector current, or $I_B = I_E - I_C$.

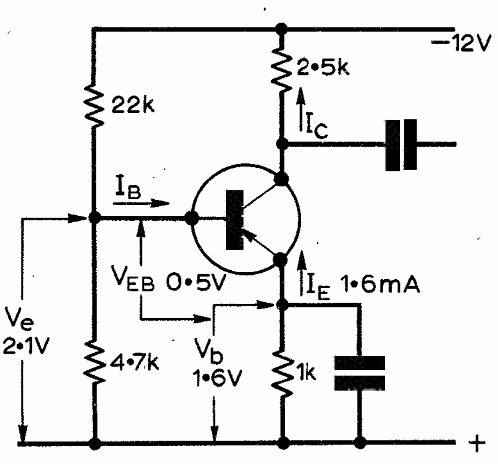


Fig. 7: A silicon p.n.p. transistor connected as a common-emitter amplifier.

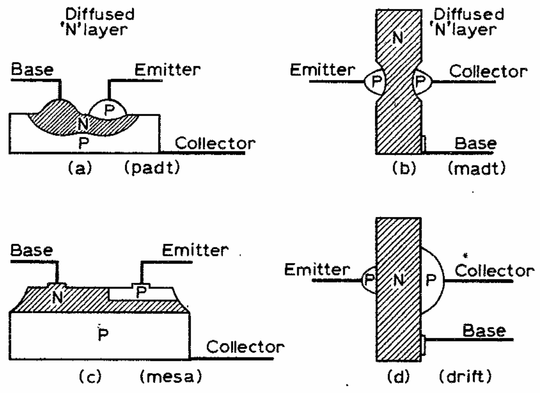


Fig. 8: Typical construction of some transistors.

Some actual constructions of p.n.p. transistors are shown in diagrammatic form in Fig. 8. These are (a) post alloy diffused, (b) microalloy diffused, (c) mesa type, and (d) 'drift' type. In the construction of transistors, a number of very delicate refining processes take place, and the following notes are only a brief look at production techniques.

Production Techniques

Germanium occurs in certain coal formations and as an impurity in zinc and copper ores. It can be extracted from the flue dust of coal-burning power stations. It is chemically extracted from its source, converted to germanium dioxide and heated in hydrogen to reduce to the metal. Impurities at this stage are as low as one part in a million. To purify further, zone refining is carried out by concentrating power in one part of the ingot, producing a narrow molten zone and moving this to the end of the ingot, which tends to move the impurities toward the end, which may be cut off and rejected. Refinement to reduce impurities to as little as one part in 10^{10} can be carried out in this way.

The selected donor or acceptor impurity is added in similarly small controlled amounts. This is done during the same process as seeding, when a small 'seed' of the metal is lowered into contact with molten germanium in a crucible heated a little above the melting point and raised very slowly so that a crystal solidifies on the seed.

This process of 'pulling from the melt' is also used in manufacture of silicon transistors. Silicon is a common substance (sand is mainly silicon dioxide) and chemical extraction is employed to refine it. A floating zone process is often used both to complete refining and to produce the correct crystal, whereby a rod of polycrystalline silicon is held vertically and a molten zone, narrow enough to be held in position by surface tension is passed up, from a single crystal seed at the bottom, to the top. As the zone passes up, silicon melts into it at the top and boron and other impurities are taken to the top while the silicon solidifies out into single crystal form at the bottom.

After refinement and preparation, the single crystal material is sawn into slices about fifteen-thousandths of an inch thick, using diamond impregnated wheels. The slices are lapped to a thickness of about eight to ten thou' by carborundum and finally surface irregularity is removed by etching in an acid mixture. For some diffused types the whole subsequent process is carried out on the whole slice, which is then scribed and cut to size, but for many other applications the processing is done separately.

The junctions between the p and n type materials may be 'grown' during the process of pulling from the melt, or formed by other methods. These include alloying, diffusion and epitaxy. Epitaxial junctions are formed on a substrate wafer by growing a thin film of the same semiconductor on to it, hence the term 'epitaxial', meaning, on the same axis. Again, heating is the key to the process, and very precise methods of temperature control have been developed by transistor manufacturers.

Alloy diffused transistors are made by a combination of diffusion and alloying techniques. This gives a narrower base width and a better high frequency performance. They have a high current gain and an upper cut-off around 100 MHz.

Diffusion transistors of both germanium and silicon types have much better characteristics because of the more rigid control of dimensions of the elements during construction. In general, germanium offers higher frequency possibilities than silicon and germanium diffused transistors operating up to several thousand MHz are available. The method of construction gives rise to the term 'mesa'. whereby an area of the diffused collector junction is defined by masking over the emitter and base stripes (evaporated gold contacts being used) and the wafer etched to leave a raised 'mesa' containing the active part of the transistor—a process that greatly aids mass production.

Silicon diffused transistors can be sub-divided into several types but most variations are the result of research into closer production control. Some forms similar to mesa etching are employed, and diffused mesa transistors are generally of the silicon type.

Planar Transistors

A development of manufacturing processes to overcome instability caused by contamination at the surface of the mesa led to the planar type of silicon transistor. The process is quite involved, including the use of photo-etching techniques, deposition and diffusion, but the great advantage is the protection of the collector-base junction, resulting in very low collector leakage current. Very thin base layers are possible giving good high frequency performance, up to several thousands of MHz. Manufacturing techniques can be modified to easily make different size transistors and a whole range of types, from small signal high frequency, to high power medium frequency (typically 50 watts at 10 MHz) can be produced.

One disadvantage of the diffused transistor is the series resistance between the collector junction and the contact at the bottom of the wafer. This sets up an internal voltage drop when collector current flows. To improve upon this, the epitaxial planar transistor has been developed. This is perhaps the most versatile transistor to date, with good, all-round characteristics. Manufacture includes the previous processes, but a composite slice of very low resistance substrate on which a thin epitaxial layer has been formed is now employed and the epitaxial structure can be developed by depositing alternate p and n layers on a suitable substrate.

Field-effect Transistors

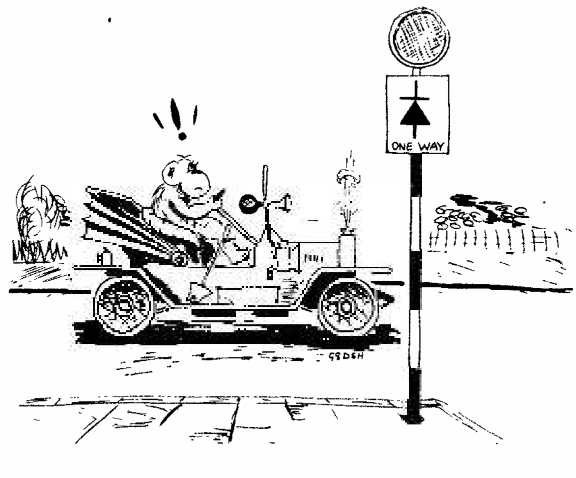
One very important development of this process is the construction of the field-effect transistor. Its special properties are likely to lead to a rapid increase in applications. In particular, its high input impedance makes it suitable for a number of circuit configurations where other types of transistor are not appropriate. Another important feature is that only one type of carrier is involved—the majority carrier in the basic bar of semiconductor. This is in contrast to the normal type of junction transistor, which depends for its action on the flow of minority carriers through the base region and majority carriers in the emitter and collector regions. A high impedance linked with a low noise factor makes this device eminently suitable for small-signal input stages. The most significant difference for the designer, is that the f.e.t. is a voltage-controlled device but more about f.e.t.'s later.

The zener diode is essentially a specially constructed diode designed to work in reverse, employing what would be regarded as the 'failure' part of the characteristic of an ordinary silicon diode. The silicon controlled diode or thyristor is a further device which finds special uses. Normally, this rectifier blocks current both ways, but when triggered by a pulse fed to a gate electrode, current is allowed to flow in the forward direction only. As this is basically a three-junction device, more detailed explanation will be left until later.

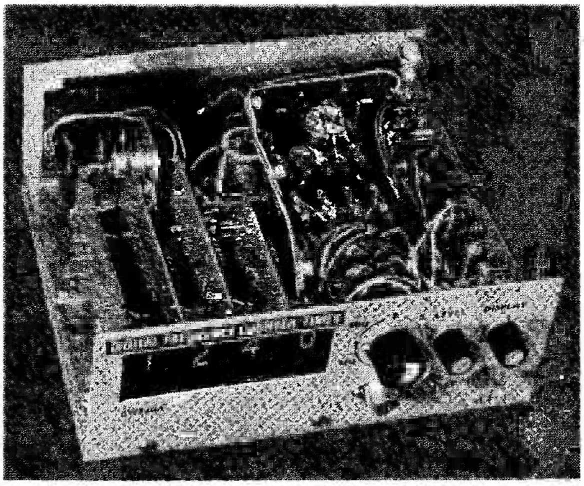
TO BE CONTINUED

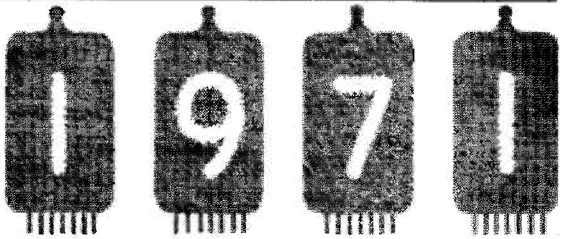
MAXWELL

by G8DSH



DIGITAL FREQUENCY COUNTER/TIMER





J. THORNTON-LAWRENCE GW3JGA

PART 3 *(continued from the October issue)*

The cutting and drilling of the panels is shown in Fig. 15 and the drilling and position of the components on the chassis is shown in Fig. 16.

The top cover consists of a simple drop-over inverted 'U' shape. It is $\frac{1}{2}$in longer front to back than the chassis and overhangs the front panel by about $\frac{3}{8}$in to produce a 'visor' effect. The top cover is fastened by two 6BA screws on each side.

To conceal the screws which protrude through the chassis underneath, a snugly fitting base cover is fitted inside the underside of the chassis and the top cover screws pass through the sides of the chassis into the base cover. The base cover is drilled and tapped 6BA for this purpose, but 6BA self-tapping screws would be equally suitable. The base cover is fitted with four stick-on plastic feet.

To avoid any bending of metalwork, it would be possible to use a piece of $\frac{3}{8}$in plywood for the chassis and plastic covered hardboard for the cover. It would still be desirable to make the front and rear panels of aluminium.

The window cut-out for the indicator tubes can be made either by drilling a line of holes and then joining these by filing through, or more simply by using an Abrafile in a hacksaw frame and finally finishing off with a flat file.

The front and rear panels are sprayed with car touch-up enamel and lettered with Letraset. The cover may also be sprayed or alternatively it may be covered with Contact or Fablon self-adhesive plastic material.

Assembly and Wiring

The various sections of the Digital Frequency Counter/Timer are built separately and then assembled and wired to each other and to the supplies and controls on the main chassis and panels.

The operation of the complete working instrument

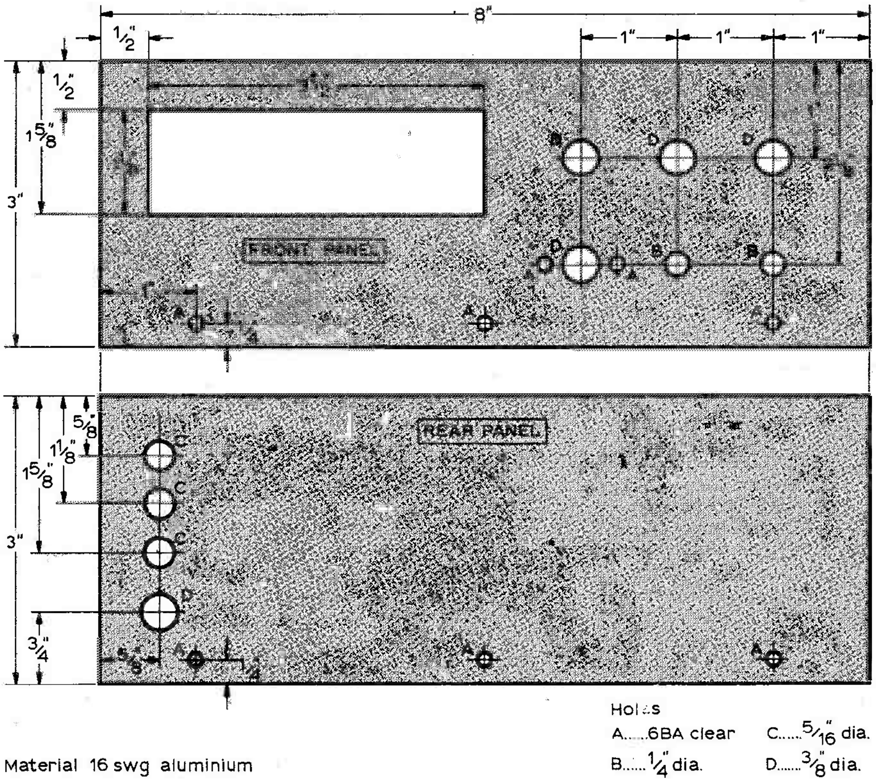


Fig. 15: Front and rear panel metalwork.

is not in itself very complicated, but should any part malfunction due to a wiring error or faulty component, the locating of the fault could prove to be very time consuming. This is mainly due to the fact that the cycle of operation depends on several stages operating in sequence. If the sequence is broken due to a fault condition, all stages become suspect and it may be quite difficult to locate the section containing the fault.

The operation of most of the panels can be checked before being assembled on the chassis and by doing this the possibility of building-in a fault is greatly reduced.

In any case it is always important to try to prevent wiring errors right from the outset and although, to some constructors, the following suggestions on wiring the Veroboard panels may be rather trivial, it is hoped that they will help to produce an instrument which will work first time.

Main Chassis and Power Supply

It is suggested that this is constructed first as it will provide the various voltages required to test the other parts of the instrument.

The component positions and wiring are shown in Fig. 17.

Testing

When operated without a load, the h.t. section of the power supply will develop an h.t. voltage of about +350 volts. The −5 volt section will not operate correctly until the h.t. section is loaded, but some negative voltage should be detected across D9, depending on the current drawn by the meter (approximately −5 volts on a 20,000 ohm/volt meter). All voltages are with respect to chassis.

The +5 volt section is regulated and here the no-load voltage will be about +5·2 volts. The voltage across C14 is about +8 volts.

Crystal Clock and Divider (Panel B)

This panel is built and tested next, as it is needed to provide a test signal for testing the other panels. The components, links and pins are fitted in the manner suggested previously.

Connect the crystal and trimmer to the appropriate pins and, with temporary wires, connect the panel to the chassis earth and the +5 volt supply.

Testing

The oscillator transistors Tr8 and Tr9 operate in class A and the voltage of +2·3 volts on each collector remains about the same whether the crystal circuit is oscillating or not.

However, the clipper stage Tr10 has a normal operating collector voltage of about +2 volts but if the oscillator is not functioning this voltage will rise to nearly +5 volts. The oscillator circuit has adequate gain for most crystals but for very stubborn surplus types which may refuse to oscillate, C8 may be reduced in value to 220pF. Any further reduction of C8 may cause the circuit to oscillate at some spurious frequency not controlled by the crystal.

With the oscillator and each stage of the divider chain functioning, the voltage at each output point will be approximately +1·6 volts d.c. with the oscillator not functioning the voltage at each point could be +3·5 volts or +0·1 volts depending on the state of the output of the decade counter.

The waveform at any of the divider outlets should be a square-wave of 1:1 mark-space ratio and 3·4 volts peak to peak amplitude and of the appro-

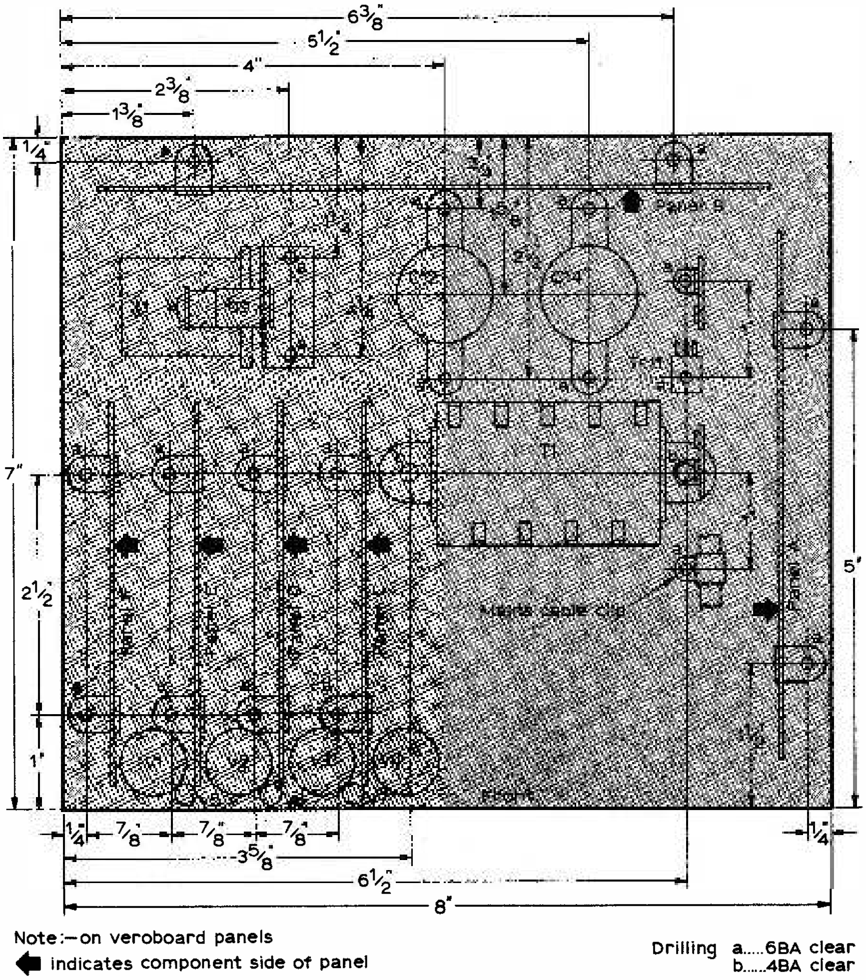


Fig. 16: Chassis metalwork and main component layout.

priate frequency. The 100kHz output at Tr10 collector should be about 4·7 volts peak to peak. The frequency of the 100kHz oscillator can be checked and set exactly by beating its second harmonic with the 200kHz signal from Droitwich (BBC Radio 2).

A simple way of doing this is by tuning a broadcast receiver to Radio 2 on 200kHz and by connecting a length of insulated wire to the 100kHz output, B(3), to provide coupling. The wire is placed close to or around the receiver to cause a beat note or whistle to be heard. The trimmer capacitor C9 is then carefully adjusted so that the beat reduces to zero. If the 200kHz signal is very strong it will be necessary to reduce the pick-up of this signal by removing the external aerial or by rotating the set if it has an inbuilt ferrite rod aerial, to obtain a weak reception of the 200kHz transmission.

Near zero beat the difference frequency will be heard as a cyclic variation of the background noise rather than a 'note'. The final setting of the oscillator frequency should be made when the instrument is complete.

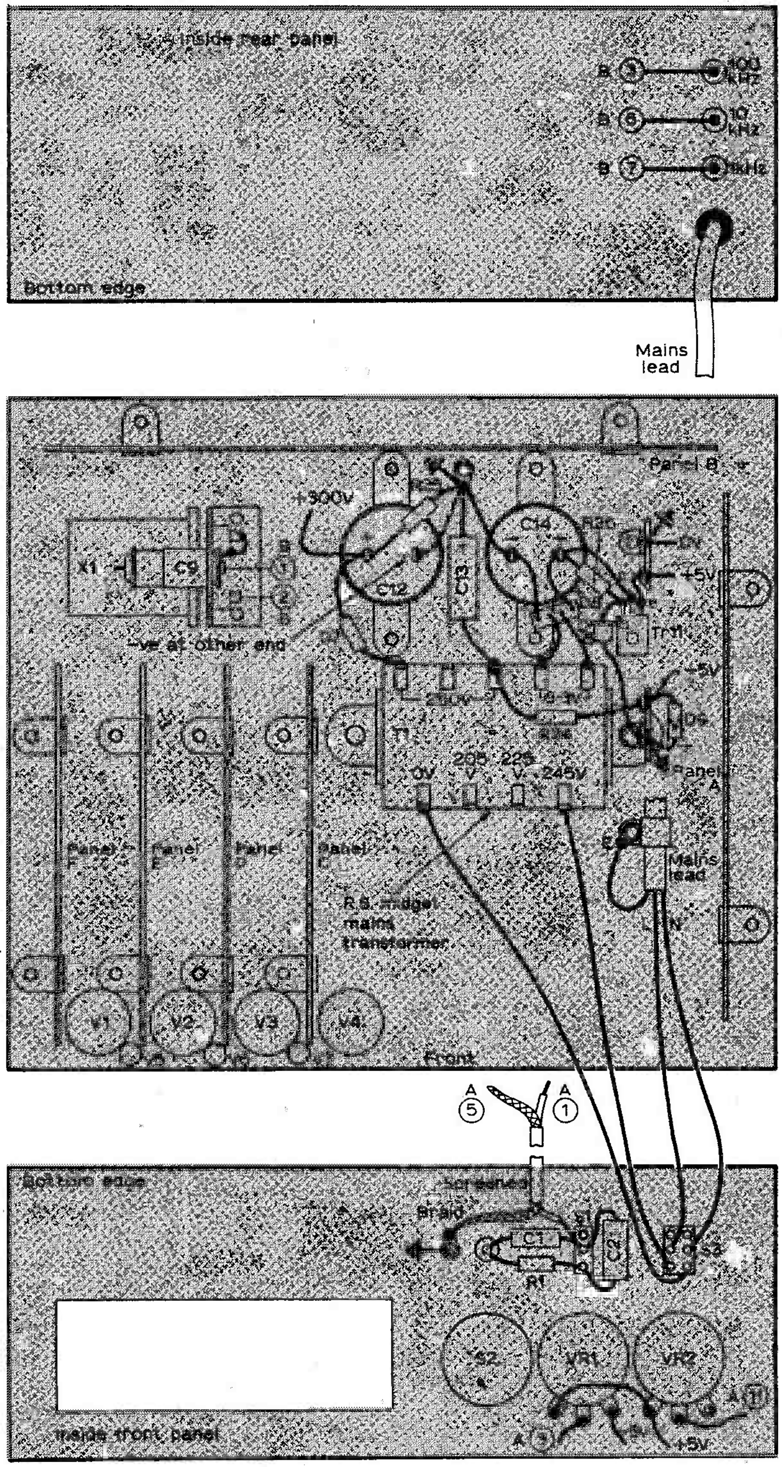


Fig. 17: Chassis and panel wiring.

Counter and Display Panels, C, D, E and F

The components, links and pins are fitted to the panel in the usual way.

The numeral indicator tube is fitted to the panel and held in place by the glass pip which fits snugly into a $\frac{1}{8}$in × $\frac{1}{4}$in grommet. The grommet is supported by a crossed loop of 20 s.w.g. wire fitted in holes A1 and A4.

The numbers must face the correct direction, the top of the glass pip should be in line with the top of the panel and the straight surface of the glass envelope should extend about $\frac{1}{8}$in beyond the end of the panel.

Wiring should commence with the low numbers and the lead-out wires sleeved using small diameter sleeving. The last few wires to be connected should pass over the previous wires. The wires, when soldered, effectively support the base end of the tube.

Testing

Each panel should be tested separately by connecting it with temporary wiring to the +300 volt, +5 volt and earth, 0 volt, connections.

Connect the crystal clock and divider panel to the same +5 volt supply and using a croc-clip 'jumper' lead join the input of the counter panel (7) to the 1Hz output of the divider B(10).

As the reset input (4) is not connected to 0 volt the counter is continually in the reset condition and the numeral tube should indicate '0'. With another jumper lead join the reset input (4) to 0 volt (6). The numeral tube should now display continuous counting 0-9 at one digit per second.

Disconnecting the jumper lead between (4) and (6) at any time should reset the count to zero, '0'. Counting should recommence when the connection is remade.

The neon 'decimal point' may be checked by connecting a 220kΩ resistor between the decimal point connection (1) and 0 volt (6). A wrong sequence of numbers probably indicates a fault in the wiring of the numeral tube. Two numbers being on together is probably caused by a solder blob short circuiting two strips on the Veroboard, but also could be due to a faulty decoder-driver integrated circuit.

I.C's. can be checked by substitution and as four panels are required for the complete instrument a faulty panel can be easily checked against the other three.

When testing counter and display panels it is advisable to insulate the +300 volt connection to the panel in case a jumper lead going to an i.c. accidentally strays on to the +300 volt connection.

Each panel should be checked individually for correct operation and then mounted on the chassis and linked together as shown in Fig. 6. (Part 1. September issue.)

The counting and 'carry' operation of the complete counter and display section may be checked by applying the 1Hz output B(10) from the divider to the signal input C(7) and checking that the carry to the next higher decade is made on the transition from 9 to 0.

The previous remarks about the reset line now apply to all the panels simultaneously.

Input Stage, Control Oscillator and Gate (Panel A)

To test this panel, it is necessary to have all the other panels installed on the chassis and connected to the appropriate supplies. This applies particularly to the +300 volt supply to the numeral tubes as without the normal loading on this supply the −5 volt supply will not regulate correctly under load. It is not necessary to have S2 connected in circuit when testing the operation of Panel A, and it is advisable to check the operation of all the sections before connecting S2 into circuit.

Input Stage

With all the supplies connected to panel A, and to VR1 and VR2, connect A(3) to the slider of VR1 and monitor the output of Tr5 A(6) with a voltmeter. Slowly rotate VR1 until a point is found where the voltage at A(6) flips between +4·0 volts and +0·1 volt. Dual voltages are given at various points in the circuit diagram of the input stage and these may be checked if faulty operation is suspected. The actual position of VR1 at which the circuit operates depends on the individual gate characteristic of Tr1.

An oscilloscope check may be made by connecting the input components and S1 to A(1) and A(5) as shown in the circuit diagram and feeding in a 100mV r.m.s. audio frequency signal to the input socket. Switch S1 should be in the a.c. position and the output should be monitored at the output A(6).

The square-wave output should vary in mark-space ratio as VR1 is adjusted and the operating point is moved over the amplitude range of the input signal voltage.

Control Oscillator

For the control oscillator to function, A(11) must be connected to VR2 as shown in the diagram. Depending on circuit conditions the oscillator circuit may be held in the clamped condition by D4 and D4

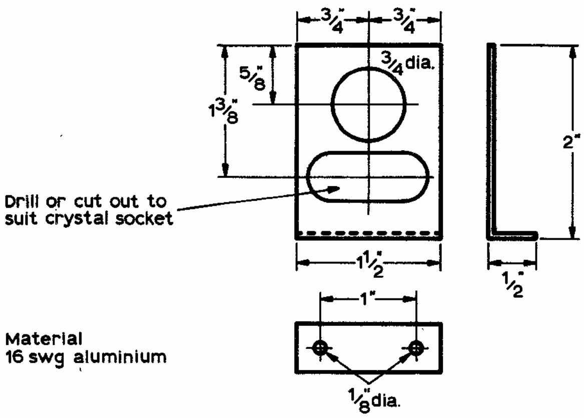


Fig. 18: Crystal mounting bracket.

should be temporarily disconnected by unsoldering one end to stop any clamping action.

The control oscillator should now free-run at a speed determined by the setting of VR2. The slowest speed is one cycle in about 4 seconds.

The square-wave output at Tr6 and Tr7 collectors should have a voltage swing from 0·1 volt to nearly +5 volts. An oscilloscope test may be made at A(8) to check the presence of the positive-going 200μS pulse which performs the resetting of the counter and the setting of IC1a. However, due to the short duration of the pulse and the low repetition rate it may be difficult to observe this pulse on a simple oscilloscope.

The diode D4 should be reconnected after this test.

If the oscillator refuses to run, check the collector voltages of Tr6 and Tr7, if either of these are low, about +0·1 volt, check the coupling capacitors for open circuit. If either is +0·6 volt, check the coupling capacitor for short circuit. If either collector voltage is about +5 volts check the appropriate base feed resistor circuit.

Gate

The testing of the gate is most easily carried out with all the remaining sections of the instrument operational. The function switch S2 should be left disconnected and temporary wire links used to connect between the various sections.

All supplies should be connected to all panels. Temporary wire connections should be made as follows: Clock divider 1Hz output B(10) to clock period input A(7). Clock divider 1kHz output B(7) to signal input A(9). Gate output A(10) to signal input C(7). Reset output A(8) to reset input C(4).

With these connections made, the instrument should count the 1kHz output for a period of one second and display a reading of 1000. The counter should then reset to 0000 and then commence counting again. This is equivalent to the 'TEST' position on the function switch, position 6.

The time that the reading is displayed before resetting is determined by VR2.

With the exception of wiring errors, it is unlikely that a fault will exist in the gate circuit but in any event the sequence of operations can be followed through from the circuit description given previously and the fault diagnosed from the point in the sequence at which the operation ceased.

With all sections operating correctly the function

—continued on page 634

practically wireless commentary by HENRY

No. 85

Made in Where?

KILTED soldiers march across the sea to be sold in Aberdeen. It's enough to make a haggis weep. But until now, November 1971, there had to be, somewhere, a label denoting the country of origin. Or, at least, a tiny ticket under the sporran that said, unequivocally, 'Foreign'.

Parliament, proud of British prowess, demanded that goods should be so marked way back in 1926. It has taken forty-two years for us to bring in the Trades Descriptions Act, and one of the things written-in when this became law, in 1968, was that by November 1971 the need for declaring a country of origin would end.

Philips introduction of the *Popmaster* radio woke up some of us stick-in-the-muds. Now, we have come to accept the flair of the Italians, the inventiveness of the Scandinavians, the engineering efficiency of the Germans. It is the idea of Oriental precocity that still fails to sink in.

Yet, as I write, the hold on the television market is being tightened by Far East competition. BREMA figures tell us that in the first quarter of this year British-made TV sets dropped from 484,000 to 401,000, i.e., a 16 per cent loss. The increase, taken up by importers, was practically a total invasion from Japan. In the radio receiver market, we came down from 342,000 to 323,000. I dread to think what a survey of the audio market would reveal.

Kilted soldiers march across the seas.

Henry gets rather hot under the collar when he hears of the 'rationalisation' that the big boys impose on a taken-over small concern. In no time, the special position that made the back-alley company worth taking-over has been flattened and stultified, making its products part of the bland image that the parent company projects.

In the name of 'efficiency' the economies imposed rob the product of all its individuality. It becomes just another wireless set, tape recorder, gramophone . . .

There is an ironically apt story in an American publication just out: *'Welcome to our conglomerate—you're fired!'* Large concern takes over small, specialist company and sacks the boss. A little later, sales begin to slump and the whizz-kids search around for a reason. Can't be the absent boss—after all, he spent most of his time playing poker with the salesmen.

Then it comes out: the poker games were the breeding ground for ideas, and the way the boss instilled his very individual flair in his team.

We have seen the loss of the personal touch more than once in the audio world. A notable case has recently been exemplified by some facelifted models. A small firm with an international reputation is merged into a large group. Almost overnight its keen service fades; models are restyled and, basically similar, with no progressive modification, have a posher faceplate. The companion tuner-amplifier, however, is an imported model.

What's wrong with that? Oh, nothing, except that the *implied* 'Made in England' is held in the brand name. The imported gear does not even have its gramophone pickup input equalised to the standards of the records we, in this country, are going to be able to buy. But to the unsuspecting public, this is a new (and by implication, better) product from the famous stable.

"Welcome to our conglomerate—you're fired!"

Many electronic goodies masquerade under strange flags. Home-grown labels mean little when the bits have been imported, needing only assembly, boxing and test.

Perhaps that is why the Government have said 'Drop it.'

Do you remember how Max Grundig started? Back in the days when the Germans were not allowed to purchase a complete radio, he brought out a radio, constructed except for the plugging in of a valve, sold the valve separately, circumvented the regulations and laid the basis of a fortune.

Using the Henry method—what the artistic circle call 'the aleatory technique of random connections and accidental parallels—I present to you the following information. G.E.C. propose closing the Marconi-Elliott Microelectronics factories at Witham, Essex and at Glenrothes. The first was especially built as recently as 1968. The second has a prospective new neighbour—a microcircuit factory to be built at East Kilbride, Lanarkshire, for the great American concern, Motorola.

Will *their* chips be marked 'Made in Britain'?

GOING BACK...

1970 60 50 40 30 20

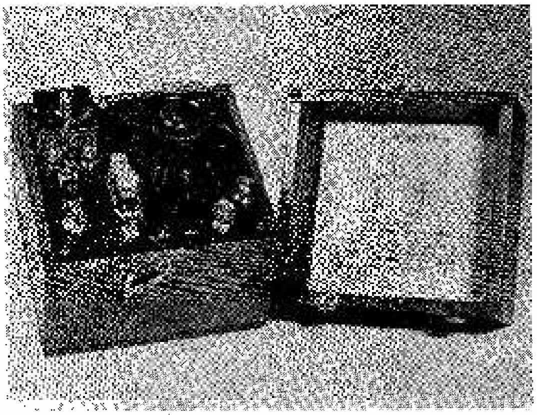
COLIN RICHES
ARTHUR DOW

OUR request for information on the little buzzer unit shown in our September issue met with little response. However, Mr. F. Kirkby of Ruislip, Middlesex, came to the rescue in no uncertain way by producing what appears to be a more sophisticated version of the unit.

Recently Mr. Kirkby had the task of clearing out the house of an elderly relative and amongst the 'junk', some of which is thought to be over 100 years old, was found the wavemeter shown in the accompanying photograph. The circuit, mounted inside the lid of the teak case, is still perfectly clear and shows a parallel tuned circuit which, in the "receive" position of the changeover switch, is connected to an adjustable carborundum detector and to the telephone terminals at the front. In the "send" position the tuned circuit is connected to the buzzer and cell. The cell in the equipment appears to be the original Siemen's 'S' type cell.

The circuit notes that "the inductance is a 5-turn rectangular coil $3\frac{1}{2}$in. × 2in. lying close against the front face of the case" presumably to allow the wavemeter to be closely coupled to the external equipment under test.

The dial is finely engraved in steps from '45' to '95' and this is presumed to be the range covered, in metres. Anyway, a new cell was fitted to the wavemeter and the buzzer adjusted on "send" and the unit placed a few feet from a communications receiver tuned to 5MHz (60 metres) and sure enough the signal, if it can be called that, did peak when the dial of the wavemeter was tuned through the 60m. point on the dial.

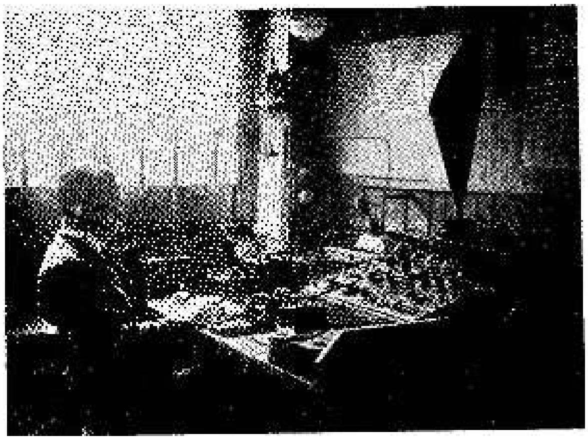


Since no aerial terminal is provided it is presumed that the "receiver" was used as a monitor for a local transmitter and used to set the transmitter to a particular wavelength.

Unfortunately there is no indication of the maker's name or the year of manufacture so once again we must ask our readers to help in identifying this bit of vintage equipment.

Mr. Kirkby is to be congratulated on his vigilance and for rescuing this piece of ancient equipment. We make no excuse for again reminding readers of the thousands of pieces of similar equipment that must be hidden away in sheds, attics and storerooms and which must not be allowed to finish up in some dustcart. There are collectors in the UK who will see that such equipment gets the attention it deserves.

Since writing the above we have heard further from Mr. Kirkby. He has now discovered some old documents including the photograph we show of an amateur radio station operating in 1922. The actual wavemeter under discussion can be seen at the left hand end of the operating desk. Mr. Kirkby now believes that the wavemeter dates from 1916 and that it was obtained as "Ordnance Disposal" or "Government Surplus" as we would call it today.



Incidentally, the two wall charts to the right of the speaker were issued by the Marconi Company and represent the movement of ships equipped with wireless. Presumably listeners could estimate the "range" of their receivers by listening for these ships over varying distances.

PART 2

MODULAR AUDIO MIXING SYSTEM

F. C. JUDD

DETAILS concerning the possible audio signal mixing combinations, and circuits for the line amplifier, a microphone pre-amp for low impedance microphones and a suitable power supply etc., were given in Part 1.

We continue now with more circuits for pre-amplifier stages beginning with one for crystal microphones (Code: **Mic Hi-ZX**). This is given in Fig. 11 and the circuit board layout is shown in Fig. 12. Crystal microphones have a high output impedance, hence the need for the high series input resistance, R1, to the base of Tr1. The circuit is conventional with d.c. stabilization and negative feedback which also sets the amplifier gain by the feedback network C5 and R3. The 100pF capacitor across R3 produces a roll-off in frequency response above about 30kHz to prevent pick up of r.f. signals as is often the case with preamplifiers having a high frequency response. As with all the preamplifier stages, the output is taken to the gain control VR1 and thence to the line amplifier (or tone control unit) via the passive mixing component R9. Details of the circuit board and screen construction for all the preamps and the tone control were given in Part 1.

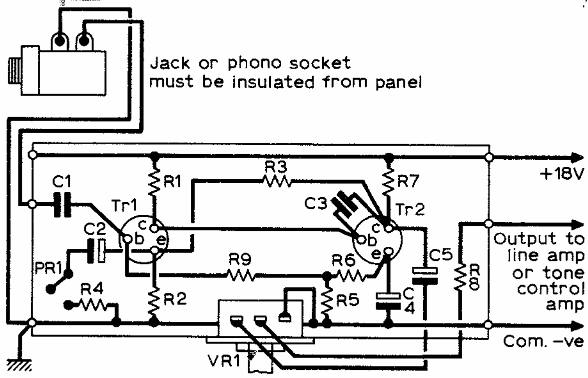


Fig. 12: The component layout for the crystal mic. preamp.

PREAMPLIFIER FOR MAGNETIC PICK-UPS

The circuit is given in Fig. 13 and its code is **PU Mag.** Again a conventional BC109 pair is used with d.c. stabilization and a negative feedback equalization network between Tr2 collector and Tr1 emitter to obtain the correct R.I.A.A. response for magnetic cartridges. The actual response curve was

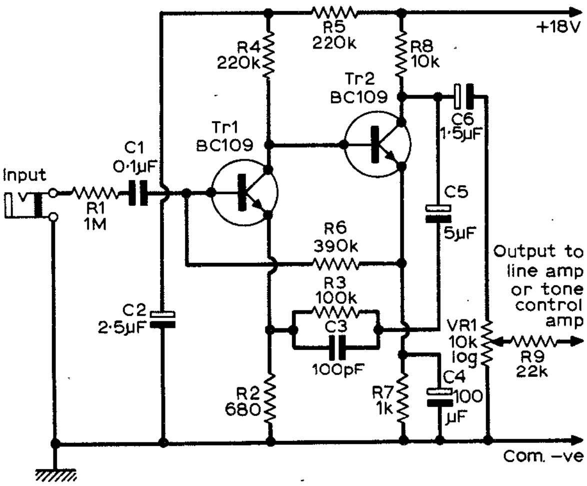


Fig. 11: The crystal microphone preamp circuit.

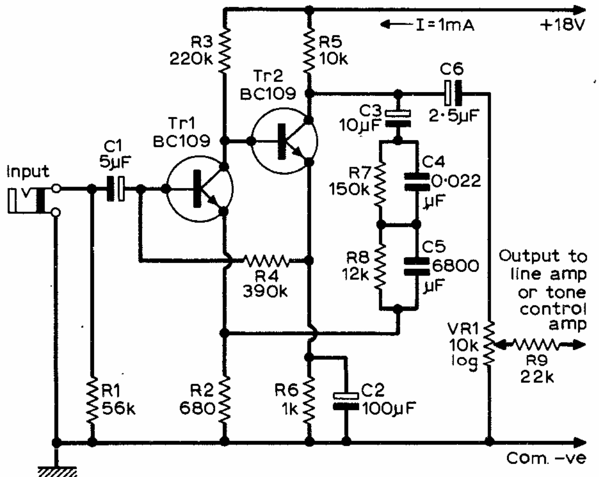
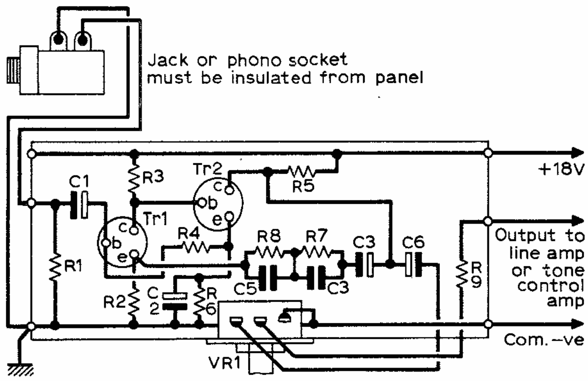


Fig. 13: The circuit of the magnetic pickup preamp.



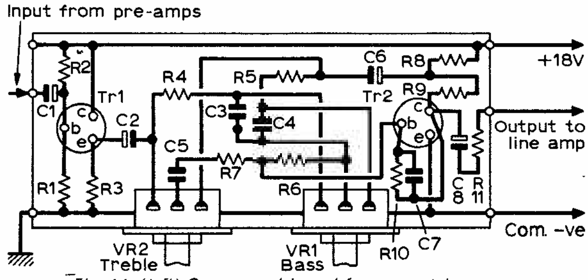
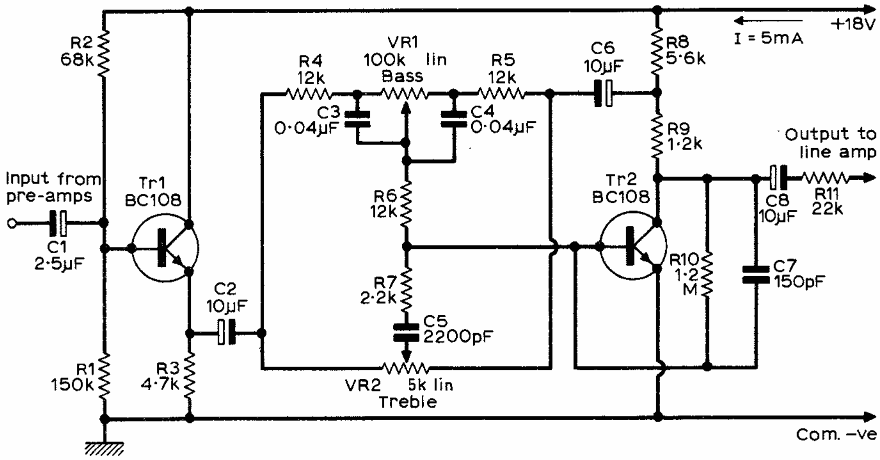


Fig. 14: (left) Component layout for mag. pickup preamp.
Fig. 15: (below) The tone control module circuit.
Fig. 16: (above) Layout of the tone control module.



given in Part 1. The output, via VR1 and R9, is again as common to all the preamps. The input sensitivity is approximately 5mV and the overload margin at least 10 times this. The circuit board layout and wiring is given in Fig. 14.

THE TONE CONTROL UNIT

This has unity gain and an input sensitivity of 100mV so the output is therefore 100mV. The tone control unit will accept the outputs from any of the preamps and one or more may be connected to its

★ components list

Mic Pre-amp (Mic Hi ZX)

Tr1, Tr2	BC109	
VR1	10kΩ	Carbon log. pot.

Resistors

R1	1MΩ	R6	390kΩ
R2	680Ω	R7	1kΩ
R3	100kΩ	R8	10kΩ
R4	220kΩ	R9	22kΩ
R5	220kΩ		

All $\frac{1}{4}$W, 10% types

Capacitors

C1	0·1μF		C4	100μF	25V
C2	2·5μF	25V	C5	5μF	25V
C3	100pF		C6	1·5μF	25V

Magnetic p.u. pre-amp (PU Mag)

Tr1, Tr2	BC109	
VR1	10kΩ	Carbon log. pot.

Resistors

R1	56kΩ	R6	1kΩ
R2	680Ω	R7	150kΩ
R3	220kΩ	R8	12kΩ
R4	390kΩ	R9	22kΩ
R5	10kΩ		

All $\frac{1}{4}$W, 10% types

Capacitors

C1	5μF	25V	C4	0·022μF	
C2	100μF	25V	C5	6800pF	
C3	10μF	25V	C6	2·5μF	25V

Tone Control Unit (TC)

Tr1, Tr2	BC108	
VR1 (bass)	100kΩ	Carbon lin. pot.
VR2 (treble)	5kΩ	Carbon lin. pot.

Resistors

R1	150kΩ	R5	12kΩ	R9	1·2kΩ
R2	68kΩ	R6	12kΩ	R10	1·2MΩ
R3	4·7kΩ	R7	2·2kΩ	R11	22kΩ
R4	12kΩ	R8	5·6kΩ		

All $\frac{1}{4}$W, 10% types

Capacitors

C1	2·5μF	25V	C4	0·04μF	C7	150pF	
C2	10μF	25V	C5	2200pF	C8	10μF	25V
C3	0·04μF		C6	10μF 25V			

Ceramic p.u. amp (P.U. Cer)

Tr1, Tr2	BC109	
VR1	10kΩ	Carbon log. pot.

Resistors

R1	470kΩ	R5	1·5MΩ	R9	820Ω
R2	120kΩ	R6	12kΩ	R10	22kΩ
R3	150kΩ	R7	120kΩ		
R4	1·5kΩ	R8	10kΩ		

All $\frac{1}{4}$W, 10% types

Capacitors

C1	0·1μF		C4	100μF	25V
C2	0·1μF		C5	2·5μF	25V
C3	2·5μF	25V			

input. The output from the tone control unit is taken via the passive mixing component R11 so it may, in turn, be connected to the line amplifier together with any one or more preamps. Equally two or more tone control units each accepting a number of preamps may be simultaneously connected to the line amplifier. The circuit for the tone control unit is shown in Fig. 15. (Note that BC108 transistors are used) and the board layout in Fig. 16. The input is taken to the active (negative feedback) network via the emitter follower Tr1. The insertion loss of the tone control network is recovered by the amplifier stage Tr2 but amplification is controlled to obtain unity gain. The frequency response curves for the unit were given in Part 1 but it provides approximately 15dB cut and lift at 40 and 20,000Hz respectively.

PREAMPLIFIER FOR CERAMIC PICK-UP CARTRIDGES

The requirements for the preamplifier input are generally similar to those for a crystal pick-up cartridge except that the input sensitivity is higher. The circuit in Fig. 17 provides a high input impedance and a sensitivity of about 60mV. Tr1 is an emitter follower and Tr2 the amplifier with negative

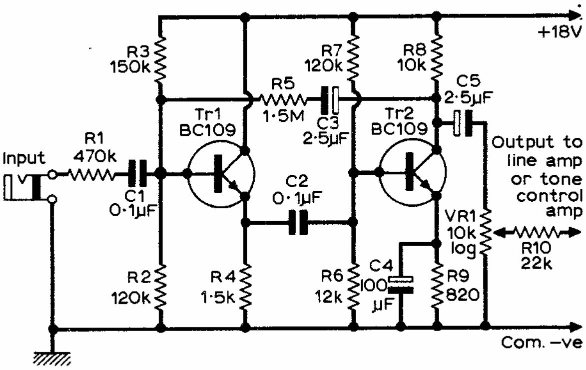


Fig. 17: The ceramic pickup cartridge circuit.

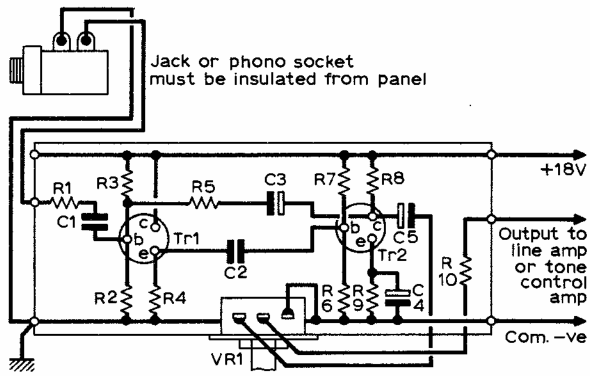
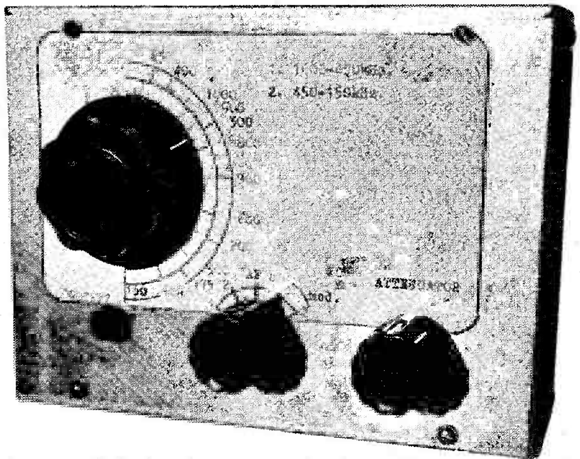


Fig. 18: The layout of the ceramic pickup preamp.

feedback between output and input to obtain the correct gain and wide frequency response. The output is taken via the gain control VR1 and the passive mixing component R10. The circuit board layout is shown in Fig. 18.

TO BE CONTINUED

BASIC signal generator



R. H. LONGDEN

ALTHOUGH a signal generator is extremely useful for the testing, aligning and calibrating of receivers and for quick tests of audio circuits, the construction of such a project may be considered to be complicated and possibly expensive. In this case, however, the signal generator here should prove ideal. It has a basic circuit, requires only a few components, yet will easily fill most of the needs which arise when dealing with receivers.

The following outputs are available from the generator:

1. Tone-modulated r.f. signal in the range 150-450kHz.
2. Tone-modulated r.f. signal in the range 450-1600kHz.
3. Audio tone.
4. Unmodulated signal in the range 150-450kHz.
5. Unmodulated signal in the range 450-1600kHz.

1 and 2 are used for the general alignment and testing of receivers, and includes the 455-470kHz i.f. frequencies. 4 and 5 are used for similar purposes when modulation is not required. 3 allows testing of a.f. stages and amplifiers.

THE CIRCUIT

Figure 1 shows the circuit and uses a single double-triode valve, one section performing as a tunable r.f. oscillator and the other section as an a.f. oscillator. Power is derived from a small 12·6V heater transformer and this also gives a little over 20V d.c. across C7 for the anode supply voltage.

V1a is the r.f. oscillator, tuned by VC1. With S1a in position 1, L1 and L2 are in series, for Range 1 (450-150kHz). With position 2, L2 is shorted, L1 covering about 450-1600kHz, for Range 2. V1b is the a.f. oscillator. Both valve anodes draw h.t. through the primary of T2, thus modulating the r.f. output.

R.F. is taken through C4 to the attenuator or output control VR1. With S1 in position 3, S1a shorts VC1 so that no r.f. is produced, and S1b brings in the larger capacitor C5, the a.f. output of V1b passing to VR1.

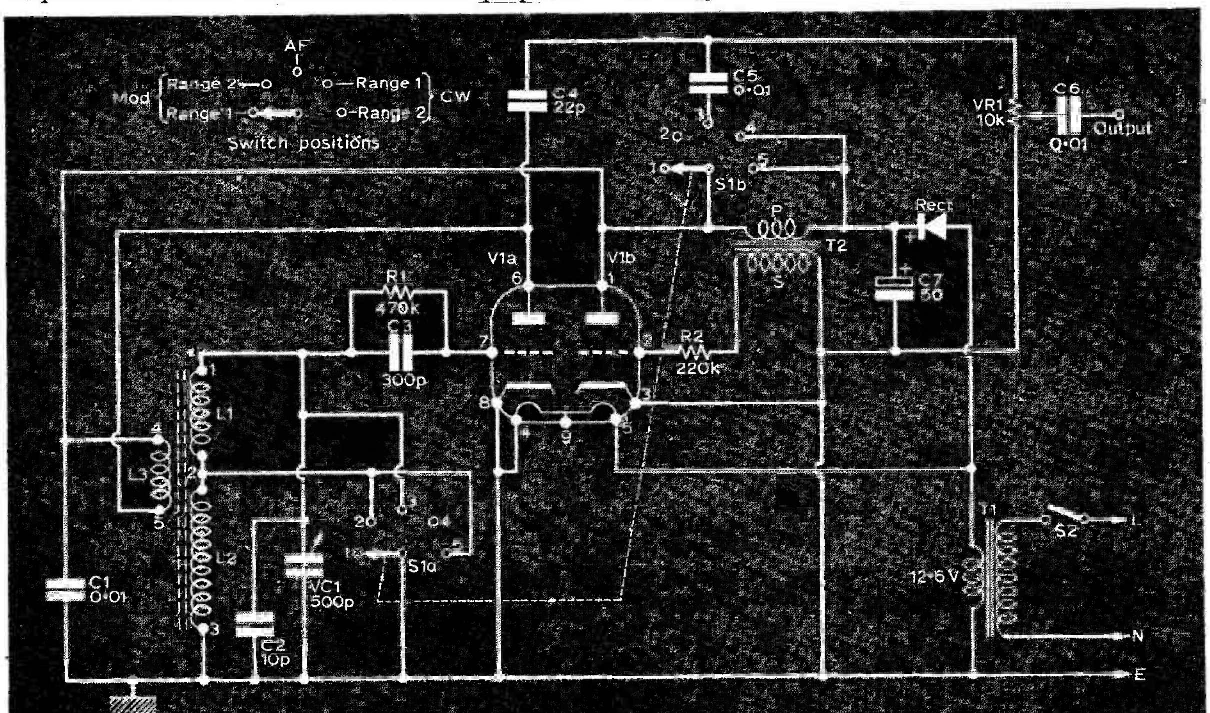


Fig. 1: Complete circuit of the basic signal generator.

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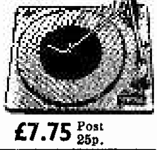

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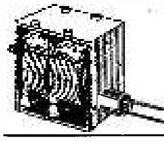

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16/450V	15p	1000/50V..	47p	32+32/250V ..	18p
32/450V	20p	8+8/450V	18p	32+32/450V ..	33p
25/25V	10p	8+16/450V	20p	350+50/325V	50p
50/50V ..	10p	16+16/450V	25p	32+32+32/350V	43p
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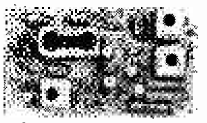

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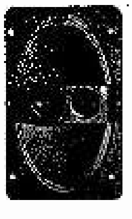

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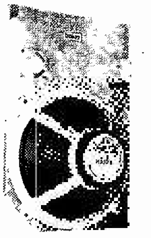

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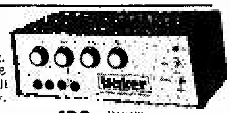

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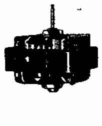

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2N2218	20p	BC158	17p	NKT403	75p
2N2219	20p	BC159	20p	NKT404	62p
2N2222	20p	BC169C	15p	OA5	20p
2N2222A	25p	BC177	25p	OA9	10p
2N2369	20p	BC178	25p	OA10	25p
2N2484	35p	BC179	27p	OA47	10p
2N2646	50p	BC182L	12p	OA70	10p
2N2904	20p	BC183L	12p	OA73	10p
2N2904A	25p	BC184L	15p	OA79	10p
2N2905	25p	BC212	12p	OA81	10p
2N2906	20p	BCY30	25p	OA85	12p
2N2906A	25p	BCY31	30p	OA90	10p
2N2907	23p	BCY32	50p	OA91	7p
2N2926	10p	BCY33	25p	OA95	7p
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2N3709	10p	BCZ10	35p	OC35	50p
2N3710	10p	BCZ11	45p	OC36	60p
2N3819	35p	BD112	50p	OC41	25p
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2N4058	15p	BD123	80p	OC43	40p
2N4061	15p	BD124	75p	OC44	17p
2N5457	35p	BD125	50p	OC45	15p
2N5458	37p	BD131	75p	OC70	12p
2N5459	50p	BD132	85p	OC71	15p
2S301	50p	BD153	62p	OC72	25p
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2S304	75p	BDY11	£1·62	OC75	25p
40250	50p	BDY17	£1·50	OC76	25p
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AAY30	10p	BDY61	£1·25	OC82	25p
AAY42	15p	BDY62	£1·00	OC83	25p
AAZ13	12p	BF115	25p	OC84	25p
AAZ17	10p	BF152	30p	OC139	25p
AC107	37p	BF154	40p	OC140	37p
AC126	25p	BF158	30p	OC141	62p
AC127	25p	BF159	60p	OC170	25p
AC128	25p	BF167	25p	OC171	30p
AC176	25p	BF170	35p	OC200	40p
AC187	30p	BF173	30p	OC201	70p
AC188	30p	BF177	40p	OC202	80p
ACY17	30p	BF178	25p	OC203	40p
ACY18	25p	BF179	40p	OC204	40p
ACY19	25p	BF180	35p	OC205	75p
ACY20	20p	BF181	35p	OC206	90p
ACY21	20p	BF182	30p	OC207	90p
ACY22	10p	BF184	20p	OCP71	97p
ACY39	50p	BF185	20p	ORP12	50p
ACY40	15p	BF194	17p	ORP60	40p
AD140	50p	BF195	15p	ORP61	42p
AD149	50p	BF196	15p	TIP29A	50p
AD161	37p	BF197	15p	TIP30A	60p
AD162	37p	BF200	37p	TIP31A	62p
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AF125	20p	BFX85	35p	TIS60	22p
AF126	17p	BFX86	25p	TIS61	25p
AF127	17p	BFX87	25p	TIS62	27p
AF139	30p	BFX88	20p	ZTX107	15p
AF178	47p	BFY18	30p	ZTX108	15p
AF179	65p	BFY50	22p	ZTX300	12p
AF180	52p	BFY51	20p	ZTX301	15p
AF181	42p	BFY52	22p	ZTX302	20p
AF186	40p	BFY53	17p	ZTX303	20p
AF239	40p	BFY90	65p	ZTX304	25p
ASY26	25p	BSX20	17p	ZTX500	20p
ASY27	32p	BSX21	20p	ZTX501	25p
ASY28	25p	BSX76	15p	ZTX502	25p
ASY29	30p	BSY95	15p	ZTX503	20p
ASY67	47p	BSY95A	15p	ZTX504	40p
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Part No.	Description	Price and Qty. 1–24	25–99	100	250+
7400	Quadruple 2-input NAND Gate	20p	18p	15p	13p
7401	Quadruple 2-input Positive NAND Gate (with open collector output)	20p	18p	15p	13p
7402	Quadruple 2-input Positive NOR Gates	20p	18p	15p	13p
7403	Quadruple 2-input Positive NAND Gates (with open collector output)	20p	18p	15p	13p
7404	Hex Inverters	20p	18p	15p	13p
7405	Hex Inverter with open collector	20p	18p	15p	13p
7410	Triple 3-input Positive NAND Gates	20p	18p	15p	13p
7413	Dual 4-input Schmitt Trigger	35p	32p	29p	25p
7420	Dual 4-input Positive NAND Gates	20p	18p	15p	13p
7430	8-input Positive NAND Gates	20p	18p	15p	13p
7440	Dual 4-input Positive NAND Buffers	20p	18p	15p	13p
7441	BCD to decimal nixie driver	87p	77p	66p	60p
7442	BCD to decimal decoder (4-10 lines, 1 of 10)	87p	77p	67p	60p
7447	BCD-Seven-Segment Decoder/Drivers (15-V Outputs)	£1·40	£1·30	£1·20	£1·05
7450	Expandable dual 2-input AND-OR-INVERT	20p	18p	15p	13p
7451	Dual 2-wide 2-input AND-OR-INVERT GATES	20p	18p	15p	13p
7453	Quad 2-input Expandable AND-OR-INVERT	20p	18p	15p	13p
7454	4-wide 2-input AND-OR-INVERT Gates	20p	18p	15p	12p
7460	Dual 4-input Expander	20p	18p	15p	13p
7470	Single-phase J-K Flip-Flop	35p	32p	29p	25p
7472	Master-slave J-K Flip-Flop	35p	32p	29p	25p
7473	Dual Master slave J-K Flip-Flop	43p	40p	37p	33p
7474	Dual O type Flip-Flop	43p	40p	37p	33p
7475	Quad latch	47p	45p	43p	40p
7476	Dual J-K with pre-set and clear	47p	45p	48p	40p
7480	Gated Full Adders	87p	77p	67p	60p
7481	16-bit read/write memory	£1·35	£1·25	£1·15	£1·00
7482	2-bit Binary Full Adders	£1·30	£1·20	£1·00	85p
7483	Quad Full Adder	87p	77p	67p	60p
7486	Quad 2 input Exclusive OR Gates	80p	70p	60p	50p
7490	BCD decade counter	87p	77p	67p	60p
7491	8-bit Shift Registers	£1·21	£1·00	87p	75p
7492	Divide-by-Twelve Counters	87p	77p	67p	60p
7493	4-bit Binary Counters	87p	77p	67p	60p
7494	Dual entry 4-bit shift register	87p	77p	67p	60p
7495	4-bit up-down shift register	87p	77p	67p	60p
7496	5-bit Parallel in parallel out Shift Register	87p	77p	67p	60p
74100	8-bit Bistable Latches	£1·75	£1·65	£1·65	£1·35
74118	Hex Set-Reset Latches	£1·30	£1·20	£1·00	85p
74121	Monostable Multivibrators	87p	77p	67p	60p
74141	BCD-to-Decimal Decoder/Driver	87p	77p	67p	60p
74145	BCD-to-Decimal Decoder/Drivers	£1·80	£1·70	£1·60	£1·50
74151	8-bit Data Selectors (with Strobe)	£1·40	£1·30	£1·20	£1·05
74153	Dual 4-Line-to-1-Line Data Selectors/Multiplexers	£1·40	£1·30	£1·20	£1·05
74191	Binary Counter reversible	£2·50	£2·25	£2·00	£1·50

Devices may be mixed to qualify for quantity price.
Data available for above series in booklet form, price 10p. (*Ref No.* 30).
Larger quantity prices Extn. 4. Dual Inline 14 Pin Socket 30p each 16 Pin 35p each.

SILICON RECTIFIERS

1 AMP MINIATURE WIRE ENDED PLASTIC RECTIFIERS

Type	P.I.V.	1–49	50+	100+	500+	1000+
IN4001	50	8p	7p	6p	5p	4p
IN4002	100	9p	8p	7p	5½p	4½p
IN4003	200	10p	9p	7½p	6p	5p
IN4004	400	10p	9p	8p	7p	6p
IN4005	600	12p	10p	9p	7p	7p
IN4006	800	15p	14p	12p	11p	9p
IN4007	1000	20p	16p	13p	12p	10p

1.5 AMP MINIATURE WIRE ENDED PLASTIC RECTIFIERS

Type	P.I.V.	1–49	50+	100+	500+	1000+
PL4001	50	10p	9p	8p	7p	6p
PL4002	100	11p	10p	9p	8p	7p
PL4003	200	12p	11p	10p	9p	8p
PL4004	400	12p	11p	10p	9p	8p
PL4005	600	15p	13p	11p	10p	9p
PL4006	800	17p	15p	13p	12p	10p
PL4007	1000	20p	17p	15p	13p	11p

3 AMP PLASTIC WIRE ENDED RECTIFIERS

Type	P.I.V.	1–49	50+	100+	500+	1000+
PL7001	50	20p	18p	17p	16p	14p
PL7002	100	20p	19p	18p	17p	15p
PL7003	200	22p	20p	19p	18p	16p
PL7004	400	25p	23p	21p	20p	18p
PL7005	600	26p	24p	23p	22p	20p
PL7006	800	27p	25p	24p	23p	21p
PL7007	1000	30p	28p	26p	24p	22p

POTTED BRIDGE RECTIFIERS (SILICON) SIZE ½ x ½ x ¾ins.

Type	P.I.V.	Current	1–49	50+	100+	500+
1002	100	2 amps	60p	55p	50p	45p
2002	200	2 amps	70p	65p	60p	55p
4002	400	2 amps	80p	75p	70p	65p
1004	100	4 amps	70p	60p	55p	50p
2004	200	4 amps	75p	70p	65p	60p
4004	400	4 amps	80p	75p	70p	65p
6002	600	2 amps	90p	80p	75p	70p
6004	600	4 amps	90p	80p	75p	70p
1006	100	6 amps	75p	70p	65p	60p
2006	200	6 amps	80p	75p	70p	65p
4006	400	6 amps	£1·10	£1·00	90p	80p
6006	600	6 amps	£1·25	£1·10	£1·00	90p

INTEGRATED CIRCUITS

MCFC4000P	£1·12	LA709C	65p
I.C. 12	£2·75	MC1304	£2·75
PA246	£2·45	MC724P	60p
TAA263	75p	741c (T05)	85p
TAD100	£1·97	741c (DIL)	85p
TAD110	£1·97	709c (T05)	65p
MC1303	£2·60	709c (DIL)	65p
UL900	40p	Toshiba 20 watt Amp	£4·47
UL914	40p	Toshiba PreAmp	£1·50
UL923	40p		

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3 Watt Plastic Wire Ends 5%
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25+ 27p; 100+ 25p; 500+ 23p; 1000+ 21p. Any one type.
10 Watt Stud Mounting 5%
All voltages 5·1–100V. 40p each.
25+ 37p; 100+ 35p. Any one type.

TRIACS

(All stud mounting)

Type	P.I. Volts	Current	1–49	50+	100+
SC35A	100	3 amps	90p	75p	65p
SC35B	200	3 amps	95p	80p	70p
SC35D	400	3 amps	£1·00	85p	75p
SC40A	100	6 amps	£1·00	85p	75p
SC40B	200	6 amps	£1·20	£1·00	85p
SC40D	400	6 amps	£1·25	£1·10	£1·00
SC45A	100	10 amps	£1·25	£1·10	£1·00
SC45B	200	10 amps	£1·35	£1·20	£1·10
SC45D	400	10 amps	£1·50	£1·35	£1·20
SC50A	100	15 amps	£1·65	£1·50	£1·35
SC50B	200	15 amps	£1·75	£1·60	£1·45
SC50D	400	15 amps	£2·00	£1·75	£1·60
SC40E	500	6 amps	£1·50	£1·25	£1·10
SC45E	500	10 amps	£1·75	£1·50	£1·35
SC50E	500	15 amps	£2·25	£2·00	£1·75
DIAC ST2	20p				

Larger quantity prices Extn. 4

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OC71 Mullard 15p
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500 + 21p
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ORP12 Mullard 50p
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100 + 42p
500 + 40p

OC45 Mullard 15p
25 + 13p
100 + 12p
500 + 10p
1000 + 8p

2N930 25p
25 + 23p
100 + 20p
500 + 17p
1000 + 15p

OC75 Mullard 25p
25 + 21p
100 + 17p
500 + 15p
1000 + 13p

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25 + 20p
100 + 17p
500 + 15p
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OC20 97p
Mullard 100v
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25 + 20p
100 + 17p
500 + 15p
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100 + 13p
500 + 11p
1000 + 10p

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100 + 17p
500 + 15p
1000 + 13p

OC139 Mullard 25p
25 + 20p
100 + 17p
500 + 15p

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25 + 35p
100 + 30p
500 + 25p
1000 + 20p

OC81 Mullard 25p
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100 + 17p
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Positions 4 and 5 of S1 give r.f. coverage as for positions 1 and 2, but S1b shorts the primary of T2, so that an audio tone is no longer present to modulate the output. C6 is an isolating capacitor for external circuits.

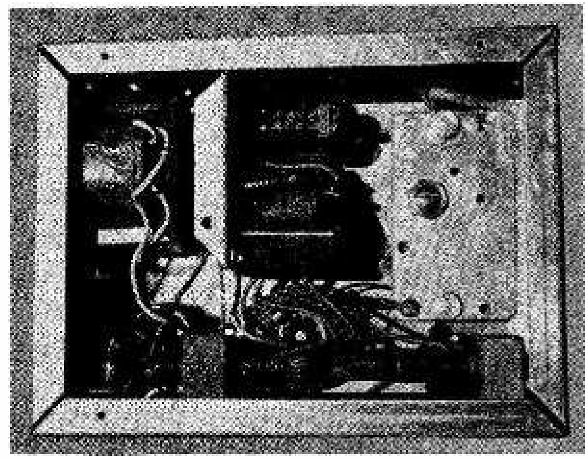
THE R.F. COIL

This is wound on a ferrite rod about 5in. long and $\frac{3}{8}$in. in diameter, which gives a higher Q and requires fewer turns than an air-cored inductor. All windings are of 32 or 34s.w.g. enamelled wire and are wound on thin tubes made by winding paper round the rod. L1 and L2 can then be slid along to adjust band coverage if necessary.

★ components list

R1	470kΩ ½W, 10%
R2	220kΩ ½W, 10%
VR1	10kΩ pot with switch
C1	0·01µF 250V disc ceramic
C2	10pF silver mica
C3	300pF silver mica
C4	22pF silver mica
C5	0·01µF 250V disc ceramic
C6	0·01µF 350V disc ceramic
C7	50µF 50V electrolytic
VC1	500pF Jackson variable
S1	2-pole, 5-way rotary switch
T1	240V, 12·6V, 0·5A or similar heater transformer
V1	ECC82

B9A valve holder; Rectifier, GJ3M or similar (BY100 will do); T2, Radiospares intervalve, 8mA 1:3 ratio; Ferrite rod, enamelled wire, tag strips, knobs, etc.; Case: Two 5 x 2in. and two 7 x 2in. universal chassis flanged members, two 5 x 7in. flat plates (Home Radio)



An internal view of the completed prototype; compare this with Fig. 2.

The ends of the windings can be secured with cotton or adhesive tape. After construction is finished, and coverage has been checked, windings and ends are secured using clear *Bostik*, as any movement here will upset dial calibration.

A space of about $\frac{3}{4}$in. is left to the end of the rod, and L1 is commenced at point 1. Seventy turns are wound on, side by side, and the wire is fixed at point 2. The beginning of L2 is about $1\frac{3}{4}$in. from the other end of the rod. L2 is wound in a compact pile about $\frac{5}{8}$in. long, and has 140 turns. End 3 of L2 will thus come about $1\frac{1}{8}$in. from this end of the rod. L3 has 25 turns side by side and is about $\frac{1}{4}$in. from L2.

The end of L1 and beginning of L2 are soldered together to form point 2. Windings must be in the same direction, as shown. Leads to L3 must not be reversed or feedback will be in the wrong phase.

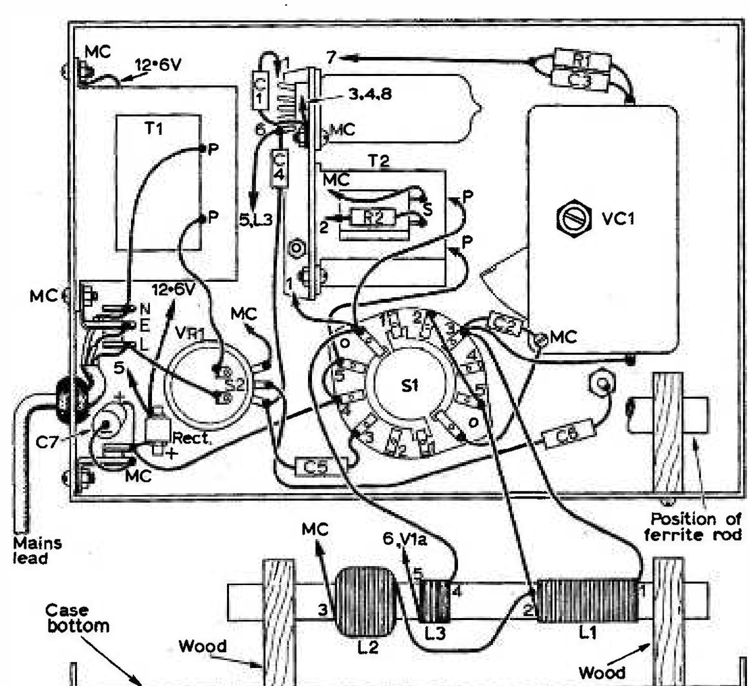


Fig. 2: Wiring details and the construction of the r.f. inductor.

A.F. INDUCTOR

The transformer listed can easily carry the required primary current but other transformers could probably be used, though not transistor types. When the generator is first tested, set S1 at position 3, and listen for an audio output, either with phones or by taking a lead to an amplifier. If no tone is heard, reverse secondary connections to T2.

R2 raises the pitch of the tone produced and may be changed in value if necessary. Should an available transformer produce a tone of too high a pitch, this can be altered by connecting a capacitor of about 0·01µF (or as found necessary) across the primary or secondary.

CONSTRUCTION POINTS

The complete generator occupies a case 7×5×2in. deep, made by assembling 7×2in. and 5×2in. "universal chassis" flanged members. The panel is a 7×5in. plate, and most of the construction is upon this, and on a $2\frac{1}{2}$×2in. chassis bolted to the panel. The chassis is most easily made by cutting a $2\frac{1}{2}$in. length from a 2in. wide flanged universal chassis member.

Mount components on the panel in the positions shown in Fig. 2. Countersunk screws hold VC1 to the panel. Fit the valveholder and T2 to the small chassis, and bolt this to the panel, also with countersunk screws.

All wiring except for the r.f. inductor, mains transformer T1, rectifier, and C7 can now be done.

One 5×2in. flanged member is then drilled to take T1, and a grommet for the 3-core mains lead. The lead is anchored at a 3-tag strip. Equip the lead with a 13A type 3-pin plug having a 2A or 3A fuse. Use brown (or red) for *L*, which runs to S2, and blue (or black) for *N*, which is connected to the primary of T1. Yellow-green (or green) is for the earth or metal box connection.

The rectifier is supported on an insulated tag. When this part of the wiring is finished, assemble the top, bottom and sides of the case, securing them with bolts through the perforated flanges provided. The panel is then fitted in place and fixed with four bolts.

The leads from the tag-strip to S2, T1 to S2, and other circuit points can now be soldered on. All wiring is finished except for the r.f. inductor.

The ferrite rod is mounted by drilling two pieces of wood to take it and when in position it should be about ⅝in. clear of the bottom of the case. Screws pass up through the bottom member into the wooden mounts. Insulated sleeving is fitted onto the wire ends of the windings, which are scraped and soldered to the various connecting points.

Coverage can be checked by taking a lead from the output socket and placing this near a receiver, or near a short wire connected to the receiver aerial terminal. Note that the two bands obtained should overlap, giving continuous coverage from about 1600kHz to 150kHz. This means that with S1 in position 2, and VC1 fully closed, the signal should be heard at the high frequency end of the long wave band of the receiver, or that with the generator switch in position 1, and VC1 fully open, the signal should be tuned in at the low frequency end of the receiver medium wave band. If necessary, slide L1 or L2 along the rod to achieve this, then cement the windings in place.

C2 in parallel with VC1 enables dial readings at the extreme minimum position of VC1 to be rather less crowded, so that frequencies around 1600-1400kHz can be more easily read.

All connections should be quite short and rigid. The flanged top and sides of the case allow a 5×7in. plate to be fixed on using self-tapping screws.

SCALES

VC1 can have a fairly large knob with a pointer, or with a hair-line or cursor. Frequencies are read on two semi-circular scales drawn on thin card which can be cemented to the front of the case. The scales may be covered with transparent material for protection after calibration, or a piece of thin perspex, 7×5in., can be bolted on to cover the whole front.

CALIBRATION

The simplest method of calibration is to plug a lead into the generator output socket and place this near a receiver, or its aerial or aerial lead. The receiver is then tuned to known frequencies, the generator is tuned to the same frequency and its scales are suitably marked. Alternatively, if a calibrated generator is available, tune both generators to the same frequency, by means of the receiver, and calibrate the scales.

A very good guide to markings can also be made by temporarily fitting a 0-100 scale, and preparing a graph with the aid of stations of known frequency. Round figures for the generator can then be read from the graph, and marked on the scales.

HARMONICS

It is also possible to secure good calibration of the generator with an ordinary long and medium wave band receiver, using harmonics. This depends on the fact that if the generator is set to some particular frequency F, harmonics of this frequency will be heard on the receiver, at Fx2, Fx3, and other multiples. These grow weaker as the multiplier increases, the upper limit depending on receiver sensitivity. For this method, the following steps should be followed:—

1. Tune receiver (R) to 200kHz (BBC Radio 2).
2. Tune signal generator (SG) to this and mark scale 200kHz.
3. Leave SG untouched. Tune R to find Fx3, or 600kHz.
4. Leave R untouched. Tune SG to 600kHz and mark scale.
5. Tune SG to 300kHz and mark scale. (R is at Fx2.)
6. Leave SG tuning untouched. Tune R to 300kHz.
7. Tune SG to 150kHz and mark scale. (R is at Fx2.)
8. Tune R to 200kHz and SG to 200kHz.
9. Tune R to Fx3, or 600kHz.
10. Tune SG to 600kHz.
11. Leave SG untouched and tune R to Fx2, or 1200kHz.
12. Leave R untouched and tune SG to 1200kHz. Mark scale.
13. Leave R untouched and tune SG to 400kHz. Mark scale. (R is at Fx3.)
14. Tune SG to 200kHz and receiver to Fx5, or 1000kHz.
15. Leave R untouched. Tune SG to 500kHz. Mark scale. (R is at Fx2.)

By proceeding in this way, calibration points can be found through both bands, including frequencies outside the normal coverage of the usual 2-band receiver. For accuracy, obtain all reference points by tuning originally to zero beat with BBC Radio 2 on 200kHz, as at (8) not relying on *visual* readings of the 200kHz mark or other signal generator or receiver calibration markings. ■

Back Numbers Important Announcement

We regret to inform readers that owing to the closure by the Company of the department concerned it will no longer be possible to supply back numbers of **Practical Wireless** and **Television**.

To ensure obtaining regular copies of these magazines readers are strongly urged to place a regular order with their local newsagent, or to take out an annual postal subscription.

Reference to past issues of the magazines may sometimes be obtained at certain public libraries who may hold bound volumes. A few libraries are said to offer a photostat service. Alternatively, we are always willing to insert a free request for specific back numbers in our "CQ" column which appears in most issues.

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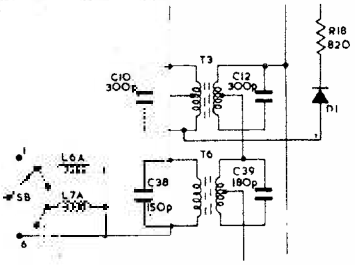

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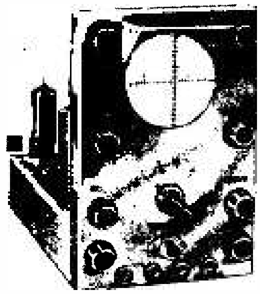

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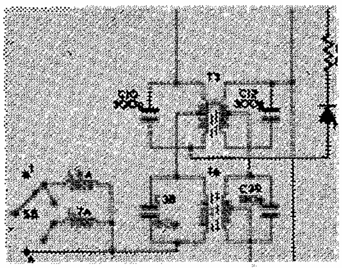

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ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

THE BROADCAST BANDS

Malcolm Connah

Frequencies in kHz ● Times in GMT

THE first reporter this month is **Terry Gibbs** of Swindon who uses a Murphy 'Overlander' receiver and a long-wire which he has recently extended to 500 feet. This equipment enabled him to hear:—

3905 *New Hebrides B.C.* in broken English at 0700.
4895 *Mauritius B.C.* in English at 1800.
4895 *R. Malaysia* in vernacular at 1240.
4926 *R. Bata, Guinea* (Equat.) at 2300.
4975 *R. Timbira, Brazil* in English at 2330.
6055 *R. Continental, Peru* at 0600.
9610 *VLX9, R. Perth, Australia* at 1200.
11835 *4VEH, R. Haiti* in English at 2345.

Philip Nichols of Longlevens, Gloucester has an Eddystone 830 receiver and a 50 foot long-wire at 19 feet helping him to hear:—

6010 *RT Belge,* in French at 1506.
9630 *R. Sweden* with sign-on at 1100.
9555 *CBC, Canada* in French at 1830.
9582 *R. Australia* in English at 1832.
10530 *Alma Ata* in German at 1740.
11620 *AIR, Delhi* in English at 1820.
15200 *Nigeria* noted at 1835.
15265 *R. Afghanistan* in English at 1815.
15345 *R. Kuwait* in English at 1730.
21460 *HCJB, Quito, Ecuador* in English at 1900.
21495 *R. Portugal* in English at 0840.
21690 *WIBS, Windward Is.* at 2124.

A new reporter this time is **Ian Alexander Kelly** of Bulawayo, Rhodesia. Ian's equipment is best described in his own words: "My equipment comprises of two radio receivers, a 5-band a.m./f.m. supersonic PR127 (11 transistor) and a 6-transistor, 3-band home-made regeneration receiver. There are four different types of antenna systems which I use, there is a 100 foot inverted 'L' aerial; a 200 foot centre-top aerial; a 9 foot telescopic aerial and the internal telescopic aerial on the 5-band set." That impressive line-up enabled him to hear:—

2306 *RSA, South Africa* at 2045.
3250 *Lourenco Marques, Mozambique* at 2100.
3295 *R. Lusaka, Zambia* with news at 2105.
9410 *BBC World Service* to Europe at 2056.
9505 *R. Belgrade, Yugoslavia* at 2010.
11815 *NHK, Japan* in English at 1600.
11935 *R. Portugal* in Portuguese at 1830.
11980 *R. Prague, Czechoslovakia* at 1815.
15350 *ORTF* relay from Brazzaville (Congo), 2028.
15400 *Ulan Bator, Mongolia* at 2345.
15600 *Manila, Philippines* at 1335.
21501 *R. Accra, Ghana* at 1500.
21520 *SBC, Berne, Switzerland* at 1900.

Another new reporter is **Ronald L. J. Winson** of Reading whose equipment consists of a Codar CR70A and an 80 foot long-wire antenna.

6020 *R. Nederland* in Spanish at 2130.
11970 *R. Bucharest,* News in Spanish at 2130.
15295 *Sweden Calling DXers* at 0000.
15325 *CBC, Canada* in English at 2115.
21700 *Vatican Radio* with News at 1245.

Ross Pullen of Crawley has added an 18 foot vertical aerial and had his Murphy A72 re-aligned giving the following results:—

9510 *RTA, Algeria* in French at 1215.
9575 *Gronlands Radio (Greenland)* in Danish at 2207.
11735 *R.T.V. Morocco* in English at 1720.
15018 *Hanoi Radio* in English at 2000.
15115 *KBS, Seoul* in English at 0630.
15115 *R. diff. de Sao Paulo, Brazil* at 2335.
15170 *ELWA, Liberia* in French at 2040.
15200 *Nigeria* in English at 0735.

Neil Smith of Sutton Coldfield used his Unica UNR-30 receiver and a 170 foot long-wire to hear the following stations:—

7100 *RSA, South Africa* in English at 1900.
7108 *R. Budapest* in English at 1900.
9620 *R. Belgrade, Yugoslavia* in English at 2312.
9615 *Vatican Radio* in English at 2154.
9770 *Austrian Radio* in English at 1130.

Tony Alcock of Bath has a Codar CR70A receiver and a Joystick antenna which helped him to hear:—

9620 *Radio Belgrade, Yugoslavia* at 2200.
9805 *R. Cairo, U.A.R.* noted at 2235.
9833 *R. Budapest, Hungary.*
11060 *Radio Vilnius, Lithuanian SSR.* at 2240.
11740 *Vatican Radio* noted at 2045.
11765 *Radio Australia* noted at 0845.
15345 *Kuwait B.S.* at 1723.
17810 *R. Nederland, Bonaire* relay at 2230.
17825 *Radio Sofia, Bulgaria* at 1920.

News

Peter Reed of Brighton has a R1155N receiver and a Joystick antenna. Peter used his equipment to send in several items of news including:—

Finland: Radio Finland can be heard from 2000 to 2100 on the following frequencies: 9530, 11755 and 15185.

Ceylon: The Ceylon Broadcasting Corporation transmits to Asia at 0212 on 15120 but the broadcast can be heard in this country.

Tahiti: Faint signals have been picked up from Radio Tahiti on 11825 at 1630.

Turkey: Radio Ankara has been heard broadcasting at 2300 on a frequency of 15160.

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

IT'S happened! A log has been received for 70cm. Honours for being first go to **Nick Richardson** (Wendover, Bucks) who has a 46-element multibeam at 33ft. Receiving line-up is a BF180 preamp, AF239 converter, i.f. amp. and a Trio 9R59DE tuning 28-30MHz. The log shows the great majority of stations using a.m. on 70cm. Callsigns logged include: G2RD, G2FNW, G3BNL/P, G3COJ, G3DAH, G3EHM, G3HAZ, G3HXS, G3KEQ, G3KMS, G3LQR, G3LTN, G3ZYC, G5QA, G5UM, G6GN, G8ACN, G8AMG, G8ANZ, G8ARC, G8ATS, G8AZU/P, G8BBB, G8BGC, G8BII, G8BQH, G8BSH, G8CIT, G8DDC/P, G8DXJ/P, G8EFX/P, G8ERW, G8APZ/P (Merionethshire), GW8AWS/P (Flintshire).

Down on 144MHz, Nick uses an 8-element Yagi at 28ft. feeding an f.e.t. preamp, Garex converter, i.f. amp into the 9R59DE. Goodies on 2 metres were: DL1XJ, ON5NY, GW3GIZ, PA0BDH, PA0CBN, PA0DTC, PA0RLS, PA0TLX, PA0UVP all s.s.b. On a.m., 144MHz sigs. were received from: DL0DD, DK1OV, F1AOY, F1BCI, F3LP, ON5UI, PA0DMS.

"I am 12 years old," claims **Paul Dumpleton** of Dunstable. Paul uses a Cossor domestic receiver and a television aerial "mounted on the chimney." The log shows plenty of EU activity on 14MHz such as DJ, DK, DL, DM, EI, F, HA, HB9, I1, LA, OH, OK, ON, OZ, SM, UA and YU. From further afield: DU4CC, ET9SPI, KANKI, K6YRD, VU1HH, VK3AP, WA6EGL, 4U1ITU, 9HIBG, 9K2AM, which is pretty good going no matter how old you are.

Stephen Hopkins (Gloucester), admits that ". . . this is the first report I have sent." Receiver is a H.A.C. DX Mk2 with a "slight modification." Antenna is 40ft. end-fed and raised EI9Q on 3·5MHz, F6ARC on 7MHz and HB9XUM/M, K1NJE, ON8WF/A, and W2BLQ on 14MHz s.s.b.

Stephen Terry writes from Banbury to take me to task for my remarks about the l.f. bands and DX. He includes the following callsigns as evidence of 80 metre activity: FP8CT, JY1/B, LU7AAC, OY7JD, PJ2CW, PY3APH, PY7AF, VE1AM, VE1ZZ, VE2XD, VE3FXT, VO1FG, ZS1MH.

Even dreaded 7MHz was persuaded to reveal signals from: CX7AP, HK3LT, PZ1AX, TF5TP, UW9AF, VP2AA, YV1BI, YV5CYA. All are s.s.b. and received on a Lasky's Skyrover MkII with a 120ft. end-fed.

Alan Newman, G8CXC (Portsmouth) used an HW17 transceiver on 144MHz to work PA0—RKS, PVC, CSL, ON5RE. Antenna is a 14-element Parabeam at 21ft. although Alan says he is at zero feet a.s.l. On 80 metres s.s.b. using 9R59DS, Alan logged CT2AK, FP8CT, FP0CA, KP4AN, KV4FZ, LU7AAC, PJ2CW, PZ1AX, PY1HA, PY3CIQ, PY7AF, PY0PK, TF3EB, WA6EGL/P/TF, VE1AAN, VO1AR, WA1KK, WA3WFJ, ZB2CC, ZP3AQ. Having received these (plus a long list of others) in some 3 hours of listening time, Alan is sold on 80 as a DX band and is now polishing up his c.w.

Another first-timer with a log for this column is **David Bettington** (Upton) who has a CR150 which, he claims, ". . . is older than I am." A 20 metre dipole just fits into the loft-shack and gave s.s.b. messages from: JH1OMS, KP4DEY, OX3OJ, VP2MF, WA2OYP/MM, 4X4OH.

Richard Mortimore (Cardiff) can now receive c.w. at 20w.p.m. His log for 21MHz (c.w., of course) reads: CO2FC, EL2CB, JA4ONC, JA5FQU/MM, JH1WKS, JH1YCW, K9YXA, LU9FAN, PY1KEK, WB6VVZ/MM, YV4AQ, 3A0ML, 4Z4KKI. Receiver is a 9R59DS and antenna is a 60ft. long wire.

Tom Brosnan (tnx QSL OM) uses a Windom antenna on 20 metres to feed his JR3LO receiver. Signals received (s.s.b.) include: AP5HP, EQ2BQ, ET3USA, JA1HBC, JA1JTH, JA6YG, KR6JX, TI2JU, VU2NH, ZE1DP, 9M8DEA. Fifteen metres s.s.b. revealed: CR6IY, JA6BSM, VQ9R, WB4BFZ, ZS5OV, 5Z4MW, 3V8ZK. QTH is Tadworth in Surrey.

The Modular Three featured in P.W. is the receiver used by **M. Evans** (Good Evans!) The antenna system consists of unspecified lengths of wire "tangled round the garden and fed to an a.t.u. with a coil former made from a drain pipe," Eighty metre sigs received from: CR7IC, CT1IPS, CT2HK, EA4LH, EL9LS, F0HH/M, JY1, OY2R, OY7JD, PY7AF, VE1IE, VP5KG, VP9GQ, WA6EGL/TF, ZB2CC, ZL3LE, ZL4JFA, ZS1MH, ZS5LB, 3V8ZK, 5Z4KL, 9K2AL.

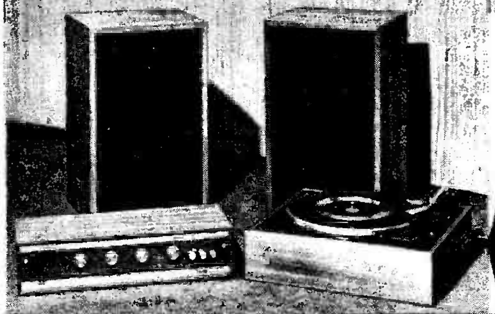
Good samaritan of the month is G3ZRD who resurrected an ailing B40 belonging to a sad **Crispin Henderson.** Just to show how well things are going now, Crispin sends in a multiband, multimode log. On 160 c.w.: EI8H, EI9J. Signals on 80 s.s.b.: CT1MK, K4QM, VE1IE, W3EFX, W5SZ, W8KEX. Best on 40 c.w. were VK3CC and YV5DRN. Twenty c.w. raised: EA8FE, GM3UYF, HC8GG, HP7KAL, OX3HU, PY7GV, SM0FY, W7HBQ, ZC4CB, ZL2IR, 7Q7AA, 9H1BB. While s.s.b. on the same band was received from: CE3OE, HK1BQR/P7, KZ5OD, OY9LV, VK7MB, 4X4KM, 9K2AM, 9Y4VV. Fifteen c.w.: CR7FM, PY2YCC, YO6KBM, and s.s.b.—KP4AOW, LU5MAO, LU8LH, PY5DI, YV6JB, 4X4GB, 5Z4GK.

Many happenings in October for the keen contest enthusiast. October 9-10, 21-28MHz telephony contest; 9-10, VK/ZL Oceana c.w. contest; 13 (and 27), 70MHz contest; 23-24, 7MHz c.w. contest—well worth a listen; 30-31, 432MHz contest; 30-31, CQ WW phone contest; November 6-7, 144/432MHz c.w. contest; 6-7, 7MHz phone contest; 6-8, CHC/FHC—both phone and c.w.; 7, OK contest.

Logs, in alphabetical order please, to arrive by the 15th of the month to:

12, Cross Way, Harpenden, Herts.

BUDGET HIGH-FIDELITY STEREO SYSTEMS



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Metrosound ST20 Stereo Amplifier in teak case (List £36)	£24·50
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Garrard 3500 with Sonotone 9TAHCD stereo cartridge (List £15·50)	£9·97
Garrard 2025 T/C with Sonotone 9TAHC Diamond Cartridge	£8·97
Garrard 2025 T/C with Sonotone 9TAHC Diamond Cartridge ready wired in teak plinth with cover	£14·00

Carriage and Insurance 50p extra any item.

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GARRARD SP25 MK III SINGLE RECORD PLAYER. FITTED GOLDRING 850 or AT66 MAGNETIC STEREO CARTRIDGE as available. COMPLETE IN TEAK PLINTH WITH RIGID PERSPEX COVER.
Total list price over £29.
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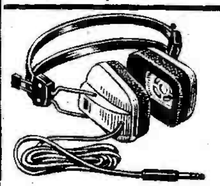

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Fitted two 2½in tweeters and crossover network. Impedance 8 or 15 ohm. Handling capacity 10W. Brand new.
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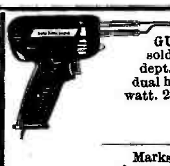

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TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped–attractively boxed.

LP3	3"	250'	P.V.C.	28p	DT6	5¾"	1800'	POLYESTER	£1·12
TT3	3"	450'	POLYESTER	37p	TT6	5¾"	2400'	POLYESTER	£1·87
DT3	3½"	600'	POLYESTER	57p	SP7	7"	1200'	P.V.C.	62p
SP5	5"	600'	P.V.C.	42p	LP7	7"	1800'	ACETATE	75p
LP5	5"	900'	P.V.C.	50p	DT7	7"	2400'	POLYESTER	£1·25
DT5	5"	1200'	POLYESTER	75p	TT7	7"	3600'	POLYESTER	£2·50

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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. 31
GENERAL PURPOSE AUDIO AMPLIFIER

THE term "general purpose" amplifier is rather a sweeping one; a design suitable for one function may be poor for another. However, the characteristics of the one described here will allow it to fulfil a variety of needs.

The output is in the order of 750mW, peanuts perhaps when compared with the modern day "block-busters" but still quite sufficient for most purposes. For those who find it hard to relate output in watts to actual loudness, 750mW is the sort of level produced by a large portable transistor radio at full volume, which, of course, is adequate for most purposes. The input impedance of the amplifier is high which gives it far more versatility than low impedance types. It is perfectly O.K. to feed a low impedance source into a high impedance amplifier, though not the other way around. The cheaper sorts of transducers are usually high impedance, such as crystal pickups and microphones.

I hope that no one thinks that I am cheating, for our £1 limit does not include the battery, loudspeaker or the on-off switch; the latter should preferably be incorporated with the volume control.

THE CIRCUIT

The first stage of the amplifier, represented by Tr1, is an emitter follower. This configuration has a very high input impedance, here it is likely to be at least 1MΩ though the actual figure depends on the gain of the transistor used. The volume control, a 5kΩ potentiometer, is directly in the emitter of the first transistor. If you do not require the high impedance input, this complete stage, together with C1 and R2, can be omitted, coupling the input directly across the volume control, however, although no gain will be sacrificed, it means that the input impedance will only be 5kΩ and this makes it rather less versatile.

The output from the volume control feeds into a fairly conventional driver/complimentary pair audio output stage. Tr2 operates as a conventional amplifier with a collector potential equal to half the supply potential. When the signal swings negative with respect to this potential, Tr4 conducts and Tr3 is held off; when the signal swings positive, Tr3 conducts and Tr4 is held off.

The output appears at the emitters of the two transistors and is coupled via C3 to the loudspeaker.

—continued overleaf

★ components list

Tr1 2N2926 (any colour)	11p
Tr2 2N2926 (any colour)	11p
Tr3 AC176	16p
Tr4 AC128	20p
R1 1MΩ ¼W, 5% type	1p
R2 2·2kΩ ,,	1p
R3 220kΩ ,,	1p
R4 47kΩ ,,	1p
R5 47Ω ,,	1p
R6 470Ω ,,	1p
C1 5μF 12V	4p
C2 5μF 12V	4p
C3 100μF 12V	4p
C4 100μF 12V	4p
C5 0·1μF	4p
VR1 5kΩ log. pot.	12p
	96p

Prices are those recently advertised in Practical Wireless and may have changed. No allowance is made for minimum order costs or for post and packing; these should be checked before ordering.

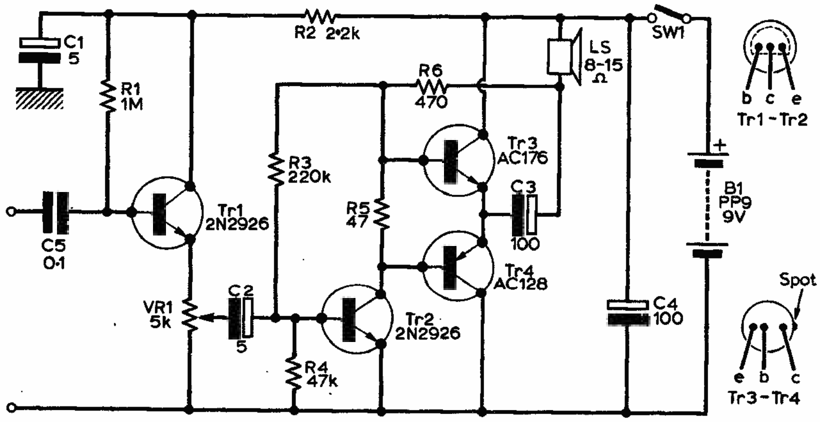


Fig. 1: The circuit of the amplifier.

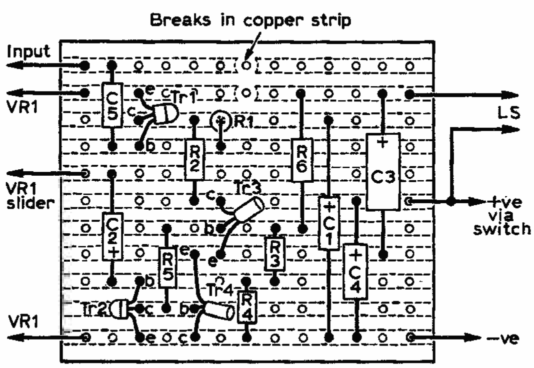


Fig. 2: A suggested layout on Veroboard.

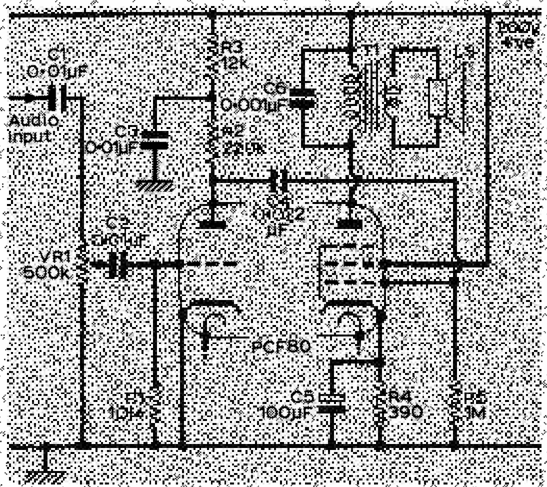
TAKE 20—*continued from previous page*

Negative feedback is applied via R6 which is coupled to the "live" side of the speaker. Circuits of this type usually include resistors of 1Ω or 2Ω in the emitters of the output transistors but if the battery supply does not exceed 9V these are not really necessary. If the supply voltage is increased greater output is achieved but the output pair will overheat and eventually blow.

CONSTRUCTION

A suggested layout for the amplifier is shown in Fig. 2, but this is not critical. One point must be carefully checked. If R5 is not connected properly the output transistors will blow instantly, so be especially careful here with regard to dry joints etc. The speaker impedance can vary over a wide range and even 3Ω types work perfectly well though it is better not to go this low and 8Ω is the lowest that should be used for any length of time. ■

SERVICING—Part 6. October Issue
We apologise for the wrong circuit being given in Fig. 1. The correct circuit is shown below.



TESTING SURPLUS TRANSISTORS. October issue.
The battery polarity is shown reversed in Fig. 4b.

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Digital Frequency Counter— *continued from page 616*

switch S2 can now be connected. The temporary wires should be removed.

Overall Check

The crystal oscillator should be allowed to run for about 20 minutes and then the frequency should be checked and set against Droitwich as previously described.

Using an audio oscillator and then an r.f. signal generator check the operation of the counter on signals of various frequencies and amplitudes. The 'LEVEL' control should be adjusted carefully so that the input signal operates the input clipping stage correctly and ensures reliable operation of the counter and display.

The top operating frequency should be in excess of 15MHz and may be as high as 25MHz depending on the integrated circuits used. The time measurement may be checked by measuring the duration of one cycle of the 50Hz mains. A few volts from a mains stepdown transformer is suitable for this. With the function switch in the 'mS' positions, the time of one cycle will be very close to 20mS, depending on the true frequency.

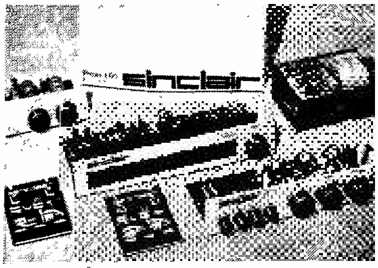
In common with all digital frequency timer/counters of this type there is always the possibility of an error of one least significant digit. This is due to the input signal not being synchronised with the crystal oscillator from which the counting period is derived. For example, during one counting period n cycles of the input signal may be counted. The next counting period may be very slightly shifted in time with respect to the input signal so that this time $n+1$ cycles are counted. This error is not present in the internal check, position 6, as here the signal being counted is synchronised with the gate period, one having been divided from the other.

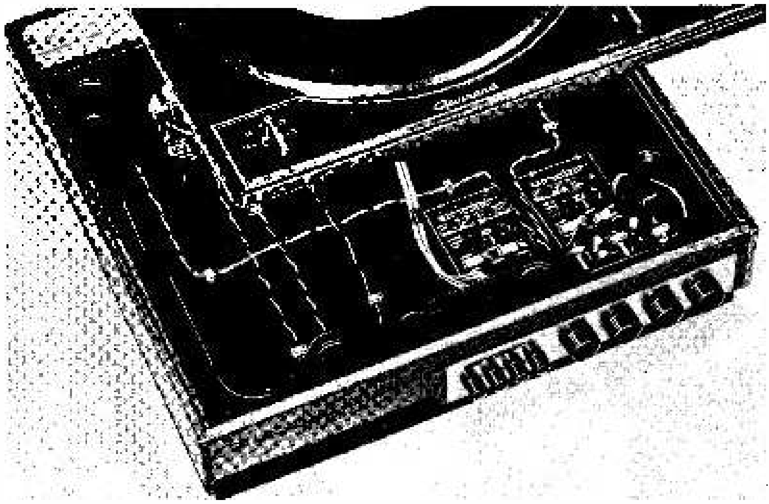
TO BE CONTINUED

We regret that, due to shortage of space. I.C. of the Month and Servicing, Part 7 have had to be held over until next month.

Sinclair Project 60

The World's leading range of high fidelity modules

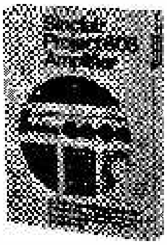




New!

Project 605

The easy way to buy and build **Project 60**



Project 605 is one pack containing: one PZ5, two Z30's, one Stereo 60 and one Masterlink. This new module contains all the input sockets and output components needed together with all necessary leads cut to length and fitted with neat little clips to plug straight on to the modules. Thus all soldering and hunting for the odd part is eliminated. You will be able to add further Project 60 modules as they become available adapted to the Project 605 method of connecting.

Complete Project 605 pack with comprehensive manual, post free **£29.95**

All you need for a superb 30 watt high fidelity stereo amplifier.

Project 60 offers more advantage to the constructor and user of high fidelity equipment than any other system in the world.
Performance characteristics are so good they hold their own with any other available system irrespective of price or size.
Project 60 modules are more versatile – using them you can have anything from a simple record player or car radio amplifier to a sophisticated and powerful stereo tuner-amplifier. Either power amplifier can be used in a wide variety of applications as well as high fidelity. The Stereo 60 pre-amplifier control unit may also be used with any other power amplifier system, as can the AFU filter unit. The stereo FM tuner operates on the unique phase lock loop principle to provide the best ever standards of sensitivity and audio quality. Project 60 modules are very easily connected together by following the 48 page manual supplied free with all Project 60 equipment. The modules are great space savers too and are sold individually boxed in distinctive white and black cartons. With all these wonderful advantages, there remains the most attractive of all – price. When you choose Project 60 you know you are going to get the best high fidelity in the world, yet thanks to Sinclair's vast manufacturing resources (the largest in Europe) prices are fantastically low and everything you buy is covered by the famous Sinclair guarantee of reliability and satisfaction.

Typical Project 60 applications

System	The Units to use	together with	Cost of Units
Simple battery record player	**Z.30**	Crystal P.U., 12V battery volume control	**£4.48**
Mains powered record player	**Z.30, PZ.5**	Crystal or ceramic P.U. volume control etc.	**£9.45**
20 + 20 W. stereo amplifier for most needs	**2 x Z.30s, Stereo 60, PZ.5**	Crystal, ceramic or mag. P.U., F.M. Tuner, etc.	**£23.90**
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40 + 40 W. R.M.S. de-luxe stereo amplifier	**2 x Z.50s, Stereo 60 PZ.8, mains trsfrmr**	As above	**£34.88**
Indoor P.A.	**Z.50, PZ.8, mains transformer**	Mic., guitar, speakers, etc., controls	**£19.43**

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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 ***(Z.50 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 300,000Hz ±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: 14 x 80 x 57 mm.

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Z.50
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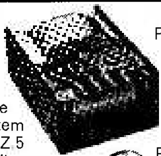
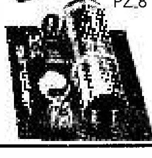


PZ.5



PZ.8

Designed special for use with the Project 60 system of your choice. Use PZ.5 for normal Z.30 assemblies and PZ.6 where a stabilised supply is essential.

PZ.5 *30 volts unstabilised* **£4.98**
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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.

Project 60 Stereo F.M. Tuner

First in the world to use the phase lock loop principle

The phase lock loop principle was used for receiving signals from space craft because of its vastly improved signal to noise ratio. Now, Sinclair have applied the principle to an F.M. 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. Good reception is possible in difficult areas, 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:** 2μV for 30dB quieting: 7μV for lock-in over full deviation. **Squelch level:** 20μV. **A.F.C. range:** ±200 KHz. **Signal to noise ratio:** > 65dB. **Audio frequency response:** 10 Hz – 15 KHz (±1dB). **Total harmonic distortion:** 0.15% for 30% modulation. **Stereo decoder operating level:** 2μV. **Cross talk:** 40dB. **Output voltage:** 2 x 150mV R.M.S. **Operating voltage:** 25-30 VDC. **Indicators:** Power on/tuning/stereo. **Size:** 93 x 40 x 207 mm.

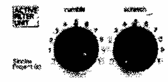
Built and tested. Post free. **£25**

Stereo 60 Pre-amp/control unit

Designed for 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 10 KHz: BASS + 15 to —15dB at 100Hz. **Front panel:** brushed aluminium with black knobs and controls. **Size:** 66 x 40 x 207mm.
Built tested and guaranteed. **£9.98**

A.F.U. High & Low Pass 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 filter stages – 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 1 KHz (35V. supply (0.02% at rated output. **Size:** 66 x 40 x 90 mm. *Built tested and guaranteed.* **£5.98**

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

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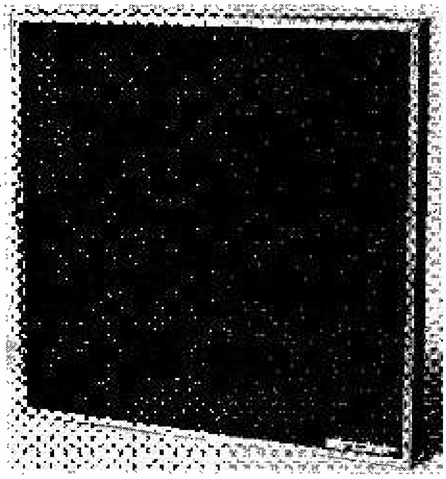
Construction: Special sealed seamless sound or pressure chamber with internal baffle.
Loading: up to 14 watts RMS.
Input Impedance: 8 ohms.
Frequency response: From 60 to 16,000 Hz. confirmed by independently plotted B and K curve.
Driver unit: Special high compliance unit having massive ceramic magnet 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.



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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.
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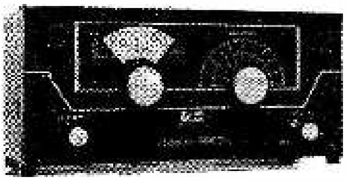

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This is a quality CODAR-KIT with full 12 months guarantee. No technical knowledge required, printed circuit construction, Instruction Manual with pictorial drawings backed by friendly Help-U After Sales Service if you have any queries.

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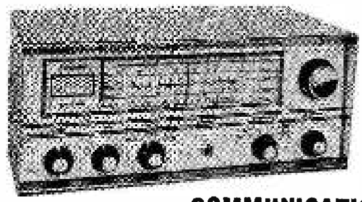

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It tunes from 540 metres medium through to 10 metres with no gaps. Covers shipping, coastguard and distress frequencies, all five amateur bands 160-10 metres, international broadcast, Met. stations etc. etc. giving world-wide reception. Exclusive features include Air-spaced CODAR-COIL Hi-"Q" Aerial input, Illuminated "S" Meter and Slide Rule Scale, Two Speed vernier tuning, Separate B.F.O. for CW/SSB signals, 5 valves inc. two twin triodes giving 7 valve line-up, separate output for Tape recorder.

Ready to plug in to 200/240 volts A.C. it only needs your aerial and a 2/3 ohm loudspeaker to bring the world to your finger tips. 12 months full guarantee.

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Ask the chap who's got one, there's lots of them!

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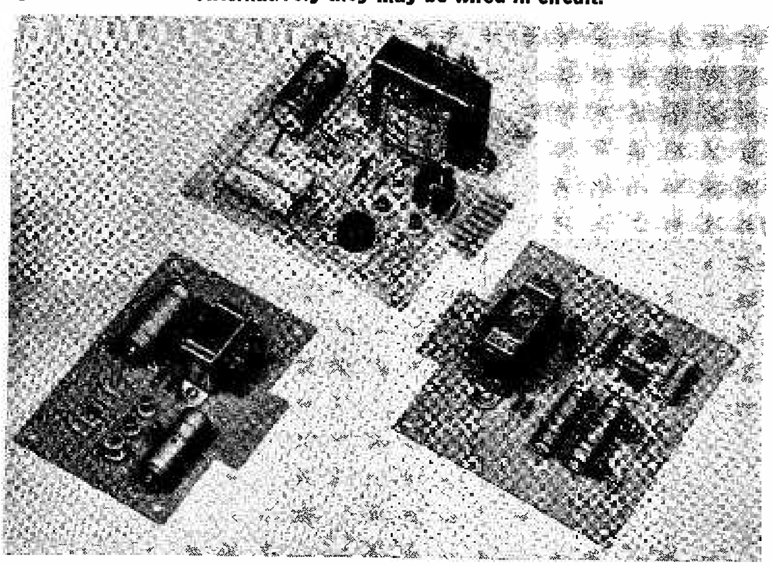

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71ZR RANGE. A more complex circuit than the 71Z Range giving greater stability with changing loads and with reduced ripple content. Output current limiting is included for general protection. An ideal P.U. for electronic instruments and control circuits. Size 4" x 3".

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71ZR12 + 12v at 40mA nom.
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} Price £4·50 each +£0·25 P & P.

71ZA. An extension of the 71ZR embodying an error amplifier with current limiting and adjustable output voltage regulated to better than 1.5% for load and mains variations. Ripple better than 3mV. Size 4" x 4·4".

71ZA. 15v ± 3v at 100mA. Price £5·50 each + £0·25 P & P.

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PIV	1A TO-5	3A TO-66	7A TO-66	10A	16A TO-48	30A TO-48
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50	0·23	0·25	0·47	0·50	0·53	1·15
100	0·25	0·33	0·53	0·58	0·63	1·40
200	0·35	0·37	0·57	0·61	0·75	1·60
400	0·43	0·47	0·67	0·75	0·93	1·75
600	0·53	0·57	0·77	0·97	1·25	—
800	0·63	0·70	0·90	1·20	1·50	4·00

SIL. RECTS. TESTED

PIV	300mA	750mA	1A	1·5A	3A	10A	30A
	£p	£p	£p	£p	£p	£p	£p
50	0·04	0·05	0·05	0·07	0·14	0·21	0·47
100	0·04	0·06	0·05	0·13	0·16	0·23	0·75
200	0·05	0·09	0·06	0·14	0·20	0·24	1·00
400	0·06	0·13	0·07	0·20	0·27	0·37	1·25
600	0·07	0·16	0·10	0·23	0·34	0·45	1·85
800	0·10	0·17	0·13	0·25	0·37	0·55	2·00
1000	0·11	0·25	0·15	0·30	0·46	0·63	2·50
1200	—	0·33	—	0·33	0·57	0·75	—

TRIACS

VBOM	2A TO-1	6A TO-66	10A TO-88
	£p	£p	£p
100	0·50	0·63	1·00
200	0·70	0·90	1·25
400	0·90	1·00	1·60

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35 amp, 400 p.i.v. stud type. £1·10p each.

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T2	8	2G374	OC75
T3	8	2G3744A	OC81D
T4	8	2G381A	OC81
T5	8	2G382T	OC82
T6	8	2G344A	OC44
T7	8	2G345A	OC45
T8	8	2G378	OC78
T9	8	2G399A	2N1302
T10	8	2G417	AF117

All **50p** each pak

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2N 3819 .... **35p**
2N 3820 .... **93p**
MPF105 .... **40p**

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ORP60, ORP61 **40p** each

PHOTO TRANS.

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40PIV (Min.) 100 .. **1·50**
Sub-Min. 500 .. **5·00**
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U3	75 Germanium gold bonded diodes sim. OA5, OA47	0·50
U4	40 Germanium transistors like OC81, AC128	0·50
U5	60 200mA sub-min. Sil. diodes	0·50
U6	30 Silicon planar transistors NPN sim. BSY95A, 2N706	0·50
U7	16 Silicon rectifiers Top-Hat 750mA up to 1,000V	0·50
U8	50 Sil. planar diodes 250mA, OA/200/202	0·50
U9	20 Mixed volts 1 watt Zener diodes	0·50
U11	30 PNP silicon planar transistors TO-5 sim. 2N1132	0·50
U13	30 PNP-NPN sil. transistors OC200 & 2S104	0·50
U14	150 Mixed silicon and germanium diodes	0·50
U15	25 NPN Silicon planar transistors TO-5 sim. 2N697	0·50
U16	10 3-Amp silicon rectifiers stud type up to 1000 PIV	0·50
U17	30 Germanium PNP AF transistors TO-5 like ACY 17-22	0·50
U18	8 6-Amp silicon rectifiers BYZ13 type up to 600 PIV	0·50
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U20	12 1·5-Amp silicon rectifiers Top-Hat up to 1,000 PIV	0·50
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U25	25 300Mc/s NPN silicon transistors 2N708, BSY27	0·50
U26	30 Fast switching silicon diodes like IN914 micro-min	0·50
U28	Experimenters' assortment of integrated circuits, untested. Gates, flip-flops, registers, etc., 8 assorted pieces	1·00
U29	10 1-Amp SCR's TO-5 can up to 600 PIV CRS1/25-600	1·00
U31	20 Sil. Planar NPN trans. low noise amp 2N3707	0·50
U32	25 Zener diodes 400mW D07 case mixed volts, 3–18	0·50
U33	15 Plastic case 1 amp silicon rectifiers IN4000 series	0·50
U34	30 Sil. PNP alloy trans. TO-5 BCY26, 2S302/4	0·50
U35	25 Sil. planar trans. PNP TO-18 2N2906	0·50
U36	25 Sil. planar NPN trans. TO-5 BFY50/51/52	0·50
U37	30 Sil. alloy trans. SO-2 PNP, OC200 2S322	0·50
U38	20 Fast switching sil. trans. NPN, 400Mc/s 2N3011	0·50
U39	30 RF germ. PNP trans. 2N1303/5 TO-5	0·50
U40	10 Dual trans. 6 lead TO-5 2N2060	0·50
U41	25 RF germ. trans. TO-1 OC45 NKT72	0·50
U42	10 VHF germ. PNP trans. TO-1 NKT667 AF117	0·50

Code Nos. mentioned above are given as a guide to the type of device in the Pak. The devices themselves are normally unmarked.

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Pak	Description	Price £p
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Q5	4 OC75 transistors	0·50
Q6	4 OC72 transistors	0·50
Q7	4 AC128 trans. PNP high gain	0·50
Q8	4 AC126 trans. PNP	0·50
Q9	7 OC81 type trans.	0·50
Q10	7 OC71 type trans.	0·50
Q11	2 AC127/128 comp. pairs PNP/NPN	0·50
Q12	3 AF116 type trans.	0·50
Q13	3 AF117 type trans.	0·50
Q14	3 OC171 H.F. type trans.	0·50
Q15	5 2N2926 sil. epoxy trans.	0·50
Q16	2 GET880 low noise germ. trans.	0·50
Q17	3 NPN 1 ST141 & 2 ST140	0·50
Q18	4 Madt's 2 MAT 100 & 2 MAT 120	0·50
Q19	3 Madt's 2 MAT 101 & 1 MAT 121	0·50
Q20	4 OC44 germ. trans. A.F.	0·50
Q21	3 AC127 NPN germ. trans.	0·50
Q22	20 NKT trans. A.F. R.F. coded	0·50
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Q24	8 OA81 diodes	0·50
Q25	8 IN914 sil. diodes 75PIV 75mA	0·50
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Q27	2 10A 600PIV sil. rects. IS45R	0·50
Q28	2 Sil. power rects. BYZ13	0·50
Q29	4 Sil. trans. 2 × 2N696, 1 × 2N697, 1 × 2N698	0·50
Q30	7 Sil. switch trans. 2N706 NPN	0·50
Q31	6 Sil. switch trans. 2N708 NPN	0·50
Q32	3 PNP sil. trans. 2 × 2N1131, 1 × 2N1132	0·50
Q33	3 Sil. NPN trans. 2N1711	0·50
Q34	7 Sil. NPN trans. 2N2369, 500MHZ	0·50
Q35	3 Sil. PNP TO-5 2 × 2N2904 & 1 × 2905	0·50
Q36	7 2N3646 TO-18 plastic 300MHZ NPN	0·50
Q37	3 2N3053 NPN sil. trans.	0·50
Q38	7 PNP trans. 4×2N3703, 3×2N3702	0·50
Q39	7 NPN trans. 4×2N3704, 3×2N3705	0·50
Q40	7 NPN amp. 4×2N3707, 3×2N3708	0·50
Q41	3 Plastic NPN TO-18 2N3904	0·50
Q42	6 NPN trans. 2N5172	0·50
Q43	7 BC107 NPN trans.	0·50
Q44	7 NPN trans. 4×BC108, 3×BC109	0·50
Q45	3 BC113 NPN TO-18 trans.	0·50
Q46	3 BC115 NPN TO-5 trans.	0·50
Q47	6 NPN high gain 3×BC167, 3×BC168	0·50
Q48	4 BCY70 NPN trans. TO-18	0·50
Q49	4 NPN trans. 2×BFY51, 2×BFY52	0·50
Q50	7 BSY28 NPN switch TO-18	0·50
Q51	7 BSY95A NPN trans. 300MHZ	0·50
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Coded GP100. BRAND NEW TO-3 CASE. POSS. REPLACEMENTS FOR:—OC25-28-29-30-35-36. NKT 401-403-404-405-406-430-451-452-453. TI3027-3028, 2N250A, 2N456A-457A-458A, 2N511 A & B. 2G220-222, ETC.
SPECIFICATION
VCBO 80V VCEO 50V IC 10A PT. 30 WATTS Hfe 30–170.

PRICE	1–24	25–99	100 up
	43p each	**40p** each	**36p** each

GENERAL PURPOSE SILICON NPN POWER TRANSISTORS

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SPECIFICATION
VCBO 100V, VCEO 60V, IC 15AMPS, PT. 115 WATTS. Hfe 20–100. FT1 MHZ

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Type	Price each	Type	Price each
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20	For	0·50	100	For	1·75
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Data and Circuits Booklet for I.C's Price 7p.

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14 and 16 Lead Sockets for use with Dual-in-Line Integrated Circuits

Order No.	1–24	25–99	100 up
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Check our 74 Series List before you buy any I.C's. **Our prices are the lowest possible.** All devices ex-stock. Full spec. guaranteed.

BI-PAK Order No.	Similar Types to:—Description	Price and qty. prices 1-24 £p	25-99 £p	100 up £p
BP00 = 7400	Quad 2-input NAND gate	0·15	0·14	0·12
BP01 = 7401	Quad 2-input pos. NAND gate (with open collector output)	0·15	0·14	0·12
BP02 = 7402	Quad 2-input pos. NOR gates	0·15	0·14	0·12
BP03 = 7403	Quad 2-input pos. NAND gates (with open collector output)	0·15	0·14	0·12
BP04 = 7404	Hex Inverters	0·15	0·14	0·12
BP05 = 7405	Hex Inverter (with open-collector output)	0·15	0·14	0·12
BP10 = 7410	Triple 3-input pos. NAND gates	0·15	0·14	0·12
BP13 = 7413	Dual 4-input Schmitt trigger	0·29	0·26	0·24
BP20 = 7420	Dual 4-input pos. NAND gates	0·15	0·14	0·12
BP30 = 7430	8-input pos. NAND gates	0·15	0·14	0·12
BP40 = 7440	Dual 4-input pos. NAND buffers	0·15	0·14	0·12
BP41 = 7441	BCD to decimal nixie driver	0·67	0·64	0·58
BP42 = 7442	BCD to decimal decoder (4-10 lines, 1 of 10)	0·67	0·64	0·58
BP46 = 7446	BCD-to-seven-segment decoder/driver	2·00	1·75	1·50
BP47 = 7447	BCD-seven-segment decoder/drivers (15V outputs)	0·97	0·94	0·88
BP48 = 7448	BCD-to-seven-segment decoder/driver	0·97	0·94	0·88
BP50 = 7450	Expandable dual 2-input and-or-invert	0·15	0·14	0·12
BP51 = 7451	Dual 2-wide 2-input and-or-invert gates	0·15	0·14	0·12
BP53 = 7453	Quad 2-input expandable and-or-invert	0·15	0·14	0·12
BP54 = 7454	4-wide 2-input and-or-invert gates	0·15	0·14	0·12
BP60 = 7460	Dual 4-input expander	0·15	0·14	0·12
BP70 = 7470	Single-phase J-K flip-flop	0·29	0·26	0·24
BP72 = 7472	Master slave J-K flip-flop	0·29	0·26	0·24
BP73 = 7473	Dual Master slave J-K flip-flop	0·37	0·35	0·32
BP74 = 7474	Dual D type flip-flop	0·37	0·35	0·32
BP75 = 7475	Quad latch	0·47	0·45	0·42
BP76 = 7476	Dual J-K with pre-set and clear	0·43	0·40	0·38
BP80 = 7480	Gated full adders	0·67	0·64	0·58
BP81 = 7481	16-bit read/write memory	0·97	0·94	0·88
BP82 = 7482	2-bit binary full adders	0·97	0·94	0·88
BP83 = 7483	Quad full adder	1·10	1·05	0·95
BP86 = 7486	Quad 2-input exclusive NOR gates	0·32	0·30	0·28
BP90 = 7490	BCD decade counter	0·67	0·64	0·58
BP91 = 7491	8-bit shift registers	0·87	0·84	0·78
BP92 = 7492	Divide-by-twelve counters	0·67	0·64	0·58
BP93 = 7493	4-bit binary counters	0·67	0·64	0·58
BP94 = 7494	Dual entry 4-bit shift register	0·77	0·74	0·68
BP95 = 7495	4-bit up-down shift register	0·77	0·74	0·68
BP96 = 7496	5-bit parallel in parallel out shift-register	0·77	0·74	0·68
BP100 = 74100	8-bit bistable latches	1·75	1·65	1·55
BP104 = 74104	Single J-K flip-flop equivalent 9000 series	0·97	9·94	0·88
BP105 = 74105	Single J-K flip flop equivalent 9001 series	0·97	0·94	0·88
BP107 = 74107	Dual Master slave flip-flops	0·40	0·38	0·36
BP110 = 74110	Gates master-slave flip-flops	0·55	0·53	0·50
BP111 = 74111	Dual data lock-out flip-flop	1·25	1·15	1·00
BP118 = 74118	Hex set-reset latches	1·00	0·95	0·90
BP119 = 74119	Hex set-reset latches. 24-pin	1·35	1·25	1·10
BP121 = 74121	Monostable multivibrators	0·67	0·64	0·58
BP141 = 74141	BCD-to-decimal decoder/driver	0·67	0·64	0·58
BP145 = 74145	BCD-to-decimal decoder/driver O/C	1·50	1·40	1·30
BP150 = 74150	16-bit data selector	1·80	1·70	1·60
BP151 = 74151	8-bit data selectors (with strobe)	1·00	0·95	0·90
BP153 = 74153	Dual 4-line-to-1-line data	1·20	1·10	0·95
BP154 = 74154	4- to 16-line decoder	1·80	1·70	1·60
BP155 = 74155	Dual 2- to 4-line decoder	1·40	1·30	1·20
BP156 = 74156	Dual 2- to 4-line decoder O/C	1·40	1·30	1·20
BP160 = 74160	Sync. decade counter	1·80	1·70	1·60
BP161 = 74161	Sync. 4-bit binary counter	1·80	1·70	1·60
BP190 = 74190	Sync. up-down BCD counter	3·50	3·25	3·00
BP191 = 74191	Sync. binary up-down counter (single clock line)	3·50	3·25	3·00
BP192 = 74192	Sync. up-down decade counter	2·10	1·95	1·75
BP193 = 74193	Sync. binary up-down counter (tow clock lines)	2·10	1·95	1·75
BP196 = 74196	Pre-setable 50MHz decade counter	1·80	1·70	1·60
BP197 = 74197	Pre-setable 50MHz binary counter	1·80	1·70	1·60
BP198 = 74198	8-bit parallel L-R shift register	5·50	5·00	4·00
BP199 = 74199	8-bit parallel access shift register	5·50	5·00	4·00

Devices may be mixed to qualify for quantity price. Larger quantities—prices on application (TTL 74 Series only).
Data is available for the above series of I.C's in booklet form. Price 13p.

TTL INTEGRATED CIRCUITS

Manufacturers' "Fall outs"—out of spec. devices including functional units and part function but classed as out of spec. from the manufacturers' very rigid specifications. Ideal for learning about I.C's and experimental work.

PAK No.		PAK No.		PAK No.	
UIC00 = 12 × 7400N	50p	UIC42 = 5 × 7450N	50p	UIC80 = 5 × 7480N	50p
UIC01 = 12 × 7401N	50p	UIC50 = 12 × 7450N	50p	UIC82 = 5 × 7482N	50p
UIC02 = 12 × 7402N	50p	UIC51 = 12 × 7451N	50p	UIC83 = 5 × 7483N	50p
UIC03 = 12 × 7403N	50p	UIC60 = 12 × 7460N	50p	UIC86 = 5 × 7486N	50p
UIC04 = 12 × 7404N	50p	UIC70 = 8 × 7470N	50p	UIC90 = 5 × 7490N	50p
UIC05 = 12 × 7495N	50p	UIC72 = 8 × 7472N	50p	UIC92 = 5 × 7492N	50p
UIC10 = 12 × 7410N	50p	UIC73 = 8 × 7473N	50p	UIC93 = 5 × 7493N	50p
UIC20 = 12 × 7420N	50p	UIC74 = 8 × 7474N	50p	UIC94 = 5 × 7494N	50p
UIC40 = 12 × 7440N	50p	UIC75 = 8 × 7475N	50p	UIC95 = 5 × 7495N	50p
UIC41 = 5 × 7441AN	50p	UIC76 = 8 × 7476N	50p	UIC96 = 5 × 7496N	50p

UICX1 = 25 × Asst'd 74's £1·50

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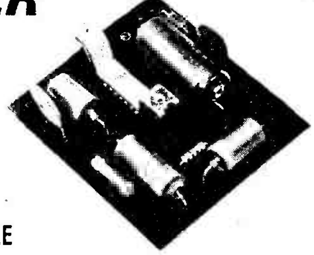

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- **Sensitivity 40 mV for 1 watt VOLTAGE GAIN 40dB but can be varied up to 73dB for some applications.**
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- **Frequency response better than 50 Hz to 25 KHz for −3dB.**
- **Normal supply Voltage 9-24V.**
- **Suitable for 8-16 OHM Loads.**
- **Overall Size 2″ × 3″ × ¾″.**
- **Typical Total Harmonic distortion at 1 watt less than 1%.**

****Supply voltage (Vs) = 24V 15ohm load.***

Module Tested and Guaranteed

Quantity	1-9	10-25
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Full hook-up diagrams and complete technical data supplied free with each module or available separately at 10p each.

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LOGIC — DTL 930 SERIES — IC's

Type No.	Function	Price 1-24	25-99	100 up
BP930	Expandable dual 4-input NAND	12p	11p	10p
BP932	Expandable dual 4-input NAND buffer	13p	12p	11p
BP933	Dual 4-input expander	13p	12p	11p
BP935	Expandable Hex Inverter	13p	12p	11p
BP936	Hex Inverter	13p	12p	11p
BP944	Dual 4-input NAND expandable buffer without pull-up	13p	12p	11p
BP945	Master-slave JK or RS	25p	24p	22p
BP946	Quad, 2-input NAND	12p	11p	10p
BP948	Master-slave JK or RS	25p	24p	22p
BP951	Monostable	65p	60p	55p
BP962	Triple 3-input NAND	12p	11p	10p
BP9093	Dual Master-slave JK with separate clock	40p	38p	35p
BP9094	Dual Master-slave JK with separate clock	40p	38p	35p
BP9097	Dual Master-slave JK with Common Clock	40p	38p	35p
BP9099	Dual Master-slave JK Common Clock	40p	38p	35p

Devices may be mixed to qualify for quantity price. Larger quantity prices on application. (DTL 930 Series only).

BRAND NEW LINEAR I.C's—FULL SPEC.

Type No.	Case	Leads	Description	Price 1-24	25-99	100 up
BP 201C—SL201C	TO-5	8	G.P. Amp	63p	53p	45p
BP 701C—SL701C	TO-5	8	OP Amp	63p	50p	45p
BP 702C—SL702C	TO-5	8	OP Amp Direct OP	63p	50p	45p
BP 702—72702	D.I.L.	14	G.P. OP Amp (Wide Band)	53p	45p	40p
BP 709 —72709	D.I.L.	14	High OP Amp	53p	45p	40p
BP 709P—μA709C	TO-5	8	High Gain OP Amp	53p	45p	40p
BP 711—μA711	TO-5	10	Dual comparator	58p	50p	45p
BP 741 —72741	D.I.L.	14	High Gain OP Amp (Protected)	75p	60p	50p
μA 703C—μA703C	TO-5	6	R.F.-I.F. Amp	43p	35p	27p
TAA 263—	TO-72	4	A.F. Amp	70p	60p	55p
TAA 293—	TO-74	10	G.P. Amp	90p	75p	70p

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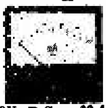
50–0–50µA £3·37½	50V. D.C. .. £2·97½
100µA .... £3·37½	300V. D.C. £2·97½
100–0–100µA £3·25	1 amp. D.C. £2·97½
500µA .... £3·12½	5 amp. D.C. £2·97½
1mA ...... £2·97½	300V. A.C. £2·97½
	VU Meter.. £3·75

BAKELITE PANEL METERS

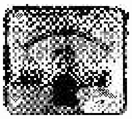
TYPE S-80 80 mm. square fronts



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

"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. 2½in. 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. 3¼in. × 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.

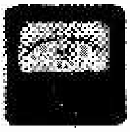
	200mA .... £1·37½
	300mA .... £1·37½
	500mA .... £1·37½
	750mA .... £1·37½
	1 amp. .... £1·37½
	2 amp. .... £1·37½
	5 amp. .... £1·37½
	10 amp. .. £1·37½
50µA ...... £2·00	3V. D.C. .. £1·37½
50–0–50µA £1·87½	10V. D.C... £1·37½
100µA .... £1·87½	15V. D.C... £1·37½
100–0–100µA £1·75	20V. D.C... £1·37½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

*MOVING IRON— ALL OTHERS MOVING COIL

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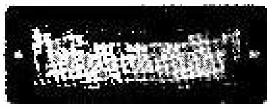
SEW EDUCATIONAL METERS

Type ED.107. Size overall 100mm × 90mm × 108mm. A new range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

50µA ...... £4·50	20V d.c. .... £3·97
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. × 2½ 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	

Send for illustrated brochure on SEW Panel Meters—discounts for quantities.

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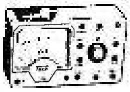
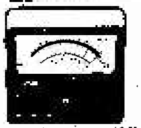


TECH PT-34. 1,000 O.P.V. 0/10/50/250/500/1,000V. A.C. and D.C. 0/1/100/500mA. D.C. 0/100K. **£1·97½.** P. & P. 12½p.

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.

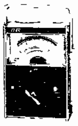
MODEL TE-70. 30,000 O.P.V. 0/3/15/60/300/600/1,200v. D.C. 0/6/30/120/600/1,200v. A.C. 0/30uA/3/30/300mA. 0/16K/160K/1.6M/16 MegΩ. **£5·50.** P. & P. 15p.

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.

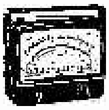


MODEL PL436 20kΩ/Volt D.C. 8kΩ/Volt A.C. Mirror scale. .6/3/12/30/120/600V D.C. 3/30/120/600V A.C. 50/600uA/60/600 mA. 10/100K/1 Meg/10 MegΩ. −20 to + 46db. **£6·97½** P & P 12½

MODEL 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 MegΩ. **£8·87½.** Post paid.



TMK MODEL TW-20CB FEATURES RESETTABLE OVERLOAD BUTTON. Sensitivity: 20KΩ/Volt D.C. 5KΩ/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.



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 6¾in. x 3¼in. **£18·90.** P. & P. 25p.

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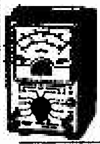
MW1-8 80mm square £4·97½

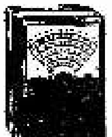
P. & P. extra

TE-40 HIGH SENSITIVITY A.C. VOLTMETER

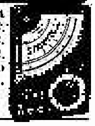


10 meg. input 10 ranges: 01/·003/·1/·3/1/3/10/30/100/300V. R.M.S. 4cps.-1·2 Mc/s. Decibels −40 to +50dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. **£17·50.** Carr. 25p.

TE-65 VALVE VOLTMETER

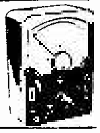


High quality instrument with 28 ranges. D.C. volts 1·5–1,500v. A.C. volts 1·5—1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions. **£17·50.** P. & P. 30p. Additional probes available: R.F. £2·12½; H.V. £2·50.



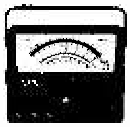
HONOR TE.10A. 20kΩ/Volt 5/25/50/250/500/2,500 v. D.C. 10/50/100/500/1,000 v. A.C. 0/50uA/2.5mA/250mA D.C. 0/6K/6 meg. ohm. −20 to +22 dB. 10–0, 100 mfd. 0.100–0.1 mfd. **£3·47½.** P. & P. 15p.

MODEL TE-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.

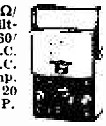


TMK MODEL MD.120 Mirror scale. 20k/Volt D.C. 10kΩ Volt A.C. 30/60/300/600/3,000 V. D.C. 6/120/1,200 V. A.C. Current 0–60uA/0—12/0 300mA. 0–60K/0–6 Mohms −20 to + 63 dB. **£4·62½** P & P 15p

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. A.C. .03/6/60/600mA. D.C. 16K/160K/1.6/16 MEGΩ. −20 to +63 db. **£7·50.** P. & P. 15p.



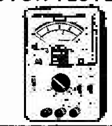
SKYWOOD SW-500 50KΩ/Volt. Mirror scale DC Volts 0.6/3/12/30/300/600. DC Current 20uA/6/600mA Resistance 10K/100K/1 Meg/10 Meg. Decibels — 20 to +57 db. **£7·50.** P. & P. 15p.



MODEL AS-100D. 100KΩ/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.

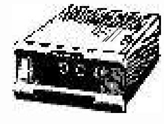
TE-900 20,000Ω/VOLT GIANT MULTIMETER. Mirror scale and overload protection. 6in. full view meter. 2 colour scale. 0/2.5/10/250/1,000/5,000 v. A.C. 0/25/12.5/10/50/250/1,000/5,000 v. D.C. 0/50uA/10/100/500mA/10 amp. D.C. 02K/200K/20 MEG. OHM. **£15.** P. & P. 25p.

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.

HONEYWELL DIGITAL VOLTMETER VT.100



Can be panel or bench mounted. Basic meter measures 1 volt D.C. but can be used to measure a wide range of AC and DC volt, current and ohms with optional plug in cards. Specification: Accuracy: ± 0.2, ± 1 digit. Resolution: 1mV. Number of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1·999) Input impedance: 1000 Meg ohm. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100v. D.C. Input: Fully floating (3 poles). Input power: 110-230v. A.C. 50/60-cycles. Overall size: 5¾in. x 2 13/16in. x 83/16in.

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2G301	20p	2N3417	37p	2S102	25p	BC116	15p	BFX12	22p	NKT224	22p
2G302	19p	2N3439	130p	2S103	25p	BC118	15p	BFX13	22p	NKT225	22p
2G303	20p	2N3440	97p	2S104	25p	BC119	35p	BFX29	25p	NKT229	30p
2G306	30p	2N3564	17p	2S301	47p	BC121	20p	BFX30	25p	NKT237	35p
2G308	30p	2N3565	15p	2S302	47p	BC122	20p	BFX37	30p	NKT238	25p
2G309	30p	2N3566	22p	2S303	57p	BC125	15p	BFX44	37p	NKT240	27p
2G371	15p	2N3568	25p	2S304	72p	BC126	25p	BFX68	67p	NKT241	27p
2G374	20p	2N3569	25p	2S501	32p	BC134	15p	BFX84	25p	NKT242	20p
2G381	22p	2N3570	125p	2S502	35p	BC135	15p	BFX85	32p	NKT243	62p
2N388A	49p	2N3572	97p	2S503	27p	BC136	15p	BFX86	25p	NKT244	17p
2N404	20p	2N3605	27p	3N83	40p	BC137	15p	BFX87	25p	NKT245	20p
2N696	15p	2N3606	27p	3N128	70p	BC138	37p	BFX88	20p	NKT261	20p
2N697	15p	2N3607	22p	3N140	77p	BC140	35p	BFX89	62p	NKT262	20p
2N698	25p	2N3638	18p	3N141	72p	BC141	35p	BFX93A	70p	NKT264	20p
2N699	42p	2N3638A	20p	3N142	55p	BC147	15p	BFY11	42p	NKT271	20p
2N706	9p	2N3641	18p	3N143	67p	BC148	11p	BFY18	25p	NKT262	20p
2N706A	11p	2N3642	18p	3N152	87p	BC149	15p	BFY19	25p	NKT274	20p
2N708	15p	2N3643	20p	40050	55p	BC152	17p	BFY21	42p	NKT275	20p
2N709	45p	2N3644	25p	40250	50p	BC153	35p	BFY24	45p	NKT278	25p
2N718	25p	2N3645	25p	40251	32p	BC154	35p	BFY29	40p	NKT281	27p
2N718A	30p	2N3691	15p	40309	32p	BC157	15p	BFY30	40p	NKT401	87p
2N726	25p	2N3692	18p	40310	45p	BC158	15p	BFY41	50p	NKT402	90p
2N727	25p	2N3693	15p	40311	35p	BC159	15p	BFY43	62p	MKT403	75p
2N914	17p	2N3694	18p	40312	47p	BC160	35p	BFY50	22p	NKT404	62p
2N916	17p	2N3702	10p	40314	37p	BC167	15p	BFY51	20p	NKT405	75p
2N918	30p	2N3703	10p	40315	37p	BC168B	14p	BFY52	22p	NKT406	63p
2N929	22p	2N3704	12p	40316	47p	BC168C	15p	BFY53	17p	NKT451	62p
2N930	24p	2N3705	10p	40317	37p	BC169B	14p	BFY56A	57p	NKT452	63p
2N937	52p	2N3706	10p	40319	55p	BC169C	15p	BFY76	42p	NKT453	47p
2N1090	22p	2N3707	12p	40320	47p	BC170	12p	BFY77	57p	NKT713	20p
2N1091	22p	2N3708	8p	40323	32p	BC171	15p	BFY90	65p	NKT717	42p
2N1131	25p	2N3709	10p	40324	47p	BC172	15p	BSX19	17p	NKT734	27p
2N1132	25p	2N3710	10p	40326	37p	BC175	25p	BSX20	17p	NKT736	35p
2N1302	17p	2N3711	10p	40329	30p	BC177	20p	BSX21	20p	NKT773	25p
2N1303	17p	2N3713	187p	40344	27p	BC178	20p	BSX26	45p	NKT781	30p
2N1304	22p	2N3714	200p	40347	57p	BC179	22p	BSX27	47p	OC16	50p
2N1305	22p	2N3715	222p	40348	52p	BC182	12p	BSX28	32p	OC19	37p
2N1306	24p	2N3716	290p	40360	42p	BC182L	10p	BSX60	82p	OC20	75p
2N1307	24p	2N3773	240p	40361	47p	BC183	10p	BSX61	62p	OC22	50p
2N1308	25p	2N3791	275p	40362	55p	BC183L	10p	BSX76	15p	OC23	60p
2N1309	24p	2N3819	34p	40370	32p	BC184	12p	BSX77	20p	OC24	60p
2N1507	17p	2N3820	57p	40406	37p	BC184L	12p	BSX78	25p	OC25	37p
2N1613	21p	2N3823	75p	40407	40p	BC186	25p	BSY24	15p	OC26	25p
2N1631	35p	2N3854	27p	40408	52p	BC187	27p	BSY25	15p	OC28	60p
2N1632	30p	2N3854A	27p	40409	55p	BC212L	12p	BSY26	17p	OC29	60p
2N1637	30p	2N3855	27p	40410	62p	BC213L	12p	BSY27	17p	OC35	50p
2N1638	27p	2N3855A	30p	40412	50p	BC214L	15p	BSY28	17p	OC36	60p
2N1639	27p	2N3856	30p	40467A	57p	BCY10	27p	BSY29	17p	OC41	22p
2N1701	110p	2N3856A	35p	40468A	35p	BCY30	24p	BSY32	25p	OC42	25p
2N1711	24p	2N3858	25p	40528	72p	BCY31	30p	BSY36	25p	OC44	17p
2N1889	32p	2N3858A	30p	40600	52p	BCY32	50p	BSY37	25p	OC45	12p
2N1893	37p	2N3859	27p	40603	50p	BCY33	20p	BSY38	20p	OC46	15p
2N2147	72p	2N3859A	32p	AC107	30p	BCY34	25p	BSY39	22p	OC70	15p
2N2160	57p	2N3860	30p	AC126	20p	BCY38	30p	BSY43	50p	OC71	12p
2N2193	40p	2N3866	150p	AC127	24p	BCY39	60p	BSY51	25p	OC72	12p
2N2193A	42p	2N3877	40p	AC128	20p	BCY40	50p	BSY52	32p	OC73	30p
2N2194	27p	2N3877A	40p	AC151	18p	BCY41	15p	BSY53	37p	OC74	30p
2N2194A	30p	2N3900	37p	AC152	22p	BCY42	15p	BSY54	40p	OC75	23p
2N2217	27p	2N3900A	40p	AC154	22p	BCY43	15p	BSY56	90p	OC76	22p
2N2218	20p	2N3901	97p	AC176	22p	BCY54	15p	BSY79	35p	OC77	30p
2N2219	20p	2N3903	25p	AC187	25p	BCY58	22p	BSY90	57p	OC78	20p
2N2220	25p	2N3904	25p	AC188	27p	BCY59	22p	BSY95A	12p	OC81	20p
2N2221	25p	2N3905	30p	ACY17	27p	BCY60	97p	C424	15p	OC81D	20p
2N2222	20p	2N3906	30p	ACY18	24p	BCY70	15p	C450	15p	OC82	25p
2N2222A	25p	2N4058	15p	ACY19	24p	BCY71	20p	GET102	30p	OC82D	15p
2N2297	30p	2N4059	10p	ACY20	20p	BCY72	15p	GET113	30p	OC83	25p
2N2368	15p	2N4060	12p	ACY21	20p	BCY78	30p	GET114	15p	OC84	25p
2N2369	17p	2N4061	12p	ACY22	10p	BCY79	30p	GET118	20p	OC139	25p
2N2369A	17p	2N4062	12p	ACY28	17p	BCZ10	27p	GET120	25p	OC140	32p
2N2410	42p	2N4244	47p	ACY39	47p	BCZ11	40p	GET873	18p	OC170	25p
2N2483	27p	2N4248	15p	ACY40	14p	BD112	50p	GET880	30p	OC171	30p
2N2484	32p	2N4249	15p	ACY41	25p	BD116	112p	GET887	15p	OC200	40p
2N2539	22p	2N4250	18p	ACY44	40p	BD121	65p	GET889	22p	OC201	60p
2N2540	22p	2N4254	42p	AD140	47p	BD123	80p	GET890	22p	OC202	75p
2N2613	27p	2N4255	42p	AD149	47p	BD124	75p	GET896	22p	OC203	40p
2N2614	30p	2N4284	17p	AD150	62p	BD131	75p	GET897	22p	OC204	40p
2N2646	47p	2N4285	17p	AD161	35p	BD132	85p	GET898	22p	OC205	75p
2N2711	25p	2N4286	17p	AD162	35p	BDY10	125p	MAT100	25p	OC206	90p
2N2712	25p	2N4287	17p	AF109	45p	BDY20	105p	MAT101	30p	OC207	75p
2N2713	27p	2N4288	15p	AF114	25p	BDY61	135p	MAT120	25p	OCP71	42p
2N2714	30p	2N4289	15p	AF115	25p	BDY62	100p	MAT121	30p	ORP12	50p
2N2904	20p	2N4290	15p	AF116	25p	BF115	25p	MJ400	107p	ORP60	40p
2N2904A	25p	2N4291	15p	AF117	20p	BF117	47p	MJ420	112p	ORP61	42p
2N2905	25p	2N4292	15p	AF118	47p	BF152	28p	MJ421	112p	P346A	22p
2N2905A	30p	2N4294	17p	AF121	30p	BF154	35p	MJ430	105p	ST140	15p
2N2906	20p	2N4303	47p	AF124	22p	BF158	35p	MJ440	95p	ST141	20p
2N2906A	25p	2N4964	15p	AF125	19p	BF159	57p	MJ480	97p	TIS34	63p
2N2907	23p	2N4965	18p	AF126	16p	BF163	35p	MJ481	125p	TIS43	40p
2N2923	15p	2N5027	52p	AF127	16p	BF167	25p	MJ490	100p	TIS44	12p
2N2924	15p	2N5028	57p	AF139	28p	BF170	33p	MJ491	137p	TIS45	12p
2N2925	15p	2N5029	47p	AF178	45p	BF173	30p	MJE340	62p	TIS46	12p
2N2926G	12p	2N5030	42p	AF179	45p	BF177	30p	MJE370	95p	TIS47	12p
2N2926O	12p	2N5172	12p	AF180	50p	BF178	25p	MJE371	87p	TIS48	12p
2N2926Y	12p	2N5174	52p	AF181	40p	BF179	30p	MJE520	87p	TIS49	12p
2N3011	24p	2N5175	52p	AF186	39p	BF180	35p	MJE521	87p	TIS50	17p
2N3014	25p	2N5176	45p	AF239	30p	BF181	35p	MPF102	42p	TIS51	12p
2N3053	20p	2N5232A	30p	AF279	47p	BF182	30p	MPF103	35p	TIS52	12p
2N3054	49p	2N5245	45p	AF280	47p	BF184	20p	MPF104	37p	TIS53	23p
2N3055	72p	2N5246	42p	AFZ11	32p	BF185	20p	MPF105	37p	XB112	12p
2N3133	25p	2N5249	67	ASY26	25p	BF194	17p	MPS3638	32p	XC141	35p
2N3134	30p	2N5265	325p	ASY27	31p	BF195	15p	NKT124	42p	ZTX107	14p
2N3135	25p	2N5305	37p	ASY28	24p	BF196	15p	NKT125	27p	ZTX108	11p
2N3136	25p	2N5306	40p	ASY29	27p	BF197	15p	NKT126	27p	ZTX109	17p
2N3390	25p	2N5307	37p	ASY50	25p	BF198	42p	NKT128	27p	ZTX300	11p
2N3391	20p	2N5308	37p	ASY51	32p	BF200	35p	NKT135	27p	ZTX301	17p
2N3391A	30p	2N5309	62p	ASY54	25p	BF224	20p	NKT137	32p	ZTX302	18p
2N3392	17p	2N5310	42p	ASY67	45p	BF225	20p	NKT210	30p	ZTX303	18p
2N3393	15p	2N5354	27p	ASY86	32p	BF237	22p	NKT211	30p	ZTX304	25p
2N3394	15p	2N5355	27p	ASZ21	37p	BF238	22p	NKT212	30p	ZTX500	16p
2N3402	22p	2N5356	32p	AUY10	150p	BF244	32p	NKT213	30p	ZTX501	16p
2N3403	22p	2N5365	47p	BC107	10p	BFW61	47p	NKT214	23p	ZTX502	20p
2N3404	32p	2N5366	32p	BC108	10p	BFW87	25p	NKT215	22p	ZTX503	17p
2N3405	45p	2N5367	57p	BC109	10p	BFW88	23p	NKT216	37p	ZTX504	40p
2N3414	22p	2N5457	34p	BC113	15p	BFW89	20p	NKT217	40p	ZTX531	38p

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CA3043	187p	MC792P	66p		180p
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CA3045	122p	MC1303L			220p
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20D1	45p	EL34	50p	UL41	65p
20F2	75p	EL33	£1·25	UL84	30p
20L1	£1·10	EL41	55p	UY41	45p
20P1	60p	EL42	58p	UY85	30p
20P3	60p	EL81	55p	VR105/30	33p
20P4	£1·10	EL84	25p	VR150/30	35p
20P5	£1·20	EL85	43p	*Add 12p in £*	
25L6	45p	EL91	32p	*for postage*	

DIODES & RECTIFIERS

1N34A	10p	BA154	12p	GJ7M	37p
1N914	7p	BAX13	12p	OA5	17p
1N916	7p	BAX16	7p	OA6	12p
AA119	7p	BAY31	7p	OA10	23p
AA129	10p	BAY38	17p	OA9	10p
AAZ13	10p	BY100	15p	OA47	7p
AAZ15	12p	BY103	22p	OA70	7p
BA100	15p	BY122	37p	OA73	10p
BA102	22p	BY124	15p	OA79	9p
BA110	32p	BY126	15p	OA81	7p
BA111	27p	BY127	17p	OA85	7p
BA112	70p	BY164	57p	OA90	7p
BA115	7p	BY210	35p	OA91	7p
BA141	32p	BYZ11	32p	OA95	7p
BA142	32p	BYZ12	30p	OA200	7p
BA144	12p	BYZ13	25p	OA202	10p
BA145	20p	BYZ16	40p	OA210	17p

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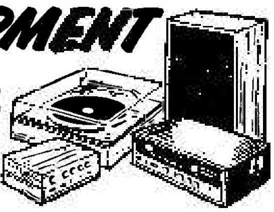
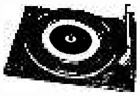


RECORD DECKS



B.S.R.		**GARRARD**	
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C129†	£6·70	2025 T/C*	£8·50
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610	£15·15	SP25 III	£10·95
510	£12·47	A70 II	£11·97
310	£10·55	SL65B	£14·40
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H.T.70	£16·60	**GOLDRING**	
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TD150AII	£34·60	G99	£21·97
TD150ABII	£41·35	**PIONEER**	
TX11	£3·77	PL12AC	£36·50

† Mono * Stereo Cartridge
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Carriage 50p extra any model.

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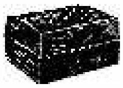

Decks supplied ready wired in plinth and cover fitted with cartridge.

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Garrard SP25III with 9TAHCD	£15·95
Garrard SP25III Goldring G800....	£18·95
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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.
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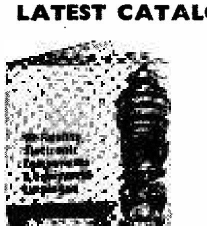

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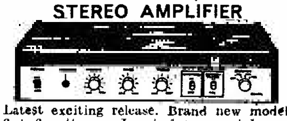

Latest exciting release. Brand new model. 6 + 6 watts rms. Inputs for mag, xtal, aux tape. Volume, bass, treble, sliding balance, scratch filter and loudness controls. List £32.50 OUR PRICE £18·50 Carr. 37p.

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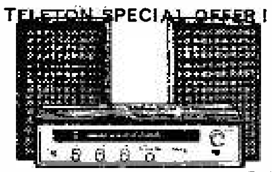

CR10T AM/FM STEREO TUNER AMPLIFIER WITH MATCHING PAIR OF SPEAKER SYSTEMS. Output 4 watts per channel. Excellent reception, AFC, built-in MPX. Cer/XTAL Input. Total List £50·25. OUR PRICE £22·75. Carr. 62½p.
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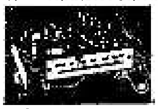

6 TRANSISTOR HIGH QUALITY TUNER, SIZE ONLY 6×4×2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9 V battery. Coverage 88–108Mc/s. Ready built ready for use. Fantastic value for money. £6·37½. P. & P. 12½p.
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Low 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

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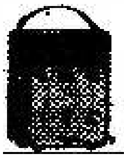

New high quality portable instrument. Sine 1 Hz to 100 KHz. Square 20 Hz to 20 KHz. Output max + 10 dB (10 K ohms). Operation 220/240v. Size 215mm x 150mm x 120mm.
Price £27·50. Carr. 25p.

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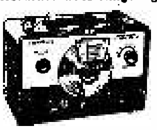
Accurate wide range signal generator covering 120 kc/s-260 Mc/s on 6 bands. Directly calibrated variable R.F. attenuator. Operation 200/240V a.c. Brand new with instruction. £15. P. & P. 37½p. S.A.E. for details.



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latest release 125 KHz—20 MHz. Excellent condition. Fully tested and checked and complete with calibrator charts. £27·50 each. Carr. 50p.

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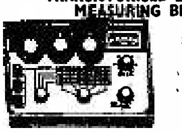

A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1 Ω-11·1 meg Ω 6 Ranges ±1% L.1 μ H - 111 HENRYS 6 Ranges2=%C.10pF±1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7¾ × 5 × 2in. £20. P. & P. 25p

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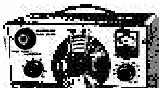
5 ranges 400kHz—30mHz. An inexpensive instrument for the handyman. Operates on 9v battery. Wide easy to read scale. 800kHz modulation. 5¼ × 5¼ × 3½in. Complete with instructions and leads. £7·97½. P. & P. 20p.

LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYSER



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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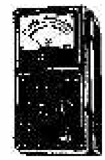

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RUSSIAN C1-16 DOUBLE BEAM OSCILLOSCOPES

5 MHz Pass Band. Separate Y1, Y2 amplifiers. Calibrated triggered sweep from ·2 sec to 100 milli sec/cm.
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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.

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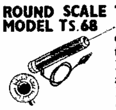
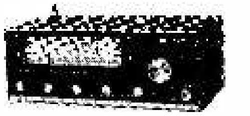


Completely portable, simple to use pocket sized tester. Ranges 0/3/30/300V AC and DC at 2,000 o.p.v. Resistance 0-20K ohms. ONLY £1·97 P. & P. 13p.



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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. 12¾" x 4½" x 7". Brand new with instructions. £25. Carr. 37½p.

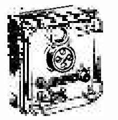
UNR-30 RECEIVER

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.

LAFAYETTE HA-600 SOLID STATE RECEIVER

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 9¾" x 8½". 18 lbs. 220/240v. A.C. or 12v. D.C Brand new with instructions. £45. Carr. 50p.

CRYSTAL CALIBRATORS NO. 10



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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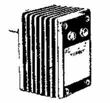

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1000 W.	£7·25	P. & P. 37½p
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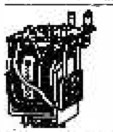
5000 W.	£36·00	P. & P. £1

VOLTAGE STABILISER TRANSFORMERS

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

230 VOLT A.C. 50 CYCLES RELAYS



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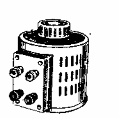
Excellent quality . Low price . Immediate delivery



S-260 General Purpose Bench Mounting

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10 Amp	£18·50
12 Amp	£21·00
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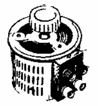

S-260B Panel Mounting

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2N708	15p	2N3706	09p	40370	32½p	BCY70	20p	BSY36	25p	NKT781	30p
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2N726	30p	2N3709	09p	40408	52½p	BCZ10	27½p	BSY39	22½p		37½p
2N727	30p	2N3710	09p	40410	62½p	BCZ11	42½p	BSY40	32½p	NKT10519	
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2N1132	25p	2N3855	27½p	AC176	25p	BDY17	£1·50	BSY90	57½p		97½p
2N1302	17½p	2N3855A	30p	AC187	62½p	BDY18	£1·75	BSY95A	12½p	NKT80113	
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2N1304	22½p	2N3856A	35p	ACY17	27½p	BDY20	£1·12½	BSW70	27½p	NKT80211	
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2N1306	25p	2N3858A	30p	ACY19	25p	BDY60	£1·25	C424	27½p	NKT80212	
2N1307	25p	2N3859	27½p	ACY20	25p	BDY61	£1·25	C425	55p		92½p
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2N1631	85p	2N3877A	40p	ACY41	25p	BF167	18p	D16P2	40p	NKT80215	
2N1632	30p	2N3900	37½p	ACY44	40p	BF173	19p	D16P3	37½p		92½p
2N1638	27½p	2N3900A	40p	AD140	52½p	BF177	30p	D16P4	40p	NKT80216	
2N1639	27½p	2N3901	97½p	AD149	57½p	BF178	30p	GET102	30p		92½p
2N1671B	£1·00	2N3903	35p	AD150	62½p	BF179	30p	GET113	20p	OC20	75p
2N1711	25p	2N3904	35p	AD161	37½p	BF180	35p	GET114	20p	OC22	50p
2N1889	32½p	2N3905	37½p	AD162	37½p	BF181	32½p	GET118	20p	OC23	60p
2N1893	37½p	2N3906	37½p	AF106	42½p	BF184	25p	GET119	20p	OC24	60p
2N2147	82½p	2N4058	17½p	AF114	25p	BF185	42½p	GET120	52½p	OC25	50p
2N2148	57½p	2N4059	10p	AF115	25p	BF194	17½p	GET873	12½p	OC26	27½p
2N2160	57½p	2N4060	12½p	AF116	25p	BF195	15p	GET880	30p	OC28	62½p
2N2193	40p	2N4061	12½p	AF117	25p	BF196	42½p	GET887	20p	OC29	62½p
2N2193A	42½p	2N4062	12½p	AF118	62½p	BF197	42½p	GET889	22½p	OC35	50p
2N2194A	30p	2N4244	47½p	AF119	20p	BF198	42½p	GET890	22½p	OC36	62½p
2N2217	27½p	2N4285	17½p	AF124	22½p	BF200	52½p	GET896	22½p	OC41	22½p
2N2218	23p	2N4286	17½p	AF125	20p	BF224	14p	GET897	22½p	OC42	25p
2N2219	23p	2N4287	17½p	AF126	20p	BF225	19p	GET898	22½p	OC44	20p
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2N2369	17½p	2N5027	52½p	AF239	42½p	BFX29	30p	MJ481	£1·25	OC75	22½p
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2N2483	27½p	2N5030	42½p	AF211	32½p	BFX44	37½p	MJ1800	£2·17½	OC81	20p
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2N2540	22½p	2N5175	52½p	ASY28	27½p	BFX85	32½p	MJE521	73p	OC84	25p
2N2613	35p	2N5176	45p	ASY29	27½p	BFX86	25p	MPF102	42½p	OC139	32½p
2N2614	30p	2N5232A	30p	ASY36	25p	BFX87	27½p	MPF103	37½p	OC140	32½p
2N2646	52½p	2N5245	45p	ASY50	25p	BFX88	25p	MPF104	37½p	OC170	30p
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IS130	12½p	BA114	22½p	BY126	15p	OA79	09p
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IS132	15p	BA141	32½p	BY164	57½p	OA85	07½p
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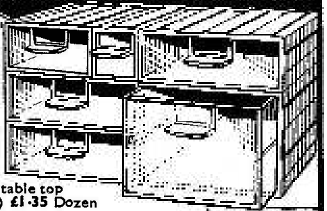

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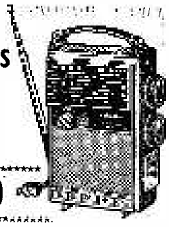

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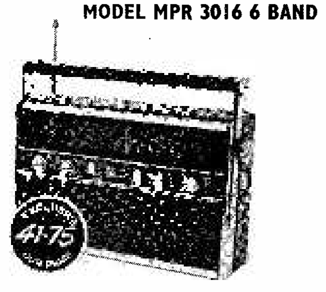

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2D21	0.38	6BS7	1.30	6L6GT	0.45	12AV6	0.40
3A4	0.40	6BW6	0.85	6L7	0.40	12AV7	0.65
3BP1	3.00	6BW7	0.80	6L18	0.45	12AX7	0.30
3S4	0.35	6BX6	0.25	6LD20	0.50	12AY7	0.75
3V4	0.48	6BZ6	0.40	6N7GT	0.45	12B4A	0.60
5R4GY	0.75	6C4	0.33	6P1	0.60	12BA6	0.40
5U4G	0.35	6C5GT	0.40	6P28	0.65	12BA7	0.40
5V4G	0.45	6CB6	0.35	6Q7	0.40	12BE6	0.40
5Y3GT	0.40	6CD6GA	1.25	6SA7	0.40	12BH7	0.45
5Z3	0.60	6CG7	0.55	6SG7	0.40	12BY7	0.60
5Z4G	0.40	6CH6	0.60	6SK7	0.40	12K5	0.70
6/30L2	0.80	6CL6	0.55	6SL7GT	0.35	12K7GT	0.40
6AB4	0.35	6CW4	0.65	6SN7GT	0.35	12Q7GT	0.40
6AF4A	0.55	6CY5	0.45	6SQ7	0.40	12SR7	0.40
6AG7	0.40	6CY7	0.70	6SR7	0.40	20D1	0.50
6AH6	0.50	6D3	0.50	6T8	0.35	20L1	1.10
6AJ8	0.30	6DC6	0.80	6U4GT	0.65	20P1	0.50
6AK5	0.35	6DK6	0.50	6U8A	0.40	20P4	1.10
6AK6	0.60	6DQ6B	0.70	6V6GT	0.40	20P5	1.20
6AL3	0.43	6DS4	0.75	6X4	0.35	25C5	0.50
6AL5	0.20	6EA8	0.60	6X5GT	0.40	25L6GT	0.50
6AM5	0.35	6EH7	0.30	6X8	0.60	25Z4G	0.30
6AM6	0.33	6EJ7	0.35	6Y6G	0.70	25Z6GT	0.65
6AQ5	0.38	6EW6	0.70	7Y4	0.65	30A5	0.50
6AQ6	0.65	6F1	0.75	9BW6	0.60	30AE3	0.40
6AR5	0.45	6F5	0.75	10C2	0.50	30C1	0.30
6AR6	0.55	6F6G	0.35	10D1	0.55	30C15	0.80

First Quality Fully Guaranteed

ZAERIX BRAND

ELECTRONIC VALVES

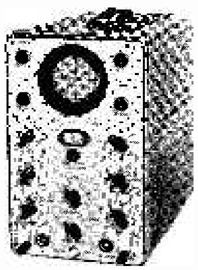
30C17	0.90	90AG	2.40	DY87	0.33	ECC189	0.65
30C18	0.80	90AV	2.50	DY802	0.35	ECF80	0.35
30F5	0.85	90C1	0.65	E88CC	0.65	ECF82	0.35
30FL1	0.75	90CV	2.40	E180F	1.00	ECF86	0.65
30FL12	1.20	807	0.50	E810F	2.90	ECF804	1.65
30FL14	0.85	813	3.75	EABC80	0.35	ECH42	0.75
30L1	0.40	866A	0.75	EAF42	0.55	ECH81	0.30
30L15	0.85	5642	0.70	EBC33	0.50	ECH83	0.45
30L17	0.80	6080	1.60	EBC41	0.55	ECH84	0.45
30P12	0.80	6146	1.60	EBC81	0.30	ECL80	0.45
30P19	0.85	6360	1.25	EBF80	0.40	ECL81	0.50
30PL1	0.75	6939	2.25	EBF83	0.40	ECL82	0.35
30PL13	0.98	7199	0.80	EBF89	0.30	ECL83	0.70
30PL14	0.90	7360	2.00	EC53	0.50	ECL84	0.55
35A3	0.55	7586	1.25	EC86	0.60	ECL85	0.55
35A5	0.75	7895	1.25	EC88	0.60	ECL86	0.40
35B5	0.65	9002	0.40	EC90	0.33	ECLL800	
35C5	0.50	9003	0.50	EC91	0.60		1.65
35D5	0.75	AZ1	0.55	EC92	0.35	EF40	0.50
35L6GT	0.50	AZ31	0.55	EC93	0.55	EF41	0.65
35W4	0.35	CBL1	0.90	EC8010	2.25	EF42	0.70
35Z3	0.70	CBL31	1.00	ECC40	0.65	EF80	0.25
35Z4G	0.35	CY31	0.35	ECC81	0.35	EF83	0.55
35Z5GT	0.60	DAF96	0.45	ECC82	0.30	EF85	0.35
50A5	0.75	DF96	0.45	ECC83	0.30	EF86	0.30
50B5	0.50	DK40	0.60	ECC84	0.30	EF89	0.28
50C5	0.50	DK92	0.55	ECC85	0.40	EF91	0.33
50CD6G	1.20	DL96	0.45	ECC88	0.40	EF92	0.35
50L6GT	0.55	DM160	0.65	ECC89	0.50	EF95	0.35
85A2	0.50	DY86	0.32	ECC91	0.20	EF97	0.65

EP98	0.65	GZ34	0.60	PL81	0.50	U282	0.40
EF183	0.30	HABC80	0.45	PL82	0.45	U301	0.40
EF184	0.35	HK90	0.40	PL83	0.45	U403	0.60
EF800	1.00	KT66	2.05	PL84	0.40	U404	0.60
EK90	0.30	KT88	2.00	PL302	0.85	U801	0.80
EL33	1.25	N78	1.50	PL504	0.80	UABC80	
EL34	0.50	PABC80	0.40	PL508	0.90		0.40
EL36	0.50	PC86	0.60	PL509	1.10	UAF41	0.50
EL37	1.60	PC88	0.60	PL801	0.80	UAF42	0.55
EL41	0.60	PC97	0.50	PL802	0·95	UB41	0·60
EL42	0.65	PC900	0.48	PM84	0.60	UBC41	0.50
EL81	0.55	PABC80	0·40	PY31	0.30	UBC81	0.40
EL83	0.42	PCC84	0.40	PY33	0.63	UBF80	0.40
EL84	0.25	PCC85	0.40	PY80	0.40	UBF89	0.35
EL85	0.43	PCC88	0.55	PY81	0.30	UBL1	0.60
EL86	0.40	PCC89	0.55	PY82	0.35	UBL21	0.65
EL90	0.38	PCC189	0.55	PY83	0.38	UC92	0.40
EL95	0.35	PCC805	0.85	PY88	0.40	UCC85	0.40
EL821	0.60	PCC806	0.80	PY500	1.00	UCF80	0.55
EL822	1.30	PCF80	0.30	PY800	0.40	UCH21	0.60
ELL80	0.75	PCF82	0.35	PY801	0.50	UCH42	0.70
EM34	1.00	PCF84	0.60	PZ30	0.35	UCH81	0.40
EM71	0.80	PCF86	0.60	QQVO2-6		UCL81	0.60
EM80	0.45	PCF87	0.90		2.25	UCL82	0.35
EM81	0.60	PCF801	0.50	QQVO3-10		UCL83	0.60
EM84	0.35	PCF802	0.50		1.25	UF9	0·60
EM85	1.00	PCF805	0.80	QQV03-20A		UF11	0·50
EM87	0.70	PCF806	0.70		5.25	UF41	0.60
EN91	0.38	PCF808	0.85	QQV06-40A		UF42	0.60
EY51	0.40	PCH200	0.70		5.50	UF43	0.60
EY80	0.55	PCL81	0.50	TT21	3.00	UF80	0.35
EY81	0.40	PCL82	0.35	TT22	3.20	UF85	0.40
EY83	0.55	PCL83	0.65	TY2-125		UF89	0.40
EY86	0.40	PCL84	0.45		10.00	UL41	0.65
EY87	0.43	PCL85	0.40	U18/20	0.75	UL84	0.40
EY88	0.43	PCL86	0.45	U25	0.80	UM84	0.25
EZ40	0.50	PCL88	0.90	U26	0.80	UU8	0.60
EZ41	0.50	PCL800	0.93	U31	0.60	UY1N	0.50
EZ80	0.27	PCL801	0.75	U37	2.10	UY11	1.00
EZ81	0.29	PD500	1.30	U52	0.35	UY41	0.48
GY501	0.80	PF86	0.65	U76	0.35	UY82	0.50
GZ30	0.40	PF818	0.85	U78	0.35	UY85	0.40
GZ31	0.35	PFL200	0.65	U191	0.75	W729	0.75
GZ32	0.48	PL33	0.35	U201	0.35	Z759	2.00
GZ33	0.70	PL36	0.55	U281	0.40	Z803U	1.20

TRANSISTORS

2N696	0.17	AC127	0.20	BD121	0.65
2N697	0.17	AC128	0.15	BD123	0.80
2N698	0.30	AC132	0.35	BD131	0.85
2N705	0.70	AC153	0.20	BD132	0.85
2N706	0.10	AC154	0.15	BD135	0.80
2N708	0.15	AC157	0.20	BF115	0.20
2N753	0.25	AC169	0.10	BF167	0.18
2N929	0.22	AC176	0.25	BF173	0.20
2N930	0.25	AC187	0.30	BF178	0.25
2N987	0.30	AC188	0.30	BF179	0.30
2N1131	0.25	ACY17	0.275	BF180	0.35
2N1132	0.25	ACY18	0.20	BF181	0.25
2N1184	1.25	ACY19	0.25	BF184	0.25
2N1301	0.40	ACY20	0.20	BF185	0.20
2N1302	0.75	ACY21	0.20	BF194	0.15
2N1304	0.25	ACY22	0.15	BF195	0.15
2N1305	0.25	AD140	0.50	BF196	0.20
2N1306	0.25	AD149	0.50	BF197	0.20
2N1307	0.30	AD161	0.35	BF200	0.35
2N1308	0.25	AD162	0.35	BFW87	0.25
2N1309	0.30	ADZ11	1.25	BFW88	0.23
2N1613	0.22	ADZ12	1.25	BFW89	0.20
2N1711	0.25	AF114	0.20	BFW91	0.20
2N1756	0.75	AF115	0.20	BFX88	0.25
2N2147	0.75	AF116	0.20	BFY17	0.40
2N2160	0.65	AF117	0.20	BFY19	0.60
2N2217	0.30	AF118	0.45	BFY50	0.25
2N2218	0.30	AF125	0.25	BFY51	0.20
2N2219	0.35	AF127	0.20	BFY52	0.25
2N2369A	0.20	AF180	0.35	BSY26	0.20
2N2477	0.65	AF181	0.35	BSY27	0.20
2N2646	0.60	AF186	0.40	BSY28	0.20
2N2905	0.35	AF239	0.40	BSY65	0.20
2N2923	0.15	AFZ11	0.45	BSY95A	0.15
2N2924	0.15	ASY26	0.25	OC16	0.50
2N2926	0.125	ASY27	0.30	OC22	0.50
2N3053	0.25	ASY28	0.25	OC23	0.60
2N3054	0.60	ASY29	0.30	OC24	0.60
2N3055	0.75	ASY54	0.25	OC25	0.35
2N3133	0.30	ASZ15	0.70	OC26	0.25
2N3134	0.30	ASZ16	0.70	OC28	0.60
2N3391	0.20	ASZ17	0.75	OC29	0.60
2N3392	0.15	ASZ18	0.75	OC30	0.75
2N3393	0.15	ASZ20	0.25	OC35	0.50
2N3394	0.15	ASZ21	0.40	OC36	0.60
2N3395	0.20	BC107	0.125	OC42	0.20
2N3402	0.15	BC108	0.125	OC44	0.20
2N3403	0.15	BC109	0.125	OC45	0.15
2N3404	0.35	BC113	0.25	OC70	0.10
2N3414	0.20	BC118	0.30	OC71	0.12
2N3415	0.15	BC134	0.30	OC72	0.25
2N3416	0.25	BC147	0.175	OC73	0.30
2N3417	0.25	BC148	0.15	OC75	0.20
2N3702	0.12	BC149	0.15	OC76	0.20
2N3703	0.12	BC152	0.15	OC78	0.25
2N3704	0.17	BC158	0.15	OC78D	0.20
2N3707	0.15	BC175	0.20	OC81	0.25
2N3709	0.12	BC186	0.25	OC81D	0.15
2N3710	0.12	BCY30	0.25	OC83	0.20
2N3819	0.35	BCY31	0.40	OC139	0.30
2N3906	0.20	BCY33	0.25	OC140	0.35
2S702	0.50	BCY34	0.30	OC141	0.60
2S746	0.25	BCY72	0.20	OC170	0.25
AC113	0.15	BCZ10	0.30	OC171	0.25
AC125	0.30	BCZ11	0.40	OC200	0.30
AC126	0.20	BD115	0.80	OC202	0.65

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.
Input attenuator 1-10-100.
Power supplies 127/230v AC.

PRICE £39.00. Packing and carriage 1.50

INTEGRATED CIRCUITS

TAA263 Direct coupled 3-stage amplifier up to 600kc. Supply voltage 6-8V output 10mW TO72 outline	0·75
TAA293. Medium frequency amplifier up to 600kc. Supply voltage 6V. output 10mW TO74 outline	0·95
TAA320. MOST stage followed by a bi-polar stage Gate-to-source voltage 9-14V. Power dissipation 200mW. TO18 outline	0·65
TAA570. Four-stage limiter-amplifier with F.M. quadrator detector and remote D.C. volume control facility. Nominal supply voltage 12V. TO74 outline	0·95
TAD100. AM receiver circuit containing all active components (except output stage) required to build a complete receiver ..	£1·95

PHOTO-EMISSIVE DEVICES

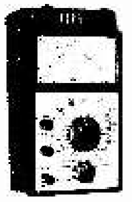
GAS Light emitting diode type MV10B ..	£1·05
Photo-transistor OC71	0·90
Photo-conductive cell ORP12	0·50
Photo-conductive cell ORP60	0·50
Photo-conductive cell ORP61	0·32
Photo conductive cell ORP90	1·10
Photo-conductive cell ORP91	1·10
GAS Photocells 90AG	2·40
90CG	2·40
Vacuum Photocells 90AV	2·50
90CV	2·40

TWO NEW MULTIMETERS FROM RUSSIA

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.
PRICE, complete with leads and steel carrying case £9.75

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.
PRICE, complete with test leads and steel carrying case £10.50



AC/DC MULTIMETER AND TRANSISTOR TESTER

8–DC voltage ranges 0·3–900V
6–AC voltage ranges 1·5–750V
5–DC current ranges 0·06–600mA
4–AC current ranges 0·3–300mA
4–resistance ranges 0·5–500 Kohms
Transistor cut-off current 60μA max
Transistor DC current gain 10–350
Sensitivity: 16700 Ω/V DC; 3300 Ω/V AC
PRICE £10·50

OUR NEW 1971/1972 CATALOGUE IS NOW READY AND AVAILABLE FREE OF CHARGE. PLEASE SEND QUARTO STAMPED AND ADDRESSED ENVELOPE FOR THIS VALUABLE SOURCE OF REFERENCE LISTING MANY THOUSAND TYPES OF VALVES, SEMICONDUCTORS, TUBES, ETC.

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