PRACTICAL WIRELESS

JULY 1968

2'6

Build this PORTABLE KEYLESS ORGAN

also inside

the STEPTRON
electronic stop watch for the photographer

10 GNS WRAPS UP YOUR SPEAKER PROBLEMS

with Wharfedale's Unit 3 Speaker kit

Wharfedale have designed a new genuine high fidelity system that *you can build yourself*. With the Unit 3 Kit you get: an 8" speaker (with a magnetic field of 12,000 oersteds) which covers the bass and middle ranges; the new Wharfedale tweeter with acoustiprene dome; an electrical cross-over unit; acoustic wadding, wiring, etc., and a complete assembly instruction leaflet, in fact, everything you need to build a compact speaker system.

You can build the Unit 3 Kit into one of two cabinet sizes. In the smaller cabinet the system will give a faithful and rich reproduction of all musical sounds from 65 - 17,000 Hz. The larger cabinet increases the range from 40 - 17,000 Hz.

WHARFEDALE

RANK WHARFEDALE LTD., IDLE, BRADFORD, YORKSHIRE.

VIKING AMPLIFIER

50 WATT AMPLIFIER

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

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

SENSITIVITIES AND INPUT IMPEDANCES

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

Input sensitivity relative to 10w output.

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

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

NEGATIVE FEED BACK 20dB at 1KHz/s.
SIGNAL TO NOISE RATIO 60dB.
MAINS VOLTAGES
Adjustable from 200–250v A.C. 50–60 Hz/s.
A protective fuse is located at the rear of unit.
VALVE LINE UP
Double purpose ECC83 x 3, EL34 x 2 and GZ34.

Price
27 gns
P & P 20/-

FOUR *PLUS* FOUR *Stereo Amplifier*

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

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

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

INPUTS AND OUTPUTS
(per channel)
Gram, aux, tape out and speaker out. A switched mains socket is also provided at the rear of unit. Employs Mullard valves throughout. ECC83 and 2 x ECL86 with a metal bridge rectification.

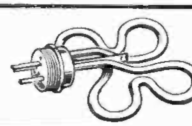
TECHNICAL SPECIFICATIONS
Gram sensitivity 40mV at 1 KHz. Aux sensitivity 50mV at 1 KHz. (Sensitivities are given for rated output). 4 watts r.m.s. (8 watts r.m.s. in monaural position). Output matches into standard 3 ohms speaker system. Suitable 10″ x 6″ speakers are available at **29/6** each, plus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

Price
13 gns
P & P 15/-

REDUCE SPEED NOW with a speedex

infinitely variable electronic speed controller for your electric power drill. Varies the speed of all power tools (up to 600W) between 12 r.p.m. and maximum r.p.m.
Instantly adjustable with simple single control overriding switch for instant maximum speed. Simply connected into lead of power tool. Only **25/-** plus 3/6 P. & P.

GEC KETTLE ELEMENT



3,000W WITH AUTOMATIC EJECTION
200/240v. Size of hole required 1⅝″
List Price 32/-. Our PRICE
15/-. P. & P. 1/6.

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21c High Street, Acton, London, W3

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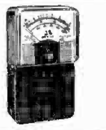
All enquiries Stamped Addressed Envelope

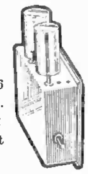
Also at **323 EDGWARE ROAD, LONDON, W.2.** Personal shoppers only. Early Closing Thursday. All orders by post to our Acton address.



POCKET MULTI-METER

Size 3¾ x 2⅝ x 1⅜in Meter size 2⅛ x 1⅜in Sensitivity 1000 O.P.V. on both A.C. and D.C. volts. 0–15, 0–150, 0–1000 D.C. current 0–150mA. Resistance 0–100kΩ. Complete with test prods, battery and full instructions, 42/6. P. & P. 3/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value 15/- to every purchaser of the Pocket Multi-Meter.

CYLDON U.H.F. TUNER



Complete with PC88 and PC86 Valves. Full variable tuning. New and unused. Size 4¼ x 5½ x 1½in. Complete with circuit diagram. **35/-** P. & P. 3/6

THREE-IN-ONE HI-FI 10 WATT SPEAKER

A complete Loud Speaker system on one frame, combining three matched ceramic magnet speakers with a low loss cross over network. Peak handling power 10 watts. Impedance 15 ohms. Flux density 11,000 gauss. Resonance 40–60 c/s. Frequency range 50c/s to 20kc/s. Size 13¼ x 8 1/16 x 4¼ inches. By famous manufacturer. List Price £7. Our price 69/6 plus 3/6 P. & P.

600 mW FOUR TRANSISTOR AMPLIFIER

Features N.P.N. and P.N.P. complementary symmetrical output stage, 2¼″ x ⅞″ x ⅞″ Speaker. Output impedance 12 ohms frequency response 3dB points 90 c/s and 12 Kc/s. Price **19/6** plus **1/-** P. & P. 7 x 4″ Speaker to suit, **13/6** plus **2/-** P. & P.

2½ watt ALL TRANSISTOR AMPLIFIER

AC mains 240V. Size 7″ x 4¼″ x 1¾″. Frequency response 100 c/s—10 Kc/s Semi conductors, two OC 75's two AC 128's and two stabilizers AA129. Tone and volume controls on flying leads. **£2.10.0** plus P. & P. 3/6. Suitable 8″ x 5″ 10,000 line high flux speaker, **18/6** plus 2/- P. & P.

NEW TRANSISTORISED SIGNAL GENERATOR

Size 5½ x 3¼ x 1½in. For IF and RF alignment and AF output 700 c/s frequency coverage 460 kc/s to 2 mc/s in switched frequencies. Ideal for alignment to our Elegant Seven and Musette. Built and tested. P. & P. 3/6. **49/6**

FIRST QUALITY P.V.C. TAPE

5¾″	Std.	850ft.	**9/-**	5″	L.P.	850ft.	**10/6**
7″	Std.	1200ft.	**11/6**	3″	T.P.	600ft.	**10/6**
3″	L.P.	240ft.	**4/-**	5″	T.P.	1800ft.	**25/6**
5¾″	L.P.	1200ft.	**11/6**	5¾″	T.P.	2400ft.	**32/6**
7″	L.P.	1800ft.	**18/6**	7″	T.P.	3600ft.	**42/6**
5¾″	D.P.	1800ft.	**18/6**	4″	T.P.	900ft.	**15/-**

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

THE RELIANT 10W SOLID-STATE HIGH QUALITY AMPLIFIER

SPECIFICATIONS
Output—10 watts RMS Sine-wave
13 watts RMS Music-power
Output Impedance—3 to 4 ohms
Inputs—1. -xtal mic 10mV
2. -gram/radio 250mV
Tone Controls—Treble control range ± 12dB at 10KH2
Bass control range ± 13dB at 100H2
Frequency Response—(with tone controls central) Minus 3dB points are 20H2 and 40KH2. Signal to Noise Ratio—better than —60dB. Transistors—4 silicon Planar type and 3 Germanium type. Mains input— —220 —250V. A.C. Size of chassis—10″ × 3¾″ × 2″. A.C. Mains, 200-250V. For use with Std or L.P. records, musical instruments, all makes of pick-ups and mikes. Separate bass and treble lift control. Two inputs with control for gram. and mike. Built and tested. 8″ × 5″ speaker to suit price **14/6** plus 1/6 P. & P. Crystal mike to suit 12/6 plus 1/6 P. & P.
PRICE £5.5.0 plus 5/- P. & P.

LESLIE TREMOLO SPEAKER UNIT

Model 10C3. Made in U.S.A. by Electro Music Corp., Pasadena, Calif. Complete with 8″ 6 ohm Heavy Duty Loud Speaker. (Larger Speaker may be fitted without major structural change). Dimensions: baffle size 18½″ × 19″. Rotor size 15″. A.C. mains 110-220-240 50 c/s. suitable for organs.
PRICE £30 plus £2 P. & P.

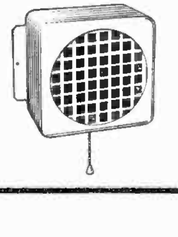
50 WATT POWER AMPLIFIER

Manufactured by Livingstone Labs. at a cost price of £90. In two units, Amplifier size 15½″ × 9″ × 7″. Heat sink size 14½″ × 9″ × 4″. Output into 15 ohm Speaker. Transistors—eight OC28s. Two 2G374. Sensitivity 1V. RMS at 6K input impedance. Power Response 5H2–15KHZ (50 watts). Ideal for Tannoy Systems or organs where constant use is essential.
PRICE 28gns. plus £2 P. & P.

ANTI-THIEF CAR BURGLAR ALARM

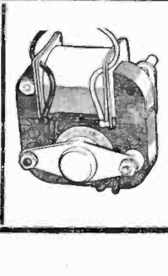
The Melguard Safermatic consists of an electrical device housed in small metal box 4″ × 2″ × 1½″, which has been designed and developed to provide protection required by the average motorist at an economic cost. Using this system, an alarm and the immobilised condition is set automatically as soon as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

EXTRACTOR FAN



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

AC MAINS MOTOR



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

S B ELECTRONICS

A better buy each month

● **BARGAIN PRICE STEREO AMPLIFIER—13½ GNS. ONLY.** 27 gns. retail value. A fully transistorised high fidelity stereo amplifier complete in free standing case. Switched input facilities. Socket (1) Tape or crystal pick-up. (2) Radio tuner. (3) Ceramic pick-up mike. Controls: volume, bass, treble, balance, input selector switch. Stereo/mono switch. Facia plate rigid Perspex with black/silver background and matching black edged knobs with spun silver centre. **Output 6 watts per channel (R.M.S.), 12 watts mono.** Free response +3dB 20–20,000 hz. Bass boost approx. 10+12dB. Treble cut 2–16dB. Approx. negative feedback —18dB over main amp. 12 months unconditional guarantee. P. & P. 6/-.

● **BARGAIN PRICE STEREO AMPLIFIER—7 GNS. ONLY.** 16 gns. retail value. A high fidelity unit complete in free standing case. Ideal for crystal or ceramic pick-up, tape, radio tuner. Fully integrated. Facia plate rigid Perspex. Black/silver matching knobs. **Output 4 watts per channel R.M.S.** 12 months unconditional guarantee. P. & P. 5/6.

● **BARGAIN PRICE MONO AMPLIFIER—7 GNS. ONLY.** 14 gns. retail value. A high fidelity unit providing excellent results at all output levels complete in free standing case. Frequency response: 30–20,000 c.p.s. —2dB. Sensitivity 5 mV max. Harmonic distortion 0·5% at 1,000 c.p.s. Output 3–8–15 ohms. Input: mike, gram, radio tuner, tape recorder. Controls (5): volume, bass, treble, mains switch, input selector. Facia rigid Perspex black/silver with matching knobs. **Output 6 watts R.M.S. (certified).** 12 months unconditional guarantee. P. & P. 5

● **CHANGER DECKS—ALL AT BARGAIN PRICES.**

GARRARD 1000–1025	**£6 5 0**	P. & P. 7/6
GARRARD 2000–2025	**£6 15 0**	P. & P. 7/6
GARRARD 3000–3500	**£8 19 6**	P. & P. 7/6
GARRARD AT60 Mk. II	**£12 10 0**	P. & P. 8/6
GARRARD SL55	**£11 10 0**	P. & P. 8/6
GARRARD SP25 Mk. II	**£11 15 0**	P. & P. 8/6
GARRARD LAB80 Mk. II	**£23 10 0**	P. & P. 10/6
GARRARD SRP22	**£4.10.0**	P. & P. 5/6
B.S.R. UA25	**£6.5.0**	P. & P. 7/6

Plinths to suit all the above, beautifully styled and of No. 1 manufacture. **£2.5.0** ONLY. P. & P. 5/-.

● **BARGAIN PRICE A.M. SUPERHET TUNER UNIT—6 GNS. ONLY.** 12 gns. retail value. Mains operated, fully transistorised, ferrite rod aerials. Simply add to any of our amplifiers for outstanding results. 12 months unconditional guarantee. P. & P. 5/6.

● **BARGAIN PRICE F.M. TUNER UNIT—8 GNS. ONLY.** 16 gns. retail value. Mains operated, 6 transistor unit. S/M horizontal dial, 2 I.F. stages, coupled double tuned discriminator terminating in I.F. Ample output for all amplifiers. Highly recommended. 12 months unconditional guarantee. P. & P. 5/6.

● **BARGAIN PRICE L.W./M.W./F.M. TUNER UNIT—16 GNS. ONLY.** 30 gns. retail value. Mains operated, fully transistorised. Output 5 mV, exceptional sensitivity and selectivity on all bands. L.W. 180–360 Kc/s. A.M. 600–1400 Kc/s. F.M. 88–108 Mc/s. Complete with aerials, 3 band horizontal dial. 12 months unconditional guarantee. P. & P. 6/6.

● **BARGAIN—RECORD PLAYER AMPLIFIERS—47/6 ONLY.** EL84 output, 2 controls, flying panel, A.C. mains operated 230–240 volt. Non-live chassis. Fully built and tested. 12 months unconditional guarantee. P. & P. 2/6.

● **BARGAIN—RECORD PLAYER AMPLIFIER UNIT—52/6 ONLY.** Complete with valves (UCL82 output). Fully built and tested, mounted on board with speaker. Knobs supplied. All leads attached ready for instant connection to your turntable. 12 months unconditional guarantee. P. & P. 3/6.

● **BARGAIN—RECORD PLAYER CABINETS—52/6 ONLY.** Strongly built wooden cabinet—two tone gilt fittings, carrying handle. Suitable for any amplifier. Ample space for speaker. Matching Garrard or B.S.R. cut-out board supplied free. P. & P. 5/-.

● **BARGAIN—SPEAKERS, STANDARD AND HIGH FIDELITY.** 5in. round, 7 x 4in. elliptical, 8in. round. All 3 ohms. ALL ONE PRICE, 15/-. P. & P. 2/6.

● **BARGAIN—E.M.I. 8 x 5in. ELLIPTICAL—OUR PRICE 27/6 POST FREE.** 12,000 lines gauss, 5 watts, Accomax magnet. Sold elsewhere at 50/-. 3 or 15 ohms. Brand new with 12 months unconditional guarantee.

● **BARGAIN—E.M.I. 13 x 8in. ELLIPTICAL—OUR PRICE 47/6 POST FREE.** 12,000 lines gauss, 10 watts, Accomax magnet. Sold elsewhere at £4. 3 or 15 ohms. Brand new with 12 months unconditional guarantee.

● **BARGAIN—BAKER-SELHURST DE-LUXE—OUR PRICE £4.19.6 ONLY.** 12in. dia. round, 15 watt rating, 12,000 lines gauss, Accomax magnet. 3 or 15 ohms. Response: 45–13,000 c.p.s. Bass resonance 40–50 c.p.s. Solid aluminium chassis. Brand new with 12 months unconditional guarantee. P. & P. 6/6.

● **BARGAIN—BAKER-SELHURST GUITAR GROUP 25—£4.19.6 ONLY.** 12in. dia. round, 25 watt rating, 12,000 lines gauss, 15 ohms. Response: 30–10,000 c.p.s. Solid aluminium chassis. Heavy duty core. Brand new with 12 months unconditional guarantee. P. & P. 6/6.

● **CARTRIDGES—ALL AT BARGAIN PRICES.**

SONOTONE 9TA/HC sapphire (stereo)	**£2 0 0**
SONOTONE 9TA/HC diamond (stereo)	**£2 5 0**
SONOTONE 2T ceramic HC (mono)	**£1 2 0**
ACOS GP91/3 HC (mono)	**£1 0 0**
E.R.S.M.B. crystal (mono)	**£1 0 0**
E.R.S.M.B. ceramic (mono)	**£1 0 0**
E.R.S.M.B. ceramic (stereo)	**£1 5 0**
TC8H (mono)	**£1 0 0**
TC8M (mono)	**£1 0 0**
CI stereo	**£2 2 0**

All cartridges are supplied with fixing brackets and screws at no extra cost.

● **BARGAIN—PHILIPS INTERCOM SYSTEM—OUR PRICE 59/6 ONLY.** Retail value £6.6.0. This equipment is ideal for baby alarm, office, home. Hundreds of uses. Absolutely brand new in handsome presentation case containing all leads, etc. 12 months unconditional guarantee. P. & P. 3/6.

● **BARGAIN—CAR RADIOS—OUR PRICE 9 GNS.** Retail value 16 gns. Negative or positive earth (switched). Well known brand name. Fully transistorised, 12 volt, medium and long waves. Speaker and fitting kit supplied at no extra cost. 12 months unconditional guarantee. P. & P. 7/6.

● **BARGAIN—CAR AERIALS. OUR PRICE 22/6.** Retail value 37/6. Wing mounting, heavy chrome plate, retractable. A snip. Buy while stocks last.

● **BARGAIN—CAR RADIO/PORTABLE—OUR PRICE 4½ GNS. ONLY.** Retail value 7½ gns. Single waveband (medium). Fully transistorised. A beautiful radio, the performance has to be heard to be believed. 12 months guarantee. P. & P. 4/6. **Free with this Radio—suitable window mounting car aerial.**

● **BARGAIN—SLIMLINE TV RECEIVERS IN MINT CONDITION.** 17in., 19in., 21in. Checked complete and working but less I.F. strip. OUR PRICE **£9.10.0 ONLY.** I.F. strips supplied at 45/- if required. Fitting charge for I.F. strip **£2.2.0** if requested. P. & P. TV Set 30/-. P. & P. I.F. strip 5/-. If purchased together 30/-. Personal collection advised, otherwise despatched at customers risk.

● **BARGAIN—DIODES—OUR PRICE £1** for 750. In 750 lots only. All assorted.

Our high fidelity equipment is not advertised due to space limitations. In stock and on demonstration all famous names—Leak, Wharfedale, Rogers, Rason, Thorens. **Up to 15% discount against recommended retail prices.**

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VALVES/SEMI-CONDUCTORS
BRAND NEW & GUARANTEED

OA2	6/-	6J4	9/-	30FL1	15/-	ECF82	7/6	GZ32	11/6	PY801	8/-
OB2	6/-	6J6	3/6	30L15	15/-	ECH35	11/-	GZ34	11/6	U25	15/-
IR5	6/-	6K8	4/-	30P19	14/-	ECH42	11/-	MU14	8/-	U26	15/-
IS5	4/6	6L6	9/6	30PL1	15/-	ECH81	6/3	PABC80	7/6	U191	14/-
IT4	3/-	6Q7	8/3	30PL13	16/-	ECH83	8/6	PCC84	6/6	U281	8/-
IU4	6/-	6SG7	6/-	35L6	8/-	ECL80	7/9	PCC85	8/-	U301	11/-
IU5	7/-	6SJ7	7/-	35Z4	8/6	ECL82	7/-	PCC88	11/6	U801	17/-
2D21	5/-	6SL7	6/-	35W4	5/3	ECL83	10/6	PCC89	11/6	UABC80	6/-
3A5	10/-	6SM7	5/6	50B5	6/6	ECL86	9/-	PCC189	12/6	UAF42	10/-
3Q4	7/-	6U7	7/-	50C5	6/6	EF37A	8/-	PC86	11/-	UBC41	8/-
3S4	5/-	6V6	5/-	80	7/-	EF40	10/-	PC88	11/-	UBF80	7/-
3V4	6/-	6X4	4/3	AZ31	10/-	EF41	9/6	PC97	8/6	UBF89	7/-
5R4	9/-	6X5	5/-	DAF91	4/6	EF42	10/6	PC900	9/6	UCC84	10/-
5U4	5/-	7B7	7/-	DAF96	7/-	EF80	5/-	PCF80	7/3	UCC85	7/-
5V4	8/6	7C6	6/6	DF91	3/-	EF85	6/6	PCF82	7/-	UCF80	9/6
5Y3	5/9	7Y4	8/6	DF96	7/-	EF86	7/-	PCF84	9/-	UCH42	10/-
5Z4	8/-	10C2	15/-	DK91	6/-	EF89	6/3	PCF86	9/-	UCH81	7/-
6/30L2	12/6	10F1	9/-	DK92	8/9	EF91	4/-	PCF800	15/-	UCL82	8/-
6AC7	4/-	10P13	15/-	DK96	8/-	EF92	4/-	PCF801	10/-	UCL83	10/-
6A67	6/-	10P14	16/-	DL92	5/-	EF183	7/-	PCF802	10/-	UF41	10/-
6AK5	5/-	12AT6	5/-	DL94	6/-	EF184	7/-	PCF805	14/-	UF80	7/-
6AL5	3/-	12AT7	4/-	DL96	8/-	EL33	12/6	PCL82	7/6	UF85	7/6
6AM6	4/-	12AU7	5/-	DY86	6/6	EL34	11/-	PCL83	9/6	UF89	7/6
6AQ5	6/-	12AX7	6/-	E88CC	12/6	EL41	9/9	PCL84	8/-	UL41	10/-
6AS6	6/-	12BA6	6/9	EABC80	7/-	EL42	11/-	PCL85	9/6	UL84	7/-
6AT6	5/-	12BE6	6/3	E180F	15/-	EL81	9/-	PCL86	9/-	UY41	7/6
6AU6	5/9	12BH7	6/6	EAF42	9/6	EL84	5/-	PFL200	12/6	UY85	6/6
6BA6	4/9	12Q7	5/6	EB91	3/-	EL85	3/6	PL36	10/6	VR105/30	5/6
6BE6	5/3	12SQ7	7/6	EBC41	9/6	EL91	4/-	PL81	7/6		
6BH6	8/-	19AQ5	6/-	EBC81	7/-	EL95	5/3	PL82	7/-	VR150/30	5/-
6BJ6	8/-	20F2	14/-	EBF80	7/6	EM80	7/6	PL83	7/-		
6BR7	11/-	20L1	13/-	EBF83	9/-	EM81	8/-	PL84	6/9		
6BZ6	7/-	20P1	12/-	EBF89	7/6	EM84	7/6	PL500	14/6	MANY	
6C4	3/6	20P3	12/-	ECC40	11/6	EM87	7/6	PY33	9/9		
6C6	4/-	20P4	19/-	ECC81	4/-	EY51	7/6	PY80	5/6	OTHER	
6CD6	20/-	25L6	6/6	ECC82	5/-	EY86	7/-	PY81	6/-		
6CH6	6/-	25Z4	8/-	ECC83	6/-	EZ40	8/6	PY82	6/-	TYPES IN	
6CL6	10/-	30C15	13/6	ECC84	6/6	EZ41	8/6	PY83	6/6		
6D6	3/-	30C18	14/-	ECC85	5/6	EZ80	5/6	PY88	7/6	STOCK.	
6E5	8/-	30F5	14/-	ECF80	7/-	EZ81	5/6	PY800	8/-		

TRANSISTORS

2N 753	4/6	BC108	5/6	OC71	4/-	ST140	4/-
2N 2160	14/11	BC109	5/6	OC72	4/-	ST141	6/-
2N 2926	5/-	BSY26	4/6	OC73	5/-	XA104	4/6
AC107	4/6	BSY28	4/6	OC74	5/6	XA124	4/6
AC126	4/6	BSY65	4/6	OC75	4/6	XA125	4/6
AC127	4/6	BSY95A	5/-	OC76	4/6	XB112	3/-
AC128	4/6	GET106	5/6	OC77	4/6	XC141	7/-
ACY19	5/-	GET113	5/6	OC78	5/-	PHOTO-TRANSISTORS	12/6
ACY21	5/-	GET873	5/6	OC81	4/-		
AD140	8/6	GET874	4/6	OC81M	2/6		
AD149	16/-	MAT100	7/9	OC81D	4/-		
ADT140	15/-	MAT101	8/6	OC81DM	2/6		
AF114	6/6	MAT120	7/9	OC82	4/6		
AF115	4/6	MAT121	8/6	OC83	5/-		
AF116	4/6	OC23	8/6	OC139	8/6		
AF117	4/6	OC26	7/6	OC140	11/-		
AF118	4/6	OC28	8/6	OC169	4/6		
AF119	4/6	OC35	8/6	OC170	4/6		
ASY28	7/-	OC41	5/-	OC171	4/6		
BC107	5/6	OC42	5/-	OC200	9/-		
		OC44	4/-	OC201	11/-		
		OC45	4/-	OC203	12/6		

SIGNAL DIODES

IN34A	4/-
OA5	3/6
OA10	4/6
OA70	2/-
OA79	2/-
OA81	2/-
OA90	2/6
OA95	2/6

ZENER DIODES

OAZ200	12/-	OAZ204	8/6	OAZ208	6/6	OAZ212	6/6
OAZ201	10/-	OAZ205	8/6	OAZ209	6/6	OAZ213	6/6
OAZ202	8/6	OAZ206	8/6	OAZ210	6/6	OAZ227	15/-
OAZ203	8/6	OAZ207	9/6	OAZ211	6/6		

STC. 1 WATT SERIES 5%
2.4/2.7/3/3.9/4.3/13/16/18/20/30/33 volt, 5/- each.
Z series. All voltages from 3.9–50 volt. 250 mW, 2/6 ea.
1.5 w. 4/- ea. 7 w. 5/- each.

SILICON POWER DIODES

60 P.I.V. 290 MA 2/-	6 AMP 5/6
70 P.I.V. 1 AMP 3/6	400 P.I.V. 8 AMP 7/6
140 P.I.V. 165MA 1/-	700 P.I.V. 100 AMP 35/-
150 P.I.V. 25AMP 10/-	800 P.I.V. 500MA 5/6
200 P.I.V 6 AMP 5/6	800 P.I.V. 5 AMP 7/6
400 P.I.V. 500MA 3/6	1000 P.I.V. 6 AMP 7/6
400 P.I.V.	1000 P.I.V. 650MA 6/6

THYRISTORS
SILICON CONTROL RECTIFIERS

400 P.I.V. 3 AMP 7/6	200 P.I.V. 7 AMP 15/6
100 P.I.V. 7 AMP 13/6	400 P.I.V. 7 AMP 15/6

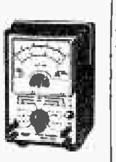
PLEASE ADD POSTAGE

LAFAYETTE TE46 RESISTANCE CAPACITY ANALYSER

2 pF–2,000 mFd 2 ohms 200 megohms. Also checks impedance, turns ratio, insulation, 200/250V A.C.

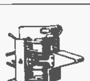
Brand New £15. Carr. 7/6.

T.E.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.– 1·2Mc/s. Decibels –40 to +50 dB. Supplied brand new complete with leads and instructions. Operation 230V. A.C. £17.10.0. Carr. 5/-.

T.M.C. 1000 SERIES KEY SWITCHES



Brand New with knobs as follows:

1 way, 2 c/o 7/6; 1 way, 2 c/o 2b, 7/6; 1 way 4 c/o, 8/-; 2 way, 3m., 3 m. 8/6; 2 way, 2 c/o, 2 c/o. 8/6; 2 way, 2 c/o, 4 c/o, 10/-. Post extra. Quantities available.

ARF-100 COMBINED AF-RF SIGNAL GENERATOR

AF. SINE WAVE 20–200,000 c/s. Square wave 20–30,000 c/s. O/P HIGH IMP. 21V P/P600Ω 3·8V P/P. TF 100Kc/s–300 Mc/s. Variable R.F. attenuation int/ext. modulation. Incorporates dual purpose meter to monitor AF output and % mod. on R.F. 220/240V A.C. £27.10.0. Carr. 7/6.

TE-20RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s—260 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator. Operation 200/240V. A.C. Brand new with instructions. £15.0.0. P. & P. 7/6, S.A.E. for details.

AUTO TRANSFORMERS

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

500 W.	£3.10.0	P. & P. 6/6.
1,000 W.	£5.10.0	P. & P. 7/6.
1,500 W.	£6.10.0	P. & P. 8/6.
3,000 W.	£7.10.0	P. & P. 12/6.
7,500 W.	£15.10.0	P. & P. 20/-.

ADMIRALTY B.40 RECEIVERS

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

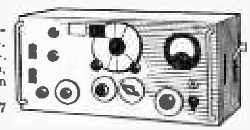
SOLATRON CD711S.2. DOUBLE BEAM OSCILLOSCOPE

An extremely high quality oscilloscope originally costing £400. Switched beam. Identical Y1, Y2 Amplifiers D.C. to 9 Mc/s. Sensitivity 3mV/CM to 100 V/CM. Time base 10µ/sec. to 10 M/secs. Calibrator. X amplifier D.C. to 2·5 Mc/s. Z Modulation. 110/200/250V. A.C. Supplied in good working order. £65, carriage £2, or available as received from Ministry unserviced. £50. Carriage £2. (Handbooks £2 extra.)

AVO CT.38 ELECTRONIC MULTIMETERS

High quality 97 range instrument which measures A.C. and D.C. Voltage. Current, Resistance and Power output. Ranges D.C. volts 250mV-10,000 v. (10 megΩ-110mgΩ input). D.C. current 10µA 25 amps. Ohms: 0-1,000 megΩ. A.C. volt 100 mV-250V. (with R.F. measuring head up to 250 Mc/s). A.C. current 10µA-25 amps. Power output 50 micro-watts-5 watts. Operation 0/110/200/250v. C. Supplied in perfect condition complete with circuit lead and R.F. probe £25. Carr. 15/-.

MARCONI TEST EQUIPMENT

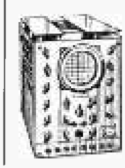


Ex-Military reconditioned. **T.F. 144G Standard Signal Generators.** 85 Kc/s–25 Mc/s, £25. Carr. 30/-. **T.F. 885 Video Oscillator.** 0–5 Mc/s. £45. Carr. 30/-. **T.F. 195M. Beat Frequency Oscillator.** 0–40 Kc/s, 200/250 v. A.C. £20. Carr. 30/-. All above offered in excellent condition fully tested and checked.
T.F. 1100 Valve Voltmeter. Brand new, £50. **T.F. 1267 Transmission Test Set.** Brand new, £75.

AM/FM SIGNAL GENERATORS

Oscillator Test No. 2. A high quality precision instrument made for the ministry by Airmec. Frequency coverage 20–80 Mc/s. AM/C.W./FM. Incorporates precision dial, level meter, precision attenuator 1 µV–100mV. Operation from 12 volt D.C. or 0/110/200/250 volt A.C. Size 12×8½×9in. Supplied in brand new condition complete with all connectors fully tested. £45. Carr. 20/-.

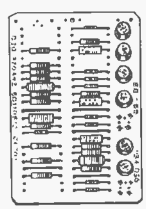
TYPE 13A DOUBLE BEAM OSCILLOSCOPES



An excellent general purpose D/B oscilloscope. T.B. 2cps–750 Kc/s. Bandwith 5·5 Mc/s. Sensitivity 33MV/CM. Operating voltage 0/110/200/250V. A.C. Supplied in excellent working condition. £22.10.0. Or complete with all accessories, probe, leads, lid, etc. £25. Carriage 30/-.

Variable Voltage TRANSFORMERS

Brand new, guaranteed and carriage paid.
High quality construction. Input 230V. 50–60 cycles.
Output full variable from 0–260 volts. Bulk quantities available.
1 amp.—£5.10.0; 2·5 amp.—£6.15.0; 5 amp.—£9.15.0;
8 amp.—£14.10.0; 10 amp.—£18.10.0; 12 amp.—£21.0.0;
20 amp.—£37.0.0.



PRINTED CIRCUITS

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

AVOMETERS

Supplied in excellent condition, fully tested and checked. Complete with prods, leads and instructions.

Model 47A £9.19.6.
Model 7 £13.10.0
Model 8 £18.
P. & P. 7/6 each.

TE22 SINE SQUARE WAVE AUDIO GENERATORS

Sine: 20c/s to 200 Kc/s on 4 bands. Square: 20c/s to 30Kc/s. Output impedance 5,000 ohms, 200/250V A.C. Supplied brand and new guaranteed with instruction manual and leads, £15. Carr. 7/6.

DUBILIER NITROGEL CONDENSERS

Brand new. 8 mfd. 800V. 8/6. P. & P. 2/-; 2 mFd. 5,000 V., 42/6. P. & P. 5/-.

LUCAS 20/0/20 AMMETERS

Brand new boxed. Suitable car-motorcycle. 12/6. P. & P. 2/-.

LELAND MODEL 27 BEAT FREQUENCY OSCILLATORS

0–25 Kc/s. Output 5K or 500 ohms. 200/250 V. A.C. offered in excellent condition. £12.10.0. Carriage 10/-.

SOLARTRON MONITOR OSCILLOSCOPE TYPE 101

An extremely high quality oscilloscope with time base of 10Q/sec. to 20 m/sec. Internal Y amplifier. Separate mains power supply 200/250V. Supplied in excellent condition with cables, probe, etc., as received from Ministry. £8.19.6. Carriage 30/-.

R.C.A. AR88 SPEAKERS

8in. 3 ohm speakers in metal case. Black crackle finish to match our 88 Receivers. Available brand new and boxed with leads. 59/6. Carr. 7/6.

HANSEN SWR BRIDGES

52 ohm 69/6 P. & P. 3/6

G. W. SMITH & CO (RADIO) LTD.
3-34 Lisle St., W.C.2
Also see oppos. page

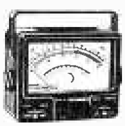
MULTIMETERS *for EVERY purpose!*

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. 0/10μA/6/60/300MA/12 Amp. 0/2K/200K/2M/200MΩ. —20 to +17 dB. **£12.10.0.** P. & P. 3/6.

MODEL TE-10A. 200kΩ/Volt 5/25/50/250/500/2,500 v. D.C. 10/50/100/500/1,000 v. A.C. 0/50μA/2·5 mA/250 mA D.C. 0/6K/6 meg. ohm. —20 to +22dB. 10·0,100 mFd. 0·100-0·1 mFd. **69/6.** P. & P. 2/6.

MODEL TE-70. 30,000 O.P.V. 0/3/15/60/300/600/1,200 v. D.C. 0/6/30/120/600/1,200 v. A.C. 0/30μA/3/30/300mA. 0/16K/160K/1·6M/16 Meg. Ω. **£5.10.0.** P. & P. 3/-.

MODEL 250J. 2,000 O.P.V. 0/10/50/500/2,500 v. D.C. 0/10/50/500/2,500 v. A.C. 0/2 Meg. Ω. 0/250 mA. —20 to +36 dB. **49/6.** P. & P 2/6



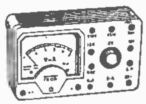
LAFAYETTE 57 Range Super 50kΩ/volt Multimeter. D.C. volts 125mV -1000V. A.C. volts 1·5V -1000V. D.C. current 25μA-10 amp. Ohms 0-10 megΩ. dB —20 to +81dB. Overload protection. **£12.10.0.** Carr. 3/6.

NEW MODEL 500 30,000 O.P.V. with overload protection, mirror scale 0/·5/2·5/10/25/100/250/500/1,000 v D.C. 0/2·5/10/25/100/250/500/1,000 v. A.C. 0/50μA/5/50/500 mA. 12 amp. D.C. 0/60/K6. Meg./60. Meg. Ω. **£8.17.6.** Post paid.

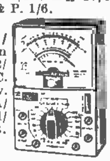
MODEL TE-12 20,000 OPV 0/0·6/6/30/120/600/1,200/3,000/6,000 V. D.C. 0/6/30/120/600/1,200 V. A.C. 0/60μA/6/60/600mA. 0/6/K/600K/6 Meg./60. Meg. Ω50 pF. 0·2 mFd. **£5.19.6.** P. & P. 3/6.

MODEL TE.80. 20,000 O.P.V. 0/10/50/100/500/1,000 v. A.C. 0/5/25/50/250/500/1,000 v. D.C. 0-50Ω A, 5/50/500mA. 0/6K/60K/600K/6 meg. **£4.17.6.** P.P. 3/-.

TE-51. NEW 20,000Ω/VOLT MULTIMETER. with overload protection and mirror scale. 0/6/60/120, 1,200 v. A.C. 0/3/30/60/300/600/3,000v. D.C. 0/60μA/12/300mA. D.C. 0/60K/6 meg. ohm. **85/-.** P. & P. 2/6.



MODEL PT-34, 1,000 O.P.V. 0/10/50/250/500/1,000 v. A.C. and D.C. 0/1/100/500 mA. D.C. 0/100 KΩ **39/6.** P. & P. 1/6.

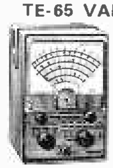


MODEL AF-105. 50kΩ/Volt. Mirror scale, built-in meter protection. 0/·3/3/12/60/120/300/600/1,200v. D.C. 0/6/30/120/300/600/1,200 v. A.C. 0/30μA/6/60/300mA/12 Amp. 0/10K/1M/10M/100 MΩ. —20 to +17 dB. **£8.10.0.** P. & P. 3/6.

MODEL ZQM TRANSISTOR CHECKER

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

TE-65 VALVE VOLTMETER

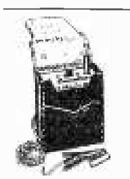


High quality instrument with 28 ranges. D.C. volts 1·5-1,500 v. A.C. volts 1·5-1,500 v. Resistance up to 1,000 megohms. 220/240 v. A.C. operation. Complete with probe and instructions **£17.10.0.** P. & P. 6/-. Additional Probes available: R.F. **35/-.** H.V. **42/6.**

HOSIDEN DH04S 2.WAY STEREO HEADPHONES

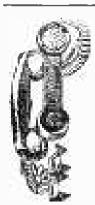
Each headphone contains a 2½in. woofer and a ¾in. tweeter. Built in individual level controls. 25-18,000 c.p.s. 8Ω imp. with cable and stereo plug.
£5.19.6. P. & P. 2/6.

F.M. WIRELESS MICROPHONES



94-104Mc/s. Transistorised. Operate from 9V battery. Complete with additional secret tie-clip microphone. List £12.10.0. ONLY **£6.15.0.** P. & P. 2/6.
These cannot be operated in U.K.

TRANSISTORISED TWO-WAY TELEPHONE INTERCOM



Operative over amazingly long distances. Separate call and press to talk buttons, 2-wire connection. 1000's of applications. Beautifully finished in ebony. Supplied complete with batteries and wall brackets.
£6.19.6. P. & P. 3/6.

GARRARD DECKS

Brand New and Guaranteed.

1025 with cartridge	£7.10.0
A70 Mk II less cartridge	£12.12.0
LAB 80 Mk II less cartridge	£23.10.0
LAB 80 Mk II with base	£27.10.0
401 Transcription less cartridge	£27.6.0

Carriage 7/6.

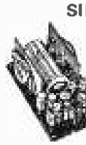
2-WAY RADIOS

Super quality. Brand new and guaranteed.

3 transistor	£6.15.0 pr.
4 transistor	£6.19.6 pr.
5 transistor	£7.19.6 pr.
6 transistor	£8.12.6 pr.
6 transistor De Luxe	£12.10.0 pr.
10 transistor	£22.10.0 pr.
13 transistor 500 mW	£31.10.0 pr.

Post extra. *These cannot be operated in U.K.*

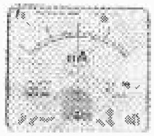
SINCLAIR EQUIPMENT



Z12 12 watt amplifier, 89/6
PZ4 Power Supply Unit 89/6
Stereo 25 Preamp., £9.19.6
Q14 Speakers. £7.19.6
Micromatic Radio Kit. 49/6. Built 59/6
Micro FM Radio Kit £5.19.6
ALL POST PAID

SPECIAL OFFER
2 Z12 Amps., PZ4 Power Supply. Stereo 25 Preamplifier, **£22,** or with two Q14 speakers **£37.**

CLEAR PLASTIC PANEL METERS

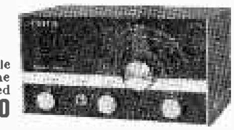


First grade quality Moving Coil panel meters available ex-stock. S.A.E. for illustrated leaflet. Discounts for quantity. Type MR 38P, 1..in. square fronts.

50μA	37/6
50-0-50μA	35/-
100μA	35/-
100-0-100μA	32/6
200μA	32/6
500μA	37/6
500-0-500μA	25/-
1mA	25/-
1-0-1mA	25/-
2mA	25/-
5mA	25/-
10mA	25/-
750mA	25/-
1 amp	25/-
2 amp	25/-
5 amp	25/-
20mA	25/-
50mA	25/-
100mA	25/-
150mA	25/-
200mA	25/-
300mA	25/-
500mA	25/-
3V. D.C.	25/-
10V. D.C.	25/-
20V. D.C.	25/-
50V. D.C.	25/-
100V. D.C.	25/-
150V. D.C.	25/-
300V. D.C.	25/-
500V. D.C.	25/-
750V. D.C.	25/-
15V. A.C.	25/-
50V. A.C.	25/-
150V. A.C.	25/-
300V. A.C.	25/-
500V. A.C.	25/-
S meter 1mA	29/6
VU meter	38/6

Post Extra. Larger sizes available—send for lists.

UNR-30. 4-BAND COMMUNICATION RECEIVER

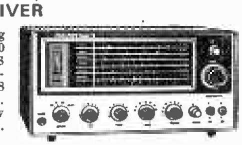


Covering 550 Kc/s–30 Mc/s. Incorporates variable BFO for CW/SSB reception. Built in speaker and phone jack. Metal cabinet. Operation 220/240V. A.C. Supplied brand new, guaranteed with instructions. Carr. 7/6. **£12.10.0**

LAFAYETTE MODEL HA-700 AM/CW/SSB AMATEUR COMMUNICATION RECEIVER

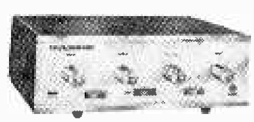
8 Valves, 5 bands incorporating 2 MECHANICAL FILTERS for exceptional selectivity and sensitivity. Frequency coverage on 5 bands 150–400 Kc/s, 550/1,600 Kc/s, 1·6–4·0 Mc/s, 4·8–14·5 Mc/s, 10·5–30 Mc/s. Circuit incorporates R.F. stage, aerial trimmer, noise limiter, B.F.O. product detector, electrical bandspread, S meter, slide rule dial. Output for phones, low to 2kΩ or speaker 4 or 8Ω. Operation 220/240V A.C. Size 7¼ × 15 × 10in. Supplied brand new and guaranteed with handbook. **36 GNS.** Carr. 10/-. S.A.E. for leaflet.

LAFAYETTE MODEL HA-500 SSB/AM/CW 80 THROUGH 6 METRE RECEIVER



New outstanding Ham Bands only receiver covering the 80/40/20/15/10/6 metre bands. Incorporates 10 valves, product detector, two mechanical filters, S Meter, dual conversion on all bands, crystal calibrator, B.F.O. noise limiter, aerial trimmer, I.F.s. 2,608 Mc/s and 455 Kc/s. Output 8 ohms and 500 ohms. Operations 220/240 volts A.C. Supplied brand new and guaranteed with handbook **42 Gns.** Carr. 10/-. 100 Kc/s. crystal, **35/-.**

LAFAYETTE LA-224T TRANSISTOR STEREO AMPLIFIER



19 transistors, 8 diodes, IHF music power, 30W at 8Ω. Response 30–20,000 ±2dB at 1W. Distortion 1% or less. Inputs 3mV and 250mV. Output 3–16Ω. Separate L. and R. volume controls. Treble and bass control. Stereo phone jack. Brushed aluminium, gold anodised extruded front panel with complementary metal case. Size 10¼ × 3 9/16 × 7 13/16in. Operation 115/230V A.V. **£25.** Carr. 7/6.

★ TRANSISTORISED FM TUNER ★

6 TRANSISTOR HIGH QUALITY TUNER, SIZE ONLY 6 × 4 × 2½in. 3 I.F stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9V battery. Coverage 88–108Mc/s. Ready built ready for use. Fantastic value for money. **£6.7.6.** P. & P. 2/6.
Stereo multiflex adaptors **5 gns.**

AMERICAN TAPE

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

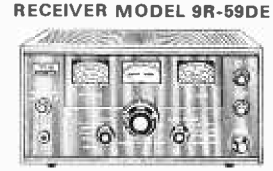
3in., 225ft. L.P. acetate	3/6
3¼in. 600ft. T.P. mylar	10/-
5in. 600ft. std. plastic	8/6
5in. 900ft. L.P. acetate	10/-
5in. 1,200ft. D.P. mylar	15/-
5in. 1,800ft. T.P. mylar	32/6
5¾in. 1,200ft. L.P. acetate	12/6
5¾in. 1,200ft. L.P. mylar	16/-
5¾in 1,800ft. D.P. mylar	22/6
5¾in. 2,400ft. T.P. mylar	39/6
7in. 1,200ft. std. acetate	12/6
7in. 1,800ft. L.P. acetate	15/-
7in. 1,800ft. mylar	20/-
7in. 2,400ft. D.P. mylar	25/-
7in. 3,600ft. T.P. mylar	45/-

Postage 2/-. Over £3 post paid.

COSSOR DOUBLE BEAM OSCILLOSCOPES

TYPE 1035 General purpose A.C. coupled. **TYPE 1049** L.F., D.C. coupled, **£35** each. Carr. 30/-.

TRIO COMMUNICATION RECEIVER MODEL 9R-59DE



4 band receiver covering 550 Kc/s to 30 Mc/s. continuous and electrical bandspread on 10, 15, 20, 40 and 80 metres. 8 valve plus 7 diode circuit. 4/8 ohm output and phone jack. SSB-CW ● ANL ● Variable BFO ● S meter. ● Sep. bandspread dial. ● IF 455 Kc/s. ● Audio output 1·5 W. ● Variable RF and AF gain controls. 115/250V. A.C. Mains. Beautifully designed. Size: 7 × 15 × 10in. With instruction manual and service data **£37.10.0.** Carriage 12/6.

MAGNAVOX 363 3-SPEED TAPE DECKS

4-track, **£13.10.0.** Carriage extra.

RECORDING HEADS

Reuter ½-track. As fitted to Collaro Mk. IV and Studio Decks. High imp. record play back, low imp. erase. Brand new. 19/6 pair. Miniflux ¼ track, set of 3 29/6. Cosmocord with mounting plate:

TR1-500/P/W record/replay	65/-
TR1-120/P/W record/replay	65/-
TEL1-6P/W erase	20/-

Post extra.

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Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
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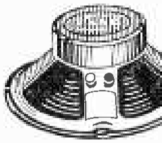
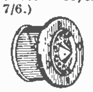
UNREPEATABLE BARGAINS!



FANE 122/17. 12in. in 25 WATT HEAVY DUTY HI-FI LOUDSPEAKERS. With high efficiency Antistropic Ferrite magnet. 17,000 gauss. Imp. 3-5 ohms. Brand new and guaranteed. List Price £12. **LIND-AIR PRICE £8.19.6.** P. & P. 5/6.

E.M.I. COMBINATION LOUD SPEAKERS. 13¼ x 8½in. Elliptical with 3¼in. dia. Tweeter. Imp. 8 ohms. Power handling 10 watts. Brand new and guaranteed. List price £8.5.0. **LIND-AIR PRICE 99/6.** P. & P. 7/6. (Also available without tweeter **59/6.** P. & P. 7/6.)



FANE 301 3in. TWEETERS Imp. 3-5 ohms. 17,000 gauss. 12 watt. Brand new and guaranteed. List price £3.15.0. **LIND-AIR PRICE 59/6.** P. & P. 3/6.

GOODMANS SPEAKER BARGAINS! 5in. 3 ohm, **15/6**; 6in. 3 ohm, **29/6**; 8in. 3 ohm, **32/6**; 10in. 5 ohm, **65/-**; 10in. x 6in. 3 ohm, **32/6**, Tweeter, **19/6.** P. & P. 3/6 per Speaker.

STEREO HEADPHONES

Enjoy Stereo Sound as you have never heard it before. **MODEL TTC. G1111** as illustrated. Soft padded earphones. Adjustable headband. Impedance 8 ohms per phone. Frequency range 25-13,000c.p.s. With 5ft. lead. Price **69/6.** P. & P. 4/6. Other similar types available. **AKAI ASE8S.** 8 ohms, **£7.10.0. CORAL E102** 16 ohms, **£4.19.6. EAGLE SE1** 16 ohms, **84/-.** T.T.C. Stethoscope 8 ohms, **49/6.** P. & P. 4/6 each.

AUTO TRANSFORMERS

Input 0-200, 220, 240 V.
Output 110V.

50W	£1.7.6	1,000W	£9.9.0
75W	£1.17.0	1,500W	£15.15.0
100W	£2.5.0	2,000W	£18.10.0
150W	£2.15.0	3,000W	£25.10.0
200W	£3.5.0	4,000W	£34.18.0
300W	£4.5.0	0-30V, 1A	30/-
400W	£4.19.6	0-30V, ½A	17/9
500W	£5.9.6	0-30V, 2A	37/6
600W	£6.9.6	0-30V, 3A	42/-

Post extra

MAINS TRANSFORMERS

Input 200/250V 50c/s.

24V 3A	£2.12.6	24V 8A	£5.5.0
24V 5A	£3.15.0	24V 12A	£6.15.0

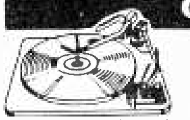
Post extra.
Mains and Output Transformer lists available on request.

EXTENSION TELEPHONES

ONLY **37/6**
P. & P. 5/-
Complete with lead, automatic dial numbered 1-10 and internal bell. Guaranteed perfect working order. Made by famous manufacturer to G.P.O. specification.

SEE OPPOSITE

GARRARD DECKS



TEAK FINISH PLINTHS with Perspex cover **6¼ gns.** (for LAB80 8¼ gns.). P. & P. 12/6. Agents for Thorens, Dual Goldring, etc.

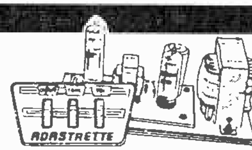
3000 with Sonotone 9TAHC Stereo Cartridge	£9.19.6
3000 with Sonotone 9TAHC Diamond Stereo Cartridge	£10.19.6
AT60 MK. II less cartridge	£13.19.6
AT60 MK. II with Decca Deram Stereo Cartridge	£18.14.0
SP.25 MK. II less cartridge	£11.19.6
SP.25 MK. II with Decca Deram Stereo Cartridge	£16.14.0
AP.75 less cartridge	£23.4.11
LAB.80 MK. II less cartridge	£24.19.6

All plus P. & P. 12/6.

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

2-3 WATT AMPLIFIER

An ideal basis for building your own portable record player. Just add speaker and turntable and you will have an above-average model for a mere fraction of the cost. 2-3 watt printed circuit with control panel on flying lead. ON, OFF, TONE CONTROL AND VOLUME, colourful escutcheon. Brimar valves: EZ80, ECL82 and composite installation booklet. PRICE **85/-** P. & P. 3/6



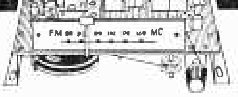
BARGAIN OFFER! FANTAVOX CASSETTE TAPE PLAYER

Specially designed to replay the well known and popular Musicassettes—prerecorded tape cassettes offering a wide choice of all types of music from pop to classical. Up to 40 minutes of quality reproduction through built-in speaker. Simple off/play and volume controls. Fully transistorised operating on 6 penlight batteries. Modern compact styling with earpiece socket and wrist strap. Size 6¼ x 4¼ x 2in.

LIND-AIR PRICE **£9.19.6** Carr., pkg. and Ins. 5/-

TRANSISTOR F.M. TUNER

SAVE £2.2.0!



6 Transistor FM tuner. Frequency range 88-108 Mc/s. Size 6 x 4 x 2½in. Ready built for use with most amplifiers, 9v battery operation. Complete with instructions. List Price 9 gns.

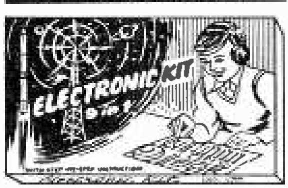
LIND-AIR PRICE **7 Gns.** P. & P. 4/-

MULTIPLEX ADAPTOR for above tuner giving Stereo Radio Reception **£5.19.6**

LINEAR AMPLIFIERS

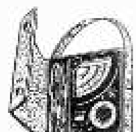
Latest A.C. Mains Models offering highest quality at modest cost.
LT66. All Transistor 12 watts Stereo. Inputs for Tuner, Gram., Mike, Separate Bass, Treble, Balance and Volume Controls. **£15.15.0.** Carr. 7/6. Teak case **£3.10.0** extra.
PTA 15 (as illus.). All Transistor, 15 watts Mono. Inputs for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

9 in 1 ELECTRONIC KIT

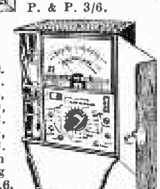


Build nine different projects from one basic kit—simple instructions, no technical knowledge required for you to build a Police Siren, Metronome, Morse Code Amplifier, Electronic Massager, W/T Transmitter, Radio Telephone, One-transistor Radio, Two-transistor Radio, Electronic Music Kit. Completely safe, operated on 9v. PP3 battery. Hours of fun for boys and dads of all ages. Complete with all parts and simple step by step instructions. **ONLY 69/6.** P. & P. 5/-.

MULTIMETERS



MODEL TTC.1001 20,000 O.P.V. with overload protection. D.C. Volts 5, 25, 125, 500, 2,500v. A.C. volts 10, 50, 250, 100v. D.C. MA 250mA-50A. With prods and carrying case. **ONLY £4.5.0.** P. & P. 3/6.

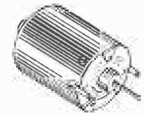


MODEL TTC.1030. 50,000 O.P.V. D.C. Volts, 0-3, 12, 60, 120, 300, 600, 1,200v. A.C. Volts, 6, 30, 120, 600, 1,200v. D.C. mA. 0-3-300. With prods and carrying case. **ONLY £11.19.6.** P. & P. 5/-.

MOTOR BARGAINS

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

6.3 D.C. Motor. 10,900 r.p.m. at 230mA. 1¼in. x 1in. diameter. Shaft ⅛in. long x 3/64in. diameter, **9/6.** P. & P. 2/6.

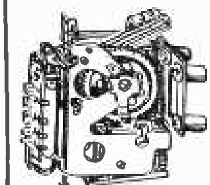


9v. D.C. Gram deck replacement motor. 2in. x 1⅜in. diameter. Shaft ½in. long x 3/32in., **17/6.** P. & P. 2/-. TWO FOR **30/-** P. & P. 2/6

SYNCHRONOUS CLOCK MOTORS

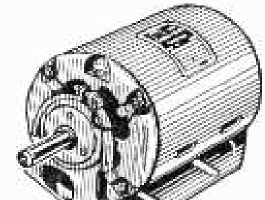
Geared for 40 revolutions per hour. 230v. 50 cycle, with mounting flanges. Size approximately 1⅝in. deep x 2¼in. diameter. **ONLY 22/6.** P. & P. 2/6.

SELECTOR DRIVE



Numerous applications. Electro magnet and brass tooth wheel. A switch wafer and contacts are coupled to this and arranged to be on for 10 pulses and off for 15. An Auxiliary contact is normally on but off 1 in every 25. Complete with suppressor, resistors, plus series contact for continuous operation. Ideal window displays, switching lamps, models, etc. 12v. or 24v. D.C. Brand new and boxed, **12/6.** P. & P. 2/6.

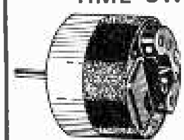
ELECTRIC MOTOR



FEW ONLY LEFT!

Made by Crompton Parkinson. Single phase ⅛th h.p. Motor 230/250v. 50 cycles. 1·3 amps. 1,425 r.p.m. Continuous rating. Spindle 1⅝ x ⅜in. dia. Overall size less spindle approx. 8 x 6in. Perfect condition. A bargain for the work bench. **ONLY 79/6.** Carr. 20/-.

DELAY ACTION TIME SWITCH



Made by Smiths. A.C. operation 200/250v. Double pole. Will give time delays from 0–10 minutes. Size 2¼in. dia. x 2¼in. long inc. ⅜in. x 3/16in. dia. spindle. **BARGAIN PRICE 17/6.** P. & P. 2/6.

PRACTICAL WIRELESS

VOL 44 No 3

issue 737

JULY 1968

TOPIC OF THE MONTH

What is "standard"?

WE often hear that commercial radio sets use "standard circuits". Superficially this may be true, but a study of current models will uncover many variations in style and design. It is really quite remarkable that six makers can come up with six different approaches to the design of, say, a seven transistor portable. Except in fundamental aspects, there is no such thing as a standard circuit outside the pages of a textbook.

This will become abundantly clear when called upon to service some of the offerings from the Orient and elsewhere and there is no circuit diagram available. Often it is necessary (and is a useful exercise anyway) to trace out the circuit from the chassis. The basic stages should be easily located and from then on it is simply a matter of patience to fill in the gaps.

This is one activity in which the amateur scores over the professional. A technician trying to earn his bread and butter (and maybe a little jam) usually has little time to probe around a strange circuit while he could be engaged on more profitable work. The amateur, on the other hand, is not too concerned with the time factor and is relatively free to indulge his curiosity. And he can also learn a good deal into the bargain, for no amount of textbook swatting will compensate for practical work on actual receivers.

Yet, purely practical work will not advance a constructor's knowledge unless he takes the trouble to work out not only what a circuit *is* but what it *does*, and *how*. He should find out why a certain component is placed in a particular part of the circuit and why it has a certain value or rating. He should also be interested in knowing what might happen if the component breaks down in any way.

So, next time you find yourself with an unfamiliar set to look over, think of it not as a chore but as an opportunity to expand your knowledge and expertise. Such activity should be part of any enthusiast's education!

W. N. STEVENS—*Editor.*

NEWS AND COMMENT

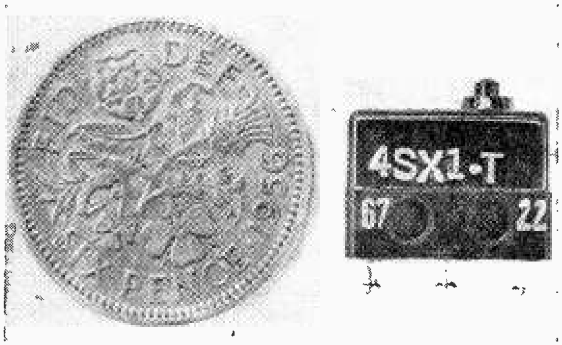
CONSTRUCTIONAL

OTHER FEATURES

AUGUST ISSUE WILL BE PUBLISHED ON JULY 5th

NEWS AND COMMENT...

MICRO-MICRO

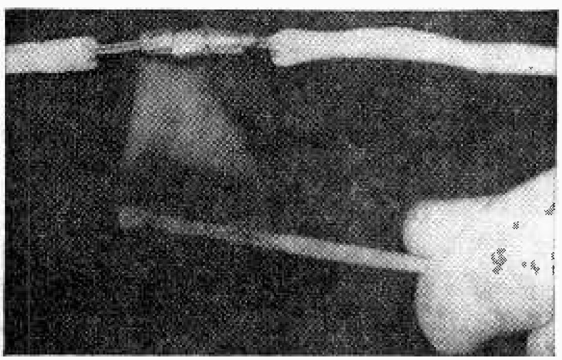


Yes, we know it's a photograph of a "tanner" but look at the little black thing next to the coin. This is a sub-subminiature micro switch and the makers, Honeywell, claim that this range is the smallest in the world. Certainly an indication of the way in which the discreet components are slowly shrinking to keep pace with the semiconductor miniaturisation programme. Statistics of our pin-up are: Operating Force—5oz. max.; Release Force—1oz. min.; Pretravel—0·020in. max.; Overtravel—0·004in. min.; Differential travel—0·005in. max.; Weight—1/28th of an ounce. Temperature range—minus 95°F. to plus 375°F. (Phew!).

The electrical ratings given on the spec. sheet are very comprehensive. The d.c. ratings: 30 volts at –7A resistive; 4A inductive (sea level); 2·5A inductive (50,000ft); 24A max. surge. For a.c.: 115/250 volts at 7A resistive and inductive; 20A surge.

The switch itself is a single-pole double-throw snap-action type. Further information from Honeywell Controls Ltd., Great West Road, Brentford, Middlesex.

HAR YER GOT A LIGHT BOY?



A new re-styled pack of their Match-Melting Multicore Tape Solder has been marketed by Multicore Solders Ltd. of Maylands Avenue, Hemel Hempstead, Herts. It is supplied in cut lengths sufficient for about 50 joints. This tape solder can be used without a soldering iron or extra flux, and can be applied with the aid of a match. The recommended retail price is 2s. 6d., matches extra—of course! Further details may be obtained from the manufacturers.

OH DEAR!

The gentlemen of Jodrell Bank, home of Britain's giant radio telescope, are unhappy. Signals are being received which just can't be explained and will not fit into any physical theory put forward so far. Until quite recently, the only spectral line known was that emanating from Hydrogen at around 21cms. Now, at frequencies in the 1,600Mc/s region from OH sources, come other spectral lines whose intensities don't coincide with what theory dictates.

The energy from these sources also appears to be polarised in various planes which again causes much frowning among radio astronomers. However, a recent set of measurements carried out in conjunction with American radio astronomers looks like proving fruitful. To date, the information from these experiments is still being carefully sifted and interpreted, but it could be that those giant concave steel eyes have already taken the first step to solve another of those mysteries of space. Some people have seriously suggested that the signals might be intelligible, but we are reserving judgement.

FERGUSON FUTURA II

The Futura II is Ferguson's first transistorised mains operated table radio. It preserves the low, long look and is styled in rosewood. For the size-conscious reader, the manufacturers confess to the following dimensions: $22\frac{1}{8} \times 9 \times 5\frac{5}{8}$in. including feet.

The controls all have spun aluminium caps with polished edges. The two large knobs are on/off and volume, and tuning, while the two smaller ones are bass and treble. Five push-buttons function for v.h.f., a.f.c., long, medium and short waves. Coverage on v.h.f.—87·5 to 108Mc/s, while long, medium and short waves are covered in three segments 1110-2020, 185-565 and 17-50 metres respectively.

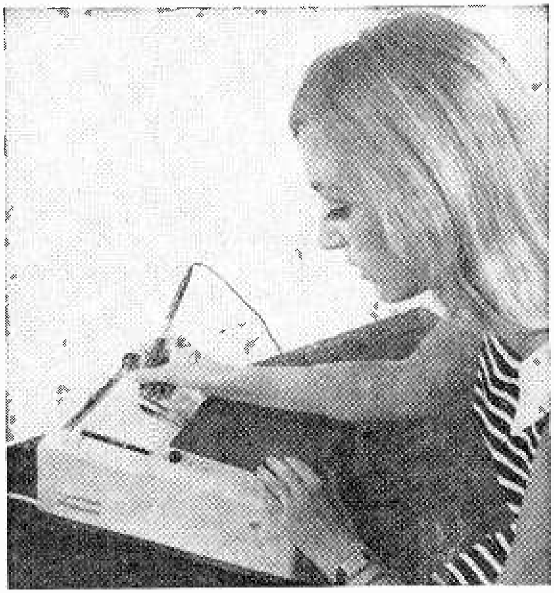
Sockets are provided for a.m. and f.m. external aerials although the set boasts its own internal 8in. ferrite rod for a.m. An internal f.m. aerial using the mains lead is also fitted and may be disconnected when an external aerial is used. Output from the 5 × 3in. 15Ω speaker is 1·5 watts (speech and music rating).

The Futura II requires 200-250V. a.c. 50c/s, 5 watts, has ten transistors and six diodes, and if you want one will cost you £41 10s. 0d.

Also from Ferguson is the Autotwin portable, suitable for home or car. A nine transistor circuit covers long and medium waves with 700mW output.

NEWS AND COMMENT...

THE ELECTROWRITER



This device enables one to send a drawing or sketch over the telephone or radio. One writes with a ball-point pen on regular paper as on a note pad, and as the pen is moved, the remote receiver(s) instantaneously and faithfully reproduces the copy as it is written. No extraneous power supplies are required since the instruments are fully transistorised and self-contained.

The electrowriter can be attached to a telephone system permitting alternate written messages and voice service. The device is an electro-mechanical pantograph giving the facility that one can write to other points by remote control. This is done by creating two frequencies transmitted down a pair of wires compositely, one of which is governed by horizontal movement and the other by vertical movement. This gives true analogue service unlike a teleprinter which relies on single pulses and is therefore a digital device.

The receiving unit has a mechanical response to a varying frequency on the line. The input is filtered in such a way that it splits the composite signal into two distinct frequencies each of which is then able to operate the vertical and horizontal pantograph motors, which in turn operates the pen. The action of the pen nib is achieved by frequency modulating one channel, which is then detected and converted to "pure" d.c. to operate a solenoid which, by mechanical linkages, causes the pen to touch the paper. This sequence of events is touched of at the transmitter by the operation of a gravity switch within the stylus and thereafter by a spring loaded plunger which operates the pen-down mechanism.

The receiving machine is inactive until a signal appears at its input, which operates a "squelch" relay which brings the whole device to life. Since both horizontal and vertical frequencies (1310-1490 and 2060-2340c/s) are within the voice bandwidth, whenever voice reception is possible this system will operate. You'll be able to send those circuits by telephone soon!

RADIO LEEDS

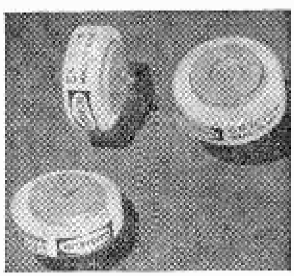
Construction is in progress on the transmitter building for BBC Radio Leeds which should be on the air this month. The building is in the grounds of Meanwood Park Hospital, about 3¼ miles north of the city.

The station will operate on v.h.f. 94·6Mc/s, horizontally polarised and will cover the whole of the city. The local programmes will be originated from the headquarters of BBC Radio Leeds at Merrion Centre. Reception is expected over an area bounded by Pudsey, Arthington, Scarcroft, Swillington and Lofthouse.

FLUID 101

"A transistor radio was completely immersed in water and obviously ceased to function. Afterwards it was sprayed with Fluid 101 and recommenced working within seconds". "An electric light bulb was connected with bare wires, immersed in water after spraying the wires with Fluid 101 and lit quite normally". This is what Special Products Distributors Limited claim for a can of Fluid 101, which costs 9s. 6d. for the 6oz. size. Almost worth getting a small can just to see—isn't it?

METHOD 101

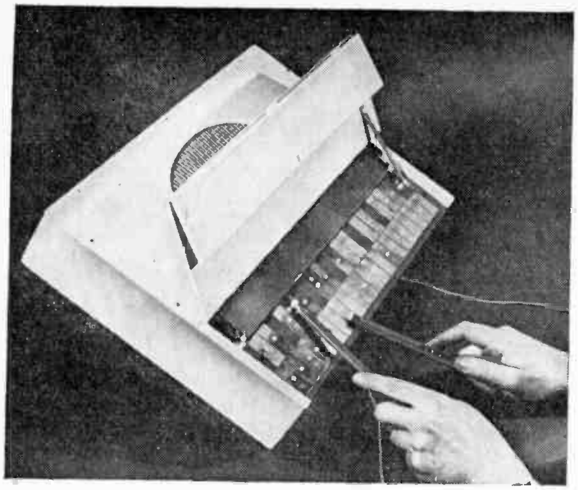


Have you ever wondered just how much testing goes on to ensure that your electronic components are reliable? Raytheon Company of Lexington, Massachusetts, really go the whole hog. If you were one of their new gold-plated precision spark gaps (for instance) you would have been subjected to the following shock test described as "method 205C": 15G's for 11ms; 18 impacts in three mutually perpendicular axes. Had enough? Well, there's still the vibration test—10 to 300c/s along each axis for 30 minutes, ambient temperature check from minus 55°C to plus 85°C and just to finish you off—salt spray testing "... in accordance with method 101".

The photograph shows three who made it—well done chaps! (Bet you readers are glad you're on the other end of the soldering iron).

BROADCASTING CONVENTION

The International Broadcasting Convention is to be held in London from 9 to 13 September, 1968, at the Grosvenor House Hotel, Park Lane. The Television Conference, already announced by the learned societies for 1968, is incorporated within this Convention at which a wide cross-section of the latest broadcasting equipment will be shown. Further information from E.E.A., Berkeley Square House, Berkeley Square, W.1. The Convention Secretariat address is to be: The International Broadcasting Convention, Savoy Place, Victoria Embankment, London, W.C.2.



G.W. HARDY'S

portable KEYLESS ORGAN

TRANSISTORS are used throughout this instrument, which is complete with power amplifier and loudspeaker. Despite its simplicity and low cost, the tone obtained is of great appeal, and compares with the solo voice of an expensive commercial electronic organ. Keys are not always easy to obtain, and then will need altering and adapting to the new instrument. The method used by the author in this instrument, is a series of small metal plates, arranged in the usual layout of standard keys, so that it is easy to recognise and select any required note.

Two wands terminating with a contact stud are needed, one for each hand. When the contact makes with any plate, the note generator starts oscillating at the previously tuned pitch of that note. Having two wands makes for smooth or legato playing. The switch on wand No. 2 disconnects the preamplifier, but a sound is still produced provided contact is still made with that plate, but slowly decays while capacitor C13 Fig. 2 discharges. For normal playing the switch is kept closed with the forefinger. The metal plates are kept very close to each other, so that the wand contact can freely glide from one to another.

Solo Organ Prototype

The system of tuning used in the new instrument was experimentally tried out in the author's prototype of the organ described in an article which appeared in the February, March and April 1965 issues* of P.W. Readers who have built this instrument will be interested to know that the new tuning method has proved very satisfactory while in constant use for a period of over 12 months. Constructors will only need to remove the tagstrip containing the tuning resistors, and subsitute the tuning device to be explained later in this article. The vibrato used in this new instrument is a true vibrato, which means that the frequency of the sound is modulated, and is obtained from a one transistor phase shift oscillator. Another toggle switch was fitted alongside the original vibrato switch, and room found inside the case to accommodate a PP3 9 volt battery. The battery positive is taken to the common positive, negative through the new on/off switch, and then to the oscillator panel. Output from the capacitor C5 (Fig. 1) is taken direct to base of Tr3 Fig. 1 (Feb 1965 issue).

The Note Generator

A multivibrator circuit (Fig. 1) has been used again, as it is very accommodating and easy to set up. What other oscillator will give over three octaves of musical notes while only changing one resistance! With the components' values given a range of three octaves will be comfortably covered, that is from C one octave above middle C and down three octaves to C in the bass, a most useful range. A limiting resistance, R7 should be altered if necessary so that top C will be in tune when the moving arm of the tuning control VR3 is at half travel. Do not use lower value than 10kΩ or Tr3 will pass excessive current, 15kΩ should be about right, a lower value will raise the pitch, and a higher one lower the pitch. Provision has been made in the layout of panel Fig. 2 for R7 to be experimentally tried out before finally soldering to the two tags provided.

Unless the constructor has another keyed instrument to give the pitch C (C above middle C on the piano), a tuning fork or pitch pipe becomes necessary. One can be purchased from any good music store and must be marked "C international or Standard Pitch". The vibrations are 523·25c/s.

Vibrato

In Fig. 1 will be seen the circuit for the phase shift oscillator. It is important to use a high gain transistor, in order to maintain oscillation. The OC72 used was to hand and works very well. An OC45 and white spot germanium transistor have been satisfactory. VR1 alters frequency slightly, and should it not cover the requisite range of 5 to 7c/s, R3, 6·8kΩ, can be varied slightly in value. In the layout two tags have been left for an experimental try-out. VR2 slightly alters depth of modulation, and should be placed about half-way when setting up. Both controls should be midget or skeleton preset types.

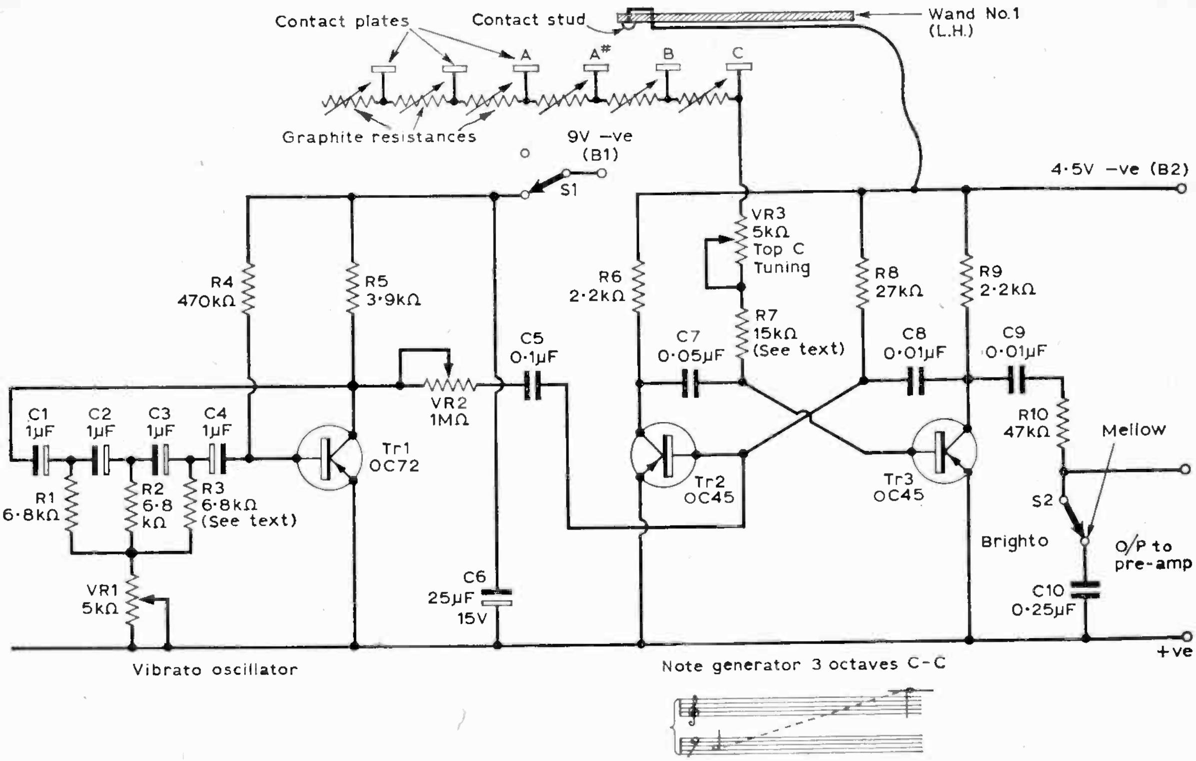


Fig. 1: Circuit of the vibrato (phase shift) oscillator with variable speed and depth control, and the three octave note generator.

The preamp Fig. 2 is a common emitter amplifier. The purpose of the 25Ω resistance R11, in series with the expression control VR4, is to prevent the sound being completely turned off, leaving it possible to play very softly. The sustain switch, S3, enables the sound to slowly decay, the duration being fixed by the capacity of C13. The 50μF specified is quite satisfactory, and gives some useful effects. R17 is to absorb make and break clicks.

The output stage has been designed around an AD140 transistor (cost about 10s.) instead of using the more conventional Class B push-pull amplifier, which has many more components and more complicated wiring. The main advantage of the latter is of course in the battery current economy. However, this is more of a consideration when used in a radio set, which might be on for long periods, in our case, the instrument would normally be used for shorter periods, and it is up to the player to make a habit of switching off at every opportunity after and between the intervals of playing. There is no warming up period to wait for when switching on again. The consumption is 40mA, and a 4½ volt flat torch battery will give good long service with care.

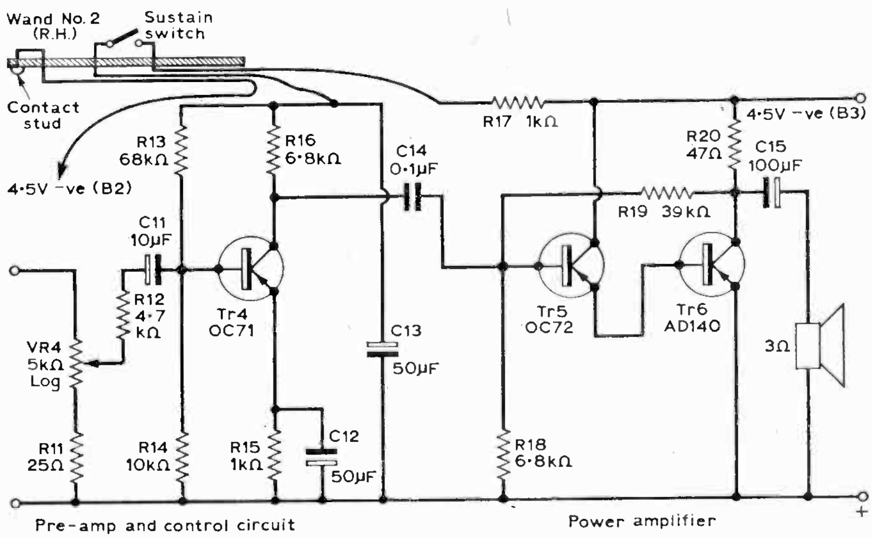


Fig. 2: Pre-amplifier and control circuit plus power output stage. VR4 is the expression (volume) control.

In the rather unusual output stage, the bias for the AD140 is derived from the driver emitter direct connection. The driver being a p-n-p transistor ensures correct polarity. Negative feedback is taken via R19 to the base of Tr5. This simple amplifier gives good quality musical output.

The contact plate board is made from a piece of exterior quality hardboard, which is oil hardened during manufacture and much harder than ordinary hardboard, but very little dearer. A suitable off-cut may be obtained from a shopfitter or builder. The size is 18 × 5½in. and is fitted with metal plates which form the "keys". At the rear of the board is a ⅜in. wide strip of the same hardboard, divided into 36 equal spaces. Each one, after treatment, will provide a variable resistance to tune each note, the soldering tags on the resistance strip are connected and wired through a small hole in the hardboard to the tag fixed by a screw to its respective plate. On the extreme right is a simple made up on/off switch, the arm of which, when moved to the left, makes contact with the countersunk head of a screw connected underneath with the top C screw. In the on position, top C will sound continuously, while the preset tuning control is adjusted into tune with a tuning fork or other reference.

Panel Wiring

Knowledgeable constructors will have their own ideas about wiring, but the method used by the author has proved straightforward, alterations are easily made, and components can be salvaged with useful lengths of lead-out wires intact. Assemble all the components and straighten out the wires, which are then cleaned bright. With a small tapering pair of pliers, place against the body of the component, so that a 1in. of wire is in the grip of the pliers, now with the component values shown uppermost, the wires are bent down at right angles. Cut a piece of cardboard same size as the panel and mark position of tags. With a pair of dividers measure off the distance apart of the right angle bends, and using the lay-out drawing as a guide, impress on the cardboard where the component will be fixed. When finished the cardboard can be laid upon the panel and the impressions marked through with a sharp awl, these holes are then drilled with a $\frac{1}{16}$in. drill.

After this, the wires are pushed through the holes and bent over towards each other, with the component held tightly on the panel. Wires are snipped off leaving a ¼in. stub, under which connecting wire is placed, and stub pressed down hard to grip ready for soldering. In some cases leads will be long enough to orientate and place under the wire of the component to which it is to be connected. Sleeving should be used as necessary, and transistors wired in last with their full length of lead-out wires. A ½-in length of tight fitting sleeving should be put on transistor base leads and pushed up as far as possible. This will assist in identification and prevent possible shorting of leads. The tip of each transistor wire is cleaned and tinned while being held in a pair of pliers.

The AD140 transistor is bolted down flat on to the panel, after making holes to take the stout base and emitter pins. The metal body is the collector, and when wiring up, terminate the lead to the collector with a soldering tag to fit on the bolt and tighten up with a nut. Observe the usual precautions when soldering transistor leads, and those of small electrolytic capacitors. Preparatory cleaning and tinning is a great help to good soldering. To assist in the external wiring to panels, it is recommended that they be marked with a sharp-pointed awl the legends as marked on Figs. 3 and 4. Correct battery markings are important.

★ components list

Resistors:

R1	6·8kΩ	R13	68kΩ
R2	6·8kΩ	R14	10kΩ
R3	6·8kΩ	R15	1kΩ
R4	470kΩ	R16	6·8kΩ
R5	3·9kΩ	R17	1kΩ
R6	2·2kΩ	R18	6·8kΩ
R7	15kΩ see text	R19	39kΩ
R8	27kΩ	R20	47Ω 1W
R9	2·2kΩ	VR1	5kΩ preset
R10	47kΩ	VR2	1MΩ preset
R11	25Ω	VR3	5kΩ preset
R12	4·7kΩ	VR4	5kΩ Log.

All ½ Watt except R20

Capacitors:

C1	1μF electrolytic
C2	1μF electrolytic
C3	1μF electrolytic
C4	1μF electrolytic
C5	0·1μF paper
C6	25μF electrolytic
C7	0·05μF paper
C8	0·01μF paper
C9	0·01μF paper
C10	0·25μF paper
C11	10μF electrolytic
C12	50μF electrolytic
C13	50μF electrolytic
C14	0·1μF paper
C15	100μF electrolytic

Electrolytics all 15 or 25V wkg.

Transistors:

Tr1	OC72
Tr2	OC45
Tr3	OC45
Tr4	OC71
Tr5	OC72
Tr6	AD140

Miscellaneous:

One double pole on/off switch; two toggle on/off switches; four 4½ Volt flat flash lamp batteries; hardboard (exterior) 1ft. 6in. × 6in.; phosphor bronze draught excluder strip; 6ft. length stainless steel ⅜in. wide (polished on one side); thirty-seven double ended tags; forty single ended tags; six ½in. wood screws for top fixing; forty ½in. 6BA round head bolts and nuts; thirty-seven ½in. 6BA cheese head bolts and nuts; ⅜in. and 1in. panel pins; Bostic No. 1 adhesive; L.S. covering material; carrying handle; plastic off-cut 1ft. 6in. × 3in.; 6ft. 6in. of ½in. square (ramin wood); 5ft. of ¼in. square (ramin wood); 4ft. of 3in. × ½in. wood; paxolin $\frac{1}{16}$in. thick for panels; sheet aluminium; 6in. of thin leather strap; thick felt 6in. × 1½in.; thin coloured felt 1ft. 6in. × 6in.; solder; connecting wire.

At this stage it may be as well to explain the type of soldering tags used by the author. Phosphor bronze draught excluder strip (Woolworths) is cut off into 6in. lengths—old scissors will do for this—then cut into strips $\frac{3}{16}$in. wide. Try out with a scrap piece of paxolin. Drill a $\frac{5}{16}$in. hole and thread one of the strips through until it jams tight. Bend each end down flat outwards. Place a small straight edge on

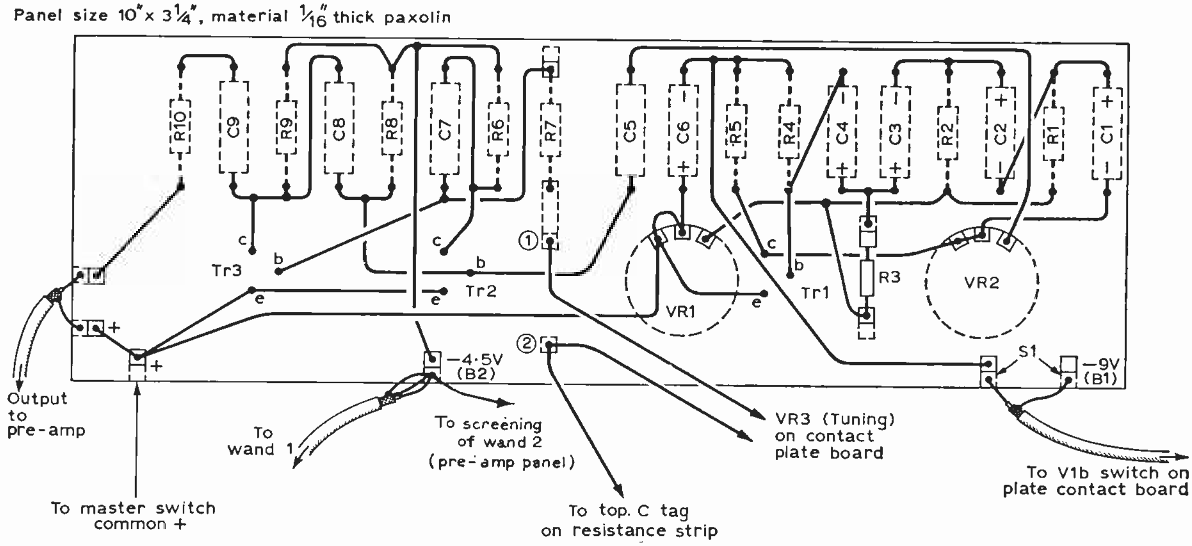


Fig. 3: Circuit board layout for the vibrato oscillator and note generator. All components are mounted on the reverse side, to the wiring.

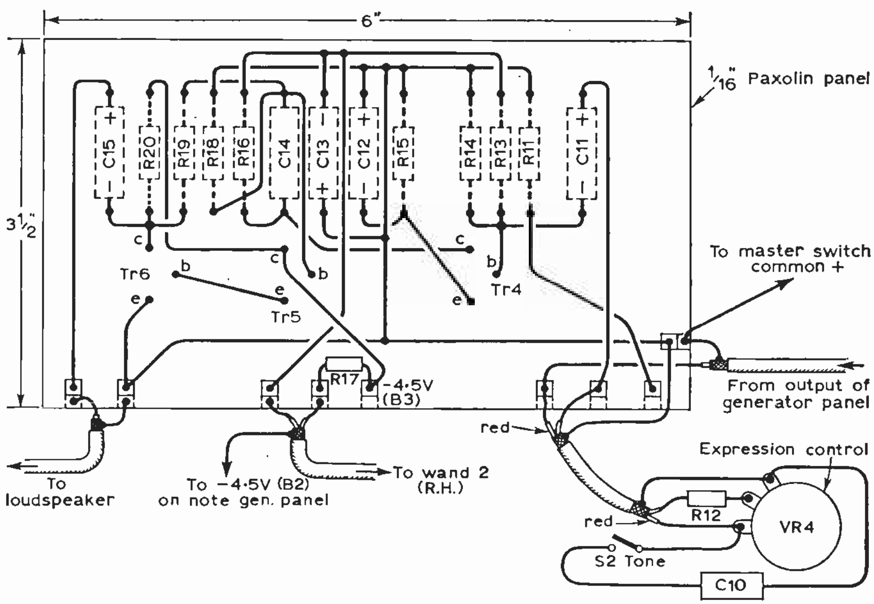


Fig. 4: Circuit board details of the pre-amplifier and output stage.

the strip over the hole ¼in. from the bend, and with a sharp penknife score across the metal, still holding the straight edge firmly down, bend the strip up and down a few times until the metal breaks, leaving a ¼in. tag. The same is done at the back of the panel. Tags will be mostly used on the edges of panels, in this case drill the hole so that there is a space ⅛in. left between the hole and the edge, bend outwards as before, this time using the panel as a straight edge, score and bend until the metal breaks clean in line with the panel edge. Deal with the other side as before. To use up strips which are slightly narrow, drill with a size smaller drill. With wider strip these are helped through the hole by using a wire file removed from its frame, broken pieces are ideal for this. File slightly each side where the strip will be inserted. These tags take solder delightfully easy, and with practice can be fixed quicker than ordinary tags. If desired the constructor can use the latter where indicated.

The contact plates are ¾ × 1½in. each and we require 37. First experiments were made with aluminium, but proved too soft. Bright polished copper was an improvement, but stainless steel was finally chosen, because it can be conveniently obtained in 6 foot lengths at the required ¾in. width (cost about 12s.) one length being sufficient. We only need to take care in cutting off 1½in. lengths, dead square. With a fine file clean off sawcuts, slightly radius the four corners, and slightly round the edges on the polished side. When finished, stack together and with the edges on the flat surface of a board see that they are reasonably square, none unduly proud. Remember that with 37 saw cuts something like 2½in. will be wasted, however there should still be several inches left if needed. Contrary to expectations the metal is not unduly hard to work. With the polished sides down, the plates should be laid down on a flat surface and protected with some newspaper. On the back of each plate mark two pencil lines diagonally from opposite corners, at the intersection, make a punch mark for drilling the centre hole to take the 6BA screws. After drilling, to cleanly finish the holes on the polished side use a countersunk bit or larger

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It seems that each year the Fi goes Hi-gher and Hi-gher, unfortunately so does the price! A criticism of audio enthusiasts was given by one cynic who defined them as "People who listen to the equipment and not the music". After a day at the Hotel Russell listening to a great number of both units and music the following items of interest were noted.

TUNERS AND AMPLIFIERS

Richard Allen displayed their *Class A Stereophonic Amplifiers*. These amplifiers use transistors in Class A and Richard Allen offer some pretty convincing literature that this is the way to real solid state hi-fi. Also on show, the *C41* control unit. As shown in the photograph, this is quite a sophisticated unit.

Braun have preserved their see-through covers, their new *Audio 250* stereo control unit being no exception. It is equipped with a *PS410* turntable, tuner which incorporates a stereo decoder, and an amplifier section. The improved pick-up arm is fitted with a vernier scale for correct stylus pressure adjustment and is equipped with a *M75-6* cartridge. The player has a fine speed control and a semi-automatic cueing device. There is also a tuner section for the reception of f.m., f.m. stereo, s.w., m.w., and l.w. broadcasts. Power output is given as 2 × 15 watts continuous rating with a frequency response of 30-30kc/s ± 0·5dB. Distortion below 0·5% at 2 × 12 watts is claimed. If you want one it'll cost you £284 17s. 4d.

Leak, a big name in hi-fi, showed "big brother" to their *Stereo 30*. The new *Stereo 70* is all solid state and makers give the output as 35 watts per channel (both channels sine wave driven), total harmonic distortion 0·1% for all power levels up to 25 watts r.m.s., response flat ± 1dB 30-20kc/s.

Philips offered an attractive system costing about £67 and consisting of a *GA228* record player, a *GH925* stereo amplifier providing six watts per channel, plus two *GL559* speaker enclosures ideal for shelf mounting as they stand less than a foot high.

Quad too are boasting all transistor circuitry. Their *Quad 33* control unit and *303* power amplifier were on show, the latter rated at 45 watts. Also on show, the *Quad FM Stereo Tuner* covering 87·5-108Mc/s.

J. Richardson Electronics Ltd. appeared for the first time at the Fair with their *MA135* and *MA200* giving 35 watts and 100 watts respectively for 0·25% distortion at 1kc/s in each case. These are valve amplifiers as is the *SA170* stereo amplifier which has the same quoted figures per channel as the other two. Frequency response ± 0·5dB 20-20kc/s.

Sansui showed four new units at the Fair. One, their *3000A* stereo tuner/amplifier, might accurately be described as the most beautifully styled audio bomb I have ever seen. Don't be taken in by the total harmonic distortion factor of less than 0·8% nor the ± 1·5dB response from 10-50kc/s. Neither should the 53 transistors and 46 diodes fool you. If you get one you will have a complete hi-fi set-up which will give a total of 130 watts. If this is too much, then try the *AU777* giving only 70 watts total with a total harmonic distortion factor of 0·1% and ± 1dB from 20-100kc/s. Prices 167gns. and 105gns. respectively.

TAPE RECORDERS AND DECKS

Last year in our Audio Fair report, we mentioned that possibly the most noticeable trend was towards the use of cassette loading machines. This year however there were not many of these units around and the accent seemed to be on the big, high-quality machines ("high quality" varies from maker to maker quite noticeably this year). It is also interesting to note that the British manufacturers were outnumbered by overseas competitors in the tape recorder market, with **Akai, Ampex, Oki, Sennheiser, Tandberg,** featuring strongly.

Akai exhibited their four-track stereo tape deck model *3000D* which utilises silicon transistor preamps, three head system and grained wood finish. The price is £105 11s. 4d. Also on the stand were tape deck model *X-150D*—a cross-field stereo silicon transistor preamp type with four-track stereo/mono recording and playback at £130 2s. 4d., and the *M9* stereo tape recorder—a replacement for the company's *M8* at the price of £195 3s. 5d.

Model *753* stereo four-track tape deck was shown on the **Ampex** stand as the firm's lowest priced recorder at 91gns. and **Brenell** introduced their *Mark 510 series 3* deck accommodating tape reels up to 10½in. diameter. **Bosch (Uher)** were showing their *Royal De-luxe* stereo tape recorder with two- and four-track facilities and 2 × 10W power output.

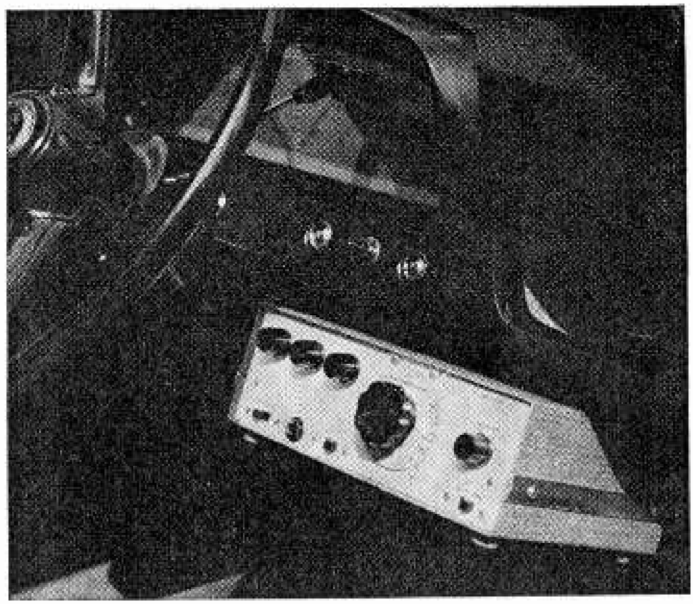
It was pleasant to see that **Ferrograph** have introduced a completely new generation of tape decks—the *Series 7*—which, the makers say, is a completely new design and incorporates features that a market survey showed users desired. This new unit is an all-silicon solid state model with field effect transistors used in the input stages. It can be vertically or horizontally mounted (this could be another trend) and unit construction provides for the mounting of three individual units—the amplifier complex, power supply unit and the actual deck itself. These are mounted on a separate frame which is easily removable from the cabinet. Three motors are used—no belt or pulleys to go wrong—there are three tape speeds, variable speed spooling,

—continued on page 212

A–Garrard SL95: B–Philips GH925: C–Richard Allen Class A Stereo: D–BSR UA75: E–Sansui 3000A: F–Bosch (Uher) Royal De-luxe: G–Ferrograph Series Seven: H–EMI Speaker Set Model "750": I–Philips PRO12: J–Sansui AU777

THE 'CLUBMAN'

J. THORNTON-LAWRENCE GW3JGA



continued from the June issue

THE Clubman Mk VI is a Car Radio version of the Mk IV, but the a.f. power output stage is housed in a separate small box, which may either be attached to the back of the receiver or mounted separately.

The Clubman Mk VI is connected to its output stage box by a multiway cable. This cable terminates, at the receiver, in a B9A plug which connects with a corresponding B9A valveholder socket (SK1) on the receiver back panel. See Fig. 39. The box may be disconnected at any time by removing the plug. A link plug may then be inserted into the socket to restore the receiver to normal operation from its internal 9 volt battery. The "box" requires a 12 volt d.c. supply from the car battery (which must have positive earth) and provides approximately 2 watts a.f. output to a 3 ohm loudspeaker.

Circuit Description

The circuit diagram is shown in Fig. 38. The 12 volt negative supply enters the box via the fuse, F1, and the terminal block. This supply then passes to the receiver through SK1 pin 2 and then to the on-off switch S1. This slide switch is a double pole type, of which one pole is already being used for the 9 volt internal battery supply. For the sake of clarity, this pole will be referred to as S1a. See Fig. 40. The remaining unused pole S1b is now used for the 12 volt supply, the input being connected from SK1 pin 2 to S1b tag 1. The 12 volt supply is returned to the box from S1b tag 2 to SK1 pin 3. The 12 volt negative supply provides current for the output stage transistors Tr10 and Tr11, and for the receiver.

A 9 volt supply is required for the receiver circuits

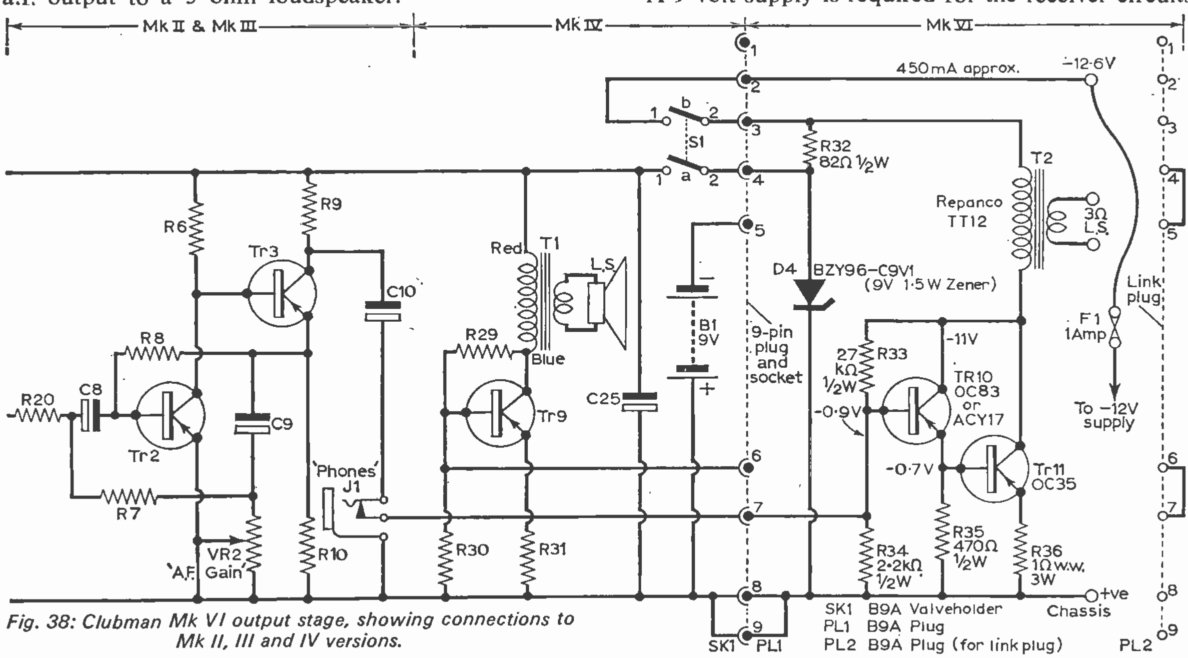


Fig. 38: Clubman Mk VI output stage, showing connections to Mk II, III and IV versions.

and this is provided by the voltage dropping resistor R32 and the zener diode D4. The zener diode regulates the 9 volt supply so that correct operation of the receiver is achieved over the normal variation of input voltages expected from a car battery system. The regulated 9 volt negative supply is taken to the receiver via SK1 pin 4 to the on-off switch S1a tag 2. The connection from the negative terminal of the 9 volt internal battery is now taken to SK1 pin 5. When the box is disconnected, a link plug, having pins 4 and 5 joined, may be inserted, thus restoring the 9 volt negative supply from the internal battery B1 to the receiver 9 volt negative line.

The output stage in the box consists of transistors Tr10 and Tr11 connected as a Darlington pair and operating in class A. The input to Tr10 is taken from the headphone closed-circuit jack socket J1, via SK1 pin 7. With the headphone jack plug removed a.f. signals from Tr3 collector are passed to Tr10 base via C10. Tr10 operates as an emitter follower, in that amplified a.f current signals are fed directly to Tr11 base. The combined collector currents of Tr10 and Tr11 pass through the primary of the output transformer T2. Amplified a.f. signal currents are passed through T2 to the external loudspeaker.

D.C. biasing of the Tr10 and Tr11 is provided by the potential divider R33 and R34, the emitter stabilising resistor, for the pair, is R36. Two forms of negative feedback are incorporated in the output stage to improve the quality of reproduction. Negative series

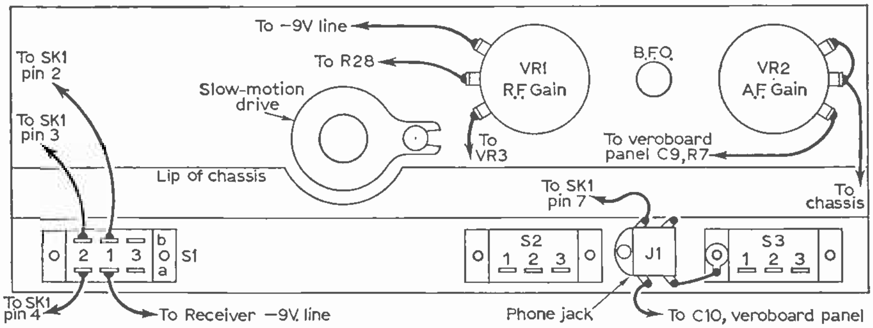


Fig. 40 (above left): Rear of front panel, showing connections to S1a, b and J1.

Fig. 39 (below): Rear panel showing position of SK1 and power output stage.

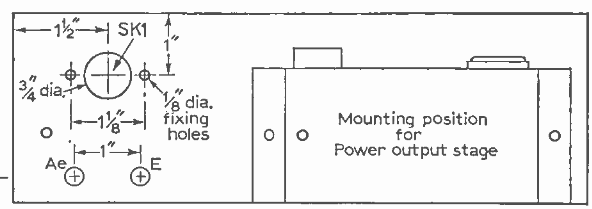
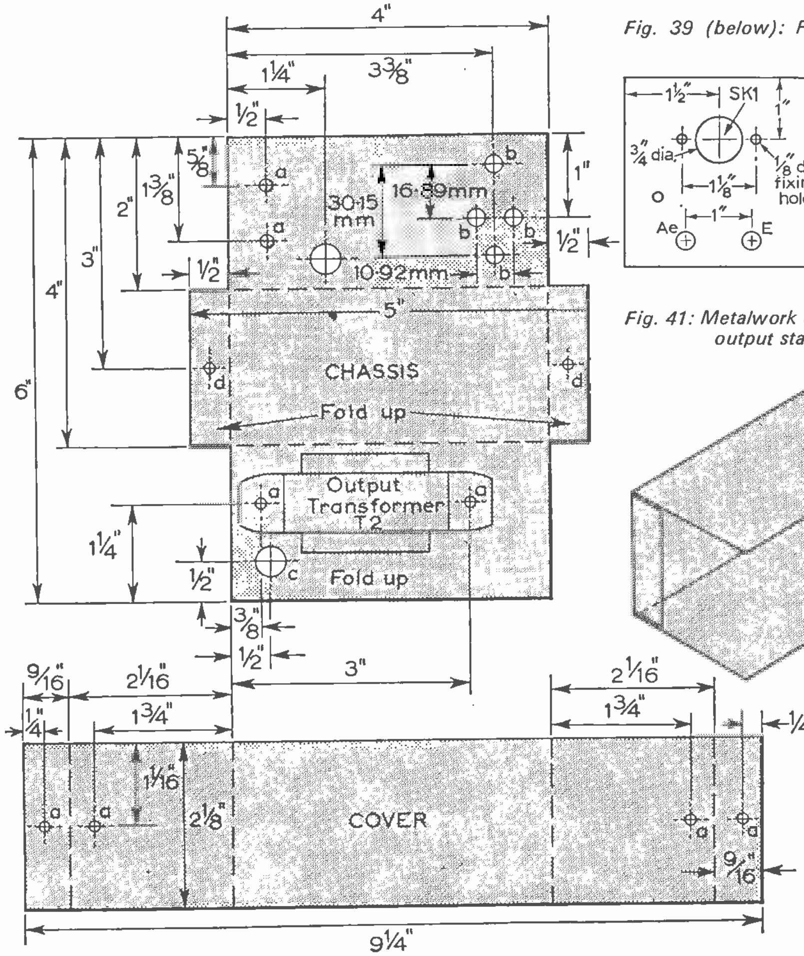
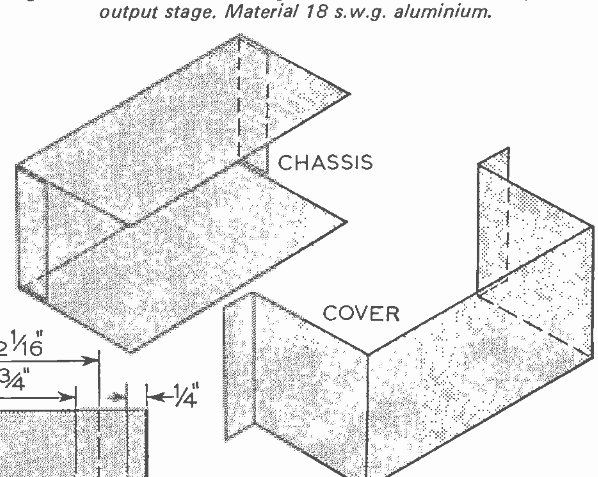


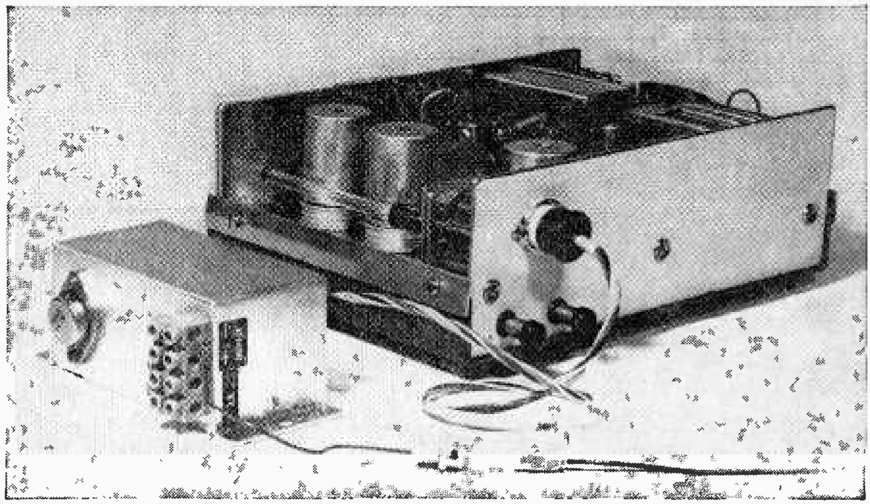
Fig. 41: Metalwork comprising chassis and cover for the power output stage. Material 18 s.w.g. aluminium.





DRILLING
a—⅛in. dia. b—¼in. dia.
c—⅜in. dia. d—$\frac{1}{16}$in. dia.

current feedback is provided by omitting the usual by-pass capacitor across R36, in this way the output signal current develops a signal voltage across R36 and this voltage is in phase and in series with the input signal. Negative shunt voltage feedback is provided by connecting R33 to the collectors of Tr10 and Tr11. The a.f. voltage across the primary of T2 produces an a.f. current through R33 and this is out of phase and in shunt with the input signal. If the receiver is disconnected from the box and the link plug inserted, a link from pin 7 to pin 6 reconnects the a.f. signal from J1 to the base of Tr9 and restores the normal operation of the internal loudspeaker output stage. Internal connections to SK1 are shown in Fig. 42.



View of receiver and power output stage (not mounted on rear panel).

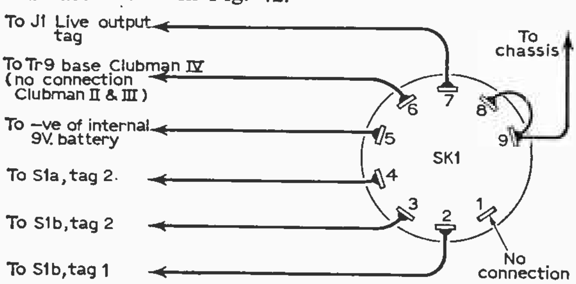
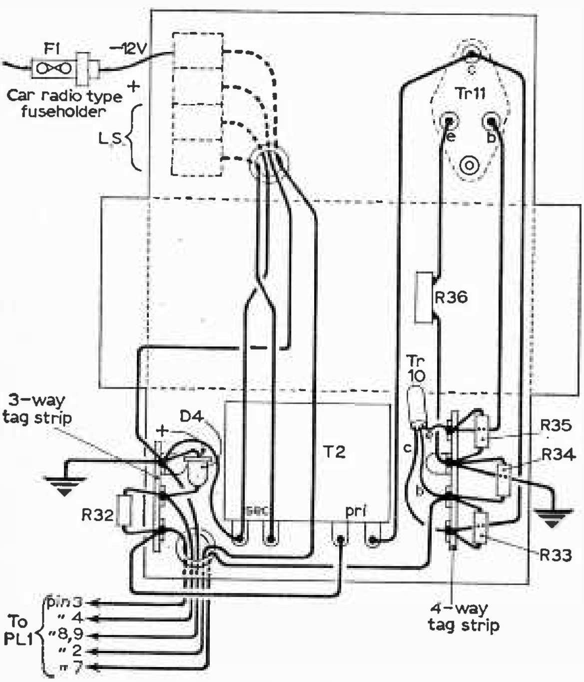


Fig. 42 (above): SK1 (B9A valveholder) viewed at tags.

Fig. 43 (below): Internal wiring of power output stage.



Construction

The complete a.f. power output stage and zener diode regulator are housed in an aluminium box, the construction of this is shown in Fig. 41. The box is made from 18 s.w.g. sheet aluminium. Providing usual care is taken with the bending no difficulties should be encountered. The chassis part of the box should be made first and the cover made afterwards so that a good fit can be obtained. If the chassis is printed 'in the flat", before bending, it is recommended that the cover fixing screw holes "d" should be left undrilled. When the complete box is assembled, the actual position of these holes can be marked through the holes in the cover and then drilled. The cover is held on with two 4BA self-threading screws fitted in these holes. The output transistor Tr11 (OC35) is mounted in the position shown using a mica washer and insulated fixing bushes. An excellent illustration of the method of mounting is shown on page 25 of the May 1968 issue of PRACTICAL WIRELESS. Before fixing the transistor great care should be taken to ensure that no swarf or burrs are present on the chassis as this may puncture the mica washer when the whole assembly is tightened up. The driver transistor Tr10 is mounted as shown in Fig. 43. The multiway cable is made up by twisting together the requisite number of different coloured stranded insulated wires. Screening of the cable was not found to be necessary.

Installation

The completed box may be mounted on the rear panel of the receiver using two self-threading screws, as shown in Fig. 39. Alternatively the box may be fixed to the car in some more convenient place. The interior of the engine compartment should be avoided because of the possible high temperature.

The standard type of car radio aerial will provide reasonable results for general listening. The inner of the coaxial cable should be connected to the aerial terminal and the outer to the earth terminal. For the very best possible performance over a narrow band it is desirable to use a loaded whip aerial resonant at the desired frequency. ■

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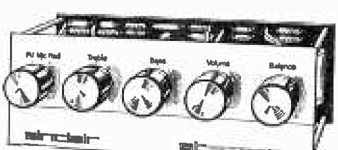
Eight special H.F. Transistors are used in this remarkable integrated twelve watt amplifier. Outstanding features are its great versatility, compactness, power and brilliant performance. The Z-12 is equally suitable for use as a true Hi-Fi amplifier, in an electric guitar, as a P.A. unit for car radio or in an intercom system. The inputs can be matched to all pick ups, microphones and radio tuners and detailed circuits for appropriate tone and volume controls are given in the manual supplied with every Z-12. Technical specification: Output: Class B, ultra linear, with generous negative feed-back. Output: 12 watts R.M.S. music power (30 watts peak). Frequency response: 15 to 50,000 c/s ± 1dB. Input sensitivity: 2mV into 2K ohms. Signal to noise ratio: better than 60dB. Output impedance: suitable for 3, 7·5 and 15 ohms speakers. (Two 3 ohms speakers may be used in parallel.) Power requirements: 6 to 20 volts D.C. or Sinclair PZ. 4 mains power supply unit which is available at 99/6 extra. Size 3 × 1⅞ × 1⅛in. Weight 3 ozs.

LASKY'S PRICE 89/6 FULLY BUILT. Post 3/-

STEREO 25

DE LUXE STEREO PRE-AMP AND CONTROL UNIT



A first class pre-amp and tone control unit is vital to the performance of any hi-fi system and particularly where a modern light-weight stereo pick up and high quality loud speakers are used. The Sinclair Stereo 25 has been designed to match the excellent characteristics of the Z.12 Controls: Bass lift/cut, treble lift/cut, volume, balance and input selection. Supplied ready built with full installation and operating manual. Front panel finished in brushed aluminium with black figuring. knobs in solid aluminium. The Stereo 25 is unusually compact and a delight to use. Technical spec.: Performance figures obtained from using Stereo 25, two Z.12's and a PZ.4 power supply unit. Sensitivity: for 10 watts into 1·5 ohm load per channel. Mic: 2mV into 50 K ohms. Pick up: 3mV in 50 K ohms. Radio: 20mV into 10 K ohms. Frequency response: (Mic and Radio) 20 c/s to 30 Kc/s ± 1dB to 100 Kc/s ± 3dB. RIAA equalisation for pick up. Size 6¼ × 2¼ × 2⅛ins.

LASKY'S PRICE £9.19.6 FULLY BUILT. Post 3/6

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Package "A"	Micro FM with Z.12 Amplifier	£9.9.0	Post 3/6
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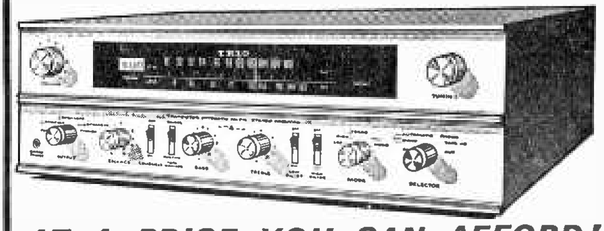
Package "C"	1—Stereo 25 pre-amp control unit. 2—Z.12 amplifiers. 1—PZ.4 power pack, 2—Sinclair Q14 speaker systems	£35.0.0	Post 10/-

SPECIAL INTEREST ITEMS!

TRIO Model TK-60BE

TRANSISTORISED AM/FM MULTIPLEX STEREO TUNER AMPLIFIER



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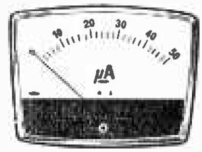
The 36 Transistor TRIO TK-60BE incorporates superb modern styling with many features normally found in models costing £££'s more. This great value for money Hi-Fi unit offers the following superb features: Tuner AM/FM 4-gang tuning condenser all transistor front end provides FM 2·5mV sensitivity. •Automatic FM/Stereo Mono mode silent switching circuit with Stereo signal beacon. •Illuminated pinpoint AM/FM tuning meter. •4 diode time division multiplexer de-coder giving 35dB channel separation. Amplifier. •All silicon transistor amplifier provides wide 20—50,000 Hz frequency response. •Exclusive blow-out free automatic circuit breaker for power transistor protection. •Speaker output terminals and power for 2 sets of stereo speakers—switch selected (A speakers, B speakers, A + B speakers, head phones). •Centre channel output. •Full range of controls. •Front panel stereo phone jack. •Direct tape monitor switch for tape monitoring without changing cable connections. •DIN connector for tape recorder. Brief spec.: Amplifier—Music Power 60 watts (IHF standard 4 ohms). Continuous power—20 watts per channel. Signal to noise ratio—Phono 60dB, Tape HD-60dB. Input sensitivity—Phono 2mV, Tape HD-2·5mV, AUX 150mV, Tape play 150mV. Speaker Impedance—4/16 ohms. Controls: Input selector, Mode, HF and LF filters, separate treble and bass controls for each channel, balance, loudness tape monitoring, output selector. Tuner: FM cover 88-108 Mc/s, AM cover 540-1600 Kc/s. FM Harmonic Distortion—0·6%. FM Signal to Noise Ratio—60dB. FM Selectivity—40dB. General: For 110/250V mains. Finish—brushed aluminium with hammer enamel case. Size 17¾ × 5¾ × 14in.

LASKY'S PRICE 69 Gns. Carriage FREE in U.K.

LASKY'S CLEAR PLASTIC PANEL METERS



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5in.	Long play, 900ft. Acetate	10 0
5in.	Standard play, 600ft. PVC	8 6
5in.	Triple play, 1800ft. Mylar	35 0
5¾in.	Double play, 1800ft. Mylar	22 6
5¾in.	Long play, 1200ft. Acetate	12 6
5¾in.	Standard play, 850ft. PVC	11 6
5¾in.	Long play, 1200ft. Mylar	15 0
5¾in.	Triple play, 2400ft. Mylar	45 0
7in.	Standard play, 1200ft. Acetate	12 6
7in.	Standard play, 1200 ft. Mylar	12 6
7in.	Long play, 1800ft. Mylar	19 6
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6X4	3/6	B729	12/6	ECL80	6/9	PCF800	11/6	U801	18/9	OC45	2/3
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Times GMT
Frequencies in kc/s

THE BROADCAST BANDS by CHRISTOPHER DANPURE

WITH the summer schedules now in the second month of operation and sunspots at their height of the 11-year cycle everyone is happy. In last month's issue I devoted the column to propagation and clearing up transmission queries. This month I will reverse that and only give the propagation predictions in details for N.E. Asia, S.E. Asia, Australia via Asia and S. America North of Amazon, so here we go.

Africa: Mornings and afternoons, 25 and 21Mc/s; evenings, 21, 17, 15 and 11Mc/s; night hours, 15, 11, 9, 7 and 6Mc/s.

N.E. Asia: 0400-1600, 17 and 15Mc/s; 1600-2200, 17, 15 and 11Mc/s; 2200-2400, 15 and 11Mc/s; 2400-0400, 15Mc/s only.

S.E. Asia: 0800-1200, 21 and 17Mc/s; 1200-1400, 21, 17 and 15Mc/s; 1400-1600, 21, 17, 15 and 11Mc/s; 1600-1800, 21, 17, 15, 11 and 9Mc/s; 1800-2000, 21, 17, 15, 11, 9, 7 and 6Mc/s; 2000-2200, 17, 15, 11, 9, 7 and 6Mc/s; 2200-2400, 17, 15, 11 and 9Mc/s; 2400-0200, 17, 15 and 11Mc/s; 0200-0600, 17 and 15Mc/s; 0600-0800, 21 and 17Mc/s.

Australia via Asia: 1000-1200, 21Mc/s only; 1200-1330, 17Mc/s only; 1330-1600, 15Mc/s; 1600-1800, 11Mc/s; 1800-2100, 11, 9 and 7Mc/s; 2100-2200, 15, 11 and 9 Mc/s; 2200-2400, 17, 15 and 11Mc/s; 2400-0200, 17 and 15Mc/s; 0200-1000. This circuit is closed for Broadcast Bands.

S. America (North of Amazon): 1200-2000, 21Mc/s; 2000-2200, 21, 17 and 15Mc/s; 2200-2400, 21, 17, 15 and 11Mc/s; 2400-0200, 17, 15, 11 and 9Mc/s; 0200-0400, 17, 15 and 11Mc/s; 0400-1000, 17 and 15Mc/s; 1000-1200, 17Mc/s only.

EUROPE

Holland: *R. Nederland* will operate the following schedule for its weekday English programmes, 0730-0820 on 11,730, 9,715 and 9,525; 1430-1520 on 21,480, 17,810 and 6,020; 1900-1950 on 11,730, 9,590 and 6,020; 2000-2050 on 11,730 and 6,020; 2100-2150 on 17,810 and 11,730; daily English relayed from Bonaire 2130-2220 on 15,220 and 0130-0220 on 9,590; special English programme relays on Tuesdays and Fridays only 1430-1445 on 21,540; 1530-1545 on 21,570 and 21,540; 1700-1715 on 21,570 and 21,540; 2035-2050 on 21,540 and 17,810. Weekday English news relays to the West Indies 1652-1704 on 21,505 and 21,480; 1900-1912 on 21,505 and 21,540; 2352-0004 on 17,750 and 11,945.

Happy Station programmes from Hilversum on Sundays only 0600-0720 on 9,715 and 6,020; 0730-0850 on 11,945 and 9,525; 1030-1150 on 11,730, 9,715 and 6,020; 1430-1550 on 21,480, 17,810 and 6,020; 1600-1720 on 21,570 and 11,730 only; 1900-2020 on 15,425 and 11,730; 2030-2150 on 21,540, 17,810 and 6,020; 2200-2320 on 21,540, 15,320 and 6,020. Dutch by radio lessons in English on Sundays only 0530-0550 on 11,730, 9,715, 9,525 and 6,020; 0730-0750 on 21,570, 21,480 and 6,020; 0800-0820 on 21,570, 21,480 and 6,020; 1600-1620 on 21,480, 17,810 and 6,020; 1700-1720 on 21,540, 21,505 and 6,020, the above schedule runs until September 1, 1968.

Norway: *R. Norway* now operates as follows until September 1 on Sundays and Monday mornings the last 30 minutes is in English. 0700-0830 on 25,730, 21,730, 17, 825, 17,755 and 15,175; 1100-1230 on 25,730, 21,730, 17,825, 17,755 and 7,240; 1300-1430 on 25,730, 21,730, 21,655 and 17,825; 1500-1630 on 25,730, 21,730, 21,655, 17,825 and 15,175; 1700-1830 on 25,730, 21,730, 21,655 and 17,825; 1900-2030 on 25,730, 21,730, 21,655, 17,825 and 15,175; 2100-2230 on 21,730, 21,655, 17,825 and 15,175; 2300-0030 on 21,730, 17,825, 15,345, 15,175 and 1,578; 0100-0230 on 15,345, 11,850, 11,735 and 1578; 0300-0430 on 21,730, 11,860, 11,850 and 11,735.

Switzerland: *The Swiss Shortwave Service* now transmits: 0700-0800 (weekdays only) on 9,535, 6,165 and 3,985 in English. Daily English transmissions now run: 0700-0800 on 11,775 and 9,590; 0845-0945 on 21,520 and 17,830; 1000-1100 on 21,520, 17,855 and 15,305; 1130-1230 on 11,865 and 9,665; 1315-1415 on 21,520, 17,845 and 15,305; 1500-1600 on 21,540, 17,830 and 15,305; 1815-1915 on 17,845 and 15,180; 1930-2030 on 11,865 and 9,665; 0130-0230 on 15,305, 11,715 and 9,535; 0445-0545 on 11,715 and 9,720.

AFRICA

Congo Democratic Republic: *R. Congo, Kinshasa* has been heard by M. Reed in Bournemouth, Hants on 15,245 starting at 2230 until after 0400.

South Africa: The All Night Internal Service of *Radio South Africa* is now on 3,250 and 2,376.

ASIA

Afghanistan: *R. Kabul* now transmits from 1730-1830 in German and English on 15,265 and 11,770 to Europe.

Cambodia: *R. Pnom Penh* has been heard with European Service on 17,710 from 0530-0800 but with extreme interference from Moscow also operating on 17,710, also beams to Europe from 1730-1800 on 15,255 but this is blotted out by *R. Nigeria,* Lagos, also on 15,255.

Ceylon: *R. Ceylon* has a daily overseas transmission to Europe from 0700-0800 on 17,815 in English, it has also been heard irregularly on 21,525.

India: *All India Radio* transmits to the UK and W. Europe from 1745-1945 on 11,620 and 7,215; 1945-2030 on 11,620, 9,912 and 7,215; 2030-2230 on 9,912 and 7,215.

Indonesia: *The Voice of Indonesia* has been heard with its programme in English beamed to Europe from 1900-2000 on the new frequency of 15,110.

THE AMATEUR BANDS by DAVID GIBSON, G3JDG

QUITE a good month on the six amateur bands, but 10 metres has been a little disappointing. One would have thought that openings and propagation would have been more consistent, bearing in mind the help this latter band is (or should) be getting from the sun.

The Pacific and S. America have been in frequent evidence on 20 metres and Oceana has featured prominently on 40 metres at times. The l.f. segments (160/80/40) have been rather more noisy than usual, while top band in particular has been an awful din, particularly after dark.

S. Herod reckons "peak" DX times are early mornings (0700-0830) and late night (2000-2400). Two reliable scribes query 4K2A—sounds like a new prefix for Dogger Bank! R. King relates that 5LZ was used by Liberian stations for two days, and Sweden is now issuing SK call signs. **P. Johnson** queries JX1RL and so do I. He says 7P8 is Lesotho and that Mexico (XE) is now 4A. I'm sure some countries' prefixes are taken from disused bus number plates.

160/80/40

J. Edwards (London, S.E.20), SX24, 137ft. end fed, discovered the following happily "at it" on 160—G3SVK/P, GI5DX, GM3OUU, GM3OXX, GM3TSL/P, GW3TSH, OK1AUJ, OL1AJM, OL6AIU OL7AB, PAØAHO. On 80 metres—ET3USA VE1IE, W1FJZ/P/KP4, W2PNB, ZC4MO, 3A2MJC, 4U1ITU. Forty metres—CM2DC, CN8CS, EA4JV, K3JH, PY2EGA, UA6KOE, VO1AK, WA1HXW, W2JA, 4X4QX.

J. East (Worcester), R1475 (I remember dropping one of those on my foot!), 67ft. end fed, snuffled on forty armed only with his trusty b.f.o. Captures included—K3YWJ, K3ZNV, K4RSH/MM, K5YSO, PJ5MM, PY7AUT, UA5KD, W4KET, W8KMQ, WA6POD, YN2JF, YV1BI, ZP3AB, 4A1CCW, 4U1ITU.

S. Herod (Suffolk), R109A, 40ft. end fed, also braved 40 metres and hooked—CN8AW, CN8CS, EA8BQ, EA8EX, FP8CY, PY7ARP, UA9KDL, UV9CQ, VK3ZL, ZC4RB, ZP3AB. All these on s.s.b.

P. Hampton (Worcester) says he's heard G3AOO in QSO with VK's most mornings at 0700. His log for 7Mc/s fair sends a tingle up "me" co-ax—CN8AW, K3ZNV, PZ1CF, VK2DO, VK2AHZ, VK3BM, VK3PB/M, VK3XM, VK7SM, YN2JF, ZL4BO, ZS1JA. I'll have to oil the alarm clock.

20/15

D. Henbry (Sussex), HA500, 7ft. vertical rod at 30ft. confesses to building the "Clubman" MkII. Also contained in his statement was a 14Mc/s s.s.b. log from which the following are offered in evidence—FG7TI/FS7, FY7YL, FO8BV, HC2RZ, HKØBKW, HS3DR, JW7YF, KH6EDY, KS6CL, KW6EJ, TA2BK, UAØNL, UI8LC, VQ9JW, VQ9V, VS9MB, XE1OE, XP1AA, YA1DAN, YN1GLF, ZD3D, 4A1WS, 5U7AN, 5W1AR, 7Z3AB, 9K2BV, 9L2SL.

H. Dearing (Goffs Oak), Super-Pro, 140ft. end fed, is s.s. s.s.b. (staunchly supporting single sideband) as the following log for 20 s.s.b. proves—CN8AW, CR6IS, ET3USA, HI3ELJ, HK5VS, JA6AUZ, KH6BZM, KJ6BZ, KL7EBK, OD5BV, PY1MK, PZ1PW, TG8IA, TG9EP, TF2WKP, VK1CN, VK2ON, VK3WW, VK3AON, VK4DO, VK5WD, VK6FB, VK7ED, VK7RX, VK9GN, VP1BT, VP2GBG, VR6TC, XW8AX, YV5AG, ZL4BX, ZL4IG, 4A1AE, 4A1LL, 4X4FQ, 4Z4HF, 5H3JL, 7XØAH, and the best DX this month—G3JDG/M. (Aw shucks!).

R. Spencer (Scarborough), SX111, PR30X, 20 metre dipole, shuffled the 20 metre pack and dealt himself the following—AP2AD, CEØAE, DU1FH, FO8BS, FR7Zg (Reunion Is.), HS1AF, JA3KHV, JW2BH (Bear Is.), JX6AL, K8NHW/P/XV5, KG6AAY, KH6IJ, KL7MF, KR6KG, KR6MH, MP4BEU, TA2BK, VK3BM, VR6IV, VU2CT, VU2KO, XE2CO, XW8BQ, YA5RG, YV4UA, ZL4BX, 3A2CP, 4S7PB, 7Z3AB, 9Q5DG, 9M2NK, 9N1MM—full house Sir!

P. Batt (Lancs.), PCR3, 65ft. end fed only 6ft. high, heard these on 15 metres CT1AC, CT1ID, CX2CS CX4A, CX6BA, CX6EA, EA7MH, PJ3OI, PY2CDY, WA4PBY, WA8GBE, W5KC, all on a.m. too.

D. M. Clark (Bucks.), P.W. Progressive s.w. superhet, dipole for 21Mc/s, bagged these on 15 metres s.s.b.—DU1IK, EA8EX, EA9AQ, HL9KD, HS3DR, KG6EF, KH6BB, KX6FB, JA1AEA, JA2HTV, JA3KBP, JA6DHE, JA7UJ, JA8DSC, VK2FA, VK4TY, VK5GM, VK7GK, VK9LR, VS9MB, XW8BX, ZL1TU, ZL2LH, ZL3JO, 4A1CB, 4S7PB, 5W1AS, 9M2PO, 9U5SK, 9X5MH.

10

Quite a bit of r.f. about in spite of the sun not being quite as spotty as it should.

P. Starling (Essex), HR05T, 40ft. end fed, bagged these on 28Mc/s between 1400 and 1800—EL2X, ET3FMA, HK4AET, LU9DTA, OD5BA, PY1BLZ, PY6PQ, PY7VNY, SVØWL, UA6JWN, W4QKK W9EXE, ZC4MO, ZC4RB, ZE1BP, ZE6BNT, 5N2ABG, 5Z4LG, 9J2DT.

P. Johnson (Northampton), RX60, 100ft. end fed, also went QRX on 28 for—CN8MI, CP3RCS, CR4BL, CR6CS, CR6KV, CV7CZ, CT2AA, CT3AS, EA8CV, ET3REL, HK4AB, HP9AAX, LU5DNT, PJ2CQ, PY2BG, SV1AE, UA9FBK, UI8DFP, W6UFG, W7WLL, W9IOV/MM, XE1CY, YV3NS, YV5ANE, ZS1BE, ZS2FA, ZS4CJ, ZS6DT, 4X4JH, 5Z4BS, 9H1AV, 9J2AB.

R. Dinning (Ayrshire), HA350 plus PR30X, 252ft. end fed, queries IØARI (no, it's not the Isle of Wight). He also heard—CR6KL, KG4CRC, LU1DAB, PZ1BF, UF6CR, VQ9JW, SV1AN, SVØWM, ZC4AK, ZD7KH, ZS5RS, 5Z4KT, 9J2DT, 9K2BV, 9L2SL, 9X5AA and W1-Ø.

CONTESTS

Eyes down for a full house—8th-9th June, UBA c.w. contest (80-10 metres); 8th-9th, National Field Day; 23rd, 70 c.m. contest (portables); 24th, 2 metre s.s.b. contest; 6th-7th July, 160 metre contest.

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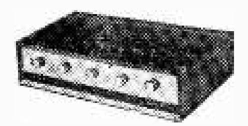

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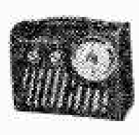

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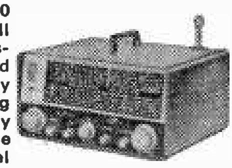

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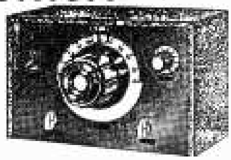

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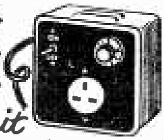

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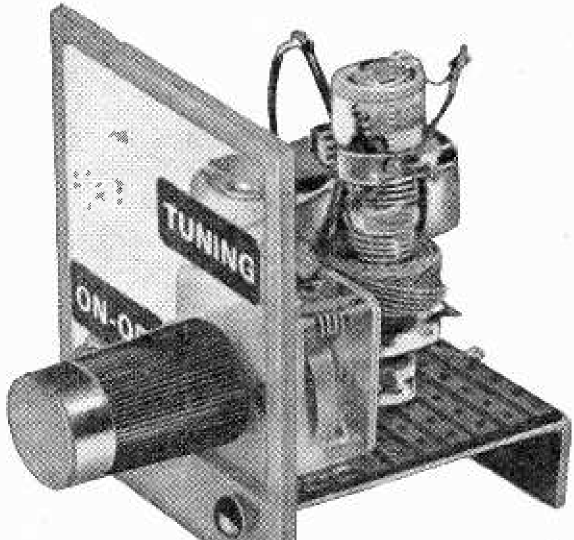
3 SIMPLE RECEIVERS FOR Beginners

TWO TRANSISTOR

NUMBER TWO . . . *in our beginner's series gives details for building a dual function two transistor receiver. It uses the minimum number of components —note that there are no resistors or coupling capacitors.*

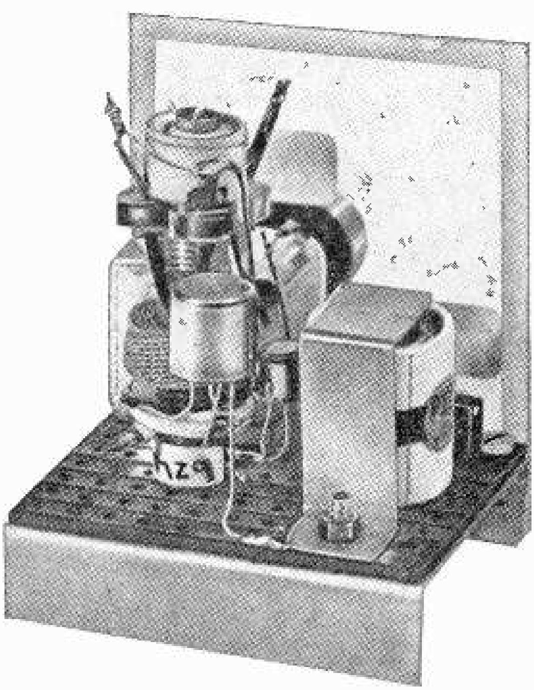
LAST month, in part one of this short series, a receiver was described which used only one transistor plus two diodes in a reflex circuit. The second receiver, shown here, uses two transistors in a complimentary direct-coupled circuit. Although this sounds rather a mouthful it boils down to super-simple circuitry and practically no components. There are no resistors and no fixed capacitors and, unlike last month's circuit, no separate diodes for detection either.



By T. SIMON

Dual-function

One great advantage of this little receiver is that when the battery switch is off, the receiver will function as a crystal set. In areas of good signal strength, say for a local station, the switch can be left in the off position thus saving the battery.



Switching the battery into circuit boosts the signal very considerably. At the writer's home, a small transistor output transformer, connected in place of the headphones, allowed a small speaker to give very good results from the local station at Brookmans Park on medium waves.

Selectivity

Although the set has only one tuned circuit, separation of stations was easily possible and no overlap was detected. This is probably due to the very high "Q" of the coil which aids the selectivity of the receiver. Normally, with 150ft. of wire for an aerial, both BBC1 and BBC4 tend to tune in together on a crystal receiver with a home wound coil. This is at the writer's home in St. Albans. In other locations things might be better or worse, however, with such a large aerial, it speaks well for the selectivity

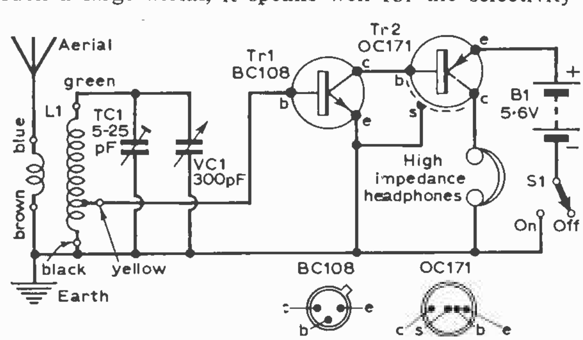


Fig. 1: Circuit of the two transistor receiver.

of the receiver at being able to separate the stations so easily and successfully.

Referring to the circuit shown in Fig. 1. The aerial is connected to the coupling winding on the coil L1. The signal is thus inductively coupled to the main tuned winding, and from here is fed to the base of the first transistor Tr1 via a low impedance tap on the coil. Transistor Tr1 is directly coupled to the second transistor, Tr2, in whose collector lead the headphones are connected. With the battery switched off, Tr1 functions as a diode feeding the signal to the base of Tr2. This second transistor might be considered as acting as a collector load for Tr1.

Polarity

Note that Tr1 is a p-n-p type whereas Tr2 is an n-p-n type. This is important for the circuit to function. The battery is connected in such a way as to supply power in the correct polarity to both transistors. The emitter of Tr2 goes to the positive side of the battery which is normal for a p-n-p transistor. While the emitter of Tr1 connects, via the on/off switch, to the negative terminal of the battery. With the battery switched off, the diode action of the junctions of the transistors allows the circuit to function as a simple crystal receiver. With the battery switched on, the circuit will amplify the signal quite considerably. In this respect it is possible that too much amplification will be present for the strength of signal entering the set. This will be characterised by distortion due to clipping of the signal waveform. The solution is to use a smaller and/or perhaps a less efficient aerial. Or, if one signal is very loud while a more distant one much lower in strength, then the receiver could be used as a crystal set for the very strong signal, thus conserving the battery and avoiding the clipping referred to.

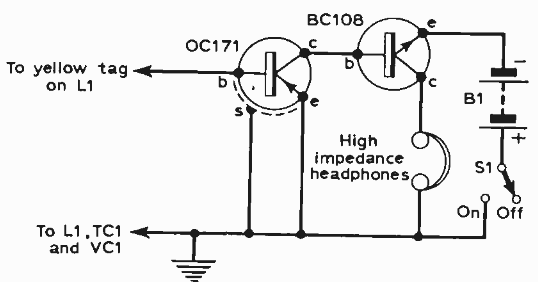


Fig. 2: Tr1 and Tr2 interchanged, but note battery polarity.

Results with the prototype were excellent using a pair of high resistance headphones (2000Ω), a good earth, and 150ft. of aerial wire. Very good results were also obtained from 40ft. of aerial wire with the same earth.

Construction

Construction is very simple but it is important to make sure of the connections to the transistors bearing in mind that one is p-n-p and the other n-p-n. The transistor used for Tr1 might be considered a strange choice since these are usually thought of as useful for audio applications and not r.f. However, the maker's specifications give the F_T of the BC108 as 150Mc/s typical, and thus it would appear well suited to medium wave circuitry.

For those who would like to experiment, it is possible to turn the circuit round and use the OC171

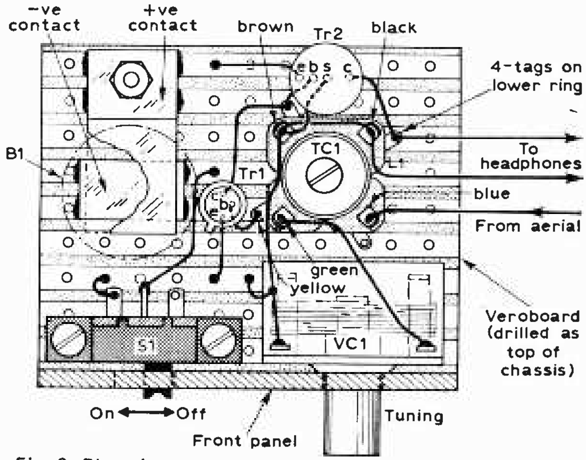


Fig. 3: Plan view of the receiver showing positioning of components and the wiring. Note that there is a lower ring of tags on the coil.

in the Tr1 position, and the BC108 in the audio stage. This circuitry is shown in Fig. 2, again the only points to note are the correct connection of the transistors with regard to polarity.

Chassis

The chassis is bent from a small scrap of aluminimum and drilled as shown in Fig. 4. The front panel was made from a piece of thin Perspex which was to hand. Cut and drill as shown in Fig. 4. *Note:* Perspex cracks very easily so be very careful when drilling and filing.

The piece of Veroboard is used mainly as something to solder to. It is held to the chassis by the various bolts and also the coil. The tuning capacitor was glued to the Veroboard with Evostick applied along its bottom edge only. The coil mounts in the hole drilled and is held in position by its own threaded plastic nut supplied. The on/off switch

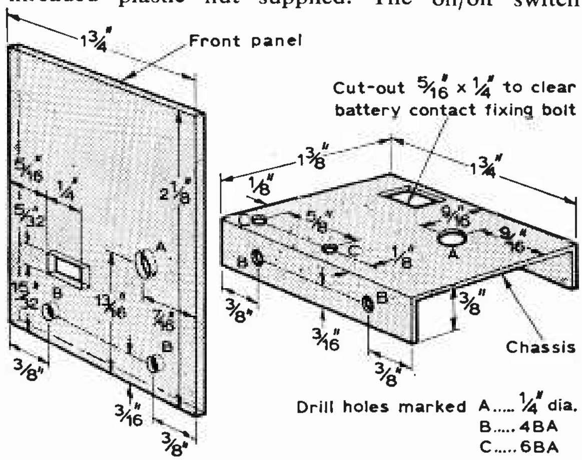


Fig. 4: Drilling details for the chassis and front panel. Note—these details might alter with differing components. Check sizes etc., first before drilling.

needs two 8BA nuts and bolts which may be purchased from most good ironmongers in a small plastic pack containing half a dozen. These bolts may need to be cut down if they are too long.

The battery is a special Mallory type which is rated at 5·6 volts. It is clipped into position with a small piece of springy brass, perhaps taken from an old cycle lamp battery? This is bent to shape and bolted to the chassis. Note that there is a hole cut out in the chassis so that this bolt does not short the battery to the aluminium.

Wiring

When all components are mounted wiring up can commence, but do not bolt the front panel on yet. It is all too easy to touch it with a hot soldering iron with gruesome results. Wiring should be carried out to conform with Fig. 1 and Fig. 3. Use a pair of pliers as a heat shunt when soldering in the transistors. Leave clipping in the battery until the very last. Immediately prior to this, check again the connections to the transistors, remember that connecting the battery in the wrong way will almost certainly destroy these devices. Check if you have used the alternative circuit shown in Fig. 2, if so have you orientated the battery correctly?

Testing

Connect the headphones to the collector of Tr2 and earth, clip on aerial and earth leads but *do not* switch on the battery. Tune VC1 from max to min and see if you can hear any stations. If you have ever built a crystal set and got it working in your area, then it is almost certain that this receiver will pick up the station(s). If you can receive more than one station, tune in to the weakest one and switch in the battery. The signal should be boosted quite appreciably. Having got the receiver working satisfactorily, you might like to try experimenting with the aerial. Try the bedsprings—mine work quite well with the battery switched in and no earth at all!

There is no point in increasing the battery voltage since this will not increase the signal level to any significant degree. You might consider building a small case for the receiver for which almost any material would be suitable—plastic, wood etc.

The coil shown in the photographs has its own "built-in" trimmer. This is not really required in this circuit and thus it should be ignored. It does not require any adjustment at all.

★ components list

Transistors:
Tr1 BC108 Mullard
Tr2 OC171 Mullard

Capacitors:
VC1 300pF midget solid dielectric

Coil:
L1 StabQoil type TMZ9 complete with trimmer TC2 (Electroniques)

Miscellaneous:
Battery—5·6V Mallory type PX23; midget on/off slide switch (G. W. Smith); high impedance headphones (2000–4000Ω); small piece veroboard $1\frac{3}{4}$ x $1\frac{3}{8}$in. (nine strips); aluminium for chassis $2\frac{1}{8}$ x $1\frac{3}{4}$in.; piece thin Perspex $1\frac{3}{4}$ x $2\frac{1}{8}$in.; strip of brass $\frac{3}{8}$ x $1\frac{1}{2}$in.; three 8BA nuts and bolts; two 6BA nuts and bolts; wire; solder; aerial and earth wire.

NUMBER THREE . . . next month—a simple three transistor superhet receiver with a reflexed i.f. stage, and its own miniature 1in. speaker.

THE majority of purely "electronic" timers are dependent for their operation upon the length of time it takes a capacitor to charge up to, or discharge from, a given voltage. The charging and discharging processes are usually accomplished by means of a resistor, though a thermionic diode or valve is sometimes used. In the charging process, the valve or resistor is in series with the capacitor; in the discharging process, in parallel.

Variation of the timing period is achieved by varying either R or C, sometimes both. Since C is usually one to several thousands of μF, R is usually the variable element. The product of $C \times R$ is the time constant, and is in seconds when $C = \mu F$ and $R = M\Omega$. This time constant can be maintained if either C or R is altered, by altering the other quantity by the same factor.

In the practical circuit of Fig. 1, C and R are represented by C1, and R1 to R12. The timing period is therefore variable in 12 steps, the shorter times being associated with the lower value resistors. Practical experience dictated the upper and lower limits, as well as the progression, which is roughly logarithmic. In practice, the theoretical time constants are somewhat modified by the characteristics of two of the associated components. These are the timing capacitor itself and the first transistor Tr1.

the time constant to change in a random manner when the leakage resistance is of the same order of magnitude as the discharging device's resistance.

The input resistance of a transistor is $h_{fe} \times R_E$ where h_{fe} is the gain and R_E the emitter resistor. In parallel with this resistance is the leakage resistance of the diode formed by the transistor's base emitter contact. The former can be increased by increasing R_E, and by using a transistor having a high value of h_{fe}. The latter, by using a silicon transistor which has an inherently lower leakage, between base and emitter, than a germanium transistor. The timing period can also be affected by any variation in the voltage to which the capacitor is charged. Yet further variations can be caused by components altering in value.

Circuitry

In the circuit of Fig. 1, constancy of the timing cycle is secured by using a good quality capacitor for C1 and by choosing the constants so that the leakage resistance is appreciably greater than the discharging resistance; by stabilising the supply which is, of course, the voltage to which C1 is charged; by using only good quality components used well within their ratings.

THE STEPTRON

An ideal capacitor would, when charged up to any given voltage, and in the absence of an external discharging device, hold that charge indefinitely. Very few capacitors do. The reason is due to the inherent leakage resistance within the capacitor itself, which causes it to discharge over a period of time. This leakage resistance, which can be safely disregarded in many applications, can have serious consequences when capacitors are used in timing circuits. Not only does it limit theoretical calculations of time constant, particularly when long periods are involved, but, in my own experience, causes

The operation of the circuit is quite simple. The mains voltage is reduced by T1 to 9–0–9V, is rectified by D3 D4 and smoothed by C2. Stabilisation of the voltage at 9V is effected by D2, a 9·1V $\pm 5\%$ zener diode. R17 drops the surplus voltage, with Tr2 cut off, at the zener's working current load of approximately 20mA. In the prototype a value of 47Ω proved to be just right. As Tr2 draws a current of 16mA when conducting, the line voltage remains virtually unaltered at 9V, the zener and Tr1 accounting for the current difference.

Capacitor C1 is connected to the central or

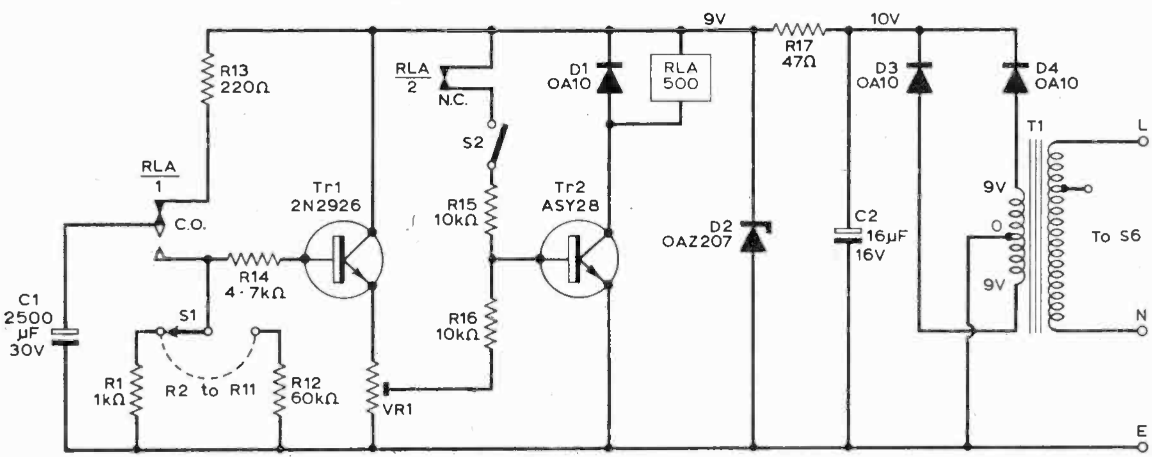
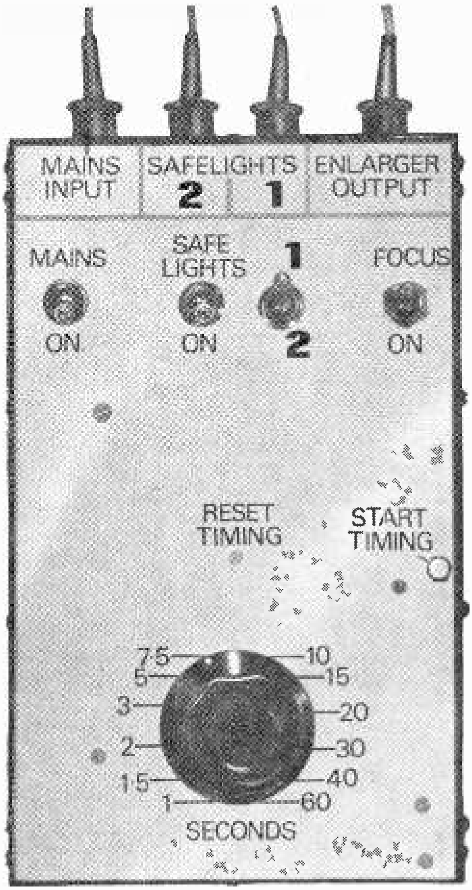


Fig. 1: Circuitry for the electronic darkroom stopwatch.



by H.T. KITCHEN

★ components list

Capacitors:

C1	2500μF 30V	C2	250μF 15V

Resistors:

R1	1kΩ 5%	R10	30kΩ 5%
R2	1·5kΩ 5%	R11	40kΩ 5%
R3	2kΩ 5%	R12	60kΩ 5%
R4	3kΩ 5%	R13	220Ω 10%
R5	5kΩ 5%	R14	4·7kΩ 10%
R6	7·5kΩ 5%	R15	10kΩ 10%
R7	10kΩ 1% (see text)	R16	10kΩ 10%
R8	15kΩ 5%	R17	47Ω 10%
R9	20kΩ 5%		

Semiconductors:

Tr1	2N2926 green spot	D2	OAZ207
Tr2	ASY28	D3	OA10
D1	OA10	D4	OA10

Switches:

S1	1 pole 12 way	S4	single pole two way
S2	press to make	S5	single pole two way
S3	single pole on/off	S6	double pole on/off

Transformers:
9–0–9V 80mA Osmor

Relay:
500Ω coil

contacts $\left\{ \begin{array}{l} \frac{RLA}{1} \text{ light duty changeover} \\ \frac{RLA}{2} \text{ light duty normally closed} \\ \frac{RLA}{3} \text{ heavy duty normally open} \end{array} \right.$

Plugs and sockets:
3 pin, Bulgin, miniature

changeover section of the relay contacts designated $\frac{RLA}{1}$.
In the normally off position when Tr2 is non-conducting, this capacitor is connected to the supply line via the anti-surge resistor R13, and when the supply is on, is charged up to the supply voltage.

When the relay is conducting, the changeover contact moves and connects C1 to the base of Tr1 via R14, and via S1 to one of the discharging resistors R1 to R12. Since Tr1 is an emitter follower, a proportion of the voltage to which C1 has been charged, typically 95%, appears across VR1. A further proportion of this voltage, depending on the setting of VR1, is therefore passed on to the base of Tr2 via R16, and causes it to conduct, pulling the relay on. The result is that C1 is held connected to the base of Tr1 until it is virtually discharged When this happens, the voltage across VR1, and hence the base of Tr2, is too low to cause it to pass sufficient current to hold the relay on. As soon as the relay drops out, C1 is reconnected to the supply line, is recharged, and is ready for the next duty cycle. There is no delay and the next cycle can be initiated as soon as the user wishes.

Initiation of the timing period is effected by S1. This is a miniature spring loaded "press to make" switch, in series with $\frac{RLA}{2}$ contacts and R15. The $\frac{RLA}{2}$ contacts are normally on, when the relay is off. When the relay is pulled in, these contacts open. S2 causes the base of Tr2 to be connected to the 9V supply line via the $\frac{RLA}{2}$ contacts and R15. This causes the base voltage of Tr2 to rise, so causing an increase in collector current and the pulling in of the relay. Immediately this happens, C1 is brought into circuit by $\frac{RLA}{1}$ and the timing period begins.

So much is obvious. Less obvious is the need for the $\frac{RLA}{2}$ contacts. Different ways of initiating the timing period were tried and the method finally used was found to be the most reliable *provided* $\frac{RLA}{2}$ *contacts were included*. Omitting these contacts led to some variation in the timing period, depending on the length of time S1 was held down. By including $\frac{RLA}{2}$ contacts, yet another source of possible inaccuracy was removed, because as soon as the relay closes, $\frac{RLA}{2}$ contacts open, and continuing pressure on S1 cannot affect the timing period.

Capacitors

The Daly capacitor used for C1 has, over a period of time, proved reliable. It is desirable to use a capacitor with a working voltage in excess of that actually required, as leakage increases as the working voltage is approached. Also, the capacity marked on the capacitor is only nominal, the tolerance often being +100% and −50% of nominal. Obviously, this can have a marked effect on the timing periods obtained in individual cases.

The transistors chosen have excellent characteristics as well as being expensive. Tr2 could be replaced by an n–p–n germanium transistor of adequate rating. It is, however, advisable to retain Tr1 as specified, which is a green spot 2N2926 having a h_{fe} of 470.

The relay could possibly prove difficult to obtain locally in some areas, though it should be obtainable from nationally advertised sources. Provided the requisite contacts are there, coil resistances between 500 and 1,000Ω should prove adequate. By adjusting R17 or even disposing of it altogether, and by changing D2 for a higher rated component, lower coil resistances could be used, without exceeding the maximum wattage rating of Tr2. This is because when Tr2 is non-conducting its collector is at supply potential. The products of $Ic \times Vs$, where Ic is collector current and Vs supply voltage, is well below the maximum permitted dissipation. Similarly, when Tr2 is conducting, it is virtually bottomed, and again $Ic \times Vc$ or collector to emitter voltage, is well within the maximum permitted dissipation. There is therefore room for experiment with varying coil resistances, *provided Ic is always monitored and the maximum ratings are not exceeded.*

Some saving in expense can be effected by omitting the zener diode. In an area of stable mains voltages, the effect upon timing periods will be minimal. Varying mains voltages, as in my own area, could cause some variation in the timing periods. Although these variations can be masked by the tolerance of the printing papers, experienced "enlargers!" (or perhaps more correctly, enlarging operators) will know that optimum print quality can only be obtained when all variables are reduced to their precise, correct, proportions. Thus the slight additional expense of the zener diode is considered justified.

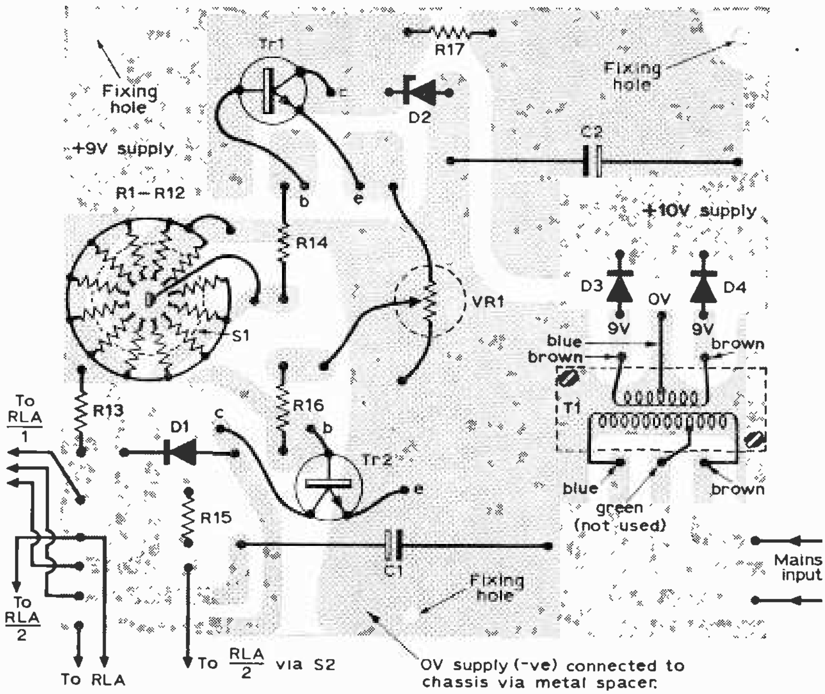


Fig. 2 (above): Suggested layout and p.c. board pattern.

Fig. 3 (below): Layout of the p.c board and other components.

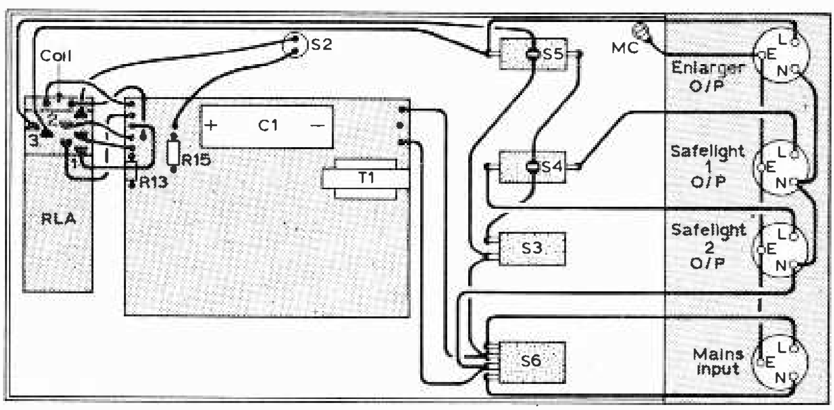
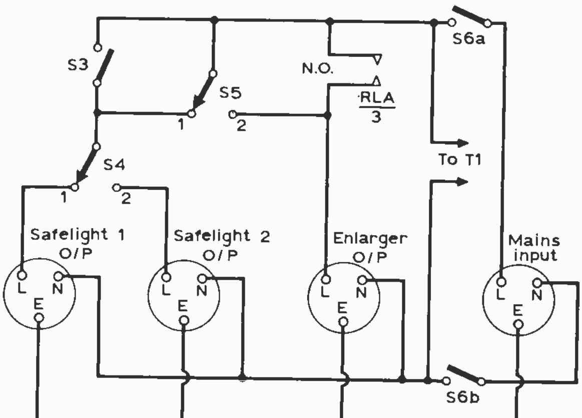


Fig. 4 (below): Wiring of the sockets and remaining switches.



Resistors

Resistor R17 should be chosen, assuming the recommended relay is used, to allow approximately 20mA to flow through the zener with Tr2 non-conducting. This is sufficient to adequately stabilise the line voltage with Tr2 passing some 16mA when "on", whilst allowing a few mA spare in case the mains voltage should rise. The timing resistors must be hi-stabs of 5% or better accuracy. The progression chosen is logarithmic with alternative times being halved or doubled. If the enlarging lens has the more modern click stops where the light output is exactly $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, etc., of wide open, these

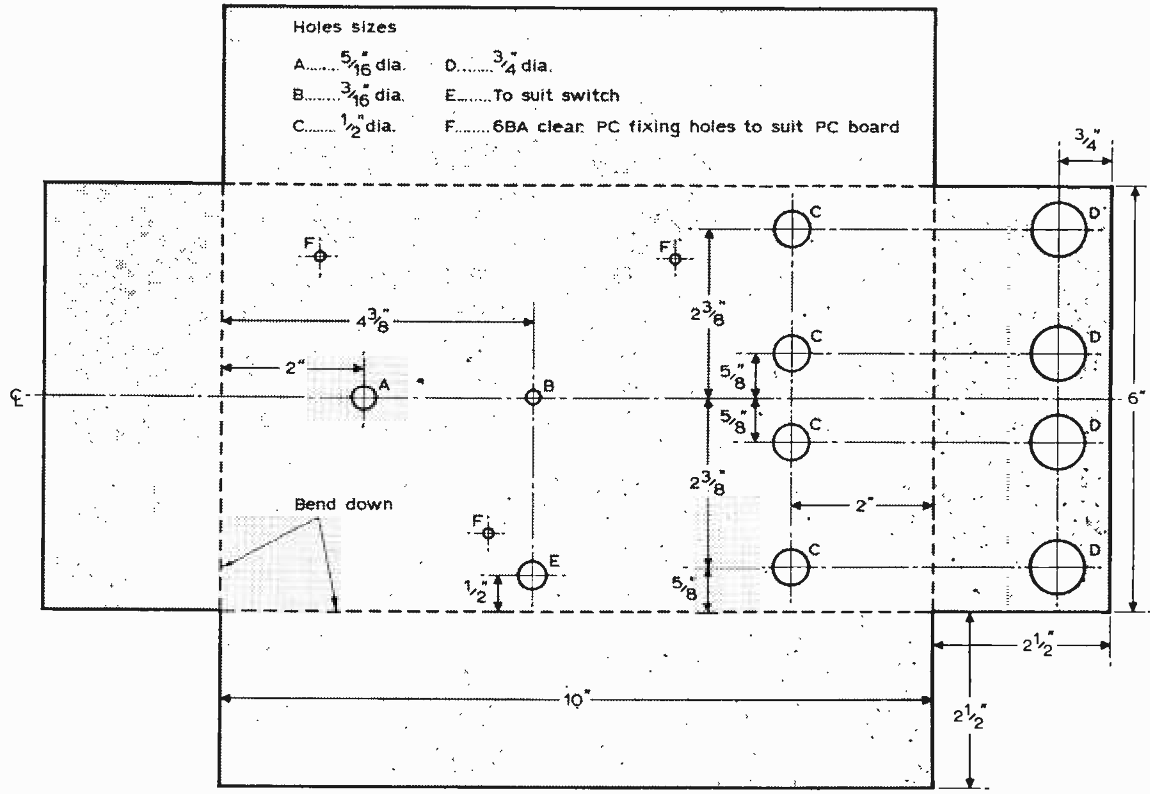


Fig. 5: Drilling and layout details for the case/chassis. These are not critical and may need to be varied if odd components are used.

times will prove most useful. Initial exposure, whether by meter or test strips, can be determined with the lens wide open. The lens is stopped down as required and the timer adjusted to suit.

Diode D1 across the relay must not be omitted. When the transistor "switches off", very high induced back e.m.f. voltages are present across the relay coil and transistor. This back e.m.f. is in the form of a pulse of opposite polarity to the supply voltage and could damage the transistor. The diode across the coil short-circuits this pulse and therefore protects the transistor.

The timing circuit, with the exception of the relay and ancillary switches, is built on a piece of p.c. board measuring $5 \times 4\frac{1}{4} \times \frac{1}{16}$ in. The layout is shown in Figs. 2 and 3. The use of heat shunts for soldering the semiconductors and range resistors is recommended.

Calibration

For ease of testing and calibration, the timer should be assembled out of its case, coupled to the relay and S2 by means of flexible leads. After switching on the mains, the voltages should be checked, and should agree with those given. The zener diode and Tr2 emitter currents can be checked, bearing in mind that as one increases, the other decreases, and vice versa. The currents given are min. and max. The values allotted the timing resistors include one or two values that may prove hard to obtain in some areas. In this case, they may be made up of a series/parallel combination. The 5kΩ resistor could thus be obtained from two 10kΩ's in parallel, and so on.

The use of a stop watch is of the greatest assistance during calibration. Failing this, the seconds hand of a clock or wrist watch may be used. The procedure is quite simple. A suitable time, for example the ten second position of S1, is selected with the wiper of VR1 at the Tr1 emitter and of its travel. S2 is depressed, whereupon the relay should pull in smartly. If it does not, but its armature is seen to move, R15 can be reduced in value until it does pull in smartly. If it does not move, connect a voltmeter (0–10V) across VR1 and close the armature by hand. As soon as C1 is brought into circuit, approx. 8·5V should appear across VR1, and via R16 to the base of Tr2. The voltage across VR1 will begin to fall, and it may be necessary to release the relay and depress it again. The collector voltage of Tr2, whilst Tr2 is cut off, will be virtually supply voltage. As soon as C1 is brought into circuit, and assuming the earlier stages check out satisfactorily, the collector voltage should fall to about 1V above earth potential. If the relay does not now move, the fault is almost certainly mechanical, or, perhaps, the coil resistance is incorrect.

If the $\frac{\text{RLA}}{2}$ contacts are present in the relay actually used, R15 can be reduced drastically or even dispensed with. If the $\frac{\text{RLA}}{2}$ contacts are absent, R15 must be kept as high in value as practicable with reliable operation. It must not be removed from circuit under these circumstances as it is quite possible to burn out Tr2 by holding S2 closed for an excessively long time. A "vacuum state" anology; connecting the grid of a value to h.t.!

Assuming all is well, the time obtained in the ten second position should be noted. It will almost certainly be in excess of ten seconds, in which case VR1 is reduced and another check is made. After several attempts it should be possible to obtain a time of ten seconds precisely. As this is the "calibrating" range, and as 10kΩ is a preferred value anyway, a 1% resistor is recommended for this position. This is to ensure that the other ranges have a "standard time" to be checked against.

The other ranges are similarly checked, except that VR1 is not touched. Assuming a good capacitor for C1, and accurate range resistors, the times obtained should be in substantial agreement with the nominal times marked on the dial. Times shorter than those marked on the dial will require additional series resistors; longer times, additional parallel resistors.

Constructors who feel that fixed, stepped times are unsuitable for their particular use, could replace S1, R1–R12 with a variable resistor having a value commensurate with the longest time required. The disadvantage of a continuously variable timer is in accurately calibrating very short times, plus the difficulty of reproducing these short times accurately once changed to a longer time.

The disadvantage of a fixed, stepped timer, is the time required to accurately select the timing resistors. The long and short term accuracies can be very high, whilst there is no resetting error.

Once working satisfactorily, the timer can be mounted in the cabinet. The p.c. board in the prototype was mounted at three points, by means of 6BA bolts having $\frac{3}{8}$in. spacers between the p.c. board and the panel, the bolts also serving to hold the Perspex facing the panel. The legends are drawn with indian ink upon thin white card which is clamped between the Perspex and the front panel.

The ancillary switching is shown in Fig. 4. The $\frac{RLA}{3}$ contacts control the current flow to the enlarger lamp, and are normally open. The focus switch S5 performs two functions. In position 2 it is in parallel with $\frac{RLA}{3}$ contacts and allows the enlarger to be focused, or to be used for timing periods longer than that allowed by S1/R12. In this position it switches off the safelight which is normally not required during focusing, particularly when large enlargements are being made, or when the negative used is very dense. If required, however, the safelight can be switched on by S3.

In position 1, S5 brings one of two safelights used, one for reflected, one for direct lighting, into operation, the safelight used being selected by S4. S6 switches the mains supply to the timer and is the mains switch. The ancillary switching adds greatly to the flexibility of the timer which has proved, over a period of time, to be consistently reliable. ■

KEYLESS ORGAN

—continued from page 173

drill, apply to the hole giving a twist with the fingers. When finished each plate is like a small mirror, and an attractive feature when laying on the coloured felt in the completed instrument. Now place plates polished side up and in a row with long sides adjoining. With a black *wax* pencil number from left to right from 1 to 37, above the screw holes. Below the holes write C, C sharp, D, D sharp, E, F, F sharp, G, G sharp, A, A sharp, B. (This should be numbered 12), repeat this sequence twice more and mark No 37, C. The wax pencil will plainly mark the polished surface, will not scratch, and can be easily rubbed off later.

Resistance Tuning Strip

We require the $\frac{3}{8}$in. wide strip of hardboard for the resistance strip. Make a pencil line right down the centre, on the smooth side. With a pair of dividers set to $\frac{7}{16}$in. starting $\frac{3}{8}$in. from one end, mark off 37—$\frac{7}{16}$in. spaces along this line, prepare for drilling with a punch mark on the centre line at each division. Drill the holes, to take the 6BA screws, with a clearance drill, and avoid making the holes too large. With a medium file laid flat on the underside, rub along the strip to remove any extrusion left by the drilling. The strip is now trimmed off $\frac{3}{8}$in. from the last hole.

Lay the strip down on a flat firm surface, smooth surface uppermost, with a piece of medium glasspaper placed around a small block of wood, rub from end to end along the top smooth side of the strip. Keep the block flat and avoid any rounding towards the edges. This is to remove the smooth surface and leave it slightly scored. A short worn down piece of HB pencil is now required. Remove the wood, half-way from an inch of the pencil leaving the lead exposed and half embedded in the wood. Rub the exposed lead flatwise on the roughened side of the strip, and rub well all over from end to end. The resistance strip should now be placed on one side, until the plate contact board is prepared.

** Back issues containing details of the author's prototype organ that appeared in this magazine during 1965, are out of print, and therefore we regret, are no longer available from this magazine.*

TO BE CONTINUED

practically wireless commentary by HENRY

No. 46

Air Shares For All

BANNING the critics from the première of his epic, *The Charge of the Light Brigade*, film director Tony Richardson called them '. . . A *group of acidulated intellectual eunuchs, hugging their prejudices like feather boas*." He commented that one of the many indulgencies the critics permitted themselves was to talk "honestly" about their own prejudices, imagining that this would make them even more lovable.

This critic in a feather boa.

Well now, this critic makes no claim to cuddly lovability, and would probably look even less prepossessing in a feather boa, but he must admit to a few prejudices.

So he must join with the Editor in deprecating the unsatisfactory episode of Ted Short's throw away line in the Commons about the Beginners' Licence.

Henry has no particular claim to a vested interest in B licences or any form of radionic L-plate.

Nevertheless, this matter is important to anyone who dabbles in wireless, whether or not he has ever bashed a key in anger.

Should we throw open the airways to all, or restrict the bands to those with sufficient sense of responsibility to take what is, after all, quite a simple test? That seems to be the crux of the argument.

This projected Beginners' Licence could be like the American "Novice Licence".

We shudder to think what that could mean. As recently as April 1st, we saw the ban on sales of imported Citizen's Band Equipment come into force. This 27Mc/s stuff is still widely advertised, and, we suspect, available under the counter. All manner of unlikely applicants will now be lined up to chip loopholes in any fence the PMG may choose to erect to safeguard the Beginners' Licence. But as to what our loyal band of hams will say to a possible restriction of their air-space—that would hardly be covered by the Q-code.

There are plenty of existing restrictions. The A licence permits telegraphy and telephony on all h.f., v.h.f. and microwave bands. The City and Guilds of London Institute set a Radio Amateurs' Exam. that should not daunt the determined. And surely, 12 words a minute with the morse key is not asking too much, even of an under-fourteen contender. which, I understand, the new licence may admit?

We must wait and see whether the proposed Beginners' Licence will be used as an incentive to those wishing to progress toward a full ticket—or some bending of the rules to placate a vested interest.

One of my short-wave enthusiast colleagues grunted: *"For Licence* read *License*." And if we extend our vision a bit he is not far wrong. Think of the overcrowded m.f. and l.f. bands which makes all but the most local of programmes an aural obstacle course.

The Copenhagen Plan authorised 600 stations on Medium and 18 stations on Low Frequencies. But not all countries were parties to the Plan, and there is no international air-space police force. The price of freedom has been a 226 per cent increase of m.f. stations (power going up 230 per cent), 1360 stations on m.f. against the original 600 and 28 on l.f. against the original 18—that's a heck of an argument against overcrowding. No wonder the pirates were banned. Pity those eight blighters that do nothing but jam could not be boarded also!

What is the answer? Despite the BBC's plugging of v.h.f., there is a real need for both m.f. and l.f. communications. The partial solution of day and night band-sharing that the USA has toyed with does not go far enough. S.S.B. seems to be the best solution—but that has its snags.

Available under the counter.

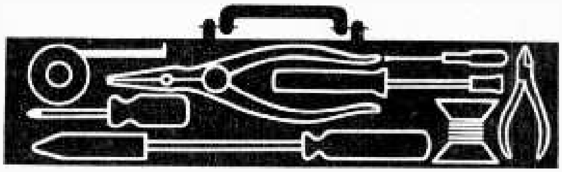
Recently, Georges Hansen, technical director of the EBU and H. Eden of the Institut fuer Rundfunktechnik, have suggested non-compatible single sideband transmissions as being the only way of sharing the bands without adjacent channel interference. The implications, much as we heard *ad nauseam* when the colour TV controversy was raging are that we should need new sets, and because of the need for synchronous detection, the cost of these would be higher.

repairing radio sets

PART 4

H. W. HELLYER

Cabinet appearance and care is important, and attempts at repair when damaged can often end in disaster unless you have the know-how . . .



YOU may perform miracles of electronic diagnosis; you may dig out of the spares box all the transistors and components you need; you may wield your soldering iron with consumate skill . . . but just wait until you hand the repaired receiver back to the lady of the house. If it has a tatty cabinet, all your good work was in vain.

Appearance matters. Repairs often entail small rejuvenating touches to woodwork and plastic, and unless you know what you are doing, the end result can be disaster.

Woodwork—even for transistor radios, for the modern trend to wood finishes, even if it fades out temporarily, is sure to come around again when our designers feel the seven-year itch. Different woods need different treatment. Veneers require great care, and some of the artificial wood laminates present yet more problems of their own.

Very often a damaged cabinet will not respond to any patching or camouflaging: it may be necessary to re-colour or re-cover it. The success of a recent gay-colour range of television receivers prompts one to suggest that this sort of treatment may occasionally be a good thing. First requirement is to remove all the appendages, knobs, escutcheons, etc., that can be removed, and carefully mask all those that cannot. When masking, always use a simple form of tape or paper with an innocuous adhesive. Lettering on panels or glass dials is so easily damaged by being "lifted" when the adhesive surface is stripped—and this point must be considered before you begin. Remember that ordinary adhesive tape of the transparent variety can become very tacky with heat, and will tend to leave an edge mark when removed. Although the material is more expensive, the cellulose tape as supplied to radio dealers by Messrs. Radiospares is very suitable for odd jobs of this nature. It can be stretched slightly, thus giving a more intimate bond, and the adhesive is not destructive to cabinets and laminate finishes. Readers will undoubtedly be able to suggest alternatives.

If masking a straight edge, do not fiddle with the tape to get an accurate line, but overlap slightly, press and smooth the tape, then trim the surplus tape with a razor blade, or some form of patent cutter, angling this inwards so that the cutting motion also tends to take the edge of the tape under the panels, etc., presenting a cellulose surface to the stain or paint rather than the necessarily rougher edge of the tape. A neater completed job will result when the masking is removed.

Covering a curved surface can be rather more tricky. It is best to use a similar approach, i.e., to overlay in a series of straight pieces, then trim as before. A useful dodge when doing small touch-up jobs with cellulose paint or any high-gloss touching-up medium, is to mask by simply painting over the protected surface with grease or even water-colour poster paint. This need only be done at the edge where the two surfaces meet, to prevent the hard gloss paint or stain running beyond its required limit. Then, after the main body of the work has been finished, the grease can be cleaned off with a lint-free rag, or, except in the case of cellulose surfaces, a cloth damped slightly with methylated spirit.

The other problem is lettering. All too often this is stencilled on the main panel, and to colour round it is, except for a master forger, a much too formidable task. Why not consider renewing the legends completely? There are sets of symbols, words, individual letters and signs in a multitude of styles now available. Most of them go on the finished smooth surface as easily as the transfers we got smacked for sticking on our wrists when we were young. Some of those offered as a free gift in a recent issue of this journal can be used to improve upon a manufacturer's design with telling effect. At least, one has an original piece of apparatus to show for one's efforts.

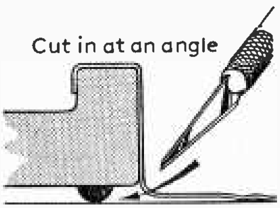


Fig. 20: Masking curved surfaces presents problems. The tape can be applied quite roughly, then trimmed to the shape of the raised portion of the cabinet, using an angled cut with a sharp blade to fold the masking tape inwards, as shown.

Touching-up may not be good enough for you. Nothing is as good as a completed job in true wood, you may argue. This approach is especially valid when loudspeaker cabinets are being constructed. Timber is still one of our best materials, despite the proliferation of plastic substances. And there is something opulent about the look and feel of true wood surfaces that pleases the constructor. There are one or two points he must remember, however, if he is not an experienced handyman. This article cannot go too deeply into woodworking—even if its author was qualified to deal adequately with the subject!—so do-it-yourselfers, and regular subscribers to *Practical Householder* must forgive a few relevant points thrown off at random.

Before we attempt to do any colouring at all, there is the very necessary preparation to consider.

BUILD YOURSELF A QUALITY TRANSISTOR RADIO-GUARANTEED RESULTS BACKED BY OUR SUPER AFTER SALES SERVICE!

THE MAGNIFICENT ROAMER 7 MK IV

SEVEN WAVEBAND PORTABLE AND CAR RADIO WITH A SUPER SPECIFICATION GIVING OUTSTANDING PERFORMANCE!

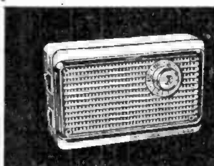
- **7 FULLY TUNABLE WAVEBANDS—MW1, MW2, LW, SW1, SW2, SW3 AND TRAWLER BAND.**

- Extra tuning of Luxembourg, etc.
- Built in ferrite rod aerial for Medium and Long Waves.
- 5 Section 22 inch chrome plated telescopic aerial for Short Waves—can be angled and rotated for peak S.W. listening.
- Socket for Car Aerial.
- Powerful push pull output.
- 7 transistors and two diodes including Philco Micro-Alloy R.F. Transistors.
- Famous make 7in. x 4in. P.M. speaker for rich-tone volume.
- Air spaced ganged tuning condenser.
- Separate on/off switch, volume control, wave change switches and tuning control.
- Attractive case with hand and shoulder straps. Size 9in. x 7in. x 4in. approx.
- First grade components.
- Easy to follow instructions and diagrams make the Roamer 7 a pleasure to build with guaranteed results.

Total building costs **£5.19.6** P. & P. 7/6

Parts price list and easy build plans 3/- with (Free parts).

TRANSONA FIVE

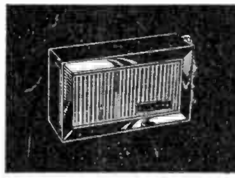


MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE

Attractive case with red speaker grille. Size 6¾ x 4½ x 1½in. Fully tunable. 7 stages—5 transistors and 2 diodes, ferrite rod aerial, tuning condenser, volume control, fine tone super dynamic 2¾in. speaker, all first grade components. Easy build plans and parts price list 1/6. (FREE with parts).

Total building costs **42/6** P. & P. 4/6

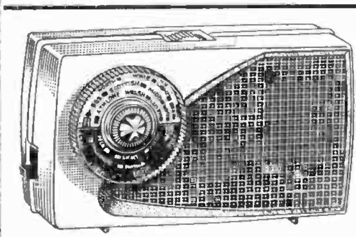
POCKET FIVE



MEDIUM WAVE, LONG WAVE AND TRAWLER BAND PORTABLE

Attractive black and gold case. Size 5½ x 1¼ x 3½in. Fully tunable over both Medium and Long Waves with extended M.W. band for easier tuning of Luxembourg, etc. All first grade components—7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone 2¾in. moving coil speaker etc. Easy build plans and parts price list. 1/6 (FREE with parts).

Total building costs **39/6** P. & P. 4/6



NEW MELODY MAKER SIX

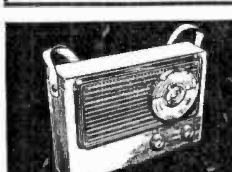
3 WAVEBAND PORTABLE — **8 stages—6 transistors and 2 diodes**

Covers Medium and Long Waves and EXTRA BAND FOR EASIER TUNING OF LUXEMBOURG, etc. Top quality 3in. Loudspeaker for quality output. Two RF stages for extra boost. High "Q". Ferrite Rod Aerial. Push-pull output. Handsome pocket size case with gilt fittings. Size 6½ x 3¾ x 1½in.

This amazing receiver may be built for only **69/6** P. & P. 4/6

Parts Price List and easy build plans 2/— (Free with parts).

ROAMER SIX

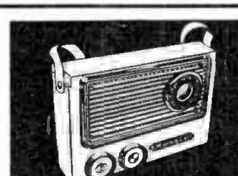


SIX WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case with gilt fittings, size 7½ x 5½ x 1½in. World wide reception. Tunable on Medium and Long waves, two short waves, Trawler Band Plus an extra M.W. band for easier tuning of Luxembourg, etc. Sensitive ferrite rod aerial and telescopic aerial for Short waves. All top grade components, 8 stages—6 transistors and 2 diodes including Philco Micro-Alloy R.F. Transistors etc. (Carrying strap 1/6 extra.) Easy build plans and parts price list 2/- (FREE with parts).

Total building costs **79/6** P. & P. 4/6

SUPER SEVEN



THREE WAVEBAND PORTABLE WITH 3in. SPEAKER

Attractive case size 7½ x 5½ x 1½in. with gilt fittings. The ideal radio for home, car or outdoors. Covers Medium and Long Waves and Trawler Band. Special circuit incorporating 2 R.F. Stages, push pull output, ferrite rod aerial, 7 transistors and 2 diodes. 3in. speaker (will drive larger speaker) and all first grade components. Easy build plans and parts. Price list 2/- (FREE with parts).

Total building costs **69/6** P. & P. 4/6

RADIO EXCHANGE CO.

61 HIGH STREET, BEDFORD

Callers side entrance Stylo Shoe Shop • Open 9-5 p.m. Saturday 9-12.30 p.m.

Telephone: Bedford 52367

This may sometimes seem tedious, but the finished result will greatly depend on the trouble we took at this stage. All holes must be stopped or filled and the filler rubbed down to level exactly with the main surface. Small grooves, scratches or protrusions become very noticeable when the job is polished, the more so if a high gloss finish is used. Even when merely patching-up damage, the primary rubbing-down is worthy of a great deal of care.

For basic wood and some plywoods and laminates, a sanding block is useful. This is simply a rubbing block with flat faces, on to which sandpaper can be fastened. Starting with coarse grade and gradually working towards the lower number, i.e. finer grades, the wood is rubbed down along the grain to give a surface smooth to the touch and even to the view, when inspected along its edge plane under a strong light. For a final rubbing down, a cork block in place of the more solid wood will allow the sandpaper sufficient "give" to achieve a satiny finish.

Small holes and cracks can be filled with a putty filler, plastic wood or one of the many water-mixes available. When using putty filling, remember that the oil in it will tend to seep into the wood. These, and some of the water-mix preparations, shrink as they dry. Therefore it is necessary to overfill, allowing the stopping to stand "proud" of the surface and dry, then sand away the surplus. Experience tells us just how much to allow extra, but for odd jobs, we must err on the liberal side.

Stained hardwoods can look very effective. Oil, wax or french polishing methods can be used, though the last mentioned needs a lot of patience and careful control of conditions. Dust is absolute anathema to cabinet polishing, so do not get on with other constructional work in the same room while waiting for the polish to dry. Oil staining can be fairly quick and easy, with the oil laid on thickly, then the surplus wiped off, and the process repeated until the required shade is obtained. End grains must be treated with more care, being more porous, and tending to soak up the oil, leaving a darker finish.

WATER STAINING

Water stains are not so easy. They need more applications, and one approaches the darkening process gently, even though the stain itself is fairly quick-drying and simple to use. An emergency water-stain that can be used to protect a natural wood and simply darken its colour, is obtained from dissolving crystals of potassium permanganate in water.

Staining is not the end of the job, and one must never be tempted to go too far along this line or the surface will be darkened beyond what one needs. After staining, the grain must be filled to get a smooth surface, this filling rubbed down, and final polishing can then take place. There are numerous patent fillers on the market, and these are generally applied with a pad of cloth *across* the grain of the wood, beginning with a small area and gradually extending the action. A drop of linseed oil can then be wiped over the surface when the filler is quite hard—usually an overnight process.

Deeper scratches may be filled as before, with polymer and plaster mixes, but it is always wise to incise the cut a little with a sharp knife or chisel to allow the filler a "key", and again remember to allow protrusion, then rub down. The shellac is then employed as a finish on top of the basic filler, and this will give a hard match for the original surface. Wide, shallow depressions can be filled with shellac and spirit mixture, with greater care being needed to obtain a level surface when rubbing down.

Plastic cabinets need quite different treatment. Minor scratches can be removed on most plastics by patiently rubbing them down with metal polish. For deeper scratches, a rubbing compound should be used to smooth off the surface to its new, lower level, before finishing with the milder abrasive. But it must be remembered that the colouring of a plastic material is part of the construction, not added to the surface. Although this may make the job easier, in that we have no problems of matching, it will always mean that the polished part will be lower than the original. Thus it may be required to extend the area of polishing to camouflage this depression.

Cracks and definite breaks offer more of a challenge. It is sometimes possible to fill these with chippings from a less obvious part of the cabinet than that to be treated, i.e., foot ridges and so on. The chippings can be softened with a slight application of trichlorethylene or a similar solvent, taking great care not to splash this around, and the resultant paste is moulded into the crack after keying ridges have been cut. The solvent evaporates and eventually the plastic hardens, leaving a rough surface that can be rubbed down.

It is even possible to repair clean splits by this method, moistening the edges of each side of the split with the solvent, pressing them together and clamping them until the plastic hardens—overnight is sufficient—and then rubbing down and polishing as before. If you want to make a clean joint and avoid the polishing, use a fine pointed paint brush, apply the solvent along the edge of the crack with a bias toward the unseen surface of the cabinet, and let it dry a little, as when using a contact adhesive, before pressing the two parts together. This last operation needs a steady hand. The solvent tends to spread, and one shaky attempt can ruin a smooth surface.

The join can be reinforced on the inside with a rougher seam, made by application of solvent and a "kneading" action, taking care that any protrusions thus formed will not foul the innards of the receiver when it is reassembled. And always remember that the solvent softens the material, so that excessive pressure or clumsy handling will irrevocably deform the plastic shell. These repairs need great patience—but can be immensely rewarding, and an aid to economy. Occasionally a hot soldering iron may be used on inner surfaces to "weld" a seam in plastic.

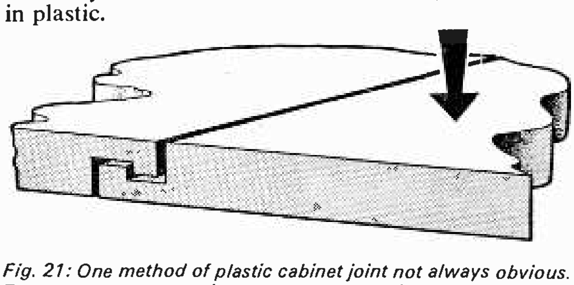
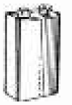


Fig. 21: One method of plastic cabinet joint not always obvious. To release the two portions, gentle pressure is needed along the seam at the side shown arrowed.



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

FLOOD LAMP CONTROL

Our dim and full switch is ideal for controlling photo flood lamps: it gives two lamps in series, two lamps full brilliance and lamps off. Similar control of other appliances can be arranged where used in pair or where circuit can be split exactly in half. Technically the switch is known as a double-pole change over with off. Our price 4/6.

Timer Switch & Thermostatic Switch

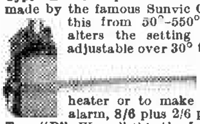
For control of oil fired boilers and process ovens in fact any equipment where parts of it have to operate for short starting periods—but which will be switched off immediately should a high enough temperature be reached.

The clockwork mechanism with jewelled escapement may be set for up to 4 mins. and operates 15 amp. changeover contacts. The thermostat can be set 70°–300°F and operates more switches directly the preset temperature is reached. Made by Smith's Electrics brand new and perfect 29/6 each plus 2/9 post and ins.

THERMOSTATS

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

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



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

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

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

TAPE BARGAINS

American made P.V.C. base 250ft. tape in message boxes (space provided for name and address of recipient) 3/9 each, 4 for 14/6 post paid. Other P.V.C. tape bargain 5in.–1800ft. 25/6, 5in.–850ft. 10/6, 5¾in.–850ft. 9/-, 5¾in.–1200ft. 11/6, 5¾in.–1800ft. 18/6, 5¾in.–2400ft. 32/6, 7in.–1200ft. 11/6, 7in.–1800ft. 8/6, 7in.–2400ft. 35/-, 7in.–3600ft. 42/6.

A.E.I. FRACTIONAL H.P. MOTOR, 200/250v. 50/60 c.p.s. enclosed, continuous rating 1/40 h.p., ex equipt. Perfect order 19/6 plus 4/6.

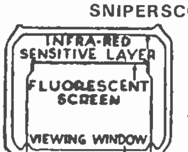
A.C. FAN, powerful mains motor with 6¼in. blade, ideal blow or extract. 17/6 plus 3/6.

1.2v. NICKEL CADMIUM CELLS, dia. ¾in. by ¼in. thick (approx.) 3/6 each, charger for two cells, 12/6.

OIL THERMOSTAT, Teddington type, T.B.B. with capillary tube and sensor adjustable by knob (not supplied), controls ¼ h.p. motor or up to 15 amp. resistive load, 9/6.

5 PUSH SWITCH, one push operates mains on/off switch, the other four operate various on/off and change/over switches, 2/6.

SNIPERSCOPE



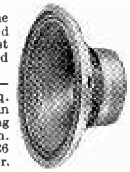
Famous war-tme "cat's eye" used for seeing in the dark. This is an infra-red image converter cell with a silver caesium screen which lights up (like a cathode ray tube) when the electrons released by the infra-red strike it. A golden opportunity for some interesting experiments. 7/6 each, post 2/6. Data will be supplied with cells, if requested.

FIELD TELEPHONE UNIT. Each unit contains magneto type ringer and bell—as well as transformer—relay and switches. A pair of these with suitable hand-telephone (not supplied) will give two-way communication over distances of up to 5 miles. Unused but in stored condition. 19/6 plus 10/6 carriage.

Multi Purpose Neon Test Unit

Robust, useful and instructive—tests insulation—capacity—continuity—resistor—volume controls—also acts as signal injector and L.T. fault finder—kit comprises neon indicator—4-way wafer switch—ebonite tubes—resistors-condensers—terminals, etc. with diagram only 9/6, plus 2/- post and insurance.

HI FI BARGAIN



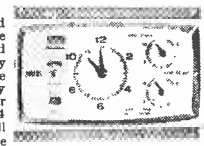
FULL FI 12 INCH LOUDSPEAKER. This is undoubtedly one of the finest loudspeakers that we have ever offered, produced by one of the country's most famous makers. It has a die-cast metal frame and is strongly recommended for Hi-Fi load and Rhythm Guitar and public address.

Flux Density 11,000 gauss—Total Flux 44,000 Maxwells—Power Handling 15 watts R.M.S.—Cone Moulded fibre—Freq. response 30-10,000 c.p.s.—Input Impedance 15 ohms—Main resonance 60 c.p.s.—Chassis Diam. 12in.—12¾in. over mounting lugs—Baffle hole 11in. Diam.—Mounting holes 4, holes—¼in. diam. on pitch circle 11⅝in. diam.—Overall height 5½in. A £6 speaker offered for only £3.9.6 plus 7/6 p & p. Don't miss this offer.

GARRARD Model 3000

This is one of the latest products of the World's most experienced maker of fine record reproducers. Its superior features include—automatic playing of up to 8 mixed size records—stopping and starting without rejecting—manual playing—pick-up pivots to give low stylus pressure—large diameter turntable for max. stability adjustments include pick-up height—pick-up dropping position and stylus pressure. Size is 13½ × 11¾in., clearance 4¾in. above, 2½in. below—Fitted with the very superior ceramic stereo cartridge type 9TAHC with diamond stylus which is listed at over £4. Price complete £10.9.6, carr. and ins. 7/6.

THIS MONTH'S SNIP



Electric Clock with 20 amp. Switch

Made by Smith's these units are as fitted to many top quality cookers to control the oven. The clock is mains driven and frequency controlled so it is extremely accurate. The two small dials enable switch on and off times to be accurately set—also on the left is another timer or alarm—this may be set in minutes up to 4 hours. At the end of the period a bell will sound. Offered at only a fraction of the regular price—new and unused only 39/6 less than the value of the clock alone—post and ins. 2/9.

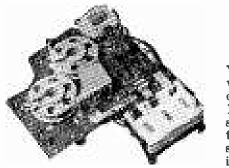
BARGAIN OF THE YEAR

MICRO-SONIC

7 transistor Key chain Radio in very pretty case, size 2⅜ × 2⅛ × 1⅛in.—complete with soft leather zipped bag. Specification:—Circuit: 7 transistor superheterodyne. Frequency range: 530 to 1600 Kc/s. Sensitivity: 5 mv/m. Intermediate frequency: 465 Kcs, or 455 Kcs. Power output: 40mW. Antenna: ferrite rod. Loudspeaker: Permanent magnet type.

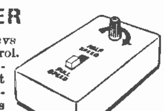
In transit from the East these sets suffered slight corrosion as the batteries were left in them but when this corrosion is cleared away they should work perfectly—offered without guarantee except that they are new 19/6 plus 2/6 post and ins., less batteries.

BATTERY OPERATED TAPE DECK



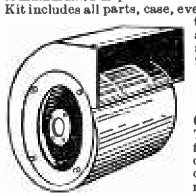
With Capstan control. This unit is extremely well made and measures approx. 6 x 5 x 2in. deep. Has three piano key type controls for Record, Playback and Rewind. Motor is a special heavy duty type intended for operation off 4/5 volts. Supplied complete with 2 spools ready to install. Record, Replay head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

DRILL CONTROLLER



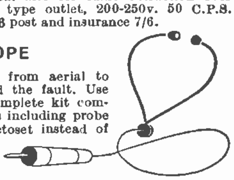
Electronically changes speed from approximately 10 revs to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. 19/6, plus 2/6 post and insurance. Or available made up 32/6, plus 2/6 P. & P.

CENTRIFUGAL FAN



CENTRIFUGAL BLOWER or extractor by Torrington, very low noise but large capacity air flow, designed for central heating and air conditioning, ideal also for fume extraction over cooker, duct type outlet, 200-250v. 50 C.P.S. motor, £3.19.6 post and insurance 7/6.

RADIO STETHOSCOPE



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

CASSETTE LOADED DICTATING MACHINE

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

MAINS TRANSISTOR POWER PACK

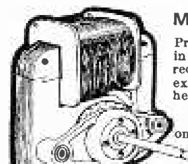
Designed to operate transistor sets and amplifiers Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, condensers and instructions. Real snip at only 16/6, plus 3/6 postage.

CAPSTAN DRIVEN TAPE RECORDER. Only £5/19/6.

(Batteries extra)

Portable with built-in microphone and loudspeaker using a 5 transistor amplifier with P.P. output. Operation by chargeable batteries. Tape capacity 25 mins. Tape position indicator. Recording level automatically preset. Inter-lock prevents unintentional erasures. Tape speed controlled by flywheel driven capstan. Neat case with carrying handle, size approx. 6½ x 7½ x 2in. Postage and insurance 7/6.

MAINS MOTOR



Precision made—as used in record decks and tape recorders—ideal also for extractor fans, blower, heater, etc. New and Perfect. Snip at 9/6. Postage 3/- for first one then 1/- for each one ordered. 12 and over post free.

FLUORESCENT CONTROL KITS

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

AUDIO SWITCH

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

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Cleaning the plastic surface, both before the repair and afterwards, is best done with warm, soapy water. Beware of some detergents, which have a discolouring effect. Pure soap is recommended. Although some engineers favour the use of methylated spirit for practically every operation except cleaning their teeth, it is wise to avoid this or any other spirit when cabinets are lettered of over-painted in any way. No matter how carefully you try to clean around taboo sections, the capillary action of fluids may defeat you, and the ancillary paintwork smudge and smear. It may seem a little like cheating, but this writer has found the cleaning fluid supplied in the BIB kit for tape-head cleaning and the like to be ideal for intricate cleaning jobs on plastics, and quite harmless to paintwork, and cheap at 4s. 6d. a bottle. It can even be used to get the dirt from the milled edges of some of those ducky little knobs.

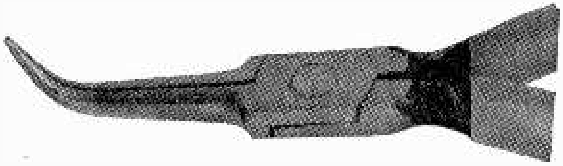
Flutings, louvers, milled knobs and such can be nasty-looking dirt-traps. This is where the orange-stick and cotton-wool, or, again, one of BIB's cleaning sticks comes into its own. If the brushing action is done away from the closed end of flutes or louvers, the accumulated dirt can be wiped away with these quite easily.

ANTI-STATIC TREATMENT

However clean her ladyship thinks she may be, some dust will be present in the atmosphere. Plastic cabinets attract it. Dimple or crackle finishes look very dull and unattractive when dust has gathered in the hollows, even quite minute amounts. The cure, after cleaning and drying, is to wipe over with an anti-static cloth, such as supplied by most retailers of gramophone records. Following this treatment with an overall wipe with one of the disc cleaning preparation can leave a cabinet pristine and sparkling.

This is all very fine, I hear some unfortunate say, but before I can begin to repair my cabinet I have to remove the knobs, perhaps the dials, and often most of the working parts inside. How to start going about it?

Admittedly, the task is not always simple. Some knobs appear welded forever to their spindles, and are shaped so that a strong pull simply leaves one pinching air. With these, it can be helpful to apply



Angled pliers are very useful for difficult jobs such as removing reluctant knobs or gripping screws in awkward places.

the old button-stick method of slotting a piece of thin, stiff card, sliding under the knob, then using two screwdrivers to apply a regular lifting movement from beneath its outer flanges. An assistant to help by holding the receiver down while you do this would be an asset. The use of two screwdrivers is to prevent a sideways twist that can so easily fracture the spindle grip of a fragile knob. Even better is a home-made lifter, consisting of a slotted piece of thin brass, that applies the pressure around more of the base of the knob. An invaluable item of the author's toolkit, often used for knob-lifting, is a long-nosed pliers with angled points.

Fixing screws in cabinets are often one-shot devices. Coarse-threaded types are employed and removal may ruin the plastic thread in the hole. One remedy is to insert a piece of pvc sleeving in the screw hole to make a kind of plug, before re-assembly. It is a better system than building up the plastic with some form of putty, as it then becomes easier to dismantle next time.

Not the best way to deal with portable radios.

Cabinets themselves may be sprung together in sections. Many plastics lend themselves to this, and where a joint is obvious and no removal method indicated, it is best to press gingerly at each side of the joint to discover which of the two is the underside section of the key (see diagram). Having found this, and applied even pressure, the cabinet will generally split along the seam with frightening ease. As with all other jobs on plastic cabinets, pursue this operation with the care you would take in handling women—be gentle, but firm!

Removal of the chassis may entail disconnection of aerial rods, speaker or earphone sockets and sundry hardware. Do not overlook the basic chore —make a small drawing of connections, colour-codes of wires, etc. Trusting to memory has led many a good man into error. Some of the mini-jack sockets are secured with knurled rings which defy attack from outside the cabinet. With these, it is best to wedge a fine-bladed screwdriver in the knurled edge, then gently turn the whole socket from within to free the thread. Only a portion of a turn is required, as a rule, and it is seldom necessary to disconnect completely. Always take care, when handling these sockets, not to twist the connecting blades relative to each other, as short-circuits are not only disconcerting but can, in some instances, damage output transistors. Many of the earphone sockets are "shorting" types, with the connecting blade pushed away from a contact blade by insertion of the plug. With these, the common fault is weakening of the spring connection, always accelerated by mishandling, so again—take care.

That, if anything, has been the theme of this section. Take care of your cabinets as well as the works inside, to make a worthwhile job of radio repairs.

TO BE CONTINUED

LETTERS...

The Editor does not necessarily endorse the views expressed by correspondents.

Hoof tugging

Your letter about leg pulling. by your letter you have not much experience on transistor as I have had OC45 specimen working at 30MC/s AND more as these transistor seem to improve with age and it is up to the circuit confushoin that controls the operating poin. So think befor you critising I would like to add the same about OC44 are the same mind you you have to have a transistor tester which put the transistor into oserlaision at they's FREQSIS your's sorry about bad spilling.—**G. Williams** (*Walthamstow, E.17*).

The above letter, printed as it was received, refers (we presume) to comments in The Amateur Bands, page 850, March issue. The author replies—"Cor" de G3JDG.

Ham-band converter

Regarding the 10-metre transistorised converter (Feb. 1968). The following modification has been carried out with success enabling both 10 and 15 metre bands to be covered.

A 100pF twin-gang variable capacitor is substituted for VC1a–b which, in the original circuit, was a 20–25pF maximum. With the 100pF gang, 10 metres will peak with this capacitor almost fully unmeshed, the tunable i.f. remaining as in the original article. Fifteen metres will peak with the new gang almost fully meshed and with the main receiver tuning over 4·5–4·95Mc/s. —**L. Case** (*Lancs*).

Such a state

"Solid State", what does it mean? This term nowadays prevalent in our reading matter, be it editorial or advertising, it is beautifully engraved on to equipment obviously to proclaim something. Hi-Fi I can relate to high fidelity, but solid state—I am at a loss. Can anyone offer an acceptable explanation? — **W. J. Tomlinson** (*London, E.17*).

Soldering saga . . . cont.

I have no wish to develop J. Macfarlane's 110V 75W soldering iron into a saga. But—if the method of M. Francis (Cheltenham) is followed the 75W iron would be converted into a 150W iron. To achieve 75W with a series diode would require an additional series resistor of 68Ω or so. Even with this resistor, the BY100 diode is over-run.—**H. Bisplan** (*Morecambe, Lancs*).

Beginner's Licence

I wholeheartedly endorse your comments in last month's Leader (June issue, page 95) *re* the Beginner's Licence. However, I suggest that the rot has already set in, and was probably instigated by the amateurs themselves.

Why should Class B licensees be allowed on the two-metre band? If you subscribe to this idea, then why stop at two metres—why not let the Class B types down on to four metres? Many arguments could be put forward to support this. Then, once they are on four—why not ten metres? In allowing and indeed supporting this move, the radio amateur is surely guilty of sowing the seeds of an idea that there is need for greater laxity in the rules and regulations governing licences.

It is too early to comment on the proposed plan for a true Beginner's Licence since nobody (well, only the late PMG) has any real idea of just what is involved. But with the present amateur's eagerness to allow all and sundry on to the two-metre band, one shudders to think what the real beginners will be allowed to do when they get going.—**E. Mason** (*Cheyne Walk, London*).

Car radio interference

With reference to "Your Questions Answered" May, 1968 *re* Interference Suppression in car radios.

What you have suggested is sound advice but I think you have overlooked one important factor, namely, aerial adjustment. Most modern car radios have a trimming screw and the usual method of adjusting it is to—rotate the screw through the position for maximum volume and return again to the maximum position to ascertain that a peak has been found. Should you be unable to find a peak position, poor matching should be suspected and may be due to fitting of an inferior aerial. This will inevitably result in reduced efficiency, and in poor reception of the more distant popular stations. It will also make the set more prone to interference.

This advice is given with Motorola Radiomobile car radios and I can assure you that if these instructions are not carried out, interference is the result.—**W. Doran** (*Bangor West, Co. Down, Northern Ireland*).

Advertisers' Rating

In view of the number of letters concerning advertisers, could they be given "star" ratings like the AA do in assessing hotels?—**J. Mirren** (*Bath, Somerset*).

[*You mean the advts should read like—OC71 3s.; AF115 4s. 6d.; bed and breakfast 15s. (17s. 6d. with integrated f.m. tuner); BC108 3s. etc.*]—*Ed.*

The bob drain

Mr. McLaren, Letters May, writes of the fortunes being made from 1s. postal orders sent in reply to adverts.

We advertise on this basis because we find that 95% of requests for literature do not result in orders. If no charge was made the costs of printing, postage and advertising would have to be paid solely by those ordering goods, with a consequent increase in prices.

I can assure Mr. McLaren that 1s. is a small amount towards the handling costs of an inquiry, if all costs are considered.

This is in no way to condone deliberate fraud of this type, but before condemning try a little simple arithmetic, and also remember that mistakes can happen with regard to enclosures omitted.—**R. G. Silson** (*near Station, Tring, Herts.*)

Twenty-two sets

As you are aware there has been a release of Ministry 22 sets.

I have a manual on these sets showing heater values, circuits, resistor and capacitor values together with technical descriptions. No doubt some of your readers have bought these sets, so if there is any query they have, please contact me and I will try and answer their questions, or supply information.—**P. James** (*27 Herbert Road, Sompting, Lancing, Sussex*).

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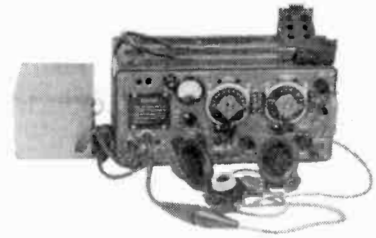

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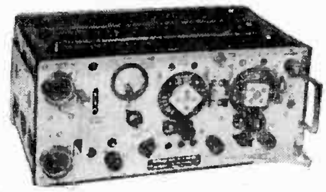

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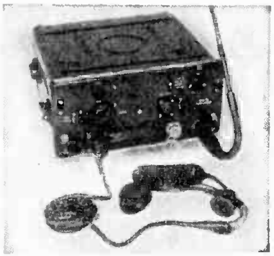
This set is made up of 3 separate units: (1) a two valve amplifier using a 6V6 output valve; (2) (some only, not built in the very latest models) a V.H.F. transreceiver covering 229–241 Mc/s using 4 valves; (3) the mainshort wave transmitter/receiver covering in two switched bands, just below 2 Mc/s–4½ Mc/s and 4½ Mc/s–8 Mc/s (approx. 160–37·5 metres) using 9 valves. For R.T., C.W. and M.C.W. The receiver is superhetrodyne having 1 R.F. stage, frequency changer, two I.F. (465 Kc/s) signal detector, A.V.C. and output stage. A B.F.O. included for C.W. or single side-band reception. T.X. output valve 807 other valves octal bases. Many extras, e.g. netting switch, quick flick dial settings, squelch etc. Power requirements LT 12 volts, HT receiver 275 volts D.C. HT transmitter 500 volts D.C., size approx. 17½ x 7½ x 11ins. Every set supplied in new or as new condition in carton with book including circuits, only £4.10.0, or Grade 2 slightly used 50/-. Grade 3, used but complete, 35/-. Carr. ALL 15/-. WE MAKE A MAINS 200/250 VOLT POWER UNIT in louvred metal case to plug direct into set power socket to run (1) receiver, 70/-, post 5/-. (2) TX and RX, £6.10.0, post 7/6. (3) 12 volt D.C. P.U. (original). FAIR CONDITION, 40/-, Carr. 5/-. A charge of 10/- to unpack and test the receiver of these sets is made only if requested. Headphones and Mike 15/-, new and boxed.



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

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Five steps to hi-fi

PART THREE . . . . . . AMPLIFIERS

IAIN SMITH

IN Part 1 of this series I mentioned that the amplifier was the strongest link in the reproducing chain. This is probably due to the fact that an extremely accurate assessment of the performance of an amplifier can be made, as the function of an amplifier is purely electrical. There are no mechanical considerations, such as with pick-ups or loudspeakers. Amplifiers are the power producing link in the chain and must be very efficient. They must also be distortion free in their signal handling capacity. With modern amplifier circuit design this sort of performance is not uncommon.

The Choice

Valve or transistor? This is the question that most aspiring high fidelity sound enthusiasts ask. The answer really depends on how much you are prepared to spend on this vital but superlative link. I firmly believe that unless you are professional, or prepared to pay the sort of price a professional expects to pay, you would be better off with a valve amplifier. Up to the present, transistor amplifiers have not turned out quite as we were led to believe. The term "transistor sound" implies an insult rather than merely a performance description. The main point is that there should be no such thing as "transistor" or any other sound, just the original sound actually as it occurred.

Design of valve amplifiers and understanding of valve parameters has reached such a stage that harmonic distortion can be brought down to the 0·1% region, which is negligible. It is true that this can also be achieved with transistor amplifiers. However, it is achieved with the application of greater amounts of negative feedback, meaning less output power for a circuit giving equivalent gain without feedback. One characteristic of transistor amplifiers, not prevalent in valve amplifiers of comparable cost, is "crossover distortion" due to the fact that transistor amplifiers usually have outputs in Class B operation. This distortion cannot be reduced with negative feedback.

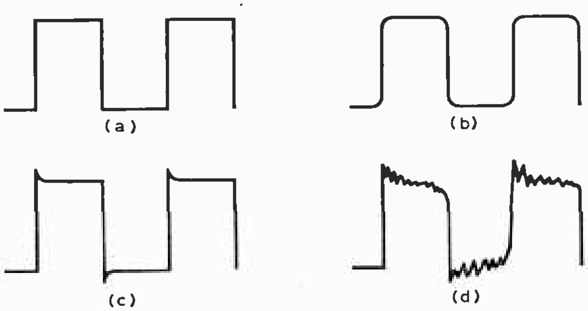

Fig. 3: Some examples of square wave performance: (a) very good, (b) reasonably good, (c) fair, (d) poor.

To sum up this argument on valves or transistors I would say that transistor performance *can* equal valve performance in all aspects but the cost is far greater at present. No doubt this situation will rapidly change. Now let us examine amplifiers in general.

Good quality amplifiers suitable for high fidelity use will have a frequency response from 20c/s to 20,000c/s ±1dB. The ±1dB assures an even flat response. Response curves for sound performance are usually plotted as frequency, to a logarithmic scale, against decibels, which is the sound output. The reference of 0dB is usually taken as 1,000c/s and any variation from the straight line of this reference is quoted as plus or minus the number of decibels (dB) variation. Why is frequency plotted as a logarithmic scale? This is in order to compress the frequency range so that the whole spectrum can be fitted on to one graph. Besides having a wide frequency response amplifiers should have outputs with a low harmonic distortion output in the region of 0·1% to 0·5%. Square wave response is important and there should be little or no traces of overshoot, ringing or fall-off in the output. Figure 3 shows some examples of good and bad square wave response.

Valve amplifiers, because of the high impedance loading necessary for valves, have an output or matching transformer. The primary winding of this transformer is wound to the impedance value necessary for correct loading of the valve and the secondary winding is wound to the same impedance as that of the speaker coil. The turns ratio is determined by the relationship Z primary $= n^2$Z secondary where n is the number of turns of the primary winding.

Output Transformer

The output transformer is, perhaps, the most important single component in a valve amplifier. Unless carefully designed it can cause the response curve to drop in the upper frequencies. This is because $XL=2\pi fL$ where XL is the winding reactance, f is the frequency and L is the winding inductance. The bigger XL is, the bigger is the impedance and the bigger is the volts drop across the winding. The output transformer must also be conservatively rated so that it is "man enough for the job". If the amplifier is rated at the maximum output of 15 watts then the transformer should be rated, at least, to this value. If the transformer is under rated then saturation of the core will occur, causing "clipping" of the waveform and hence distortion. This is particularly so at the low frequency end of the range. Transistor amplifiers, due to the low impedance loading necessary, can be designed to function with a transformerless output stage, an obvious advantage.

Noise and Hum

A problem more prevalent with valve amplifiers is hum and noise. Transistor amplifiers tend to give some hiss and crackle, known as noise; but they give virtually no hum. Valve amplifiers usually hum because of the a.c. heater supply. You have probably seen in specifications that hum and noise is −60dB at full power. This means that with the amplifier delivering full power the hum and noise level is 60 decibels less in intensity. In other words, the signal is 1,000 times greater than the hum and noise. This is referred to as the signal-to-noise ratio and a good amplifier will be in the region of −60dB.

Earlier, negative feedback was mentioned as a cure for harmonic distortion. Quite simply, negative feedback means taking a portion of the output signal and feeding it back to one of the earlier stages in phase opposition to the main signal. This cancels, to some extent, harmonics. There is another way of reducing harmonics by connecting output valves or transistors in "push-pull" operation. Figure 4 shows two valves connected in this fashion. The previous stage is a phase splitter and inverter stage, and feeds each output valve with half of the output signal, one valve handling the positive half, the other handling the negative half. By feeding these two halves into a primary winding of a transformer, which is centre tapped, a continuous output signal can be obtained. The fact that the signal is split and "pushed and pulled" in this way tends to cancel all even harmonics, thereby greatly reducing harmonic distortion. Amplifiers with output stages not connected in push-pull are termed "single ended" and are not really of a high enough quality for us to consider here.

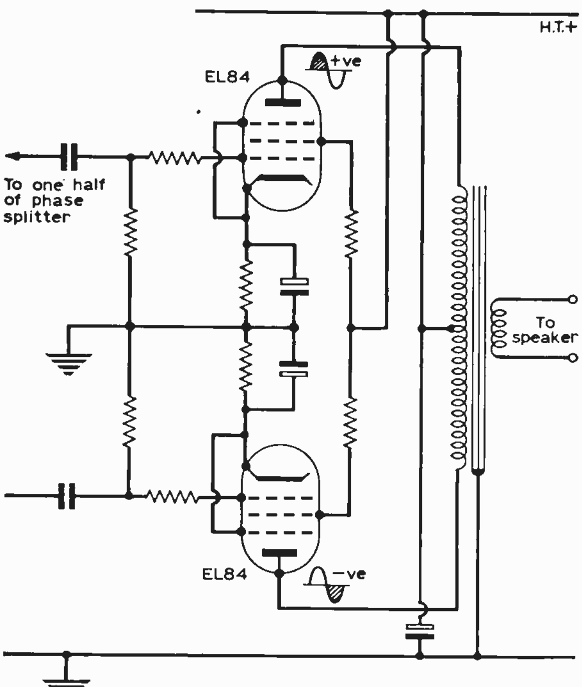

Fig. 4: A typical push-pull output stage of an audio amplifier.

Sensitivity

Now let us switch our attention from the output to the input and the "sensitivity" of our amplifier. Briefly, sensitivity is the minimum signal required to develop full output power. Our signal source, therefore, must be able to develop this magnitude of signal if we are to obtain maximum power. This is particularly important with low-gain, low-power amplifiers where power reserve is small. If your signal is too small to drive your main power amplifier then you need what is known as a pre-amplifier. This is a small voltage amplifier, connected between the signal source and the main amplifier input, to "boost" the signal voltage to the required magnitude.

At what power should your amplifier be rated? The answer really depends on the area to be covered by the sound. For outside use, 50 to 100 watts is reasonable, but the majority of domestic requirements will be satisfied by 10 watts, which will give adequate reserve.

Amplifiers can be examined in great technical detail but this is not meant to be a technical article, just an advisory one. Let us, therefore, summarise as follows:

1. On a cost/quality basis a valve amplifier is probably a better buy.
2. The frequency response should be 20c/s to 20,000c/s.
3. The harmonic distortion should be 0·1% to 0·5%.
4. Hum and noise should be in the region of —60dB.
5. Square wave response should be good.
6. The output transformer should be conservatively rated.
7. The output stage should preferably be in "push-pull" mode.
8. The input signal should match the sensitivity of the amplifier.

to be continued

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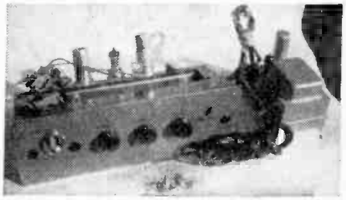

Chassis 12¾ x 5½ x 4½in. high. Front panel "gold" finish—12½ x 4½in. 200—250 A.C. Record/Playback amp. switch Off/On-Tone; Vol./Mic.; Vol./Gram; Mic. Input; Gram. Input; Monitor; Speaker Socket. Valves 6BR7; 12AX7; EM84; EL84; 6X4. Separate power pack. 2 Track **£8.19.6**; 4 Track **£10.4.6** (6/- post each). Rexine covered cabinet (tan) 15¾ x 17 x 9½in. high with sloping front for amp.; complete with two tweeter speakers, and special adapting brackets for Magnavox Deck **85/-** (8/- carr.) 3 speed Magnavox. 4 track tape deck Type 363 **£16.10.0** carr. paid.

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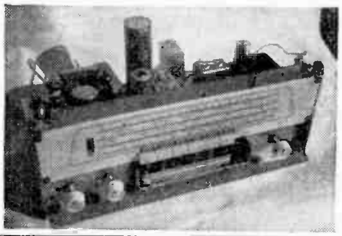

M.W.; S.W.1; S.W.2; V.H.F.; Gram: Stereo Gram. Two separate channels for Stereogram with balance control. Also operates with two speakers on Radio. Chassis size: 15 x 7 x 6½in. high. Dial silver and black 15 x 3in. 190-550M; 18-51M; 60-187M; VHF 86-100 Mc/s. Valves: ECC85, ECH81, EF89, 2 x ECL86, EM84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

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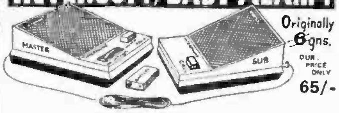

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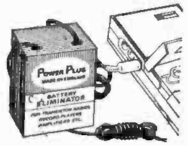

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THE club came into being three years ago, and was founded by Mr. I. G. Rees (G3VKZ). The club has a number of licensed members; Tony (G3WRY), Andy (G3PKW), Ken (G3WCS) and Ivor (G3VKZ). The club also boasts a group of keen s.w.l's who are always willing to help out at contests etc., by logging, while those who cannot read c.w. are quite content to make tea. The tea makers, however, plan to graduate to a callsign of their own, and the club offers every assistance. At every meeting a half-hour Morse class is taken by one of the licensed members, and every other week talks and demonstrations are given by G3VKZ on basic radio theory. Thus it is hoped that in time all the s.w.l's will hold tickets of their own. One member has already taken the R.A.E. and Peter, harmonic of G3WRY, will be doing so as soon as school exams permit.

The members are fortunate in having a really good QTH, since meetings are held in the Scout H.Q. in Church Road, Woolton. Woolton is the highest point in Liverpool, and rises to 350ft. a.s.l. This QTH is excellent for v.h.f. and u.h.f. as contacts on 4 metres have revealed. During the recent Jamboree On The Air, contacts on the h.f. bands included Australia and Japan, while on topband contacts were also good despite bad conditions. The antennas used for J.O.T.A. were a half-wave for 160, and dipoles for the h.f. bands. Unfortunately, the antennas cannot be left erected due to vandalism.

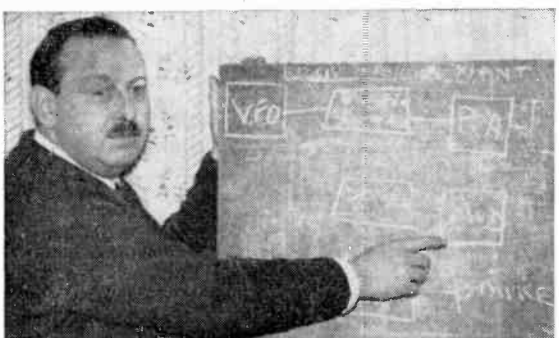
Three of the licensed members caught by the camera. Left to right: Ken (G3WCS), Lauerence (G3XGL), Tony (G3WRY).

Besides operating from Woolton, the club also operates /A and /P such as in the recent Scout Challenge, when all members and equipment had to be transported to Maghull, north of Liverpool.

Members come from all walks of life and most are still in the process of receiving education of one sort or another. The club can obtain from within virtually all its needs either free or at trade prices. It even has its own photographer who was duly converted and now hopes to get his ticket soon. Licensed members can be heard on the air fairly regularly and when more members are licensed regular skeds are planned.

Future plans for the club include entry into as many contests as possible, and a DX-pedition to a "rare" County operating on topband and 4 metres. All prospective members are very welcome and a fair proportion of members are not actually scouts, but are regarded as permanent visitors.

If you live in or near Liverpool, why not drop in and see the club for yourself? Meetings are held regularly on Thursdays at 8 p.m. clock time. Don't forget the address: Scout H.Q., Church Road, Woolton. See you this Thursday OM?

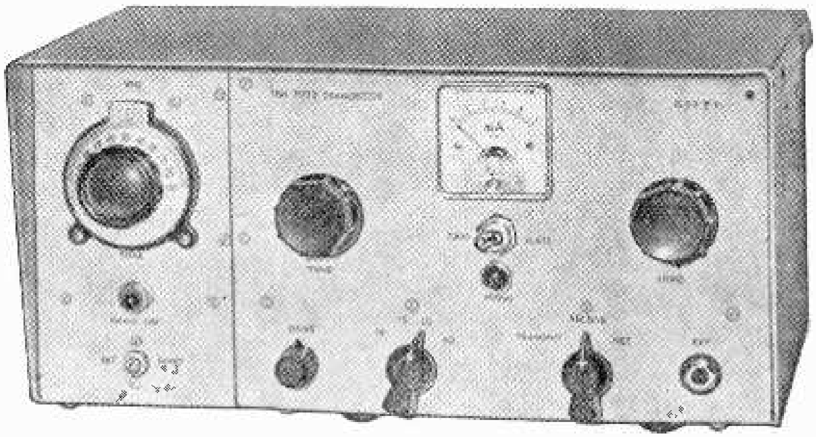


▲ *Morse practice for two s.w.l's trying to reach that magic figure of twelve words per minute.*

G3VKZ giving an informal lecture on how and why transmitters tick. ▶

V.F.O. for the Ten-Fifty Transmitter

A. S. CARPENTER G3TYJ



ALTHOUGH the "Ten-Fifty" Transmitter described last month is a compact and effective rig, its usefulness is limited by crystal control. Even when several crystals, differing slightly frequencywise, are available, attempts at operating may prove frustrating on a crowded band, and one soon realises that if it were possible to QSY slightly a clear channel could be found.

Circuitry

The complete circuit diagram of the v.f.o. is given in Fig. 1. The familiar Clapp configuration as adopted for such an oscillator is reliable. Excellent stability results due to heavy capacitance "swamping" and to the fact that the input and output circuits are very effectively divorced from each other.

The fundamental operating frequency range chosen is 3500—3550kc/s and the L1/VC1 combination and associated items tune this range. Coarse bandsetting is effected by capacitor C1 with trimmer TC1 providing a means of setting the LF band-edge as required to 3500kc/s. Since the effective valve oscillator anode is grid 2, the d.c. potential to this electrode is voltage stabilised at 150V which assists frequency stability.

The fundamental oscillator frequency plus harmonics appear at the valve anode proper where L2, tuned to approximately 7000kc/s is fitted. All four frequency bands, viz., 7, 14, 21 and 28Mc/s are workable from the basic v.f.o. frequency and "straight-through" operation is avoided. To counteract inevitable harmonic "tail-off" coil L3 is provided to stimulate output on "10".

Power supplies, viz., 220V d.c. at 25mA and 6·3V a.c. at 0·6A are picked up from the main "Ten-Fifty" chassis at the octal socket provided, whilst the v.f.o. signal is fed via coaxial cable—and only 3in. is required—to socket Sk1 on the Tx; screened inter-connecting cables are essential.

Constructional

Dimensions of the metal-work required are given in Fig. 2, the simple chassis matching that of the main transmitter. In the interests of stability care has been taken in positioning components, and the layout adopted and recommended is shown in Fig. 3. Tuning is accomplished via a vernier reduction drive mechanism through an insulated coupler, capacitor VC1 being rigidly held by an inverted screening "L" section; the band-edge setting capacitor TC1 is also fitted to the front panel.

All the coils are easily wound by hand and details are given in Table 1. Use of an air-cored coil former is preferred for L1 whilst L2 must be provided with a screening can. Since it is essential for all wiring to be taut and rigid 22 s.w.g. copper wire is used throughout, adequately sleeved. A single tagstrip conveniently anchors power supply leads to the rear chassis apron.

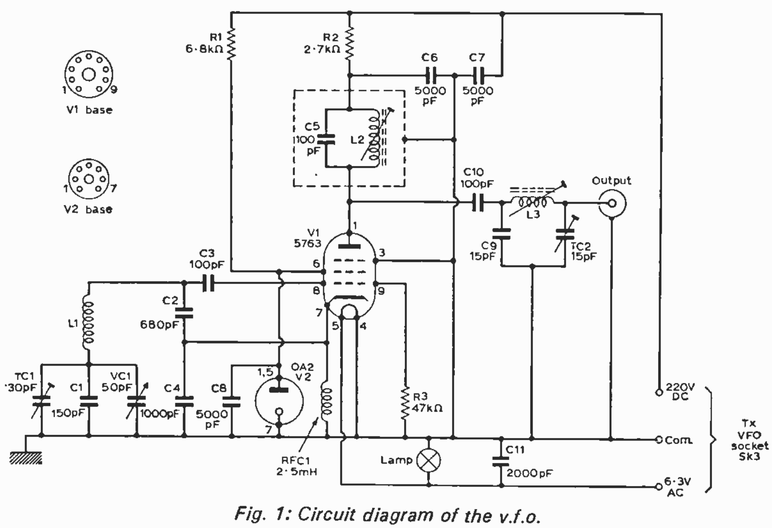


Fig. 1: Circuit diagram of the v.f.o.

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OC30 7/-
OC35 10/-
OC36 7/6
OC38 11/6
OC41 10/-
OC42 6/9
OC43 12/6
OC44 2/-
OC44PM 8/8
OC45 1/9
OC45M 8/-
OC46 3/-
OC65 22/6
OC66 25/-
OC70 2/3
OC71 2/-
OC72 2/-
OC73 16/-
OC74 8/-
OC75 2/-
OC76 3/-
OC77 3/4
OC78 3/-
OC78D 3/-
OC79 8/-
OC81 2/-
OC81D 2/-
OC81M 5/-
OC81Z 5/6
per pair
OC82 2/3
OC82D 2/6
OC83 2/-
OC84 3/-
OC123 4/6
OC139 12/-
OC140 19/-
OC169 3/9
OC170 2/6
OC171 3/4
OC172 4/-
OC200 5/-
OC201 23/-
OC202 5/6
OC203 5/6
OC204 10/6
OC205 7/6
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MATCHED TRANSISTOR SETS 1—OC44 and 2—OC45 8/6; 1-OC81D and 2-OC81 7/6; 1 OC82D and 2-OC82 8/6; Set of three-OC83 (GET118/119) 8/6; LP15 package (AC113, AC154, AC157, AA120) 12/6; Postage 6d. per set.
S.T.C. 1 watt Zener diodes. 2·4v: 2·7v: 3·0v: 3·6v: 4·3v: 13v: 16v: 18v: 30v. All 3/6d. each.

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ELECTROLYTICS. Can types: 8 × 8mfd/500v **6/9**; 8 × 16mfd/500v **7/3**; 16mfd/500v **5/6**; 16 × 16mfd/500v **8/9**; 16 × 32mfd/450v **9/-**; 32mfd/500v **7/-**; 32 × 32mfd/450v **4/9**; 50 × 50mfd/350v **5/6**; 60 × 250mfd/275v **9/9**; 60 × 250mfd/350v **16/6**; 60 × 250 × 10mfd/275v **13/-**; 64 × 100mfd/450v **18/9**; 64 × 120mfd/350v **8/6**; 100 × 200mfd/275v **8/-**; 100 × 200mfd/350v **17/9**; 100 × 200 × 60mfd/300v **17/9**; 100 × 300 × 100 × 16mfd/275v **22/-**; 100 × 400mfd/275v **12/9**; 100 × 400 × 16mfd/275v **20/9**; 150 × 200mfd/350v **20/9**; 200mfd/350v **10/9**; 200 × 200 × 100mfd/350v **24/9**; 1000mfd/50v **9/9**; 2000mfd/50v **11/9**; 5000mfd/25v **13/6**; 5000mfd/50v **24/9**; 8mfd/600v **9/9**; 16 × 16 × 16mfd/275v **6/6**; 50 × 50 × 50mfd/350v **11/-**; 16mfd/600v **13/-**; 32mfd/450v **7/6**; 47mfd/450v **7/9**; 10,000mfd/30v **26/6d**; **Tubular types:** 1mfd/500v **2/3**; 2mfd/500v **2/6**; 4mfd/500v **2/9**; 8mfd/450v **1/9**; 8mfd/500v **3/-**; 8 × 8mfd/450v **2/9**; 8 × 16mfd/450v **3/-**; 10mfd/50v **1/9**; 16mfd/450v **2/6**; 16 × 16mfd/450v **3/6**; 16 × 32mfd/350v **3/6**; 32mfd/350v **3/-**; 32mfd/450v **3/6**; 32 × 32mfd/450v **4/9**; 50mfd/350v **5/3**; 100mfd/450v **9/6**; 64mfd/450v **8/9**.

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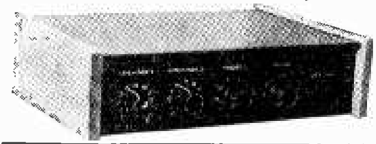
TRANSISTOR STEREO 8+8



A really first-class Hi-Fi Stereo Amplifier Kit. Uses 14 transistors giving 8 watts push-pull output per channel (16 W mono). Integrated pre-amp with Bass, Treble and Volume controls. Suitable for use with Ceramic or Crystal cartridges. Output stage for any speakers from 3 to 15 ohms. Compact design, all parts supplied including drilled metal work, Cir-Kit board, attractive front panel, knobs, wire, solder, nuts, bolts—no extras to buy. Simple step by step instructions enable any constructor to build an amplifier to be proud of.

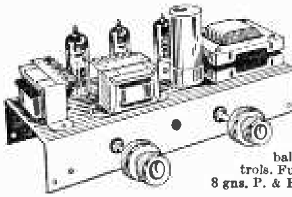
Brief Specification: Freq. response ±3 db 20–20,000 c/s. Bass boost approx. to +12 db. Treble cut approx. to —16 db. Negative feedback 18 db over main amp. Power requirements 25 V at 0·6 amp.

PRICES

Amplifier Kit	£9.10.0	P. & P. 4/6
Built and Tested	£12.10.0	P. & P. 4/6
Power Pack Kit	£2.10.0	P. & P. 4/-
Built and Tested	£3. 0.0	P. & P. 4/-
Cabinet (as illus.)	£2.10.0	P. & P. 5/6

(Special offer—£14.10.0. Post Free if all above kits ordered at same time or can be supplied built and tested for £18.0.0 Post Free).
Circuit diagram, construction details and parts list (free with kit) 1/6 (S.A.E.)

STEREO AMPLIFIER
Incorporating 2 ECL86s and 1 EZ80, heavy duty, double wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.



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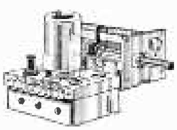
HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT
Type TA1

- Peak output in excess of 1½ watts.
- All standard British components.
- Built on printed circuit panel size 6×3in.
- Generous size Driver and Output Transformers.
- Output transformer tapped for 3 ohm and 15 ohm speakers.
- Transistors (GET114 or 81 Mullard OC81D and matched pair of OC81 o/p).
- 9 volt operation.
- Everything supplied, wire, battery clips, solder, etc.
- Comprehensive easy to follow instructions and circuit diagram 2/6 (Free with Kit). All parts sold separately.

SPECIAL PRICE 45/-. P. & P. 3/-. Also ready built and tested, 52/6. P. & P. 3/-.

FM/AM TUNER HEAD



Beautifully designed and precision engineered by Dormer & Wadsworth Ltd. Supplied ready fitted with twin ·0005 tuning condenser for AM connection. Prealigned FM section covers 86–102 Mc/s. I.F. output 10·7 Mc/s. Complete with ECC85 (6L12) valve and full circuit diagram of tuner head. Another special bulk purchase enables us to offer these at 27/6 each. P. & P. 3/-. Order quickly!

MATCHED PAIR AM/FM I.F.'s. Comprising 1st I.F. and 2nd I.F. discriminator (465 Kc/s/10·7 Mc/s). Size 1×1½×2½in. H. Will match above tuner head. 11/- pair. P & P 2/-.

GORLER F.M. TUNER HEAD. 88–100 Mc/s 10·7 Mc/s. I.F., 15/- plus 2/6 P. & P. (ECC85 valves, 8/6 extra.)

S.T.C. SILICON AVALANCHE HALF-WAVE RECTIFIERS. Type RAS. 508 AF. 6 amps. 960 P.I.V. 1in. long ×½in. dia. approx. List 50/-. OUR PRICE 8/6 Post Free.

SPECIAL OFFER! PLESSEY TYPE 29 TWIN TUNING GANG. 400 pf+146 pf. Fitted with trimmers and 5:1 integral slow motion. Suitable for nominal 470 Kc/s. I.F. Size approx 2×1×1½in. ONLY 8/6. P. & P. 2/6.

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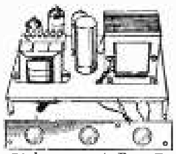
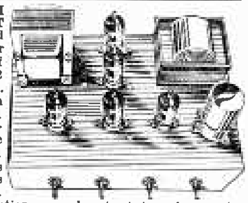
3-VALVE AUDIO AMPLIFIER MODEL HA34



Designed for Hi-Fi reproduction of records. A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7½" w.×4" d.×4½" h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls. Complete with knobs, valves, etc., wired and tested for only £4.5.0. P. & P. 6/-.

HSL "FOUR" AMPLIFIER KIT. Similar in appearance to HA34 above but employs entirely different and advanced circuitry. Complete set of parts, etc. 79/6. P. & P. 6/-.

10/14 WATT HI-FI AMPLIFIER KIT



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3–15 Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 2/6 (Free with parts). All parts sold separately. ONLY £7.9.6. P. & P. 8/6. Also available ready built and tested complete with std. input sockets, £9.5.0. P. & P. 8/6.

MAINS TRANSFORMER. For transistor power supplies. Pri. 200/240v. Sec. 9-0-9 at 500 mA. 11/-. P. & P. 2/6. Pri. 200/240v. Sec. 12-0-12 at 1 amp. 14/6. P. & P. 2/6.

MAINS TRANSFORMER. For transistor power supplies. Tapped pri. 200/250v. Sec. 40–0–40 at 1 amp (with electrostatic screen) and 6·3v. at ·5 amp for dial lamps etc. Drop thro' mounting. Stack size 1⅞×3¾×3¼in. 27/6. P. & P. 4/6.

MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS. Stack size 1½×1½×⅝in. Output trans. tapped for 3 ohm and 15 ohm output. 10/- pair plus 2/- P. & P.

PARMEKO 7-10 watt OUTPUT TRANSFORMERS to match pair of ECL82's in push-pull. Sec. tapped 3·75, 7·5 and 15 ohm. Stack size 2½×1×2in. approx. ONLY 12/-. P. & P. 3/-.

7-10 watt OUTPUT TRANSFORMERS to match pair of ECL86's in push-pull to 3 ohm output. ONLY 11/-. P. & P. 2/6.

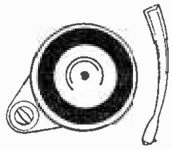
10-12 watt OUTPUT TRANSFORMERS. Size 2½×2in. Clamp fitting. For two EL84's in push-pull. State 3 or 15 ohm impedance. 12/6. P. & P. 2/6.

ACOS HIGH IMPEDANCE CRYSTAL STICK MIKES. Listed at 42/-. Our price 21/-. P. & P. 1/6.

ACOS CRYSTAL MIKES. High imp. For desk or hand use. High sensitivity, 18/6. P. & P. 1/6.

SPECIAL OFFER! MOVING COIL MIKE. Fitted on/off switch for remote control High quality. High or Low impedance. (State imp. reqd.) BARGAIN PRICE 30/-. P. & P. 2/6.

HUGE PURCHASE! E.M.I. 4-SPEED PLAYER



Heavy 8½in. metal turntable. Low flutter performance 200/250 v. shaded motor (90 v. tap. Complete with latest type lightweight pick-up arm and mono cartridge with t/o styli for LP/78. LIMITED NUMBER ONLY 63/-. P. & P. 6/6.

4-SPEED RECORD PLAYER BARGAINS
Mains models. All brand new in maker's packing.
E.M.I. MODEL 999 Single Player with unit mounted pick-up arm and mono cartridge...... £5.5.0
B.S.R. UA25 Changer with mono cartridge.... £6.7.6
All plus Carriage and Packing 6/6.
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LATEST B.S.R. X3M MONO COMPATIBLE CARTRIDGE With turnover sapphire styli suitable for playing 78, EP, LP and Stereo records with mono equipment. ONLY 22/6. P. & P. 1/6.
SONOTONE 9TAHC compatible Stereo Cartridge with diamond stylus 50/-. P. & P. 1/6 each.

QUALITY RECORD PLAYER AMPLIFIER
A top-quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, EZ80 valves. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7" w.×3" d.×6" h. Ready built and tested. PRICE 75/-. P. & P. 6/-.
ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE 97/6. P. & P. 7/6.

DE LUXE QUALITY PORTABLE R/P CABINET
Uncut motor board size 14½×12in. clearance 2in. below, 5½in. above. Will take above amplifier and any B.S.R. or GARRARD autochanger or Single Player unit (except AT60 and SP25). Size 18×15×8in. PRICE £3.9.6. P. & P. 9/6.

VYNAIR AND REXINE SPEAKER AND CABINET FABRICS app. 54in. wide. Usually 35/- yd., our price 13/6 yd. length. P. & P. 2/6 (min. 1 yd.). S.A.E. for samples.

BRAND NEW 3 OHM LOUDSPEAKERS
5in. 14/-; 6½in. 18/6; 8in. 27/-; 7×4in. 18/6; 10×6in. 27/6. E.M.I. 8×5in. with high flux magnet 21/-. E.M.I. 13½×8in. with high flux ceramic magnet 42/- (15 ohm 45/-). P. & P. 5in. 2/-, 6½ & 8in. 2/6, 10 & 12in. 3/6 per speaker.
BRAND NEW. 12in. 15w. H/D Speakers, 3 or 15 ohms. Current production by well-known British maker. Offered below list price at 89/6. P. & P. 5/-. Guitar models: 25w. £5.5.0; 35w. £8.8.0.
E.M.I. 3½in. HEAVY DUTY TWEETERS. Powerful ceramic magnet. Available in 3, 8 or 15 ohms. 15/-. P. & P. 2/6.
12in. "RA" TWIN CONE LOUDSPEAKER. 10 watts peak output. 3 or 15 ohm. 35/-. P. & P. 3/6.

35 OHM SPEAKERS
3½in. 12/6; 7×4in. 21/-. P. & P. 2/- per speaker.

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

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

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Quantity and Trade enquiries invited.
NOTE. *Large tape stocks at all branches.*

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Proof of operation is readily found by inserting a test meter adjusted to read 0—50mA in circuit on the "hot" side of L2 when at switch-on a reading of approximately 15mA should be obtained; V2 should also be seen to glow. By disturbing the grid circuit of V1 in some way—short-circuiting L1 momentarily for example—should cause the meter pointer to swing smartly to a higher reading immediately falling back when the temporary short is removed. If, however, it is found that the meter indicates a steady current of say 35—40mA during the test it is clear that the circuit is not oscillating and before proceeding a circuit and component check must be made. When the circuit is functioning correctly the external meter may be transferred to V2 and when connected between pin 7 and chassis should show a reading of around 10mA when power is applied.

Checking

The station receiver is then switched on and tuned to 3500kc/s precisely with the aid of a frequency marker. With the v.f.o. dial set to "100" and the vanes of VC1 fully engaged, TC1 is carefully adjusted until the signal is detectable on the receiver; the v.f.o. signal should also appear at approximately 3550kc/s when VC1 is tuned to the other end of its travel. If excessive frequency coverage results, this may be reduced by inserting a fixed value capacitor in series with VC1 and if it is not possible to tune down to 3500kc/s, a small capacitor connected across C1 may do the trick. To adjust L2 the receiver is tuned to 7050kc/s and the v.f.o. signal sought. Using the receiver "S" meter as a guide, the coil of L2 may be adjusted for maximum deflection. Due to the interconnecting cable, coil L3 cannot be adjusted until both v.f.o. and transmitter are connected.

With both units connected the transmitter band-switch is set to "10", the key inserted in its jack socket and the panel meter switch set to show grid current. The transmitter function switch is then moved to "Net" and the key depressed whereupon the drive control is set to show maximum meter deflection. Coil L3 and trimmer TC2 may then be carefully adjusted to increase the current indication and some 4mA of drive should be obtainable, although this is more than normally required. A similar amount of drive should also be present when the transmitter band-switch is set to the other bands covered.

TABLE 1—COIL DETAILS

Coil	*Turns*	*Wire*	*SWG*	*Former dia. (inches)*	*Core*	*Remarks*
L1	26	enamel	22	1·0	Air	Close-wound. Former length= 1·25in.
L2	22	d.s.c.	36	0·25	Iron	Close-wound. Screened
L3	8	enamel	30	0·25	Iron	Close-wound

Winding details for the inductors.

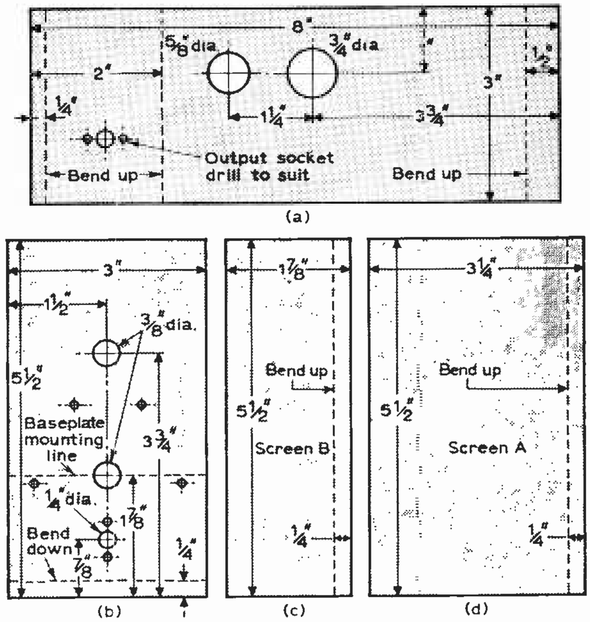
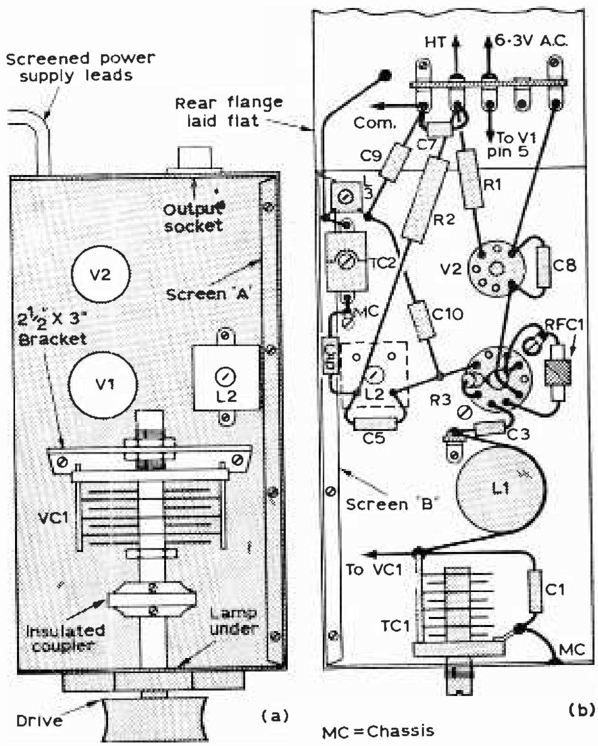


Fig. 2 (above): Drilling details and dimensions for (a) chassis, (b) bracket for VC1, (c) screen B, (d) screen A.

Fig. 3 (below): Layout and wiring of components above and below chassis.



With the v.f.o. complete, the idea of integrating the two units should be considered. In the interests of t.v.i. elimination a metal case is required; it is also essential to fit vertical screens between the v.f.o. and Tx units, extended to shield both above and below chassis items from each other.

Two sheets of 16 s.w.g. aluminium each 12 × 8in. will provide enough metal for the main case shell whilst a further section will serve as a base-plate. The base-plate—to which rubber feet are fitted—is easily secured to the chassis undersurface flanges provided using self-tapping screws. The case and panels are grey-lacquered with legends applied using transfers.

After checking the v.f.o. for drift its dial may be made more useful if a set of band calibration curves are drawn up on graph paper using as a reference a Crystal-marker/Receiver combination. It may also be additionally interesting to note that the "Ten-Fifty" Transmitter may be made a 5-band affair to include "80". This may be done by increasing the tank coil windings to 32, fitting an additional coil to the 6CH6 anode assembly and making S1 a two-pole, six-way rotary type switch with one of the "ways" blanked off. Adequate drive is obtainable although a poor or chirpy note may result due to "straight through" working. ■

Note. *A licence is required to operate the 10-50 transmitter and v.f.o. Details are obtainable from Radio Service Branch, G.P.O. Headquarters Building, St. Martins le Grande, London, E.C.1.*

★ components list

Capacitors:

C1	150pF s.m.	C10	100pF s.m.
C2	680pF s.m.	C11	2000pF ceramic
C3	100pF s.m.	TC1	30pF trimmer type C801
C4	1000pF s.m.		
C5	100pF s.m.	TC2	15pF ceramic trimmer
C6	5000pF ceramic		
C7	5000pF ceramic	VC1	50pF variable (Wavemaster)
C8	5000pF ceramic		
C9	15pF s.m.		

Resistors:

R1	6·8kΩ 5W
R2	6·8kΩ 5W
R3	47kΩ 1W

Valves:

V1	5763
V2	OA2

Coils:
See text

Miscellaneous:
B9A valveholder with skirt and can; B7G valveholder; panel lamp and lens; insulated coupler; tagstrip; two coil formers—0·25in. (one with screening can); coil former 1in. diameter; coax socket; 2·5mH r.f.c.; I.O. plug; vernier drive—Eagle, type T502; aluminium for case, chassis, etc.

AUDIO FAIR 1968

—continued from page 175

endless loop tape cassette facility etc. Models *713*, *713H* and *715* are mono types and models *702*, *702H*, *722*, *722H*, *704* and *724* are stereo models.

From **Philips** comes the model *PRO 12* recorder designed for hi-fi enthusiasts who want something more than the ordinary domestic recorder, and professional people who want a recorder for studio applications. It is a two-speed machine (3¾ and 7½ i.p.s.) which can be operated either vertically or horizontally and is suitable for twin-track mono or twin-track stereo recordings. Price is 180gns. Also from **Philips** comes the stereo player *N2500*. This unit has preamp output which can be fed through a hi-fi amplifier to provide full stereo reproduction. The price was not fixed at the time of going to press.

PICK-UP CARTRIDGES, LOUDSPEAKERS AND TURNTABLES

There were many new products on show, especially in pick-up cartridges. **Cosmocord** displayed an improved version of their **Acos Cosmocord;** including the Acos stylus pack. Latest of the **Decca** Mark 4 pick-up cartridges was the *FFSS 4RC* which was being demonstrated, and priced at 16 gns. On display by **Shure** was the *M75E-95G Gard-a-Matic Hi-track* cartridge, which we understand has been designed specifically for use with the **Garrard SL95** turntable. Various other new models on show by **Shure Electronics**, including the *M31E* and *M32E*, both with bi-radial elliptical stylus.

Kef Electronics' new addition to their range of loudspeaker systems was the *Concerto*, a three speaker system in an enclosure measuring 28 × 17 × 12in. Maximum audio input 25 watts r.m.s. 50 watts music rating with a frequency response of 30-30,000c/s.

The **Lowther** range has been augmented by the *PM6 MK1*, which has an entirely new diaphragm assembly, giving an all-round improved performance.

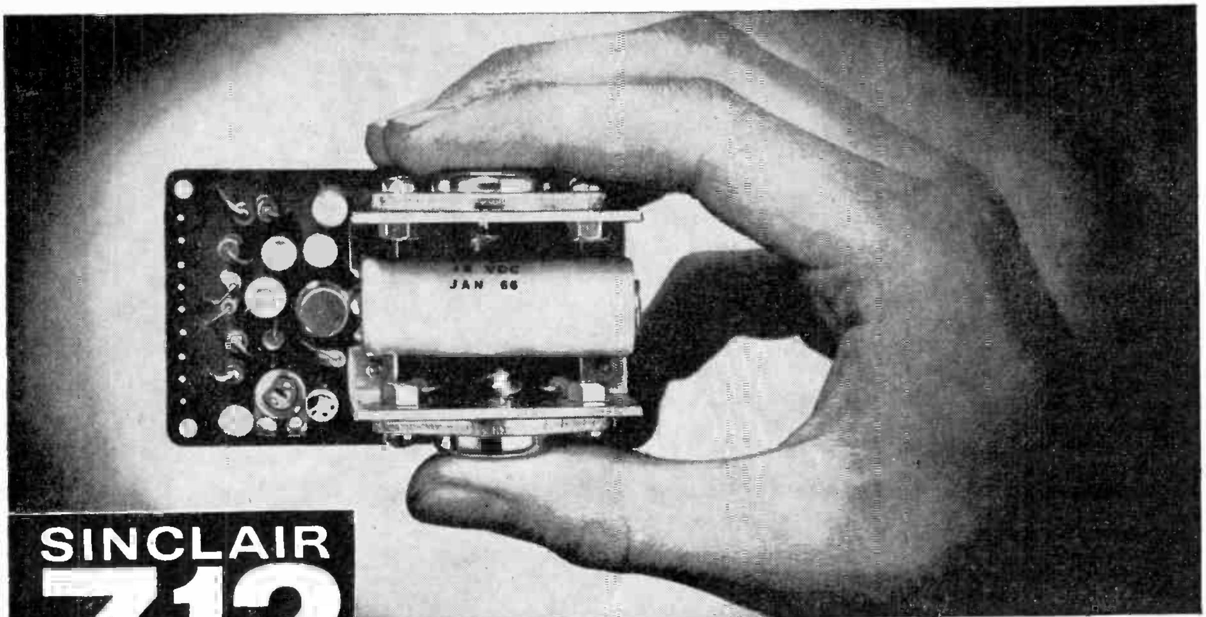
EMI were offering matched loudspeaker sets, complete and ready for enclosures. They came in seven different sizes ranging from the "*250*", with a 5in. "woofer" designed for a 0·4 cu.ft. enclosure, up to the "*950*", with a 19 × 14in. "woofer" for a 4 cu.ft. enclosure. The photograph shows the "*750*" matched loudspeaker set, suitable for a 2·5 cu.ft. enclosure, which comprises a bass, mid-range, and two high-frequency tweeters. The "*750*" has a frequency response of 20-20,000c/s.

Amongst the new range from **Garrard** were the *SL75*, *SL65*, *AP75* and *3500*. Models *SL95* and *SL75* are automatic transcription turntables, and *SL65* a high quality automatic turntable. Model *AP75* is a moderately-priced single record playing unit fitted with a four-pole induction motor. Model *3500* is a moderately-priced automatic turntable, featuring a low mass pick-up arm for use with high compliance pick-up cartridges.

As an extension to their range of automatic turntables **BSR** introduced the *UA75*. Additional refinements, exclusive to the *UA75* over their earlier models, include a heavy cast non-magnetic machined turntable. A muting switch provides complete silence during the record changing cycle and a "pop" filter suppresses switch arcing when the unit shuts off. It also has manual facilities and alternative spindles are provided.

Lustraphone had several new microphones on show. In their *Series Four*, these included the *4-20* multi-impedance omni-directional moving coil; *4-30* multi-impedance hyper-cardioid moving coil; *4-50* professional multi-impedance dual ribbon studio quality with noise cancelling (for the first time).

Amongst the host of microphones on show **AKG (Politechnica Ltd.)** were showing the *D200*, a cheap version of their earlier model *D202*. Also appearing for the first time was the *D224*, a microphone for the professional user of the dynamic cardioid type. **AKG** also displayed the *K20* and *K60* moving coil headphones, suitable for stereo listening. ■



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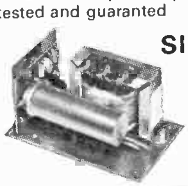

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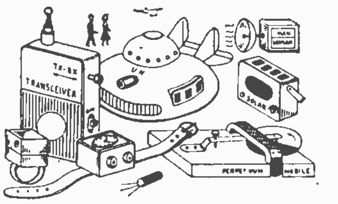

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SEMI-CONDUCTORS: OA5, OA81, **1/6d.** OC44, **2/-.** OC45, **1/9d.** OC71, OC72, OC73, OC81, OC81D, OC82D, OC170, OC171, **2/3d.** OC140, AF115, AF116, AF117, **3/-.**
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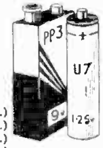
(continued)

COMPONENTS



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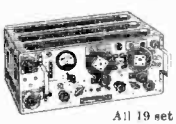

Covers 2–8 Mc/s in 2 bands. 11 valve superhet transceiver including 807 P.A. Power reqs. LT 12v. H.T. rec. 275v. H.T. transmit 500v. D.C. Slightly used **55/-**. Selected condition **85/-**.
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34ft. 6 section **90/-.**

MAKE YOUR OWN AERIAL MAST!
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P.C.R. Rx

These are a 6 valve plus rectifiers Long, Med. and S.W. Rx covering S.W. 6 to 18Mc/s 50 to 16 metres, they have internal speaker, sks for phones, tone control. Ae trimmer, and good slow motion drive supplied fitted with 200/250v mains P.U. Tested and ready to work. size 16 x 8in. front by 10in. deep. Good condition.
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RECT UNIT TYPE 7

I/P 200/250v 50c/s or 12v D.C. O/Ps 150v D.C. at 30mA. 40v A.C. at 30mA. 12v D.C. at 300mA. fitted fuse, on/off swt. Ind lamp. term strips. etc. Also spare vibrator. Ideal for small charger. New and boxed.
Price: **25s.** plus 7s. 6d. carr.
Also in used condition **17s. 6d.** plus 7s. 6d. carr.

INDICATOR UNIT TYPE 95

Contains CRT type VCR.97 green screen. 16 octal valves, CRT filament trans Focus. Brill. Gain controls fitted. Also Mu Metal shield slow motion dial. 2 x 500pF tuning conds. 100Kc/s standard crystal unit. slow motion drives and large number of other parts in good condition with outer cover.
Price: **£3 15s. 0d.** plus 10s. carr.

TEST SETS 261 and 266

These are a portable test osc intended to work off 6v D.C. The 261 covers 175 to 305Mc/s and the 266 covers 95 to 180Mc/s. These units are directly calibrated. no Xtals are required and the O/P is modulated with var freq osc. A small Ae system is supplied. and a 6v Vib unit is built into unit.
Price: Either type **£3 5s. 0d.** plus 10s. carr.
OR **£6** per pair carr. paid.

Rx UNIT TYPE ARR-2

These are a small airborne Rx tuning the band 234 to 258Mc/s and use valves 6AK5 x 3, 9001 x 7 and 12A6 O/P. These have O/P for 300 ohm phones. size 5½ x 4½in. front, 11in. deep. These Rx in their present condition are unsuitable for normal use. They can, however. be modified to tune the band 125 to 150Mc/s circuit diagrams and full modifications are supplied with Rx in good condition. A test Osc or Sig gen is required to carry out the modifications.
Price: **£3 10s. 0d.** plus 6s. post.

R.F. AMP No. 4

This is the V.F.O. and P.A. section of the Army No. 53 Tx covering the freq range 1·2 to 17·5Mc/s in 4 bands and uses the following valves: Osc TT11, Buffer TT11, Driver 807. P.A. two 813s. Bias rect 6X5. Volt stab VS110x2. 3 meters are fitted to monitor Grid, Anode and Ae current. Ae C/O relay is fitted and unit is intended to work into a dipole Ae. ext supplies of 1.5Kv. 400v D.C.. 230v A.C. and 12v D.C. are required. Unit can be operated with one 813 to bring I/P power down to 150 watts. Supplied new and crated with circ.
Price: **£15** plus 20s. carr.
V.F.O. section of above in used condition with circ price **£4** plus 10s. carr.

ROLLER INDUCTORS

For Ae tuning and loading. size of coil 2½in. dia., 7in. long. approx. 48 turns with knob and counter dial. Ex equip.
Price: **17s. 6d.** plus 4s. 6d. post.

465 Kc/s I.F. TRANSFORMERS

Size 1½ x 1½ x 3½in. can be used in 19 set or P.C.R. ideal for improving gain and selectivity in old units. New and boxed.
Price: **8s. 6d.** per pair post paid.

POWER UNIT TYPE 311

I/P 200/250v 50c/s. O/Ps +300v at 250mA. —130v at 40mA. 12v D.C. smoothed at 4 amps. The O/Ps are all fused and can be switched remotely by relays in P.U. Supplied in good condition with outer cover and circ. This unit is the ground supply unit for the SCR.522 (BC624/5 Tx/Rx).
Price: **£4 10s. 0d.** plus £1 carr.

POWER UNIT KIT

Complete kit of parts to build a 230v I/P P.U. with the following O/Ps: 500v D.C. smoothed at 140mA. 6·3v at 6 amps and 6·3v at 2 amps. Parts supplied as follows: H.T. trans, L.T. trans. Choke. 2x conds. 5U4. On/Off swt. Ind lamp. fuse. valve holder. mains cable. connecting wire and circuit. All you need is chassis. All parts are ex equip and in good condition.
Price: **£2 10s. 0d.** plus 8s. 6d. carr.

TEST SET TYPE 219

I/P 230v 50c/s this is a variable freq pulse generator covering 500c/s to 10Kc/s in 2 ranges. The width of the O/P pulses can be adjusted from 5 to 0·5µ secs. There is also a fixed width O/P pulse of 20µ sec. The O/P can be switched to +50. +10 and —10v and is variable down to 1 Mil volt in steps of 10. By making an internal connection to the unit it is possible to obtain a 1 to 1 square wave and sawtooth waveforms. Supplied in good condition. Tested with circ and leads in transit case.
Price: **£5 10s. 0d.** plus 12s. 6d. carr.

TAG BOARD ASSEMBLY

This is a 26-way Tag Board fitted with the following parts: 17 1N538 and Top Hat Diodes. These are rated 200v P.I.V. at 250mA, 2N414 P.N.P. and 2N438 N.P.N. transistors. 7 1% resistors and 18 other small parts. All parts can be removed and reused.
Price: **12s. 6d.** plus 2s. 6d. post.

POLARISED RELAYS

These have two coils of 1·8K ohm each, contacts 1 pole c/o. with dust cover. Both contacts and magnet can be adjusted and moving contact will stay in either position. These can be put to use in the construction of a Scope calibrator and 50c/s square wave generator. A circ diagram and instructions are supplied with them. Ex American equip.
Price: **10s.** plus 1s. 6d. post.

MINIATURE UNISELECTORS

Coil 600 ohm 50v. contacts 1 pole 11-way 3-bank. made by Clare & Co., U.S.A. Ex equip.
Price: **18s. 6d.** plus 3s. post.

DIGITAL IND UNIT

This is a digital indicator unit built into a 19in. rack panel, 3½in. high by 17in. deep. There are three low voltage number tubes plus one with special markings. These give numbers 0 to 9, ⅞in. high and requires 6v. Each number tube has 10 lamps, each lamp has one 2N404 and one 2N1184 transistors which are mounted on plug-in boards. One board with 20 transistors to each tube. Size of each number tube 4in. long, 1½in. high and 1in. wide. Extra tubes can be mounted side by side. These were made in '63 by Sylvania U.S.A. for USAF. In very good condition.
Price: **£8** plus 10s. carr.
Single tubes with transistor board and plugs price **50s. 0d.** plus 4s. 6d. post.

POWER UNIT FLR-9

I/P 120v 50c/s O/Ps +100v D.C. at 8 amps, —26v D.C. at 4 amps, 7·25v A.C. at 78 amps. These are a very elaborate P.U. made by Bogue Elec. U.S.A. for the USAF in '63. All three O/Ps are stabilised and can be adjusted over limited ranges. Further details available on request. Supplied in very good condition.
Price: **£26** plus 30s. carr.

POWER UNIT FLR-9

I/P 120v 50c/s O/P 10v D.C. at 20 amps. the O/P is fully stabilised and can be adjusted from front panel over the range 9 to 12v at 20 amps. O/P ripple at full load is less than 10 Mil/V. Made in '63 by Bogue Elec. for USAF. Supplied in good condition. Further details on request.
Price: **£16** plus 15s. carr.

MIN PANEL METERS 500 Ua scaled 1mA 2½ OSD **14/-**. Whip Aes 12ft 3-section with base **18/-**, B.N.C. plugs and Sks **2/6** ea. 100ft insulated Ae wire with 3 insulators **10/-**, 115v 50c/s blower motors new boxed **28/-**, Trans 230/110 pria. sec 6v 1·5a twice new boxed **14/6**. 12v 1a F.W. metal rect **6/-**, Panel neon indicators with res for 230v good quality 3 for **7/6**, Control knob 12 ass to fit ¼ shafts **6/-** or pointer knobs 1½in long **7/6** for 12. Large W.W. pots 25K 3in. dia. ¼ shaft **6/-**, Toggle swts 3 types as follows all 3 for **6/-**: D.P. c/o. D.P. c/o biased one way. Single pole c/o. Top hat diodes type 1N538 200v P.I.V. at 250mA **6/6** per doz ex equip. Conds 1uF 400v block paper with clip modern make 3 for **6/-**, Conds 20uF 100v and 15uF 150v Tantalum new unused **2/-** ea. A.F. O/P trans Pria 10/60K sec 600 ohm new **9/-**. Meters 50Ua scaled in milli Rontgens 2½in proj **20/-**, Small insulated test sockets to take 1/16th dia. prod **6/-** per doz. CV2247 Geiger Muller tubes new tested with circ **10/-**, Conds 8uF 750v block paper 4 for **£1**. Relays 115v A.C. 2p c/o will work off 230v through 2K ww res **5/-**, U.S. Army Xtal boxes 4½ x 6½ x 1¾in. hinged lid no holes 8 for **£1**. Two-sided box 11 x 3 x 4¼in. with 2 hinged lids 4 for **£1** (both types new). Lesdex swts 24v 6p 4w 3b small type **12/6**, Xtal units 100kc standard **11/6**. All above post paid.

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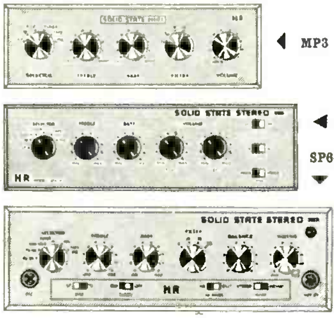

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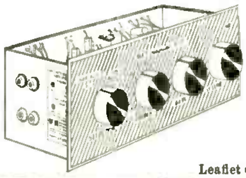

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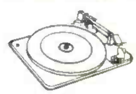

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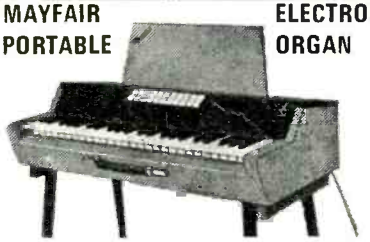

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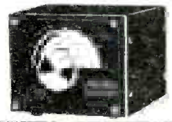

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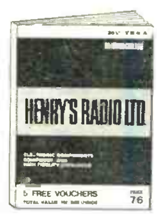

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