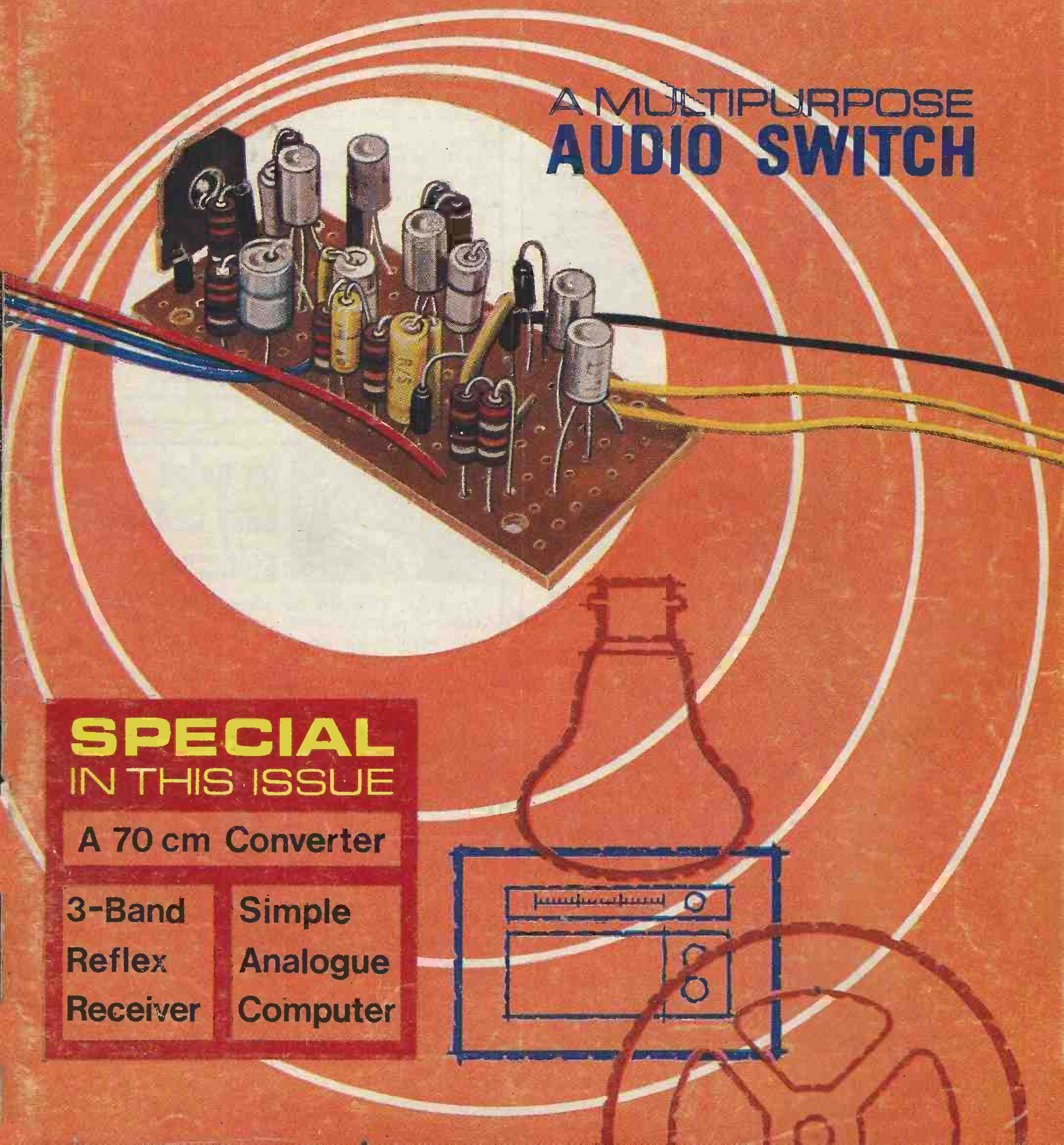
PRACTICAL WIRELESS

MAY 1967

2/6



A MULTIPURPOSE AUDIO SWITCH

SPECIAL IN THIS ISSUE

- A 70 cm Converter
- 3-Band Reflex Receiver
- Simple Analogue Computer

JASON

★ TAPE ★

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**

Postage 1/- *reel.*

Post Free less 5% on three reels.

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

BARGAIN PARCELS

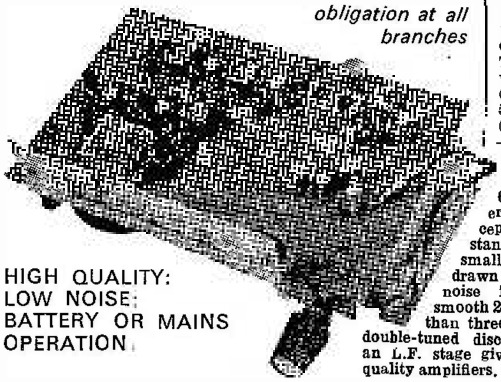
Including variable condensers, i.f. coils, loudspeaker plugs/sockets, knobs, pots, condensers, resistors, nuts, bolts, cabinet fittings, switches, transformer choke, rectifier, transistors at a small fraction of list value. Due to heavy demand we are now packing them in several sizes—**TRY ONE.**

3 lbs. (post 3/-)	9/-
7 lbs. (post 5/-)	17/6
14 lbs. (post 6/-)	29/-

Transistorised FM Tuner

CALLERS WELCOME

Demonstration without obligation at all branches



HIGH QUALITY: LOW NOISE; BATTERY OR MAINS OPERATION

This beautifully compact 6 transistor machine (size 6 x 4 x 2¼in.) will give quieter, more interference free reception. Months of use from a standard 9 volt battery or its small power requirements can be drawn from any amplifier. Low noise frequency changer with smooth 2 gang tuning feeding no less than three I.F. stages coupled to a double-tuned discriminator terminating in an L.F. stage giving ample output for all quality amplifiers.

avoid disappointment

ORDER NOW £8-10

TRANSISTORS GUARANTEED TOP QUALITY

Mullard Matched Output Kits OC81D and 2-OC81	9/6
R.F. Kits OC44, OC45 (2) 3 transistors	9/6

GERMANIUM DIODES

General Purpose miniature detector A.V.C. etc. 6/6 doz. **8d.**

Gold Bonded highest quality. Individually tested 9/6 doz. **1/-**

SILICON H.T. RECTIFIERS

Guaranteed performance. Top makes. Tested 250v. working. 120 mA (3 for 6/6) **2/9**

500 mA (3 for 19/6) **7/6**

LATEST

GARRARD

All Factory Fresh. All with cartridge. EV26 Ceramic Stereo cartridge fitted to any deck for 15/- extra.

SRP12	£4.7.6
SP25	£9.19.0
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Model 1,000	£6.5.0
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Model 3,000	£8.10.0
AT60	£9.19.0
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B.S.R. BARGAINS

TU14	59/-
GU7	85/-
UA14	89/-
UA16	99/-
UA25 SUPERSLIM	£5.10.0

CARTRIDGES

G.C.2. Garrard Mono	16/-
EV26 Garrard Stereo Ceramic	24/-
EUPHONIC SUPER Ceramic Stereo Diamond 100mV Output	29/-

AVOID AMPLITUDE DISTORTION WITH YOUR HI-FI AMP.

STABILISED

TRANSISTOR POWER SUPPLY

- VARIABLE 0—15V. AT 0—1 AMP.
- STABILISED FOR MAINS VAR. 210 - 250V.
- RIPPLE CORRECTED
- SHORT CIRCUIT PROTECTION
- HANDSOME STYLED CABINET

★ PRICE ONLY 6GNS.

10 WATT TRANSISTOR AMP

Consisting above stabilised power pack (can be used separately), with built-in pre-amp and controls driving two x OC26 main amp. in styled cabinet. New concept in value and design. 10 transistors, selection, vol. and tone controls equalisation.

PRICE 12GNS.

ELPICO MONO PREAMPS

DPA15. Latest black/satin chrome finish multiple input channels selector bass and treble controls. Matches all pick-ups and mikes. Provision tape recording. Normally **10 gns.** our price **4 Gns.**

Value in VALVES

GUARANTEED 3 MONTHS BY RETURN OF POST

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

1L4	2/3	6K8GT	9/6	20P4	17/9	ECC88	9/6	GZ34	10/6	SP61	2/9
1R5	4/9	6L1	9/6	25L6GT	7/-	ECF80	7/9	KT61	12/-	TDD4	7/-
1S4	4/9	6L6G	8/6	25Z4G	7/-	ECF82	7/6	KT63	5/9	U14/18	7/6
1S5	4/6	6L18	7/9	30F5	9/-	ECH21	10/-	KT66	19/6	U25	9/6
1T4	3/-	6LD20	8/6	30FL1	9/9	ECH35	11/-	KT88	27/6	U26	9/6
2D21	5/6	6P25	12/-	30L15	11/6	ECH42	10/6	KTW61	5/9	U35	12/6
3A5	6/-	6P28	9/6	30P4	11/6	ECH81	6/9	KTW63	5/-	U37	11/-
3Q4	5/3	6Q7G	7/-	30P12	9/-	ECH83	7/9	KTZ63	7/-	U107	12/6
5U4G	6/-	6Q7GT	8/9	30PL1	11/-	ECL80	5/9	MU14	7/-	U191	12/6
5Y3GT	6/6	6SL7GT	6/9	35A5	9/6	ECL82	7/6	N37	9/6	U281	9/6
5Z4G	6/9	6SN7GT	6/9	35L6GT	8/6	ECL83	10/6	N78	13/-	U282	15/-
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6AK5	4/9	6X4	4/6	80	7/6	EF40	10/-	PCC84	6/6	UAF42	7/9
6AQ5	5/-	6X5G	5/-	185BTA	19/6	EF41	9/-	PCC85	7/6	UB41	6/6
6AT6	5/-	6X5GT	6/9	807	9/6	EF50	3/3	PCC88	11/9	UBC41	8/9
6BA6	5/6	7B6	11/6	955	3/6	EF80	4/3	PCC89	11/-	UBC81	6/9
6BE6	5/6	7B7	7/6	956	3/-	EF85	6/3	PCC189	9/9	UBF80	7/6
6BH6	6/6	7C5	9/6	AZ31	8/6	EF86	7/6	PCF80	6/9	UBF89	7/6
6BJ6	7/-	7C6	7/6	CBL31	19/6	EF89	6/6	PCF82	6/9	UBL21	10/9
6BR7	9/6	7H7	7/6	DAF96	7/3	EF91	3/6	PCF86	8/3	UC92	6/9
6BW6	7/6	7S7	14/6	DF96	7/3	EF183	8/-	PCL82	7/9	UCC85	7/3
6BW7	5/-	7Y4	7/-	DK92	8/6	EF184	8/-	PCL83	9/6	UCF80	8/6
6C4	3/-	10C1	11/-	DL96	7/3	EL32	5/-	PCL84	9/-	UCH21	10/9
6C5	5/6	10C2	12/6	DL92	6/-	EL33	12/-	PCL85	9/6	UCH42	8/6
6C6	4/-	10F1	7/6	DL94	6/6	EL34	11/6	PCL86	9/6	UCH81	7/-
6C9	11/-	10LD11	14/6	DL96	7/3	EL35	8/-	PL33	8/6	UCL82	8/-
6CD6G	17/-	10P13	9/6	EABC80	6/9	EL38	15/-	PL36	11/-	UCL83	10/6
6D6	4/-	10P14	9/6	EAF42	8/-	EL41	9/9	PL38	12/6	UF41	9/-
6F1	6/6	12AT7	4/9	EB41	4/6	EL42	8/9	PL81	7/9	UF42	6/9
6F6G	5/-	12AU7	5/6	EB92	2/9	EL84	6/6	PL82	5/9	UF85	7/6
6F13	4/6	12AX7	6/-	EBC33	7/6	EM80	7/-	PL83	6/-	UF89	6/9
6F14	7/6	12J7GT	9/-	EBC41	9/6	EM81	7/6	PL84	7/-	UL41	10/-
6F15	9/6	12K7GT	5/-	EBC91	6/9	EM84	7/9	PY31	7/6	UL44	14/-
6F23	8/-	12K8GT	9/6	EBF80	7/9	EY51	7/6	PY32	9/6	UL46	10/6
6J5G	4/-	12Q7GT	6/6	EBF89	7/-	EY86	7/6	PY33	7/6	UL84	6/8
6J5GT	6/6	14S7	14/6	EBL21	11/-	EY88	8/6	PY80	5/9	UM80	9/6
6J6	3/3	19AQ5	5/6	ECC40	9/6	EZ40	7/6	PY81	5/9	UY21	8/9
6J7G	5/6	20D1	8/9	ECC81	4/9	EZ41	8/6	PY82	5/6	UY41	7/-
6J7GT	9/6	20F2	9/6	ECC82	5/6	EZ80	5/6	PY83	5/9	UY85	5/6
6K7G	2/8	29L1	16/-	ECC83	6/-	EZ81	6/-	PY88	8/6	VR105	5/-
6K7GT	5/9	20P1	9/6	ECC84	7/-	FC4	8/-	PY800	7/-	VR150	5/-
6K8G	5/9	20P3	9/6	ECC85	5/9	GZ32	9/6	PZ30	9/6	X66	7/9

STEREO PORTABLE CABINETS

Latest black and silver metal finish. Consisting of centre cabinet size 16½in. x 13in. x 8in. deep with lift up lid together with two 10 x 6 speaker cabinets which clip on ends of main cabinet size 4½in. x 13in. x 8in. making overall size of 25½in. x 13in. x 8in. High quality chrome fittings. Will take almost any autochanger or tape dec. Approx. half price at **£3.19.0**

Ditto, but less chrome, takes 7 x 4 speaker **£2.19.9**

MONO PORTABLE CABINETS. B.S.R. tape deck or single record player, new, attractive finish, half price. **19/6**

AUTOCHANGE PORTABLE CABINETS. As used on 18 gns. record player. Due to fortunate purchase we offer complete with motor board and all fittings at only **49/-**

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

100 HI-STABS 9/6

1% to 5% 100Ω to 5 mΩ.

CO-AX, low loss. **6d.** yd. 25 yds. **11/6**; 50 yds. **22/-**; 100 yds. **42/6**. Plugs **1/3.**

100 RESISTORS 6/6

SIZES ⅛–3 watt.

MICROPHONE CABLE Highest quality, black, grey, white, **9d.** per yard.

100 CONDENSERS 9/6

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

25 ELECTROLYTICS

Assorted 2 to 500 mfd 6 to 400 volt. LIST VALUE OVER £5. **9/6**

50 TAG STRIPS 7/6

Mixed sizes 2 to 15 way.

25 POTENTIOMETERS

Including with switch, long and short spindle, pre-sets, log and lin. unused, 1k-2mΩ. LIST VALUE APPROX. £4. **9/6**

CONNECTING WIRE

P.V.C. Bright Colours. Five 25ft. coils only. **4/-**

CALLERS. *A very wide range of electronic components await you at all branches. Your enquiries welcomed.*

Stockists of Leak, Quad, Chapman, Goodman, Armstrong, Tripletone Linear Rogers, Truvox, Ferrograph, Wharfedale, etc.

Post: 1 lb. **1/5**, 1½ lb. **2/6**, 2 lb. **2/9**, 4 lb. **3/3**, 6 lb. **4/-**, 14 lb. **5/6**,

All Mail Orders to Brighton please

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LASKY'S RADIO

For the Finest Value and Service to HOME CONSTRUCTORS & ELECTRONICS ENTHUSIASTS

TRANSISTOR PORTABLES

THE SKYROVER De Luxe

7 transistor plus 2 diode superhet, 6 waveband portable receiver covering the full Medium Waveband and Short Waveband 31-94M and also 4 separate switched bandspread ranges, 13M., 16M., 19M and 25M., with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow, stage by stage instructions. Superhet, 470 Kc/s. All Mullard Transistors and Diodes. Uses 4 U2 batteries. 5in. Ceramic Magnet P.M. Speaker. 500 MW Output. Telescopic and Ferrite Rod Aerial. Tone Circuit with separate Tone Control. Volume Control. Tuning Control and Waveband Selector. In wood cabinet, size $11\frac{1}{2}$ x $6\frac{1}{2}$ x 3in. covered with washable material, plastic trim and carrying handle. Car aerial socket fitted.

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

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

Four U2 batteries 3/4 extra.

LONG WAVEBAND COVER FOR THE SKYROVER

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

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

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

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

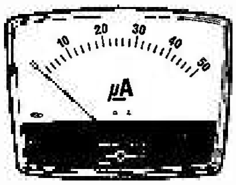
SINCLAIR SUPER MINIATURE KITS

Write for details of Package Deals

THE MICRO-6 miniature radio only $1\frac{4}{5}$ x $1\frac{3}{10}$ x $1\frac{1}{2}$in.	£2 19 6
THE MICRO-FM (tuner/receiver)	£5 19 6
THE MICROMATIC World's smallest radio kit $1\frac{4}{5}$ x $1\frac{3}{10}$ x $\frac{1}{2}$	£2 19 6
THE MICROMATIC Ready built, tested and guaranteed	£3 19 6
THE Z-12 12 watt amp. and pre-amp., fully built	£4 9 6
PZ-3 power pack for Z-12	£3 19 6
STEREO 25 Pre-amplifier control unit fully built	£9 19 6

SPECIAL INTEREST ITEMS!

NEW! LASKY'S CLEAR PLASTIC PANEL METERS



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

Type KR-52 3 x $2\frac{1}{2}$in. (illustrated)

1 mA DC	32/6	300 V DC	32/6
5 mA DC	32/6	500µA	37/6
1 mA S Meter	39/6		

Type MK-38A 2in. square

1 mA DC	22/6
5 mA DC	22/6
300 V DC	22/6
55µA	27/6
1 mA S Meter	29/6

Type KR-65 $3\frac{3}{4}$ x 3in.

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

Type MK-45A $1\frac{3}{4}$in. square

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

Type MK-65A 3in. square

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

NOW AVAILABLE! — JOYSTICK AERIALS

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

VFA Standard	£4 15 0
VFA DeLuxe	£5 19 6

Matching units

A.T.V. 3A	£3 12 6
A.T.V. 4	£4 4 0
A.T.V. 4/RF	£6 6 0

INTERNATIONAL TAPE

Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft.	2 6
3in.	Message tape, 225ft.	3 9
3in.	Message tape, 300ft.	7 6
$3\frac{1}{4}$in.	Triple play, 600ft. Mylar	10 0
4in.	Triple play, 900ft. Mylar	17 6
5in.	Double play, 1200ft. Mylar	15 0
5in.	Long play, 900ft. Acetate	10 0
5in.	Standard play, 600ft. PVC	8 6
5in.	Triple play, 1800ft. Mylar	35 0
$5\frac{3}{4}$in.	Double play, 1800ft. Mylar	22 6
$5\frac{3}{4}$in.	Long play, 1200ft. Acetate	12 6
$5\frac{3}{4}$in.	Standard play, 850ft. PVC	11 6
$5\frac{3}{4}$in.	Long play, 1200ft. Mylar	15 0
$5\frac{3}{4}$in.	Triple play, 2400ft. Mylar	45 0
7in.	Standard play, 1200ft. Acet.	12 6
7in.	Standard play, 1200ft. Mylar	12 6
7in.	Long play, 1800ft. Mylar	19 6
7in.	Double play, 2400ft. Mylar	26 0
7in.	Long play, 1800ft. Acetate	15 0
7in.	Triple play, 3600ft. Mylar	50 0

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

CONSTRUCTORS' BARGAINS

SPECIAL PURCHASE—UHF/VHF TV TUNERS

Well known British makers surplus stocks. Now available for the first time to the Home Constructor. **Add 2/6 Post and Packing on each.**

TRANSISTORISED UHF MODEL

Metal case size $3\frac{3}{4}$ (plus spindle) x $2\frac{3}{4}$ x $1\frac{1}{4}$in. Fully tunable with slow motion drive. Complete with two AF186 transistors. LASKY'S PRICE **25/6**

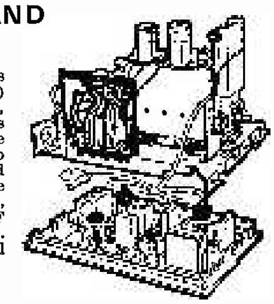
VALVE UHF MODEL (illustrated)

In metal case size 4 x 6 x $1\frac{1}{4}$in. Fully tunable—complete with PC86 and PC88 values. LASKY'S PRICE **29/6** Without valves **12/6**

TRANSISTORISED VHF TUNER

Sub-Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 3 x $1\frac{1}{2}$ x $2\frac{1}{4}$in. LASKY'S PRICE **37/6**

BARGAIN—TV UHF TUNER AND IF AMPLIFIER PANEL

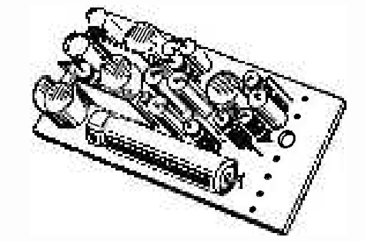


Model No. 89384 made by famous manufacturer as standard conversion unit to 625 line reception (BBC 2) for 19" and 23" 405 line (convertible model) Cossor, Philips, Scott and Stella television receivers. The units are boxed, brand new and fully guaranteed, complete with detailed conversion and operating instructions. To effect conversion on the sets mentioned above you need only a pair of pliers and a screwdriver! The units are fitted with 7 Mullard valves—PCF80 x 2, EF184, EF185, ECC82, PC86, PC88. Size of units: tuner $7\frac{1}{2}$ x 4 x 8in., IF panel on 9 x $4\frac{7}{8}$in. printed circuit board x $2\frac{1}{4}$in. deep. Complete with all leads, screws, washers etc. **Original Price £10.10.0.**

LASKY'S PRICE **49/6** Post 5/-

TREMENDOUS VALUE IF BOUGHT ONLY FOR THE VALVES AND COMPONENTS

NEW—LASKY'S MINIATURE TRANSISTOR AMPLIFIER MODULES



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

TYPE LRPC 1. 3 transistor. Input sens. 50mV. output 150mW output imp 40 Ω, size 2 x 1 x $\frac{3}{4}$in. PRICE **27/6**

TYPE LRPC 2. 5 transistor. Input sens. 1mV. output 330mW, output imp. 15 Ω, size $2\frac{1}{2}$ x $1\frac{1}{2}$ x $\frac{3}{4}$in. PRICE **22/6**

TYPE LRPC 4. 5 transistor, Input sens. 150mV, output 330mW, output imp. 15 Ω, size $2\frac{1}{2}$ x $1\frac{1}{2}$ x $\frac{3}{4}$in. PRICE **22/6**

TYPE LRPC 5. 6 transistor. Input sens. 8mV, output 3W, output imp. 3 Ω, size $5\frac{1}{2}$ x $1\frac{3}{4}$ x 1in. PRICE **59/6**

TYPE LRPC 6. Tape record/playback amp. (for use with self oscillating erase head). Output 750mW, output imp. 8 Ω. Size $4\frac{1}{2}$ x 2 x 1in. PRICE **39/6**

VEROBOARD —

High grade laminated board with copper strips bonded to it and pierced with holes.

Boards

42/1503	$2\frac{1}{2}$ × 5 in.	3/11
43/1504	$2\frac{1}{2}$ × $3\frac{3}{4}$ in.	3/3
45/1507	$3\frac{3}{4}$ × 5 in.	5/6
46/1508	$3\frac{3}{4}$ × $3\frac{3}{4}$ in.	3/11
44/1505	$3\frac{3}{4}$ × 17 in.	15/6

Accessories

Terminal pins—pkt. of 50	3/-
Spot face cutter tool	7/3
Pin inserting tool	9/6

Post 6d. per item extra. Orders of 10/- and over post free.

GORLER UT 340 FM/VHF TUNING HEART

Permeability tuned—covering 87 to 108 Mc/s. For use with one ECC85 valve. In metal case, size 3 x $2\frac{1}{2}$ x $1\frac{3}{4}$in. Circuit supplied.

LASKY'S PRICE **15/11** Post 2/-. ECC85 valve **9/-** extra.

TRANSISTORS

ALL BRAND NEW AND GUARANTEED

GET S1, GET S5, GET S6 **2/6**; 873A, 874P **3/6**; OC45, OC71, OC81D **4/6**; OC44, OC70, OC76, OC81 **5/6**; (match pair **10/6**); AF117, OC200 **6/6**; OC42, OC43, OC73, OC82D **7/6**; OC201, OC204 **15/-**; OC205, PC206 **19/6**; OC28 **24/6**; OC75 **8/-**.

TRANSFILTERS

by BRUSH CRYSTAL CO., Available from stock.

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

9/6 each Post 6d.

NOW AVAILABLE—OUR NEW BARGAIN BULLETIN. 24 foolscap pages packed with hundreds of bargains for the "ham" and service man—exclusive to Lasky's—plus full list of regular stock items. **PRICE 6d.** ***POST FREE.***

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Complete your motoring pleasure with this small, compact, high-performance car radio. It can be fitted to any make of car having 12 volt positive or negative earth system. Tastefully styled in neutral grey with matching black knobs and chrome trim to harmonise with any car colour scheme.

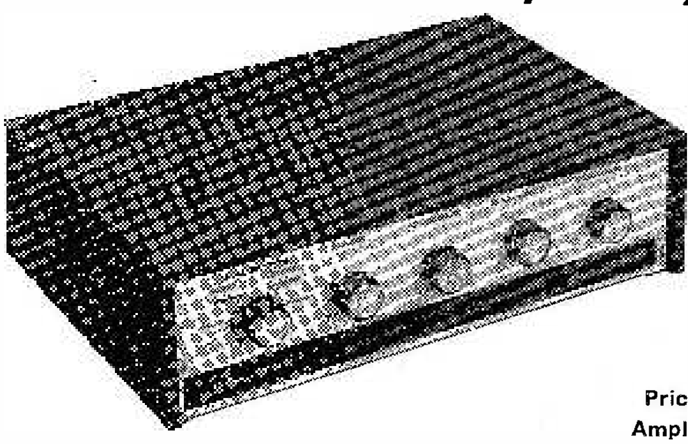
Features include:— Six transistor, 2-diode circuit. Completely pre-assembled and aligned tuning unit. High sensitivity, combined with wide range automatic gain control (AGC), minimises fading under weak reception conditions. Easy-tune dial. Push button long, medium, and tone selection.

The car radio is available for your convenience, in two separate units: RF Amplifier Kit CR-IT, **£1.13.6** incl. P.T. IF/AF Amplifier Kit CR-IA, **£11.3.6.**

TOTAL PRICE KIT (excluding loudspeaker) £12.17.0 incl. P.T.

8 x 5in. Loudspeaker, Pt. No. 401-505, **£1.16.1** incl. P.T.

The Transistor Amplifier you have been looking for!



3 + 3W Stereo Amplifier Kit, TS-23

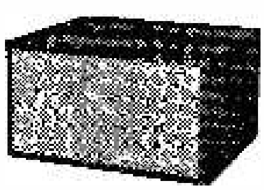
Breaks the price barrier in transistor amplifier cost

Incorporates all the essential features for good quality reproduction from gramophone records, radio and other sources. Its many features include: 3 watts rms (15Ω) each channel. Good frequency response for outstanding fidelity. Compact slim-line styling. Ganged BASS, TREBLE and VOLUME controls. Six position SELECTOR switch for programme sources. Attractive perspex front panel, two-tone. 16 transistor, 4 diode circuit. Handsome fully finished walnut veneered cabinet. Outputs for 8 or 15 ohm loudspeakers. Printed circuit boards for free-standing or cabinet mounting. Size $3\frac{3}{4}$ x 13 x 8in. deep.

Prices Amplifier Kit £17.15.0
Amplifier kit & Cabinet £18.19.0

Walnut veneered Cabinet separate £2.0.0

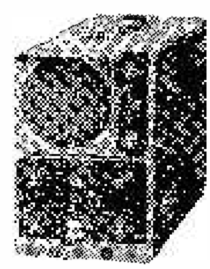
Hi-Fi performance from a "Mini" speaker kit with the 'AVON' BOOKSHELF SPEAKER SYSTEM



The challenge to our acoustic engineers was to design a speaker occupying the minimum space consistent with first class reproduction. The result of our efforts was the AVON, a compact unit of exceptional quality. Features two special speakers $6\frac{1}{2}$in. BASS, $3\frac{3}{8}$in. HF unit and cross over network. Good frequency response. Beautiful fully finished walnut veneered cabinet. Size only $7\frac{3}{4}$ x $13\frac{1}{4}$ x $8\frac{3}{8}$in. deep. Supplied in two units. Can be built for a total price

KIT £13.16.0 incl. P.T.

A 3" Service Oscilloscope kit with outstanding features. Model OS-2



The attractively styled OS-2 is a compact, lightweight, portable and surprisingly versatile oscilloscope that fulfils many of the general requirements in Laboratories, Service Departments and Educational Training. It is ideal for use in production line testing where otherwise expensive equipment would be tied up on ordinary routine tests. The bandwidth of the OS-2 is from 2 c/s-3 Mc/s±3dB, this 'scope can therefore be used in applications ranging through audio, ultrasonic and radio frequencies. The time base operates from 20 c/s to 200 kc/s in four ranges and is self-synchronising.
Size 5 x $7\frac{5}{8}$ x 12in. deep. Weight $9\frac{3}{4}$ lb.

KIT £23.18.0 Assembled £31.18.0

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Ready for plugging in to Amplifier or Tape Recorder.
RP2 Consisting of Garrard SP25 fitted Goldring CS90 high compliance ceramic Stereo/Mono ctrge with dmnd stylus, above plinth & cover. Normally £25. Carr. 15/- Only **19½ Gns.**
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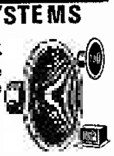

Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit and Tweeter. Smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating. Or **Senior 20 watt** inc. Fane 122/10 speaker **7 Gns.** Carr. 8/9. Carr. 6/9 **5 Gns.**

ALL LEADING MAKES OF HI-FI EQUIPMENT STOCKED Cash or Terms
Full range Hi-Fi Furniture

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All types of pleasing modern design acoustically lined and ported and beautifully finished in light Teak or Walnut veneer. Credit terms available.
JE8. Size 16 x 11 x 8in. Gives pleasing results with 8in. Hi-Fi speaker. **£4.15.0**

SE8. For optimum performance with any Hi-Fi 8in. speaker. Size 22 x 15 x 9in. Carr. 7/6 **£5.19.9**
SE10. For 10in. Hi-Fi speaker with provision for tweeter. Size 24 x 15 x 9in. Carr. 10/- **£6.19.9**
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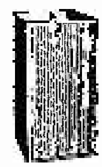
NEW RANGE OF LINEAR HI-FI UNITS STOCKED

HIGH FIDELITY LOUDSPEAKER UNITS

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



MINI 8 8 WATT rating. 3 or 15 ohm. Frequency response 50-13,000 c.p.s. Specially designed high flux 5in. speaker with low fundamental resonance. Handsome Teak veneered cabinet. 9¾ x 6½ x 7in. Carr. 7/6 **£6/19/11**

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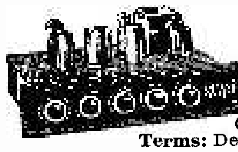
The BRONTE Size 22 x 15 x 9in. Fitted Wharfedale Super 8 RSDD or Audiotrine HF 815D Speaker, with Roll surround and dual cone. Rating 6/10 watts. Impedance 3 or 15 ohms. Carr. 15/-. **12½ Gns.**

Tweeters R.A. 3 ohm or 15 ohm 25/9

R.S.C. STEREO/TEN HIGH QUALITY AMPLIFIER

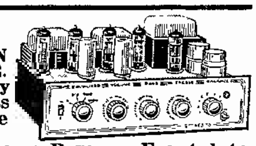


A complete set of parts for the construction of a unit giving 5 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable all crystal or ceramic stereo heads. Ganged Bass and Treble Controls. Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point to point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. Or supplied factory assembled with 12 months' guarantee for 11 gns. Terms: Dep. 36/- and 9 monthly payments 25/5 (Total £13.4.9). Carr. 11/6 **£8.15.0**

15 watt HI-FI TRANSISTORISED AMPLIFIER TYPE A15

with integral pre-amp tone control stages. Output for 3, 7.5 and 15 ohm spkrs. Kit includes Printed Circuit and all parts including 9 latest type semi-conductors. Heat sink and full wiring instructions or with printed circuit fully wired and tested 21/- extra. **£4.12.9** Post 5/-. **Frequency Response:** ±1dB 20-20,000 c.p.s. **Harmonic Distortion:** 0.1%. **Hum and Noise:** —80dB. **Sensitivity:** 2mV. **Bass Control:** +9dB to —14dB at 40 c.p.s. **Treble Control:** +8dB to —13dB at 10 Kc/s. **Will operate from batteries giving 24v.** Suitable Power Pack Kit 47/9 or ready built 69/9

R.S.C. STEREO 20/HIGH FIDELITY AMPLIFIER



PROVIDING 10/14 WATT ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL. SUITABLE FOR "MIKE", GRAM, RADIO OR TAPE. Employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. **Frequency Response:** ±2dB 30-20,000 c.p.s. **Hum Level:** 65dB down. **Sensitivity:** 5 millivolts maximum. **Harmonic Distortion:** (each channel): 0.2%. **★Four-position tone compensation and Input Selector Switch. ★Stereo/Mono switch. ★Will amplify direct from Tape Heads. ★Neon panel indicator. ★Handsome Perspex Frontplate. ★Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.** Output transformers are high-quality sectionally wound to required specification. Output matching for 3 and 15 ohm spkrs. on each channel. Complete set of parts, point-to-point wiring diagrams and instructions. Carr. 12/6 **14 Gns.**
Or factory assembled, tested and supplied with our usual 12 months guarantee.
Or Deposit £3 and 9 monthly payments 43/2 (Total £22.4.6). *Send S.A.E. for leaflet.* Carr. 12/6 **19 Gns.**

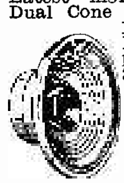
R.S.C. TFM1 TRANSISTORISED VHF/FM RADIO TUNER

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

★ High-sensitivity ★ 200-250v. A.C. Mains operation. ★ Sharp A.M. Rejection. ★ Drift-free reception. ★ Output ample for any amplifier (approx. 500 m.v.). ★Simple alignment instructions. ★ Output available for feeding tuning meter. ★ Output for feeding Stereo Multiplexer. ★ Tuner head using Silicon Planar Transistors. ★ Designed for standard 80 ohm co-axial input. Made to visually match our Super 15 and 30 amplifiers and of the same high standard of performance and reliability. The pre-wired tuning head facilitates speed and simplicity of construction. Printed circuitry. Only first grade transistors and components used. Our latest product giving you the best at half the cost of comparable units. Stereo Multiplexer available.

AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS

Heavy cast construction. Latest high efficiency ceramic magnets. Dual Cone for extended frequency range. Plastic treated surround giving low fundamental resonance. Response 40-18,000 c.p.s., Impedance 3 or 15 ohms. Carr. 5/6.

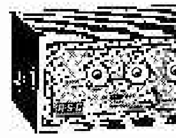


HF811D	**8in.**	**10 WATT**	**4 Gns.**
HF101D	**10in.**	**12 WATT**	**5 Gns.**
HF100D	**10in.**	**15 WATT**	**£5.15.0**
HF121D	**12in.**	**20 WATT**	**£6.15.0**
HF127D	**12in.**	**30 WATT**	**9 Gns.**

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

FULLY TRANSISTORISED 200/250v. A.C. Mains.
OUTPUT 10 WATTS R.M.S. cont. into 15 ohms.
15 WATTS R.M.S. cont. into 3-4 ohms.
Maximum instantaneous Peak power output 28 watts.
PRINTED CIRCUIT CONSTRUCTION.
LATEST MULLARD TRANSISTORS. AD149, AD149, OC127Z, OC81Z, OC44, OC44, OC81Z, OC44, AC107.
5 POSITION INPUT SELECTOR SWITCH
EQUALISATION to Standard R.I.A.A. and C.C.I.R. Characteristics for Gram and Tape Heads.
FULL TAPE MONITORING FACILITIES.
SENSITIVITIES: Magnetic P.U. 4 mV. Crystal or Ceramic P.U. 400 mV. Microphone 4.5 mV. Tape Head 2.5 mV. Radio/Aux or Ceramic P.U. 110 mV.
FREQUENCY RESPONSE: ± 2dB 20-20,000 c.p.s.
TREBLE CONTROL: +15dB to —14dB at 10 Kc/s.
BASS CONTROL: +12dB to —15dB at 50 c/s. **HUM LEVEL:** —75dB.
HARMONIC DISTORTION at 10 Watts R.M.S. 1,000 c.p.s. 0.25%.
NEGATIVE FEEDBACK: 52dB.
Complete Kit of parts with full constructional details and point to point wiring diagrams. Carr. 11/- **11 Gns.**
Supplied factory built **15 Gns.** Carr. 12/6. Terms: Deposit **49/-** and 9 monthly payments 33/9 (Total £17.12.9). Or fitted in beautiful Walnut or Teak veneered cabinet as illustrated, 4 Gns. extra.
ALL COMPONENTS ETC. ARE OF A HIGH STANDARD AND SUPPLIED BY LEADING BRITISH MANUFACTURERS.

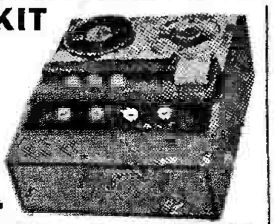
TECHNICAL SPECIFICATIONS COMPARE MORE THAN FAVOURABLY with SIMILAR AMPLIFIERS AT TWICE THE COST



R.S.C. SUPER 30 STEREO AMPLIFIER

A DUAL CHANNEL VERSION OF THE SUPER 15. Employing Twin Printed Circuits. Close tolerance Ganged Pots. Matched Components.
CROSS TALK: —52dB at 1,000 c.p.s.
CONTROLS: 5 position Input Selector, Bass Control, Treble Control, Volume Control, Balance Control, Stereo/Mono Switch, Tape Monitor Switch, Mains Switch.
INPUT SOCKETS (Matched Pairs). (1) Magnetic P.U. (2) Ceramic or Crystal P.U. (3) Radio/Aux. (4) Tape Head/Microphone. Operation of the Input Selector Switch assures appropriate equalisation.
Rigid 18 s.w.g. Chassis. Size approx. 12in. Wide, 3in. High and 8in. Deep. Neon Panel Indicator. Attractive Facia Plate and Spun Silver Matching Knobs. Above facilities, etc., except for Ganging and Balance Control, apply also to Super 15.
THESE UNITS ARE EMINENTLY SUITABLE FOR USE WITH ANY MAKE OF PICK-UP OR MICROPHONE (Crystal, Ceramic, Magnetic, Moving Coil, Ribbon) CURRENTLY AVAILABLE. SUPERB SOUND OUTPUT QUALITY CAN BE OBTAINED BY USING WITH FIRST RATE ANCILLARY EQUIPMENT. All required parts, point to point wiring diagrams and detailed instructions. Carr. 13/9 **18½ Gns.**
Unit factory built 25½ Gns. or deposit 83/9 and 9 monthly payments 56/9 (Total £29.14.6). Fitted cabinet as Super 15 29½ Gns. Carr. 15/- or Deposit £4.14.9 and 9 mthly paymts 65/10 (Total £34.7.3). *Send S.A.E. for leaflet.*

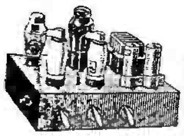
AUDIOTRINE HI-FI TAPE RECORDER KIT



REALISM AT INCREDIBLY LOW COST: CAN BE ASSEMBLED IN AN HOUR. ONLY 4 PAIRS OF SOLDERED JOINTS PLUS MAINS. S.A.E. for leaflet.
Incorporating the latest Magnavox Tapedeck. The Audiotrine High Quality Tape Amplifier with switched equalisation for each of 3 speeds. High Flux P.M. Speaker, empty Tape Spool, a Reel of Best Quality Tape and a handsome Portable Cabinet of latest styling finished dark grey leathercloth. Size 14¼ x 17 x 8¼in. and circuit. Purchased separately would total approx. £34. Performance equal to units in the £50-£60 class. Deposit 4 gns. and 9 mthly paymts 59/6 (Total 29¼ gns.) **26½ Gns.**
4 Track Model 3 gns. extra. Carr. 19/6

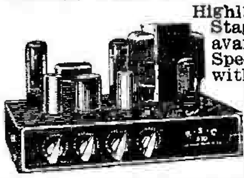
LINEAR TAPE PRE-AMPLIFIER. Type LP/1 Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier suitable most Tape Decks. Terms available. **10½ Gns.**

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



A highly-sensitive 4-valve quality amplifier for the home, small club, etc. Suitable for all crystal or ceramic P.U. heads and practically all "mikes". Separate Bass and Treble controls giving "lift" and "cut". Hum level 71dB down. Negative Feedback 15dB. Reserve power supply 300v 25 m.a., 6.3v 1.5 a. for Radio Tuner or Tape Pre-amp. For A.C. mains 200-250v. Speaker output 3 ohms. Complete in every detail with fully punched enamelled chassis, point-to-point wiring diagrams and instructions. Or assembled ready for use 6 gns. plus 5/9 carr. **£4.17.9**

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



Highly sensitive. Push-Pull high output, with Pre-amp./Tone Control Stages. Performance figures equal to most expensive amplifiers available. Hum level —70dB. Frequency response ±3dB 30-20,000 c/s. Specially designed sectionally wound ultra linear output transformer with 807 output valves. All first grade components. Valves EF86. EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Sensitivity 12 millivolts so that **any kind of Microphone or Pick-up is suitable. Designed for Clubs, Schools, Theatres, Dance Halls or Outdoor Functions, etc. For use with Electronic Organ, Guitar, String Bass, etc.** Gram. Radio or Tape. Reserve L.T. and H.T. for **Radio Tuner.** Two inputs with associated volume controls so that two separate inputs such as Gram and "Mike" can be mixed. 200-250v. 50c/s A.C. mains. For 3 and 15 ohm speakers. Complete kit of parts fully punched chassis, point to point wiring diagrams and instructions. **12 Gns.** Carr. 12/6
Supplied factory built with EL34 output valves. 12 months guarantee for 15 gns. If required perforated cover with carrying handles can be supplied for 21/-. Send s.a.e. for leaflet. **TERMS: Deposit 48/-** and 9 monthly payments of 33/7 (Total £17.10.3).

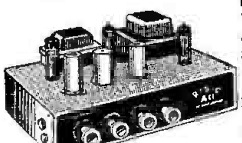
JASON VHF/FM TUNER

Complete kit with valves. **£6.19.11**

WIRELESS MICROPHONES

Complete with lapel mike. Range up to one mile. Reception on any V.H.F. radio. *These cannot be used in U.K.* **10 Gns.**

R.S.C. A11 HIGH FIDELITY 12-14 WATT AMPLIFIER



PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP Two input sockets with associated controls allow mixing of "mike" and gram. etc., etc. High sensitivity. Valves ECC83, ECC83, EL84, EL84. EZ81. High quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE. Frequency response ±3dB 30-20,000 c/s. Six negative feedback loops. Hum level —60dB. SENSITIVITY 23 millivolts. Suitable for Crystal or Ceramic P.U.s, all types "mikes". Comparable with the very best designs. **For Musical Instruments such as String Bass, Electronic Guitars,** etc. **Reserve Power** provides 300v. 30mA. and 6.3v. 1.5a. for **Radio Tuner** or **Tape Pre-amp.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v, 50 c.p.s. Output for 4 and 15 ohm speakers. Kit complete to last nut. Chassis fully punched. Full instructions and point-to-point wiring diagrams (or factory built £11.15.0). Metal cover with 2 handles available for 21/-. **TERMS ON ASSEMBLED UNITS: Deposit 36/6** and 9 monthly payments of 25/9 (Total £13.8.3). Send S.A.E. for illustrated leaflet of Cabinets, Speakers, Mikes, etc. **£8.15.0** Carr. 11/6

R.S.C. BASS-REGENT 50 WATT AMPLIFIER

AN EXCEPTIONALLY POWERFUL HIGH QUALITY ALL-PURPOSE UNIT For lead, rhythm, bass guitar and all other musical instruments. For vocalists, gram, radio, tape, and general public address.

★ UNUSUALLY POWERFUL LOUDSPEAKER COMBINATION consisting of a FANE HIGH FLUX 15in. 30 watt unit PLUS a FANE 12in. 20 watt unit with extended frequency response. ★ 4 Jack Inputs and two Volume Controls for simultaneous use of up to 4 pick-ups or "mikes". ★ Cabinets covered in two-tone Rexine/Vynair with gold trimming. Fitted carrying handles. ★ Separate Bass and Treble Controls giving "lift" and "cut".
49½ Gns. Carr. 30/- Send S.A.E. for leaflet. Or call at one of our many branches and compare the Bass-Regent with units at three times the cost. Or deposit £7.17.6 and 9 monthly payments of £5.10.10. (Total 55 gns.)

B20 MULTI-PURPOSE AMPLIFIER especially suitable for Bass Guitar

Incorporating massive 15in. high flux loudspeaker. Rating 25 watts. Individual bass and treble controls. Two jack inputs separately controlled. Substantial cabinet attractively finished in Rexine and Vynair. Size approx. 24 x 21 x 11in. Send S.A.E. for leaflet. Or Deposit £4.14.6 and 9 monthly payments of 66/-. (Total £34.8.6). Carr. 17/6. **29½ Gns.**

G15 15 WATT AMPLIFIER for Lead or Rhythm Guitar, Vocal Groups, etc.

High-fidelity output. Separate bass and treble controls. Twin separately controlled inputs so that two instruments or "mike" and pick-ups can be used at the same time. Heavy Duty 12in. 20 watt Speaker. Cabinet covered in attractive Rexine/Vynair. Size 18 x 18 x 8in. Deposit 3 gns. and 9 monthly payments of 43/7 (Total £22.15.3). S.A.E. for leaflet. **19½ Gns.** Carr. 15/-.

LINEAR TREMOLO PRE-AMP UNIT

Suitable for use with any of our Amplifiers. Controls are Speed (frequency of interruptions), Depth (for heavy or light effect). Volume and Switch. **4½ Gns.**

R.S.C. BATTERY/MAINS CONVERSION UNITS

Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries supplying 1.5v. and 90v. where A.C. mains 200/250v. 50 c/s is available. Complete kit with diagram 47/9 or ready for use 59/11.

SELENIUM RECTIFIERS F.W. (Bridged)

All 6/12 v. D.C. output. Max A.C. input 18 v.
1 a. 3/11. 2 a. 6/11. 3 a. 9/9. 4 a. 12/9. 6 a. 15/9.

HEAVY DUTY SELENIUM RECTIFIERS

12v. 15 amps, F.W. (Bridged). Only **19/9**

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WATKINS COPYCAT ECHO UNITS 19½ GNS. Carr. 17/6
Listed £38.10.0. Brand new
VOX and LINEAR GUITAR AMPLIFIERS.
Various models at half list price.

POWER PACK KIT

Consisting of Mains transformer. Metal Rectifier, Electrolytics, smoothing choke, chassis and circuit. 200/250v. A.C. mains. Output 250v. 60mA 6.3v. 2a Supplied with case in lieu of chassis 26/11. Or assembled 39/11. **22/11**

HEAVY DUTY BATTERY CHARGER KITS 6/12 v.

Consisting of Mains Trans. 200-250 v., Rectifier, Ammeter, Variable Charge Rate Selector, Panels, Plugs, Fuses and Holders. Fully punched stove enamelled case and circuit. **4a 49/11** **6a 69/11**
Or assembled ready for use 10/- extra.

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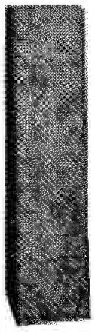
R.S.C. COLUMN SPEAKERS

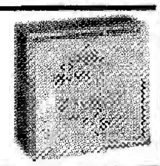


Covered in two-tone Rexine/Vynair. Ideal for vocalists and Public Address. 15 ohm matching.
Type C58, 15-20 watts. Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. Or Deposit 44/-and 9 mthly pmts 31/5 (Total £16.6.9) **14 Gns.** Carr. 10/-
Type C412, 40 watts. Fitted four 12in. 12,000 line 10 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/- **21 Gns.** Or Deposit £3.11.0 and 9 monthly payments of 46/7 (Total £24.10.3).

30 WATT HI-FI AMPLIFIER for Guitar, Vocal or Instrumental Group

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

12in. HIGH QUALITY L'SPEAKERS



In teak veneered cabinets.
10 Watt Model. Gauss 12,000 lines. 3 or 15 ohms. Carr. 7/6 **£4.19.11**
20 Watt Model. 15 ohm. Size 18x18x10in. Gauss 12,000 lines. **£7.19.11**
Rexine covered £1 extra. Carr. 10/6
Terms available on both.

FANE HEAVY DUTY HI-FI SPEAKERS 5 Gns.

12in. 20 watt. Type 122/10. Carr. 5/9

LOUDSPEAKERS

Limited number at fraction of list price 15 ohms. impedance. Brand new, guaranteed.
12in. HEAVY DUTY 30 watts 7 GNS. Carr. 12/6 Normally £12 approx.
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Massive units with 3in. Diam. Pole Pieces. Terms available. (Normally appr. £19)

R.S.C. GRAM AMPLIFIER KIT. 3-4 watts output. Negative feedback. Controls: Vol., Tone and Switch. Mains operation 200-250v. A.C. Fully isolated chassis. Circuit, etc. supplied. Only 49/11.

HIGH FIDELITY 12in. 10 WATT SPEAKERS 59/11

Flux Density 12,000 lines. Impedance 3 or 15 ohms.

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FULLY GUARANTEED, Interleaved and Impregnated. Primaries 200-250v. 50 c/s. Screened.

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250v., 60mA, 6.3v. 2a	14/11
250-0-250v., 60mA, 6.3v. 2a	15/11

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a	19/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a.	33/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a.	33/9
300-0-300v. 130mA, 6.3v. 4a c.t., 6.3v. 1a. For Mullard 510 Amplifier	41/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	33/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a.	42/9
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425-0-425v. 200mA, 6.3v. 4a, 6.3v. 4a, 5v. 3a	69/9
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250-0-250v. 100mA, 6.3v. 2a, 6.3v. 1a.	22/9
350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a.	23/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a.	32/9
300-0-300v. 100mA. 6.3v. 4a, 0-5-6.3v. 3a.	32/9
300-0-300v. 130mA, 6.3v. 4a., 0-5-6.3v. 1a. Suitable for Mullard 510 Amplifier	39/9
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a	32/9
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/11

FILAMENT or TRANSISTOR POWER PACK Types 6.3v. 1.5a 6/9, 6.3v. 2a 7/9, 6.3v. 3a 9/9, 6.3v. 6a 19/9, 12v. 1a 8/9, 12v. 3a or 24v. 1.5a 19/9, 0-9-18v. 1½a. 15/9. 0-25-35-42v. 2a 27/9.

CHARGER TRANSFORMERS 0-9-15v. 1½a, 13/11 2½a, 16/11, 3a, 18/11, 5a, 21/11, 6a, 25/11, 8a, 31/11

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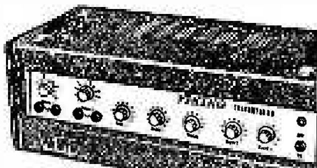
R·S·C HI-FI CENTRES LTD.

VIKING TRANSISTOR

40-50 WATT AMPLIFIER



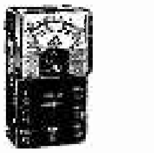
OPERATING INSTRUCTIONS GENERAL, An extremely reliable lightweight amplifier capable of giving 40-50 watts of undistorted sound, made possible by the use of the latest semi-conductors (transistors) and techniques which ensure space-age reliability under the most rugged conditions. It is designed as a general purpose amplifier particularly suitable for use with musical instruments that require exceptionally high treble response (not recommended for Bass Guitar). Tremolo facilities are available on Channel 1 only. INPUTS—CONTROLS—CHANNEL 1 (Tremolo): this contains two high gain input jack sockets controlled by **Volume Control 1** which is mounted directly above the two sockets marked tremolo. BASS 1: gives a controlled boost to the lower frequencies on Channel 1 only. TREBLE 1: gives a controlled boost to the high frequencies on **Channel** 1 only. TREMOLO: this operates on Channel 1 only and the variations of intensity and speed of the Tremolo beat is adjusted by the controls DEPTH and SPEED. A socket is provided in the rear of the amplifier so that the Tremolo may be switched on and off by the use of a footswitch plugged into the socket. If you wish the Tremolo to be used without the footswitch, this is possible as the footswitch is only used to short out the effect. INPUTS AND CONTROLS—CHANNEL 2 (Normal): this contains two high gain input jack sockets controlled by **Volume Control 2** which is mounted directly above the sockets marked **Normal. TREBLE:** gives a controlled boost to the treble frequencies on Channel 2 only. MAINS VOLTAGE: fully adjustable, 200-250 volts, A.C. .50 cycles. POWER OUTPUT: 40-50 watts sine wave British rating. Very little distortion. OUTPUT IMPEDANCE: 3 ohms. Price **21 gns.** plus £1 postage and packing.

WOLSEY U.H.F. AERIAL AMPLIFIER, two stage, gain 23 dB, noise factor 8 dB, power consumption 6 mA at 14 volts. Two AF186 transistors, complete with built-in power supply in metal case, list price 9 gns., our price **4½ gns.** plus 2/6 postage and packing.

MAINS TRANSFORMER, primary 200/250 volt, secondary 425/425 volt. 250 mA, 6·3 volt 4 amp, 5 volt 3 amp; fully shrouded. chassis mounting. Price **£2.5.0** plus 7/6 postage and packing. Auto transformer step-up-step-down, 240/110 volt 400 watt. Price **£1.5.0** plus 7/6 postage and packing.

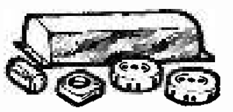
MAINS TRANSFORMER 200/250 volt, secondary 250/250 volt, 70 mA, 6·3 volt, 3 amp drop through. Price **12/6** plus 4/6 postage and packing. Elac 10 inch, 10,000 lines ceramic magnet, 3 or 15 ohms, 7 watt, **£1.9.6** plus 4/6 postage and packing.

POCKET MULTI-METER



Size 3⅝ x 2½ x 1⅜in. Meter size 2½ x 1⅜in. Sensitivity 1000 O.P.V. on both A.C. and D.C. volts. 0·15, 0·150 0·1000. D.C. current 0·150mA. Resistance 0·100kΩ. Complete with test prods, battery and full instructions, **42/6.** P. & P. 3/6. **FREE GIFT** for limited period only. **30** watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

40W FLUORESCENT LIGHT KIT

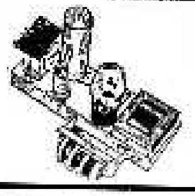


Incorporating **GEC** Choke size 8¼in. x 1¼in. x 1¼in., 2 bi-pin holders, starter and starter-holder. P. & P. 5/6. **11/6**

Similar to above: 80W. Fluorescent Light Kit incorporating **GEC** choke size 11¾in. x 1¼in. x 1¼in. 2 bi-pin holders start and starter holder. P. & P. 6/6. **17/6**

Twin 40W Choke instant start for 2 x 2ft. tubes **17/6.** P. & P. 5/6.

3 to 4 Watt AMPLIFIER



3-4 watt Amplifier built and tested. Chassis size 7 x 3¼ x 1in. Separate bass, treble and volume control. Double wound mains transformer, metal rectifier and output transformer for 3 ohms speaker. Valves ECC81 and 6V6. £2.5.0 plus 5/6 p. & p.
The above in Kit Form, £1.14.6 plus 5/6 p. & p.

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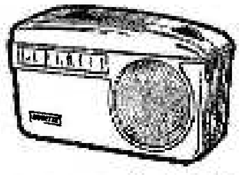
★ 2¼" Speaker. ★ 6 Transistor Superhet Output 200mW. ★ **Plastic Cabinet** in red, size 4¾" x 3" x 1⅜" and gold **speaker louvre.** ★ **Horizontal Tuning** Scale. ★ Ferrite Rod Internal Aerial. ★ IF 460 kc/s. ★ All components Ferrite Rod and Tuning Assembly mount on printed board. ★ Operated from PP3 Battery. ★ Fully comprehensive instructions and point-to-point wiring diagram. ★ Printed Circuit Board. ★ Tunable over medium and long waveband. ★ Car aerial and earpiece socket.



Price **39/6d.** inc. carrying strap. Circuit Diagram 2/6 free with parts. P. & P. 3/6.

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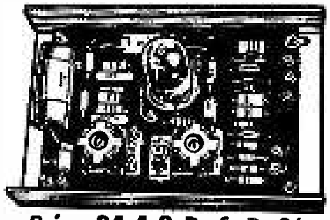
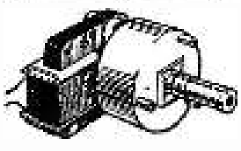


Now is your chance to benefit in full from the new B.B.C. stereo transmissions with our Multiplex Decoder. **Design features: Highly** efficient Mullard vinkor pot cores. Two semiconductor diodes. Double purpose valve. Printed circuit type construction high input impedance. Specification: Cross talk minus 26 dB at 1 kc/s. Input requirements 0·5—1·5 RMS. Stability plus or minus 0·1%. Voltage requirements H.T. 190—250 volts. D.C. at 5 mA, heaters 6·3 volts. A.C. at 300 mA. Self powered unit shortly available, price to be announced. Size 5¼" x 3½" x 1". Fully built and tested.

Price £4.4.0 P. & P. 3/-

Type E MOTOR

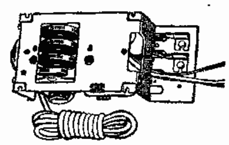


Small A.C. mains motor 230/250 volts complete with gearbox, **6 r.p.m.** Price **15/-** plus 4/- P. & P. Similar to above motor but without gearbox. Price **9/6** plus 3/- P. & P.

Silicon Rectifiers

250 v. P.I.V. 750 milliamps. Six for **7/6,** Post paid.

TRANSISTORISED 1½ WATT AMPLIFIER



comprising 2AC 128, 20C 75 and 2 AA129 separate bass and treble volume controls. Complete with Power Supply AC mains 240 v. Size 7½" × 3¾" × 2". Price **50/-** plus 2/6 P. & P.

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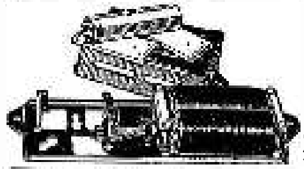

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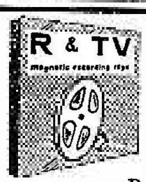

5¾" Std.	850ft.	9/-	5" L.P.	850ft.	10/6
7" Std.	1200ft.	11/6	3" T.P.	600ft.	10/6
3" L.P.	240ft.	4/-	5" T.P.	1800ft.	25/6
5¾" L.P.	1200ft.	11/6	5¾" T.P.	2400ft.	32/6
7" L.P.	1800ft.	18/6	7" T.P.	3600ft.	42/6
5¾" D.P.	1800ft.	18/6	4" T.P.	900ft.	15/-

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

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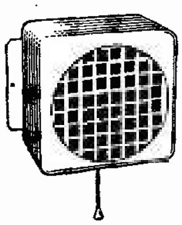

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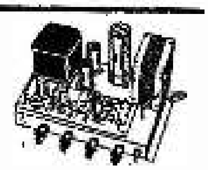
8-watt 4-valve PUSH-PULL AMPLIFIER & METAL RECTIFIER



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

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3,000W WITH AUTOMATIC EJECTION
200/240 v. Size of hole required 1⅛".
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- ★ Parts list and circuit diagram 2s. 6d., free with parts.

ONLY £4.4.0

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

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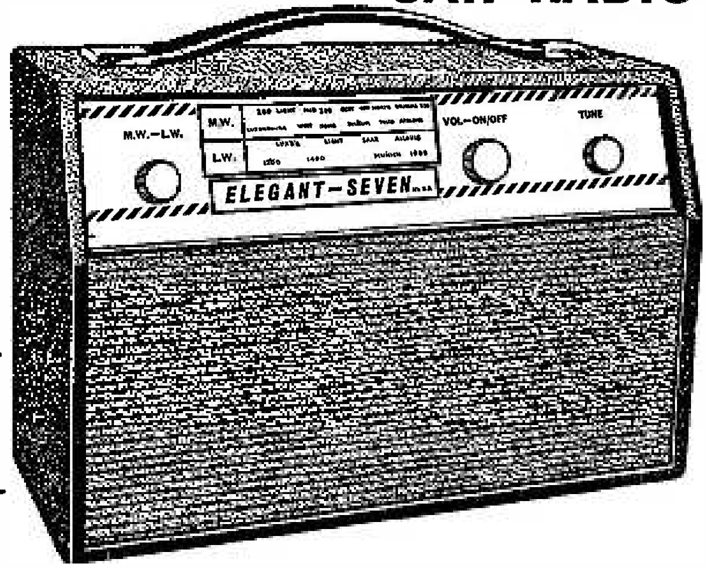

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To purchasers of 'Elegant Seven' parts, incorporating mains transformer, rectifier and smoothing condenser, A.C. mains 200/250 volts. Output 9v 100mA. 7/6 extra.

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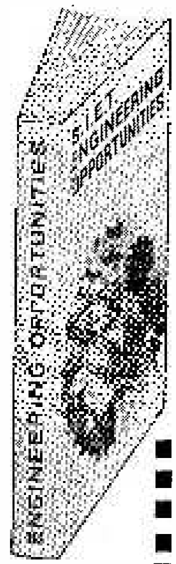

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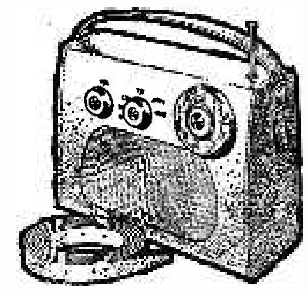

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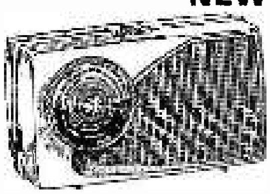
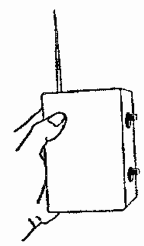
Parts Price List and easy build plans 3/- (Free with kit)

NEW MELODY MAKER SIX

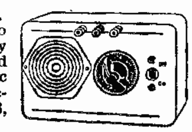


★**8 stages. Six transistors and two diodes.** Covers Medium and Long Waves and Extra Band for EASIER tuning of LUXEMBOURG etc. Top grade 3in. Loudspeaker for quality output. Two R.F. stages for extra boost. High 'Q' 6in. Ferrite Rod Aerial. Approx. 350 Milliwatts push pull output. Handsome pocket size case with gilt fittings. Size 6¼ x 3¾ x 1¼. (Uses long-life PP6 battery). Carrying strap 1/6 extra.

This amazing receiver may be built for only **£3.9.6** P. & P. 3/6. *Parts price list and easy build plans 2/-.* (Free with kit).

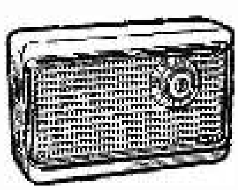


QUICK CHECK TRANSISTOR TESTER. Checks gain of R.F. and Audio Transistors. Also checks for noise level and duds. All parts ready to be assembled in attractive grey case with red grille, complete with Dial, Knobs, and Dynamic Speaker. Simple assembly instructions free with set of parts. 29/6, P. & P. 2/6.



THE SIG-GEN. A versatile Signal Injector. Something no constructor should be without. The ingenious device generates an audible signal through the Audio and R.F. ranges. With variable output. Telescopic Probe. Pocket size slim line case measures 4¼ x 3¼ x ⅝in. Complete set of parts with full instructions. 19/6, P. & P. 2/-.

NEW TRANSONA FIVE



Now with 3in. Speaker!

"Home, Light, A.F.N., Lux. all at good volume." G.P., Durham.

● **7 stages—5 transistors and 2 diodes**

Fully tunable over Medium and Long Waves and Trawler Band. Incorporates Ferrite rod aerial, tuning condenser volume control, new type fine tone super dynamic 3in. speaker, etc. Attractive case. Size 6¼ x 4¼ x 1½in. with red speaker grille. (Uses 1289 battery, available anywhere.)

Total cost of all parts now only **42/6** P. & P. 3/6

Parts Price List and easy build plans 2/- (Free with kit)

POCKET FIVE *Now with 3in. Speaker!*

● **7 stages—5 transistors & 2 diodes**

Covers Medium and Long Waves and Trawler Band, a feature usually found in only the most expensive radios. On test Home, Light, Luxembourg and many Continental stations were received loud and clear. Designed round supersensitive Ferrite Rod Aerial and fine tone 3in. moving coil speaker, built into attractive black and gold case. Size 5½ x 1¼ x 3½in. (Uses 1289 battery available anywhere.)

Total cost of all parts now only **42/6** P. & P. 3/-

Parts Price List and easy build plans 1/6 (Free with kit)

STOP PRESS! Pocket 5 med. and long wave version with miniature speaker. **29/6** P. & P. 3/-.

NEW ROAMER SIX

NOW, WITH PHILCO MICRO-ALLOY R.F. TRANSISTORS

● 6 WAVEBAND ! !

● **8 stages—6 transistors and 2 diodes**

Listen to stations half a world away with this 6 waveband portable. Tunable on Medium and Long Waves, Trawler Band and two Short Waves. Sensitive Ferrite rod aerial and telescopic aerial for short waves. Top grade transistors. 3in. speaker, handsome case with gilt fittings. Size 7¼ x 5¼ x 1½in. (Carrying strap 1/6 extra.)

★ **EXTRA BAND FOR EASIER TUNING OF LUXEMBOURG, ETC.**

Total cost of all parts now only **£3.19.6** P. & P. 3/6

Parts Price List and easy build plans 2/- (Free with kit)

TRANSONA SIX

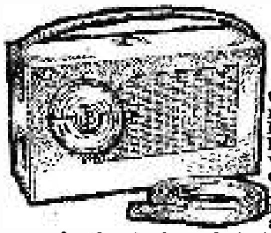
● **8 stages—6 transistors and 2 diodes**

This is a top performance receiver covering full Medium and Long Waves and Trawler Band. High-grade 3in. speaker makes listening a pleasure. Push-pull output. Ferrite rod aerial. Many stations listed in one evening including Luxembourg loud and clear. Attractive case in grey with red grille. Size 6¼ x 4¼ x 1½in. (Uses PP4 battery available anywhere). Carrying strap 1/- extra.

Total cost of all parts now only **59/6** P. & P. 3/6

Parts Price List and easy build plans 1/6 (Free with kit)

MELODY SIX



● **8 stages—6 transistors and 2 diodes**

Our latest completely portable transistor radio covering Medium and Long Waves. Incorporates pre-tagged circuit board, 3in. heavy duty speaker, top grade transistors, volume control, tuning condenser, wave change slide switch, sensitive 6in. Ferrite rod aerial. Push-pull output. Wonderful reception of BBC, Home and Light, 208 and many Continental stations. Handsome leather-look pocket size case, only 6¾ x 3¼ x 1½in. approx. with gilt speaker grille and supplied with hand and shoulder straps.

Total cost of all parts now only **£3.9.6** P. & P. 3/6

Parts Price List and easy build plans 2/- (Free with kit)

SUPER SEVEN

● **9 stages—7 transistors and 2 diodes**

Covers Medium and Long Waves and Trawler Band. The ideal radio for home, car, or can be fitted with carrying strap for outdoor use. Completely portable—has built-in Ferrite rod aerial for wonderful reception. Special circuit incorporating 2 RF Stages, push-pull output, 3in. speaker (will drive large speaker). Size 7¼ x 5¼ x 1½in. (Uses 9V battery, available anywhere.)

Total cost of all parts now only **£3.19.6** P. & P. 3/6

Parts Price List and easy build plans 2/- (Free with kit)

Callers side entrance Barratts Shoe Shop.

RADIO EXCHANGE CO.

Open 9—5 p.m. Saturday 9—12-30 p.m.

61 HIGH STREET, BEDFORD Telephone: Bedford 52367

PRACTICAL WIRELESS

VOL 43 No 1

issue 723

MAY 1967

TOPIC OF THE MONTH

Kitmanship

OUR contributor Henry certainly touched an exposed nerve with his essay *To Kit or Not* in the March issue. The resulting correspondence, coupled with our own experience, indicates that a few of the kits currently being offered are shoddy affairs.

Principally kits are for the beginner and as such they must be easy to assemble and contain clear and concise assembly instructions. In fact some would tax the ingenuity of "advanced" constructors. Common complaints include wrong value resistors, faulty or sub-standard components, incorrect assemblage of components, misleading instructions, and so on. Substitute components also cause the home constructor a lot of trouble, particularly coils where the connections differ from the accompanying instructions. Identification problems are not, however, confined to coils, for we have had our attention drawn to unmarked resistors, capacitors, transistors and so on.

We know of one kit in which there were *fourteen* mistakes in the accompanying instructions. This is not good enough and must be stopped!

The gloom continues with the disquieting reports of abuses in "after-sales service" facilities which, if our informants are correct, are no more than rackets. Don't get us wrong, they are not all bad, but remember the old phrase *Caveat Emptor*—let the buyer beware.

It appears that the buyer of the more expensive kits gets the better deal, but this is no excuse for some of the rubbish we have heard of and seen. Even the cheapest kit of parts should be intact, and complete with easy-to-follow instructions. Often it is the youngster who buys these. He may have had to save weeks of pocket money to get one of these. It is a tragedy if he ends up with a heap of useless parts.

We strongly condemn sharp practice and will do our best to stamp it out. Any reader with a genuine complaint about goods or services from any *Wireless* advertiser, should send us clear and concise details. We will take up his case with the company concerned. Readers should, however, bear in mind that some of the "mail order" concerns handle very large quantities of kits and occasional packaging errors and delays are inevitable.

W. N. STEVENS—*Editor*

NEWS AND COMMENT

CONSTRUCTIONAL

GENERAL ARTICLES

JUNE ISSUE WILL BE PUBLISHED ON MAY 5th

Kits and Henry

I read with interest Henry's commentary about Kits in the March issue of PRACTICAL WIRELESS. A few months ago, I bought a kit from a firm who advertise in this magazine. It arrived short of the carrying strap and with a tuning dial the wrong size and with the scale reading in the wrong direction. The circuit diagram contradicted the instructions and the paxolin board on which the works were soldered, had to be wedged with cardboard. A short time later, I sent for another receiver from the same firm. This one was much worse! The parts were soldered to tag strips which were glued to a piece of cardboard. There was apparently no method of holding the battery still in the case and the back flew off the set at the slightest provocation. It has never worked and a letter to the firm concerned proved to be a waste of fourpence.

H. Boys. Walsall, Staffordshire.

★ ★ ★

Henry's comments are only too true. I am a constructor of some experience and have built many sets for friends. I would hate to think of a newcomer tackling one of these kits for the first time—some of which, the firms claim, can be built in a matter of hours.

One more grouse I have is about so-called postage charges. You are charged say, 7s. 6d. and when the parcel arrives, it has stamps on it to the value of 3s. 6d.! The same is for valves. In some adverts, the postage charge is 6d. per valve, so if you order six valves, the postage charge is 3s. Why, then, when the package does arrive, does it have stamps to the value of 8d. on it?

A. H. Brough. Leek, Staffordshire.

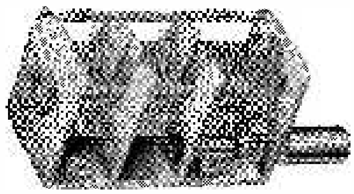
★ ★ ★

I agree with every word Henry says in "To Kit or Not". As a science teacher I had been approached by various pupils as to possible reasons why their kits did not work. This made me curious, so I sent away for a kit myself. The result was precisely the same as Henry's, with the final result that I returned it, paid the £1 fee, received a further demand for a further 15s., which being duly paid, brought back the chassis—but only working on one band! I wrote a letter to the firm saying that the so-called changes weren't made (I can recognise my own work) and that the so-called defective parts were their responsibility, seeing that they were selling the kit. This brought no reply at all!

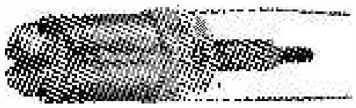
C. Miller. Maidstone, Kent.

NEWS AND..

VARIABLE CAPACITORS FOR PRINTED CIRCUITS AND VHF



Type CG80–01 is a miniature three-section, ganged capacitor designed for v.h.f receivers. Each section has a capacity of from 2·5pF to 17pF. An internal gear and pinion drive gives a 3:1 reduction. High-grade ceramic posts insulate the stator from the frame, and the capacitor is 1·5in. long, 0·65in. wide and 0·85in. high overall.



Type S60–01, piston-type trimmer has an overall diameter of 0·25in. with 0·2in. fixing centres and is variable from 2pF to 25pF by means of a screwdriver slot in the rotor. It has a polystyrene dielectric, but for operation in extremes of temperature, a P.T.F.E. dielectric can be supplied. Wingrove and Rogers Ltd., Domville Road, Mill Lane, Liverpool 13.

A.A. RADIO AT IDEAL HOME

The A.A. Linkline radiotelephone service (see News and Comment, page 732, February 1967 issue) was one of the main features of the Automobile Association's display at the Ideal Home Exhibition.

Direct contact between Olympia and the Linkline control centre at the A.A.'s Leicester Square headquarters was maintained and visitors to the A.A. stand were able to talk over the air and also listen to traffic information broadcasts and other messages being transmitted to Linkline users.

144th "COSMOS" SPUTNIK

The Soviet Union recently launched its 144th scientific earth satellite. Cosmos-144 was placed in a circular orbit at a distance from the earth's surface of 388 miles. In addition to scientific equipment the sputnik has a radio system for the accurate measurement of orbital elements and a radio telemetric system for transmitting data to earth concerning the function of instruments and apparatus.

CURB ON LICENCE DODGERS

Under the terms of a Government Bill aimed at licence dodgers, published recently, TV dealers will be compelled to let the GPO know the names of customers buying or hiring sets.

It is estimated that the BBC loses £10M annually through people not obtaining licences.

Applicants for Road Fund Licences will also have to state whether or not their cars are fitted with radios.

Also under this Bill, the PMG Mr. Edward Short, will be able to prohibit the import or manufacture of certain wireless telegraphy apparatus, which, it is understood will include imported walkie-talkies and similar apparatus.

It is understood that dealers who do not comply with the requirement to furnish lists of purchasers will be liable to fines.

...COMMENT

LOCAL RADIO IN THE NORTH AND MIDLANDS

The first three sites chosen for the BBC's experimental radio stations are at Leicester, Merseyside and Sheffield stated the Postmaster General recently. Merseyside includes Liverpool, Birkenhead and Wallasey. All stations will transmit on v.h.f. and have a range of 12 miles. They are expected to be on the air by the end of this year.

The BBC will build the stations at a cost of about £35,000 each and each station will have a staff of about 15. Running costs will be in the region of £1,000 per week.

Local output will be about four hours a day and will cover news, current affairs, local information and request programmes. After a transmission from his own studio, a station manager will then be able to switch over to one of the main BBC networks.

ELECTRONICS PULL ASIDE IRON CURTAIN

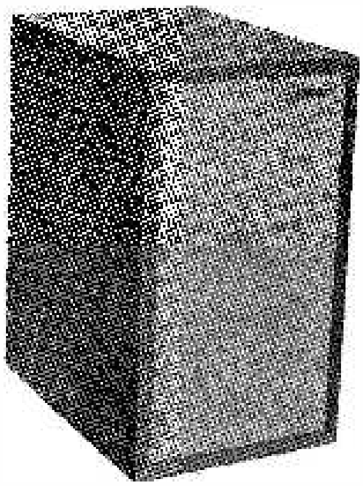
Three years of negotiations have resulted in Plessey signing a 5-year agreement with Russia for the exchange of specialised knowledge and joint co-operation in the field of electronic equipment and components and automation.

Signed in Moscow recently with the Soviet State Committee for Science and Technology, the agreement is hoped to result in firm business within the next few months. Plessey will offer licensing agreements to the Russians and expect to be licensed for the sale of Soviet developments all over the world.

ULTRASONICS HELP THE DOCTORS

The sound-visor, an instrument which transforms a reflected sound signal into a picture, making it possible to see in detail objects only a few tenths of a millimetre in size concealed in a mass of absolutely non-transparent substances, has been developed at the Institute of Acoustics of the USSR Academy of Sciences. The instrument is 200 times as sensitive as an X-ray machine in studying the human body. X-rays make it possible to discern the bone from the muscle but they cannot discern a tumour from a muscle. Scientists hope that tumours will be detected by the sound-visor.

AVON BOOKSHELF SPEAKER



Frequency response: 50c/s–19kc/s.
Crossover frequency: 2kc/s.
Power rating: 9W r.m.s. max.
Nominal impedance: 15Ω.
Speakers: 6½in. bass, $\frac{3}{16}$in. totally enclosed treble.
Cabinet dimensions: 7¾ x 13¼ x 8¾in.
Cabinet material. 12mm. high grade plywood with $\frac{3}{16}$in. aluminium alloy speaker mounting plate.
Finish: Walnut veneer.
Cross-over: Inductor-capacitor type.

The walnut veneered cabinet kit costs £8 18s., and the loudspeakers and cross-over network kit cost £4 18s. Daystrom Ltd., Gloucester.

Phonetics and RAE

Mr. Haagensen may be glad to know that those who sat the Radio Amateurs' Examination in December, 1966, were confronted by this question: "How may the letters of the call sign be confirmed by radio-telephony? Give six examples of the recommended phonetic alphabet".

I might add that I have heard Czechoslovakia, Canada, America, Iceland, Sweden, Holland and many other countries in contact with British Amateurs, who varied their phonetical alphabet confirmations, and none of these countries seemed disturbed. Furthermore, the foreign countries varied their phonetical confirmations and I was able to comprehend all the callsigns.

All these countries were heard on 80m., using a 19 set and phones with a 67ft. long wire running 20 ft. from the ground NE SW. I can only suggest that Mr. Haagensen is slightly hard of hearing.

A. Barroclough. Rotherham, Yorkshire.

★ ★ ★

I wonder how many Radio Hams Mr. Haagensen actually listened to? Surely he realises that there are many thousands of Hams who are active all over the world, all hours of the day and night, so how can he possibly judge all just by a few? I am not entirely in agreement with the NATO phonetic alphabet and I know it inside out, being a RAF Wireless Op and it is fine only if conditions are suited.

I was operating 5B4PC from 1962—65 and at time static was so bad that the NATO phonetics were truly useless. Here is an example of what I mean: Germany, Washington, Three, Santiago, Bravo, Ontario for the callsign GW3SBO is much clearer and understandable in the hissing static than Golf, Whiskey, 3, Sierra, Bravo, Oscar. There are many hams who agree with me—especially those who have missed the hissing Sierra or Oscar in a burst of static.

If I pass the RAE this year, I shall use phonetics which best suit the conditions I work under, until the NATO phonetic alphabet becomes compulsory.

W. F. Wright. Sleaford, Lincolnshire.

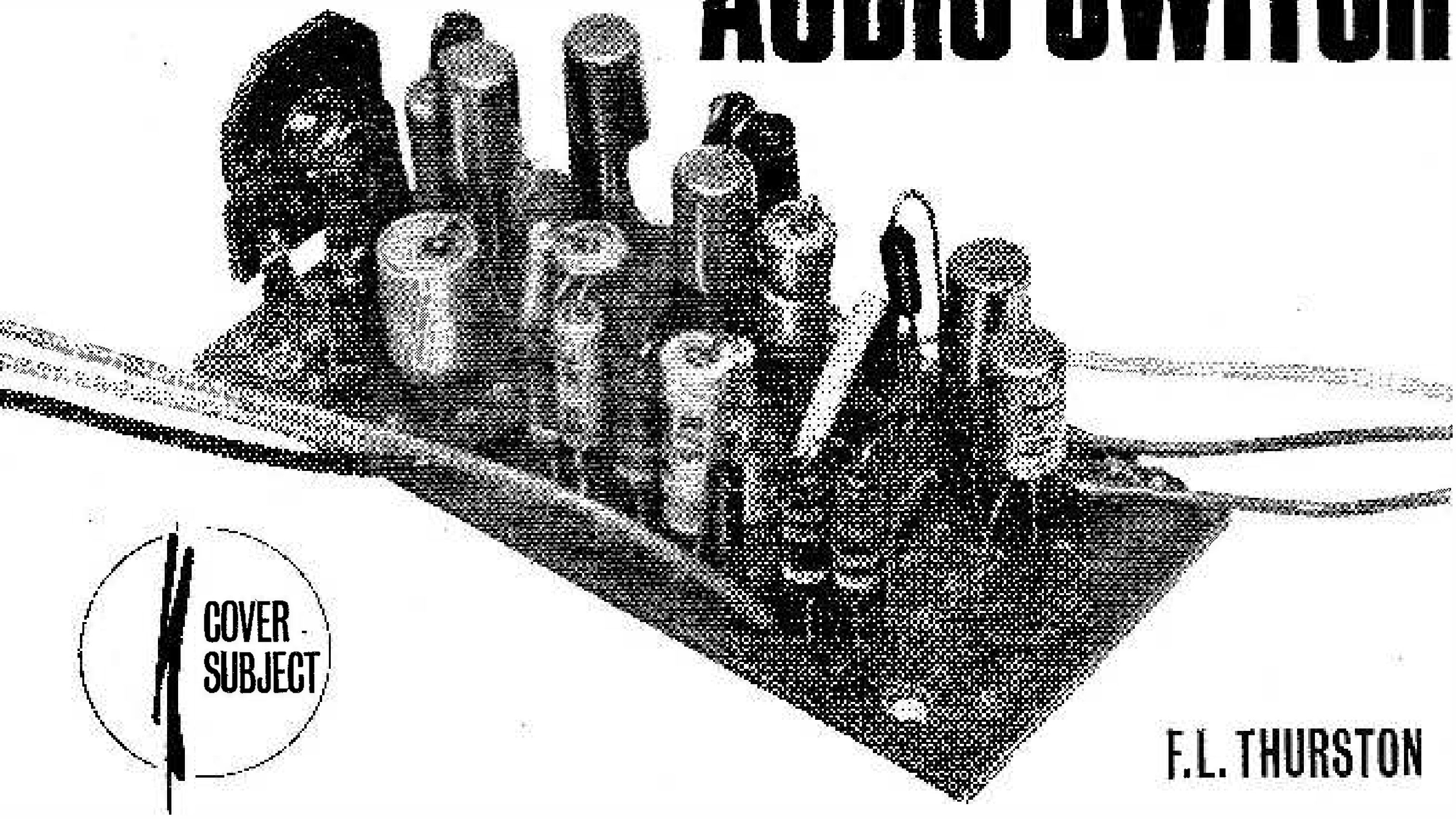
FILMSHOW TICKETS

Applications for Filmshow tickets—which are free—should be made to: Filmshow, Practical Wireless, Tower House, Southampton Street, London, W.C.2. A stamped addressed envelope must be included with all applications. See page 57.

More News and Comment on Page 44

MULTIPURPOSE

AUDIO SWITCH



COVER SUBJECT

F.L. THURSTON

Sound-operated switches are extremely useful devices and can be used in many applications, from saving tape (and thus extending the playing time) in recording machines . . . to burglar alarms. The multipurpose switch described in this article is quite sensitive and will operate—at normal conversation levels—at distances up to 30 feet.

One of the difficulties in designing a sound-operated switch with a high sensitivity hinges on the fact that long microphone leads are almost inevitable. Also, the microphone (which in the author's case is a low impedance loudspeaker) has to be matched into the amplifier section of the switch. A microphone transformer can be used for this, but with reservations. For example, if the "switch" is powered from the mains, pick-up by the microphone transformer from the mains transformer can cause the switch to be permanently "on". For this reason, another form of input matching was chosen: a grounded base transistor configuration, as shown in Fig. 1a. In this circuit, the input (from the "microphone") is fed directly into the emitter, with the base decoupled by C1. The emitter resistor can be omitted since a low impedance "microphone" is used as the pick-up. The other components in the circuit are included to give correct d.c. operating levels. Signal gain is approximately 100.

Inter-stage Matching

Although the circuit shown in Fig. 1a has a reasonably high voltage gain, the problem comes when the gain has to be transferred to another stage. Should the following stage be a common emitter amplifier, it will offer a fairly low impedance to the first stage: shown as Rz in Fig. 1a. As far as the signal is concerned, Rz is effectively in parallel with R1 the collector load, reducing its ohmic value (to the signal) to about 800Ω. This reduces the stage gain to about 8. The way to overcome this is to use an emitter follower as an inter-stage buffer. This has quite a high input impedance and does not load Rz. Figure 1b shows an emitter follower connected to the original circuit.

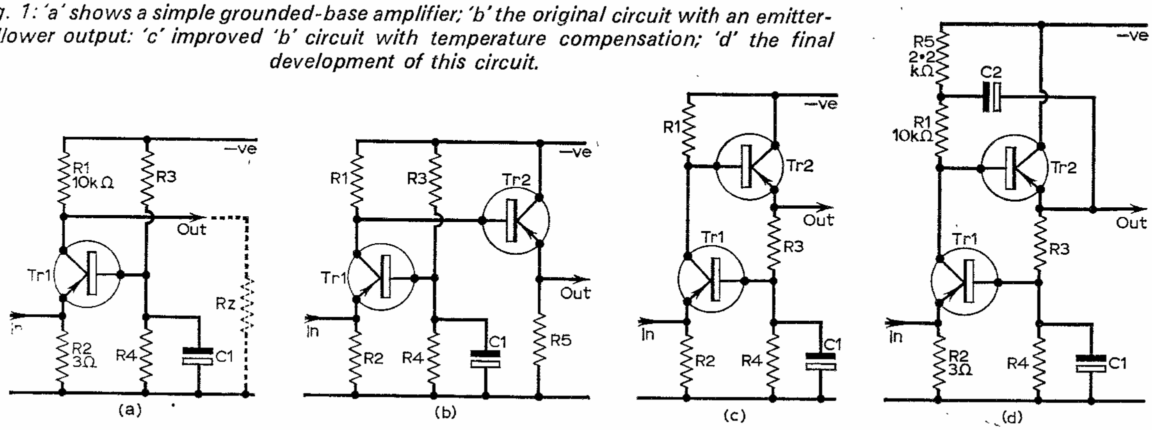
The temperature stability of the two circuits so far described is not very good: both circuits having small emitter resistors. It can be improved by adding a negative d.c. feedback loop from the emitter of Tr2 to the top of the Tr1 base chain—as shown in Fig. 1c. If the total resistance of R3, R4 is kept low, it can be made to serve as the emitter load of Tr2, making it possible to save in components without affecting the gain. The final development of this circuit is shown in Fig. 1d.

Bootstrap Technique

One of the advantages of the emitter follower is that its output (which is taken from the emitter) is in the same phase and almost the same amplitude as the input signal applied to its base. The impedance levels are, of course, different.

Referring to Fig. 1d, note how the collector load of Tr1 is split into two parts. R1 forms the major load, while R5 acts as an "isolating" resistor, since the voltage appearing at the emitter of Tr2 approximates that at the collector of Tr1 and is fed back (via C2) to the junction R1/R5. Thus, similar a.c. signals appear at either end of R1, and consequently only a small signal current flows through R1 when

Fig. 1: 'a' shows a simple grounded-base amplifier; 'b' the original circuit with an emitter-follower output: 'c' improved 'b' circuit with temperature compensation; 'd' the final development of this circuit.



a given signal output is available. This enables the value of R1 to be increased by about ten times, hence, the 10kΩ looks like 100kΩ to a.c. signals and gives the circuit a voltage gain of the order of 500.

This method of increasing the ohmic value of R1 is known as Bootstrapping—it being analogous to the idea of a man lifting himself by his shoelaces. For this technique to work the signals appearing across R1 must come from isolated sources: putting a capacitor across R1 to isolate the ends will not work.

Full Circuit

Looking at the full circuit diagram of the sound-operated switch, Fig. 2, you will see that Tr1 and Tr2 are wired in a similar fashion to the circuits in Fig. 1. The main collector load resistor being R2, with Bootstrapping being applied through R1, the "isolating" resistor. Potentiometer VR1 forms the major part of the emitter load and serves as a sensitivity control for the amplifier: R3 is simply a limiter and can be omitted if preferred.

The amplified signals appearing across the potentiometer are capacitively coupled by C3 into the base of Tr3, a conventional common emitter amplifier which further amplifies the signal. The output of this stage is rectified by D1/D2 (smoothed by C6/R9) and fed to a d.c. switching amplifier Tr4/Tr5. These two transistors are wired as a Super-Alpha pair and can be looked upon as an ultra-high-gain single transistor connected in a common emitter configuration. In the absence of an input signal, no rectified or d.c. bias is available to the base of Tr4, so the combination transistor is cut-off. As soon as the bias condition changes (through the rectification of incoming signals) Tr4 is turned on. This shorts the base/collector junction of Tr5 and turns the transistor full on, energising the switching relay RLA. When the signal is removed, the transistors revert to their original condition.

The power requirements of the circuit are not critical, as the "switch" will function from a nine to twelve volt supply: either a battery or a mains power supply unit.

Construction

All the components, excepting the "microphone" and the relay, are vertically mounted on a piece of Veroboard, which should be cut to the size (and the copper strips broken) in accordance with the information given in Fig. 3. Before assembly starts, it is as well to reduce the thickness of the mounting legs of the skeleton type potentiometer before trying to mount it, otherwise the "legs" will not go through the holes in the Veroboard. Remember to use heat shunts when soldering the semiconductors into circuit.

Once the Veroboard unit has been completed, check the circuitry, especially the electrolytic polarities, and check it again—a cross connection can easily cost a transistor. Now attach a "microphone", almost any three-ohm speaker will do, the relay and a power supply. The relay will probably operate when power is applied, but this is not important so long as it releases after a second or so.

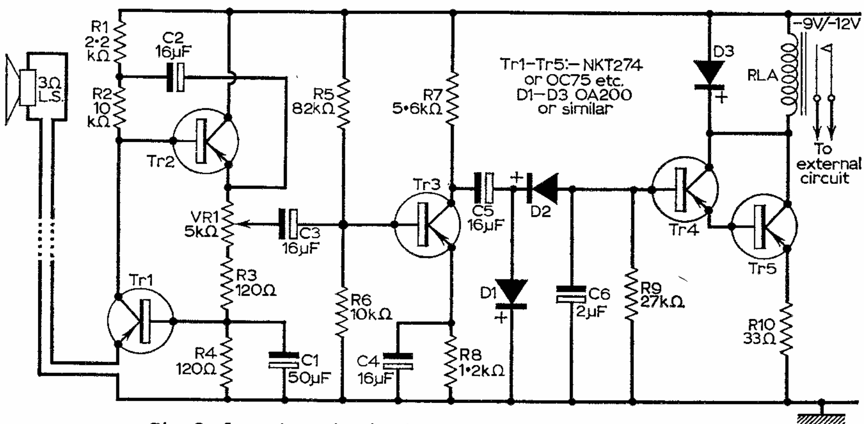


Fig. 2: Complete circuit of the audio switch.

Circuit Modifications

The circuit shown in Fig. 2 switches off almost immediately the signal is removed. The unit can, however, be made to remain on for a few seconds after the input signal has been removed by increasing the value of C6. Should the constructor want the relay to be held on for a long time after the input signal is removed, a self-latching relay is needed. Fig. 4a shows that an additional pair of relay contacts are needed, which are normally open but, when the relay operates, close and connect the negative supply rail to the base of Tr4 (via Rx and S1). The exact value of Rx has to be found by trial and error: a good kicking-off point is 100kΩ. Switch S1 (a normally closed push-button type) is used to re-set the unit.

The basic audio switch can be operated from almost any a.c. signals, and in this context the "microphone" can be replaced by any low impedance transducer or pick-up. Thus, the unit can be activated by vibration, by changes in water pressure, changes in a magnetic field, and so on. Should the transducer or pick-up be a medium impedance device, the Tr1 and Tr2 circuitry should be replaced with a circuit identical to Tr3, except that the collector load should be replaced with a 5kΩ pre-set, which acts as a sensitivity control. A 1kΩ/16μF decoupling network should be wired in the negative supply lead between the two stages to prevent instability. It may be found that the sensitivity of the new circuitry does not match the former.

If the transducer or pick-up is a high impedance device (up to about 100kΩ) then Tr1 and Tr2 should be replaced by the circuit shown in Fig. 4b. In this circuit, Tr1 is wired as an emitter follower, with the input applied to its base and the output taken from the slider of the 5kΩ pre-set and fed into Tr2, a conventional common emitter amplifier. (The output from Tr2 collector is then fed on to C3 of Fig. 2.) Again a 1kΩ/16μF decoupling network is inserted to prevent instability. Should the transducer or pick-up be of ultra-high-impedance (1MΩ or greater), Tr1 and Tr2 should be replaced with the circuit shown in Fig. 4c, where Tr1 and Tr2 are wired as a Super-Alpha pair. Bootstrapping is applied to the base-bias network.

The "switch" may be built into existing equipment where it may, for example, be used to indicate the presence of a call signal at a receiver, or the presence of an input to a monitoring device. In these applications, if the "triggering" signal is of sufficient amplitude, the first three stages (Tr1 to Tr3) of the circuit can be omitted. ■

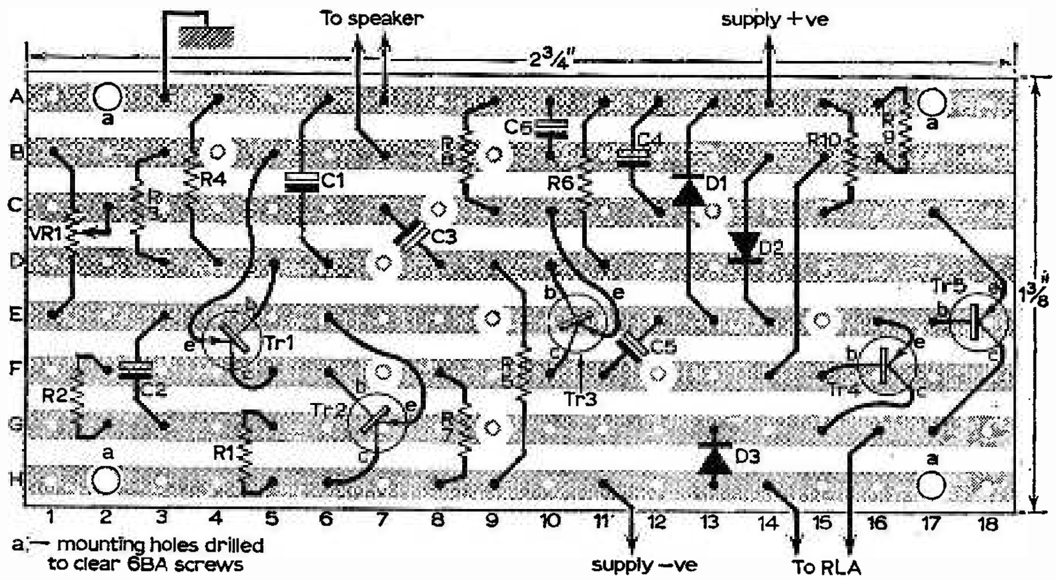


Fig 3: Layout and constructional diagram of the Veroboard panel.

★ components list

Resistors:

R1	2·2kΩ	R6	10kΩ
R2	10kΩ	R7	5·6kΩ
R3	120Ω	R8	1·2kΩ
R4	120Ω	R9	27kΩ
R5	82kΩ	R10	33Ω

All ½W, 10% carbon
VR1 5kΩ skeleton pre-set

Capacitors:

C1	50μF	C4	16μF
C2	16μF	C5	16μF
C3	16μF	C6	2μF

All sub-min. electrolytics 12VW, except C1 which may be 6VW.

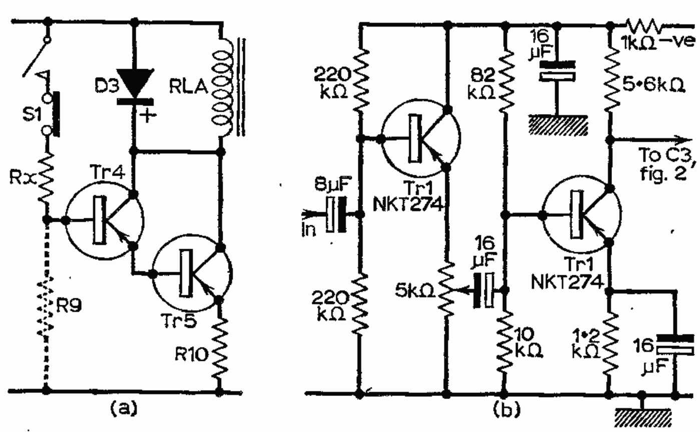
Semiconductors:

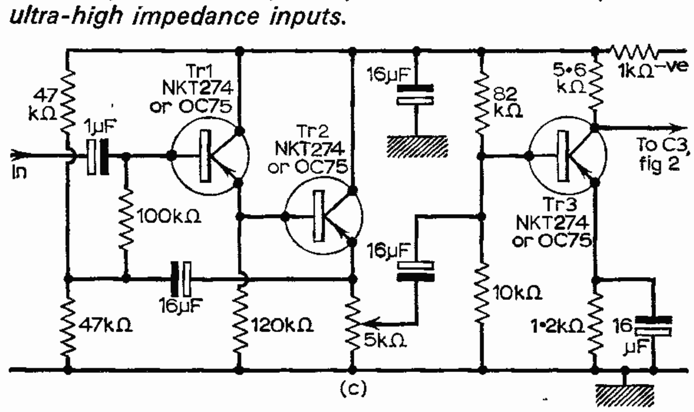
Tr1 to Tr5 Newmarket NKT274, Mullard OC75 etc.
D1, D2 Mullard 0A200, etc.

Miscellaneous:

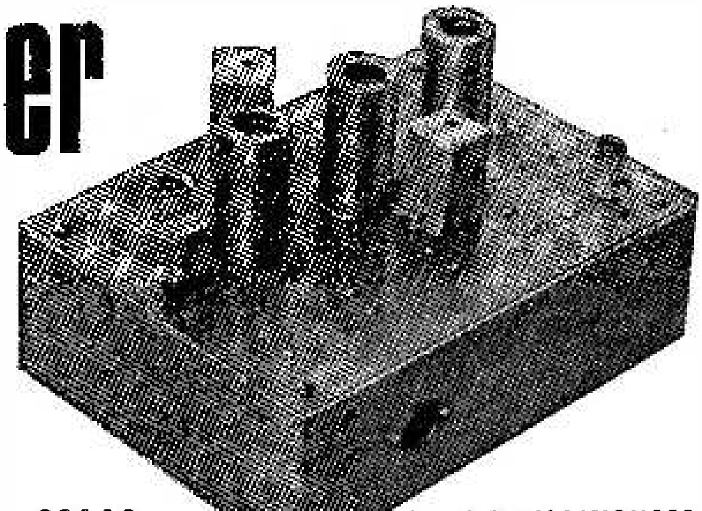
Three-ohm loudspeaker; six-to-eight volt (600Ω or greater relay; Veroboard, wiring, sleeving, etc.

Fig 4: 'a' shows a self-latching relay output for conditions where the switch must be held on after the activating signal is removed; 'b' a new input stage for use with high impedance inputs; 'c' a Super Alpha front end to cope with ultra-high impedance inputs.





70cm converter



G8AAC by J.P. BILLINGHAM

This three-valve, crystal-controlled, converter covers the frequency range 432 to 434Mc/s in the u.h.f. band and has an intermediate frequency output of 12 to 14Mc/s. This permits the converter to be used with almost any h.f. receiver, although a communications receiver is suggested for optimum results.

The converter does not have its own power supplies, however, if the main receiver cannot supply the necessary power for the three extra double-triode valves, a circuit for a stabilised p.s.u. is included in the article.

Before describing the prototype, shown in Fig. 1, the author would like to point out, to more advanced readers, that a higher i.f. output is desirable, and suggests 22 to 25, 26 to 30Mc/s or even higher. Adopting a lower i.f. than used in the prototype will result in poor image rejection and a higher noise level.

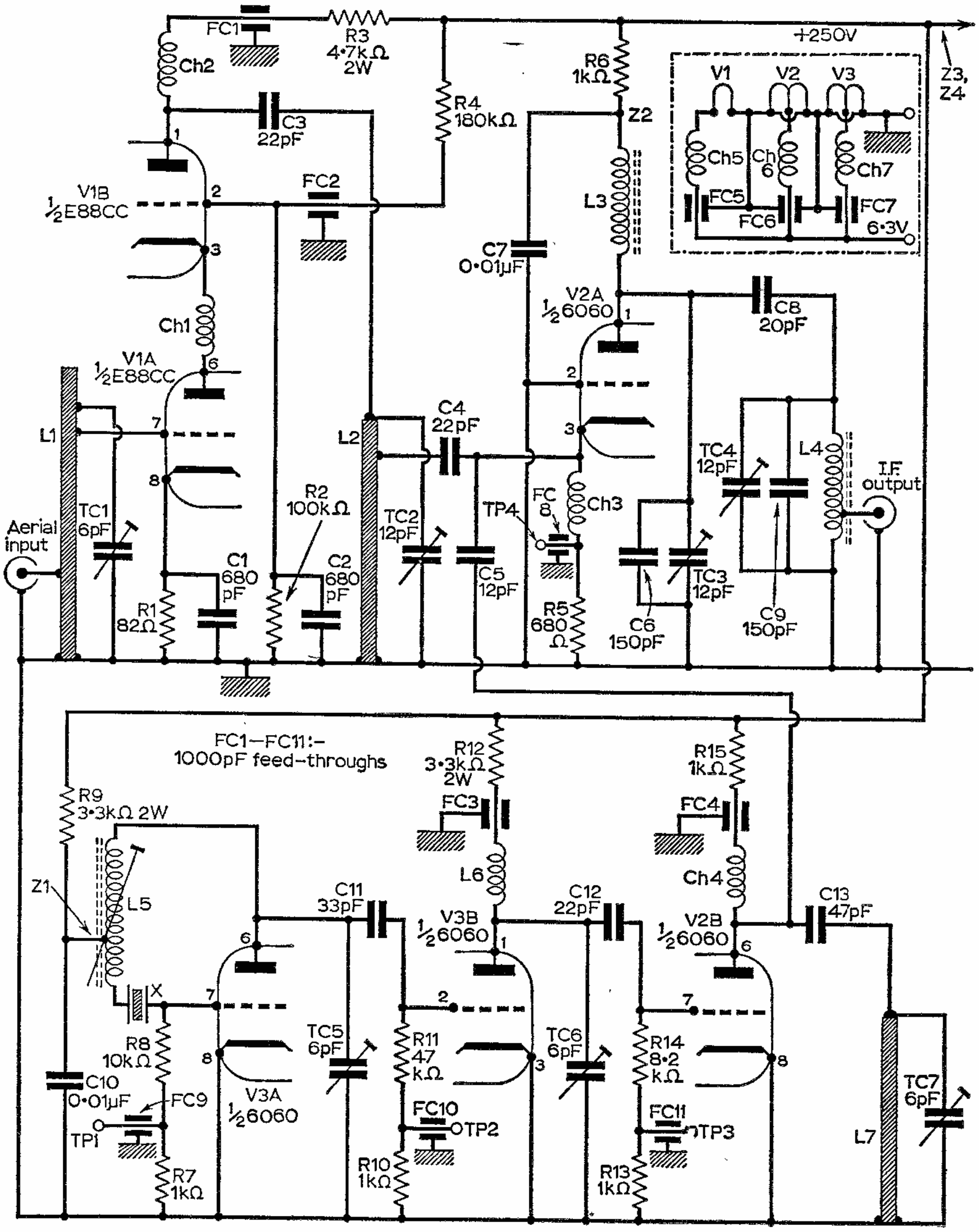


Fig. 1: Circuit diagram of the converter.

Circuit description

The input signal is taken directly to the input line L1 (tuned by TC1), which is connected to the grid of the first section of V1 — an E88CC double triode, operating as a cascode amplifier. This arrangement gives as much gain as a pentode stage, is just as stable, but is far less noisy. The amplified signal is coupled by C3 to the next tuned circuit L2, TC2 (the choke Ch2 provides adequate blocking to the r.f. signals). The r.f. amplifier is neutralised by Ch1, which has to be physically adjusted for optimum performance. If the choke has insufficient inductance, the stage will have a higher noise figure and may become unstable. Too much inductance will reduce the sensitivity of the converter.

The mixer stage of any converter is the most critical, for weak signals can be lost in a noisy mixer, and usually they are the most interesting. The traditional methods of mixing were investigated: multi-grid valves such as pentodes, hexodes, etc, were all ruled out by their high partition noise. Silicon diodes looked good at first sight with noise figures of 3 to 4dB, but

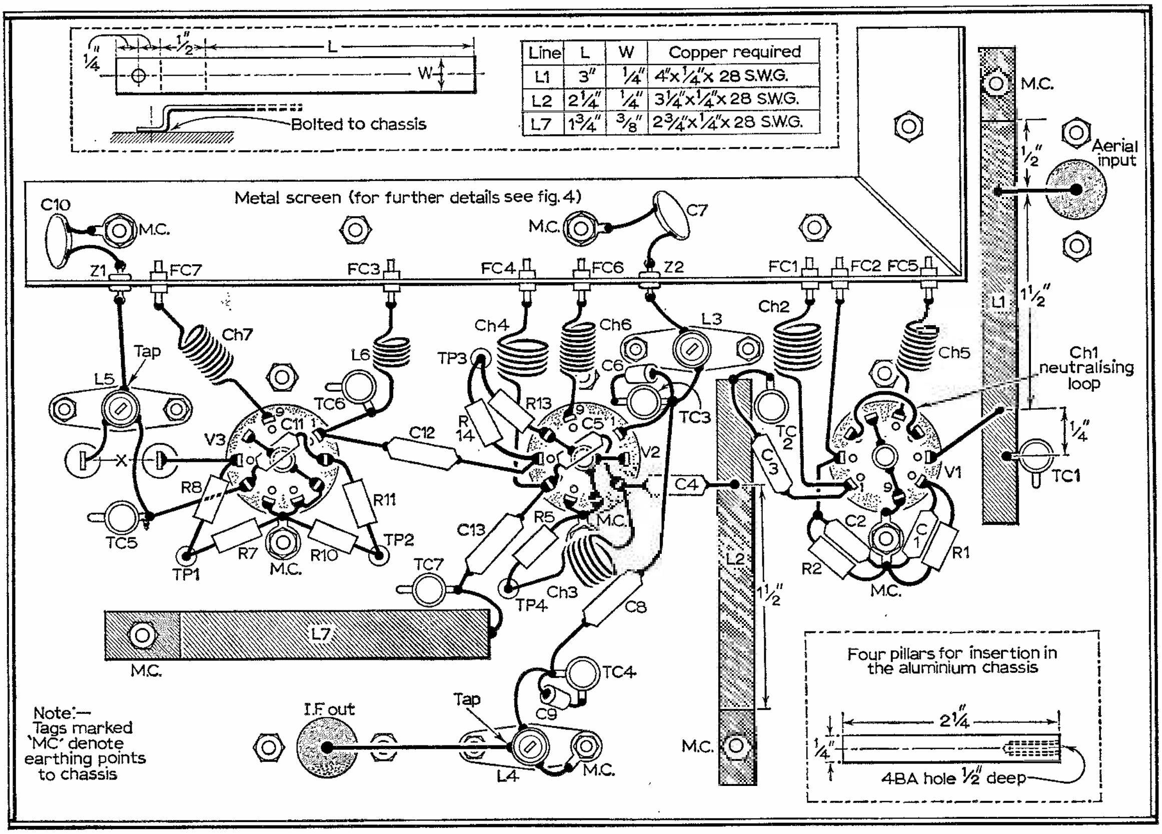


Fig. 2: Layout of the chassis—underside. Note: tapping points on the tuned lines are critical.

seemed less attractive when one considers they have a conversion loss of at least 6dB; thus, the signal to noise ratio is reduced by a minimum of 9dB, or nearly two S-points.

The grounded-grid triode was chosen as it provides a conversion gain and has only a slightly higher noise figure (6dB or more). Consulting the circuit diagram, it will be seen that the r.f. signal and local oscillator signals are capacitively coupled to the cathode of the mixer V2a by C4 and C5 respectively. The mixed signal is fed to a band-pass circuit which is broadly-tuned from 12 to 14Mc/s (L3, C6, TC3 coupled through C8 to L4, C9 and TC4). The i.f. output is taken from a low impedance tap on L4 to a 75Ω coaxial socket: the mixer current is monitored at TP4.

A crystal overtone frequency of 35Mc/s was chosen to keep the number of multiplier circuits to a minimum and to avoid TVI (television interference). The first link in this chain is a Squier overtone oscillator using V3a: the crystal is a miniature HC6/U, 35Mc/s third overtone. Coil L5 and TC5 form the resonant circuit for this stage; the ferrite slug for L5 determines the degree of feedback in the circuit, and TC5 permits the final tuning to be trimmed. Grid current is monitored at TP1.

The other half of V3 acts as a quadrupler, to raise the frequency to 140Mc/s—the anode of V3b is tuned by L6 and TC6, grid current is monitored at TP2. The final stage in the oscillator chain V2b trebles the frequency to 420Mc/s: the output is tuned by L7 and TC7, and grid current is monitored at TP3.

A 12AT7 may be used in place of the 6060, but care must be taken as the input/output capacitances may differ, requiring adjustment of the tuned circuits.

Construction

It is essential that all joints should be cleaned and that all the components should be mounted as rigidly as possible. Valve bases, lines, trimmers and so on should be soldered to the chassis. A 65-watt soldering iron is essential for this operation. However, as some constructors may not have a large iron, provisions have been made in the design for bolting components to the chassis—even feed-through capacitors.

Constructors may find it easier to fix all the bolt-on or solder-on components to the chassis before beginning wiring-up operations. When wiring-up, start with the oscillator chain, checking each stage before moving on to the next. Earth connections to the bases should be the first to be completed, followed by the components nearest the chassis.

So long as all the tuned circuits are constructed as suggested, only one resonance can be obtained for each of the tuned circuits in the oscillator chain. To align the first tuned circuit, pull the core of L5 out so it is flush with the base of the coil and adjust TC5 for maximum (negative) voltage on TP1—rising from a few millivolts to a few volts. The voltage on TP2 should also reach a similar level. Trimming capacitor TC6 is adjusted for

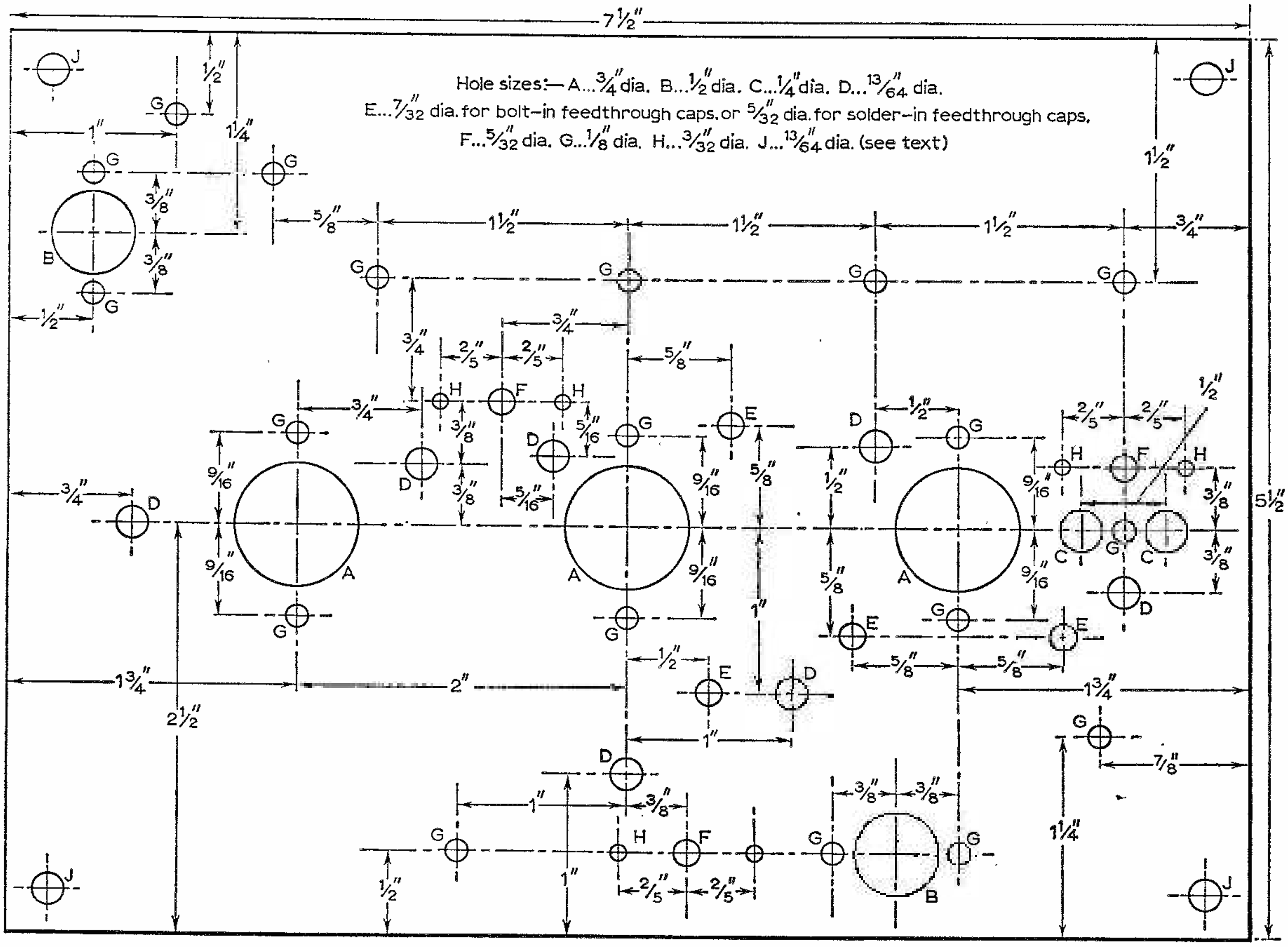


Fig. 3: Chassis drilling details (viewed from above).

maximum (negative) voltage at TP3. The 420Mc/s circuit is of sufficiently low "Q" to allow output over any part of the range of TC7.

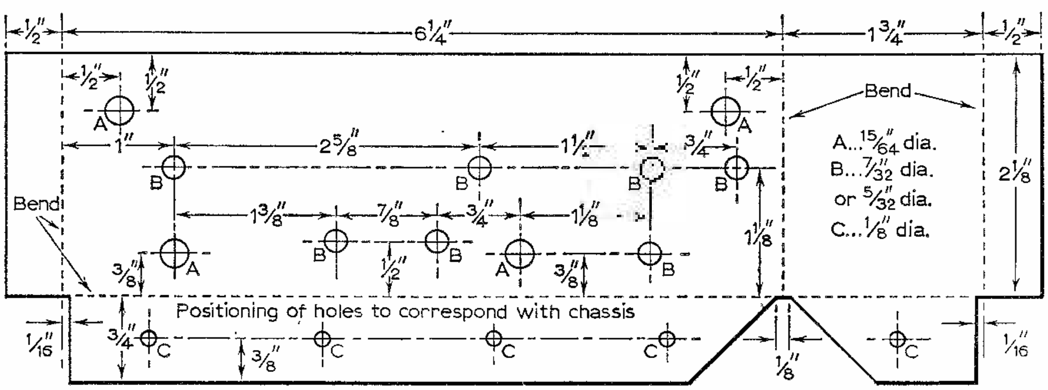
The next step is to tune the i.f. output stage. To do this, one must hook the converter to a suitable receiver. The cores of L3 and L4 affect the "Q" of the circuits and trimmers TC3 and TC4 shift the frequency. The i.f. stage is correctly set when converter noise can be heard throughout the 12 to 14Mc/s range on the main receiver.

Finally, the r.f. circuits should be tuned. Ideally this should be done with the aid of a locally generated signal. At first, the signal may have to be injected directly into the aerial socket, but as adjustments progress, stray radiations should be detected with little difficulty from a signal source some feet away.

Constructors living in the London area will find the beacon GB3GEC, located in Hammersmith and radiating several hundreds of watts on 431·5Mc/s, useful in setting up this converter.

If a u.h.f. source is not available, the r.f. circuits will have to be tuned to peak up on noise. This is quite difficult especially when two circuits have to be tuned. Harmonics from a lower frequency oscillator can be tuned quite easily.

Final adjustments can now be made, peaking up the r.f. and oscillator circuits. By now input signals



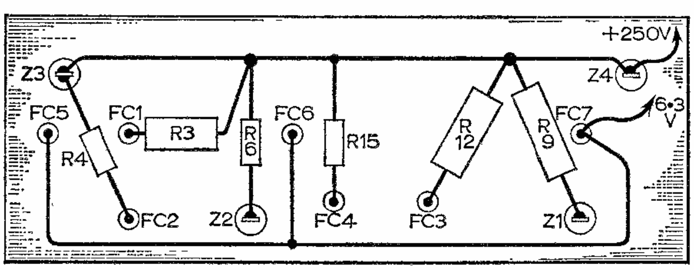


Fig. 4: Drilling and layout details for the screen panel.

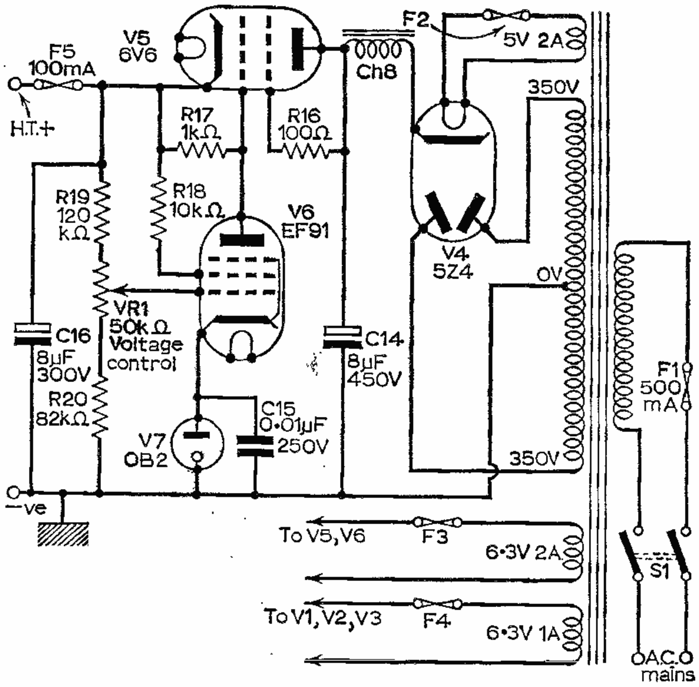


Fig. 5: Stabilised 250V power supply circuit suitable for the 70cm converter.

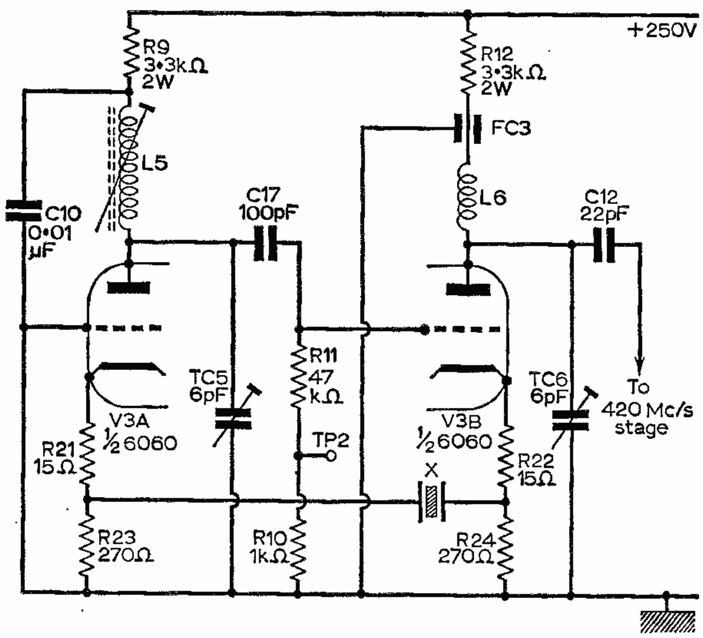


Fig. 6: Butler overtone oscillator. This circuit may well be an improvement on the existing oscillator, although the author has yet to try it.

of 0·1µV should be readable.

One of the problems of using a converter is breakthrough, as it is difficult—to start with—to distinguish between u.h.f. and any signals being picked up by the aerial circuits of the main receiver. The best way to tackle i.f. breakthrough is to mount the converter and the main receiver (and power supplies if separate) all in a single metal cabinet. Connecting leads should be kept as short as possible, and all the equipment should be adequately earthed. An additional safeguard is to filter the power supplies.

An unstable r.f. stage and too much output from the local oscillator are the two most probable causes of instability. The cure for unstable r.f. stages is dealt with earlier in this article. The cure for the latter is to slightly detune either the 420Mc/s or the 140Mc/s oscillator stages. Another problem one may encounter is that of the received signal suffering a long period of oscillation, of the order of one cycle per second or so. This is cured by slightly reducing the capacitance of TC5 and then retuning the main receiver.

Table 1: Test Point Voltages

TP1	−0·5 to −2V
TP2	−0·5 to −2V
TP3	−0·5 to −2V
TP4	+4V rising to +4·5V with very strong signals.

Future developments

An improvement over the prototype can be effected by mounting the i.f. coils above the chassis and using screening cans. Further modifications are being considered by the author, including the use of a Butler oscillator (see Fig. 6) which may improve the frequency stability. A better signal to noise ratio may be achieved by replacing the E88CC grounded-grid amplifier with an EC88, but this may entail additional underchassis screening. ■

Miscellaneous Items

Chassis measuring 7½ x 5½ x 2¼in.
Copper sheet 16 s.w.g. measuring 7½ x 5½in.
Copper sheet 20 s.w.g. measuring 9 x 2⅞in.
Copper sheet for L1, L2 and L7 (see Fig. 2).
Skirted ceramic base for V3 and two p.t.f.e. bases for V1 and V2.

Coil Data:
- L3, ten turns of 30 s.w.g.
- L4, as L3, but tapped two turns from earthy end.
- L5, 19 turns 30 s.w.g., tapped four turns from crystal end.
- L6, five turns 22 s.w.g. airspaced ¼in. diameter.

Note: L3–L5 are wound on Radiospares ¼in. formers (Type 'A' cores are used.)

Chokes:
- Ch1, neutralising loop.
- Ch2, 4, nine inches of 22 s.w.g. wound ⅜in. diameter, leaving ½in. ends.
- Ch3, as Ch2, but using 12in. of 22 s.w.g.
- Ch5, 7, as Ch2, but ¼in. diameter.

Trimmers:
- TC1, 5, 6, 7 Mullard COOAEA/6E, 6pF.
- TC2, 3, 4 Mullard COOAEA/12E, 12pF.

practically wireless commentary by HENRY

No. 33

No Holds Barred

IN my daily paper, not so long ago, I read of a magnificent scheme for abolishing Income Tax. Briefly, it consisted of slapping a 30 per cent tax on all goods and services. At almost the same time, the trade papers were bursting with the news that Retail Price Maintenance had gone with the wind. Those of us who still imagined that r.p.m. was something to do with rotation were due for a rude shock.

Price cuts of between 15 and 55 per cent on radio and electrical goods were announced by one multiple group of stores. Another had started slashing prices way

You just grit your teeth

back in the Christmas period, with the rather naïve excuse that "the windows of our 208 branches cannot be dressed in a day". Others, more cautious, reduced the mark-down on selected lines, principally washing machines and the larger appliances. One North-Country dealer reminded us wryly of the price-cut pioneers who had forced themselves out of business.

Readers of this column need no reminding of the consequences of price-cutting by the radio trade. Service is the first thing to go by the board. And when the purchaser of a bargain found that most of his saving was taken up in subsequent repair charges it would be too late for him to have a rethink.

Of course, we are told that this is the age of the handyman. Do-it-yourself is the vogue. When your special offer, ridiculous reduction, must be disposed of, marked-down-bargain goes wrong it is pretty hopeless toddling round to the shop where you bought it. You just grit your teeth, fish out the snappily packaged toolkit that Aunt Ada sent for your birthday and thumb through a few back numbers of *PW* or *PT* in the hope of finding a crumb of information that might help.

Which may be all very fine for the regular reader who can distinguish a bootstrap from a locked-oscillator discriminator and who just happens to have the equivalent to an unidentifiable Japanese VDR in his ubiquitous, bottomless spares box.

Unfortunately for the electronics bargain-hunter, the parts most prone to breakdown are inevitably those specially produced for the manufacturer. Brackets, levers, pulleys, switches, drums or components of Lilliputian dimensions in spaces that forbid any conventional substitute. If it is any comfort, the Group Marketing Manager of one of our largest radio and TV makers forecast that more than half the 2·6 million radio sets expected to be sold in 1967 will be imported—most of them made in Hong Kong.

This does not deter some of our intrepid handymen, to judge by a sample of the equipment that lands on my workshop bench. Tape recorder belts fashioned from redundant garters, switch-springs made from twisted safety-pins, even a tarnished apostle spoon that did surprisingly effective duty as a clutch lever, all showed evidence of abundant enthusiastic ingenuity.

The chap I always feel sorry for is he who slouches disconsolately up to the counter and waves a burned-out transformer under the salesman's nose. Even if he knew its rating, and could be supplied with an alternative, he would probably find it had to fit between a mini-gang capacitor and a paper-thin scale-plate. Footsore, dispirited, he travels on to the next shop, and probably ends up dreaming of white-coated assistants amid their gleaming banks of "bargains" sadly shaking their heads in unison.

Under the salesman's nose

With all the give-away gimmicks that operate, we may find it necessary to buy a bedroom suite to get the magnificent free-gift radio, or sign for a year's subscription to a paperback if we want a buckshee food mixer. Henry has dreams of opening one of those monster cereal packets one day to find it full of matchbox intercoms with a single corn-flake nestling in the middle.

The joint managing director of Elliott Automation forecast that every home would have its own computer within ten years. I can't think what for—unless it is to work out what we have saved by snapping up these ex-RPM bargains. But what happens when the shoe-box computer goes wrong?

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequencies in kc/s

THE BROADCAST BANDS

by JOHN GUTTRIDGE

FIRST a plea to contributors. Most of the big stations send us their schedules regularly and there is no shortage of information about them. However, many stations keep no regular mailing lists, and information is scarce. We want more information on these harder stations.

Conditions are getting much better for DX now. With the high-power stations moving to the higher frequency bands the smaller low-powered stations in the lower band are not being blotted out nearly so much.

AFRICA

Congo: *Radiodiffusion de la Republique Democratique du Congo* (B.P. 3171, Kinshasa) has French and other programmes from 1700-2200 on 7,205/9,775/11,795.

Portuguese Guinea: *Emisora Provincial de Guine* (Avenue da Republica, Bissau) is drifting from 5,040 to 5,044 when it has QRM from Togo on 5,047. Has also occasionally been heard on 5,017.

Kenya: *Voice of Kenya* (Box 30456, Nairobi). The home service on 4,885 (10kW) gives good reception in the evening until sign off at 2003 (2100 Saturdays).

Morocco: *Radiodiffusion Television Marocaine* (1 Pierre Parent, Rabat) has English on 7,225 at 1800-1900 and has been heard in English from 1830-1900 on 11,735.

South Africa: *Radio South Africa* (P.O. Box 8606, Johannesburg) has English at 0500-0512 on 7,270/9,525; 0645-0657 11,900/15,285; 2100-2155 11,900/15,285; 2200-2255 9,720/11,785/15,215.

MIDDLE EAST

Israel: *Israel Broadcasting Authority* (Kol Yisrael, Broadcasting House, Jerusalem) is using 9,009/9,625/9,725 for its 2015-2030 and 2115-2130 English transmissions. Only announces 9,009/9,725.

Lebanon: *Radio Lebanon* (Ministry of Information, Beirut) now uses 11,940 for its African service from 1830-2030.

ASIA

Ceylon: *Radio Ceylon* (P.O. Box 574, Colombo) has English for Europe from 0700-0815 on 15,330 and to South Asia from 0915-1030 on 17,830.

China: *Radio Pekin* (Broadcasting Administration, Fu Hsin Men, Pekin) has a Russian transmission at 1900 on 11,290. The U.S.S.R. jams many of these Russian transmissions from Pekin. The jamming consists of over-modulated, distorted transmissions of the Radio Moscow Home service. Radio Pekin's home service has been heard on 4,500 around 1530.

Pakistan: *Radio Pakistan* (Karachi) now uses 7,010/9,750 for its 1945-2030 English transmission to Europe.

NORTH AMERICA

U.S.A.: *Voice of America* (U.S. Information Agency, Washington, D.C. 20547) has dropped a number of frequencies from its schedules. English to Europe is now at 0300-0500 on 3,980/6,125/7,200/9,740; 0500-0715 as 0300 plus 6,040/1,196; 1400-1600 and 1800-2100 5,965/9,760/15,205/15,290; 1600-1800 as 1400 plus 1,196; 2100-2215 5,965/9,760/15,205/15,290/1,196 (not 2130-2200); 2215-2330 (to 2345 Sundays) 5,965/9,760/15,290/1,196. The Greenville transmitter has been heard signing on at 1900 on 9,710 with strong QRM from Radio Moscow.

Radio New York, Worldwide, WNYW (485 Madison Avenue, New York, N.Y.) now starts as DX programme at 1605 on Sundays and 2303 Saturdays.

SOUTH AMERICA

Brazil: Frequency 11,925 listed as *Radio Bandeirantes* appears to be being used by *Agencia National, La Voz de Brasil.*

Radio TV Gaucha (Casila Postale 1164, Porto Alegie) has moved PRC23 to 11,915. Reception is fair to good around 2200.

Colombia: *Radio Sutatenza* (Aereo 1770, Bogota) gives a good signal on HJEC 5,075 and HJEG 5,095 after 2230.

Radio Nacional (Apartado Nacional 1824, Bogota) has been signing off as early as 0100 over HJCQ 4,955 recently.

EUROPE

Austria: *Osterreichischen Reudfunk* (P.O. Box 700A, 1040 Vienna) has replaced 17,755 by 17,820 for its 1000-1130 transmission.

Switzerland: Swiss Broadcasting Corporation (CH 3000, Bern 16) has made some interim frequency changes until its summer schedule starts on May 7th. Frequencies affected for English programmes are 7,220 replaced by 9,665 at 1845; 9,670 replaced by 17,800 at 0700; 9,665 replaced by 17,830 at 1500; 5,965 replaced by 11,790 at 0115 and by 9,655 at 0500.

U.S.S.R.: *Radio Moscow* (Moscow) has English to North America at 2200-2230 on 9,760/9,680/9,620/9,570/7,250; 2300-2330 9,760/9,680/9,660/9,620/9,570/9,530/7,250/7,200; 0000-0030 9,760/9,680/9,660/9,610/9,570/9,530/7,310/7,250/7,200.

Radio Vilnius (Kanarskio g-ve 49, Vilnius) has English Sundays and Fridays 2100-2130 665/1,106/1,554 and 2230-2300 on 665/1,106/1,554/5,920/5,940/7,180/7,250.

Vatican: *Vatican Radio* (Vatican City) has English to the Philippines Tuesdays, Thursdays and Saturdays from 1155-1210 over the new frequencies 17,820/21,515.

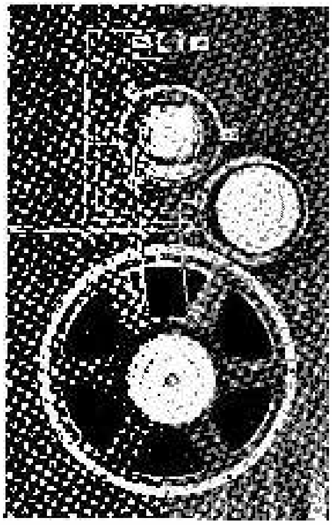
Thanks this month go to A. B. Thompson, World Communications Club of Great Britain, A. E. Roxburgh, International Short Wave Club, Swiss Broadcasting Corporation, R. A. Miller, S. Shaw, Radio Sweden, and Radio New York, Worldwide.

Peerless

HI-FI BAFFLE SPEAKER SYSTEMS FOR MONO OR STEREO

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

All the speaker systems are mounted and wired on a front board covered with plastic fabric grille and ready for cabinet mounting. Standard impedance for PABS 2-8, 3-15 and 3-25: 8 ohms (3.2 ohms or 16 ohms on request).
Standard impedance for PABS 2-10 and 4-30: 4 ohms (8 ohms or 16 ohms on request).



PABS 3-25

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

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

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

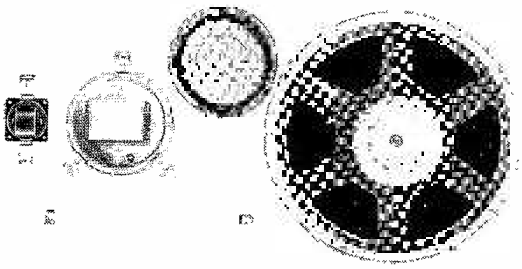
PABS 3-15 (also available as KIT, see below).
is a 3-way speaker system consisting of 3 speakers and crossover network.
Max. Power Input: 15 Watts.
Frequency Range: 45-18000 c.p.s. in 30 litres (1.06 cu. ft.) cabinet.
Speakers: Woofer P 825 W. Mid Range GT 50 MRC. Tweeter MT 20 HFC.
Crossover Frequencies: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

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

Peerless

LOUDSPEAKER SYSTEMS IN KITS FOR MONO AND STEREO

If you want to spend a little extra time to establish your high-fidelity sound system and at the same time save money, you can get four of our PABS systems in KITS. A KIT system consists of speakers, crossover network, drawing of cabinet as well as mounting instruction, but without baffle.
Standard Impedance for KIT 2-8, 3-15 and 3-25: 8 ohms (3.2 ohms or 16 ohms on request).
Standard Impedance for KIT 4-30: 4 ohms (8 ohms or 16 ohms on request).



KIT 3-25

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HI-FI CABINET SPEAKERS FOR MONO AND STEREO

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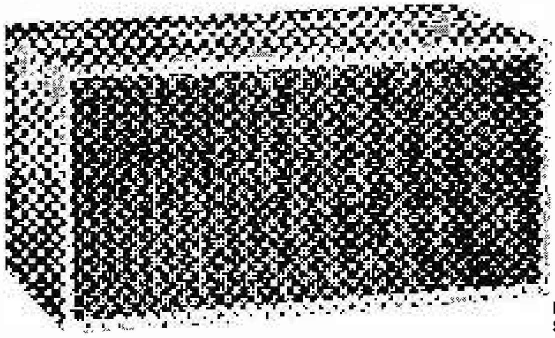

MEDIUM SIZE SYSTEM 24-2

COMPACT SYSTEM 6,5-2

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

MEDIUM SIZE SYSTEM 24-2

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

MONITOR SYSTEM 50-4

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

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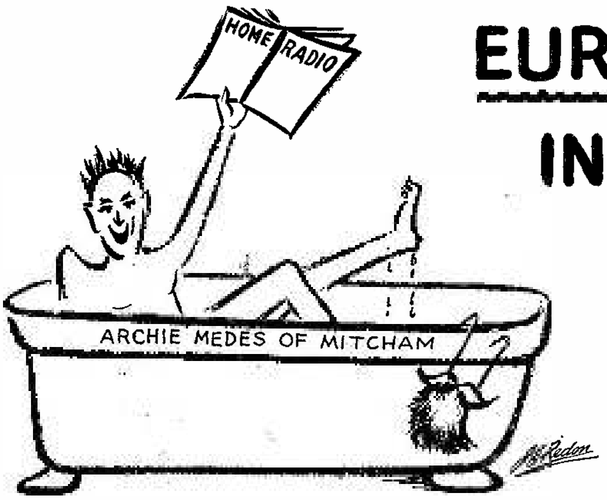

EUREKA!!! *I've found it!!!!!*

IN THE HOME RADIO CATALOGUE

Our tame cartoonist (to whom all praise is due for his excellent illustrations) has made a psychological error this time! Nobody, but nobody, would be *surprised* at finding the electronic part they require in the Home Radio Catalogue. Quite the reverse... in fact they are surprised if they *can't* find a particular item in it! However, it seemed a pity not to use such a good cartoon.
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1N5GT	8/-	6BS7	16/9	6K8GT	8/3	10F1	14/-	25A6	6/6	150C4	12/6	DL66	15/-	ECH83	7/-	EZ40	7/-	PCF802	9/9	T41	9/-	UY85	5/-
1R5	5/-	6BW6	7/6	6K25	20/-	10F3	12/-	25L6GT	4/6	801	5/-	DL92	4/9	ECL80	6/6	EZ41	8/-	PCF805	10/9	TDD4	7/-	VMP4G	17/-
1S4	5/-	6BW7	8/6	6L1	9/6	10F9	9/9	25Y5	6/-	807	7/9	DL93	3/6	ECL82	6/6	EZ80	5/-	PCF806	12/-	U10	7/-	VP4B	27/6
1S5	3/3	6C4	3/-	6L6G	7/-	10F18	9/-	25Z4	6/3	813	80/-	DL94	5/9	ECL83	9/-	EZ81	5/-	PCF808	11/6	U14	7/-	VR105/30	5/-
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5U4G	4/-	6E5	5/9	6SJ7	5/-	12AU7	4/9	30FL1	13/6	ATP4	1/9	EABC80	5/9	EF80	5/-	KT88	27/6	PEN45	6/-	U403	6/6	X79	41/-
5V4G	8/-	6F1	9/-	6SK7GT	4/9	12AX7	5/9	30L15	12/6	ATP5	7/-	EAF42	7/6	EF85	6/6	KTW61	4/3	PEN46	2/9	U801	18/6	XH1-5	5/-
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6AU6	6/-	6J7M	8/6	7C5	10/-	12SK7	2/9	42	4/6	DF33	8/-	ECC83	5/9	EL90	5/6	PC88	9/-	R2	4/-	UF41	8/-		
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PLEASE NOTE OUR NEW ADDRESS

LURID stories and 'orrible tales of goings on just below 28Mc/s have poured in this month. "They are allowed up to 100 watts and a 3 element beam" quotes one informant. "Up to 100mW with no licence and up to five watts with", reckons another. Many people sent in reports and received these stations on a wide variety of gear ranging from a simple t.r.f. to an AR88. The hand-picked "callsigns" are quite novel—"Rattlesnake", "Jack Rabbit", "Humpty Sumpty", "Colorado Batman", etc. Certainly the Citizens Band is humming and I forecast that it will hum even louder when the sunspot maximum gets nearer. Incidentally, I read that the GPO have recently said a very loud and emphatic "No" to a Citizens Band in this country. Ah well, looks like you'll just have to swot up the R.A.E. and get cracking on the slow morse transmissions on topband.

A fantastic month all round for reception. On topband GM's arriving at the home QTH in St. Albans loud and clear and on a.m. too. G3SED in Portsmouth was peaking so loud at one time I thought he was a local. His 160 metre antenna takes a bit of beating, a few hundred feet of wire in the form of an "inverted V", held up in the middle by—wait for it—a balloon! (So help me it's true.) He also has around a half square mile of earth mat to tune it against. (An' there's me with a mobile whip 8ft. 6in. tall—no justice these days.) Twenty has been going like the proverbial bomb, but let's keep that band for a while and take a peep l.f.

1·8/3·5/7·0

Not much on 1·8Mc/s reported this month but 80 has fared a little better.

N. Flatman (Suffolk), R1155, 68ft. end fed, logged these on 80 metre phone—CN8AW, K1ARD, K2DPA, K4KZZ, K5KFD, KØWFJ, OY7S, TI9AC, UA9BE, VE-1IE, 1UM, 2WM, 3ADX, 3HEW, VO1EG, VK1AF, 1FW, 4AJ, 9AU/M, VS9KRV, W-1HKK, 1FKJ, 3BFF, 4IML, 4SIB, 4YRW, WA2GSX, ZL-2GG, 3RJ, 4KE, 4LZ, 4OD, 3B1FX, 3C1-UA, UM, 5A4TK, 7XØAM.

G. Watson (Yorks), R1155, 10 Metre dipole plus a 19 set variometer, had a quick listen on 80 s.s.b. and heard—CN8AW, K3PHP, K4IUQ, LX1BW, OHØNF, UA2KBD (c.w.), 3B1FX, 3C3FJZ/P/SU, 9H1AR.

N. Hembrey (Sussex), EA12, 7ft. vertical rod at 30ft., reckons 80 is pretty lively. Unbelievers should peruse the following log, all s.s.b.—CN8AW, K-2RBT, 3UQU, 8DOC, 8YWG, MP4MAW, OY7ML, TI2NA, UA9BE, VE-1AFB, 1IE, 2WM, VP9FB, VS9ALV, VS9HRV, W1FZJ/KP4, W-1HAD, 3BMS, 3PHL, 9JLH, WA2KTI, 3C3FJZ/SU, 4X4AS, 5A1TK, 7XØAH, 9V1LP. A bit higher up on 7Mc/s, Norman logged—K7MNA, LX1BW, PI7AYJ, SV1BH, UF6FE, W3BMS, W4DQO, W8EZK, ZC4MO, ZD8RB, all s.s.b.

20 AND 15

If you don't hear much on these bands there's something wrong somewhere. Twenty is really back in the swing—but let's let the reports tell the story.

H. Dearing (Herts), Hammarlund Super Pro., 140ft. end fed. Twenty s.s.b.—JA-1AEA, 8BNK, 9KCE, KG6AAY, KL7EBK, SV1BH, VKØCR, VK2AYT, VK3UQ, VK4SD, VK5MS, VK8OE, ZD3F, ZL3OS, ZL4BA, 5A1TE, 5A5TV, 7XØAH.

C. Morris (Worcs), 10 tube home brew (good lad!) s/het, indoor joystick, all s.s.b. on 20—CR4AJ, KG6FAE (Guam), KG6IJ, KG6SB (Saipan, Mariana Is.), KX6FD, VK9XI (Christmas Is.), VK3AHI/VK9 (Norfolk Is.), VP2GSM, VP8HZ (Falkland Is.), VP8IE (South Georgia Is.), VKØCR (Marquarie Is.), VQ8AX, VS9HRV, VU2WNV, ZK1AR, ZD3G, ZS3HT, ZS8L, 5U7AL.

S. Cushworth (Yorks), 52 RX, 132ft. l.w., 20 s.s.b. —CR6IF, HK2KO, HV1CN, PY4ASV, PY7AEW, VK2ID, VK3HW, YV5CMZ, 9K2WR.

P. Cooper (Mddx), CR45 (t.r.f.), 25ft. of wire "taped" to the ceiling, all s.s.b. on 20—CX3BR, DU1FH (Philippines), KG6ALV, KR6UL, KS6DO, MP4TBO, PY2CHM, PY7AKQ, TG9EP, VQ9AR, WAØPOG/P/KL7, WA6BMG, YV1BF, YV5CMQ, ZL1AIX, 3C3FJZ/P/SU, 5Z4AA, 9H1AN.

R. Pearson (Cleckheaton), BC 1147A, 140ft. l.w., on 15 a.m. and s.s.b.—EA5HW, EA9EJ, F2CD, HP9AJM, I1RMV, K2UTC, K4BZY, MP4BBA, OH2BR, SVØWL, UA9KCB, UT5OF, VO1HS, WA9BUI, ZC4MO, 3C1AFY, 4U1SU, 9G1DM.

A. Darragh (Berks), GC1U, 80ft. l.w., all s.s.b. on 15—AP8AD, BY2KU, CN8FF, CT1BB, CX8AAW, EL2AG, EP3AB, HI8XDA, HK4TA, JA—1JXU, 2ECG, 3FTB, 6CMI, 7MA, 9JX, KA2DO, KA3KGC, KP4BCL, KR6MB, KV4CX, OX3WX, PY2II, SVØWF, TF3EA, TU2AY, VK2FA, VP2GSM, VS9AFC, ZB2AM, ZC4RM, ZE1BS, ZS6BUY, 3B1IR, 3C3FGN, 3C5FO, 5A1TV, 9G1DY, 9H1R.

10 METRES

D. Harvey (Salop), Eddystone 730/4, 100ft. l.w., 10 metres all s.s.b.—CR6DX, K5AIQ/M, PY7EZ, VP5RB, VQ9AR, W-1/2/3/5/8/9/, YV5CMQ, ZL1AH, ZS4BV, 3C3FHO.

D. Varley (Notts), CR7OA + PR30, 20 metre folded capacitive loaded dipole. Ten metres, phone—CT3AS, K4QWM, OD5BZ, PY2CK, TG9EP, UB5CZT, W-1YRC, 2PH, 3POG, 8OCT, ZE1BR, 5A5TE.

P. Baker (S. Wales), HE30, 100ft. l.w., ten metres, all phone—CN8CS, CT2AC, EA8FG, EP3AM, KØIAF, LU1DAB, MP4BBA, OD5BZ, SVØWL (Crete), UA9MBM, UF6JAF, UL7HB, UW9DZ, VQ8BJ, W-1/2/3/4/5/8/9/Ø, XE2DDZ, ZC4GY, ZE2JA, ZS1BW, 3B1EB, 5A1TK, 5N2AAF, 9G1DM, 9H1AM, 9J2RO.

CONTESTS

Only one and that's on 15th-16th April on 70Mc/s. There's the transmitting part of the contest on the Saturday starting at 1800 and finishing Sunday at 1800. There's also a s.w.l. contest on 70Mc/s from 1800 on 15th April to 1800 on 16th April. Deadline for reports and logs this month is 20th April. What have you heard?

new books

Books reviewed on this page are normally obtainable through any retail bookshop. In this instance, the information printed in **heavy** type should be quoted.

RAPID SERVICING OF TRANSISTOR EQUIPMENT
By Gordon J. King. Published by George Newnes Ltd.
151 pages, 8½ × 5½in. Hard covers. Price 30s.

A REMARKABLY good book. The author is to be congratulated for his fresh and stimulating treatment of what has almost become a hackneyed subject.

He makes no compromise. *"I have endeavoured"*, he says "to discuss transistors, transistor circuits and their faults as though thermionic valves had never existed". This is the right approach, for more confusion has been caused by attempted parallels and analogies than ever by the faults themselves.

No time is wasted on fundamentals. In one concise chapter this essentially practical writer sets out the basic theory that we need to know before tackling transistor circuits. By Chapter 2, the reader is ready for preliminary circuit and transistor tests.

Throughout this book, the practical approach is paramount. We find such 'throwaway' remarks as: *"A good way of checking for capacitor leakage is to meter the Ic of the coupled stage . . .* and, when connecting a meter, " *. . . remember that the terminal resistance of any voltmeter is equal to the ohms/volt value multiplied by the fullscale voltage range selected,"* Small points, taken for granted by the practising technician, but for the beginner, or the service engineer whose training on valved equipment has produced the kind of mental blockage that needs careful handling, such tips are invaluable.

In Chapter 4, useful information on equalisation is included, plus some warnings about the interpretation of test results that again underline the essentially down-to-earth methods of this author.

Chapters 5 and 6 discuss fault-finding in r.f. circuits, and oscillator stages. Here again, we find the subject treated in a way that is both easily understood and technically efficient. The author has quite obviously sweated at the bench, repairing receivers with no more than his own basic knowledge to aid him.

In the seventh chapter we encounter transistor radios and hi-fi amplifiers as a whole. The treatment is less detailed than we would have liked; due, doubtless, to space restrictions. Full typical circuits are given, with component vales.

Chapter 8, 'Practice of transistor equipment servicing' is actually a run-down on the various appropriate instruments, their use and application, and a few remarks on soldering and printed circuits.

With each chapter, a table of faults, their causes, and the tests to prove them, is appended, providing not only a useful reference but a summary of the foregoing information.

It is not often that we find a book of value both to the beginner and the practising technician, but this is one.—*BRG.*

ACOUSTICAL TESTS AND MEASUREMENTS
By Don Davis. Published by Foulsham-Sams Technical Books.
192 pages, 8½ × 5½in. Hard covers. Price 30s.

INTEREST in audio, by both amateur and professional enthusiasts, too often ends at the hole where the sound comes out. Great trouble may be taken in loudspeaker enclosure design, in speaker placing, matching and general disposition, but the space into which the sound is projected is either taken for granted or simply accepted 'warts and all'.

Mr. Davis purports to write for the advanced technician, but his style of presentation and the plain good sense of the information he gives allows an appeal to any audio enthusiast.

His book abounds in the graphs and tables beloved by the academics. He details the work done on various halls, churches and stadiums. He tells us how to measure ambient noise, reverberation time, quietness (which is just as important as loudness) and sound distribution.

Why it is necessary to measure at all; why not trust our ears? The author tells us, with convincing detail. He goes on to describe some of the instruments needed to make these audio assessments, shows the various charts that are used "in the trade" and even gives a specimen survey report for the benefit of readers who may think of branching out into this highly specialised line.

For anybody who has listened to a hi-fi set-up in demonstration-room conditions, then heard the same equipment in the limited confines of a living-room, this book is a confirmation.—*HWH.*

LOUDSPEAKERS AND LOUDSPEAKER CABINETS
By P. W. Van Der Wal. Published by Iliffe Books Ltd.
107 pages. 8¾ × 5½in. Price 15s

THIS is the latest in the series of Philips paperbacks (P12) and is an English version of original Dutch material. A quick flip through gives the impression of a book packed with useful information and this is largely justified on closer inspection. Starting with the inevitable "How it Works" chapter, the author goes on to give notes on choosing a loudspeaker, important points in a sound installation, discussion on distortion and layouts of mono and stereo set-ups.

An important chapter deals with the frequently neglected factor of room acoustics and almost the whole second half of the book is devoted to enclosures, including a welcome chapter on how to build loudspeaker enclosures (practical carpentry hints) and 26 pages of plans for cabinets.

One possible criticism is that the 24 enclosures described all relate to Philips loudspeaker types. Perhaps this is natural in the circumstances but seeing that this is in effect a promotional project we think the price might have been lower!—*CRR.*

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INTERCOMS

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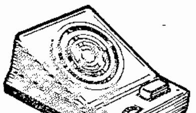
P. & P. 2/6



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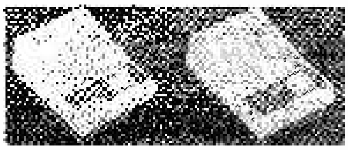

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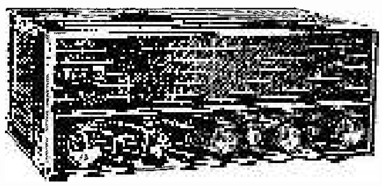

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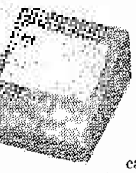

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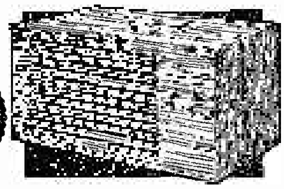

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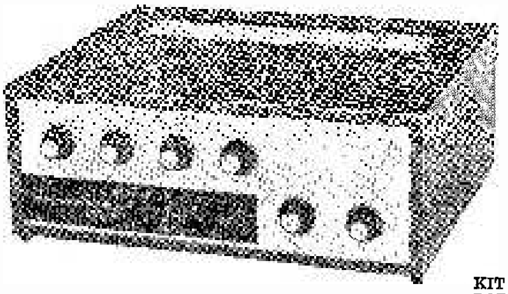

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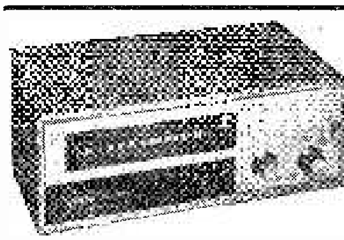

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repairing radio sets

PART 2

H. W. HELLYER

In the first article of this series, Gordon J. King has compressed a wealth of technical information. My brief is to discuss the important mechanical aspects of servicing. Before we can do this, it is necessary to review the tools, instruments and other bench aids that are necessary, and others that are desirable though not indispensable. The emphasis is on tidy and methodical service procedure; hence the treatment of the subject which regards even the kitchen table workshop as a 'service department'.

Beginning at the beginning, we take a look at the basic tools of our trade or hobby.

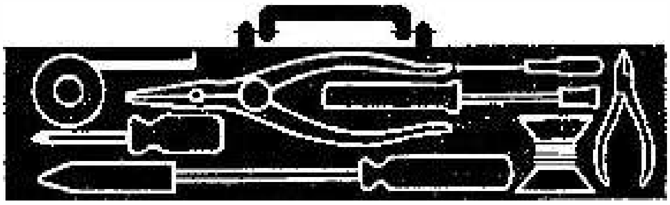
TOOLS

TOOLS are personal items. A toolkit is built up from humble beginnings, with experience proving the worth of some tools, modifying the use of others. One or two favourites will be to hand at all times; others are rarely needed. The following list is a suggestion of basic tools most often needed at the bench.

★ SCREWDRIVERS

At least three are needed of different lengths and blade size. A standard $\frac{1}{4}$in. blade type, with 8 to 10in. blade and straight taper; shorter type with broader blade, for tight wood-screws, etc.; a grub-screw driver.

Phillips type screwdriver and Posidrive tools are



commonly needed. There are two principal sizes, but tight chassis screws often need one of the larger types, with a cross-bar, such as used in cycle shops. The screwdrivers should preferably have insulated plastic handles. A number of makers market these especially for electrical work.

★ PLIERS

A large pair are essential with square, parallel jaws, a serrated circular section and strong edge cutting blade to deal with iron wire, bolt ends, chassis burrs. A pair of long-nosed "electrician's" pliers, with insulated handle and a smaller, flat-ended pair for delicate work are also recommended.

★ CUTTERS

Side and top-cutters of various styles and sizes are available. Choose a pair to suit one's hand and ensure that the blades have no gaps. Both types have their special uses. For transistor radio work, new types with small blades at the end of longer jaws are being produced and will be found handy in confined spaces.

★ SPANNERS

Flat and box spanners covering the BA sizes

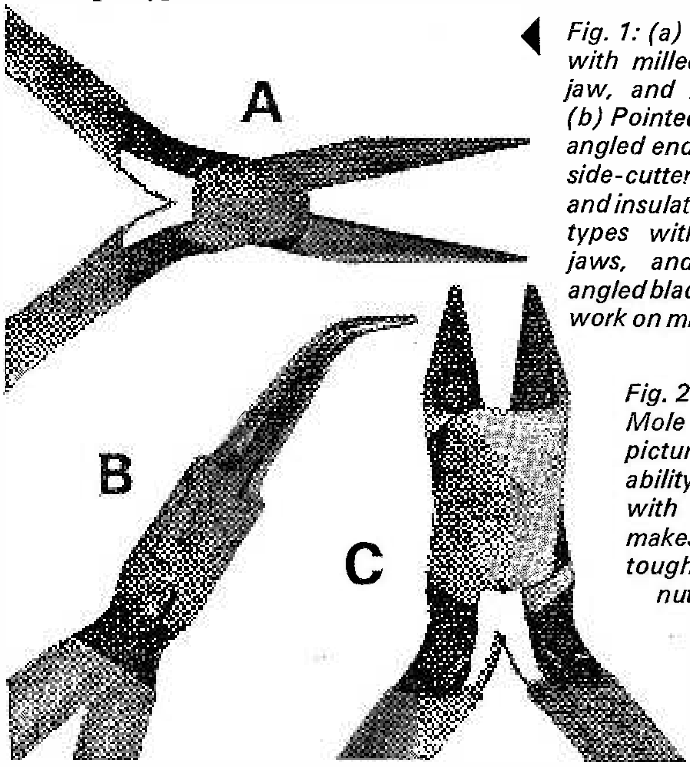


Fig. 1: (a) Long-nosed pliers, with milled inner surface to jaw, and insulated handles. (b) Pointed-nosed pliers with angled end. (c) Conventional side-cutters, with snub jaws and insulated handles. Special types with longer, slimmer jaws, and with differently angled blades, are available for work on miniature equipment.

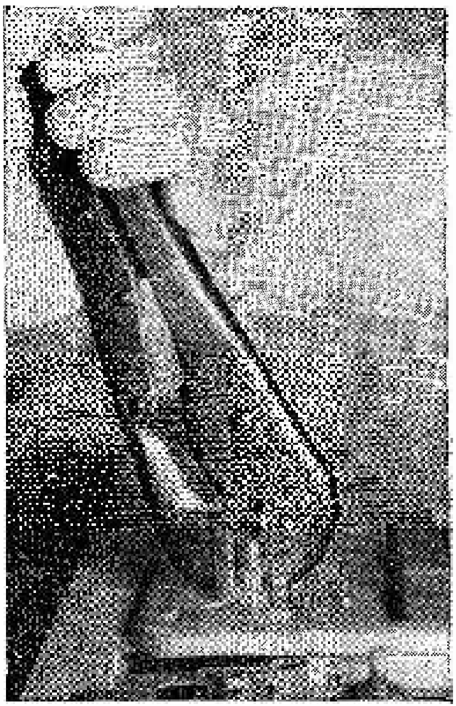


Fig. 2: The advantage of the Mole wrench or (in our picture) Guygrip tool is its ability to lock into place with a parallel grip. This makes it useful for releasing tough nuts without scarring nut, bolt or chassis.

from 0 to 8 are needed most often. Box spanners with 6in. shanks and insulated handles for the "popular" sizes, 2 and 4BA will be found useful. Sets of spanners are available at reasonable prices, with angled tommy bar and separate ends. Nests of flat spanners (which should include the metric sizes for dealing with the growing number of imported sets) are also a great help. A small adjustable spanner of the "King Dick" variety and a larger Mole wrench or Guygrip tool will assist with odd sizes of nut and bolt.

★ WIRESTRIPPERS

These are great time-savers. The popular Bib model by Multicore Solders Ltd. is now available in a version with wire-gauge selector and insulated handles.

★ HACKSAWS

Even if no chassis work is undertaken, the "Junior" hacksaw will prove worth its modest cost, and a standard electrician's hacksaw, with tubular steel frame, extendable to 12in. blade length, is a very useful acquisition. Spare blades should be kept in the toolkit, protected by soft wrapping.

★ FILES

Principal requirements are 6 to 8in. flat, half-round and round files with bastard teeth. Second-cut and fine-toothed versions will be found handy, and a small triangular file is useful for some special work. A set of ward files, or "jeweller's" kit, will be an aid when dealing with transistorised equipment. At least one handle for each set of blades is desirable.

★ BENCH-VICE

Small vices (or vises) that clamp on the edge of a table are available quite cheaply, but a good bench vice is needed for any quantity of service work, proving itself as clamp, support, pressure tool, and even anvil when required. Jaw protectors in aluminium, tin-plate and wood-block are an extra that can save time and trouble for special jobs.

★ SUNDRIES

For radio service work, certain additional tools have proved their worth, including tweezers, a magnifying watchglass, jeweller's screwdrivers and British and Metric Allen Key kits. Special tools for transistor work have been developed, and are worthy of note. A small camel-hair brush and a larger type such as a pastry brush or one-inch paint-brush will be found useful both on wired chassis and printed-circuit work.

Clamps fashioned from crocodile clips, extension prods, wire grips and other "home-made" items should be kept in the toolbox ready for use. A torch, or other form of small portable bench light is often needed, especially when working with printed circuit boards. An electric drill and hand-brace, with a selection of bits, completes the basic "hardware" tools.

Many of the foregoing items are to be found in kits of tools, especially combined for radio service work. These are held in neat cases and enable the user to keep his tools tidy and in constant review, to keep them from rubbing and chipping together, which quickly blunts cutting edges, and to carry them with him when working away from his base. Their extra cost is offset by their convenience.

★ SOLDER TOOLS

The most important item of a radio service tool-kit is the soldering iron or gun. Three main sizes will be needed: a large, 100-watt type, for tin-plate and chassis work; a medium, general-purpose type, about 25 watts, of good quality, which can be left on for long periods without deterioration of the bit or overheating of the handle; and a miniature type suitable for transistor work, some

Fig. 3: A small soldering iron is a vital tool. It should be kept clean and used only for its purpose—not to lever wires from tags, etc. Larger types are necessary for work on chassis connections, screen plates, lugs, etc.

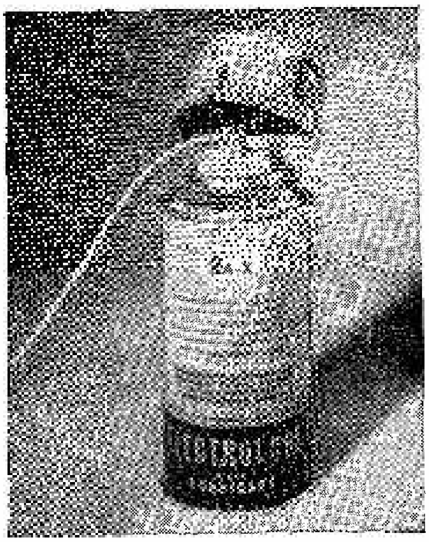
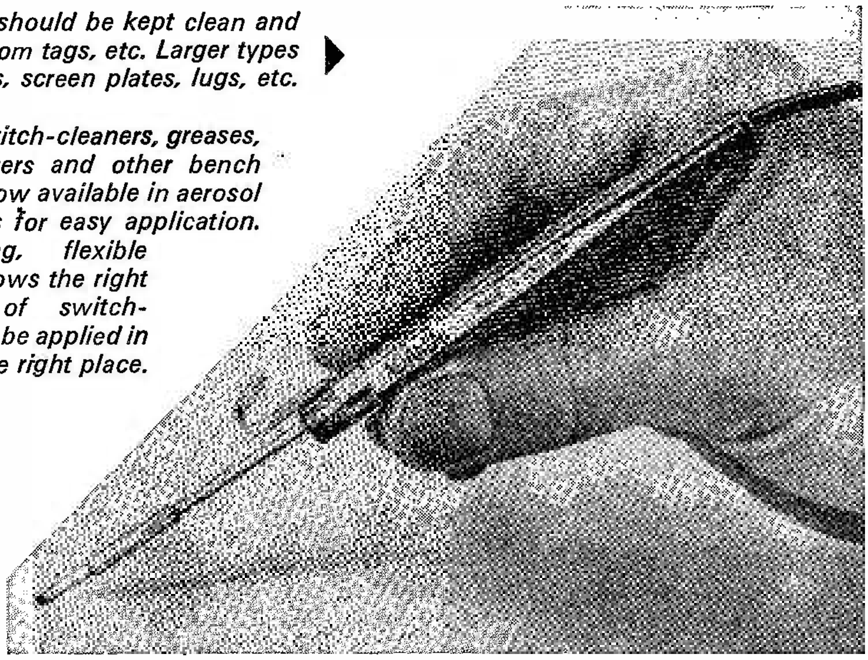


Fig. 4: Switch-cleaners, greases, oils, freezers and other bench aids are now available in aerosol containers for easy application. The long, flexible nozzle allows the right amount of switch-cleaner to be applied in exactly the right place.



of which are provided with shank guards to prevent the heat of the iron attacking closely-spaced components.

A solder gun is favoured by many engineers and hobbyists. The heat is applied only when the gun is activated by pressing a trigger or button. It is possible to apply more heat quickly in a small area of work but against this must be set the slightly heavier bulk of the tool compared with conventional electric soldering iron, shorter bit life (even though bits are more easily replaced, being mere loops of wire), and the waiting period of a couple of seconds while the bit heats up each time the tool is used. Some solder guns, and one or two conventional irons, have lamps mounted to throw a beam of light on the work at the tip. A few have solder dispensers.

Later versions, developed especially for dealing with printed circuits and multi-tag mountings, use aspirator techniques for drawing off the surplus solder as heat is applied. These can be a great asset for bench work that is likely to include a large number of transistor radios or other printed-circuit jobs. Some of the details of these tools will be dealt with more fully when we come to consider their applications.

TEST GEAR

The depth of one's purse determines the amount and quality of test equipment that the workshop will contain. By following the constructional articles in *Practical Wireless, Practical Television* and *Practical Electronics,* a useful nucleus of test gear can be built at reasonable cost. (See Table 1.)

★ TEST METER

Basic requirement is a good test meter. This should preferably be a multimeter capable of measuring d.c. volts up to 1,000, current up to 100 microamps (with suitable ranges up to one or two amperes) plus resistance ranges capable of measuring both low ohms, (below 10) with accuracy, and from 1 to 20 Megohms also with a clear indication.

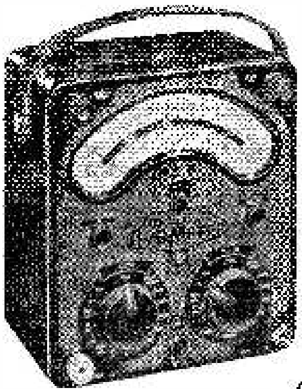
The sensitivity of the meter for radio work should not be less than 20,000 ohms/volt on d.c. A.C. measurements are less frequently required, and a 1,000 ohms/volt sensitivity may be adequate, as long as the ranges will cover 0—10 (for heater readings) and up to 500 volts for various mains and transformed input measurements.

Extending the ranges of such a meter is often a matter of adding probes with suitable resistance, and using series batteries to widen the ohms range coverage. The details of exact alterations should be available from the meter manufacturer where a commercial model is employed. Calculations that enable one to adapt instruments are fairly straightforward and will be found in several of the constructional articles that have appeared in these pages from time to time.

An important factor in choice of meter is the diversion of ranges. For example, transistor radio equipment will demand readings of 0 to 25 volts, with accurate determination of voltages as low as one-tenth of a volt. The most accurate readings are obtained in the middle third sector of a linear scale, and the instrument should be chosen with this point in mind. The marking of the scale is important, and provision of a knife-bladed pointer with rear mirror scale to avoid parallax error is extremely helpful for accurate work.

Some form of protective device is another aid that can save expensive repairs. Accidents happen in the best regulated circles! The form of cut-out used by Avo is well known and practically foolproof, but all the leading meter manufacturers incorporate some form of meter protection and it is as well to become familiar with the instrument before committing oneself to any outlay. More will be said on this subject as the series of articles progresses.

Sensitivity of the meter was mentioned as a prime



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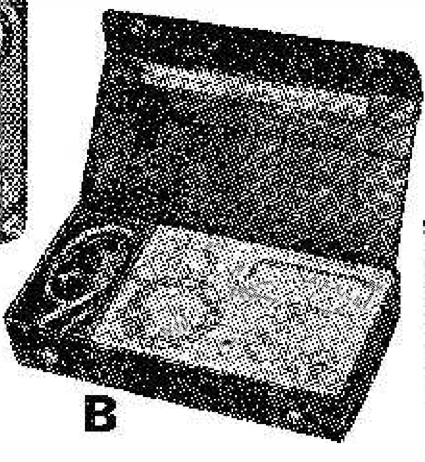

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Fig. 5: (a) A sensitive, robust meter like the Avo 9 is an asset for bench work and portable enough for field work. (b) A versatile small meter such as the Multiminor is indispensable for outside work.

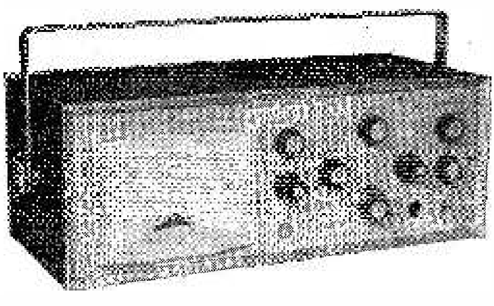


Fig. 6: Transistor testers are coming into more frequent use. The model illustrated makes "in-circuit" tests by balancing out the shunting effect of components in the transistor circuit. Measures collector voltage and current, current gain (Beta) and leakage current.

point. In this respect, the electronic testmeter scores. With a basic valve-voltmeter as its heart and an extremely high ohm/volt figure, it is a very efficient workshop instrument. For static work, its dependence on a power supply is no drawback. Many tests can be carried out with the valve-voltmeter that would be entirely misleading with less sensitive instruments.

Transistorised versions of electronic testmeters are now available, using battery supplies for field use. Some experience is needed in using this type of equipment, to avoid incorrect interpretation of results.

★ OUTPUT METER

Although the conventional multimeter can be used as an output meter, for more accurate results a correctly designed instrument is needed. Where a fair amount of audio work is undertaken, a good output meter comes high on the list of essentials. Output meters measure power and can be scaled directly in watts or decibels. Some interesting designs have been described in previous issues of *Practical Wireless,* and are worth further study.

★ SIGNAL INJECTORS

Signal injection can be carried out in one of several ways. For rough and ready tracing of the circuit—merely determining the signal path — a form of injector can be employed with no regulation of output, either as regards frequency or level.

A simple square-wave generator is a typical example, with frequencies in the audio range and sufficient output also in the intermediate and radio frequency bands to produce a noise at the output of the receiver. Several of these injectors are marketed, and constructional details of others have appeared from time to time. They are effective for rapid testing, enabling location of the fault to a particular section of the set. They do not permit quality testing, nor can they give more than a rough indication of stage gain. Nevertheless, such instruments have their place, especially in field service, where their portability is a virtue.

★SIGNAL GENERATORS

The signal generator, whether audio or r.f., modulated correctly, with a reasonably pure waveform and a regulated and calibrated output, is the instrument that the test bench is generally built around. The quality of the signal generator, which will be reflected in its cost, is based on the frequency accuracy, the stability, the pureness of the output waveform and the calibration of the output level.

The more ambitious types include crystal check frequencies as references and output monitoring, by a valve-voltmeter inbuilt and matched to the instrument, or by oscilloscope trace. Modulation should also be variable, although many standard service instruments employ a fixed modulation frequency and depth.

For frequency modulation alignment a sweep generator is needed, its output changing regularity in frequency over a determined band, again with controlled reference points which may be provided externally or be a built-in property.

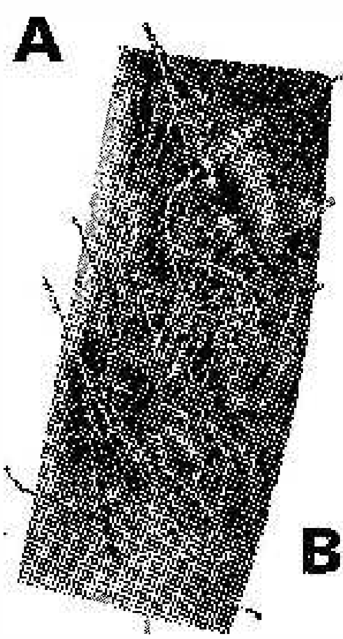
The modulation frequency for a sweep generator is usually derived from an internal oscillator, but arrangements can be made to obtain this source from the timebase of an oscilloscope. It is in the combination of these two instruments that the most useful alignment set-up is obtained.

★ OSCILLOSCOPES

Oscilloscopes, giving a visual trace of the waveform being measured, have wide variations of specification. Basically, the oscilloscope is a voltage measuring device with an extremely high impedance loading to the circuit under test, presenting the least disturbance to it.

The cathode ray tube is one determining factor when choice is made; its size, persistence of the phosphor and sensitivity which limits spot size must be taken into consideration. Two other factors are

A



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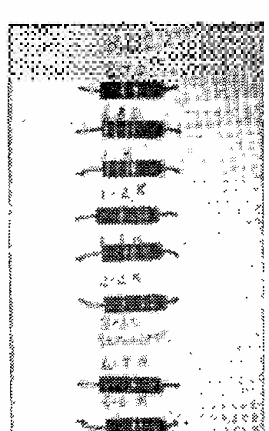


Fig. 7: (a) the wrong way, and (b) a better way to store components. A few minutes with marking pencil and a piece of card can save hours of searching time later. Note that replacements can be immediately listed by the obvious spaces on the card.

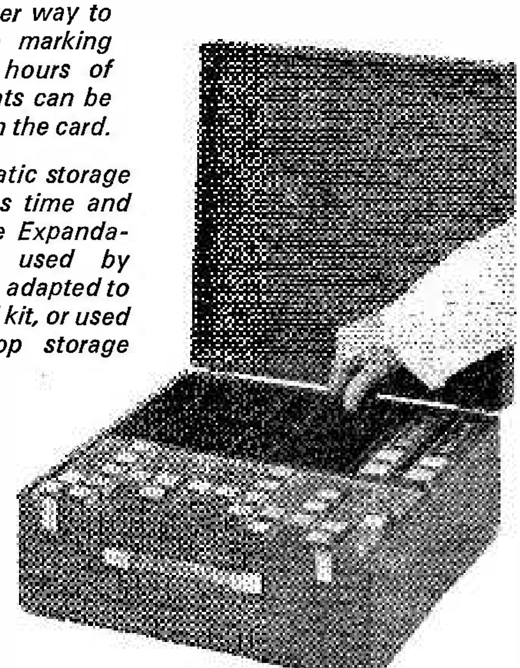


Fig. 8: Systematic storage of valves saves time and breakages. The Expandapack system used by Mullard can be adapted to make up a field kit, or used as a workshop storage system.

the rise time and bandwidth of the Y-amplifier (or amplifiers, in the case of a double-beam instrument).

These two are linked, and limit the frequency response of the instrument. A greater bandwidth is needed for a faster rise-time, which would be needed for accurate display of a true square-wave signal. In practice some compromise is necessary and the frequency response of the Y-amplifier, falls off gradually at high frequencies giving a faster rise-time, while maintaining good overall response to prevent overshoot, which results in distortion of the trace.

The oscilloscope has an X-amplifier to permit expansion of the trace, to facilitate display of one or two cycles of the waveform in the viewing area of the tube. The repetition frequency of the time-base of the instrument must be equal to the frequency of the signal applied to the Y input to reduce the trace to one complete sine wave, which gives us another limiting factor.

Synchronisation of the timebase with the input frequency requires feedback of a small amount of test signal to the timebase under controlled conditions, which necessitates a "Sync" terminal, and if the amplitude of this test signal is made variable, a "Sync Control" will be fitted.

Further refinements are the synchronisation on either positive or negative waveforms, addition of repetitive triggering, with sensitivity control for this function and an inbuilt integrator for TV repair work. Some types have other facilities, such as a calibration output or a square-wave oscillator integral with the instrument. Choice of an oscilloscope depends both on the available funds and the work it is intended to do.

For comparison of signals and several special tests a twin beam oscilloscope is an advantage. This instrument has two Y-amplifiers, which may or may not be identical, and costs considerably more. Conversion of a single beam 'scope to a twin or split-beam type is possible by the addition of an external beam splitting unit. Details of these instruments, and their applications, will be found in the references listed in Table 1.

Applications of the instruments mentioned in the

TABLE 1.—TEST GEAR

A selective index of constructional articles on Test Gear, which have appeared in *Practical Wireless, Practical Television* and *Practical Electronics* during the past three years. (Where more than one successive article is involved, the symbol * follows the initial month.)

TEST METERS

"PW" Sixteen	Jan.	64	PW
Multitest with LCR Bridge	Aug.*	66	PW
Multirange Test Meter	Dec.	65	PE
Push-button Multimeter	Jan.	66	PW
Multimeter with electronic ohmeter	Sept.	64	PW
Simple multimeter	July	64	PW
A.C./D.C. volt-ohmeter	May	65	PW
D.C. volt-amp-ohmeter	June	65	PW
Comprehensive multimeter	June	65	PW
Direct reading frequency meter	April	66	PW
Add-on unit to increase sensitivity	Mar.	64	PT
Extending multimeter ranges	June*	64	PW
A.C. Millivoltmeter	Aug.	66	PE
Low-resistance ohmeter	July	66	PT
Basic Moullin RF resonance voltmeter	Aug.	65	PW
Transistorised EHT voltmeter	Aug.	65	PT

OSCILLATORS AND SIGNAL GENERATORS

AF/RF Signal Generator	May*	65	PW
Wide-range LF oscillator	Jan.	64	PW
Audio oscillator	April	65	PE
Audio oscillator with output meter	May	65	PE
Audio oscillator with valve-voltmeter	Nov.*	65	PE
Keyed audio oscillator	Mar.*	65	PW
Wien Bridge Transistorised audio osc.	Aug.	64	PW
Neon relaxation oscillator	Feb.	64	PW
Stable pulse generator	July	64	PT
UHF transistorised test oscillator	Nov.	65	PT
Grid Dip Oscillator	Feb.	66	PW
Colour Bar Generator	Feb.	65	PT

SIGNAL INJECTORS AND TRACERS

Handy signal injector	Aug.	64	PW
Miniprobe signal injector	Jan.	66	PE
Widerange harmonic oscillator	April	66	PE
Simple noise generator	Sept.	64	PW
Pocket signal tracer	Mar.	64	PW
Inexpensive signal tracer	Mar.	64	PW
AF/RF signal tracer	Feb.	66	PE

OSCILLOSCOPES, ETC.

Miniature oscilloscope	Nov.*	65	PW
Inexpensive oscilloscope	Mar.*	65	PE
Videoscope	Oct.*	64	PT
Videoscope modifications	June	65	PT
Oscilloscope from TV chassis	Feb.	66	PT
Oscilloscope amplifier	Mar.	65	PT
'Scope improvements	Sept.	65	PT
Probes (Test Gear Accessories)	Mar.*	64	PW
Beam switching unit	Aug.	66	PE
Electronic Gate trace doubler	April*	66	PE
Ellipse Generator	Aug.	66	PW

BRIDGES, ETC.

Mutual and Self Inductance bridge	Aug.	65	PT
Inductance-Capacitance tester	Oct.	64	PW
"Ravenor" C-R bridge	Jan.	65	PT
R-C bridge	June	65	PE
Transistorised LCR bridge	Dec.*	65	PW
L-C Pico Meter	April	66	PT

TRANSISTOR TESTERS

Simple transistor tester	Oct.	64	PW
Transistor and diode tester	Aug.	65	PE
Transistor tester	May	66	PE

TABLE 2—BENCH AIDS

A selective index of constructional and descriptive articles on Bench Aids which have appeared in *Practical Wireless, Practical Television* and *Practical Electronics* during the past three years. (Where more than one successive article is involved, the symbol * follows the initial month.)

POWER SUPPLY UNITS

Stabilised power supply	July	66	PE
Compact power unit	Feb.	66	PE
Variable low-voltage d.c. supply	Dec.	64	PE
Basic stabilised power pack	Mar.	64	PW
Variable power supply—transistors	Jan.	64	PW
Transistor radio mains unit	June	64	PW
Regulated power for transistor receivers	July	65	PW
Stabilised 9 volts	June	65	PW
Stabilised 9 volts	June	66	PE
Low voltage battery pack	Aug.	65	PE
Thyristor power control unit	June	66	PE
D.C./A.C. Inverter	Feb.	65	PE
Low-powered d.c. inverter	Dec.	65	PW
A.C. mains voltage stabiliser	June*	65	PE
Mains voltage adjuster	Feb.	64	PW
Mains distribution panel	May	64	PW

SUNDRY BENCH AIDS

Attenuator unit	June	64	PW
Dummy aerials (test gear accessories)	Feb.	64	PW
Impedance matching unit	April	65	PE
Electrolytic tester	June	65	PT
CRT tester and rejuvenator	June	64	PT
Low voltage neon indicator	June	66	PW
Photocell circuits	Aug.	65	PW
Simple timing device	Jan.	65	PW
Photographic timer	Feb.	64	PW
Dual calibration standard	Nov.	64	PW
Light operated switches	Dec.	64	PW
Unit construction boards	May	64	PW
Making P-C boards	Feb.	64	PT
Making P-C boards	Mar.	66	PE
Heat sinks	Sept.	64	PW
Trimming tools	Mar.	64	PW
Practical service aids (tools, etc.)	Aug.	64	PT

previous notes, plus other less frequently used, aids to service, will be described at appropriate points in this series of articles.

WORKSHOP TECHNIQUES

Workshop techniques depend largely upon the equipment available and the scope of work to be carried out. Many of the aids to service are items which will not be on the general market—indeed, most engineers fashion tools and other aids for special purposes.

★ IRONMONGERY

Examples of these miscellaneous pieces of "ironmongery" are the heat shunts, soldering iron extensions for multiple tags, chassis clamps, solder brushes, trimming tools, angled tools and those with odd-shaped jaws. A collection can be built as needs arise.

Heat shunts can be made from crocodile clips with pads inserted or even "beds" of solder run between the jaws to form a smooth heat-conducting surface.

Iron extensions may be made from a twist of heavy-gauge copper wire formed to contact the tags to which heat must be applied, then wrapped at the free end around the iron bit.

Trimming tools are easily fashioned from plastic knitting needles and probes, printed-circuit hole cleaners, other aids to solder point manipulation and general purpose non-metallic blades fairly impervious to heat are easily whittled from small orange-sticks which can be purchased for a few coppers from any chemist.

★ SPECIAL TOOLS

Some special tools of frequent help are split-ended screwdrivers to release castellated nuts in confined spaces, angled flat and box spanners (the last being angled at the tommy bar or clamp) and bent-end pliers.

Aerosol switch-cleaners that are not dangerous when used near plastics, etc., can now be obtained. In addition, an aerosol grease applier is marketed, which carries the light grease on a film of vapour and greatly aids application in previously inaccessible spots. Special fluids for cleaning of tape heads and guides and for tape lubrication are also obtainable and will speed service, where time is at a premium.

Jumper leads are devices that normally tend to clutter a service department. It is a great help to make up short leads with terminations to suit the jobs that are anticipated. To hang these neatly and in some order is the work of a few moments, but can save much time later. Similarly, attenuator pads, damping networks and matching devices can be ready-made and placed near to hand, correctly labelled for speedy selection.

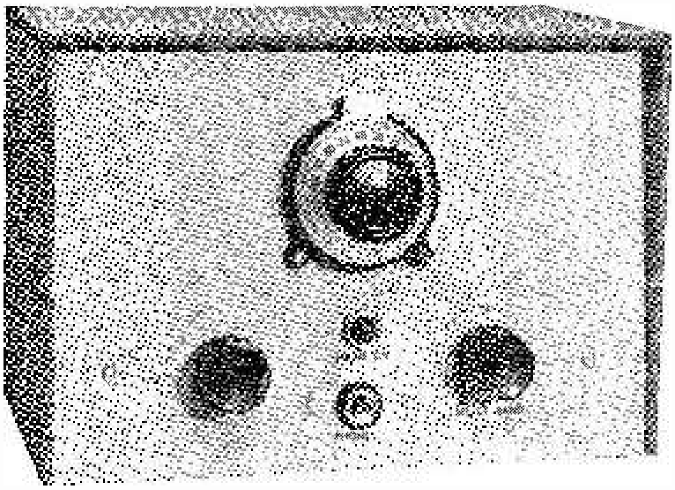
★ POWER SUPPLIES

Power supply sources of many different kinds will be needed if any volume of work is undertaken. A fully comprehensive supply, adequately regulated, is a great asset, but tends to be both expensive and time consuming to construct.

It is a help to keep available small sources for the "popular" needs, such as transistor radios, pre-amplifiers, mixers and so on. These can be made up quite cheaply, and terminated in flyleads which allow testing to take place with the least inconvenience. A list of these bench aids is given in Table 2, which includes some of the other handy devices mentioned above.

The main supply to the bench should be isolated, for complete safety. An isolating transformer, ratio 1:1, or for a refinement, with selective voltage tappings to suit popular supply voltages, is not a cheap

—*continued on page 46*



beginner's 3-ban

A.S.CARPE

THIS simple radio receiver can be built in 10—12 hours at a cost of approximately £4 10s., or less if the proverbial "junk box" is available, the valves may be purchased for about 2s. 6d. each.

The receiver is a.c. mains powered and is completely safe to use at all times if built as described. All the coils are hand wound and easily copied. A few minor circuit changes mentioned later will enable the receiver to function in an alternative and even simpler mode. The receiver is of necessity a t.r.f. (tuned-radio-frequency) type and relies mainly on the use of variable positive feedback (regeneration) for sensitivity. This can, if not carefully adjusted, introduce instability, but the type of circuit chosen has the advantage of not affecting receiver tuning to any great extent.

CIRCUITRY

The complete circuit diagram is given in Fig. 1. Signals from the aerial are inductively fed via coil LA to the valve grid choke RFC1 and pass via buffer valve V1 to the anode circuit. R.F. signals pass via C6 to the tuned grid circuit of V2, the required signal being selected by means of VC1. Radio frequency chokes RFC1 and RFC2 function as loads for the signals. The cathode and grid 1 of V2 permit demodulation and audio frequency appears at the anode to be passed back via C9 and RFC1 to V1. Valve V1 now fuctions as a normal audio frequency amplifier and the signals selected may be heard when high impedance (4,000Ω) headphones are plugged in to socket J1. During this operation RFC1 and RFC2 function as filtering devices removing any unwanted r.f. from the

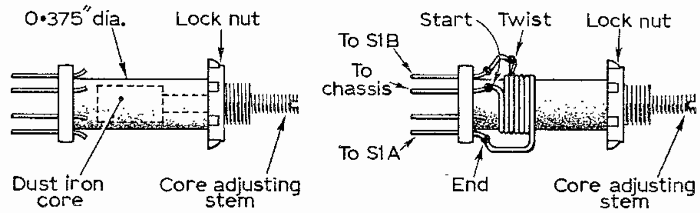


Fig. 2: Type of coil former used and method of winding.

audio signals. The phones are required to carry the direct current of V1 and are at h.t. potential; if this is objected to the "hot" (h.t.) end of RFC2 may be connected to the h.t. line via a 10kΩ resistor and socket J1 connected between chassis and the "hot" end of RFC2 via a 0·01μF d.c. blocking capacitor, leaving C4 *in situ.* The two chokes are seen to perform a double duty and must not be omitted.

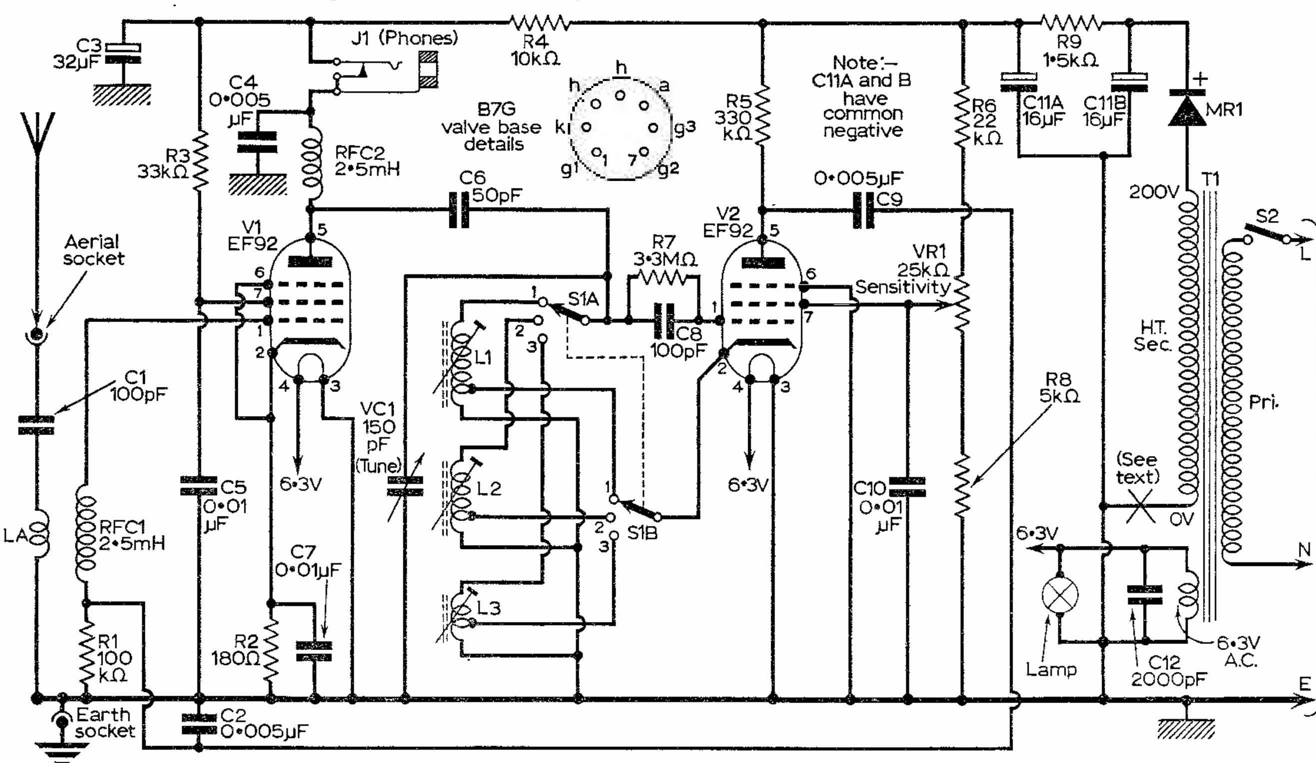


Fig. 1: Complete circuit of the reflex receiver.

d mains receiver

NTER

The relatively low sensitivity of the receiver is improved by including controllable regeneration around V2, the arrangement being that of an e.c.o. (electron-coupled-oscillator) with the valve cathode and grids 1 and 2 forming a triode. If VR1 is over-advanced V1 will oscillate and signal reception will be impossible; by keeping the stage at the edge of oscillation by adjustment of VR1, a high degree of sensitivity can be obtained and selectivity improved. When receiver tuning is changed VR1 must also be re-adjusted slightly. Since the grid circuit of V1 is untuned little r.f. gain results, the valve's purpose here is to act as a r.f. buffer and if V2 does break into oscillation such oscillations cannot reach the aerial and be radiated. The buffer stage also prevents the aerial from damping the tuned circuit. Powering of the receiver is simply and safely effected by utilising a small half-wave type mains transformer in conjunction with a contact-cooled rectifier and associated smoothing items.

COILS

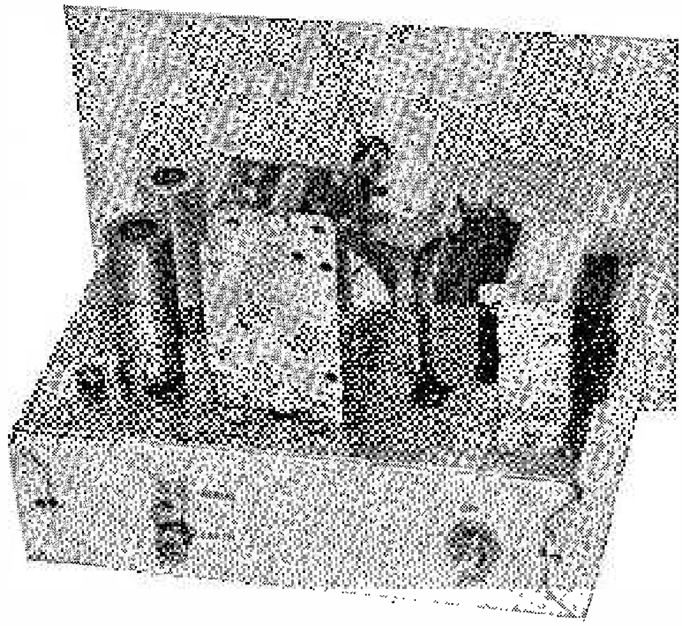
Coils are wound on 0·375in. dust-cored formers available from Denco Ltd., and three switched ranges are accommodated in the prototype receiver. The particular coil formers selected are designed to plug in to a noval valveholder and for a simpler band-changing system switch S1 may be omitted, a standard noval valveholder being mounted in-

Wire gauge swg enamelled	No. of turns (Total)	Tapping turns	Range in Mc/s
40	60	9	1·8– 4·8
30	22	4	5·0–15·0
30	14	3	7·0–19·0
30	8	1·5	11·5–25·0

Table showing winding details of coils covering from 1·8Mc/s to 25Mc/s. Details are given in the text for a MW coil.

stead close to V2. Only three of the extra valveholder tags will be needed and the coil to be used will stand on the chassis upper surface conveniently placed for band-changing. Coil tuning is effected via VC1 coupled to a vernier reduction drive mechanism and direct driving, or the use of a larger value tuning capacitor, is not recommended. Various coil windings with details of ranges covered may be seen in the table and constructors may select as required remembering that the dust iron core fitted will permit of slight frequency variations.

Coil windings are secured by a layer of Sellotape or suitable adhesive. Each coil requires a tapping point connection and it is simplest to commence winding at the "earthy" end.



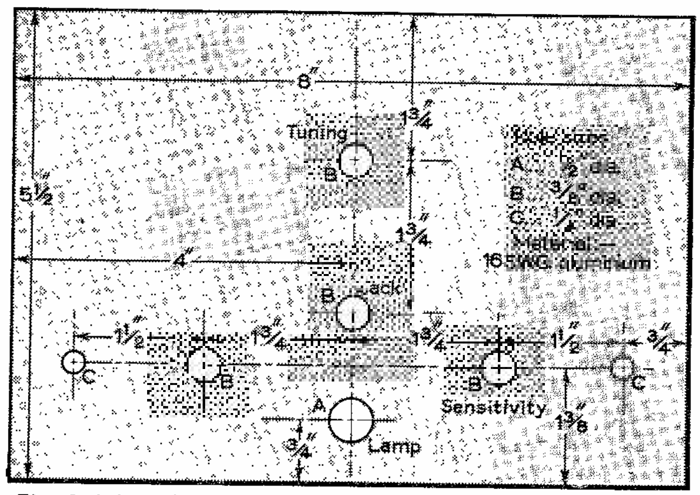
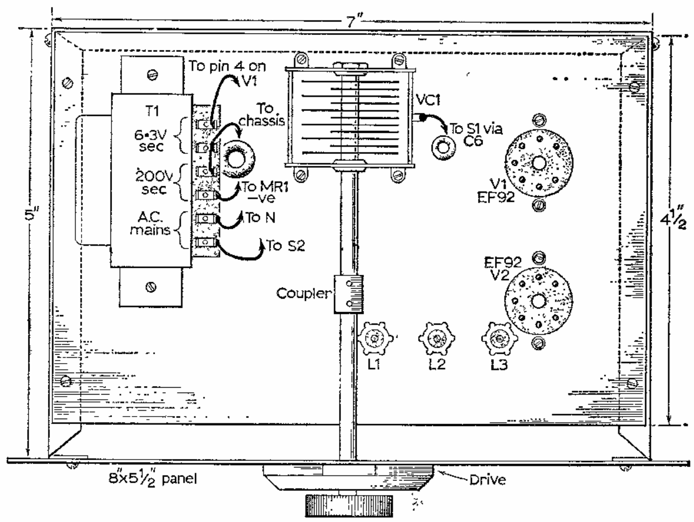


Fig. 3 (above): Front panel drilling details and dimensions.

Fig. 4 (below): Layout of components above chassis and dimensions.



Referring to Fig. 2, solder one end of the wire, wind on the required number of turns, make the tap by twisting the wire, then add the remaining number of turns. Holding the complete winding firmly apply a layer of Sellotape, cut away excess wire, scrape off the enamel, then solder. Suitable enamelled copper wire may be easily salvaged from unwanted transformers, coils, chokes, etc., and the exact thickness is not unduly critical. The gauge

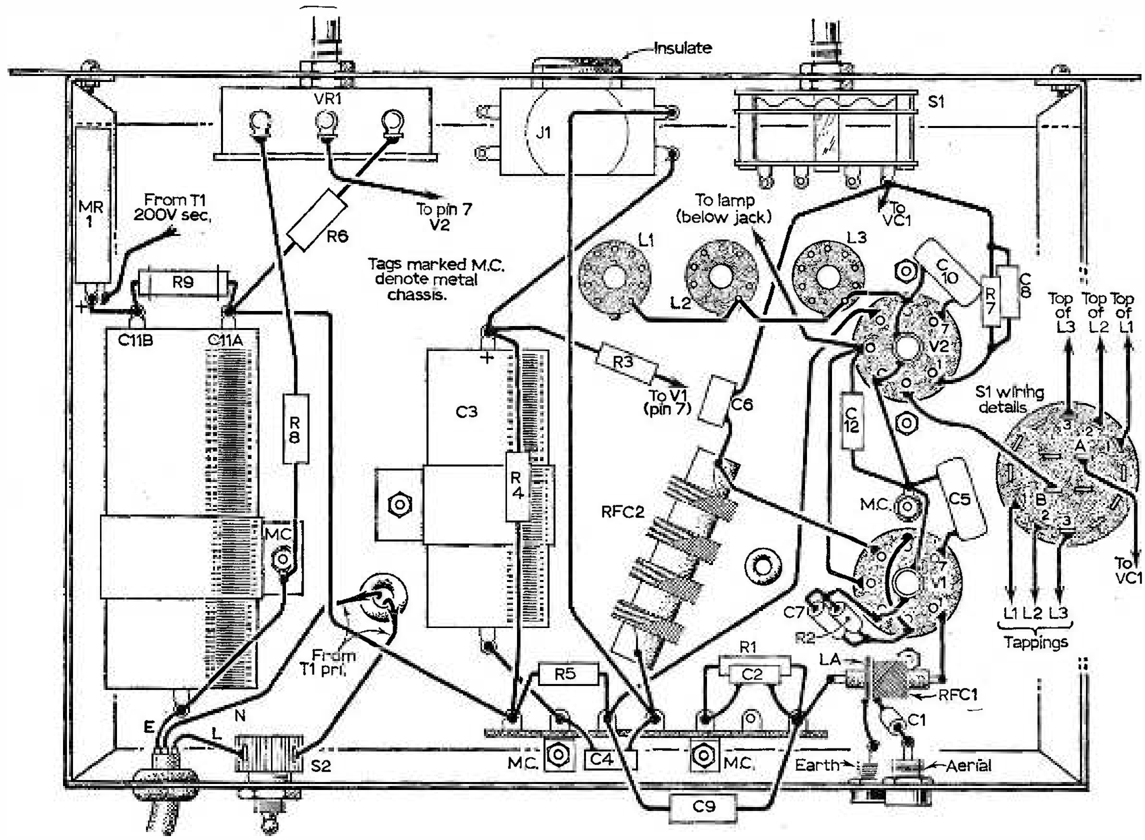


Fig. 5: Wiring and layout below chassis.

may be assessed by close winding some turns on to any dummy "former" and measuring the winding length with a ruler. The result may be compared with a book of "Wire Tables" but if a winding length of 0·5in. contains 36 turns the wire may be taken to be 30 swg.

Other ranges may be experimented with in addition to those shown in the Table and for Medium waveband coverage, 100 turns of fine wire —say 36 swg dsc—may be tried with a tapping at about 15—20 turns. Alternatively a commercial coil may be used; in this case some turns must be taken off carefully, the tapping made and the wire replaced as nearly as possible to its original form. If a commercial coil has a separate coupling winding, this and the main winding may be series-connected such that both windings are in the same direction; the junction of these two windings may then form the tapping point with the extremities going to chassis and S1A respectively.

CONSTRUCTIONAL

Details of the front panel are given in Fig. 3, above- and below-chassis plans are detailed in Figs. 4 and 5. All the metal work is easily prepared using only a simple hand drill plus a few round and flat files. The chassis "box" is so bolted to the panel that the latter slopes slightly backwards; the chassis is a sectional type comprising of three sides plus a top plate. Choke RFC1 requires winding LA to be added (Fig. 6), this may consist of 20 turns of 36 swg dsc wire random wound over the "earthy" end, in the case of a miniature ferrite type choke, or between two of the pies in a conventional type.

Note: Great care should be taken when fitting socket J1 for this must be completely isolated from the chassis and panel by means of insulating bushes or washers. Should J1 be in contact with

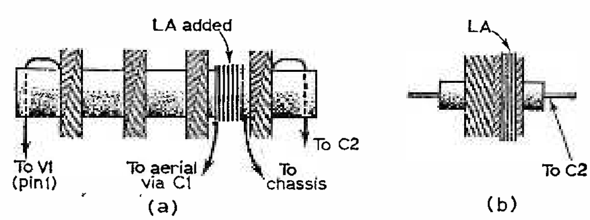


Fig. 6: Modifications made to RFC1.

the panel when the phones are plugged in the h.t. supply will be completely short-circuited to chassis and danger may result!

The tuning capacitor is not unduly critical and any small air-spaced variable of 150pF (maximum) may be used. Care should be taken with the wiring which should be rigid avoiding long, droopy leads.

ALTERNATIVE CIRCUITRY

Although the layout is in no way super-critical the one shown in Fig. 5 has proved to be satisfactory and works out very well. The position of the mains switch for example is a matter of choice and it can be fitted anywhere to suit individual taste. Slight rearrangement to suit components to hand will not alter the efficiency of the circuit to any real degree, although wide variation from the values of the components quoted is not advisable.

In Fig. 1 the receiver is a three-stage affair, viz., Buffer (V1), Demodulator (V2), Audio Amplifier (V1) but by making a few changes a simpler version is achieved. To simplify the design:— (1) Omit C1 and RFC1 (with LA) completely. (2) Omit capacitor C2 and connect the top of R1 together with the existing lead from C9 direct to V1 grid pin 1. (3) Lift the end of C6 connected to pin 5, V1 and connect it instead to the aerial socket.

The receiver will now function in two-stage mode, viz., Demodulator (V2), Audio Amplifier (V1). Some damping of the tuned circuit is likely to result due to the aerial and "dead spots" may be found on the dial but despite these disadvantages much of interest will be receivable. The effect of feeding the aerial, via C6, to the pole of S2B may also be tried and it might prove beneficial to connect a 15kΩ resistor across the Aerial/Earth sockets.

TESTING

With no power applied the finished receiver should be checked with an ohmeter to ensure that no direct short-circuit exists between the h.t. rail and the chassis and that except for the earthing pin, neither side of the mains supply plug is in connection with the chassis at either setting of S2. Particular attention in this respect should be given to socket J1 as mentioned earlier! If all is in order headphones may be plugged in, VR1 turned fully anti-clockwise, and aerial connected and also an earth if possible. The mains plug is then inserted and S2 closed whereupon both valves should glow. Signals should be heard when VR1 and VC1 are carefully adjusted but the detector valve should not be allowed to oscillate if at all possible since this will cause all signals to vanish! As VR1 is advanced towards its optimum point noise will be heard to increase and the improvement in sensitivity will become apparent; signals will seem to tune more sharply also. The h.t. rail voltage may now be measured and this should approximate to 230V d.c.

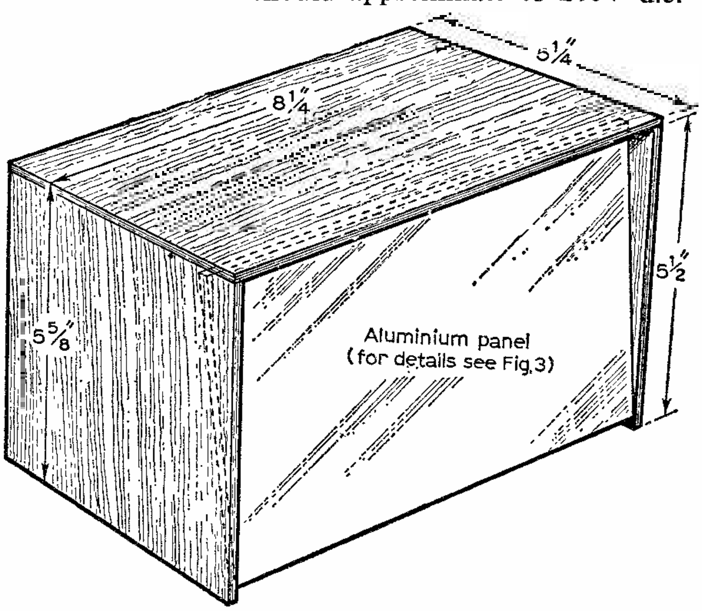


Fig. 7: Dimensions for a suitable cabinet. Details of the front panel are given in Fig. 3.

★ components list

Resistors:

All 20% ¼W except where stated

R1	100kΩ	R7	3·3MΩ
R2	180Ω	R8	5kΩ
R3	33kΩ	R9	1·5kΩ 1W
R4	10kΩ	VR1	25kΩ Potentiometer wire-wound
R5	330kΩ		
R6	22kΩ		

Capacitors:

C1	100pF silver mica
C2	0·005 μF (5000pF) ceramic
C3	32μF, 350V D.C. electrolytic
C4	0·005μF (5000pF) ceramic
C5	0·01μF (10,000pF) ceramic
C6	50pF silver mica
C7	0·01μF (10,000pF) ceramic
C8	100pF silver mica
C9	0·005μF (5000pF) ceramic
C10	0·01μF (10,000pF) ceramic
C11	16+16μF, 350V d.c. electrolytic
C12	2000pF ceramic
VC1	150pF variable

Rectifier:

MR1 Electrix Contact-cooled, 250V d.c. 50mA

Valves:

V1/V2—EF92

Chokes:

RFC1/RFC2 2·5mH

Switches:

S1 4-pole, 3-way rotary (or 2-pole, 3-way)
S2 Toggle type on/off, 250V d.c.

Mains Transformer:

T1 Primary: 230V a.c. input.
Secondaries: 0–200V 25mA, 6·3V 1A

Drive:

Eagle Vernier type T-502.

Chassis:

7 x 5 x 2in. Sectional type, plus panel 8 x 5½in.

Miscellaneous:

Coil formers (3)–Denco 0·375in. diameter, Valveholders (2) B7G, 6·5V 0·15A bulb, Lens and holder, Closed-circuit jack socket (Radiospares), Aerial and Earth sockets, Spindle coupler ¼in., Spire clips (2), Grommets (3), 6BA nuts, bolts, washers, tags, material for casing, wire, solder, etc.

CONCLUSION

To finalise the receiver fabricate a simple casing of faced hardboard, or paxolin. Grey-lacquer the panel and apply legends either by means of Letraset symbols or transfers. The end product is an attractive little receiver capable of providing considerable pleasure. Do not expect "communications-type" efficiency however for after all the receiver uses but two valves and a handful of components! ■

Mods for the R1155

I would like to put forward the following points which may prove useful to those using this set.

(A) The small metal panel formerly supporting the Meter Amplitude control can be replaced by one of insulating material on which can be placed a 50pF variable capacitor. The b.f.o. trimmer is then disconnected and the wires extended to the new control. The ease of operation on c.w. and s.s.b. is much enhanced.

(B) The rear portion of the b.f.o. box is cleared of components and a small bracket prepared to fit across it, on which are mounted the components of a Product Detector Stage, as in the April 1965 issue of *Practical Wireless.* This leaves the d.f. valve position next to the box vacant, one use for this valve base being a triode infinite impedance detector. The change-over switch from a.m. to s.s.b. is mounted on the front panel next to the wave range switch.

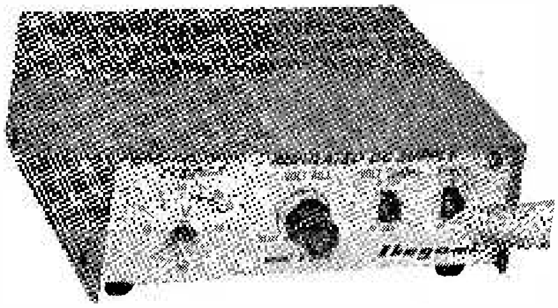
(C) A number of modifications such as adding an output stage, noise limiter, preamplifier stage Q-multiplier and valve type S-meter to replace the "magic eye" can be carried out very easily and neatly if all the d.f. components at the r.f. end of the chassis are removed and the wiring to the master switch and magic eye stripped off. The a.v.c. wiring to the Master Switch is re-routed to the Meter Balance position, where a DPST switch can be placed and the wires connected very conveniently. A metal panel 6in. x 5in. is now mounted vertically between the chassis and the main support bracket (this being countersunk so that the chassis will slide back into the case) next to the r.f. coils. The panel will accommodate four or five valves with B7G or B9A bases. According to the modifications being carried out, some may be horizontal and project over the tuning capacitor, or be fastened vertically to a bracket on the new panel. The exact mode of use will suggest itself to the constructor, but it will be found that all the wiring can be carried out conveniently, and above all, neatly. By this means also, the whole of the space beneath the chassis in this region will now be vacated. It is possible that a power supply could be fitted here, though most users have external PSU's.

By these means, considerable modifications can be made to the set without untidy wiring or interaction between stages.

K. H. Ashcroft, B.Sc., Wirral, Cheshire.

NEWS AND..

MIDGET FROM IKEGAMI



Claimed to be the smallest pack in the world, measuring 6 x 2 x 5in. and weighing less than 3lb. is the Ikegami regulated d.c. supply. Output voltage is d.c. 0–12V–24V. Output current is 0–400mA, regulation load is less than 30mV, temperature coefficient is 8mV per 1°C. Ripple is 3mV (p–p). The regulators are supplied with zip-carrying case. Price is £24 13s 6d. *Sole UK Agents, H. F. Collison (Goodwell Ltd.) High Street, Coleshill, Birmingham.*

NORTHAMPTON MOVES—RHYL REVIVES

Due to the pressure of space, the Northampton Short Wave Radio Club, G3GWB, is moving to Kingsthorpe Community Centre, Kingsthorpe Hall, Northampton. Work is proceeding with the installation of transmitters on all bands up to 2m. Meetings will continue to be held on Thursdays at 7 p.m.

Sincere thanks are offered to Mr. T. Howard who has been the long-suffering host at the old Club Rooms at Duke Street.

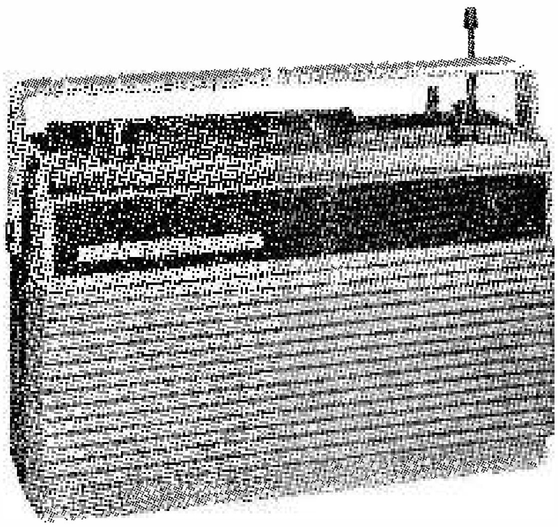
The A.G.M. of the Flintshire Radio Society was held recently and after a dormant period of twelve months, the Club is commencing its 1967 programme with a new look.

The name has been changed to the Rhyl and District Amateur Radio Club and meetings are held at 8 p.m. on the second Tuesday of each month at the Rhyl Silver Band Rooms, off Windsor Street, Rhyl. Details from the Hon. Sec., A. Antley, GW3UTG, Fairholme, Fairfield Avenue, Rhyl. Tel. 1362.

CANADA-BERMUDA PHONE CABLE

Cable and Wireless Ltd. and the Canadian Overseas Telecommunication Corp. recently announced their intention to provide a jointly-owned coax phone cable between Bermuda and Canada. Approximately 800 miles long, the new cable will have 480 circuits and a maximum capability of 640 telephone circuits.

MULTI-WAVEBAND PORTABLE



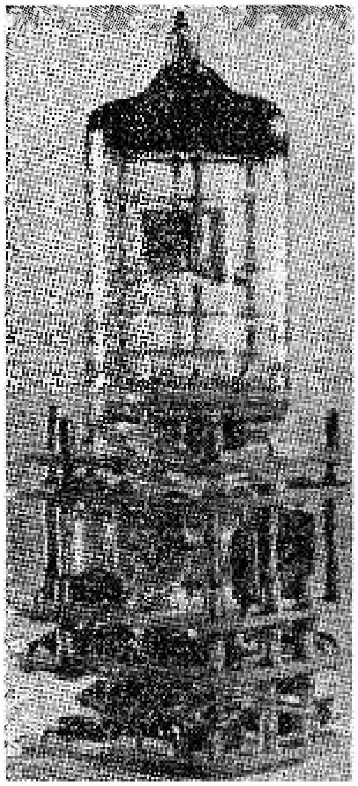
Recently announced is the 'Plein Feu', a de-luxe transistor portable from the French manufacturers Sonolor. It incorporates l.w., m.w. and four short wave bands. A car aerial socket with isolating switch is provided together with a tone control, telescopic aerial, dial light, 8 push-button controls and earphone/extension speaker socket. Recommended retail price is 23 guineas. Denham and Morley Ltd, 173/175 Cleveland St., London, W.1.

...COMMENT

RNLI GOES FOR BANTEX

Two new types of lifeboat, developed for the RNLI are being fitted with Bantex glass-fibre aerials. The first of these boats, a 48ft. 6in. class has recently been launched by Wm. Osborne of Littlehampton and represents a new self-righting design. Its electronic installation includes radar and maritime v.h.f. and u.h.f. communication with aircraft, plus echo sounder and direction finder. Mounted aft for radio telephone are twin 18ft. Bantex aerials built to withstand extreme conditions of high speed and severe weather.

The second type is a 44ft. boat built for high speed to the design of the U.S. coastguard vessel. For h.f. radio telephone they carry a single 18ft. aerial mounted on the fo'c'sle.



LOW POWER MINI OSCILLATOR

A new temperature stabilisation technique employing a microelectronic circuit is embodied in a new range of miniature master oscillators announced recently by Marconi's Specialised Components Division. The oscillators which have a short term stability of 1 part in 100,000,000, have applications in airborne equipment and portable manpack receivers.

The photograph shows the complete oscillator assembly removed from its aluminium case. At the top is the glass envelope containing the transistor can in which a crystal, microcircuit heater and a thermistor are housed. Beneath are the layers of printed circuit boards which make up the rest of the oscillator circuit. The trimmer which allows for 10 years of crystal ageing can be seen in the centre. The Marconi Company Limited, Chelmsford, Essex.

FIRST IB CONVENTION FOR ROYAL LANCASTER

London and its newest hotel—the Royal Lancaster Hotel, Lancaster Gate, London, W.2, are to be the centre this year for the first International Broadcasting Convention, to be held from September 20 to 22, 1967. The Convention, organised jointly by the Electronic Engineering Association and the Royal Television Society, will comprise an exhibition of broadcasting equipment by leading manufacturers and a conference at which delegates can attend lectures by leading experts in all aspects of broadcasting.

THIRD EDITION OF AVO MANUAL

Avo (MI Group) has produced the third edition of its Transistor Data Manual. This international reference book gives in-line data for more than 8000 transistors including those of Russian manufacture. A comprehensive list of transistor equivalents is included with commercial equivalents of Service transistors and connection diagrams. Copies of the manual are available from the Spares Department, Avo, Avocet House, Dover, Kent. Price in the U.K. postage paid is £2 5s.

More on the R1155

The i.f. stages can be aligned without a signal generator by disconnecting the top cap of the frequency changer valve and poking the end of a few yards of insulated wire inside the first i.f. screening can. Broadcast signals from the Athlone 100kW transmitter on 566kc/s should be received without trouble and the i.f. transformers can be adjusted for peak output. This will align the i.f. strip to 566kc/s instead of 560kc/s but the error is only about 1% whereas many commercial signal generators have a calibration inaccuracy much worse than this.

U. Smith, G3UTI, Darlington, Co. Durham.

Ancient and Modern

Mr. A. W. Jenner P.W., February, 1967, asks for advice on Edison Cylinder reproduction.

The first essentials are a button stylus horizontally mounted i.e. tangentially to the cylinder and a pickup modified for response vertically and high lateral compliance. Considerable stylus pressure must be allowed for in the mounting.

The pickup, driven across the cylinder by the lead-screw should be free to move over two or three grooves to allow for shrinkage of old recordings.

Excellent recordings can also be made on these fascinating machines with far less trouble than cutting "acetate" discs.

If readers are seriously interested, I will reply in greater detail.

T. A. Bartlett, MBKS, Lusaka, Republic of Zambia.

Simple Electronic Organ

I would like to thank people who have contacted me concerning my article on the construction of an electronic organ (page 657, P.W., January, 1967).

The use of a multivibrator circuit as the oscillator was satisfactory for the higher notes, but the lower notes lacked the deep bass quality which I wanted. I found (perhaps with the ear of faith) that the phase shift oscillator brought out the smooth deeper notes much better.

I now realise that using a 2½in. speaker was the main reason for failing to produce the most musical sounds. Since writing the article, however, I have been experimenting with methods of improving the tone without increasing the speaker size. The system which I find most satisfactory is to use the speaker as an "agitator" (as a reed in a clarinet) at the open end of a jam jar or tube of perspex which acts as a resonator.

J. M. Watt. Northfield, Birmingham 31.

EXPERIMENTERS CORNER

R/C CIRCUITS WITH GAIN

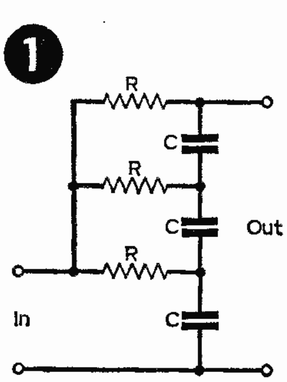
K. T. WILSON

IT is generally believed that resistance/capacitance circuits have less than unity gain: that is to say, the voltage or current out of such a circuit is less than that put into it. This might be thought to be true of all passive circuits—those which have no active components such as valves and semi-conductors. In fact, it is far from true. Take the transformer, for example, although it is a passive device, it can be arranged to give a good circuit gain.

The amount of gain from an R/C circuit is by no means comparable to what is possible from a transformer, but is sufficient for some purposes. The surprising thing is that gain is possible. However, to achieve gain, the R/C network has to be frequency conscious, has to be fed from a low impedance source and has to look into a high impedance—in just the same way a transformer has to achieve gain.

Analysis of the circuit given in Fig. 1 shows that the circuit will have zero phase shift at a given frequency. This frequency can be derived from the following formula: $WT = \frac{1}{\sqrt{6}}$ *where W is equal to 2πf and T is equal to the product of the resistance and capacitance.* At the resonant frequency the gain is approximately 1·03. Further examination of the circuit shows a strong resemblance to the somewhat familiar phase-shift oscillator. It is, in fact, of this class and the phase-shift is the reason for the gain. One may consider the circuit as an equivalent to the more conventional resonant circuit having inductive and capacitive elements.

If the circuit is so arranged that the output can be fed back to the input with zero phase shift, the circuit will oscillate at a given frequency—this can be found by the formula given earlier. It is also important that the output of the circuit looks into a high impedance and is fed from a low impedance source. This can be achieved using a cathode follower arrangement. Although the gain of the cathode follower is less than one (unity), the phase shift is zero, and the impedances are correct. The gain of the cathode follower can be arranged (using a high-slope valve) so that it is almost unity, and the coupling and biasing components selected not to introduce any further phase shift. If the slope of the selected valve is low, the circuit acts as a very selective amplifier, which 'rings' with a damped oscillation when a pulse is applied to its grid. The complete circuit is shown in Fig. 2. This circuit does not work with transistors, but might with F.E.T's although the author has not proved such a circuit.



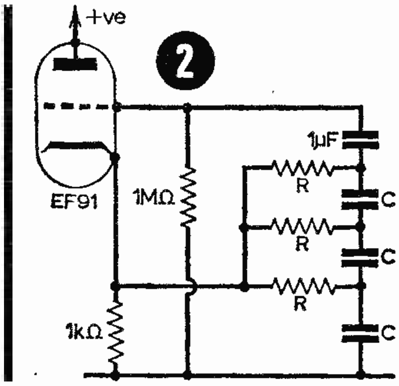


Fig. 1: At one specific frequency (depending upon the time constant CR) it is possible to achieve gain with this arrangement.

Fig. 2: Cathode follower hooked to the basic Fig. 1 circuit for impedance matching, see text. Note: For 1,000c/s, R should be 6·8kΩ and C 0·01µF.

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repairing radio sets

—continued from page 39

item, but should not be overlooked if work is anticipated on a.c./d.c. equipment, where one side of the mains supply is connected to the chassis of the test piece. Wrong connection can be harmful, even lethal, and it is wise to invest in safety.

★ SPARES

Store-keeping again depends on the amount of work anticipated. But whether one is running an economic workshop or simply pottering for amusement, systematic filing of service data, collecting of small spares and storing of larger ones makes life much easier.

Small items tend to get lost and damaged when tumbled haphazardly in the nearest cardboard box. In these days of increasing miniaturisation, valuable parts may be quite small and easily overlooked. A few moments spent in listing, filing and storing pay dividends later.

The foregoing may seem a counsel of perfection, but experience has shown that service work is so much a matter of applied logic that a logical approach to its practice is not only good economy but satisfying in itself.

To be continued

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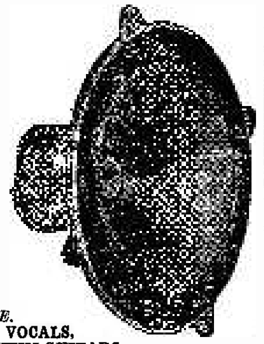

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IMPROVING CHEAP TAPE RECORDERS

W. S. FOWLER M.A.

LAST month details were given for fitting an electric remote stop/start control to portable transistor recorders, and for varying the record and playback speed of the machine.

The amplifier section of a transistor tape recorder commonly consists of a four transistor circuit as shown in Fig. 3. As the signal from the tape head is only of the order of a few millivolts, a quite sensitive circuit is necessary and this readily lends itself to modification to increase the usefulness of the apparatus. As the amplifier alone is to be used, the stop/start jack previously described should be first inserted, in order to prevent the tape motor from operating unnecessarily.

STRAIGHT AMPLIFIER

To use the tape recorder as a straight amplifier, the only modification required is to break the input circuit at point "X" in Fig. 3. Removal of the tape head cover usually reveals red and black leads connected to the record/playback head. The red lead should be broken and connected across the contacts of a miniature jack socket. The socket itself can be mounted at some convenient point on the cabinet, preferably choosing a non-metallic section, in order to avoid accidental short circuiting through the jack fixing nut.

When a jack plug is not inserted, the tape recorder circuit functions normally. Insertion of the jack disconnects the tape head and puts one of the auxiliary circuits (shown in Figs. 4-8) into operation. The main function switch on the recorder is set at "playback".

An alternative method of tapping into the amplifier consists of using the existing microphone input socket. In this case the recorder is set to the "record" position and the loudspeaker muting connections are by-passed by fitting a small switch across the contact points. The speaker must normally be muted when recording from the microphone in order to avoid acoustic feedback which would result in howl.

Figure 4 shows a simple diode receiver circuit, using approximately seventy turns of 26 swg wire wound on to a 4 inch ferrite rod of $\frac{3}{8}$in. diameter. The OA81 diode is tapped off ten turns from the aerial end of the coil. Tuning is provided by a 500pF solid dielectric capacitor, connected in parallel with the tuning coil. This covers the medium wave band. The Light Programme on long wave can be brought in by shunting a fixed capacitor of about 0·002μF across the tuning coil.

Figure 5 shows an alternative form of tuner in which the station selection is achieved by moving the ferrite rod in or out of the coil former. Some of the early TV converters which used slug tuning provide useful components for cog and rachet drive for the ferrite rod.

One of the difficulties of the simple diode circuit lies in the fact that the load is heavily damped by

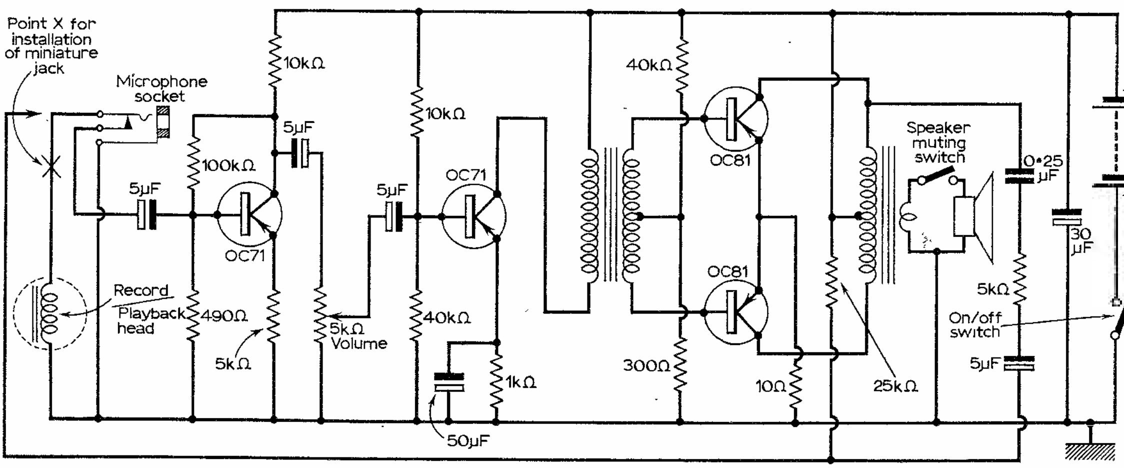


Fig. 3: Typical amplifier section of a transistor tape recorder.

the input side of the first transistor in the tape recorder amplifier. In poor signal areas this leads to loss of sensitivity and poor station selectivity.

Figure 6 shows a single transistor tuner circuit. The transistor is used first as an r.f. amplifier; the signal is then detected in the diode circuits and amplified, by reflexing, by the same transistor, before being fed, via the coupling jack, into the tape recorder amplifier.

The tuning coil consists of 76 turns of 26 swg wire wound on a five inch ferrite rod of ⅜in. diameter. The bottom tap is taken ten turns from the "earthy" end of the winding. A good r.f. transistor such as the OC44 is essential here. The coil covers the medium waveband and once again, the Light Programme can be brought in on long wave by the parallel addition of a fixed capacitor of about 0·002—0·003μF.

If the power supply is to be separate, a miniature cell of the Mallory Mercury type may be used. The whole assembly can be arranged within very small dimensions, with the jack plug itself rigidly mounted to the assembly casing. It should be remembered that the proximity of metal reduces the efficiency

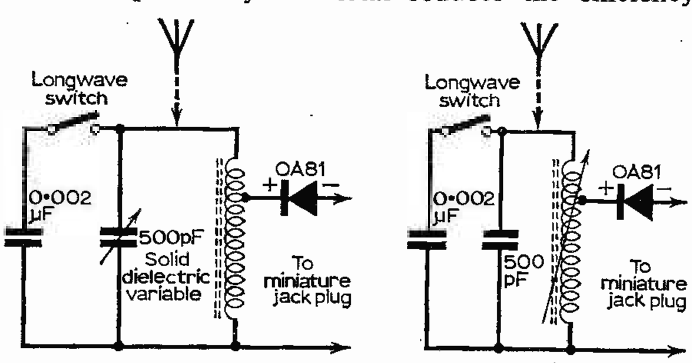


Fig. 4 (left): Simple capacity tuned radio jack.
Fig. 5 (right): As Fig. 4 but permeability tuned.

of the ferrite rod considerably. Alternatively, in some tape recorders, the complete unit can be mounted inside the tape recorder case. The normal tape recorder amplifier battery supply can then be utilised to power the tuner.

Use of the remote electric stop-start control will enable the tape recorder motors to be brought into play, thus permitting the recording of the tuner signal, if required.

Figure 7 shows the utilisation of the recorder amplifier for baby alarm and intercom. purposes. The simple carbon "war surplus" mikes are very suitable for this purpose, and are energised via a bell battery and small step-up transformer. It is important to note that where long leads from the microphone are necessary these should be arranged on the low impedance side of the circuit (i.e. the step-up transformer should come directly next to the amplifier input). If this is not done, considerable hum and loss of volume will be caused.

An alternative to the carbon microphone is the miniature moving coil loudspeaker (see Fig. 8). Once again, the long leads must be kept on the low impedance side of the circuit. The moving coil speaker will serve well as a microphone and has the added advantage of not requiring an energising battery. The output is, however, considerably lower than from the carbon microphone.

Using the moving coil speaker, a two way intercom. can be built up by means of suitable switch-

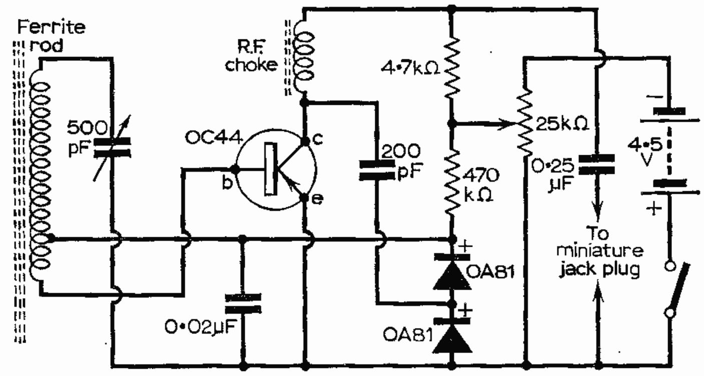


Fig. 6: Simple single transistor reflex tuner.

ing: the principal factor is the use of the moving coil speakers alternately as microphones and as loudspeakers.

GRAMOPHONE AMPLIFIER

The tape recorder amplifier can readily be used as a gramophone amplifier by the connection of pick-up leads to a miniature jack plug which is then inserted into the jack socket already fitted at point "X" on Fig. 1.

An interesting variation is the adaptation of the tape recorder motor itself to provide a turntable drive for playing 45 r.p.m. records. By suitable adjustment of the potentiometer speed control previously described, most portable tape recorder drive motors can be adjusted to a speed of 45 r.p.m.

The right hand spool (take-up spool) is utilised as a miniature turntable, and the pick up itself is mounted on the left hand spool. Two empty three inch spools can be utilised to provide the "turntable" and the base for the pick-up arm. In order to ensure that the gramophone record clears the tape head assembly etc., one of the tape spools should be placed on the right hand spool drive base. The record is centred by gluing a 45 r.p.m. large diameter spindle on to the empty three inch spool, taking care that the centre holes are concentric (the tape recorder drive spindle usually protrudes far enough to ensure this).

The only other point which must be watched is that the direction of rotation of the gramophone

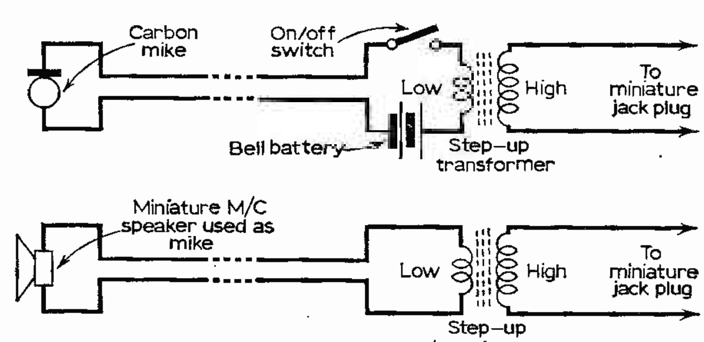
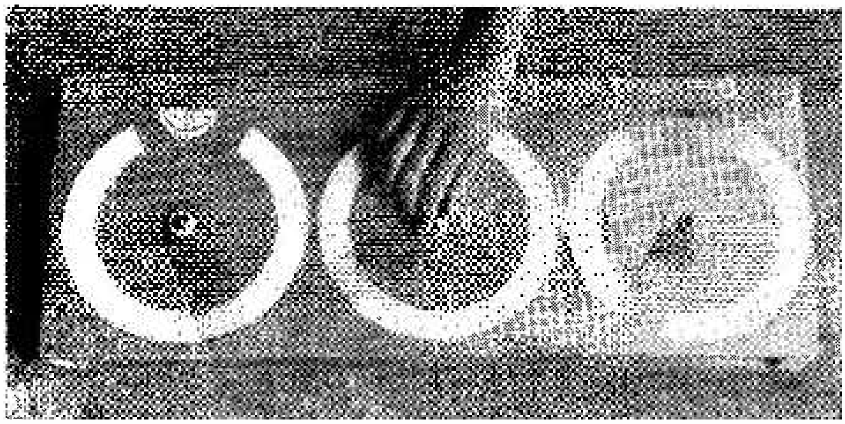


Fig. 7 (above): Input circuitry for carbon mike.
Fig. 8 (below): Circuit for use with moving coil speaker.

record is the reverse of the normal tape drive (a record turns clockwise, but a tape spool take-up is anticlockwise). This is easily taken care of by reversing the polarity of the batteries with reference to the tape recorder motor. As these batteries are separate from the transistor battery supply, the operation of the amplifier is not affected. ■



A SIMPLE ANALOGUE COMPUTER

C. R. BRADLEY

COMPUTERS may be divided into two main classes, the *digital* and the *analogue*. Digital computers employ enormous numbers of interconnected switching circuits and in spite of modern advances in miniaturization by the use of semiconductors and printed circuits they are usually very large pieces of equipment.

Since they are composed mainly of switches with two positions, "ON" and "OFF", they can only deal with problems translated into an "ON/OFF" or two term "language" such as the *binary code*. Any number may be expressed in this code solely in terms of 0 (or "OFF") and 1 (or "ON"). Complex equipment is required to translate problems into binary code and to translate the answer produced by the computer into intelligible form. Needless to say, the tremendous expense of such equipment puts it beyond the range of the layman.

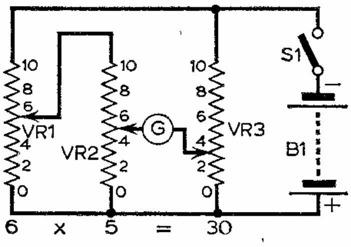


Fig. 1: Basic circuit.

Analogue computers solve problems by electrically simulating the conditions of the problem. Their advantage over digital computers is that it is often unnecessary to convert the problem into a special form for the computer to handle. All this will be clear when the operation of a very simple and inexpensive analogue computer is considered.

The circuit diagram Fig. 1 shows a battery, a switch, a galvanometer and three linear potentiometers connected together. Each of the potentiometers is fitted with a pointer knob moving over a 0 to 10 scale. The operation of the computer is best seen by considering a simple multiplication sum, say 6 x 5. Firstly, the pointer on VR1 is set to 6. If the voltage supplied by the battery is X volts, then the voltage between the slider of VR1 and its lower end (and hence the voltage across VR2) is 0·6X volts (the voltage drop across VR1 is linear). VR2 is now set to 5 and the voltage between its slider and lower end is therefore 0·5 x 0·6X volts, i.e: 0·3X volts.

VR3 is now adjusted until the galvanometer indicates zero current. At this "balance" point, the potentials at the sliders of VR2 and VR3 must be equal. The pointer reading on VR3 is therefore 3, and adding a nought to this gives the answer to our simple multiplication sum, i.e.: 6 x 5=30.

This demonstrates the computer's ability to multiply; by a converse process it can divide. Example: To divide 8 by 2: Set VR3 to 8, set VR2 to 2 and adjust VR1 for zero deflection of the galvanometer. This is obtained at 4 which is the answer to the problem. In other words, all that has been done is to calculate 4 x 2=8 in reverse.

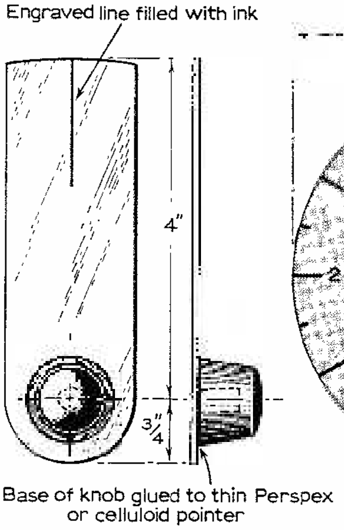
So far only simple problems have been considered which one can do without a computer. However, a problem such as 2·35 x 9·2 is a different matter, but the analogue computer will handle this problem just as easily. The correct answer is read out on VR3, viz.; 21·6 to 1 decimal place (actually read as 2·16 but seen to be obviously 1/10th too small).

The computer is not limited to manipulating numbers under 10; it can calculate 2,350,000 x 0·092 just as easily. VR1 and VR2 are still set to 2·35 and 9·2 and the answer is still read as 2·16, but a moment's thought shows that it must actually be 216,000. (Alternatively: 2,350,000 x 0·092=2·35 x 10^6 x 9·2 x 10^{-2}=2·35 x 9·2 x 10^{6-2}=21·6 x 10^4=216,000).

The computer is not limited by the *size* of numbers, but by the accuracy of the calibration of the potentiometers. The figure 5·2967 cannot be accurately set on a conveniently sized dial, the closest possible being 5·30.

Construction

In practical form the computer employs eight-inch diameter dials for VR1, VR2 and VR3. This is large enough to give fairly accurate answers and easy reading. Any further increase in size would



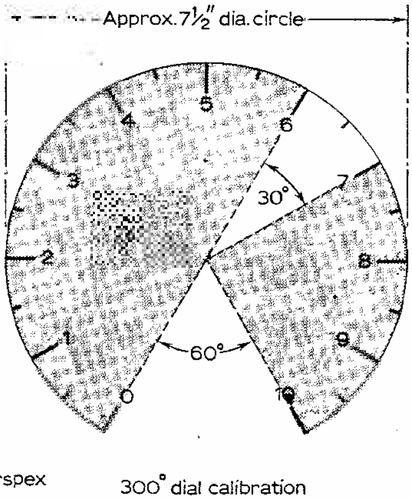


Fig. 2 (left): Suggested construction of the pointers.
Fig. 3 (right): Dial suitable for a 300° potentiometer.

make the unit very bulky and would not greatly increase accuracy because the dials can only be calibrated to a certain accuracy and the potentiometers used will have a certain limiting resolution.

A simple "sandwich" construction is used consisting of two 12in. x 26in. pieces of ½in. plywood separated by 1in. x 1in. x 2in. struts at each corner. Besides the three large potentiometer dials, the upper panel carries an on/off switch and the galvanometer. This is mounted on the lower surface of the panel and viewed through a semi-circular cutout.

Potentiometer Values

If the pointer of VR1 is set to (say) 7 the voltage between its slider and lower end will only be exactly 0·7X if no current is drawn from it. If an appreciable current is drawn, more current will be flowing through the upper portion of the potentiometer than the lower and hence there will be a greater voltage drop across the upper portion than under no-load conditions. As VR2 must draw some current, the potential difference across it will always be slightly *below* that indicated on the pointer of VR1 because of this *loading error.*

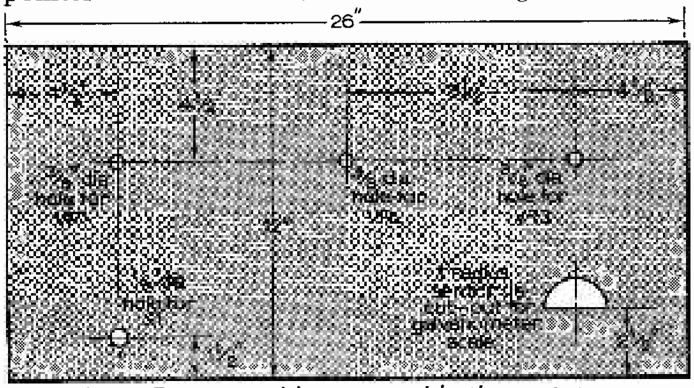


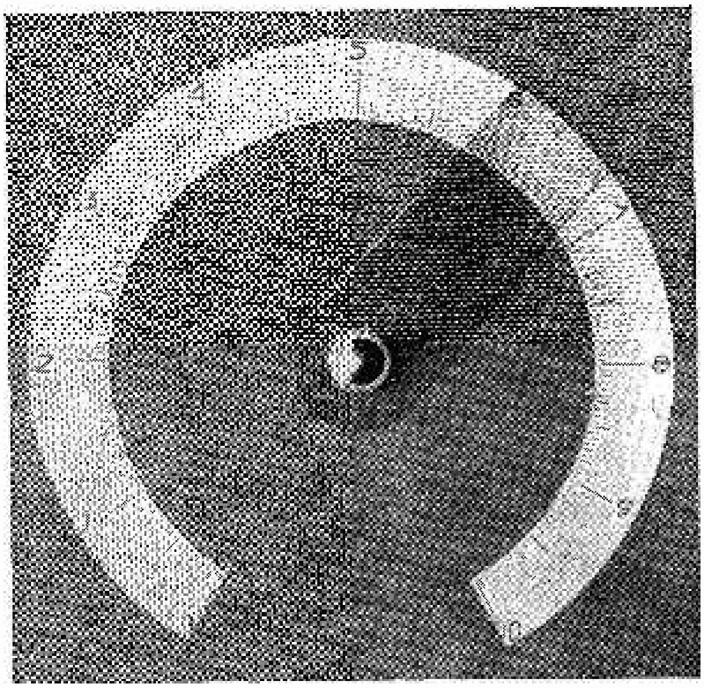
Fig. 4: Front panel layout used in the prototype.

Loading error can be minimised by using a low resistance potentiometer for VR1 (so that a large current flows through it and the current drawn by VR2 is very small in comparison) and a high resistance potentiometer for VR2 so that it draws only a small current. There is no loading error due to current drawn from VR2 or VR3 since, when the galvanometer indicates zero, no current is being drawn from either slider. VR3 should be low in value so that a small deviation from balance point will give a large galvanometer deflection.

Suitable values for VR1, VR2 and VR3 are 100Ω, 5kΩ, and 100Ω respectively, but these are not very critical (see components list). It is very important, however, to ensure that these are *linear* potentiometers and not the logarithmic type used in audio circuits. Large wirewound controls as used in Wheatstone bridge instruments may be used if available, although good results may be obtained from ordinary carbon potentiometers.

Calibration

The easiest way to calibrate VR1, VR2 and VR3 is to measure their angles of rotation and mark off the divisions 0 to 10 using a protractor. Fig. 3 shows a dial for a 300° potentiometer; the angle between divisions in 300°/10, i.e.: 30°. The dial may be further subdivided into graduations of 0·1. This



Close-up of one of the dials.

dial is easily drawn on an 8in. diameter circle of paper which is glued to the control board.

A smart pointer knob for each of the potentiometers may be made by gluing an ordinary small knob to a shaped piece of celluloid or perspex (see Fig. 2). The pointer is completed by engraving a line as shown with a sharp needle and filling it with indian ink to show up against the paper scale. Such a calibration will be fairly accurate provided the potentiometers are precisely linear and the resistive track does not terminate well before the limit of revolution.

If an accurate ohmmeter is available, each potentiometer may be calibrated by actual measurement, i.e.: by marking "1" where the resistance on the lower side of the slider is 1/10th the total and so on.

Alternatively, if a *high resistance* voltmeter (20,000 Ω/V or greater) or valve voltmeter is avail-

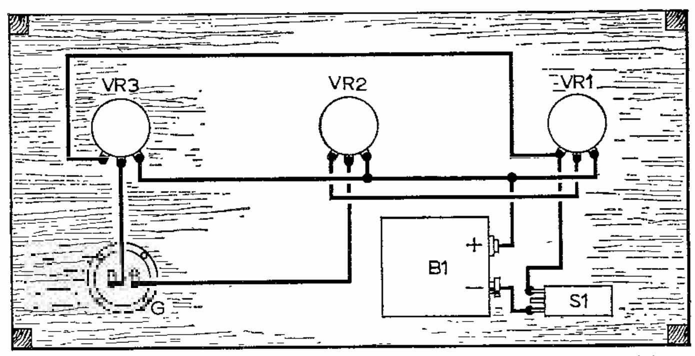
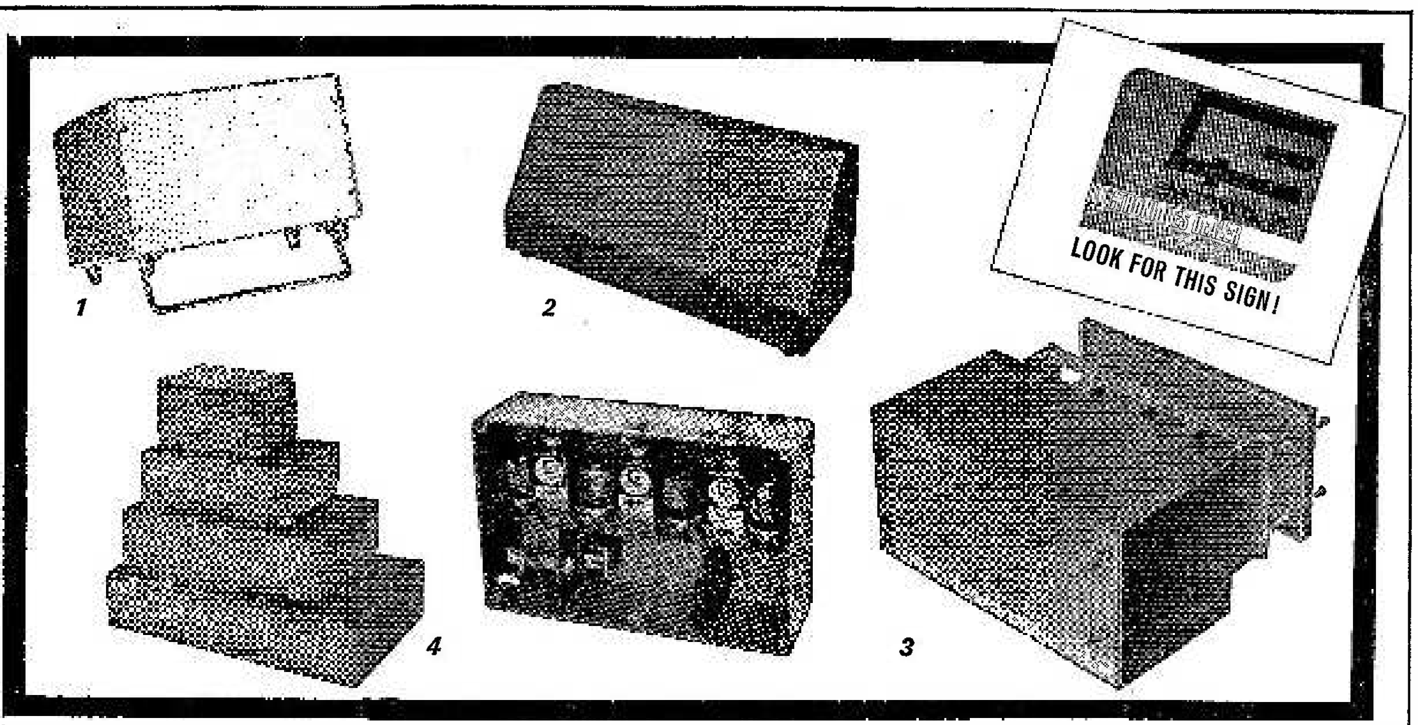


Fig. 5: Rear view of the front panel showing wiring.

able, calibration may be done by comparing the slider potential with an accurately measured voltage applied across the potentiometer.

The wiring of the unit is very simple. Any small 6 to 12 volt battery may be used as the battery voltage does not affect the answers obtained. A 100-0-100μA galvanometer is sensitive enough to give an accurate zero indication. If required, an even sharper indication may be obtained by raising the battery voltage and/or using a more sensitive galvanometer.



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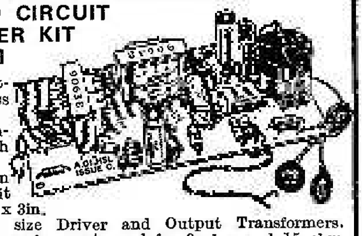

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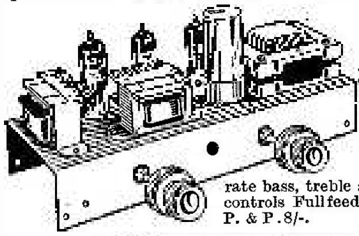

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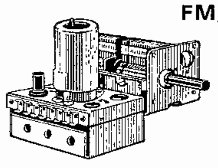

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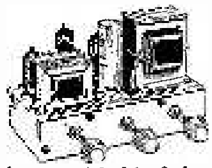

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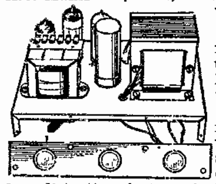
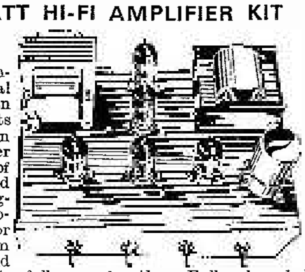


● Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss. ● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● Chassis size only 7¼in. wide x 4in. deep. Overall height 4¾in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves output transformer (3 ohms only) screened lead, wire, nuts, bolts solder etc. (No extras to buy). PRICE **79/6.** P. & P. 6/-.
Comprehensive circuit diagram practical layout and parts list 2/6 (free with kit).
This kit although similar in appearance to HA34 employs entirely different and advanced circuitry.

10/14 WATT HI-FI AMPLIFIER KIT



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Care must be taken not to damage the galvanometer by overload; when solving a problem it is a good plan to set the answer potentiometer to the approximate result expected before switching on. In this way the galvanometer will only carry a small current as the circuit is nearly in balance. Example: To multiply 2·95 by 8·30: Set VR1 and VR2 to 2·95 and 8·30. As the answer will clearly be approximately 24 (3 x 8), set VR3 to 2·4 and then switch on. The balance point and hence the answer is found very close to this at 2·45; the final answer is therefore 24·5 (to one decimal place).

Slide rule users will see that the scope of this simple computer may be greatly extended by the addition of further scales (e.g.: trigonometrical, logarithmic etc,) although these are beyond the scope of this article. Suffice to say that this simple computer should demonstrate just how uncomplicated analogue computers can be while still exceeding the brain's mental capabilities. ■

★ components list

VR1	50Ω to 500Ω linear carbon potentiometer
VR2	1kΩ to 10kΩ linear carbon potentiometer
VR3	50Ω to 500Ω linear carbon potentiometer
S1	Single pole single throw (SPST) switch
B1	Any small 6–12 volt battery
G	Approx. 100–0–100μA galvanometer

Wood: Two pieces ½in. plywood, 12in. x 26in.
Four pieces 2in. x 1in. x 1in.
Three knobs
Perspex for knobs, wire, solder, screws etc.

CQ! CQ! CQ! CQ! CQ!

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. . . October, November, 1964 and April, November, 1965. These issues covered the 10–5 Rx.—M. D. Ellse, 86 Bennethorpe, Doncaster, Yorkshire.

. . . April 1965 which contained details of the Transistorised Solo Organ.—A. Sheldon, 12 Walker Street, Toll End, Tipton, Staffordshire.

. . . January 1964, July 1965, January 1966 and April 1966.—Cpl. Symes, REME Wing, T.E.R.A. Ty Croes Camp, Anglesey.

. . . July 1961 issue dealing with the 1392 v.h.f. Rx. I would swop any issue since 1945 for this.—J. A. Bird, 43 Manor Road, Bolehall, Tamworth, Staffordshire.

. . . April 1965 issue.—A. Rush, 5 Durham Road, S. Stanley, Co. Durham.

. . . January, February and March, 1966, and January, February and March 1967. C.O.D. or cash in advance.—M. Ivan Nicholls, 15a Iverson Road, Kilburn, London, N.W.6.

. . . July 1960 issue—D. Cole, 6 Alexandra Avenue, Newtown, Great Yarmouth, Norfolk.

. . . March 1966 issue dealing with Part 1 of 19 set mods.—T. R. Smith, 50b Aldershot Road, Guildford, Surrey.

. . . June 1965 (complete with blueprint) and September 1966 concerning the radio control Tx.—A. Scott, 83 Elmfield Avenue, Erdington, Birmingham 24.

ISSUES FOR DISPOSAL

. . . Practical Wireless and Practical Television, complete issues from 1960 to 1966 inclusive.—H. Dodgson, 15 Chestnut Street, Parkinson Lane, Halifax, Yorkshire.

. . . February 1960, May, July, September, October, November and December 1963. 1964–1965 complete. January–September and November 1966 and January 1967.—J. Tring, Folyambe Terrace, Namartine Street, Nottingham.

THE MW COLUMN

As we approach summer, reception of North America will become more difficult and there will be a noticeable swing to the more southerly regions. During the past few weeks, nothing of great interest has been heard from North America, only the more common ones like WNRC 660, WOR 710, WABC 770, WHDH 850, WABI 910, CJCH 920, CJON 930, CKBW 1000, KDKA 1020, WHN 1030, CBD 1110, WCAU 1210 WEZE 1260, WORK 1300, WAVY 1350, WPOP 1410, WMEX 1510, WKBW 1520 and WCKY 1530. CBA has been better received lately on 1070, after weeks when LR1 Radio el Mundo was the dominant station. CBN St Johns (Newfoundland) has at times been the strongest signal from North America (640).

WINS, the all-news station, on 1010 has been strongly received, as has CJCB on 1270. St. Pierre et Miquelon on 1375 is also strong still at times.

South America has been better and the log includes YVLL 670, HJAJ 760, ZFY 760, PJB 800, HJKC 850, WVKM 810 (often very good and the best from Puerto Rico), LR3 950, PRB9 1000, YVOZ 1020, LR1 1070, PRG3 1280, PJD2 1295.

Asia has been very poor and apart from the Russian Service Chinese station on 1525, the only ones heard by the writer have been Rajkot (India) 910 and Hanoi 1010—although other DX'ers have done better. Asiatic openings have been all too infrequent this season; last year you could hear several almost daily through the winter months.

With conditions changing we will have to look towards Latin America and we can hope for more from Central American and Caribbean areas. Some to look for are: TIRICA La Voz de Victor, Costa Rica (625), TIGPH 1505, YSS (El Salvador) 655, TGRR (Guatemala) 1120, 4VEF (Haiti) 1035, Belize 835, Jamaica 750, Martinique (now heard consistently) 1310, XEOY (Mexico) 1000, XEJP 1150, YND Union Radio (Nicaragua) 675. If you want Panama, the best chance is HOL55 Radio Reforma on 1315, but it is usually weak. For Puerto Rico try WAPA 680, WKVM 810, WHOA 870, WRJS 1090, WUNO 1320 and WMDD 1480 (now consistent and good). In Surinam there is a choice of stations on 600 and 725, neither easy. Virgin Islands via WIVI on 970 is possible, but tough! St. Lucia, with Radio Caribbean is easy on 840; it has been consistent around 0030. A few more to search for are Chile on 1060, Peru on 854 and Uruguay (CX14 El Espectador 810 and CX16 Radio Carve 850). These are the best bets of a quite wide range of stations which should make an appearance in the next few weeks.

According to my files, about fifty readers asked for details of my medium wave loop aerial. I hope that by now you have all built them up and are getting results. I look forward to hearing from you all on what has been achieved!

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1µF	350 volt	8µF	3 volt	64µF	2·5 volt
1·25µF	16 volt	8µF	6 volt	64µF	9 volt
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2µF	3 volt	10µF	6 volt	64µF	16 volt
2µF	9 volt	10µF	10 volt	64µF	40 volt
2µF	10 volt	10µF	12 volt	100µF	3 volt
2µF	15 volt	10µF	25 volt	100µF	6 volt
2µF	70 volt	12·5µF	4 volt	100µF	10 volt
2µF	150 volt	12·5µF	40 volt	100µF	12 volt
2·5µF	16 volt	16µF	16 volt	100µF	15 volt
2·5µF	25 volt	16µF	30 volt	150µF	12 volt
3µF	3 volt	16µF	150 volt	150µF	25 volt
3µF	12 volt	20µF	3 volt	200µF	3 volt
3µF	25 volt	20µF	6 volt	200µF	4 volt
3·2µF	6 volt	20µF	9 volt	200µF	16 volt
3·2µF	6·4 volt	20µF	15 volt	250µF	2·5 volt
3·2µF	40 volt	25µF	6 volt	250µF	9 volt
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4µF	4 volt	25µF	25 volt	320µF	2·5 volt
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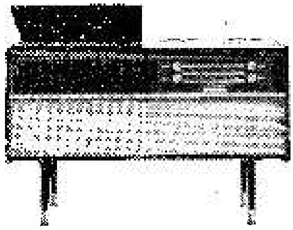

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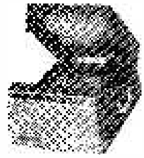

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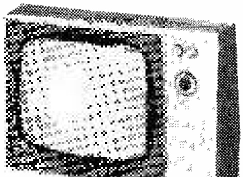

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ADD-ON 500 MW AMPLIFIER

BY MIKE FISHER

MANY small transistor radios, record players, etc., give only a very limited maximum undistorted output, frequently in the order of a mere 60mW or less. The quality of reproduction from these small sets is frequently very poor, being due almost entirely to the use of very small built in speakers.

A satisfactory way of overcoming these problems is to feed the output of the unit into an external amplifier and speaker assembly, and in this way good quality at a reasonable volume level can be obtained from even the cheapest of sets. The unit to be described is designed for just this purpose, and will push up to 500mW or more into a 3 ohm speaker. The complete amplifier uses three transistors, measures 2½in. x 2¼in. x 1in., and may thus be built into a very compact add-on unit complete with speaker or, in certain cases, may even be built into existing equipment. For ease of construction the unit is assembled on a piece of Veroboard panel, thus retaining all of the advantages of a printed circuit layout while at the same time involving none of the difficulties of marking out, etching, etc., which are involved in normal printed circuit practice.

The Circuit: How It Works

The circuit of the unit is shown in Fig. 1, the design is exceptionally simple. The input is applied directly to VR1, a 10kΩ variable resistor which acts as the volume control. The signal is passed on from the volume control, via C1, to the base of

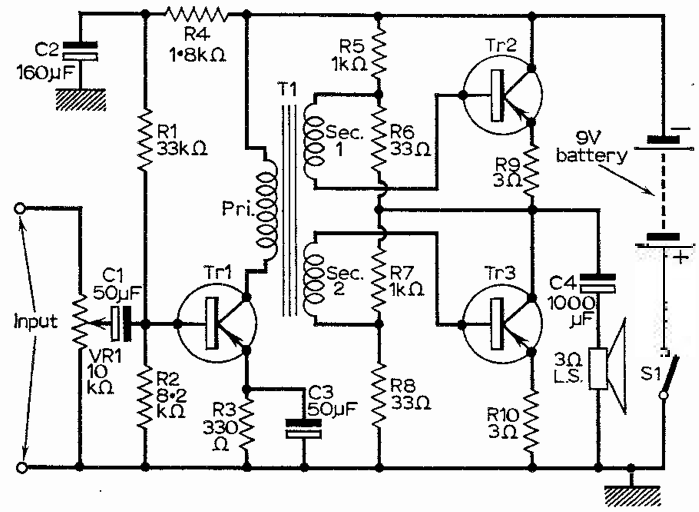

Fig. 1: Theoretical circuit diagram of the amplifier.

Tr1, which is connected as a common emitter amplifier with the primary of T1 as its collector load. R1 and R2 act as the base-bias voltage divider network of Tr1, and R3 is the emitter bias resistor, decoupled by C3 to give d.c. negative feedback over the stage, ensuring good thermal stability. To prevent a.c. instability, the base-bias network of Tr1 is decoupled from the rest of the circuit by R4—C2.

Test Point	Tr1	Tr2	Tr3
Collector	≃8·8	9·0	4·3–4·6
Base	1·0	4·4	0·15
Emitter	0·9	4·3–4·6	≃0·03

Typical test voltages using a 9-volt supply. Nominal current with input shorted=8·5mA. Voltages measured with a 20,000Ω/V meter on the 10 volt range.

Transformer T1 acts as the phase splitter for driving the two output transistors, Tr2 and Tr3, the secondary of the transformer being split into two equal windings which are connected in anti-phase. For practical purposes it can be considered that the voltage divider chain R5 to R8 consists of two sections of equal value, i.e., R5 and R6 form the upper section, and R7 and R8 make up the lower section, so that the junction of these two sections is at approximately half of the negative supply rail potential. Thus, each of the two output transistors can be considered as an independent amplifier operating from its own power supply equal to half the full negative rail voltage. Transistor Tr2 is wired as an emitter follower, with R5 and R6 as its base-bias network. The small emitter resistor, R9, is used for thermal stabilisation, and can be ignored, the true emitter load being the external speaker. This emitter follower gives unity voltage gain, and its output, taken from the emitter, is in phase with the input to its base. When an input signal is applied to the base of Tr2 via the secondary of T1, the transistor will conduct on negative half cycles only, and the output signal, of the same phase and form as the input, appears at low impedance at the emitter and is fed to the external speaker. When positive input signals arrive, the emitter-base junction of Tr2 is reverse biased and the transistor is cut off. Tr3, on the other hand, is wired as a common emitter amplifier with 100 per cent. voltage negative feedback, thus giving unity voltage gain but with 180° phase shift between input and output, the output being taken from Tr3 collector. This transistor is also driven on by negative signals and cut off by positive ones, but the two windings of T1 are so arranged that when Tr2 is driven on, Tr3 is driven off; consequently, the outputs from Tr2 emitter and Tr3 collecter complement each other, with the result that the two output transistors operate as a single-ended class-B push-pull amplifier.

The two small resistors, R6 and R8, in the base-bias networks of the output transistors, give a small amount of forward bias to these transistors, so that they conduct even when no input signal is applied. These no-signal currents are kept as small as possible, but must be large enough to prevent any appreciable degree of cross-over distortion. On the prototype, the total no-signal current of the unit was measured as 8·5mA.

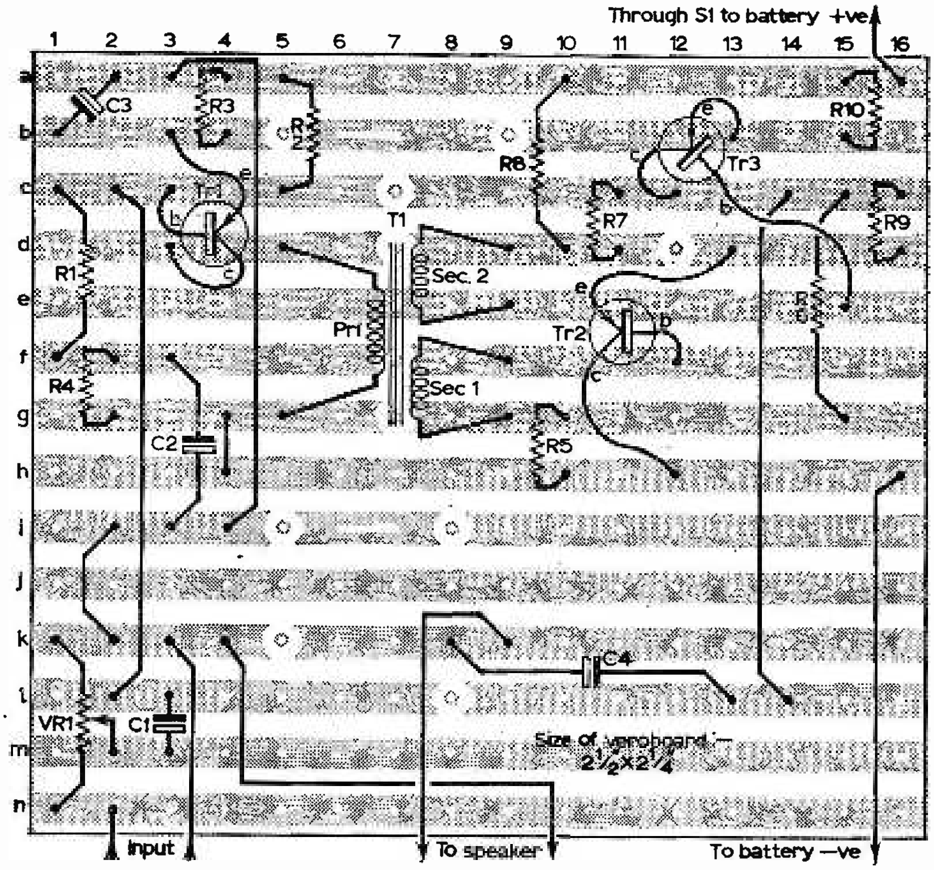

Fig. 2: Wiring diagram of the Veroboard.

The output of the unit is fed to the external speaker via C4. It should be noted that the speaker plays no active part in the operation of the unit, and that no damage results even if the speaker is disconnected. Because of this, the amplifier is suitable for use with any value of speaker impedance, above a couple of ohms, although the maximum available output power will be reduced as speaker impedances are increased. The full 500mW of output power is available when feeding into a 3Ω speaker load.

Although the unit is specifically designed for operation from a 9 volt supply, the circuit can be easily modified to work from any supply in the range of 6 to 18 volts.

Building the Unit

The unit is wired up on a piece of Veroboard panel, cut from a standard sized sheet. Although the unit is quite small, the layout is not particularly "cramped", since all components are mounted vertically, and the novice can undertake construction with reasonable confidence.

Start construction by cutting the Veroboard panel to size, as shown in Fig. 2, and then break the copper strips where shown. Use a drill, pen-knife, or the special tool that is available for breaking the strips. Next, make the slots for holding the transformer; there are two of these slots, and they are made with the aid of a fret-saw fitted with a small metal cutting blade.

Start assembly of the unit by carefully positioning the transformer, T1, on the blank side of the board, as shown, and solder the leads and the two lugs to the copper strips on the other side. The leads are made of stiff wire, and will have to be bent slightly to fit into the correct holes; scrape the varnish off the leads and lugs before attempting to solder them in position. Carefully file and trim the mounting legs of VR1, reducing their width until they fit in the holes in the Veroboard, and then mount and solder the component in position. Finally, wire up the rest of the components on the panel taking care to mount the electrolytics with their polarities as shown; use insulated sleeving where necessary; use heat-shunts when soldering the transistors in place.

When complete, the unit can be tested by shorting the input terminals and, with no external speaker fitted, connecting a 9 volt supply and checking the test voltages and currents as shown in the table. If satisfactory, the unit can now be given a functional check by connecting the external speaker and feeding a signal into the units input. The quality of reproduction should be good up to approximately 500mW r.m.s., with negligible cross over distortion. Distortion will be heard above approximately 500mW, as the amplifier is over-driven. It will be noticed from the circuit diagram that no negative feedback loops are used from output to input; the quality of reproduction is considered to be sufficiently good to make this practice unnecessary.

Applications and Modifications

The unit is intended to be driven from the earphone jack of a small radio, etc., with which it is used; in such cases, the signal at the output jack is usually isolated from d.c. by either a blocking capacitor or transformer built into the radio, and the signal can thus be fed directly to VR1. As a safety precaution the input can be "double isolated" to d.c. by wiring a 50μF electrolytic between the top end of VR1 and the input terminal, the positive

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De-luxe pre-amp readily built and ideal for two Z.12s **£9.19.6**

PZ.3

Mains Power Unit **79/6**

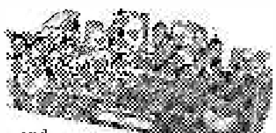
PEAK SOUND SA.8-8

14 transistor integrated stereo pre-amp and amplifier giving 17 watts output into two 5 ohm speakers. A fascinating kit to build, crammed with original features including "Shadow Template" and supply of Cir-kit. Complete down to wire and solder. With front panel, transistors and instructions. **£12.19.6**
Mains power supply unit for SA.8-8 75/-

TUNING UNITS

6 VALVE A.M./F.M. TUNER UNIT

In Kit Form with or without Power Pack



Med. 190 m., 550 m., V.H.F.—86 Mc/s-103 Mc/s., 6 valves and metal rectifier. Self - contained power unit. Magic-eye, 3 push-button controls, on/off, Med., V.H.F. Diodes and high output sockets with gain control. Illuminated 2-colour perspex dial 11½in. x 4 in. chassis size 11½in. x 4in. x 5¾in. Strongly recommended for use with Mullard amplifiers. For A.C. mains 200/250 v. **Unbeatable value.** Complete kit, inc. Power Pack as illustrated, **11 gns.** Carr. 7/6. Ditto less Power Pack, **10 gns.** Carr. 7/6. Circuit and Construction details, **4/6.** Free with kit.

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Kit and assembly instructions complete with Mullard specified inductors Type WF2949 and WF2951.
£4.19.6 with coils pre-aligned **£5.5.0**
Packing and postage either model 2/6.

MULLARD FM DECODER COILS

Designed and made by Mullard, these inductors are as used in T.R.S. Decoder above. TYPE WF2949 and WF2951, each **25/-**. Per pair **49/6.** Post free.

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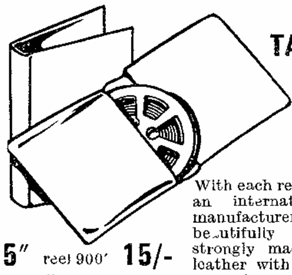

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side of the capacitor being connected to VR1. If the amplifier is to be built into a small cabinet complete with speaker, VR1 may be replaced by a front panel mounted fully variable component of the same value; this component should preferably be complete with a ganged on/off switch.

The unit may be driven from any supply in the range of 6 to 18 volts, but in such cases the values of R6 and R8 will have to be adjusted to bring the total no signal currents of the amplifier within the approximate range of 8 to 12mA, the precise current value being the minimum that will give satisfactory operation without appreciable cross-over distortion. As the operating voltage is increased, the maximum available output level will rise, and it may be necessary to use heat sinks on the two output transistors; the output transistors may become warm, but should not be allowed to become hot when driven at full output level for appreciable periods of time.

The completed amplifier panel can be mounted to a chassis, etc., by drilling two small holes in the panel to clear 6BA screws, which are pushed through the Veroboard from the blank side and bolted to the chassis, using small rubber grommets as spacers/insulators. If this modification is made, make sure that the screws do not short out any of the components, or the holes break any of the copper strips in places where the circuit operation will be effected.

Low Impedance Preamplifiers

The sensitivity of the amplifier can be increased by incorporating a simple preamplifier into the design. The precise form of the preamplifier will depend on individual requirements, and four alternative types are shown in Figs. 3a to 3d.

Less than 100Ω

If the input is to be fed from a very low impedance source, less than a hundred or so ohms, the preamplifier shown in Fig. 3a should be used. Here, Tr4 is wired as a grounded base amplifier, with the input fed via C5 to the emitter. The output of the grounded base amplifier is taken from R11, the Tr4 collector load. The input impedance of the main amplifier is very low, in the order of a few hundred ohms, and this impedance is effectively in parallel with the output impedance of the preceding stage, so that, if the output of Tr4 were fed directly to the main amplifier, the effective value of R11 would be greatly reduced and very little extra gain would be available. In Fig. 3a this snag is overcome by interposing emitter follower Tr5 between the output of Tr4 and the main amplifier, this emitter follower acting as a buffer and making considerable extra gain available. The final output of the preamplifier is taken from Tr5 emitter and fed, via C7, to the input of the main amplifier.

1000Ω Impedance

If the amplifier is to be fed from a medium impedance source, in the range of 1000 ohms or so, Fig. 3b should be used. Here, Tr4 is wired as a conventional common emitter amplifier, with the input signal fed to Tr4 base via C5. R11 and R12 are the base-bias resistors and R14 decoupled by C6 provides emitter bias, and R13 is the main

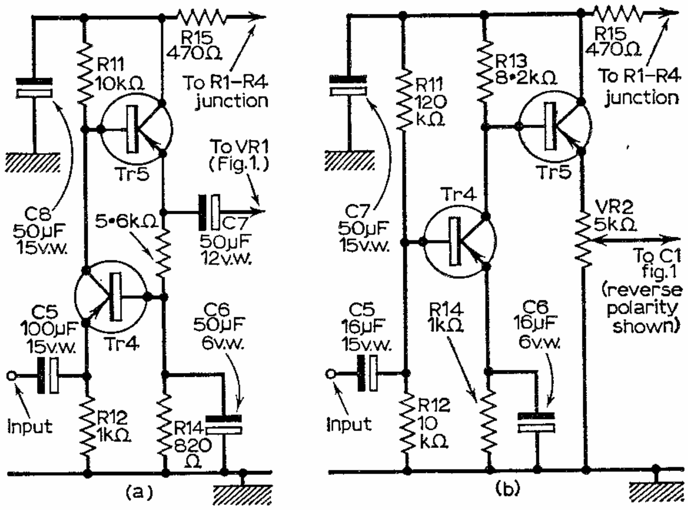
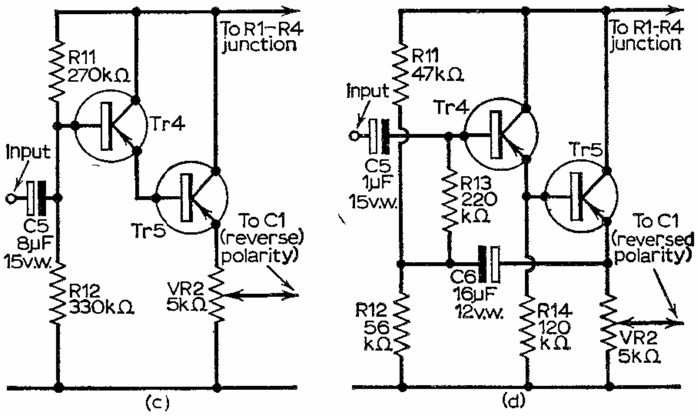


Fig. 3 (a): Preamp for use with low impedance input.
Fig. 3 (b): Circuitry for medium impedance inputs.
Fig. 3 (c): Super-alpha configuration for high impedance.
Fig. 3 (d): Very high input impedance preamp.



collector load of Tr4. An emitter follower, Tr5, is again used as a buffer between Tr4 and the main amplifier, but in this case variable resistor VR2 is used as the emitter load. The output of this stage is taken from the slider of VR2 and fed directly to C1 of Fig. 1. Note that in this case VR1 of Fig. 1 should be omitted from the circuit and the polarity of C1 should be reversed. In the cases of the two preamplifiers so far considered, decoupling networks R15—C7 or C8 are inserted in the negative supply lines to prevent instability.

High Impedance Preamps

If the amplifier is to be driven from a high source impedance, the input signal will usually be of reasonable amplitude, and will not require additional voltage amplification, but will need to have its impedance matched to the low input impedance of the main amplifier without any significant loss of signal strength. In this case, one of the preamplifiers shown in Figs. 3c and 3d should be used.

Up to 100kΩ

If the source impedance is in the order of 100kΩ or less, the circuit shown in Fig. 3c should be used. Here, transistors Tr4 and Tr5 are compound connected in the Super-Alpha or Darlington configuration, and may be regarded as a single transistor with a current gain equal to the product of the two individual transistor gains. This compound

★ components list

Resistors:

R1	33kΩ	carbon ½ Watt 10%
R2	8·2kΩ	
R3	330Ω	
R4	1·8kΩ	
R5	1kΩ	
R6	33Ω	
R7	1kΩ	
R8	33Ω	
R9	3Ω	
R10	3Ω	
VR1	10kΩ sub-min pre-set skeleton type	

Capacitors:

C1	50µF	15V sub-min electrolytic
C2	50µF	
C3	160µF	
C4	1000µF	

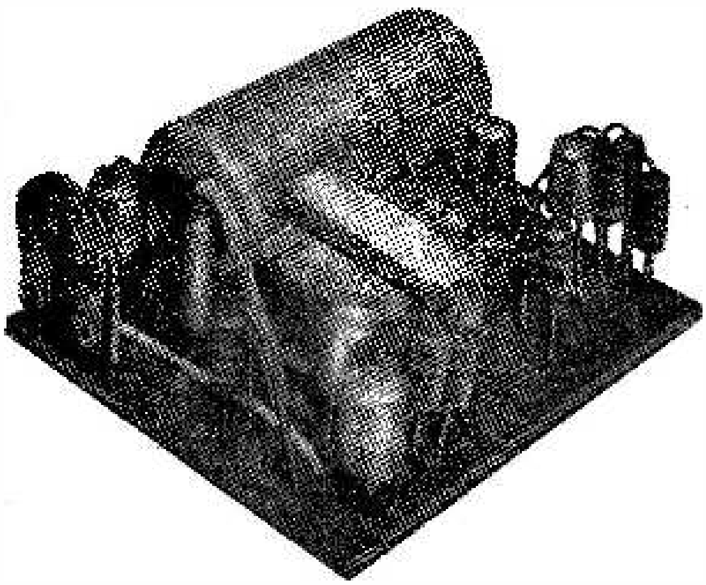
Transistors:

Tr1	OC75
Tr2	OC81
Tr3	OC81

Transformer:

T1	Radio spares type TT3 Ratio 3·6 : 1 + 1.

Miscellaneous:
Veroboard, wire, sleeving, 9V battery, 3Ω speaker, solder, etc.



General view of the completed main amplifier.

"transistor" is wired as an emitter follower, with R11 and R12 providing base-bias and VR2 as the main emitter load. The input signal to this circuit is applied to the base of Tr4 via C5, and the output is taken from the slider of VR2 and fed directly to C1 of Fig. 1. The input impedance of this preamplifier is in the order of 120kΩ when the unit is connected up to the main amplifier.

1MΩ and higher

If the source impedance of the input signal is very high, in the order of 1MΩ or so, as in the case of a crystal microphone, etc., the preamplifier shown in Fig 3d should be used. Here, if R13, R14 and C6 are ignored, the circuit can be seen to be similar to that of Fig 3c. In the case of 3c, however, the input impedance is limited by the shunting effects of the base-bias resistors, R11 and R12. In Fig 3d these limitations are overcome by interposing an isolating resistor, R13, between the junction of R11 and R12 and the base of Tr4. The output signal, taken from the emitter of Tr5, is of the same form and phase as the input, which is applied directly to Tr4 base, and a part of this output is taken from the Tr5 emitter and fed to the R11-R12 junction, so that, when an input signal is applied, similar signals appear at both ends of R13 and very little a.c. current thus flows in this resistor, which thus appears to a.c. as a very high impedance, in the order of a couple of Megohms, in spite of the fact that its real value is only 220Ω. A very high input impedance to Tr4 base is thus obtained. This technique of artificially increasing the apparent value of a resistance is known as Bootstrapping, and it may be used to give effective input impedances of up to several hundred Megohms using normal germanium transistors.

Note that in the cases of the preamplifiers shown in Figs 3c and 3d the outputs are fed directly to C1 of Fig 1, which should have its polarity reversed, and that VR1 should be omitted from the circuit. Also note that additional decoupling networks are not required in the negative supply lines. ■

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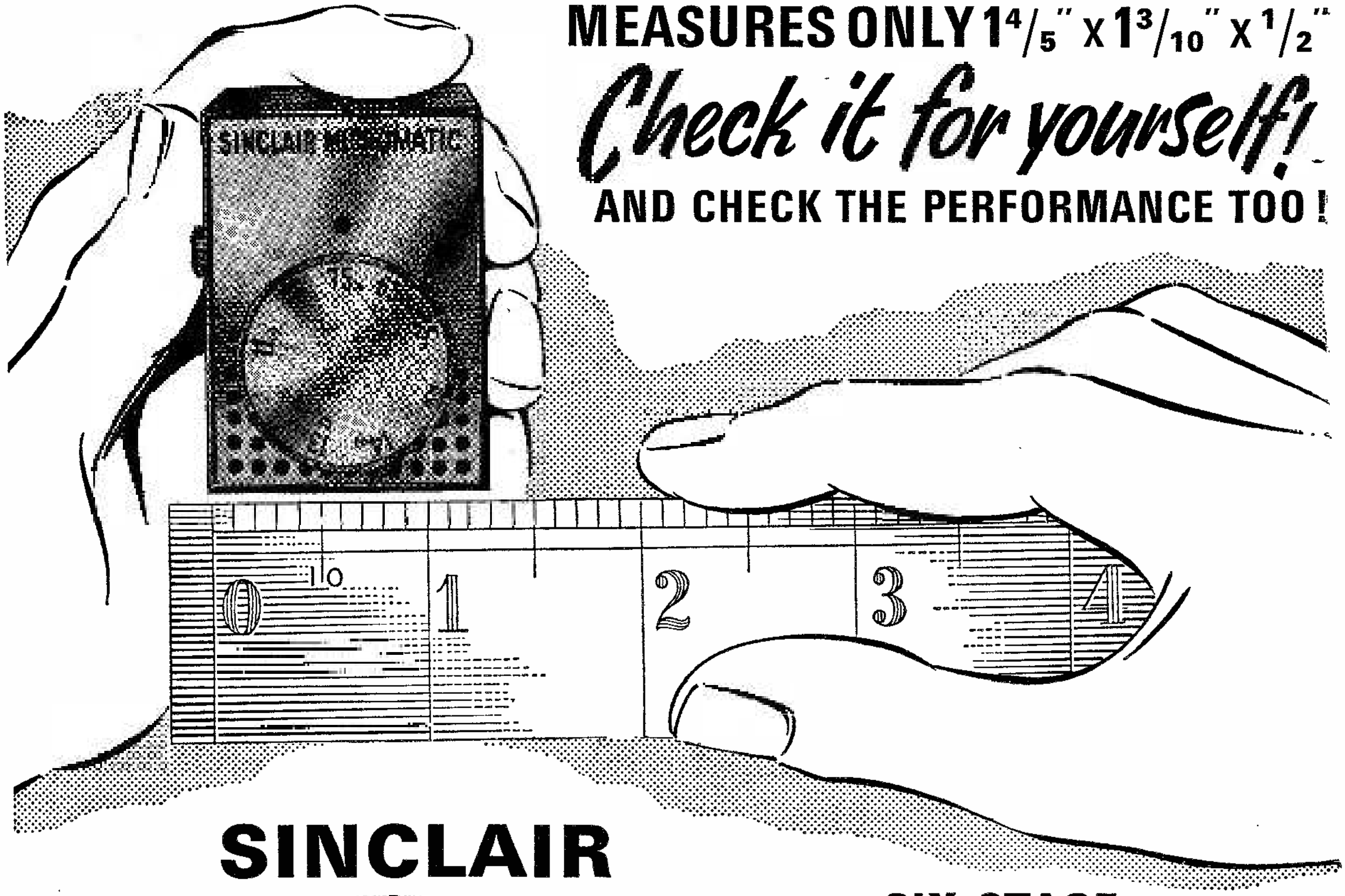

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In neat plastic case with aluminium front panel and calibrated aluminium tuning dial. Two stages of powerful R.F. amplification are followed by a double diode detector from which the tuned signal passes to a high gain three stage audio amplifier. Automatic Gain control counteracts fading from distant stations. The set is powered by two Mallory ZM.312 Cells obtainable anywhere for 1/7 each and giving approx. 70 hrs. working life. Inserting the earpiece plug switches the set on.

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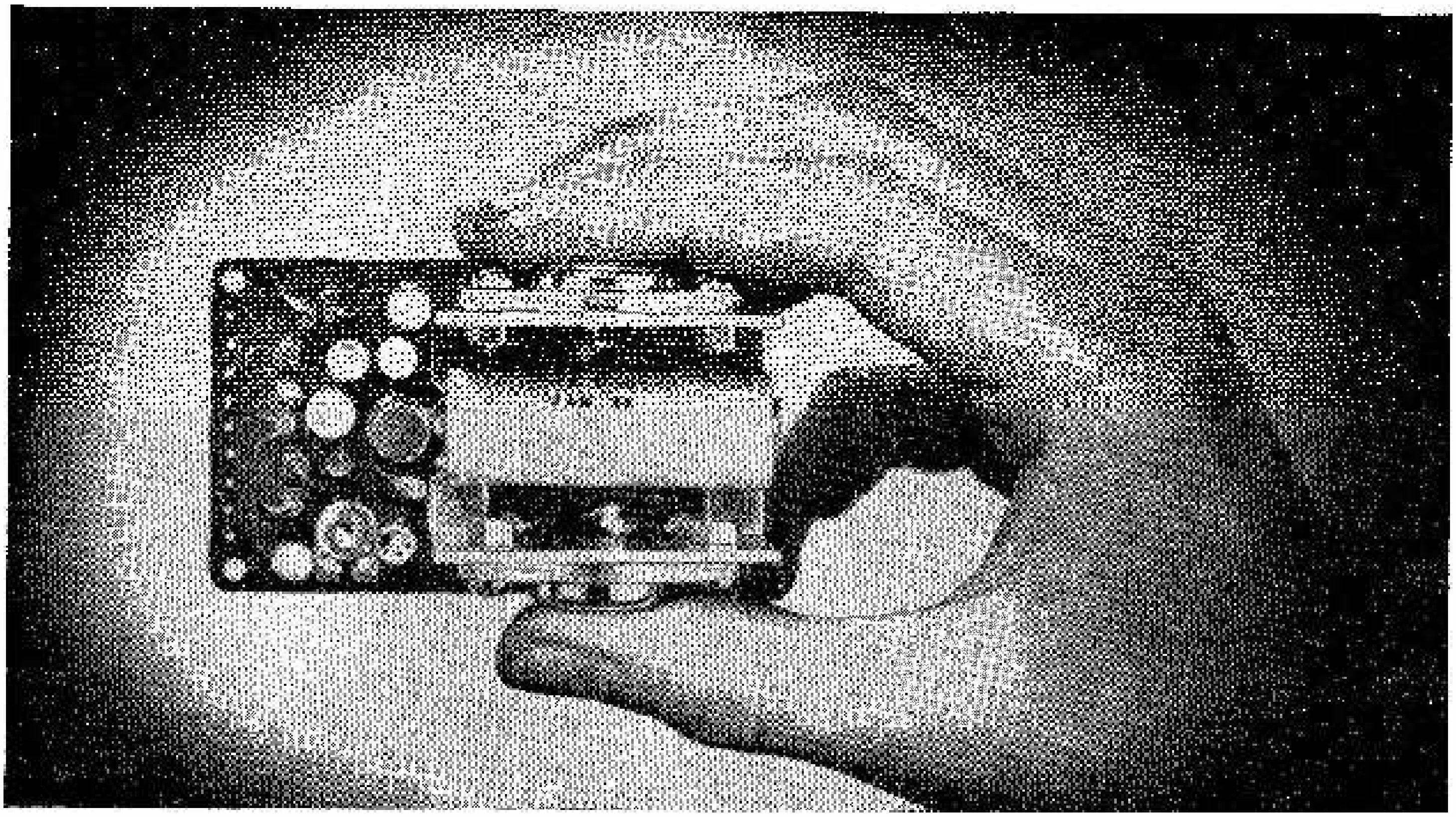

Z.12 - THE WORLD'S MOST REMARKABLE AMPLIFIER

for size

The Z.12 uses eight transistors measures 3in. x 1¾in. x 1½in. and weighs 3 ounces.

for power

A 12 watt R.M.S. continuous sine wave output (24w. peak) is obtainable from the Z.12. Music Power—15 watts (30w. peak). It can be used with loudspeakers from 3 to 15 ohm impedances. Two 3 ohm speakers may be used in parallel.

for versatility

Designed essentially for use as a high fidelity unit the Z.12 can be used equally well with radio tuners such as the Sinclair FM, as a car radio, in an electric guitar system, for P.A. or intercom, in the lab., etc., etc. It will operate from 6 to 20V., D.C., and can be run ideally from a car battery.

for reliability

Your Z.12 reaches you assembled, bench tested and guaranteed. The instructions supplied make installation simple; full details are included for wiring up control circuits.

for value

Built tested and guaranteed the Z.12 costs only

89/6

PZ.3 Mains Power Unit **79/6**

THE SINCLAIR Z.12 combined 12 watt amplifier and pre-amp is now the accepted standard for high fidelity units for constructors. It has ultralinear class B output with an input sensitivity of 2mV into 2K ohms. Frequency response—15-50,000c/s ±1dB. Signal to noise ratio is better than 60dB. This brilliantly versatile amplifier comes to you ready built, tested and guaranteed, ready for use, and complete with comprehensive instructions manual for matching tone control circuits in mono and stereo (two Z.12s are required for the latter).

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"I have recently bought a Z.12 and have been amazed at the power output from such a small unit. I use it for an electric guitar system and find that for small halls it is quite powerful enough."

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C.R.R., St. Vincent, West Indies.

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J.S.H.S., London, W.2.

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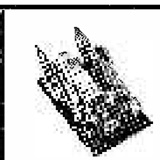

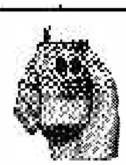

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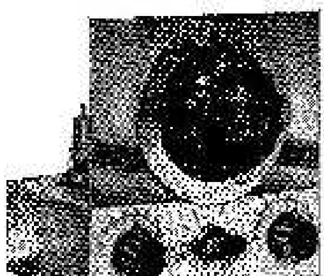

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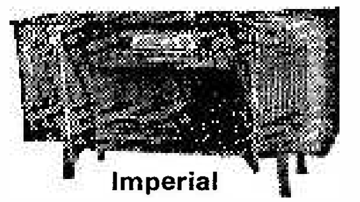

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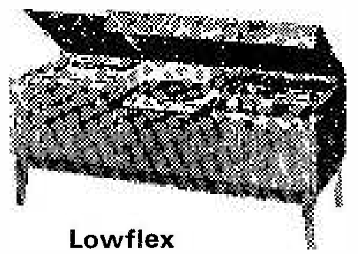

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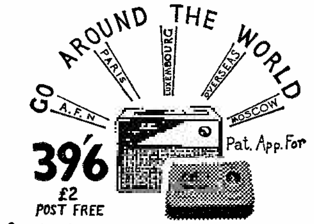

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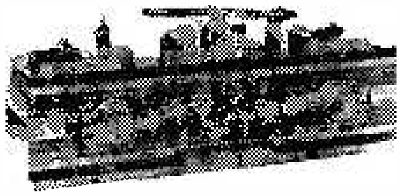

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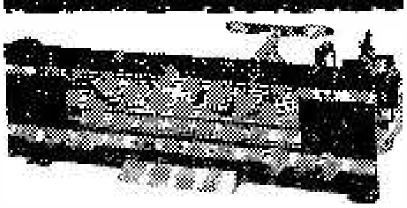

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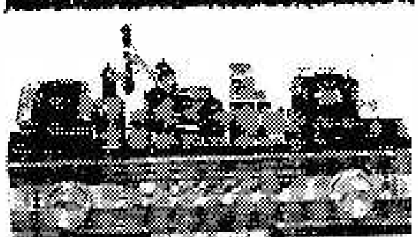

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19 Sets in fair condition as above and also removed is the meter and Relay, **10/-.** Carriage 10/-.

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Ex RAF Wave Meter. Type W1649. All complete with Slow Motion drive and six valves. Housed in wooden box. Used **17/6.** New **30/-** plus carriage B.R.S. 10/-.

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Ex. Equipment, 3 months' guarantee.
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EB91	**9d.**	PY82	**1/6**	U301	**5/-**
EBF80	**3/-**	PL81	**4/-**	U191	**5/-**
ECC81	**3/-**	PL36	**5/-**	U281	**5/-**
ECC82	**3/-**	PY33	**5/-**	U282	**5/-**
ECC83	**4/-**	6B8	**1/6**	U25	**5/-**
EY86	**5/-**	6F1	**1/-**	ARP12	**1/6**
EF50	**1/-**	6F14	**5/-**	EL38	**5/-**
6K25	**5/-**	10C2	**5/-**	5U49	**4/-**
6U4	**5/-**	10P13	**2/6**	6K7	**1/9**
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KT36	**5/-**	20D1	**3/-**	185BT	**8/6**
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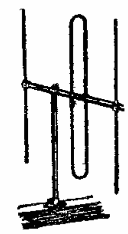

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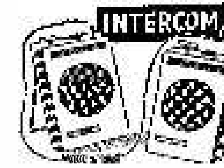

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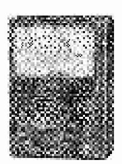

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The following blueprints are available from stock. **Descriptive text is not available** *but the date of issue is shown for each blueprint. Send, preferably, a postal order to cover cost of the blueprint (stamps over 6d. unacceptable) to Blueprint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

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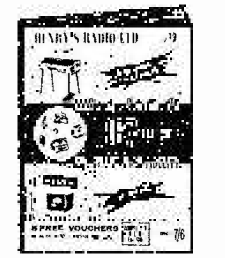

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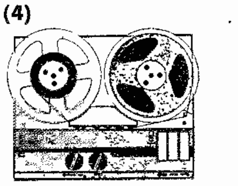

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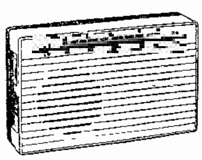

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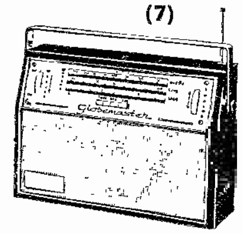

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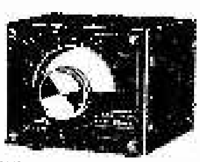

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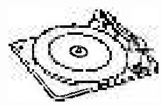

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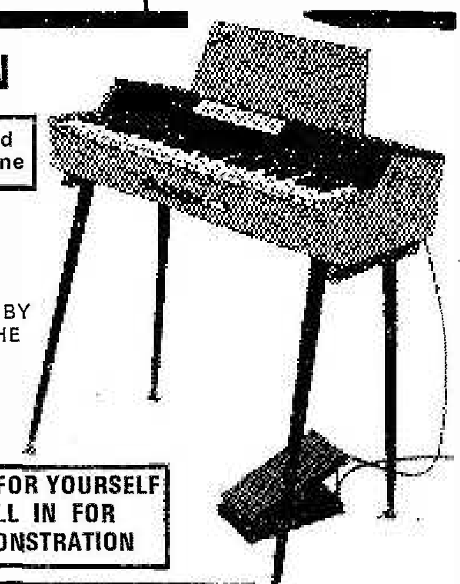

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