PRACTICAL WIRELESS

JUNE
1966

2/6

FREE INSIDE!
24 PAGE POCKET GUIDE TO
TRANSISTOR CIRCUITS

SUB MINIATURE 300mW transformerless AMPLIFIER

LASKY'S RADIO

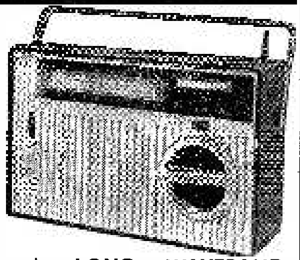
FOR THE FINEST VALUE TO HOME CONSTRUCTORS

We consider our construction parcels to be the finest value on the home constructor market. If on receipt you feel not competent to build the set, you may return it as received within 7 days when the sum paid will be refunded less postage.

TRANSISTOR PORTABLES

THE SKYROVER RANGE

7 transistor and 2 diode superhet portables—covering full med. plus 6 SW Bands.



The SKYROVER Mk. III.

(Illustrated). Now supplied with redesigned plastic cabinet in black, grey and chrome with edgewise controls.

Controls: Waveband Selector. Volume Control with on/off Switch, Tuning Control. In plastic cabinet, size 10 x 6½ x 3½in. with metal trim and carrying handle.

Can now be built for **£8 . 19 . 6** Post 5/- extra

H.P. Terms: **45/-** deposit and 11 monthly payments of **13/9**. Total H.P.P., **£9.16.3.**

THE SKYROVER De Luxe

Tone Circuit is incorporated, with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet, size 11½ x 6½ x 3in. covered with a washable material, with plastic trim and carrying handle. Also car aerial socket fitted.

Can now be built for **£10.19.6** Post 5/- extra

H.P. Terms: **55/-** deposit and 11 monthly payments of **16/11.** Total H.P.P., **£12.1.1.**

★ LONG WAVEBAND COVERAGE IS NOW AVAILABLE 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 both receivers that have already been constructed.

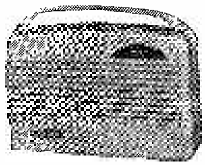
Data for each receiver: 2/6 extra: Refunded if you purchase the parcel. **Four U2** batteries 3/4 extra. All components available separately.

REALISTIC SEVEN

Fully tunable long and medium bands. Uses 7 Mullard Transistors; plus Diode OA70.

STAR features:

● 7 Transistor Superhet. ● 350 Milliwatt output 4in. high flux speaker. ● All components mounted on a single printed circuit board. Size 5½ x 5½in. in one complete assembly. ● Plastic cabinet, with carrying handle, size 7 x 10 x 3½in., in blue/grey. ● Easy to read dial. ● External socket for car aerial. ● I.F.-frequency 470 Kc/s. ● Ferrite rod internal aerial. ● Operates from PP9 or similar battery. ● Full comprehensive data supplied with each Receiver. ● All coils and I.F.s, etc., fully wound ready for immediate assembly. An outstanding Receiver.



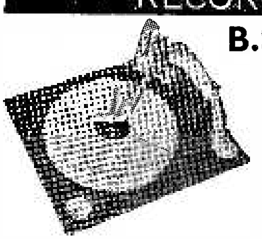
Can be built for **£5 . 19 . 6**
P. & P. 4/6

REALISTIC SEVEN De Luxe

With the same electrical specification as standard model—PLUS A SUPERIOR WOOD CABINET IN CONTEMPORARY STYLING covered in attractive washable material with super-chrome trim and carrying handle. Also a full vision circular dial, externally mounted to further enhance the pleasant styling. **ONLY £1 EXTRA.**

Both models: Battery **3/9** extra. **(All components available separately). Data and instructions separately, 2/6, refunded if you purchase parcel.**

RECORD PLAYERS



B.S.R. 4-Speed Autochangers

BRAND NEW AT LOWEST EVER PRICES

Brand new and fully guaranteed—complete with cartridge and stylus.

UA14 4 speed mains model	£4. 9.6
UA16 4 speed mains model	£4.19.6
UA16 9v. battery model	£5.19.6
UA20 4 speed mains model	£5.19.6

Add 5/- carriage and packing on each.

GARRARD AUTOCHANGERS

Auto-Slim Mono	£4 19 6			AT60 less cartridge	£10 19 6		
AT6 Mono	£8 19 6			A70 less cartridge	£19 19 0		
AT6 Stereo	£9 9 0			A50 less cartridge	£9 14 6		
3000LM with stereo cartridge	£8 8 0			A1000 with GC8 cartridge	£6 6 0		
SP25 Mono	£9 19 6			A2000 with GC8 cartridge	£7 7 0		
SP25 Stereo	£10 19 6			Postage on all above 5/-			

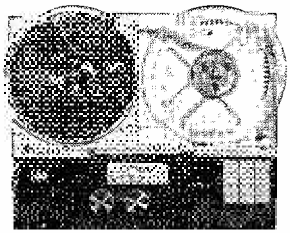
SPECIAL OFFER—GARRARD AT5 AUTOCHANGERS

4 speed mains model—brand new and fully guaranteed

LASKY'S PRICE with Mono Crystal Cartridge £5 19 6
with Stereo Cartridge ....£6 9 6 Post 5/-

TAPE RECORDERS

MAGNAVOX-COLLARO 363 TAPE DECKS



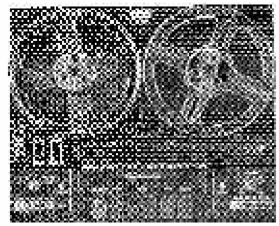
The very latest 3 speed model—1⅞, 3¾, 7½ ips, available with either ½ track or ¼ track head. Features include: pause control; digital counter; fast forward and rewind; new 4 pole fully screened induction motor; interlocking keys. Size of top plate 13½ x 11in. x 5¼in. deep below unit plate. For 200/250v. A.C. mains, 50 cps operation New, unused and fully guaranteed.

Lasky's Price ½ track model **£10.10.0**

Lasky's Price ¼ track model **£13.9.6**

Carriage and Packing 7/6 extra.

JUST ARRIVED—THE NEW GARRARD STEREO DECK



Now available from stock—superb specification: three ¼ track stereo/mono heads; 3 speeds—1⅞, 3¾, 7½ i.p.s.; takes 7in. spools; fast forward and rewind; tape position indicator; pause control; separate record, replay and erase heads—4 tracks; piano key controls interlocked for all functions; stop/start can be remotely controlled; auto, tape-end stop. Heavy duty motor, capacitor start and run, large dynamically balanced flywheel. Deck finished in grey plastic, size: 14½ x 12 x 6in., depth below plinth 4in. For 110v. 50 c.p.s. Mains operation. Auto-transformer for 200/250v. included free.

LASKY'S PRICE 29½ GNS. Carriage & Packing 10/6 extra

CONSTRUCTORS BARGAINS

TRANSISTORS

ALL BRAND NEW AND GUARANTEED

GET 81, GET 85, GET 86 **2/6;** 873A, 874P **3/6;** OC45 OC71,, OC81D **4/6;** OC 44, OC 70, OC 76, OC 81 **5/6;** (match pair **10/6**); AF 117, OC 75, OC 200 **6/6;** OC 42, OC 43, OC 73, OC 82D **7/6;** OC 201, OC 204 **15/-;** OC 205, OC 206 **19/6;** OC 28 **24/6.**

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by BRUSH CRYSTAL CO., Available from stock.

TO—01B 465 kc/s. ± 2 kc/s	TO—02D 470 kc/s. ± 1 kc/s.	**7/6 each**
TO—01D 470 kc/s. ± 2 kc/s.	TF—01B 465 kc/s. ± 2 kc/s.	**Post 6d.**
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SINCLAIR SUPER MINIATURE KITS

THE MICRO-6 miniature radio only 1 4/5 x 1 x 3/10 1½in.	£2 19 6
THE SLIMLINE 2-transistor pocket radio	£2 9 6
THE MICRO-FM (tuner/receiver)	£5 19 6
THE X-20 20 watt P.W.M. amplifier	£7 19 6
Available ready built, tested and guaranteed	£9 19 6
THE X-10 10 watt amplifier and pre-amp	£5 19 6
Available ready built, tested and guaranteed	£6 19 6
THE Z-12 12 watt amp. and pre-amp., fully built	£4 9 6

Write for details of package deals.

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INTERNATIONAL TAPE

Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft.	2 6	5¾in.	Long play, 1200ft. Acetate	12 6
3in.	Message tape, 225ft.	3 9	5¾in.	Standard play, 850ft. PVC	11 6
3in.	Message tape, 300ft.	7 6	5¾in.	Long play, 1200ft. Mylar	15 0
3¼in.	Triple play, 600ft. Mylar	15 0	5¾in.	Triple play, 2400ft. Mylar	45 0
4in.	Triple play, 900ft. Mylar	17 6	7in.	Standard play, 1200ft. Acet.	10 0
5in.	Double play, 1200ft. Mylar	15 0	7in.	Standard play, 1200ft. Mylar	12 6
5in.	Long play, 900ft. Acetate	10 0	7in.	Long play, 1800ft. Mylar	19 6
5in.	Standard play, 600ft. PVC	8 6	7in.	Double play, 2400ft. Mylar	25 0
5in.	Triple play, 1800ft. Mylar	35 0	7in.	Long play, 1800ft. Acetate	15 0
5¾in.	Double play, 1800ft. Mylar	22 6	7in.	Triple play, 3600ft. Mylar	58 6

P. & P. 1/- extra per reel. 4 reels 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 2½ x 1¼in. Circuit supplied.

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

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Only a few available. Complete with PC86 and PC88 valves. We regret no circuit or data is available. Knobs included.

LASKY'S PRICE **59/6** Post 2/6

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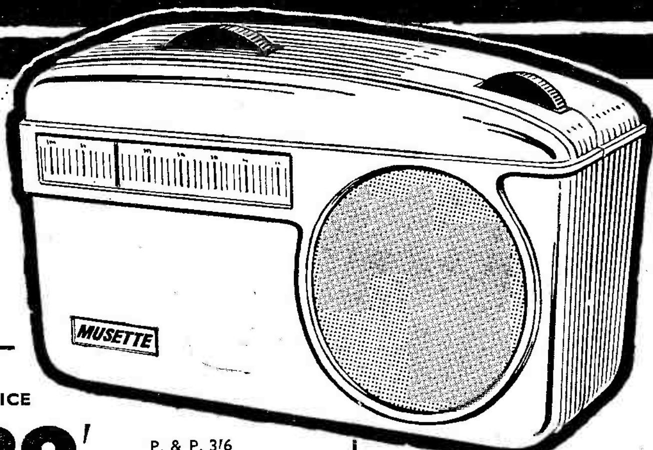
LASKY'S FOR SPEEDY MAIL ORDER SERVICE

MUSETTE 6 TRANSISTOR SUPERHET PORTABLE RADIO



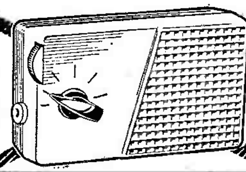
- $2\frac{1}{4}''$ Speaker.
- 6 Transistors Superhet Output 200mw.
- Plastic Cabinet in red, size $4\frac{3}{4}'' \times 3'' \times 1\frac{3}{8}''$ and gold speaker louvre.
- Horizontal Tuning Scale.
- Ferrite Rod Internal Aerial.
- IF 470 Kc.
- All components, Ferrite Rod and Tuning Assembly mounted on printed board.
- Operated from PP3 Battery.
- Full comprehensive instructions and point-to-point wiring diagram.
- Printed Circuit Board.
- Tunable over medium and long wave band. Car aerial and ear piece socket.

PRICE

39/6 P. & P. 3/6
Circuit diagram 2/6.
Free with parts.

INCLUDING CARRYING STRAP.

NEW TRANSISTORISED SIGNAL GENERATOR



Size $5\frac{1}{2}'' \times 3\frac{1}{4}'' \times 1\frac{1}{2}''$. For IF and RF alignment and AF output 700 c/s frequency coverage 460 Kc/s to 2 Mc/s in switched frequencies. Ideal for alignment to our Elegant Seven and Musette. Built and tested. **39/6** P. & P. 3/6

Elegant Seven Mk II

COMBINED PORTABLE *and* CAR RADIO

The Radio with the STAR features

★ 4in. Speaker.
★ 7-transistor superhet. Output 350mW.
★ Wooden cabinet, fitted handle with silver coloured fittings. Size $12\frac{1}{4} \times 8\frac{1}{2} \times 3\frac{1}{2}$in.
★ Horizontal tuning scale, size $11\frac{1}{4} \times 2\frac{5}{8}$in. in silver with black lettering.
★ All stations clearly marked.
★ Ferrite-rod internal aerial.
★ I.F. neutralisation on each stage 460 kc/s.
★ D.C. coupled output stage with separate A.C. negative feed back.
★ All components: ferrite rod and tuning assembly mounted on printed board.
★ Operated from PP9 battery.
★ Full comprehensive instructions and point-to-point wiring diagrams.
★ Printed circuit board, back printed with all component values.
★ Fully tunable over medium and long waveband.
★ Car aerial socket. Full after-sale service.

ONLY **£4.4.0**

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

POWER SUPPLY KIT

To purchasers of "Elegant Seven" parts, incorporating mains transformer, etc. A.C. mains 200-250v. Output 9v. 50mA. 7/6 extra.

ALL ENQUIRIES STAMPED ADDRESSED ENVELOPE

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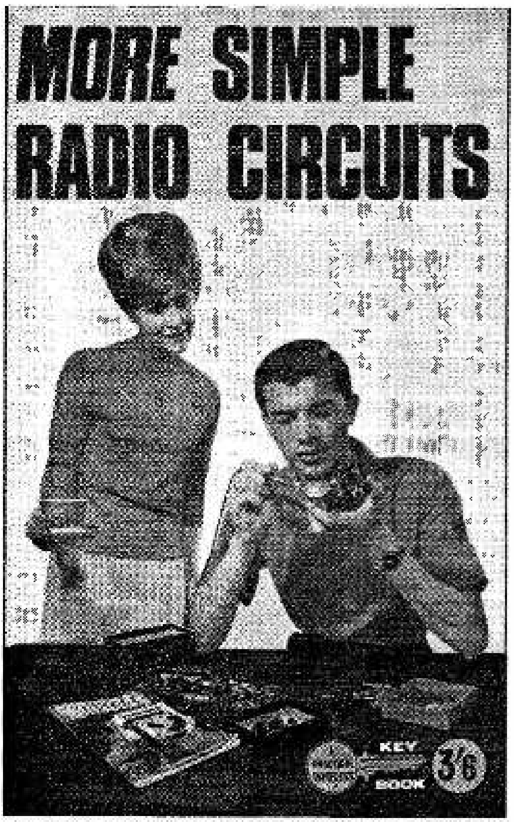

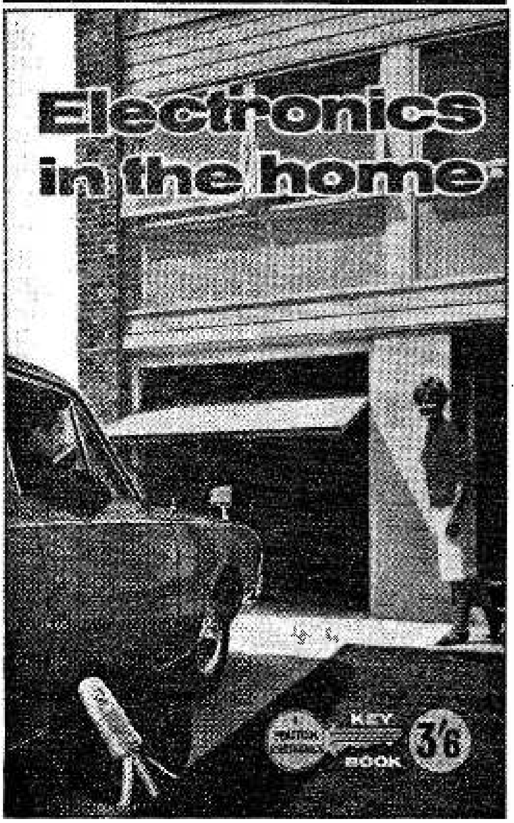

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A. T. Collins

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The popularity of electronics has increased considerably during the past few years and therefore this book has been produced for the constructor who wishes to open his garage doors by remote control, build his own intercom unit for the home, add sound to his projection of films and cutting out man-made interference on radio reception. These are a few of the many interesting chapters in the book. Contents: Unit for Remote Control - Recording Radio Receivers - Home Audio System - M.W. and L.W. Mast Head Pre-Amp - Home Intercom Unit - Variable Voltage Transformer - Electronic Timer - Mains Filter Unit - Extension Loudspeakers - 4W Amplifier for Home Films.

63 line illustrations. 96 pages.

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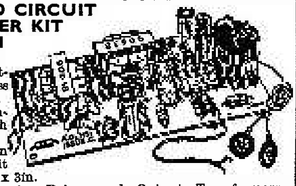
NEWNES

HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT
Type TAI

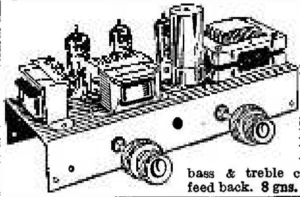


- Peak output in excess of 1½ watts.
- All standard British components.
- Built on printed circuit panel, size 6 x 3in.
- Generous size Driver and Output Transformers.
- Output transformer tapped for 3 ohm and 15 ohm speakers.
- Transistors (GET 114 or 81 Mullard OC81D and matched pair of OC81 o/p).
- 9 volt operation.
- Everything supplied, wire, battery clips, solder, etc.
- Comprehensive easy to follow instructions and circuit diagram 1/6 (Free with Kit). All parts sold separately.

SPECIAL PRICE 45/-. P. & P. 3/-. Also ready built and tested, **52/6.** P. & P. 3/-. A pair of TA1s are ideal for stereo.

STEREO AMPLIFIER

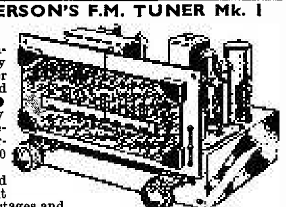
Incorporating 2 ECL82s and 1 EZ80, heavy duty, double wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.



ONLY **£4.19.6** P. & P. 6/6

Super De-luxe version with ECL86 valves. sep. bass & treble controls, full feed back. **8 gns.** P. & P. 6/6

HARVERSON'S F.M. TUNER Mk. I



- F.M. tuning head by famous maker
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- Permeability tuning
- Frequency coverage. 88-100 Mc/s
- Balanced diode output
- Two I.F. stages and discriminator.
- Attractive maroon and gold dial (7 x 3in. glass).
- Self powered, using a good quality mains transformer and valve rectifier.
- Valves used ECC85, two EF80s, and EZ80 (rectifier)
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- Size of completed tuner 8 x 6 x 5½in.
- All parts sold separately. Set of parts if purchased at one time **£5.19.6**, plus 8/6 P.P. and ins. Circuit diagram and instructions 1/6 post free.

Mark II Version as above but complete with magic eye, front panel and brackets, **£6.12.6.** P. & P. 8/6.
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SPECIAL PURCHASE! TURRET TUNERS

By famous maker. Brand new and unused. Complete with PCC84 and PCF80 valves 34-38 Mc/s IF. Biscuits for Channel 1 to 5 and 8 and 9. Circuit diagram supplied. ONLY **25/-** each. P. & P. 3/9.

GÖRLER F.M. TUNER HEAD

88-100 Mc/s 10.7 Mc/s I.F., **15/-**, plus 2/- P. & P. (ECC85 valve, **8/6** extra).

6 TRANSISTOR AND DIODE SUPERHET

A first-class 2 waveband transistor superhet. ● Printed circuit panel (size 8½ x 2½in.). ● 3 pre-aligned IF transformers. ● High-gain Ferrite Rod Aerial. ● All First-grade transistors. ● Car aerial winding. ● Push-pull output. ● All parts supplied with simple instructions **All parts sold separately.** Set of parts if purchased at one time ONLY **£4.5.0.** P. & P. 2/6 (Circuit diagram 2/-. Free with set of parts.)

35 OHM SPEAKERS

Suitable for use with above. 2in. Goodmans Ideal replacement for most pocket portables, **8/6;** 3½in. **12/6;** 7 x 4in., **21/-;** P. & P. 2/- per speaker.

Portable CABINET

Size approx. 9½ x 6¾ x 3½in. Suitable for above using. 3½in. speaker, **25/-,** P. & P. 2/6.

COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET

3 IF transformers one oscillator coil one driver transformer and wound Ferrite aerial (med. long and car aerial coupling), **32/6** complete post 2/-. 6 transistor printed circuit board to match **8/6.** Post 1/-. Circuit diagram 1/6 extra.

TWIN TELESCOPIC AERIAL. Comprising two 3-section heavily chromed rods. Closed 12in. each extending to 32in. Completely adjustable from vertical to horizontal. Supplied complete with universal mounting bracket, coax lead and plug. Suitable for F.M. or TV, **12/6.** P. & P. 2/-.

QUALITY RECORD PLAYER AMPLIFIER

A top-quality record player amplifier. This amplifier (which is used in a 29 gn. record player) employs heavy duty double wound mains transformer, ECC83, EL84, EZ80 valves. Separate Bass, Treble and Volume controls Complete with output transformer matched for 3 ohm speaker. Size 7in. w. x 2½in. d. x 5½in. h. Ready built and tested. **PRICE 69/6.** P. & P. 4/9.
ALSO AVAILABLE mounted on board with output transformer and 6in. speaker ready to fit into cabinet below. **PRICE 89/6.** P. & P. 5/9.

QUALITY PORTABLE R/P CABINET

Uncut motor board. Will take above amplifier and B.S.R. or GARRARD Autochanger or Single Record Player Unit. Size 18 x 14 x 8½in.
Price **£3.9.6.** Carr. 7/6.

4-SPEED PLAYER UNIT BARGAINS

All brand new in maker's original packing.

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GARRARD SP25 De Luxe **£12.10.6.** Carr. 5/6.
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AUTO CHANGERS

Latest B.S.R. UA25 Super slim **£6. 2.6**
GARRARD Autoslim (4 pole motor) plug-in hd. **£5.10.0**
GARRARD AT6...... **£9.10.0.** Carr. 6/6 on each.
All the above units are complete with t/o mono head and sapphire styli or can be supplied with compatible stereo head for 12/6 extra.

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RONETTE STEREO 105 CARTRIDGE. Stereo L.P./78 complete with two sapphires. Original list price **67/9.** Our price **24/-.** P. & P. 1/-.
ACOS GP67-1. Mono complete. List price **21/-.** Our price **13/6.** P. & P. 1/-.

BRAND NEW 3 OHM LOUDSPEAKERS

5in., **12/6;** 6½in., **15/-;** 8in., **21/-;** 10in., **25/-;** 12 in., **27/6;** (12in. 15 ohm. **30/-**). 10in. x 6in., **26/-.**
E.M.I. 13½ x 8in. with high flux ceramic magnet, **42/-** (15 ohm, **45/-**). P. & P. 5" 2/-, 6½" & 8" 2/6, 10" & 12" 3/6 per speaker.

BRAND NEW HEAVY DUTY 12in. SPEAKERS Response 45 c/s-13 Kc/s. 1½in. voice coil. Available in 3 or 15 ohms. Guaranteed full 15 watts British rating. Heavy cast aluminium frame. These are current production by world famous maker and as they are offered well below list price we are not permitted to disclose the name. LIMITED NUMBER ONLY. UNREPEATABLE at **89/6.** P. & P. 5/-. Also 25 watt Guitar Model available at **£5.5.0.** And 35 watt Guitar Model **£8.8.0.**

VYNAIR AND REXINE SPEAKER AND CABINET FABRICS.
Approx. 54in. wide. Usually **35/-** yard. OUR PRICE **13/6** per yard length. P. & P. 2/6 (min. one yd.) S.A.E. for samples.

MAINS TRANSFORMER For transistor power supplies. Tapped pri 200-250v. Sec. 40-0-40 at 1 amp (with electrostatic screen) and 6.3v at .5 amp for dial lamps etc. Drop thro mounting. Stack size 1¾" x 3¼" x 3¾" **27/6.** P. & P. 4/6.

SMOOTHING CONDENSER. Suitable for use with above 4000 mfd. 40v. size 1¾" dia. x 3½" high. **3/6** each. P. & P. 1/6 and 2800 mfd. 25v. 1¼" dia x 3" high **3/-.** P. & P. 1/-.

MATCHED PAIR OF 2½ WATT TRANSISTOR DRIVER AND OUTPUT TRANSFORMERS. Stack size 1¼ x 1½ x ⅞in. Output trans. tapped for 3 ohm and 15 ohm output. **10/-** pair plus 2/- P. & P.

7-10 watt OUTPUT TRANSFORMERS to match pair of ECL 86's in push-pull to 3 ohm output. ONLY **11/-.** P. & P. 2/6.

7-10 watt ULTRA LINEAR OUTPUT TRANSFORMERS to match pair of ECL 82's in push-pull to 3 ohm output. ONLY **15/-.** P. & P. 2/6.

BRAND NEW TRANSISTOR BARGAINS

GET 15 (Matched Pair) **15/-;** V15/10p, **10/-;** OC71 **5/-;** OC76 **6/-;** AF117 **7/6.**
Set of Mullard 6 transistors OC44, 2—OC45 OC81D matched pair OC81 **25/-,** ORP12 Cadmium Sulphide Cell **10/6.**

EDISWAN MAZDA

PXA101 **6/6;** XA103 **6/6.**
R.F.I. Pack: 1—PXA102 Mixer; 2—PXA101 I.F. Amp. (Equiv. OC44 and OC45) **10/6**
R.F. 2 Pack: 2—PXA101 I.F. 1—PXA102 Osc.1—PXA102 Mixer **12/6**
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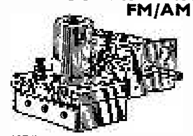
ALL TRANSISTORS POST FREE.

HEAVY DUTY NON-INDUCTIVE D/P MICRO SWITCH. Conservatively rated 10 amps at 250v. Standard one-hole fixing. Body size 1¾ x ⅞ x 1in. deep inc. terminals **3/-** each. P. & P. 1/- (6 or more post free).

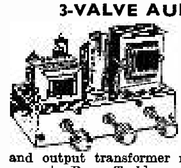
NEON A.C. MAINS INDICATOR. For panel mounting, cut out size 1½ x ⅞ x ⅞in. deep inc. terminal. White case with lens giving brighter light. For mains 200/250v. **2/6** each P.P. 6d. (6 or more post free).

ANOTHER HARVERSON SCOOP!
FM/AM TUNER HEAD



Beautifully designed and precision engineered by Dormer and Wadsworth Ltd. Supplied ready fitted with twin .0005 tuning condenser for AM connection. F M section covers 86-102 Mc/s. I.F. output 10.7 Mc/s. Complete with ECC85 (6L12) valve and full circuit diagram of tuner head. All prealigned FM and perfect. Another special bulk purchase enables us to offer these at **27/6** each. P. & P. 3/-. Order quickly! Limited number also available with precision geared 3:1 reduction drive, **30/-.** P. & P. 3/-.

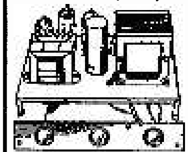
3-VALVE AUDIO AMPLIFIER MODEL HA34



Designed for Hi-Fi reproduction of records. A.C Mains operation. Ready built on plated heavy gauge metal chassis, size 7½in. w. x 4in. d. x 4¾in. h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls.
The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs, valves, etc., wired and tested for only **£4.5.0** P. & P. 6/-.

HSL 'FOUR' AMPLIFIER KIT

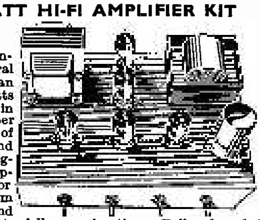
A.C. Mains 200/250v., 4 watt, using **ECC83, EL84, EZ80** valves.



- 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 7½in. 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



A stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram allow records and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86, and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts.) **All parts sold separately.** ONLY **£7.9.6.** P. & P. 8/6. Also available ready built and tested complete with std. input sockets, **£9.5.0.** P. & P. 8/6.
Carrying case for above **28/6.** P. & P. 7/6.

B.S.R. MONARDECK (Single speed) 3¾in. per sec., simple control, uses 5¾in. spools, **£6.15.0** plus 7/6 carr. and ins. (Tapes extra).

LATEST COLLARO MAGNAVOX 363 TAPE DECK DE LUXE. Three speeds, 2 track, takes up to 7in. spools. **10 gns.** Plus 7/6 Carr. & ins. on each (Tapes extra).

ACOS CRYSTAL MIKES. High imp. For desk or hand use. High sensitivity, **18/6.** P. & P. 1/6.
TSL CRYSTAL STICK MIKE. Listed at **45/-.** Our price. **18/6.** P. & P. 1/6.

PORTABLE TAPE RECORDER CASE

Beautifully made and expensively finished in dark grey heavy grade rexine. Satin Chrome metal grille front and chrome fittings. Speaker aperture 9" x 4". Overall size 15½" w. x 15" d. x 7½" h. Will take any standard tape deck or single record player. Limited number only. Worth at least £5. OUR PRICE **49/6.** P. & P. 5/-. Brand new and unused.

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PCF84	6/-
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PCL81	9/-
PCL82	7/-
PCL83	8/6
PCL84	7/-
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6SG7GT	5/-
6SFGT	5/6
6SH7	6/-
6SJ7	5/-
6SJ7G	6/6
6SK7	4/6
6SL7GT	5/6
6SN7	3/6
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7C6	7/-
7C7	6/-
7H7	7/3
7Q7	7/-
7V7	5/-
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12AX7	6/-
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12BA6	5/-
12BE6	7/-
12BH7	7/-
12C8	3/-
12H6	2/-
12J5GT	2/6
12J7GT	6/6
12K7GT	2/-
12K8M	10/-
12Q7GT	3/3
12SA7	7/-
12SC7	4/-
12SG7	3/-
12SH7	3/-
12SJ7	5/-
12SK7	5/-
12SN7GT	5/9
12SR7	5/-
12Y4	2/-
12L7	7/-
15D2	6/-
19E2	15/-
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19G7	5/-
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19M1	5/-
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25L6GT	5/-
25Y5	6/-
25Z4G	6/6
25Z5	7/6
25Z6GT	8/6
25D7	6/-
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30C15	9/6
30F5	8/6
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30P12	10/-
30P19	15/-
30PL1	8/-
3516GT	7/-
35T	17/6
35W4	5/-
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35Z4GT	6/-
35Z5GT	6/-
37	4/-
38	4/-
215SG	6/-
50L6GT	8/-
53A	7/6
57	6/-
58	6/-
59	6/-
75	5/6
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803	22/6
807	8/-
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832	15/-
843	5/-
866A	14/-
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2N1091	29/-

MANY OTHERS IN STOCK include Cathode Ray Tubes and Special Valves. All U.K. orders below £1, P. & P. 1/-; over £1, 2/-; over £3, P. & P. free. C.O.D. 2/6 extra. Overseas Postage extra at cost.

THERMAL PLUS MECHANICAL CIRCUIT BREAKER FOR A.C. & D.C. Current 1 amp. Protects against shorts (instantaneous cut out at approximately 8 amps.) and against overloads: 1.8 amp. 30 seconds, 2.1 amp. 15 seconds, 2.5 amp. 8 seconds. Delayed cut off may be adjusted to different currents and times. Separate pair of contacts to indicating device. Dimensions 3½ x 1⅝ x 7/16in. Price **12/6.** P. &P. 2/6.

"CONNECT AND FORGET, CANNOT OVERCHARGE" "ESSTRON" MARK I AUTOMATIC BATTERY CHARGER. Initial charging rate 6-7 amps. The charging rate automatically adjusts itself to the charge in the battery. Automatic current and voltage control. Patented application of magnetic amplification to battery charging. Indicator lights show battery fully charged, receiving charge incorrectly connected or faulty cells. Mains voltage 200/250 v. Built for 6 or 12 v. batteries. Measurements 7 x 5 x 5¼in. Weight 8¼lb. Price **£7.19.6.** P.P. 3/6.

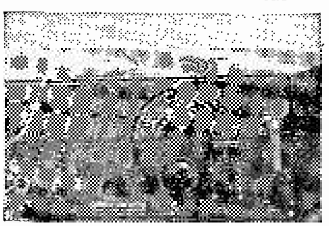
2 KW ULTRASONIC GENERATOR together with power supply unit for 200-250 v. A.C. Complete two chassis with interconnecting cables. Frequency 37 to 43 kc/s adjusted by fine control. Peak output 2 kw., average output 500 w. Completely new with valves and manual £65 carriage paid U.K. Large selection of mains and Heavy Duty L.F. TRANSFORMERS.

VARIOMETER for No. 19 sets, **17/6.** P. & P. 3/-.

MARCONI SIGNAL GENERATOR TYPE TF 801B/3/S. Frequency range 12-485 Mc/s. in five ranges. Directly calibrated frequency dial. Output waveform: C.W. sinewave A.M., pulse A.M. (from ext. source only). Internal modulation frequency 1,000 c/s. Output: a, normal—continuously variable directly calibrated from 0.1 μv.—0.5 v. b, high: up to 1 v. modulated or 2 v. unmodulated, output impedance 50 ohms. Fine frequency tuning control, carrier on/off switch, built-in crystal calibration for 2 Mc/s. and 10 Mc/s. Stabilised voltage supply. In excellent "as new" condition. Fully checked and guaranteed. **£115.** Carr. 30/-.

C.R. 100 RECEIVER. 60kc—420kc, 500kc—13mc. In 6 bands, 2 HF stages, 3 IF stages, AVC on both phone and CW. Excellent condition, correctly tuned and guaranteed, **£31.** Carr. 30/-.

WELL PROVEN RELIABLE COMMUNICATION RECEIVER P.C.R.3



(Made by Pye.) 3 bands, 1 medium wave, 2 120-43m, 3 43-13m. Overall sensitivity 1-2μV. S/Noise ratio 10 dB at 6μV. Circuit incorporates an RF stage, two I.F. stages, tone control, A.V.C. antenna trimmer 6V6 output. Set in fully working condition together with headphones and speaker plug, **£9.12.6.** With vibratory supply unit, 12v, **£10.15.0.** With specially built in P.S.U. for 210-250v A.C., **£11.17.6.** Carriage either set 15/-.

H.R.O. SENIOR TABLE MODEL TYPE 5A with "S" meter and crystal filter in excellent fully checked and tested condition together with set of 8 general coverage coils and mains P.S.U., **£33.** Carriage and packing 30/-.
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TELEPHONE HANDSET. Standard G.P.O. type, new **12/-.** P. & P. 2/-.

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A.R.88D. RECEIVERS. Fully reconditioned, **£55.** Rebuilt model, **£85.** Carriage paid U.K.

ULTRA MODERN POWER SUPPLY UNIT. Supply voltage A.C.: 105, 110, 115, 200, 205, 210, 220, 225, 230, 240, 245, 250 v. Available voltages D.C.:
(a) 1700-1900 v. Stabilised, adjustable approx. 1 mA.
(b) HT2 approx. 45mA.
(c) 260-350 v. stabilised, adjustable, approx. 45 m.
(d) 450 v. approx. 30 mA.
(e) 50 v. approx. 150 mA.
(f) 4.5 v. A.C. amp. common earth.
(g) 6.3 v. A.C., 4.5 amp. common earth.
5 valves, 7 silicon rectifiers, 4 Solenium HV rectifiers. Brand new, **£9.10.0.** Carriage 12/-.

PHASE MONITOR ME-63/U. Manufactured recently by Control Electronics Inc. Measures directly and displays on a panel meter the phase angle between two applied audio frequency signals within the range from 20-20,000 cps to an accuracy of ±1.0°. Input signals can be sinusoidal or non-sinusoidal between 2 and 30v peak. In excellent condition together with handbook and necessary connector. **£45.** Carriage 30/-.

COMPLETE V.F.O. UNIT from TX53. Freq. range in 4 switched bands from 1.2-17.5 mc/s. Two V.T. 501s. as oscillator and buffer, 807 as driver, two S130s as voltage stabilisers. Output sufficient to drive two 813s in parallel. Slow motion drive directly calibrated in mc/s. Provision for crystal control, metering of buffer and driver stage. Power requirements 400v. and 6.3 v. D.C. Can also be used as low power transmitter. In excellent condition with valves and circuit diagram. **£5.** P. & P. 15/-.

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EX GOVT. SELENIUM RECTIFIERS 12v 15 AMP (BRIDGE) F.W. ONLY 19/9

TRANSISTOR SALE Mullard OC71 2/11, OC45 3/11, OC44 3/11, OC72 2/11, OC81 2/11, OC171 8/9, AF117 6/9. Ediswan XA101 3/9, XA112 3/9, XC101A 3/9. Postage 6d. for up to 3 transistors.

INTRODUCING A NEW RANGE OF HIGH FIDELITY LOUDSPEAKER UNITS

AUDIOTRINE PETITE Really astounding performance. Size only 10½ x 6½ x 7¼in. Rating 10 watts. Frequency range 45-20,000 c.p.s. Cabinet beautifully finished in Teak (light) or Walnut (medium.) Fitted specially designed Heavy cast 5in. speaker with large pole pieces, extra long voice coil and rubber cone surround giving low fundamental resonance. Impedance 3 ohms or 15 ohms. Or Deposit 29/6 and 9 monthly payments of 19/10 (Total £10.8.0). **11 Gns.** Carr. 7/6

The AUDIOTRINE MINI-TEN Size only 12½in High, 6⅞in. Wide, 8¼in. Deep. Rating 10 watts. Impedance 15 ohms. De-luxe Teak or Walnut finished cabinet acoustically lined. Heavy cast 5in. Bass speaker with extra high flux density ceramic magnet plastic treated surround and long voice coil giving low fundamental resonance. Cross-over and Tweeter. Really astounding performance. Frequency range 45-20,000 c.p.s. Or Deposit £2 and 9 mthly pymts 27/9 (Total £14.9.0). **12½ Gns.** Carr. 8/6.

The GLOUCESTER Handsome "slimline" cabinet, acoustically lined. Size 24in. High, 20in. Wide, 6¾in. Deep. Finished light Teak or medium Walnut. 12in. high flux 12,000 line speaker, Cross-over unit and Tweeter. Rating 10 watts. Smooth response 40-20,000 c.p.s. Impedance 15 ohms. Or Deposit 36/- and 9 monthly payments 24/8 (Total £12.18.0). **11 Gns.** Carr. 15/-

The BRONTE Handsome cabinet of modern styling. Acoustically lined and finished Teak or Walnut. Size 22in. High. 15in. Wide. 7½in. Deep. Fitted Wharfedale Super 8 RSDD Speaker, with Roll surround and dual cone. Rating 6 watts. Impedance 15 ohms. Or Deposit 39/- and 9 monthly payments 26/10 (Total £14.0.6). **12 Gns.** Carr. 15/-

The DORCHESTER Attractive cabinet in luxurious Teak or Walnut finish. Acoustically lined. Size 24in. High, 15in. Wide, 7½in. Deep. Incorporating specially designed 10in. Heavy cast speaker with massive 2in. pole pieces and dual cone with plastic treated surround. Frequency response 20-20,000 c.p.s. Rating 15 watts. Impedance 15 ohms. Or Deposit 48/- and 9 monthly payments 33/- (Total £17.7.3). **15 Gns.** Carr. 15/-

The STANWAY Attractive contemporary styled cabinet finished Teak (light) or Walnut (medium). Acoustically lined. Size 24in. High, 20in. Wide, 8in. Deep. Fitted 12in. high flux Bass speaker with plastic treated surround giving extremely low fundamental resonance and high sensitivity. The smooth frequency response 20-20,000 c.p.s. is achieved by addition of high flux tweeter and cross-over unit. Rating 20 watts. Impedance 15 ohms. Or Deposit 3 Gns. and 9 monthly payments 43/4 (Total £22.13.0). **19½ Gns.** Carr. 17/6

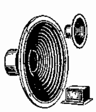
TWEETERS R.A. 3 ohm. 25/9 15 ohm 25/9

AUDIOTRINE HIGH FIDELITY LOUDSPEAKER ENCLOSURES

All types of pleasing modern "slimline" design acoustically lined and ported in alternative finishes of light Teak or medium Walnut.
SE8. Designed for optimum performance with any Hi-Fi 8in. speaker. Size 22in. High, 15in. Wide, 7in. Deep. Or Deposit 18/- and 9 monthly payments 12/3 (Total £6.8.3). Carr. 7/6 **£5.15.0**

SE10. For 10in. High Fidelity Speaker with provision for tweeter. Especially recommended for use with Audiotrine HF100D speaker. Size 24in. High, 15in. Wide, 7¼in. Deep. Or deposit 21/- and 9 monthly payments of 15/- (Total £7.16.0). Carr. 10/- **£6.19.9**
SE12. For outstanding performance with any 12in. Hi-Fi Speaker but especially suitable for types with low fundamental resonance. A tweeter cut-out is provided. Size 24 x 20 x 7½in. approx. Or Deposit 27/- and 9 monthly payments of 17/10 (Total £9.7.6). Carr. 10/- ONLY **8 Gns.**

AUDIOTRINE HI-FI SPEAKER SYSTEMS Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) 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, £6.19.9. Carr. 5/6 7/6. Or Dep. 21/- and 9 mthly pmts of 15/- (Ttl £7.16.0). **£4.19.9** Carr.



AUDIOTRINE HF100D 10in. 15 watt HI-FI Loudspeakers. Heavy cast construction. Dual cone. Smooth frequency response 20-20,000 c.p.s. Speech coil 3 or 15 ohms. Exceptional value at **£5.15.0** Carr. 5/9

FANE HEAVY DUTY HI-FI SPEAKERS 12in. 20 watt. Type 122/10. Post 5/6. ONLY **5 Gns.**

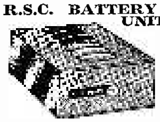
SPECIAL PURCHASE OF GARRARD 3000 AUTO-CHANGERS Fitted Sonotone Low Mass Cartridge. Limited number. Carr. 7/6 **£8.19.9**

W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS HF1012. 10 watts rating. Where a really good quality speaker at a low price is required we highly recommend this unit with an amazing performance. Please state whether 3 or 15 ohms required. **£4.19.9**

COMPLETE 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 or with metal cover 25/-. **19/11**

TANNOY RE-ENTRANT LOUDSPEAKERS. For outdoor or factory use, 8 ohms, 8 watts. Carr. 4/6 **27/6**

R.S.C. BATTERY TO MAINS CONVERSION UNITS. Type BM1. An all-dry battery eliminator. Size 5½ x 4½ x 2in. approx. Completely replaces batteries supplying 1.4v. and 90v. where A.C. mains 200/250v. 50 c/s is available. Complete kit with diagram 39/9 or ready for use 49/9.



R.A. 12in. DUAL CONE 3 ohm LOUDSPEAKERS. Ideal for Stereo. 39/9. Carr. 4/6.

R.S.C. BABY ALARM OR INTERCOMM KIT Parts with diagrams, etc. In two polished Walnut finished cabinets. 3-4 watts output. High sensitivity. For 200-250v. A.C. mains. Fully isolated. Controllable at both units. A unit of this class would normally cost £20-£30. Only 89/6. Carr. 5/-. Ready for use. 6 Gns.

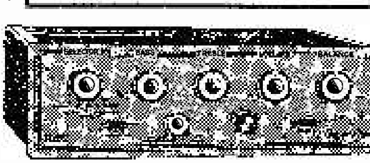
R.S.C. SUPER 15 HI-FI AMPLIFIER

WE PROUDLY INTRODUCE TWO COMPLETELY NEW UNITS WITH TECHNICAL SPECIFICATIONS COMPARING MORE THAN FAVOURABLY WITH SIMILAR AMPLIFIERS AT 2-3 TIMES THE COST

R.S.C. SUPER 30 STEREO AMPLIFIER

FULLY TRANSISTORISED 200/250v. A.C. Mains Operation.
OUTPUT 10 WATTS R.M.S. into 15 ohms.
15 WATTS R.M.S. 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: 20-20,000 c.p.s.
TREBLE CONTROL: +15dB to —14dB at 10 Kc/s.
BASS CONTROL: +12dB to —15dB at 50 c/s.
HARMONIC DISTORTION at 10 Watts R.M.S. 1,000 c.p.s. 0.35%. **HUM LEVEL:** —75dB.
NEGATIVE FEEDBACK: 52dB.
Complete Kit of parts with full constructional details and point to point wiring diagrams. Carr. 10/- **10½ GNS.** Or Kit with Printed Circuit wired and tested 30/- extra, or Deposit 72/- and 9 monthly payments of 22/6 (Total £13.14.6).
Attractive Walnut or Teak finished cabinet 5 gns. or Deposit 17/- and 9 monthly payments 11/- (Total £5.16.0). Or unit factory built and tested, complete with cabinet and with our usual 12 months guarantee. Or Deposit £3.9.0 and 9 monthly payments £2 (Total £21.9.0). **18½ GNS.** Carr. 12/6

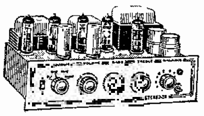
ALL COMPONENTS ETC. ARE OF A HIGH STANDARD AND SUPPLIED BY LEADING BRITISH MANUFACTURERS.



IMPORTANT NOTE. Rated output figures are given in R.M.S. and not speech and music or I.H.F.M., otherwise we could obviously quote much higher outputs.

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.
Attractive Facia Plate and Matching Knobs. Neon Panel Indicator.
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 REGARDLESS OF THE COST. SUPERB SOUND OUPTUT QUALITY CAN BE OBTAINED BY USING WITH FIRST RATE ANCILLARY EQUIPMENT. All required parts, point to point wiring diagrams and detailed instructions. If required printed circuits can be supplied with appropriate components assembled, soldered and tested for £3 extra. Terms: Deposit 6 Gns. and 9 monthly payments 38/6 (Total £23.12.6). Carr. 12/6 **18 GNS.**
Attractive Walnut or Teak finished cabinet 5 Gns. or Deposit 17/- and 9 monthly payments 11/- (Total £5.16.0). Or unit completely assembled ready for use housed in cabinet. 29 GNS. Carr. 15/-
Or Deposit £4.12.0 and 9 monthly payments 64/-. (Total £33.8.0).
Send S.A.E. for leaflet.

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

Based on a current Mullard design and employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. Send s.a.e. for leaflet.
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.**
- ★ **Will amplify direct from Tape Heads.**
- ★ **Stereo/Mono switch.**
- ★ **Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.**
- ★ **Neon panel indicator.**
- ★ **Handsome Perspex Frontplate.**

Output transformers are high-quality sectionally wound to required specification. Output matching for 3 and 15 ohm speakers on each channel. Complete set of parts with point-to-point wiring diagrams and instructions. Carr. 12/6 **13 Gns.**
Or factory assembled, tested and supplied with our usual 12 months guarantee. **18 Gns.** Or Deposit **57/-** and 9 monthly payments **39/10** (Total **£20.15.6**). Carr. 12/6

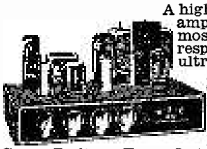
AUDIOTRINE HI-FI TAPE RECORDER KIT

REALISM AT INCREDIBLY LOW COST.
CAN BE ASSEMBLED IN AN HOUR.
ONLY 4 PAIRS OF SOLDERED JOINTS PLUS MAINS.

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 Carrying Cabinet of latest styling and finished dark grey leathercloth. Size 14¼ x 17 x 8½in. high and circuit. Total cost if purchased individually approximately **£35.** Performance equal to units in the £50-£60 class. S.A.E. for leaflets. **TERMS: Deposit 4 gns.** and 9 monthly payments of **56/-** (Total **28 gns.**). 4 Track Model **3 gns.** extra.

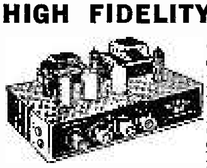
25½ Gns. Carr. 18/6

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



A highly sensitive Push-Pull high output unit with self-contained Pre-amp./Tone Control Stages. Performance figures compare equally with most expensive amplifiers available. Hum level —70dB. Frequency response ±3dB 30-20,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All first grade components. Valves EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls. Minimum input required for full output 12 millivolts so that **any kind of Microphone or Pick-up is suitable.** The unit is designed for **Clubs, Schools, Theatres, Dance Halls** or **Outdoor Functions,** etc. For use with **Electronic Organ, Guitar, String Bass,** etc. Gram, Radio or Tape. **Output Socket provides** 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. 50 c/s A.C. mains. Output for 3 and 15 ohm speakers. Complete kit of parts with fully punched chassis and point to point wiring diagrams and instructions. **12 Gns.** Carr. 10/-
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/-** & 9 mthly payments of **33/3** (Total **£17.7.3**).

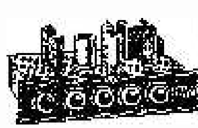
HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11



PUSH-PULL ULTRA LINEAR OUTPUT "BUILT-IN" TONE CONTROL PRE-AMP

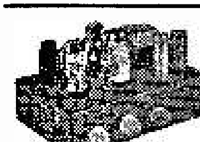
Two input sockets with associated controls allow mixing of "mike" and gram, etc., etc. High sensitivity. Valves ECC83, ECC83, EL84, EL84, EZ81. High quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut". Frequency response ±3dB 30-20,000 c/s. Six negative feedback loops. Hum level —60dB. SENSITIVITY 23 millivolts. Suitable for Crystal or Ceramic P.Us, all types "mikes". Comparable with the very best designs. For **Musical Instruments** such as **String Bass, Electronic Guitars,** etc. **Output Socket** provides 300v. 30mA, and 6.3v. 1.5a. for supply of a **Radio Tuner.** Size approx. 12 x 9 x 7in. For A.C. mains 200-250v. 50 c.p.s. Output for 3 and 15 ohms speakers. Kit complete to last nut. Chassis fully punched. Full instructions and point-to-point wiring diagrams supplied (or factory built **51/6** extra). Carr. 10/- ONLY **8 Gns.**
Metal covers with 2 carrying handles can be supplied for **£1. TERMS ON ASSEMBLED UNITS: Deposit 33/3** and 9 monthly payments of **24/1** (Total **£12.10.0**). Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Mikes, etc.

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



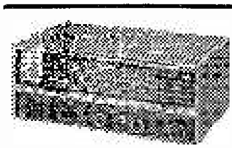
A complete set of parts for the construction of a stereo amplifier giving 5 watts high quality output on each channel (total 10 watts) Sensitivity is 50 millivolts. Suitable all crystal or ceramic stereo heads. Ganged Bass and Treble Control give equal variation of "lift" and "cut". Provision is made for use as straight (monaural) 10 watt amplifier. Valve line-up ECC83, ECC83, EL84, EL84, EL84, EZ81. Outputs for 2-3 ohm speakers. Point to point wiring diagrams and instructions supplied. Send S.A.E. for leaflet. Full constructional details and price list 2/6. **8 Gns.**
Or supplied factory assembled with 12 months' guarantee for **£11.7.6. Terms:** Dep. **2 gns.** and 9 mthly pmts **24/2** (Total **£12.19.6**). Carr. 10/-

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. H.T. of 300v. 25mA and L.T. of 6.3v. 1.5a. available for supply of Radio Tuner or Tape Deck pre-amp. For A.C. mains 200-250v. Speaker output 3 ohms. Kit is complete in every detail with fully punched Hammer finished chassis, point-to-point wiring diagrams and instructions. Exceptional value **£4.15.0**
or assembled ready for use 25/- extra, plus 3/6 carr. Deposit 22/6 and 5 monthly payments of 22/6 (Total £6.15.0) for assembled unit.

COMMUNICATION RECEIVERS RX 60 DE LUXE

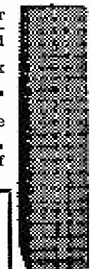


4 BAND. 220/240v. 50/60 c.p.s. A.C. mains operation. Frequencies covered 1600 Kc/s to 30 Mc/s continuous. Incorporates 5in. speaker. Slide rule tuning dial 'S' meter. Internal ferrite aerial 58in. 10 section for short waves. Fitted sockets for optional outdoor aerial. Headphones, external speaker socket. Other features are electrical bandspread tuning. Noise limiter, A.V.C., B.F.O., stand-by switch. Size approx. 12½ x 5¾ x 8½in. Handsome crackle finished metal cabinet. Brand new with full instructions manual. Usual guarantee. Or Deposit **£5** and 9 monthly payments **37/8** (Total **£21.19.0**). Carr. 10/- **19 Gns.**

R.S.C. A15 20 WATT (R.M.S.) HI-FI TRANSISTOR AMPLIFIER with integral pre-amp tone control stages

Output for 3, 7.5 and 15 ohm speakers. Kit of parts consisting of Printed Circuit and all components for same including 9 Mullard or Newmarket latest type semi-conductors. Heat sink and full wiring instructions or with printed circuit fully wired and tested £2 extra. **£6.19.9** Post 5/-
Frequency Response: ±1dB 20-20,000 cps. **Harmonic Distortion:** 0.1% measured at 1000 c.p.s. **Hum and Noise:** —80dB. **Sensitivity:** 2 mV. **Bass Control:** +9dB to —14dB at 40 c.p.s. **Treble Control:** +8dB to —13dB at 10 Kc/s.
Suitable Power Pack Kit **39/6** or ready built **59/6.**

R.S.C. COLUMN SPEAKERS



Covered in two-tone Rexine/Vynair. Ideal for vocalists and Public Address. Normally supplied for 15 ohm matching but can be supplied for 100v. line for **35/-** extra.
Type C58, 15-20 watts. Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. Or Deposit **£2** and 9 mthly pmts **27/9** (Total **£14.9.9**) Carr. 10/- **12½ Gns.**
Type C412, 40 watts. Fitted four 12in. 12,000 line 10 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/- **19½ Gns.**
Or Deposit **3 gns.** and 9 monthly payments of **43/2** (Total **21¼ gns.**).

18in. 60 WATT EXTRA HEAVY DUTY LOUDSPEAKERS

Famous make. Normal price over **£25.** Very limited number to clear **17 Gns.** with full guarantee. Terms available. Carr. 15/-

30 WATT HI-FI AMPLIFIER for Lead, Rhythm, Bass Guitar, Vocal or Instrumental Groups

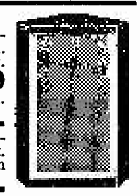
A Four Input, two volume control Hi-Fi unit with separate Bass and Treble 'cut' and 'boost' controls. Latest type valves. Housed in strong Rexine covered cabinet with twin carrying handles Attractive black and gold perspex fascia plate. For 200-250v. A.C. mains. Output for 3 or 15 ohm speakers. Send S.A.E. for leaflet. Deposit **£3** and 9 monthly payments of **37/-** (Total **£19.13.0**). Carr. 12/6 **17 Gns.**

INTEREST CHARGES REFUNDED

on H.P. and Credit Sale Accounts settled in 6 months.

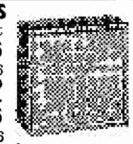
LINEAR TAPE PRE-AMPLIFIER. Type LP/1. Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback, EM84 Recording Level Indicator. Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier, suitable almost any Tape Deck. S.A.E. for leaflet. **9½ Gns.**

CORNER CONSOLE CABINETS



Strongly made. Beautiful polished walnut veneered finish. Pleasing design.
Junior Model. For up to 8in. speaker. Approx. 20 x 11 x 8in. Carr. 5/6 **49/9**
Standard Model. To take up to 10in. speaker. Size 27 x 18 x 8in. Carr. 7/6 **5 Gns.**
Senior Model. To take up to 12in. speaker and with Tweeter cut-out. Size approx. 30 x 30 x 15in. (Recommended for use with Audiotrine speaker system.) **8 Gns.**
Terms available. Carr. 8/6

12in. HIGH QUALITY LOUDSPEAKERS



In walnut veneered cabinet. **10 Watt Model.** Gauss 12,000 lines. Speech coil 3 or 15 ohms. **£4.19.6**
Terms: Deposit **15/-** and 9 monthly payments of **10/10** (Total **£5.12.6**) Carr. 5/6
20 Watt Model. 15 ohm. Size 18x18x10in. **Terms:** Deposit **24/6** and 9 monthly payments of **17/-** (Total **£8.17.6**). **£7.19.6** Carr. 8/6
30 Watt Model. 15 ohms. Carr. 10/-. Or Deposit **32/-** and 9 monthly payments of **22/-** (Total **£11.10.0**). **10 Gns.** **Any of above in extra heavy Rexine covered Cabinets, £1 extra.**

R.S.C. JUNIOR BASS REFLEX CABINET. Designed for above speaker, but suitable for any good quality 8in. or 10in. speaker. Acoustically lined and ported. Medium Walnut veneer finish. Size 18 x 12 x 10in. Strongly made. Handsome appearance. Superb reproduction. **£4.10.0** Carr. 5/-

SELENIUM RECTIFIERS F.W. (BRIDGED)

6/12v. 1a. **3/11;** 6/12v. 3a. **9/9;** 6/12v. 6a. **15/3;** 6/12v. 2a. **6/11;** 6/12v. 4a. **12/3;** 6/12v. 10a. **26/9.**

R.S.C. GRAM AMPLIFIER KIT. 3 watts output. Negative feedback. Controls: Vol., Tone and Switch. Mains operation 200-250v. A.C. Fully isolated chassis. Circuit, etc., supplied. Only **39/9.** Carr. 3/9.

R.S.C. 4 WATT GRAM. AMPLIFIER KIT. Complete set of parts to build a good quality compact unit suitable for use with any record playing unit. Mains isolated chassis, separate Bass and Treble controls. Output for 2-3 ohm speaker. For 200-250 v. A.C. **59/9**

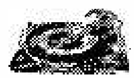
R.S.C. (MANCHESTER) LTD.

For addresses see page 89

HI-FI AMPLIFIERS — TUNERS — RECORD PLAYERS

20+20 STEREO AMP. AA-22U

GARRARD PLAYER AT-60



TRANSISTOR MIXER. Model TM-1. A must for the tape enthusiast. Four channels. Battery operated. Similar styling to Model AA-22U Amplifier. Kit **£11.16.6** Assembled **£16.17.6**

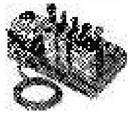
20+20W TRANSISTOR STEREO AMPLIFIER. Model AA-22U. Outstanding performance and appearance. Kit **£39.10.0** (less cabinet). Attractive walnut veneered cabinet £2.5.0 extra. Assembled **£68.16.0**

GARRARD AUTO/RECORD PLAYER. Model AT-60, less cartridge **£13.1.7.** With Decca Deram pick-up **£17.16.1** incl. P.T.

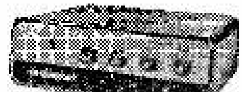
Many other Garrard models available, ask for Lists.

HI-FI MONO AMPLIFIER. Model MA-5. A general purpose 5W Amplifier, with inputs for Gram., Radio. Modern functional presentation. Kit **£10.19.6** Assembled **£15.10.0**

10W POWER AMP. MA-12



9+9W STEREO AMP. S-99



HI-FI MONO AMPLIFIER. Model MA-12. 10W output, wide freq. range, low distortion. Use with control unit. Kit **£11.18.0** Assembled **£15.18.0**

3+3W STEREO AMPLIFIER. Model S-33. An easy-to-build, low cost unit. 2 inputs per channel. Kit **£13.7.6** Assembled **£18.18.0**

DE LUXE STEREO AMPLIFIER. Model S-33H. De luxe version of the S-33 with two-tone grey perspex panel, and high sensitivity necessary to accept the Decca Deram pick-up. Kit **£15.17.6** Assembled **£21.7.6**

HI-FI STEREO AMPLIFIER. Model S-99. 9+9W output. Ganged controls. Stereo/Mono gram, radio and tape inputs. Push-button selection. Printed circuit construction. Kit **£28.9.6** Assembled **£38.9.6**

POWER SUPPLY UNIT. Model MGP-1. Input 100/120V, 200/250V, 40–60 c/s. Output 6.3V, 2.5A A.C. 200, 250, 270V, 120mA max. D.C. Kit **£5.2.6** Assembled **£6.12.6**

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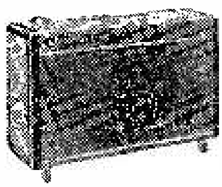
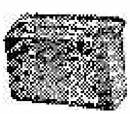


PA-2

TRANSISTOR PA/GUITAR AMPLIFIER, PA-2. 20 Watt amplifier. Two heavy duty speakers. Four inputs. Two channels. Variable tremolo. Speed and depth controls. Weight 51 lb. 18″ high x 29″ wide x 10″ deep. Kit **£44.19.0** Assembled **£59.10.0**

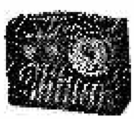
VALVE PA/GUITAR AMPLIFIER, PA-1. 50 Watt amplifier. Kit **£54.15.0** Assembled **£74.0.0** Castors or legs available as extras.

TRANSISTOR RECEIVERS



Oxford

"OXFORD" LUXURY PORTABLE Model UXR-2. Specially designed for use as a domestic, car or personal portable receiver. Many features, including solid leather case. Kit **£14.18.0** incl. P.T.



UXR-1

TRANSISTOR PORTABLE. Model UXR-1. Pre-aligned I.F. transformers, printed circuit. Covers L.W. and M.W. Has 7″ x 4″ loudspeaker. Real hide case. Kit **£12.11.0** incl. P.T.

JUNIOR EXPERIMENTAL WORKSHOP. Model EW-1. More than a toy! Will make over 20 exciting electronic devices, incl.: Radios, Burglar Alarms, etc. 72 page Manual. The ideal present! Kit **£7.13.6** incl. P.T.

GC-IU

"MOHICAN" GENERAL COV. RECEIVER for Amateur or Short Wave listening. Send for leaflet. Kit **£37.17.6** Assembled **£45.17.6**

WELCOME TO OUR LONDON HEATHKIT CENTRE
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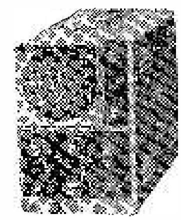
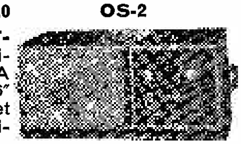


OS-2

NEW! **3″ LOW-PRICED SERVICE OSCILLOSCOPE. Model OS-2.** Compact size 5″ x 7⅜″ x 12″ deep. Wt. only 9⅝lb. "Y" bandwidth 2 c/s–3 Mc/s±3dB. Sensitivity 100mV/cm. T/B 20 c/s–200 kc/s in four ranges, fitted mu-metal CRT Shield. Modern functional styling. Kit **£22.18.0** Assembled **£30.8.0**

5″ GEN.-PURPOSE OSCILLOSCOPE. Model 10-12U. An outstanding model with professional specification and styling. "Y" bandwidth 3 c/s–4.5 Mc/s±3dB. T/B 10 c/s–500 kc/s. Kit **£35.17.6** Assembled **£45.15.0**



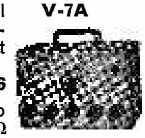
VVM, IM-13U

DE LUXE LARGE-SCALE VALVE VOLTMETER. Model IM-13U. Circuit and specification based on the well-known model V-7A but with many worth-while refinements. 6″ Ernest Turner meter. Unique gimbal bracket allows operation of instrument in many positions. Modern styling. Kit **£18.18.0** Assembled **£26.18.0**

V-7A

AUDIO SIGNAL GENERATOR. Model AG-9U. 10 c/s to 100 kc/s, switch selected. Distortion less than 0.1%, 10V sine wave output metered in volts and dB's. Kit **£22.10.0** Assembled **£30.10.0**

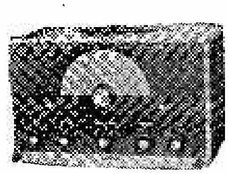
VALVE VOLTMETER. Model V-7A. 7 voltage ranges d.c. volts to 1,500. A.C. to 1,500 r.m.s. and 4,000 peak to peak. Resistance 0·1 Ω to 1,000M Ω with internal battery. D.C. input resistance 11MΩ. dB measurement, has centre-zero scale. Complete with test prods, leads and standardising battery. Kit **£13.18.6** Assembled **£19.18.6**



RF-1U

MULTIMETER. Model MM-1U. Ranges 0–1.5V to 1,500V a.c. and d.c.; 150μA to 15A d.c.; 0.2Ω to 20MΩ 4½″ 50μA meter. Kit **£12.18.0** Assembled **£18.11.6**

R.F. SIGNAL GENERATOR. Model RF-1U. Up to 100 Mc/s fundamental and 200 Mc/s on harmonics. Up to 100mV output. Kit **£13.8.0** Assembled **£19.18.0**



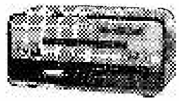
IG-82U

NEW! **SINE/SQ GENERATOR Model IG-82U.** Freq. range 20 c/s–1 Mc/s in 5 bands less than 0·5% sine wave dist. less than 0·15μ sec. sq. wave rise time. Kit **£24.10.0** Assembled **£36.10.0**

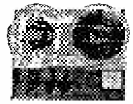
TRANSITOR POWER SUPPLY. Model IP-20U. Up to 50V, 1·5A output. Ideal for Laboratory use. Compact size. Kit **£35.8.0** Assembled **£47.8.0**

Prices and specifications subject to change without notice

TAPE AMPLIFIERS — TAPE DECKS — CONTROL UNITS



FM TUNER FM-4U

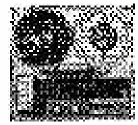


STUDIO-MATIC DECK

HI-FI FM TUNER. Model FM-4U. Available in two units. R.F. tuning unit (£2.15.0 incl. P.T.) with I.F. output of 10.7 Mc/s and I.F. amplifier unit, with power supply and valves (£13.13.0). Total Kit **£16.8.0**

STUDIOMATIC "363" TAPE DECK. The finest buy in its price range. Operating speed: $1\frac{7}{8}$", $3\frac{3}{4}$" and $7\frac{1}{2}$" p.s. Two tracks, "wow" and "flutter" not greater than 0.15% at $7\frac{1}{2}$"p.s. **£13.10.0** With TA-1M tape preamplifier kit. **£31.5.6.**

HI-FI AM/FM TUNER. Model AFM-1. Available in two units which, for your convenience, are sold separately. Tuning heart (AFM-T1—£4.13.6 incl. P.T.) and I.F. amplifier (AFM-A1—£22.11.6). Printed circuit board, 8 valves. Covers L.W., M.W., S.W., and F.M. Built-in power supply. Total Kit **£27.5.0**



TRUVOX DECK

AM/FM TUNER

TRUVOX D-93 TAPE DECKS. High quality stereo/mono tape decks. **D93/2,** $\frac{1}{2}$ track, **£36.15.0** **D93/4,** $\frac{1}{4}$ track, **£36.15.0**

TAPE RECORDING/PLAYBACK AMPLIFIER. Thermometer type recording indicators, press-button speed compensation and input selection.

Mono Model TA-1M.	Kit **£19.18.0**	Assembled **£28.18.0**
Stereo Model TA-1S.	Kit **£25.10.0**	Assembled **£35.18.0**

MONO CONTROL UNIT. Model UMC-1. Designed to work with the MA-12 or similar amplifier requiring 0.25V or less for full output. 5 inputs. Baxandall type controls. Kit **£8.12.6** Assembled **£13.12.6**

STEREO CONTROL UNIT. Model USC-1. Push-button selection, accurately matched ganged controls to ±1dB. Rumble and variable low-pass filters. Printed circuit boards. Kit **£19.10.0** Assembled **£26.10.0**

Enjoy building a Heathkit model

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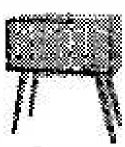
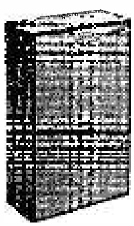
SPEAKER SYSTEMS



SSU-1

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



Berkeley

NEW! **BERKELEY Slim-line SPEAKER SYSTEM,** fully finished walnut veneered cabinet for faster construction. Special 12" bass unit and 4" mid/high frequency unit. Range 30–17,000 c/s. Size 26" x 17" only $7\frac{3}{8}$" deep. Modern attractive styling. Excellent value. Kit **£18.10.0** Assembled **£23.0.0**

COTSWOLD SPEAKER SYSTEMS. Outstanding performance for price. *MFS:* Size 36" x $16\frac{1}{2}$" x 14" deep. Kit **£25.12.0** Assembled **£33.17.0**

STANDARD: Size 26" x 23" x $14\frac{1}{2}$" deep. Kit **£25.12.0** Assembled **£33.17.0**

HI-FI CABINETS

A wide range available including kits, ready assembled cabinets or assembled and fully finished cabinets, for example:

GLOUCESTER. Kit **£18.10.0** incl. P.T.

MALVERN. Kit **£18.1.0** incl. P.T.

CHEPSTOW. Kit **£11.12.6** incl. P.T.

Malvern

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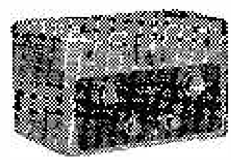
DAYSTROM LTD Dept. P.W.—6 GLOUCESTER

"AMATEUR" EQUIPMENT

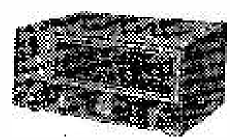
80-10m TRANSMITTER, DX-40U. Power inputs 75W. C.W., 60W peak CC phone. Output 40W to aerial. Provision for VFO. Kit **£33.19.0** Assembled **£45.8.0**



DX-40U

SSB ADAPTOR, SB-10U Kit **£39.5.0** Assembled **£54.18.0**

AMATEUR BANDS RECEIVER Model RA-1. To cover all the Amateur Bands from 160-10 metres. Many special features, including: half-lattice crystal filter; 8 valves; signal strength "S" meter; tuned R.F. Amp. stage. Kit **£39.6.6** Assembled **£52.10.0**

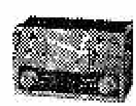


RA-1

160-10M TRANSMITTER. Model DX-100U. Careful design has achieved high performance and stability. Completely self-contained. Kit **£79.10.0** Assembled **£104.15.0**

COMMUNICATIONS TYPE RECEIVER. Model RG-1. A high performance, low cost receiver for the discriminating listener. Frequency coverage: 600 kc/s-1·5 Mc/s and 1·7 Mc/s–32 Mc/s. Kit **£39.16.0** Assembled **£53.0.0**

REFLECTED POWER METER and SWR BRIDGE. Model HM-11U. Indicates reliably, but inexpensively, whether the RF power output of your TX is being transferred efficiently to radiating antenna. Kit **£8.5.0** Assembled **£10.10.0**



HM-11U

OUTSTANDING "AMATEUR" EQUIPMENT
A wide range of American Amateur SSB equipment is now available in the U.K. Why not send for full details of range, for example:

FILTER TYPE SSB TRANSCEIVERS
Models for 80, 40 or 20 metre bands.
Model HW-12 (80M)
Model HW-22 (40M) **£66.0.0 each kit.**
Model HW-32 (20M) price inc. duty, etc.

80M Transceiver HW-12

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FULL DETAILS OF MODEL(S)................................ ☐
(*Please write in BLOCK CAPITALS*)
NAME ....
ADDRESS..
.... **DEPT. P.W.6**

Why NOT BUILD ONE OF OUR PORTABLE TRANSISTOR RADIOS...

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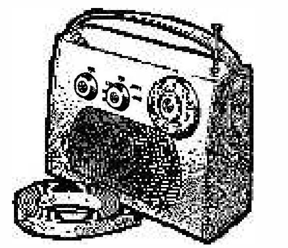
All components used in our receivers may be purchased separately if desired. Parts price list and easy build plans available separately at prices stated. Overseas post 10/-.

FIRST FOR QUALITY, PERFORMANCE & PRICE!

"A wonderful range of transistor radios using first grade components for guaranteed results"

NEW ROAMER SEVEN Mk IV



7 WAVEBAND PORTABLE OR CAR RADIO *Amazing performance and specification*

★ **Now with PHILCO MICRO-ALLOY R.F. TRANSISTORS**

● **9 stages—7 transistors and 2 diodes** **FULLY TUNABLE ON ALL WAVEBANDS**

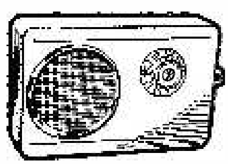
Covers Medium and Long Waves, Trawler Band and three Short Waves to approx. 15 metres. Push-pull output for room filling volume from rich toned 7 x 4in. speaker. Air spaced ganged tuning condenser. Ferrite rod aerial for M & L waves and telescopic aerial for S waves. Real leather look case with gilt trim and shoulder and hand straps. Size 9 x 7 x 4in. approx. **The perfect portable and the ideal car radio.** (Uses PP7 batteries available anywhere).

★ **EXTRA BAND FOR EASIER TUNING OF PIRATE STATIONS etc.**

Total cost of parts now only **£5.19.6** P. & P. 5/6

Parts Price List and easy build plans 3/- (FREE with Kit)

New TRANSONA FIVE



"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 2½in. speaker etc. Attractive case. Size 6¼ x 4½ 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

● **7 stages—5 transistors and 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 2½in., moving coil speaker, built into attractive black case with red speaker grille. Size 5½ x 1¼ x 3½in. (Uses 1289 battery available anywhere)

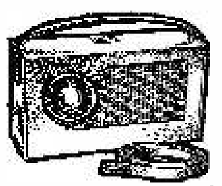
Total cost of all parts now only **42/6** P. & P. 3/-.

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/-

MELODY SIX

"... amazed at volume and performance ... has really come up to my expectations." S.G. Stockton-on-Tees.



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

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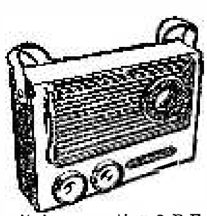

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PRACTICAL WIRELESS

VOL 42 No 2
issue 712

JUNE 1966

TOPIC OF THE MONTH

Digging the Past

FROM time to time, in these Leaders, we have commented on the varied activities of readers. A "radio enthusiast" may mean anything or nothing. He may only be interested in building equipment, or designing it; he may find his inspiration in test gear, receivers or gadgets; he may be a licensed amateur or devote his time to chasing BC band or amateur DX; he may even just like reading about radio. The permutations would fascinate a Treble Chance fan.

This month we show another facet of interest in our special feature article on The Radio Collector, in which the author opens up a novel line of research and study —that of collecting radio equipment of earlier days.

Older readers, particularly those who have grown up with radio, may realise with surprise that radio has not only grown up but has sprouted whiskers and joined the ranks of the antiques! For, in fact, radio is ageing rapidly and it is becoming increasingly important to search out and salvage the physical reminders of radio's youth.

Radio has passed that knife-edge dividing line and what was once junk has now become sought-after collectors' material. As with other currently "in" collector items, most of the more desirable pieces have long since been discarded along with the empty beer bottles, china ornaments and refuse. This makes the hunt all the more exciting and the end result is not only satisfying but educational.

Remember, too, that the radio of today is the antique of tomorrow! Your latest piece of equipment may *look* like the last word, but in a few years' time it may seem positively antediluvian. In pre-war days, equipment and techniques hardly changed year after year, but now—last year's equipment can often look old hat.

Therefore, it might be as well for younger readers to keep a junk box of representative parts and a few pieces of completed gear. They will then be able to amaze their grandchildren with the crudity of radio in the 1960's!

W. N. STEVENS, Editor

NEWS AND COMMENT

CONSTRUCTIONAL

GENERAL ARTICLES

The JULY ISSUE WILL BE PUBLISHED ON JUNE 9th

All correspondence intended for the Editor should be addressed to: The Editor, "Practical Wireless", George Newnes Ltd., Tower House, Southampton Street, London, W.C.2. Phone: TEMple Bar 4363. Telegrams: Newnes Rand London. Subscription rates, including postage: 36s. per year to any part of the world.

Money No Object

I RECENTLY mentioned to the leader of a youth club I belong to that I'd like to try my hand at making a radio receiver. Never having been interested in electronics before, I was hoping for some sound advice.

I certainly got it. The best I could have had.

"Why not get a copy of PRACTICAL WIRELESS?" he said.

I did, and immediately found a circuit that set me off on a new hobby I now intend to follow up with some studying and then some more advanced constructional projects.

That was a few months ago and now that P.W. is bigger, and I'm sure better, I think its a good buy, even for 2s. 6d.

James Houlton

Gravesend,
Kent.

Spring is Here

As I see it, this is the most difficult time of the year for radio enthusiasts. If the call of the spring, with us already, and the promise of summer to come, is not enough to drag the amateur away from his workbench to the great outdoors, it usually has that effect on the rest of the family and it needs a pretty good excuse to get out of loading up the car for a day in the country.

The answer of course is mobile operation. This can apply to the short-wave listener as well as the licensed amateur, and now that PRACTICAL WIRELESS has taken on a bigger format, let's hope it helps out with a few good articles on mobile equipment.

H. S. Greaves

Halifax,
Yorkshire.

Sticking With It

WITH PRACTICAL WIRELESS taking on a new size, it has occurred to me that there can be few magazines boasting such a long history. I remember my father reading it before me, and now my son beats me to the door when it is delivered.

It must mean something that it has stayed the course so long, and I think it means that P.W. gives its readers what they want. I know it to be so in my case, and indeed in the case of my whole family. Keep up the good work.

J. Dyer.

Salisbury,
Wiltshire.

Correspondent Wanted

I WOULD like to correspond with any Broadcast Band SWL of about 15.

J. S. Haworth

53, Watford Road,
Anfield,
Liverpool, 4.

NEWS AND..

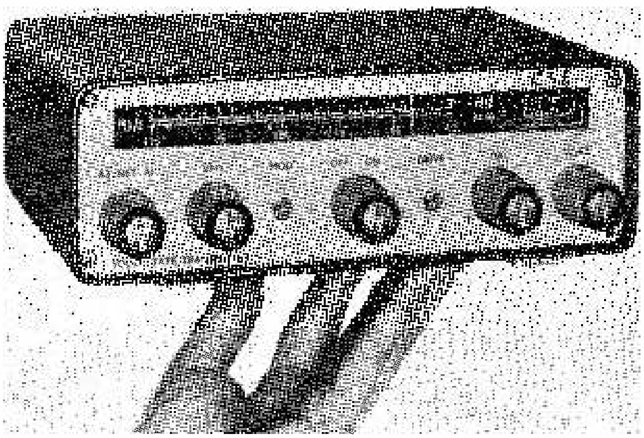
BRITAIN EQUIPS KUWAIT'S WORLD BEATER

Britain is supplying Kuwait with broadcast equipment for the most powerful national broadcasting station in the world.

The equipment, three 750kW high-power transmitters, has been ordered from the Marconi Company. Marconi's won the £1 million contract against European, Russian, Japanese and American competition.

The transmitters, each nearly twice as powerful as the BBC Droitwich Light Programme, will give Voice of Kuwait extensive coverage of the Middle East. Transistors are used throughout the low-power driving circuits of these transmitters, while vapour-cooled tetrodes are employed in modulator and high-power r.f. output stages.

MAKING MOBILE EASY



The solid-state transmitter shown above, measures 8in. x 6½in. x 2¾in. approximately and weighs only 3¾lbs. It operates on the 2Mc/s band at the full licence rating of 10W input, and working directly from a 12V car battery it will draw just over 1A.

The 2A10 transmitter is thus ideal for mobile operation on 2Mc/s, a.m. or c.w. It is made by Contactor Switchgear (Electronics) Ltd. (Moorfield Road, Wolverhampton, Staffs.) and costs £43 7s. 0d.

TAPE RECORDER KIT

R.S.C. (Manchester) Ltd. (102 Henconner Lane, Leeds 13) are selling 3-speed, twin-track tape recorder kits for 25½ guineas. Each kit comprises a Magnavox tape-deck, 4W amplifier, 7in. x 4in. speaker, and tape and a cabinet which gives the recorder an overall size of approximately 14in. x 17in. x 8in.

Apart from all usual facilities, the recorder features a superimposition switch and provision for an extra "stereo" head to be fitted. A four-track version at 28½ guineas is also available.

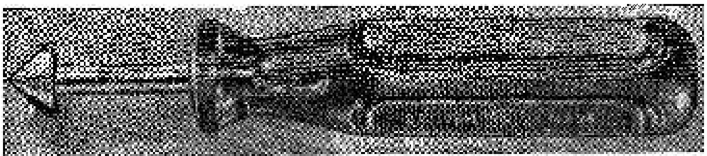
RADIO LINKS FOR SUGAR GROWERS

Portable radio equipment is finding its way into many unusual places these days, and finding a variety of uses, as in Mauritius where Pye Telecommunications have in recent years equipped police, fire and electricity services with mobile radio communications. Recently Pye have just about completed their monopoly there by supplying the country's sugar growers with a system of two-way radio.

A network of mobile transceivers and control stations puts staff in the fields or on the roads in constant touch with estates' headquarters; an important aid to the smooth running of the island's vital sugar industry.

...COMMENT

NEW HANDIBIT COUNTERSINK FROM VITREX LTD.



Made from finest Sheffield steel, hardened and tested, moulded into a tough impact resistant plastic handle, the new Handibit from Vitrex Ltd. is ideal for making countersinks in wood, hardboard, plastic laminates, aluminium and other metals and can also be used for de-burring holes in harder metals.

The Handibit is obtainable at leading Hardware, Do-it-Yourself and Department Stores at a recommended retail price of 2s. 6d. If you should have any difficulty in obtaining one please contact Vitrex (Sales) Ltd., 457-463 Caledonian Road, London, N.7.

VERSATILE AMPLIFIERS

Versatility is the maker's main claim for a new high-quality amplifier. Tape, radio or record pick-up inputs can be fed direct to the amplifier, which feeds any 15Ω impedance speaker system, mono or stereo.

The amplifier, the model LL3S1 by LL Electronics Ltd. (5 Shakespeare Road, London, N.3) has a power output of 3W per channel and at this maximum has a frequency response of 20c/s to 35kc/s. Response is better still at lower output powers. As well as separate volume, treble and base controls, the LL3S1 features a balance control and a number of other facilities which adds substance to the maker's claims for the amplifier which costs 26 guineas.

AVOMETER DESIGNER RETIRES

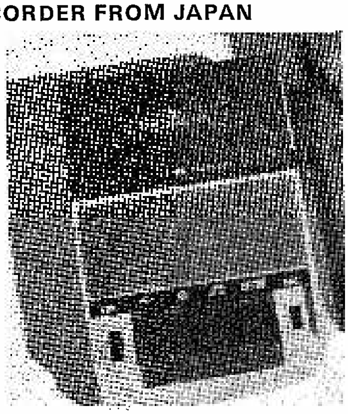
The man who designed Britain's most widely used multimeter has retired. After nearly 40 years, the inventor of the Universal Avometer, Mr. H. S. Macadie, has left Avo Ltd.

Mr. Macadie designed the first Avometer in 1932, since when its successors have become familiar sights on electricians' workbenches everywhere.

MINIATURE TAPE RECORDER FROM JAPAN

Standard of Japan make the miniature tape recorder shown right, and the UK agents are Denham and Morley Ltd. (173 Cleveland Street, London, W.1).

The recorder has a 300mW output twin tracks and at a tape speed of 1⅞in/sec., gives a recording time of 50 minutes. Its dimensions are 7½in. x 4¾in. x 2¼in., and it will operate from mains, as well as batteries, by means of an adaptor. At 18 guineas it comes complete with case, tape and remote control microphone.



NEW HEATHKIT CENTRE

Number 233 of London's Tottenham Court Road, that Mecca of amateur radio supplies, has been taken over by Daystrom Limited as a centre for their Heathkit range of equipment.

The Centre is equipped with a hi-fi demonstration room and besides the British Heathkit models, the visitor can see a selection from the American range. Kits and fully assembled equipment can be bought from the Centre.

Decibels and Watt-nots

I LEFT my radio construction days a long time ago although I still enjoy reading PRACTICAL WIRELESS. The other day I decided it was time I needed a new radiogram. A few years ago I would have built an amplifier myself and added a good quality record deck, but now I have decided to buy a commercial model.

In the local hi-fi centre I was treated quite courteously, at first, by a young salesman who had all the figures off pat and insisted on firing a whole list of frequency responses, output ratings, input sensitivities, decibels and watts at me, about this radiogram and then that. I tried explaining that I was old enough to be his father and that, at my age one's hearing capabilities tend to deteriorate rapidly, but he could not see that this was of any consequence.

As it appeared that the equipment with all these wonderful characteristics generally costs considerably more than I had anticipated, I visited another, less pretentious emporium, where I purchased a simple record player for about £25. Now, whether it is a result of my inferior hearing or, as I strongly suspect, the result of a sort of hi-fi snobbishness on the part of enthusiasts, I cannot notice any difference between my record player and the high-class, high-price transcription decks I heard demonstrated in the first shop. Certainly my wife, who has extremely good hearing, can detect no distortion in the reproduction.

Can it be that slick salesmanship has bred a race of hi-fi enthusiasts who are oblivious of real standards and only appreciate lists of figures ?

By the way, as one who remembers the very first issues of P.W., when it was even bigger than its new format, permit me to congratulate you on its new style.

K. P. L. Rutherford.

Brighton,
Sussex.

One Man and His Dog

YES, I like it. P.W.'s bigger size, that is. It's not so easy to shove in your pocket, of course, and it tends to get a bit battered when it is pushed through the door, but on the whole I certainly think it improves the contents.

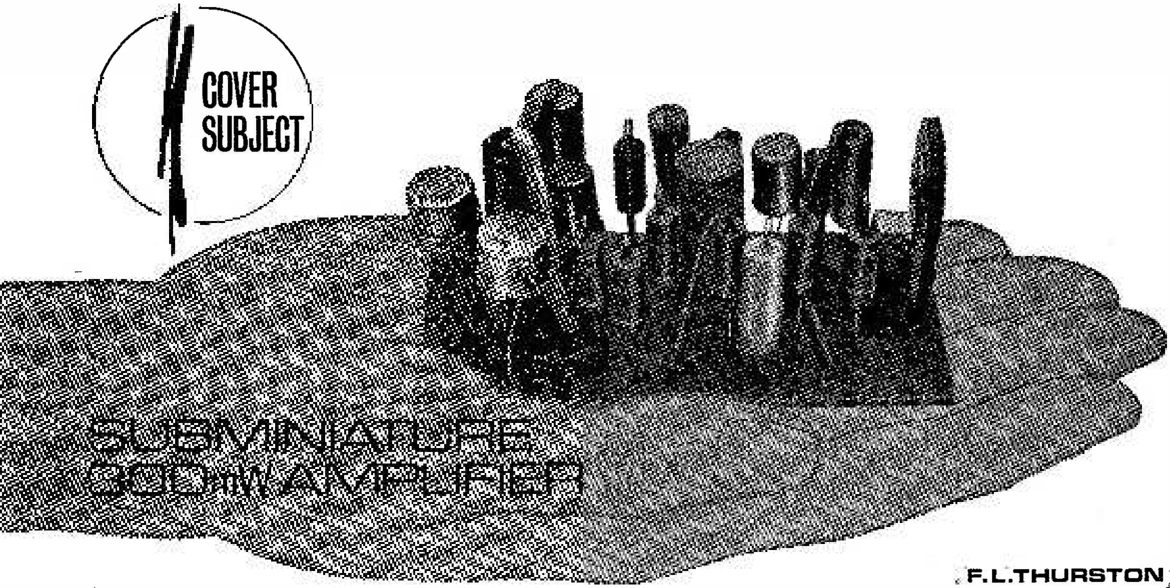
Apart from this, it's easier for the dog to bring in to me with my slippers and the wife finds it better for lighting fires—only after I've read it from cover to cover, of course!

George Lombard.

South Norwood,
London SE25.

[*Such sacrilege!*]—*Editor*

More News and Comment on Page 124



SUBMINIATURE 300mW AMPLIFIER

F. L. THURSTON

THIS handy little amplifier uses a four transistor transformerless circuit. Dimensions of the complete unit are a mere 2½in. x 1 3/16in. x 1in. There are none of those messy problems of making up a printed circuit board; the unit is built up on a Veroboard panel. The unit will pump up to 300mW into a 15Ω speaker, but alternative speaker impedances can be used if preferred, with some loss in either output power or quality.

The unit can be used on its own, as a simple amplifier, or can be built into a radio to replace the existing audio section, or can be used with a tuner, etc. To keep the cost down to a minimum, a range of good quality, low cost transistors have been used.

The Circuit

Before delving into the intricacies of this particular amplifier, it is worth while digressing a little and pointing out some of the disadvantages of the more conventional type of amplifier.

Until a couple of years ago, the most commonly used type of low power (100 to 500mW) amplifiers used a two transformer circuit, with one transformer acting as a phase splitter for driving the push-pull output stages, and the second transformer acting as an impedance changer between the output transistors and the low impedance speaker load. In order to conform to the "miniature" techniques of the rest of the transistor circuitry, these transformers were made very small in physical size; consequently, the efficiency of the transformers was low, but, more important, the efficiency varied considerably with frequency. Consequently, the frequency response and distortion characteristics of the circuits was very poor, being particularly bad at the low frequency end of the scale. The only way around this snag was to apply considerable negative feedback over the offending sections of the amplifiers, with consequent loss in gain. Additional disadvantages of these circuits were (a) that the transformers were quite expensive, contributing about one third of the total cost of the amplifiers, and (b) that the output transistors were required to operate in class 'B', and thus had to be 'matched', increasing the total cost even more.

Transformer Type

Fortunately, the two-transformer type of amplifier has now fallen out of favour with most manufacturers, although it is still quite popular in the amateur world. It should be said, in fairness, that this type of amplifier is perfectly adequate for use in baby alarms, intercoms, phone extension units, etc., where high quality reproduction is not essential.

In the modern type of amplifier, most of the snags that were inherent in the older low-power amplifiers have been overcome by changing the mode of operation of the two output transistors; they are no longer operated in class 'B', but operate either as emitter

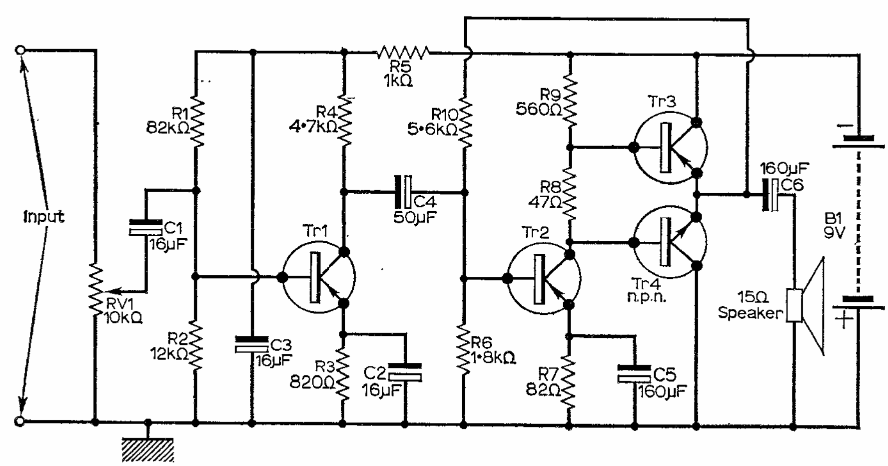


Fig. 1: Circuit of the subminiature transformerless amplifier.

followers or as common emitter amplifiers with 100% negative voltage feedback, either mode giving a very low (virtual earth) output impedance, thus making it possible to do away with the output transformer. Such circuits are referred to as 'transformerless' although, quite frequently, a transformer may be used in the phase-splitter stage, depending on the type of output circuit that is used. In the rest of this article, we shall consider a circuit which is *completely* transformerless.

Tr3 Stage

Fig. 1 shows the full circuit of this unit. Note that the output stage comprises one p-n-p and one n-p-n transistor. The operation of these two transistors can be understood with the aid of the simplified equivalent circuits shown in Figs. 2a and 2b.

Referring, first, to Fig. 2a, Tr3 can be seen to be connected as an emitter follower, with an emitter resistor Re which, in practice, is Tr4. The emitter follower gives a high input impedance (approx. equal to the ß of the transistor times the emitter load, RL), and a low output impedance (approx. equal to the ß of the transistor divided by the input source resistance, Rs). In this circuit, Rs equals 560Ω, being made up by R9 of Fig. 1. The emitter follower has a voltage gain near unity, so, when an input signal that is negative to the emitter of Tr3 is supplied to the circuit via Rs, a similar signal will appear at Tr3 emitter and will be applied, via C6, to RL, the speaker. When positive going signals are connected to Tr3, the transistor input will be reverse biased and no output will be available.

Tr4 Stage

Referring, next, to Fig. 2b, it can be seen that the n-p-n transistor, Tr4, is also connected as an emitter follower, but in this case it has Tr3 as its emitter resistor and has a slightly higher source resistance, Rs. All of the points outlined for Tr3 apply equally to Tr4, with the exception that this transistor conducts on positive input signals and is cut off by the negative ones.

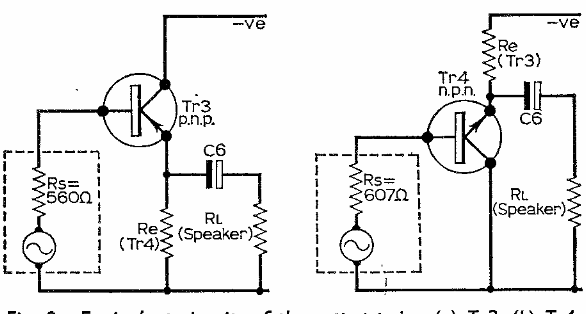


Fig. 2: Equivalent circuits of the output pair—(a) Tr3, (b) Tr4.

	Tr1	Tr2	Tr3	Tr4
Collector	3·6	4·2	9·0	0
Base	0·9	0·8	4·5	4·2
Emitter	0·8	0·7	4·4-4·6	4·4-4·6

Table showing typical check voltages taken with input shorted, using 20,000Ω/V meter on 10V range. Mean current 9mA.

★ components list

Resistors:

R1	82kΩ	R5	1kΩ	R9	560Ω
R2	12kΩ	R6	1·8kΩ	R10	5·6kΩ
R3	820Ω	R7	82Ω		
R4	4·7kΩ	R8	47Ω		

All ½ watt, 10% carbon.
VR1 10kΩ pre-set skeleton miniature.

Capacitors:
C1, C2, C3 16μF C4 50μF C5, C6 160μF
All 15 volt working sub-min. electrolytics.

Transistors:
Tr1, Tr2, GA02 (L.S.T. Components)* or OC75 (Mullard).
Tr3 GP20/60 (Longland's)† (Colour coded blue) Texas 2N1305, Mullard ASY27.
Tr4 GN20/60 (Longland's)† (Coded red/yellow) Texas 2N1304, Mullard ASY29.

Miscellaneous:
15Ω speaker, 9 volt battery, Veroboard, wire, insulated sleeving, etc.

* L.S.T. Components, 182b High Rd., Benfleet, Essex.
† Longland's, 6 Mansfield Place, Ascot, Berkshire.

Thus, if the input signal were connected to both Tr3 and Tr4 at the same time, and RL were made common to both transistors, Tr3 would conduct on all negative inputs and Tr4 on all positive ones, and the signal appearing across RL would closely follow the input.

Returning, now, to Fig. 1, it can be seen that the 15Ω speaker, the equivalent of RL in the Fig. 2a and b diagrams, is common to both Tr3 and Tr4, and that the input signal, taken from Tr2 collector, is common to both transistors except for some small difference that is caused by R9, which is used to give a small degree of base-bias to the output transistors and thus minimise cross-over distortion.

Pre-amp and Driver

Tr2 is wired as a conventional common emitter amplifier, with R8 as its major collector load, and using R6-R10 as its base-bias network. It is important to the operation of the complete circuit that the common emitter junction of Tr3-Tr4 should be maintained at a mean direct voltage level of approximately half the battery supply potential, and to this end the top of R10, the base-bias resistor of Tr2, is taken to the Tr3-Tr4 emitter junction, thus forming a direct-coupled negative feedback loop which tends to stabilise all of the direct voltage levels in this part of the circuit. This loop also provides a.c. negative feedback, which tends to cancel any distortion that might otherwise tend to arise due to the slight unbalance in the drive from Tr2 to Tr3 and Tr4.

Tr1 is wired as a simple common emitter amplifier and acts simply as a pre-amp. for driving Tr2; to prevent instability, a decoupling network, R5-C3, is wired in the negative supply line between the Tr1 stage and the rest of the circuit. The input to the complete amplifier is applied to VR1, a miniature pre-set skeleton pot., which acts as the volume control, and thence on to Tr1 base via C1.

Construction

The unit is fairly compact, all components being mounted vertically on the Veroboard panel; construction is not, however, very difficult, and can be undertaken by the comparative novice (but not the absolute beginner).

Start construction by cutting the Veroboard panel to size and break the copper strips as shown in Fig. 3a. The copper strips can be broken with the aid of a small drill (about $\frac{1}{4}$in.), a sharp penknife, or the special tool that is available.

Next, take VR1 and file and trim the mounting legs until they will fit in the holes in the Veroboard, then solder in position as shown in Fig. 3b, mounting VR1 on the blank side of the board and soldering the legs to the copper strips on the other side. Now solder in the rest of the components, working through the board from left to right, using insulated sleeving where necessary, and making sure to use heat shunts when soldering in the transistors.

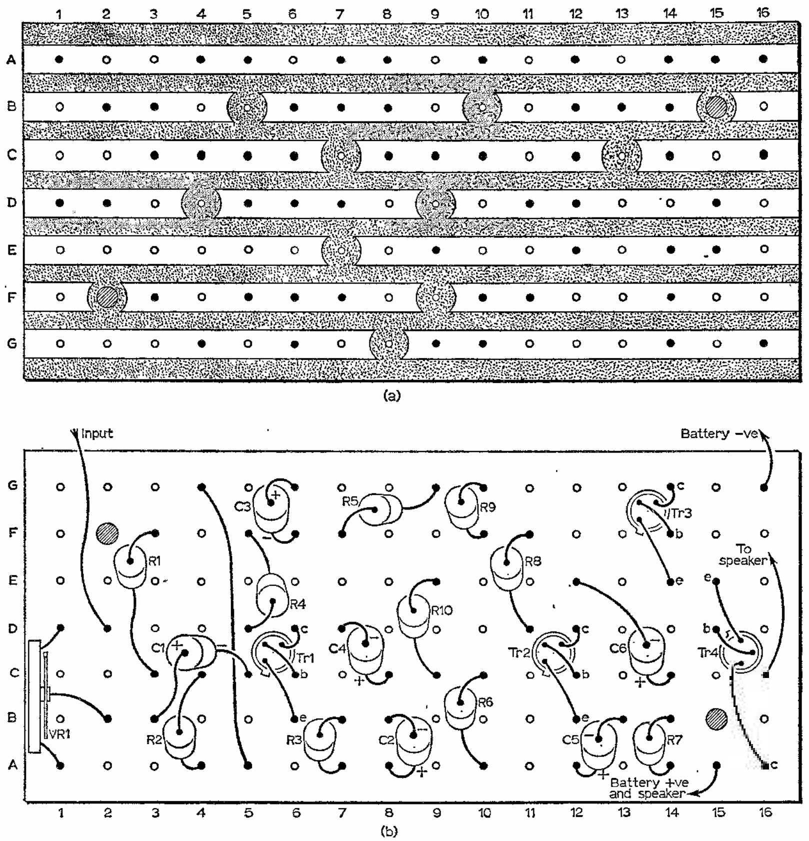


Fig. 3: (a) Copper side of Veroboard, (b) Component layout.

If the unit is to be secured to a case or sub-panel, this can be done by carefully drilling mounting holes as shown in Fig. 3a, taking care to drill the holes to just clear a 6BA screw, and pushing the screw through the Veroboard from the blank side and interposing small rubber grommets between the Veroboard and sub-panel. If this method of mounting is used, make sure that nothing is shorted out by the screws.

Using the Unit

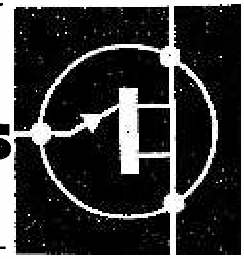
The unit is designed to operate with a 15Ω moving coil speaker, but can be used with alternative value speakers if required. If a speaker with an impedance greater than 15Ω is to be used, no modifications need be made to the circuit, but it will be found that the maximum output power will be somewhat restricted.

If a speaker with an impedance lower than 15Ω is to be used, increase the value of C6 to 1,000Ω. If a very low speaker impedance is used, i.e., 3 or 5Ω it may be found that distortion becomes quite noticeable.

Whatever speaker impedance is used, the d.c. conditions of the unit with the input shorted will be unaffected, and the voltages and currents of the unit should be checked before using the amplifier. (see table).

If preferred, the pre-set resistor, VR1, can be replaced by a 10kΩ variable resistor with a built in on/off switch, suitably placed. ■

unijunctions



By K.T. WILSON

DESPITE their considerable and increasing importance, unijunctions, or "unijunction transistors" as they are sometimes known, seem to be very little used in this country. Unfortunately, the inexorable laws of supply and demand rule that the price of unijunctions in this country should be high, and this in turn prevents them being used in many cases where they would be useful.

Prices are coming down, however, and the cheapest unijunction in the latest lists is certainly within the reach of most experimenters. For information, this is the GE type 2N2646 available at 9s. 11d. from Jermyn Industries, Vestry Estate, Vestry Road, Sevenoaks, Kent. Prices should continue to fall since the unijunction is in the USA the most common triggering device for silicon controlled rectifiers, or thyristors as they are now known, and the use of thyristors is rapidly increasing in all countries.

The unijunction is a three-terminal diode-like device in which two terminals are made to one part, the base, and one to a rectifying contact, the emitter. The symbol for the unijunction is shown in Fig. 1. The two base connections are labelled as B_1 and B_2; the emitter as E. In physical appearance, the unijunction is indistinguishable from a transistor.

Characteristics

The characteristics of the unijunction are fairly simple. As might be expected, there is a pure resistance between the two base contacts; this resistance is usually between 2 and 10kΩ and is, of course, the same measured in either direction, a useful point in distinguishing the unijunction from a transistor.

Since all available unijunctions are silicon rather than germanium devices, the temperature co-efficient of the base-to-base resistance is fairly low, about 1% change in resistance per degree centigrade change in temperature. The temperature coefficient is positive, i.e. an increase in temperature causes an increase in resistance.

If a voltage is now placed between base 1 and base 2, the emitter junction being left unconnected, the emitter, since it is connected between the two bases, will take up a potential between the extremes of voltage. Since the bases are interchangeable some convention must be followed, and, it is usually assumed that base 1 is the earthy connection.

The ratio of the voltage between the emitter and base 1 and the voltage between the bases can now be determined (see Fig. 2) and this is another important parameter, called the "instrinsic standoff ratio" or ISR. Its value is usually between $\frac{1}{2}$ and $\frac{3}{4}$.

Since the ISR $= \frac{Ve}{VB_2}$ it follows that $Ve = VB_2.ISR$, so that given the ISR for any unijunction device, the natural potential of the emitter can be calculated. This calculation is of very great importance for all unijunction circuits, as will be presently shown.

Let us now examine what happens when an external voltage is applied to the emitter at the same time that a voltage is applied between the bases. If the voltage at the emitter is below the natural potential calculated above, then only a very small leakage current can flow. This current remains negligible until the voltage at the emitter is allowed to rise a little above the natural potential (about 0·2V).

When this occurs, the emitter junction starts to conduct like any other diode which has been forward-biassed. The resistance between the emitter and base 1 becomes very small, and the emitter then tries to supply all the current to base 1. To prevent this surge of current becoming destructive, external resistors must be arranged in the base 1 lead or in the emitter lead, or both.

We can see that the action of the unijunction is rather like that of a thyratron in the time-bases of early TV sets. It is not surprising that our first illustration of the use of a unijunction shows it playing the part of two transistors in a time-base type of circuit (Fig. 3).

Consider the circuit of Fig. 3 when the voltage is

Fig. 1: Symbol for a Unijunction.

Fig. 2: Determining the ISR

Fig. 3: Unijunction timebase oscillator.

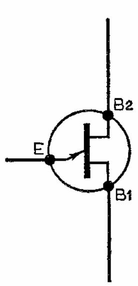


Fig. 1

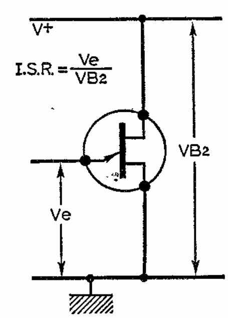


Fig. 2

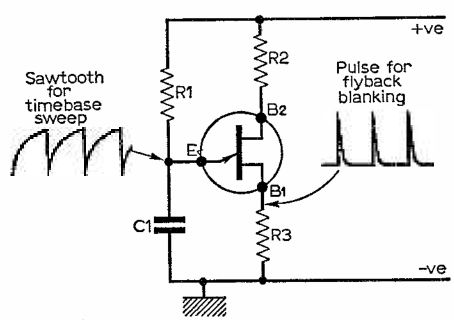


Fig. 3

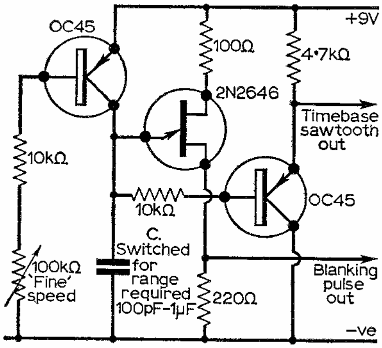


Fig.4

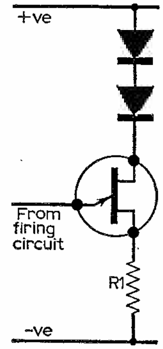
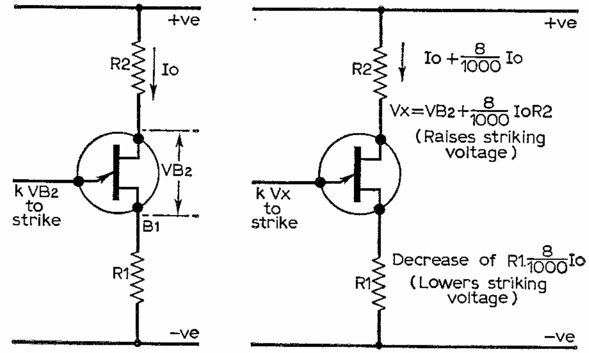


Fig.5



(a) Fig.6 (b)

Fig. 4: Timebase circuit suitable for use with the new low-deflection-voltage c.r.t. Fig. 5: Use of silicon diodes to compensate emitter potential variation. Fig. 6: Use of base resistors to compensate emitter variation (a) 25°C, (b) 26°C.

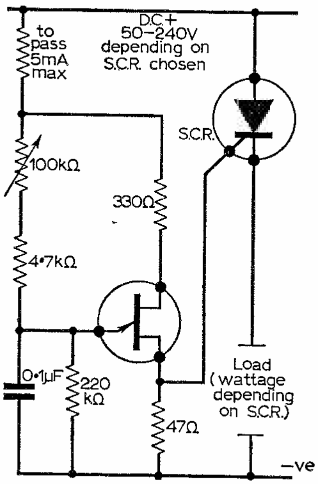


Fig.7

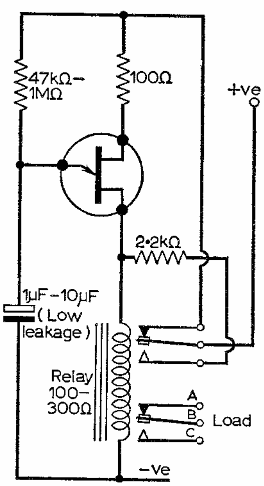
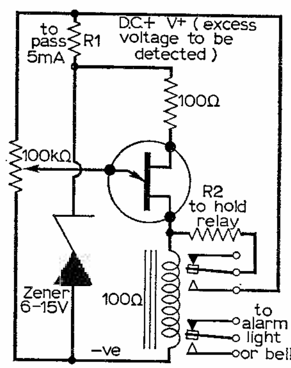


Fig.8



R1 is chosen so as to pass 5mA.
i.e. R1= $\frac{V+-Vz}{5}$ in kΩ
R2 is chosen so as to hold relay on
i.e. R2(kΩ)= $\frac{Vx}{\text{Relay holding current in mA}}$

Fig.9

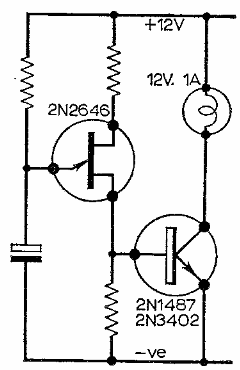


Fig.10

Fig. 7: Typical circuit for a unijunction-fired thyristor power controller. Fig. 8: Electronic timer. NOTE that one set of changeover contacts on the relay is used to hold the relay on. For photographic use, the contacts A and B would be in series with the exposure light. Fig. 9: Excess voltage detector. Fig. 10: Light flasher circuit. NOTE that both the n-p-n power transistor 2N3402 and the unijunction 2N2646 are available from Jermyn Industries.

first applied. Since the capacitor C1 is uncharged, the potential at the emitter must be zero, and no emitter current will flow. As the capacitor charges, the emitter potential increases until the device " fires ", and the capacitor discharges through the resistor in the base 1 circuit.

The emitter voltage then drops until the high current can no longer be sustained (usually at an emitter voltage of 1—2V) and the action starts all over again. The outputs of this circuit consist of an approximate sawtooth from the capacitor, and a sharp pulse from the resistor in the base 1 circuit.

If the capacitor charging resistor is replaced by a transistor, an excellent sawtooth can be obtained, especially if the output is taken via an emitter-follower, as in the circuit of Fig. 4, which shows a time-base circuit suitable for oscilloscope use with the new low-deflection-voltage oscilloscope tubes which are now available.

Temperature Effects

Unlike a thyratron, however, the unijunction is affected by temperature, as might be expected of any semiconductor device. The parameter most affected by temperature is the emitter firing voltage which is equal to the natural potential Ve calculated before, plus the voltage across the diode formed by the emitter and the base contact.

It is this latter diode voltage which is temperature sensitive to the tune of some 2 millivolts per degree centigrade; the diode voltage decreasing as the temperature increases and vice versa.

There are several methods of compensating for this change of firing voltage with temperature, one shown in Fig. 5 uses silicon junction diodes with the same temperature sensitivity as the unijunction to compensate. Another method is to use the temperature variation of the base 1 to base 2 resistance (which is about 0·8% per degree C) as a form of compensation, as this temperature variation is in the opposite direction.

If the base-to-base resistance is much greater than the external resistances, the current through the unijunction is set by the base-to-base resistance. Let this current be Io. Then, following Fig. 6, for a temperature rise of one degree the current must change by

—continued on page 146

new books

BUILDING AND USING SOUND MIXERS.
By R. E. STEELE, A.M.S.E., GRAD. I.E.D. Focal Press Ltd., London and New York. 152 pages. Size 8½in. x 7¼in. Price 30s.

IF you are interested in sound mixers and you require a practical book, then this one is a bargain. A bargain because it provides a complete and practical study of precisely what the title implies. Commencing with a simple introduction to the subject, it presses on with decibels and their use; simple resistive circuits, design problems and technicalities; power supplies; installation; practical circuits; and use and adjustment. Also included is an extra 8 page appendix with useful information on logarithms, decibels, impedances, resistors, colour coding, and a glossary of terms. For the audio enthusiast and those interested in the mixing and building side of the business, this book is highly recommended.—*DLG*

PRINCIPLES OF AERIAL DESIGN.
By H. Page. Published by Iliffe Books. 172 pages. Size 8½ x 5in. Price 50s.

TO present a book on the subject of aerial design is no easy task. On the one hand is the vast ocean of abstruse mathematics, while on the other the danger of over-simplification. The author attempts to steer a middle course between these two extremes. The theory of aerials is developed from first principles, but where approximations are necessary in order to avoid mathematical complication the reasons are given and the significance of the approximations indicated. It opens with a concise exposition of the laws governing electric and magnetic phenomena upon the basis of field theory, and the fundamental concepts and quantities are introduced and defined. The theory and practical applications of Maxwell's electromagnetic wave equations are next dealt with (and there is an appendix which gives the derivation of the vector formulae employed). A further chapter is concerned mainly with the two important characteristics of an aerial for transmission or reception—the radiation pattern and the impedance—while the final chapter describes the practical forms which aerials take for particular uses and the various techniques employed to obtain the effect.—*HCA*.

ABC's OF ELECTRIC ORGANS.
By Norman H. Crowhurst. Published by W. Foulsham & Co., Ltd., Slough, Bucks. 96 pages. Size 8¾in. x 5½in. Price 16s.

THIS book has attempted to include, in 96 pages, what should really require 296. As a result it is difficult to see that it will satisfy any reader no matter what level is considered.

Although headed the *ABC's of Electronic Organs* it spends the first twenty-odd pages, one-fifth of the entire book, talking about *non*-electronic devices, and it might have been better to condense this into far fewer pages.

The inside cover assures that items will be of special interest to the electronics technician. However the few odd parts of circuits that are illustrated are devoid of component values, except for just one isolated item.

The crowning glory for the technician is the amazing logic in the statement on page 85 which imparts the knowledge that "Failure to oscillate indicates some quite obvious defect . . .!" It is regrettable that the only parts of this book which held your reviewer's attention were the introduction by W. Oliver, and the Glossary.—*LSA*

SCIENCE PROJECTS IN ELECTRICITY.
By Edward M. Noll. Published by Foulsham-Sams & Co. Ltd., Slough, Buckinghamshire. 142 pages. Size 8¾in. x 5½in. Price 24s.

THIS book enables the beginner to the world of radio and electronics to find out "what it's all about". Chapter 1 introduces the reader to the principles of electric current flow and subsequent chapters cover electrical units, terms and circuits, magnetism, d.c. and a.c. electricity, inductors and transformers, capacitors. The final chapter deals with the construction and use of a simple crystal set.

In addition to the practical constructional projects, each chapter contains sufficient text to explain the basic theory necessary to understand the principles involved. So that with this book, it is possible for the beginner to observe what happens in electrical circuits and to understand why it happens.—*CRR*

FOULSHAM-SAMS POCKET DICTIONARY OF COMPUTER TERMS.
Compiled by The Howard W. Sams Technical Staff. Published by W. Foulsham & Co. Ltd., Slough, Bucks. 96 pages. Size 6¾in. x 4¼in. Price 10s. 6d.

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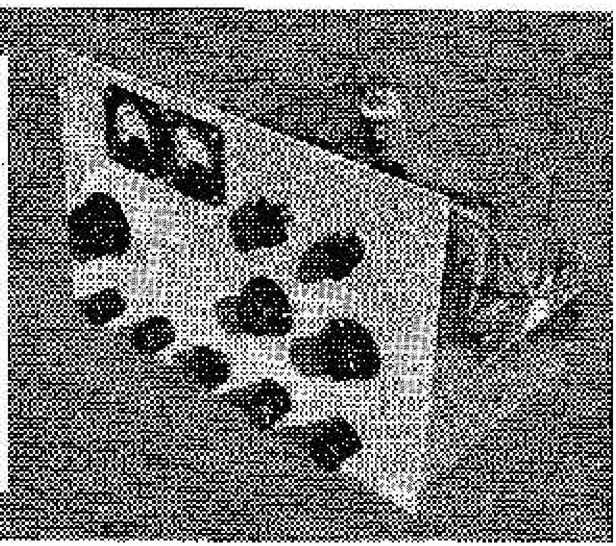
THE 'IMPERIAL' 3-band transmitter

F.G.RAYER G3OGR



A TRANSMITTER in the 30-60 watt range, with internal v.f.o. and high level modulation, is extremely useful, and the one described here can be constructed at much less cost than that of a ready-made transmitter of equal power. Actual building is straightforward, with no snags or particular difficulties. The whole transmitter occupies a single chassis, the power pack being separate. It covers 80, 40 and 20 metre bands, and incorporates send-receive switching to avoid the need for an external switch or relay.

THE CIRCUIT

The circuit is shown in Fig. 1 and a brief explanation of valve functions may be helpful. V1 is the variable frequency oscillator or v.f.o., operating with a regulated supply from V2, and covering 3·5—3·8 mc/s. It is constructed in a box, easily made as described. Drive from the v.f.o. cathode is through C6 to the buffer/multiplier V3.

For 80 and 40, the anode circuit of V3 is untuned. For 20, S1 introduces the broad-banded coil L2, so that V3 functions as doubler. V4 is the amplifier/driver, the coil L3 being tuned to the working frequency on all bands. VR1 allows grid drive to the power amplifier V5 to be adjusted as required. By closing the "Net" switch, h.t. is applied to V1—V4, so that tuning and grid drive may be adjusted.

V5 is the p.a., operating straight through on all bands. More than enough grid drive is available on all bands. L3 may in fact be switched to give 15m coverage, with sufficient grid drive. V5 may be operated with up to 60 watts input.

As it is essential to observe grid and anode currents of V5, two meters are provided. Surplus meters can be purchased at low cost, and this is much more convenient than having a single meter, with grid/anode switching. L4 is the switched tank coil, intended to operate into 75Ω, but actually able to work with aerial impedances up to some hundreds of Ω.

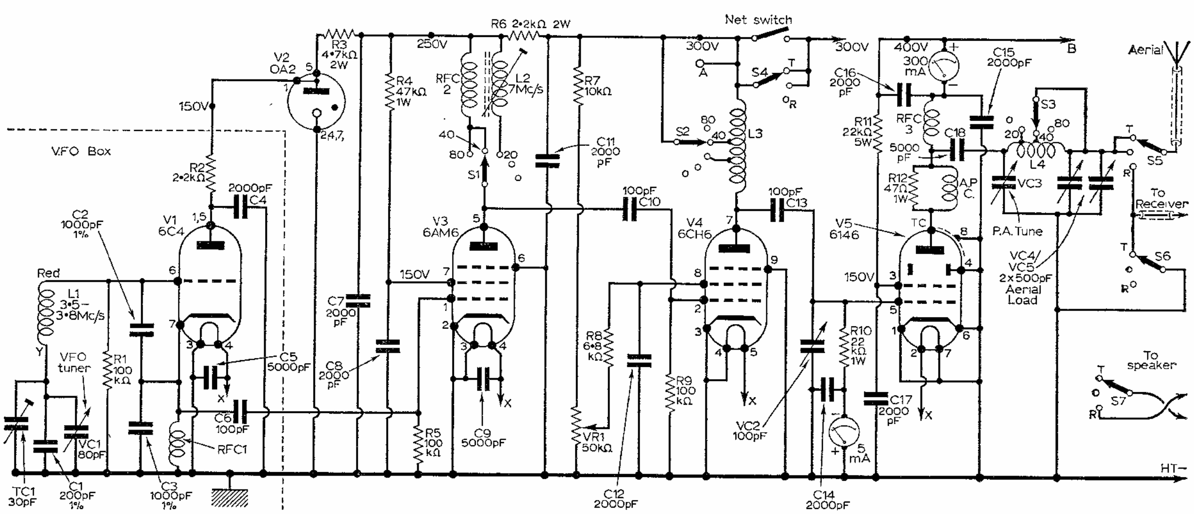


Fig. 1: Complete circuit diagram of the 3-band transmitter.

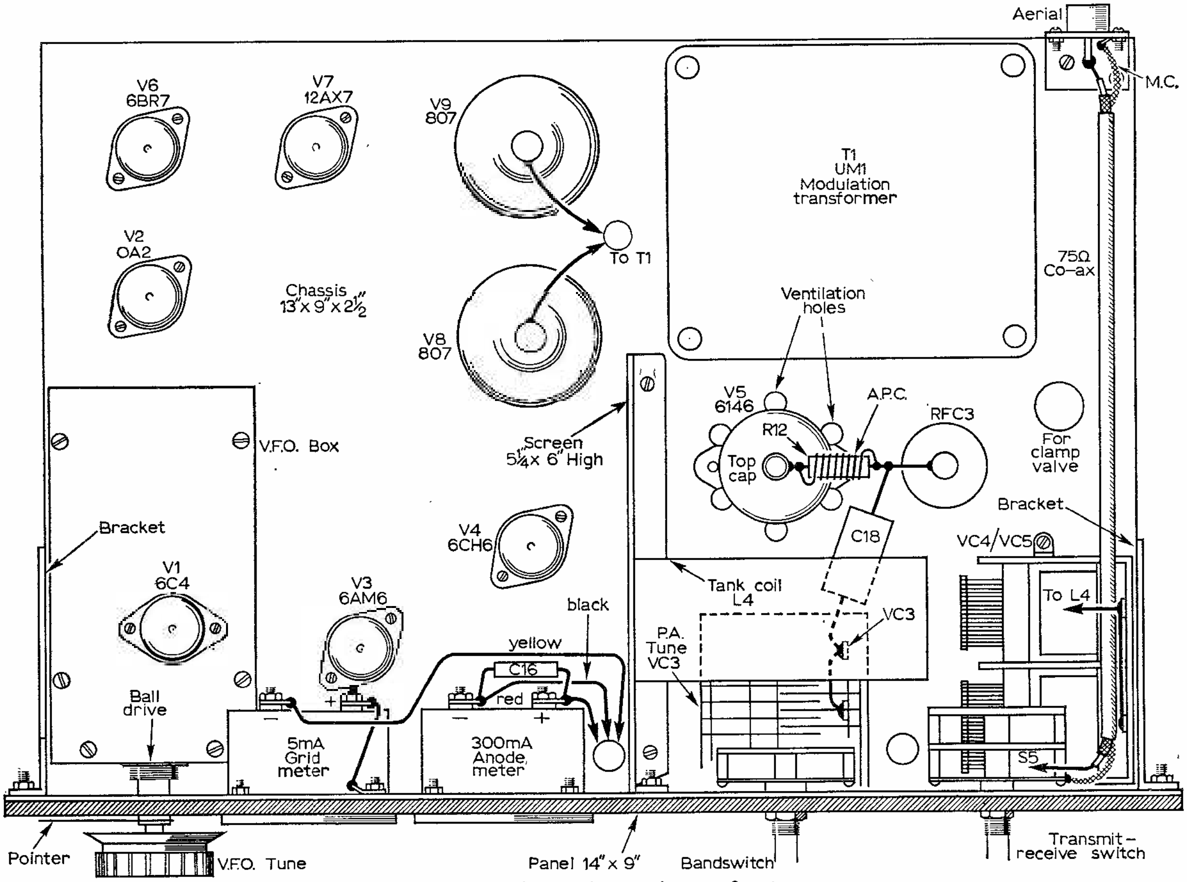


Fig. 2: Top-of-chassis view layout showing layout of major components.

V6 is a high-gain pre-amplifier, for crystal microphone. V7 acts as amplifier and phase splitter, driving the pair of 807's which provide high level anode and screen grid modulation. The Woden modulation transformer is rated for 60W to the p.a. and 30W of audio, and gives excellent results with lower inputs.

The transmit-receive switch has five sections. S4 applies h.t. to the exciter and V6 and V7 of the audio amplifier. S5 transfers the aerial from transmitter to receiver. S6 shorts the aerial circuit of the receiver on transmit, while S7 mutes the receiver speaker. S8 switches h.t. to the p.a. V5 and modulator valves V8 and V9. There is no need to use the particular h.t. voltages shown.

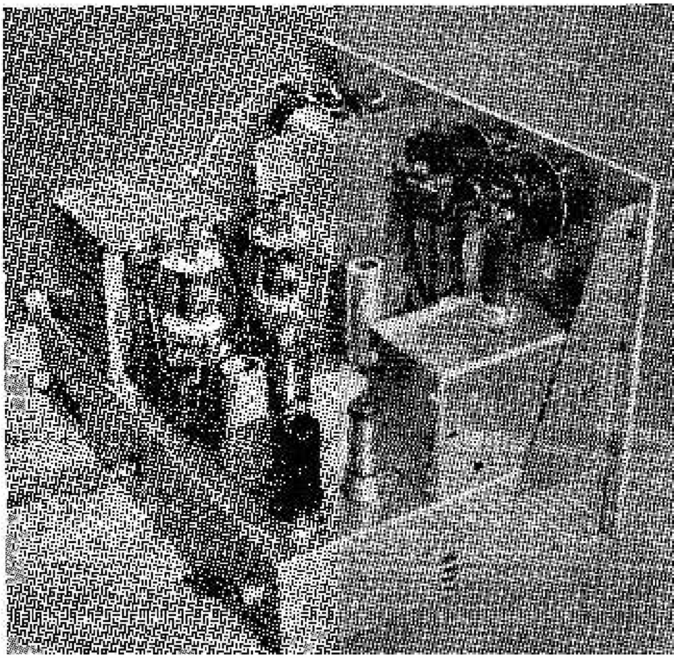
LATER MODS

Some modifications can be made to the transmitter later. These include adding a screen clamp valve to protect the p.a. and allow keying in an earlier stage. V.F.O. coverage can also be modified for greater bandspread on 7mc/s and 14 mc/s. This does not increase efficiency, but opens out the v.f.o. scale on these bands. The transmitter has also been used on 21mc/s, but this is not included as adjustments become somewhat critical. A high/low power switch can also be added, to permit tuning up V5 at reduced power.

—continued overleaf

★ **WARNING !** ★
It is an offence to use transmitting equipment except where a GPO licence is held.

View of the completed transmitter showing main constructional features.



METALWORK

Fig. 2 is the chassis layout, with positions of the valveholders, etc. Note ventilation holes are punched round the V5 position. The modulation transformer requires an opening about $2\frac{1}{2}$ in. by $2\frac{1}{2}$ in. which can be made by drilling at the corners, then cutting the piece away with a metal saw.

The centre screen is aluminium, $5\frac{3}{4}$ in. x $6\frac{1}{2}$ in. and a $\frac{1}{2}$ in. flange is bent at right angles to meet the chassis and panel. This, and two side brackets, about 3 in. wide and 7 in. high, bolted to chassis sides and panel, give a rigid assembly.

The panel was 22 s.w.g. aluminium faced with hardboard painted grey, both pieces being 14 in x 9 in. The aluminium and hardboard can be fixed together with bolts in the bracket positions, and both can then be drilled together. Also punch or drill the front chassis runner for the five control bushes located below the chassis. A clearance hole is required for the v.f.o. ball drive.

All the most important drilling should be finished before mounting any components to avoid trouble from metal fragments. These parts can then be assembled. A tag is placed under each valveholder fixing nut.

WIRING

The anti-parasitic choke is five turns of 18 s.w.g. wire, forming a coil $\frac{3}{4}$ in. long and with an outside diameter of $\frac{3}{8}$ in. R12 is placed inside the choke, and connected to V5 cap clip and C18 by the shortest possible leads.

A co-axial socket is fitted to a bracket at the rear of the chassis, and a piece of 75Ω transmitter grade co-axial cable runs to the transmit-receive switch. This socket should not be under the chassis. L4 and its switch are best left until the transmit-receive switch has been connected.

Ceramic disc capacitors are best for most r.f. by-pass positions, though not essential. They should be connected by very short leads.

When wiring V5, use 16 or 18 s.w.g. for the chassis return, and solder this as near the pin contact part of the sockets as possible, not to the socket tag ends. The descending lead of RFC3 must also go immediately to C15.

Heater and h.t. circuit connections run against the chassis. Wires and components carrying r.f. (notably grid and anode circuits of V3 and V4, and the grid circuit of V5) should be connected in the most direct manner.

In the audio amplifier, screened leads run from VR2 to C22 and grid pin 7 of V7. R13 and C19 are to keep r.f. out of the amplifier, and C22 and C24 are of such value as to give a strong middle frequency response. Note that R21 and R22 are five per cent, or checked as similar with a meter. This also applies to R24 and R25.

BUFFER ANODE CIRCUIT

The coil L2 has 36 turns of 32 s.w.g. enamelled wire side by side on a $\frac{1}{2}$ in. diameter cored former as in Fig. 3. Any other small coil which can be tuned to about 7·1Mc/s would do. Section S1 of the exciter bandswitch selects L2 for 14Mc/s and r.f.c.2 for 3·5 and 7Mc/s. Switching here is in the anode circuit, but as V4 is doubling except when V3

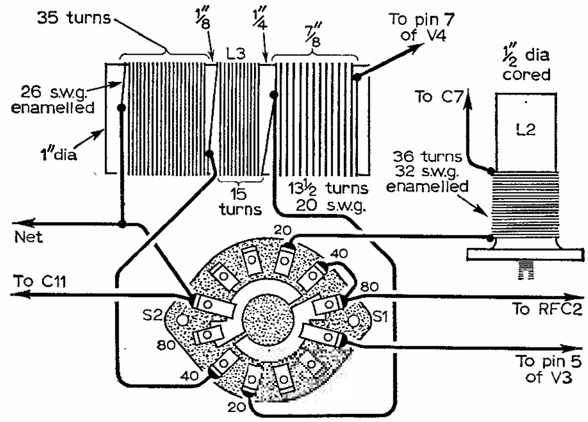


Fig. 3: Details of L2 and L3 with switching.

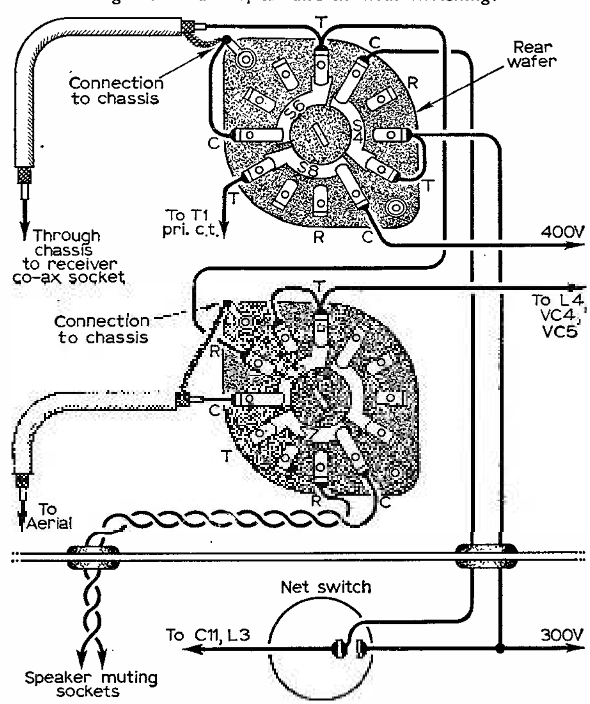


Fig. 4: Transmit/Receive and Net switching.

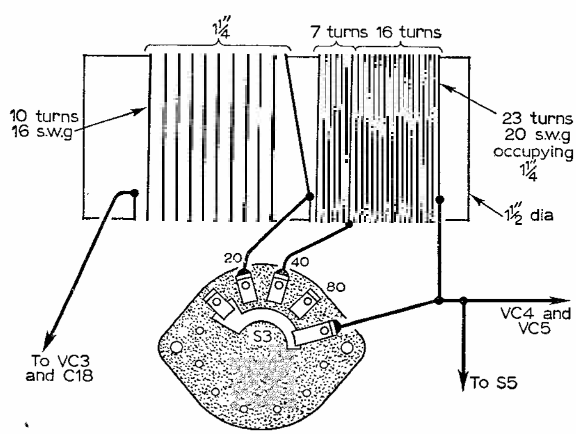
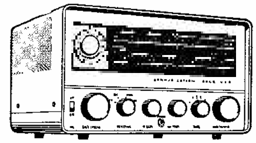


Fig. 5: Details of tank coil L4.

LAFAYETTE HA-63 COMMUNICATION RECEIVER



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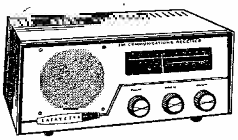

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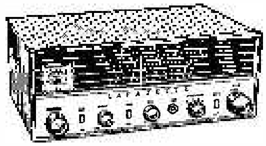

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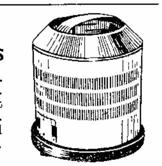

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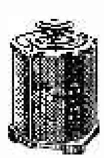

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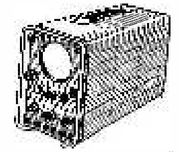

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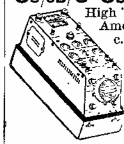

High quality Portable American Oscilloscope, 3in. c.r.t. T/B 3c/s-50kc/s X Amp: 0-500 kc/s Y Amp: 0.2 Mc/s. Power requirements 105-125v. A.C. Supplied in brand new condition. Fully tested. **£25.** Carr. 10/-. Suitable 230-115 v. Transformer, **15/6.**

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Time base 2 c/s-750 kc/s. Calibrators at 100 kc/s and 1 Mc/s. Separate Y1 and Y2 amplifiers up to 5.5 Mc/s. Operation 110/230 volt A.C. Supplied in perfect working order. **£27.10.0.** Carriage 20/-.

LAFAYETTE TE-46 RESISTANCE CAPACITY ANALYZER

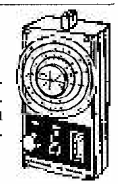
2 PF—2,000 MFD, 2 ohms—200 Megohms. Also checks impedance, turns ratio insulation 200-250 v. A.C. Brand New **£15.** Carr. 7/6.

TE-20 RF SIGNAL GENERATOR

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

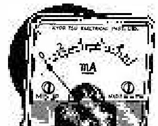
S.A.E. for details.

LAFAYETTE NUVISTOR GRID DIP METER



Compact, true one hand operation. Frequency range 1.7 - 180 Mc/s. 230v. A.C. operation. Supplied complete with all coils and instructions. **£12.10.0.** Carr. 5/-.

CLEAR PLASTIC PANEL METERS



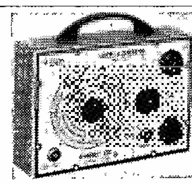
First grade quality, Moving Coil panel meters, available ex-stock. S.A.E. for illustrated leaflet. Discounts for quantity. Available as follows: Type MR, 38P, 1 21/32in. square fronts.

100-0-100µA	**27/6**	200mA	**22/6**	100V D.C.	**22/6**
500-0-500µA	**22/6**	300mA	**22/6**	150V D.C.	**22/6**
1-0-1mA	**22/6**	500mA	**22/6**	300V D.C.	**22/6**
1mA	**22/6**	750mA	**22/6**	500V D.C.	**22/6**
2mA	**22/6**	1A D.C.	**22/6**	750V D.C.	**22/6**
5mA	**22/6**	2A D.C.	**22/6**	15V A.C.	**22/6**
10mA	**22/6**	5A D.C.	**22/6**	50V A.C.	**22/6**
20mA	**22/6**	3V D.C.	**22/6**	150V A.C.	**22/6**
50mA	**22/6**	10V D.C.	**22/6**	300V A.C.	**22/6**
100mA	**22/6**	20V D.C.	**22/6**	500V A.C.	**22/6**
150mA	**22/6**	50V D.C.	**22/6**	'S' Meter 1mA	**29/6**

50µA	**32/6**
100µA	**29/6**
200µA	**27/6**
500µA	**25/-**
50-0-50µA	**29/6**

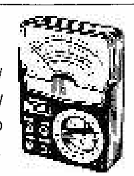
POST EXTRA. Larger sizes available—send for lists.

NOMBREX EQUIPMENT



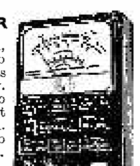
Transistorised Audio Generator 10-100,000 c/s. Sine or square wave. **£16.15.0.**
Transistorised Signal Generator 150 kc/s. 350 Mc/s. **£10.0.0.**
Transistorised resistance capacity bridge 1Ω. 100 MegΩ. 1pF-100µF. **£9.10.0.**
Transistorised Induction bridge, 1µN-100H. **£18.** Mains operated Transistor power supply unit, output 1-15v. up to 100mA. **£6.10.0.**
All above post paid with battery.

TE-51 NEW 20,000Ω /VOLT MULTIMETER



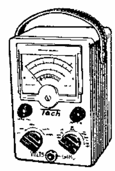
0 / 6 / 60 / 120 / 1,200V. A.C.
0 / 3 / 30 / 60 / 300 / 600/3,000V. D.C.
0 / 60µA / 12 / 300 MA. D.C.
0 / 60K / 6 Meg.Ω
85/-. P. & P. 2/6.

TS-76 20,000 O.P.V. PUSH BUTTON MULTI-TESTER



Simple operation, D.C. volts up to 1,000 v. A.C. volts up to 1,000 v. Resistance up to 10 megohm. Current up to 250 mA. Decibels — 20 to + 36 db. **£5.5.0.** P. & P. 2/-.

MODEL PV-58 VALVE VOLTMETER



11 meg. input. 7 D.C. volt ranges. 1.5-1,500 v. 7 A.C. volt ranges. 1.5-1,500 v. 4,000 Peak to Peak. Resistance .2 ohm to 1,000 megohm. Decibels — 10db to +65db. Supplied brand new with instructions, leads and probe. **£12.10.0.** P. & P. 3/6.

MODEL 500. 30,000 opv, 0/.5/1/2.5/10/25 / 100 / 250 / 500 / 1,000 v. D.C.
0 / 2.5 / 10 / 25 / 100 / 250 / 500 / 1,000v. A.C.
0 / 50µA / 5 / 50 / 500mA. 12 amp D.C.
0 / 60K / 6 Meg. / 60 MegΩ. **£8.17.6.**
Post paid.

G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155
Cables: SMITHEX LESQUARE
3-34 LISLE STREET, LONDON, W.C.2

★ components list

Capacitors

C1 200pF 1%
C2 1000pF 1%
C3 1000pF 1%
C4 2000pF disc ceramic
C5 5000pF ,, ,,

C6 100pF ,, ,,
C7 2000pF ,, ,,
C8 2000pF ,, ,,
C9 5000pF ,, ,,
C10 100pF ,, ,,

C11 2000pF ,, ,,
C12 2000pF ,, ,,
C13 100pF ,, ,,
C14 2000pF ,, ,,
C15 2000pF 2-4kV.

C16 2000pF disc ceramic
C17 2000pF ,, ,,
C18 5000pF 2-4kV.
C19 35pF
C20 0·05μF 250V.

C21 50μF, 6V. Electrolytic
C22 2000pF disc ceramic
C23 8μF, 350V. Electrolytic
C24 2000pF disc ceramic
C25 0·01μF mica

C26 0·01μF mica
C27 50μF, 50V } Electrolytic
C28 8μF, 350V } Electrolytic
C29 5000pF mica
C30 5000pF mica

TC1 30pF high stability trimmer
VC1 Air spaced tuning, 80pF or similar
VC2 100pF air spaced tuning
VC3 150-250pF or similar wide spaced (Eddystone 817 etc.)
VC4/VC5 2-gang 500pF or similar non-miniature type.

Valves

V1 6C4
V2 OA2
V3 6AM6
V4 6CH6
V5 6146
V6 6BR7
V7 12AX7
V8/V9 2 x 807's

Switches

2 pole 5 way rotary switch
1 pole on/off ditto
1 pole 4 way ditto
3 pole 3 way bank

Inductors

RFC1 2·5mH cored miniature type.
RFC2 Denco (Clacton) Ltd. type RFC5.
RFC3 Denco (Clacton) Ltd. type RFC9 (250mA).
T1 Woden UM1

Resistors

All resistors ½ watt except where marked

R1 100kΩ
R2 2·2kΩ
R3 4·7kΩ 2W
R4 47kΩ 1W
R5 100kΩ

R6 2·2kΩ 2W
R7 10kΩ
R8 6·8kΩ
R9 100kΩ
R10 22kΩ 1W

R11 22kΩ 5W (10W for CW)
R12 47 ohms 1 watt
R13 33kΩ
R14 470kΩ
R15 1MΩ

R16 270kΩ
R17 1·8kΩ
R18 270kΩ
R19 3·3kΩ
R20 470kΩ

R21 100kΩ 5%
R22 100kΩ 5%
R23 3·3kΩ
R24 220kΩ 5%
R25 220kΩ 5%

R26 33kΩ
R27 33kΩ
R28 330 ohms 3W
R29 47kΩ 2W
R30 15kΩ 6W

VR1 50kΩ 2-watt potentiometer
VR2 500kΩ potentiometer

Miscellaneous

5mA meter. 150-300mA meter, or shunted as necessary

Ten knobs. 75 ohms co-axial cable. Screened insulated cable.
Three B7G holders, skirted type. Two cans
Three B9A holders with cans
Two UX5 holders
Octal ceramic holder

Chassis 13 x 9 x 2½in.
Panel 14 x 9in.
Universal Chassis runners 7 x 3in. and 4½ x 3in. (Home Radio, Mitcham), 20swg aluminium 4½ x 2½in., and 3 x 2½in. (VFO box).
Screen about 6 x 5¼in. with flanges. Two panel brackets.
Ball drive. Tag strips. Two co-axial sockets. Twin socket strip.
Wire and formers for coils described. Wearite PHF6 or equivalent.

is untuned on 3·5Mc/s there is no trouble from instability.

L3 is wound as in Fig. 3.

With L3 wound as shown, 14Mc/s should be found with VC2 almost fully open. For 3·5Mc/s, VC2 is about half closed, and 7Mc/s falls between these positions. L3 is supported on a pillar (or long bolt).

FUNCTION SWITCHING

Connections for this are shown in Fig. 4. The switch has three positions. This allows the transmitter aerial circuit to be made before h.t. is applied to the p.a., while h.t. is removed before the aerial circuit is interrupted. In addition, h.t. is always present on the exciter before the p.a. is operating.

The front wafer has only two poles in use. The rear wafer needs three poles. The latter wafer was actually a 2-way 4-pole assembly, providing no contact to any circuit at "receive". An ordinary 3-way wafer is equally suitable, of course.

Wiring is most easily carried out by soldering coloured flexible leads to the tags as in Fig. 4, and taking them down through the chassis. They can then be identified and connected below. The Net switch is simply in parallel with S4. The speaker muting and receiver co-axial leads are kept clear of the aerial co-axial lead from S5. Short connections are made to the points MC by placing tags under the switch assembly bolt. Adequately insulated wire must be used for the h.t. circuits, and especially from S8 and the modulation transformer.

TANK COIL

The p.a. tank coil is wound as in Fig. 5, using very short leads. It is supported from the centre screen. It is most convenient to prepare the coil with projecting leads, then to cut and shape these, and solder them to the switch and capacitors.

This coil will allow loading of the transmitter by any of the usual transmitter aerials. A dipole is suitable, or one of the popular multi-band arrangements.

Continued Next Month

ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequences in kc/s

THE BROADCAST BANDS by JOHN GUTTRIDGE

Burma: Burma Broadcasting Service (Prome Road, Kamayut P.O., Rangoon) has been heard in Burmese on 4,795. Sign off is 1445.

China: *Radio Peking* (Broadcasting Administration, Fu Hsin Men, Peking) reported in English 0830—0930 on 15,450/15,300/9,530 and in 25 m.b. Also 0930—1030 on 15,300 and in 19 and 25 m.b. A medium wave transmitter located in Western China and beaming Russian to Soviet Union is audible in the U.K. on 1,523.

Indonesia: *Radio Republik Indonesia* (P.O. Box 157, Djakarta) has English for Europe 1900—2000 on 9,865/9,690. The frequency of 9,780 has also been reported. There is also an English transmission at 1430—1530 on 9,865/11,795.

Japan: *N.H.K.* (Tokyo) introduced a retimed schedule at the beginning of April the most important feature of which is the return of the evening service for Europe from 1930—2030. Languages are German, English and Swedish and frequencies are 9,700/11,965. An English segment is retained in the morning transmission retimed to run from 0630—0830 on 15,135. Other retimed services in English or with English segments are: North American 2345—0045 11,780/15,135; North and Latin American 0100—0300 15,135/15,235/17,875; Hawaiian 0630—0730 15,235/17,725; Philippine, Indonesian and Malaysian 1130—1300 9,525/11,780/11,940; Southeast Asian 1230—1530 9,765/11,705/11,875; South Asian 1330—1500 9,525/9,765/11,780; African 1600—1700 9,670/11,780; Middle East and North African 1730—1900 9525/11780. A new set of QSL cards has been produced by N.H.K.

Pakistan: *Radio Pakistan* (71 Garden Road, Karachi 3) has English 0030—0100 on 9,625. Dictation news in English may be heard 1335—1350 on 9,820. This frequency is also used for English news at 1500. The UK English service at 1945—2030 now uses 7,100/9,675.

Singapore: *Radio Singapore* (Broadcasting Division, Ministry of Culture, P.O. Box 1902, Singapore) has English 0200—0300 on 11,940.

Vietnam: (Democratic Republic): *The Voice of Vietnam*, (No. 58 Quan-Su Street, Hanoi) is using the new frequency of 11,720. Reported with Japanese 1330—1400. English transmissions, all on 11,840/9,840, are aired at 1000—1030, 1300—1330, 1530—1600, 2300—2330.

Australia: *Radio Australia* (P.O. Box 428G, G.P.O. Melbourne) now transmits in English to Europe from 0645—0745. Frequencies are 9,570/11,710. The North American 1214—1315 English transmission is now on 11,840.

New Zealand: *Radio New Zealand* (New Zealand Broadcasting Corporation, P.O. Box 2396, Wellington C1) uses 9,540/11,780 1700—1945, 0600—0845, 0900—1145; on 9,540 0815—0845 (Sundays only); on 11,780 2000—2230. U.K. reception is reported best on 9,540 at 0900—1030.

Canada: Canadian Broadcasting Corporation (P.O. Box 6000, Montreal). The North Canada service from 0230—0700 is now carried on 11,720/9,625. For the 2200—2245 transmission 9,625 has been replaced by 15,190. Other frequencies are 11,720/5,970. A new QSL giving all verification details is now being issued.

U.S.A.: Although strictly broadcast band stations RCA communications stations provide an interesting catch. A very good QSL is provided. Try for WES 65, New York on 15,460 and DZR 41 at Manila in the Philippines on 19,980.

Radio New York Worldwide (4 West 58th Street, New York, N.Y. 10019) expects to have the following frequency usage until September 3. On 15,300 1200—1400, on 15,440 1200—2400; on 17,780 1215—1800; on 17,845 1800—2145; on 17,730 1500—2200; on 17,840 2200—2400.

Cuba: *Radio Habana*, (Apartado 7026, Habana) transmits in English 0100—0330 6,170; 0330—0600 6,170/6,135; 1800—1900 15,340; 2010—2140 11,735; 2050—2150 15,300/15,270.

Haiti: Radio Station 4 VEH (Box 1, Cape Haitien) has English 1030—1400 on 11,835/9,770/6,120/2,450.

Brazil: *Radio Sociedad da Bahia* (Rua Carlos Gomes 57, Salvador) reported with a powerful signal 2240—2330 on 11,875. Frequent identification given during programme of Latin American musics. Some reports give the frequency as 11,871. Also heard on 15,160 up to 2,000.

Radio Feira de Santana (Casilla Postale 32, Feira de Santana) can be heard over ZYN37, 4,765, at 0030.

Radio Brasil Central (Casilla Postale 330, Goiania) is reported with ZYY2 on 5,000 at 2400. The station is listed on 4,995. 5,000 is a frequency reserved for standard frequency transmitters.

Radio Rio Mar (Casilla Postale 443, Manaus) has been heard with excellent signal at 0030 on 9,695.

Clandestine: *Radio Scali* has been heard on 13,800 with sign off at 2205. Does anyone know anything about this station?

Thanks to reports and help this month go to S. Ormerod, John W. Smith, Middlesbrough High School SW Club, A. E. Martin, M. Goodwin, S. Peter Jones, S. Shaw, "Sweden calling Dxers", B. Petifer, S. L. Brunt, G. Roberts, J. Halpin, Roy Patrick, Radio New York Worldwide, W. F. Goulding, C. Skelcher, A. J. Jenkins and the Swiss Broadcasting Corporation.

STERN-CLYNE ELECTRONIC CENTRES

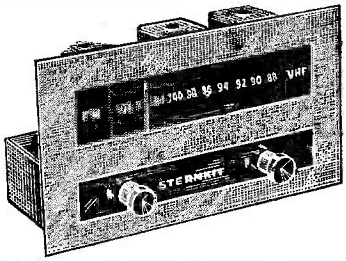
MEMBER OF THE PANTIYA GROUP OF COMPANIES

MAIL ORDER & ALL ENQUIRIES TO: DEPT. PW, 3-5 EDEN GROVE, HOLLOWAY, LONDON, N.7. Tel. NORth 8161/5.

LONDON:
18 Tottenham Court Road, W.1 MUS 5929/0095
23 Tottenham Court Road, W.1 MUSeum 3451
309 Edgware Road, W.2. PADdington 6963
109 Fleet Street, E.C.4. FLEet Street 5812/3
162 Holloway Road, N.7. NORth 7941

9 Camberwell Church Street, S.E.5. RODney 2875
220 Edgware Road, W.2. PADdington 5607
CROYDON: 12 Suffolk House, George Street. MUNicipal 3250
BRISTOL: 26 Merchant Street, Bristol 1. Bristol 20261

LIVERPOOL: 52 Lord Street. Royal 7450
MANCHESTER: 20/22 Withy Grove, M/c 4. Blackfriars 5379/5246
SHEFFIELD: 125 The Moor. Sheffield 29993
NOTTINGHAM: Eastown House, Lincoln St. Nottingham 45889



SUPERB NEW STERN-CLYNE FMI VHF TUNER

Specially designed for the Amateur builder, a new sensitive tuner unit that provides stable, interference-free reception of BBC FM transmissions. High quality output signal ensures optimum performance from any Hi-Fi audio system, superb styling makes for harmonious installation with existing equipment. Reliable easily aligned circuit employs RF stage, tuned anode tuned grid freq. changer, 2 IF's, Noise Limiter and Ratio Detector. Input sens. 100mV for 40 db. req. changer, 2 IF's, Noise Limiter and Ratio Detector. Input sens. 100mV for 40 db. Distortion less than 1% at full deviation. Power req. 200v at 20 mA and 6.3v at 1.8A. Panel black and silver-grey, size 8 x 5in.

FM1 Kit of parts **£7.9.6** Carr. 4/-.
Assembled and tested £10.9.6 Carr. 4/-.
Optional Power Pack available.

HIRE PURCHASE TRANS. AVAILABLE FOR ALL GOODS OVER £13.10.0.

TEST 7 POCKET MULTIMETER

39/6 Carr. 2/-

A really versatile instrument that makes a handy pocket-size tool. Measures AC or DC voltage in three ranges of 0-15-150-1000v. Resistance 0-100,000 ohms, and Current 0-150 mA.DC. Size only 3¾ x 2¼ x 1⅛in., with ingenious dial design providing a clear, easily read scale. Complete with battery and test leads.

GARRARD 3000 AUTOCHANGER

Intended for use with high compliance cartridges and featuring a low mass arm that minimizes record wear. Four standard speeds. Finished dark grey with chrome relief. Clearance required 13⅞in. wide x 12¼in. front rear. Above board 4⅞in. below 2⅝in. For 100/130v and 200/250v AC. Complete with 9TA/HC cartridge.

£8.8.0 Carr. 5/-

EXCLUSIVE OFFER OF TOP QUALITY RECORDING TAPE

New American branded tape by world renowned manufacturers and equal in quality to the best obtainable anywhere. Guaranteed splice free, red oxide coated, with full frequency response and uniform output. Resistant to moisture, heat, cold and abrasion. Available in a wide range of Acetate and Polyester qualities. each distinctively boxed and cellophane wrapped in colour coded cartons showing recording times at 7½, 3¾ and 1⅞ i.p.s. Compare the prices!

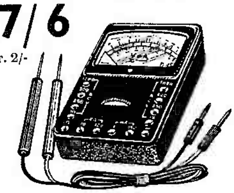
RANGE AVAILABLE:

POLYESTER			ACETATE		
3¾in.	600ft. Double Play	11 6	5in.	600ft. Standard	8 6
7in.	1,200ft. Standard	12 6	5in.	900ft. Long Play	10 0
5in.	1,200ft. Double Play	15 0	5¾in.	1,200ft. Long Play	12 6
7in.	1,800ft. Long Play	20 0			
5¾in.	1,800ft. Double Play	22 6			
7in.	2,400ft. Double Play	25 0			

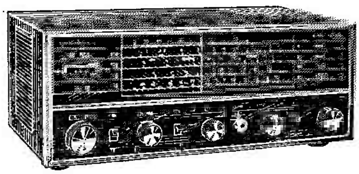
Both types post and packing 1/- per reel. Four or more reels post free.

TEST 8 MULTIMETER

57/6 Carr. 2/-



Compact all purpose tester with 12 specially selected ranges for all home and motor car wiring and servicing, amateur radio, TV fixing, electronic hobby work, etc. Extremely robust construction employs rugged large scale meter movement and plug-in range selection to obviate switch wear defects and ensure trouble-free life. In tough metal backed impact resisting case Ranges: 0-10-250-500-1,000v. A.C. and D.C. (sens. 1,000 ohms per volt) 0-1-250 mA D.C. current. 0-10,000-100,000 ohms resistance. Size only 4⅞" x 3½" x 1½" deep. Complete with test leads and battery.

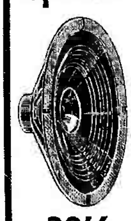


NEW ADVANCED DESIGN.... VERITONE Compact Communications Receiver

20 Gns. Carr. & Ins. 15/-

New, highly developed communications receiver has portable radio proportions and a performance comparable with many highly expensive professional receivers. Continuous frequency coverage from 540 kc/s to 30 mc/s takes in all broadcast bands, shipping, world-wide short wave and amateur bands. Built in superfeatures include extra large dial. 'S' meter, variable pitch BFO, Noise Limiter, extra quality loudspeaker, extending rod aerial to receive all but more distant stations. Extras include phone output. Standby switch, etc. Uses ultra modern multi valves 12BE6, 12AU6, 12BA6, 50OC5 and silicon rect. Meticulously constructed and handsomely finished in attractive metal case. Only 13½ x 5 x 8in. deep. Essential for all serious listeners yet cheaper than many commercial sets. For 200/250 volts mains operation.

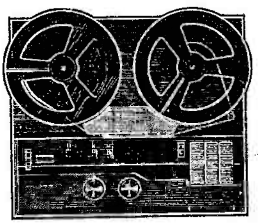
Special offer of 12 inch LOUD-SPEAKERS



39/6 Carr. 3/6

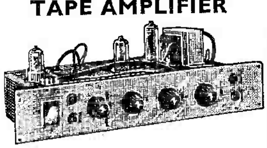
High quality, all British units with built-in tweeter cone, and a high flux magnet that ensures wide range reproduction. Handles 6 watts easily. Heavy pressed steel construction. Available for 15 ohms or 3 ohms impedance.

MAGNAVOX 363 TAPE TRANSPORTER



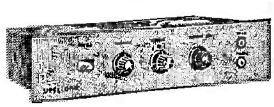
Manufactured to precise limits that permit recording and tape playback to the highest standards set by the Music Industry. Simple reliable design employs a single high-duty motor with heavy flywheel. Features include fast wind on and rapid rewind, pause control, 3-speed selection with interlock, built-in revolution indicator, piano key controls. Speeds 1⅞, 3¾ and 7½ i.p.s. Wow and flutter 0.15% on 7½ i.p.s. Max. spool size 7in. Playing time up to 120 min. per track from 1,200ft. standard tape. Size 13½ x 11in. plus 5¼in. below mounting board. With ½ track heads, £10.10.0. With ¼ track heads. £13.19.6. *Add 10/- carriage and insurance.*

HF/TR3 TAPE AMPLIFIER



Easily the best complete tape amplifier available to the home builder. Supplied already matched for the Magnavox 363 tapedeck, but may be readily matched to most other decks.
Features include: switched equalization for all speeds (CCIR standards at 7½ i.p.s.) Treble boost incorporated during Record. Bass boost during playback, speaker output matched for 3, 7.5, and 15 ohms, additional outputs for extension speaker, phone monitoring on Record and Hi-Fi playback through existing systems, Inputs for Mic. Pick-up, and VHF Radio. Valves: EF86, ECC83, EL84, EM81, EZ81. Size overall: 11 x 6 x 6in. (Panel 13¾ x 3in.). Power pack on separate chassis size 7½ x 3 x 4½in. Amp. and power pack. Kit of parts £13.13s. Assembled and tested £19. *Add 7/6 carriage.*
Carrying Case specially designed to take Magnavox 363 and HF/TR3 unit. Superbly constructed finish, dark grey cloth. £5 extra.
10in. x 6in. elliptical speaker suitable for use with above.

TAPE PRE-AMP AMPLIFIER TYPE 'C'



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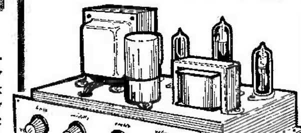

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A MAJOR tragedy this month. A bumper crop of "real fab" logs but not enough room on one page to get them all in. So my thanks to all those who did send in those very excellent reports and sorry if yours is not in print this month.

Top Band

Conditions all round have varied from superb to even more superb. From **Portsmouth G3SED** informs that topband is not merely alive—it's positively crawling. Proof of this is Mike's QSO with ZL3RB (New Zealand) when the ZL was 579. This is no freak either since ZL3RB has also worked G3RPB and G3RFS on this band. Even on 20 a ZL is DX so how does one describe it on topband? So fantastic have conditions been on this frequency that 9V1LP (Ex 9M4) sent Mike a tape of his (Mike's) sigs. arriving there at 599! The log for the past couple of weeks at G3SED reads—EP2BK/MM, HK4EB, IS1FR, VE2UQ, VE3LI, W1BB/1, W1HGT, W1JXV/KP4, W1MO, W2AQV, W2IU, WA4LDM, W8HGW, W9PNE, W9VXO, W9YYG, ZB2AM, ZL3RB, 4U1ITU, 9H1AE, 9L1HX, 9V1LP. Just for the record the antenna is a Marconi with 85ft. semi-vertical section and tuned against an earth mat, half a square mile in area! (Must get the XYL to knit me one for Christmas out of ex-gvt. telephone wire.)

10 Metres

At the other end of the spectrum we find those openings on 28Mc/s getting more frequent. In March openings came on the 6th, 12th, 13th, 16th, 19th and 20th. **Chris Clarke** comments that the openings on 19th, 20th, were just 28 days after the amazing conditions and openings to "W" land on February 19th i.e. approximately the sun's rotational period. Wonder if the real keen types phone Jodrell Bank to check what the sun's up to before switching on? The log **Chris** (Farnham) sends for 10 metres is as follows, all on phone too—CE8AO 55, CR6AL 54, CR6BX 54, CR7IZ 57, CX1BY 54, CX2AY 57, CX7AAS 57, EA8EV 57, EL2AP 55, FS7RT 54, plus scores of G's. All between 1300 and 1900hrs. Others include HK4KL, LU8EVH, PY2AQQ, UA6FEG, UL7APG, VP6JC, YV5BPJ, ZE1AN, ZE2JA, ZE5JS, ZS4OI, ZS6JK, ZS9J, 4X4IH, 9J2DT, 9J2VX.

Fifteen and Twenty

Fifteen and Twenty have been superb at times and sometimes so much DX about it's been difficult to decide who to listen for. An indication of these happenings can be judged from the following log from **Chris Claydon** (Fife) 840C, the log is not in alphabetical order, just as they queued up at the antenna for recognition on 15, VS9KRV (Kamaran Is.) ZS1ACO, CN8LK, VQ8AW (Mauritius), 9K2AD, ZC4TX, JA5BII, PY2CTF, VS9AMD, 9J2WR, KV4CI, 6W8LQ, WØKDF, 5R8CB, 7G1A, TN8AA, VO1AW, WA8MSR, VE3YD, CR6JA, 9H1R, ZE1JR, CR7IZ, ZS6AAC, W6QI, W6MSM, ZB2AM, VE3AZZ, W2CSQ/MM, KP4BFF, K7UKS, CM1AR, CO5FS, CX2FD, CX9AAN, FG7XX (Guadeloupe) HK7UL, MP4BEU, OA4UO, PJ2ME (St. Maarten) PZ1BE, TF2WJS, 9Y4LZ, 7Q7LC, 7X2AH, 9K2AD, WA1EAV/VP9, VU2FN, VU2GC. **C. Clarke** (Surrey), 12 valve homebrew s/het, 33ft. piece of wire, also on 21 all on phone logged. JA–1CIA, 1DQL, 1LVS, 1NSJ, 2AYP, 2BRR, 7BEI, ØBLU, K–1ZKW, 2VTC, 2KZX/MM, 3NHL, 5MOH, 8AXK, 9AWK, KR6DJ, KV4CX, MP4BAA, OA4KY, OD5BZ, OX3JV, SV1AB, UA3KAO, UA6AW, UA9UH, UW3IN, VE3AXF, VK2NN, VS6AJ, VS9AFR, W–1EEP, 2GKZ, 3FF8, 4GHT, 5PMZ, 8DAF, 9HOG, ØYCT/MM, YW8AX, YV1SB.

Ian Black's HE30 (Kent) informed him of the following stations on 20 via his multee antenna—CN8BV, CR6CN, CR7GF, CR9AI, DU1BA, EA8H, FG7XL, HI1SO, HI8XMT, HKØAI (San Andres Is.), HL7AZ, HR1JMF, HS1JMF, KG4BD, KL7WAH, K2GGN/P/KL7, KP4RK, KZ5PW, LA2JK/P (Jan Meyen Is.), OD5BV, OHØNI, OX3YK, PJ4AC, PZ1BW, ST2BSS, VE1AED/P/SU, TF3EA, VK7RX, VK9DJ, VP2GLE, VP5RB, VP9BN, VQ8BJ, VQ9HB (Seychelles), VS9KRV (Kamaran Is.), XE1CCW, XW8BM, YS1AG, ZB2AJ, ZC4CI, ZD5D, ZF1XX (Cayman Is.), 4X4BL, 5A1TS, 5A3TS, 5A5TJ, 5Z4GT, 6O1AU, 6Y5AR, 7Q7LA, 7X2MD, 9J2VX, 9K2AM, 9M2AA, 9M6NQ, 9Q5HF, 9V1MY. All on phone, s.s.b./a.m.

Eighty

Eighty metres totally deserted! One of those disagreeing with this is **Chris Peel** (Stoke-on-Trent), S750, 45ft. l.w. he heard the following on s.s.b. all around 2400hrs. W1, 2, 3, 4, 5, 8, 9, Ø, VE1, 2, 3, VO1, CN8AW, EA9IC (Ifni) 4S1WL, OHØNF, OX3KI, SM6CKU/MM (off Ceylon coast) VK2AVA (1900hrs.) VK4FJ, ZB2AO, 6W8CW, 9J2MX. **F. Simpson** (Hull) confesses to hearing on 80–CN8MT, KP4ASP, KZ5FX, OHØNI, PJ3CD, TF3ST, UB5CEP, UW9AF, VE1, 2, 3, VO1, VP2AA, VP7NS, VP9DC, YV5BWY, ZL4LM, 6Y5XG, 7X2AH.

Odds and Ends

Something to listen for this month? Try the following, VR6TC 15/20 s.s.b. daily skeds, KX6JI 20 c.w. (Japtan) WA9QJW 29100 kc/s using 5 watts! HP9FC/MM on board ship on the New York/South Africa run. VP5GC (Grand Cayman) evenings only due to p.s.u. problems. VS9K (Kamaran Is.). VQ9HB will be visiting 7Q7 (Aldabra Is.) 6O1AU to do a jaunt round Jordan as JY1AU. 9Q5HF a missionary station starting up again with skeds to W-land, nice to hear you back gents. Contests for the keen include June 4th and 5th, National Field Day, 4th and 5th, CHC/FHC HTH QSO Party, 12th R.S.G.B. National Mobile Rally at Wethersfield, Essex. 19th D/F Qualifying Event, July 3rd. 144 mc/s Contest (Portables).

Lastly if you can put the logs in alphabetical order it does help your columnist's ageing eyeballs, (after a couple of hours all the callsigns start to look the same!). Deadline this month is 20th, how about a log from you this month?

practically wireless commentary by HENRY

No 22

Sending it back

HOW many times have you picked up a piece of faulty equipment and felt like wrapping it around the manufacturer's neck?

More and more often in latter years, we'll be bound. Built-in obsolescence, intentional or otherwise, seems to be the watchword of the "sixties"! And nowhere is it more apparent than in the radio industry — the domestic sector, at any rate.

Wrapping it around the manufacturer's neck.

These wry thoughts are sparked off by some Mullard pronouncements on the subject of servicing. A while ago, the Mullard Films and Lectures Organisation were bustling up and down the country meeting radio dealers and their engineers and warning them that the near future would bring many more solid-state devices on the market.

They were concerned with the reluctance of many radio dealers to tackle the servicing of transistorised equipment. They were even more worried about the growing (we nearly said escalating) number of sets being returned to the manufacturer's service departments.

" You won't be able to send 'em back so easily when hybrid and fully transistorised TV gets into full swing—which may be sooner than many of us suspect," warned Mr. Ian Nicholson.

Won't they, indeed! Henry would not care to take bets on it. Mr. Nicholson, usually so assiduous with his homework, has not been looking at the few examples of transistorised TV at present on the market. It may not be a feasible proposition to wrap them up in brown paper and trust them to Her Majesty's Mails, but all the " mystery bits " are removable in sections, once you have managed to crack open the cabinet.

* * *

On the subject of radios, Mr. N. was also off the beam. He proferred a mild amazement that 60 to 70 per cent of returned receivers had "mechanical" faults. Broken aerial coil leads, cracked ferrite rods, poor switch contacts, faulty earphone sockets, broken components — these were just a few of the things that should have been cured " at source ".

Granted—but where is the source, and why, in fact, are so many mini-midgets packed and dispatched to the manufacturer instead of to the dealer's workshop?

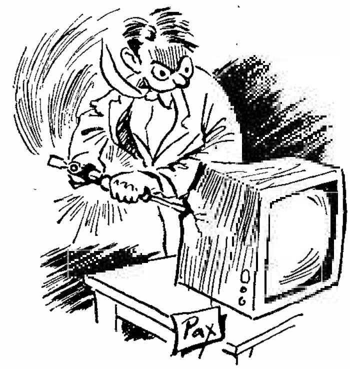
First, the time source is the production line at the factory, where many of these faults can be circumvented. This especially applies to dry joints, tightly wired components that strain both the foil and themselves, and cracked PC boards.

* * *

Looking deeper the prevalent fault of the broken aerial coil, the cracked rod, and even faulty switch contacts, can be the result of downright bad construction. Add to this the knobs that either invite a heavy thumb to dislodge a control from the board (or the board from the cabinet) and the other type which defies removal without something, somewhere going " Crack "!

Add the self-tapping screws machine fitted so tightly into plastic mouldings that one attempt at removal must inevitably strip the thread. Add a dozen more examples any service engineer can give you and there, Mr. N. is the reason the dealer just will not waste his time on the mini-midget set.

Dealers can be excused for risking manufacturers' service charges and postage and hoping to recoup their losses from the customer—at least, this worthy is more likely to pay if he thinks the "proper authorities" have dealt with his precious little monster.



Managed to crack open the cabinet.

As a typical Henry afterthought —manufacturers who perpetrate such atrocities deserve to have them dumped on their doorstep.

Finally, Mr. N. take heart. This state of affairs is not the fault of Mullard (or Brimar, or G.E.C.) whose original designs may be impeccable — often brilliant. We can lay the blame squarely at the door of the cost-conscious production boys who interpret the circuits in terms of cheaply available hardware.

How many home-built sets based on Mullard circuits do our readers return, Mr. N?

transistor set booster

FOR THE CAR

GORDON J. KING

A GREAT deal of interest has resulted from my article in the June, 1965, edition of PRACTICAL WIRELESS entitled "Using a Portable in a Car" and many readers have asked for circuit and constructional information for a wideband medium-frequency amplifier that can be connected between a simple car-type aerial and the aerial socket of a transistor portable.

One of the biggest problems in running an ordinary ferrite-rod aerial portable in a car lies in overcoming the screening due to the metal body. The connection of a car-type aerial direct to the aerial socket generally gives only marginal improvement due to the limited amount of signal that such an aerial can abstract from the radio wave and the poor coupling coefficient between the aerial and the set.

An amplifier can overcome these problems by boosting the aerial signal about ten times and by serving as a matching device between the aerial and the aerial socket of the set. Of course, the directional properties of the set are also outweighed when the majority of signal is by way of a boosted outside aerial.

RE-RADIATION

The article in the June edition also mentioned re-radiation of the boosted aerial signal in the car itself as a means of avoiding connection between the amplifier and the aerial socket of the set. At the present time the added complication of this technique is barely necessary because most transistor sets have an aerial socket anyway, and those that have not can easily have a coupling loop fitted, as this article shows. This ensures maximum signal transfer from the amplifier to the transistor set at all times. Thus, this article can be considered as a sequel to that in the June edition. It gives details of a circuit and suggestions for the construction of a suitable wideband amplifier. The amplifier also has facilities for the powering of a transistor portable from the car battery itself, thereby relieving the drain on the internal batteries of the set when it is used in the car.

The circuit of the device is given in Fig. 1. There is not a great deal of non-convention in this circuit, and the amplifier part follows ordinary practice.

The aerial signal is fed to the base of Tr1 via the isolating capacitor C1. This has a fairly high value to avoid attentuation of the higher frequency signals, since the impedance at the base is in order of 1kΩ. This value is desirable since the amplifier may be fed from a screened cable from the aerial (see later). A very small forward current is applied to the emitter junction of Tr1 by the fairly high value base resistor R1. This results in an emitter current of about 400μA at normal temperatures. The collector is loaded with an r.f. choke which has an impedance which is high at all medium-frequencies, falling around the 2Mc/s mark. This choke, in conjunction with its self-capacitance and the collector capacitance of Tr1, resonates around 200kc/s, thereby giving a substantial lift on the Light Programme (1,500 metres).

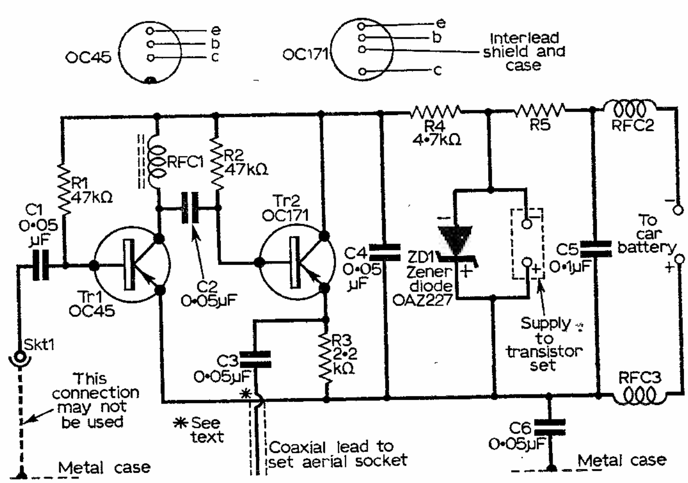


Fig. 1: Circuit diagram of the unit.

LIGHT PROGRAMME BOOST

A lift here is often desirable in many areas of the country where the l.w. Light Programme is not all that easily received, particularly in a car. True, the m.w. Light Programme may be receivable, but then after dusk this is often masked by a very bad adjacent station interference. The Light Programme is rather important now that the BBC is extending its "popular" programme into the early hours of the morning from this transmitter—particularly so far as late night and early morning car drivers are concerned.

The amplified signals at the collector of Tr1 are capacitively-coupled to the base of Tr2. This transistor is virtually a "buffer" stage. It is arranged in common-collector (emitter-follower) mode, so has a high input impedance and a fairly low output impedance. This means that Tr1 is not unduly loaded so keeps its fairly high gain and that a resonable match can be attained into the aerial socket of a transistor portable. The signal at the emitter of the transistor is fed to the aerial socket of the set through the coupling capacitor C3 and a screened coaxial lead. C4 provides decoupling, but by adjusting the value of this capacitor the gain of the device can be varied. For instance, if the value is taken down to 0·005μF the overall gain of the amplifier is reduced by about 6dB. R4 is the associated decoupling resistor, and it also protects the transistors from thermal runaway, for if the temperature of transistors is caused to rise—by the unit being exposed to the sun through the car windows or by it being placed in the air stream from the car heater, for instance—the emitter/collector current of the transistor is limited to a safe value by R4. Without this resistor, the emitter/collector current of Tr1 could rise to a value of destruction. The current in Tr2 is somewhat limited by R3, however.

Tr2 takes little more than about 400μA at normal temperature, so the total consumption of the amplifier is less than 1mA! The transistor currents have purposely been kept low to minimise noise, and overload problems are not all that serious in practice. If one drives close to a powerful transmitter with the amplifier working, a whistle, buzz or other characteristic breakthrough may occur, but this lasts only for a short period of time. When passing an airfield, for example, a buzz may occur when the radar aerials beam energy on to the car.

★ components list

Resistors (all ½W. unless otherwise stated)
R1 47kΩ
R2 47kΩ
R3 2·2kΩ
R4 4·7kΩ
R5 50Ω 2 watt

Capacitors (all 12V wkg. unless otherwise stated)
C1, C2, C3, C4 0·05μF
C5 0·1μF 25V wkg.
C6 0·05μF

Semiconductors:
Tr1 Mullard OC45
Tr2 Mullard OC171
*ZD1 Mullard Zener diode type OAZ227 (connection E2 with "eyelet" to cathode) or equivalent.

Chokes:
RFC1 10mH miniature h.f. choke (Home Radio Mitcham Ltd.)
RFC2, RFC3 1A TV-type suppressor choke (Radio Spares)

Miscellaneous:
2-oz. tobacco tin. Tag strips. Aerial socket. Sundry wire, etc.

***Important:** The connections to the diode **must** be reversed when a diode with eyelet to anode (cathode to stud) is used. For operation as a zener diode it is important that the **cathode** is connected to positive voltage.

POWER SUPPLY

So much, then, for the amplifier part of the circuit. The remaining part concerns the power supply. The unit is designed to work from the car battery, and there is also a voltage regulated supply therein enabling the transistor set to draw its power from the car battery, if required.

Stabilisation is provided by the zener diode ZD1. The zener stabilises at 9·1V (from a 12V car battery, as shown in the circuit). The zener current is adjusted by the series resistor R5. It will be noticed that this diode is connected across the supply for reverse conduction. That is, with the "anode" connected to supply negative. A characteristic of this kind of diode is that at a certain value of reverse voltage there is heavy conduction. This is called the "zener voltage", at which point the effective diode resistance is very low. The voltage then across the zener diode is independent of the applied voltage, so that should this vary the zener voltage remains substantially constant.

Such a device is necessary to operate a transistor set from a car battery for the battery voltage may vary from about 11V in a discharged state up to about 14V when fully charged. The voltage across the battery is also affected by the amount of power being supplied by the dynamo and by the load on the battery due to the electrical equipment in the car. If the amplifier is to be used solely from the car battery without the transistor set itself drawing power from the supply, then the zener diode and the 50Ω resistor can be omitted. Slight variation of voltage so far as the constant-current amplifier circuit is concerned is of no consequence.

Nevertheless some form of r.f. filtering is desirable, particularly to keep the high-frequency components of the electrical pulses produced by the ignition and electrical equipment of the car from the amplifier supply. This is taken care of by the two chokes, RFC2 and RFC3, and the 0·1μF capacitor C5.

CONSTRUCTION

The amplifier can easily be built into a small metal box, an ideal housing being a 2oz. tobacco tin. How such an amplifier can be built into such a housing is revealed in great detail in Fig. 2. This shows that the components are supported in the tin by seven tag panels, four with five tags (carrying three tags isolated from the tin) and three with three tags (carrying two tags isolated from the tin).

An important point to note is that the tin itself is *not* used as a common earth. That is, it is not in direct electrical connection with either the positive or negative supply. This is to avoid any possibility of a short circuit relative to the car electrical system should the metal of the car make contact with the tin. From the r.f. point of view, however, the tin is connected to supply positive through C6.

It will be noticed that the braid of the coaxial lead to the set is directly terminated to supply positive on the amplifier circuit. It is essential, therefore, to ensure that the braid of this lead does not come into contact either with the tin or with any metal part of the car. It is led out of the tin through a rubber grommet.

ZENER MOUNTING

The construction of the amplifier is so straightforward that no comment is necessary apart, perhaps, from the mounting of the zener diode. The zener chosen is a 7W type at a case temperature of 45° C. A small heat sink is thus desirable and this is made from a piece of copper plate of about $\frac{1}{8}$in. thick measuring $\frac{3}{4}$in. by $\frac{3}{4}$in. This is threaded to accommodate the zener and is soldered to the two isolated tags of the three-tag strip, as shown in Fig. 3. It is arranged so as to be isolated from the " earth " tag and from the tin box. Circuit connection is then made to the tags, as shown in Fig. 2. The eyelet connection on the zener is soldered direct to the tag on the adjacent strip as also accommodated by C6. The diode is thus adequately supported mechanically and is easy to connect electrically.

Rubber grommets are used for leading in the car battery cable and for leading out the wires for connecting to the battery circuit of the transistor set (in place of the internal battery).

Extreme care must be taken with respect to the polarity of the battery supply to the transistor set and with respect to the polarity of the supply from the car battery to the amplifier unit. Reversal of polarity in either case could lead to serious damage to the transistor set and the zener diode and also to alteration in the characteristics of the amplifier transistors. It may be a good idea to incorporate non-reversible plugs and sockets in the " car battery " and " supply to transistor set " leads, making reversal impossible.

EARTHING

In Fig. 2 the aerial socket, Sk1, is of the insulated type, catering for the plug which is usually employed on car aerials. There is no " earth " connection on this, just a single tag to C1. Fig. 1, however, shows a connection from the " earth " tag on this socket to the metal box housing the amplifier. This connection would be used only in cases of excessive car ignition interference, and would generally be made through the braid of the cable to the car aerial.

This means that if the " insulated " type of socket is used, a connection would be made between the tin box and the braid of the screened aerial lead, as shown in Fig. 4. Here there is a connection between the metal car body and the box of the amplifier, via the braid of the aerial lead.

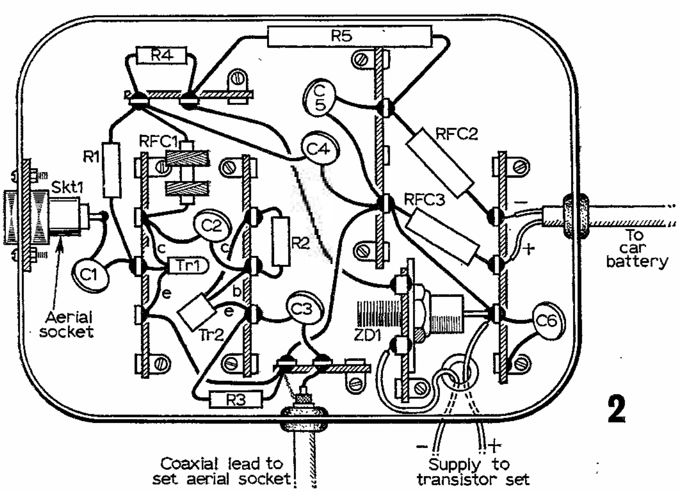
If the amplifier is tried with an ordinary car radio, or if there is any possibility of the braid of the signal connecting lead to the transistor set coming into contact with the metal of the car (bearing in mind that this is connected to one side of the car battery), then the braid MUST NOT be connected to supply positive as shown on the circuit and in Fig. 2, but it should be connected direct to the tin box on one of the earthing tags. Indeed, this method of connection may prove advantageous even when the amplifier is used with a transistor portable should interference be particularly troublesome.

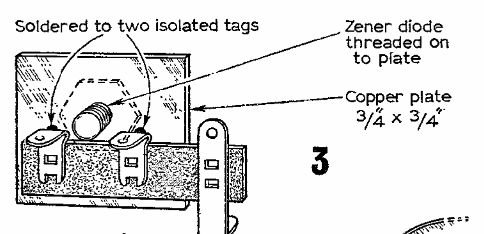
OPERATION

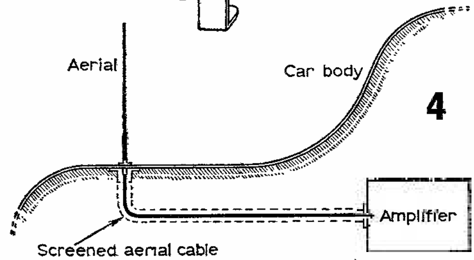
The unit does not require any adjustment, but the circuit should be very carefully checked before connection is made to the car electrical system. It is desirable to try the unit on a 9V PP4 battery with the zener diode disconnected before connecting it to the car system.

With the zener out of circuit, the total amplifier current should be a little below 1mA. The best way to check the unit is thoroughly to screen the transistor set with which it is to be used. One way of doing this is to put the set into a large metal tin (such as a biscuit tin) so as to cut off all signals via the ferrite aerial. With a 10ft. length of wire or car radio aerial connected to the amplifier and the

—*continued on page 146*







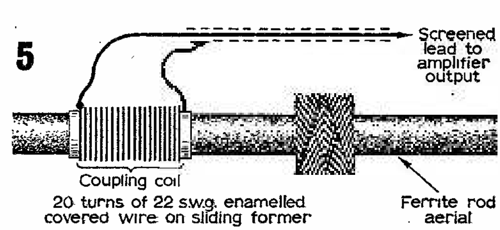


Fig. 2: A suggested method of construction.

Fig. 3: Method of mounting the zener diode.

Fig. 4: Here a connection is made between the metal of the car and the tin box through the braid of the aerial connecting cable. A screened aerial cable and earthing of this nature would be required in cases of obstinate interference problems.

Fig. 5: A simple aerial coupling coil.

THE RADIO COLLECTOR

P. N. WOOD

RADIO construction, which of course includes making anything from short wave receivers to electronic time-bombs, is undoubtedly the pre-eminent technological hobby. This article, however, is intended to serve as an introduction to an equally fascinating, though "offbeat" branch of recreational wireless — collecting "vintage" apparatus. There is, even here, more than one field for the collector and the briefest reference to the historical development of wireless must be made.

Early Equipment

Now the two decades from 1900 to 1920 saw the first primitive spark apparatus of Marconi and others giving way to more and more sophisticated equipment, until finally conventional valve circuits were firmly established. Practically all the historic equipment surviving from this period is now safely preserved in museums and private collections. But the same cannot be said of radio receivers dating as far back as the commencement of broadcasting by the BBC in 1922. This leaves the field open to the collector: let us see how he is rewarded.

From the inception of broadcasting, until nearly 1930, the majority of receivers were homemade. This association with the world of the radio constructor as well as the very age and scarcity of the equipment makes sets and components of the "twenties" specially interesting to the collector.

Components of this period are far different in size and shape from those used today. Sometimes they also performed circuit functions which are now never required. For example, most valve receivers used a special type of holder into which were plugged two multilayer tuning coils, about 2½in. in diameter. These were wound in specially anti-capacitative modes, such as the picturesquely named "Honeycomb Dualateral".

The holder was connected so that one coil formed the detector grid tuning inductance whilst the other was in the detector anode circuit. This latter coil could be rotated through 90°, the grid coil remaining stationary. In this way, the amount of positive h.f. feedback could be increased gradually with corresponding improvement in the receiver's sensitivity and selectivity.

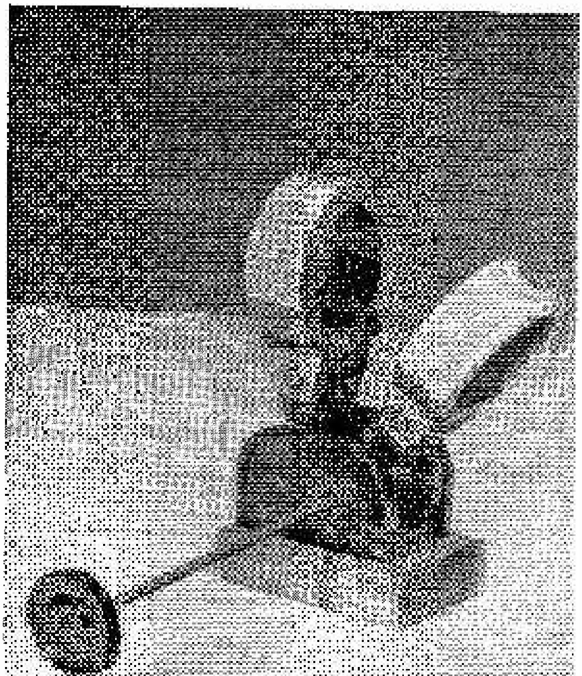
Reaction

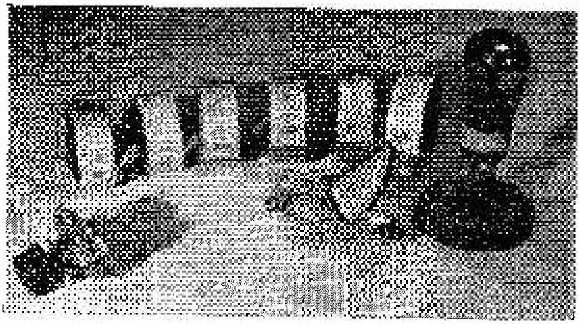
This well-known arrangement (known variously as "reaction", "retraction" or "regeneration") was generally employed until the introduction of the superheterodyne circuit, though later on the variable mutual inductances needed for reaction control was replaced by a variable capacitor strategically situated in the detector anode circuit.

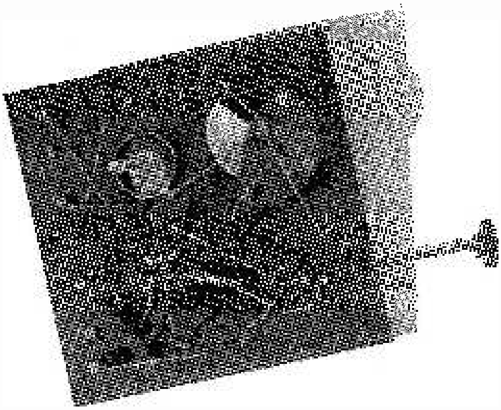
Coupling between audio valves was usually accomplished by using a "step-up" transformer. Complete with polished brass terminals on ebonite

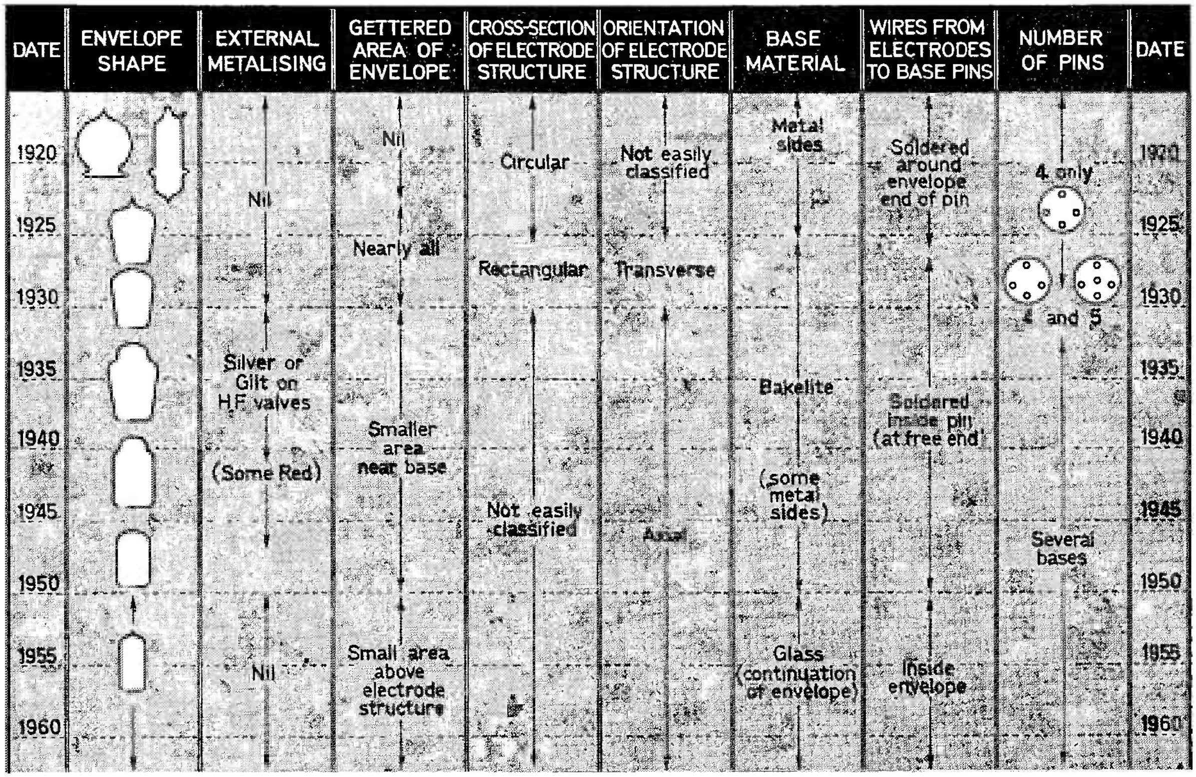
Left: Ancient coil holder with grid coil and anode coil for "reaction". The unusual length of the spindle is to prevent hand capacitance effects when making adjustments.

Right: Radio, c. 1924. Left of the group of Igranic coils is a filament rheostat (gain was decreased by reducing filament current, thus conserving accumulator power at same time) and, right, a rather vicious-looking tuning capacitor. A contemporary valve completes the group. Below is shown the underside of a 1924 one-valve receiver showing the wiring technique.









Dating chart for vintage valves based on physical characteristics

Group of horn loudspeakers made by B.T.H., Stirling and Amplion. They consisted of a moving diaphragm transducer, almost identical to that used in an ordinary telephone headpiece, acoustically matched to the surroundings by a horn.

strips and bulging black coils, the earlier ones seem vaguely to resemble Stephenson's "Rocket"! At any rate they are definitely pleasing to the eye. Foremost in the field of elegance, however, are vintage valves, of which, more later.

The constructor usually mounted his components on a wooden baseboard, with the controls on an ebonite front panel: alternatively everything was mounted on a flat ebonite sheet. Wiring was executed in heavy gauge copper, sometimes of square, rather than round, cross section, and proceeded from polished terminal to polished terminal in a succession of straight lines and right angled bends. The whole effect was most pleasing!

Collecting

It is time to say something about the actual business of collecting. Most of us radio constructors have one or two antediluvian odds and ends residing on shelves or in boxes in the work room. We probably look upon them as junk, and this is their generally accepted status.

Unlike old phonographs, vintage radios are still non-"U" for collecting, though (possibly through the agency of a well-known "period" television series) an occasional horn loudspeaker can be seen in the (very "U") Portobello Road.

It is the lowlier gathering grounds for junk, such as jumble sales, junk shops, and street markets which are "El Dorado" for the urban collector. Incidentally, experience is needed to identify a genuine "junk" shop, but those piled to the ceiling inside with old furniture, and having an over-spill on to the pavement during the daytime is always promising. Doing a regular round of such places is, of course, time consuming, but to make a find is immensely satisfying.

Regrettably, however, most vintage sets have been used to enrich corporation dust tips and green belt beauty spots, the real addict will even give these a regular inspection!

Literature

"Period" receivers and components are intuitively recognisable even to those who never knew wireless in the 'twenties; but the collector soon wishes to learn more about his acquisitions. To this end, there is no substitute for contemporary literature on the subject. Manufacturers advertised their latest components in each issue of the constructors' magazines, so a set of these is invaluable.

"Harmsworth's Wireless Encyclopaedia" (192...) is also a comprehensive guide to components and

PARADE OF VETERANS

1-6: Group of old Mazda mains valves
1—AC/SG/VM vari-mu h.f. tetrode. 2—AC/HL triode. 3—AC/2/HL triode. 4—AC/PEN output pentode. 5—UU2 rectifier. 6—UU3 rectifier.

7-9: 1923-4 Bright Emitter valves
7—Marconi-Osram R5V (or improved R type). Very widely used. 8—Mullard ORA, HF type. Had a small anode to reduce grid-anode capacitance. 9—Cossor P1. Unusual form of construction with semicircular looped filament and hood shaped grid and anode was peculiar to Cossor valves.

10-12: 1924-5, mostly Dull Emitters
10—Marconi-Osram DE5. 11—Mullard D06. 12—Cossor WR1. A screw on the side of the base enabled an internal resistance to be switched in series with the filament, thus facilitating its use from two different accumulator voltages.

13-15: 1925-7 Dull Emitters
13—Marconi-Osram DE3. 14—Mullard PM2. There were over 20 different types of PM valves constituting a 2, 4 and 6V series for different accumulator combinations. They were very widely used and the earlier ones with paper labels on their bases form an excellent set to collect. 15—Cossor 610FP.

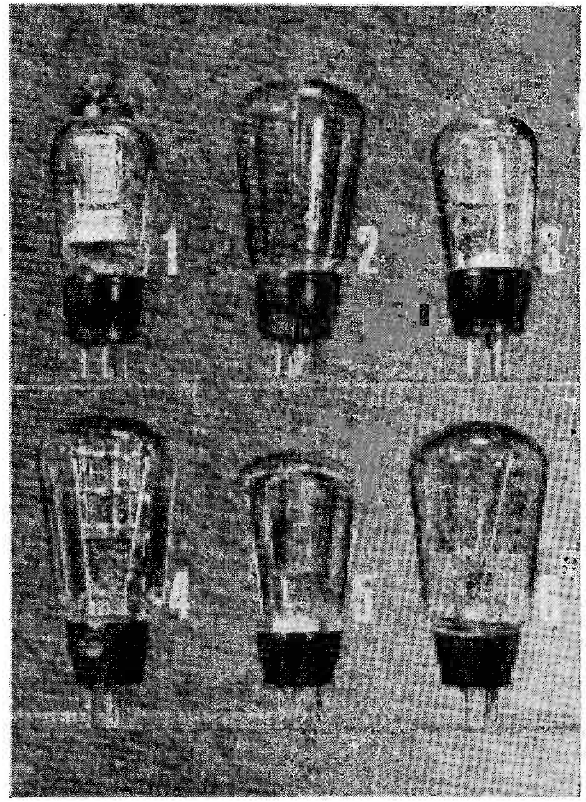
techniques, as well as giving instructions for building dozens of different receivers.* This calls to mind another facet of "Wireless Collecting": the construction of "Period" sets. It is surprising how many components drift singly into one's collection, and to build up a working receiver from them is an interesting challenge.

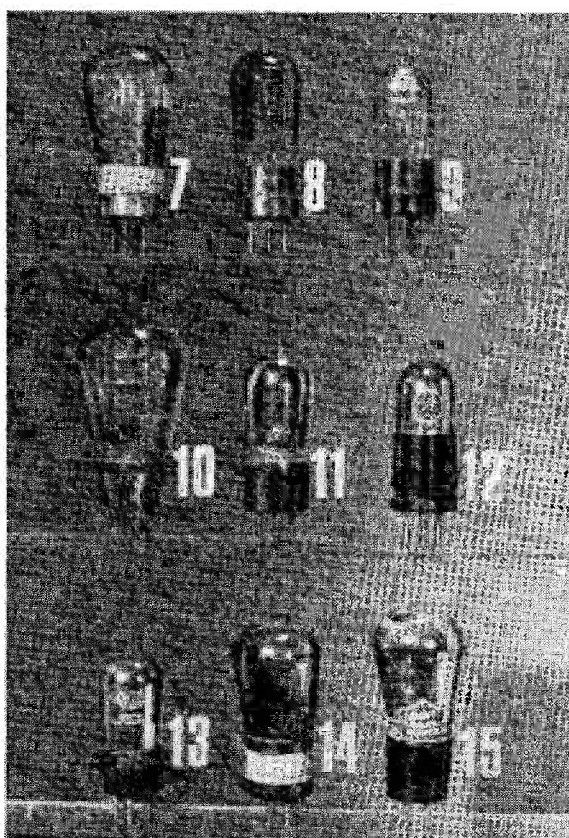
For those not already acquainted with it, contemporary books and magazines also give a fascinating insight into the atmosphere of "Wireless in the 'Twenties". Here are one or two irresistible and revealing quotations from a "Guide to Wireless Telegraphy and Telephony" published by a manufacturer. They are labelled: "Unsolicited Testimonials":—

"Dear Sir,

I am a wireless constructor and dealer, and the first in the district to construct the 3-valve set made from your parts and diagram.

I have my place full every night with listeners, and they all say it is the best they have ever heard".





Dear Sir,

The set I made from your parts and diagram works well on three pairs of 'phones taken into the next room. I have had several wireless experts to listen in, and they all say the results are wonderful".

The Wireless Expert was quite a common figure in those days. He had sometimes only built a single receiver of his own, without having any theoretical knowledge of wireless. The booklet mentioned above hardly helped to educate him. It was at its most explanatory when in referring to "Grid condensers and bypass condensers", it stated:—

"These are condensers of small capacity—fitted in the circuit to receive higher efficiency".

Readers were subtly misled by such terminology as: *"The Thermionic or Three-Electrode valve"*, and grossly, as in the following faux pas:

"Amperes" is the word applied to the amount of current an accumulator contains".

It is very tempting to write more on the early days of broadcasting, but these are for the collector and amateur archivist to explore for himself.

Factory Built Sets

This article has so far concentrated on radio in the "twenties", as it is the receivers, components and relevant literature of that era which need collecting most urgently. Nevertheless, factory-built sets, made in the early "thirties" (particularly those with fretworked loudspeaker apertures) are difficult to resist.

Less demanding on storage space are radio valves. Making a collection of any pre-war types is to be recommended. Although most of the five- and seven-pin valves of the "thirties" are still easily obtainable, there are always the interesting ones, with anomalous features, such as mains valves with filament connections at each end of the cathode, or with two cathodes placed side by side and connected together.

Then there are the "bestsellers" which come out year after year with slight modifications to their design. For example, the author has five mutations of the famous Mazda AC/PEN.

Valves of the early 1920's were known as "bright emitters", since their plain tungsten filament had to be white hot to give a suitably high electron emission. Around 1925, they were gradually superceded by "dull emitters" whose oxide-coated filaments functioned at a much lower temperature. In the order of ten times less filament power was required to heat them: a considerable saving in those days when an accumulator was used to supply the power.

The first mains valve generally available (the Marconi "KL1") was introduced early in 1927. Now that a battery was no longer required, it did not matter how much filament power was taken. In fact, 32W was required to heat the massive cathode of this particular valve!

Handling

There is a very important point to be made about early valves in general, which may seem incredible to anyone acquainted only with modern types. The vibration to which a bright emitter is subjected during for example a bus journey, can be sufficient to break its delicate filament. This explains the lavishly sprung valve holders which are such a charming feature of vintage receivers.

As with all *objets d'art,* there is a code of handling to be observed with valves. Apart from avoiding the slightest mechanical shock, it is good practice not to finger the glass envelope, as any lettering stamped on it is easily obliterated. As if this were not enough, one must even be careful of the humidity in the storage room.

The author has seen tragic cases of corrosion damage: pins eaten away, and most infuriating of all, a breakage in internal connection between base pin and envelope interior, just at the point where the wire entered the envelope.

Dating

A very rough guide to dating radio valves is given in the table. However, a definite date can clearly never be assigned to when a feature such as envelope shape changed style, as innovations in construction were not simultaneously copied by all manufacutrers. Moreover, a given valve is almost sure to have at least one anomalous feature.

Since broadcasting began, the radio constructor has seen several curious pieces of equipment. There were designs for receivers to run off gas, and for "Hanging Sets" in which the bright emitters were arranged to form chandeliers!

At one time, a loudspeaker containing clockwork motors was manufactured. It was called the Frenophone† and used the friction between a pad and a revolving disc as the basis for a simple, but effective mechanical amplifier. Whether or not the collector is lucky enough to find one of these curiosities, he will doubtless shortly have acquired a set of "Igranic" tuning coils. It says, on their labels:—

"What are the Wild Waves saying?" ■

---

* *Bound volumes or single copies of* PRACTICAL WIRELESS *and other wireless magazines of the 1920's and 1930's are also a prolific source of material, particularly the advertisement pages. Needless to say, these should be picked up if discovered.*

† *Details of the Frenophone and of a "Hanging Set" can be found in Harmsworth's Wireless Encyclopaedia.*

Save the Grand Old Sets

It is sad that every day fine old vintage radio sets are cast on to rubbish dumps. Often these could be put into good order at small cost and given to an old-age pensioner.

Any reader who is keen to improve his skill in radio servicing should get hold of a few such sets and restore them. I have done 25 sets in a year. These sets can often be picked up at jumble sales—my main source of supply however is the Rag and Bone Man, who is only too pleased to fetch 'em along for five shillings a time. I have had no difficulty in obtaining valves for them. Common faults are open circuit primaries of output transformers and worn out volume controls and smoothing capacitors.

To readers who have a nostalgia for the good old days, I say get an old stalwart and put it in working order.

P. J. Plater.

Wallington,
Surrey.

Another Offer

I have in my possession some 100 valves —octal, British seven-pin, B9A, B7G, four-pin and five-pin based types. I would like to offer these valves to other Practical Wireless readers.

For further details, please send a stamped, addressed envelope.

P. H. Du Feu

6 Tavistock Road,
Launceston,
Cornwall.

Book Reviewed

It is not my practice to answer book reviewers, not even when their review was as gracious as that which dealt with my Tape Recorder Servicing Manual in the April issue of Practical Wireless, but I would like to take up one point.

I agree, wholeheartedly, that circuit diagrams in any magazine, service data series, or by companion volumes by any publishing house should follow a common form. There are several opposing ideas on presentation, on component numbering, on circuit layout and on general style, and it would seem that some manufacturers employ myopic spiders in the preparation of their service manuals. (Even they are better than those who issue no more than a glorified sales brochure and a cyclostyled, often incomplete circuit!) The present style employed by PW and PT, which observant readers may have noted has been "tidied up" in recent times, is an excellent example of clarity.

As your reviewer notes, the reason for the use of circuits from manufacturers' literature was the formidable expense that would have been involved in re-drawing.

H. W. Hellyer.

Bargoed,
Glamorgan.

NEWS AND..

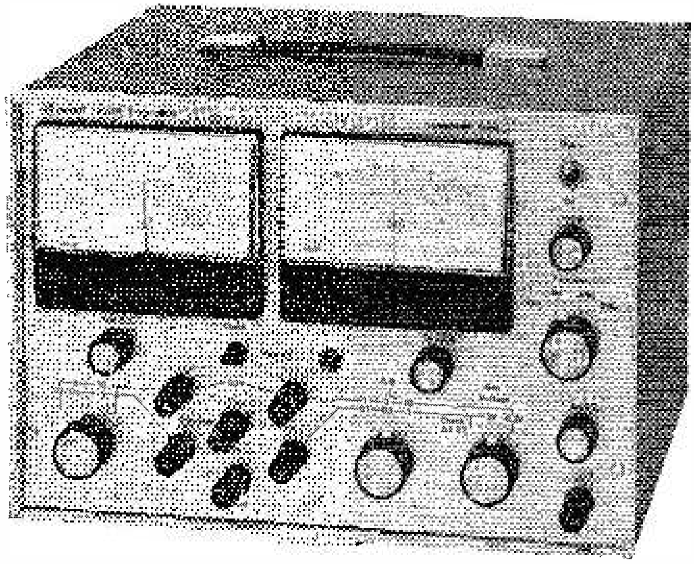
CATALOGUE FROM HENRY'S RADIO

From Henry's Radio Ltd., comes their 1966 catalogue. It comprises 152 pages fully detailed and illustrated with over 5,000 stock items. Components, valves, quartz crystals, semi-conductors, test equipment, high fidelity equipment and accessories, ready-built units and kits to build are but a few of the items listed.

Page 2 has three discount vouchers for retail and mail order customers, so that when these are used the catalogue will have cost the purchaser nothing.

The price is 6s. post paid and copies may be obtained from Messrs. Henry's Radio Ltd., 303 Edgware Road, London, W.2.

NEW COMPONENT TESTER



The Instrument and Digital Measurement Division of Dawe Instruments Limited, as sole U.K. agents for A/S Danbridge of Denmark, are now able to supply the R-C-L Component Tester Type CPT2 which is manufactured by this Danish company.

The instrument provides a direct reading comparison bridge for comparing impedances and phase angles over a wide range of impedance and frequency.

The R.C. oscillator provides power supply frequencies of 100c/s, 1kc/s, 10kc/s and 100kc/s to the bridge circuit and facilities are provided for direct reading on two separate meters.

Typical applications are acceptance, production and grading tests on components and circuit parts, measurements on inductors, electrolytic capacitors with superposed d-c and low-pass capacitors. The instrument is also suitable for testing and adjusting ganged components.

Impedance range is 3Ω to 5MΩ on 0·3 volt range, 100Ω to 5MΩ on 3 volt range. High impedance values up to 50MΩ may be measured to the same accuracy by calibration adjustment.

The dimensions are 13½in. x 9½in. x 9½in. and the weight is 18½lbs.

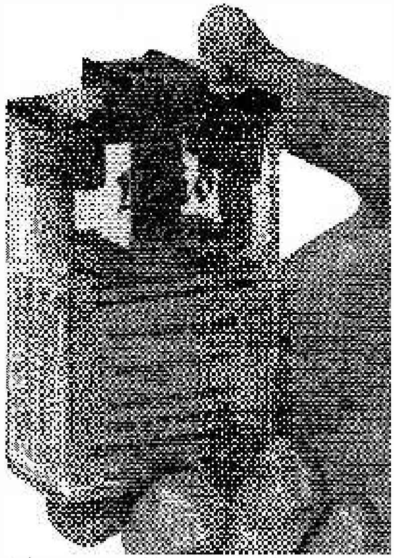
U.K. price £399.

CAMBRIDGE RELAY STATION

The BBC's new Television and v.h.f. sound relay station to serve Cambridge was brought into service on 7th March. It transmits BBC-1 television on Channel 2 with horizontal polarization, and the three sound programmes on v.h.f., also horizontally polarized, on the following frequencies: Midland Home Service 93·3 Mc/s, Light Programme 88·9 Mc/s, Third Network 91·1 Mc/s.

...COMMENT

LIGHT-WEIGHT LEAD ACID BATTERY



A new compact 2 volt rechargeable Exide battery originally developed for the English Electric 'Automatic Firedamp Detector and Alarm' for use in coal mines is announced by Exide Batteries. Known as Type MRP7, the battery is available for general use and should prove suitable for many electrical and electronic applications where a light-weight source of power is needed.

The MRP7 cell is completely unspillable even when inverted. The alloy used in the battery plates makes it ideal for duties where it will be maintained under floating and trickle charge conditions, and for those where frequent discharging and recharging are involved. The cell is capable of standing idle for long periods without deterioration thus making it suitable for intermittent and standby work. The container is moulded in a plastic material, transparent styrene acrylonitrile.

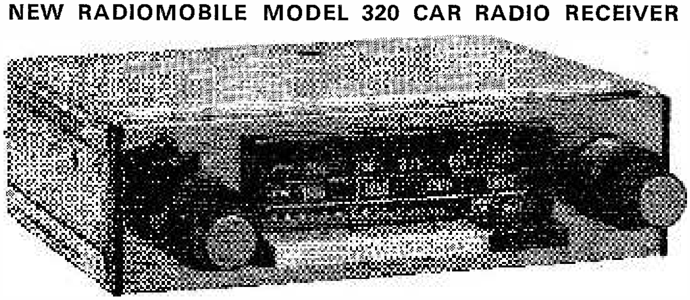
The MRP7 cell has a capacity of 4 Ah. at the 20-hour rate of discharge. It measures $2\frac{13}{32}$in. wide by $1\frac{5}{32}$in. long by $3\frac{3}{4}$in. high and the weight is 12 oz. when filled. The MRP7 cell can be obtained from any Exide Service Agent.

RADIO REPORTERS

The "London Evening Standard" newspaper has equipped its reporters with pocket-sized two-way radios. Now "Standard" men will be able to send on-the-spot stories to their news desks without relying on public telephones.

The transceiver chosen by the "London Evening Standard" is called the Pocketfone and is made by Pye Telecommunications and works on a u.h.f. band.

NEW RADIOMOBILE MODEL 320 CAR RADIO RECEIVER



The new Radiomobile Model 320 Car Radio Receiver is an all-transistor compact car radio (it measures only 7in. x 2in. x $4\frac{1}{2}$in.) which has been specifically designed for small cars such as the B.M.C. Mini and Hillman Imp. Recommended price in the U.K. for this new model is £15 tax paid.

Printed circuitry with a tuned r.f. stage is featured which with six transistors and two crystal diodes ensures good reception and full coverage of the medium and long wave bands at 3W peak output.

For 12V operation only the Radiomobile Model 320 is easily adapted to suit positive or negative earth vehicle ignition systems. Complete installation kits are available for most makes of car.

"Henry" Replies

Dear Mr. Douglas.

Thank you very much for your letter of the 5th Feb., since published, in part, in a subsequent issue of Practical Wireless. I bow to your superior knowledge and apologise for the time taken to afford this reply. In fact, I have been trying to turn up the particular source from which I quoted, when making reference to Frequency Synthesisers, and have failed to do so. But in the research, I have learned quite a bit on the subject, and must thank you for sparking off this interest. Among other things, I note that the principle, although basically concentrating on a stable frequency source, has now been applied, via certain defence projects, to the multi-frequency transmitter-receiver system, and allied to computer techniques, and necessarily making use of microminiaturisation. You will probably know more about this than I do, and I look forward to hearing your further comment.

Finally, thanks once again for your interest. I hope future articles will not fall below your high standard.

"Henry".

Anyone a Genius?

Are there any electronic geniuses amongst your readers? If so, how would they like to design a "controlled distortion" unit for me. I believe it is the latest in sound effects and has been entitled FUZZ!

I think the way in which it works is, a signal, say from a guitar string is amplified under very distorting conditions. It is then controlled purposely to sound like the "rasp" from a trombone, and then reduced for feeding into a main amplifier.

I have excellent equipment for testing such a unit, so if any readers could design a FUZZ BOX, I would build all those designs sent to me and report the results back to the designer.

W. F. Wright.

9 Priory Road Caravan Site,
Ruskington,
Sleaford,
Lincolnshire.

VHF & UHF Enthusiasts

I agree with S. Peat (Practical Wireless, March issue). There appears to be little to offer the v.h.f./u.h.f. enthusiast in P.W.

Even on the commercial market, the only v.h.f. kit available (apart from f.m. tuners) is a one-valve super-regenerative receiver. This would be ideal for the newcomer to the v.h.f. bands, but surely the more ambitious advanced constructor desires something more complicated.

R. Casey. Co. Tipperary,
Ireland.

ACCURATE ALIGNMENT – ...the easy way

P.N.HANCOCK B.Sc.

THE writer was faced with the problem of accurate alignment of a poorly-aligned communications receiver. A cheap R.F. signal generator and trimming tools were available. The aim was to get the receiver sufficiently well tuned so that the frequencies of amateur stations could be read to the second places of decimals. This meant an accuracy about 10 times as high as the signal generator was capable of yielding. The following method is applicable to any radio using any cheap R.F. generator. It is assumed that the ordinary alignment procedure will be familiar to the reader who wishes to get a receiver spot-on. There are a number of fairly cheap and reliable transistor R.F. generators on the market.

At frequencies of 5, 10, 15, 20, 25 and 30Mc/s there are stations whose frequency is very accurate; these usually can be identified by the continuous time signal (clock ticking one second beats) which they carry.

The first stage is to search in the vicinity of one of these frequencies (e.g. 10Mc/s) on the receiver until the time signal is heard. Now the signal generator is switched on and connected to the receiver aerial terminal. The signal generator is tuned through 10Mc/s until it can be heard on top of the time signal. At this point we know that the signal generator is giving a signal of exactly 10Mc/s. A note is made of the exact reading on the dial of the signal generator.

The set is left tuned to the time signal and the signal generator is tuned near 5Mc/s until it is again heard on top of the time signal. Now it is giving its fundamental frequency (5Mc/s) and also harmonics 10Mc/s, 15Mc/s, etc. A note is made of the signal generator scale reading which gives exactly 5Mc/s.

The receiver is left on 10Mc/s (time signal) and the signal generator is tuned to around 2Mc/s until it is again heard on top of the time signal. Now it is giving its fundamental 2Mc/s and also 4, 6, 8, 10Mc/s, etc. The exact position of 2Mc/s on the signal generator is noted.

Now if the signal generator is tuned to 10Mc/s, we know that it is also giving 20Mc/s and 30Mc/s, etc. Tuned to 5Mc/s it is giving also 10, 15, 20Mc/s, etc. Tuned to 2Mc/s, it provides us with 4, 6, 8Mc/s, etc.

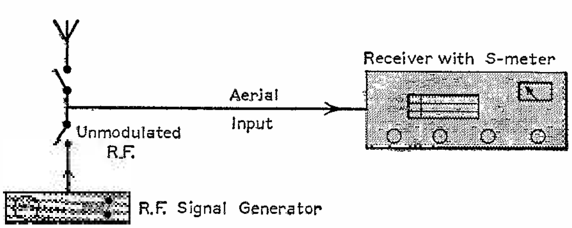
Convenient tracking points can now be selected at each end of each band, e.g. for a band stretching from 4·5 to 9Mc/s we set the R.F. generator to 5Mc/s (fundamental) and 2Mc/s (3rd harmonic 8Mc/s).

Any frequency above or below the original standard time signal can be obtained in this way. Only two points need special mention. Firstly, if we want, say, 24Mc/s and the receiver is originally fairly badly out, it is easy to mistune at 22 or 26Mc/s if the fundamental chosen is 2Mc/s. A check can, however, quickly be made by tuning the 4th harmonic of 5Mc/s (i.e. 25Mc/s). Secondly, as is always the case with receiver alignment, one must beware of tuning the image frequency. For example, with an I.F. of 450kc/s, 12Mc/s could be tuned in at 11·1Mc/s or 12·9Mc/s.

The limit to the accuracy and usefulness of this method is set by the ultimate accuracy and stability of the components and design of the receiver. The R.F. generator can be frequently checked by reference to the original time signal.

An S-meter built into the receiver is an asset because one may then use an unmodulated R.F. signal (see fig. 1). A slight sacrifice of accuracy is incurred if an A.F. modulated signal is used in conjunction with a voltmeter connected across the L.S. terminals (Fig. 2).

Once the basic frequency is established on the signal generator, the aerial may be disconnected from the receiver, except for occasional spot-checks. The basic frequency chosen will depend on the standard frequency station(s) available and on the requirements of the receiver under test. However, it was found that the 9th harmonic of 10Mc/s was satisfactory for checking 100Mc/s on the v.h.f. band. The method also applies in the usual way to the I.F. strip. ■



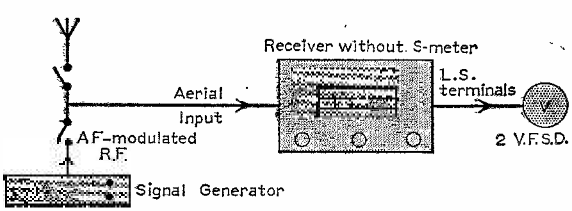


Fig. 1: (above) Set-up for receiver with S-meter.
Fig. 2: (below) Set-up for receiver without S-meter.

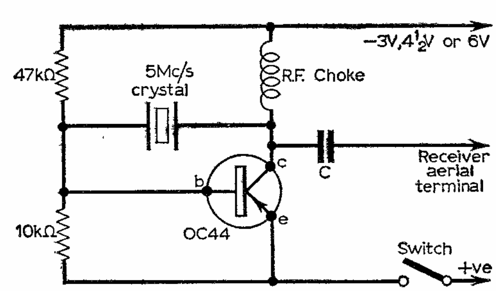
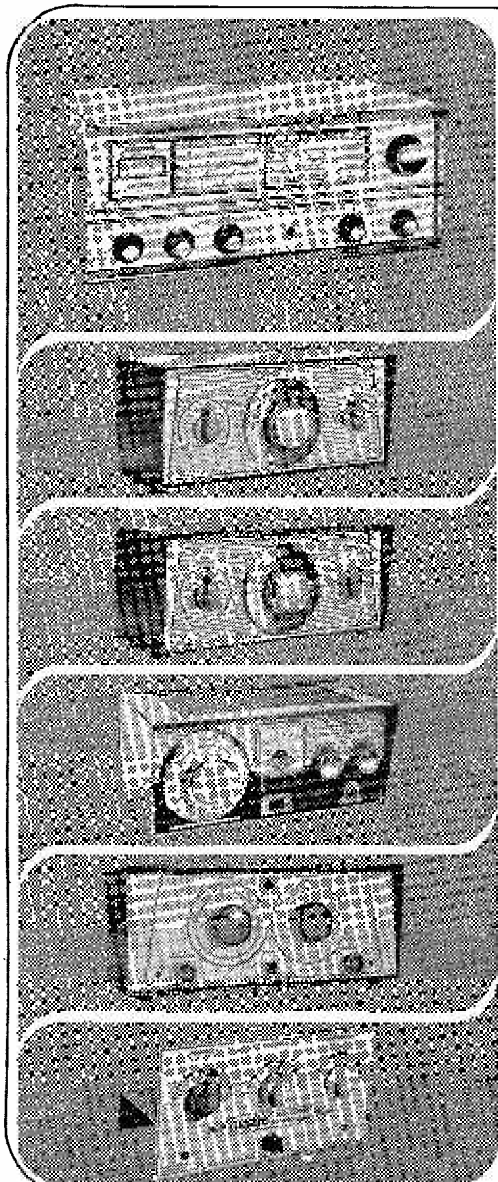


Fig. 3: Circuit of simple 5Mc/s. oscillator.

CODAR – QUALITY



ANOTHER CODAR TRIUMPH!

THE NEW 1966 CR.70A COMMUNICATION RECEIVER

This completely new receiver sets a new high standard for performance and finish unequalled at the price, and is a worthy addition to the outstanding range of **CODAR** quality communication equipment. Frequency range: 560 Kc/s-30 Mc/s (540-10 metres) in four ranges; 560 Kc/s-1.5 Mc/s; 1.5 Mc/s-4.2 Mc/s; 4.2 Mc/s-11.5 Mc/s; 11.5 Mc/s-30 Mc/s. Slide rule scales for each band calibrated in frequencies plus an additional logging scale in degrees. Two speed vernier tuning control with reverse slow tune action. Unique aerial input stage exclusive to the CR.70A employing High 'Q' Air-spaced **CODAR-QOIL** Inductor giving extremely high gain with low noise level. Panel aerial trimmer for peaking weak signals. Double tuned I.F. Iron cored transformers. 470 Kc/s with EF183 frame grid valve for maximum gain and selectivity. 5 valves (including two twin triodes) giving 7 valve line-up. Separate B.F.O. stage for CW and SSB reception. Calibrated signal strength 'S' meter, illuminated. Automatic Volume control. Panel phone jack for 'private' listening. 2-3 ohm output for external speaker. Superb styling, metal cabinet in the new Organasol Satin lustre finish. Size: 13" x 5¾" x 7¾". For A.C. 200/250v. Ready built. **Not a Kit** at the fantastic low price of **£19.10.0.** Carr. 7/6.

CODAR R.F. PRE-SELECTOR MODEL P.R.30. Considerably improves the performance of any superhet receiver over 1.5-30 Mc/s. Uses EF183 Frame Grid Valve, and provides up to 20dB gain plus substantial image rejection, improved signal/noise ratio and selectivity. Selector switch for either dipole or single wire antenna. Power requirements 180-250 volts 12mA H.T. 6.3 volts, 3 amp L.T. Size 8½ x 5 x 4in. Ready built, complete with cables, plugs and instructions, **£5.10.0.** Carr. 3/6. **MODEL P.R.30X.** Self powered model for 200-250v. A.C. Also provides 25mA at 200v. H.T. and 6.3v. 1 amp L.T. for other accessories **£7.4.0.** Carr. 3/6.

CODAR "Q" MULTIPLIER MODEL R.Q.10. For use with any superhet receiver with an I.F. between 450 and 470 Kc/s. Provides considerable increase in selectivity for either peaking or rejecting a signal on AM, CW, or SSB, BFO. Size 8½ x 5 x 4in. Power requirements 180-250v. H.T. at 5mA 6.3v. .3 amp L.T. Ready built complete with cables, plugs and instructions. **£6.15.0.** Carr. 3/6. **MODEL R.Q.10X.** Self powered version for 200-250v. A.C. and also provides 25mA at 200v. H.T. and 6.3v. 1 amp. L.T. for other accessories **£8.8.0.** Carriage 3/6.

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CUT-OUTS AND CURRENT TRANSFORMERS

by Lionel C. Waring

THE high tension cut-out (Fig. 1) was first used by the writer in a stabilized power supply delivering about 200mA. The use of such a cut-out in this position is particularly advantageous, in view of the fact that high tension fuses cannot be repaired unless fuse wire of very low current rating (250mA) is available. Moreover a power supply used for experimental work is much more prone to overload than is one which is built into equipment.

The relay used in the high tension cut-out is a G.P.O. 1,000Ω type which fires at about 7V. The value of the resistor in parallel with the relay winding determines the current at which the cut-out comes into operation. If the value of this resistor is RΩ and R⩽1,000 then the value of the operating current I (amps) is given by:

$$I \times R = 7 \text{ or } R = \frac{7}{I}.$$

In the prototype cut-out R was made 33Ω and so I = 212mA.

The function of the 20kΩ resistor is to hold on the relay by allowing a suitable current to flow through the winding. The capacitor connected across the relay is to prevent chatter due to the a.c. component of the current flowing through the winding.

The next logical step from a high tension cut-out is a mains supply cut-out. It is essential that in this device the voltage drop should be very small; a possible voltage drop of up to 7V in the mains supply to equipment would be inadvisable. It is therefore not possible to modify the circuit of Fig. 1 for the purpose simply by the addition of a bridge rectifier unit. Apart from the question of voltage drop the bridge rectifier would have to carry the full load current (perhaps up to 5A) and the wattage dissipation would be considerable.

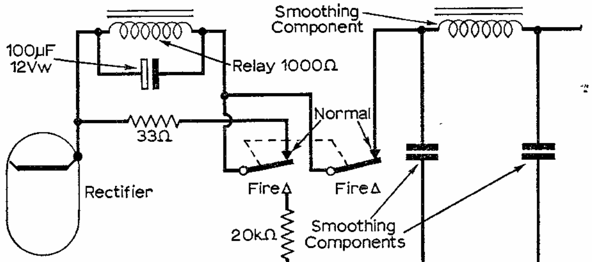

Fig. 1: H.T. cut-out.

The problem may however be solved neatly and simply by using a current transformer. This device is rather neglected by amateur constructors, although it is used more frequently in commercial equipment.

The current transformer, although similar in construction to the voltage transformer, works on a slightly different principle. If a current transformer has P turns on the primary and S turns on the secondary and Ip is the primary current, then the secondary current Is is given by:

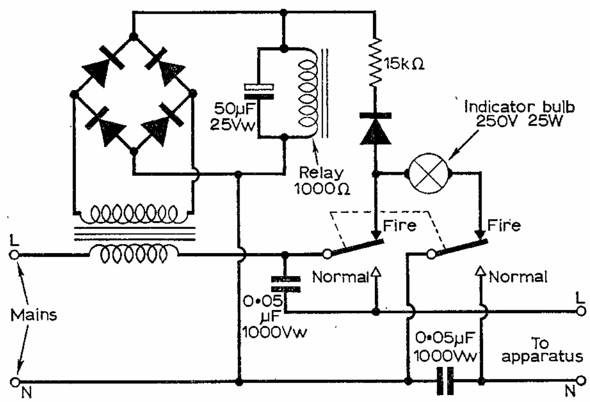

Fig. 2: Mains cut-out.

$$Is = Ip \times \frac{P}{S}$$

The corresponding formula for a voltage transformer (which also applies to a current transformer) is:

$$Vs = Vp \times \frac{S}{P}$$

where Vs, Vp are the secondary and primary voltages respectively.

Ideal Transformers

It must be remembered, of course, that these formulae apply to ideal transformers; the various losses are not taken into consideration. The losses in a small transformer such as used in the mains cut-out are of the order of 10% so due allowance must be made for this when calculating the turns ratio.

The current transformer of Fig. 2 was made from a choke which had 2,500 turns. The same type of relay was used (1,000Ω, firing current 7mA) and it was desired that the cut-out should operate with a mains load current of 2A.

i.e. Is = 7mA; Ip = 2A; S = 2,500 turns.

Hence substituting in the formula

$$Is = Ip \times \frac{P}{S}$$

we have $0{\cdot}007 = 2 \times \frac{P}{2{,}500}$

therefore $P = \frac{0{\cdot}007 \times 2{,}500}{2}$ turns

$= 8\frac{3}{4}$ turns.

Allowing for losses, the primary should have ten turns.

The current transformer was made by removing the laminations from the choke and winding on the outside of the former ten turns of p.v.c. wire. This constituted the primary.

Since the winding of the relay was 1,000Ω and the current transformer secondary was about 200Ω the secondary voltage was, just before overload, about 8·5 volts. Hence the primary voltage was:

$$8{\cdot}5 \times \frac{10}{2{,}500} \text{ volts} = 0{\cdot}034 \text{ volts.}$$

This minute voltage drop is much smaller than the random fluctuations of the mains.

The bridge rectifier used in Fig. 2 may be a low current 12V battery charger rectifier. The rectifier used to hold the relay in the cut-out position must be rated at 250V r.m.s. and about 20mA current. The cut-out indicator used in the prototype was a 25W mains bulb but this could be replaced, if desired, by a neon or a bulb of lower wattage.

0·05μF capacitors are shown across the circuit breaking contacts to minimise arcing. It is very important to ensure that these capacitors do not form a series resonant circuit with the primary of a mains transformer when the cut-out has fired. This eventuality is unlikely in view of the low value of the capacitors as a very large value of primary inductance would be required for resonance. If resonance were to occur very high voltages would be produced which would destroy the capacitors and possibly damage the transformer primary.

Modified Circuit

In view of the very low voltage drop of the cut-out of Fig. 2 it is quite practical to modify the circuit for use as an l.t. cut-out. This is shown in Fig. 3. The principle of the circuit is exactly the same; the only difference being that the hold-on current is obtained from the cathode of the h.t. rectifier. The turns ratio of the current transformer must, of course, be adjusted so that the relay fires at the desired current.

No capacitors are shown across the relay contacts in Fig. 3 as they are not normally necessary at low voltages. However, if a heavy current is being drawn from the l.t. supply such capacitors may be required.

Current transformers may be used to provide an a.c. current range on home-made multimeters as is done in commercial instruments. This is a facility which is rarely found in most amateur multimeter design.

In order to avoid saturation and consequent non-linearity of scale, current transformers for use in multimeters should be fairly large; preferably not smaller than a 6·3V 2A heater transformer. Since the lowest full scale deflection generally required for a.c. current is 100mA the transformer may be designed for this minimum range. If a 1mA f.s.d. meter is to be used this will mean a turns ratio of 100:1 for the transformer; i.e. 2,500 turns on the secondary and 25 turns on the primary.

In practice it would be advisable to wind 30 turns on the primary and have a preset resistor in parallel with the meter as shown in Fig. 4. The value of this resistor should be about 6 times the value of the internal resistance of the meter. If the latter is very low (<10Ω) a resistor may be connected in series with the meter to increase its resistance to a convenient value (say 500Ω). This will not impair the performance of the circuit.

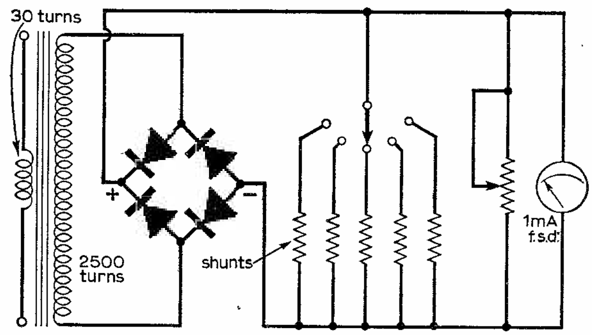

Fig. 4: A.C. ammeter.

Shunts

Shunts may be switched in parallel with the meter and preset resistor as in a d.c. ammeter. The same formula may be used in calculating the value of these shunts as in the d.c. instrument. Care must be taken to make shunts with as low an inductance as possible, particularly if they consist of long lengths of wire in which case they should be wound non-inductively as shown in Fig. 5. In the circuit of Fig. 4 the range switch should be of the make-before-break type.

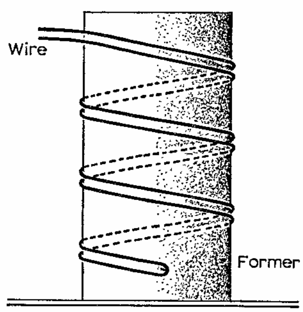

Fig. 5: Non-inductive shunts.

Trickle Charge

A current transformer may be used to trickle-charge accumulators where the expense of a conventional battery charger is not justified. In this case the current transformer is wired in series with an electrical appliance whose efficiency is little affected by operating on a

—continued on page 134

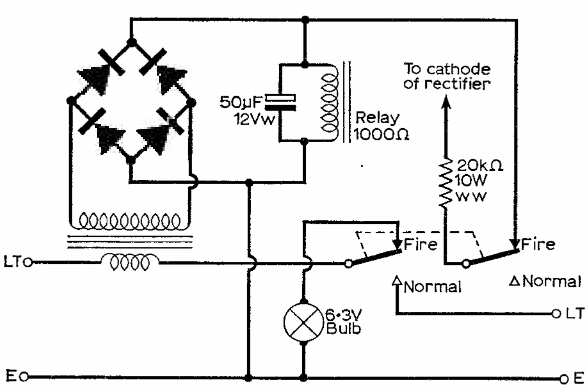

Fig. 3: L.T. cut-out.

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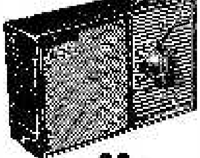

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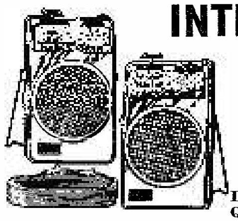

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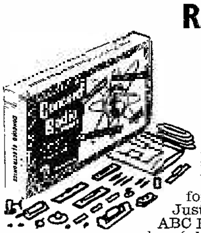

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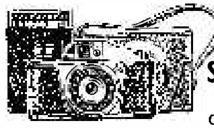

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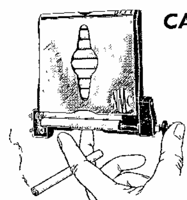

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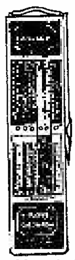

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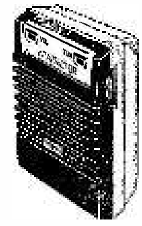

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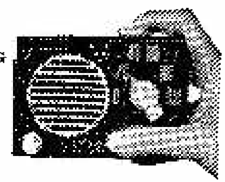

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EVEN THE OLDER CHILDREN BUILD THEM! . . . no soldering — only 16 connections! then hear it reach out bringing in station after station, loud and clear. Palm-of-hand size 4⅞ x 2⅞ x 1⅛in. Many Testimonials: **M.H. of Bradford writes:** *" . . . I have just completed one of your sets successfully, it is the first time I have ever tackled anything like a radio, and I must state here and now, I am amazed how easy it is to a layman like me. Your instructions and plan have obviously been very carefully thought out so that even the most dim can follow them . . . "* **Direct from Manufacturers' to You. Send 19/6 plus 2/6 post, etc.**

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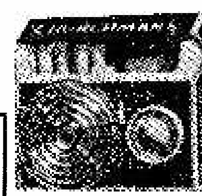

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Yes a perfectly ordinary packet of cigarettes ! But watch your friends astonishment on hearing it fetch in station after station, loud and clear! Still holds 10 cigarettes — yet cleverly conceals highly sensitive, fully transistorised circuit **(including tiny battery).** Even a young boy can assemble it in under 2 hours. **No soldering. No experience necessary. Only 16 connections to make.** Ideal for taking to work with you. From our bulging testimonial file,**Mr. D.B. of Huddersfield, writes:** *" . . . I have fitted the parts in and it is working wonderfully . . . "* ALL PARTS including Semi-Conductors, ABC Plans, etc. **ONLY 18/6, plus 2/6 post, etc.**

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*NEON low voltage INDICATOR

A.J. BASSETT

EARLY transistorised audio equipment gave positive indication of being switched on by virtue of loud transistor noise. Improved modern transistors are far less noisy, and do not give this positive indication of battery drainage under quiescent conditions.

Constructor and manufacturer alike tend to fight shy of filament-type indicator lamps on transistorised equipment; high current drainage often precludes their use. A low-current on/off indicator lamp could, however, be a good proposition, as it could help save batteries whilst adding aesthetic appeal to the equipment. To this end the author has constructed a neon indicator lamp which is most economical and runs from any dry battery in the region of 9 volts. Only four components need be used in the construction of this interesting device, whose theoretical circuit is shown in Fig. 1.

Theory in Brief

The circuit functions as a blocking oscillator with heavy positive feedback. When the transistor enters the "cut off" state a high voltage pulse is induced in the windings of the transformer. In the absence of a tuning capacitor, this pulse would ordinarily break down the collector junction of the transistor and destroy the circuit. An alternative path is, however, available here; i.e., the neon tube. This protects the transistor, which continues to oscillate violently, the neon tube conducts during part of the cycle, and a glow is emitted from the gas around its cathode.

Circuit is Flexible

Although this circuit is specified for 9 volt operation, it will operate over a wide range of supply voltage almost up to the "extinguish" voltage of the neon simply by adjustment of VR1, or in the higher voltage ranges, replacement of VR1 by a 250KΩ component. If the circuit is carefully adjusted, the neon will glow faintly on a supply voltage of only 1·5 volts!

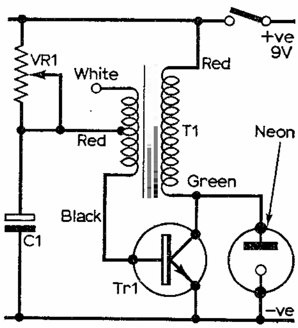


Fig. 1: Complete circuit of the Low Voltage Neon Indicator.

The Capacitor

The circuit is very tolerant of variations in the value of C1. This component may be omitted altogether if space is lacking, or values of several microfarads electrolytic may be used. Use of a capacitor in this position may improve efficiency of the circuit by over 30%; a suitable type is indicated in the components table.

The Transformer

Here an LT44 transistor driver transformer is used. Although this is amongst the cheapest available, the author experienced no trouble at all in its use. The circuit worked upon first trial. Other transformers could certainly be tried in this circuit, and as the total power handled is almost negligible, miniature transformers are favoured. The transformer chosen should be perfectly dry and well insulated; should have a useful ratio, and impedances suitable for use with transistors at the supply voltage you intend to use.

Here, however, a word of warning. If you use a large transformer in place of the miniature LT44, the magnetic energy stored in its core and discharged with each cycle may be correspondingly greater. This means a more energetic output pulse, and a warning against electric shock if you use a larger transformer.

The Neon Tube

Several types of neon tube are suitable. The tube used should strike at below 100 volts and extinguish at a voltage above the value of the supply voltage. Use of a miniature tube such as is used in neon mains testers and panel lamps is recommended. These are usually supplied together with a series resistor as safeguard against heavy mains current. This should be omitted from the circuit, for such a resistor would cut down the useful current through the neon, and probably cause destruction of the transistor.

The Transistor

The transistor should be suitable for use with a collector voltage above 100 volts; i.e., well above the "strike" voltage of the neon. Suitable types are: Texas 2SO18; Ediswan XB121. The circuit diagram

★ components list

T1	Driver transformer LT44
Tr1	Transistor type Texas 2SO18 (n-p-n) or Ediswan XB121 (p-n-p)
Neon	Type HRNT2 or similar
C1	1μF 12V electrolytic
VR1	100kΩ potentiometer

shows use of an n-p-n transistor; e.g., 2SO18. If a p-n-p type is used (e.g., XB121) the circuit connections to the battery should be reversed, also the connections of the electrolytic capacitor if used. No heat sink is required as the power handled by the transistor does not warrant this precaution.

Construction

Construction of this device is not very critical if reasonable care is taken. Standard tagboard, breadboard or printed circuit techniques may be used to connect up the components as best suits the constructor. Heat-sinks must be used whilst soldering to ensure that the transistor and neon are not damaged, and all joints should be soldered before connection to the battery. With care, this unit may be made very compact, and tucked away in some corner of your equipment.

If the unit is to be used near the input or aerial of your equipment, it should be shielded in a small metal box, or in a cardboard pill-box, covered with metal foil, and connections to the battery and neon should be made with shielded wire.

Operation

Never operate this circuit without the neon tube as this invites almost immediate destruction of the transistor.

Before connecting the battery, trim VR1 to its highest value. If you have a milliammeter, it may be of interest to connect this in series with the unit. Connect the battery. Very little current flows and the neon does not light (unless a very high gain transistor is used). Adjust VR1 gradually to a lower value. At a certain stage the neon will begin to glow, and as VR1 is adjusted, the brilliance will increase. At a certain point, the neon will flicker on and off, or extinguish altogether. If this happens, trim VR1 back up again as a heavy current drainage is indicated.

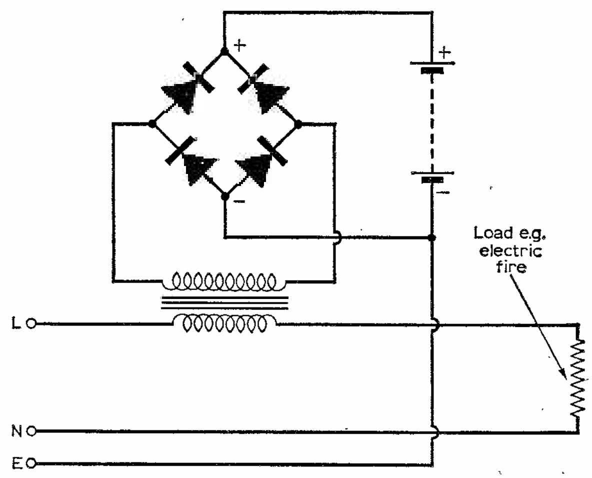
The author found that using the components specified, maximum brilliance occurred when the total current taken was 0·7mA, and with VR1 at about 40kΩ. The neon lit with a total current of 0·25mA and VR1 at about 70kΩ. The neon flickered and extinguished when the overall current reached approximately 1·6mA. The transistor then "bottomed", and the current taken rose to a high value which could heat up and destroy the transistor if allowed to persist. If C1 was ommitted, maximum brilliance occurred with a total current of around 1·2mA, and produced a slight loss of brilliance as compared with the complete circuit. It will be seen that the current drawn by this neon indicator is negligible, and the cost reasonable when balanced against possible saving in battery power. The circuit is highly reliable; the author's model has run continuously for several days from a PP9 battery with no perceptible drop in battery voltage. ■

CUT-OUTS AND CURRENT TRANSFORMERS

—continued from page 130

lower voltage; for example, an electric heater or a lamp used when watching television. The circuit of such a charger is shown in Fig. 6.

The turns ratio of the current transformer for this application will vary depending on the mains load current and the charging current required. Suppose, for example, a 60W bulb is being used for illumination while viewing television, and that a 12V car battery is to



g. 6: Battery charger.

be charged. If the mains voltage drop is to be restricted to 24V then the current transformer will have 1:2 turns ratio and the battery will be charged at half an amp. The number of turns per volt required to avoid saturation in a core of the size used by the writer (about the size of a 6·3V 2A heater transformer) is between 10 and 12. Hence the transformer primary would have 240 turns at least and the secondary 120 turns.

Low Charging Rates

It must be admitted, of course, that half an amp is a very low charging rate for a car battery; indeed nearly four days would be required to completely charge it. If however, the current transformer were to have a 1:1 ratio and be connected in series with a 1kW electric fire, then a charging rate of 4A would be obtained, which is the recommended rate.

Bridge Rectifier

The bridge rectifier should be a 12V type with adequate current rating. The wire used for the current transformer should be as large as can be accommodated on the former.

This type of battery charger has the advantage that if the 12V battery is replaced by a 6V or 2V accumulator the charging rate remains constant. If a battery is not being charged and the charger is left in circuit then the output terminals must be short-circuited. If this is not done fairly high voltages will be produced which will cause breakdown of the rectifier. ■

Loudspeaker Matching

by Leslie Moore

IMPEDANCE matching between stages of audio equipment usually causes a certain amount of difficulty to the newcomer. Power amplifier coupling or output to some speaker system is probably the most common cause of inefficiency in such equipment.

Fig. 1 shows a series circuit of variable resistor R and battery B. Suppose internal resistance r were 2 ohms and battery voltage 2 volts. When R is zero, then current in the circuit will be a function of internal resistance and battery voltage.

i.e. $I = \frac{V}{r} = \frac{2 \text{ volts}}{2 \text{ ohms}} = \text{ampère}$.

When R is $0{\cdot}5\,\Omega$, $I = \frac{2}{2{\cdot}5} = 0{\cdot}8$ ampères, and so on.

Power dissipated in a resistor is given by

$P = I^2 \times \text{resistance}$.

When $R = 0 \quad P = 0$

„ $R = 0{\cdot}5 \quad P = 0{\cdot}8 \times 0{\cdot}8 \times 0{\cdot}5 = 0{\cdot}32$ Watts.

Voltage across R and r is again dependent on their values.

$V = 2 \times \frac{R}{R+r}$, therefore when $R = 0{\cdot}5\,\Omega$, $V = 2 \times \frac{0{\cdot}5}{2{\cdot}5}$

$= 0{\cdot}4$ volts.

The table gives suitable values of variables to demonstrate the purpose of this test.

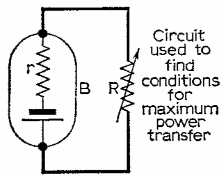
R ohms	*I amps*	*I^2R watts*	*V volts*
0	1	0	0
0·5	0·8	0·32	0·4
1	0·66	0·44	0·66
1·5	0·57	0·49	0·86
2	0·5	0·5	1·0
2·5	0·44	0·49	1·11
3	0·4	0·48	1·2
3·5	0·36	0·45	1·3
4	0·33	0·44	1·33
5	0·28	0·39	1·43

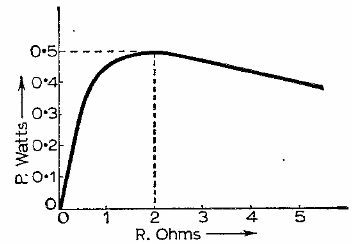
A graph drawn of power against resistance (Fig. 2) shows that maximum value of power transferred from battery to resistance R, takes place when R is equal to r, battery internal resistance. This is of importance especially when dealing with loudspeaker matching by transformer.

TYPICAL OUTPUT STAGE

Fig. 3 shows a typical power output stage of an audio amplifier. Suppose output resistance of the power amplifier is $4000\,\Omega$, then for maximum power transfer, effective loading of the loudspeaker should also be $4000\,\Omega$.

Voltage ratio of secondary to primary transformer windings is equal to $\frac{N2.}{N1.}$



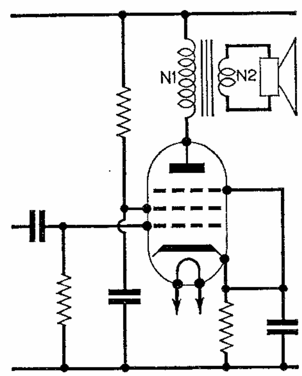


Value of R is 2Ω when maximum power is transferred

Fig. 1 (top left): Circuit used to find condition for maximum power transfer.

Fig. 2 (top right): Value of R is 2Ω when maximum power is transferred.

Fig. 3: Typical output stage of power amplifier.



Current ratio of secondary to primary transformer windings is equal to N1/N2.

From Ohm's Law resistance $= \frac{V}{I}$, therefore resistance ratio of secondary to primary transformer windings

$$= \frac{N2/N1}{N1/N2} = \frac{N2 \times N2}{N1 \times N1} = \left(\frac{N2}{N1}\right)^2$$

If a $15\,\Omega$ loudspeaker were to be used, then to obtain maximum power transfer

$$4000 = 15 \times \left(\frac{N2}{N1}\right)^2 \therefore \frac{N2}{N1} = \sqrt{\frac{4000}{15}} = 16{\cdot}3.$$

Therefore turns ratio of transformer used should be about 16:1.

IMPEDANCE MATCHING

Correct impedance matching is often neglected; common practice is to place additional loudspeakers in parallel with the existing one. If two $15\,\Omega$ loudspeakers were placed in parallel connection instead of one, on the output of the previous amplifier, actual resistance of parallel combination is reduced to $7{\cdot}5\,\Omega$. Effective load of two loudspeakers in parallel then

$$= 7{\cdot}5 \times \left(\frac{N2}{N1}\right)^2 = 2000\,\Omega.$$

Examining Fig. 2 will reveal that when load resistance

—continued on page 142

COMPOSITE UNIT

D. AVIS

radio, tape, record-player

THE writer, having moved into a new house, required a neat single unit housing a radio tuner, tape deck, record-player, power amplifier (2-3 watts) and two speakers. It was decided that the unit had to have the following requirements:—

1. To be completely self-contained;
2. A switching system enabling the units to be connected directly to the amplifier, independently, without changing plugs and sockets at the back;
3. A switching system to record off, or play back through the power amplifier when one of the other units was connected to it;
4. A pre-amplifier and mixer for two inputs;
5. High impedance and low impedance audio output sockets;
6. Provision for external input to the tape deck;
7. Tone network.

The Circuit

Fig. 1 shows the main circuit in block form. A moment's reflection will show that it contains all the above requirements.

The heart of the unit is the main switch (S3) and the main amplifier. In position 1 either the record player or external input is connected to the power amplifier depending on S1. In this position the pre-amplifier is used. This can be bought, but is easily constructed, a suitable circuit diagram is shown in Fig. 2a and the corresponding wiring diagram in Fig. 2b. Any low noise pentode can be used providing that R2 is adjusted to suit the bias conditions recommended by the manufacturer. This information can be found by consulting a valve data manual. The h.t. and l.t. supply is drawn from the power supply of the main amplifier. As the main amplifier will have a fairly large power pack the 3mA drawn by the 6BR7 is extremely unlikely to overload it.

When S3 is in position 2 the radio tuner is connected to the main amplifier. This may be a.m. or f.m. depending on what is to hand. If an f.m. tuner is used a fairly high quality amplifier should be used. With S3 in position 3 the tape deck output is fed into the amplifier when the deck is switched to playback. The input to the tape deck is controlled by S2. In position 1 it receives its input from the

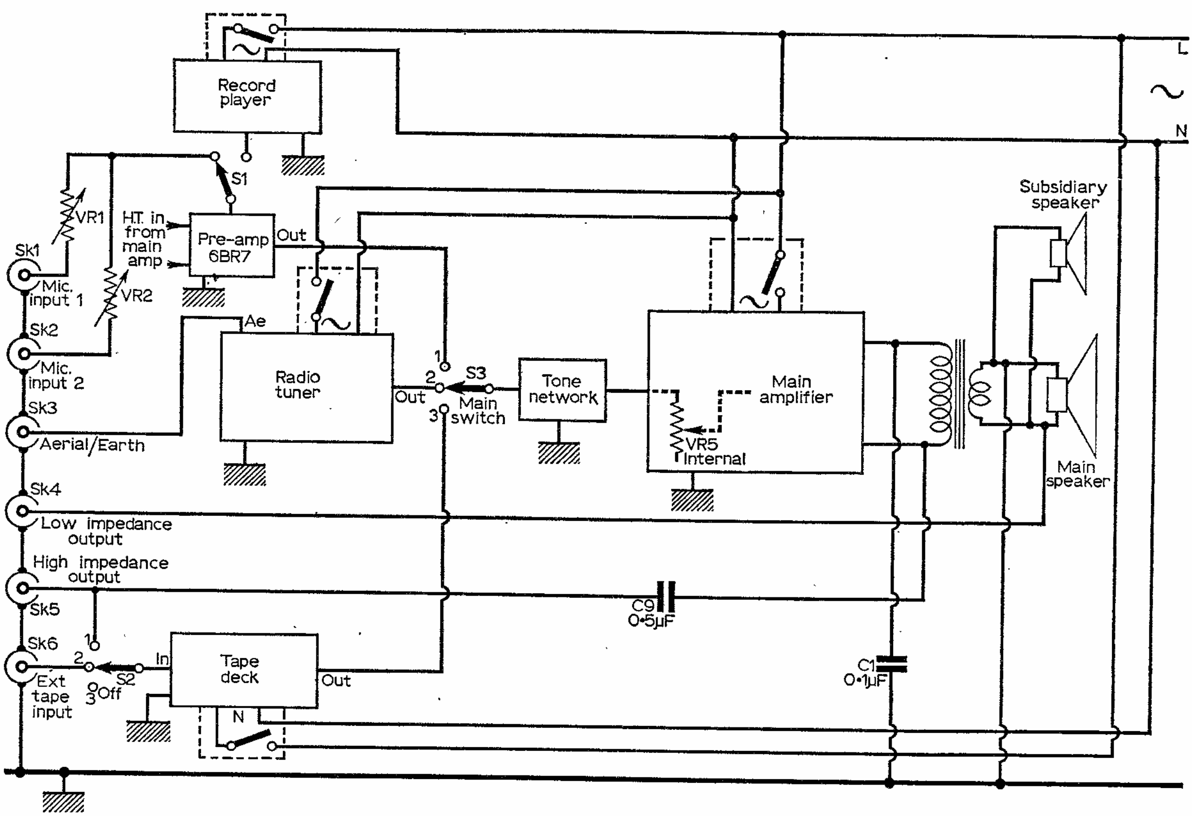


Fig. 1: Block diagram of the main circuit.

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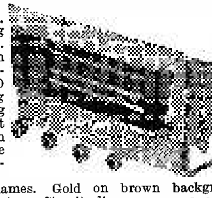

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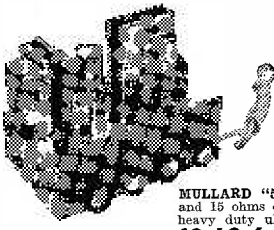

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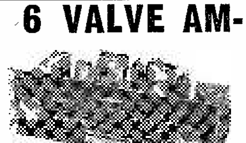
6 VALVE AM-FM TUNER UNIT



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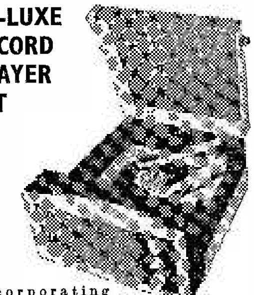

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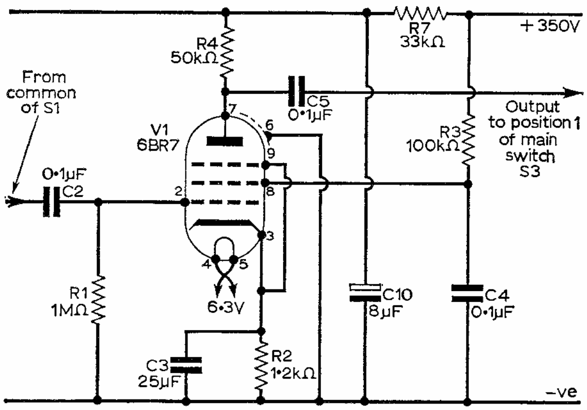
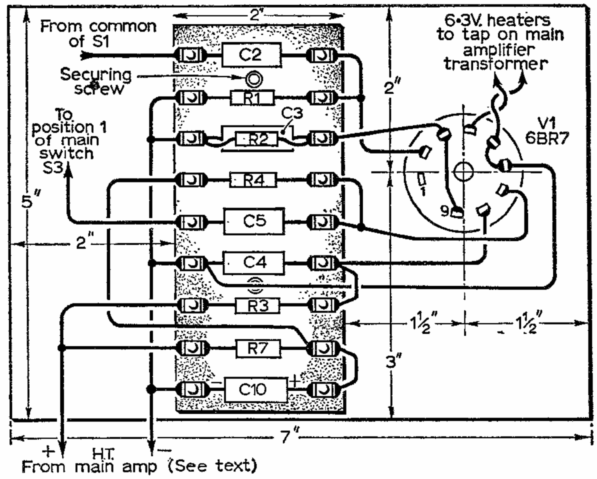
Fig. 2a (left): Circuit of the preamplifier.
Fig. 2b (right): Wiring of the preamplifier.





main amplifier which, as previously described, obtains its input from any of the other units. In position 2 the tape recorder receives its input externally through SK6.

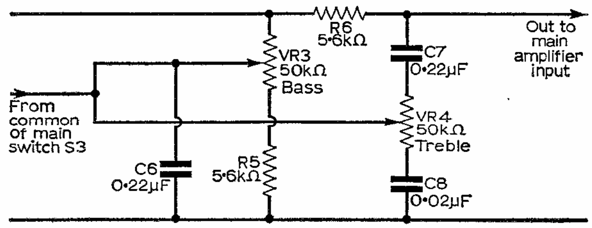
A tone network is shown in Figs. 3a-3b. This may be omitted if the main amplifier obtained has its own tone networks.

The dotted lines around the mains switches of the various units indicate that the mains switch is incorporated in the particular unit. Whilst on the subject of mains it must be stressed that each unit *must* be mains isolated; i.e. *no* item must be a.c./d.c. This is because of the interconnecting of chassis in this design.

A new cabinet for this design would be very expensive but a 'home-brew' design could be constructed for about half the cost. No constructional details of the cabinet are given as most constructors building this item will have their own ideas depending on the space available, the place it is likely to be used in and the ability of the individual constructor.

Construction

Details of the construction of the preamplifier and the tone network are given in Figs. 2b and 3b respectively. There should be room somewhere in the cabinet for the single stage preamplifier which only measures 7in. x 5in. The tone network is best built on the front panel around the controls themselves. All wiring should be short and direct



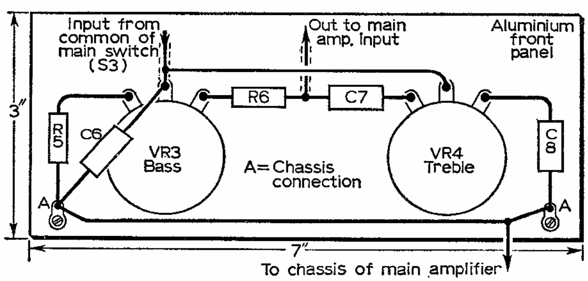


Fig. 3a (left): Circuit of tone control network.
Fig. 3b (right): Wiring of tone control network.

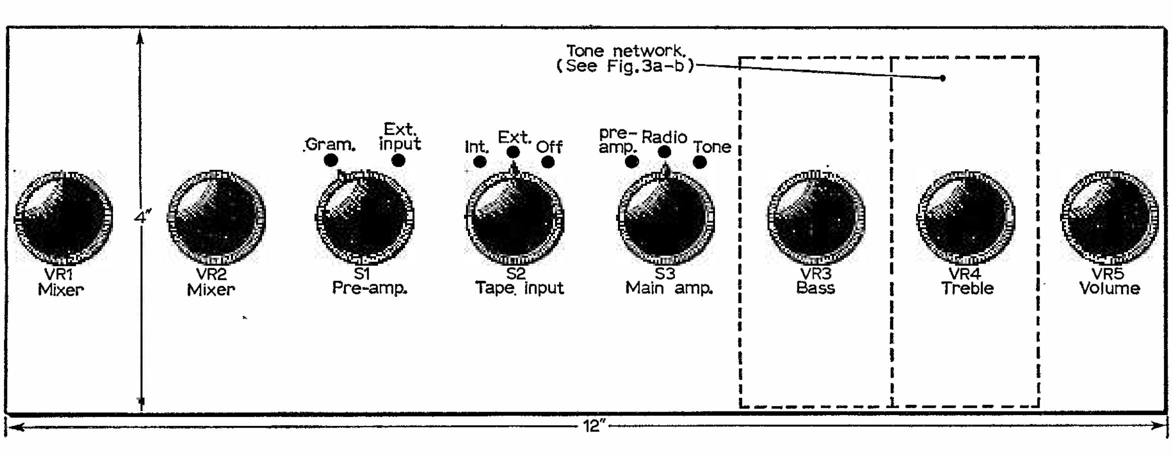


Fig. 4: Suggested layout of front panel controls.

especially to the input to the main amplifier. Some long wires are almost inevitable however and these wires will have to be screened.

Components

When purchasing components a compromise must be drawn between cheap, low quality equipment and expensive high quality equipment. If all the components have to be purchased reasonable parts can be bought for about £50, but most constructors will have some if not all of the components. Perhaps the most important item, quality wise, is the main speaker as this is where most of the distortion arises. For anything like good quality results a speaker in the £5 range is really necessary. The sub-speaker can be situated on the other side of the room to spread the sound through the room. It must be remembered however that by connecting two speakers in parallel the impedance is halved. That is, if the speaker's impedances are both the same. If for example they were both 15Ω the total impedance would be 7·5Ω, therefore the output transformer must be adjusted accordingly.

The main amplifier can be bought or constructed from one of the many articles in this magazine. It needs to have an output of at least 3W.

Operation and Use

After construction the unit should be fully tested and every control tried before the unit is sealed away. Suitable labelling for the front panel is shown in Fig. 4. The unit will have many uses when constructed, such as for example, being able to record at any time by turning a switch, instead of being encumbered by a large number of untidy loose wires. ■

★ components list

Main Circuit

Resistors:
All ½W 10%
VR1 1MΩ log. variable
VR2 1MΩ log. variable

Capacitors:
C1 – 0·1μF 350V wkg.
C9 – 0·5μF 350V wkg.

Switches:
S1 1 pole 2 way rotary
S2 1 pole 3 way rotary
S3 1 pole 3 way rotary

Sockets:
6 co-ax sockets

Miscellaneous:
5 control knobs, front panel (12″ x 4″) co-ax cable (see text)

Preamplifier

Resistors:
All ½W 10%
R1 1MΩ
R2 1·2kΩ
R3 100kΩ
R4 50kΩ
R7 33kΩ

Capacitors:
C2 0·1μF 150V
C3 25μF 25V
C4 0·1μF 350V
C5 0·1μF 350V
C10 8μF 350V

Miscellaneous:
V1 6BR7 or similar low noise pentode
B9A valveholder,
7 way tag strip

Tone control network

Resistors:
VR3/VR4 50kΩ carbon
R5/R6—5·6kΩ

Capacitors:
C6/C7—0·22μF 350V
C8—0·02μF 350V

LOUDSPEAKER MATCHING

—*continued from page 137*

of maximum power transfer is halved, power transferred is reduced, not by half, but in the example given, by 12%. Total power transferred, 88% of maximum power, would then be approximately halved when dissipated between the two loudspeakers. Therefore the sound produced by only 44% of maximum power is obtained due to adding one loudspeaker of 15Ω in parallel with an existing one. This is not the only disadvantage; in fact it may be regarded as an advantage when available power is far in excess of that required and sound dispersion of greater necessity. By halving a load, current drawn from the supply is increased. Such a load would change working characteristics of any output valve (or transistor) and probably result in distortion. The new working characteristics produced may lie outside power limitations.

OVERLOADING

The possibility also arises, especially when output transformers have been designed for a particular output circuit and the load is halved, that one of the transformer windings will fuse due to increased current. (i.e. $P = I^2R$ and resistance of windings is approximately constant.) Similar occurrences may take place when a loudspeaker of smaller impedance than required is placed in the output.

To calculate the turns ratio for a new transformer when two loudspeakers are placed in parallel, for example given previously:

$$4000 = 7{\cdot}5\left(\frac{N2}{N1}\right)^2 \therefore \frac{N2}{N1} = \sqrt{\frac{4000}{7{\cdot}5}} = \sqrt{533} = 23.$$

Therefore New turns ratio of output transformer required = 23:1.

Care must be taken to ensure correct impedance matching when fitting new loudspeakers into audio systems; nothing can be more disappointing than to build or buy a first-class power amplifier and, unknowingly, fit too low an impedance loudspeaker to the output, and listen to third rate reproduction as a result, or land yourself with an open circuit output transformer, a useless power output valve or transistor, or even a completely destroyed amplifier power supply.

It should be noted that reactances and impedances have not been taken into account in the previous example to enable this explanation to be as simple as possible. ■

TRANSISTOR MOBILE TRANSMITTER (March 1966 issue)

The LA2105 Vinkor pot core is no longer in current production. Messrs. Mullard Limited recommend the LA2102 pot plus DT2151 core as an alternative. These items can be ordered from Radio Crosland, 24 Foley Street, London, W1 and **NOT** Mullard Limited.

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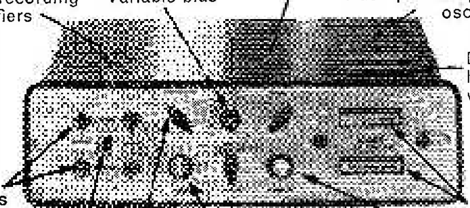
MONO/STEREO HI-FI TAPE LINK



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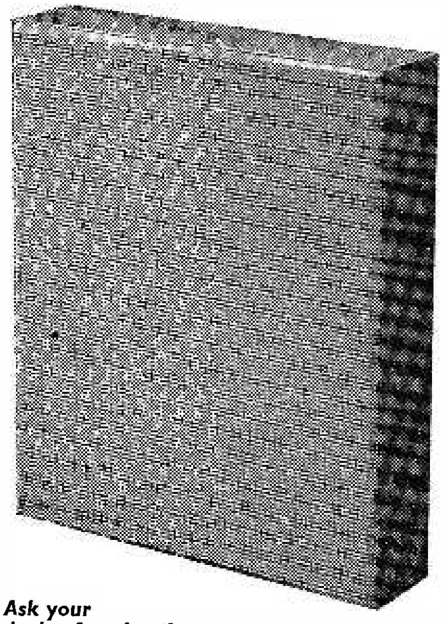

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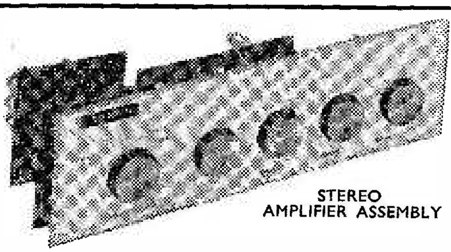
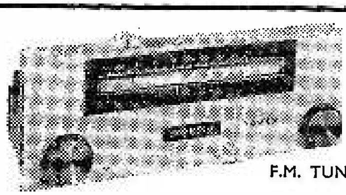


STEREO AMPLIFIER ASSEMBLY



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CLUB SPOT

No. 8 MAGNUS RADIO SOCIETY

G3PAW

THE existence of a radio or wireless society at the Magnus Grammar School at Newark in the early 1920's is shown in the records of the Derby Wireless Club, now the Derby & District Amateur Radio Society. This Club, recently featured in Club Spot No. 1 was evidently in contact with a kindred society at Magnus.

Both Societies were operating in the early 'twenties and some details of the Magnus Club's activities are to be found in the school magazines of that time. Now, forty years later, the Magnus Radio Society is proud still to have one of those pioneers as an Honorary Member of the present society founded in January 1960.

Amongst the founder members of the Magnus Radio Society were G3SGB, G3SHY, G3TBK, G3TBM, G3TFU and G3TWX. Of these, G3TBM is, today, the Club Secretary, while G3SGB is now on the high seas having trained as a Marine Radio Operator.

By 1961 the Magnus Radio Society had acquired the annexe to a room near the Laboratory for use as a shack. It started as a listener station using an 1155 but by 1962 a DX40 had been constructed and a long wire had been erected between two flag poles on the top of the building giving the school a rather ship-like appearance. The top is about 90ft. long and is some 50ft. above ground level. It is of hard drawn copper wire and with its down lead is roughly 130ft. long. It is fed through an ATU and works well on all bands.

G3PAW in action. At the controls G3UVT: logging, G3UYU: keeping an eye on things, s.w.l. Lacey.

The first contact by the Club Station G3PAW was made in February 1962 by which time we had acquired an Eddystone 840C receiver and a BC221 frequency meter. A Minimitter converter is now used in front of the 840C. In addition to the main rig we have a Codar AT5 which has proved valuable in covering top band, for experiments away from the shack and as a means of getting the newly licensed on the air quickly.

Activity varies according to the available operators and the time at their disposal but G3PAW is on the air most lunch times.

Membership of the Magnus Radio Society is kept to about twenty-five and ages range from 11—18. Meetings are held every Tuesday in a modern science laboratory which provides many basic facilities.

Programmes for the Club are planned ahead by a committee on which every age group is represented. This committee, while working the present programme, makes the plans for the coming term with such enthusiasm that there is sometimes a danger of the programmes becoming super-charged with ambition and it is quite usual for events to be held in holiday time.

The regular weekly meetings provide both for constructional work and practical effort with, in addition, talks, visits, films and social activities.

Demonstrations and talks have been given to the Club by its own members as well as local amateurs and visitors from Derby, Nottingham, Worksop, Lincoln and other towns.

The R.A.C. and the police have demonstrated mobile radio and we have recently visited the Notts County Police Communications Centre. Visits made by the Club have been varied and wide ranging and have included observation of the manufacture of telephone equipment and television camera assembly and the making of loudspeakers.

We have visited, also, different types of telephone exchanges and seen watches being checked electronically but, possibly the most exciting of all was being entertained by the BBC at the Television Centre in 1963 where we were able to see many personalities as well as the technical wonders.

An adequate lending library catering for all abilities is open in the shack at all meetings and at mid-morning each Wednesday. It is here that the Clubroom atmosphere is to be found.

Stores and tools have gradually been built up and these are housed in the shack which has good storage facilities.

All QSL cards are displayed and those taken down are classified by the QSL manager.

RAE classes are held each Friday between September and May. In this way eleven successes have been achieved, often at the early age of 14. The ideal is for the candidates to become licensed the year before they are due to take G.C.E. "O" level, otherwise it is better left till afterwards.

All licensed members help with Morse instruction. There is a quarter of an hour each day for those who care to "come and get it". Morse records are available and we have a professional telegraphist always willing to lend a hand.

Some members of the Magnus Society join the Newark and District Amateur Radio Society and the two societies have enjoyed many joint activities. One example being d.f. contests in the summer months. Several DF receivers have been built by Magnus members and a good deal of time has been spent on d.f. experiments. We have even had one "DFpedition" during the hours of darkness. Many snags were discovered before the TX was located some 8 miles from the initial rendezvous.

DF events of course, only cater for a limited number of members, but film shows, model control demonstrations and things with a wider appeal are frequently open meetings for anyone to attend.

For two years Magnus members who belong to N. & D.A.R.S. have enjoyed trips to the RSGB Communications Exhibition at Seymour Hall.

Incidentally, being a school club, does not make us a closed shop, any amateur travelling down the A1 is welcome during our meeting times.

A three minute regional spot on the BBC in 1965 brought a request from Brockhampton Press for a photograph of some of our Club members doing constructional work. This now features on the jacket of "Illustrated Teach Yourself Radio".

Special Activity Stations. The Magnus Radio Society was affiliated to the RSGB in 1960 and took part in NFD for the first time in 1964. G3PAW has taken part in the Top Band Contest on two occasions and has three times participated in the Magazine Club Contest with varying degrees of success.

We have always had Scouts among our members and for the last four years we have taken part in Jamboree-on-the-Air, acting host to Scouts in Newark and surrounding districts. Last year we joined forces with the Thieves Wood Short Wave Club which we helped to form at the Thieves Wood Special School, near Mansfield. This joint station using an AR77 and a KW Vanguard was a great success. The number of Scouts, Guides and club members from Thieves Wood, Newark and Mansfield made it an outstanding social event.

The committee has aimed to interest everyone. It has organised listening contests, demonstrations of home built equipment (Hi-Fi included), entertainments and social activities. Two mammoth junk sales have been held, the proceeds of which went to the Newark Parish Church Restoration Fund and the Winston Churchill Memorial Fund. Another is planned this year.

It is always sad to have to say goodbye to members when they leave Newark, as many of them do, to enter University or pursue their careers in radio and allied subjects but, of one thing we are confident, namely that some radio club somewhere will have the benefit of the loyalty and enthusiasm of these ex-members of the Magnus Radio Society.

If you are passing through Newark, why not drop in for a personal QSO? ■

UNIJUNCTIONS

—continued from page 104

8/1,000 Io. Since the current has decreased (because the resistance has increased) the voltage at B2 must have increased by 8/1,000 Io. R2 and this in turn causes an increase in the emitter firing voltage of 8/1,000 Io. R2.k where k is the intrinsic stand-off ratio defined earlier.

All this must be equal to the 2 millivolts drop due to the effect of the one degree rise on the emitter-base diode plus the drop in voltage due to the drop in current at B1 (since a drop in voltage at B1 is equal to a rise in voltage at the emitter just as a drop in voltage at the cathode of a valve is equal to a rise in voltage at the grid). Equating the two gives us:

$$R2 \frac{1+4Io.R1}{4Io.k}$$

Selecting a value for R2 as near as possible to the value given by the above equation will compensate for temperature effects over the range of temperatures normally encountered in transistorised equipment.

The task for which the unijunction has been most frequently used is the firing of silicon controlled rectifiers, or thyristors. A typical circuit for a unijunction-fired thyristor power controller is shown in Fig. 7. The load may be lamps, if variable brightness is required, or an electric drill, etc., provided that the thyristor is chosen for the peak inverse volts and maximum operating current present in the circuit.

Other useful circuits using unijunctions include the timer of Fig. 8 and the excess voltage detector of Fig. 9. Fig. 10 shows a lamp-flashing circuit using a unijunction and an inexpensive power transistor. ■

TRANSISTOR SET BOOSTER

—continued from page 119

amplifier plugged into the aerial socket of the set, a dramatic boost of all signals should result when the amplifier is connected to a power source. Note, that with insufficient strength of aerial signal the background hiss may be abnormally high, but this should apply only on the weakest of signals that the set without the amplifier fails to respond to, anyway.

A switch is not shown on the design because it may be decided to switch the battery supply lead to the amplifier on the dashboard of the car. However, the unit should be switched off when not in use, as the zener current is quite high and can put a reasonable load on the car battery (this will not apply, however, when the amplifier only is energised from the car battery. Here the current is so low that a switch is virtually unnecessary).

To minimise interference, of course, the car itself must be suppressed in the usual manner.

COUPLING COIL

Fig. 5 shows how a simple coupling coil can be made to slide along the ferrite core of the set's aerial, should such a coil not be fitted. A very good match to the emitter of Tr2 is achieved by this coupling, thereby resulting in maximum signal transfer. The coil should be slid along the ferrite rod for maxi-response of the weakest station required.

Before putting the amplifier in operation it is recommended that the article in the June, 1965, edition of PRACTICAL WIRELESS be studied as this gives the basic principles involved. ■

THE AUDIO FIDELITY STEREO-33

A High Fidelity All Transistor Stereo Amplifier providing 10 watts R.M.S. on each channel

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TOTAL HARMONIC DISTORTION
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DAMPING FACTOR 20

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AC107, OC44(3), OC81Z(2), OA5, OC127Z, AD149 (2).

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+11 dB to —16 dB at 40 c.p.s.

TREBLE CONTROLS
+15 dB to —15 dB at 10 Kc/s.

EQUALISATION
Gram. to std. R.I.A.A. characteristic.
Tape head to std. C.C.I.R. characteristic.

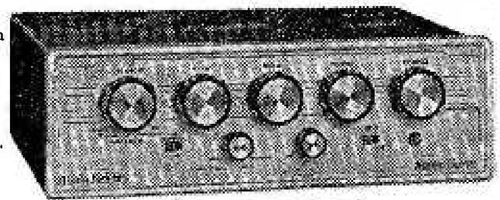
SIZE 12¾" x 4" x 8⅞"

WEIGHT 12½lb.

FILTER (Steep Cut)
7 Kc/s, 11 Kc/s, 15 Kc/s.

Please send SAE for leaflet

Incorporation of the very latest Mullard Transistors has made possible the really outstanding performance figures of this brilliant design. Compare them with other leading makes currently available.
NOTE: Rated output is in watts R.M.S. (continuous) which should not be confused with I.H.F.M. momentary pulses.)



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THE PRE-AMPLIFIER IS A COMPLETELY NEW DESIGN

IT ELIMINATES THE NECESSITY OF MATCHED INPUTS & COMPLICATED SWITCHING ARRANGEMENTS. IT ALSO PRODUCES CONDITIONS OF MINIMUM NOISE AT HIGHEST SENSITIVITIES.

INPUT SENSITIVITIES
(for 10 watts R.M.S. into 15 ohms)
Pick-up Magnetic 3.5 m.v. 33⅓ r.p.m.
7 m.v. 78 r.p.m.
Pick-up Crystal/Ceramic 400 m.v.
Microphone 5 m.v.
Tape Head 2 m.v. Aux. (Radio Tuner, Tape Rec. Ceramic P.U. etc.) 100 m.v. (Above sensitivities will be doubled when output load is 3-4 ohms.)

INPUT SELECTOR
33⅓ r.p.m., 78 r.p.m., Aux. Mic. Tape Head.

INPUT SOCKETS
Magnetic P.U., Crystal/Ceramic Pick-up Aux. Tape Head Microphone.

Built to the highest standards employing latest materials and techniques

DESIGNED FOR EASE OF FITTING IN CABINET OR FOR FREE-STANDING USE.

Tested for satisfactory operation in temperatures of up to 50°C. (120°F.)

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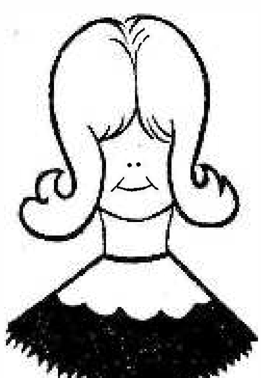

(Oh dear! our artist is thinking of Gloria again)

One of the fringe benefits that purchasers of the Home Radio Catalogue get is our Special List of Bargains. This is sent automatically with the first parcel of goods. Let us high-light a few items from our list:

BG6A Condenser Pack, Silver Mica Condensers values 15, 25, 71, 80, 160, 200, 240, 330, 470, 1000, 1500, 1670, 4000pf (the 470 pf are 750v). Twelve of the fourteen in each pack. Moulded Micas—values 68, 820, 1000, .002, .005, .01 (the .002 are 2250 volts test). Five out of the six in each pack, plus one .02 and one .1 paper, both 750v. All this for **5/6** plus 2/6 Postage and Packing **(To-day's value 15/-).**

BG28 Jackson type 100 pf air dielectric trimming Condenser. Three for **2/6** plus 2/6 Postage & Packing. **(To-day's value 25/-).**

BG42 Resistor Kit consisting of thirty different preferred values between 120 Ohms and 4.7 Megs. 2 Watt Resistors (Erie type T2). **5/-** plus 2/6 Postage & Packing. **(To-day's value at least 21/-).**

These are three out of about sixty Bargains offered to purchasers of our Catalogue.

Now as to the Catalogue itself,.. it has 210 pages containing 5,800 items, with over 900 illustrations. Price 7/6 plus 1/6 Postage and Packing. Every catalogue contains 5 coupons, each worth 1/- when used as directed.

P.S. If you are interested in the above bargains send your money, quoting the Catalogue numbers.

Please write Name and Address in block capitals

Name ....

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Home Radio Ltd., Dept. PW, London Rd., Mitcham, Surrey

THE SINCLAIR AUDIO-

Build a SINCLAIR Hi-Fi System

By building ALL three Sinclair designs featured this month, you can become the proud owner of a unique A.M.-F.M./Stereo Hi-Fi system that will give complete satisfaction and save pounds compared with other systems. Each unit is complete in itself and you will have two radio units, each of which can be used separately as an independent self-contained personal receiver. These designs cover all aspects.

A.M — *The Micro-6. It has amazing range and power and combines readily with the Z.12.*

F.M — *For quality, the Micro FM gives all you want both as a tuner and a pocket receiver for personal listening.*

HI-FI — *The Z.12 more than replaces larger conventional amplifiers for price, size and power. Two in stereo cannot be bettered.*

A CONSTRUCTOR TELLS US

"I was determined to finish it (The Micro FM) at one sitting. Having completed it, I am amazed at its quality of reproduction, and am spending far too much time listening to it; it even works on trains which is more than can be said of AM radios."
(*Signed*) D.V.B., Tunbridge Wells, Kent.

sinclair MICRO FM

ALL YOU WANT FROM AN F.M. TUNER AND RECEIVER IN A SINGLE UNIT

7 TRANSISTOR COMBINED F.M. TUNER RECEIVER

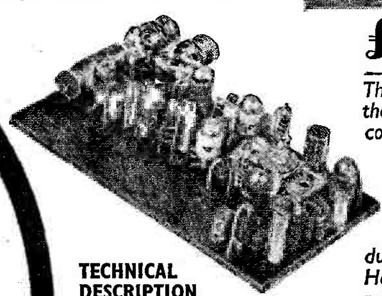
When Sinclair Radionics decided to design an F.M. receiver which could be carried in the pocket and yet satisfy the most stringent demands likely to be made of it, it was realised from the start that radical departures would have to be made from conventional F.M. design techniques. The problems of alignment would have to be eliminated for constructors. Sensitivity had to be such that good reception could be enjoyed using no more than the telescopic aerial necessary to keep the set truly portable. Audio quality had to be at least as good as that from sets where size and price were not important considerations. Sinclair Radionics achieved this and much more in their Sinclair Micro FM. Today, it enjoys the unique distinction of being the only set of its kind in the world, it can be used as a tuner and as an independent pocket size personal F.M. receiver. In appearance, this fully-fledged 7 transistor superhet F.M. is as outstanding as it is in its performance. The brushed and polished aluminium front panel with spun aluminium tuning dial makes it the most elegant, professionally styled set ever made available to constructors. Yet with these and many other important features, the Micro F.M. costs pounds less and enables constructors to enjoy F.M. reception to the full at once.

- **$2\frac{15}{16}$ x $1\frac{11}{16}$ x $\frac{3}{4}$in.**
- **Needs no Alignment**
- **One output for Hi-Fi**
- **One output for personal listening**
- **Tunes from 88-108 Mc/s**

Complete kit of parts including transistors, aerial, case, front panel, dial, earpiece and instructions

£5.19.6

The set works perfectly from the moment the battery was connected ... the standard of performance exceeds anything I have so far heard. You have clearly designed a very efficient circuit and credit is very rightly due to you. (Signed) L.E.H., Harrogate, Yorks.



TECHNICAL DESCRIPTION

The Sinclair Micro FM is a completely self-contained double-purpose FM superhet housed within a case less than 3in. high x $1\frac{3}{4}$in. wide with a depth of $\frac{3}{4}$in. It uses 7 transistors and 2 diodes in special superhet FM circuitry. The R.F. amplifier is followed by a self-oscillating mixer and 3 stages of I.F. amplification which dispense with I.F. transformer and all problems of alignment. The final I.F. amplifier produces a square wave of constant amplitude which is converted into uniform pulses so arranged that the original modulation is reproduced exactly. A pulse-counting detector ensures improved linearity and therefore better audio quality at the output stages. After equalisation the signal is channelled to one output for feeding to amplifier or recorder and to another in which the receiver's own audio amplifying stage enables the Micro FM to be used as an independent self-contained pocket portable. A.F.C. is used to lock the programme tuned in; the telescopic aerial included with the kit will be found sufficient for all but the worst signal areas.

- **Supply voltage—9v from self contained standard battery.**
- **Consumption—5mA.**
- **Sensitivity—Typically 3mV**
- **Signal to Noise Ratio—30dB at 30 microvolts.**
- **Audio frequency response—10-20,000 c/s.**
- **Two Audio Outputs—One for feeding to amplifier or tape recorder. One for feeding to earpiece to enable set to be used as a portable receiver.**
- **A.F.C. for automatically locking on to each station tuned in.**
- *Inserting plug of earpiece or tuner lead switches set ON.*

the smallest set on earth

—it's the inimitable

SINCLAIR MICRO-6

SIX STAGE A.M. RECEIVER

- **$1^4/_5$in. x $1^3/_{10}$in. x $\frac{1}{2}$in.**
- **Weight—1 oz.**
- **Bandspread for Luxembourg**
- **Build it in an evening**
- **Plays anywhere**

No transistor set in the world has ever yet compared with this six-stage marvel for power, range and size. It gives you the whole of Europe to listen to. The Micro-6 has 2 stages of R.F. amplification, double diode detection and 3 stage high gain A.F. amplifier. A.G.C. counteracts fading from distant stations. Tunes over medium waveband. The whole set complete with ferrite rod aerial and batteries is contained in a case smaller than a matchbox, and is a delight to build.

All parts inc. transistors, case and dial assembly in white, gold, black, earpiece and instructions

59/6

MALLORY MERCURY CELL ZM312 (2 reqd.) each 1/11

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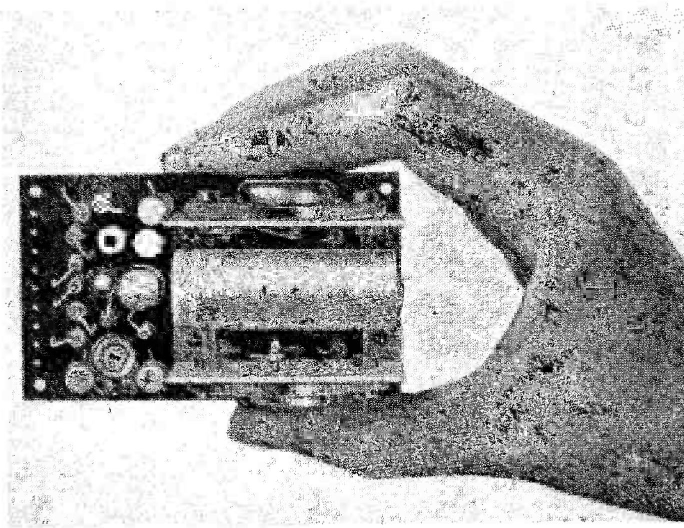
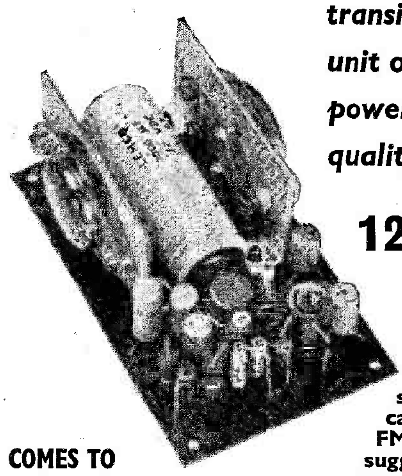
Z.12

COMBINED AMPLIFIER AND PRE-AMP

An eight transistor unit of enormous power and superb quality giving





12 WATTS RMS OUTPUT CONTINUOUS SINE WAVE

For size alone, the Z.12 marks another important advance in quality design, for its amazing compactness opens up exciting new vistas in amplifier housing and application. Combined with this are the fantastic power and superb quality of the Z.12 which can provide an effortless output of 12 watts R.M.S. continuous sine wave from its unique eight transistor circuit. Basically intended as the heart of any good mono or stereo hi-fi system, the size and efficiency of this Sinclair unit make it equally useful for a car radio (with the Micro-6 for example), a high quality radio with the Micro FM, in a guitar, P.A. or intercom system, etc. Other applications are sure to suggest themselves to constructors. The manual included with the Z.12 details many mono and stereo tone and volume control circuits by which inputs can be matched (and switched in) to the pre-amp. The size, performance and price of the Z.12 all favour the constructor seeking the finest in transistorised audio reproduction—it is in fact today's finest buy in top grade high fidelity.

COMES TO YOU BUILT, TESTED AND READY FOR IMMEDIATE USE

Ready built, tested and guaranteed with Z.12 manual **89/6**

- FOR 6-20V OPERATION
- SIZE 3in. x $1\frac{3}{4}$in. x $1\frac{1}{2}$in.
- IDEAL FOR 12 VOLT BATTERY OPERATION
- MAKES A SUPER STEREO ASSEMBLY

Technical Specification

- 8 special HF transistors.
- Ultra-linear class B output and generous neg. feed back.
- Response—15 to 50,000 c/s ±1dB.
- Output suitable for 3, 7.5 and 15 ohm loads. Two 3 ohm speakers may be used in parallel.
- RMS Output—12 watts continuous sine wave (24w. peak). 15 watts continuous music power (30w. peak).
- Input—2mV into 2K ohms.
- Signal to noise ratio-better than 60dB.

THREE MONEY-SAVING OFFERS TO Z.12 PURCHASERS

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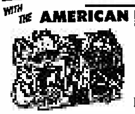

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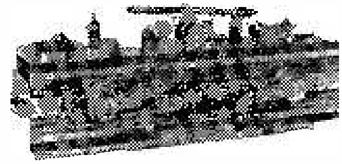

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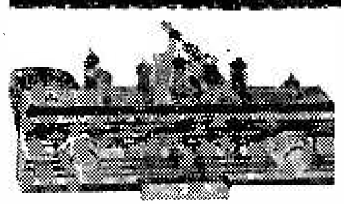

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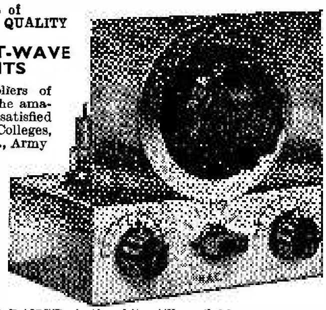

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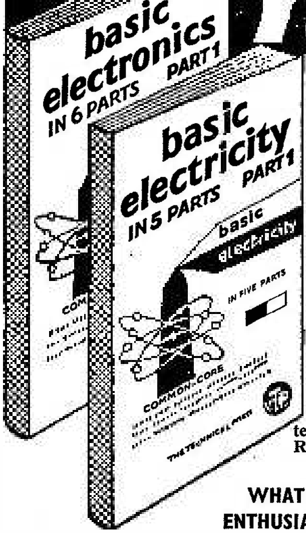

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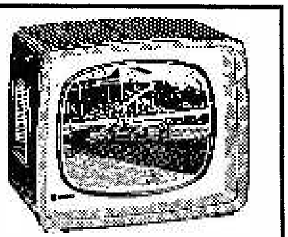

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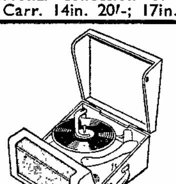

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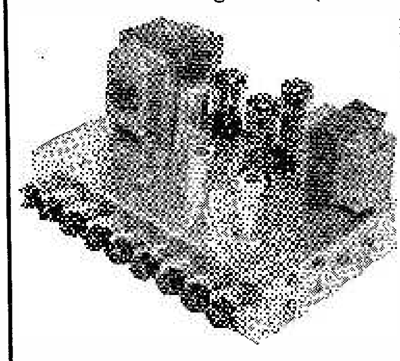
12 months' guarantee (valves 3 months)



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DANE Electronics

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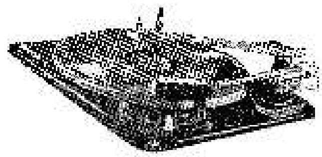

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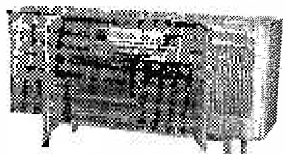

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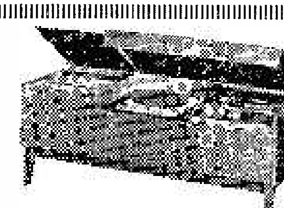

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PRACTICAL WIRELESS, JUNE, 1966

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