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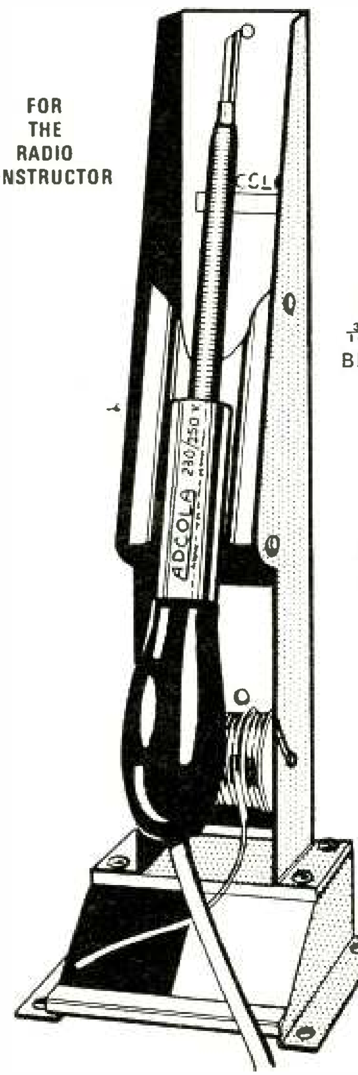

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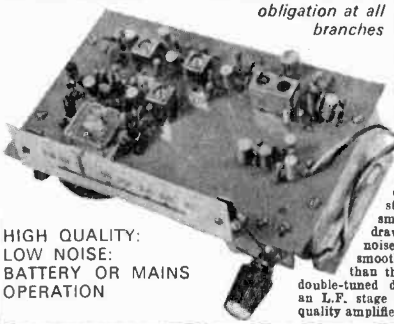

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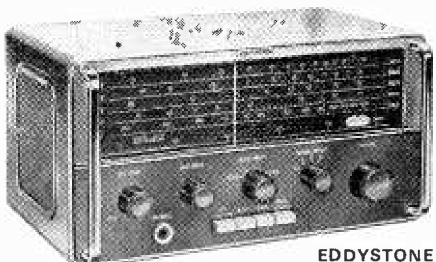

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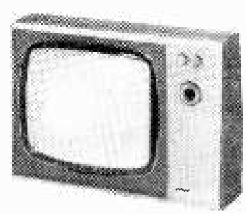

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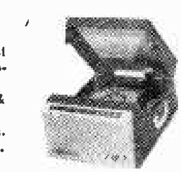

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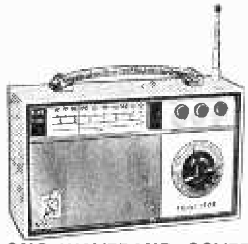

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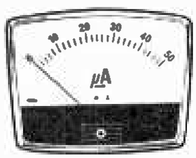

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1 mA DC	**32/6**	300 V DC	**32/6**
5 mA DC	**32/6**	500μA	**37/6**
1mA S Meter	**39/6**		

Type MK-38A 2in. square		**Type KR-65** 3¾ x 3in.	
1 mA DC	**22/6**	1 mA DC	**36/-**
5 mA DC	**22/6**	5 mA DC	**35/-**
300 V DC	**22/6**	300 V DC	**35/-**
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1 mA S Meter	**29/6**	1 mA S Meter	**39/6**
Type MK-45A 1¾in. square		**Type MK-65A** 3in. square	
1 mA DC	**25/-**	1 mA DC	**36/-**
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300 V DC	**25/-**	300 V DC	**35/-**
500μA	**25/-**	500μA	**39/6**
1 mA S Meter	**35/-**	1 mA S Meter	**37/6**

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VFA Standard	**£4 15 0**	A.T.V. 3A	**£3 12 6**
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3in. Message tape, 300ft.	**7 6**	5¾in. Long play, 1200ft. Mylar ..	**15 0**
3¼in. Triple play, 600ft. Mylar	**10 0**	5¾in. Triple play, 2400ft. Mylar ..	**45 0**
4in. Triple play, 900ft. Mylar	**17 6**	7in. Standard play, 1200ft. Acet.	**12 6**
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	**26 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 ..	**50 0**

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

EXPORT FM WIRELESS MICROPHONES

THE TTC MODEL B4002
Highly sensitive—suitable for either static or mobile use. Signals can be picked up by any FM radio or tuner which receives frequencies between 96—104 Mc/s over several hundred yards. Size only 3 x 2½ x 1in. (in leather case). Operates on one PP3 type battery. Complete with neck cord, clip on dynamic extension mike (½ x ¾ x 5/16in.) and battery. **LASKY'S PRICE 10 Gns.** Post Free anywhere in world.

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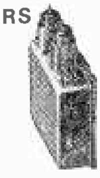

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In metal case size 4 x 6 x 1½in. Fully tunable—complete with PC86 and PC88 valves. LASKY'S PRICE **29/6** Without valves **7/6**

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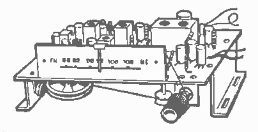
Sub-miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 3 x 1½ x 2½in.

LASKY'S PRICE **37/6**

TRANSISTOR FM TUNER CHASSIS



Fully tunable—range 88 to 108 Mc/s. Completely wired on printed circuit. 10·3 Mc/s. IF. 6 transistors and 3 diodes. Slow motion tuning drive. Size 6½ x 4 x 2½in. Operates from any 9v. D.C. source. Full data and circuit supplied.

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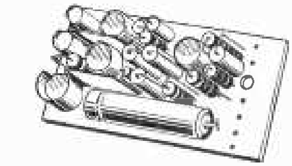

Incorporating the very latest circuitry to provide high sensitivity and good quality in conjunction with extreme small size and compactness. High quality Newmarket transistors used throughout. All designed to operate on 9v. miniature battery.
Add 1/- on each for Post and Packing.

TYPE LRPC 1. 3 transistor. Input sens. 50mV. Output 150mW. Output imp. 40 Ω. Size 2 x 1 x ¾in. .... PRICE **27/6**

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TYPE LRPC 5. 6 transistor. Input sens. 8mV output 3W output imp. 3 Ω size 5½ x 1¾ x 1in. .... PRICE **59/6**

LRPC 9. High to Low input matching pre-amplifier. Input imp. 1 meg ohm output imp. 2 k/ohms. Size 1½ x 1½ x ¾in. .... PRICE **10/6**

LRPC 10. Magnetic tape replay preamp. designed so that a 450 mH head can be matched into any of the audio amp. modules listed above. Size 2½ x 1½ x ¾in. PRICE **10/6**

Note the **LRPC 9** and **10 are ideal for use with the LRPC 1, 4 or 5 and are available at the reduced price of 7/6 if bought with the LRPC 4.**

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44/1505 3¾ x 17in.	**15/6**	**Orders of 10/- and over post free.**	

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ECC83	4/–	PZ30	5/–	20P4	8/6
ECL80	1/6	U25	5/–	5U4G	4/–
EF50	1/–	U191	5/–	6B8	1/8
EF80	1/6	U281	5/–	6K7	1/9
EF91	9d.	U282	5/–	6K25	5/–
EL38	5/–	U301	5/–	6P25	5/–
EY86	5/–	U329	5/–	6U4	5/–
KT36	5/–	U251	5/–	6V6	1/9
PCC84	2/–	U801	8/6	6P28	5/–
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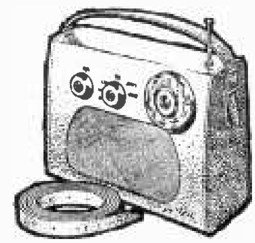

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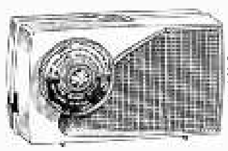

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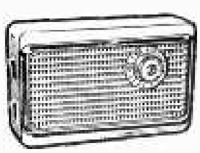

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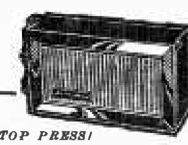

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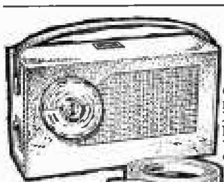
MELODY SIX



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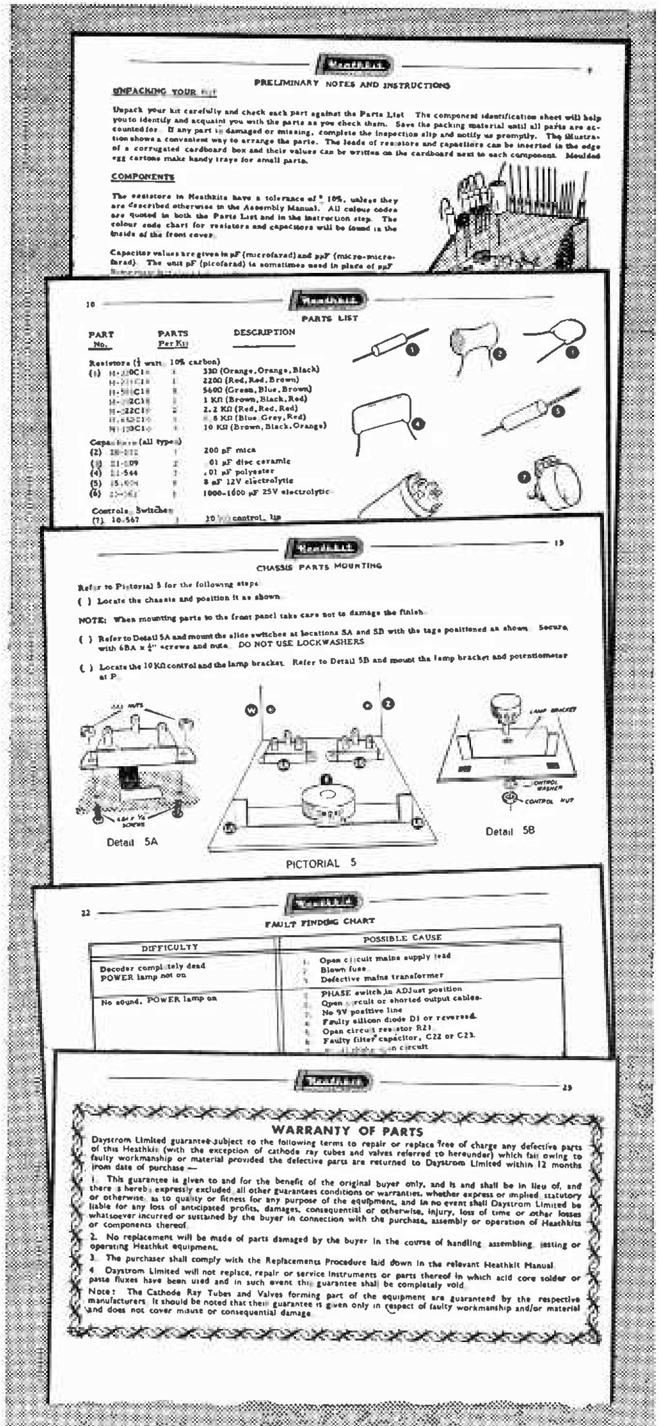

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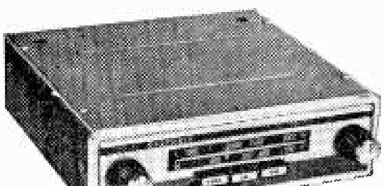
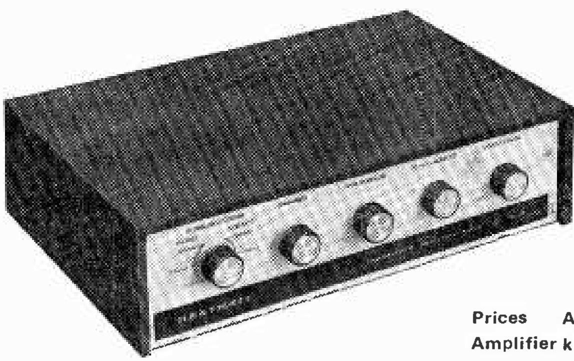


Complete your motoring pleasure with this small, compact, high-performance car radio. It can be fitted to any make of car having 12 volt positive or negative earth system. Tastefully styled in neutral grey with matching black knobs and chrome trim to harmonise with any car colour scheme.

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

The car radio is available for your convenience, in two separate units: RF Amplifier Kit CR-IT, **£1.13.6** incl. P.T. IF/AF Amplifier Kit CR-IA, **£11.3.6.**
TOTAL PRICE KIT (excluding loudspeaker) £12.17.0 incl. P.T.
8 x 5in. Loudspeaker, Pt. No. 401-505, **£1.16.1** incl. P.T.

The Transistor Amplifier you have been looking for !



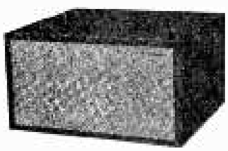
3 + 3W Stereo Amplifier Kit, TS-23

Breaks the price barrier in transistor amplifier cost

Incorporates all the essential features for good quality reproduction from gramophone records, radio and other sources. Its many features include: 3 watts rms (15Ω) each channel. Good frequency response for outstanding fidelity. Compact slim-line styling. Ganged BASS, TREBLE and VOLUME controls. Six position SELECTOR switch for programme sources. Attractive perspex front panel, two-tone. 16 transistor, 4 diode circuit. Handsome fully finished walnut veneered cabinet. Outputs for 8 or 15 ohm loudspeakers. Printed circuit boards for free-standing or cabinet mounting. Size $3\frac{7}{8}$in. x 13in. x 8in. deep.

Prices Amplifier Kit £17.15.0
Amplifier kit & Cabinet £18.19.0
Walnut veneered Cabinet separate £2.0.0

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



The challenge to our acoustic engineers was to design a speaker occupying the minimum space consistent with first class reproduction. The result of our efforts was the AVON, a compact unit of exceptional quality.

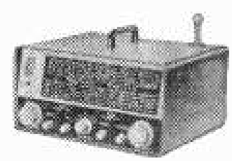
Features two special speakers $6\frac{1}{2}$in. BASS, $3\frac{3}{8}$in. HF unit and cross over network. Good frequency response. Beautiful fully finished walnut veneered cabinet. Size only $7\frac{3}{4}$ x $13\frac{1}{4}$ x $8\frac{3}{8}$in. deep. Supplied in two units.

Can be built for a total price

KIT **£13.16.0** incl. P.T.

"Mohican" General Coverage Receiver, GC-1U

Powerful 10 transistor, 5 diode circuit. Tunes 580 to 1550 kc/s and 1·69 to 30 Mc/s in five bands. Bandspread on all bands. Fixed-aligned ceramic IF transfilters for best selectivity. Pre-assembled and aligned 'front-end' for fast, easy assembly. Built-in 6 x 4in. speaker. Tuning meter for pin-point tuning. Completely self-contained for portability—can be operated on 230 volt AC with Model UBE-1. Kit £2.17.6 extra.



Wherever you go, the "Mohican" is a Welcome Traveller! The "Mohican" offers "fuss-free" portability at the beach, picnic, on a boat or camping expedition. Simply pull out its built-in 50in. telescopic whip aerial, switch it on, and tune any of its five bands to find out the latest world happenings . . . or be entertained with popular music.

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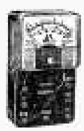
40-50 WATT AMPLIFIER

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

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

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

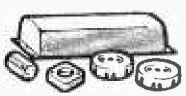
MAINS TRANSFORMER 200/250 volt, secondary 250/250 volt, 70 mA, 6·3 volt, 3 amp drop through. Price **12/6** plus 4/6 postage and packing. Elac 10 inch, 10,000 lines ceramic magnet, 3 or 15 ohms, 7 watt, **£1.9.6** plus 4/6 postage and packing.



POCKET MULTI-METER

Size 3¾ x 2¼ x 1⅜in. Meter size 2¼ x 1⅜in. Sensitivity 1000 O.P.V. on both A.C. and D.C. volts. 0-15, 0-150, 0-1000. D.C. current 0-150mA. Resistance 0-100kΩ. Complete with test prods, battery and full instructions, **42/6.** P. & P. 3/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering Iron value **15/-** to every purchaser of the Pocket Multi-Meter.

40W FLUORESCENT LIGHT KIT



Incorporating **GEC** Choke size 8¼in. x 1¾in. x 1¾in. 2 bi-pin holders, starter and starter-holder. P. & P. 5/6. **11/6**

Similar to above: 80W. Fluorescent Light Kit incorporating **GEC** choke size 11¾in. x 1¾in. x 1¾in. 2 bi-pin holders, starter and starter holder. P. & P. 6/6. **17/6**

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

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3-4 watt Amplifier built and tested. Chassis size 7 x 3¼ x 1in. Separate bass, treble and volume control. Double wound mains transformer, metal rectifier and output transformer for 3 ohms speaker. Valves ECC81 and 6V6. **£3.5.0** plus 5/6 p. & p.
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★ 2½" Speaker. ★ 6 Transistor Superhet Output 200mW. ★ Plastic Cabinet in red, size 4¾" x 3" x 1⅝" and gold speaker louvre. ★ Horizontal Tuning Scale. ★ Ferrite Rod Internal Aerial. ★ IF 460 kc/s. ★ All components Ferrite Rod and Tuning Assembly mount on printed board. ★ Operated from PP3 Battery. ★ Fully comprehensive instructions and point-to-point wiring diagram. ★ Printed Circuit Board. ★ Tunable over medium and long waveband. ★ Car aerial and earpiece socket.

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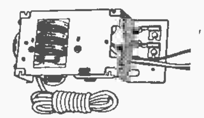
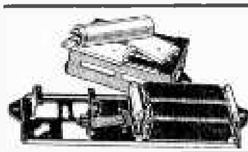


comprising 2AC 128, 20C 75 and 2 AA129 separate bass and treble volume controls. Complete with Power Supply AC mains 240 v. Size 7½" x 3¾" x 2". Price **50/-** plus 2/6 P. & P.



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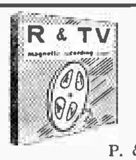
Incorporating "C" core type mains transformer, full wave metal rectification and smoothing condenser. Smooth output 250 v. 250mA and 6·3v. 4 amp. for Heaters. **25/-.** P. & P. 9/6.



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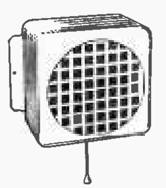

AC Mains 230/250 v. complete with pull switch. Size 6" x 6" x 4". Price **27/6** plus 5/- P. & P.

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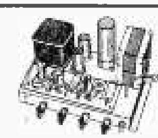
8-watt 4-valve PUSH-PULL AMPLIFIER & METAL RECTIFIER



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

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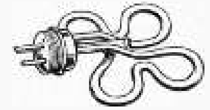

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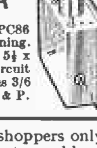

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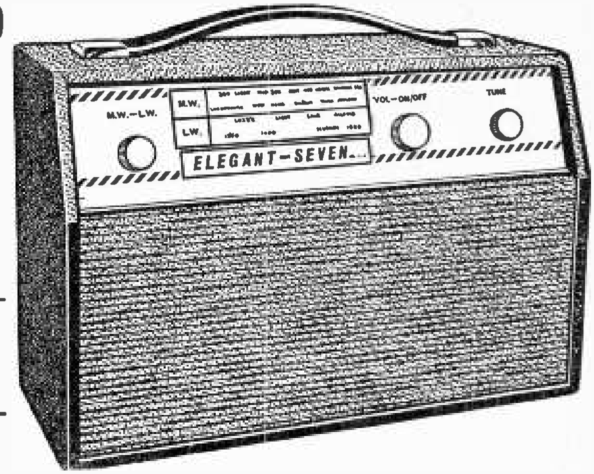

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- ★ Parts list and circuit diagram 2s. 6d. free with parts.

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AC127	9/-	OA70	2/-	OC78D	5/-
ACY17	8/6	OA79	2/6	OC81	5/-
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ACY19	6/6	OA85	2/6	OC82	5/-
ACY20	5/6	OA90	2/6	OC83	5/-
ACY21	6/-	OA91	2/6	OC84	6/-
ACY22	4/6	OA200	3/3	OC139	8/6
AF114	7/-	OA202	4/3	OC140	12/6
AF115	6/6	OC22	10/-	OC170	5/-
AF116	7/-	OC23	17/6	OC171	6/-
AF117	5/-	OC24	15/-	OC200	9/-
AF118	10/-	OC26	7/6	OC201	12/6
AF139	12/6	OC28	15/-	OC202	13/6
AF186	17/6	OC29	17/6	OC203	12/6
AFZ12	15/-	OC35	12/6	OCP71	15/-
ASZ21	15/-	OC36	15/-	ORP12	8/6
BC107	14/6	OC42	6/6	ORP60	10/-
BY100	4/6	OC44	4/-	SB078	6/6
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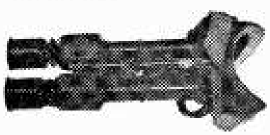
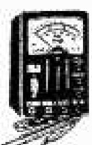
MAT100	7/9	OC70	4/-	SB251	10/-

See in the Dark INFRA-RED BINOCULARS



These infra-red binoculars when fed from a high voltage source will enable objects to be seen in the dark, providing the objects are in the rays of an infra-red beam. Each eye tube contains a complete optical lens system as well as the infra-red cell. These optical systems can be used as lenses for T.V. cameras—light cells, etc. (details supplied The binoculars form part of the Army night driving (Tabby) equipment. They are unused and believed to be in good working order but sold without a guarantee. Price £3.17.6, plus 10/- carr. and ins. Handbook 2/6.



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Measure AC/DC volts. DC current, Resistance. Will last a lifetime.

39/6 (P. & P. 3/6)

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Only recently sold for £10.9.6. Note these features: ● Long & Medium Wave ● Long dial ● Push pull output ● A.V.C. and feed back ● Ferrite aerial ● Six transistors ● Cabinet size 4½in. x 3in. x 1½in. with carrying strap. You get everything you need and instructions. 39/6 plus 3/6 p. & p. or supplied with made up chassis 10/- extra. Battery 1/9 extra. Data separately 2/6.

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Range 20°F – 550°F. Set by spindle control. Contact rated at 20amps 250v. 10" sensing element on approximately 4' copper capilliary tube. 12/6d each, plus 2/6d postage and insurance.

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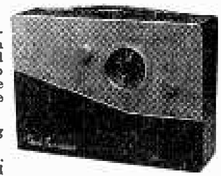
24v. AC Solenoid operated—inlet has removable filter. 17/6 plus 2/6 postage and insurance.

SUPERTONE G.C.V.

Saves you work— It's partly built



Like its predecessors this latest Companion has full fi performance—such as only a good wooden cabinet and biflux speaker can give, and due to its being partly built you will have it going in an evening. Note these features:

- All Mullard Transistors including 3 × AF117.
- Two-tone Cabinet, size 11 × 8 × 3in.
- All circuit requirements—Push-pull output—A.V.C. and feed back, etc.
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Electronically changes speed from approximately 10 revs. to max. Full power at all speeds by fingertip control. Kit includes all parts, case, everything and full instructions. 19/6 plus 2/6 post and insurance.

SMALLEST TAPE RECORDER AVAILABLE (6¼ × 2¼ × 1½in.)

Will record or play back (into earphones) whilst still in your pocket. Uses standard tape which is re-usable indefinitely. Complete with batteries, ready to work. £6. plus 5/- post and insurance.

THIS MONTH'S SNIP

Admiralty motor alternator, giving regulated 230v. 50cycle stand-by AC supply is required. Also to yacht owners, caravan dwellers where 50 cycle supply is required to work TV or similar.

Admiralty motor alternator giving regulated 230v. 50cycle output from 24v. DC supply. Wonderfully made to stringent specification. Rating is 80watts but like other Admiralty equipment this rating can be increased 50% with safety. In grey metal box size 24 × 10 × 14in. approximately. Controls are DC on/off switch and changeover switch from mains to alternator. On the front panel also is output volt meter, and panel with fuses protecting input and output. Weight approximately 100lbs, unused. Price £45 each (probably one tenth of cost to Government). Carriage extra at cost.

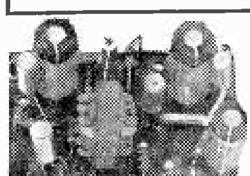
THE VECTRONOME CAPSTAN DRIVEN TAPE RECORDER

This is a truly portable self-contained instrument with built-in microphone and loudspeaker using a 5 transistor amplifier with P.P. output and suitable for operation from mains or by chargeable batteries. Tape capacity is 25 minutes on easily changed spools. A tape position indicator gives quick reference to any part of dictation. Recording level is automatically preset during dictation and can be adjusted to suit operator. Interlock prevents unintentional erasures. Tape speed controlled by fly wheel driven capstan. Very portable in neat case with carrying handle, overall size of which is approximately 6¼ × 7½ × 2 in. Price with tape, nickel cadmium rechargeable batteries and mains battery charger £9.19.6. (rather less than 1/3 original price). Postage and insurance 7/6. Unused and in perfect working order.

TWO NEW KITS

Multi-purpose Audio Switch. 5 transistors and all other components to make this ingenious unit described in May issue—only 48/6d. plus 2/9d. post and ins.

Analog Computer, all parts including centre zero galvonometer, perspex cursors, 8in. dials, to make the unit described in May issue. Available at 39/6d., plus 2/9d. post and ins.



750mW TRANSISTOR AMPLIFIER

4 transistors including two in push-pull input for crystal or magnetic microphone or pick-up—feed-back loops—sensitivity 5mV. Price 19/6. Post and insurance 2/6. Speakers 3in. 12/6, 5in. 13/6, 6 × 4in. 14/6

SRP 12 BATTERY OPERATED RECORD DECK

The SRP 12 Battery Operated record deck. Made by Garrard unit of proved reliability, ideal if you intend making a portable player. Operates from P.P.9 or similar battery, runs at 33 or 45 R.P.M. Supplied complete with ceramic cartridge, suitable stereo or mono. Limited quantity. Price £3.7.6. plus 6/- post and insurance.

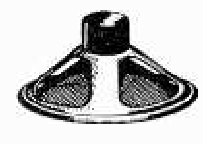
MAIN TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers. Adjustable output 6v., 9v., 12 volts for up to 500mA (class B working). Takes the place of any of the following batteries: PP1, PP3, PP4, PP6, PP7, PP9, and others. Kit comprises: mains transformer rectifier, smoothing and load resistor, 5,000 and 500 mfd. condensers. Zener diode and instructions. Real snip at only 14/6, plus 3/6 postage.

9 VOLT PRECISION MOTOR

Intended for driving battery operated tape recorders and record players. Laminated, 6 Pole armature with Brush Gear and rapid start switch. Normally 25/-. Our Price 9/-. plus post and insurance 1/6.

HI-FI SPEAKER BARGAIN



12in. High fidelity loudspeaker. High flux permanent magnet type with either 3 or 15 ohm speech coil. Will handle up to 10 watts. Brand new by famous maker. Price 29/6. With built-in tweeter 35/- plus 3/6 post and insurance.

SILICON RECTIFIERS

Tested and guaranteed

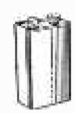
750mA.	100v.	1/3	1 Amp.	100v.	3/-
	200v.	1/6		200v.	4/-
	400v.	3/6		400v.	6/-
3A	100v.	3/6			
	200v.	5/-	10 Amp.	100v.	9/6
	400v.	7/6		200v.	12/6
	600v.	9/6		400v.	14/6

Sub-miniature glass encased—only approx. ⅜in. long wire ended.

400mA .50v. 1/6 100v. 2/6
200v. 4/6

MINIATURE WAFER SWITCHES

4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole, 6 way—1 pole, 12 way. All at 3/6 each 36/- dozen, your assortment.



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

SILICON PLANAR TRANSISTORS

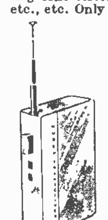
2N2926—general purpose type, Suitable for A.F. or R.F. up to 200 mc/s, 3/- each or 4 for 10/-.

FLUORESCENT SNIP

Your opportunity to install non-flicker strip lighting at silly price—this month we offer the famous A.E.I. (Mazda) instant start lighting transformer suitable for one 4ft. 40 watt tube. This transformer is listed at over £7 but this month you can buy the complete kit comprising instant start choke/transformer, two tube ends and two Terry clips to hold tube. Special snip price only 14/6, plus 4/6 post and insurance—don't miss this tremendous bargain.

PHOTO-ELECTRIC KIT

All parts to make light operated switch/burglar alarm/counter, etc. Kit comprises printed circuit, Laminated Boards and chemicals, Latching relay, Infra-red sensitive Photocell and Hood, 2 Transistors, cond., Terminal block. Plastic case. Essential data, circuits and P.C. chassis plans of 10 photo-electric devices including auto. car parking light, modulated light alarm. Simple invisible ray switch—counter—stray light alarm—warbling tone electronic alarm—projector lamp stabiliser etc., etc. Only 39/6, plus 2/- post and insurance.



TRANS/CEIVERS

Communicate without connecting wires. Wonderful present for child. All transistor, crystal controlled with telescopic aerial and push button operation. Uses P.P.3 batteries. Pair of instruments, complete and ready to use, £5.9.6. the two plus 5/- post and insurance. These cannot be used in U.K.

SIMMERSTAT HEATER REGULATOR

Suitable to control elements, heater, soldering irons and boiling rings up to 2,500 watts. Completely adjustable, normal price 55/- each. Special Snip Price 12/6 plus 2/- post and ins.

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

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Joymatch Type 3—General short wave coverage SWL (Junior model).

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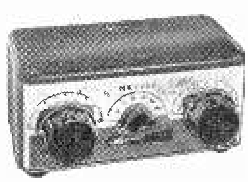

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AUDIOTRINE PLINTHS

for Record Playing units. Teak finish cut for Garrard 1000, 2000, 3000, AT6 Mk 2. AT60, SP25 or Goldring GL68. Available with clear Perspex cover as illustrated £5.19.11. complete. **66/-**

RECORD PLAYING UNITS

Ready for plugging in to Amplifier or Tape Recorder.
RP2 Consisting of Garrard SP25 fitted Goldring CS90 high compliance ceramic Stereo/Mono ctrge with dmnd stylus, above plinth & cover. Normally £25. Carr. 15/- Only **19½ Gns.**
RP3 As above but with Goldring Lenco GL68 Transcription unit and CS90 Cartridge. Normally over £33. Terms available both units. Carr. 15/- Only **26½ Gns.**

TAPE AMPLIFIERS 4–5 Watts Output

Suitable for use with Magnavox 363 Decks. Switched equalization. 200-250v Mains A.C. Originally 13 Gns. Size 11" × 2¼" × 6" **£6.19.11**

AUDIOTRINE HI-FI 'SPEAKER SYSTEMS

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

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

HI-FI CATALOGUE NOW AVAILABLE price 3/3 post paid.
Personal shoppers welcome. Open all day Sats. except High Holborn branch.

ALL LEADING MAKES OF HI-FI EQUIPMENT STOCKED Cash or Terms
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HI-FI LOUDSPEAKER ENCLOSURES

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

SE8. For optimum performance with any Hi-Fi 8in. speaker. Size 22 x 15 x 9in. Carr. 7/6 **£5.19.9**
SE10. For 10in. Hi-Fi speaker with provision for tweeter. Size 24 x 15 x 9in. Carr. 10/- **£6.19.9**
SE12. For outstanding performance with any 12in. Hi-Fi speaker. Cut for tweeter. Size 24 x 20 x 10in. Carr. 10/- **8 Gns.**

NEW RANGE OF LINEAR HI-FI UNITS STOCKED

HIGH FIDELITY LOUDSPEAKER UNITS

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

MINI 8 8 WATT rating. 3 or 15 ohm. Frequency response 50-13,000 c.p.s. Specially designed high flux 5in. speaker with low fundamental resonance. Handsome Teak veneered cabinet. 9¾ x 6¼ x 7in. Carr. 7/6 **£6/19/11**
The DORSET Size 16 x 11 x 8in. Response 45-18,000 c.p.s. Rating 10 watts. Fitted Audiotrine HF811D speaker. Impedance 3 or 15 ohms. Carr. 7/6 **£8/19/9**
The DORCHESTER Size 24 x 15 x 10in. Fitted Audiotrine HF101D Speaker. Rating 12 watts. Impedance 3 or 15 ohms. Frequency Response 30-20,000 c.p.s. Carr. 15/- **12½ Gns.**
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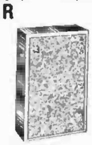
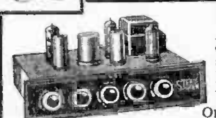


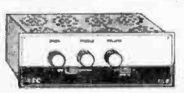
The BRONTE Size 22 x 15 x 9in. Fitted Wharfedale Super 8 RSDD or Audiotrine HF 815D Speaker, with Roll surround and dual cone. Rating 6/10 watts. Impedance 3 or 15 ohms. Carr. 15/-. **12½ Gns.**

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



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

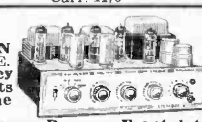
RSC TA6 6 WATT HI-FI TRANSISTORISED AMPLIFIER



200-250 AC mains operation

Frequency Response 30–20,000 cps –2db. Separate Bass and Treble 'lift' and 'cut' controls 3 input sockets for "Mike" Gram. Radio or Tape. Input Selector Switch. Output for 3–15 ohm speakers. Max. Sensitivity 5 mv. Fully enclosed enamelled case, 9¼ x 3 x 5¼in. Attractive Facia. **£7.19.11**

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



PROVIDING 10/14 WATT ULTRA LINEAR PUSH-PULL OUTPUT ON EACH CHANNEL. SUITABLE FOR "MIKE", GRAM, RADIO OR TAPE. Employing valves ECC83, ECC83, ECL86, ECL86, ECL86, ECL86, EZ81. **Frequency Response:** ±2dB 30-20,000 c.p.s. **Hum Level:** 65dB down. **Sensitivity:** 5 millivolts maximum. **Harmonic Distortion:** (each channel): 0.2%. ★**Four-position tone compensation and Input Selector Switch.** ★**Stereo/Mono switch.** ★**Will amplify direct from Tape Heads.** ★**Neon panel indicator.** ★**Handsome Perspex Frontplate.** ★**Separate Bass "Lift" and "Cut" and treble "Lift" and "Cut" controls.** Output transformers are high-quality sectionally wound to required specification. Output matching for 3 and 15 ohm spkrs. on each channel. Complete set of parts. point-to-point wiring diagrams and instructions. Carr. 12/6 **14 Gns.**
Or factory assembled, tested and supplied with our usual 12 months guarantee. Carr. 12/6 **19 Gns.**
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Total cost of parts with detailed wiring diagramsandinstructions. Carr. 10/- **12½ Gns.**
Or factory built 15¼ Gns. Or in Teak finished cabinet as illustrated 19¼ Gns. Terms: Deposit £5 and 9 monthly payments 39/-. Total £22.11.0.

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

AUDIOTRINE HIGH FIDELITY LOUDSPEAKERS

Heavy cast construction.
Latest high efficiency ceramic magnets. Dual Cone for extended frequency range.

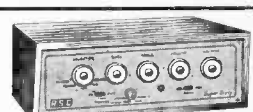
Plastic treated surround giving low fundamental resonance. Response 40-18,000 c.p.s.. Impedance 3 or 15 ohms. Carr. 5/6.

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

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

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

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



R.S.C. SUPER 30 STEREO AMPLIFIER

A DUAL CHANNEL VERSION OF THE SUPER 15. Employing Twin Printed Circuits. Close tolerance Ganged Pots. Matched Components.
CROSS TALK: —52dB at 1,000 c.p.s.
CONTROLS: 5 position Input Selector, Bass Control, Treble Control. Volume Control, Balance Control, Stereo/Mono Switch. Tape Monitor Switch. Mains Switch.
INPUT SOCKETS (Matched Pairs). (1) Magnetic P.U. (2) Ceramic or Crystal P.U. (3) Radio/Aux. (4) Tape Head/Microphone. Operation of the Input Selector Switch assures appropriate equalisation.
Rigid 18 s.w.g. Chassis. Size approx. 12in. Wide. 3in. High and 8in. Deep. Neon Panel Indicator. Attractive Facia Plate and Spun Silver Matching Knobs. Above facilities, etc., except for Ganging and Balance Control, apply also to Super 15.
THESE UNITS ARE EMINENTLY SUITABLE FOR USE WITH ANY MAKE OF PICK-UP OR MICROPHONE (Crystal, Ceramic, Magnetic, Moving Coil, Ribbon) CURRENTLY AVAILABLE, SUPERB SOUND OUTPUT QUALITY CAN BE OBTAINED BY USING WITH FIRST RATE ANCILLARY EQUIPMENT. All required parts. point to point wiring diagrams and detailed instructions. Carr. 13/9 **18½ Gns.**
Unit factory built 25¼ Gns. or deposit 83/9 and 9 monthly payments 56/9 (Total £29.14.6). Fitted cabinet as Super 15 29¼ Gns. Carr. 15/- or Deposit £4.14.9 and 9 mthly paymts 65/10 (Total £34.7.3). *Send S.A.E. for leaflet.*

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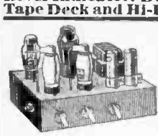
AUDIOTRINE HI-FI TAPE RECORDER KIT

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

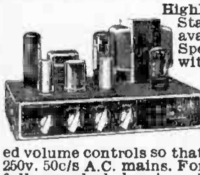
LINEAR TAPE PRE-AMPLIFIER. Type LP/1 Switched Equalisation. Positions for Recording at 1⅞in., 3¾in., 7½in. per sec., and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier suitable most Tape Decks. Terms available. **10½ Gns.**

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



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

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

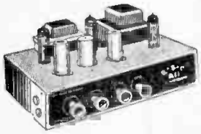


Highly sensitive. Push-Pull high output, with Pre-amp./Tone Control Stages. Performance **figures** equal to most expensive amplifiers available. Hum level —70dB. Frequency response ±3dB 30-20,000 c/s. Specially designed sectionally wound ultra linear output transformer with 807 output valves. All first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

JASON VHF/FM TUNER Complete kit with valves. **£6.19.11**

LOUDSPEAKER CORNER CABINETS Attractive polished walnut finish. Model M for 10" speaker **59/11** Model S for 12" spkr & tweeter **5 Gns**

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



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

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

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

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

B20 MULTI-PURPOSE AMPLIFIER especially suitable for Bass Guitar

Incorporating massive 12in. high flux loudspeaker. Rating 25 watts. Individual bass and treble controls. Two jack inputs separately controlled. Substantial cabinet attractively finished in Rexine and Vynair. Size approx. 24 x 21 x 11in. Send S.A.E. for leaflet. Or Deposit £4.14.6 and 9 monthly payments of 66/-. (Total £34.8.6). Carr. 17/6. **29½ Gns.**

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

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

LINEAR TREMOLO PRE-AMP UNIT

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

R.S.C. BATTERY/MAINS CONVERSION UNITS

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

SELENIUM RECTIFIERS F.W. (Bridged)

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

HEAVY DUTY SELENIUM RECTIFIERS

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

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WATKINS COPYCAT ECHO UNITS Listed £38.10.0. Brand new **19½ GNS.** Carr. 17/6
15 WATT Ex Guitar Amplifiers 15 ohm output, 2 inputs Carr. 7/6. **7 Gns.**

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

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Consisting of Mains Trans. 200-250 v.. Rectifier. Ammeter. Variable Charge Rate Selector. Panels. Plugs. Fuses and Holders. Fully punched stove enamelled case and circuit. **4a 49/11** **6a 69/11**
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Covered in two-tone Rexine/Vynair. Ideal for vocalists and Public Address. 15 ohm matching.
Type C58, 15-20 watts. Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. Or Deposit 44/- and 9 mthly pmts 31/5 (Total £16.6.9) **14 Gns.** Carr. 10/-
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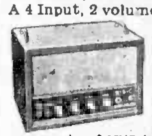
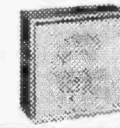
30 WATT HI-FI AMPLIFIER for Guitar, Vocal or Instrumental Group



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

12in. HIGH QUALITY L'SPEAKERS



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

FANE HEAVY DUTY HI-FI SPEAKERS

12in. 20 watt. With Tweeter Cone. Carr. 5/9 **£5.11.9**

LOUDSPEAKERS

Limited number at fraction of list price 15 ohms. impedance. Brand new, guaranteed.
12in. HEAVY DUTY 30 watts 7 GNS. Carr. 12/6 Normally £12 approx.
15in. EXTRA HEAVY DUTY 40-50 watts 12 GNS. Carr. 17/6
Massive units with 3in. Diam. Pole Pieces. Terms available. (Normally appr. £19)

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

HIGH FIDELITY 12in. 10 WATT SPEAKERS 59/11

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

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

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

FULLY SHROUDED UPRIGHT MOUNTING

250-0-250v. 60mA, 6.3v. 2a, 0-5-6.3v. 2a	19/9
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300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a.	33/9
300-0-300v. 130mA, 6.3v. 4a c.t., 6.3v. 1a. For Mullard 510 Amplifier	41/9
350-0-350v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a	33/9
350-0-350v. 150mA, 6.3v. 4a, 0-5-6.3v. 3a.	42/9
425-0-425v. 200mA, 6.3v. 4a, c.t., 5v. 3a.	67/9
425-0-425v. 200mA, 6.3v. 4a, 6.3v. 4a, 5v. 3a	69/9
450-0-450v. 250mA, 6.3v. 4a, c.t., 5v. 3a	79/9

TOP SHROUDED DROP-THROUGH TYPE

250-0-250v. 70mA, 6.3v. 2a., 0-5-6.3v. 2a	19/9
250-0-250v. 100mA, 6.3v. 3.5a.	21/9
250-0-250v. 100mA, 6.3v. 2a, 6.3v. 1a.	22/9
350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a.	23/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a.	32/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a.	32/9
300-0-300v. 130mA, 6.3v. 4a., 0-5-6.3v. 1a. Suitable for Mullard 510 Amplifier	39/9
350-0-350v. 100mA, 6.3v. 4a., 0-5-6.3v. 3a	32/9
350-0-350v. 150mA, 6.3v. 4a., 0-5-6.3v. 3a.	39/11

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

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AUTO (Step UP/Step DOWN) TRANSFORMERS 0-110/120v.-200-230-250v. 50-80 watts, 14/9 150 watts, 29/11, 250 watts, 49/9, 500 watts, 99/9

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Standard Pentode 5,000 Ω or 7,000 Ω to 3 Ω	7/9
Push-Pull 8 watts EL84 to 3 Ω or 15 Ω	11/9
Push-pull 10 watts 6V6 ECL86 to 3, 5, 8 or 15 Ω	21/9
Push-pull EL84 to 3 or 15 Ω 10-12 watts	19/9
Push-pull Ultra Linear for Mullard 510, etc.	35/9
Push-pull 15-18 watts, sectionally wound 6L6, KT66, etc., for 3 or 15 Ω	29/9
Push-pull 20 watt high quality sectionally wound, EL34, 6L6, KT66, etc., to 3 or 15 Ω fully shrouded	55/9

SMOOTHING CHOKES
150 mA, 7-10H, 250 Ω 12/9.
100 mA, 10H, 200 Ω 9/11.
80 mA, 10H, 350 Ω 7/9.
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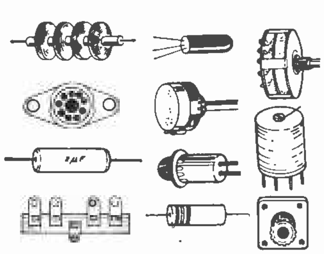

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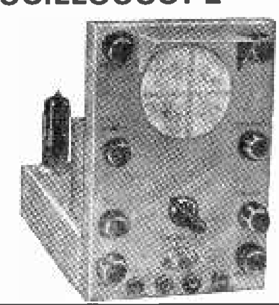

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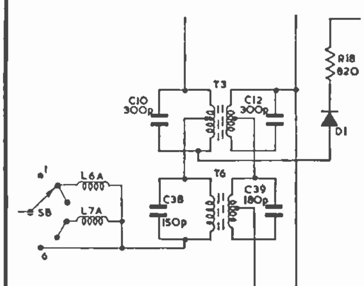

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- ELECTRONIC SWITCH
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PRACTICAL WIRELESS

VOL 43 No 3

issue 725

JULY 1967

TOPIC OF THE MONTH

Flexibility

ONE thing about radio—life need never become dull. On the constructional side, there are always new ideas and developments to stimulate grey matter that may be in danger of becoming stagnant. In this issue, for instance, we have details of an experimental receiver using Transfilters in place of the more conventional i.f. transformers. These devices are new enough to be novel to most readers and they open up an interesting line for those with enquiring minds. Next month, too, we follow up with some experimental circuits based on field effect transistors, again offering scope for those wanting to work on something a little different.

But it is not only at his workbench that the keen amateur can keep on his toes. Users of the electromagnetic wave spectrum—and that must include almost all readers—should never complain of staleness or get into a rut. So long as we are dependent on the ionosphere and troposphere for radio communications, and subject to solar and other natural influences on propagation, one can always exploit the particular favourable circumstances of the moment with the added spur of anticipating how things will shape up in the near future.

The wise radio listener, or amateur transmitter, will take advantage of the prevailing situation and while the value of specialisation is acknowledged it is surely the amateur with an eye to opportunity and willingness for adaptability that will ultimately get the most out of the hobby.

In the last few years, conditions have favoured the l.f. bands and the more flexible enthusiasts have done well. Now that the sunspot pendulum is swinging back, the h.f. bands are coming into their own. Ten and fifteen metres, so often dead in recent years, are blossoming like spring flowers and 20m is more like its old self. Despite the cyclic fluctuations, what might be called the middle h.f. bands (such as 20m) remain *comparatively* consistent and this has led to a tendency with some to restrict their activities principally to these regions. Now that the sunspot cycle is favouring higher frequencies we hope that readers will take advantage of the fact—and that they will also try the l.f. areas more seriously when more optimised conditions return.

W. N. STEVENS—*Editor*

NEWS AND COMMENT

CONSTRUCTIONAL

GENERAL ARTICLES

AUGUST ISSUE WILL BE PUBLISHED ON JULY 7th

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 London, W.C.2. Subscription rates, including postage: 36s. per year to any part of the world. © George Newnes Ltd., 1967. Copyright in all drawings, photographs and articles published in "Practical Wireless" is specifically reserved throughout the countries signatory to the Berne Convention and the U.S.A. Reproductions or imitations of any of these are therefore expressly forbidden.

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Clause 7

Would it be possible to print the details of your June leader on the next cover of PRACTICAL WIRELESS? As this item is of such great importance, it should be printed where everyone can see it as I feel it has not had the publicity it should have.

A. Parnham. Grimethorpe, Yorkshire.

[Other technical periodicals have also drawn attention to the possible dangers of this section of the Wireless Telegraphy Act. MP's have been alerted and questions have been raised in the House. Representations have been made to the PMG. So it would seem that this clause will be closely watched as the Bill goes through the House.

In a letter to the RSGB, the Post Office Radio Services Department says "Under this clause the Postmaster General will have the power to make orders specifying apparatus which is to be banned. In making an order we shall try to limit its scope to roughly the sort of apparatus which we wish to stop."

In our opinion the words "try" and "roughly" have an ominous ring about them, for here is a repetition of the very loose phraseology in the proposed amendments.

The GPO claim they are not aiming at "apparatus which amateurs purchase or construct themselves for their own use within the terms of their licence" and that their concern is "essentially to offer a measure of consumer protection, partly to the unsuspecting person who might obtain something before discovering that he cannot get a licence to use it."

The RSGB is pressing that exemption for radio amateurs should be written into the Bill. In the meantime, public spirited readers could well help protect our cause by bringing the matter to the attention of their local MP's]—Editor.

Improving Cheap Tape Recorders

Commenting on the article in the April 1967 issue of PRACTICAL WIRELESS, I have a 4TR Model A4411 and have found that to use the amplifier system on its own, it is unnecessary to incorporate a jack socket in series with the record/playback head.

Instead, by plugging in the microphone, turning the volume up, and putting the record/playback slide switch to a central position, the tape recorder readily serves as a public address, or amplifier for a radio tuner.

It would be interesting to know if this method is possible on other models.

M. J. Osborn. Cowplain, Hants

NEWS AND..

PANEL LABELS

If you would like some labels to smarten up the gear then you're in luck. At Digswell, in Hertfordshire, the Sherrards Spastics Training Centre are turning out some very nice labels to order. Engraved on plastic with a choice of colours, they offer a very attractive bargain for the home constructor. The labels are adhesive backed and the lettering of your choice is available from $\frac{1}{16}$in. to $1\frac{1}{2}$in. deep. Ham call-signs (not adhesive backed) containing 6/7 letters engraved on plastic $6\frac{1}{2} \times 2\frac{1}{4}$in. cost only 2s. 6d. Small labels—on/off, volume or what you will cost $1\frac{1}{2}$d. per character, minimum order 9d.

The choice of colours is: white letters on a black background; black letters on white; red letters on white; white letters on red. Just send the label size, the wording you want, and leave the rest to "Sherrards".

Inquiries should be accompanied by a s.a.e. Orders should be sent to —Sherrards Training Centre, Digswell Hill, Welwyn, Herts. Terms c.w.o., delivery 3–4 weeks. Cheques and P.O's crossed and made payable to "Sherrards Training Centre".

ARMS MOBILE RALLY

The Amateur Radio Mobile Society is holding its annual Mobile Rally on Sunday June 18 at R.A.F. Alconbury, Huntingdon, now used by the U.S. Air Force.

A section will be set aside for the Hi-Fi enthusiast, and for the amateur radio enthusiast. Transmitting stations will be operating and talk-in stations will be working throughout the day on several wavebands.

The exhibition is open from 10 a.m. until 6 p.m. It is free of charge and there is a possibility of an air display and other attractions for the wives and children etc.

WE QUOTE

The following is a quote from the News Sheet of the Verulam Amateur Radio Club: "One of our members, has acquired a colour TV set. He has always been fascinated by TV. He says that he can turn elephants pink by just turning a knob." (We know a MUCH better way!).

PIRATE INTERFERENCE

It has been reported to the Postmaster General that "Radio Scotland" has recently been causing severe interference both to broadcasting services in the Republic of Ireland and to radio communications with the New Island Lighthouse, at the entrance to Belfast Lough.

BATTERY/MAINS AUTOCHANGER FROM FIDELITY

Fidelity's portable record player, model HF34 is a transistorised battery/mains model with 4-speed autochanger deck. It uses six U2 batteries or 110/200/250 volts. A material-covered wooden cabinet is used, and a 7 x 4in. speaker takes a full watt output from the 5-transistor amplifier.

Recommended retail price is $18\frac{1}{2}$ gns.

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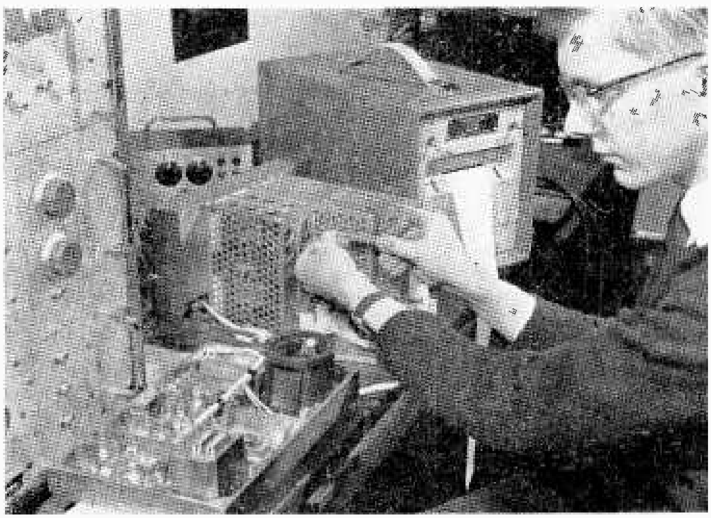
...COMMENT

MULLARD SPACE SCIENCE LABORATORY



Following a donation of £65,000 by the Mullard company, the Physics Department of University College, London, has established in Surrey an outstation for space science research, to be known as the Mullard Space Science Laboratory.

This picture taken in the Physics Department in London shows equipment to be mounted in a U.S. orbiting solar observatory satellite to be launched this year. The experiment is to study the emission of X-rays by the sun and is a more sophisticated version of one originally flown in the satellite Ariel I. Leicester University is collaborating with University College, London, in this experiment.

AN IMPROVED RADIOTELEPHONY TERMINAL

A new type of radio terminal equipment, known as Lincompex (*Lin*ked *Com*pressor and *Ex*pander), which is claimed to improve the quality and efficiency of radio telephone circuits, is now going into service on a number of h.f. circuits operated by the GPO and the American Telephone and Telegraph Company.

The new system largely eliminates variations in speech volume and timbre caused by fading of the radio circuit and is very little affected by radio noise, which is effectively suppressed between syllables of speech.

Lincompex equipment was developed and designed by the GPO and is manufactured in the UK. It has something in common with the compander systems used on long-distance cable circuits in that the speech signal is heavily compressed. This achieves a high level of modulation of the transmitter irrespective of speech amplitude and thus helps to minimise the effects of radio noise. Information required for restoring the original variations in speech amplitude is passed at syllabic rate to complementary expanders at the receiving end of the circuit by means of a narrow-band frequency-modulated control signal contained within the normal speech channel. The overall bandwidth requirements are, therefore, unchanged and modern independent sideband radio equipment will accept one or more Lincompex channels.

Zowie Henry!

I thought Batman had the edge on modern science, but I did not know modern transistor research had progressed so much until I read some copies of certain American magazines.

What exactly does the layman think a transistor is? According to the American mags. it is a cross between a perpetual motion machine and a sonic boom flame thrower. Just think! some people actually believe that sort of trash. (I used to before I discovered P.W.)

Why not have a competition to find out the most way-out use for a transistor? First prize could be a pile of old American fiction magazines.

J. Perry. Wallasey, Cheshire.

[*We'd like to hear of ideas, anyway!*]—Editor.

You get what you pay for

Over a period of years I have bought kits from four P.W. advertisers, all without complaint. One *does* take a chance with many mail order goods but with radio kits one can get an insight by buying the plans and circuit usually offered for around 2s. 6d. If these are studied, the customer can gain some idea of what might be good value or just junk.

My advice to youngsters is not to buy kits at "give-away" prices. They may be tempting but the advertiser is in business to make money and naturally he's not giving anything away!

K. Marlow. Worcester Park, Surrey.

No case?

My worst fears materialised—dragged through Henry's column like a service sheet through a tuning condenser (June '67). Seriously though, surely 27Mc/s R/T's should be advertised as export only (appreciating P.W. goes further afield than these shores)? Having experience in v.h.f. TV relay, problems from R/T pirates are a menace (G. J. King can confirm this).

The question of wasted space referred to pop pirate prosecution rather than new legislation, comment and Henry's humor-cum-criticism. By all means let us have comment and reference on the Wireless and Telegraphy Acts, but are court cases relevant to the home constructor? I think not.

By the way, Henry, I am DX'ing a full two hours before Coronation Street, and throwing kits out of the window is costly, glass is not cheap you know!

Touché Henry.

Ivor N. Newport. New Marston, Oxford.

More News and Comment on page 202

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THE CLASS D WAVEMETER

C. MOLLOY

Few short-wave listeners realise that a heterodyne frequency meter could assist them in pin-pointing stations. This article describes how the Class D, No. 1, wavemeter works, and how it may be used by short-wave listeners. Also included are modification details to enable the wavemeter to be operated from 6V a.c. and from a.c. mains supplies.

One does not associate heterodyne frequency meters with DX-ing, for they are normally used for checking the frequency of transmitters. They can be used to check the scale calibration of receivers, to set a receiver accurately to a desired frequency and to ascertain the exact frequency of a station that is tuned in. Short-wave listeners may not be aware that such a low-priced precision instrument as the ex-WD Wavemeter Class D can bring these advantages. With its aid, the frequency of a new or an unidentified station can be measured with precision; quite an advantage if a report is to be sent to a DX club. Conversely, a station of known frequency can be located with ease even if it lies outside the normal broadcast bands.

Many short-wave receivers have a totally inadequate tuning scale. For example, the 60 metre band, which covers 300 kc/s, is compressed into approximately ⅝ inch on the R.1155, making accurate frequency determination rather difficult. Experience of the band and reference to the position of known stations on it, can give good results but the method is tedious and uncertain. A bandspread control can be valuable but it has to be reset whenever the band is changed. A good logging scale (such as the CR.100 possesses) does not solve the problem entirely as the scale has to be calibrated against frequency. This is a lengthy process involving the identification of a number of stations, always with the possibility of error.

The Wavemeter Class D enables a receiver to be set to any chosen frequency over a large part of the short waves with an accuracy of 1kc/s or better. The final two digits of the frequency in kilocycles are read direct from a scale marked 0—100, on the wavemeter. Reference to graphs and calibration charts is unnecessary. In short, the wavemeter takes a lot of the guesswork out of DX-ing, especially for those who do not possess an expensive receiver.

PRINCIPLE OF OPERATION

The instrument consists of a 1Mc/s crystal calibrator, which provides useful harmonics up to 30Mc/s, and a heterodyne frequency meter with two ranges, 1·9 Mc/s to 4Mc/s and 4Mc/s to 8 Mc/s. The frequency meter comprises a variable frequency carrier oscillator modulated by a 100kc/s crystal oscillator that is rich in harmonics. Upper and lower sidebands are produced and these spread over a large section of the short wave spectrum.

If a carrier frequency F is modulated by a lower frequency f, the products will include F, F+f, F−f; i.e. the carrier frequency, the upper sideband and the lower sideband. If f is rich in harmonics, that is

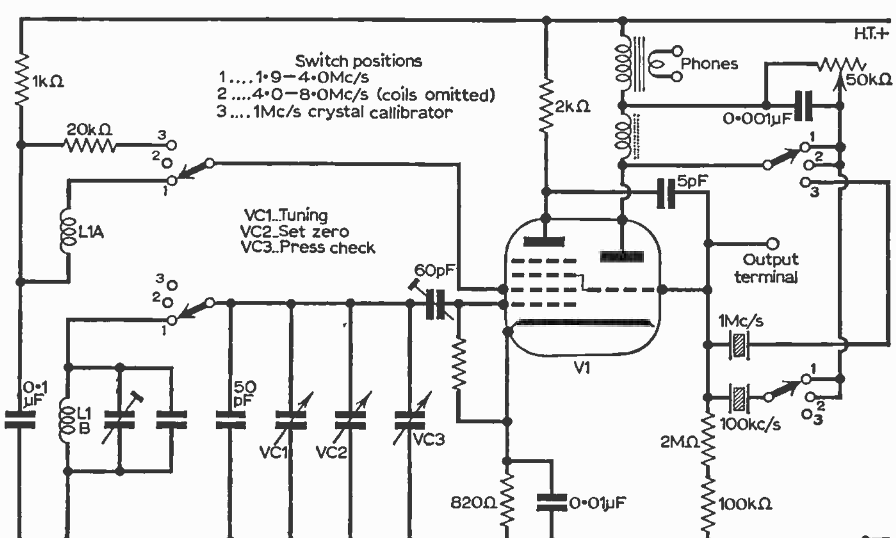

Fig. 1: Circuit diagram of the Wavemeter Class D, No. 1.

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to say, if it contains frequencies of 2 times f, 3 times f, etc., then these two will modulate F and the additional upper and lower sidebands will be F+2f, F−2f, F+3f, F−3f and so on. The total products can be more conveniently written as F; F±f; F±2f; F±3f and so on; these being the frequencies generated by the wavemeter.

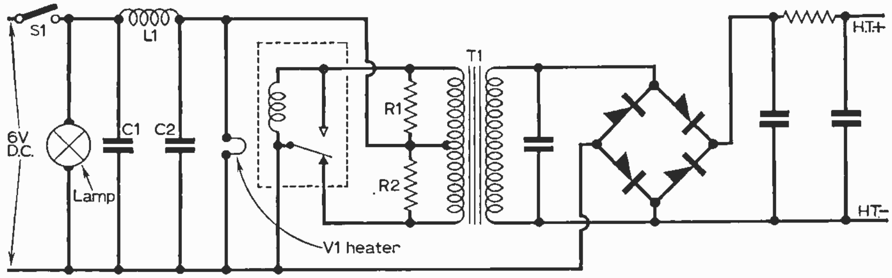

Fig. 2: Unmodified power supply circuit of the Class D wavemeter.

A triode hexode mixer valve is used (see Fig. 1), the triode working as a 100kc/s crystal oscillator whose output is rich in harmonics. The control grid and screen grid of the mixer section form a feedback carrier oscillator which is adjustable over a range of 100kc/s and has a scale marked from 0 to 100. The two oscillations are mixed to produce at the output terminal, the carrier frequency C and C±100kc/s, C±200kc/s C±300kc/s and so on throughout the range of the instrument. Means are provided for calibrating the carrier frequency scale against the 100kc/s crystal, so accuracy is ensured.

An example will make the operation clear. On the range marked 1·9Mc/s to 4Mc/s the carrier frequency is 3·4Mc/s (0 on the scale) and is adjustable to 3·5Mc/s (100 on the scale). When the scale is at zero the carrier of 3·4Mc/s plus the upper sidebands 3·5, 3·6, 3·7 etc., and the lower sidebands 3·3, 3·2, 3·1, etc., will be generated. If the scale is set to 01, the carrier will now be 3·401Mc/s and the upper and lower sideband will be 3·501, 3·601, etc., and 3·301, 3·201, etc. With the scale set to 43, the carrier will be 3·443Mc/s, 3·543, 3·743, etc., and 3·343, 3·243, 3·143, etc. Briefly, the carrier frequency whatever its value will be accompanied by the carrier plus and minus 100kc/s and harmonics of 100kc/s.

If a lead from the wavemeter output terminal is brought near the receiver aerial terminal, the frequencies generated by the frequency meter will be picked up by the receiver as unmodulated carriers. When the receiver is tuned to an unknown station and the wavemeter tuning control is rotated, a whistle will be heard at the receiver output. This is the beat between the unknown station and one of the outputs from the wavemeter. When the beat is adjusted to zero, the last two digits of the station's frequency in kc/s are read direct from the wavemeter's tuning scale. The other digits will be read from the receiver tuning scale provided it is accurate to within 100kc/s, which will normally be the case.

USING THE 1Mc/s CRYSTAL CALIBRATOR

When the receiver tuning scale is not accurate enough to estimate frequency to the nearest 100kc/s, then the 1Mc/s calibrator will have to be used. For example, to tune the receiver to 4311kc/s, set the switch to the 1Mc/s position and pick up the 4th harmonic. Now switch-in the frequency meter to the 4 to 8Mc/s range and set the dial to zero. An output will be obtained at 4·0 Mc/s and also at 4·1, 4·2, 4·3. Advance the receiver tuning until 4·1, 4·2 and finally 4·3 are picked up. Set the wavemeter to 11 and advance the receiver tuning once more. When the wavemeter is next heard it will be tuned to 4311kc/s.

When testing a newly-constructed receiver, it may not be possible to identify the different harmonics of 1Mc/s and in this case the transmissions from the frequency standard stations must be utilised. MSF in Rugby operates on 5Mc/s and can easily be identified by the 1-second clock-like pulses of tone that it transmits. There are also frequent transmissions of the callsign in morse. Do not be surprised if the station suddenly disappears. The schedule is 5 minutes ON and 5 minutes OFF. This is by international agreement so that the frequency can be used by other frequency standard stations abroad without mutual interference. Frequency standard stations can also be heard on 2·5, 10, 15, 20 and 25Mc/s, the well-known WWV, at Fort Collins, Colorado, can be heard on the higher frequencies.

Once 5Mc/s has been located, the receiver tuning is decreased in frequency until the 4th harmonic at 4Mc/s is found and the wavemeter set as described above. As can be seen, the wavemeter is an excellent substitute for a signal generator when lining up r.f. and oscillator circuits.

EXTENDING THE RANGE

Although the range of the frequency meter is only from 1·9Mc/s to 8·0Mc/s, weaker harmonics extend well outside these limits. The writer often uses his wavemeter on the medium waveband and it can certainly be used on the 31, 25 and 19 meter bands. The harmonics become progressively weaker the further they are from the fundamental and a direct connection from the wavemeter to the receiver input may be necessary in order to receive them. When checking a frequency in the 19m band the procedure to adopt is to tune in the wanted station, unplug the aerial, connect the wavemeter output in

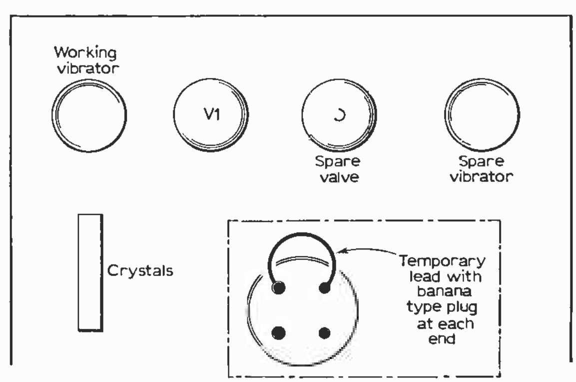

Fig. 3: Top view of the chassis with the socket arrangement of the vibrator inset.

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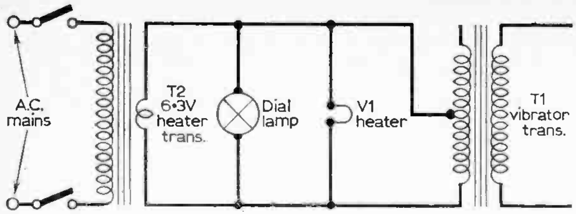

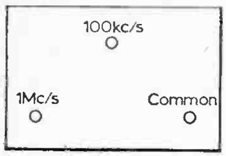

Fig. 4: Modified power supply circuit of the Class D wavemeter. Bottom view of the crystal holder is shown on the left.

its place and use the wavemeter as before. Operation on frequencies higher than the 19m band gradually becomes more difficult as the harmonics are weak and closely spaced, but with care, results can be obtained on 16m.

PHYSICAL DESCRIPTION

The wavemeter is housed in a metal case approximately 8½ by 7½ by 6in. Mounted on the front panel are:

(1) A tuning knob and illuminated scale marked 0 to 100.
(2) A calibration control, used to set the zero of the tuning scale.
(3) Phones socket, for use with low impedance phones for listening to beats when calibrating. The phones are only used when calibrating and are not required while measuring.
(4) A 3-position switch which enables the 1Mc/s marker oscillator or alternatively either of the two frequency meter ranges, to be selected.
(5) An output terminal.

The wavemeter is supplied in a wooden transit case complete with working instructions, a pair of low impedance phones and a pair of battery clips. The intending purchaser should ensure that all of these items are supplied. The power requirement is 1·1A at 6V d.c. and the battery clips are used to make connection to a 6V battery.

CONVERTING TO 6V A.C. OPERATION

Some readers will find it inconvenient to operate the wavemeter from a 6V battery owing to the high current consumption. Reference to Fig. 2 shows that the 6V d.c. is applied to the dial lamp, then through a filter circuit (C1, L1, and C2) to the heater of valve V1 and finally to a vibrator which is connected to the primary of transformer T1. The secondary is connected to a bridge rectifier and smoothing circuit to produce the h.t. supply.

The vibrator switches rapidly between the two sections of the centre tapped primary of T1 applying a 6V pulse to each half in turn. If the vibrator is removed and a 6V a.c. supply connected to either of the two halves of T1 primary, an alternating voltage of approximately the correct value will appear across T1 secondary and drive the h.t. supply as before. The dial lamp and heater of V1 can also be run from 6V a.c. All that is required then to convert the instrument to work from a 6V a.c. supply is to unplug the vibrator and connect either half of the primary of T1 to the new power supply. This can be done quite easily by strapping *either but not both* ends of the primary winding of T1 to chassis. A convenient method of doing this is to use a pair of banana-type plugs, joined by a short length of wire and plugged into the working vibrator holder as shown in Fig. 3. The power leads can now be connected to any 6V a.c. supply that is available and is capable of supplying 1·1A. Figure 3 also shows the location of the working vibrator.

A word of caution. Depending on the Mark number, C2 can be either a 0·5μF paper capacitor or a 50μF 12V working reversible electrolytic. The electrolytic will not be damaged by the temporary application of 6V a.c. but if the wavemeter is to be used permanently on a.c. supplies it would be advisable to disconnect one side of this capacitor. If the 0·5μF paper capacitor is fitted it can be left in circuit.

CONVERTING TO A.C. MAINS OPERATION

After preliminary tests using an external heater transformer and the method described above, the writer decided it would be convenient to operate the wavemeter direct from the mains supply. This entailed fitting a heater transformer inside the wavemeter. There is plenty of room to mount it underneath the chassis if redundant components and the spare valve, spare vibrator and their holders are removed. Figure 4 shows the power supply section of the instrument after modification. Capacitors C1 and C2, choke L1, suppressor resistors R1 and R2 and the working vibrator ought to be removed. Before starting work, the 3-pin crystal should be unplugged to prevent damage to it. The 1Mc/s and 100kc/s crystals are mounted together in a common case, see Fig. 4 for the pin connections.

The heater transformer is bolted to the bottom surface of the chassis in the space vacated by the spare valve-holder and spare vibrator holder. If C2 is the electrolytic type, the mounting bracket will have to be removed. This is soldered to the chassis in two places. A small hacksaw was used to cut off the bracket. This method was thought to be the lesser of two evils as the application of heat to the instrument to unsweat the bracket would very likely cause damage. No problem exists of course if the paper type of capacitor is in use. As the working vibrator is no longer required its holder and associated wiring might as well be removed.

Precise details how to fit the transformer to the chassis are not given, as the item used came from the spares box and was un-named. It is a standard 1·5A heater transformer and it fitted easily into the available space. Additional space can be created if required, by removing the paxolin panel fixed in an upright position to the rear of the chassis. This panel mounts the 820Ω bias resistor and parallel 0·01μF capacitor connected to the cathode of V1; these can be wired from the valve base.

Great care should be taken not to interfere with any of the components around the switch especially the trimmers and cores. The small variable tuning capacitor which is the frequency control looks like any small panel mounting variable but is in fact a precision straight-line frequency capacitor. On no account should the split vanes be bent, otherwise the scale shape and calibration will be ruined. ■

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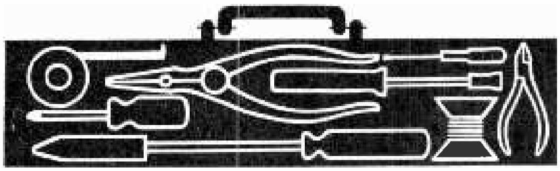
repairing radio sets

PART 4

H. W. HELLYER



Nothing is more frustrating than having to tackle a completely unfamiliar drive cord system. Faced with a control spindle that goes one way, a drive drum that wants to go another and a pointer traverse that appears to bear no relation to either, the faint-heart will probably surrender; spending the rest of his days twiddling the ganged tuning capacitor by hand from the back of the set!

Working out the mechanics of the unfamiliar drive system needs patience, a steady hand and a knowledge of the fundamental reasons for the position of springs, cords, stops and pointers. Gordon J. King, in his notes on alignment, gives us many of the clues, and we now have to adapt the theory to practice. The following notes are based on a number of popular and typical systems, chosen to illustrate a range of manufacturers' foibles.

Figure 4-1, for example, shows a simple system which is very widely used. It consists of a drum attached to the spindle of the tuning capacitor, a separate drive spindle, rotating in a bush that is usually built into the faceplate behind the dial or the front flange of the chassis, a pointer and a single pulley.

★ THE DRIVE DRUM

There are many sorts of drum, some as simple as the type illustrated, others with ridges, flanges and perhaps auxiliary grooves to accommodate a drive system for the more restricted travel of a v.h.f. tuner.

Nevertheless, they follow the same principle, being clamped to the capacitor spindle and turned by the pull of the drive cord wrapped around the grooved outer flange. The cord enters the face portion of the drum through a cut-out in the flange and is anchored to lugs that usually consist of simple pressed-out stampings.

The system shown has one end of the cord anchored, the other attached to a spring, to take up inevitable play in the complete system and to reduce backlash. (Like any other shock-absorber device, it suffers from the defect that over-tensioning can cause the fault it is intended to overcome.)

The position of the drum relative to the capacitor spindle is important. With the pointer at one end of its travel the ganged capacitor will be either fully open or fully closed. Note the scale markings and check that the pointer is at the lowest frequency (highest wavelength) end of the scale when the vanes of the tuning capacitor are fully meshed. The setting of the drum will then depend on the direction of rotation needed to open the gang and the way the cord is routed.

If the arrangement is like Fig. 4-1, with the drum having to rotate anti-clockwise, and the cord coming directly from the drum to the pointer, then the cut-out will be as shown, so that a small amount of wrap remains on this portion of the cord (drawn darker to identify the direction of traverse).

Then, the other end of the cord, from the pointer or any pulley system, will approach the drum and wrap around it completely once before entering the cut-out. Anti-clockwise pull then unwraps this turn while wrapping on a similar length from the pointer section.

A little patient study should enable us to relate this to systems which differ in physical layout—and, *in extremis*, a few moments with the stub of a pencil and the back of an envelope should clear up any doubts.

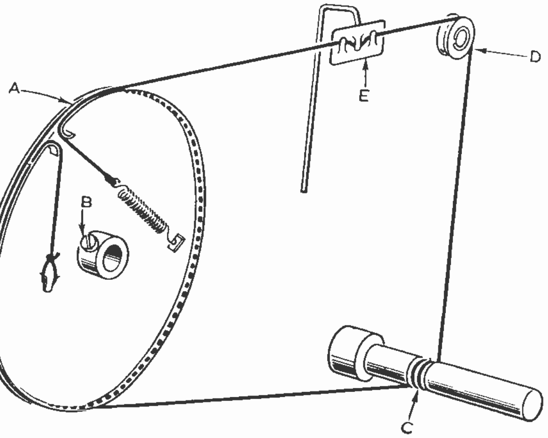
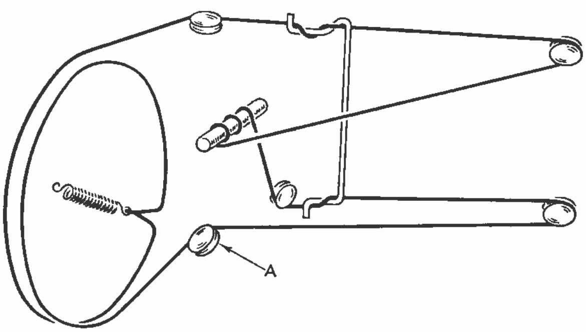


Fig. 4-1: Simple cord drive system. A, drum with grooved flange; B, centre-boss, bush on gang spindle; C, waist in manual control spindle; D, free-running pulley; E, pointer, angled to lap over scaleplate.

Fig. 4-2 (below): Philips system, with pointer held at each end and drum at right angles to scale. A, angled pulley.



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From the pointer, the cord passes over a free-running pulley and thence to the drive spindle. The general method is to wrap two or more turns around a "waist" of the spindle, but there are again many variations depending on the grip required to overcome inertia of the system. Some spindles have no waist, others use a flanged bush.

The important factor is the relative entry and departure position of the cord, to prevent turns riding over each other and perhaps jamming. This is quite a common fault; once more, a little study before assembling will pay dividends.

★ THE DRIVE CORD

A similar stricture applies to the position of the cord in the flange of the drum. Turns should ride beside each other, and it may be necessary to move the drum in or out along the spindle to achieve this. Note that the drum is usually secured by a couple of screws through the central bush, and make sure these are tight.

There is a great deal of drag with some systems, especially when the ham-handed friend tries to reach a station beyond the end of the band! Anti-backlash springs are no proof against this sort of treatment, and the result is that the drum moves around slightly, eventually spilling the cord off when the rotation is reversed. This fault is prevalent with the large, thin drums that tend to flex with the pull.

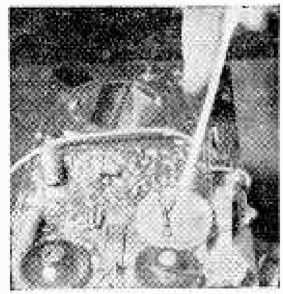
One other fault source to inspect is the pressing where the brass bush is fastened to the aluminium or mild steel drum. Looseness at this point can be troublesome. On occasion, a touch of Araldite around the joint will cure a tendency to "creep".

When fitting drive cords to this type of system, and many similar types, it is best to start at the fully open or fully closed position, leaving the pointer off for the preliminary work.

Anchor the loop of the cord and pass it round the drum in the required direction—which you will already have worked out—and hold it near the departure point with a small piece of adhesive tape. Then loop around the drive spindle, over the pulley, again securing with sticky tape, and back to the drum. Hook the spring on its lug, feed the end of the cord through the loop of the spring, make sure all the slack in the system is taken up and pull to tension the spring before knotting the cord.

As the final move is made, it will be necessary to hold the drum in its extreme position. Do not over-tension the spring; the fitting of the pointer will probably take up a little more slack in the cord.

One useful hint, when a complicated run makes the final tying of the cord a job for a nimble-fingered octopus, is to run the drive cord over the inner spindles of one or two free pulleys (D in Fig. 4-1). This helps hold the cord temporarily in position and allows a little extra tensioning as the cord is fed into the groove of the pulley to complete the job.



Even the small transistor radio has its drum and pulley. The cord ends are coupled to a single spring.

★ THE POINTER

The pointer is fitted to the cord in such a way as to ensure a straight approach and departure, as shown in detail in Fig. 4-5. When a cursor is used, this is bent to run along the edge of the face-plate, and a clean surface is essential to prevent erratic jumping of the pointer.

This type of fitting has the pointer pushed in the shape of a U-clip through the small spring or slotted channel at the bottom of the cursor, allowing some adjustment of vertical and horizontal alignment. This can be handy to avoid the free-running pointer knocking against dial bulbs or plate bolt-heads.

Figure 4-5A shows the bent clip type of pointer and in this case a small felt pad is fitted near the bottom, to aid even running, prevent the pointer scraping and catching or rattling against the dial glass.

★ PHILIPS SYSTEM

From the general to the particular. Fig. 4-2 shows a popular Philips arrangement that is devised to keep the pointer travelling in a regular plane across a fairly broad dial. The direction of travel is at right angles to the diameter of the drum so the pulley assembly includes one (A in diagram) set at an angle.

This pulley is usually mounted on a pressed-out lug which may become bent, and a common fault with the rather wide and thin drums is incorrect

Fig. 4-3: Example of the spring-tensioned cord on a small-diameter pulley. This will give precise drive.

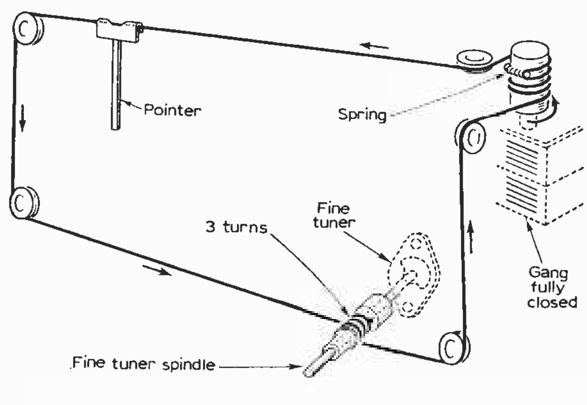
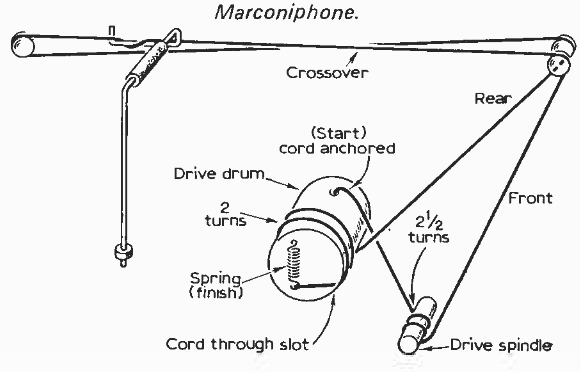


Fig. 4-4 (below): Crossover cord system used by Marconiphone.



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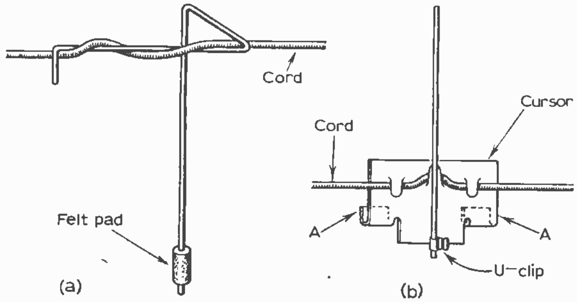
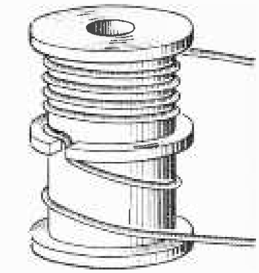


Fig. 4-5 (left): Two methods of mounting pointer on cord.

Fig. 4-6 (right): Dual-section drum for cord take-up where travel of pointer exceeds circumference of tuning drum.

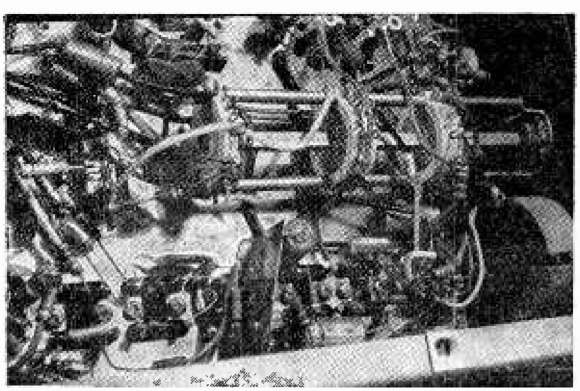


entry angle of the cord, with consequent spillage. Note that the Philips technique of attaching both cords to the anchor spring is employed. This is necessary as any displacement will offset the pointer from the vertical. When making up this type it is easier to measure off the complete length, allowing for loops, and refit as a unit. In the example, Philips F4G50A or Stella ST332, the cord length from loop knot to loop knot is 71½ in. For the position shown, the tuning gang is at maximum, i.e. closed.

An example of precise drive with a spring-tensioned cord, but employing a small drum and a "square" pulley arrangement, is the RGD RR214, or K-B KRO16 of Fig. 4-3. Here, the cord loops around each end of a small spring that itself turns with the extension drum. In addition to the waist on the manual control spindle, an anti-spill flange is used—an idea some other makers could copy to advantage. This is a small transistorised set, with a medium-wave and two short-wave bands, plus an f.m./v.h.f. band, and the drive must be quite precise in action. To assist spot tuning on a.m. bands, a fine tuning control is fitted, consisting of a small capacitor mounted with its spindle concentric with the tuning spindle.

★ MARCONIPHONE SYSTEM

Also using a drum but with a very different pulley arrangement is the Marconiphone 4308 system of Fig. 4-4. This example is given to show the type of cord routing necessary when drive is greatly toward one end. This is an a.m./f.m. radiogram chassis, and the precision of the gang movement is aided by a type of gear arrangement with thin brass plates toothed to the drive wheel.



Robust band-switch with sealed contacts, the stage sections isolated to minimise interaction. Note flywheel employed to give smooth tuning control.

The gang is a four-section type, tracking differences being made up by shaped plates. The backlash is taken up by the end of the cord being passed through a slot in the drum and attached to the spring which anchors to a small peg.

The important factor here is the crossover point and the run of the pointer. Incorrect initial setting can cause tangles and spillage that will give some trouble as the chassis is mounted sideways in a fairly confined cabinet.

★ TWO-SECTION DRUM

A small drum device that can give problems when encountered for the first time is the two-section type on which the cord is wrapped several times, as shown in Fig. 4-6. This was widely employed on earlier models of the Raymond and Beethoven range and has since been used by Alba and others. In the latter assembly, a manual drive spindle with a small drum of its own is used, the cord wrapping twice around this.

Another peculiarity is the pointer, which has a short inner arm that is intended to be the alignment marker. The cord wraps in the drum in the manner shown when the pointer is at the remote end; the exact point of crossover from one drum section to the other, through the cut-out, is vital. Too many turns on one or other section leads to a most horrifying tangle.

When facing one of these assemblies with no exact information, always start with the pointer at one end and wrap the cord on the first section of the drum just once, then as many times on the second section as will take up the pointer travel. This can be calculated or quite simply measured. Again, a few moments longer in preparation saves hours of guesswork.

★ F.M. TUNING

F.M. tuning on the Alba 5601, 5701 and associated models, is by movement of cores of the f.m. unit, actuated by the common tuning capacitor control. To align, it is necessary to set up the a.m. tuning for correct movement of pointer and scale traverse, then position the spindle of the f.m. tuner so that it rests against the front stop with the main gang fully open. This should provide correct tracking, and preset capacitors then allow for the fine adjustment.

Other types of f.m. tuner have the coil or capacitor adjustment effected by traverse of a pivoted bracket in a slot or cam cut-out of the main drum.

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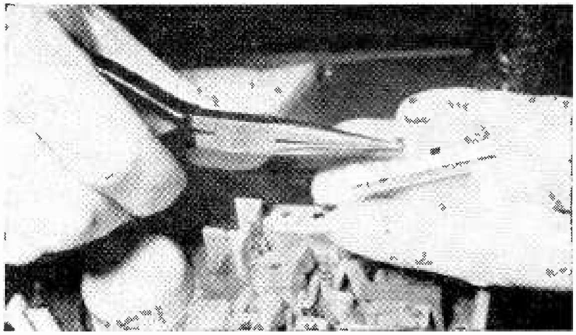
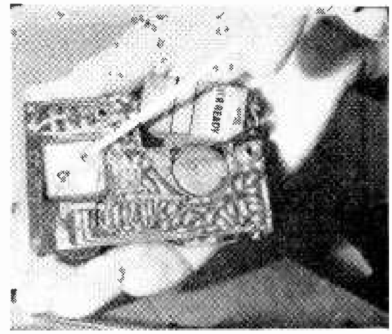


Simple slide switch for band-changing on printed-circuit board, with contact springs that slot into ◀ the plastic runner.

Sealed tuning gang has small compression trimmers. Care must be taken not to damage dielectric plates—see text. ▶



Usually, as with typical Bush designs, there is some adjustment provided by setting of a calibration lever around which the secondary drive cord is wrapped.

On all assemblies of this type, which employ a subsidiary drive depending on the a.m. drive to position f.m. capacitors or coils, it is imperative that the main drum position is checked and a.m. calibration double-checked before setting the f.m. drive travel from one end of the movement.

Preset tuning has been achieved in a number of ways, from the cumbersome motorised devices which swept the gang and pointer to a pre-arranged stop, down to the simple electrical selection of alternative tuning components. The latter system is used, for example, on those sets with a single station button, generally tuned to Luxembourg. Selection disconnects the ganged capacitor and substitutes fixed and preset components.

There are many types of band switch, some being quite delicate assemblies, others robust rotary "clangers". The latter seldom need any adjustment, but contacts are generally quite large and a touch of cleaning is of benefit.

Care must be taken when using switch-cleaner on these switches as a little time is needed for the carrier to evaporate, and even when it does, an excess of oil may provide a tracking path from switch contacts bearing h.t. voltages to others of lower potential.

★ SWITCH FAULTS

A common fault with slide type switches is displacement of one of the fine wiper contacts. These are lightly sprung against small lugs of metal pressed into the composition slide, or against foil print that forms the shorting bars.

Clumsy adjustment will always lead to trouble, and the first check is for complete travel and retraction of the slide. Dirt can cause inadequate movement and the usual system is reception on one waveband only, or reception of a single station on both bands.

The latter effect is caused by the incorrect switching of the type of circuit that merely adds capacity for Long Wave tuning. Slide switches with ball-bearings in runners along the top and usually activated by Bowden cable are common to a number of Philips models.

Adjustment is limited to bending the lugs that contain the nipples at the end of the cable. Care must be taken not to kink the steel wire of the cable. A touch of light grease at the ends will help stop the small scraping noises that these devices make when they are ageing.

Some types of rotary switch tend to wear at the slotted centre portion of the wafer, allowing a little play which gives erratic contact. It is a legitimate repair practice to fit a small wedge (cut from a valve support spring or similar brass strip), finishing off with a touch of solder at each side of the wedge to retain its position. Alternatively, wood or plastic with Araldite fixing can be used.

Slot wear is also the enemy in the type of switch lever that operates by remote control from the knob spindle. One type is favoured by Philips and depends on a hinge and pivot action. Some of the wear can be compensated by dismantling the clamp bracket, hammering the edges of the slot and roughening the clamp-screw thread to ensure a tighter fit: but replacement is the only certain cure.

Another type, employed on some B.R.C. models, requires a sprung clamp to be screwed on the circular section spindle. Again, wear that is usually caused by loosening and subsequent continued use requires a complete dismantling, re-shaping and resetting. Always look for the correct action of the switch actuating levers before suspecting the switch itself.

★ NOISE TROUBLES

Sources of noise that are relevant to switch action, and often difficult to pin-point, are the earth return blades fitted to many types of ganged tuning capacitors. These are sprung into engagement with the rotor, acting as a "brush" type of earth return. Contact lubricant at the wiper point helps considerably.

Always check that the vanes of open-type tuning capacitors are clean. Blow out the particles of dust and make sure no oil or grease has run on to the vanes. Where magnetic particles are attracted to steel blades—rare, but possible—disconnect the gang completely, apply a low a.c. such as the heater voltage, and blow between the vanes to loosen the particles.

Do not try to rub off the particles and risk distorting the vanes. Above all, avoid loosening blades at their roots—once a common source of noise on short-waves, but less often encountered in these days of improved component design.

The small, sealed ganged capacitors used in many portable sets should need no attention—in theory. In practice, it is all too easy to distort the assembly by excessive pressure on the trimmers. Paper or

—continued on page 200

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MONITOR for CW, AM AND RF OUTPUT

by A. H. Jubb BSc. GW3PMR

THE usual method of monitoring c.w. transmissions from the writer's station was simply to cut down the gain of the receiver, in the conventional manner, when going over to transmit. This worked fine when the receiver and transmitter were operating on the same frequency, but when the writer decided to have a go at working transatlantic stations on Top Band some other form of monitoring had to be devised, as the DX stations transmit at the extreme l.f. end of the band, while European stations operate higher in frequency.

The unit described here consists simply of an audio oscillator, which is turned on and off by r.f. picked up from the transmitter. No direct electrical connection is made to the transmitter or receiver, and as the unit is battery operated, it is ideal for portable work as well as having several useful functions at the home station.

The circuit diagram is shown in Fig. 1. When the transmitter is switched on, r.f. is picked up by the aerial and is rectified by the diode D1 to form a positive bias to switch on transistor Tr1. When Tr1, which may be almost any n-p-n type, is switched on by this bias the collector to emitter impedance is very low so that the battery B1 is connected to the oscillator, consisting of Tr2 and its associated components.

The zener diode, D2, can be any type having a low current drain and a reference voltage of the order of 6 to 8 volts. The writer used a diode having a 5mA current drain and a reference voltage of 7·5 volts (A.E.I. type MR75). This diode is necessary to avoid variations of oscillator frequency with different amounts of r.f. pick up.

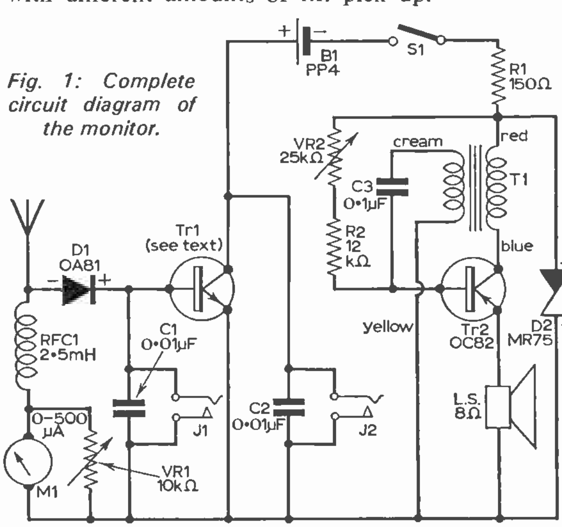

Fig. 1: Complete circuit diagram of the monitor.

The meter M1 measures the diode current and may therefore be used as an indication of r.f. power output from the transmitter. The meter should be a moving coil type having a sensitivity of 500 microamps or better. In the writer's case a 50 microamp meter was used as this was to hand. Resistor VR1 controls the sensitivity of the meter and should always be left in the zero resistance position when not in use to avoid damaging the meter movement when switching the transmitter on.

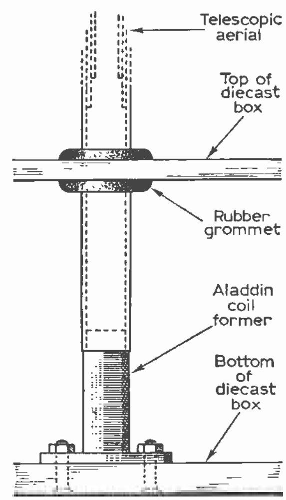

Fig. 2: Suggested method for mounting the telescopic whip aerial.

The loudspeaker used in the oscillator can be almost any miniature low impedance type; the writer used a small 8 ohm speaker taken from a discarded pocket receiver. If required a level control can be added by connecting a 100Ω variable resistor in parallel with the speaker.

★ components list

Resistors:		**Inductors:**	
R1	150Ω	T1	Repanco TT9
R2	12kΩ	RFC1	2·5mH
VR1	10kΩ		
VR2	25kΩ		
Capacitors:		**Semiconductors:**	
C1	0·01μF disc ceramic	Tr1	n-p-n see text
C2	0·01μF disc ceramic	Tr2	OC82
C3	0·1μF	D1	OA81
		D2	MR75 see text

Miscellaneous:
SPST toggle switch, two normally open jack sockets, PP4 battery, 500μA meter (see text), low impedance loudspeaker, solder, wire, etc.

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ON THE SHORT WAVES

MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequencies in kc/s

THE BROADCAST BANDS

by JOHN GUTTRIDGE

AFRICA

EGYPT: *Cairo Radio* (P.O. Box 1186, Cairo) now is 13m.b. on 21,615 with Bengali 1100, Hindi 1200 and English 1300-1430. The European TX from 1745-2315 (English 2145) now on 12,005/9,475. For the South American service 15,360 is being used. Noted on this frequency is Portuguese 2330-0030.

Ethiopia: *Radio Voice of the Gospel* (P.O. Box 654, Addis Ababa) has English at 0530 on 11,890; 1900 on 15,115; 1700 on 9,570; 1800 on 9,705; 1655 on 6,055; 1345 on 15,315/15,410. Also Monday to Friday only at 0930 on 17,840; 1000 on 21,590; 1130 on 17,740; and 1200 on 15,340.

Ghana: *Ghana Broadcasting Corporation* (Broadcasting House, P.O. Box 1633, Accra). Recent schedule changes include English 2000-2100 on 11,850/9,760; 1330-1430 17,910; Portuguese 1500-1630, 1815-1900 6,070 (New TXs). Hausa transmissions have been dropped as have all transmissions before 1330. Good reception of the internal service has been noted on 4,980 around 1900.

Liberia: *Radio Station ELWA* (Box 192, Monrovia) has English on 11,950/17,760/21,535 at 0600-0800, 1000-1200, 1545-1645.

Nigeria: *Nigerian Broadcasting Corporation* (Broadcasting House, Lagos). Good reception given by the commercial service on 4,990 around 1830.

Tunisia: *Radiodiffusion Television Tunisienne* (139 Avenue de Paris, Tunis) transmits in Arabic 0400-0800 and 1700-0030 on 6,195 and 0400-1800 on 11,970.

South Africa: *Radio South Africa* (P.O. Box 8606, Johannesburg). The European service is now as follows: English 1900-1955 11,785/9,525; French 1800-1855 15,245/11,900/9,525; German 2030-2125 15,200/11,785; Dutch 2130-2225 and Portuguese 2230-2325 on 11,785/9,720.

ASIA

Afghanistan: *Radio Afghanistan* (Ansari Watt, Kabul) now has English to Europe at 1800-1830 on 15,265 and 11,856 or 11,770. German is at 1730 on the same frequencies. The Home Service schedule is now 0100-0400 and 0700-0900 on 6,000/7,200, 1100-1330 6,000, and 1130-1800 on 7,200.

China: *Radio Peking* (Broadcasting Administration, Fu Hsin Men, Peking). English reported at 1300 on 9,340 and 2030-2230 on 6,290/6,300 and 42 and 45m.b. Arabic has been noted at 1900 on 7,485, French at 2200 on 7,315 and Hindi at 1645 on 6,290.

India: *All India Radio* (P.O. Box 500, New Delhi) now uses 49, 41, 25, and 19m.b. for English 2245-0115 and 16, 19m.b. at 1330-1500.

Iran: *Radio Iran* (Meidan Ark, Tehran) now using 11,752/15,132 from 1000-2200. English is 2000-2030.

Japan: *N.H.K.* (Tokyo) has made following frequency changes: General service—2000-2030 9,560/11,815/15,195; 2100-2130 and 2200-2230 9,700/11,815/15,195. The Middle East and North African service in French, English and Arabic is now on 9,525/11,780 at 1730-1900.

Jordan: *Broadcasting Service of Hashimite Kingdom of Jordan* (P.O. Box 909, Amman) using new frequency of 6,045 for Arabic home service. Signs on at 0330.

Korea (Republic): *Korean Broadcasting System* (Yejangdong 8, Chung-ku, Seoul) now to Europe in English 0630 and French 0700-0730 on 15,425.

Lebanon: *Radio Lebanon* (Ministry of Information, Beirut) now uses 15,350 for its 1830-2030 transmission beamed to Africa. English is at 1830-1900.

Saudi Arabia: *Saudi Arabian Broadcasting* (Ministry of Information, Airport Road, Djeddah) has been noted using the 100kW transmitter on 15,150 for the Arabic service after 2100.

Turkey: *Radio Ankara* (T.RT, Genel Mudurlugu, Ankara) now has Turkish 1730-1815 and French 1930-1945 on 9,515.

Vietnam (North) *Radio Hanoi* (58 Quan-su Street, Hanoi) has English 1000-1030, 9,760/7,210; 1300-1330, 1530-1600 1,240/7,210/9,840/11,840; 2300-2330 1,240/9,840/11,840.

AUSTRALASIA

Australia: *Radio Australia* (P.O. Box 428G, Melbourne) now transmits in English to Europe from 0645-0745 on 11,710/9,560.

NORTH AMERICA

Canada: *C.B.C.* (P.O. Box 6000, Montreal) now in English to Europe at 1215-1313 on 15,365, 0730-0800 9,625/5,990; 1516-1529 17,820/21,595; 2115-2150 15,320/11,720/9,630 and to Africa 0730-0800 17,715/15,390/11,920 (BBC relay frequencies) and 1832-1915 21,595/15,390/11,920.

USA: *Radio New York Worldwide* (WNYW) (485 Madison Avenue, New York, NY 10022) was off the air from April 9 to 17 when its five transmitters were destroyed by fire. A skeleton schedule is now being operated in English to Western Europe from 1800 to 2100 on 21,530/17,845/15,440 although full-time operations are being planned for the near future. DXing Worldwide is at 2030. Reception reports will be greatly appreciated.

Voice of America (Washington D.C., 20547) is still using 3,980 for English to Europe 1400-2330 despite the fact it is not listed in the current schedule.

Information has come this month from Radio New York Worldwide, Swiss Broadcasting Corporation, Internation Short Wave Club, A. E. Roxburgh, A. Givens, D. Walsh, S. L. Utting, G. Rutherford, T. E. Rogers, and R. Bowen.

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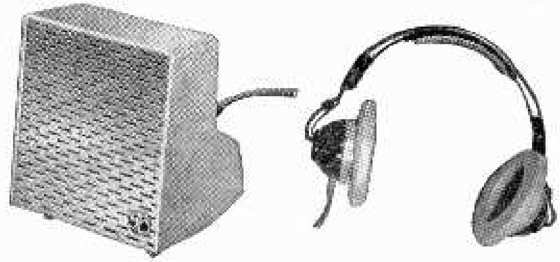

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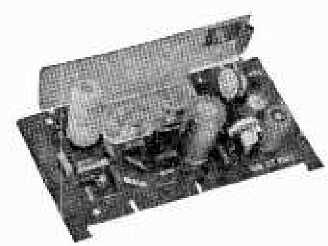

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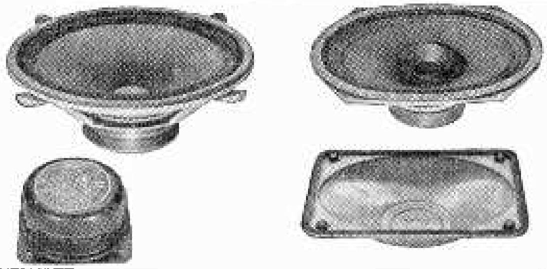

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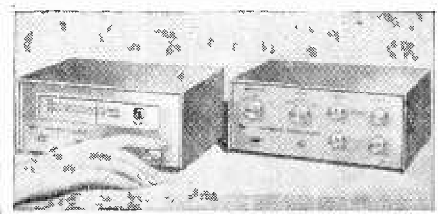

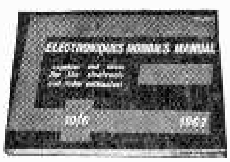

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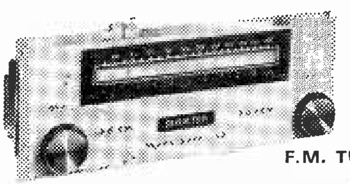

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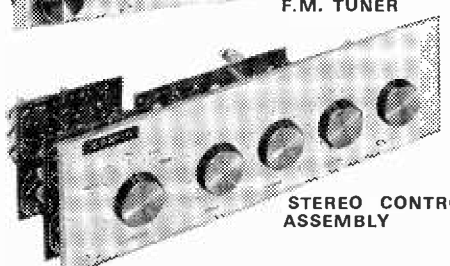

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FOR those who have been patiently awaiting the arrival of the sun spots, I've got news—they're here! Here, there, everywhere, lovely sun spots. The h.f. bands have been wide open to just about everywhere. Ten metres has been crammed with W's, and some really good openings to the Pacific. Fifteen has brought in the fabulous crop of consistent DX, and Twenty has been anything but quiet.

TWENTY/FIFTEEN

David Henbrey (Sussex), has really clobbered me this month. I was all set to casually brag about my DX on Twenty when I found he'd heard 'em all plus a couple of dozen more! The bit that really hurt is that he's using an O-V-O receiver. It must be the earthing system that does it. David's log for 20 s.s.b. reads—CN8AW, CX4AW, FG7XL, HK3LT, HR1KAS, JA1AEA, K6KPS, KH6BX, KH-6FRT, KP4AST, MP4BEU, OD5FA, OHØNH, TF2WKH, VK — 2AVA, 2KM, 2LA, 3AOK, 3SX, 4TY, 5LC, VP8AO/OX, VP8IU, VS9ALV, VU2-DKZ, ZD7IP, ZSIJF, 3C8ML, 5T5KG, 9Q5HF. It must be the earth—must be.

D Clark (Bucks), P.W. Progressive S.W. Receiver + PR30 preselector heard these on 20 s.s.b.—BY2PJ, CN8AW, CR6HF, DU2BH, EP2AX, HK4AET, HR1CX, HV3SJ, JA4VX/MM, KA2EP, KP4AST, KV4AB, KW6EJ, LU1ALF, OD5EP, PY3BXW, UJ8AC, VP2AP, VP8AO/P/OX, VP8IU, VP9CP, VQ1DK, VR5FB, VR6YB/P, VS9ALV, XW8AX, YV5ANF, ZC4CN ZE1AE, ZS1KG, 3C3FJZ/P/SU, 5H3KJ, 6Y5TB, 9H1I, 9M2NF, 9Q5HF.

Howard Dearing (Herts), is 13 years old, and is taking the R.A.E. in December. His Hammarlund Super Pro. plus 140ft. end fed raked in—BY1CYG, HS4AK, JA1AEA, JA2JAA, KG6IJ, KH6SIN, KJ6BZ (Johnston Is.), KL7AAH, OA5KAL, OD5OK, OX3WX, ST3ELJ (Sudan), SVØWS, TF2WKH, TG9EP (Guatemala), VK2—AGW, ALQ, AMB, AR, AVW, KAL, KM, LA, NI, OAR, QN, WV, VK3AAR, VK4JR, VU2BN, XE1CCC, YK1AM (Syria), ZL—1AFG, 1AX, 2AFZ, 2BDA, 2HPK, 3IR, 5A4TK. All on 20 metres s.s.b.

L. Rowland (Cheshire), 9R-59, 150ft. end fed shows what's about on 21Mc/s. On s.s.b. he logged—CE3ZN, CX7CP, EL2A, EL2Z, EP2BQ, HC1KQ, HZ1AZ, KL7BFB, KV4FA, KP4CSU, SVØSM, TF2WKE, VK—2AH, 2ATB, 2AYT, 3ABA, 3AHS, 3JT, 3VP, 3VT, 3ZR, 5FM, 5DX, 5PX, 5SN, 7RX, VR2EK, W6BE, WA6EPP, YS1DHE, ZD8CX, ZE8SKI, ZL—1AFO, 1AIE, 2BE, 4AC, ZS6AOU, 5T5KG, 5T5KJ, 9G1BY, 9Q5FF.

B. Stratton (Middx), PCR3, PR3OX, 18ft. vertical fed at the top (yeah, why not?), hooked these on 21 Mc/s s.s.b. EA8CB, HL9KH, HL9TC, KZ5JB, KZ5TN, PJ2CH, PZ1BO (a.m.), UD6BR, YA1DAN, 9M6MG, 9Q5GZ, 9U5DP.

Someone sent in a magnificent log for 15 metres, but forgot to enclose a letter, no name or anything. Whoever you are, if you heard that lot I'd like to buy your receiver. Please write your name and the gear on the reports OM's.

TEN

Don't wait for the sunspot peak, listen now. **George Owen** (Bristol), did on his GC1U and Joystick antenna. The following were all a.m.—CO8RA, CR4BC, CR6AR, CT2AP, CT3AS, CX1BY, CX4DG (not guilty), EA8BN, FM7WQ, HI3XRM, HI8XAL, HK4AEU, KP4ACX, LU1IN, LU4DIU, LU5DEG, LU6DRL, MP4BGM, OA4JR, PY1ATV, PY2CDS, PY3AF, PY4DFJ, SV3ZAI, VP3GI, VP3ELJ, VP6UN, XE2CJ, YO3ABU, YV1LH, YV4AW, YV5AQD, ZD3E, ZC4GY, ZS1BS, ZS6RO, 9G1GM, 9H1X, 9J2GJ, 9Y4VS. On s.s.b.—CE6EZ, CX2CN, HC8JG, KV4CI, KZ5NS, OA4OV, OD5CN, PY1YD, YV5BCS, ZD8CX, ZE1AA, ZS1JA, ZS4OI, ZS6OY, 4U1FU (Gaza Strip), 5A1TS, 9G1FF, 9H1AM, 9J2DT.

P. Rotheroe (Surrey), 10-5, 45ft. end fed, all s.s.b. —BY4AS, CP1IW, CR6DX, CT1OS, CX8AAW, FH8CD, JA3SZ, K3SBB, K4SDW, K6ILB/P, KØREV, MP4BEU, PY7ALC, SVØWU, UA6CP, VO1HI, VS9APW, WA5REB, W5LAT, WA6HXW, WØBUL, YV1FV, ZC4GB, ZS5BC, 9G1DM.

LF END

D. Baker (Lancs), PCR3 into a BC-453-B, 66ft. dipole heard I1CTL, OK1AIR (5 watts), VE1UT, VO1FX, VO1HI, VS9ALV on 80 s.s.b. **M. Pemberton** (Bucks) Veritone CR150+PR30 also listened on 80 s.s.b. for LA5KS, ON5JE, UR2QZ, VE1AA, VE1IE, WA1MLR.

Norman Henbrey (Sussex), EA12, 20 metre dipole bagged some goodies on 80 s.s.b.—CN8AW, TF3OM, TI2NA, W4FZJ/KP4, ZL—3AAD, 3RJ, 3WT, 4LM, 3B1FX, 3C1UA. Norman says there's not much on 40 this month and confesses he only heard —CN8AW, CN8BV, HK3BEJ, JA2BAY, PY2EGA, PY7ARJ, PY7VON, PZ1CF, UA9BE, VP6KL, YV1PW, 4X4DH, 7XØAH. It must be the earth!

F. Simpson (Yorks) 840c, 10 metre dipole, listened on 40 and rescued—EP2BG, KP4CQY, K1GZL, K3WQC, K4EV, TG7EH, UA3RDO, UA4KED, UW9AF, W2HSB, W3SNC, W4NTU, W8LCT, W9TCT, WA1HFC, WA4PNG, WB4EVM.

NEWS

Rumours that VP3 (Guiana) will soon be 8R, anyone confirm? GB3STD is the St. Dunstan's Station, and in June (21—30) there will be a special station on from the Isle of Wight at the third Island Industries Fair. 160—10+2 with the callsign GB3IIF. FB8YY is on 20 c.w. at breakfast-time (take your toast into the shack) from Adelie Island. How about listening for G3JDG/P, 160 a.m./c.w., from Point Clear Bay, June 4—11th?

Contests and rallies for June include 3rd—4th, National Field Day; 11th, Medway Mobile Rally near Maidstone in Kent; 18th, ARMS Mobile Rally at Alconbury, Hunts.; 18th, Hunstanton Bucket and Spade Party; 18th, DF Qualifying Event; 25th, Longleat Mobile Rally near Warminster, Wilts.; July 2nd, 2 metre portable contest; July 9th, RSGB National Mobile Rally at Gilwell Park, Chingford. I hope to be at most of these rallies and would be pleased to have an eyeball QSO with any readers. Deadline for logs is 20th.

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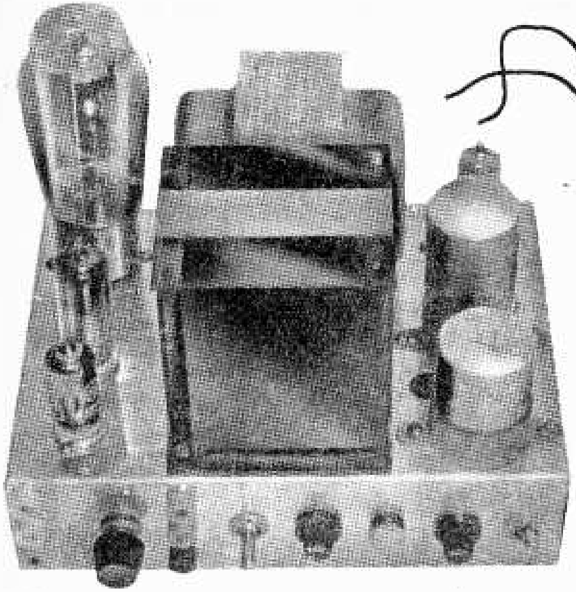


SIMPLE STABILISED POWER SUPPLY

H.T. KITCHEN

SPECIFICATION

H.T. voltage:	Variable from 200V to 260V
H.T. current:	60mA max.
H.T. ripple:	15mV at 250V
Heater voltage:	3·15–0–3·15V at 2·7A (floating)
IP/OP variations:	O/P varies 1% for 10% I/P variation
O/P resistance:	15Ω at D.C.

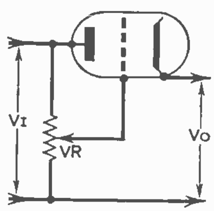
WHERE ever work of an experimental nature is undertaken, the provision of suitable power supplies is one of the primary concerns. Although it is sometimes possible to tap into an existing power supply, this is not always convenient or desirable. Overlooking convenience, let us examine "desirability" a little further, particularly in respect of a.f. high tension supplies. The first apparent effect of tapping into an existing supply is that the o/p, or terminal voltage will fall, the fall increasing as the current drawn increases. This is due to the source resistance of the supply, and is an inherent characteristic of all basic power supplies. While this fall may not matter in some applications, in others it may prove to be completely unacceptable, for example the fall in terminal voltage may be so great that the remaining voltage will be too low to fulfil its intended purpose.

Supposing the load current is fluctuating in a regular or sporadic fashion, the terminal voltage will rise and fall in sympathy. The greater the difference in the off load/on load currents, the greater will be the amplitude of the terminal voltage fluctuations. This virtual modulation of the terminal voltage could cause instability in a high gain amplifier consisting of several voltage amplifying stages in cascade. In the case of a single ended power amplifier, the anode current could exceed 50 or 60mA, and the voltage across the anode load could exceed 100V peak to peak. If the power supply has a high source resistance, a goodly portion of this voltage swing will find its way onto the h.t. line, and from there (assuming intervalve decoupling is absent) will arrive at the anode of the input valve. Although the input signal will have received some amplification at this point, its amplitude may still be less than the amplitude of the feed back voltage. If the relative phase angles are just right, the circuit will burst into instability, the frequency of oscillation depending on the time constants of the amplifying and feedback networks.

A further disadvantage of a basic supply, is that the o/p voltage cannot be easily altered. True, a variable resistor in series with the h.t. line will permit some variation, but if large currents are involved this system becomes impracticable. Also, since it is in series with the supply voltage, the poor regulation is made even worse.

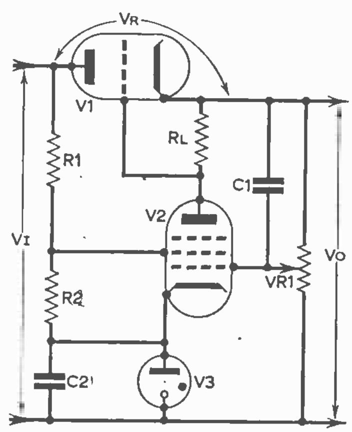
The Solution

The answer to these problems lies in the use of an electronic regulator or stabiliser. The most elementary type (Fig. 1) is capable of controlling the output voltage at the operators' will, but is not capable of compensating automatically for varying load currents. Variation of o/p voltage is achieved by the manual operation of the potentiometer VR across the input voltage. The action of the circuit



▲ *Fig. 1: Circuit showing an elementary type of voltage stabilisation.*

Fig. 2: Basic circuit ▶ *providing automatic control of the terminal voltage.*



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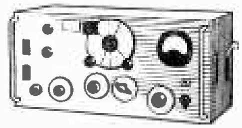
MARCONI TEST EQUIPMENT



TF.144G STANDARD SIGNAL GENERATOR. 85 Kc/s.-25 Mc/s. 200/250 v. A.C. £25. Carr. 30/-. TF.329G "Q" METER Brand new with all accessories £75. T.F. 195M. BEAT FREQUENCY OSCILLATOR. 0-40 Kc/s. 200/250 v. A.C £20. Carr. 30/-. All above offered in excellent condition fully tested and checked and offered at a fraction of original cost.

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Post extra.

These cannot be operated in U.K.

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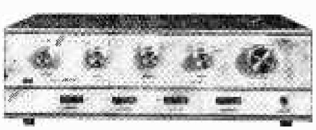
LAFAYETTE HI-FIDELITY SOLID STATE STEREO AMPLIFIERS



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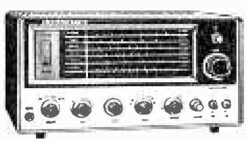
Model LA-224T 30 watt £25. Carr. 7/6. Model LA-60T. 60 watt £37.10.0. Carr. 7/6.

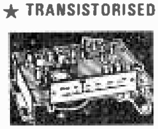
DETAILS ON REQUEST

LAFAYETTE MODEL HA-500 3SB/AM/CW 80 THROUGH 6 METRE RECEIVER



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

★ TRANSISTORISED FM TUNER ★



6 TRANSISTOR HIGH QUALITY TUNER. SIZE ONLY 6in. × 4in. × 2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9 volt battery. Coverage 88-108 Mc/s. Ready built ready for use. Fantastic value for money. £6.17.6. P. & P. 2/6.

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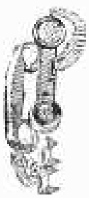

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5¾in., 1,200ft. L.P. acetate	12/6
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7in., 1,200ft. std. mylar	12/6
7in., 1,800ft. L.P. acetate	15/-
7in., 1,800ft. L.P. mylar	20/-
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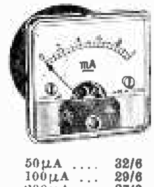

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		2MA	22/6	1A D.C....	22/6	750V D.C....	22/6
		5mA	22/6	2A D.C....	22/6	15V A.C. ...	22/6
		10mA	22/6	5A D.C....	22/6	50V A.C. ...	22/6
50µA	32/6	20mA	22/6	3V D.C....	22/6	150V A.C. ..	22/6
100µA ...	29/6	50mA	22/6	10V D.C...	22/6	300V A.C. ..	22/6
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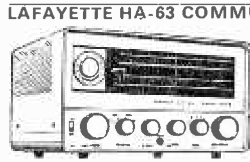
11 valve high grade communication receiver suitable for tropical use. 1-20 Mc/s. on 4 bands. AM/CW/FM operation. Incorporates precision vernier driver, BFO. Aerial trimmer, internal speaker and 12v. D.C. internal power supply. Supplied in excellent condition, fully tested and checked. £15.0.0. Carr. 20/-.

LAFAYETTE HA-63 COMMUNICATION RECEIVER



Outstanding value. High-class 4 band receiver covering 550kc/s—31 Mc/s. Seven valves plus rectifier, RF stage, illuminated "S" meter, 1·5µV sensitivity. Electrical bandspread on 80/40/20/15 and 10 metre bands. Slide rule dial, aerial trimmer. B.F.O., ANL, Output for phones or speaker. 115/220/240V. A.C. Brand new, guaranteed, with manual. 24 gns. Carr. 10/-

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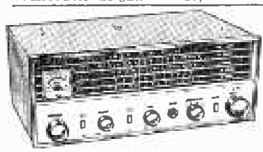
Build this wonderful receiver and save pounds. Supplied semi completed, main components ready mounted, R.F. section already wired and aligned. Full and precise instructions supplied. Specification:— 8 valves + rectifier, 4 bands covering 550 kc/s.-30 Mc/s. Incorporates 1 R.F. and 2 I.F. stages, 'Q' multiplier, B.F.O., A.N.L., 'S' meter, bandspread, aerial trimmer etc. Operation 115/230 V. A.C. Price 25 gns. Carr. 10/-.

HAM-1, 4 BAND COMMUNICATION RECEIVER



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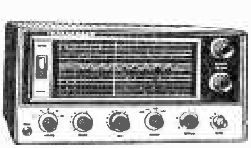

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6K7G	1/6	35W4	4/6	ECH42	9/-	PCC189	8/6	U78	3/6	AF126	7/-
6K8G	4/3	35Z4GT	4/6	ECH81	5/-	PCF80	6/6	U191	10/-	AF127	7/-
6K8GT	7/6	85A2	5/9	ECH84	8/6	PCF82	6/-	U301	11/9	OC22	9/9
6L18	6/-	6063	12/6	ECL80	6/-	PCF86	8/3	U801	16/3	OC25	9/6
6V6G	3/6	AZ31	9/-	ECL82	6/3	PCF800	10/6	UABC80	5/9	OC26	6/9
6V6GT	6/6	B729	10/-	ECL86	7/9	PCF801	8/9	UAF42	7/9	OC44	3/9
6X4	3/6	DAC32	7/3	EF39	3/9	PCF802	9/6	UBC41	6/9	OC45	3/3
6X5GT	5/9	DAF91	3/9	EF41	6/3	PCF808	11/3	UBF80	6/-	OC71	3/6
7B6	10/9	DAF96	6/-	EF80	4/9	PCF805	9/9	UBF89	5/9	OC72	4/9
7B7	7/-	DCC90	7/-	EF85	5/-	PCF806	11/6	UBL21	9/-	OC75	5/9
7C5	9/6	DF33	7/9	EF86	6/3	PCL82	6/9	UC92	5/6	OC81	3/6
7C6	6/9	DF91	2/9	EF89	5/-	PCL83	8/6	UCC84	7/9	OC81D	3/6
7H7	5/6	DF96	6/-	EF91	3/6	PCL84	7/-	UCC85	6/6	OC82	5/9
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is quite simple. VR is capable of adjusting the valves' grid bias so that it is positive or negative with respect to its cathode. If it is positive, the valve conducts and the terminal voltage increases. If it goes negative, the valve is cut off and the terminal voltage decreases. Provided the valves' voltage and current ratings are not exceeded quite a wide control of voltage and current can be provided.

Automatic control of terminal voltage in spite of varying load currents, and variation of terminal voltage at the will of the operator is provided by the circuit of Fig. 2, which differs from its predecessor by the inclusion of V2, V3, R1, C1. VR has been transferred from the input to the output.

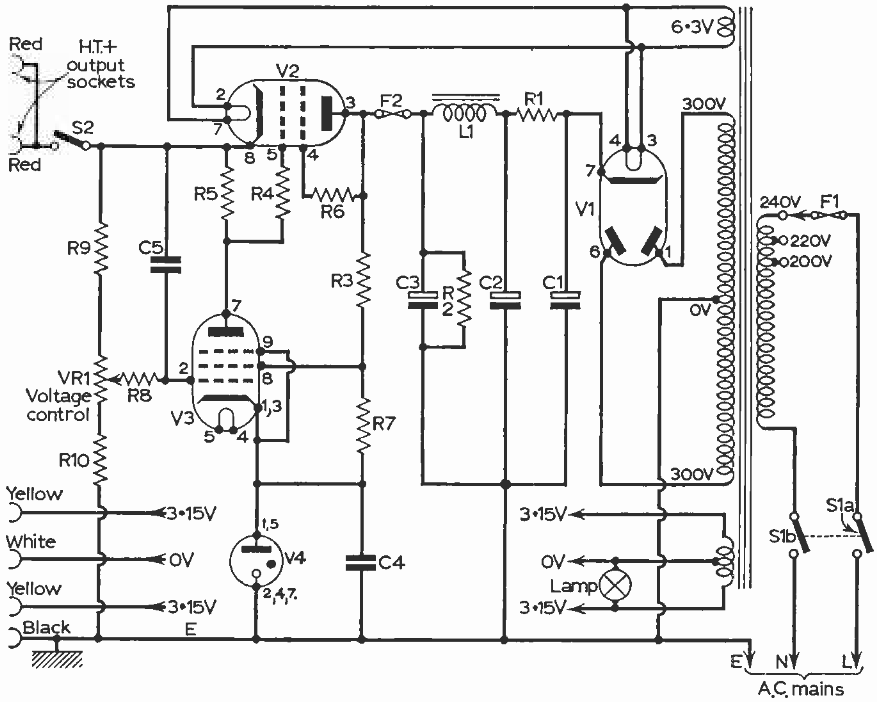
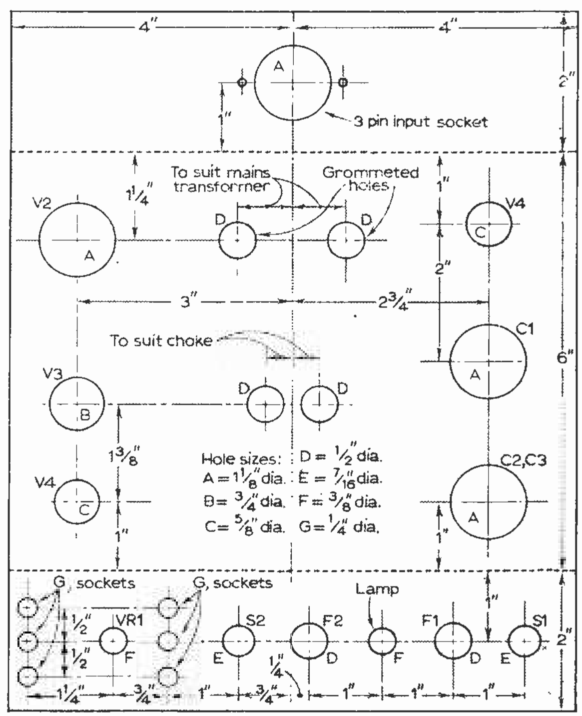


Fig. 3 (above): Complete circuit of the power unit.

Fig. 4 (below): Component positioning and drilling guide.



The operation of the circuit of Fig. 2 is quite simple and depends on negative feedback for its operation. Effectively, there are two n.f.b. loops operating in parallel, one to deal with slow changes in the load current or when the load is intermittently switched on and off, and the other to deal with rapid changes in the load current. Both are initiated at the grid of V2 and operate as follows. Let us suppose that a load has been suddenly switched into ciruit and, as a result, the terminal voltage starts to fall. A fraction of this voltage is fed to V2 grid by VR1. The cathode of V2 is held at a constant voltage by the stabiliser or reference neon V3 and the grid voltage therefore goes negative with respect to the cathode. As the grid goes negative the anode current falls, and the voltage across the anode load resistor R1 decreases. The anode voltage therefore increases, and this increase is passed to the grid of V1. As this increase is positive going V1 will pass an increased current and in a well designed regulator this increase will be just enough to maintain the terminal voltage at its original value. Disconnecting a load will work in an opposite direction and in each case the terminal voltage will remain (almost) unchanged.

The second feed back loop for rapid fluctuations in load current is provided by C1. This capacitor is necessary because although rapid fluctuations are fed back to the grid of V2 via VR1, they are attenuated by a factor equal to the resistance either side of the wiper of VR1. Since the original amplitude of these fluctuations is often less than the change in terminal voltage occasioned by the switching in and out of a load, the voltage arriving at the grid is insufficient to provide adequate compensation. C1 allows virtually the full fluctuating (terminal) voltage to be impressed upon the grid of V2 and compensation is therefore more effective.

Stabilisation against fairly rapid mains voltage variation is provided by R1 and R2 which form a potential divider feeding the screen of V2, and therefore exercise some control over its gain. At the same time they allow an increased current to be fed to the reference neon V3 which would suffer

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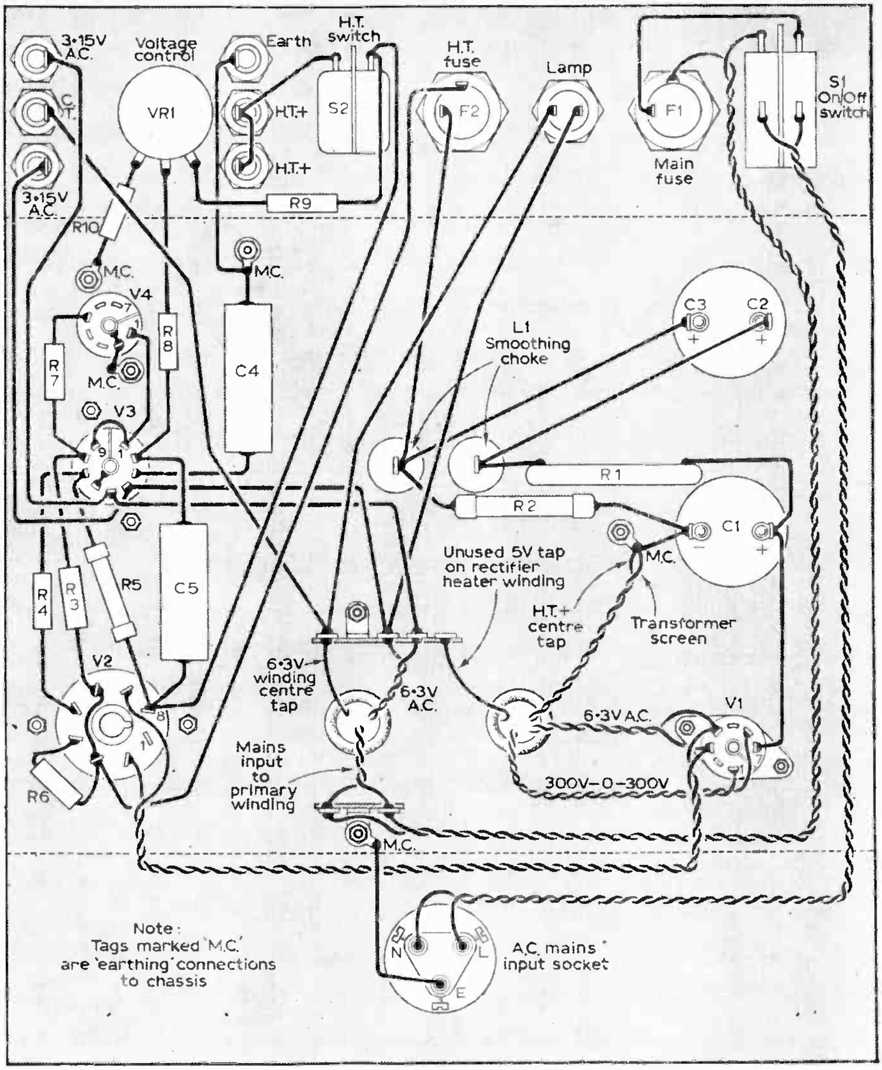

Fig. 5: Under chassis layout and wiring diagram.

current starvation (and thereby fail to perform its function of providing a stable reference voltage) if it were fed only by the meagre cathode current of V2. C2 performs the function of suppressing any noise generated by V3.

Circuitry

The complete circuit is shown in Fig. 3 and consists essentially of the circuit of Fig. 2 with the addition of the power supply components, plus the alteration of V1 from a triode to a pentode. The mains transformer is a standard type but the 6·3V winding used to power the heater of the 6X4 rectifier and the 6L6 regulator valve must be well insulated because it supplies two valves whose cathodes are several hundred volts above earth potential. This winding must *not* be earthed to chassis, if it is, or if its insulation breaks down, the heater to cathode ratings of the two valves will be exceeded.

The second heater winding is used to supply V3 heater and also external equipment. On the prototype a 3·15V - 0 - 3·15V (or 6·3V C.T.) winding was used, having a current rating of 3A. As the EF80 has a 0·3A heater, 2·7A was left for the external equipment. This winding was also left floating permitting either the centre tap, or either side of the heater to be earthed at will. The winding can also be used to supply a valve or valves whose cathode/s may be well above earth potential, without putting undue strain on their heater/cathode insulation.

Smoothing

During off load periods, the voltage across the smoothing components C1, C2, C3, R1, L1, will rise to the peak value of the input voltage, approximately 420V. R1 can be replaced by another choke, in which case the smoothing will be somewhat improved. Conversely, R1, C1 can be omitted when smoothing will only be fractionally poorer since the feedback network will tend to compensate for their omission. This does not mean that pre-regulator smoothing can be, or should be, skimped, as every little helps. From L1 C3 the smoothed unregulated h.t. is fed into the anode of V2 the series regulator valve via the fuse F2. This affords a measure of protection should the valve fail, or should the o/p terminals be short circuited.

The rest of the circuit is essentially similar to the skeleton of Fig. 2 with the addition of the grid stoppers R4 and R8 and the V2 screen stopper R6, these values being uncritical. All grid stoppers should be soldered as close to their respective valve base tags as possible, as their effectiveness decreases as the separation between valve tag and resistor body increases.

As before VR1 controls the terminal voltage but its range has been restricted by R9 and R10. At first sight, it might appear possible to vary the terminal voltage between zero and the voltage at the anode of V2, in practice this is not possible. In order to pass current, V2 has to have a voltage across it (V_R in Fig. 2), and this voltage subtracted from V_I leaves us with V_o, which is the terminal voltage. V_o can therefore never equal V_I. A second reason for restricting the range of the terminal

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voltage is that the stabilisation rapidly deteriorates (which is the same as saying the internal resistance is increased) below and above a certain terminal voltage.

It is vitally important not to exceed the voltage and current ratings of all components. To do so is to curtail the life of the over run components, perhaps abruptly and violently. Over run electrolytic capacitors can explode with almost unbelievable force and can constitute a considerable personal hazard. C1 in particular has a busy time and must possess not only an adequate d.c. voltage rating but also an adequate a.c. current rating. This must be $\sqrt{2}$ times greater than the peak d.c. current drawn. Thus it must have an a.c. ripple rating of 150mA if the peak d.c. current drawn is 100mA.

Resistor R5 is most important, and must be a 1W high stability type if the internally generated noise is to be held to a very low level. It is desirable, though not essential, for R8, R9 and R10 to be ½W hi stabs. If the constructor feels particularly affluent, he could, with some advantage, make R3 and R7 hi stabs.

Construction

A chassis drilling guide is shown in Fig. 4, and Fig. 5 shows the under chassis layout. The mains transformer, smoothing choke, valve holders, fuses, switches, and capacitors are bolted on, and wiring can commence using 22 s.w.g. tinned copper wire suitably sleeved. Sleeving can be obtained in various colours and the beginner is strongly advised to obtain several different colours. Subsequent fault-finding is much easier if the various parts of the circuit are colour coded. Particular attention must be paid when the electrolytic capacitors C1, C2, C3 are being wired in, as a reversal of polarity could prove explosively disastrous. Short circuits can also cause great damage and a sharp lookout should be kept for drops of solder and wire clippings lodged among valve pins.

Initial tests can commence with an ohmmeter connected between chassis and the unregulated and regulated h.t. points. The electrolytic capacitors will give a low initial reading, which should slowly increase to around 50kΩ. The regulated h.t. should not read under 250kΩ, which is the combined resistance of R9, VR1, R10. The resistance between rectifier heater and chassis should be infinity. If the resistance checks are satisfactory it is safe to proceed with voltage and current measurements.

With the mains connected, and a voltmeter capable of reading some 500V d.c. connected between C1 and earth, the mains switch S1 can be closed. The voltage should commence to rise after several seconds, smoothly and steadily to 420V. Due to meter and component tolerances, the indicated voltage may differ slightly from the nominal of 420V. Since there is no load current being drawn, the same voltage should be present at the anode of V2. The next check point is the o/p terminal, where the voltage should be variable between 260V and 200V. Again, due to tolerances, the indicated voltage may be somewhat different. The voltage across V4 will be 85V, its cathode current should be centred round 6mA, with a top and bottom limit of 10mA and 2·7mA. Exceeding the top limit will over run the valve, whilst a current, less than 2·7mA will result in poor stabilisation. These currents can be controlled by altering R3 and R7 in proportion i.e. if R3 is halved, R7 should also be halved, so that the screen grid of V3 is maintained at around 200V. If these checks aare satisfactory the power supply can be considered ready for active service. Provided the current drain is kept within the ratings of V1, V2 and the mains transformer, a long and trouble free period of service should result.

—continued on page 208

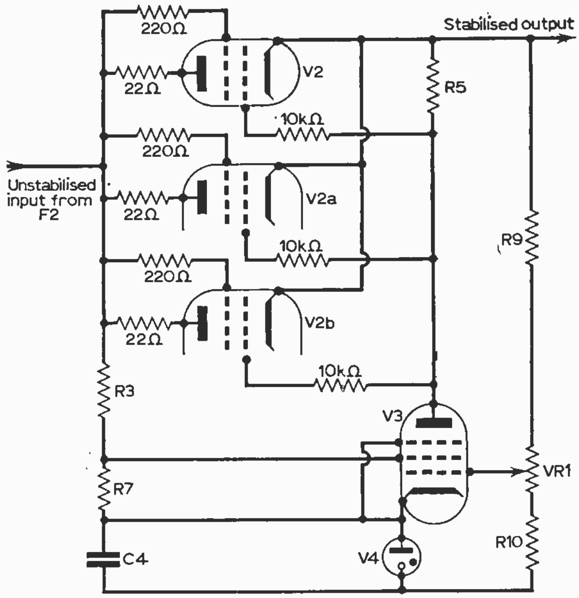

Fig. 6: Paralleling valves for increased current rating.

★ components list

Resistors:

R1	270Ω 3W wire wound	R6	220Ω ½W
R2	100kΩ 1W	R7	68kΩ 1W
R3	68kΩ 1W	R8	100kΩ ½W
R4	10kΩ ½W	R9	100kΩ 1W
R5	300kΩ 1W HiStab	R10	100kΩ 1W
VR1	50kΩ Lin		

Capacitors:

C1	8μF 450V electrolytic	C4	0·5μF 350V
C2	16μF 450V electrolytic	C5	0·1μF 350V
C3	16μF 450V electrolytic		

Valves:

V1	6X4	V3	EF80
V2	6L6	V4	85A2

Miscellaneous:

Mains transformer 300-0-300V 60mA, 6·3V 2A, 3·15-0-3·15V 3A.; two-way tag strip, four-way tag strip; two B7G valve holders, B9A valve holder, octal valve holder; three-way mains input plug and socket, two output sockets, red, two output sockets, yellow, output socket, black, output socket, white; bulb 6·3V 0·15A, 2A fuse and holder, 100mA fuse and holder, choke—10H 60mA 200Ω, 2-pole 2-way switch, 1-pole 2-way switch.

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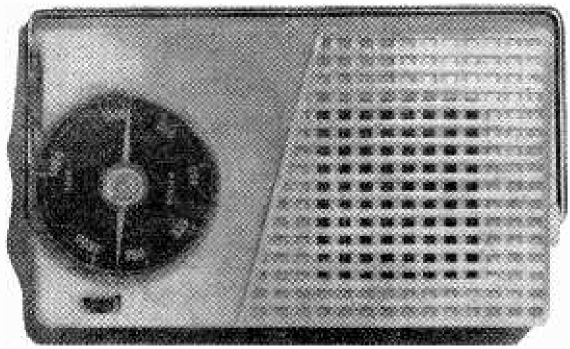

TRANSFILTE

A.J.Mc

THE writer, who has for some time been considering the construction of a comprehensive transistorised communications receiver, decided to assemble a fairly simple radio using Transfilters* (ceramic filters) before committing himself to their use in a more complex project.

Readers will be familiar with at least one application of the piezoelectric effect, in the crystal cartridge of a record player. Here a mechanical stress is applied to a crystal of Rochelle salt by the needle as it tracks the groove in the record, and a voltage proportional to the stress is developed, across the crystal due to the piezoelectric effect. Similarly, if a voltage is applied across such a crystal from an outside source, the dimensions of the crystal change. The principle is also applied in the quartz crystals often used as frequency standards in "ham" and commercial transmitters. Just as a clock pendulum takes a fixed time for each swing, so each crystal has a natural frequency of vibration from which it cannot depart. If the frequency of an applied alternating voltage matches this natural frequency, the energy supplied electrically transfers to the mechanical vibration. The amplitude of the displacements is therefore much larger than in the case of forced vibrations resulting from an applied field of a different frequency. This is the phenomenon known as resonance. A resonant crystal can then fix the frequency of an oscillator in the same way as a tuned circuit. In the Transfilter these characteristics are added to an impedance matching facility, and as a consequence the device can replace a tuned transformer. A closer examination of this final point is worthwhile.

* Registered trade mark Brush Clevite Company Ltd.

IMPEDANCE MATCHING

It will be remembered that maximum power transfer between two circuits occurs when the output impedance of the first is equal to the input impedance of the second. In a common-emitter transistor amplifier, the input impedance is low, while the output impedance is relatively high; in other words, the signal applied to a transistor is at a fairly high current and low amplitude (voltage), while, at the output, the current is quite low for the amplitude involved. If much of the transistor's amplification is not to be lost in the coupling, some form of impedance matching circuit must be inserted between this and the following stage. This is effected in the i.f. transformer by choice of an appropriate ratio between the number of turns in the primary and in the secondary windings of the transformer. A further design consideration is selectivity, the ability of the transformer to reject signals at frequencies even slightly separated from the i.f. This depends on the "Q" of the coil, a factor influenced by the actual number of turns on the tuned winding of the coil. All these characteristics are built into the Transfilter.

The element of importance in a Transfilter is, of course, the piezoelectric crystal; in those used in the radio to be described, it is a disc of lead-zirconate-titanate ceramic. One side is coated with

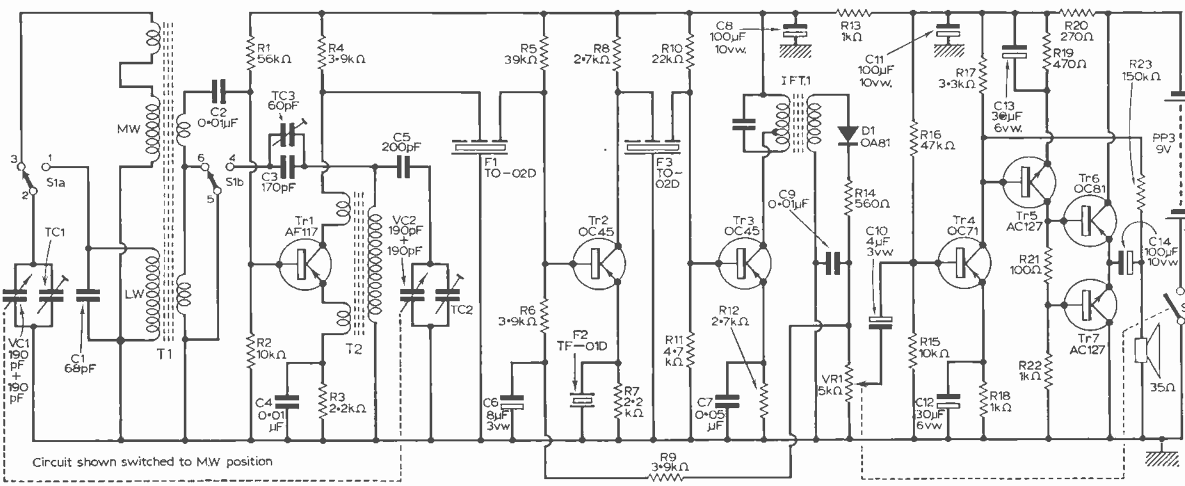

Fig. 1: Circuit diagram of the complete receiver.

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PORTABLE

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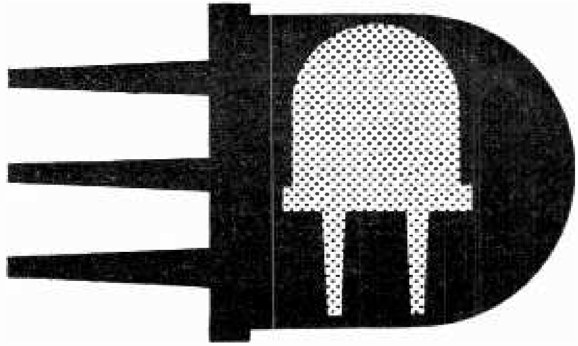


silver and forms a terminal common to the input and output circuits. A ring and a dot of silver on the other face form the output and input terminals respectively. It will be remembered from the description of the piezoelectric effect that the potential generated is proportional to the mechanical stress at any point on the crystal. Therefore the high impedance electrode is applied at the point where maximum displacement occurs, and as the discs vibrate in a radial mode, this corresponds with the dot terminal at the centre of the disc. No current actually flows through the device, but as already explained, there is an energy transfer between the electrical circuits and the mechanical vibration. The resulting power loss from the driving stage is the equivalent of a load; similarly the input of the

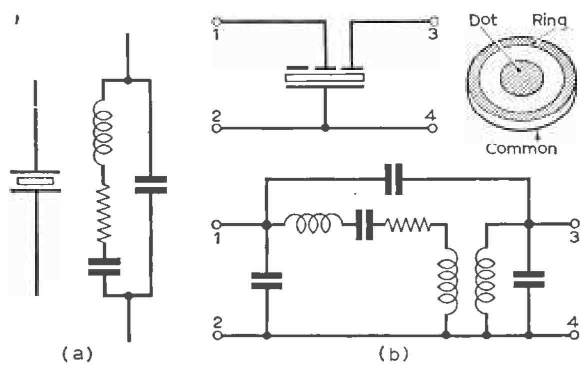


Fig. 2. Transfilter equivalent circuits in conventional components.

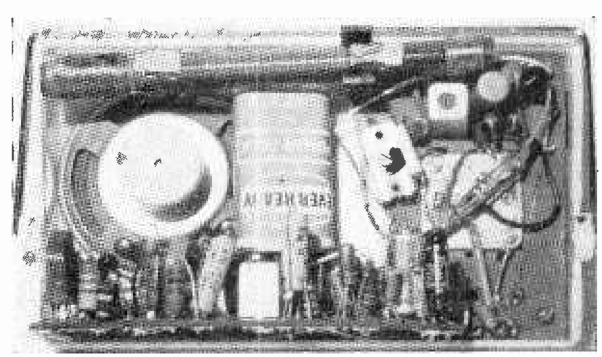
following stage places a mechanical damping on the vibrating crystal. The energy transferred depends on the area across which transfer is possible, as well as the concentration of energy in that area. Therefore, the central high-impedance dot terminal is of small area, while the outer ring terminal has a much larger contact area; this is because, as already mentioned, a higher voltage is applied, and a larger displacement occurs at the centre, so that there is a concentration of energy there. On the ring, in contrast, the amplitude of the mechanical vibration is lower, and a larger area is required to absorb the power transferred through the Transfilter. Therefore, the difference in area and amplitude correspond exactly to the differences in current and voltage in a conventional transformer, and an impedance matching characteristic results. Further, this matching is frequency-specific, since the applied signal cannot cause vibrations of appreciable amplitude unless it is at the resonant frequency. As for the selectivity of the current, it will be remembered that the Q of a crystal is very high. The damping effect of the load will reduce this somewhat, but the figure of 450 is quoted for the units specified, which compares very favourable with the 110 of a typical single-tuned i.f. transformer.

How, then, could the Transfilter be expected to compare with the transformer in a typical i.f. stage? Obviously, with the higher Q, greater selectivity would be expected, which would give sharper tuning and a reduction in adjacent-channel interference, a property which is very desirable with the current overcrowded wavebands. This is associated with a low mid-band insertion loss, that is, that most of the power of the input signal applied at the resonant frequency of the Transfilter finds its way at the proper impedance into the following stage. As a result, the radio should be more sensitive to the station to which it is tuned, while discriminating more effectively against transmissions on frequencies even only slightly separated from the desired carrier.

FREQUENCY STABILITY

Such advantages are not achieved without some difficulties, however. It is important to ensure that the ratio between the source and load impedances is set close to the value for which the Transfilter is designed to match; otherwise damping exceeding the specified limits may cause its resonant frequency to change. This will not trouble the constructor if he uses transistors manufactured to a reasonably close tolerance, especially in regard to their input impedance. (If, however, "surplus" transistors are employed, and unsatisfactory operation results, this may be the explanation of the problem, and a possible cure is to vary the base bias, so shifting the operating point of the transistor.)

One other piezoelectric device is employed in the circuit, the filter element type TF-01D, which



Internal view of the completed receiver.

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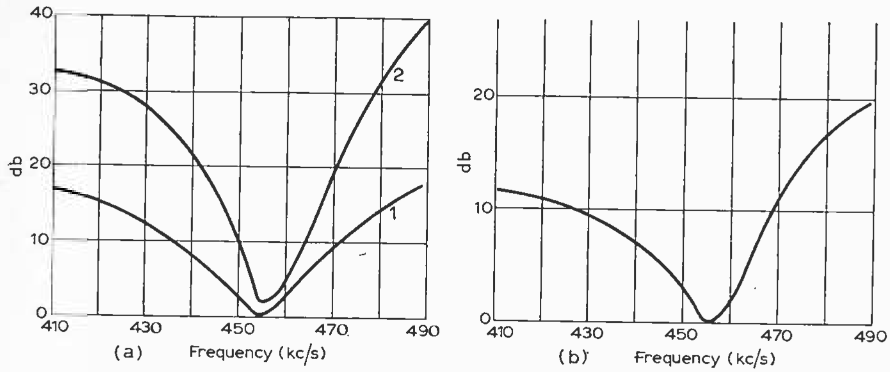

Fig. 3(a): Passband of i.f. stage using (1) an emitter bypass capacitor (2) a type TF Transfilter.

Fig. 3(b): Attenuation curve of emitter bypass Transfilter type TF.

replaces the bypass capacitor otherwise required across the emitter resistor of TR2. This increases still further the selectivity of the circuit, the attenuation curve is shown in Fig. 3a. All three of the ceramic filters are chosen to operate at the same resonant frequency under the conditions expected in the circuit. As external adjustment of this frequency analogous to tuning an i.f. transformer is impossible, the supplier has to set this accurately during manufacture, and package the element so that long-term stability of resonant frequency can be expected. In fact the Transfilters are supplied to operate at 470kc/s $\pm$ 1kc/s, and frequency stability is claimed to be within 0·2% over ten years, and within 0·1% between -20°C. and $+60$°C. Such figures should satisfy even the most critical constructor.

CIRCUIT DESCRIPTION

Now to consider the particular circuit employed. The frequency changer is completely standard, covering long and medium wavebands, and as such requires no further comment. As no current can flow through the Transfilters, resistors R4 and R8 are inserted to carry the collector currents of Tr1 and Tr2. As can be seen, the symbol chosen by the manufacturers to represent the Transfilter clearly expresses its structure and relationship to the quartz crystals used in transmitting, as already noted. An orthodox i.f. transformer is used to drive the diode detector.

The audio stage is a four-transistor unit with an n-p-n—p-n-p complementary output stage delivering approximately 300mW to a 2½in. loudspeaker.

A PP3 type battery was used in the prototype, but depending on the loudspeaker fitted, there may be space for the larger and more economical PP4.

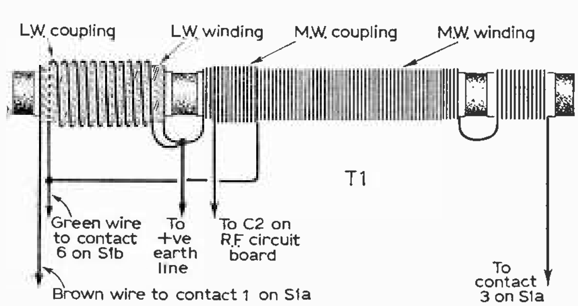

Fig. 4: Connection details for the ferrite rod aerial.

The receiver is assembled on two separate etched circuit boards, one carrying the frequency changer and band switching components, and the other the i.f. amplifier with its transfilters and the audio stage. The mounting of these boards is illustrated—the r.f. board fixed with screws to the front of the cabinet so that the spindle of the tuning capacitor projects through the hole in the front of the cabinet, and the volume control is accessible through the aperture in the side; the i.f. and audio board then fits perpendicular to this along the length of the cabinet. The ferrite rod (T1) is mounted in a plastic

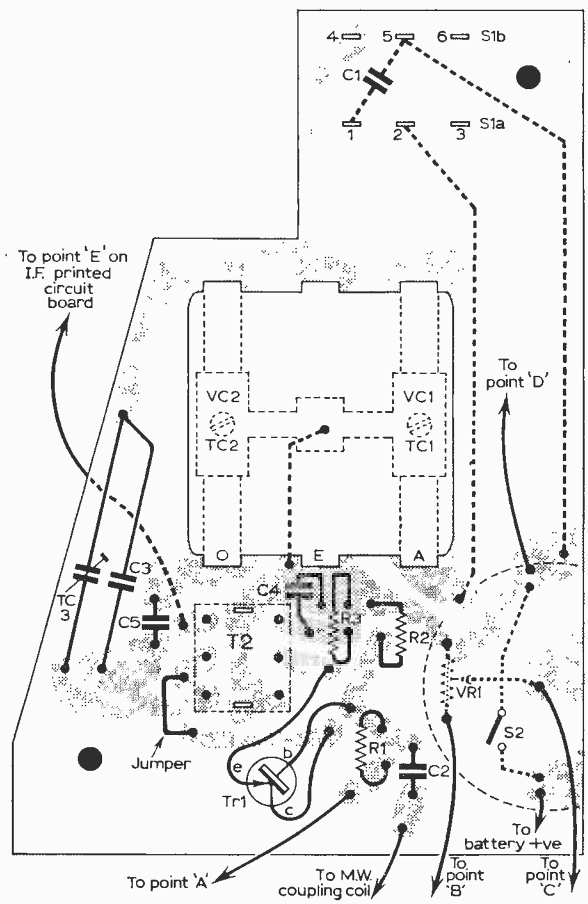

Fig. 5: Component layout of r.f. printed circuit board.

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clip on the r.f. board. The tuning dial may have to be modified for the Plessey gang specified. This is done by obtaining two metal washers which just fit on the spindle and pressing them with a hot soldering iron into the plastic of the dial, one on each side. The dial will now be a good fit on the spindle, and when the set is assembled, can be retained in place by a screw in the threaded centre hole of the spindle.

ETCHED CIRCUIT BOARD

The method of preparation of etched circuit boards will be familar to regular readers. The patterns for the application of the protective paint to the copper laminate on the boards are shown, and should be carefully copied. When this paint is dry, the unwanted copper is removed with ferric chloride ($FeCl_3$) solution, the paint scraped off, and the board carefully washed and dried. In this particular case, due to the complex patterns, the alternative of assembly on pieces of "Veroboard" seems impractical, but for those really anxious to avoid the use of chemicals it is possible to mount the components on a plain paxolin sheet, and connect them on the reverse side with thin tinned copper wire. With either method, component mounting holes must be drilled with a fine bit, and a cut-out made in the r.f. board to take the tuning capacitor. (A fretsaw proves the most convenient tool for the operation.) On the r.f. board, the volume control, tuning capacitor, and wavechange switch must be mounted on the copper side of the board if they are to be accessible through the appropriate apertures. The tuning capacitor is fixed in position by bending its terminals stepwise to let it a little into its cut-out, and then soldering them to the "islands" of copper left for them. It must not be forgotten to earth the tag at the centre of the tuning capacitor with a short length of copper wire to the circuit board. Other connections between the two boards are the negative supply to the potential divider for the base of Tr1, the earth or positive line, and the signal output to F1 at intermediate frequency from the collector of Tr1. Finally the ferrite rod aerial (T1) is mounted in its clip and the appropriate connections made to the tuning

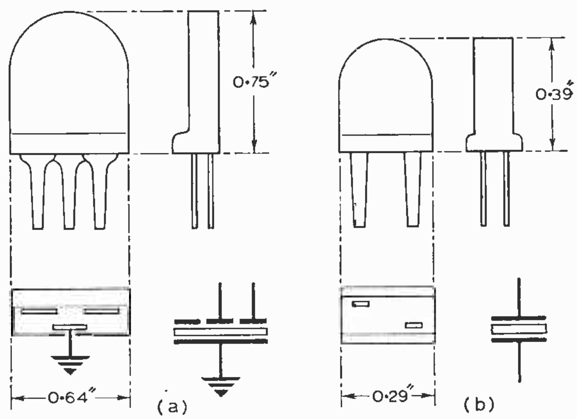

Fig. 7: Transfilter details (a) type TO (b) type TF.

capacitor and wavechange switch. The wires to the aerial windings should not be made unduly short, as the position of these must be adjusted during alignment. Before mounting the assembly in the cabinet, a slot must be cut in the front of the cabinet for access to the wavechange switch, as the photograph shows.

R.F. ALIGNMENT

After checking with a testmeter to ensure that there are no short circuits or other obvious faults, a battery may be connected and the set switched on. Since the i.f. stages are already aligned, with the exception of the i.f. transformer preceding the diode, the local station should be audible at fair strength. Alignment can therefore begin by peaking i.f.t.1 core. R.F. alignment is carried out first on the medium wave, by adjusting the aerial and oscillator inductances while tuning a station at the low-frequency (longer wavelength) end of the band. A station at the high-frequency (Luxembourg) end is then selected, and maximum volume obtained by the proper setting of the trimmers mounted on the

—continued on next page

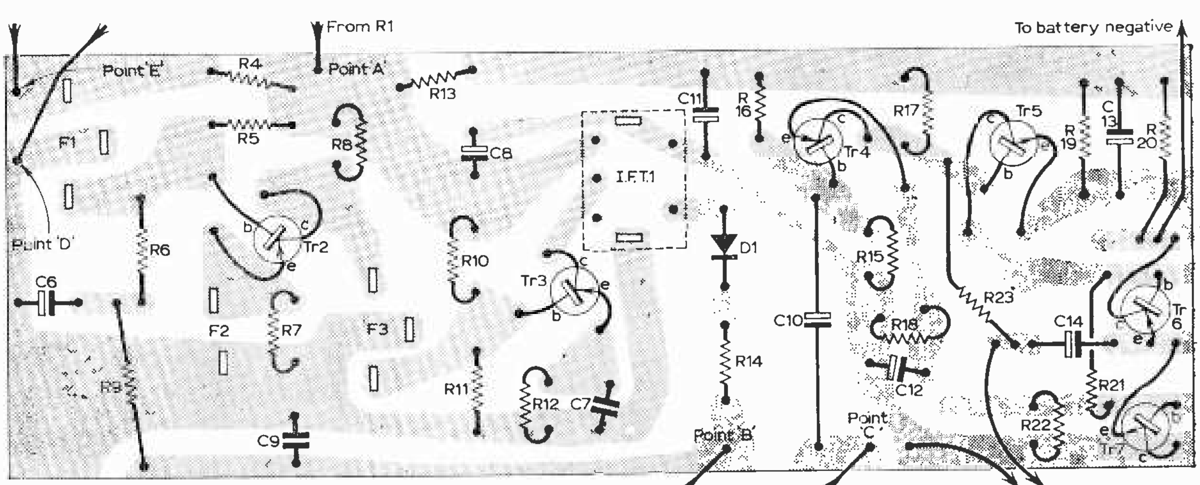

Fig. 6: Layout of the i.f. and audio printed circuit board.

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tuning capacitor. For perfect alignment the aerial coil and oscillator core may be rechecked. Since only the BBC Light programme is of interest on the long waveband, the oscillator trimmer and the aerial coil were considered to provide sufficient adjustment for this band. If the medium wave alignment was properly carried out, this programme should be immediately audible, and maximum volume is achieved using the above components, without touching those which affect performance on the other band.

★ components list

Resistors:

R1	56kΩ	R13	1kΩ
R2	10kΩ	R14	560Ω
R3	2·2kΩ	R15	10kΩ
R4	3·9kΩ	R16	47kΩ
R5	39kΩ	R17	3·3kΩ
R6	3·9kΩ	R18	1kΩ
R7	2·2kΩ	R19	470Ω
R8	2·7kΩ	R20	270Ω
R9	3·9kΩ	R21	100Ω
R10	22kΩ	R22	1kΩ
R11	4·7kΩ	R23	150kΩ
R12	2·7kΩ	All 10% ¼W min.	

VR1 5kΩ with switch, edge operated, e.g. Henry's Radio type VC200

Capacitors:

C1	68pF silver mica
C2	0·01μF ceramic
C3	170pF silver mica
C4	0·01μF ceramic
C5	200pF silver mica
C6	8μF 3V electrolytic
C7	0·05μF paper
C8	100μF 10V electrolytic
C9	0·01μF ceramic
C10	4μF 3V electrolytic
C11	30μF 6V electrolytic
C12	30μF 6V electrolytic
C13	100μF 10V electrolytic
C14	100μF 10V electrolytic
TC1	0/60pF trimmer
VC1/VC2	Plessey 190 + 190pF tuner with trimmers

Semiconductors:

TR1	AF117	TR4	OC71	TR7	AC127
TR2	OC45	TR5	AC127	D1	OA81
TR3	OC45	TR6	OC81		

Transfilters:

F1, F3 TO–02D F2
TF–01D (Brush Clevite Co. Ltd)

Miscellaneous:

T1 MW/LW ferrite rod aerial, T2 10mm. square 6-pin oscillator coil, I.F.T.1 3rd i.f. transformer (Henry's Radio Ltd., Edgware Road, London. Components as in their "Regent-6" radio kit).

Wave change switch, 2-pole, 2-way, min., slider, loudspeaker, 35Ω, 2½in., aerial clip, earphone socket, battery clip, nuts and screws, cabinet and dial.

The reader will realise that this is not a set recommended as a first attempt for the beginner; neither is it to be regarded as a quality "hi-fi" receiver, but rather as a test and experimental unit to gain experience with unfamiliar components, both as regards assembly and in general use. As such, the writer feels that it is a worthwhile project, and would make the following assessment of the finished receiver. Sensitivity, while as good as that of any comparable pocket portable, was not as outstanding as one would expect from the quoted insertion loss figures for the Transfilters. However, they really proved their worth for selectivity. On the long waveband, the Light programme came in with the precision of tuning that one associates with a medium wave station, while in the evening the usual confused babble of stations around 200 metres was incisively cut through. As for quality, the simple output stage and small loudspeaker do not provide a fair test, but on making tape recordings from the diode detector stage, very satisfactory results were obtained. In conclusion, the author would like to thank the Brush Clevite Company Limited, manufacturers of the Transfilters, for information and co-operation received. ■

repairing radio sets

—continued from page 184

polythene spacers may be used (the dielectric constant thus obtained enabling a physically smaller capacitor to be constructed).

With these devices, as with compression trimmers that employ thin slips of mica, it is important that the dielectric is not chipped, bent or otherwise damaged. Replacing these insulating chips with another material (the ubiquitous polythene bag has possibilities!) may then require re-setting of the trimmers and padders to regain correct calibration and tracking.

Gordon J. King has discussed the techniques of alignment in Part 3 and at this point we need not pursue the matter.

★ AERIAL SECTION

As a final note, the aerial section of the average receiver consists nowadays of coils wound on a ferrite rod or slab, giving fairly broad tuning, their position on the rod providing a point of maximum gain. The danger points are always the lead-out wires. These are very fine, usually enamelled and perhaps covered as well. When they break it is often an advantage to repair at the coil end, taping the joint to the rod or coil former and allowing the strain to be taken by the new lead—not the original fine wire.

More will be said about this, and the types of switch and control component used in smaller sets when we discuss the repair and adjustment of portable receivers.

To be continued

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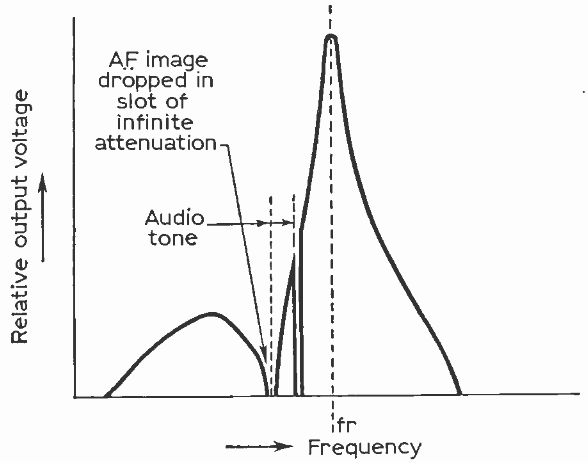
SINGLE SIGNAL RECEPTION

J. O'HARE



FOR maximum response from any receiver, all stages should be in tune, i.e.: r.f., i.f., and b.f.o. By the method described here this can be achieved easily and speedily for any desired frequency, involves only one movement—the main tuning dial—and ensures that each time the receiver is "spot on". It is a method used by all professional radio operators throughout the world and is called "single signal reception".

S.S.R. is a method of tuning a receiver by listening for a predetermined tone output. When at anytime this predetermined tone is heard, it is immediately known that the receiver is "on tune" in every stage in the set. In the initial setting up of the receiver the b.f.o. is off-set by an amount equal to the required tone so that the signal received must be at intermediate frequency in the i.f. stages and hence receiving maximum response.

All too often one picks up a radio journal and reads an article on the subject which states something like. . . . " . . . . and if the signal should drift, follow it down with the b.f.o. . . . ." or " . . . . search with the b.f.o. . . . ." This is wrong! The beat frequency oscillator is not a fine tuner. When your receiver is properly set up, the b.f.o. control should never be touched! If it is, you will be upsetting the output response curve, thus lowering the gain and therefore reducing signal strength of those already too weak and coveted DX stations.

AUDIO FREQUENCY IMAGE

Enthusiasts fresh to radio and lacking experience, sometimes unknowingly tune their receiver to the audio image and attempt copy.

The difference between the resonant signal and the audio image in terms of readability and signal strength is a staggering amount and is only appreciated when one has learnt to discriminate between the two.

In technical terms the audio frequency image is a frequency 2kc/s off tune in the i.f. stages at intermediate frequency. Let us take an example. If we wish to tune our receiver to WWV on 10Mc/s and our i.f. is say 500kc/s, our b.f.o. should be 499kc/s. We have:—

R.F.	L.O.	I.F.	B.F.O.	A.F.
10000kc/s	10500kc/s	500kc/s	499kc/s	1kc/s

Now if our receiver is tuned to 9998kc/s in mistake for 10000kc/s we have:—

R.F.	L.O.	I.F.	B.F.O.	A.F.
9998kc/s	10498kc/s	498kc/s	499kc/s	1kc/s

In other words we have a signal identical to the required one but 2kc/s off tune in the i.f. stages and not giving maximum response.

This effect is known as the audio image and can easily be demonstrated by taking the main tuning dial through any c.w. signal past the zero beat and up through the other side with the crystal filter in circuit.

The advantages of single signal reception are speedy and accurate tuning. Also, no interfering signal can give you the exact same tone output as the required signal tuned to resonance, therefore the interfering signal has a weaker response and consequently a weaker gain.

SETTING UP

Before you commence work the receiver should be set up initially as follows:—

(1) Switch receiver to its highest range and set main dial around say 25 to 30Mc/s with only background noise in the headphones.

(2) Switch to narrowest selectivity. This brings the crystal filter into circuit.

(3) Zero beat the b.f.o. with the noise in the i.f. stages. This will be noticed as a "hole" in the noise or a drop in intensity. The b.f.o. is now at intermediate frequency.

(4) Still in the narrow selectivity position switch the receiver to a lower range and with the main dial find and zero-beat any strong signal. The receiver is now at resonance in all stages.

(5) Now off-set the b.f.o. control to the required tone of your own choice.

(6) Using the main tuning dial go down through the dead-space and up the other side until the audio image is heard; this is a regional tone but weaker. If the receiver is fitted with a phasing control eliminate the a.f. image. A word here to the novice; in some receivers such as the HRO series, the phasing control is external. In practice it is also used to eliminate unwanted interfering stations 0·3 to 3kc/s above and below resonance.

Other receivers (such as the AR88 etc.) have the phasing control internal and it is preset by trimmer adjustment; this comes into circuit with the crystal filter at selectivity 4 (1·5kc/s). The audio image could be eliminated by having such good selectivity in the i.f. stages that it receives no response at all, but in practice this has not yet been realised.

The receiver is now set up for single signal reception providing the b.f.o. control and phasing control are *not*, repeat *not*, moved. ■

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West Kent Courses

Readers living in the West Kent area may be interested to hear of our radio and electronics courses. From September 1967 until July 1968 we shall be running full time radio and television servicing and electronics servicing courses to intermediate City and Guilds/ETEB Certificate level. Applications can be considered from prospective students residing outside Kent.

M. D. Turner. West Kent College, 88 Grosvenor Road, Tunbridge Wells.

9 to 5 Ham

One of my pet grouses concerns amateur licences. During the course of my work I am fully competent to be trusted with the use of v.h.f. radiotelephone equipment with a range of up to 35 miles under favourable conditions. As a member of the AA, I could also enjoy the facilities of two-way radio—albeit at a fee.

Yet, as simple me has failed the RAE twice, I am denied the pleasure of ham radio. Where is the sense in it all? I only hope that my third attempt at the RAE may prove more successful. Meanwhile it looks as if I'm confined to v.h.f. 9 to 5!

T. Hawker. Southmead, Bristol.

Unimportance of Transistors

Edwin King (P.W. April '67) seems to be having trouble with his transistors. I used to worry unduly once, but now I find the best way round this trouble is put in any old transistor, using sockets in the experimental set-ups, and gradually increase the voltage to the stage under development, whilst monitoring the current in the collector circuit. One can get quite a good idea of what's going on, and even save a semiconductor from destruction. There is, by the way, quite a good transistor equivalents book by R.C.A. It is not cheap, but it is very helpful.

In actual fact, it's really extraordinary how similar any given type of transistor (r.f. a.f. etc.) of one make is to its equivalent of another make; this sounds Irish, but I'm sure Edwin King will get my point. It's only when we soar into the v.h.f. and u.h.f. regions that we find we have to get the right transistor . . . or else.

I'd like to see a nice "one square Hertz" on my scope screen. Teenagers really would take me for a nut, if I said he was a square.

Hugh Wagner. Kuala Lumpur, Malaysia.

NEWS AND..

P.W. AND P.TV. FILMSHOW 1967

The Chairman, Mr. W. N. Stevens, opened the meeting and introduced members of the *P.TV.* and P.W. editorial team to the audience. He explained the problems of catering for a wide variety of interests and a wide range of technical levels among readers of both journals. He then introduced Mr. S. L. Johnson who spoke of the market research he is undertaking in order to provide the editor with facts and figures to add to the pool of knowledge as to reader requirements.

Mr. I. Nicholson then introduced the Mullard film "Electrons in Harness"—in essence a tour around the Mullard Research Laboratories outlining the programmes of development now being undertaken. After the film, and a break for refreshments, during which readers had an opportunity to meet fellow enthusiasts, Mr. Nicholson delivered a lecture on "Transistors in Television".

He outlined the advantages and disadvantages of the use of transistors in television circuitry, explaining that it was because of their greatly improved noise performance at u.h.f. that transistors first entered the television field, of necessity in the u.h.f. tuner. The four main stages in a transistorised TV receiver which had presented design problems, were the tuner, the video output stage, the line output stage and the power supply. Mr. Nicholson said that these difficulties had been presented because, until recently, they simply had not had suitable transistors to fulfil these requirements.

In conclusion, Mr. Nicholson said that there was little doubt that the use of transistors in colour television would move faster than in monochrome. The stages in a colour receiver from the decoder system right up to the colour difference (chrominance and luminance output stages would be transistorised also. He said that on average the colour set would utilise fifteen transistors in addition to the eleven or so in the tuners and i.f.'s. So, with monochrome sets having several diodes, eleven transistors and seven or eight valves, the colour sets would have rather more diodes, twenty-five transistors (instead of eleven) and probably ten valves (instead of seven or eight), so it should now be obvious to everybody that as far as television was concerned, transistors were definitely IN.

Picture shows Dennis Rookard from Radio New York Worldwide interviewing Mr. I. Nicholson (centre) and Mr. W. N. Stevens, the Editor.

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...COMMENT

HIGH PERFORMANCE 'SCOPE

The Solartron Electronic Group, Farnborough, Hampshire, has introduced a new high performance solid state portable oscilloscope. Called the CD 1642, it weighs only 22 lb. and has a screen area of 6 x 10cms. Operation can be from mains, external d.c. 12—30V or from an internal battery. UK selling price is £299.

RADIO NEW YORK WORDWIDE BACK ON AIR!

After eight days of radio silence due to a fire which destroyed its transmitters, Radio New York Worldwide's international outlet, WNYW resumed operations on Monday, 17 April 1967 with broadcasts to Western Europe in the English language on 21·530, 17·845 and 15·440 Mc/s from 1800 to 2100 GMT daily.

With full-time operations now being planned for the near future, Radio New York Worldwide will operate on this provisional schedule until further notice.

DXing Worldwide . . . Radio New York Worldwide's special programme for the international listener interested in news as to what stations are being heard in his area, features dealing with the world of international radio, electronics and technical news can be heard at 2030 GMT on 21·530, 17·845 and 15·440.

CARDIN DESIGNS A TRANSISTOR RADIO

Pierre Cardin, Paris fashion designer has set a new trend—in transistor radios! He has designed a new set—the Civic—made to be worn rather than carried.

The set was produced as a result of international co-operation between France as represented by Cardin; Civic, the British electrical retailing group and Mitsubishi, the 3,000,000,000 dollar a year Japanese manufacturing complex. The result is a pocket-sized m.w.7-transistor receiver weighing only 7oz. and measuring $3\frac{3}{8}$ x $1\frac{3}{4}$ x $3\frac{3}{8}$in. which should sell at about 6 guineas.

It is housed in a green case with gold trim and there is a space for personalising the set with the owner's initials. It has a small cord attached enabling it to be hung from a belt or a lapel.

THE LATEST HEATHKIT CATALOGUE FROM DAYSTROM

Daystrom Ltd., Gloucester, announce their latest catalogue 87/2. The new models featured in it include the a.m./f.m. Stereo Tuner, model AFM-2 which matches the styling of the AA-22U amplifier, and the new American s.s.b. models consisting of the SB-101 Transceiver, SB-301 Receiver and SB-401 Transmitter. In addition the HW-12A and HW-32A restyled transceivers are featured. Copies of the catalogue are obtainable free, from Daystrom at the above address.

Chance of Success

A kit is sold to amateurs on the basis that it will make a functional radio if parts are assembled with the necessary care. If parts are missing or if any component is defective or outside tolerances, the kit will not produce the object it was sold to the customer to make. Surely the reverse of *caveat emptor* applies here, for the amateur cannot be expected to test components. The position is different if any part of the construction has been attempted, for the goods will have been materially altered.

A kit I recently purchased contained small components which the supplier stated had been "batch tested" only. The standard reached in the tests was not disclosed, but using the conventional formula $P = x^n$, where P is the probability of making a defect-free set, x is the batch-test good proportion and n is the number of components in the set, then the following table is obtained:

% good components in batch-test sample	% probability of set being defect free
Over 99·9	Certainty
99·9	95·5
99·0	60
98·0	36
97·0	22
96·0	12
95·0	8
94·0	4·5
Below 94·0	No chance at all

n=50 in the table, since this is the minimum number of components in a transistor superhet radio set.

Who would buy a set with the assurance of only a 60% chance of success? What are the normal batch-test results like? A star system, like that for petrol, now that BS4040 is in use, should be employed. In this case, packets of components for kits would bear stars giving a grading for the range of the first per-cent of defectives found in batch tests. The 99 rating could be omitted completely!

Since the above grading system would be too fine for some kits, it clearly pays to examine the components before starting assembly and to query even one defect. The Sale of Goods 1893 Act is almost sure to be on the purchaser's side.

R. B. Anderton. Blackheath, London, S.E.3.

Topband Transceiver

With reference to my topband transceiver (P.W. March, 1967), I have found a vast improvement in speech quality by connecting a 33pF capacitor between the diode and the v.f.o. tuned circuit. The capacity of the diode by itself is not really sufficient.

T. Simon. St. Albans, Hertfordshire.

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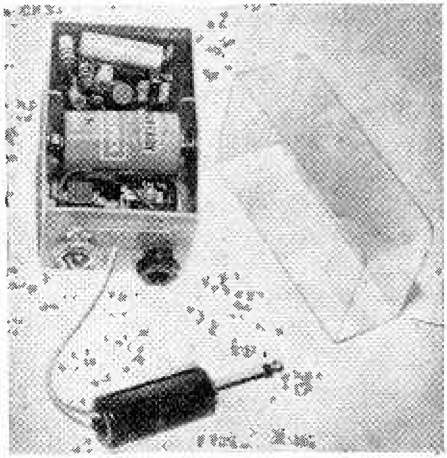
in-line audio AGC unit

L. McNAMARA B.Sc.



★ components list

Resistors:
R1 47kΩ
R2 10kΩ
R3 6·8kΩ
R4 2·2kΩ
R5 1kΩ

Capacitors:
C1 32μF, 6VW
C2 32μF, 6VW
C3 32μF, 6VW
C4 250μF, 6VW

Semiconductors:
Tr1 OC81D   Tr2 AC127   D1 OA79
(or equivalents)

Miscellaneous:
T1 4·5:1 miniature transistor interstage transformer; jack socket; switch; circuit board; etc.

READERS familiar with semiconductor radio circuits will know that the gain of an amplifier stage is dependent on the biasing of the various transistors. In the standard superhet circuit, the diode following the final i.f. transformer performs a dual function. When an amplitude modulated, high frequency signal enters it, the negative-going half of each cycle is blocked, while the positive-going half passes through, to develop a proportional voltage across the load. This is usually the volume control, see Fig. 1. The amplitude of this voltage at any moment corresponds to the audio signal modulating the distant transmitter, but there is also a d.c. component generated.

Since only positive-going half cycles are passed by the detecting diode, it follows that the time average of the voltage across the volume control will be a d.c. which is positive with respect to the earth line. (In this discussion, it is assumed that the usual p-n-p transistors and positive earth line are employed, as illustrated in Fig. 1.) This d.c. component as filtered out and smoothed by R2, C1 and C2 (cp. the smoothing circuit of the standard h.t. power supply) has a voltage dependent on the power of the r.f. signal received by the set. If, then, the potential divider supplying the bias to the first i.f. amplifying transistor is connected between the decoupled negative line and this smoothed positive d.c. source, rather than between the negative line and earth, it follows that when a more powerful signal is tuned in, the base will go more positive and the transistor will be biased nearer cut-off. The gain of that particular amplifier stage will therefore drop. This is the whole point of an a.g.c. circuit—to reduce the difference in the signal as delivered to the audio amplifier when stations of significantly different powers are received. Otherwise, if the set were made sufficiently sensitive to receive the weaker signals, it would be seriously overloaded, with resultant distortion, when tuned to a local transmitter.

The same problem arises with audio systems. If one tries to tape a discussion, it is usually necessary to adjust the gain control each time a speaker nearer or further from the microphone wishes to come in. A similar problem arises with public address systems in halls. It is almost comparable to the operation of one of the earlier t.r.f. radio receivers, in which it was necessary to tune the band with one hand on the tuning knob and the other on a reaction or r.f. gain control! Prompted to some extent by a recent PRACTICAL WIRELESS article (H. W. Hellyer, July 1966), the author decided to investigate an add-on unit that would give existing p.a. systems or tape recorders an automatic gain control feature (now available on a few models.) For convenience, the unit should require no adjustment once built, otherwise it would confer no advantage over the normal manual gain control, but would simply receive the output from the microphone, apply the automatic amplitude limitation, and pass the resulting signal into the recorder or amplifier in the normal manner. It was also required that the quality of the reproduction would be, as far as possible, unimpaired, unlike the "clipper" type of limiter, which changes the shape of the input waveform, and, though satis-

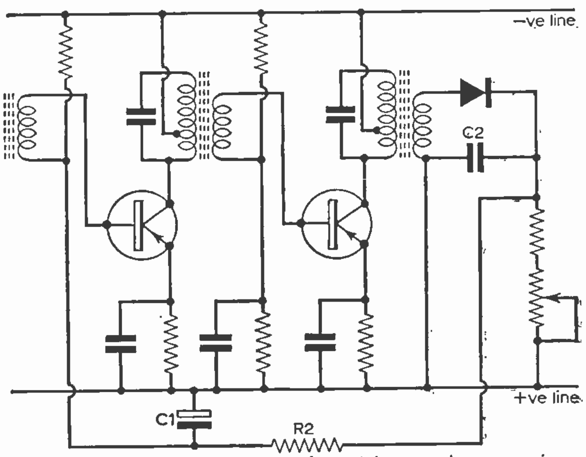


Fig. 1: Typical a.g.c. system found in transistor receivers.

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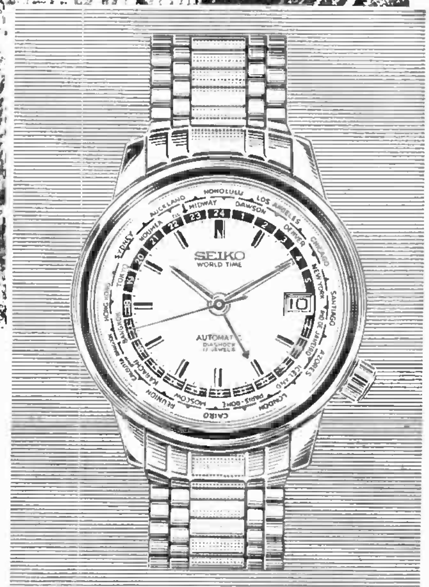

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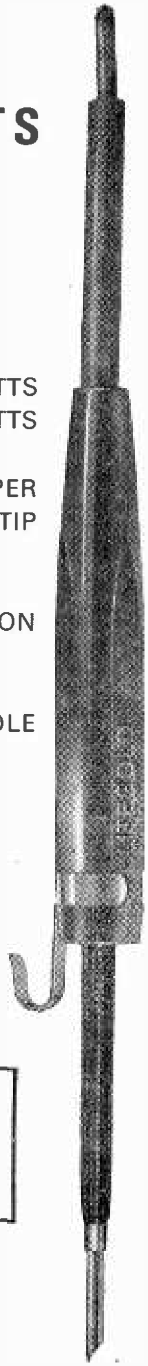

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1μF	10 volt	4μF	4 volt	16μF	30 volt	64μF	10 volt
1μF	15 volt	4μF	12 volt	16μF	150 volt	64μF	40 volt
1μF	40 volt	4μF	25 volt	20μF	3 volt	100μF	3 volt
1μF	50 volt	4μF	100 volt	20μF	6 volt	100μF	6 volt
1μF	350 volt	5μF	6 volt	20μF	9 volt	100μF	10 volt
1·25μF	16 volt	5μF	25 volt	20μF	15 volt	100μF	12 volt
2μF	3 volt	5μF	50 volt	25μF	6 volt	100μF	15 volt
2μF	9 volt	5μF	70 volt	25μF	12 volt	150μF	12 volt
2μF	10 volt	6μF	12 volt	25μF	25 volt	150μF	25 volt
2μF	15 volt	6μF	15 volt	25μF	30 volt	200μF	3 volt
2μF	70 volt	6·4μF	40 volt	30μF	6 volt	200μF	4 volt
2μF	150 volt	8μF	3 volt	30μF	10 volt	200μF	16 volt
2·5μF	16 volt	8μF	6 volt	30μF	15 volt	250μF	2·5 volt
2·5μF	25 volt	8μF	50 volt	32μF	1·5 volt	250μF	9 volt
3μF	3 volt	10μF	6 volt	32μF	25 volt	250μF	15 volt
3μF	12 volt	10μF	10 volt	40μF	3 volt	320μF	2·5 volt
3μF	25 volt	10μF	12 volt	40μF	6·4 volt	500μF	4 volt
3·2μF	6 volt	10μF	25 volt	50μF	6 volt	640μF	2·5 volt
3·2μF	6·4 volt	12·5μF	4 volt	50μF	9 volt	750μF	18 volt
3·2μF	40 volt	12·5μF	40 volt	64μF	2·5 volt	1000μF	6 volt

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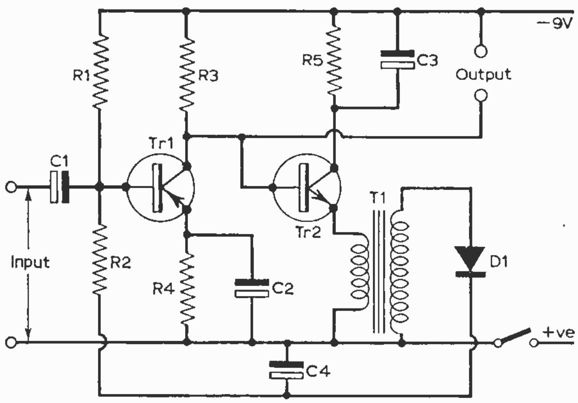

Fig. 2 (above): Circuit of the in-line audio a.g.c. unit.

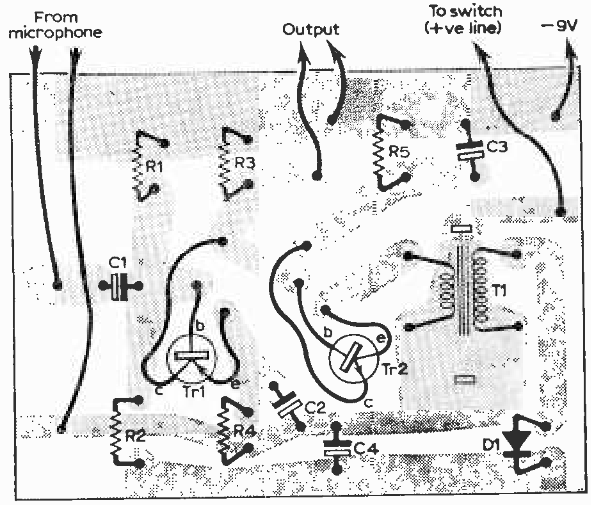

Fig. 3 (right): Printed circuit board layout and component position information. Note: the polarity of C4 is correct.

factory for amateur transmitters, is obviously unacceptable where more than intelligible speech is wanted.

Figure 2 shows the circuit ultimately evolved, and a comparison with the radio type of a.g.c. circuit brings out its most important features. The first transistor, Tr1, is used as a normal common-emitter amplifier, if we ignore for the moment the variation in the bias supply. It develops an amplified output across R3, which is taken to the main amplifier. However, Tr1 and R3 also form the potential divider supplying the base bias of Tr2, as well as applying to it the amplified signal from Tr1. Tr2 is an n-p-n transistor, also operated in a common-emitter amplifying mode. The primary of the transformer T1 is the load in which the output of Tr2 appears. If the signal is regarded merely as an alternating current, it may be pointed out that in the secondary of T1 there will be an induced alternating voltage whose amplitude depends on that of the microphone output. D1 then simply converts this into a d.c. positive supply, just as in the case of the a.g.c. circuit discussed earlier. Its application to the bias circuit of Tr1 with the resulting effect on the gain of this transistor, is obvious.

The smoothing components, however, deserve closer attention. In the case of the radio receiver, the volume control is paralleled by a small capacitor. This component is insufficient to smooth the fluctuations across it completely, but serves merely to turn the series of half-cycles of i.f. passed by the diode into an even audio signal. C1, following later, smooths the d.c. component, to provide the bias supply to the i.f. amplifier. In the audio a.g.c. circuit, on the other hand, all signals are at the same frequency, and the problem is rather to design the circuit to average the signal over a sufficiently long time. The biasing resistors and C4 form a network with a fixed time constant. Should this time constant be too short, transient peaks such as sudden crescendos in music, will be suppressed. However, if it is too long, the amplifier will be overloaded for a noticeable period before the automatic reduction in gain becomes effective. The values given in Fig. 2 were found satisfactory in practice, realistic presentation of musical passages is achieved, since the device does not eliminate those rapid variations in loudness which give music life, but rather adjusts over a period of some seconds to accommodate changes in the general volume level.

Before proceeding to describe the actual construction of the unit, it is necessary to point out that, as transistors used in the common-emitter mode have a much lower input impedance than valves, there will be a serious mismatch if a high-impedance crystal microphone, as supplied with many tape recorders, is employed, resulting in a great loss of sensitivity. This circuit is a satisfactory match only to magnetic microphones, and if the reader wishes to use a crystal microphone, it will be necessary to insert a matching transformer between the microphone and the a.g.c. unit or drive the unit through a common-collector (emitter-follower) preamp.

Figure 3 shows the pattern of the conductors on the etched circuit board used in the prototype, though the reader may have to modify it if he requires a preamp as mentioned earlier, or is forced to use a larger (or smaller!) transformer. Production of etched boards is an operation familiar to regular readers, involving the application of a protective layer of cellulose paint to those areas of the copper foil on the paxolin circuit board which are to be retained as conductors, after which the unwanted remainder is etched away by soaking for some hours in a concentrated solution of ferric chloride. The components are then mounted through

TABLE 1: TEST RESULTS OF THE AUTHOR'S PROTOTYPE

Input amplitude (mV)	0	4	6	8	10	12	14	16	18	20	40	60	80	100	120	140	160
Output (volts) ..	0	·03	·06	·16	·22	·28	·34	·38	·41	·44	·53	·54	·54	·54	·54	·54	·54
A.G.C. (volts) ..	0	0	·04	·08	·14	·20	·27	·34	·41	·47	·77	·90	1·00	1·10	1·16	1·21	1·27

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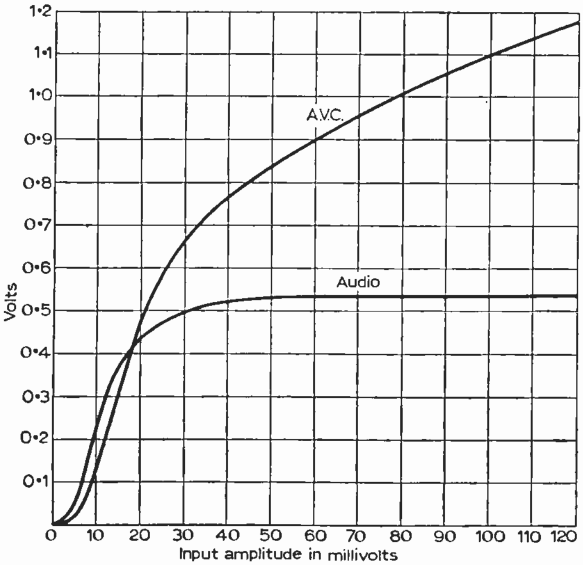

Fig. 4: From this graph it can be seen that inputs within the range 30 to 120mV give an almost constant output.

holes drilled in the panel and their terminal wires soldered carefully to the conductors. Care must be taken with the polarity of the capacitors—that shown for C4 is not an error, remembering the explanation given of the operation of the rectifying diode D1.

The case used to contain the unit will depend on the application to which it is put, the materials available, etc., but for the reader's guidance the prototype is illustrated. A neat and professional appearance was achieved by building it, with its on/off switch, input jack socket, and battery (a PP4) into a plastic container supplied as a storage box for colour slides.

In operation, the unit is connected to the microphone and tape recorder, and switched on. The average recording level is set in the normal way using the gain control and observing the deflection of the meter or closing of the tuning indicator. From then on, the unit operates to maintain the amplitude of the recording signal at this level. The difference in the recording is easily observable, and not the least attractive feature is the degree of pre-amplification accorded.

The graph, shown in Fig. 4, is the result of a test-run on the prototype. A 400c/s audio tone was fed into the unit from an Advance type H1 calibrated audio signal generator, and for each setting of the input level, the r.m.s. value of the output voltage and the a.g.c. line d.c. voltage were read on a Heathkit model V7A valve voltmeter. The actual results are given in Table 1. For the determination of the a.g.c. voltage developed, the meter was set at zero for quiescent conditions, so that the occurrence of the small negative voltage across the diode is not indicated in the table. The graph indicates that, with inputs of between 6 and 18mV from a 600Ω source the output has a linear relation to the input, but for higher inputs, the output amplitude tends towards a constant value. The a.g.c. voltage, on the other hand, continues to rise, levelling off only with inputs of the order of 200mV. The fact that, over a wide range of input levels, the gain of the unit falls off with increasing amplitude, is obvious. ■

SIMPLE STABILISED POWER SUPPLY

—*continued from page 195*

Higher current demands will require a new transformer having the requisite current capacity. Also, the series regulator valve will need attention, and here the simplest course is to add further valves in parallel with the existing valve, as in Fig. 6. The series valves are connected effectively in parallel, separated only by additional anode, screen and grid stoppers. As the *gm* of the valves are additive, the additional gain is very high and instability has to be guarded against. The use of stoppers wired hard up against their respective valve tags, and the avoidance of long straggling leads should prove satisfactory.

Different Outputs

Output voltages that differ from the prototype will require a suitable transformer and, possibly, a change in the values of R9 and R10, bearing in mind the remarks made earlier about the deterioration in the stability if R9 and R10 are incorrectly selected. In order to increase the output voltage, R9 will have to be decreased in value, allowing V3 grid to be made more positive with respect to its cathode. A decrease in terminal voltage will require a reduction in the value of R10, allowing the grid of V3 to be made more negative than its cathode.

Conclusion

In conclusion a few words about the series regulator valve, V2. Almost any high power valve can be used in this position. A 6L6 valve was used in the prototype because it was to hand. Direct equivalents are the Osram KT66 and the Mullard EL35. An EL34 can also be plugged straight in, but requires pin one, which is its suppressor grid, to be connected to its cathode, pin 8. Pin 1 on the 6L6, KT66, EL35, is not connected to any electrode. Pin 6 on these valves has been omitted and has been used as a tie point for R3. With a change of base to UX5 the 807 can be used but, as it has a top cap anode, an anode suppressor having a value of 22Ω must be regarded as essential. In order to be effective, it must be soldered as close to the connector as possible. Among the B9A based valves, the line output valve EL81, would make an excellent choice. This too has a top cap anode and requires an anode stopper of about 22Ω. A single 6L6, EL34 or 807, could be replaced by a number of B9A based EL84's or N709's but, as this valve already has a high *gm* the risk of instability is very much greater if more than three or four valves are paralleled. Stoppers must be fitted in every anode, screen and grid, and the anode and grid wiring kept well apart. As far as the rectifier is concerned, ensure that its voltage and current ratings are adequate and that it has a heater that can be run off the same winding that feeds the series regulator valve.

It is difficult to arrive at an accurate estimate of probable cost since much depends on the individual's spares box and on what he can beg or exchange. Assuming that surplus valves, purchased from a reputable dealer, are used with new components, the total cost should not exceed £7. ■

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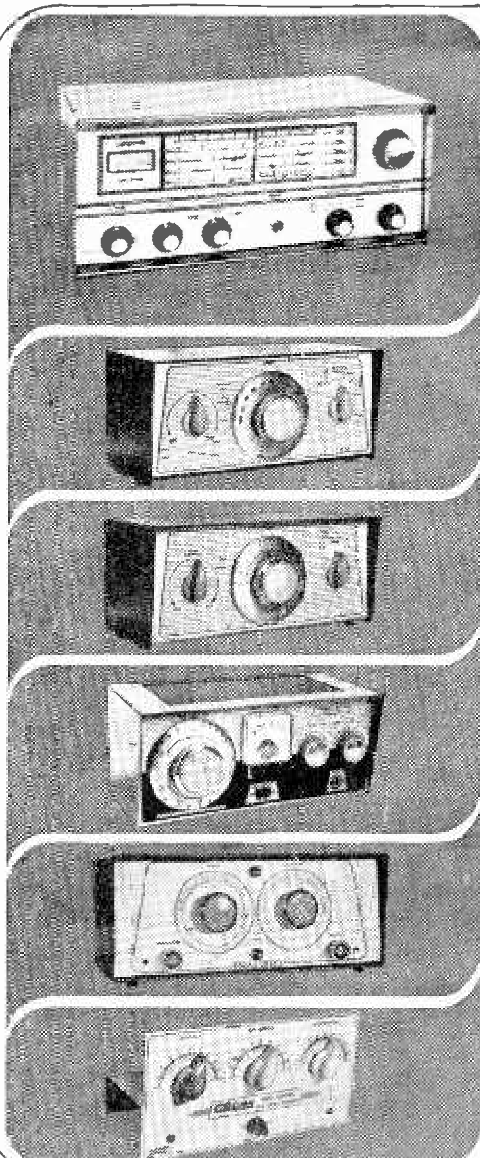

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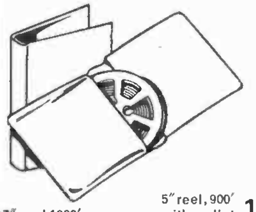

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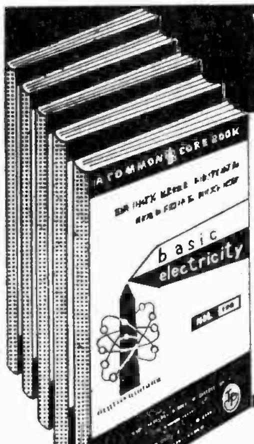

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practically wireless commentary by HENRY

No. 35

Come now — fair play

WEARING one of his other hats, Henry is required on occasion to answer readers' queries. And what a mixed bunch of perplexing posers these turn out to be.

"I have a Super-Fi special with Squared-Plus Output Wide Range Speakers", says one trusting innocent, who has read too many advertisements. 'How do I add a stereo decoder?"

How indeed? One could be brutally honest and tell him to scrap the whole arrangement and start again from scratch—but that might lead to the kind of recriminations that end in solicitor's letters from the managing director of Super-Fi Incorporated. One could waste editorial paper in relating the various theoretical dictas on the subject: one could write a minor treatise on stereo—but to what effect? All our innocent wants is a plain direction . . . *connect A to B and X to Y and tune over the band till the bleeps reach a null* . . . To be absolutely blunt, one could refer him to the down-to-earth articles that Gordon King, to name but one, has published in these pages. But our fourpenny stamp would just be wasted.

Come out from behind that manual, Joe!

My heart bleeds for the chap who cries that he cannot get his kit to work. Henry's views on kits have already been aired, yet it must again be said that *"you gets what you pays for."* Some kit suppliers bend over backwards to help the constructor. Having seen their enquiries department in action, this contributor wonders how they ever make a profit. Others are not so accommodating.

This bloke wants to connect a microphone via a mile or two of cheap flex to a high impedance input. That one says he has "low output" on a set whose hazy description would suit practically anything in the catalogue. The next letter gives masses of details about valve voltages, but makes no mention of what constructive tests are being made—we hope that the writer is taking note of the current series of articles on servicing.

Would it be cheeky to hope that some of the servicemen among our readers are also taking note? Yes, you, Joe. Come out from behind that over-sized service manual where you hide your copy of PW, and none of that: "Well, we've got to see what the opposition is getting up to."

Now and again we get the plaintive query from Joe and his mates: "Where can I get a hum-pot for a Sunfire X5?" or can you tell us the present address of Messrs. Fly-by-night, he may ask in desperation. Even using letter-headed notepaper, or, more likely, the firm's order form. He *could* get the information from his public library in many cases, but after all that's what we are paid for, he thinks. Pause for hollow laughter — if Henry worked out the time per letter in research, cross-correspondence, paper, envelopes and stamps to the odd readers who forget to enclose them, plus airmail to the international readers who do not know how to repay us for our kindness, etc . . . the ultimate cost would work out to something quite formidable.

Cry on our corporate shoulder

Then why do it? Why be an Aunt Ada? In moments of depression Henry may echo, "Why, indeed". But, truly, the rewards are great. In chasing for information up one alley, the enquiring mind turns up all sorts of interesting signposts to other alleys. Many an article has germinated from the seed planted by a reader's letter.

One point should be stressed. This letter-answering is spare-time work. Henry is only a small cog in a geared-up team of specialists. Each is a practising engineer. Each probably has more than enough to keep him busy with his daily round. The correspondence tends to mount till one tackles it in an excess of guilt on a convenient wet Sunday. hence the occasional delay. Forgive us our trespasses, Dear Reader; curse us if you like, cry on our corporate shoulder—here, borrow my hanky—ask the impossible, describe the improbable, give voice to the unprintable, but write.

After all, it's the only proof we have that you are reading us!

Sincerely,

Henry, in another hat.

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70cm preamp

by

J. L. OLIVER, G8ANJ

MANY users of the v.h.f. and u.h.f. bands are not satisfied with the equipment they operate, and have at some time or other thought about adding a preamplifier to boost gain. The author of this article has had several previous attempts at building preamps with little success. In fact, they tended to make matters worse instead of better. It is not, however, the case for the one described in this article. The number of QSOs have literally doubled since it was introduced. Stations that were R3, S5 are now coming in R5, S8—9.

DESIGN CONSIDERATIONS

In developing the final circuit a number of design considerations were taken into account. Noise was the most important factor, the author not being prepared to accept anything falling below commercially made wide-band amplifiers. Bandwidth did not create too much of a problem, for the 70cm band is quite narrow (extending from 432 to 434Mc/s). However, the author feels the preamplifier should be adaptable to be used on other bands, especially BBC-2. To this end, coil details for the London BBC-2 transmissions are included in Table 1 along with data for the 2 metre band.

The idea of using valves was rejected for they consume rather a lot of power and their noise figures are no better than (if comparable to) semiconductor devices. Also it makes things tricky should the preamplifier want to be used in mobile applications. Field effect transistors were considered, but their price tags still put them out of reach of most amateurs. When they come down in price, they will certainly be worth considering. So back to the transistor. Several were looked at before the AF239 was chosen: a compromise of price and noise figures. Alternative transistors that will work in the circuit are the AF139 and GM0290. The former is not quite so "hot" as the suggested device and the latter might need some bias adjustment for optimum performance.

A circuit diagram of the preamplifier is shown in Fig. 1. As it can be seen from the diagram, the circuit is conventional, using a common-base configuration. This was adopted to avoid the problems of neutralisation. In the author's opinion, the noise figure is fractionally better using this method—although it may well be at the expense of a little gain.

CONSTRUCTION

The sealed chassis can be fabricated in brass or copper, or can be built into a discarded tin: the author used an old tobacco tin. Aluminium is not suitable for it is almost impossible to solder directly to it.

Once all the holes have been drilled in the chassis (see Figs. 2 and 3), the screen should be soldered into position. The screen can be cut from a small piece of tinplate, brass or copper (even an old piece of printed circuit board will suffice). Care must be taken to leave enough room for the transistor, which lies beneath the screen. The emitter and screen leads of the transistor should go to the input side and the collector and base leads to the output side of the chassis screen.

The next components to be fitted should be the trimmers, feed-throughs and the coaxial sockets. The trimmers may be 1—10pF or 1—5pF for 70cm; provided the range 1—4pF is covered.

The coils can be made by winding $1\frac{1}{2}$ turns of 18 s.w.g. around a $\frac{1}{4}$-in. diameter mandrel: leaving $\frac{1}{4}$in. at the ends for mounting. Silver plated wire can be used, but the improvement is only marginal.

Component interconnections should be kept as short as possible, using only the component leads for the connections. Any positive-earth supply between 9 and 12V d.c. (5mA) will suffice.

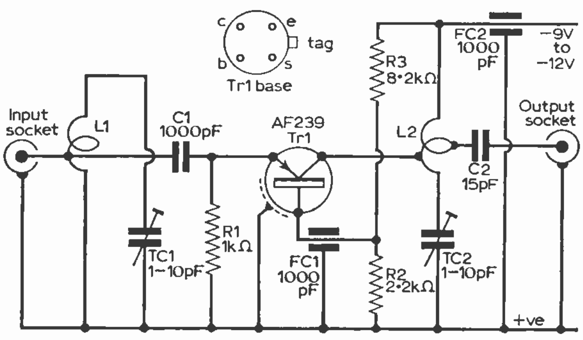
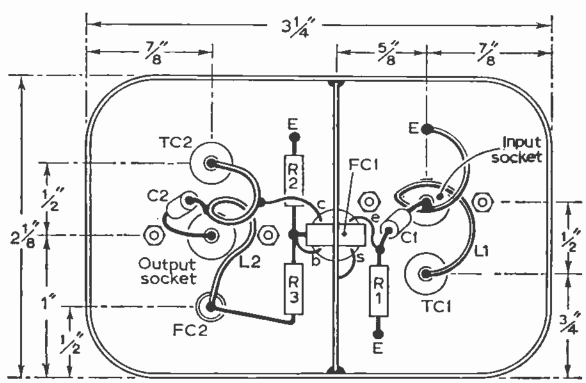


Fig. 1: Circuit diagram of the 70cm preamplifier. An alternative for the AF239 is the AF139.

Fig. 2 (right): Underside view of the preamplifier.



Points marked 'E' are connections to tin box

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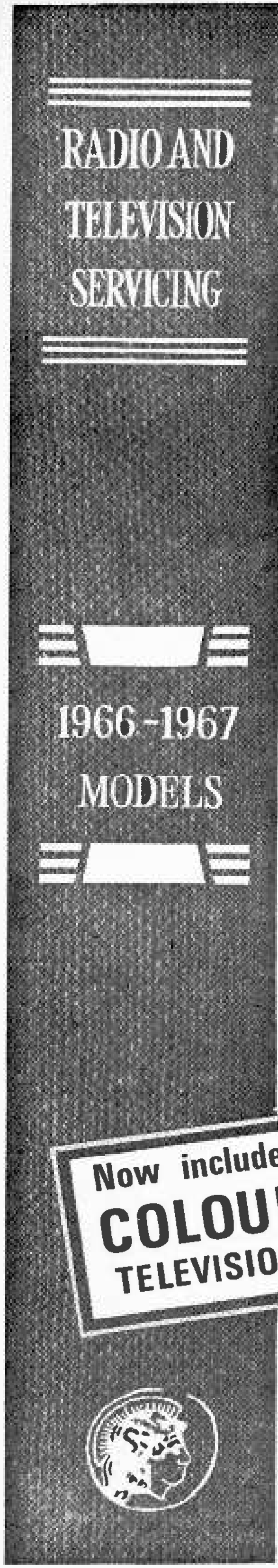

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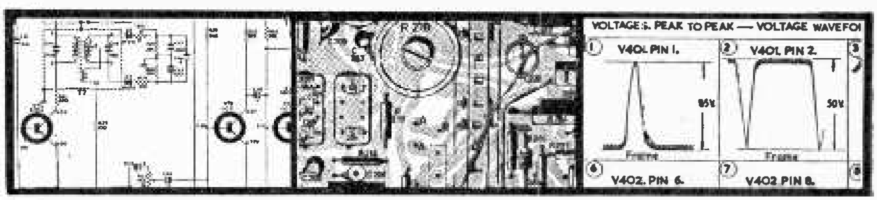

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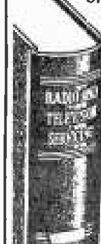

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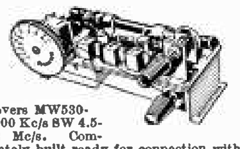

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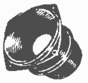

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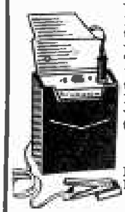

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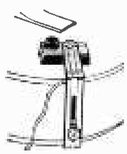

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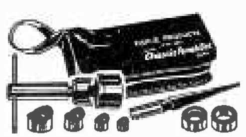

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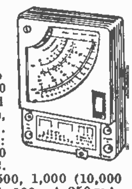

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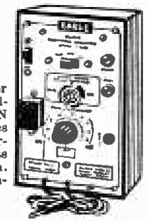

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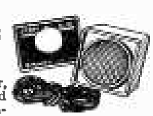

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AF117	5/-	NKT213	6/-	OAZ200	11/-	OC81M	5/-	EL41	8/6	30C15	10/-
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TABLE 1

The preamplifier may be used on any v.h.f. or u.h.f. band provided that the tuned circuits are at resonance. This table details coil and trimmer changes necessary for BBC-2 London and the 2-metre band. 18 s.w.g. is used air spaced, wound on a $\frac{1}{4}$-in. diameter mandrel; taps are from the "cold" end.

	Coils		Trimmers
	L1	L2	
BBC-2 2 Metres	6 turns tapped at 1 turn	6 turns tapped at 3 and 1 turns	0—15pF
(London)	1 turn tapped at $\frac{1}{4}$ turn	1 turn tapped at $\frac{1}{2}$ and $\frac{1}{4}$ turns	0—3pF

ALIGNMENT

Before alignment of the preamplifier can take place, it is necessary to thoroughly warm-up the associated receiver and convertor if they are of the valve type. With the preamp out of circuit, tune in a weak signal using the b.f.o. Now connect the preamplifier and peak it with TC1 and TC2. If this method fails, the stray pick-up of the third harmonic of a 2-metre transmitter may be used. On no account must a strong signal be connected to the preamplifier (direct transmitter connection) otherwise damage may result. Some adjustment may be necessary to the coils, but this was not the case on the prototype.

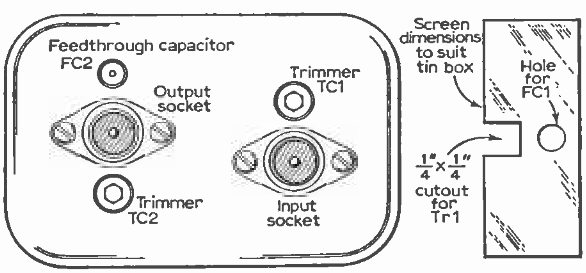


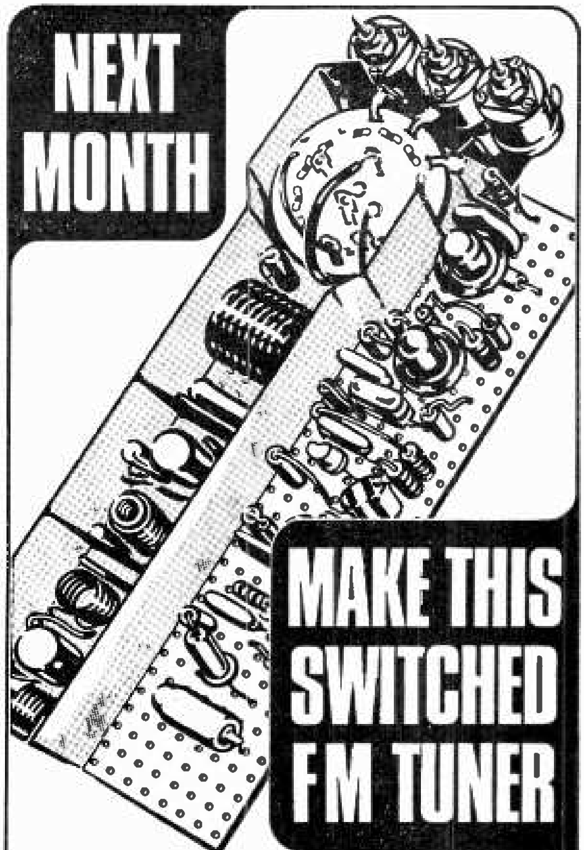
Fig. 3: Top view of the preamplifier, plus the screen.

OPERATION

The preamplifier should not be used adjacent to the convertor (or main receiver if a single superhet) as this could lead to direct feedback causing instability as the gain of the preamplifier is quite high.

Should one wish to use the preamplifier at the mast head, it is a simple matter to adapt the unit for coaxial line powering. An r.f. choke, consisting of six turns of 32 s.w.g. close-wound $\frac{1}{8}$-in diameter, is required from the centre conductor of the output socket to the feed-through FC2.

In some cases it may be necessary to run the unit with a negative earth. To do this, complete inversion of the circuit is necessary. ■



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new books

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EVERYDAY ELECTRONICS
By Thomas Roddam. Published by Harrap & Co. Ltd. 245 pages, 8½ x 5½in. Hard covers. Price 22s. 6d.

THIS book describes how present-day electronic devices work in true Roddam fashion—textbook information presented in an easy-to-read style. Although the book ranges over the whole of the electronics field, emphasis is laid on the familiar radio and television receivers and on the way in which other electronic systems relate to them.

Beginning with a very elementary electrostatic experiment, the book progresses to computers and control; a subject that everyone should be familiar with. Intermediate chapters cover Circuit Elements, Valves, Transistors and Related Devices; Special Electronic Devices; Amplification of Electronic Signals; Oscillators and Modulators; Sound Waves; Television and Picture Transmission; Aerials and Propagation; Magnetrons, Lasers and Other New Devices.

Obviously it is not possible to cover such a wide field comprehensively in the space of one book, but Roddam's treatment of the subject makes compulsive reading for the newcomer; particularly sixth-formers. Mathematics have been kept to a minimum.—*DCR.*

TRANSISTOR CIRCUIT DESIGN AND ANALYSIS
By E. Wolfendale, B.Sc., M.I.E.E. Published by Iliffe Books Ltd. 292 pages, 8¾ x 5½in. Hard covers. Price 70s.

ALTHOUGH this book is aimed to give the professional engineer and the newcomer (undergraduate level) a comprehensive introduction to transistor circuit design and analysis, it may well be of interest to the amateur who wants to do some original work. Theory has been worked out from first principles for most of the equivalent circuits normally encountered in the electronics field. Theoretical equations have been used in the practical design examples so that the reader can see how the component values are selected.

The design examples illustrate the important points of theoretical design analysis for practical designs but, it must be emphasised, they are not for optimum working—for in many cases the examples do not take into account spreads and tolerances. Hypothetical transistors, the characteristics of which are specified, are used in the design examples. It is, of course, possible to find semiconductors having the same characteristics as those used in the examples, but it is not the intention of this work to be a handbook of worked-out designs.

To fully understand the work covered by this book, a fairly high level of mathematics is required. There are nine chapters covering: Characteristics and Biasing; Small Signal Equivalent Circuits; The Large Signal or Pulse Equivalent Circuit and its Application to the Transistor as a Switch; Small Signal Low Frequency Amplifiers; Power Amplifiers; Oscillators; Switching Circuits; and D.C. Amplifiers.

In the preface, the author states that this book has been designed to be used in conjunction with *The Transistor,* and together replace *The Junction Transistor and its Applications.—DCR.*

AUDIO *CONSTRUCTORS* GUIDE

High Fidelity Audio Designs is a new publication from Ferranti Ltd. aimed at the designer and the home constructor. The text deals with design and performance factors of transistor audio circuitry including complete circuits (with full component values and specifications) of various preamplifiers, (from 7 to 150 watts), stabilised power supplies, a tape recording amplifier, a tape playback amplifier, a tape record level indicator, a tape erase/bias oscillator and an f.m. tuner. Performance figures and graphs are provided. All the designs are based on Ferranti n-p-n and p-n-p silicon planar epitaxial transistors.

Although comprehensive data are given with all the designs, the general rule is not to provide physical constructional drawings. However, the end section of the 47-page book covers the construction of amplifiers, a preamp and power supply in a practical way. These units use printed circuit panels which are obtainable from Ferranti Ltd.

All the preamplifiers and main amplifiers described are completely compatible and may be mixed without regard to impedance levels or sensitivities. All amplifiers are transformerless and an attempt has been made to exclude inductance either in the form of chokes or transformers in both large and small signal circuits.

The booklet *High Fidelity Audio Designs* is obtainable free to readers of P.W. from the address given below. The printed circuit boards needed to build the specific hi-fi set-up dealt with as a construction project can also be obtained from the same address at £1 the pair. Write to: Ferranti Ltd., Gem Mill, Oldham, Lancashire.

PRACTICAL TELEVISION

Readers interested in colour television cannot afford to miss the current issue of our sister journal PRACTICAL TELEVISION in which a new colour television series begins. It is written by A. G. Priestley, a development engineer in one of the manufacturing organisations, for those who have a good understanding of black-and-white television and wish to know how the PAL colour receiver works.

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42	5/6
50CD6G	27/6
50L6GT	8/-
53A	7/6
57	6/-
58	6/-
59	6/-
75	5/6
76	5/-
77	6/6
78	5/-
80	5/6
81	9/-
84	5/-
85A2	8/-
210VPT 7-pin	2/6
215SG	6/-
220PA	7/-
220TH	4/-
225DU	9/-
282A	100/-
307A	5/6
310C	25/-
350B	8/-
357A	7/-
368A	5/-
368AS	30/-
393A	27/6
408C	80/-
446A	8/-
703A	30/-
705A	10/-
715B	60/-
717A	3/-
803	22/6
807	8/-
808	8/-
813	75/-
815	35/-
829B	50/-
830B	4/-
832A	45/-
843	5/-
866A	14/-
884	10/-
954	4/7
955	2/6
956	2/-
957	5/-
958A	4/-
1616	3/-
1619	5/-
1625	6/-
1626	8/-
1629	4/6

2051	5/-
4043C	35/-
4313C	20/-
5676	10/-
5678	10/-
5704	9/-
5726	7/-
6060	5/6
6064	7/-
6065	8/-
6080	22/-
6146	25/-
7193	1/9
7475	2/-
8013A	25/-
8020	15/-
9001	3/-
9002	4/6
9003	6/-
9004	2/6
9006	2/6

C.R. Tubes

E450/B/16	28/-
09J	75/-
VCR97	28/-
VCR517	50/-
VCR517B	55/-
VCR517C	60/-
3FP7	45/-
3EG1	40/-
5PC1	30/-
5FP7	25/-
88D	80/-

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G816	12/6
931A	62/6
6097	350/-

Special Valves

ACT6	£8
CV1031	£3.10.0
CV2339	£20
K301	£4
KRN2A	£3.10.0
1B24	25/-
2J22	£2.10.0
WL417A	30/-
3J/92/E	£37.10.0
714AY	£4
725A	£5
726A	19/-

TELEPHONE HANDSET. Standard G.P.O. type; new 12/-. P. & P. 2/-.

AVO ELECTRONIC MULTIMETER TYPE CT 38. AC mains operated 105–125v. & 195–255v, 45–66 c/s. 97 measurement ranges covering DC and AC current, voltage, resistance and power output. Accuracy on DC ranges ±2% FSD. Accuracy on AC ranges ±3% full FSD at 50 c/s. Ranges: DC volts 250mV–10,000V (10M ohms–110M ohms input resistance) DC current 10µA–25A. Ohms: 0–1,000M ohms. AC volts 100mV–250V (with RF measuring head to 250 Mc/s) AC current—10µA–25A. Power output—50µW–5W. Automatic movement protection against overload. Meter reverse, balanced measurement facilities. Complete with all accessories. Laboratory tested condition. £42.10.0. Carriage 15/-.

HAMMARLUND SP 600-JX RECEIVER. Dual conversion superhet. 540 kc/s to 54 Mc/s in 6 bands. Stability 0·01% or better. In as new, laboratory tested condition. Price on application.

"S" Meter for H.R.O. Receivers, Brand new £2.10.0. Carriage paid U.K.

CRYSTALS for H.R.O. in original National Union Housing, 25/-. P. & P. 2/-.

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

INSET MICROPHONE for telephone handset 2/6. P. & P. 2/-.

SPARES FOR A.R.88D. RECEIVERS. Ask for your needs from our huge selection.

CR 150/6 RECEIVER. 2–32mc/s. In 4 bands. Double conversion. Miniature valves. 8 positions 1st oscillator selector, variable band with 100c–13kc built in calibrator, 4kc bandspread, valve metering and signal indicator. Noise limiter, £40. Original P.S.U. £7.10.0. Carriage 20/-.

MOVING IRON METERS

15 VAC	2½" round panel	27/6
500 VAC	2½" round clip fix	25/-

P. & P. all the above 3/- each

MINIATURE METERS

General Electric 1½" round flush, clip mounted: 1mA DC, 22/6; 25mA DC, 20/-; 75mA DC, 18/-; 150mA DC 16/-. P. & P. 3/-.

SUB MINIATURE "PENNY SIZE" METERS

1" round, flush, ring nut mounted 500 mA FDS, Calibrated 0–1 mA, 20/-. P. & P. 3/-.

LABORATORY TYPE VOLTMETERS

160V AC/DC 8" mirror Scale in wooden boxes, 9¼" x 8¾" x 3¼" with carrying handle, brand new, 32/-. P. & P. 3/-.

METERS, 4½" x 4½", 4" long mirror scale panel mounted, calibrated 0–1mA, 55/-. P. & P. 3/-.

32/44FT. AERIALS each consisting of ten 3ft., ⅞in. dia. tubular screw-in sections. 14ft. (7 section) whip aerial with adaptor to fit the ⅞in. rod, insulated base, stay plate and stay assemblies, pegs, reamer, hammer, etc. Absolutely brand new and complete ready to erect, in canvas bag, £3.9.6. P. & P. 10/6.

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

MARCONI SIGNAL GENERATOR TYPE TF144G

85 kc/s-25 Mc/s. Excellent laboratory tested condition with all necessary accessories with instruction manual, £45. P. & P. 15/-.

BOONTON STANDARD SIGNAL GENERATOR MODEL 80. Frequency 2-400 Mc/s in six ranges. A.M., 400 and 1,000 c/s. and external modulation. Provision for pulse modulation. Piston type attenuator, 0·1µV-100mV. Separate meter for modulation level and carrier level. Precision flywheeling. 117v. AC input with instruction manual. £95. Carriage 30/-.

RADIO FREQ.: THERMO-COUPLE METERS

300mA	2½" round panel	25/-
350mA	2" round plug-in	14/6
1 Amp	2½" round proj.	17/6
2·5 Amp	2" square panel	22/6

P. & P. 3/- each

DC MOVING COIL METERS

0-5µA	2½" round proj.	25/-
200µA	2" round panel sealed Calibre-30..	22/6
200µA	3½" round panel	32/6
750–0–750µA	2" round plug-in	20/-
0·1mA	1" round nut fix	22/6
1mA	2½" round clip fix, metal clad ..	27/6
1mA	2½" round panel	30/-
1mA	2" round panel sealed	27/6
1mA	3½" round panel	30/-
5mA	2" round clip fix panel or proj. ..	20/-
5–0–5mA	1½" round panel	17/6
10–0–10mA	2½" round panel	17/6
0–30mA	2½" round panel	17/6
75mA	2½" plug in	14/-
100mA	1½" proj.	17/6
100mA	1½" round panel	17/6
100mA	2½" square panel	19/-
100mA	3½" round panel	25/-
2 Amp	2½" round panel	22/6
5–0–5 Amp	2½" round panel	25/-
8 Amp	2½" round panel	25/-
25 Amp	3½" round proj.	27/6
50 Amp	2½" round panel	27/6
20 VDC	2" square panel	19/-
150 VDC	4" round panel	25/-
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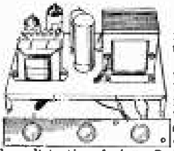
HSL 'FOUR' AMPLIFIER KIT

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 4½in. ● 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).

10/14 WATT HI-FI AMPLIFIER KIT

For super reproduction—see previous advertisements for full details. Kit £7.9.6. Ready built £9.5.0. P. & P. 8/6 each.

BRAND NEW TV U.H.F. TUNER AND SOUND AND VISION I.F. PANEL

By world famous maker. Suitable for use in conversion of TV sets to BBC2 (625 line reception). OFFERED (less valves) AT THE BARGAIN PRICE OF ONLY 27/6. Post paid. (The components are worth far more than our price for the complete unit and due to the very high value we regret that no correspondence can be entered into regarding this item).

MAINS TRANSFORMER. For Transistor power supplies. Pri. 200/240 v. Sec. 9-0-9 v. at 500 mA. 11/-. P. & P. 2/6.

MAINS TRANSFORMER. For transistor power supplies. Tapped pri. 200-250 v. Sec. 40-0-40 at 1 amp (with electrostatic screen) and 6.3 v. at .5 amp for dial lamps etc. Drop thro mounting. Stack size 1½ x 3¾ x 3½in. 27/6. P. & P. 4/6.

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

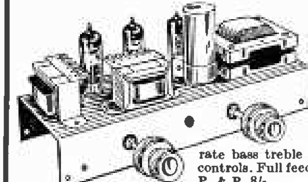
7-10 watt **OUTPUT TRANSFORMERS** to match pair of ECL 86's in push-pull to 3 ohm output. ONLY 11/-. P. & P. 2/6.

ALL GARRARD & B.S.R. UNITS AVAILABLE AS ADVERTISED JUNE

STEREO AMPLIFIER

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

ONLY **£4.19.6** P. & P. 8/-



Super Deluxeversion with ECL86 valvesseparate bass treble and balance controls. Full feed back 8 gns. P. & P. 8/-.

QUALITY RECORD PLAYER AMPLIFIER

A top quality record player amplifier employing heavy duty double wound mains transformer, ECC83, EL84, EZ80 valves. Separate Bass, Treble and Volume controls. Complete with output transformer matched for 3 ohm speaker. Size 7in. w. x 3in. d. x 6in. h. Ready built and tested. PRICE 69/6. P. & P. 6/-.

ALSO AVAILABLE mounted on board with output transformer and speaker ready to fit into cabinet below. PRICE 89/6. P. & P. 7/6.

DE-LUXE PORTABLE R/P CABINET

Uncut motor board size 14½ x 12in. Clearance 2in. below, 5½in. above. Will take above amplifier and any B.S.R. or Garrard Autochanger or Single Player Unit (except AT60 and SP25) Size 18 x 15 x 8in. Price £3.9.6. Carr. 9/6.

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).

QUALITY PORTABLE TAPE RECORDER CASE. Brand new. Beautifully made. Only 49/6. P. & P. 8/6.

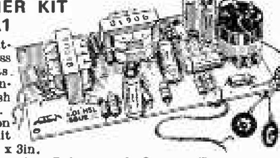
Dual Purpose Bulk Tape Eraser and Tape Head Demagnetiser 35/-. P. & P. 3/-.

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

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

HIGH GAIN 4 TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT

Type TA1



● Peak output in excess of 1½ watts. ● All standard British components. ● Built on printedcircuit 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 2/6. (Free with Kit). All parts sold separately.

SPECIAL PRICE 45/-. P. & P. 3/-.

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

A pair of TA1s are ideal for stereo.

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.1, 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

L.F.6 Pack: Consisting of PXB113 Driver Matched pair. PX171 mounted complete with heat sinks (Equiv. OC81D and OC81) 12/6

ALL TRANSISTORS POST FREE.

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.

BRAND NEW. 12in. 15w. H/D Speakers, 3 or 15 ohm. Current production by well-known British maker. Offered below list price at 89/6. P. & P. 5/-. Guitar models: 25w. £5.5.0; 35w. £8.8.0.

E.M.I. PLASTIC CONED TWEETERS. 2½in. 3 ohm. Limited number 12/6 each. P. & P. 1/6.

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A few minutes from South Wimbledon Tube Station.

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All valves brand new and boxed

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1D5	6/-
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6B8G	2/-
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6BE6	4/6
6BH6	7/-
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6BQ7A	7/-
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6BR8	7/6
6BS7	16/9
6BW6	7/6
6BW7	8/6
6C4	2/9
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6C8G	6/-
6CD6G	22/6
6CH6	5/9
6CW4	12/-
6D6	2/9
6E5	5/9
6F1	9/-
6F5G	5/-
6F6G	4/-
6F8G	4/6
6F11	12/6
6F13	5/-
6F14	12/6
6F23	10/6
6G6	2/6
6H6	1/3
6J5M	6/6
6J5G	2/6
6J5GT	4/6
6J6	3/-
6J7M	8/6
6J7G	4/9
6J7GT	8/6
6K6GT	5/-
6K7M	5/-
6K7G	1/3
6K7GT	4/6
6K8M	8/6
6K8G	3/-
6K8GT	8/3
6K25	20/-
6L1	9/6
6L6G	7/-
6L18	7/6
6Q7G	5/6
6Q7GT	9/-
6SA7	7/-
6SC7	6/6
6SG7	4/-
6SH7	2/6
6SJ7	5/-
6SK7GT	4/9
6SL7GT	4/9
6SN7GT	4/-
6SQ7	6/-
6U4GT	12/-
6U5G	7/6
6V6M	8/-
6V6G	3/6
6V6GT	7/-
6X4	3/6
6X5G	4/9
6X5GT	7/6
7B6	10/-
7B7	7/-
7C5	10/-
7C6	6/-
7D5	8/-
7H7	5/-
7R7	19/6
7S7	17/9
7Y4	7/6
9BW6	8/-
10C1	9/-
10C2	12/-
10F1	14/-
10F3	12/-
10F9	9/9
10F18	9/-
10L1	10/-
10LD11	10/-
10P13	14/-
11E3	42/-
12AT6	4/6
12AT7	3/9
12AU6	5/9
12AU7	4/9
12AX7	5/9
12BA6	5/6
12BE6	5/3
12C8GT	7/6
12E1	19/6
12J5GT	2/3
12J7GT	7/3
12K7GT	3/-
12K8GT	8/-
12Q7GT	4/6
12SA7	6/6
12SG7	3/6
12SH7	2/9
12SJ7	3/9
12SK7	2/9
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20D1	10/-
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20P4	17/-
20P5	16/-
25A6	6/6
25L6GT	5/6
25Y5	6/-
25Z4	6/3
25Z5	7/-
25Z6	11/-
28D7	5/-
30C1	6/3
30C15	11/6
30C17	12/-
30F5	12/-
30FL1	13/6
30L15	12/6
30L17	12/-
30P12	10/-
30P19	13/-
30PL1	14/-
30PL13	14/-
30PL14	14/-
35A5	17/-
35L6	5/9
35W4	4/6
35Z3	10/-
35Z4GT	3/9
35Z5	5/6
37	5/-
42	4/6
50B5	6/6
50C5	5/9
50CD6G	32/6
50L6GT	6/-
75	5/-
78	4/6
80	5/-
85A2	8/6
150B2	14/6
150C4	12/6
801	5/-
807	7/9
813	80/-
866	10/-
954	4/-
1625	5/-
4022AR	15/-
5763	10/6
7193	1/6
7475	2/6
ATP4	2/3
ATP5	7/-
ATP7	5/6
AU2	80/-
AU5	7/6
AZ1	8/9
AZ31	9/-
CBL31	15/-
CCH35	21/-
CL33	20/-
CY31	10/-
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DF33	8/-
DF70	7/-
DF91	3/-
DF92	2/6
DF96	6/3
DH77	3/6
DK32	7/9
DK91	5/-
DK92	8/-
DK96	7/-
DL66	15/-
DL92	4/9
DL93	3/6
DL94	5/9
DL95	6/6
DL96	7/-
DM70	5/-
DY86	6/-
DY87	6/-
E88CC	12/-
EA50	2/-
EABC80	6/6
EAF42	8/6
EB41	4/6
EB91	3/-
EBC33	7/-
EBC41	8/3
EBC90	4/-
EBF80	6/6
EBF83	7/-
EBF89	6/6
EBL1	14/-
EBL21	10/-
EBL31	27/6
EC90	2/9
ECC81	3/9
ECC82	4/9
ECC83	5/9
ECC84	6/-
ECC85	5/-
ECC88	7/-
ECF80	6/6
ECF82	7/-
ECH21	12/6
ECH35	11/-
ECH42	9/-
ECH81	5/3
ECH83	7/-
ECL80	6/6
ECL82	6/3
ECL83	9/6
ECL86	8/9
EF9	20/-
EF36	3/6
EF37A	7/6
EF39	6/-
EF41	8/6
EF50	2/6
EF80	5/-
EF85	6/6
EF86	6/3
EF89	5/-
EF91	3/6
EF92	2/6
EF98	9/-
EF183	6/-
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EL32	3/6
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GZ30	10/-
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KT36	17/6
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PC86	8/6
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PCF808	11/6
PCL82	7/-
PCL83	8/6
PCL84	7/-
PCL85	8/6
PCL86	8/6
PENA4	20/-
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PEN45	6/-
PEN46	2/9
PL36	9/-
PL81	7/6
PL82	6/6
PL83	6/-
PL84	6/6
PL500	13/6
PX4	14/-
PY33	8/6
PY81	6/-
PY82	5/6
PY83	6/-
PY800	7/-
PY801	7/-
R2	7/6
R19	7/-
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S130	25/-
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SP41	1/6
SP61	1/-
SU25	19/6
SU2150	12/6
T41	9/-
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U10	7/6
U14	7/6
U19	30/-
U25	10/6
U26	10/6
U78	3/6
U191	11/6
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UABC80	5/6
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UBF80	5/9
UBF89	6/6
UCC84	8/6
UCC85	6/6
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UCH42	8/6
UCH81	6/3
UCL82	7/-
UCL83	8/9
UF41	8/-
UF89	6/-
UL41	8/9
UL84	6/-
UM80	7/-
UU6	13/6
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CLUB SPOT

No. 16 SOUTHGATE RADIO CLUB G3SFG

FROM a practical point of view, the Southgate Radio Club has existed in its present form since 1956 although until December 1965 it was constituted as a Group of the R.S.G.B. During this time, membership has averaged about forty and attendance at monthly meetings has fluctuated according to the season and location of the meeting place. Over half of the members hold transmitting licences.

No permanent QTH

The problem of finding an ideal headquarters seems to have been with the Club for many years, and whilst the various locations have been satisfactory the Club has yet to find the perfect place where a Club Station can be permanently installed. Meanwhile, the search is continuing.

The Club functions primarily in order to give local Amateurs and Short-Wave Listeners an opportunity to meet and chat, the meetings being held on the second Thursday of every month except August, when many members are holidaying and there are not enough people to call a meeting.

Activities

There is always a special item on the agenda. Many well-known experts have lectured from time to time, but talks given by our own members have also proved highly successful despite the lack of experience in this direction on the part of these volunteers. After all, few licensed Amateurs can begin: "Unaccustomed as I am to public speaking . . .".

Interesting speakers heard recently include the Fire Brigade and the Port of London Authority.

Members of the Committee discuss a new project. From the left: Ray, G3MWF; Ron, G3PLB; Bruce, G3CWE; Ray, SWL; Alan, G3TIE; and Tony, G3PLF.

Other popular diversions are the annual home constructors' night, when a trophy is awarded for the best piece of equipment exhibited. Junk sales are also held twice yearly.

National Field Day

Club activities are not restricted to the monthly meetings. The high-spot of the Club calendar is probably National Field Day, where the Southgate Club is usually well placed in the competition. This year the Club will be operating under the callsign G5FA/P at Trent Park. Whilst members of the public will be made welcome, it must be stressed that Trent Park is a privately owned estate. Club exhibition stands at local horticultural shows and carnivals are very popular with members and the general public alike.

Mobile rallies, combining amateur radio with the widely popular car rallies, have been held from time to time but tighter police restrictions and the extremely high demands made upon the organisers will probably curtail further activity in this direction.

R.S.G.B. Slow Morse Transmissions are held at 8 p.m. on Wednesday evenings by G8QU. He is believed to be the only Ham in the London postal district to do this.

The Club also has its own magazine: The Southgate Radio Club Newsletter which is ably edited by Bruce, G3WCE.

Helping the Scouts

On several occasions the Club has collaborated with local Scout troops to organise stations for the "Jamboree Of The Air," an international event in the Scouting

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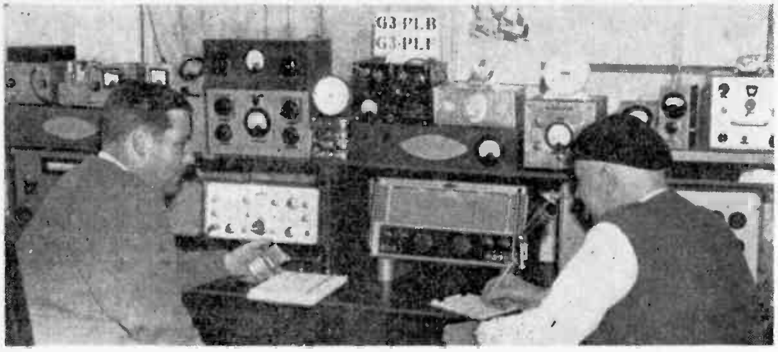
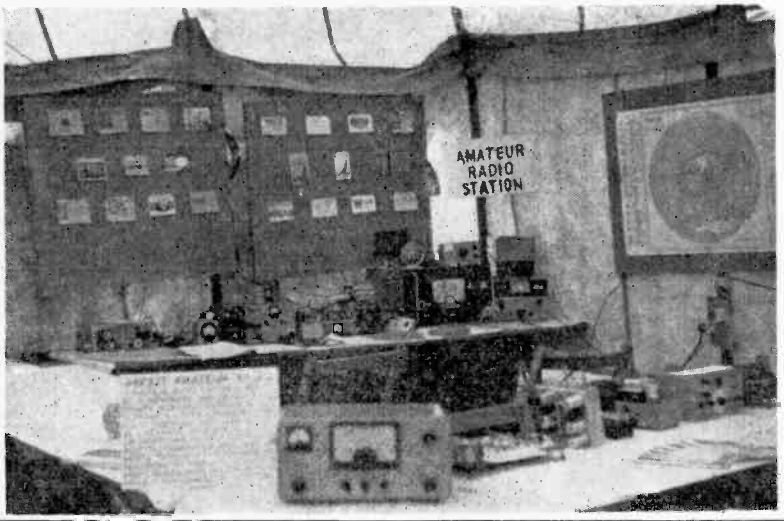


Brothers Tony and Ron with their rig. Gear from the top left is: VHF equipment, ATU's, Codar preselector, relay power supply, SWR indicator and a modified Class D wavemeter. Gear from the bottom left is: CR100, KW2000, Eddystone 888 and a KW Vanguard.

View of the Club stand at the Finchley Carnival held last July.



calendar. Licensing conditions nowadays forbid the use of transmitting equipment by unlicensed operators, and this has unfortunately made the event a lot less attractive to most Scouts.

Competitions, apart from National Field Day, seem to appeal to only a minority of the members, but recently a team has been formed to stimulate participation by the Club in other contests. They have found much pleasure in working together and hope that their efforts will help to keep the Club flag flying.

There is a growing interest in v.h.f. amongst members and G3MWF is trying to promote this even more.

New members welcome

The monthly meetings on the second Thursday of the month are held at Parkwood School, behind Wood Green Town Hall. Business begins at 8 p.m., visitors and new members whether they be licensed Hams, Short-Wave Listeners or just interested in radio will be made most welcome. Annual subscription for those under 18 is 10s. and £1 for adults. There is no age limit for members.

If anybody is interested in joining the Club, contact the Secretary, Mr. Alan G. F. Dutton, G3TIE, at 77 South Lodge Drive, Southgate, London, N.14.

CW MONITOR

—continued from page 185

Layout is not critical, and any form of construction can be used. The prototype was constructed on a small piece of perforated paxolin board, and the whole unit enclosed in an Eddystone diecast box although the unit can, in fact, be built into a much smaller box than that shown.

The pick-up aerial can be a length of stout wire, or better still, a telescopic aerial of the type used in portable radios. The aerial is mounted by passing it through a grommet in the top of the box, and its base is force fitted to an Aladdin coil former bolted to the base of the box as shown in Fig. 2.

OPERATION

(i) As a c.w. monitor

Switch the unit on by means of Sl. Extend the pick-up aerial to a convenient length and key the transmitter. A tone should be heard from the loudspeaker in sympathy with the keying; when the key is up nothing should be heard. The frequency of the tone can be adjusted to suit the individual by means of VR2.

(ii) As a modulation monitor

Leave the monitor switched off in this case, and plug a pair of headphones into socket Jl. Switch the transmitter to the a.m. position and modulate it. The modulation should now be heard in the headphones.

(iii) As an r.f. monitor

Again leave the unit switched off, and switch on the transmitter. Adjust VR1 to give a suitable reading on the meter and tune the transmitter for maximum output using the meter as an indicator.

(iv) As a code practice oscillator

Switch the monitor on and plug a morse key into socket J2. Depressing the key will result in an audio tone being generated as before. **Warning:** When not in use always turn VR1 to the minimum sensitivity position to avoid damaging the meter when first switching on the transmitter.

This simple monitor has been found exceptionally useful at the writer's station and has proved a valuable asset for split frequency c.w. working. The unit functions satisfactorily up to 30Mc/s and works on the 70Mc/s band when extra coupling, in the form of a pick-up loop, is introduced between the transmitter p.a. and the aerial on the monitor. ■

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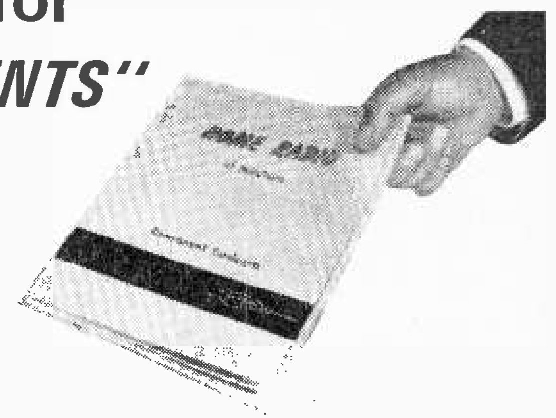

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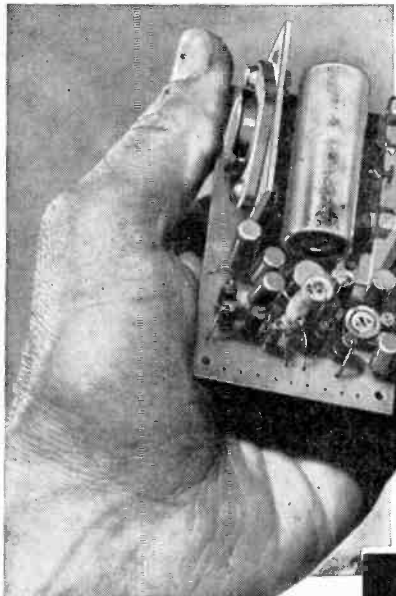

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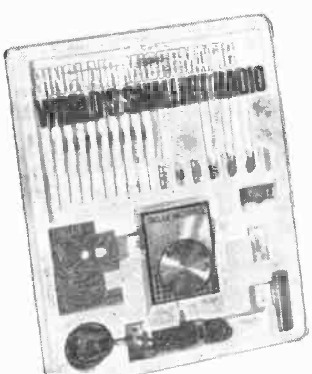

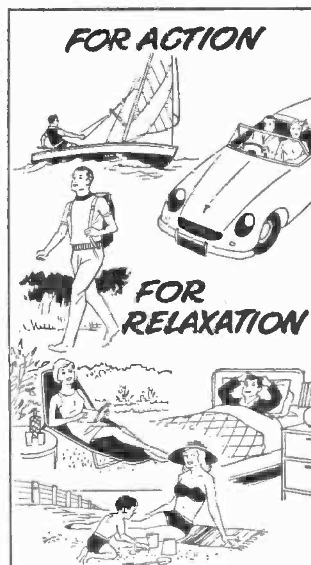

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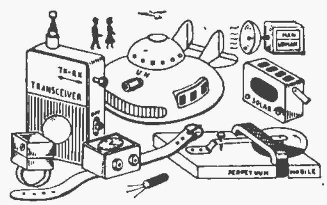

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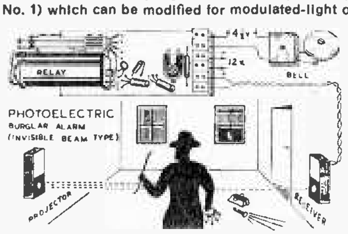

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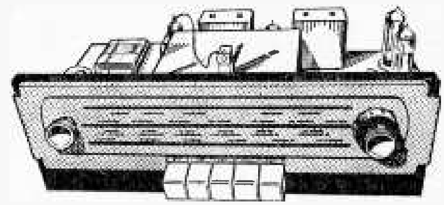

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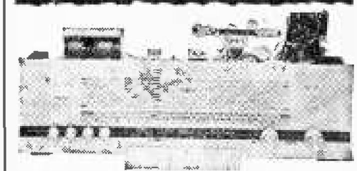

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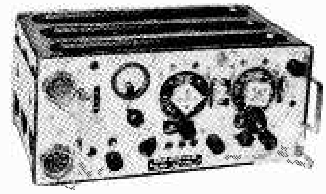

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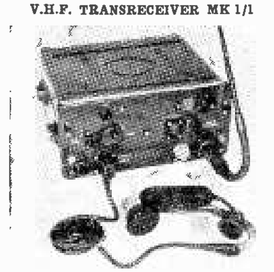

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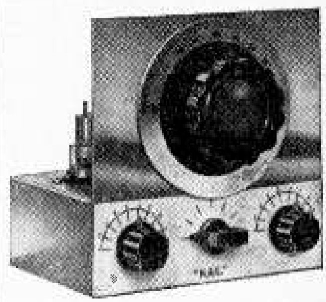

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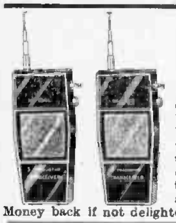

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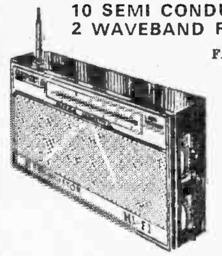

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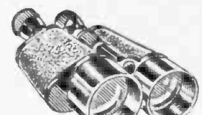

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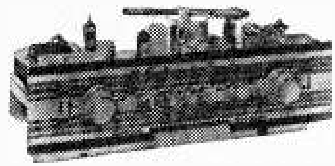

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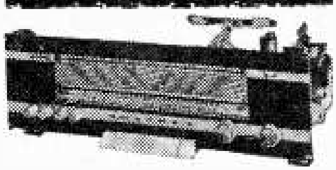

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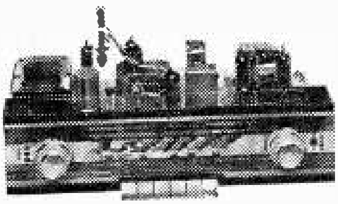

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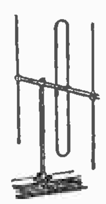

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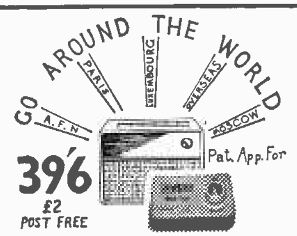

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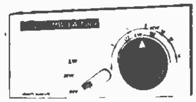

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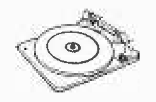

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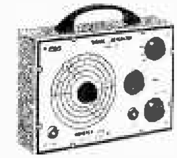

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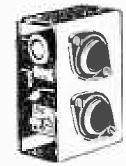

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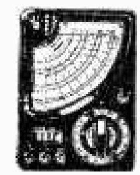

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PCF80	6/3
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PCF800	10/-
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PCL80	10/6
PCL81	9/-
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PCL83	8/6
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U10	8/-
U12/14	8/-
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UBC81	8/-
UBF80	6/6
UBF89	7/-
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UCC85	6/6
UCF80	9/6
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UCH42	9/-
UCH43	8/-
UCH81	6/3
UCL81	9/-
UCL82	7/3
UCL83	9/-
UF9	10/-
UF41	8/-
UF42	9/-
UF43	8/-
UF80	7/-
UF85	7/6
UF86	9/-
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UM80	5/-
UM81	10/-
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UU7	10/-
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UU9	7/-
UU10	8/-
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UY41	6/6
UY82	9/6
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OC24	17/6	OC140	10/-	AF102	18/-	GET116	12/-
OC25	9/6	OC141	22/6	AF114	8/-	GET875	9/6
OC26	8/-	OC170	6/-	AF115	7/-	GET880	12/-
OC28	12/6	OC171	6/-	AF116	7/-	MAT101	8/6
OC29	14/9	OC200	7/6	AF117	6/-	MAT120	7/9
OC35	12/6	OC201	17/6	AF118	14/-	MAT121	8/6
OC36	12/6	OC202	13/6	AF124	9/-	T1166	6/-
OC42	5/-	OC203	10/6	AF125	8/6	V30/30P	20/-
OC43	9/-	OC204	15/-	AF126	8/-	2G309	5/-
OC44	5/-	OC205	15/-	AF127	8/-	2G371A	5/-
OC45	4/6	OC206	22/6	AF178	12/6	2G381	5/-
OC70	5/-	AC107	10/-	AF186	15/-	2G403	6/-
OC71	5/-	AC125	6/6	AFY10	22/6	2N697	13/-
OC72	5/-	AC126	6/6	AFZ11	17/-	2N756	6/6
OC73	9/-	AC127	6/6	AFZ12	12/6	2N1134	37/-
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Blue Spot 200 P.I.V. 12/6.
Green Spot 400 P.I.V. 17/6.

TEXAS SILICON FULL-WAVE BRIDGE RECTIFIERS
1B20K10 100 piv, 2 amps, dimensions 1.4 x 1.4 x .6in. 25/-
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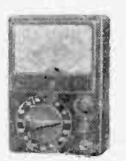
MULTIMETERS

TYPE MF 15



A.C. and D.C. voltage ranges: 0-10-50-250-500-1000V.
D.C. current ranges: 500µA-10-100mA.
Resistance ranges: 100MΩ-1MΩ. The meter is also calibrated for Inductance (10-1000H), capacity (0.6µF) and output level measurements. Sensitivity 2000Ω V. Accuracy ±2.5% for D.C. and ±4% for A.C. measurements.

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Before using the query service it is important to read the following notes:

The PW Query Service is designed primarily to answer queries on articles published in the magazine and to deal with problems which cannot easily be solved by reference to standard text books. In order to prevent unnecessary disappointment, prospective users of the service should note that:

(a) We cannot undertake to design equipment or to supply wiring diagrams or circuits, to individual requirements.

(b) We cannot undertake to supply detailed information for converting war surplus equipment, or to supply circuitry.

(c) It is usually impossible to supply information on imported domestic equipment owing to the lack of details available.

(d) We regret we are unable to answer technical queries over the telephone.

(e) It helps us if queries are clear and concise.

***(f)* We cannot guarantee to answer any query not accompanied by the current query coupon and a stamped addressed envelope.**

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This coupon is available until 7th July, 1967 and must accompany all queries in accordance with the rules of our Query Service.

PRACTICAL WIRELESS, JULY 1967

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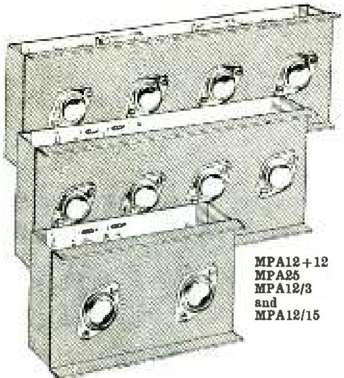
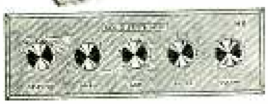
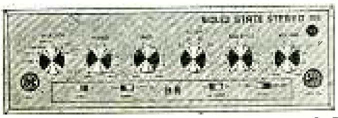


MPA12+12
MPA25
MPA12/3
and
MPA12/15



MP3

SP6-2



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SP4. Mono/stereo preamplifier as previously advertised. Complete with front panel and knobs. Size 9 x 3¼ x 1⅞in. **SP4 Price £10.19.6, P.P. 3/6**

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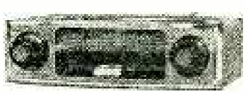

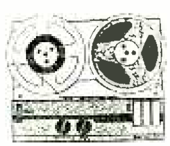

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