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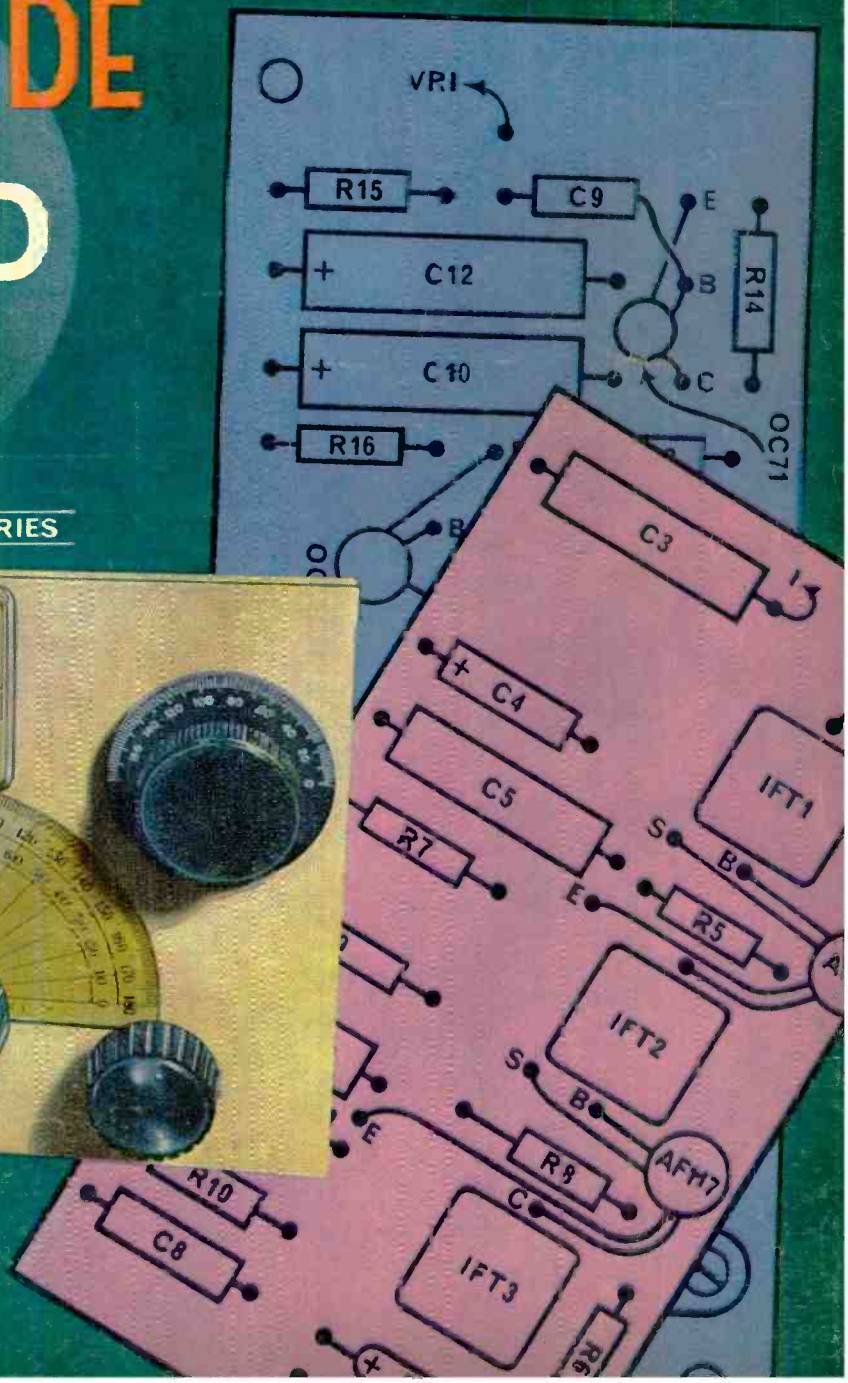

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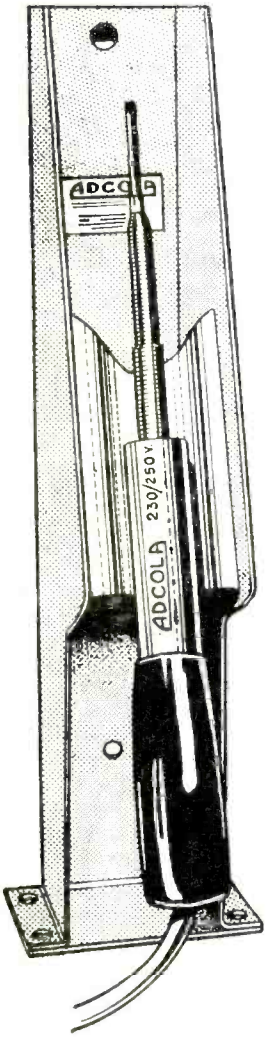

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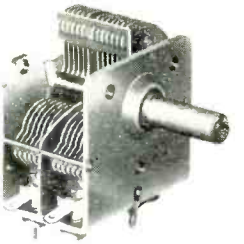

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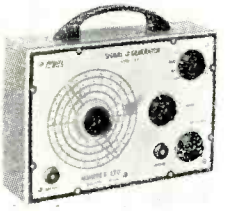

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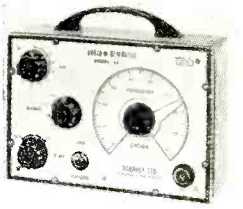

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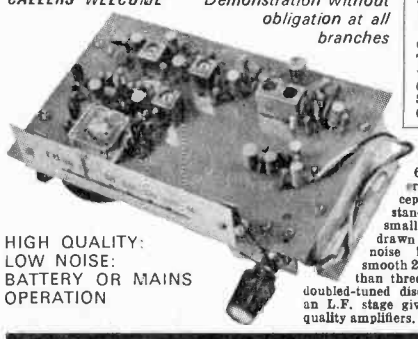

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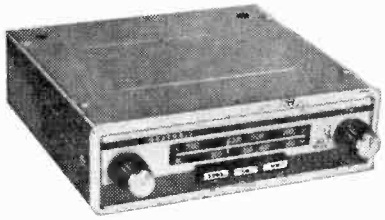

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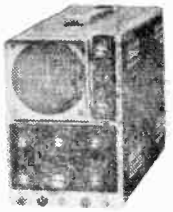

OS-2

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←FM
AM/FM →

HI-FI FM TUNER. Model FM-4U. Available in two units. R.F. tuning unit (£2.15.0 incl. P.T.) with I.F. output of 10·7 Mc/s and I.F. amplifier unit, with power supply and valves (£13.13.0). For free standing or cabinet mounting. Total Kit **£16.8.0**
(Multiplex decoder available as extra).

HI-FI AM/FM TUNER. Model AFM-1. Available in two units which, for your convenience, are sold separately. Tuning heart (AFM-T1—£4.13.6 incl. P.T.) and I.F. amplifier (AFM-A1—£22.11.6). Printed circuit board, 8 valves. Covers L.W., M.W., S.W., and F.M. Built-in power supply Total Kit **£27.5.0**
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MONO Designed to work with model MA-12 amplifier. 5 inputs. Baxandall type controls. Model UMC-1 Kit **£9.2.6**
STEREO 6 inputs. Push button selection. Ganged controls. Rumble and low pass filters. Model USC-J Kit **£19.19.0**

LATEST MODELS

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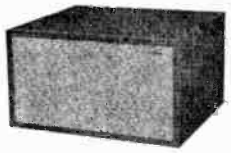

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Low-priced 3 + 3 watt TRANSISTOR AMPLIFIER, TS-23
Breaks the price barrier in quality stereo amplifier cost. Incorporates all the essential features for good quality reproduction from gram, radio and other sources. 3W rms (15Ω) each channel. Good frequency response. Modern, compact, slim-line styling. Ganged controls. 6 position selector switch. 16 transistor, 4 diode circuit. Walnut veneered cabinet, optional extra. **Kit** (Amplifier) **£17.15.0** Cabinet **£2.0.0** extra.

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Heathkit DAYSTROM

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Styled to match British Heathkit models.

SD-1

SPEAKER SYSTEMS

SSU-1

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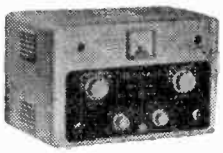

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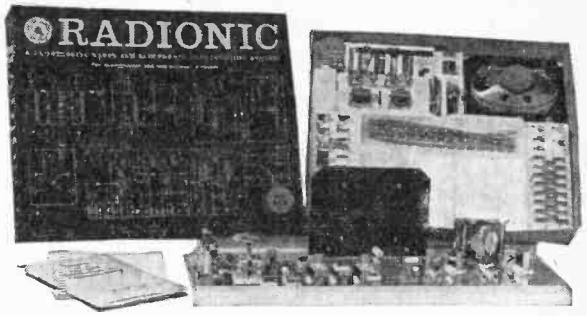

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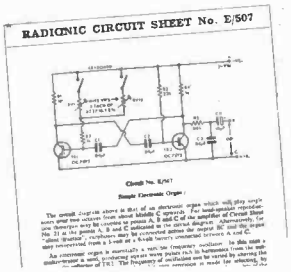
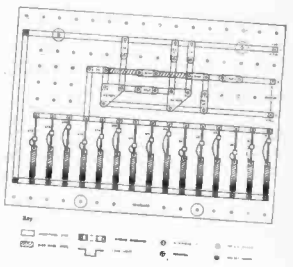


Theoretical Circuit



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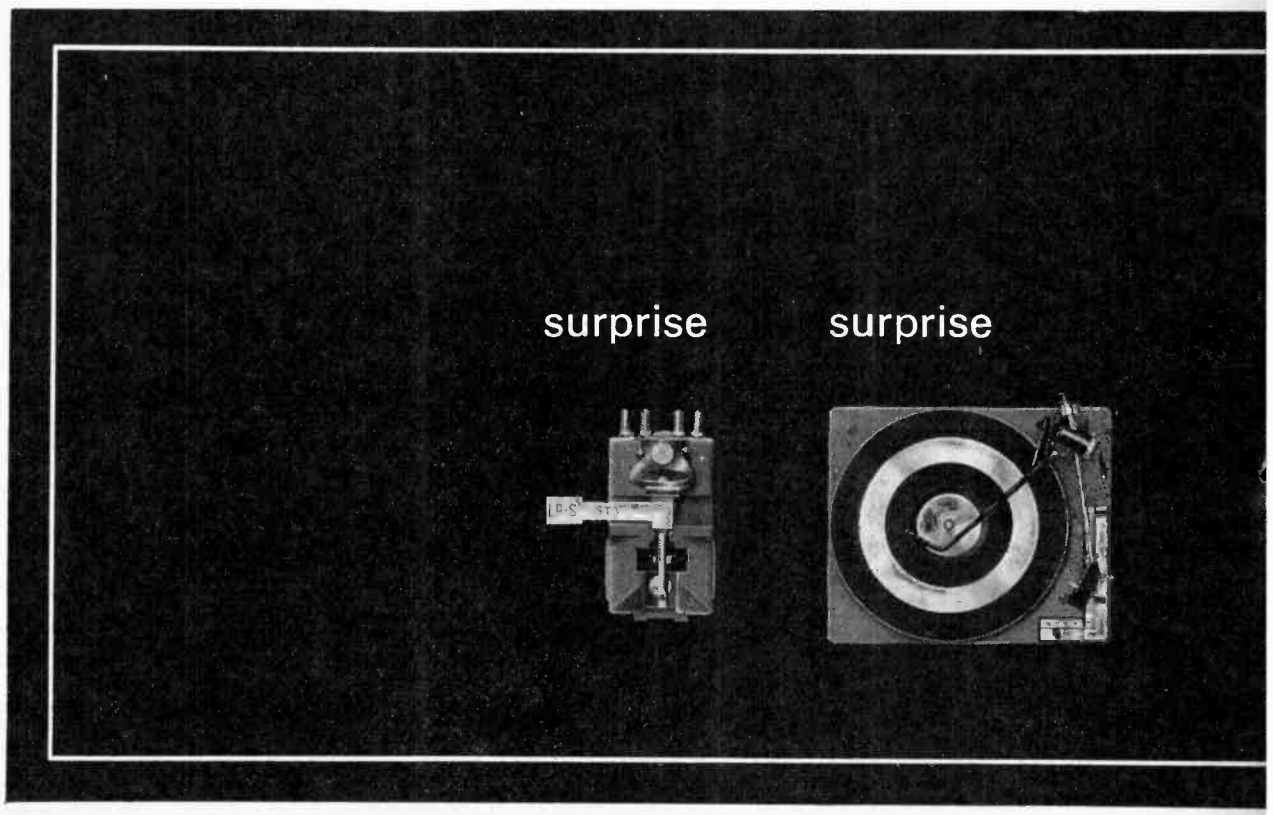

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Wow ..... Less than ·2%

Flutter ..... Less than ·06%

Long term speed variation Less than ·5% (mains voltage ± 10%)

Rumble (ref.1kHz) —29 dB

Pick-up arm

Counterbalanced lightweight arm with calibrated tracking pressure control, integral cueing device and automatic lock.

Tracking pressure (depending on cartridge) 2 grams. min.

Cartridge

The now famous C1 ceramic

Compliance $5{\cdot}2 \times 10^{-6}$ cm/dynes

Frequency response 20-15,000 Hz ± 2dB

Standard UA70 player £12.18.3*

C1 Ceramic Cartridge

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*Inc. P.T. surcharge

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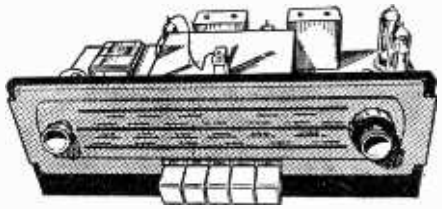
BRAND NEW AM/FM (V.H.F.) RADIOGRAM CHASSIS AT £15.15.0 (Carriage Paid)



Chassis size 15 x 6¾ x 5¾in. high. New manufacture. Dial 14¼ x 4in. in 2 colours; predominantly cream. 200-250v. A.C. only.
Pick-up Ext. Speaker. Ae., E. and Dipole Sockets. Five push-buttons—LW, MW, SW, FM and Gram. Aligned and tested. O.P. Transformer Tone control 1000-1900M; 200-550M; 88-98 Mc/s. 6-17 Mc/s. EZ80 rect.; ECH81, EF89, EABC80, EL84, ECC85, 3-ohm speaker required.
9 x 6in. ELLIPTICAL SPEAKER, 20/- to purchasers of this chassis.
TERMS: (Chassis). £5.5.0 down and 5 monthly payments of £2.5.0. Total H.P. price, £16.10.0. Cheap Room Dipole for V.H.F., 12/6. Feeder 6d. per yard. Circuit diagram 2/6. Carriage to N. Ireland, 20/- extra.

NEW 6 PUSH-BUTTON STEREOGRAM CHASSIS. M.W.; S.W.1; S.W.2; V.H.F., Gram; Stereo Gram. Two separate channels for Stereogram with balance control. Also operates with two speakers on Radio. Chassis size: 15 x 7 x 6¼in. high. Dial cream and red. 15 x 3in. 190-550M; 18-51M; 60-187M; VHF 86-100 Mc/s. Valves: ECC85, ECH81, EF89, 2 x ECL86, EM84 and Rect. Price £19.19.0, carr. paid or £6.13.0 deposit and 5 monthly payments of 56/6. Total H.P. price £20.15.6. Cream moulded escutcheon included.

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OR FULLY BUILT £6.7.6. *Tax and Carr. Paid.*

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6AM6	3/6	30F5	9/9	EBC41	7/9	EZ81	4/6	PY88	7/3	Transistors	
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6BA6	4/6	30L17	12/-	ECC81	3/9	N18	5/6	R19	7/6	AD140	15/6
6BE6	4/3	30P4	11/6	ECC82	4/9	N78	14/9	R20	12/9	AF102	18/-
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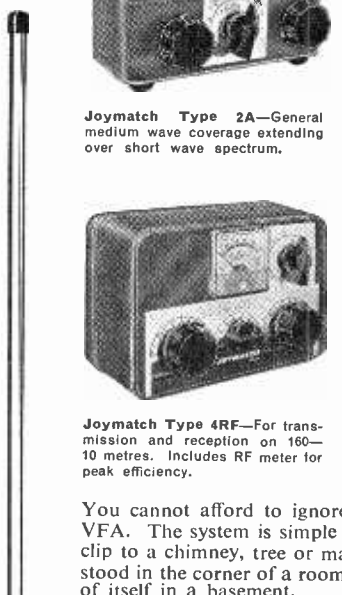
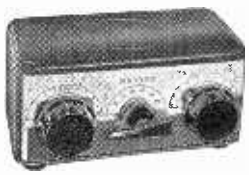


U.S. Patent No. 3274600. S. Africa Patent No. 63/4389. U.K. and World Patents applied for.

Joymatch Type 2A—General medium wave coverage extending over short wave spectrum.



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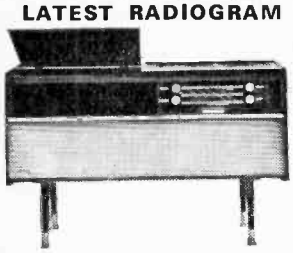

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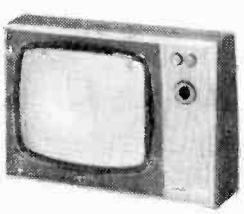

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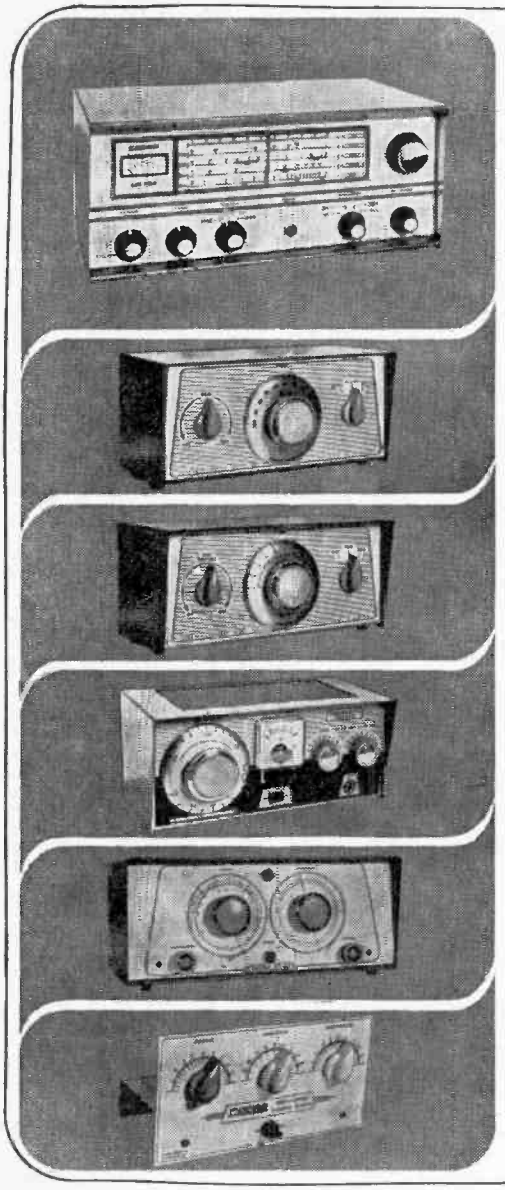

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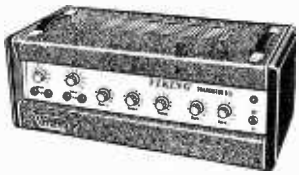

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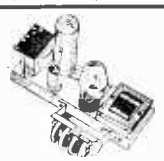

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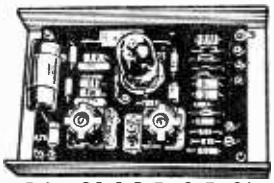

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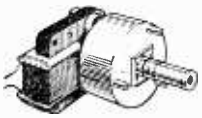

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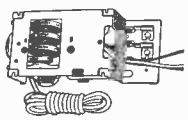

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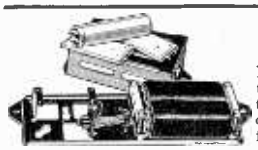

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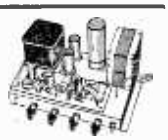

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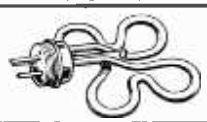

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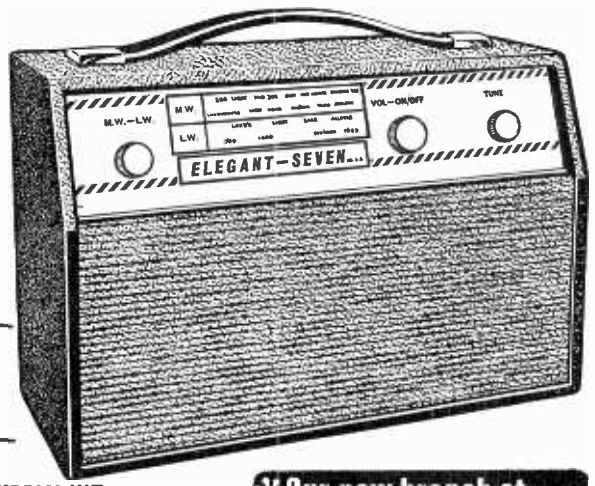

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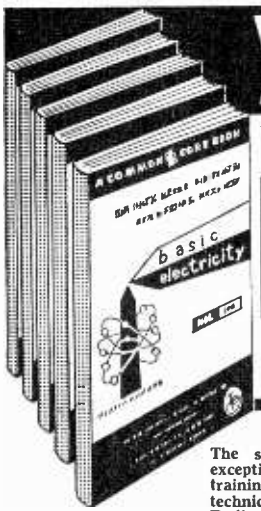

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Ready for plugging in to Amplifier or Tape Recorder.
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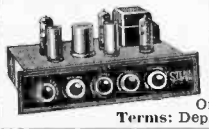
Tweeters R.A. 3 ohm or 15 ohm 25/9

15 watt HI-FI TRANSISTORISED AMPLIFIER TYPE A15

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



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

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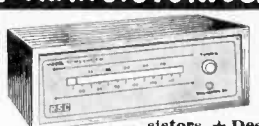
Total cost of parts with detailed wiring diagrams and instructions. Carr. 10/- **12½ Gns.** Or factory built **15½ Gns.** Or in Teak finished cabinet as illustrated **19½ Gns.** Terms: Deposit £5 and 9 monthly payments 39/-. Total £22.11.0.



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Heavy cast construction. Latest high efficiency ceramic magnets. Dual Cone for extended frequency range. Plastic treated surround giving low fundamental resonance. Response 35-20,000 c.p.s., Impedance 3 or 15 ohms. Carr. 5/6.

HF811D 8in. 10 WATT **4 Gns.**
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FULLY TRANSISTORISED 200/250v. A.C. Mains.
OUTPUT 10 WATTS R.M.S. cont. into 15 ohms.
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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.**
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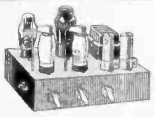
AUDIOTRINE HI-FI TAPE RECORDER KIT

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 or 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 14½ x 17 x 8½in. 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 29½ gns.) 4 Track Model 3 gns. extra. Carr. 19/6 **26½ Gns.**

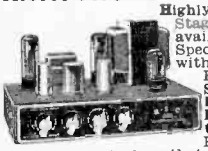
LINEAR TAPE PRE-AMPLIFIER. Type LP/1 Switched Equalisation. Positions for Recording at 1¼in., 3¾in., 7½in. per sec., and Playback. EM84 Recording Level Indicator. Designed primarily as the link between a Magnavox Tape Deck and Hi-Fi amplifier suitable most Tape Decks. Terms available. **10½ Gns.**



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

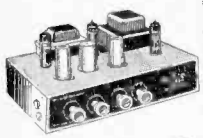


Highly sensitive, Push-Pull high output, with Pre-amp./Tone Control Stages. Performance figures equal to most expensive amplifiers available. Hum level —70dB. Frequency response ±3dB 30-20,000 c/s. Specially designed sectionally wound ultra linear output transformer with 807 output valves. All first 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. 12/6 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).** Carr. **12 Gns.**

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

MINIATURE TRANSISTORISED VHF/FM TUNER Battery operated. In plastic case complete with Telescopic Aerial. Carr. 5/- **£6.19.11**

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. Carr. 11/6 **£8.15.0**

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". Send S.A.E. for leaflet. Or call at one of our many branches and compare the Bass-Regent with units at three times the cost. Or deposit **£7.17.6** and 9 monthly payments of **£5.10.10.** (Total 55 gns.) Carr. 30/- **49½ Gns.**

B20 MULTI-PURPOSE AMPLIFIER

especially suitable for Bass Guitar

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

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

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

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 5¼ x 4¼ 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 19/9

12v. 15 amps, F.W. (Bridged). Only

CLEARANCE SALE !

WATKINS COPYCAT ECHO UNITS Listed £38.10.0. Brand new. **19½** Carr. 17/6 **GNS.**

VOX and LINEAR GUITAR AMPLIFIERS. Various models at half list price.

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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**

HEAVY DUTY BATTERY CHARGER KITS 6/12 v.

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

Or assembled ready for use 10/- extra.

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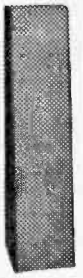
R.S.C. COLUMN SPEAKERS



Covered in two-tone Rexine/Vynair, ideal for vocalists and Public Address. 15 ohm matching. **Type C58, 15-20 watts.** Fitted five 8in. high flux speakers. Overall size approx. 42 x 10 x 5in. Or Deposit 44/-and 9 mthly pmts 31/5 (Total £16.6.9) **14 Gns.** Carr. 10/-

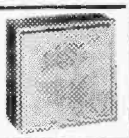
Type C412, 40 watts. Fitted four 12in. 12,000 line 10 watt speakers. Overall size 56 x 14 x 9in. approx. Carr. 15/- Or Deposit **£3.11.0** and 9 monthly payments of **46/7** (Total **£24.10.3**). **21 Gns.**

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). Carr. 12/6 **17 Gns.**

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. Carr. 10/6 **£7.19.11**
Terms available on both.

FANE HEAVY DUTY HI-FI SPEAKERS 5 Gns.

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

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Limited number at fraction of list price 15 ohms. impedance. Brand new, guaranteed.
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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.**

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

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

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250-0-250v. 100mA, 6.3v. 2a, 6.3v. 1a. 22/9
350-0-350v. 80mA, 6.3v. 2a., 0-5-6.3v. 2a. 23/9
250-0-250v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a.... 32/9
300-0-300v. 100mA, 6.3v. 4a, 0-5-6.3v. 3a... 32/9
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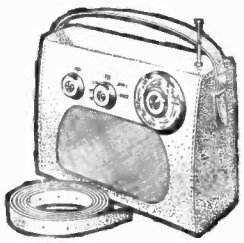


FULLY TUNABLE ON ALL WAVEBANDS ● **9 stages—7 transistors and 2 diodes**

Covers Medium and Long Waves, Trawler Band and three Short Waves to approx. 15 metres. Push-pull output for room filling volume from rich toned 7 x 4in. speaker. Air spaced ganged tuning condenser. Ferrite rod aerial for M. & L. Waves and telescopic aerial for S. Waves. Real leather-look case with gilt trim and shoulder and hand straps. Size 9 x 7 x 4in. approx.

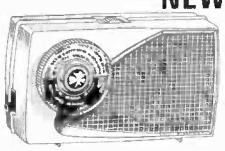
The perfect portable and the ideal car radio. (Uses PP7 batteries, available anywhere.)

● **EXTRA BAND FOR EASIER TUNING OF LUXEMBOURG, etc.**

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

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

NEW MELODY MAKER SIX



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

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

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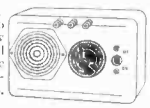
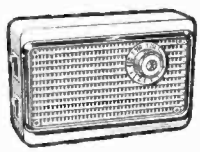


THE SIG-GEN. A versatile Signal Injector. Something no constructor should be without. The ingenious device generates an audible signal through the Audio and R.F. ranges. With variable output. Telescopic Probe. Pocket size slim line case measures 4¾ x 3¼ x ¾in. Complete set of parts with full instructions. **19/6,** P. & P. 2/-.

NEW TRANSONA FIVE



Now with 3in. Speaker!

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

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

Fully tunable over Medium and Long Waves and Trawler Band. Incorporates Ferrite rod aerial, tuning condenser volume control, new type fine tone super dynamic 3in. speaker, etc. Attractive case. Size 6¼ x 4¼ x 1¼in. with red speaker grille. (Uses 1289 battery, available anywhere.)

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POCKET FIVE *Now with 3in. Speaker!*

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

Covers Medium and Long Waves and Trawler Band, a feature usually found in only the most expensive radios. On test Home, Light, Luxembourg and many Continental stations were received loud and clear. Designed round supersensitive Ferrite Rod Aerial and fine tone 3in. moving coil speaker, built into attractive black and gold case. Size 5½ x 1¾ x 3¼in. (Uses 1289 battery available anywhere.)

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

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

STOP PRESS!

Pocket 5 med. and long wave version with miniature speaker.

29/6 P. & P. 3/-

NEW ROAMER SIX

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

● **6 WAVEBAND ! !**

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

Listen to stations half a world away with this 6 waveband portable. Tunable on Medium and Long Waves. Trawler Band and two Short Waves. Sensitive Ferrite rod aerial and telescopic aerial for short waves. Top grade transistors. 3in. speaker, handsome case with gilt fittings. Size 7¼ x 5¼ x 1¾in. (Carrying strap 1/6 extra.)

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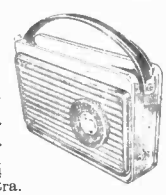
TRANSONA SIX



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

This is a top performance receiver covering full Medium and Long Waves and Trawler Band. High-grade 3in. speaker makes listening a pleasure. Push-pull output. Ferrite rod aerial. Many stations listed in one evening including Luxembourg loud and clear. Attractive case in grey with red grille. Size 6¼ x 4¼ x 1¼in. (Uses PP4 battery available anywhere). Carrying strap 1/- extra.

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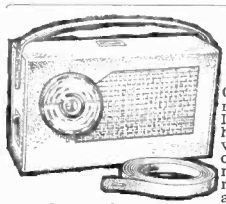
MELODY SIX



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

Our latest completely portable transistor radio covering Medium and Long Waves. Incorporates pre-tagged circuit board, 3in. heavy duty speaker, top grade transistors, volume control, tuning condenser, wave change slide switch, sensitive 6in. Ferrite rod aerial. Push-pull output. Wonderful reception of BBC, Home and Light, 208 and many Continental stations. Handsome leather-look pocket size case, only 6¼ x 3¼ x 1¾in. approx. with gilt speaker grille and supplied with hand and shoulder straps.

Total cost of all parts now only **£3.9.6** P. & P. 3/6 *Parts Price List and easy build plans 2/-* (Free with kit)

SUPER SEVEN

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

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TWEETER. 2¼in. Black plastic cone, round on Square Frame, E.M.I. 3Ω, **12/6d.** plus 1/6d. P. & P. **P.A. HORN** Speaker, 8Ω, 15 watt, 9 x 9in. Swivel mounting brackets, **£5.5.0.** Carr. Paid. Many other sizes and types available from 2in.

REMOTE CONTROL TWO-IN-ONE EXTENSION SPEAKER. In addition to providing an extension speaker, two independent knobs control volume in extension speaker and also in your radio, T.V., Hi-Fi, Gram. etc. Stereo effect if desired. Complete with 25ft. unobtrusive cable and full instructions. Easily connected. Handsome cream finish—3½ x 3 x 1¾in. Complete **27/6d.** P. & P. 2/6.

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Finest Quality British made MYLAR Recording Tape. Fully Guaranteed.

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P. & P. 1/- per reel. Four reels and over post paid. *N.B.*—MYLAR based recording tape is of infinitely superior quality and far stronger than Acetate base tape.

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D.C. Volts (20.000Ω P.V.) 0/5/25/250/500/2500 D.C. Current 0-50 microamp. 2.5mA/250mA.
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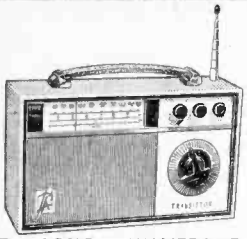
LASKY'S RADIO — FOR THE FINEST VALUE AND TO HOME CONSTRUCTORS

TRANSISTOR PORTABLES



THE SKYROVER De Luxe

7 transistor plus 2 diode superhet, 6 waveband portable receiver covering the full Medium Waveband and Short Waveband 31–94M and also 4 separate switched bandspread ranges, 13M., 16M., 19M. and 25M., with Band Spread Tuning for accurate Station Selection. The coil pack and tuning heart is completely factory assembled, wired and tested. The remaining assembly can be completed in under three hours from our easy to follow, stage by stage instructions. Superhet, 470 Kc/s. All Mullard Transistors and Diodes. Uses 4 U2 batteries. 5in. Ceramic Magnet P.M. Speaker. Easy to read Dial Scale, 500 MW Output. Telescopic Aerial and Ferrite Rod Aerial. Tone Circuit is incorporated, with separate Tone Control in addition to Volume Control. Tuning Control and Waveband Selector. In a wood cabinet, size 11½ x 6½ x 3in. covered with a washable material, with plastic trim and carrying handle. Car aerial socket fitted.

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

H.P. Terms: 60/- deposit and 11 monthly payments of 12/9. Total H.P.P. £10.0.8.

Four U2 batteries 3/4 extra.

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

■ LONG WAVEBAND COVERAGE IS NOW AVAILABLE FOR THE SKYROVER

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

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

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

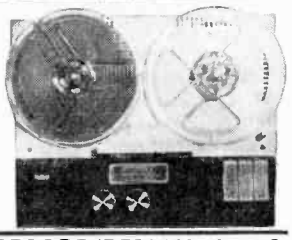
SINCLAIR SUPER MINIATURE KITS

Write for details of Package Deals

THE MICRO-6 miniature radio only 1⁴/₁₆ x 1³/₁₀ x 1½in.	£2 19 6
THE MICRO-FM (tuner/receiver)	£5 19 6
THE X-20 20 watt P.W.M. amplifier	£7 19 6
Available ready built, tested and guaranteed	£9 19 6
THE Z-12 12 watt amp. and pre-amp., fully built	£4 9 6
PZ-3 power pack for Z-12	£3 19 6
STEREO 25 Pre-amplifier control unit, fully built	£9 19 6

TAPE RECORDERS

MAGNAVOX 363 TAPE DECKS



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

Lasky's Price ¼ track model **£10.10.0**

Lasky's Price ½ track model **£13.9.6**

Carriage and Packing 7/6 extra.

NEW MARTIN TAPE RECORD/REPLAY AMPS.

Now available from stock—for use with the Magnavox 363 Tape Deck.

¼ track model..... LASKY'S PRICE **£14.19.6** Carriage and

½ track model..... LASKY'S PRICE **£15.19.6** Packing 4/6 extra.

Optional extra: Control panel escutcheon to take deck and amplifier controls.

LASKY'S PRICE **12/6** Post & Packing 2/6.

INTERNATIONAL TAPE

Famous American Brand—Fully Guaranteed

3in.	Message tape, 150ft.	2 6	5¼in.	Long play, 1200ft. Acetate	12 6
3in.	Message tape, 225ft.	3 9	5¼in.	Standard play, 850ft. PVC	11 6
3in.	Message tape, 300ft.	7 6	5¼in.	Long play, 1200ft. Mylar	15 0
3½in.	Triple play, 600ft. Mylar	10 0	5¼in.	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	25 0
5in.	Triple play, 1800ft. Mylar	35 0	7in.	Long play, 1800ft. Acetate	15 0
5¼in.	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

MICROPHONES

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 (⅛ x ⅛ x 5/16in.) and battery. **LASKY'S PRICE 10 Gns.** Post Free anywhere in world.

THE TTC MODEL 13/500. More powerful version of above—size 7½ x 1½ x ⅝in. Operates on one PP3 type battery. **LASKY'S PRICE 12 Gns.** Post Free anywhere in world. These cannot be operated in the U.K. owing to G.P.O. regulations.

CONSTRUCTORS BARGAINS

SPECIAL PURCHASE—UHF/VHF TV TUNERS

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

TRANSISTORISED UHF MINIATURE MODEL 1

Shielded metal case only 3½ x 1½ x 3in. Fully tunable—complete with two AF139 transistors. LASKY'S PRICE **39/6**

TRANSISTORISED UHF MODEL 2

Metal case size 3¾ (plus spindle) x 2¾ x 1½in. Fully tunable with slow motion drive. Complete with two AF186 transistors. LASKY'S PRICE **25/6**

VALVE UHF MODEL (illustrated)

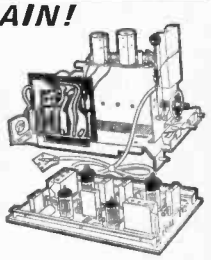
In metal case size 4 x 6 x 1¾in. Fully tunable—complete with PC86 and PC88 valves. LASKY'S PRICE **29/6** Without valves **12/6**

TRANSISTORISED VHF TUNER

Sub-Miniature turret type fitted with 12 sets of coils and 3 Mullard AF102 transistors. In metal case size 3 x 1½ x 2½in. LASKY'S PRICE **37/6**

TREMENDOUS BARGAIN!

TV UHF TUNER AND IF AMPLIFIER PANEL

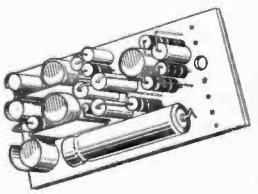


Model No. 89384 made by famous manufacturer as standard conversion unit to 625 line reception (BBC 2) for 19" and 23" 405 line (convertible model) Cossor, Philips, Scott and Stella television receivers. The units are boxed, brand new and fully guaranteed, complete with detailed conversion and operating instructions. To effect conversion on the sets mentioned above you need only a pair of pliers and a screwdriver! The units are fitted with 7 Mullard valves—PCF80 x 2, EF185, EF184, ECC82, PC86, PC88. Size of units: tuner 7½ x 4 x 8in., IF panel on 9 x 4¾in. printed circuit board x 2½in. deep. Complete with all leads, screws, washers etc. Original Price £10.10.0.

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

TREMENDOUS VALUE IF BOUGHT ONLY FOR THE VALVES AND COMPONENTS

NEW—LASKY'S MINIATURE TRANSISTOR AMPLIFIER MODULES



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

Add 1/- on each for Post and Packing.

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

TYPE LRPC 2. 5 transistor. Input sens. 1mV. output 330mW, output imp. 15Ω, size 2½ x 1½ x ¾in. .. PRICE **22/6**

TYPE LRPC 4. 5 transistor, Input sens. 150mV, output 330mW, output imp. 15Ω, size 2½ x 1½ x ¾in. ..... PRICE **22/6**

TYPE LRPC 5. 6 transistor. Input sens. 8mV, output 3W, output imp. 3Ω, size 5½ x 1½ x 1in. ..... PRICE **59/6**

TYPE LRPC 6. Tape record/playback amp. (for use with self oscillating erase head). Output 750mW, output imp. 8Ω. Size 4½ x 2 x 1in. ..... PRICE **39/6**

FULLY ENCAPSULATED MODULES

Special function modules—all one size 1⅝ x 1 x 1¼in. Complete with detailed function and installation instructions. Send S.A.E. for specification sheets.

TYPE PA-1. Public address amp. for use with carbon, crystal or Dynamic microphones, 3Ω output imp. ..... PRICE **30/-**

TYPE GR-1. Gramophone amp.—provides sufficient power to fill average room. 3Ω output imp. ..... PRICE **30/-**

TYPE CO-1. Morse code practice oscillator—for use with morse key and 3Ω speaker. PRICE **20/-**

TYPE MT-1. Metronome module—provides audible and visual beat from 30 to 240 beat per minute (for use with 3Ω speaker or indicator lamp). ..... PRICE **22/6**

GORLER UT 340 FM/VHF TUNING HEART

Permeability tuned—covering 87 to 108 Mc/s. For use with one ECC85 valve. In metal case, size 3 x 2½ x 1½in. Circuit supplied.

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

TRANSISTORS

ALL BRAND NEW AND GUARANTEED

GET 81, GET 85, GET 86 **2/6**; 873A, 874P **3/6**; OC45, OC71, OC81D **4/6**; OC44, OC70, OC76, OC81 **5/6**; (match pair 10/6); AF117, OC200 **6/6**; OC42, OC43, OC73, OC82D **7/6**; OC201, OC204 **15/-**; OC205, PC206 **19/6**; OC28 **24/8**; OC75 **8/-**.

TRANSFILTERS

by BRUSH CRYSTAL CO., Available from stock.

TO—01B 465 kc/s. ± 2 kc/s.	TO—02D 470 kc/s. ± 1 kc/s.	**9/6 each**
TO—01D 470 kc/s. ± 2 kc/s.	TF—01B 465 kc/s. ± 2 kc/s.	
TO—02B 465 kc/s. ± 1 kc/s.	TF—01D 470 kc/s. ± 2 kc/s.	**Post 6d.**

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

LASKY'S RADIO FOR FINEST VALUE and COURTEOUS SERVICE

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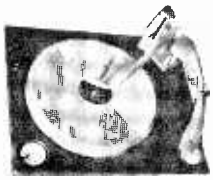
SERVICE IN GREAT BRITAIN AND HI-FI ENTHUSIASTS

LASKY'S RADIO

RECORD PLAYERS



B.S.R. AUTOCHANGERS
AT LOWEST EVER PRICES
Fully guaranteed with cartridge and stylus.
UA16 9v. battery model..... £5 19 6
UA20 4 speed mains model..... £5 19 6
NEW! — B.S.R. UA70 4 speed mains autochanger, superb modern styling at amazingly low price.
LASKY'S PRICE £9.19.6 (ex cartridge).
Add 5/- carriage and packing on each.

GARRARD AUTOCHANGERS

AT6 Mk. II	£10 19 6
3000LM with stereo cartridge	£8 19 6
AT60	£10 19 6
A70	£19 9 0
A50	£7 7 0
A1000	£6 6 0
A2000	£6 16 6

SINGLE PLAYERS

SP25 Light turntable	£9 19 6
SP25 Heavy turntable	£10 19 6
SRP12 with cartridge	£4 7 6
SRP10 Mains, with cartridge	£4 19 9
SRP10 Battery with cartridge	£4 19 6

GARRARD BASES

WB1 £3 16 3	Clearview cover £3 18 0
WB2 £5 5 0	Clearview cover £5 7 11

Postage and Packing on all above 5/-.

GREENCOAT RECORD PLAYER
33⅓ and 45 r.p.m. 6v. Battery operated Comp. with pick-up and crystal cartridge. Size 7¼ × 6in.
LASKY'S PRICE 49/6 Post 2/6

SPECIAL INTEREST ITEMS!

NEW! LASKY'S CLEAR PLASTIC PANEL METERS

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

Type KR-52 3 × 2¼in. (illustrated)

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

Type MK-38A 2in. square

1 mA DC	22/6
5 mA DC	22/6
300 V DC	22/6
500μA	27/6
1 mA S Meter	29/6

Type KR-65 3¾ × 3in.

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

Type MK-45A 1½in. square

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

Type MK-65A 3in. square

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

THE HARROW POWER PACK
Battery eliminator for portable radios, etc. Converts your Battery radio to A.C. mains. Replaces 4½v., 6v. and 9v. batts. Size only 3 × 2 × 2¾in. State voltage required when ordering.
LASKY'S PRICE 29/6 Post 2/-.

207 EDGWARE ROAD, LONDON, W.2 Tel. PAD 3271
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33 TOTTENHAM CT. RD., LONDON, W.1 Tel. MUS 2605
All the above branches open all day Saturday. Early closing Thursday.

42 TOTTENHAM CT. RD., LONDON, W.1 Tel. LAN 2573
152/3 FLEET STREET, LONDON, E.C.4 Tel. FLE 2833
Both open all day Thursday. Early closing Saturday.

Mail Orders and correspondence to 3-15 Cavell Street, Tower Hamlets, London, E.1. Tel.: STEpney Green 4821/2

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THE PEMBRIDGE COLLEGE OF ELECTRONICS

FOR TRAINING IN RADIO AND TELEVISION

FULL-TIME COLLEGE COURSE IN RADIO AND TELEVISION

Our Course, of sixteen months' duration, provides a fundamental training for radio and television engineers. It includes theoretical and practical instruction on transistor television receivers, U.H.F. television receivers and colour television.

Exactly half the time is spent on practical work and the course provides excellent practical experience on valve and transistor radio receivers and high-fidelity equipment and all well known makes of television receivers.

The Course is recognised by the Radio Trades Examination Board (R.T.E.B.) for the Radio and Television Servicing Certificate examinations.

Next Course commences 4th April, 1967.

To: **The Pembridge College of Electronics (Dept. P11)**
34a Hereford Road, London, W.2.
Please send, without obligation, details of the Full-time Course in Radio and Television.

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the versatile VERITONE 30 high power amplifier

DESCRIPTIVE LEAFLET ON REQUEST

★ For discriminating Hi-Fi.
★ Brilliant guitar reproduction
★ Crystal clear P.A. for meetings, fetes all outdoor activities

A magnificent professional instrument with a performance to satisfy the Hi-Fi enthusiast, plus superbly engineered construction and facilities that fulfil every amplifier need. Veritone 30 is packed with clean distortion-free power and a host of features found in amplifiers costing 3 times as much. It combines main amplifier giving a true 30 watts output, preamplifier with two separately controlled mixer inputs. Volume, Bass and Treble controls, speaker impedance selection (3 or 15 ohms), and extra power supply outputs of 300 volts at 40 mA. and 6.3 volts at 2A to drive auxiliary equipment. Veritone 30 is both an excellent rugged service PA amplifier, and the heart of a superlative Hi-Fi system. It makes an ideal basis for a guitar amplifier with inputs for two guitars.

£16.10.0 Carriage & Insurance 10/-. Optional top cover £1.15.0 extra. Terms: Dep. £5.10.0. 12 monthly at £1.2.6. Total credit price £19.

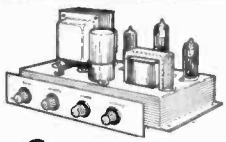
UNIPEX TRUMPET SPEAKER

★ Waterproof outdoor construction
★ Full 10 watts input
★ Adjustable mounting bracket

Superb, professional quality, re-entrant horn speaker for all outdoor P.A. work. 10in. diameter aluminium horn has rubber protected edge and diecast mounting fitted with universal bracket. Rated at 10 watts. Impedance 16 ohms. Frequency range 350 to 5000 cycles. Cut-off 280 cycles. Heavily enamelled two-tone grey finish. Length overall 10in.

£7.10.0 Carriage & Insurance 5/-

VERITONE 300 AMPLIFIER



A small versatile Gram. Amplifier with an output of 3-4 watts suitable for Crystal Pickup or Radio Tuner, ideally suited for a small domestic installation requiring good quality low output, output impedance 3 ohms, volume control, treble control, bass control and middle control. Valve line-up EL84, EF86, EZ80. Smooth grey finished chassis, size 8½ x 4 x 1¾in. with brushed aluminium front panel contrasting letters and knobs, front panel size 8½ x 2¼in. Fully assembled and tested. Carriage and Insurance 5/-

6 GNS.

The superb VERITONE VEGA STEREO AMPLIFIER

Veritone Vega means sound from the solid state. Great purity of sound comparable with that obtainable from the best valve amplifiers—plus all the advantages accruing from semi-conductor design employing the latest techniques. Important advantages such as improved reliability, absence of high-working temperatures, lack of valve noise, elimination of the output transformers, and design freedom that permits spacious layout within an optimum overall size to suit modern installation requirements. And the Vega is styled and finished in impeccable taste—totally enclosed in a handsome teak case with comprehensive controls functionally arranged on a clear silver grey and black panel.

WITH CASE **£44.2.0**

Terms: Deposit £14.14.0. 12 monthly payments of £2.14.0. Total credit price £47.2.0. Carriage and Insurance. 10/-.

LESS CASE **£40.19.0**

Terms: Deposit £13.13.0, 12 monthly payments of £2.10.1. Total credit price £43.14.0.

*stern-clyne's *TREMENDOUS PRICE BREAKTHROUGH in NEW UNIVERSAL RECORDING TAPES

- TENSILIZED, PRE-STRETCHED, EXTRA STRONG
- FULL FREQUENCY SPECTRUM RESPONSE
- GUARANTEED PLAYING TIMES

STERN-CLYNE make huge bulk purchases of recording tapes from the world's biggest manufacturers—and hand on the enormous price advantage to their customers. The quality is unequalled: Tensilized to ensure the most permanent type of base. Highly resistant to breakage, moisture, heat, cold or humidity. Highly polished, splice-free finish. Smooth output throughout entire audio range. Ideal for your most treasured recordings, cheap enough to use all the time. Double-wrapped—distinctively boxed. Available in both P.V.C. and Polyester qualities.

TENSILIZED P.V.C.			TENSILIZED POLYESTER		
3in. 250ft. Long Play	5	6	3¼in. 600ft. Double Play	11	6
5in. 600ft. Standard	8	6	5in. 1,200ft. Double Play	15	0
5in. 900ft. Long Play	10	0	5½in. 1,800ft. Double Play	22	6
5½in. 1,200ft. Long Play	12	6	5½in. 2,400ft. Triple Play	37	6
7in. 1,200ft. Standard	12	6	7in. 2,400ft. Double Play	25	0
7in. 1,800ft. Long Play	15	0	7in. 3,600ft. Triple Play	50	0

TRIPLE BARGAIN OFFER 3-Reel packs of 3in. Professional quality tape in self mailing boxes with fill-in address label on reverse. Works on all tape recorders. 250ft. per reel. Famous Audio Magnetic brand. P. & P. 1/6d. **13/6**

A selection of our famous low cost, high quality speakers

Special Offer All-British 12in. Unit built-in tweeter cone, and a high flux magnet for wide range reproduction. Handles 6 watts. Available for 15 or 3 ohms impedance **39/6** P. & P. 3/6

Miniature 8 ohm Impedance Units suitable for most transistor sets. Extra powerful permanent magnets. Sizes available (circular only): 2, 2½, 3, 3½, 4 and 5in. dia. Any size **12/6** P. & P. 2/6

Standard 3 ohm Moving Coil Units, suitable for extension speakers, radio set replacements, car radios etc., up to 3 watts output.

6½in. circular	18/6	P. & P. 3/6
8in. circular	£1	P. & P. 3/6
7 x 4in. elliptical	14/6	P. & P. 3/6
8 x 5in. elliptical	£1	P. & P. 3/6
10 x 6in. elliptical	30/-	P. & P. 3/6

Elac Extra Quality Units fitted high-flux Feroba II ceramic magnets. All sizes 3 ohm impedance.

8in. circular	30/-	P. & P. 2/6
8 x 5in. elliptical	30/-	P. & P. 2/6
9 x 5in. elliptical	32/6	P. & P. 2/6
10 x 6in. elliptical	39/6	P. & P. 2/6

BAKER "GROUP 25" 12in., bass model fitted with heavy cone giving full output down to E-string of bass guitar at 41 c/s. Impedance 15 ohms. Handling capacity 25 watts. **£5.5.0** P. & P. 5/-

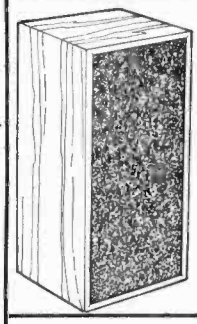
Duvidal CROSSOVER NETWORKS

Superb construction using selected high-grade components, each handsomely finished and constructed in metal case with integral mounting feet. Inputs and speaker outputs are made to standard screw terminals. Full instructions supplied.

CV-1 Variable Crossover—Standard 2-way unit for use with low to medium power woofer and tweeter arrangement. Variable control permits adjustment of bass and treble output levels. In bronze finished case with black plastic panel size 4 x 2⅝ x 1¾in. high. **12/6** Add 2/- P. & P.

CN-2 Crossover Network—Hi-Fi 2-way iron-cored choke and filter system offering high frequency crossover at 2,500 or 3,500 cycles/sec. Totally enclosed in bronze finished case size 3½ x 2¾ x 1¾in. high. **25/-** Add 3/- P. & P.

WHITEWOOD SPEAKER ENCLOSURES



Specially designed and constructed for Stern-Clyne. Construction is of high density, non-resonant ¾-inch chipboard, including rear panel. Front panels already cut for speaker sizes, rear panels are slotted to obtain correct acoustical loading. Ready for finishing, complete with attractive Vynair front panel speaker cloth and moulding.

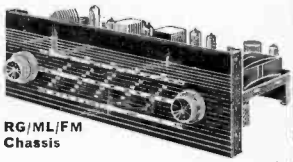
R1	8in. speakers 11 x 24 x 9in. deep	**£4.15.6**
R2	10in. speaker 15¾ x 28 x 10in. deep	**£6.10.0**
R3	12in. speakers 19 x 28½ x 12in. deep	**£7.15.0**

Models R1 and R2 can also be supplied finished and polished in handsome walnut veneers. Quote reference:

RV1 8in. speakers **£9.9.0** **RV2** 10in. speakers **£11.11.0**

Add 10/- Carriage and Insurance when ordering any model

Exceptional offer of RADIOGRAM CHASSIS



RG/ML/FM Chassis

MODEL RG/MLS

Modern 5-valve unit covers M/W (200-250 m.) L/W (1200-2000 m.) and S/W (15-50 m.). Superb sensitivity, built-in ferrite aerial external aerial unnecessary in most areas. Power output 3/4 watts. 3 ohms speaker. Attractive glass facia, concentric control knobs. Size 13 x 6 x 6in. deep. For 200/250 AC.

£10.19.6 Carriage & Ins. 7/6

Model RG/ML/FM. Covers AM and FM Bands.

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PRACTICAL WIRELESS

VOL 42 No 12
issue 722
APRIL 1967

TOPIC OF THE MONTH

Repairers All

IT is probably true to say that inside most radio enthusiasts is a service engineer trying to break out. Overlooking the whimsicality and remembering that some folk would prefer the terms "technician", "repair mechanic", "troubleshooter" or "bodger" to "engineer", there is no doubt that we all derive satisfaction from restoring a dead set or stimulating a sickly one to vigorous health.

Although relatively few readers are professional repairers, there can be even fewer who do not find themselves involved at some time or another in handling faulty equipment. Indeed, it is clear that many in our ranks obtained their introduction to the hobby purely in order to obtain sufficient grasp of the subject to be able to repair and look after their radio sets.

Once embarked on the hobby you cannot hope to escape. Apart from looking after faults which develop in equipment you have built, there is the occupational hazard we all know so well. Once having been seen with a copy of P.W. or caught with a soldering iron in his hand, the enthusiast, no matter how elementary his knowledge, immediately achieves the local reputation of being "a radio expert". He then becomes prey to all his neighbours, friends and relatives who produce a regular supply of broken-down radios, defunct tape recorders, ancient amplifiers and (probably) a miscellany of inoperative electric irons, heaters and other hardware. These pieces of equipment always have a common feature: there's nothing much wrong with them, probably just a loose wire!

To many people, however, repair work is the main interest in the hobby. There is a peculiar (some would say horrible) fascination in fault finding. A large proportion of jobs fall into general routine, but there sometimes occurs a "dog" which seems like a combination of a Chinese puzzle, *The Times* crossword and a Sherlock Holmes case. To the real service man these are the spice of life and success is sweet.

What we have been saying is that to some degree we are all repair men—some are born service engineers, some achieve skill in servicing and others have servicing thrust upon them! Although reading is no substitute for practical experience, we hope that in the months ahead our new series of articles will be of interest and help to anyone engaged in Repairing Radio Sets.

W. N. STEVENS—*Editor*

NEWS AND COMMENT

CONSTRUCTIONAL

GENERAL ARTICLES

MAY ISSUE WILL BE PUBLISHED ON APRIL 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 Rand London. Subscription rates, including postage: 36s. per year to any part of the world.

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Frequency Allocation

Having read the March 1967 issue of *Practical Wireless*, I wish to comment on some of the future broadcasting plans. On the subject of local sound radio, the White Paper says "The only possibility for such a service lies in v.h.f. . . .". We are all aware of the crowding that is prevalent in the medium wave band: could not this band be internationally stretched in frequency and this extension used solely for low power local broadcasting? The extension of the m.w. band to 1655kc/s would allow 6 extra channels (8kc/s spacing). These 6 extra outlets should be sufficient for any local radio plans if low power transmitters are used to give short range coverage of about 15 miles. Surely with the coastal and maritime services moving to the v.h.f. bands, it should be possible to extend the m.w. band for much needed local radio.

With reference to the "Pse QSL" article, I think an S-Meter calibration of 100μV in reads S9 would be correct. 1μV signals would hardly be readable on most Rx's never mind moving an S-Meter.

Desmond Walsh. Co. Tipperary, Republic of Ireland.

You have a point regarding the allocation of frequencies for broadcasting. We would go further and say there is an urgent need for revisions, and probably rethinking, in other parts of the radio spectrum. You missed the point, however, about the S-meter readings—the specimen report (as stated) was hypothetical and merely intended to give a general pattern, the callsigns, names and other details also existing only in imagination.—Editor.

Ready-made v Kits

I have been a reader of P.W. and P.TV. for many years and I have recently made up some kits offered by your advertisers. Compared to the manufactured and tested units, these kits supplied are a flop and certainly do not prove economical. Advertised goods from Japan and Russia seem to be the best buys. Any comments from other readers?

S. Lenner. Leytonstone, London, E.11.

Transistor Terminology

I too used to use valves but on account of the modest price and efficiency of transistors, have changed over. Many designs printed in this, and other journals employ Newmarket, Texas and Mullard transistors, to say nothing of Hitachi, Mazda, Sinclair, all of which use different notations. Also there does not seem to be any reliable equivalents data available.

Edwin King. Cookham Rise, Berkshire.

NEWS AND..

NEW VENUE FOR RSGB EXHIBITION

The Radio Communications Exhibition is now renamed the International Radio Engineering & Communications Exhibition and will be at a new venue, The Royal Horticultural New Hall.

VERSATILE DIE-CAST BOXES FOR THE CONSTRUCTOR

Electronic Services—STC, introduce a range of aluminium die-cast boxes in five sizes from $4\frac{3}{4}$ x $3\frac{3}{4}$ x $1\frac{5}{32}$in. to $10\frac{3}{4}$ x $6\frac{3}{4}$ x $2\frac{5}{32}$in. They feature internal slots for sliding screens and printed circuit boards. Ranges of Veroboard are available to provide a wide variation of component layout and interconnection arrangements.

ROBERTS INTRODUCE THE R303

Roberts' Radio Company Ltd., Molesey Avenue, West Molesey, Surrey recently released model R303 which employs a transformerless audio amplifier which has been designed to give extra clarity and good reproduction of the lower frequencies.

Model R303 incorporates 8 transistors and three diodes: an AF115 self oscillating mixer, two AF117 i.f. amplifiers, one BC108 audio preamplifier, one AC127 audio amplifier, one AC128 driver, one AC127 and one AC128 as complementary output pair and OA90, AA119, BA114 diodes. Medium and long waves are covered and the operating voltage is 9V. The speaker is a 7 x $3\frac{1}{2}$in. elliptical having a 10Ω impedance. A ball-bearing turntable is fitted to the receiver base and sockets are provided for a car aerial and earphones. Housed in a wooden case covered with Rexine leathercloth in a choice of scarlet, warrior blue and silver green, the complete receiver measures 10 x $5\frac{5}{8}$ x $3\frac{3}{4}$in. An alternative case has a black rexine covering with oiled natural teak end panels. Price is 15 gns. inc. battery and PT.

FROM COMMUNICATIONS Rx TO PEA BULBS

dca Electronics announce the publication of their new catalogue of equipment and components. Items listed range from communications receivers to dial bulbs. The price of this catalogue is 1s. 6d. and copies may be obtained from dca Electronics Limited, 28 Uxbridge Road, Ealing, W.5.

TREASURE TROVE

Remember all those old radar sets which flooded the surplus market after the war. There are still a few about and one begins to wonder if they might prove an investment. Some of these units were literally crammed with EF50 valves and many excellent circuits were designed and built around them. The latest price list from Mullards shows that the price for these valves new is £1 15s. 0d. each. Quick—up into the loft and search the junk box, you may be harbouring a fortune!

(A spokesman for Mullards commented that these valves were now produced specially on short run production, hence the high manufacturing cost and in turn the high purchase price.)

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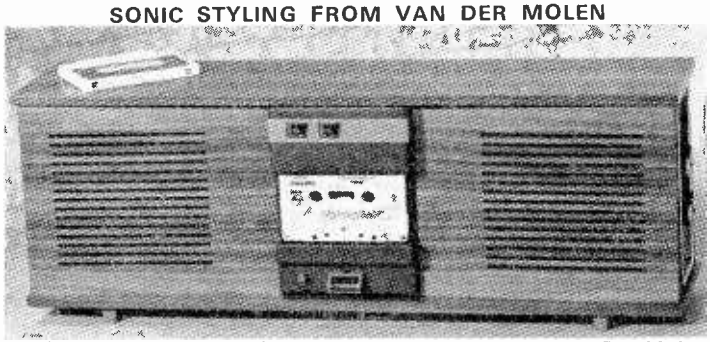
...COMMENT

SONIC STYLING FROM VAN DER MOLEN



Designed around the Philips compact cassette system, Van Der Molen have produced three units—the Sonic Range—housed in polished wood cabinets suitable for placing on a bookcase or room divider.

The *Sonic Eight* is claimed to be the first stereophonic tape recorder based on a cassette system to be designed and produced in England. Associated units are the *Sonic Six* (mono record/play) and the *Sonic Seven* (stereo play) both at 39 guineas. All these transistorised units may be used in conjunction with external pickup and turntable or an f.m. tuner. Sockets and amplifier controls are in a recessed side panel.

The *Sonic Eight* (shown above) is a 4-track machine and tapes will give either 2 x 30 mins. or 2 x 45 mins. playing time. Fast forward and rewind is 70 seconds. Playback frequency response is 60–10,000c/s ±3dB and record frequency response is 100–10,000c/s ± 3dB. Amplifier output is 4W per channel and two meters indicate the recording level. The speakers are high flux 5in. round types, one of which is detachable so that a full stereo effect may be obtained. It operates from 110–205–225–245V a.c. 50/60c/s or 20–25V d.c. Power consumption is 15W. Dimensions are 21 x 7½ x 5in., weight is approximately 15lb. and the recommended list price is 49 guineas, complete with cassette, dynamic microphone and recording lead. *Van Der Molen Ltd., 42 Mawney Road, Romford, Essex.*

TECHNICAL WRITING COURSE

International Correspondence Schools now have a home-study course on technical writing which covers the syllabus of the City and Guilds of London Institute certificate examination (329). This course is geared to the special needs of technicians, technologists, engineers, scientists, technical journalists and others. It is designed to give practice in obtaining, sorting and using the information required for technical articles and report writing and as a part of the syllabus, the student is asked to complete five selected technical writing assignments.

Full details of the course are available from the Principal, ICS Ltd., Intertext House, Parkgate Road, London, S.W.11.

MAINS TESTER SCREWDRIVER

From Vitrex (Sales) Ltd., 457/463 Caledonian Road, London, N.7, comes the "Testmaster" mains tester embodying a cartridge fuse testing socket which also carries a spare fuse.

This instrument is moulded throughout in tough nylon, has a high intensity neon, high voltage insulation and a chrome vanadium blade. Suggested retail price is 7s. 6d.

It Still Hertz!

Your leader (December, 1966) declaring the intention of PRACTICAL WIRELESS to continue use of the term "c/s" for cycles per second instead of following the recently-devised "Hz" was like a breath of fresh air to the mental asphyxia being caused in recent years in electronics by the rising generations, who might sometimes do better to pay a little regard for the simple wisdom left them by their forefathers.

The object of electronic abbreviations and symbols is to provide a shorthand that enables a circuit or data to be more readily understood than otherwise. In recent years, however, much time and thought have rather misguidedly been devoted towards devising obscure abbreviations and sub-dividing the originally sensible and moderate number of symbols into such a forest that the wood cannot now be seen for the trees. In fact, the prior equipping of oneself with a tome of symbols, of so appreciable a size that reference for a particular symbol may itself require some minutes, is becoming the accepted thing.

No one, without first having been specially taught, could possibly appreciate that "Hz" meant cycles per second. The abbreviations "c.p.s." or "c/s", are capable of ready comprehension, which is as it should be; this feature, surely, far outweighs the use of "Hz" because it may be used by foreigners, or is said to honour Hertz, or may be quicker to say?

With every respect for Hertz (1857-1894), to whom I am sure there must be better ways of paying due honour, I fully applaud and endorse the independent decision to continue "c.p.s..", or "c/s", in PRACTICAL WIRELESS and hope this outlook receives wider recognition.

Peter W. Feesey,
M.R.S.G.B., Dip.C.A.Eng.,
A.R.Ae.S. London, S.W.20.

Correction: The Explorer VHF Receiver

It has been brought to our attention, by the author, that four of the component values given in the circuit diagram and one of the items in the components list for The Explorer (January 1967 issue) are incorrect. To put matters right, the circuit diagram (page 646) should be amended as follows: R4 should read 100Ω, C4—2·2pf, TC2—3 to 8pf, and R9 should read 4·7kΩ. To correct the components list (page 649), the value of R9 should read 4·7kΩ.

More News and Comment on Page 928

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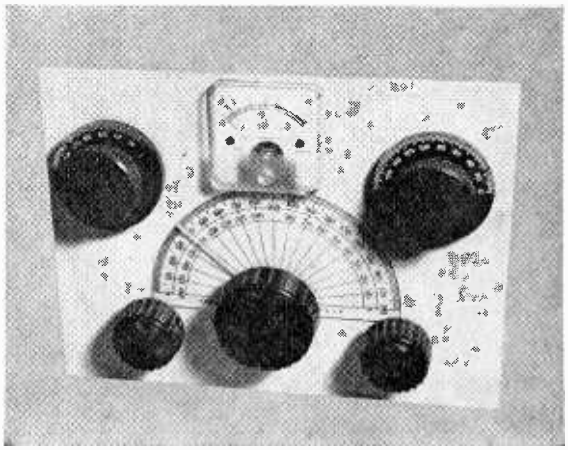
MULTIBAND TRANSISTOR SUPERHET

COVER SUBJECT

F. G. RAYER G3OGR



THIS receiver is constructed in three sections —mixer, intermediate frequency amplifier, and audio amplifier, and covers approximately 10-550 metres. It is built in a 3in. deep chassis, which encloses all items except the plug-in coils, so a cabinet is not required. This also allows the coils to be reached easily.

Denco (Clacton) Ltd. "Blue" coils are used for aerial tuning, and VC1 is a panel mounted trimmer. This circuit can thus be easily trimmed for best results, with any aerial, and there is no need for the fixed trimmers which often have to be provided and adjusted. The "Red" oscillator coils have a fixed trimmer TC1, which is left at about half capacity. VC2/VC3 is the ganged tuning capacitor. Cp1, Cp2 and Cp3 are padder capacitors, wired to tags 2, 3 and 4 of the oscillator coil holder. The coils are so made that the correct padder is in circuit when a coil is inserted. There is no padder for the highest frequency range.

The mixer section is constructed on the chassis. Coils for any of the following bands may be inserted: Range 2, 580-194m., Range 3, 180-57m., Range 4, 60-20m., Range 5, 28-9.5m. For general s.w. listening, Range 4 is recommended. Range 3 includes Amateur 80m. and 160m. bands and many other transmissions of interest. Range 5 gives very good results on those bands under 20m.

The intermediate frequency amplifier uses AF117 transistors, which give high gain and require no neutralising, and first and second i.f. transformers are double tuned. This allows five tuned i.f. circuits in all, with very good selectivity. Automatic volume control bias is obtained from the diode, and is applied to the first AF117 via R6. This operates the tuning meter, if required.

The audio amplifier has an OC71 and OC81D, directly coupled in a stabilised circuit, and driving two OC81's by means of T1. This is a very straightforward arrangement, with high gain and ample power output. Construction and testing are simplified by building i.f. and a.f. amplifiers as separate units. If necessary, the sections can be tested individually. Later, an aerial loading capacitor can be added, and helps secure best possible results on all bands, especially with a long aerial.

Audio amplifier

If this is built first, it can be tested with a pick-up, audio generator, or any other source of audio signals. It is assembled on 1/16th in. paxolin 5½ x 2¼in. Fig. 2 shows the top of the panel. Drill ¼in. holes for the mounting bolts, and for T2. A 1/16th in. drill is suitable for the other holes.

T1 is secured by its wire ends, and a green dot

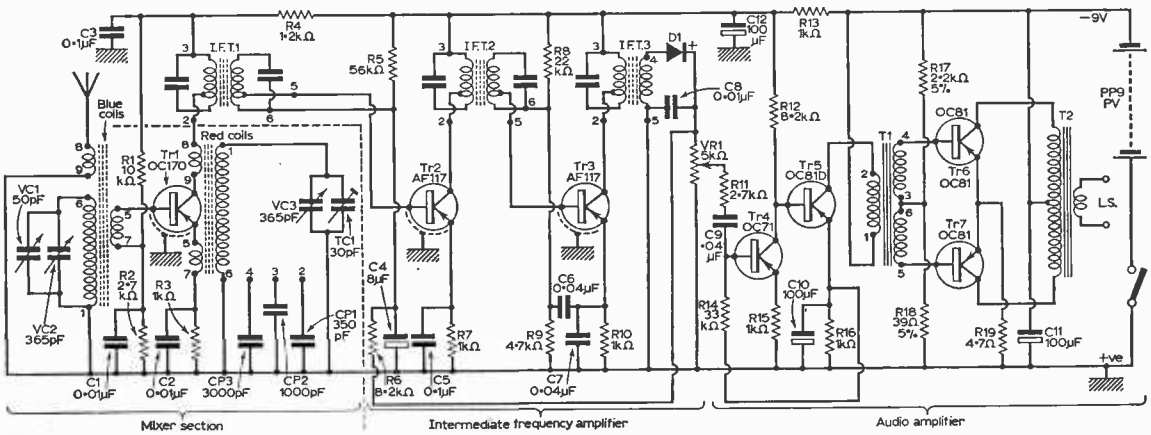


Fig. 1: Circuit diagram of the receiver showing the different sections.

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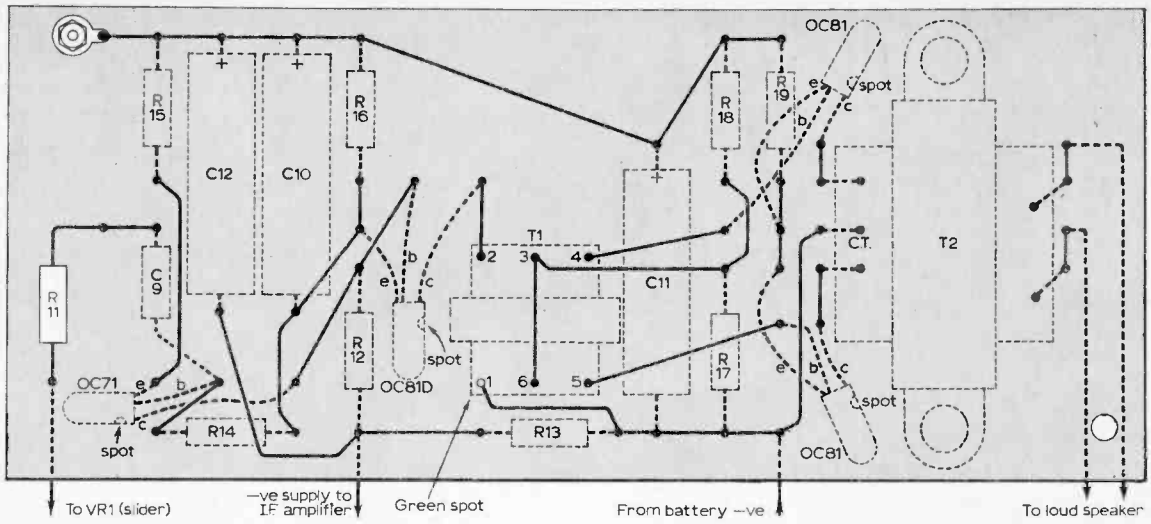

Fig. 2: Wiring diagram of the audio panel. Components shown dotted are on the other side.

marks tag 1. T2 is bolted in place.

The working of the output pair depends very much on the exact values of R17 and R18. Five per cent tolerance resistors should normally be satisfactory although ten per cent resistors do equally well if chosen for proper results. If the current drawn by the a.f. amplifier section exceeds 12mA, with no signal, R17 needs to be a trifle higher in value, or R18 a trifle lower. Should battery drain be low, and reproduction distorted, reduce the value of R17, or increase that of R18. Do not switch on with R18 disconnected. With an audio signal taken to R11, the a.f. amplifier should draw roughly 10mA with no output, rising to 40mA peaks at high volume. For normal volume, current will be in the 10-20mA range.

One of the quite large 9V batteries is recommended. Be sure polarity is correct — positive to chassis (via on/off switch).

I.F. amplifier

This is built on paxolin 4 x 2¼in. and the layout is shown in Fig. 3. Drilling positions for the i.f.t. pins can be found by pressing paper on the pins, then marking through this on to the paxolin. Each i.f.t. must go in its correct circuit position, and must be placed so that the pins come as in Fig. 3. Note that the screening can tags are connected to the earth (chassis) line. This section is assembled and wired as shown in Fig. 3. A soldering tag near C8 provides a connection with the chassis, when the amplifier is placed in position.

The leads of the transistors can be of such a length that the tops of the transistors are about level with the top of the i.f. transformer i.f.t.3, which is shorter than the other i.f.t.s. The completed amplifier occupies the position shown in Fig. 4, and is mounted in the same way as the a.f. amplifier. It may be tested first. The top i.f.t. cores can be reached with a small trimming tool when the amplifier is in place. Lower cores are reached through holes in the chassis side.

If a signal generator is available, provide a modulated output at 465kc/s. Inject this at pin 5 of i.f.t.2

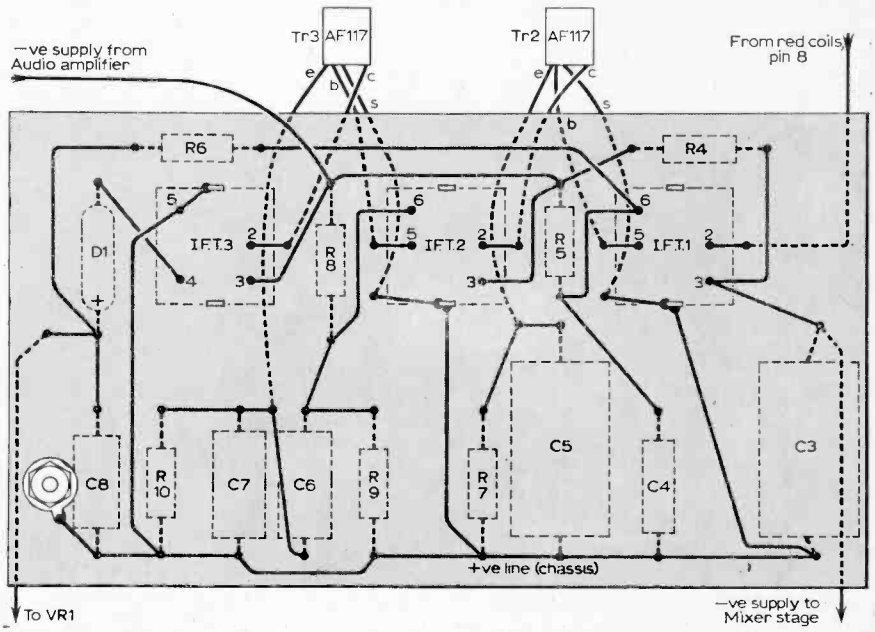

Fig. 3: Details of the i.f. panel. Frequency changer wiring shown in Figure 4.

and adjust the core of i.f.t.3 for best output. Move the generator input to pin 5 of i.f.t.1 and adjust both cores of i.f.t.2 for best results. Then inject at pin 2 on i.f.t.1, and adjust the cores of i.f.t.1. These adjustments are touched up after the amplifier is in position.

If no generator is available, leave alignment

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until the mixer is completed. Then tune in a local transmission, preferably on medium waves. Rotate each i.f.t. core for best results. If the signal strength meter is included, this will correspond to maximum meter reading. Otherwise make adjustments by ear, or by observing readings on a meter placed in one battery lead. The programme should carry speech at uniform volume when aligning for maximum battery current to the output stages. At the same time VR1 should be turned back as necessary to keep speech peaks down to 30-40mA or so. Later, either provide a small input from a signal generator, or repeat adjustments on a weak, stable signal. The latter can be a local m.w. station, received with no aerial, or with a very short wire.

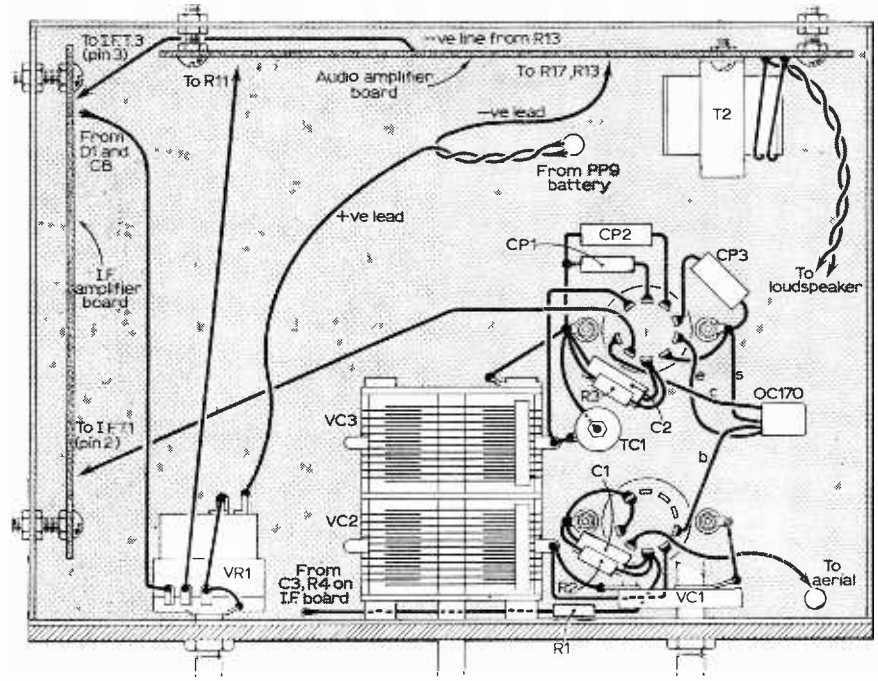

Fig. 4: Layout of first stage components. Note position of audio and i.f. panels.

Mixer section

This is assembled under the chassis as in Fig. 4. Holes should be drilled before mounting i.f. and a.f. sections. A ¾in. dia. chassis punch is most suitable for the coil holder holes. Put tags under the securing nuts for chassis connections MC. VC2/3 has an internal 6:1 ratio slow motion drive. Its spindle passes through a clearance hole, and it is fixed to the front runner of the chassis by 4BA bolts. Washers or other spacers about ⅛in. thick are required between the chassis and capacitor. The bolts must be short so as not to touch fixed or moving plates. The panel is held by the nuts on VR1 and VC1. The tuning scale was a protractor with 2in. radius. A pointer can be bought, or made from perspex, or a stout straight wire. The wire may be soldered to a piece (with grub screw hole) sawn from a shaft coupler.

VC1 is best left off until the aerial coil holder is wired. VC1 is then connected to the chassis and VC2. Trimmer TC1 is supported by short, stiff connections. All leads can be 20s.w.g. with sleeving where necessary, and should be short and direct. The OC170 is placed as in Fig. 4. In this circuit, padders Cp1, Cp2 and Cp3 are not very critical. Provided VC1 can be peaked for maximum volume, there is no loss of efficiency, so the padders need not have very close tolerance.

When wiring is completed, take the black lead from the i.f. strip along near the front of the chassis to R1.

The coils, as supplied, generally seem to have the cores screwed fully in, for packing purposes and they should be unscrewed to allow the slug to be positioned half way. Band coverage depends on the position of the oscillator core, so this should be locked with a 6BA nut, after any adjustment necessary. For best reception of weak signals an earth is required, and it can be attached to one of the chassis bolts. A long, high aerial will also improve signal strength and range.

Normally, VC1 should peak for maximum signal strength or maximum background noise. On the higher frequencies, in particular, some signals may be heard which cannot be peaked by means of VC1. This is due to "image frequency" reception, which arises with any ordinary superhet, and which would probably not be identified as such if VC1

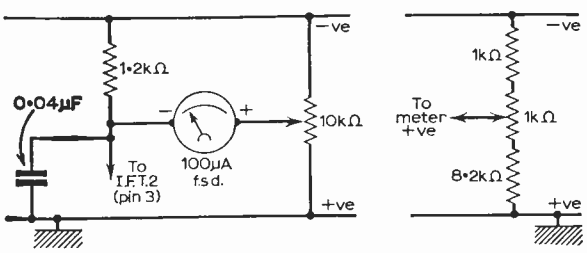

Fig. 5: Details for wiring in an "S" meter. The diagram on the right shows an alternative to the 10kΩ pot.

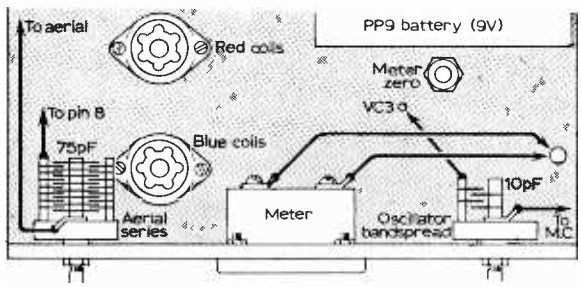

Fig. 6: Top-chassis view showing positioning of the coils and front panel components.

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were not variable. It is caused by strong signals, not tuned in by VC2, nevertheless reaching the mixer. Placing a small capacitor between tag 8 of the aerial coil holder and the aerial lead will somewhat reduce this effect. A panel operated capacitor may be used, fitted above the chassis near the aerial coils. For general purposes, a 75pF or 100pF capacitor is suitable. Opening it reduces signal input, and also somewhat increases the selectivity of the aerial coil circuit. On some frequencies it will be found quite useful. The corner of one moving plate can be bent so that the capacitor shorts out when closed.

If listening is confined to a narrow band of frequencies, the addition of a bandspreading capacitor will be found useful. This can be about 10pF. It is mounted above the chassis, and is wired to the chassis and rear section of the ganged capacitor. This allows fine tuning over a narrow band of frequencies. With very weak signals, VC1 is adjusted slightly, to maintain alignment. Should a low value 2-gang capacitor be to hand, its sections could be wired in parallel with VC2 and VC3, to remove the need for adjusting VC1 when using bandspread tuning.

Tuning Meter

The collector current of the first AF117 depends on a.v.c. bias and is around 400μA with no signal, falling to about 200μA with strong signals. This can be arranged to operate a signal strength or tuning meter. Fig. 5 shows a bridge circuit in which the meter reads zero for low signal levels, rising with signal strength. Disconnect pin 3 of the 2nd i.f.t. from the negative line, and connect a 0·04μF capacitor from pin 3 to earth line. Add the 1·2kΩ resistor and 10kΩ or similar potentiometer as shown. The latter is best on the chassis, and the spindle can be slotted or fitted with a knob. Initially place the slider near the negative end of the element. Careless adjustment will cause a quite heavy current in the meter. If preferred, this can be avoided by using a fixed resistor in series with the potentiometer, Fig. 5. A miniature type square meter can be accommodated above the tuning dial.

With the aerial disconnected, carefully adjust the potentiometer for zero reading. The reading should approach full-scale for a very strong signal. Adjusting VC1, improving alignment, or increasing the efficiency of the aerial or earth, will cause higher meter readings. There is no reading on weak signals which provide no a.v.c. voltage.

★ components list

Resistors ¼w 10% unless stated.

Resistors:

R1	10kΩ
R2	2·7kΩ
R3	1kΩ
R4	1·2kΩ
R5	56kΩ
R6	8·2kΩ
R7	1kΩ
R8	22kΩ
R9	4·7kΩ
R10	1kΩ
R11	2·7kΩ
R12	8·2kΩ
R13	1kΩ
R14	33kΩ
R15	1kΩ
R16	1kΩ
R17	2·2kΩ 5%
R18	39Ω 5%
R19	4·7Ω
VR1	5kΩ pot. with switch.

Capacitors:

C1	0·01μF 150V
C2	0·01μF 150V
C3	0·1μF 150V
C4	8μF 6V
C5	0·1μF 150V
C6	0·04μF 150V
C7	0·04μF 150V
C8	0·01μF 150V
C8	100μF 12V
C9	0·04μF 150V
C10	100μF 6V or 12V
C11	100μF 12V
C12	100μF 12V
CP1	350pF 5%
CP2	1000pF 5%
CP3	3000pF 5%
VC1	50pF air spaced variable.
VC2/3	Jackson 02 (2 x 365pF) slow motion variable.
TC1	30pF air spaced trimmer.

Semiconductors:

Tr1	OC170
Tr2	AF117
Tr3	AF117
Tr4	OC71
Tr5	OC81D
Tr6	OC81
Tr7	OC81
D1	OA81

Inductors:

T1	Weyrad (Electronics) Ltd.	LFDT4
T2	ditto	OPT1
IFT1	IFT18/465	Denco (Clacton) Ltd.
IFT2	IFT18/465	
IFT3	IFT14/465	
Coils, Blue and Red, ranges 2, 3, 4 and 5.		

Miscellaneous:

4-sided chassis 7 x 5 x 3in. deep. Two B9A non-skirted holders. Panel 7 x 5½in. Paxolin 4 x 2¼in. and 5½ x 2¼in. 9V battery (PP9), etc. Pointer and scale. Knobs.

A plug-in medium wave ferrite aerial can be used instead of the Blue m.w. coil. An aerial intended for 208pF tuning capacitor can be adjusted so that alignment over the band falls within the range of VC1. The aerial is supported a few inches clear of the metal chassis, and connected to a plug-in base to fit the B9A holder. Take the tuned winding to pins 1 and 6, and the base coupling coil to pins 5 and 7. ■

Dear Reader,

This is to invite you to join us at the Practical Wireless Film Show to be held at Caxton Hall, Caxton Street, London, S.W.1., on Friday, April 14th, at 7-30 p.m. sharp.

In conjunction with Mullard Ltd., we will be showing the Film "Electrons in Harness" followed by a topical talk "Transistors and Television". Refreshments will be provided in the interval.

Tickets are free and applications should be made to – Film Show, Practical Wireless, Tower House, Southampton Street, London, W.C.2. A stamped addressed envelope of adequate size must be included.

The Editor and Staff, Practical Wireless and Practical Television.

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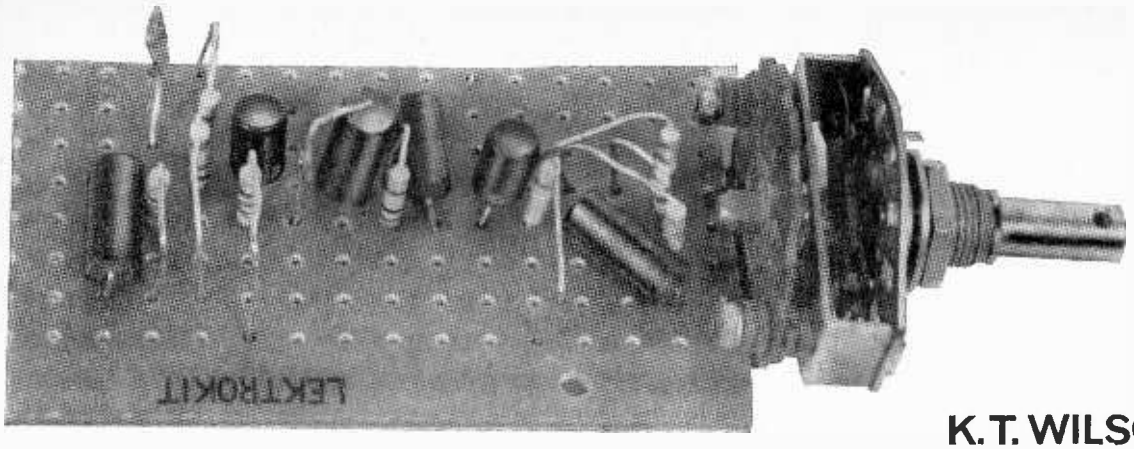


K. T. WILSON

A NOVEL TRANSISTOR PREAMP

THE amplifier described here was built to be used as a universal preamp, capable of handling audio or video signals when the gain of the a.f. amplifier, the oscilloscope or the video amplifier of the TV set was insufficient. For such a purpose the preamp had to have very good frequency response, several switched gain settings, and had to be easy to build.

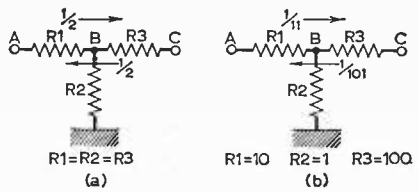
The answer was found in a new theory of transistor amplifiers developed by an Australian authority. Normally, the design of wide-band transistor amplifiers is an extremely difficult business, as anyone who has applied the formula for the gain of a single transistor stage to predict the gain of a complete amplifier will know. The whole trouble is that the gain and the input and output impedances of any stage of a transistor amplifier depends on what has gone before and on what follows. For example, if we make up a simple single-stage transistor amplifier and set up equipment to measure its gain and output impedance, we will find that the results we get from a 75Ω source are quite different from those obtained using a 50kΩ source. This effect is not found to any noticeable extent in valves and is due to the internal feedback in the common types of transistor. One method of getting round all this is to use the most modern types of silicon planar transistor, where the internal feedback has been reduced to negligible proportions. Alas, these transistors are still very expensive in this country, and the manufacturers seem reluctant to release details of circuits using such devices.

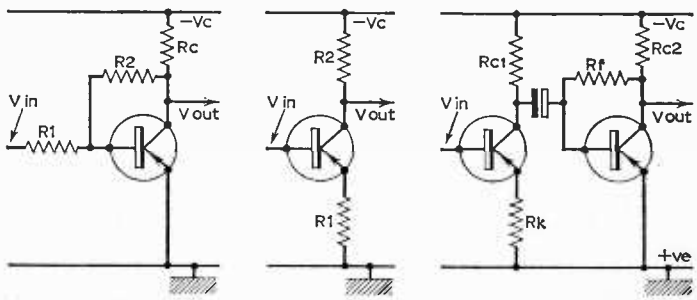
Those of us who do not have rich aunts in the USA are therefore forced to use cheap and readily available germanium transistors, and to find circuits which will enable us to construct amplifiers of good performance.

New Approach

This new approach is, like all good things, basically very simple. If the trouble with transistor amplifiers is interaction, we shall minimise the interaction by mis-matching between stages of the amplifier. Figure 1 illustrates the principle involved. In Fig. 1a, R1 represents the output impedance of one stage, and R2 and R3 represent the input and feedback impedances of the next stage. Suppose that all these impedances are equal. If now a voltage V appears at A, the voltage at B is V/2 since R1 is equal to R2; and this is the voltage "gain" of the coupling stage. The same argument applies in the opposite direction, though, and the feedback "gain" must also be 1/2. Since the forward gain is equal to the feedback gain, feedback theory tells us that the overall stage gain of the transistor to which this network is coupled must be one. Therefore a pair of transistors coupled in this way would have the same gain as a single transistor. This is a vivid example of the difficulty of predicting the effect of cascading transistor stages.

Now consider the values given in Fig. 1b. Here the forward voltage gain is 1/11 and the feedback





Left to right. Fig. 1a, 1b: Principle involved in mismatching. Fig. 2: Shunt Feedback. Fig. 3: Series feedback. Fig. 4: A series feedback stage coupled to a stage with shunt feedback.

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gain is 1/101. The ratio is a little more favourable this time, but the overall gain of the stage is still set by the feedback impedance, R3, whose precise value cannot be calculated, as it depends on the operating conditions of the transistor. The obvious method of stabilising the transistor impedances is by the use of feedback on each stage, and this indeed is the method used. There are two ways of applying local feedback to a transistor amplifier stage, shunt, illustrated in Fig. 2 and series, illustrated in Fig. 3. In either case the gain is very nearly equal to R2/R1. It is a remarkable thing about the design of transistor amplifiers that an approximation is usually better for practical purposes than the most carefully worked "exact" solution. I use the word exact in quotation marks here because such solutions are usually worked with little or no regard to the large spread of transistor parameters and to the effects of coupling stages referred to earlier.

We know from feedback theory that the series feedback amplifier has high input and output impedances and the shunt feedback amplifier has low input and output impedances. If, then, we make the stages of a transistor amplifier of alternate series and shunt stages, we should be able to predict the gain of the amplifier accurately.

This turns out to be correct, and a further simplification can be made. In the circuit of Fig. 4, where biasing arrangements have been omitted in

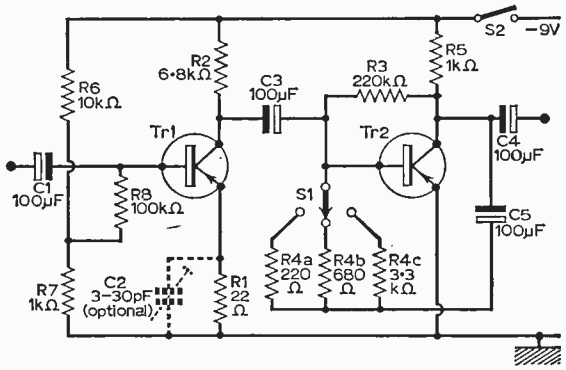


Fig. 5 (above): Circuit diagram of the preamp.

Fig. 6 (right): Veroboard layout and wiring.

order to show the feedback components more clearly, a series feedback stage has been coupled to a shunt stage. If the feedback resistor for the shunt stage is very much less than the load resistor for the first stage then the feedback resistor will in fact be the a.c. load for the first stage. The overall gain of the two stages is therefore Rf/Rk.

The following are therefore the conditions for being able accurately to predict the gain of a transistor feedback amplifier:

1. Use of alternate series and shunt stages.
2. Shunt feedback resistor must be small compared with the natural feedback of the transistor—the method may be inaccurate with some old types of power transistor.
3. Series feedback resistor (in the emitter lead) must be large compared with the emitter impedance of the transistor, which is usually about 6 ohms.

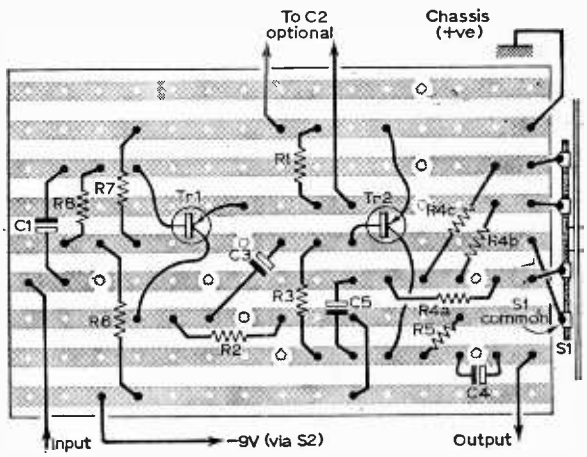
It is also necessary that for cascaded stages, the shunt feedback resistor should be much smaller than the d.c. load resistor of the series stage.

To illustrate the use of these rules, the design of the wide-band amplifier will be outlined. The basic circuit is shown in Fig. 5. We shall aim for switched gain positions of ×10, ×30 and ×100, and a bandwidth of about 20Mc/s in the ×10 gain position; this implies a bandwidth of around 2Mc/s in the ×100 gain position.

The first limitation is the emitter resistance of the series transistor because the series feedback resistor must be greater. We can reduce the emitter resistance of the transistor by using a large standing current, but this in turn will make it difficult to use a high value of d.c. load resistor, unless a fairly high voltage line is used.

Practical Values

For the series feedback resistor, 22Ω is a good compromise. This at once fixes the shunt feedback resistors as 220Ω, 680Ω and 2·2kΩ. For the d.c. load to be large compared to this last feedback resistor would require a load of at least 22kΩ, which in turn would need a battery voltage of at least 22V to bias the transistor to 1mA. We could, of course, use a 24V line; but with such a small handy amplifier it would seem a pity not to use a small 9V battery. We shall therefore bend the rules a bit;



we shall make the load large compared to the intermediate gain feedback resistor, of 680Ω. This settles the load at 6·8kΩ, and we now have to find a feedback resistor which gives us a value of 2·2kΩ when in parallel with 6·8kΩ. Using the usual formula for shunt resistors, this works out at just over 3kΩ, and we can use the nearest value of 3·3kΩ.

The d.c. shunt feedback resistor, R3 can now be specified, it must be much larger than the largest of the switched feedback resistors, and we can use 220kΩ here. The collector load of the second transistor will not be too critical due to the use of d.c. feedback through R3; we can make it 1kΩ. It only remains now to specify the coupling capacitors and the bias network for the first stage to complete.

Have we forgotten something? We have not so far specified the transistors, and this is the most

—continued on page 950

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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

SOME readers have been confused recently between kilohertz and kilocycles. The difference is purely in name, the two terms being synonymous. The actual frequency is the same e.g. 15,000kc/s=15,000khz.

ASIA

China (Taiwan): *Broadcasting Corporation of China* (53 Sec, Jen Ai Road, Taipei, Taiwan) has English at 0250—0350 on 7,130/11,825/15,125/15,345/17,720/17,780/17,890 and 1800—1900 on 9,685/9,765/11,725/11,825/15,125/17,890.

India: *All India Radio* (P.O. Box 500, New Delhi) now using 15,165/17,705 in English from 1000—1100 to Australia. To Europe 7,215 is used 1715—2200, 9,915 1915—2200, 11,905 1715—2000. The 1845—1930 French transmission is on 7,290.

Pakistan: *Radio Pakistan* (Broadcasting House, Bunder House, Karachi) now using 17,770 during its 1335—1350 English Tx.

EUROPE

Albania: *Radio Tirana* (Rue Ismail Quemal, Tirana) using the new frequencies of 6,155/1,214. English noted 0630—0700 6,155, 1200—1230 7,265 and 1500—1530 or 1,214. The 1,214 outlet blots out the BBC Light Programme in East Anglia during the 1500 Tx.

Denmark: *Radio Denmark* (Radio House, Copenhagen V) will from March 3 air its South American transmissions on 15,165 at new times. There are Danish 2000—2045 and Spanish 2045—2115.

Finland: *Radio Finland* Unioninkatu 16, Helsinki) now gives its Finlandia Mixture English programme at 1600—1630 Saturday and 1215—1245 Sunday over 9,555/11,805/15,185.

Germany: *Deutsche Welle* (Bruederstrasse 1, Postfach 344, Cologne) to have four 250kW transmitters by the summer of 1968.

Great Britain: *BBC* (C.E.X.B., Bush House, London, W.C.2) has stopped its 1730—1800 Albanian transmission and is to cut the Arabic service by two hours. The General Overseas service has been noted during the morning on 25,650/25,670. From 1415—1445 the BBC relays the Canadian Broadcasting Corporation's Russian service over 7,260.

Holland: *Radio Nederland* (P.O. Box 222, Hilversum) has free leaflets on the following: Aerials; a 13,16, 19 m.b. Converter; Selectivity improvement; a B.F.O. circuit; crystal calibrator; product detector for SSB; "This is Dxing"; and an English/Spanish DX vocabulary. Enrolment is now open for the station's propagation course to be aired from April—September.

Hungary: *Radio Budapest* (Brody-Sandor-S.O. 5-7, Budapest VIII) now uses 21,685/17,890/9,833/7,100/5,902/3,995 at 1930—2000 and 9,833/7,220/7,100 6,234/5,902/3,995 at 2200—2230 for English to Europe.

Monaco: *Radio Monte Carlo* (16 Boulevard Princesse Charlotte, Monte Carlo) has moved its 41 m.b. outlet 3AM4 to 7,140. The station is on the air from 0500—0100.

Portugal: *Radio Lisbon* (Rua do Quelhas 2, Lisbon) now transmits to Europe on 6,025/7,130/9,740 with English 2045—2130, French 1830—1915; Italian 1915—2000; German 2000—2045. The station is now understood to have two 250kW transmitters in service.

AUSTRALASIA

Australia: *Radio Australia* (Box 428G, Melbourne) reported in 11 m.b. on 25,750 in the morning. The 1214—1315 English transmission has moved to 11,710. Dxers calling programme for Europe is now being heard at 0845. Frequencies remain 11,710/9,560.

NORTH AMERICA

Canada: *Canadian Broadcasting Corporation* (P.O. Box 6000, Montreal) is to have eight 250kW transmitters by 1970.

U.S.A.: *Radio New York Worldwide* (WNYW) (485 Madison Avenue, N.Y. 10022) now transmits in English 1145—1355 17,845/15,265/15,440, 1355—1900 21,530/15,440/17,845; 1900—2115 21,530/9,740/11,970/15,440; 2115—2315 15,440/9,740/6,145; 2315—0015 11,790/6,145/15,440; 0015—0045 11,790/15,440. There are slight differences on Sundays. Dxing Worldwide is now aired on Saturdays at 2307 and Sundays at 1607. *Voice of America* (U.S. Information Agency, 330 Independence Avenue, SW, Washington 25047, DC). Greenville has been heard in English at 1200 and 1500 on 26,040 and in Urdu at 1500 on 25,950.

CENTRAL AMERICA

Netherlands Antilles: *Trans World Radio* (5C Zoutpannenweg, Bonaire) now on 11,775 to Europe with Roumanian 2000, French 2015, German 2030 and English 2130—2200.

SOUTH AMERICA

Brazil: *Radio Dragao do Mar* (Rua P. Pereira 383, Fortaleza, Ceara) reported with a fair signal at 2230 on ZYH29 4,775.

Ecuador: *La Voz de los Andes* (HCJB) (Casilla 691, Quito) now using 15,325/17,880 for English from 1845—2000. Then moves to 15,115/11,770.

Clandestine: *Radio Revistanoted* in Spanish at 2300 on 9,955. This station is thought to possibly be an outlet of Radio Pekin.

Contributors this month were Radio Nederland, E. Ashburner, Pathfinder Radio Group, A. E. Roxburgh, J. W. Smith, International Short Wave Club, Radio New York Worldwide, D. C. Oates, D. S. Abbot, Swiss Broadcasting Corporation, T. E. Rogers, M. C. Donnelly, B. Burling, S. J. Wisher.

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THE AMATEUR BANDS by DAVID GIBSON, G3JDG

WHATEVER your poison it looks as though you're in luck if conditions continue the way they have this past few weeks. Whichever band you favour there's bound to be a lovely drop of genuine vintage DX to tickle your palate—if conditions continue. Twenty metres has come back into its own again and quite a large number of reports arrived which quoted a good assortment of stations liberally sprinkled between 14000 and 14350kc/s. Quite high activity on all bands although some seem to hear quite a batch of signals and others miss the boat completely. This is particularly true of 7Mc/s and sometimes 28Mc/s. In the case of 10 metres, this band is still a bit patchy so if it seems like an r.f. cemetery when you listen, try a different time.

The comments written by some s.w.l.'s are very interesting. One such report tells of a GW station who lives in a lighthouse with the antenna up the side. (Probably keys the lamp for local working!)

Alex Liggins (Fife), listened on eighty with the Beginners 5 Band t.r.f. as per Dec. '66 "P.W". He speaks very highly of both the band and the receiver. His log includes most of Europe raised on 100ft. of garden wire. From further afield Alex logged—CT3AV, K1NPA, K2RBT, VS9ARV, W1NQN, 3A2CP, 4U1ITU. While on 20 the best was VK3AD. How about it you superhet types? Chris Claydon advises that the time to listen on fearful forty is around 0130. All owls please note!

TWENTY METRES

Very active now and certainly not dying out as some of us thought earlier in the year.

Peter Elliott (East London, South Africa) has just finished the P.W. Progressive S.W. Superhet. Using an 89ft. piece of wire he logged this lot on phone CE6EQ, CR8AG, DU-1FH, 1HR, 9FB, EP-2AX, 2BQ, 3AM, HI8EFO, HL9KX HR1KAS, HS1CB, HS4AK, JA-1KG, 4OK, 8ADQ, 8BNK, 91L, KG6-AQG, FAE, KP4BB, KR6-IQ, KS, LL, MU, UD, KW6EJ KX6BQ MP4TBO, OD5EF, VE-4AF, 5LM, 7AON, 7CE, VK-2AFU, 3MA, 4JZ, 5NY, 6XX, 9XI, VP2-AA, AQ, VP9SU, VQ9AA, VS6CJ, WA6EFB, numerous W6's and W7's, XW8-AX, BJ, BQ, BS, CA, YA1FV, YK1AA, YS-1HO, 2BB, ZL-1AH, 3AY, ZP5CF, 3W8D, 6O1AU, 9M2-NF, OV, 9M6JP, 9V1ND. If you don't hear the DX on twenty, then get yourself 89ft. of garden wire and the Feb. '66 issue of "P.W."

David Douglas usually keeps an ear on top band but lately the dial on the receiver has been tuned to 20. Best for the session—CX5AAM, K6RFW (a.m.), LA1OK/MM, HV3SJ, TF2WHI, UF6KPA, VK7CK, ZB2A, 4S7NE (Ceylon), 9M2DQ. David says that new callsigns are rampant again, 3B3= VO1, and 3C3=VE3. Wait till all G's become AX27's! Israel is now 4X and 4Z too.

Henry Law (Belfast) "Sky Champion", 70ft. l.w. plus a.t.u. heard mostly EU's on phone but also managed—CT1KT, KI6LKJ, SVØWL, SVØUF, TF2WJK, TF2WHI, VE-1AJO, 2BAZ. 3DFU, 3UR, 4OX, VO11B, VK-2AVA, 3AUP, 5XK, 9FR, 9JV, ØOV, VR2DI, VU-2KX, 4OG, XE1CCW, XF4RY.

Martin Davies (Northumberland) writes: "The VK signals were extremely strong, the S-meter reading for the VK3 station was 40dB over S9!"

40 AND DOWN

Down to 7Mc/s and lower once more, but don't worry, we're not alone. Those who do listen seriously on 40 swear by it for producing DX. The two virtues necessary are patience and persistence (course—a receiver helps too!).

N. Henbry (Rye) EA12, 20 metre dipole at 25ft. captured these goodies on phone and that takes some doing on 40—EP2BU, HI8XNO, K5OSH, PY7VON, PY8QQ, PZ1CF, UB5QG, VP6EW, VP6KL, W2SJH, WØIPB, WA1DBM, YV1PW. On eighty the same set-up raised—CN8AW, HI8XAL, K3UZE, K8YWG, MP4TBO, OD5EJ, UQ2KFT, VO1FX, W1FZJ/KP4, W2GO, W3BMS, W5KFD, 3B1FX (VO1FX) all s.s.b. Norman queries SV2HB heard on 80 at 2125 on 12.12.66.

C. Claydon (Fife), 84OC plus PR30, 12ft. vertical, tuned across 40 and heard—ET3RT, HI8XAL, HZ1AB, PY2-OTV, NE, PY6GN, PY7VON, PZ1CM, TF2WJX, TI2PZ, UL7IT, VE2TZ, VS9AJH, W8ZCK, WA9MJD, WB4CFN, XE1C, YV4NS, YV5BZH/6, 3C3BLU, 4Z4NAB, 7X2ED, 9Y4-AR.LE.

M. Smith (Shetland), PCR3, 35ft. vertical, claims he was heartbroken to read in February "P.W." "No DX on 20 and 15". His log for 21 reads—CT2AC, K1RPQ, LU1DAI, ST5SA, VE1GD, VK5KF (running 25 watts), VK6QL, VK6NA, W-1RF, 2PQG, 3LPN, 4POH, 8TUS, 9QHR, WA4UGB, WB2KWY, WØRWC, XE2SZ, ZC4DX, ZL2AQA, ZS4NL.

10 METRES

W. Nutt (Notts), says 28Mc/s is active in the early afternoons. His log reads—UA3VGN, UA3MOG, UT5KHT, VE3BVV, VP7NX, VQ8BJ, W1RFM, W2WQO, W9KAH, W9VUB.

David Douglas (see 20 metres), tuned in to ten metres and hooked—CR7CZ, CR7CI, CR7FM, FH8CD, VS9APW, ZC4MO, ZL1OD, 3C3AXF, 3C3BSM, 3C3DSL, 9J2MM.

N. Henbrey (see 80 metres) heard these on s.s.b. —K1LWI, W8HRS, WB2BEE. VK6CF, ZC4CI, ZE1JE. Norman writes to say that the VKØAA in his log printed in the Feb. issue should be DKØAA, sri OM.

NEWS AND CONTESTS

Contests and gatherings for this month include March 4-5th. 2 metre contest; 4-5th ARRL DX phone contest (should be a lively one to listen to, see if you can hear all States!); 11-12th BERU contest; 18-19th ARRL DX c.w. contest.

If you'd really like a challenge and you'd like to do something really useful then listen on April 2nd on eighty metres. It's the 3·5Mc/s QRP (low power) contest and all reports will be welcome.

Donald Wood writes from Nicosia and says that the "First Cyprus Amateur Radio Club will be on 160 and 80 by the end of March". He would like to hear from clubs or amateurs, his address is 9 Aetoles St., Nicosia.

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*idea for... INFINITE BAFFLE

G.R.FLETCHER

WITH the increasing installation of central heating systems in the older type of house, fireplaces and chimneys are becoming useless items. The unused fireplace is usually filled in and the space wasted.

This very nearly happened to the writer, but being a hi-fi enthusiast in the throes of rearrangement and in particular seeking a new location for the loudspeaker my thoughts drifted towards the type of "infinite baffle" in which the loudspeaker is built into a wall thereby taking advantage of the large effective baffle area.

It then registered that a good enclosure of this type was available—the now disused chimney and fireplace. There would be no need to knock holes in the wall and the chimney would have enough volume to load the small loudspeaker available.

This was all theorising, since I could find no account of anyone having tried it out. So it was decided to find out the hard way. As it turned out the practical work was easy and only a few tools and a little time necessary.

The first step was to ensure that the open tops of the chimney were covered, or as the builders term it "capped". Next, to prepare the fireplace by filling in with brickwork except for a hole just large enough to take the loudspeaker (Fig. 1).

A square-shaped recess was made on the face of the brickwork around the hole, to take the small wooden board on which the loudspeaker was mounted. This square-shaped recess was arranged by facing the brickwork with cement and leaving the recess the depth of the wooden board thickness. Possibly an expert mason could have prepared the hole so that the loudspeaker could be fixed directly on the wall.

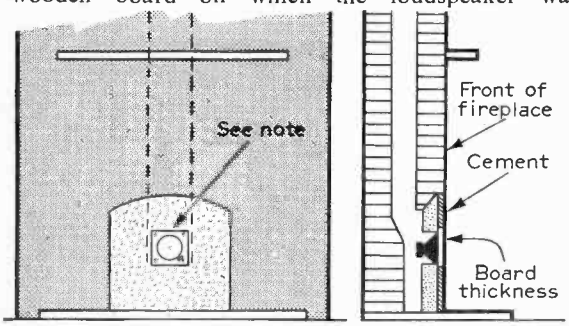

Fig. 1 (above): General details of system.

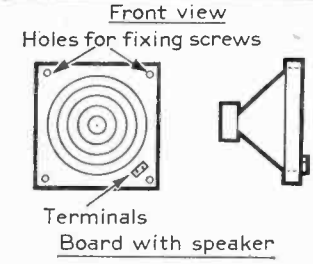

Fig. 2 (below): Loudspeaker mounting.

The next step was to prepare the small wooden board from a hard wood, for mounting the loudspeaker, as in Fig. 2. This was made as small as possible, but stiff enough to secure the loudspeaker solidly to the wall. A small terminal block was fixed in a convenient position on the front of the board to take the loudspeaker connection.

Two small holes were drilled in the board for the wires from the loudspeaker to the terminals. These holes were just large enough to allow the wires to be drawn through under slight strain leaving no air gap in the hole.

When the loudspeaker had been fitted to the board and connections made to the terminals, it was only a matter of minutes to fix the board in position, with a screw in each corner (Fig. 2).

Before finally fixing the loudspeaker and board, I rolled up the pages of several newspapers into large wads and packed these up inside the chimney as far as I could reach. I wedged enough wads in position to ensure that soot and dust would not fall down the chimney. I found that this precaution did not affect the reproduction of the system.

A simulated log fire is normally placed on the fireplace surround, and this was most effective in screening the loudspeaker from view. This also reduced to the barest minimum the slight high frequency background hiss which is just perceptible on live radio transmissions, particularly when one is directly facing the loudspeaker cone. I did not place gauze or screening material over the board in front of the cone.

On testing, I did not quite expect such a revelation in sound. I had fitted a spare loudspeaker about 6 inches in diameter. Over the whole frequency range of a large orchestra, from the deepest bass to the highest scale of the violin, each instrument could be heard clear and distinct—the piano was certainly right in the room! The percussion instruments were clean and crisp even with the volume at a high level; no boom and the sound seemed to roll out—it was not forced out. Speech was excellent and such difficult sounds as clapping hands were heard just as they really are. Most people who have listened have been most impressed.

Of course, I did check with the neighbour who shares the chimney stack if with the volume well up the sound level was noticeable. It was hardly perceptible in their room. This could have been the objectionable point to this system! ■

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...High Fidelity Amplifier by Wharfedale

Yes, designed by Wharfedale in their own laboratory to extremely high standards, to take its place in the professional studio yet handsomely styled to be equally at home in domestic surroundings.

Wharfedale Amplifier TYPE No. WHF-20 incorporates every refinement to ensure that the programmes fed into it from your tuner, pick up or tape recorder are amplified with precise accuracy at all volume levels.

Every necessary control is incorporated but there are no gimmicks. Whilst the technical expert will favour the flexibility of the controls and the reserves of power available, the layman will be delighted to find that here is a professional instrument that is easily controlled and handled.

To whet your appetite here is a brief specification:
Stereophonic high fidelity integrated control unit and power amplifier using silicon transistors throughout.
20 watts (continuous) per channel into 8 ohm load with total distortion of less than 0.2%.
Power response –3 db at 10 Hz and 50 kHz (Ref 0 db = 20 watts)
Tone control range ± 17 db at 40 Hz and ± 12 db at 10 kHz.
Filter slope variable from 0 db to 20 db per octave above 7 kHz.
Switched loudness control gives up to 10 db of bass lift at low volume control settings.
Disc input sensitivities of 3.5 mV or 50 mV (by switch) to match magnetic or ceramic cartridges.
Switched rumble filter — 3 db at 40 Hz, –18 db at 20 Hz.
Tape input and output levels of 100 mV switched to allow tape monitoring.
Tuner and auxiliary inputs with 100 mV sensitivity.

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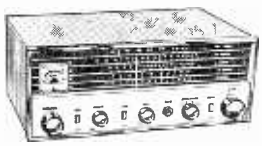
Outstanding value. High-class 4 band receiver covering 550kc/s—31 Mc/s. Seven valves plus rectifier. RF stage, illuminated "S" meter, 1.5μV sensitivity. Electrical bandspread on 80/40/20/15 and 10 metre bands. Slide rule dial, aerial trimmer. B.F.O., ANL, Output for phones or speaker. 115/220/240V. A.C. Brand new, guaranteed, with manual. **24 Gns.** Carr. 10/-

LAFAYETTE KT-340 COMMUNICATION RECEIVER SEMI-KIT

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 550kc/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 115/230V. A.C. Price **25 Gns.** Carr. 10/-.



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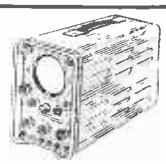

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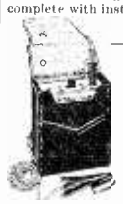

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10mA	22/6	5A D.C.	22/6	50V A.C.	22/6
20mA	22/6	3V D.C.	22/6	150V A.C.	22/6
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IMPROVING CHEAP TAPE RECORDERS

W. S. FOWLER M.A.

SEVERAL types of inexpensive transistor tape recorder are at present on the market, at a price of four to five pounds. The general usefulness of these machines can be improved in a variety of ways.

Figure 1 shows the typical layout of such recorders. A simple single motor is almost invariably used to transport the tape past the record/playback head and on to the take-up spool. This motor is centrally pivoted and mechanically swung into contact with the rim drive mounting of the take-up spool. On rewind, the "rear" drive spindle of the motor is similarly swung to contact the rewind spool mounting.

In both operations, an electrical connection is made, at the same time, to a 3 volt or 6 volt cell unit which powers the motor. In the centre or rest position, when the recorder is "off", the two spindles of the motor provide slight pressure, thus acting as brakes and preventing tape spillage.

Conventional tape recorders employ a "capstan" system which regulates the speed of transport of the tape past the record/playback head (usually the speed is $1\frac{7}{8}$in. per sec., or $3\frac{1}{2}$ and $7\frac{1}{2}$in. per sec. for music). The simple spool drive system under consideration does not employ a capstan, and the speed of the tape therefore varies, becoming faster as the spool gathers more tape, thus increasing its own working diameter.

PAUSE CONTROL

The single motor drive, however, renders it a simple matter to provide an electrical "pause" system for the machine. The advantages of an electrically operated pause are:

1. It can be remotely operated, using a length of flex with a press button at the end.
2. It saves valuable battery power.
3. It saves tape (an important feature with the standard small 3in. spool).
4. It prevents awkward silences during pauses in speech when the tape normally continues to run.
5. It permits the machine to be used for dictation, and, on playback, allows the typist to keep in step with the dictation.

To fit the remote electric pause control, the positive battery connection to the motor should be broken at a convenient point. A miniature jack socket should then be fitted to the tape recorder. It is preferable to choose a non-metal part of the recorder as a fitting point, in order to avoid any accidental short-circuit through the metal chassis.

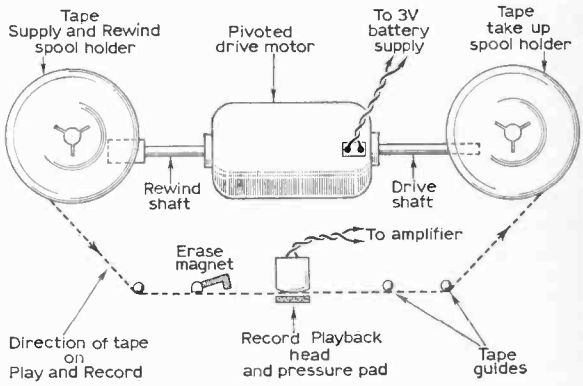

Fig. 1: Basic arrangement of tape transport system.

The broken lead should be connected with the battery side of the lead to one of the "make-break" contacts, and the motor side of the lead to the other contact. The battery lead is also joined to the "body" contact of the jack socket (the contact which is normally earth). To complete the pause control, a length of flex should be connected to a miniature jack plug. A small bell push, or similar press switch, is fitted to the other end of the flex.

When the jack plug is not inserted, the tape recorder functions normally. Inserting the jack disconnects the power supply from the drive motor, thus stopping the recorder. The reduction gearing effect of the drive system is such that stoppage is practically instantaneous. Pressing the push switch reconnects the power supply and the recorder resumes normal function, either on the record or the playback position.

SPEED CONTROL

A typical 3in. spool on a spool drive recorder results in a speed variation of from below $3\frac{3}{4}$in. per second, at the start of the recording, to above 7in. per second at the end of the spool. Furthermore, the speed varies according to the initial centre diameter of the spool, which differs according to the make of spool. Further differences will result from the type of tape used, e.g., standard or long play tape. Different makes of machine also have different "basic" motor/drive speeds, which makes interchange of tapes impossible.

It is therefore desirable to have some means of

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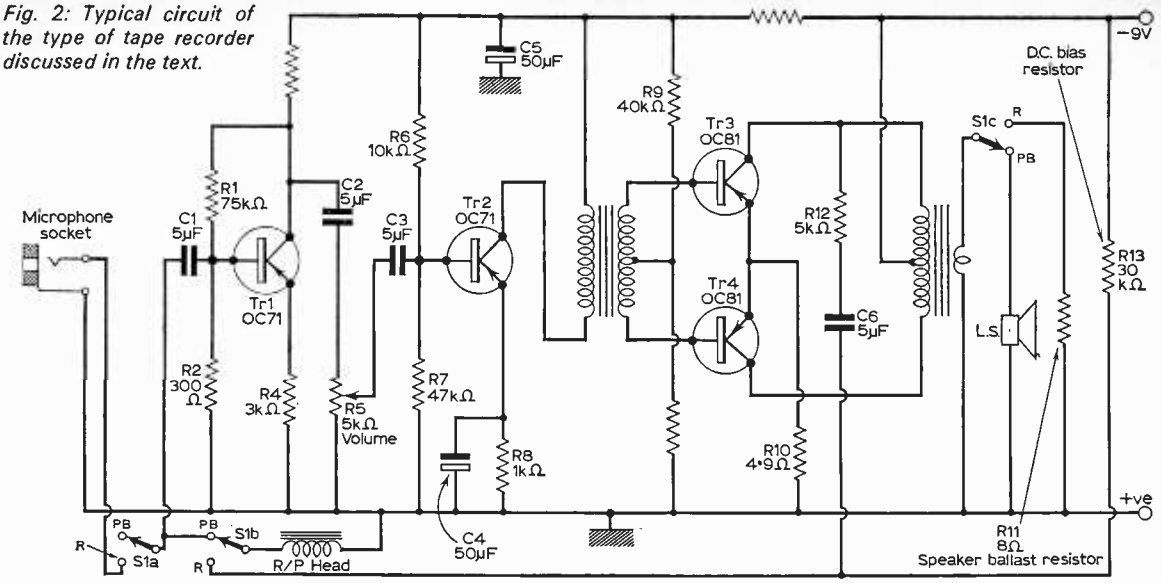

Fig. 2: Typical circuit of the type of tape recorder discussed in the text.

varying the tape speed on a spool driven recorder. This can be simply achieved by preparing a second jack plug for use in the "pause" jack socket. This second jack should have a small wirewound 10Ω variable resistor attached across it. Inserting the jack brings the resistance into the motor circuit and allows for control of speed for matching to a second recorder, or saving tape towards the end of a speech recording.

If desired the control resistance can be fitted permanently on to the tape recorder control panel. In this case, it is connected in series with the motor / battery positive lead. Some commercial spool driven recorders are now fitted with a speed control of this type.

SUPPRESSION

When considering the motor circuit, it is worth checking to see if a suppressor capacitor is fitted across the motor leads. Absence of this component tends to result in interference in the amplifier circuit, especially at the higher volume levels. A small paper capacitor of 0·05µF should be fitted if necessary.

A separate battery is usually employed to power the transistor amplifier (generally a 9 volt battery of the PP3 type). When the pause jack is inserted the motor drive batteries are disconnected, but the transistor amplifier circuit remains "on", and constitutes a useful 350mW amplifier in its own right.

AMPLIFIER CIRCUIT

The circuit of a typical transistor tape recorder (of this type) is shown in Fig. 2. The circuit is fairly conventional in all aspects. In the "record" position, the amplifier acts as a straight through circuit feeding from the microphone input. Loudspeaker output is disconnected and switched across a ballast resistor R11 to avoid feedback and consequent "howling".

The amplified signal is tapped from the primary of the push-pull output transformer and fed via an R-C network (C6/R12) to the record head. Some signal bias is necessary in all tape recording and this is normally provided by a valve oscillator circuit. Portable transistor recorders often employ d.c. bias as a substitute and this is provided from the battery negative supply via R13. Some experimenting with the value of this resistor may improve the quality of the recording, and the signal-to-noise ratio.

A valve oscillator is also normally used to provide an a.c. voltage to the erasing head which cleans off previous recordings. In portable transistor recorders, a small permanent magnet usually fulfils the erase function (see Fig. 1). The position of this permanent magnet should be checked to ensure that it is brought up to the tape surface when the recorder is in the "record" position. It is important to check that the magnet is only operating against one half of the track, otherwise both tracks of recording will be erased simultaneously.

Permanent magnet erasure is less efficient and more "noisy" than a.c. erase systems, and it is a good idea to transfer the tapes to a "mains" type recorder occasionally, to clean-up used tapes more thoroughly.

USE OF THE AMPLIFIER SYSTEM

As has already been mentioned, the four-transistor circuit of the average portable transistor tape recorder constitutes a very useful small power amplifier in its own right. The inclusion of a miniature jack socket in series with the record/playback head enables this amplifier to be used independently of the recording function of the unit. This can then form the basis of a small radio receiver, by the use of a diode jack.

Alternatively a one-transistor r.f. reflex circuit, deriving its power requirements from the tape recorder itself, works well from a ferrite slab to form an acceptable portable radio. Programmes can of course be recorded while the machine is also being used as a receiver.

The portable transistor tape recorder also contains all the essential elements of a 45 r.p.m. transistor record player, and details of these adaptations may be given in a subsequent article. ■

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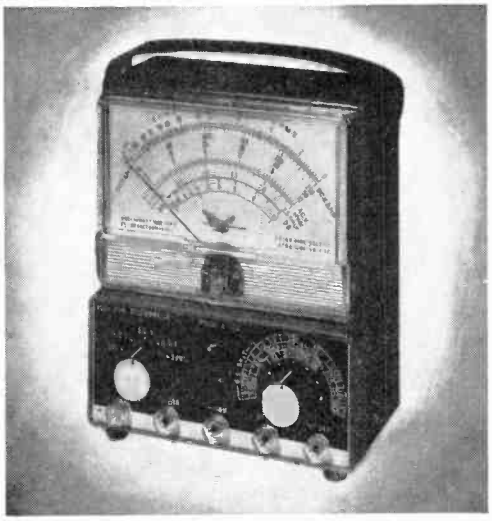

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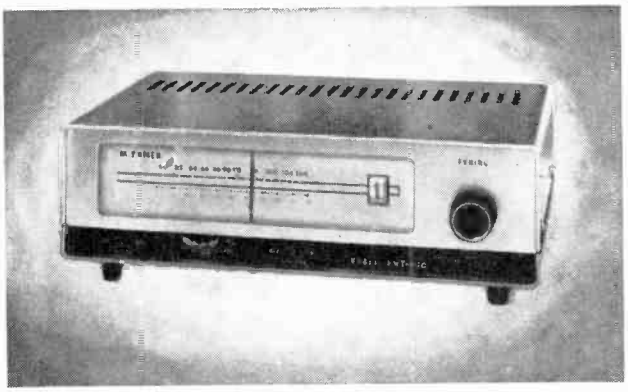

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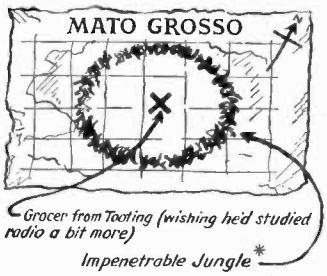

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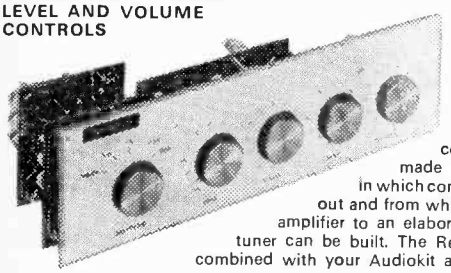

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practically wireless commentary by HENRY

No. 32

Cybernetic Serendipity

COLLECTORS of electronic snippets will have been well rewarded during the past few months. This column has picked out the curious and the exotic from the swelling heap of scientific announcements and suffered for its pains by accusations that Henry occasionally stretches the pure white elastic of truth.

But truth is stranger than science-fiction in these days, when even a humble doorbell is re-christened an "electronic indicator". There is no need for literary invention when so much of the real stuff proliferates.

Our title, for instance. That is no pleasant fancy dreamed up in a Scrabble session. The Institute of Contemporary Arts is trying to raise thirty thousand quid to put on an exhibition of computer art. This dream-child was spawned when an Atlas computer went wrong and programmers found they could draw pretty pictures with the read-out symbols.

Now they compete for the honour of the most way-out design. We have had kinetic art and psychedelic art, so why not put some of our ageing electronic oddments to use in the furtherance of culture?

This would have been better than scrapping poor Humphrey, who, you may remember, was sold to a Liverpool scrap merchant for fifty pounds because he couldn't do his sums rapidly enough. Humphrey was a cool £47,000 only five years ago when the U.S. Navy handed him over to Belfast University. But a computer that takes a week to do sums (even though those sums would take the traditional ten men ten years with ten pens etc . . .) is sadly unwanted and Belfast handed him back. The Navy, in the best traditions of the senior service, passed Humphrey on to the Air Force, and they say they made 200 enquiries in Britain before shuffling him off to a willing "Steptoe".

Makes a change, doesn't it!

We wonder if he couldn't have been better employed choosing the Rag Queen for Dudley College of Education last December. The Rag Committee tried to take the element of "bitchiness" from their search for an ideal woman. Old hands at the electronic game could have warned them that they would probably come up with a female gorilla, like the other students who used a computer for a matchmaking experiment.

No wonder the two computer matchmaking companies have been wrestling matters out in a court of law to decide who had the right to a trade mark. Serendipity indeed!

At the other end of the scale, the miniscule electronic oddment is claiming its share of the news. Little pumps that stimulate and regulate the heartbeat, transceivers that work their way around the body while "Dr. Kildare" and his cronies study screens in a control room instead of creeping around those other screens in the ward.

We heard the tale of the elderly gents in a south-western hospital who made a concerted beeline for the loo at odd times and puzzled the boffins. It was worked out that the electronic stimulators inserted to assist their bladders were being triggered off by the v.h.f. signals from the local lifeboat station.

Man the ——— boats!

As I write, there is a chappie waffling about "the Nirvana of Science" on the BBC Home Service. Soon, he says, when man thinks of God at all, he will think of him as a computer. Man, after all, is a biped whose activities are regulated by a computer that sits above his shoulders. He had better tell that to Dr. Taylor of University College, who has been slogging away at an analogue model of the electro-chemical processes of learning and has come up with a "brain" of 4,000 electronic neurons which is just able—after all their hard work, to differentiate between the sexes.

For the scoffers who imagine that Henry is trying to do a Fred Hoyle, another item of news from that prosaic body, the Electronic Engineering Association. They have drawn up a Code of Practice for laser systems. The day of the death ray is not only on us, it is passing us by. They warn against leaving the covers off equipment, citing an example of laser beams from quite modest apparatus that invisibly cuts a block of wood at forty feet. They advise, with deadpan humour, that ". . . *great care should be taken to ensure that members of the public cannot stray into the beam*".

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* A DUAL CONTROL INTERCOM

MIKE FISHER

ONE of the advantages of this solid-state intercom system is that the amplifier is switched on only when communication takes place. This makes it possible to operate the unit from a small battery and does away with the need of a mains power supply. A block schematic diagram of the intercom is shown in Fig. 1. As you can see, the two relays (RLA and RLB) are used to switch the amplifier on and to determine the direction of communication. The speakers are, of course, also used as microphones to save space and keep the cost down. Each relay has three functions: 1 to supply nine volts to the amplifier; 2 to select which speaker unit

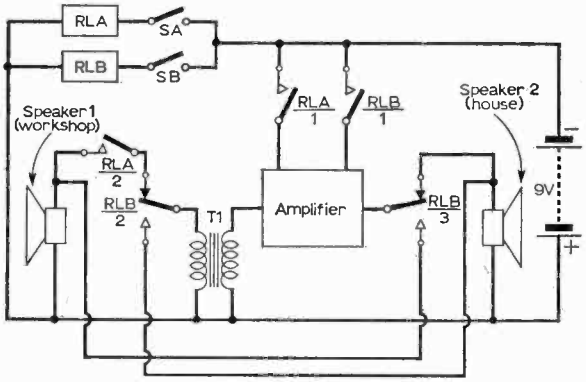

Fig. 1: Block schematic diagram of the complete intercom. Note how the relays are used to switch the speakers so that either one can be used as a microphone.

is to be used as the microphone; and 3 to connect the appropriate speaker to the input and output of the amplifier.

A circuit diagram of the amplifier is given in Fig. 2. For the purposes of explanation consider call button switch SA has been depressed. This energises relay RLA, which in turn causes the relay contacts RLA 1 and RLA 2 to change position. The first contact connects nine volts to the amplifier and the second connects the "workshop" speaker to the input transformer. As the other relay RLB is not in circuit (until call button SB is depressed), the "house" speaker is connected to the output of the amplifier, thus completing the communication path from the "workshop" to "house".

Should the "house" call button SB be depressed at the same time, relay RLB energises, and provides a secondary path for the nine volts to the amplifier. Also, contacts RLB 2 and RLB 3 change the speakers over so that the "home" speaker becomes a microphone and the "workshop" speaker is connected to the output of the amplifier.

With only the "house" call button depressed, the "house" speaker is connected (as a microphone) to the input transformer via RLB 2, the "workshop" speaker is connected to the output of the amplifier via RLB 3, and power is applied to the amplifier via RLB 1. Operating the "workshop" call button with the "house" button depressed, has no effect on the path of communication.

Strict privacy is achieved with this system, since a call button has to be operated before communication can take place.

★ components list

Resistors: (All ½ watt, 10% carbon)

R1	82kΩ	R5	22kΩ	R9	8·2kΩ
R2	10kΩ	R6	10kΩ	R10	180Ω
R3	5·6kΩ	R7	220Ω	R11	22kΩ
R4	1kΩ	R8	1·2kΩ		
RV1	10kΩ pre-set skeleton miniature				

Capacitors: (All 15VW sub-min electrolytics)

C1, C3, C4 16μF C2, C5, C6 50μF

Transistors:

Tr1, Tr2 OC75 (Mullard)
Tr3, Tr4 OC72 (Mullard)

Transformers:

T1 Step-up transformer, matching 3Ω to approx 1,000Ω. This transformer *must* be fully screened
T2 Radio Spares type TT1, ratio 1:1
T3 Radio Spares type TT2, ratio 6·6:1

Relays:

RLA 2 pole change-over, 6 to 9 volt coil, any coil resistance (prototype 680Ω)
RLB 3 pole change-over, 6 to 9 volt coil, any coil resistance (prototype 680Ω)

Miscellaneous:

Two moving coil 3Ω speakers; two single-pole, two-way switches; a 9-volt battery; wire, insulated sleeving, Veroboard, etc.

THE CIRCUIT

As loudspeakers are low impedance devices, it is necessary to step-up the impedance when they are used as microphones. This is done with T1, a microphone transformer having a primary of about 3Ω and a secondary of around 1000Ω. The ratio is not critical, but the transformer must be of the screened type. The wiper arm of the volume control, which is across the secondary of the microphone transformer, is coupled by C2 to the base of the first transistor Tr1. The output of this stage is also capacitively coupled to another common emitter amplifier Tr2, which functions as a driver.

Transformer T2 is used to split the audio signal so that Tr3 and Tr4 can operate as a push-pull

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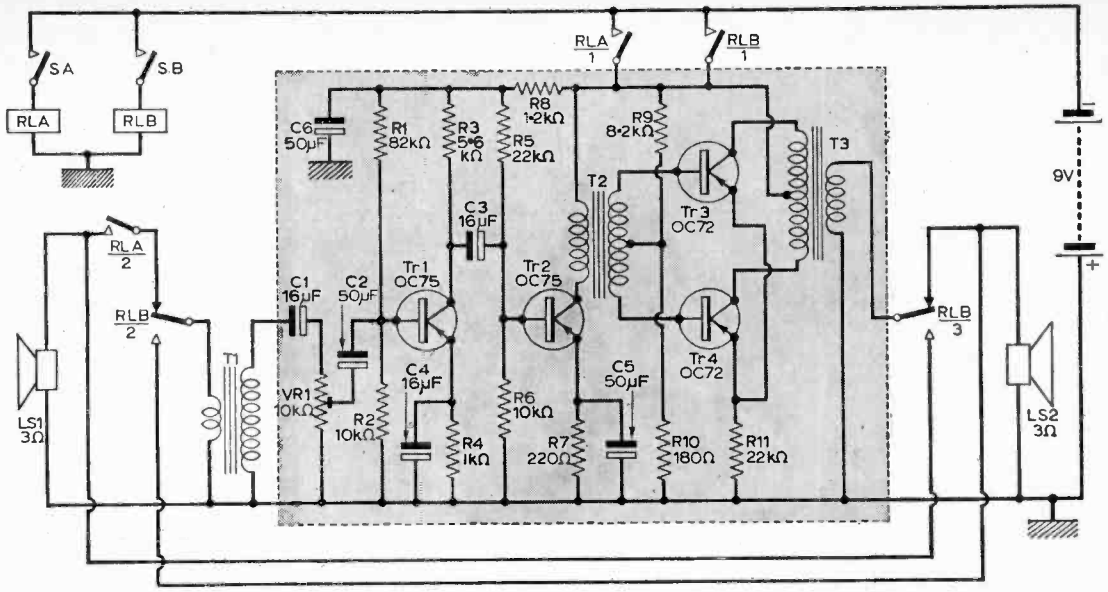

Fig. 2: Circuit diagram: the items within the dotted box are mounted on the Veroboard.

pair into the output transformer T3. This has the opposite function to the microphone transformer in as much as it has to step-down the impedance to match the 3Ω speakers. Most of the other components in the circuit are self-evident. For example, the potential dividers R1 and R2, R5 and R6, and R9 and R10 are incorporated to bias the transistors; R8 and C6 have been included to prevent instability.

This amplifier has been built for speech only and if one wishes to put music through it, a negative feedback loop should be fitted to improve the frequency response. Connections should be made from the secondary of T3 to the base of Tr2.

CONSTRUCTION

All the amplifier components are vertically mounted on a piece of Veroboard. Start construction by cutting the panel to size and breaking the copper strips as shown in Fig. 3. Now make the holes for mounting T2 and T3, using a fret-saw with a small metal-cutting blade. These blades are quite cheap and are small enough in diameter to go through the holes in the Veroboard.

Start assembly by mounting T2 and T3 on the blank side of the Veroboard and soldering their mounting lugs to the copper strips on the other side, taking care to mount the two transformers the right way round. Next, wire up the transformer leads as shown in Fig. 3. Then take the 'skeleton' pre-set variable resistor, RV1, and carefully file down the mounting lugs, reducing their width until they will fit in the holes in the Veroboard. Again, mount RV1 on the blank side of the panel and solder the lugs to the copper strips on the other side.

Now, wire up the rest of the circuit as shown, remembering that all components are mounted vertically. Take care to mount the electrolytic capacitors with the polarities as shown, and make sure that you use heat shunts when soldering in the transistors; it is good practice to make sure that the transistor leads are tinned before any attempt is made to solder them to the Veroboard.

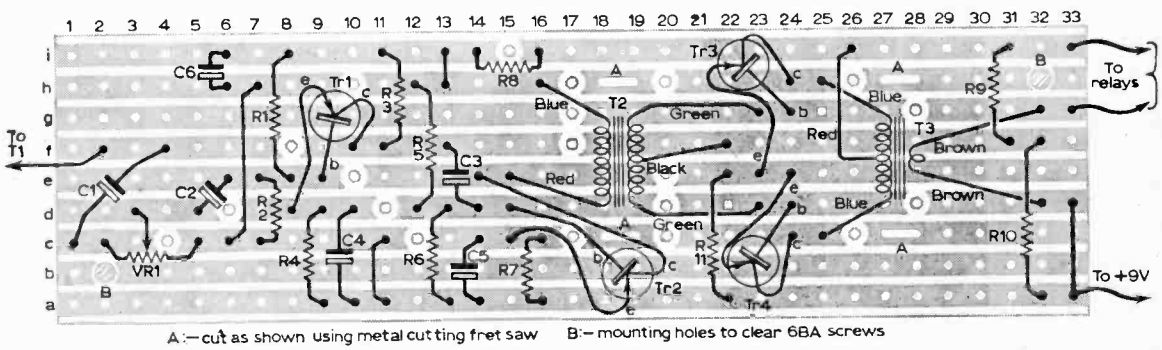

Fig. 3: Component layout diagram, showing theoretical components upon the Veroboard. In fact, all components are vertically mounted on the board to save space. One must be careful about the colour coding of the transformers T2 and T3, since the coding may only hold true for the types specified in the components list.

Two mounting holes can be drilled in the Veroboard so that the panel can then be screwed to a chassis, using small rubber grommets as insulators. The rest of the unit, i.e., the relays, switches, speakers and T1, can be wired up to suit individual needs. ■

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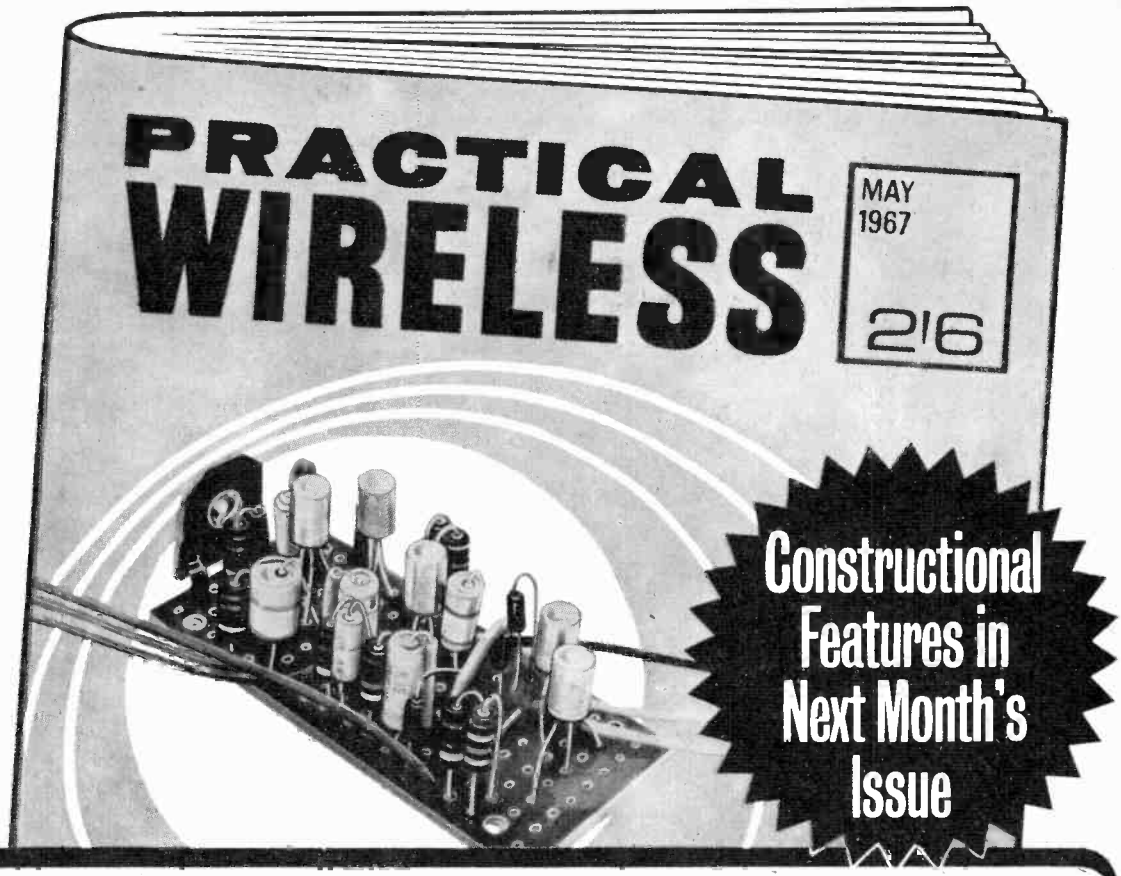

MULTI-PURPOSE AUDIO SWITCH

Extremely sensitive 5-transistor unit assembled on Veroboard and designed so that normal voices operate the "switch" at a range of up to 30ft. May be used for (either to switch on or off) radio, TV, lighting, heating equipment, tape recorders, dictation machines, etc.

BEGINNER'S 3-BAND MAINS RECEIVER

2-valve reflex receiver for headphone reception, using plug-in coils. Instructions included for winding coils for medium and short-wave bands. Optional wave-change switch.

CONVERTER FOR 70cm BAND

3-valve design for "hams", using an E88CC in the front end and two 6060 valves for mixer and crystal-controlled oscillator; i.f. output 12–14Mc/s. "Open type" construction on sheet copper simplifies assembly.

SIMPLE ANALOGUE COMPUTER

This inexpensive unit, using a minimum of components, can be quickly and simply assembled and calibration of main controls easily carried out. A centre zero meter is used as indicator.

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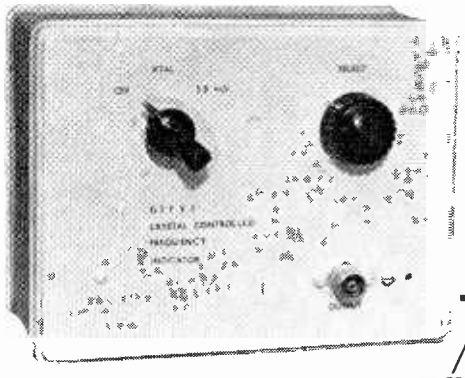

CRYSTAL CALIBRATION MARKER

A. S. CARPENTER G3TYJ

HAM FEATURE

BUILT to provide accurate "marker pips" over the various amateur bands this compact and completely self-contained unit has proved invaluable for locating band edges and intermediate points. The output from the unit when fed to the aerial socket of a radio receiver may be tuned in, amplified and detected in exactly the same way as any normal radio frequency signal. Lack of modulation is unimportant and may even be beneficial since, if the receiver used is of the "communications" type fitted with a signal strength meter, there will be visual indication of the presence of the marker signal, whilst the beat frequency oscillator may be used to facilitate aural recognition.

Although the frequency of operation chosen for the marker signal may be any that lies within the tuneable range of the receiver it is generally convenient to generate it at a comparatively low frequency and use harmonics present to calibrate higher frequency points. For example, if the chosen fundamental operating frequency for the marker is f = 500kc/s, harmonics will occur at 2f (1,000kc/s) 3f (1,500 kc/s) and so on, therefore when the associated receiver is tuned to, say 1,500kc/s (3f), a marker "pip" will be heard as it will be again at 2,000kc/s. The marker signal becomes progressively weaker as the receiver is tuned higher in frequency but may still be found at 20Mc/s or so depending on the sensitivity of the receiver used. Tests made using the prototype marker in conjunction with a RA-1 Amateur bands receiver enabled easy recognition of the signal to over 30Mc/s and this may be considered adequate for most amateur purposes.

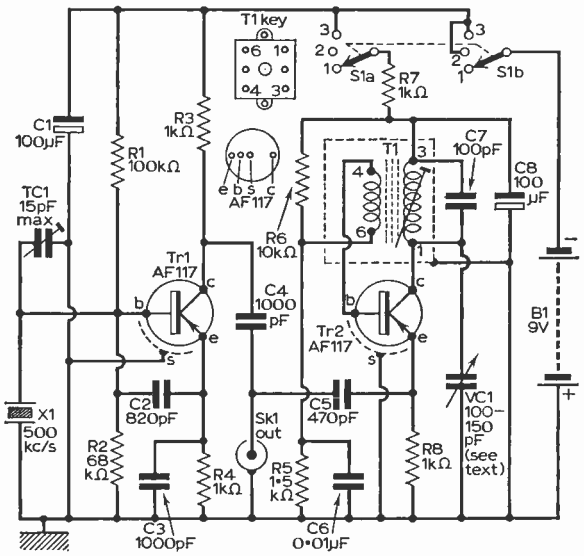

Fig. 1: Complete circuit of the marker.

Dividing the main markers

Marker pips at 500kc/s intervals although useful do tend to leave rather large uncalibrated frequency gaps on a receiver scale. The popular 80-metre band for example extends from 3,500 kc/s to 3,800 kc/s and although a marker signal pip would permit location of one end of this band (3,500kc/s) no further indication would result until the receiver was tuned to 4,000kc/s, and similar conditions exist on other bands available to amateurs: because of this it is beneficial to have optional perhaps, available. The intermediate marker pips at 50kc/s points would make possible location of both 80-metre band edges for pips would be heard at 3,500, 3,550, 3,600kc/s, and so on every 50kc/s, with the band edge at 3,800kc/s indentifiable. A complete frequency marker may thus conveniently comprise two complementary sections, an oscillator providing main marker points with the other section sub-dividing them.

Generating the fundamental marker frequency with any degree of accuracy requires use of a crystal-controlled oscillator but it is beneficial to have a limited manual control over the frequency of the dividing oscillator.

The complete circuit of the prototype crystal-controlled frequency marker is shown in Fig 1, the section around Tr1 functioning as the main crystal oscillator operative at a frequency of 500kc/s. No tuned circuit is employed and this is desirable for it is not uncommon for some such oscillators to "take off" at as spurious frequency; some in fact will oscillate freely with no crystal in circuit. In this particular section output is made available at socket Sk1 when S1 is rotated to position 2.

When S1 is further rotated to position 3 the circuitry associated with Tr2 commences to function, this being the dividing oscillator. Here, Tr2 is arranged conventionally as a feedback oscillator,

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collector/base positive feedback occurring when the windings of T1 are connected as shown. Unlike the 500kc/s oscillator this stage is tuneable over a restricted frequency band, panel-controlled VC1 being included for the purpose. Variable tuning is desirable since in practice Tr2 (which is not allowed to function unless Tr1 is operative) may be made to fall in step with the crystal oscillator at a division frequency and although capacitors C4 and C5 are the respective output "blockers" the two in series connection, do enable the repetition frequency of the Tr2 circuit to be suitably "locked". Various "locks" depending mainly on the setting chosen for VC1 are possible in practice, hence the need for variability of tuning; this point will be mentioned later.

An alternative type of crystal oscillator circuit is given in Fig 2, and this may be substituted for the circuitry around Tr1 if preferred. Feedback is secured via transformer T1 which is a sub-miniature item of the type used as the final i.f. transformer in a conventional transistor superhet receiver; capacitor Cx is prefitted. In practice the onset of oscillation is sudden when the transformer dust core is rotated to the correct operating point, but excessive core rotation results in oscillation ceasing equally abruptly. Transistor types other than that specified may be used in this circuit and the OC44 and OC45 will function, however the original circuitry is preferred.

In the prototype, work is simplified by making use of a miniature 18-way tag board and this carries the bulk of the assembly. The tag board is eventually secured to the front panel—the inside of the lid of a metal box. When the lid is placed on the box itself all items including the battery, are suitably protected with the mass of the metal container assisting in maintaining a constant temperature to aid stability. Any small metal box approximately 6½ x 5 x 2½in. is suitable but if it is of tin the lid should be reinforced internally with a rectangle of aluminium.

Wiring of the tag board is shown in Fig. 3 with panel details indicated in Fig. 4. It is beneficial when fitting T1 to bend the lugs of the screening can

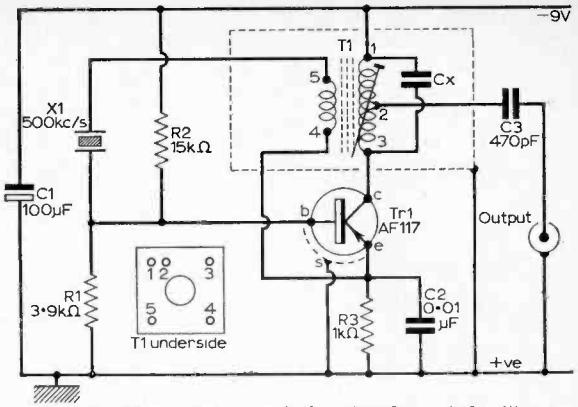

Fig. 2: Alternative circuit for the Crystal Oscillator.

outwards to coincide with holes and tags Nos. 2 and 35 on the board. Self-tapping screws hold the can securely yet permit its removal at any time without having to disturb the transformer wiring.

The on/off/function switch S1, together with VC1 (which may be any small variable capacitor of 100-150pF) and Sk1 are mounted on the lid of the box and the wiring for these items is given in Fig. 5. In the prototype a miniature 4-pole 3-way rotary switch is used for S1, the unrequired tags being left unconnected. Two stiff 'Stay' wires of 16s.w.g. copper wire are connected to the board as shown, bent to a convenient angle and soldered to the inside of the box lid to hold the whole assembly rigid; this is quite satisfactory since negligible weight is involved.

Testing

Test each oscillator separately to make sure functioning is correct. If an oscilloscope is available this is easily carried out by examining the outputs at capacitors C4 and C5. In other cases a receiver may be used when signals from the crystal oscillator should be tuneable at any multiple of 500kc/s. In cases of non-oscillation and assuming

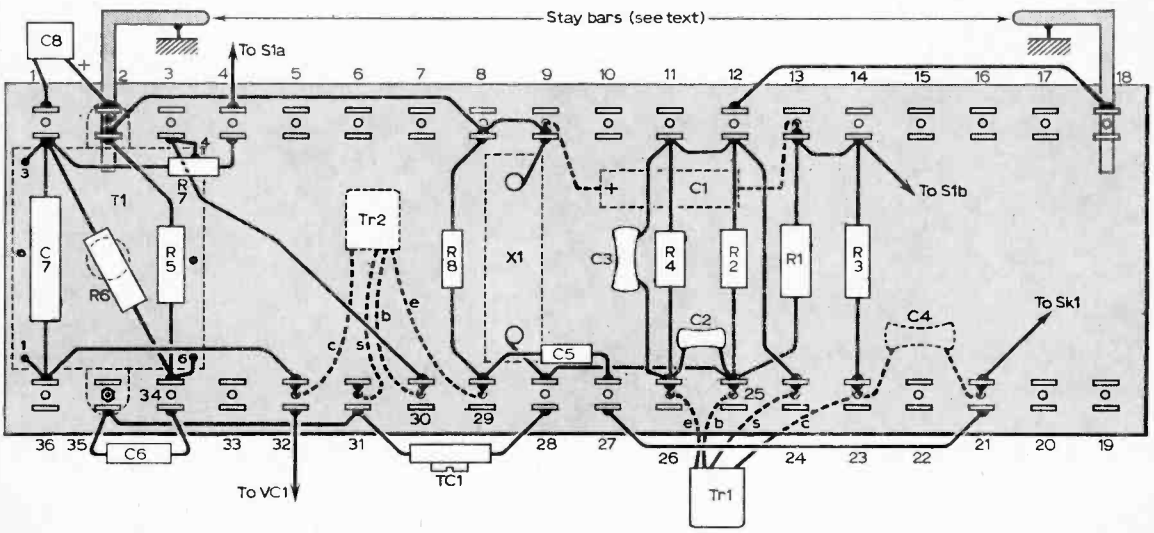

Fig. 3: Layout and wiring of the tag board. Components shown dotted are on the reserve side.

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the crystal itself to be above suspicion, slight changes to component values in the section may be required—or trimmer TC1 may be excessively engaged. If the alternative crystal oscillator circuit of Fig. 2, is in use non-oscillation may well be due to the core of T1 being incorrectly set. During these tests the current drain should be monitored

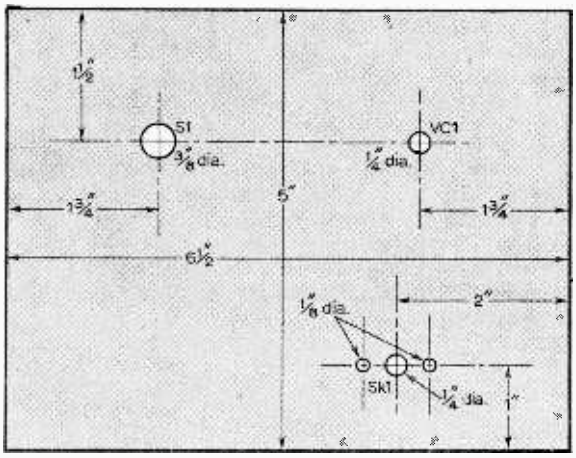

Fig. 4: Essential panel details.

and should be approximately 4mA when both oscillator and divider are funtioning simultaneously.

The accuracy of the crystal oscillator should be checked against a receiver tuned accurately to either MSF transmissions on 2·5 or 5·0Mc/s, or the Light programme on 200kc/s may be used, preferably when no modulation is present. The marker signal should be made to beat with the selected frequency standard precisely and trimmer TC1 may prove useful in this respect.

Adjusting the divider

With S1 set to position 2 the marker signal is tuned in accurately on a receiver switched to a comparatively low frequency band—say 80 metres. A marker pip should be heard at 3500kc/s and another at 4000kc/s. The 3500kc/s point is chosen and the b.f.o. switched in, and allowed to stabilize after which S1 is rotated to position 3. The signal may now suddenly sound "dirty" or unstable, indicating that Tr2 is not functioning at an exact division frequency relative to 500kc/s. By carefully adjusting VC1 control knob however the note heard will suddenly seem to 'purify' or 'sweeten' itself as a lock is obtained. If the receiver is now tuned slowly towards the 4000kc/s marker point a number of additional equally spaced pips should be heard and these should be counted. Ignoring the original pips at 3500 and 4000kc/s a total of *nine* intermediate pips should be heard for correct functioning. At the first attempt however a different number may be heard—say four, or eight. When this occurs the original 3500kc/s marker should be re-sought and a fresh lock found by means of VC1 as already described. It may be found that a lock holds on over several degrees of tuner knob rotation before the signal becomes unstable again and before the next lock point is found; the correct position for the control in such cases is midway between "ends of lock" rotation. Should eight intermediate marker pips be obtainable with the control knob of VC1 at either end of its travel, the core of T1 may be slightly adjusted or a different value chosen for C7. If possible the nine locks required should be obtainable when VC1 is at mid-travel.

With the construction, setting up and housing com-

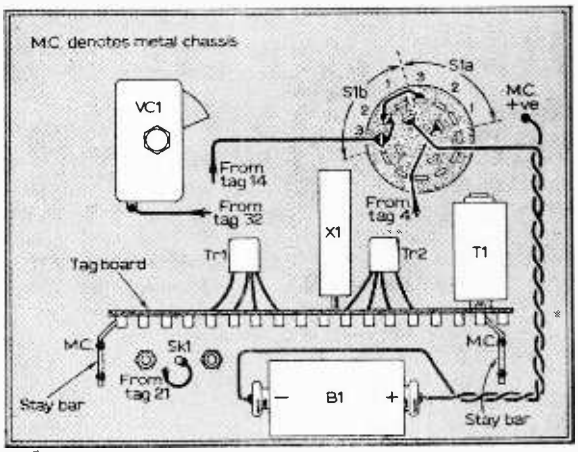

Fig. 5: Rear of panel layout and wiring.

pleted an accurate source of band edge marking is available provided care is taken thereafter with the instrument. A coat of lacquer, some neat legending by means of Leteraset symbols, transfers, or freehand, and an attractive addition to the station is made available at but small overall cost. ■

★ components list

Resistors:

R1	100kΩ	
R2	68kΩ	
R3	1kΩ	
R4	1kΩ	
R5	1·5kΩ	
R6	10kΩ	
R7	1kΩ	
R8	1kΩ	
10%	⅛W	

Capacitors:

C1	100μF 15V electrolytic
C2	820pF silver mica
C3	1000pF silver mica
C4	1000pF silver mica
C5	470pF ceramic
C6	0·01μF paper
C7	100pF silver mica
C8	100μF 15V electrolytic
VC1	150pF variable (see text)
TC1	15pF Beehive trimmer

Miscellaneous:

500kc/s crystal two-pin 10X based (Henry's Radio). T1—Denco type BF02-85. Miniature 4-pole, 3-way rotary switch (see text). Metal box approximately 6½ x 5 x 2½in. Coaxial socket. Knobs (2). Miniature 18-way tag board (Radiospares). Battery, type PP4. Pair battery stud connectors.

Alternative items when circuitry of Fig. 2 is used

Resistors

R1	3·9Ω
R2	15kΩ
R3	1kΩ

Capacitors:

C1	100μF 15V electrolytic
C2	0·01μF ceramic
C3	470pF silver mica

Transformer:

T1 Denco sub-miniature transistor-type i.f. transformer, type IFT14.

Transistors (both circuits):

AF117, OC44, OC45

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repairing radio

★The idea behind this new series of articles is to divide the receiver into sections and then deal with each section separately in terms of fault symptoms and diagnosis. The series will comprise six articles dealing with valved equipment and six articles covering transistor counterparts.

The writing will be handled by two well known technical authors. Gordon J. King will take care of basic fault finding in the electronics side and H. W. Hellyer will discuss servicing procedures, workshop methods and mechanical aspects.

Gordon J. King starts the ball rolling this month with Part 1.

THE FRONT END

The first electronics section to be considered is composed of the aerial, r.f. and frequency-changer stages, these being "the front end" of a set. All sets have an aerial circuit, but not all an r.f. stage. Usual a.m. practice caters for the aerial signal direct to the frequency-changer input, excepting highly sensitive a.m. models and most domestic f.m. sets where r.f. amplification is common.

The frequency-changer mixes the tuned aerial signal with a locally generated signal called the local oscillator signal, and the difference-frequency signal, called the i.f. signal, is developed at the frequency-changer output. The frequency-changer thus comprises two parts, the local oscillator and the mixer.

The first section is given in block diagram in Fig. 1 (a) without an r.f. stage and (b) with an r.f. stage. Fig. 2 shows at (a) the first section circuit of an ordinary domestic-type a.m. set without r.f. stage and at (b) the equivalent circuit of an f.m. tuner using an r.f. stage.

In the a.m./f.m. set, the mixer of the a.m. frequency-changer is often switched as extra i.f. amplifier on f.m., looked at in the next "electronics" instalment.

Fig. 1a should be related to Fig. 2a. The aerial circuit of the latter includes the coils and switch sections up to the first grid of the hexode section of frequency-changer valve V1. VC1 is the aerial tuning gang section, handling the signal frequency (*fs*). The main aerial signal (*fs*) is applied through C1. Note the use of a capacitive aerial in this circuit, coupled to the secondary of the aerial coupling transformers. The primary windings couple

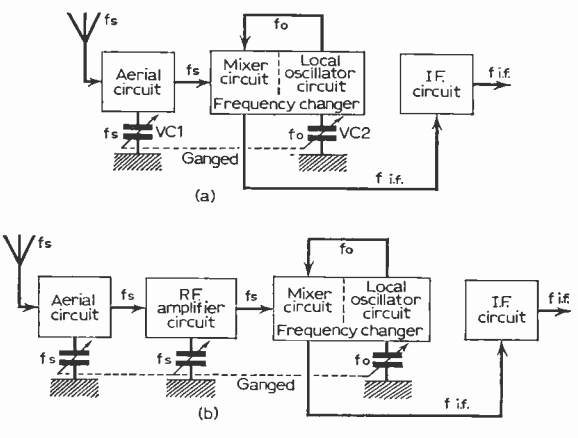

Fig. 1: (above) (a) Block diagram of superhet front-end less r.f. stage. (b) front-end block diagram with r.f. stage. fs is signal frequency, fo oscillator frequency and f.i.f. is the intermediate frequency.

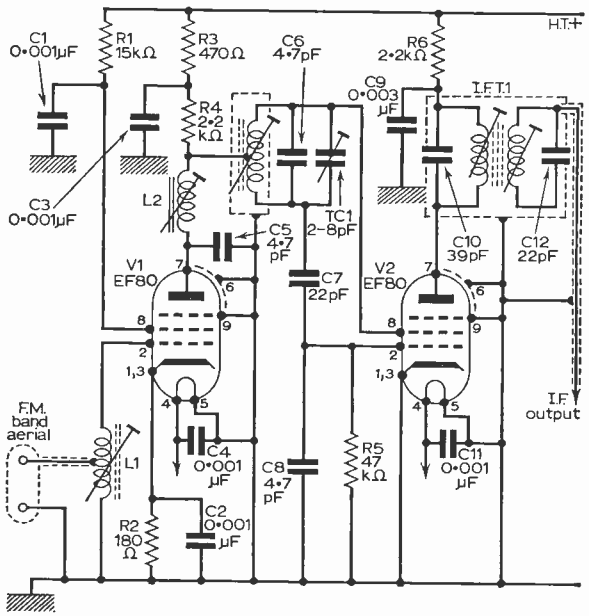

Fig. 2: (right) (b) Tuner of f.m. set or Band II front end of an a.m.—f.m. set.

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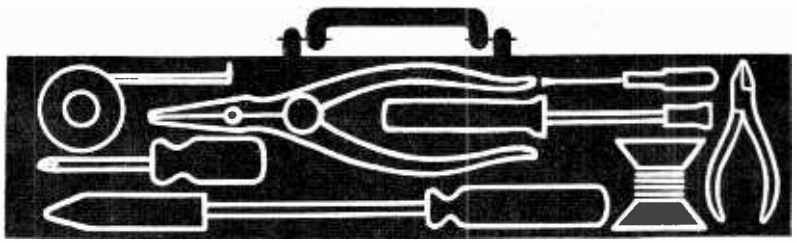
sets



H. W. HELLYER & GORDON J. KING

in the main aerial, as is normal practice.

The local oscillator circuit comprises the triode of V1 and associated tuned and switched transformers between grid and anode. The local oscillator signal (*fo*) is tuned by VC2 section of the gang.

The mixer hexode section thus receives *fo* from the aerial circuit and *fo* from the oscillator circuit. *fi.f.* is developed across the anode tuned circuits L8/C7 and L9/C10. This is the first i.f. transformer.

Fig. 2b has V1 as the r.f. amplifier and V2 as the frequency-changer. This differs from V1 in Fig. 2a in that it is a single pentode (not a double valve). It is what is called a self-oscillating mixer or frequency-changer. This is a common technique in valved f.m. front-ends.

Fig. 2b should be related to Fig. 1b. The aerial circuit is L1, the r.f. amplifier V1 with L2 in its anode, the local oscillator L3 and associated components (with the action of V2, of course), the mixer V2 and the i.f. circuit the tuned transformer in V2 anode circuit.

LOCATING THE SECTION

It is as well to locate these circuits in the set itself. The aerial circuit can quickly be traced by the lead from the aerial socket, the frequency changer is generally the first valve on the chassis to the aerial socket side of the tuning gang, while the i.f. circuit includes the i.f. transformer in a screening can the other side of the tuning gang.

The f.m front-end (tuner) is generally contained in its own small metal box, separate from the set's main chassis or printed circuit board. Instead of capacitor tuning, dust-iron cores may be arranged to traverse the coil formers (as in Fig. 2b). The cores are attached to cords, spring-loaded at one end and the other end coupled mechanically to the a.m. tuning spindle. When the main tuning spindle is rotated, the cores thus move up and down inside the coil formers.

Tuning, of course, can be accomplished either capacitively (with ganged variable capacitors) or by varying the coil inductance as described, called *permeability tuning*. Moreover, r.f. and aerial circuits of f.m. front-ends are sometimes wideband (aperiodic), requiring no variable tuning.

Medium-frequency and short-wave sets with r.f. stages nearly always have an extra tuning gang section, totalling three sections as in Fig. 1b. Four sections are less common, but are found in highly sensitive communications sets. With only one r.f. stage a four-section tuning gang is used to give a tuned bandpass coupling, and a similar arrangement is used where a three-section gang is used without an r.f. stage. The most common arrangement, though, is that of Fig. 1a.

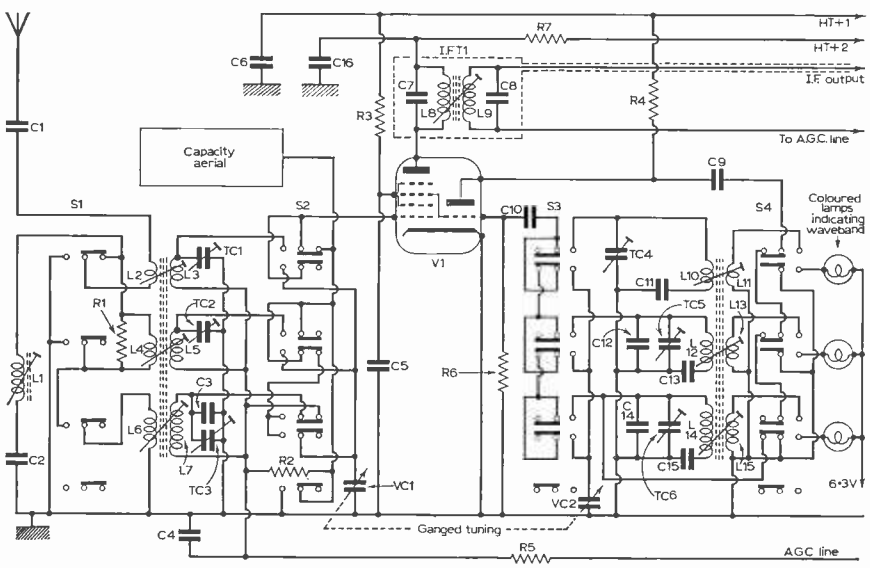


Fig. 2(a): First section of a typical mains superhet receiver.

MISALIGNMENT

The front-end of a set will fail to work if the tuned circuits are incorrectly aligned. Correct alignment is just as important as the valves receiving their correct electrode voltages. Correct alignment means that over the tuning ranges the local oscillator frequency must lead (sometimes lag) the signal frequency by an interval equal to the i.f. The i.f. tuned circuit must also be correctly tuned.

Poor sensitivity will result if the i.f. is mistuned while the aerial and oscillator circuits are correctly

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tuned. If the oscillator is out of tune, stations will ★1 fail to appear at the correct dial markings, while aerial and/or r.f. misalignment will reduce the sensitivity and might cause background whistles and instability (oscillation). If all the circuits are mistuned, then one would be lucky to get a trace of signal through the set.

The tuned circuits are designed for correct *tracking* over the whole of the various bands, but this can only be finally tailored by adjustment to trimmers and dust-iron cores (tuning slugs).

The first action is to ensure that the i.f. circuit is tuned correctly. The i.f. is nowadays 470kc/s for a.m. (though it may differ on early sets), and 10·7Mc/s for f.m. The i.f. signal is injected into the first grid of the mixer section (or common frequency changer) with the local oscillator muted. This is best done by placing a large value capacitor (about 1μF) across the oscillator section of the tuning gang.

The i.f. signal is then monitored either at the output of the i.f. channel (i.e. detector) or at the output of the audio stages (i.e., loudspeaker). In the latter case, the i.f. signal will have to be modulated with audio tone so that it can be heard. Signal generators with tone modulation that can be switched on or off are readily available, and nothing elaborate is required for ordinary broadcast set alignment.

I.F. ALIGNMENT

If the i.f. tuned circuits (i.e., i.f. transformers) are all badly mistuned, a very strong signal will need to be applied until a trace of output is obtained. This will quickly rise as the circuits are brought into tune, starting with the i.f. nearest the detector and working back, so that L9 and then L8 in Fig. 2a would receive final attention. As the output rises, so the level of the generator signal should be reduced to avoid overloading.

It is best to have some sort of metering arrangement to detect changes in output as the transformers are tuned. A low-reading a.c. voltmeter can be applied across the speaker or in place of the speaker across a suitable load resistor if the generator signal is modulated, while the voltage across the detector load resistor can be monitored with unmodulated generator signal. These output monitoring arrangements are shown respectively at (a) and (b) in Fig. 3.

With an f.m. set the voltage across the d.c. load of the ratio detector can be read on a low-reading voltmeter, as shown in Fig. 3c. Ratio detector alignment will be dealt with in a later article.

The i.f. transformer windings are nowadays nearly all tuned by dust cores threaded in the formers. Cores are used in both circuits in Fig. 2. Older sets may have trimmer capacitors instead of fixed ones, such as C7 and C8 in Fig. 2a, across the windings. Trimmer adjustment instead of core adjustment is then adopted for alignment.

R.F. ALIGNMENT

Having tuned the i.f. circuits, oscillator and aerial (and r.f. is fitted) alignment of each band in turn follows. The local oscillator is restored and the generator signal applied to the aerial socket (see later for frame and ferrite rod aerial sets). Tuning should first be to the high-frequency (low wave-length) end of the wave-band, and output indication as for i.f. tuning.

It is usual to start at the L.W. band, finishing with the lowest wavelength S.W. band (the f.m. is handled afterwards). The input signal should be tuned in wherever on the dial it falls and then the oscillator trimmer of that band should be carefully turned and the signal followed on the receiver tuning scale, working in the direction for correct dial location. The oscillator trimmers are preset capacitors in parallel with the oscillator coils, such as T4, T5 and T6 in Fig. 2a. The trimmer relating to the band under attention should be discovered either from a service sheet or by trial and error.

When the tuning is corrected at the h.f. end of the band, the l.f. end must be corrected. The generator frequency is altered to suit and the set

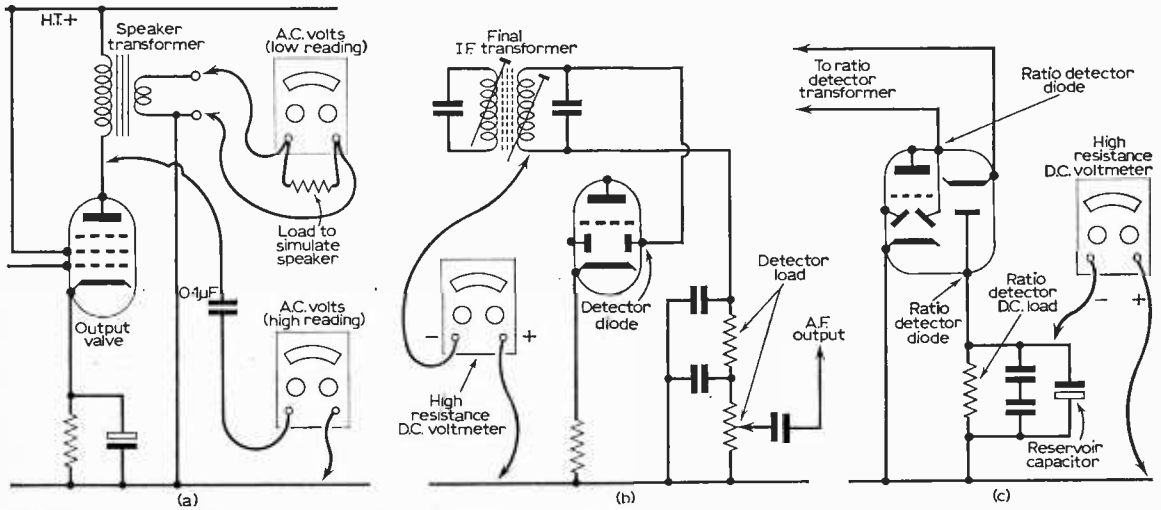

Fig. 3: Output monitoring arrangements. (a) monitoring the a.f. with the generator input signal modulated, (b) monitoring the detector load voltage on unmodulated carrier output and (c) monitoring the voltage across the d.c. load of an f.m. radio detector.

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THE PW FAULT SYMPTOM RECORD

SOME NOTES ON THE 33⅓ r.p.m. FLEXIBLE RECORD PRESENTED WITH THIS ISSUE AS A COMPANION TO THE SERIES OF ARTICLES NOW STARTING.

The PW Fault Symptom record illustrates ten different types of common faults in radio or audio equipment. These symptoms are referred to in the text where by an indented bold figure (as on page 926) and are as follows:

Symptom 1: Instability in the r.f. or i.f. stages.
Symptom 2: Adjacent channel interference.
Symptom 3: Domestic interference (a) electric motor, (b) TV set.
Symptom 4: R.F./i.f. qverloading due to faulty a.g.c.
Symptom 5: Component noise effects.
Symptom 6: Low frequency instability.
Symptom 7: Motor-boating.
Symptom 8: Out-of-centre loudspeaker.
Symptom 9: Audio distortion.
Symptom 10: Worn pickup stylus and faulty pickup cartridge.

In all the symptoms except 2, the faults are recorded as they would be heard on the test passage from a radio station or gramophone recording. In symptom 2, the effect is recorded as though the receiver is tuned to an unmodulated carrier and the interference is experienced from another station radiating the test passage.

NOTES:

1. For obvious reasons, the record should be played on equipment which is not defective, otherwise results will be misleading.
2. Ensure that the pickup itself does not exhibit symptom 10!
3. The effects recorded will reproduce as well as the equipment will allow. To compensate for shortcomings in the equipment used it may be necessary to adjust the tone control(s) for best results, i.e., if (7) is not too clear, adjust for maximum bass response, if (10) is not too clear adjust for maximum treble response.

tuned to respond. Padding corresponding to the waveband is then adjusted to secure the l.f. end tuning point on the scale. Padding is effected by either a trimmer capacitor in *series* with the coil or a dust-iron slug in the coil former.

In Fig. 2a fixed padding capacitors (C11, C13 and C15) are used, padding adjustment being by cores in the coils. Re-adjustment at the h.f. end of the band with the trimmer should then be made, followed by a further l.f. end padding adjustment, repeating for the best possible tracking over the scale.

If the aerial and/or r.f. tuning is very badly adjusted, strong generator signals will be needed at the aerial input (via a dummy aerial). The generator signal should be left at the aerial for aerial and/or r.f. alignment.

Adjustments are now for maximum *sensitivity* as distinct from tuning scale accuracy, first at the h.f. end of each band using the trimmers and then at the l.f. end with padding adjustments (if fitted), repeating until best overall sensitivity is obtained. Aerial trimmers in Fig. 1a are T1, T2 and T3, and padding is adjusted by the coil cores again. The r.f. stage is handled in a like manner, always aiming for optimum sensitivity. That is, the least input signal for maximum output.

F.M. signal alignment requires an input Band II signal (about 95Mc/s) applied at the aerial socket across 75 ohms matching impedance. The idea is to adjust the oscillator (TC1 in Fig. 2b) for dial accuracy and then follow up for maximum sensitivity by adjusting any adjustable aerial and r.f. coils, such as L1 and L2 in Fig. 2b. These are wideband, so separate alignment frequencies are not required, but a similar technique as for a.m. alignment might be needed in high-quality and complex receivers and tuners.

NO RESPONSE

A dead set can be quickly analysed by setting up as for alignment. If signals cannot be passed through the i.f. stages, the trouble is not likely to be in the front-end, excepting the frequency changer valve, which should be checked for emission and correct operating conditions. I.F. signal getting through the set from the mixer, but not signal frequency from the aerial, accompanied by lack of front-end response, signifies a defunct local oscillator. First try the frequency-changer valve, preferably by substitution. If there is still nothing, check the local oscillator circuitry.

There are several ways of doing this. One is to apply an unmodulated generator signal to the oscillator control grid with the set tuned to the L.W. Light Programme. Adjust generator frequency to the i.f. (say, 470kc/s) minus (or plus) the Light Programme L.W. frequency (200kc/s). If tuning the generator around this frequency fails to bring in the Light Programme, there is more than oscillator trouble. However, the set will probably respond.

Another test is to put a milliammeter in series with the oscillator anode (the h.t. side of R4 in Fig. 2a). The current should alter appreciably when the oscillator is muted by connecting a 1μF capacitor across the oscillator gang section. If there is no current change, there is no oscillation.

Another idea is to listen for the oscillator signal on a second set whose aerial input is coupled to the suspect set's oscillator circuit. The oscillator signal is unmodulated, of course, so will not be heard directly, but it often contains some hum modulation and if the signal is powerful enough it will not be missed when the test set is tuned.

If the test set has a tuning indicator, this will

—continued on page 949

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The Home Workshop

I read Mr. Theasby's article with great interest. I did however notice one thing which did not appear to be in order.

Whenever I operate on a wireless network, I am required to keep an accurate log of all traffic, with RST's etc. How, then, is the operator going to be able to send morse with the right hand and write in the log with the left hand as is shown in Fig. 3? Surely it would be more logical to use the system I have adopted—namely the morse key at the left hand and the log at the right hand. It is easier for most people to tap the key with the left hand than to attempt to write with it—I know, I've tried it! The result? A mass of hieroglyphics!

J. McCarthy. London, S.E.22.

The Author Replies:

This is a point that I had not noticed when drawing the diagram to Fig. 3 Mr. McCarthy is, of course, correct in his observation.

I did state in my article that the layouts were only suggested, and no one need feel bound to stick directly to the diagrams or the text.

Jam on the Bands

Referring to Mr. Mugford's letter in the February issue of P.W., I agree there are a large number of distorted modulation jammers in the short wave broadcast bands. These jammers have also started in the 13m. band within recent weeks. The band that suffers most is 19m. They just follow one after the other when rotating the dial on the h.f. side. I have counted a number of jammers in each band covered on my receiver: there are 5 in the 49m. band, 5 in the 41m. band, and 6 in the 31m. band. There were no jammers in the 16 and 25m. bands. Upon listening in the next day, the count was: 6 in the 16m. band, 7 in the 19m. band, 5 in the 25m. band, 3 in the 31m. band and 1 in the 41m. band.

Another thing I deplore is the broadcasting of programmes on channels when another station is there already. This, I think is just as bad as jamming.

G. D. Gambold, Swansea, S. Wales.

Imported Radio Equipment

In the past two or three issues of this journal I have seen letters from readers who have said that they cannot get spares, etc. for Lafayette equipment.

I have a letter from Lafayette in America stating that all parts for my HE30 receiver can be obtained from their main headquarters in Syosset, the address of which is: Lafayette Radio Electronics Corporation, 111 Jericho Turnpike, Syosset, L.I., N.Y., 11791.

George Preston. Salisbury, Wiltshire.

NEWS AND..

DXing WORLDWIDE

For over three years Radio New York Worldwide has produced and broadcast DXing Worldwide. This is a programme designed by and for the international radio listener and broadcast twice weekly to listeners in Western Europe, Europe and Latin America.

From New York, DXing Worldwide compiles features on what's "news" in international radio, new product developments, technical tips on electronics, from microphones to how to build aerials and anything of technical topical interest.

The programme is produced by Irwin Belofsky with Steve Grayson as host and is broadcast by Radio New York Worldwide on Saturdays at 2307 GMT on 15·440 and 6·015 Mc/s and again on Sundays at 1607 GMT on 17·845, 15·440 and 17·730Mc/s.

Further details of Radio New York Worldwide may be obtained from 485 Madison Avenue, New York, N.Y., 10022.

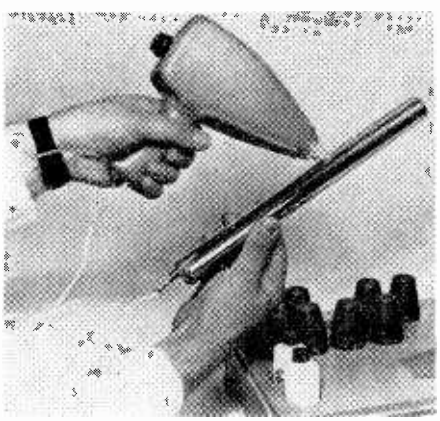
COLIN H. GARDNER

The death occurred recently of Mr Colin H. Gardner, who was with the Mullard Company for thirty-two years until his retirement in 1961. He was a past-President and Fellow of the Incorporated Practitioners in Radio & Electronics (I.P.R.E.). A radio ham since 1910, he made history in 1922 when he was the first man to transmit a radio message from a racing car engaged in breaking the world 24-hour speed record.

ELECTRONIQUES HOBBIES MANUAL

The 1967 edition of this book is now available for just 10/6d. post paid, and presents such a wealth of information on so many different items that it is quite impossible to begin to list them. This huge mail order catalogue of over 600 pages gives details of over 11,350 different parts from 85 leading manufacturers, and all items are obtainable from Messrs Electroniques. Even those obscure items are listed, like variable capacitance diodes, screw mounting feed-through capacitors, tubular trimmers and a host of other items ranging from ready made solid-state i.f. strips to stylus pressure gauges. The address to write to for your copy—Electroniques (Prop. STC Ltd.) Edinburgh Way, Harlow, Essex.

NEW PORTABLE SELF-POWERED ELECTROPLATING GUN



This instrument is a fully portable electroplating "gun". It comes in a kit which consists of 'Plectro' gun, and nine separate cartridges for plating gold, silver, brass, tin, cadmium, zinc, copper, nickel and chromium. The gun is powered by its own self-contained battery, but very large areas of plating can be tackled by using a suitable accumulator.

The standard plating kit costs £27 8s. complete, and solutions are extra to choice. A descriptive leaflet is available from David Greenwood Ltd., Camden Works, Rickmansworth Road, Watford, Herts.

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...COMMENT

STEREO RECORD PLAYER

A new addition to the Perdio/Dansette range is the Stereophon stereophonic record player. It has bass, treble, balance, volume and on/off controls; has a 5-pin DIN socket for tape input/output and has a power output of 3W per channel. The speakers are two 4in. round tweeters and two 8 x 5in. elliptical units. The amplifier employs ten transistors and power consumption is 80W at 240V. The size is 28¾ x 10 x 28in., weight is 32lb. and the price is 47 guineas plus 13s. 8d. regulator tax.

ADDITIONAL ASSISTANT SECRETARY FOR IEE

John Stanley Raven, C.B., B.Sc., C.Eng., F.I.E.E. has been appointed an Assistant Secretary of the Institution of Electrical Engineers.

Mr Raven takes charge of a Qualifications Department formed by amalgamating and reorganising the present Membership and Education Departments, and will be responsible for executive control of the processes of election to membership, for tendering advice to applicants on the Institution's requirements for the various classes of membership, for controlling examinations, and for servicing all relevant Institution committees.

N. C. Stamford, the Assistant Secretary, will continue to be responsible for policy and external relations in connection with qualifications.

RADIO SOCIETY OF GREAT BRITAIN INSTALLATION OF THE PRESIDENT

Mr A. D. Patterson GI3KYP, was installed as the thirty-third President of the Radio Society of Great Britain on Tuesday January 17th, 1967 at the Kingsley Hotel London. The retiring President, Mr R. F. Stevens G2BVN, expressed the fullest confidence in Mr Patterson, presented him with the chain of office, and wished him a happy and successful year. In his short speech the new President said that he did not envisage any startling changes during his term of office, but that increasing the membership was high on the list as was improving manners on the air. Following these remarks he presented the retiring President with a shillelagh much to the delight of the onlookers. Mr H. Wilson, President Irish Radio Transmitters Society, described Mr Patterson as a man of the very highest integrity, and said that the whole body of Irish amateurs was delighted when the news of the new President's election reached them. He then presented the new President and his (wife) with a vase of Waterford glass.

After the official installation members surged forward to the new President offering their congratulations, to which the staff of *Practical Wireless* now add theirs.

Imported Radio Receivers

I REFER to Cpl. T. K. Offord's letter in the February issue of PRACTICAL WIRELESS. This gentleman seems to be hostile towards imported receivers made in Japan but sold "under the guise" of American manufacture.

Firstly he seems to be under the impression that many radio dealers do not know where the Lafayette receivers and equipment are made. As virtually everything that comes with a Lafayette kit, including the packing box has the three well-known words "Made in Japan" prominently displayed, I am sure that he has misinterpreted the facts.

Secondly he refers to these so-called kits as being "junk" and having recently paid 25 guineas for a Lafayette KT-340 receiver which works extremely well, I should like to know if Cpl. Offord could name a new receiver with the same spec. as the KT-340 at the same price.

K. L. Kirk. Chessington, Surrey.

Transistor Terminology

I AGREE entirely with Martin Jessopp's views on Transistor Terminology (P.W. February, 1967). He remarks that he "used" to use valves; well, surely the same stupid mess existed and still exists with valve terminology. Nearly every octal based valve has different pin connections—which seems utterly stupid in my eyes, i.e. one man's grid is another man's anode and so on. Another point is, why does there exist a British Octal Base as well as the International Octal Base. I agree with Martin Jessopp, why can't the big boys sort this mess out—they've got the brains and the power.

D. Griffiths. Cardiff, Wales.

Cyprus Hams

I would like to inform you on behalf of the "First Cyprus Amateur Radio Club" that we will be going on the air by the end of this month.

Due to the limited facilities on this island, our progress has been considerably slow and it is very difficult for us to obtain any sort of technical advice. We would therefore be very grateful for any correspondence from other amateur clubs or from individuals. We will be transmitting on 160 and 80m.

Donald Wood, President. 9 Aetoles Street, Nicosia, Cyprus.

We are informed by Henry's Radio, 303 Edgware Road, London W2, that they can supply an equivalent to the BSY51 and BSY53 transistors featured in "Modernising Portable Record Players" (PRACTICAL WIRELESS, November, 1966). The alternative to both types is the 2N3705, available at 7s. 6d.

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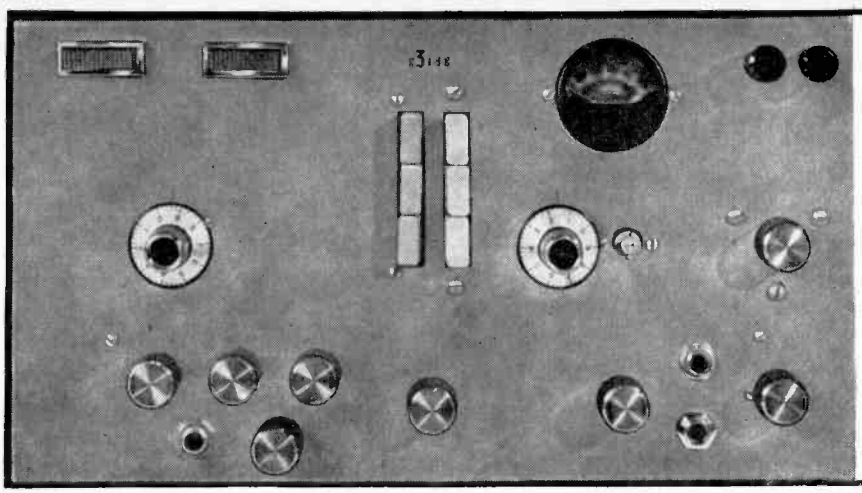

TOP BAND TRANSCEIVER

BY

T. SIMON

PART TWO

LAST month part one described the design considerations for a complete Amateur radio station measuring 12 x 6½ x 4½in. Part two continues with constructional details and testing procedures.

Since the unit is so compact there is very little room for error in the placing of components. Because of this, it is essential that all components be collected first before any chassis layout is attempted. The chassis and front panel layouts for the prototype are shown in Figs. 3, 4 and 5, but would-be constructors are urged to use these only as a guide. Perhaps the best procedure is to place the components on the chassis approximately in the positions indicated in Figs. 3 and 4, and then juggle them to suit, thus catering for any slight differences which might occur.

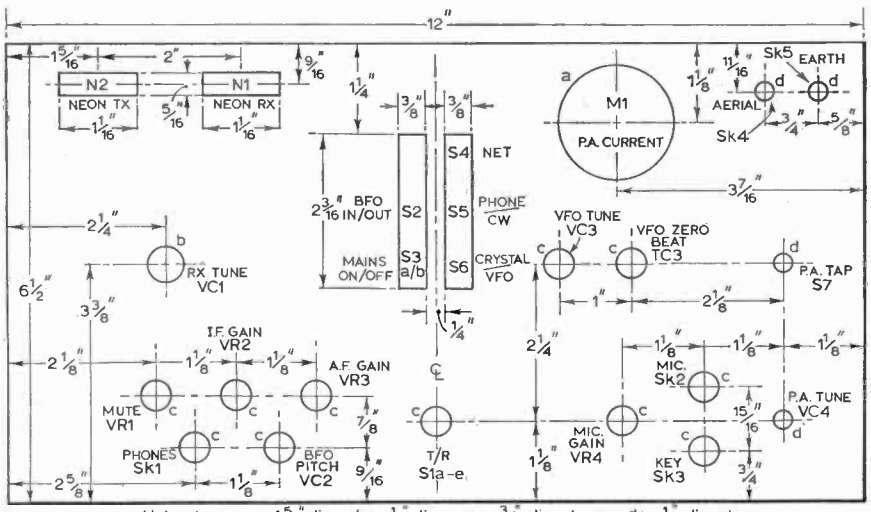

Fig. 5: Layout and drilling instructions for the front panel. Compare this figure with the heading photograph.

After drilling the appropriate holes *all* chassis mounted components should be fixed securely in position, and all front panel controls below chassis should be fitted in their allotted places. Holes should be drilled around each valve base to allow good ventilation. Later, when the outer case is ready, a pattern of holes may be drilled in the case directly below and directly above each valve. This allows the convection of hot air from the valves upwards, and thus away from the v.f.o. coil and components situated below chassis. Following this, the chassis and front panel should be bolted together, and the above-chassis front panel controls and components fitted. Strategic and generous placing of solder tags is strongly advised at the juncture. *NOTE*: None of the potentiometers should exceed one inch in diameter or trouble will be experienced in fitting due to space problems. Constructors able to layout a front panel to the nearest hundred thou. may use slightly larger pots., ordinary mortals like the writer should heed the warning.

Wire up the heaters first, twist the leads and tuck them well away from grid and signal wiring. Solder 0·01μF disc ceramics across the heater pins of each valve base using the shortest possible leads. Wire up leads to all front panel controls next, cutting them to length and leaving them floating if necessary. It is advantageous to postpone mounting the smoothing choke until last, as this allows for easier wiring up below chassis. It is also easier to leave the screens both above and below chassis until most of the wiring has been completed. The screen shown between the sections of S1 was already on the original switch and is probably superfluous, it should prove a simple matter to modify a standard switch by making a small screen out of aluminium.

The particular capacitor used for VC1 is a Jackson 208+176pF twin gang. The moving vanes on both gangs were pruned until two vanes per gang remained. This allowed the tuning swing to cover Topband with a few kc/s to spare at either end. The

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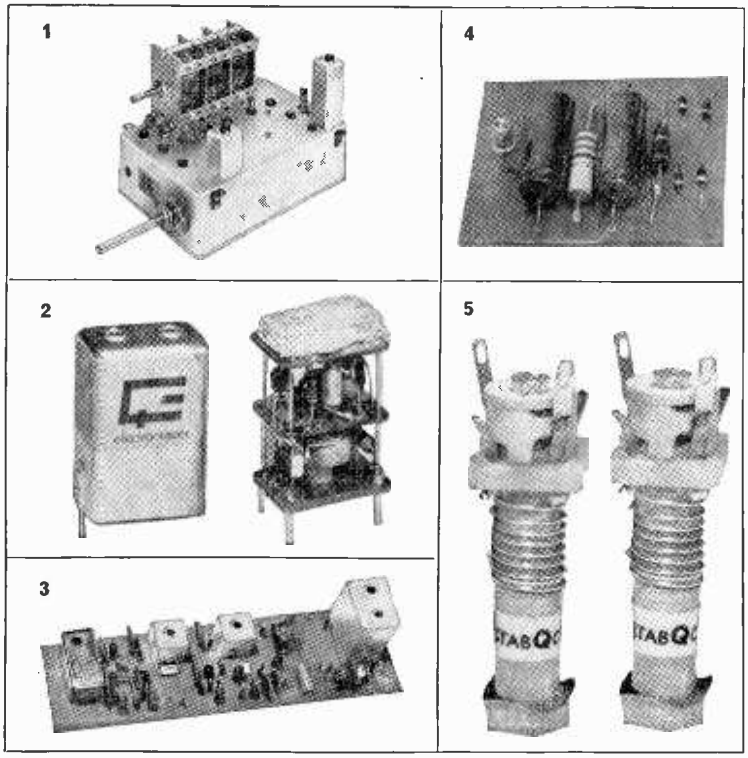

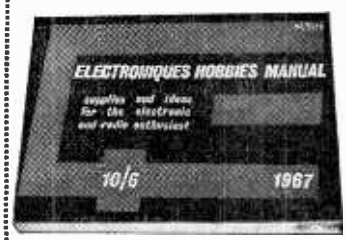

I should like a copy of the Electroniques Hobbies Manual. Enclosed is a cheque/P.O. for 10/6.

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P.W.4

Below, we've summarised 2 pages from the Electroniques Hobbies Manual

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1 Transistor Coil Packs (Qoilpax)

These silicon transistor units are available in General Coverage and Hamband versions. The IF frequency is 1620 Kc/s, ready for use with our filters and IF amplifiers as well as existing receivers as the second IF. The Manual contains comprehensive technical data and other useful information on these items.

2 Oscillator Modules

Fully transistorised, these oscillator units can be used for BFO, VFO or CIO applications. The BFO units include a variable capacitance diode as the tuning element, permitting remote control by linear law potentiometer. Extremely stable (better than ·002% per degree C), they have an exceptionally pure oscillator waveform.

3 IF Strips and Filters

Two units are available—one at 1·62 Mc/s IF for use with Qoilpax, the other for use at 455 Kc/s as a second conversion IF strip or as a main 455 Kc/s unit. Both include a half lattice crystal filter, AGC control, AM and SSB detection and BFO injection for CW reception. A third unit, also at 455 Kc/s, uses a ceramic filter.

4 Power Modules

These small stabilised power units operate directly from 6·3V AC heater supply. Two outputs available: 6·2V at 50mA Zener stabilised, and 9·0V at 70mA MAX unstabilised. Either polarity can be earthed providing AC supply is floating.

5 Coils (Stabqoils)

A comprehensive range of transistor coils is available for intermediate frequencies of 455 Kc/s and 1·62 Mc/s, together with a complementary range of IF transformers.

Send now for your Manual, on the coupon above, to this address: Electroniques (Prop.-STC Ltd.) Edinburgh Way, Harlow, Essex. Telephone: Harlow 26777.

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125μF	2·5 volt		3μF		12 volt
640μF	2·5 volt		4μF		12 volt
0·25μF	3 volt		25μF		12 volt
2μF	3 volt		200μF		12 volt
40μF	3 volt		2·5μF		16 volt
4μF	4 volt		64μF		16 volt
500μF	4 volt		200μF		16 volt
5μF	6 volt		750μF		18 volt
20μF	6 volt		2·5μF		25 volt
25μF	6 volt		3μF		25 volt
30μF	6 volt		4μF		25 volt
50μF	6 volt		10μF		25 volt
100μF	6 volt		25μF		25 volt
3·2μF	6·4 volt		12·5μF		40 volt
40μF	6·4 volt		3·2μF		64 volt

All at 1/- each, 9/- per dozen or mixed packet (our selection,) 20 for 10/-.

150μF, 25 volt; 500μF, 25 volt, **2/6 each.** 5,000μF, 12 volt, 4/- each. 200/100 275 volt; 200/200 275 volt; 125/300/50 275 volt, 5/- each; 3 for 10/-.

PAPER CONDENSERS SPECIAL CLEARANCE!

0·35μF, 150 volt; 0·02μF, 350 volt; A.C. 0·25μF, 350 volt; 0·5μF, 350 volt; 0·5μF, 500 volt: ALL at 15/- per 100.

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RESISTORS. ¼ watt, well assorted values, 10/- per 100; 55/- per 1,000. ½ watt to 3 watt, well assorted values, 10/- per 100; 55/- per 1,000. TO CLEAR: 10 Meg. 1/6th watt resistors—to clear £1 per 1,000.

TRANSISTORS. Untested, mixed, 50 for 10/-. NPN Switching transistors, Min. 200 m/cs., 6 for 10/-. PNP Switching transistors, Min. 200 m/cs., 6 for 10/-.

DIODES. Suitable for keying electronic organs, 20 for 10/-. BY100 type rectifiers, 30/- per dozen.

ORP12 light cells, 9/- each.

TRANSISTOR BATTERY ELIMINATOR—same size as PP9, 30/-. PP6, £1.

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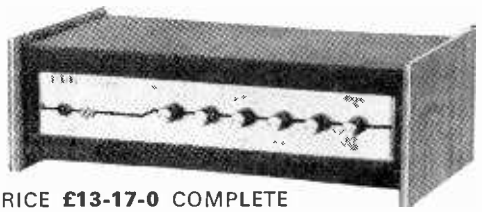

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spindle on this capacitor is very short and requires a coupler to extend it. This is a standard item and should present no problems, although it might be an idea to use a different component with a longer spindle and/or use a slow motion drive. If this is done, check the space available first.

The positioning of TC1 and TC2 is not unduly critical but their leads should be as short as possible. The coils in the receiver section can be any make of approximately similar range to those specified. The preset capacitors TC1/TC2 will "take up the slack". If coils other than those specified are used, it is possible that the padder capacitor C5 will be a different value, and the relevant manufacturer's literature should be consulted.

The push button unit in the receiver is really only a glorified bank of three switches and the top one as shown, is not used. Note that the receiver push-button unit is different from the one used in the transmitter. First the buttons are grey instead of white, and secondly, it possesses a mains rated switch. The wiring details for both receiver and transmitter switching units are shown in Fig. 6, the extra poles and switch sections available are ignored.

Although skirted valve holders were used in the prototype, screening of the valves in the receiver section was found to have negligible effect on performance. Fitting cans merely detuned the stages slightly, necessitating the tuned circuits and i.f.t.s to be re-tweeked. Other than this the use of valve cans appeared to be superfluous. Thus, in the interests of better ventilation screening cans were purposely omitted, although it might prove wise to use skirted valve holders any way as a precaution.

The remainder of the wiring in the receiver section is as for any other normal superhet, and other than using screened leads where indicated requires little comment.

Transmitter wiring

Construction and wiring of the remainder of the transmitter section requires some care since instability is easy enough to come by without encouraging it. Above chassis, the metal screen shown in Fig. 4 last month is a necessity. It is superior to valve cans since it provides better ventilation, and also completely screens the three valve sections, and the p.a. tank components, from each other. Note that the meter leads are passed through a hole in this screen directly into the p.a. compartment, down through a hole drilled in the chassis and into the screened p.a. section below chassis, thence to the h.t. and RFC2.

The p.a. coil and tapping switch take a little time and patience to wire up. The coil is wound first, 60 turns of 24s.w.g. enam. close wound on a 1½in. diameter former. The tapping points being formed by twisting the appropriate turn into a loop. The loops are then cleaned and tinned, and the coil is positioned near the switch, as it will actually be in the transceiver. Short lengths of wire can then be cut measuring from the switch contacts to the loops. Bare and tin both ends of these wires and connect up the switch and the coil on the bench. When completed there should be three spare leads protruding, one from one end of the coil to connect to earth, another from the pole of the switch for the antenna connection, and one from the top of the coil to connect to the junction of C46, VC4, C45, and Sle pole. When all is in order the switch and coil may be fixed in the case as one unit. Note the tin plate screens below chassis (Fig. 3) which shield each valve and associated components from its neighbour, also the extra screen directly across

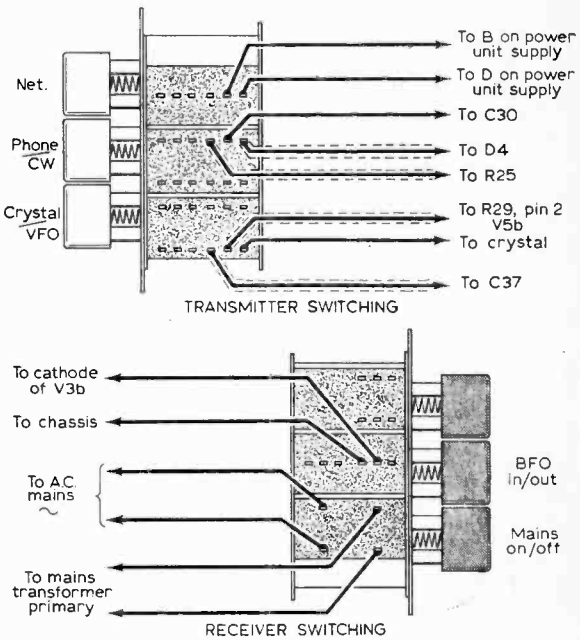

Fig. 6: Wiring details of the push-button units.

V5 valve base screening the triode from the pentode section. The screens must be securely earthed.

The v.f.o. coil consists of 90 turns of 34s.w.g. enamelled wire close wound on a ⅜in. diameter former (Ekco type F804 minus the slug). This coil is unscreened and is bolted directly to the chassis. The tuned circuit in the pentode anode is resonant at 1·9Mc/s. The former of a Denco 1·6Mc/s i.f.t. was cut to ¾in. long, and the can was then pruned to fit. The coil former was then wound with 90 turns of 34s.w.g. enamelled wire scramble-wound, and paralleled with a 50pF fixed capacitor. It is probably easier to wire in a 100pF trimmer across the coil and, with the unit in position, grid-dip it to exactly 1·9Mc/s by adjusting the trimmer. It is possible to utilise one of the windings on the original transformer, in which case the top pi should be removed completely. The pruned can is held in position by bolting it to the chassis with a 6BA bolt.

The particular meter used is a 0-5mA which reads in reverse, that is, with no current passing through it the meter reads 5mA. This means that one tunes for a peak instead of a dip when resonating the tank circuit. The meter shunt was made from a small length of fire bar element ¾in. long, 1,000 watt 250 volt spiral wound type. A normal reading meter rated 0-50mA would be entirely suitable but check the size first, and remember in this case to tune for a dip when loading the transmitter. The wiring of the v.f.o. should be solid, and heavy gauge wire should be used.

The modulator diode is completely screened by wrapping it in a strip of insulation tape and then covering it with a strip of silver paper or aluminium

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★ components list

Capacitors:

C1	0·01μF
C2	0·01μF
C3	0·001μF
C4	270pF S.M.
C5	2,500pF S.M.
C6	0·01μF
C7	0·01μF
C8	0·01μF
C9	0·01μF
C10	0·01μF
C11	0·01μF
C12	0·01μF
C13	0·01μF
C14	0·01μF
C15	100pF S.M.
C16	16μF 275/325V electrolytic
C17	25μF 25V electrolytic
C18	0·1μF
C19	0·1μF
C20	150pF S.M.
C21	100pF S.M.
C22	100pF S.M.
C23	16μF 350V electrolytic
C24	16μF 450V electrolytic
C25	100pF S.M.
C26	16μF 250V electrolytic
C27	25μF 25V electrolytic
C28	0·001μF
C29	25μF 25V electrolytic
C30	0·02μF
C31	16μF 250V electrolytic
C32	82pF S.M.
C33	1,000pF S.M.
C34	1,000pF S.M.
C35	100pF S.M.
C36	0·01μF
C37	0·01μF
C38	100pF S.M.
C39	0·01μF
C40	0·01μF
C41	100pF S.M.
C42	0·01μF
C43	0·01μF
C44	0·01μF
C45	0·001μF
C46	100pF S.M.
C47	0·01μF
C48	0·01μF
C49	82pF
TC1	300pF compression trimmer
TC2	300pF compression capacitor
TC3	30pF variable capacitor
VC1	208 + 176pF modified
VC2	15pF variable capacitor
VC3	140pF variable capacitor
VC4	140pF variable capacitor

Potentiometers:

VR1	10kΩ	VR3	500kΩ
VR2	10kΩ	VR4	500kΩ

Valves:

V1	ECF82/6U8	V4	12AX7/ECC83
V2	ECF82/6U8	V5	ECF82/6U8
V3	ECF82/6U8	V6	5763

Neons:

N1 Mains neon—Bulgin N2 Mains neon—Bulgin

Resistors:

R1	150kΩ	R19	270kΩ
R2	100kΩ	R20	6·5kΩ
R3	1·2kΩ	R21	470kΩ
R4	1kΩ	R22	270kΩ
R5	47kΩ	R23	270kΩ
R6	27kΩ 1W	R24	3kΩ
R7	100kΩ	R25	100kΩ
R8	1kΩ	R26	56kΩ
R9	1kΩ	R27	1kΩ
R10	68kΩ	R28	5·6kΩ 5W
R11	47kΩ	R29	22kΩ 2W
R12	100kΩ	R30	47kΩ
R13	1kΩ	R31	15kΩ 5W
R14	1kΩ	R32	22kΩ
R15	27kΩ 5W	R33	5·6kΩ 2W
R16	1kΩ	R34	220kΩ
R17	47kΩ	R35	50Ω carbon
R18	270kΩ	Rs	See text

Coils:

L1	Osmor QA4 or similar
L2	Osmor QO4 or similar
L3	LF Choke 10H 70mA
L4	See text
L5	See text

Transformers:

IFT1	Denco 465kc/s i.f.t.
IFT2	Denco 465kc/s i.f.t.
IFT3	Denco 465kc/s i.f.t.
T1	Output transformer Wharfedale type OP3
T2	Denco 465kc/s b.f.o. transformer
T3	250–0–250V at 80mA, 6·3V at 3A

Switches:

S1a-e	3 Pole 3 Way Two bank
S2, S3a-b	3 Button unit. Mains 2 pole on/off; 2 Pole 2 Way; 3 Pole 2 Way
S4, S5, S6	3 Button unit. 4 Pole 2 Way; 4 Pole 2 Way; 2 Pole 2 Way
S7	1 Pole 23 Way

Sockets:

Sk1	Jack socket open circuit when jack removed
Sk2	Jack socket, shorts when jack removed
Sk3	Jack socket, shorts when jack removed
Sk4	Insulated terminal
Sk5	Insulated terminal

Diodes:

D1	OA81
D2	BY100
D3	BY100
D4	OA81

Miscellaneous:

Crystal 1·9Mc/s
Crystal holder to suit
RFC1 2·5mH
RFC2 2·5mH 100mA
Case—H. L. Smith, Edgware Road, London, W.2
Tin plate for under-chassis screens.
M1 0–5mA moving coil meter see text. (Henry's Radio)
Valve holders—6 type B9A with skirts
The push-button units are available from Messrs Henry's Radio, 303 Edgware Road, London, W.2. They are coded—Three button switch units type 40 and 41 respectively.

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foil. The foil is held on with a few turns of tinned copper wire which is then soldered to one of the tin plate screens. It is important that these screens be well bonded together, and dry joints or poor soldering should be avoided at all costs.

Setting up

The prototype receiver was aligned by setting the g.d.o. to 1·9Mc/s, tuning the capacitor VC1 to mid-position, and adjusting the oscillator trimmer TC2 for a signal. The i.f.t.'s were then peaked, and finally TC1 was adjusted for maximum volume. This setting up should be done with the tank circuit peaked for maximum signal. This is important because in the unpeaked state, the tank circuit presents a different load to the receiver input circuit and this was found to have an effect on the receiver tuning, and the setting of L1/TC1. With the b.f.o. switched in and the pitch control set at half mesh, the core of T1 was adjusted for a beat note, after which the swing of VC2 was checked.

The transmitter requires very little adjustment other than to make sure that the pentode anode load is resonant at 1·9Mc/s. The v.f.o. tuning capacitor and its parallel air spaced trimmer TC3 are both set to half mesh. Using another receiver as a monitor, TC3 is adjusted until a carrier is heard. At this point the swing of VC3 is checked. The actual coverage can be adjusted either by pruning VC3 or by slight alteration of the coil L4. If a 15 watt light bulb is now connected between the antenna and earth terminals and the key pressed the bulb should light. Adjustment of the tap via S7 and further adjustment of VC4 should enable the bulb to be lit to fair brilliance. The key should not be pressed while the taps are being altered, otherwise r.f. arcing will limit the life of the switch.

There are two slight drawbacks with this economy rig. One is that when the modulator is switched in the v.f.o. changes frequency due to the extra capacitive loading of the v.f.o. grid circuit by the diode and modulator circuitry. The v.f.o. is quite stable and functions well on f.m. but on switching back to the c.w. position the frequency will change again. In practise this means that the v.f.o. dial calibration is slightly different for c.w. and phone positions, however, since there is a ready made frequency marker built in, this is not too serious.

The other snag is that the peak r.f. output position of the p.a. tuning capacitor VC4 differs slightly from the peak receiving position. These faults were not found serious in practise and doubtless other readers will think of a way round them. The measured output for ten watts input was just over 6·5 watts.

Modifications

Since part one was published, various modifications have been tried and are offered as suggestions. The screens on L1 and L2 have been removed with negligible effect other than to warrant retuning. A 2½in. 3Ω speaker has been connected to the secondary of the output transformer T2 via the spare push-button switch on the receiver bank. This functions as a speaker in/out switch. Results are quite good, and volume is sufficient for all local signals in the club net. There is room above the receiving section to fit a small bracket to wire in another valve on the audio side if required but the rating of the mains transformer should not be exceeded. An 82kΩ resistor has been wired between the junction of C38 and the v.f.o./crystal switch, and earth. This forms a load for the v.f.o. when in the net position. Another 82kΩ has been substituted for R30. Using a small 8 watt audio amplifier, amplitude modulation (anode and screen) has proved highly successful and reports have been very favourable. For those who prefer to stick to f.m. the following modifications to the speech amplifier are recommended. Substitute a 3·3MΩ fixed resistor for VR4 and transfer this pot. to the input of the next triode, i.e. wire it in place of R21. A slow

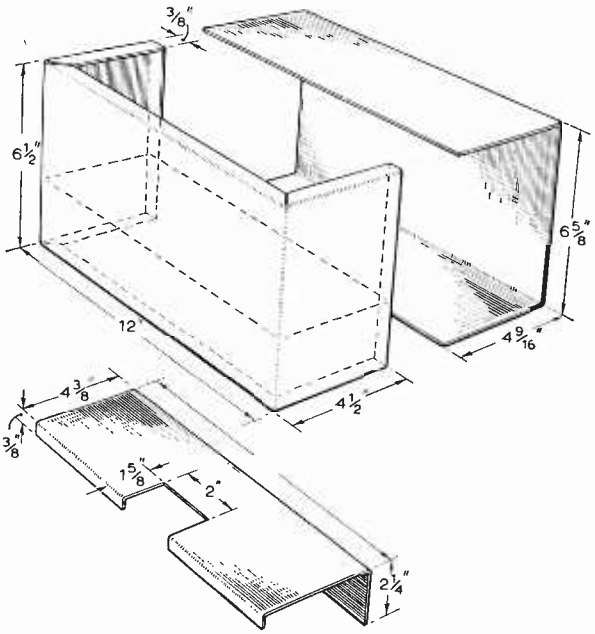

Fig. 7: Size and constructional details of the case.

motion drive on the v.f.o. would be a decided asset and make netting easier, although no great difficulty has been experienced with the prototype. In last month's article, the two capacitors shown unmarked in Fig. 3 next to the modulator valve V4, are C26 and C31.

The author is indebted to G3JDG for his assistance in testing the rig on the air. ■

FREE

Inside next month's issue of **Practical Electronics** a *Component Selection Calculator*

on sale March 17.

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new books

SHORT WAVE ANTENNAS
By J. D. Nicholson. Published by World Publications, Denmark, and distributed by Wm. Dawson and Sons Ltd.
54 pages. Size 6¾in. x 4¼in. Price 10s.

YET another book with the customary 10 or so pages on the propagation of radio waves. After this comes a useful practical chapter dealing with general features of antenna construction. The remainder of the book is given up to details, illustrated with rough sketches, of a large variety of antennae varying from a simple vertical to triple dipole and fan vertical types.

Unfortunately, most of the designs assume the listener has plenty of space outdoors for his aerial. Poor town dwellers who are unable to erect great outdoor arrays are covered by a short chapter entitled "Novelty Antennas". To your reviewer's chagrin the picture rail long-wire antenna is given 2¼ lines under this head. A town dweller, I have been using this aerial for years to pull in the rarest catches.—*JMG*

SHORT WAVE RECEPTION
By Bert Johansen. Published by World Publications, Denmark, and distributed by Wm. Dawson and Sons Ltd.
66 pages. Size 8¾in. x 5¾in. Price 19s.

"HOW to improve—and how to build" is the sub-title of this book which contains details of eight transistorised circuits designed to improve short wave reception. Constructional details are somewhat sketchy so this is not the book for the beginner.

Worse still the book covers some useful pieces of ancillary equipment but gives no real guide to operating them once constructed. For example, details are given for the construction of a 10-30Mc/s preselector—an extremely useful piece of equipment which can improve a cheaper receiver. Unfortunately there is no clue as to how the unit should be used once built. Admitted the experienced ham will know, but the beginner, and the book gives the impresssion that it is intended for the beginner, would be lost.—*JMG*

BBC HANDBOOK 1966
Published by The British Broadcasting Corporation.
260 pages. Size 7¼in. x 4¾in. Price 7s. 6d.

ON the face of it, the BBC Handbook does not seem the sort of book to review in these pages. Nevertheless, there is a great deal of useful information contained within its covers for readers of P.W. and P.T.V., including field contour maps of BBC TV and v.h.f. radio stations, together with technical information on those stations. There is also a section on frequency allocations and reception.

Among the wealth of information in the book there is certain to be much of interest to many readers. A handy, and inexpensive, book.—*LB*

RADIO AMATEURS' EXAMINATION MANUAL
By B. W. F. Mainprise, B.Sc.(Eng) G5MP.

A GUIDE TO AMATEUR RADIO
By Pat Hawker, G3VA. Published by the Radio Society of Great Britain.
Size 9¾in. x 7¼in. Price 5s. 9d. each.

THESE are both, of course, new editions of old favourites. The RAE Manual now appears in its fifth edition, the first four having achieved sales of 20,000 copies. A number of minor revisions are made and some additional information included. A very useful addition is some advice on tackling the RAE prepared by members of the RSGB who serve on the City and Guilds of London Institute Advisory Committee for the RAE. The manual contains specimen answers to actual examination papers. For those contemplating their ticket—this is a "must".

The Guide reaches the venerable age of its twelfth edition. The revised edition takes into account changes recently introduced in UK amateur regulations and the constructional projects reflect the greater use of single sideband techniques and semiconductor devices. Both these new editions represent remarkable value for money.—*CFB*

OUTLINE OF RADIO AND TELEVISION
By J. P. Hawker. Published by George Newnes Ltd., London.
400 pages. Size 8¾in. x 5¾in. Price 30s.

AS the title suggests, this book outlines the principles and operation of radio and television reception. It is written by Pat Hawker, who has many radio and television books to his credit. He starts this one with fundamentals—electric currents, radio waves and so on—continues in depth with sound and vision receivers and concludes on aerials and tape recorders. In all, there are 22 sections. There is not enough material in the various sections of this book to consider it as a reference work, but for thirty-bob it is a good buy for those who have little or no knowledge of the subject. Also, readers who have a working knowledge of radio and television could well benefit from this work. Pat Hawker, who for several years has been the Communications Correspondent for *Electronics Weekly*, is in a unique position to know what's going on in the industry. He has made good use of this in his book, which takes a fresh look at the subject. In the preface, he writes: "No prior technical knowledge has been assumed, although it is appreciated that many readers are likely to have already absorbed some information from casual reading of technical and hobby magazines. Although a virtually non-mathematical approach has been adopted, it is nevertheless recognised that readers today do not want to be spoon fed with oversimplifications that will have to be discarded, should they wish later to gain a more advanced understanding of the subject".—*DCR*

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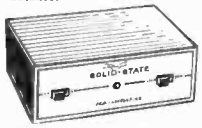

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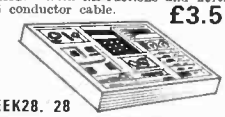

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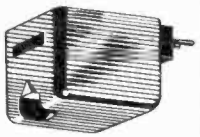

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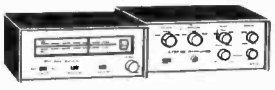

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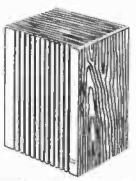

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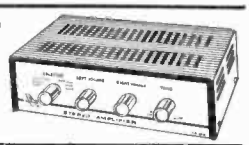

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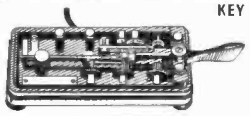

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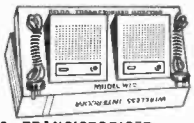

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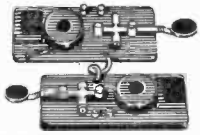

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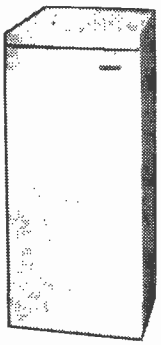

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The circuit of the transmitter is shown in Fig. 1. The input signal is fed to the first half of an ECC82 valve. The signal appearing at the anode is fed to the grid of the second half of this valve, which has, as an anode load, a miniature neon tube with self contained resistor. With care, the plastic case may be removed, exposing the neon tube and resistor.

If one of these cannot be obtained, a miniature neon of the type used in neon tester screwdrivers

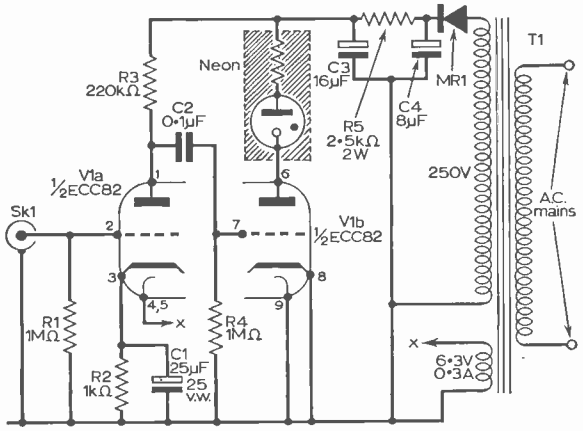

Fig. 1: Circuit of the transmitter.

may be used. The dropper resistor should be about 100kΩ. These tubes (when complete with resistor) draw a current of approximately 2mA, which is well within the rating of the ECC82 (10·5mA). The fluctuating anode current varies the neon's light output, thereby making an effective light transmitter.

Receiver

The receiver can be specifically made, or existing equipment modified. An experimental type of receiver is shown in Fig. 2a. The cathode bias components are replaced by an ORP12 photocell, the volume set at minimum and the valve used as a grounded grid amplifier. The valve (an ECC83) gave excellent quality, and was used as a preamplifier feeding a high power audio amplifier. A slightly improved circuit is shown in Fig. 2b. This uses an ORP 12 to feed an OC71, which then feeds a power amplifier.

Whichever circuit is used, especially one using valves (i.e. H.T.), care must be taken to ensure that the voltage across the ORP12 does not exceed about 80-90 volts, and that the total dissipation *never* exceeds 200mW.

Construction

This is not critical but the layout of the prototype transmitter is shown in Fig. 3. The gain of the circuit is very low as it was only intended for high input use, so there are no problems regarding hum or instability. Heater wiring must be kept away from the grid pins of the ECC82 and the valveholder spigot earthed via the valveholder bolts, together with pins 9 and 8.

Wires to the neon should have 250 volt insulation, and pass through suitable grommets on the chassis. C2 should be new, not surplus with good insulation. If treble loss is experienced (none in the prototype) C2 may be reduced to 2,000 or 3,000 pF.

Aligning

The lenses should be as large as possible (2—3in. diameter) with about an 8in. focal length. The focal length can be found by the following method. Put a sheet of white paper on the floor under an electric light. Hold the lens horizontally about 8in. above the paper, and move it up and down until a sharp image of the bulb is obtained on the paper. The lens/paper distance is the focal length, and this is the correct spacing for the lens-to-photocell and lens-to-neon. The process is repeated for both lenses.

When the lenses are correctly positioned in front of the cell and neon respectively the two units should be placed about 10ft. apart for initial testing. This should be done in a fairly dark room. When the photocell is put at the focus of one lens, and the illuminated neon at the focus of the other (i.e. H.T. on) an orange "spot" should be seen on the photo-

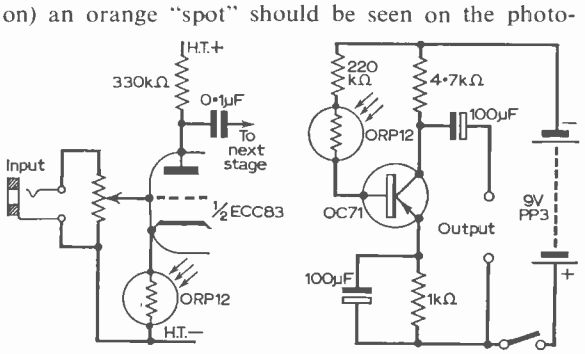

Fig. 2a: Valve receiver circuit.
Fig. 2b: Alternative transistor version.

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cell, which is of course the image of the neon. The cell is moved about for best volume. In the original, the loudest position was when the image was on the edge.

Final notes

The circuit is very simple, lending itself to experiment. Using an ECC81 and reducing R2 to 220Ω gave higher gain but results were inferior and the neon was over-modulated. The extinguishing voltage and striking voltages of a neon are different, and with over-modulation the neon may be extinguished for part of the cycle. In this case the circuit will go into darkness, squaring or "clipping" will occur, and very heavy distortion will result. Optimum modulation occurs when the neon just dims on the loudest passages.

The transmission of music with the prototype was quite good, reproducing the higher frequences well and giving good volume over a distance of 60ft. The high-impedance output of a tape-recorder was used. The output impedance was 15kΩ so R1 was adjusted to suit. With transformer input R1 may be omitted. The sensitivity is about 500mV.

If both neon and photocell are shielded, the instrument may be used in the light, providing it is not of the fluorescent variety, which produces a deafening hum at twice the mains frequency! A block diagram of the system is shown in Fig. 4. ■

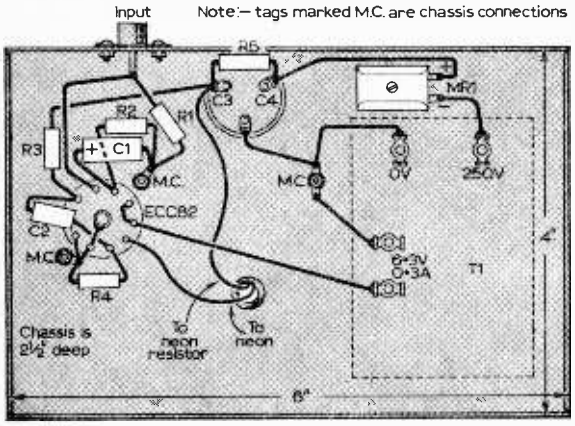
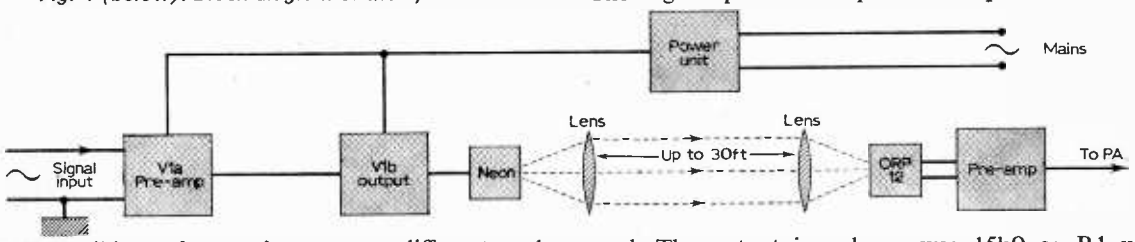


Fig. 3 (above): Layout of the prototype (Fig. 1).

Fig. 4 (below): Block diagram of the system.



★ components list

TRANSMITTER (Fig. 1)

Resistors:

R1	1MΩ, ½W
R2	1kΩ, ½W
R3	220kΩ, ½W
R4	1MΩ, ½W
R5	2·5kΩ, 2W

Capacitors:

C1	25μF, 25V electrolytic
C2	0·1μF, 350V paper
C3/C4	8–16μF, 350V electrolytic

Miscellaneous:

V1	ECC82
T1	Secondaries 250V, 20mA; 6·3V 0·3A
MR1	Halfwave rectifier 250V, 20mA

Neon tube with limiting resistor
B9A valveholder, coax input socket, wire, bolts, etc.

RECEIVER (Fig. 2b)

Resistors: 1kΩ, 220kΩ, 4·7kΩ
Capacitors: two 100μF, 3V
Semiconductors: OC71, ORP12

PRACTICAL TELEVISION—MARCH 1967 ISSUE

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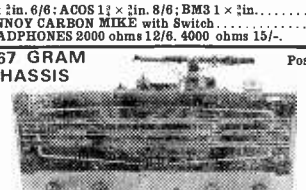

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THE MW COLUMN

FIRSTLY, apologies for those still waiting for details of the loop aerial. Response was overwhelming but I hope to clear the backlog in the near future. Several readers have asked for M.W. station lists. Apart from the well-known World Radio TV Handbook (which, of course, covers *all* broadcasting) an invaluable companion to Dx'ing is the World Medium Wave Guide, obtainable from specialist bookshops or direct from World Publications, Lindorfsalle 1, Hellerup, Denmark, at 16/3d.

Secondly, a few notes for our American readers. Dx in the USA is somewhat different and the fact that US and Canadian stations operate on a regular 10 kc/s spacing (with many stations on most channels) makes for severe interference problems since most of the Dx (outside of the European area) also use 10 kc/s spacing. This is where a loop becomes almost indispensable.

Transatlantic openings seem to start around June, peaking up in August/September. Some to look for include Dakar 764 kc/s, BBC Light 1214, Monte Carlo 1466, Spain on 584, 638 and 683, Agadir 935, French network stations on 1403 and Munich 1196. West Coast readers, of course, have exotic Pacific possibilities like Tahiti, Samoa, Tonga.

Dx conditions in the UK have generally been poor, but with a few brighter patches. North America has been unreliable, often not appearing until the very early hours. South America, however, has been excellent, some of the best being YVQB R.Carupano 940, YVRQ R.Aeropeurto 910, YVNZ R.Caldendario 1030, YVOZ R.Tiempo 1200, LR1 R.el Mundo 1070, LR5 R.Belgrano 950, Brazilians PRF4 940, PRA3 960, PRE8 980, PRG3 1280, PRB9 1000. Others include HJED 820, PJD2 1295, ZBM1 1235, Martinique 1310.

From Africa, Lagos has been noted on 1088 at 0500, Canakry (Guinea) on 1403 around 2330, and Tanzania on 638 at 0300 sign-on. Middle East has yielded Zahaden 777, Arwaz 1390, Baghdad 760, Kuwait 1345, and the Syrians on 746, 786, 953—all during the evening period.

Asia, after an excellent start late last year has been disappointing. India is still there at times between 0330-0200, but China is now poor, except for the ever-present Urumchi 1525 heard from early afternoon to late night.

By the time you read these notes, Far East opportunities may be lost until September, but last year there was a good late peak in late February-early March. Try late afternoons (around 1600) and between 2100-2330.

We have all been disappointed in the scarcity of West Coast openings, but KOMO 1000 and KING 1090, both Seattle, have been heard at times. The mid-West has also been poor and WCCO Minneapolis 830, WOWO Fort Wayne 1190, WOAI San Antonio, and KMOX St Louis 1120, have been far less frequent than last season.

To end on a note of optimism, March is usually a good month for USA and some may be audible as late as 0800—so there is still hope!

Alistair Woodland

CQ! CQ! CQ! CQ! CQ!

ISSUES WANTED

Sir,—Would any reader be kind enough to supply me with the issues containing the articles on modifications to the PCR receiver.—David Sutton, 83 St. Leonards Road, Leicester.

Sir,—I would be grateful if any reader could supply me with copies of Practical Wireless covering the RAE (lessons 1 to 12).—P. Vlietinck, 34 North Road, Islington, London, N.7.

Sir,—I am interested in building the Ten-Five receiver and require the October and November 1964 issues of Practical Wireless. I would be grateful if any readers could help me.—P. J. N. Davison, 1 Osborne Road, Clifton, Bristol 8.

Sir,—Please can anyone help me with the issue regarding the P.W. 35W Guitar Amplifier. I need the issue of the magazine and the blueprint.—H. Sarsfield, 6 Bellfields Road, London, S.W.9.

Sir,—Would any reader be kind enough to send me a copy of the December 1965 issue of Practical Wireless.—R. Austin, Arunside, Letchworth Lane, Letchworth, Hertfordshire.

Sir,—I would be grateful if any reader would be kind enough to loan me the July 1960 issue of Practical Wireless which contained conversion details of the RAF receiver type R1392.—R. G. Hayward, "Sunnyfields," Lighthouse Road, St. Margaret's Bay, Nr. Dover, Kent.

Sir,—I require the issues of Practical Wireless covering the 19 set Modifications by D. W. Dillon, commencing March 1960. I will pay the full postage on these.—M. B. Meenagh, ZL1ATW, 70 Whitmore Street, Kihikihi, New Zealand.

ISSUES FOR DISPOSAL

Sir,—I have some 70 issues of Practical Wireless dating from 1955 to 1965. Most of these are in good condition, but as I have no further use for them due to studies, I am willing to let them go very reasonably. If readers would write to me, I will be glad to send them a list of the copies I have.—D. A. Webb, Londesborough Lodge, Church Road, Kenley, Surrey.

Sir,—I have a complete set of copies of Practical Wireless dating from June 1962 to April 1966 for disposal. If any readers are interested, I would be willing to dispose of these for 1s. per copy to cover postage etc.—M. J. Hall, 4 Bertram Road, Smethwick, Staffordshire.

Sir,—I have for disposal copies of Practical Wireless for May 1964 to September 1966, complete with blueprints. If any readers would like these at a reasonable cost, would they send a stamped addressed envelope to me for details.—S. G. Collard, 55 Mill Hall, Aylesford, Maidstone, Kent.

Sir,—I have the following issues for disposal. If readers care to write to me enclosing a stamped, addressed envelope, I will send them full details. The issues are: Practical Wireless 1960-1966 inclusive and Practical Television 1960-1966 inclusive. These issues all include blueprints, data books etc.—Harry Dodgson, 15 Chestnut Street, Parkinson Lane, Halifax, Yorkshire.

INFORMATION WANTED

. . . the manual of the C52 Marconi Ground Station.—F. W. Vann, 37 Vale Road, Haringey, London, N.4.

. . . the circuit, instructions and any other information on the ex-U.S. Army Combination tester, model No. 1183-SC, part of Test Set No. 1-56-C. This unit was made by the Triplett Instrument Co. Ltd.—D. Childs, 1 Dunton Court, Sydenham Hill, London, S.E.23.

. . . a copy of the Valve Testing book published by Taylor Instruments in 1960. Whatever its condition, I am prepared to pay more than the original cost.—W. H. Dixon, 73 Kimberly Road, Pen-y-lan, Cardiff.

. . . details of Radio Transmitter marked BC625A Bendix Radio, Bendix Aviation Corp., Baltimore, U.S.A. A second plate underneath the unit reads: Type T5017 Ref. No. 110D/146.—John G. Owen, Llwyn-Fryn, Penmynydd Road, Llangefni, Anglesey.

. . . any information, i.e. ratio, connections etc. on transformer with the code X7 4086 and 980.—A Bardell, The Mount, Albion Hill, Loughton, Essex.

. . . the circuit diagrams and/or manual for U.S. Army Rx/Tx type BC-620-A serial number 3499.—K. Mealor, 8 Fir Grove, Melling Road, Liverpool, 9.

. . . the circuit diagram of the BC-624-C receiver and equivalents of the valves 9002 and 9003.—D. Torbell, 9 Pembroke Road, Framlingham, Suffolk.

. . . operating instructions, original or just written and abridged for the Pye TV Signal Generator ref. 940226-40-70Mc/s in the very heavy case.—Nykola Nyznyk, 54 Eldon Street, Glasgow, C.3.

. . . any information on converting the "receiver" section of a US Air Force radio altimeter (I believe it is type 465) to cover the 70cm amateur frequency. This particular receiver contains two 9004's—acorn valves and is in an aluminium case measuring 6 x 3¼ x 2¼in. One 9004 is strapped as a diode and all attempts to discover the i.f. frequency have failed.—D. Bailey, 163 Porters Avenue, Dagenham, Essex.

. . . a copy of the handbook for the A.M.R.1132A receiver.—J. D. Morris, 14 Brook Drive, Kempton, Bedford.

. . . the instruction book for the DST 100 Mk. 2.—W. A. Gardner, 38 Brackley Street, Walkden Worsley, Manchester.

. . . the service sheet for the Brenell Mk. II tape recorder.—W. Wood, 2 Amberton Gardens, Leeds, 8.

. . . the layout plans or any other information on a radio called the Miami Minute, made by Concord Electronics in 1962.—A. Giles, 20 Fieldway, Dagenham, Essex.

. . . instruction manual, circuit diagram etc. of the ex-RAF R1475 Communications Receiver.—S. H. Glenn, Meadfoot, Pembroke Road, Woking, Surrey.

. . . the circuit diagram of a light-sensitive switch using either an ORP12 or an ORP60 transistor.—N. Lodge, Corner Cott. Armstrong Lane, Brokenhurst, Hants.

. . . the circuit diagram or information on Lafayette tape recorder model RK-137A serial No. 5884.—R. W. Stephenson, The Bungalow, Winestead Hall Hospital, Patrington, Nr. Hull, E. Yorks.

CORRESPONDENTS WANTED

. . . anyone using the Bendix RA10DB communications receiver.—Eric J. Symonds, 5 John Street, City Road, Cambridge.

. . . any beginner to radio or any short wave listener. I am 18 years old.—Christopher Atitsogbui, Emil Institute, P.O. Box 3530, Accra, Ghana.

. . . any boy from 13 to 15 years of age who enjoys building radios and test equipment.—W. Cowell, 8 Quarters Road, Hilsea, Portsmouth, Hampshire.

. . . anyone who has built the P.W. 35 Watt Guitar Amplifier.—T. Embleton, Berners House, Woolverstone Hall, Nr. Ipswich, Suffolk.

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CLUB SPOT

No. 15 SILVERTHORN RADIO CLUB

G3SRA

THE Silverthorn Radio Club was born some fifteen years back when G2HR and s.w.l. R. Cason thought there was a real need in Chingford for a Club, completely independent, and owing no allegiance to other organisations. Initially the membership was small, but regular meetings were held at private houses. Despite many vicissitudes, membership has risen steadily, and for the past few years the Headquarters has been at Friday Hill Community Centre, Chingford, where ample facilities exist for a working station and construction. Apart from a "hard-core" of "old-timers", the Club has attracted a very youthful membership, and contingent upon this a County grant is available when the need arises. The Club is justly proud of the successes scored by the younger element over the years in getting their "tickets". Although the lower age limit is 15, more youthful aspirants are occasionally admitted when it is clear they show promise. This policy has borne fruit. The two youngest licencees were on the air at the age of 14, one of whom passed his morse test and R.A.E. when thirteen years old. Another of this age can copy nearly 20 w.p.m., and with other teenagers is studying hard for his R.A.E. under the guiding hand of the Club. The present officers are G2HR (Chairman), G3SGF (Secretary), G3ICY (Treasurer) and G3RJI (co-opted Secretary's Asst.).

Affiliated Societies' Contest. On key G3UMO, right G3RKJ. Standing (left to right) G3RJI, s.w.l's Bean and Routledge, and G2HR.

Contests are always a popular feature, and when an all-night session is entailed and members "kip" on the premises, youthful ebullience often emerges. The tape-recording played in the "wee sma' hours" comprising ghostly groans on one occasion, confirmed one member's belief that the late Lady Heathcote who occupied the old and rambling country house last century, was indeed roaming around in disembodied disbelief at the twentieth-century desecration of her former residence! The particular member would have done justice to an ITV "natural break". All present affirm he was "whiter than white".

Aerial erecting at the annual camp can be hard work, as the prostrate body indicates.

The "high-spot" of the year is the Club's own field event. This is arranged for three or four days over the August Bank Holiday under canvas when operation takes place on topband and 2m. The site, on private land, is one of the most superb spots in Epping Forest, some 300ft. a.s.l., with a vast panoramic view across Hertfordshire and beyond. One year 500ft. of wire was strung out for 160m. It seemed the entire British Isles came back to the "CQ.'s". The social side of this annual event is an enormous boost to the Club, as although operation is the primary object, not being a contest, full benefit is taken of other activities inseparable from a free-and-easy camping mini-holiday.

At the present time the Club is in the ascendant, as a number of new members have been enrolled. H.Q. is surrounded by a large amount of ground which removes the headache of sizeable aerials. The fact that the topband transmitter has been heard off Newfoundland with a bare ten watts adds force to the adage "spend as much money outside the shack as inside".

The Club meets every Friday except the first in the month. Any aspiring member is always welcome to visit, or alternatively telephone the Chairman (529-2932) or the Secretary (SIL 8550).

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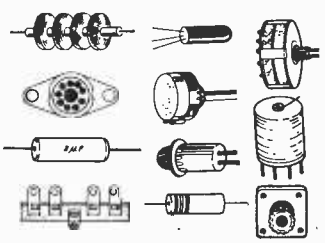

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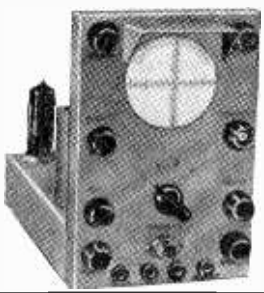

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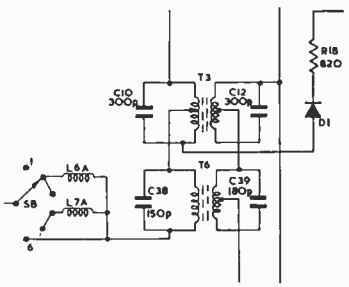

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AL60	5/-	E1266	50/-	EH90	7/6	KTW63	5/-	Q81202	8/-	UCL83	9/-	1N21B	4/-		9/-
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AU7	55/-	EB34	1/6	EL50	8/-	ML6	6/-	8L30	12/6	UY41	6/6	2A3	5/-	6AK5	5/-
AZ31	9/-	EB91	3/-	EL81	8/-	N78	15/-	8P2	3/6	UY85	5/-	2C26	7/-	6AK7	6/-
B6H	15/-	EBC23	6/-	EL84	4/3	NE17	7/-	8P41	1/6	VI120	4/-	2C26A	3/-	6AK8	5/9
BD78	40/-	EBC41	8/6	EL85	7/6	OA2	5/9	8P61	5/-	V1507	5/-	2C34	7/-	6AL5	3/-
BL63	10/-	EBC81	5/-	EL91	4/6	OB2	6/-	8P210	6/6	V1924	20/-	2C45	22/6	6AL5W	7/-
B84	8/-	EBF80	6/6	EL95	5/-	OB3	7/-	8TV280/40		VP23	3/-	2C46	30/-	6AM5	2/6
B85	20/-	EBF83	7/6	EL360	30/-	OC3	5/-		24/-	VP133	9/-	2C51	12/-	6AM6	4/-
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BT35	25/-	EC53	12/6	EN31	10/-	PC86	9/-	T41	12/6	VU33A	4/-	3A4	4/-	6AS6W	9/-
BT45	150/-	EC70	4/-	EsU74	80/-	PC88	9/-	TDOX-20		VU39	6/-	3A/108A	20/-	6AT6	15/-
BT83	35/-	EC90	2/-	E8U208	6/-	PC97	7/6		70/-	VX3208	5/-	3A146J	55/-	6AT6	4/-
CC3L	2/-	EC91	3/-	EY51	5/6	PC900	12/-								
CF23	10/6	ECC81	4/-	EY86	6/6	PCC84	5/6								
CV71	3/-	ECC82	5/-	EY91	3/-	PCC89	10/-								
CV77	5/-	ECC83	6/-	EZ40	6/6	PCC189	9/6								
CV102	1/-	ECC84	5/6	EZ41	6/6	PCF80	6/3								
CV103	4/-	ECC85	6/6	EZ80	5/6	PCF82	6/6								
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CV4014	3/-	ECC91	4/-	F/6057	5/-	PCF86	8/-								
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CV4049	6/-	ECF82	7/-	FW4/500	6/6	PCF808	12/6								
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DK96	6/6	EF74	4/-	HVR2	9/-	PY800	8/-								
DL92	4/-	EF80	5/-	K3A	60/-	PY801	7/-								
DL93	4/-	EF81	6/-	KT8C	22/-	PZ1-35	9/-								
DL94	5/9	EF85	4/6	KT32	8/-	PZ1-75	12/-								
DL96	7/-	EF86	6/6	KT44	5/9	QP21	6/-								
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U81	18/-	X76M	7/6	3Q5GT	7/-	6BE6	6/6
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U25	13/-	Y63	5/-	4C27	35/-	6BR7	9/-
U26	13/-	Y65	4/-	4D1	4/-	6BW6	7/-
U27	8/-	Y66	8/-	5A173G	5/-	6C4	2/-
U52	4/6	Z800U	20/-	5A174G	5/-	6C5G	2/6
U191	11/6	Z801U	10/-	5B251M	40/-	6C5GT	6/-
U801	17/-	1A3	8/-	5B252M	35/-	6C6	4/-
UABC80	6/-	1A5GT	5/-	5B/253M		6C6G	3/-
UAF42	9/-	1B22	30/-		15/-	6C8G	3/-
UBC41	6/-	1C5GT	6/-	5B254M	40/-	6CH6	4/6
UBF80	5/6	1D8GT	6/-	5B255M	35/-	6C21	80/-
UBF89	6/6	1E7G	7/6	5R4GY	9/-	6CL6	9/-
UBL21	10/-	1F2	3/-	5T4	7/-	6CW4	12/-
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6F5GT	5/9	6F6G	4/-	6F7	6/-	6F8G	6/6	6F12	4/-	6F13	5/-	6F14	5/-	6F32	4/-
6F33	20/-	6G6G	2/6	6H6M	1/6	6J4WA	10/-	6J5	6/-	6J5G	2/-	6J6	3/6	6J6W	6/-
6J7G	5/-	6J7M	8/-	6K6GT	5/6	6K7G	2/-	6KJGT	4/9	6K8G	3/-	6K8GT	8/3	6K8M	6/6
6K25	24/-	6L6G	6/-	6L6GA	7/6	6L6M	11/-	6L7G	4/-	6L34	3/-	6LD20	5/9	6N7	6/-
6N7G	5/9	6P25	12/-		5/9	6Q7G	5/-	6R7	5/6	6SA7	7/-	6SA7GT	6/6	6SC7	7/-
6SG7GT	5/6	6SH7	3/6	6SJ7	5/-	6SK7	5/6	6SL7GT	5/6	6SN7	3/6	6SQ7GT	6/-	6SS7	2/-
6U4GT	9/6	6V6G	5/-	6V6GT	7/6	6V6M	8/-	6X4	3/6	6X5G	5/-	6Z5GT	5/6	6Y6G	6/-
6-30L2	8/6	6Z4	5/0	7B7	7/6	7C5	10/-	7C6	7/-	7C7	6/-	7H7	7/3	7Q7	7/-
7S7	18/-	7V7	5/-	7Y4	8/-	7Z4	4/6	8D2	2/6	9D2	3/-	9D6	2/-	10F9	9/-
12A6	2/6	10P14	15/-	12AH7	5/-	12AT6	5/-	12AT7	4/-	12AV6	5/6	12AU7	5/-	12AT7WA	
	5/6	12AX7	6/-	12AY7	10/-	12BA6	5/-	12BE6	7/-	12BH7	7/-	12C8	3/-	12E1	17/6
12H6	2/-	12J5GT	2/6	12J7GT	6/6	12K7GT	2/-	12K8M	10/-	12Q7GT	3/3	12SA7	7/-	12SC7	4/6
12SG7	3/-	12SH7	3/-	12SN7GT		12SR7	5/-	12Y4	2/-	12L7	7/-	14S7	18/-	15D2	6/-
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7-pin 2/6

210VPT		220PA	7/-	220TH	4/-
225DU	9/-	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/-	724A	15/-
801	6/-	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/-	1612	5/-
1616	3/-	1619	5/-	1625	8/-
1626	3/-	1629	4/6	2051	5/-
4043C	35/-	4063	8/-	4313C	20/-
5704	9/-	5726	7/-	6060	5/-
6064	7/-	6065	6/-	6080	22/-
6146	25/-	7193	1/9	7475	2/-
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9002	4/6	9003	6/-	9004	2/6
9006	2/6				

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VCR517B	55/-
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3J/92/E	£37.10.0
714AY	£4
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35Z4GT	6/-	1625	8/-		
35Z5GT	6/-	1626	3/-		
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38	4/-	2051	5/-		
2158G	6/-	4043C	35/-		
50CD6G	27/6	4063	8/-		
50L6GT	8/-	4313C	20/-		
53A	7/6	5704	9/-		
57	6/-	5726	7/-		
58	6/-	6060	5/-		
59	6/-	6064	7/-		
75	5/6	6065	6/-		
76	5/-	6080	22/-		
77	6/6	6146	25/-		
78	5/-	7193	1/9		
80	5/6	7475	2/-		
81	9/-	8013A	25/-		
84	8/-	8020	15/-		
85A2	8/-	9001	3/-		
88D	80/-	9002	4/6		
210VPT		9003	6/-		
7-pin	2/6	9004	2/6		
220PA	7/-	9006	2/6		
220TH	4/-				
225DU	9/-				
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/-				
724A	15/-				
801	6/-				
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/-				
1612	5/-				
1616	3/-				

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MARCONI SIGNAL GENERATOR TYPE TF144G 85 kc/s-25 Mc/s. Excellent laboratory tested condition with all necessary accessories, **£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. A.C. input, **£95.** Carriage 30/-.

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repairing radio sets

—continued from page 927

respond when the oscillator signal is tuned in. It can then easily be identified. Remember that the oscillator frequency is different by the i.f. from that shown on the tuning scale.

LOCAL OSCILLATOR FAULTS

Typical causes of oscillator failure in Fig. 1a are open-circuit R4, open-circuit C9 and/or C10, oscillator switch (S3) trouble and oscillator coil open-circuit or leakage. Old sets which have been used in damp environment or stored for any length of time often develop oscillator coil leakage—coil measurement revealing low Q-factor.

Switch or coil troubles generally affect one waveband, while other faults affect all bands. Remember, too, that shorting or leaky trimmers may affect only one band.

BACKGROUND CRACKLES

An oscillator component failing can cause background fizzles and crackles which appear mainly when a station is tuned. A quick check to prove whether the oscillator section is responsible simply amounts to disconnecting the stage h.t. supply or muting the oscillator in some other way (this would be necessary in Fig. 2b to avoid killing the mixer action). Here it would be best to short out L3, while in Fig. 2a disconnecting R4 from the h.t. line would be the best bet.

The set will not receive, of course, but the volume should be fully advanced and lack of background noise now indicates that the oscillator must have been responsible. The high h.f. voltages produced by the oscillator highlight faulty associated parts by causing background noises or, more severe, complete failure. If the background noises persist with the oscillator muted, the trouble lies elsewhere in the set.

If the oscillator is producing noises, each smaller component is best tested in turn by replacement, after first making sure that the frequency-changer (or oscillating mixer) valve is noise-free. It is unlikely that the oscillator coil could be so checked, but if the noise remains after the other parts have been cleared, including wavechange switch sections, trimmers and padders, the coil or transformer should be investigated.

If the oscillator signal is monitored on a second set, as previously explained, any disturbance or crackle on its signal will be heard in the second set. This is a good test for oscillator signal purity.

OSCILLATOR INTERMITTENCY

Intermittent oscillator action can result from a low emission frequency-changer, and the l.w. seems first to suffer. The set suddenly cutting off is the symptom, to be restored possibly by switching the set off and then on again quickly or otherwise electrically disturbing the circuits. Tuning quickly from one end to the other of the band may bring the oscillator back on.

Battery and mains/battery portables are so affected by a low emission DK-series valve or by low l.t. voltage. A worn metal h.t. rectifier (on mains) is a frequent cause as this provides the filament current as well as h.t., the former through a ballast resistor. If the DK— filament voltage goes below about 1·2V oscillation ceases, but the actual voltage depends on the emission of the valve.

During periods of electricity power cuts, oscillators of mains/battery sets often fail, restoring when the voltage rises to normal or to that selected by the mains input adjustment. To obtain consistent operation it is sometimes necessary to replace both the valve and the h.t. rectifier.

Low filament voltage can be caused by unbalance of the filament chain, the filaments being series-connected in the *mains* position. The ballast (series dropper) resistor can increase in value and there can be changes in value of the small resistors shunting the filaments of the various valves. These are used to bypass the anode and screen currents to avoid unbalance of filament chain. Another factor often overlooked is change in filament characteristics of one or more of the valves. This means that low frequency-changer filament voltage could be due to a filament change of other valves on mains.

Front-end troubles are mostly round the oscillator circuits, assuming correct alignment. However, low sensitivity can result from aerial and r.f. tuned circuit faults. After a severe thunderstorm, for instance, local stations may be weak, yet at almost normal volume but with whistles, with the aerial connected to the first grid of the mixer section instead of the aerial socket. This is a sure indication of failed aerial coupling winding (L2, L4 and L6 in Fig. 2a).

POOR SENSITIVITY

A fractured ferrite aerial rod in a portable will reduce sensitivity. As a temporary measure use a ceramic cement for repair, making sure fractured ends are pushed *tight* together. This aerial is tuned for maximum sensitivity by sliding the coils along the rod, the inductance of the coils being maximum at centre. This is how the aerial circuit is tuned or trimmed in this type of set.

When aligning, direct connection should never be made to aerial windings, but a very loose coupling to the signal generator should be employed. Wind about 20 turns of wire round a piece of ferrite rod, connect this across the signal generator output and orientate the assembly for signal pickup on the portable under test. Then adjust the aerial tuning.

Fig. 4 shows the front-end of a portable set using a ferrite rod. S1A selects either L1 or L2 for M.W. and L.W., with VC1 the aerial tuning gang section. Notice that the aerial windings, in fact, represent the tuned circuits. The aerial is thus also the tuned front end and it cannot be removed. The other parts will easily be recognised from the previous descriptions of Fig. 2a circuits.

So far nothing has been said about the d.c. conditions of the valves. This is because the signal circuits give most trouble. D.C.-wise it is just a matter of checking h.t. voltage on the anodes and screen grid of the frequency-changer and l.t. voltage across the heater (or filament).

The conductivity of a valve can be checked by

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metering the voltage at the cathode with respect to earth line or chassis (positive cathode). This is the volts drop across the cathode resistor, normally about 2 to 5 volts, depending on circuit. Lack of screen voltage would signify either open-circuit feed resistor or short-circuit bypass capacitor (R3 and C5 in Fig. 2a).

Lack of oscillator anode voltage would mean open-circuit R4 or shorting C9 in same circuit, but some circuits use the oscillator coil to feed anode voltage, so coil open-circuit here would cut anode voltage. Zero mixer anode voltage should lead to check of first i.f. transformer primary winding continuity.

If r.f. stage is fitted; the testing procedures are similar. This stage and most mixers are biased from the a.g.c. line for automatic control of gain (to be dealt with in a subsequent article), the bias being taken to the control grid via a coil winding and series feed resistor, as in Fig. 2a.

OSCILLATOR DRIFT

A major trouble in v.h.f. f.m. front-ends is drift in frequency of the oscillator signal. This calls for frequent retuning as the set or tuner warms up. It can be aggravated by poor i.f. channel selectivity (to be considered in a later article), by a faulty frequency changer valve (V2 in Fig. 2b) or by change in value of critical component in oscillator tuned circuit.

Critical components in Fig. 2b are L3, C6, TC1 and C8. Some of these capacitors have a negative temperature co-efficient, meaning that they drop in value with temperature rise. This combats the positive co-efficient of the other capacitors and the coil. Component change here thus demands the correct replacement both in terms of value and temperature co-efficient.

Badly soldered connections in the oscillator, badly fitting valves in their holders and ineffective shield or screening bonding or screw-clamping to main chassis are other factors of poor oscillator stability at v.h.f.

At medium-frequencies, worn or dirty wave-change switch sections disturb oscillator stability and

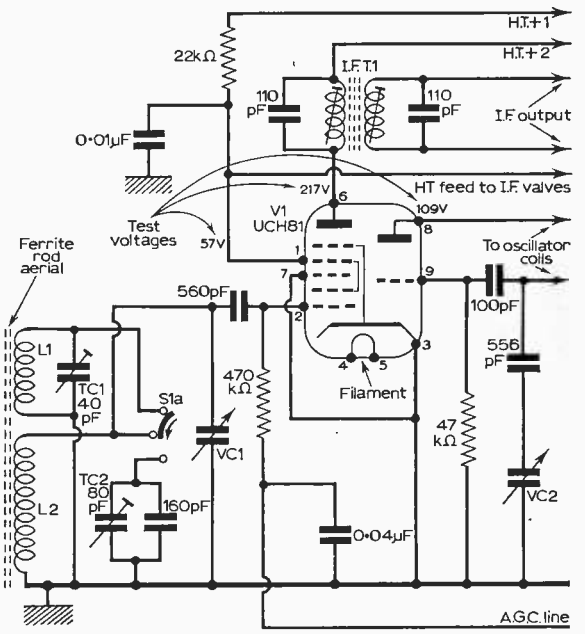

Fig. 4: The front-end section of a battery portable, L1 and L2 being the ferrite rod aerial.

sensitivity and can cause crackles and intermit-★5 tency. Electrolube No. 1 should be applied to switch contacts that do not spark, or No. 2 for sparking or arcing contacts (not found on wave-change switches, we hope!). Small sparks, though, can occur on contacts operating pilot bulbs, such as the waveband indicator lamps in Fig. 2a.

Valve holder sockets can be treated successfully with Electrolube No. 1, as also can the sliding electrical parts on tuning capacitors.

Always make sure that the front-end is free from grease and dust accumulations. Keep valve pins clean and treat all switched and plugged contacts with Electrolube or similar cleaner after any service operation.

CONTINUED NEXT MONTH

TRANSISTOR PREAMP

—continued from page 907

interesting point about this method of design. You can tear up the characteristic sheets and the tables of figures. Any transistors can be used, the gain will be the same, only the bandwidth will change. If we wanted to be fussy about the design we might ask for details of emitter impedance and feedback resistance, but those seldom appear on the characteristic tables anyway. For anyone using "surplus" transistors, this method of design is perfect. For the record, however, the prototype used OC170's to obtain the gain figures designed for with a bandwidth of over 25Mc/s at the lowest gain setting.

A final note on construction is worth while. I use Veroboard, but I prefer not to use it in the conventional manner which is wasteful and clumsy. I prefer to mount most components with their axes at right angles to the board, as in Fig. 6, and do the construction straight off the circuit diagram. ■

★ components list

Resistors: (all ⅛ watt)

R1	22Ω
R2	6·8kΩ
R3	220kΩ
R4a	220Ω
R4b	680Ω
R4c	3·3kΩ
R5	1kΩ
R6	10kΩ
R7	1kΩ
R8	100kΩ

Capacitors:

C1	100μF 12V electrolytic
C2	3-30pF trimmer
C3	100μF 12V electrolytic
C4	100μF 12V electrolytic
C5	100μF 12V electrolytic

Transistors:
Almost any type, see text

Miscellaneous:
One pole three way yaxley—S1. Single pole single throw switch—S2. One 9 volt battery type PP3 or similar. Piece of Veroboard 9 holes x 15 holes, see Fig. 6.

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NEW BARGAINS

Moving coil meter. 2½in. flush mounting 5-0-5 MA centre zero. **25/-** each.
Moving coil meter, 2½in. flush mounting 250-0-250 micro amps centre zero. **29/6** each.
50 ohm 50 watt wire wound pot-meter **8/6** each.
20 K wire wound pot-meter 20 watt type made by Colvern complete with control knob **10/-** each.
1 meg miniature pot-meter Morganite standard ¼in. spindle **1/-** each. **9/-** per dozen.
1 meg miniature pot-meter Morganite pre-set screwdriver control. **9d.** each. **8/-** per dozen.
Pre-set 100 K by Welwyn with intricate bakelite knob. **1/-** each. **9/-** per dozen.
100 K pot-meter miniature type with double pole switch and standard ¼in. spindle, by Morganite **2/-** each. **18/-** per dozen.
25 K pot-meter standard size with double pole switch by Egan with full length ¼in. spindle **3/-** each. **36/-** per dozen.
Blanketstat glass enclosed, normally closed circuit, will open should blanket overheat. **4/6** each.
Thermal Relay, Can be used to delay the supply of HT while heaters warm up, or will enable 15 amp loads to be controlled by miniature switches or relays. Regular list price over £2, price **7/6** each.
Siemens high speed relay. Twin 1000 ohm coils.
Platinum points changeover contacts. Ex equipment **8/6** each.
Electrolytic condenser 500 MF 50v. working. **5/-** each. **48/-** per dozen.
Waterproof heating element. 26 yards length, 70 watt. Self regulating temperature control. **10/-** post free.
Footswitch. Two snap-action switches in metal box with flex lead. Ideal to control tape-recorder, dark room lamp, etc. **18/6** plus 2/9 postage and insurance.
Toggle Switch Bargain. 10 amp 250 volt normal one hole fitting. **2/9** each or **30/-** per dozen.
Electric Lock. 24 volt coil, but rewindable to other voltages. **4/6** each.
Compression Trimmers. Twin 100PF. **1/-** each. **9/-** per dozen.
Miniature Relay. American make. 630 ohm coil 20/30 volt operation. 2 pole changeover. **3/-** each. **30/-** per dozen.
Precision Wheatstone Bridge. Opportunity to build cheaply. 100K wire wound pot. 15 watt rating only **5/-**.
Sheet Paxolin. Ideal for transistor projects. 12 panels each 5 x 8in. **5/-**.
3in. PM Loudspeakers. 3 ohm **12/6.** 80 ohm **13/6.**
Transistor Ferrite Slab Aerial with medium and long wave coils **7/6** each.
Slide Switch. Sub miniature double pole changeover **2/-** each. **18/-** per dozen.
Magslips (Selsyne) American made transmitter and receiver **27/6** each. Post 4/6 for any one or the pair.

SEMI-CONDUCTOR BARGAINS

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2N1728	10/-	MAT120	7/9	OC72	5/-
2N1742	25/-	MAT121	8/6	OC75	6/-
2N1747	25/-	OA5	5/-	OC76	5/-
2N1748	10/-	OA10	6/-	OC77	7/-
AC107	9/-	OA47	3/-	OC78	5/-
AC127	9/-	OA70	2/-	OC78D	5/-
ACY17	8/6	OA79	2/6	OC81	5/-
ACY18	5/6	OA81	2/6	OC81D	5/-
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	5/-
BY100	4/6	OC44	4/-	SB078	6/6
BYZ13	7/6	OC45	3/6	SB305	8/6
MAT100	7/9	OC70	4/-	SB251	10/-

S.C.Rs (THYRISTORS)
100 v. 1 amp. **6/6**, 3 amp. **7/6**, 12-amp. **15/-**, 400 v. 1 amp. **15/-**, 3 amp. **17/6**, 5 amp. **22/6**, 25 amp. **£3.** 50 v. 1 amp. **8/6**, 3 amp. **7/6**, 10 amp. **10/-**, 25 amp. **30/-**.

SILICON RECTIFIERS
Tested and guaranteed

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

Sub miniature glass encased—only approx. ¾in. long wire ended.

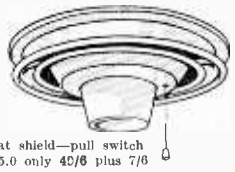
750mA	50v. 1/6	100v. 2/6
	200v. 4/6	400v. 6/6

FLUORESCENT LIGHT KITS
Comprising choke, lampholders, starter and two chrome tube clips 20 watt **19/6.** 40 watt **11/6.** Super Silent 40 watt **17/6.** 80 watt **17/6.** 65 watt **19/6.** All 4/6 P. & P.

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.

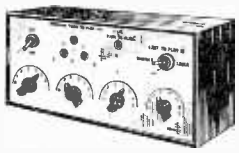
Where postage is not definitely stated as an extra then orders over **£3** are post free. Below **£3** add 2/9.

HEAT AND LIGHT UNIT



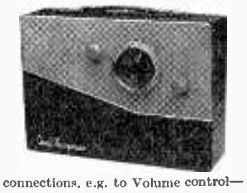
Bring luxury to your bathroom—have comforting heat where you now only have light—all the parts to build a full size (16in. diameter) model are now available—you will build it in an hour—12in. 750 watt circular silica glass encased element—opal bowl for up to 100 watt lamp—non-rust spun reflector—white enamelled base heat shield—pull switch magnificent unit as sold normally at £4.5.0 only **42/6** plus 7/6 carr. and insurance.

NIM COMPUTER



This computer will play games and do simple tricks and will provide endless amusement as well as education into computerisation. Kit comprises all the components, the printed front panel and full instructions. The box is not included but this can be made very simply from plywood. Price **£4.17.6,** plus 3/6 post 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 x AF117.
- Two-tone Cabinet, size 11 x 8 x 3in.
- All circuit requirements—Push-pull output—A.V.C. and feed back, etc.
- Printed circuit board all wired only connections, e.g. to Volume control—W.C. Switch and Tuning Condenser.
- Pre-aligned IF stages complete with full instructions. Price only **£3.19.6** plus 6/6 post and insurance.

THIS MONTH'S SNIP

THE VECTRONOME CAPSTAN DRIVEN TAPE RECORDER

This is a truly portable self-contained instrument with built-in microphone and loudspeaker using a 7 transistor amplifier with P.P. output and suitable for operation from mains or by rechargeable batteries. Tape capacity is 25 minutes on easily change 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 6½ x 7½ x 2in. Price with tape and mains unit but less batteries **£9.19.6** (rather less than 1/3 original price). Postage and insurance 7/6. Unused and in perfect working order.

F.M. TUNER

of exceptional quality giving really fantastic results with virtually no noise. Suitable for mains or battery operation. 6 transistors—three IF stages—double tuned discriminator. Complete, new, and built up all ready to work on chassis. Size 6in. x 4in. x 2in. with tuning scale and slow motion drive. A £12.12.0 tuner for only **£8.10.0.**

FINE RECORD PLAYERS ARE GARRARDS

and because they have been making record players for so long, GARRARD are your best choice—big range always in stock.
7/6 for post and ins.

2000	£6	9	6
3000	£7	10	6
AT60	£11	11	0
SP25	£10	9	0

LAB80	£25	0	0
SRP12	£3	7	0

Complete with service sheet and template.

3M SCOTCH TAPE

brand new, unused and guaranteed perfect and not second in any way—a connoisseur's tape on normal spools and in normal boxes.

Standard Play	5in.	600ft.	9/-	Long play	5in. 900ft. 11/6
	5½in.	900ft.	11/6		5½in. 1,200ft. 16/-
	7in.	1,200ft.	16/-		7in. 1,800ft. 23/-

£3 post free otherwise add 2/- post and ins.

NEON MAINS TESTER
Good length leads **2/6.**

MAINS TRANSISTOR POWER PACK

Designed to operate transistor sets and amplifiers, Adjustable output 6v. 9v. 12 volts for up to 500 mA (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.

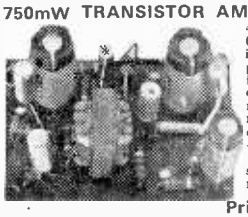
HI-FI SPEAKER BARGAIN

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.

TUBULAR HEATERS

New and unused made by G.E.C. rated at 60 watts per ft.—these are ideal in airing cupboards, bedrooms, offices, stores, greenhouses, etc., curtains or papers can touch them without fear of scorching or fire. Supplied complete with fixing brackets and available in the following sizes. Prices which are about ⅓ of list price includes carriage by B.R.S.
8ft. **30/-**; 10ft. **36/-**; 12ft. **42/-**.
Also in twin assemblies (one pipe above the other) 4ft. **40/-**; 5ft. **46/-**; 6ft. **52/-**.

750mW TRANSISTOR AMPLIFIER



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

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.

2½ kW FAN HEATER

3 heat positions to suit changes in weather: 1kW, 1½kW and 2½kW: also blows cold for summer, has thermostatic safety cut out "Proper" price **£5.17.6. Yours for only £3.15.0.** Plus 7/6 post and insurance.

MOVING COIL METER BARGAIN

Panel meters are always being needed and they are jolly costly when you have to buy them in a hurry—so you should take advantage of this offer: 2in. moving coil flush mounting meters only **5/6.** These are actually R.F. meters and cost about £3 each but if you don't want them for R.F. then all you have to do is to remove the thermocouple and you will have a 2·3 mA. meter which you can make into almost anything by adding shunts or series resistor. These are ex-government, of course.

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 + 1/-** post.

Be first this year

SEED AND PLANT RAISING

Soil heating wire and transformer. Suitable for standard size garden frame. **19/6** plus 3/6 post and ins.

Wall Mounting Thermostat

By Satchwell, intended for use to control tubular or any type of space heaters indoors or in a greenhouse—adjustable over 40/80 complete with mounting screws, **29/6,** plus post 2/9 (normal price is at least twice this).

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THE WORLD'S SMALLEST RADIO COMES TO YOU IN THE NEW "SEE FOR YOURSELF" SEALED KIT PACK

SINCLAIR MICROMATIC

Complete kit of parts including earpiece instructions and solder in sealed kit pack.

59/6

www.americanradiohistory.com

Photograph shows actual size of Sinclair Micromatic

SINCLAIR MICROMATIC

6 STAGE TRANSISTOR MICRO POCKET RECEIVER

now in the best kit pack ever made available to constructors

Now when you buy your Sinclair Micromatic Kit, you see every component instantly in the new sealed polystyrene Kit pack. Never before in the history of radio has any Kit been so elegantly presented. Your Micromatic reaches you factory fresh and guaranteed. Check for yourself at once that every component is in its proper place in the new case made and shaped to take specially the micromatic kit. Your Micromatic kit does not cost you a penny more bought this way. Such is the appearance and performance of this brilliant new Sinclair design that you will want to build and use one immediately. There is no other set in the world as small, efficient and dependable as this. Reception both of home and overseas programmes is often much easier than with larger conventional radios. In fact, your Micromatic will virtually play anywhere. *It is also available ready built.*

- ★ **MEASURES ONLY $1^4/_5$in. x $1^3/_{10}$in. x $^1/_2$in.**
- ★ **BEAUTIFULLY STYLED CASE**
- ★ **POLISHED ALUMINIUM FRONT PANEL**
- ★ **CALIBRATED SPUN ALUMINIUM TUNING DIAL**
- ★ **AMAZING POWER, RANGE AND SENSITIVITY**
- ★ **NEW CIRCUITRY**
- ★ **BANDSPREAD TUNING PLUS A.G.C.**
- ★ **5 YEAR GUARANTEE**

TECHNICAL DESCRIPTION

The Sinclair Micromatic is housed in a neat plastic case with attractive aluminium front panel and aluminium tuning dial to match, calibrated in metres and kc/s.

Special Sinclair transistors are employed in a six-stage circuit of exceptional power and sensitivity. Two stages of powerful R.F. amplification are followed by a double diode detector from which the signal tuned in is passed to a high gain three stage audio amplifier. Automatic Gain Control counteracts fading from distant stations. The set is powered by two Mallory ZM.312 Cells obtainable from radio shops, Boots Chemists, etc., for 1/7 each. They give approximately 70 hrs. working life. Inserting the earpiece plug switches the set on, withdrawing it switches off. *Complete kit of parts including lightweight earpiece, instructions and solder*

59/6

SINCLAIR MICROMATIC, ready built, tested and guaranteed, with earpiece, complete in presentation case **79/6**

sinclair

SINCLAIR RADIONICS LTD., 22 NEWMARKET ROAD, CAMBRIDGE
Telephone: 52996 (STD Code OCA3)

ORDER FORM AND MORE SINCLAIR DESIGNS APPEAR ON PAGES FOLLOWING

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SINCLAIR STEREO 25 DE-LUXE PRE-AMP CONTROL UNIT

THE SINCLAIR STEREO 25 has been designed specially to ensure the highest possible standards of reproduction when used with two Z.12s or any other first class stereo power amplifier. Best possible components are used in the construction of this superb unit, whilst its appearance reflects the professional elegance characteristics of all Sinclair designs in hi-fi, radio and TV. The front panel of the Stereo 25 is in solid brushed and polished aluminium with beautifully styled solid aluminium control knobs. Mounting the unit is simple, and power is conveniently obtainable from the Sinclair PZ.3 which can also be used to supply two Z.12s to make a complete stereo assembly. Hi-fi enthusiasts seeking the ultimate in domestic listening will find all they want from this combination of Sinclair units. With a Micro-FM for tuner, they will have an installation to compare favourably with anything costing from four to five times as much.

FOR USE WITH ANY GOOD STEREO SYSTEM

TECHNICAL SPECIFICATIONS
Performance figures obtained using Stereo 25, two Z.12s and a PZ.3.

- **SENSITIVITY** for 10 watts Into 1.5 ohms load per channel. Mic.—2 mV into 50K ohms. Pick-up—3 mV into 50K ohms. Radio—20mV into 4.7K ohms.
- **FREQUENCY RESPONSE** (Mic. and Radio)—25 c/s to 30 kc/s ±1dB extending to 100 kc/s ±3dB.
- **EQUALISATION** — Correct to within ± 1dB on RIAA curve from 50 c/s to 20 kc/s.
- **TONE CONTROLS** Treble +12dB to —10dB at 10 kc/s. Bass +15dB to —12dB at 100 c/s.
- **SIZE**—6½in. x 2½in. x 2½in. overall, plus knobs.
- **FINISH** — Front panel sectioned In brushed and polished solid aluminium with solid aluminium knobs. Black figuring on front panel.

BUILT. TESTED AND GUARANTEED **£9.19.6**

SINCLAIR MICRO-FM

COMBINED FM TUNER AND POCKET FM RECEIVER

ANYONE CAN BUILD IT

7 TRANSISTORS
●
NO ALIGNING
●
PULSE COUNTING DISCRIMINATOR
●
A.F.C.
●
TUNES 88-108Mc/s
●
SIZE—less than 3″ × 1¾″ × ¾″

This unique, superbly engineered FM superhet is the only set in the world which can be used both as an FM tuner and an independent FM pocket receiver just whenever you wish. Problems of alignment have been completely eliminated making the Micro-FM ready for use the moment you have built it. The pulse counting discriminator ensures best possible audio quality; sensitivity is such that the telescopic aerial included with the kit assures good reception in all but the very poorest reception areas. The Sinclair Micro-FM will give you all you want in FM reception and the satisfaction of building a unique design that will save you pounds.

FM superhet using 7 transistors and 2 diodes. The R.F. amplifier is followed by a self-oscillating mixer and three stages of I.F. amplification which dispense with I.F. transformers and all problems of alignment. The final I.F. amplifier produces a square wave which is converted to produce the original modulation exactly. A pulse counting discriminator ensures better audio quality. One output is for feeding to amplifier or recorder and the other enables the Micro-FM to be used as an independent self-contained pocket portable. A.F.C. "locks" programme tuned in. Signal to noise ratio 30dB at 30 microseconds.

Complete kit, including transistors, case, aerial, earpiece, etc.

£5.19.6

"Although a complete novice to radio I was able to assemble it (Micro-FM) without undue difficulty thanks to your clear and lucid instructions. I receive all B.B.C. programmes etc. very strongly."
H.T., Warrington, Lancs

"Far more sensitive (Micro-FM) than many commercial models."
M.M., New Romney, Kent

"Z.12 received in perfect order. It is wonderful to hear records properly."
J. de H.S., London, N.2

"I consider your after sales service is excellent. I wish very much that other suppliers treated their customers in the way you do. I have tried out the Micro-FM with the Z.12 and my Quad speaker and am very pleased with the results."
H.A., London., N.6

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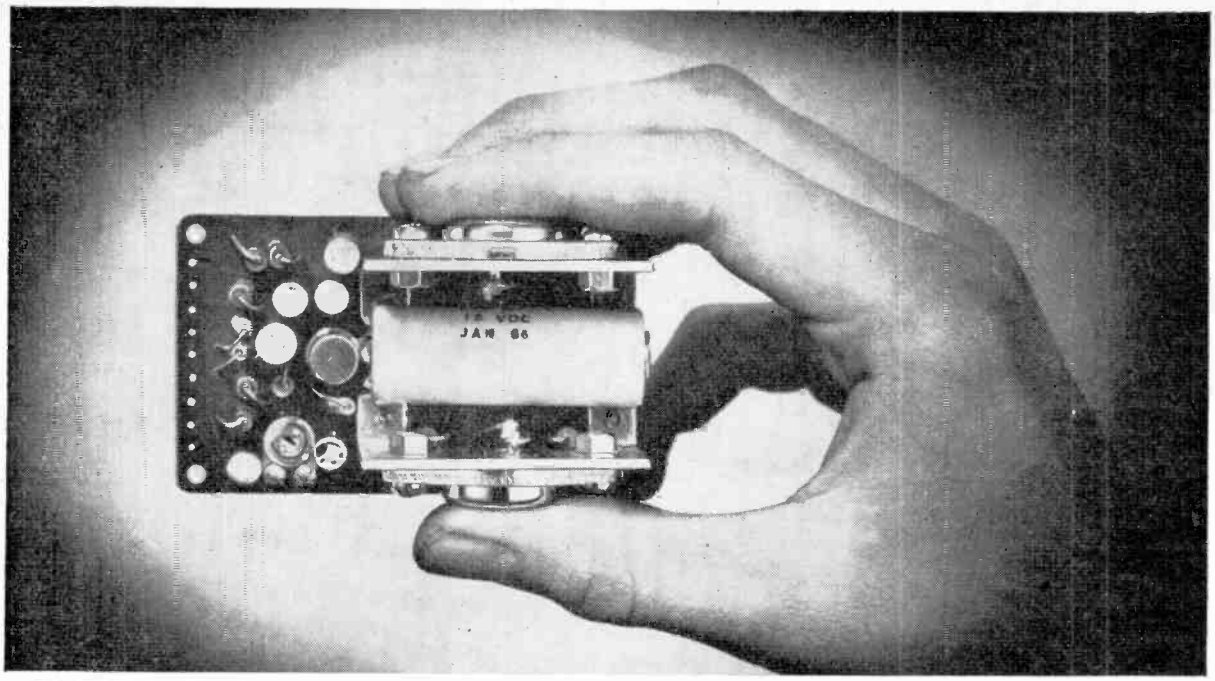


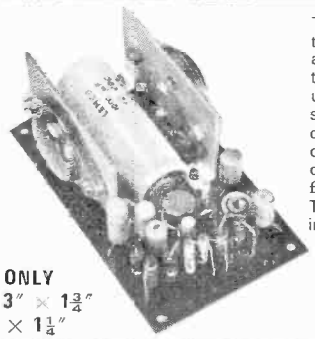
SINCLAIR Z.12

COMBINED 12 WATT HIGH FIDELITY AMPLIFIER AND PRE-AMP

12 WATTS R.M.S. OUTPUT
CONTINUOUS SINE WAVE (24W PEAK)

8 TRANSISTOR CIRCUIT WITH CLASS B ULTRALINEAR OUTPUT

IDEAL FOR HI-FI (STEREO OR MONO) CAR RADIO, ELECTRIC GUITAR, P.A., INTERCOM, ETC.



The amazing adaptability and rugged construction of this very powerful and exceptionally compact amplifier make it possible to use just one type of unit with outstanding success in an unusually wide variety of applications. Eight special H.F. transistors are used in a highly original circuit to achieve the characteristics demanded of any quality amplifier irrespective of price, yet this Sinclair unit costs well under £5, including its own integrated pre-amplifier. The Z.12 accepts radio, microphone and pick-up inputs. Detailed instructions for connecting these in mono and stereo are given in the manual supplied with every unit. A number of different control networks are also shown. The Z.12 will operate efficiently from any supply between 6 and 20 V. d.c. making it very convenient to run the amplifier from a car battery. Where it is required to run the Z.12 from mains supply, the PZ.3 is recommended. Those wishing to have a ready made pre-amp control unit can feed inputs via the Stereo 25 which, with two Z.12s, will provide the finest stereophonic hi-fi possible—and the saving in cost is fantastic.

ONLY
3″ × 1¾″ × 1¼″

PZ.3 MAINS POWER SUPPLY UNIT

This special power supply unit uses advanced transistorised circuitry to achieve exceptionally good smoothing. Ripple is a barely measurable 0.05 V. The PZ.3 will power two Z.12s and a Stereo 25 with ease. **79/6**

TECHNICAL SPECIFICATIONS

- Size 3 in. × 1¾in. × 1¼in.
- Class "B" ultralinear output.
- **RESPONSE** 15-50,000c/s ± 1dB.
- Suitable for 3, 7·5 or 15Ω speakers. Two 3Ω speakers may be used in parallel.
- **INPUT**—2mV into 2kΩ.
- **OUTPUT**—12 watts R.M.S. continuous sine wave (24 w. peak); 15 watts music power (30 w. peak).
- Signal to noise ratio better than 60dB.
- Quiescent current consumption—15mA.

Built, tested and guaranteed. Ready for immediate use. With Z.12 manual.

89/6

YOUR SINCLAIR GUARANTEE

If you are not completely satisfied when you receive your purchase from us, your money will be refunded at once in full and without question.

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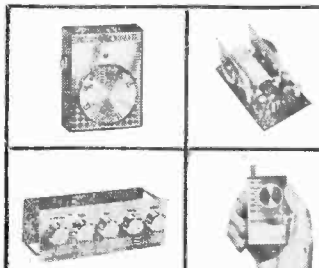

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For which I enclose cash/cheque/money order

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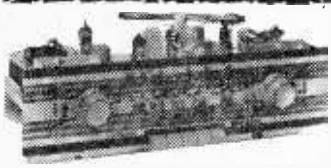
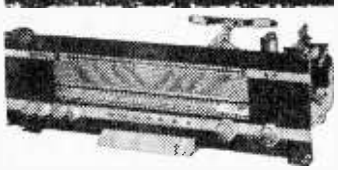
½ PRICE SPECIAL RADIO CHASSIS OFFERS

HI-FI CONTINENTAL STEREOPHONIC RADIOGRAM CHASSIS



Magnificent 'Continental' Stereophonic Radiogram Chassis with piano key switches, built-in ferrite rod aerial. Comes complete with two 10" elliptical loudspeakers, plus a mono/stereo 4-speed automatic record changer. **Complete 29½ gns.** (Units available separately if required. **Chassis only, 21 gns.**).
Special terms available of £10.6.6 deposit followed by 18 monthly payments of £1.7.3 (total H.P. of £34.17.0)+15/- P. & P. Send £11.1.6 now.

IMPERIAL HI-FI STEREOPHONIC RADIOGRAM CHASSIS



The Imperial Stereophonic 4 waveband chassis has the most advanced specifications yet offered in this country. There is a built-in ferrite rod aerial, seven piano key buttons, controlling mono/stereo selection. Gram Long-Medium-Short-FM-ON/OFF. The unit comes complete with two 10" elliptical loudspeakers plus a mono/stereo 4 speed automatic record changer. **Complete £41.9.6. Chassis only, 29½ gns.**

Special terms available of £13.16.6 deposit followed by 24 monthly payments of £1.8.10 (total H.P. £48.8.6)+17/6 P. & P. Send £14.14.0 now.

EMPRESS HI-FI AM/FM STEREOPHONIC CHASSIS

This most advanced radiogram chassis with automatic push button selection covers short, medium and long wavebands plus V.H.F./F.M. Offered complete with 2 10 x 6 speakers 4 speed Stereo/Mono autochanger only **£35.19.6. Chassis only, 25½ gns. Special terms available of £12 deposit followed by 18 monthly payments of £1.11.7. (total H.P. £40.8.6)+15/- P. & P. Send £12.15.0 now.**

All Lewis Radio equipment including valves are fully guaranteed for one year free of charge. Send your cheque or P.O. today while stocks last to Dept. P.47.

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1R5	5/-	DK91	5/-	EF86	6/-	PY80	4/9
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1T4	2/9	DL33	6/6	EL33	6/3	PY82	4/9
3S4	4/3	DL35	4/9	EL41	8/-	PY83	5/3
3V4	5/-	DL92	4/3	EL84	4/3	PY800	5/11
5V4G	7/9	DL94	5/-	EY51	5/11	R19	6/6
6F1	6/3	DL96	5/11	EY86	5/3	U25	8/9
6K7G	1/3	DY86	6/3	EZ40	5/6	U26	8/6
6K8G	3/3	DY87	6/3	EZ80	3/6	U191	10/-
6L18	7/3	EABC80	5/6	EZ81	4/3	U301	11/6
6V6G	3/-	EAF42	7/-	GZ32	8/9	U801	16/-
10C2	11/3	EBC41	6/6	KT61	6/3	UABC80	5/-
10F1	9/6	EBF80	5/9	N78	14/6	UAF42	6/11
10P13	8/3	EBF89	5/9	PCC84	5/3	UBC41	6/6
20F2	10/3	ECC81	3/3	PCC89	9/9	UBF89	5/9
20P1	8/9	ECC82	4/6	PCF80	6/3	UCC84	7/9
20P3	8/9	ECC83	4/6	PCF82	5/9	UCC85	6/-
20P4	12/6	ECC85	5/3	PCL82	6/3	UCF80	8/-
30F5	9/9	ECH35	5/9	PCL83	8/3	UCH42	8/6
30P4	11/6	ECH42	8/9	PCL84	7/3	UCH81	5/9
30P19	11/6	ECH81	5/-	PCL85	7/9	UCL82	6/9
DAC32	6/9	ECL80	5/9	PL36	9/-	UCL83	8/6
DAF91	3/9	ECL82	6/-	PL81	6/3	UF41	7/9
DAF96	5/11	ECL86	7/6	PL82	6/9	UF89	5/6
DF33	7/6	EF39	3/6	PL83	5/11	UL41	7/9
DF91	2/9	EF41	5/9	PL84	6/-	UL84	5/3
DF96	5/11	EF80	4/3	PY32	8/3	UY41	4/9
DK32	7/-	EF85	5/-	PY33	8/3	UY85	4/9

Postage on 1 valve 9d. extra. On 2 valves or more, postage 6d. per valve extra. Any parcel insured against damage in transit 6d extra. Office address, no callers.

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83 OSBALDESTON ROAD
STOKE NEWINGTON
LONDON N.16

On your own
TRANSISTOR PORTABLE!

★ Boosts Pirate and distant stations
★ No Plugs—No Connections! Just place Dewtron Wave Trap near radio.
★ Extends Battery life — reduces 'fading'.
★ Use in car, caravan, without aerial.
With PP3 battery (life several months).

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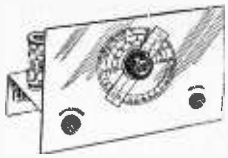

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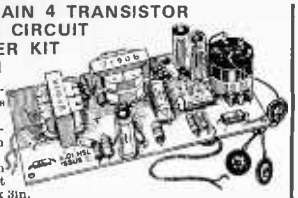
Type TA1



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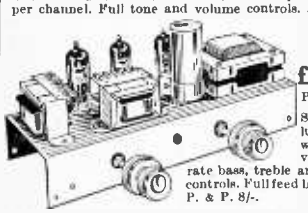

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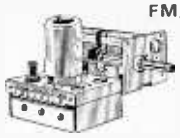

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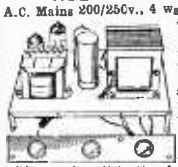

● Heavy duty double-wound mains transformer with electrostatic screen. ● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss. ● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar, microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● Chassis size only 7½in. wide x 4in. deep. Overall height 4¾in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves, output transformer (3 ohms only), screened lead, wire, nuts, bolts, solder etc. (No extras to buy.) PRICE **79/6.** P. & P. 6/-.
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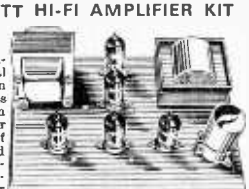

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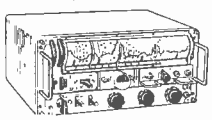
R.1475 RECEIVERS (TYPE 88)

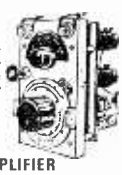


Highly stable, especially accurate, calibrated Marconi design R.A.F. Communication Receiver covering 2-20 Mc/s. in 4 bands with built-in 609 Kc/s. xtal reference oscillator for checking dial which can be reset by special panel trimmer control. 11 valves: 3-6K7, 6K8, 6J5, 3-6Q7, 6B6, Y63 tuning indicator and VR150/30 voltage regulator. Two-stage I.F. with 8 tuned circuit. Xtal controlled B.F.O., 4 position selectivity with audio filter: for narrow bandwidth. C.W. Fast and slow A.V.C. High and low suppression. A plug-in unit with additional mixer provides a "listening through" guard channel of either 2-4 or 4-7.5 Mc/s. Receiver 16½in. x 9in. x 11in. Very good condition. Complete with mains power unit. Fully tested before despatch. **£15.10.0.** Carriage paid.

NATIONAL H.R.O. SENIOR RECEIVERS 5T MODEL

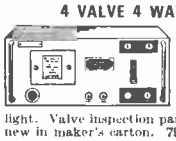
In excellent tested condition. **Complete with 9 coils 50 Kc/s-30 Mc/s and Power Unit. £31.10.0.** Carr. 30/-.

REJECTOR UNITS 1.2-10Mc/s



Switched, 4 ranges. Primarily designed as station rejector for R.C. Suitable for harmonic suppression and many other uses with slight alteration. Tuning dial with lock. Aerial in and out sockets. Brand new **25/-.** P. & P. 5/-.

4 VALVE 4 WATT AMPLIFIER



"C" Core transformers A.C. Mains 110/230 volts 600 ohms of high impedance input. Output 3 or 600 ohms (state choice). Controls: On/Off switch Gain control. Indicator light. Valve inspection panel. 19 x 7 x 7in. Brand new in maker's carton. **79/6.** Carr. 10/-.

32ft. TELESCOPIC AERIAL MASTS

Comprising 20ft. 4 section tubular steel telescopic mast and 12ft. folding whip; can be erected in less than 5 minutes. Closes to 5ft. 9in. Weight 21 lbs. Must have cost well over £20. Price **67/6.** P. & P. 7/6.

ROTARY TRANSFORMER

12v. D.C. input, 250v. D.C. output at 125mA. Size 3¼ x 5¼in. Brand new, **17/6,** P. & P. 5/-.

AMERICAN DYNAMOTOR UNIT

12v. D.C. input 240v. output, 150 watts approx. Suitable for Universal A.C./D.C. equipment. **45/-.** Carr. 7/6. Many other types.

R.F. ANTENNA TUNER (A.T.U.)

Calibrated scale, ideal 160/80/40 metres. Limited number only. Brand new with instructions, **17/6.** P. & P. 7/6.

ALL 19 SETS AND PARTS AVAILABLE

Complete list of other bargains, 1/-.
S.A.E. all enquiries. Credit Terms available.

A. J. THOMPSON (Dept. P.W.)
"EILING LODGE", CODICOTE, HITCHIN, HERTS.
Phone: CODICOTE 242

P.C.R. RXS.

These are a 6 valve long, med and short wave Rx, covering S.W. 6 to 18 Mc/s i.e. 50 to 16 metres. Fitted internal speaker sks for phones. Tested and fitted with mains P.U. for 230v mains. Price **£8.10.0** plus 10/- carr.

RECT. UNIT TYPE 7

These are a multi purpose unit that will either work off 12v D.C. or 200/250v mains to give the following O/Ps: 80v D.C. at 30 mA twice, i.e. 160v C.T. 40v A.C. at 30 mA, and 12v D.C. at 300 mA. It is also possible by making direct connection to trans to obtain any A.C. voltage between 240 and 100 v. All connections are brought out to terminal strips on top of unit. swt. fuses, ind. lamp are fitted with circ. and spare vibrator. In good condition in case, size 9 x 7 x 7in. PRICE **25/-** plus 6/6 carr.

INDICATOR UNIT TYPE 95

Contains valves VR65 (SP61) x 16, EB34 and EA50. CRT type VCR.97 green screen med persistance, CRT filament trans, controls: focus, brill, gain. 12 pre-set pots, Mu Metal shield, slow motion dial 50:1, 2 500 pF tuning conds., 100 Kc/s crystal unit, 2 slow motion drives yaxley and key swts, etc. In good condition with outer cover size: 9 x 12 x 18in. deep. PRICE **£3.15.0** plus 10/- carr.

MINE DET. UNITS

Ideal for locating buried metal objects, complete with H/Phones. Search coil, control box ready wired in waterproof containers. Req. 67/1.5v. Good condition and crated. PRICE **42/6** plus 10/- carr.

TYPE 88A WALKIE TALKIES

These are battery operated 4 channel crystal controlled unit intended to operate in the 38/42 Mc/s band and are for F.M.Tx and Rx. These require 90/1.5 v. battery carbon mike and H Phones. With crystals and circ. These would provide a good basis for Band 2 portable F.M. Rx. PRICE **£4.10.0** plus 5/6 carr.

APQ-43 I.F. AMPLIFIERS

These are a 30 Mc/s 10 Mc/s bandwidth I.F. strip using the following valves: 6AK5x7, 6AG7, 6AL5, 12AU7, in good condition. PRICE **42/6** plus 4/6 post.

APQ-43 PRE-AMPS

These are a 30 Mc/s pre-amp for use with the above I.F. strip and uses valves 6J4 x 2, 6AK5 x 3. Good condition. PRICE **25/-** plus 3/6 post. Power and B.N.C. plugs to fit both I.F. and Pre-amp **2/6** each.

TEST SETS TYPE 261/6

These are portable field test sets, the type 261 covers 175 to 305 Mc/s and the 266 covers 95 to 180 Mc/s. Both units are directly calibrated. No xtals are required. These units generate a modulated test signal that is radiated by a small aerial system that is supplied with unit. The modulation freq. can be varied. These units are intended to work off a 6v battery and a vibrator pack is built in to the unit. Provision is also made for fitting the battery inside the unit. Overall size 7 x 8 x 16in. Good condition with circ. PRICE **£3.5.0** plus 10/- carr. both types.

TABLE TOP CABINETS

These are an ali cabinet with lift up lid and removable back. Overall size 25 x 15 x 17in. Useful front size 22 x 9½in. Useful internal size 16in. deep, 10in. high. Good condition. PRICE **45/-** plus 10/- carr.

AXIAL FLOW BLOWERS

I/P 27v D.C. at 4.6 amps, O/P 90 C.F.M. speed 7,600 r.p.m. Size 5in. dia., 6in. long. These are a high efficiency fan unit of recent manufacture removed from American radar gear. Will work on 6 and 12v at reduced o/p. PRICE **32/6** plus 4/6 post.

TEST SET TYPE 219

This is a variable frequency pulse generator covering 500 c/s to 10 Kc/s in 2 ranges. The pulse width can be adjusted from .5 to 5 µsec. and the O/P can be switched to +50, +10 and —10v and is variable down to 1 mil volt. There is also a 20 µsec. sync. O/P pulse; by making internal connection to unit it is possible to obtain a sq. wave and s/tooth O/P. Good condition with circ., untested. PRICE **£4.10.0** plus 12/6 carr.

WIRELESS CONTROL UNIT II

Contain the following Key Swt, Yax swt 6p, 3w, 2b, Ind lamp, L.F. trans, 2 145+145 ohm coil relays high speed, P.O. relay, 3 small metal rect, all in box size 6 x 3½ x 10in. Brand new. PRICE **12/6** plus 4/6 post.

HEAD AND MIKE SETS

For use with 19 set in used condition but serviceable. PRICE **15/-** for 2 pairs plus 3/6 post.

B. SLATER

55 HANDSWORTH RD, SHEFFIELD 9

RECEIVERS & COMPONENTS
(continued)

Rechargeable batt. two cell. Capacity at 10 HR. rate 225mAH. V per cell 1·22V. Charge at 22mA 1·45V per cell. Dis 22mA, 10HR rate. Overall size cyl. 1in. dia., ⅞in. H. 6/- each P.P. Electrolytics, 2,500mf 70V wkg, 1¼ can, 3⅛in.H. 6/- each P.P. HOLLY ELECTRONICS, Holly House, Ford End, Chelmsford, Essex.

COMPONENTS, transistors ex-W.D. and surplus. Call at ROGERS, 31 Nelson Street, Southport. (List 6d stamp.)

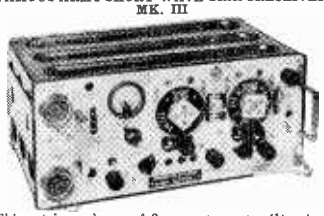
WILSON ELECTRONICS

2/- ea. AC126, 127, 128; 2G374B, S18T, S19T (OC83).
2/3 ea. OC81, OC81D, OC82, OC82D.
2/6 ea. OC44, OC45.
3/- ea. OC170, OC71, OC72.
3/6 ea. AF115, AF116, AF117.
4/- ea. AF114, OC171.

20 BRADBOURNE AVENUE, WILFORD NOTTINGHAM

JOHN'S RADIO (Dept. B)
OLD CO-OP, WHITEHALL ROAD
DRIGHLINGTON, BRADFORD

FAMOUS ARMY SHORT-WAVE TRANSRECEIVER MK. III



This set is made up of 3 separate units: (1) a two valve amplifier using a 6V6 output valve; (2) (some only) a V.H.F. transreceiver covering 229-241 Mc/s. using 4 valves; (3) the main shortwave Transmitter/receiver covering, in two switched bands, just below 2 Mc/s.–4½ Mc/s. and 4½ Mc/s.–8 Mc/s. (approx. 160–37.5 metres) using 9 valves. For R.T., C.W. or M.C.W. The receiver is superheterodyne having 1 R.F. stage, frequency changer, two IF (465 Kc/s.), signal detector, A.V.C. and output stage. A B.F.O. included for C.W. or single side-band reception. TX output valve 807, other valves octal bases. Many extras, e.g. netting switch, quick flick dial settings, squelch etc. Power requirements LT 12 volts, HT receiver 275 volts D.C., HT transmitter 500 volts D.C. Size approx. 17½ x 7½ x 11in. Every set supplied NEW in carton with a 12 pin connector and full book including circuits at only **£4.10.0.**, carriage 15/– with V.H.F. TX/RX, 10/– extra. **Brand New** and boxed No. 10 head and mike set (made for this set), only **15/–**, post 2/6. **New** 12 volt D.C. power unit for these sets **30/–**, carriage 5/–. **New** aerial tuning units, **20/–**, post 7/6. We make a mains 200/50 volt A.C. power unit in louvred metal case to plug direct into set power socket to run (1) receiver, **70/–**, post 5/–; (2) TX and RX, **£6.10.0**, post 7/6. A charge of 10/– to unpack and test the receiver of these sets is made only if requested. A few only 2nd grade sets as above ONLY **£3**, carr. and extras as above.

WALKIE-TALKIE MK III & CRYSTAL CALIBRATOR No. 9

This set is housed in a waterproof diecast aluminium case made by Murphy Radio for the Govt. having only reliability and quality in mind. Range 7.3–9 Mc/s, also on side of set is crystal calibrator No. 9 which gives pips on marks provided on the Tuning dial. Set uses a total of 5 valves power required L.T. 4 volts D.C., H.T. 100–175 volts D.C. Sets supplied in NEW or as new condition, boxed, only **50/–.** Carriage 10/-.

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2S302, 40 volt PNP Silicon transistors. Ideal for switching and general applications. Unmarked but fully guaranteed: **2/6 each or 5 for 10/-.**
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BY100, 800 p.i.v., 550 mA, Silicon Rectifiers. Unmarked. Fully guaranteed. **3 for 10/-.**

BRAND NEW MULLARD BARGAIN.

OC81 EACH 2/-

Postage and packing 9d. Catalogue 1/-. Callers welcome.

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EF80	1/6	20P5	6/6	PL82	3/6	PY81	3/6
ECC82	3/-	30P	7/-	U801	7/6	U301	6/-
ECL80	3/6	6F15	5/-	10F1	1/6	10P13	5/6
30F5	5/-	EB91	1/-	30FL1	5/-	20D1	2/-
PCF80	4/-	EF85	5/-	PY32	6/-	30P12	5/-
PL81	5/-	6/30L2	4/-	6U4GT	5/-	PY83	5/-
PZ30	5/-	20P3	6/-	EY86	4/-		

Speakers. Ex.T.V. 5in. round 6 x 4in., 3/6; 8in. round 6/-; post 2/-.

Line Output Transformers available. State set model No.

Turret Tuners, 8/-, post 2/-.

Scan Coils, etc. Quote set model No. with all enquiries and S.A.E. for prompt reply. All goods subject to satisfaction or money refunded.

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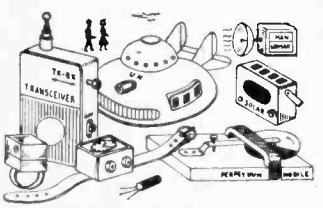
BUILD 30 TRANSISTORISED PROJECTS

on a printed circuit chassis with parts and transistors from your spare box. Latest very efficient designs for Radios, Amplifiers, Scientific Devices etc., etc., to suit everyone's needs and interests. The kit comprises 4 assorted PC laminate boards, etchant, resist, solvent, degreaser, 16-page etching manual "Printed Circuits for Amateurs", 2 miniature Radio Dials. Also Essential Design Data, Circuits and Printed Circuit. Chassis Plans for building

30 SUGGESTED PROJECTS



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Send S.A.E. for full details & Photographs.

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Comprising: Full instruction manual — Transformers — Printed circuit — Transistors — Resistors — Electrolytics — Potentiometer — Flex — Copper wire — and solder etc.
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Tests Transistors in or out or set — Tests both P.N.P. and N.P.N.
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A UNIQUE TAPE BUY! Top brand 7in. 2,400ft., **25/-**; 5¾in., 1,200ft. **15/-**. P. and P. 1 at 2/-, 2 at 2/9, 3-6 at 3/6. Bargains in all sizes. S.A.E. for list. E. C. KINGSLEY AND CO. LTD., 93 Tottenham Court Road, London W.1., EUSton 6500.

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All Heads are supplied complete with fixing plates and Technical Specifications.
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Paddington 5521. *Closed for Easter Holidays and Stocktaking, 21st March to 1st April.*

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WITH DATA

3/- each. OC44, OC45, OC70, OC71, OC81, OC81D, OC200, GET16, GET20.

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All volts between 3.9v. and 26v. ¼w **3/6** each, 1.5w **5/-** each, 7w **6/-** each.

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HAMMERITE HAMMER PATTERN BRUSH PAINT FOR PANELS, METALWORK

3/6 TIN ● JUST BRUSH ON ● WITHSTANDS 150°C. OIL. WATER ETC.

2½ oz. tins .... 3/6 | ¼ gallon..... 35/-*
½ pint ..... 7/6 | 1 gallon 58/-*
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Carriage: Orders up to 5/-, 9d.; up to 10/-, 1/9; over 10/-, 3/-. Colours: blue, silver, black or bronze. Return of post service. Monday to Friday.

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WANTED
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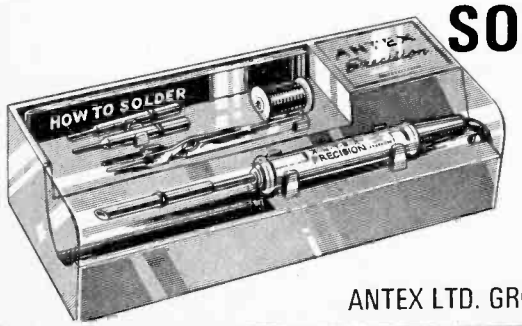

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5B4G	8/9	6D6	2/9	6SH7	2/6	12AU6	5/9	30F5	13/-	7475	2/6	EA50	2/-	EF50	2/-	KT81	10/-	PENB4	20/-	U301	13/-	VU120	12/6
5U4G	4/-	6E5	5/9	6SJ7	5/	12AU7	4/9	30FL1	13/6	ATP4	1/9	EABC80	5/9	EF80	5/-	KT88	27/6	PEN45	6/-	U403	6/6	VU508	30/-
5V4G	8/-	6F1	9/	6SK7GT	4/9	12AX7	5/9	30L15	12/6	ATP5	7/-	EAF42	7/8	EF85	6/6	KTW61	4/3	PEN46	2/9	U801	18/6	W81M	5/-
5Y3GT	5/-	6F5G	5/	6SL7GT	4/9	12BA6	6/-	30L17	12/-	ATP7	4/6	EB41	4/6	EF86	6/3	KTZ41	8/-	PL36	9/-	UABC80	5/6	X79	41/-
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6A7	15/-	6U4GT	10/-	6U5G	7/6	12E1	19/6	30PL1	14/-	AZ1	8/9	EBC41	8/3	EF92	2/6	M8P4	12/6	PL83	6/-	UBC81	7/6	X8G1-5	10/-
6A8G	12/6	6F11	12/6	6V6M	8/-	12J5GT	2/3	30PL13	14/-	AZ31	7/9	EBC90	3/9	EF98	9/-	MU14	4/-	PL84	6/6	UBF80	5/9	Y63	7/6
6AC7	3/-	6F13	5/-	6V6GT	7/-	12J7GT	7/8	30PL14	14/-	CBL31	15/-	EBF80	6/6	EF183	6/6	MX40	12/6	PL500	14/6	UBF89	6/6	Tubes	
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6AM5	2/6	6G6	2/6	6X4	3/6	35W4	4/6	CY31	10/-	DAC32	7/6	EBL1	17/6	EL33	17/6	N108	15/-	PY81	6/-	UCF80	8/6	5CP1	30/-
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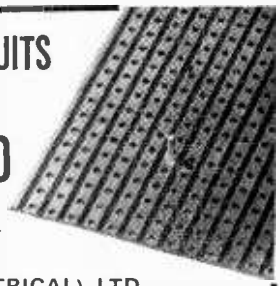

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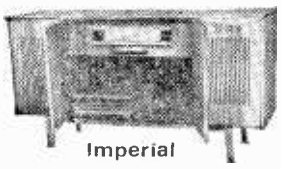

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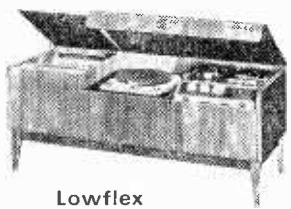

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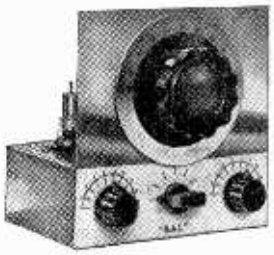

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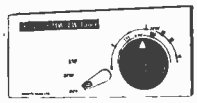

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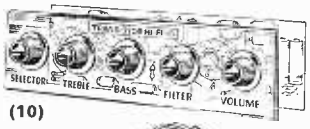

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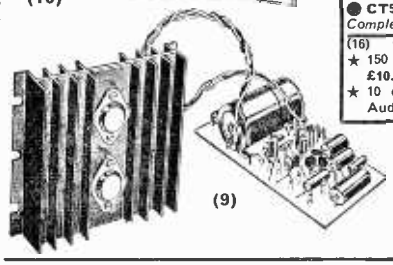

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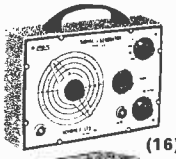

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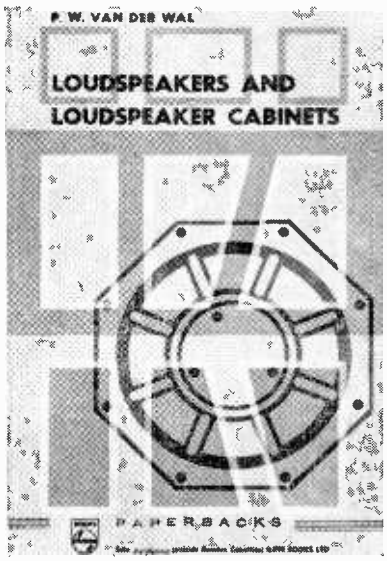

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6BL7GTA	10/-
6BN6	7/6
6BQ7A	7/-
6BR7	11/-
6BR8	5/-
6BS7	17/-
6BW6	7/-
6BW7	10/-
6BZ6	6/-
6BZ7	11/-
6C4	3/6
6C5GT	6/-
6C6	4/-
6C9	11/-
6C31	12/-
6CB6	5/-
6CD6GA	17/-
6CG7	10/-
6CH6	6/-
6CL6	9/-
6CU6	11/-
6CW4	12/-
6CY5	9/-
6CY7	11/-
6D4	15/-
6D6	3/-
6DK6	8/-
6DQ6G	11/-
6DS4	15/-
6E5GT	8/-
6EA8	11/-
6F1	14/-
6F4	30/-
6F5G	8/-
6F6G	5/-

6F7	5/-
6F8G	5/-
6F11	6/-
6F12	4/-
6F13	6/6
6F14	15/-
6F15	11/-
6F17	6/-
6F18	7/6
6F23	10/-
6F24	12/-
6F25	12/-
6F28	10/6
6H6	2/-
6J4	9/-
6J5G	4/-
6J6	3/6
6J7G	5/-
6K6G	6/-
6K7GT	5/-
6K8	8/-
6K8G	4/-
6L6GC	7/6
6L7	5/-
6L17	9/-
6L18	6/-
6LD20	5/-
6N7GT	7/-
6P25	12/-
6P28	12/6
6Q5G	15/-
6Q7	7/-
6SA7	7/-
6SC7	9/-
6SF5	8/-
6SF7	7/-
6SG7	6/-
6SH7	4/-
6SJ7	7/-
6SK7	6/-
6SL7GT	6/-
6SN7GT	5/6
6SQ7	7/-
6SR7	7/-
6T8	6/6
6U8	7/6
6U8A	9/6
6V6GT	6/6
6X4	4/-
6X5GT	5/6
6Y6G	9/-
7B6	11/-
7B7	7/-
7B8	8/-
7C5	11/-
7C6	6/6
7C7	5/-
7H7	8/-
7S7	22/-
7Y4	8/-
7Z4	6/-
9BW6	7/-
10C1	12/-
10C2	13/-
10D1	7/-
10F1	9/-
10F3	8/-

10F9	10/-
10F18	9/-
10L1	7/6
10P13	15/-
10P14	15/-
11D3	7/-
11D5	7/-
12AC6	8/-
12AD6	9/-
12AE6	7/6
12AL5	7/-
12AQ5	7/-
12AT6	5/-
12AT7	4/-
12AU6	6/-
12AU7	5/6
12AV6	5/6
12AV7	8/-
12AW6	20/-
12AX7	6/-
12AY7	10/-
12B4A	9/-
12BA6	6/-
12BE6	5/6
12BH7	6/-
12BY7	10/-
12C8	4/6
12E1	20/-
12K5	8/-
12K7GT	7/-
12K8	8/-
12Q7G	4/-
12SA7	7/-
12SC7	4/-
12SG7	5/-
12SH7	4/-
12SJ7	4/-
12SK7	5/-
12SL7GT	7/6
12SN7GT	7/6
12SR7	5/-
14S7	18/-
20D1	9/-
20F2	13/-
20L1	13/-
20P1	12/-
20P3	12/-
20P4	13/-
20P5	11/-
25L6GT	6/6
25Z4G	8/-
25Z5	8/-
25Z6GT	11/-
28D7	7/-
30A5	7/-
30C1	6/3
30C15	11/6
30C17	11/6
30C18	11/-
30F5	10/-
30FL1	14/-
30FL12	19/-
30FL13	6/-
30FL14	13/-
30L1	5/6
30L15	15/-
30L17	15/-
30P12	9/-
30P16	7/-

30P18	6/6
30P19	13/-
30PL1	15/-
30PL13	15/-
30PL14	15/-
35A3	10/-
35A5	10/-
35B5	12/-
35C5	6/6
35D5	12/-
35L6GT	6/-
35W4	4/6
35Z3	10/-
35Z4G	4/-
35Z4GT	8/6
35Z5GT	5/6
42	6/-
431U	8/-
50A5	12/-
50B5	6/3
50C5	6/-
50CD6G	27/6
50L6GT	6/-
52KU	7/-
55CG	30/-
58CG	45/-
75C1	13/-
80	6/-
83A1	12/-
85A1	25/-
85A2	7/6
85A3	5/6
90AG	46/-
90AV	46/-
90C1	12/-
90CG	25/-
90CV	25/-
117N7	30/-
150B2	10/-
150B3	8/-
211	30/-
807	9/-
815	35/-
832	20/-
837	17/6
866A	14/-
872A	40/-
884	15/-
955	3/-
956	2/-
957	5/-
958A	4/-
959	8/-
991	7/-

1267	20/-
2050	12/-
4313C	20/-
5651	7/6
5654	8/-
5670	10/-
5718	10/-
5749	10/-
5751	12/-
5763	10/-
5814A	10/-
5965	5/-
6060	5/-
6080	25/-
6146	25/-
6159	32/-
6293	60/-
6360	30/-
6939	45/-
7551	30/-
7586	22/6
7895	22/6
9002	5/6
9003	9/-
9005	15/-
A1820	20/-
AC/HL/DD	8/-
AC/HL/DDD	10/-
AC/TH1	8/-
AC/VP2	15/-
AR8	6/-
ARP12	3/6
ATS25	9/-
AW6	5/-
AZ11	6/-
AZ12	9/-
AZ31	9/-
AZ41	7/-
CBL31	15/-
DA90	4/-
DAC32	7/6
DAF40	10/-
DAF91	4/6
DAF92	6/-
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DC90	7/-
DCC90	7/-
DF33	8/-
DF64	5/-
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DF92	2/6
DF96	7/-

DH63	6/-
DK32	8/-
DK40	11/-
DK91	6/-
DK92	8/-
DK96	7/-
DL33	6/6
DL35	5/-
DL68	10/-
DL69	12/6
DL91	5/-
DL92	5/-
DL93	4/-
DL94	6/-
DL95	7/-
DL96	7/-
DM70	5/6
DY30	8/-
DY86	6/6
DY802	8/-
E88CC	12/6
E90CC	10/-
E92CC	7/-
E180CC	8/-
E180F	17/6
E182CC	23/-
EA50	2/-
EABC80	6/6
EAC91	4/-
EAF42	8/6
EBC33	7/-
EBC41	8/6
EBC81	6/3
EBC90	4/6
EBC91	5/-
EBF80	7/6
EBF83	8/-
EBF89	7/-
EBL31	20/-
EC86	12/-
EC88	11/-
EC91	5/-
EC92	6/6
ECC35	17/-
ECC40	9/6
ECC70	15/-
ECC81	4/-
ECC82	5/-
ECC83	6/-
ECC84	6/6
ECC85	5/-
ECC86	7/-
ECC88	8/-
ECC91	3/6

ECC189	11/-
ECC804	10/-
ECF80	7/-
ECF82	7/6
ECF83	12/-
ECF86	9/6
ECH35	11/-
ECH42	9/6
ECH81	5/3
ECH83	7/6
ECH84	9/-
ECL80	7/-
ECL81	7/6
ECL82	6/3
ECL83	9/6
ECL84	12/-
ECL85	11/6
ECL86	9/-
EF36	5/-
EF37A	8/-
EF39	6/-
EF40	9/-
EF41	8/6
EF42	11/-
EF52	8/-
EF54	6/-
EF80	5/-
EF83	10/-
EF85	6/6
EF86	6/3
EF89	5/6
EF91	4/-
EF92	2/6
EF93	4/6
EF94	5/6
EF95	5/-
EF96	2/6
EF98	10/-
EF183	6/6
EF184	6/6
EF800	8/-
EF804	21/-
EF811	12/-
EF812	10/-
EF814	12/-
EH90	7/6
EK90	4/6
EL22	15/-
EL33	12/6
EL34	9/6
EL35	5/-
EL36	8/6

EL38	17/6
EL41	8/6
EL42	7/6
EL81	9/-
EL82	8/-
EL83	7/-
EL84	4/3
EL85	7/6
EL86	8/-
EL90	5/6
EL91	2/6
EL95	5/-
EL360	22/-
EL821	6/-
EL822	16/-
ELL80	13/-
EM34	13/-
EM35	8/-
EM80	7/-
EM81	7/-
EM84	7/-
EM85	11/-
EN31	15/-
EN91	6/-
EN92	6/-
EY51	7/-
EY81	7/-
EY83	9/-
EY84	7/6
EY86	6/6
EY87	8/-
EY88	8/6
EZ22	6/-
EZ35	5/6
EZ40	7/6
EZ41	8/-
EZ80	5/-
EZ81	5/-
EZ90	4/-
GC10B	35/-
GS10H	40/-
GTE175M	12/-
GU50	25/-
GZ30	7/6
GZ32	10/-
GZ34	10/-
GZ37	12/-
HABC80	8/-
HBC90	5/-
HBC91	5/6
HF93	6/-
HF94	6/-
HL2	4/-
HL2K	4/-
HL23	6/-
HL23DD	6/-
HL41	4/-
HL42DD	8/-
HL92	6/6
HL94	7/-
HL132D	4/-
HL133DD	10/-
HN309	15/-
HY90	4/6
KT2	7/-
KT32	6/6
KT36	17/6

KT41	7/6
KT44	5/-
KT45	15/-
KT66	16/-
KT67	45/-
KT76	8/-
KT88	23/-
LP2	7/-
MH4	5/-
MH41	9/-
MHL4	5/-
ML4	8/-
MS/PEN	8/-
MS/PENT	10/-
PABC80	7/6
PC86	11/-
PC88	11/-
PC97	7/6
PC900	9/-
PCC84	5/6
PCC85	7/-
PCC89	11/-
PCC189	11/-
PCC805	11/-
PCC806	11/-
PCE800	10/6
PCF80	6/3
PCF82	6/6
PCF87	11/6
PCF800	10/-
PCF801	9/6
PCF802	9/6
PCF805	11/-
PCF806	12/-
PCF808	12/-
PCL80	10/6
PCL81	9/-
PCL82	7/-
PCL83	8/6
PCL84	7/6
PCL85	9/-
PCL86	8/6
PCL88	10/6
PCL800	12/-
PCL801	10/6
PEN25	5/-
PEN45	7/-
PEN45DD	12/-
PEN46	6/-
PEN220A	7/-
PEN383	10/-
PEN384	7/-
PEN453DD	10/-
PENA4	7/6
PF86	7/6
PF818	10/-
PFL200	14/-
PL36	9/-
PL38	16/-
PL81	6/-
PL82	7/-
PL83	6/6
PL84	6/6
PL302	13/-

PL500	13/6
PL504	15/-
PT15	15/-
PX4	20/-
PX25	15/-
PY32	8/6
PY33	8/6
PY80	5/6
PY81	6/-
PY82	5/6
PY83	6/-
PY88	8/-
PY301	11/-
PY800	6/-
PY801	6/-
PZ30	8/6
QP21	5/-
QP25	5/-
QP230	5/-
QQVO2-6	45/-
QQVO3-10	30/-
QQVO6-40	90/-
QS83/3	7/6
QS92/10	4/-
QS95/10	5/6
QS150/15	8/-
QS1200	10/-
QS1202	8/6
QS1203	8/6
QS1215	12/-
QVO3-12	10/-
QVO5-25	9/-
R1	8/-
R2	8/-
R10	15/-
R18	7/6
SP2	4/-
SP41	5/-
SP61	4/-
SU45	15/-
SU2150A	12/-
TP22	7/-
TP25	5/-
TP2620	7/6
TT21	35/-
TZ40	40/-
U10	8/-
U12/14	8/-
U17	5/-
U18/20	8/6
U21	7/-
U22	6/-
U25	12/6
U26	12/6
U27	7/6
U37	20/-
U50	5/-
U52	6/6
U70	4/6
U76	4/-
U78	4/-
U191	11/-
U193	7/-

U251	6/-
U281	12/-
U282	12/-
U301	11/-
U403	7/-
U404	5/-
U801	17/-
UABC80	5/3
UAF42	9/-
UB41	10/-
UBC41	8/-
UBC81	8/-
UBF80	6/6
UBF89	7/-
UBL21	10/-
UC92	6/-
UCC84	9/-
UCC85	6/6
UCF80	9/6
UCH21	9/6
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/-
UF89	7/-
UL41	9/-
UL84	6/6
UM4	10/-
UM80	5/-
UM81	10/-
UU5	8/-
UU7	10/-
UU8	7/-
UU9	7/-
UU10	8/-
UY1N	9/-
UY21	9/-
UY41	6/6
UY82	9/6
UY85	6/-
VP23	3/6
VP41	5/-
VU39	8/-
W81M	6/-
W729	10/-
X76M	7/6
XC12	6/6
XC15	4/6
XC16	7/-
Y63	8/-
Y65	5/-
Z22	5/6
Z62	5/-
Z63	9/-
Z66	10/-
Z759	23/-
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Z900T	13/-

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OC16	25/-
OC23	15/-
OC24	17/6
OC25	9/6
OC26	8/-
OC28	12/6
OC29	14/9
OC35	12/6
OC36	12/6
OC42	5/-
OC43	9/-
OC44	5/-
OC45	4/6
OC70	5/-
OC71	5/-
OC72	5/-
OC73	9/-
OC75	6/-
OC76	6/-
OC77	8/-
OC78	5/-
OC78D	5/-

OC81M	5/-
OC81DM	5/-
OC83	5/-
OC84	5/-
OC122	14/-
OC139	8/-
OC140	10/-
OC141	22/6
OC170	6/-
OC171	6/-
OC200	7/6
OC201	17/6
OC202	13/6
OC203	10/6
OC204	15/-
OC205	15/-
OC206	22/6
AC107	10/-
AC127	7/6
AC128	8/-
AC176	7/6

ACY17	8/6
ACY18	5/6
ACY19	6/6
ACY20	5/-
ACY21	6/-
ACY22	5/-
AD140	16/-
AD149	16/-
AF102	18/-
AF114	8/-
AF115	7/-
AF116	7/-
AF117	6/-
AF118	14/-
AF124	9/-
AF125	8/6
AF126	8/-
AF127	8/-
AFY10	22/6
AFZ11	17/-
AFZ12	12/6

ASY26	6/6
ASY28	6/6
ASZ20	7/6
ASZ21	15/-
GET103	5/6
GET113	5/-
GET114	4/-
GET115	8/6
GET116	12/-
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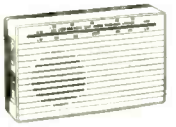

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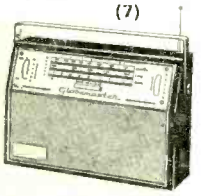

(8)

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(6)

MARRIOT TAPE HEADS

½ Track R/RP/3 Med z. 7/6, R/RP/1 High x, 8/-. R/RP/1 High z + R/E/1 erase on block, 19/6. ¼ Track L/RPS/12 High z 15/-. L/RPS/7 Med z 19/6. L/ES/9 erase, 12/6. Also H R-RP single track Rec/Play Med z 6/6.

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To charge 3.6 volt and 9.6 volt packs. Fully mains isoated in moulded case. **45/-** P.P. 2/-

(4) BUILD A QUALITY 2 OR 4 TRACK TAPE RECORDER

3-speed version using '363' decks

● TWO-TRACK. Deck £10.10.0. Martin Amplifier. £14.19.6. Cabinet and speaker 7 gns. Complete kits with FREE 7in. 1200ft. tape, spare spool Today's Value £45 **27 gns.** P.P. 15/-

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● 1 AMP SERIES WIRE LEADS

50 PIV ..	7/6	100 PIV ..	7/6
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100 PIV, 3 Amp Stud Type ..		..	9/6
400 PIV, 7 Amp (280V Rms) Stud Type			25/-
400 PIV, 8 Amp (280V Rms) Stud Type			20/-

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7 Mullard Transistors. Printed Circuit design with Stereo Indicator. For use with any valve or transistor FM. Uses pot cores to Mullard design and ger. and silicon transistors. Leaflet on request. Complete Kit Price **£5.19.6** P.P. 2/-

(5) VHF FM TUNER TO BUILD

87/105 Mc/s Transistor Superhet. Geared tuning. Terrific quality and sensitivity. For valve or transistor amplifiers. 4 x 3¼ x 2¼in. Complete with dial plate. 5 Mullard Transistors (FM Decoder Kit £5.19.6. P.P. 2/-). Leaflets on request. TOTAL COST TO BUILD **£6.19.6** P.P. 2/6 (Cabinet Assembly 20/- extra)

(6)	GARRARD DECKS—BRAND		NEW FULLY GUARANTEED	
1000 mono	£5 19 6	SP25 stereo	£10 19 6	401 less cart./arm	£27 10 0
AT5 mono	£6 9 6	SP25 Deram	£13 19 6	AT6 mono Mk. II	£8 19 6
2000 mono	£6 9 6	AT60 less cart.	£10 19 6	AT6 stereo Mk. II	£9 10 0
2000 stereo	£6 19 6	AT60 mono	£11 10 0	AT6 Deram	£11 19 0
3000 1 m stereo	£7 10 0	AT60 stereo	£11 19 6	Deccadec Mk. II	£17 17 0
SP25 less cart.	£9 19 6	AT60 Deram	£14 19 6	A70 less cart.	£17 17 0
SP25 mono	£10 10 0	LAB80 less cart.	£25 0 0	(*P. and P. 5/- any type*)	

All other makes of decks and cartridge in stock. List on request

(7) GLOBEMASTER MW/LW/SW PORTABLE RADIO TO BUILD

Full 3-waveband tuning. Pushbutton wavechange. Superhet printed circuit design. Black-chromed cabinet 11 x 7½ x 3¼in. (SW 17-50 metres). Ear/Record sockets. 1 watt Push/Pull output. 6 Mullard Transistors. Booklet on request. TOTAL COST TO BUILD **£7.19.6** P.P. 3/6

(8) TOURMASTER TRANSISTOR CAR RADIO

7-Transistor MW/LW Car Radio. 12 volt operated. 3 watt output. Push-button wavechange. RF stage. Supplied built, boxed, ready to use with Speaker and Baffle. Car fixing kit and manufacturers' current guarantee. Special Bargain Offer. Buy Now! Leaflet on request. List Price 15 gns. **£9.9.0** P.P. 3/6

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● SA200. 7½ + 7½ watt version Also Inputs for Mag. Mic. Mag. PU's, etc. **£25.10.0** P.P. 7/6

● AFM 100. AM/FM tuner to match SA100, etc. self-powered mains **£23.10.0** P.P. 5/-

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● 40 watt .. .. 97/6, p.p. 6/6

(1) REGENT-6 MW/LW POCKET RADIO TO BUILD

6-Transistor superhet. Geared tuning. Push-pull speaker output. Moulded cabinet 5 x 3 x 1¼ins. Phone socket. TOTAL COST TO BUILD **69/6** P.P. 2/-

TINY TONE RADIO CONTROL

Miniature 27 Mc/s band, Radio Control Receiver. Size only 2 x 2 x ½in. Sensitive 4 transistor design. Complete building instructions. TOTAL COST TO BUILD **55/-** P.P. 1/6

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