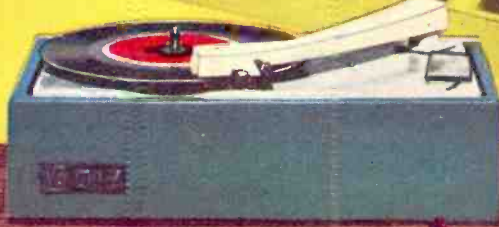


# PRACTICAL WIRELESS

SEPTEMBER 1964

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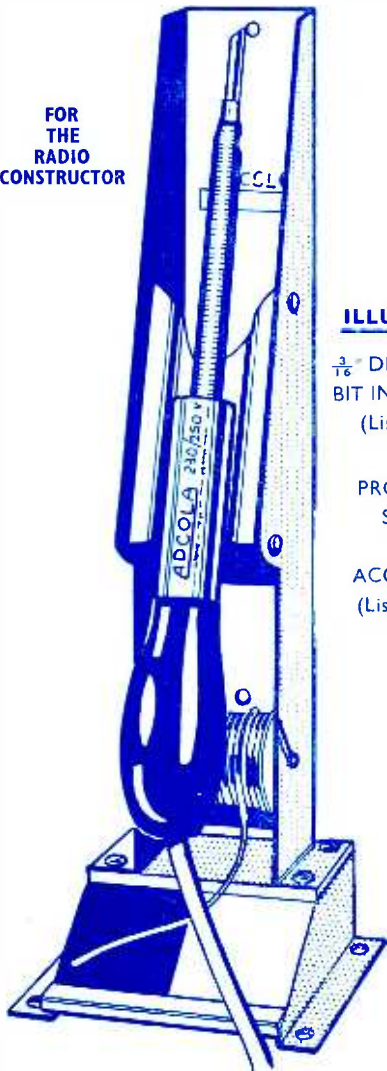
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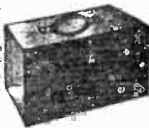
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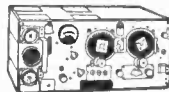
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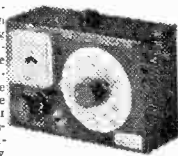


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Frequency range 20 to 100 Mc/s in two bands selected by plugging in the appropriate loop aerial, two of which are supplied with the set. Operates from a 6 v. D.C. supply which is converted by an internal vibrator pack to 450 v. and 4 v. L.T. vibrator unit worth pounds. The unit is in good condition, and a clear circuit drawing is mounted on the interior of the rear panel. The equipment contains many useful components, e.g. twin gang tuning condenser, valve, transformer, chokes, resistors, etc. A neat compact unit in grey enamelled case 16 1/2 x 7 x 6 1/2 in. with carrying handle. Price 35/6 P. & P. 5/-.

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1H8GT	5/8 6X4	3/9 DF33	5/9 EY39	3/9 PCF80B	14/9 U801	15/9
1N6GT	8/9 6X5GT	5/8 DF91	2/6 EF41	6/8 PC182	6/8 U4020	5/9
1R5	4/9 7B7	8/9 DF96	6/9 EF42	4/8 PC183	9/9 UABC80	6/9
1R5	3/9 7C5	7/9 DF76	6/8 EF80	4/8 PC184	7/8 UAF42	8/9
1T4	2/6 7G8	7/8 DH77	8/8 EF86	5/8 PC185	8/8 UBC41	6/8
3A5	6/9 7H7	5/8 DF32	8/9 EF86	6/8 PEN4DD	UBC81	7/8
3Q4	4/10 7SR	14/8 DK91	4/9 EF89	4/3	19/8 UBF80	6/9
3R4	4/9 7Y4	5/9 DK92	6/9 EF91	2/9 PEN44	6/8 UBF80	6/9
3V4	5/8 10C2	12/3 DK96	6/8 EF92	2/8 PEN8A	17/8 UC92	5/8
5U4G	4/8 12AT7	4/8 DL33	7/3 EL35	12/8 PEN383	9/8 UCC84	8/9
5Y3GT	6/9 12AT7	3/9 DL35	6/9 EL41	7/3 PL36	9/8 UCC86	6/9
6Z4G	7/9 12AU7	4/9 DL82	9/9 EL84	4/9 PL81	7/8 UCF80	8/9
6A1S	2/9 12AX7	4/8 DL92	4/9 EM34	7/11 PL82	5/8 UCH42	7/6
6AQ5	6/9 12K7GT	4/3 DL94	5/8 EM80	6/9 PL83	5/8 UCH81	6/9
6AT6	3/8 12K8GT	8/9 DL96	6/9 EM81	7/9 PL84	5/8 UCL82	7/6
6BA6	6/9 12Q7GT	4/3 EABC80	5/8 EM84	7/8 P34	9/8 UCL83	8/3
6BE6	5/8 12BG6	3/9 EA82	8/9 EM87	3/9 PA25	7/8 UCF41	7/8
6BG6	12/8 20P4	12/8 EB41	4/9 EY51	6/9 PY32	9/8 UCF42	4/9
6BH6	5/9 20P5	14/8 EB91	2/9 EY84	7/9 PY33	9/8 UDF89	6/8
6BJ6	5/8 25L6GT	4/9 EBC33	5/9 EY86	6/8 PY80	5/8 UL41	7/6
6F1	5/8 25U6GT	10/8 ERC41	7/8 EZ40	6/8 P81	5/8 UL44	15/9
6F6G	3/9 30L15	9/8 EBC81	5/9 EZ41	7/6 P82	6/8 UL46	8/6
6F13	4/9 30PL1	8/9 EBF50	6/9 EZ80	4/9 PY83	6/8 UL48	6/6
6F14	9/9 30PL13	9/9 EBF89	6/9 EZ81	4/8 PY88	7/8 UL84	8/6
6F15	6/8 30PL14	12/3 ECU40	7/8 KT22	5/9 R17	15/8 UC7	4/9
6J5G	3/8 35A5	14/9 ECC81	3/9 KT68	3/8 TDD4	7/8 UC8	10/8
6K70	1/8 35L6GT	6/8 ECC82	4/9 KT68	12/8 T81C	6/8 UC21	7/9
6K7GT	4/9 35Z6GT	4/11 ECC83	5/9 KT61	4/9 TH233	5/8 UC41	4/9
6K8G	4/9 35ZKU	13/8 ECC84	6/8 MU14	5/9 U22	4/8 UC85	5/9
6K8GT	7/9 35SKU	8/8 ECC85	8/8 N18	4/10 U25	8/8 VP41	4/9
6L18	7/8 AZ31	6/8 ECF80	6/3 PC95	9/9 U26	8/8 W75	3/6
6P28	9/8 B36	4/8 ECF82	6/3 PC97	7/8 U47	8/8 W77	2/6
6Q7G	4/9 CCL35	12/3 ECF86	10/9 PC95A	5/8 U50	8/8 W29	16/6
6Q7GT	7/8 CL33	9/8 ECH36	6/9 PC985	6/9 U59	4/8 X81M	19/6
6R7GT	9/8 CY1	12/6 ECH42	8/3 PC989	9/8 U78	3/8 X109	17/6
68L7GT	5/8 DAC32	3/3 ECH81	6/9 PCF80	5/8 U191	8/8 Y63	4/9
68N7GT	3/9 DAF91	3/9 ECL80	6/8 PCF82	6/8 U281	8/8 Z66	7/9

## READERS RADIO

24 COLBER PLACE, STAMFORD HILL, LONDON N.16  
 STA. 4587

Post 6d. per valve extra. Any Parcel Insured against Damage in Transit 6d. extra. Any C.O.D. Parcel 4/3 extra.

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## CHASSIS BARGAIN



A 6 valve Superhet Radiogram Chassis of outstanding quality covering MW 200/550 Metres, LW 1200-2000 Metres, VHF 87-100 Mc/s.

Incorporating internal Ferrite Rod Aerial and the famous Gorler Tuning Heart for VHF.

Pick-up Input suitable for most modern Record Players. Power output 4 watts, valve line up E780, EABC80, EF86, ECH71, EL84, ECC85. Volume On/Off and Tone Control, attractive black Tuning Dial size 15 x 6in. with gold lettering and contrasting cream and gold knobs. A.C. 200/250 v. Size 15 x 7 1/2 x 6 1/2in.

**PRICE 16 Gns.** P. & P. 5/-  
Or £3.9.0 deposit (plus P. & P.) and 9 monthly payments of 32/8.

## THE HE-30 4-BAND COMMUNICATION RECEIVER



One of the finest general coverage bandspread Receivers available at this price. Covering 550Kc/s—1600Kc/s, 4.8Mc/s—14.5Mc/s, 1.6Mc/s—4.8Mc/s, 10.5Mc/s—30Mc/s. Illuminated slide rule dial, calibrated every 5Kc/s on 80 and 40 metres. Edgewise S-meter, 0-100 logging scale, coverage from 9.55—30Mc/s. 8 valve plus Rectifier superhet circuits. RF stage with B.F.O. control Q-multiplier. Controls Function Switch, Audio Gain, Selectivity (Q-multiplier) Frequency (BFO), Band Selector, IF Gain, Trimmer, AVC-MVC Switch, Ant Switch, Main Tuning, Bandsread Tuning and Headphone Jack. Selectivity—60dB at 10Kc/s, 0.8Kc/s at 6dB (with Q-multiplier) IF-455Kc/s. External PM Speaker read., 4 or 8 ohms impedance. Output 1.5 watts, 8 modern Miniature BTG Base Valves and 5Y3 Rectifier. Size 15 x 10 x 7 1/2in. Grey crackle finish. 220/240 volt A.C. mains. 50/60 cycle operation. Full instructions and circuit diagram supplied. Send S.A.E. for leaflet.

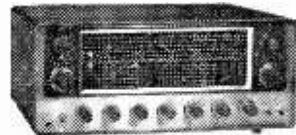
an Aerial Trimmer, 2 IF Stages, Controls Function Switch, Audio Gain, Selectivity (Q-multiplier) Frequency (BFO), Band Selector, IF Gain, Trimmer, AVC-MVC Switch, Ant Switch, Main Tuning, Bandsread Tuning and Headphone Jack. Selectivity—60dB at 10Kc/s, 0.8Kc/s at 6dB (with Q-multiplier) IF-455Kc/s. External PM Speaker read., 4 or 8 ohms impedance. Output 1.5 watts, 8 modern Miniature BTG Base Valves and 5Y3 Rectifier. Size 15 x 10 x 7 1/2in. Grey crackle finish. 220/240 volt A.C. mains. 50/60 cycle operation. Full instructions and circuit diagram supplied. Send S.A.E. for leaflet.

**PRICE 40 Gns.** Carriage Paid

**THE HE-30 COMMUNICATION RECEIVER (KT320), now available in sub-assembled form.** All I.F. transformers and coils are factory aligned and therefore only require peaking when receiver is assembled. Full easy-to-follow instructions supplied

**32 Gns.** Post Paid

## THE NEW HE-80 COMMUNICATION RECEIVER



The HE-80 has outstanding sensitivity 0-100 logging scale for instant re-set, built-in "S" meter special recording Jack, remote Control Socket allowing simultaneous control with transmitter, 100Kc crystal oscillator circuit providing accurate harmonic signals of either 4 or 8 ohms impedance. Two headphone sockets, one high, one low.

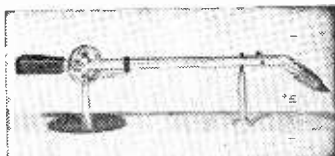
### TECHNICAL SPECIFICATIONS.

Frequency Coverage: Band 1 540—1605Kc/s; Band 2 1.6—4.8Kc/s; Band 3 4.8—14.5Mc/s; Band 4 10.5—30Mc/s; Band 5 144—146Mc/s. Band Spread (Ham Band directly read): 80 Metre Band; 40 Metre Band; 20 Metre Band; 15 Metre Band; 30 Metre Band. Sensitivity: 1 microvolt for 10dB signal to noise ratio. Selectivity: Normal 10Kc at -75dB, 1.25 at -6dB. With Q-Multi: variable to 700 c.p.s. at 6dB. Operation: AM, SSB, CW and FM. AM diode detector, SSB/CW product detector (BFO), FM rated beam detector. Power Source: 240 volts 50/60 Cycles A.C. Power Consumption: 60 watts. Audio Output: 1.5 watts, 8 or 500 ohms impedance. Auxiliary Circuit: Electrical Bandsread, Q-Multiplier, ANL, AVC-MVC, BFO, 100Kc crystal calibrator. Valve Line-up: 4-6AQ8, 6BL8, 2-6BA6, 2-6BE6, 6AL5, 6AQ5, OA2, 6CA4. Dimensions: 17in. wide, 6 1/2in. high, 10 1/2in. deep.

**PRICE 59 Gns.** Carriage Paid

## OUTSTANDING PRICE REDUCTION

THE B. & O. ST/M PICKUP COMPLETE WITH SP 11 STEREO DYNE MAGNETIC CARTRIDGE



A Transcription Pickup of outstanding quality employing a specially designed counter-balanced and unique weight adjustment. Specifications: Length 10 1/2in. from tip of Cartridge. Height 2 1/2in. Stereo/Mono Cartridge. Frequency Response: +2.5dB from 30 c.p.s. to 15 K.c/s. Output Voltage: 7mV per channel at 5 cm/sec. at 1000 c.p.s. Separation: 20dB minimum. DC Resistance: 1250 ohms. Inductance: 200mHs. Recommended Tracking Force: 2 to 4 grams. Compliance: 5 x 10<sup>-6</sup> cm/dyne in all directions. Stylus: Diamond, radius of curvature: 7th. Recommended Load: 47000 ohms.

**PRICE 9 1/2 Gns.** Plus 3/8 P. & P.

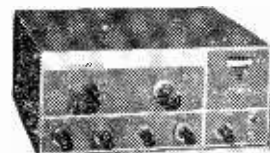
## THE HE-40 4-BAND COMMUNICATION RECEIVER

Completely built and ready to go. High sensitivity Superhet receiver covering 550Kc/s—1,600 Kc/s, 1.6 Mc/s—4.8Mc/s, 4.4 Mc/s—11 Mc/s, 11 Mc/s—30 Mc/s. Electrical Bandsread tuning. Slide rule type tuning dial. Internal ferrite rod aerial for medium waveband reception and 1 5/8in. 10 section chromium plated telescopic whip aerial for the short wave bands. Sockets for optional outdoor aerial, internal high flux monitor loudspeaker. Latest modern miniature BTG base valves. Headphone socket (may also be used for external loudspeaker). ANL, BFO, built-in "S" meter, 220/240 volt A.C. mains. 50/60 cycle operation. Handsomely styled cabinet with grey crackle finish and handsome front panel, with chrome and satin chrome fittings. Measures 13 1/2in. x 8 1/2in. x 5 1/2in. (high) and weighs only 1 1/2 lb. A comprehensive instruction manual is supplied. An ideal receiver for the radio amateur and short wave listeners of all ages. Send S.A.E. for leaflet.



**PRICE £24.15.0** Carriage Paid

## "STARFLITE TRANSMITTER"



Designed to meet the needs of most amateurs the Starflite has single-knob band-switching. Front panel switch to select any of five crystal positions with provision for an external VFO. (Controlled carrier modulator permits almost 100% of the CW input to be used on AM peaks. Grid-block, keyline provides chirp-free operation. A full wave silicon diode power supply effects extremely low output ripple for

cleaner CW transmission, electron-coupled Pierce Oscillator, capacitance bridge neutralisation of the final and a three-stage lowpass filter. An illuminated edgewise D'Arsonval panel meter. Pi-network output provides the correct impedance match between the plate circuit and any 50-72 ohm co-axial feeder. Easy to follow point-to-point instructions supplied with each set of components. When constructed the Unit is housed in a heavy gauge steel Cabinet finished in grey crackle.

**SPECIFICATIONS:** Power Input—20 watts peak; Operation: C.W., AM Phone—crystals or VFO Control; Band coverage: 80-10 metres; Coupling: Pi-network; Valve Line-up: 6148, (2) 6CL6, 12AX7, 6DE7, Low Pass Filter. Size 13 1/2in. wide x 12in. deep (inc. knobs) x 8 1/2in. high (inc. rubber feet). Weight 2 1/2 lb. Power requirements, 200/240 v. 50/60 c.p.s. 225 watts.

**MAY BE BUILT FOR 35 Gns.** Carriage & Insurance 15/-

SEE FOLLOWING PAGES FOR ADDRESSES AND OTHER ITEMS

# STERN-CLYNE

Electronics Centres throughout Great Britain

## MULLARD 2-VALVE PRE-AMPLIFIER TONE CONTROL UNIT

Employing two EF86 valves and designed to operate with the Mullard AMPLIFIERS but also perfectly suitable for other makes with input up to 250 mV.

★ Equalisation for the latest R.I.A.A. characteristics. ★ Inputs for Crystal Pickups and variable reluctance magnetic types. ★ Input (a) Direct from High Imp. Tape Head. (b) From a Tape Amplifier or Pre-Amplifier. ★ Sensitive Microphone Channel. ★ Wide range BASS and TREBLE Controls.

KIT OF PARTS **£6.60** ASSEMBLED AND TESTED **£9.10.0** (Carr. & Ins. 5/-).  
 Instruction book and detailed price list (free with kits) available separately at 2/- Post Free.



## MULLARD 3-VALVE PRE-AMPLIFIER TONE CONTROL UNIT

Designed mainly for Mullard Range of Amplifiers, also suitable for any Amplifiers requiring input up to 250mV, incorporates 5 input Channels, including for Tape and Magnetic Pickups. Separate Bass and Treble controls. High pass filter 20 to 160 c/s. low pass filter 5-9 Kc/s. Totally enclosed in case Size 11 1/2 x 4 1/2 x 4 1/2.

KIT OF PARTS **£10.00** (Carr. & Ins. 5/-) ASSEMBLED AND TESTED **£13.13.0**  
 Instruction book and detailed price list (free with kit) available separately at 1/6 Post Free.



## MULLARD "5-10" MAIN AMPLIFIER

For use with MULLARD 2 or 3 valve pre-amplifiers with which an undistorted power output of up to 10 watts is obtained. SPECIFIED COMPONENTS and MULLARD VALVES including PARTRIDGE MAINS TRANSFORMER and choice of PARMEKO or PARTRIDGE Output Transformer.

COMPLETE KIT (Parmeko Output Trans.) ASSEMBLED AND TESTED **£13.13.0**

(Carr. & Ins. 6/6). ABOVE incorporating PARTRIDGE OUTPUT TRANS. £1.6.0 extra.  
 Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.



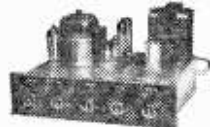
## COMBINED PRICE REDUCTION

MULLARD 5-10 Main amplifier and 2 valve Pre-Amp. Kit **£15.15.0**. C. & I. 8/6. Built and tested. **£21.10.0**. C. & I. 9/6.  
 MULLARD 5-10 Main Amplifier and 3 valve Pre-Amp. Kit **£19.10.0**. C. & I. 8/6. Built and tested. **£25.10.0**. C. & I. 8/6. With Partridge Transformer **£1.6.0** extra.

## THE MULLARD 5-10RC AMPLIFIER

The popular complete "5-10" incorporating Passive Control Unit providing up to 10 watts high quality reproduction with input of 600mV. Specified components and new MULLARD VALVES. Includes PARTRIDGE MAINS TRANSFORMERS and choice of PARMEKO or PARTRIDGE Output Transformers. Surplus power available for Tuner

COMPLETE KIT **£12.0.0** (Carr. & Ins. 7/6). With PARTRIDGE OUTPUT TRANS. **£1.6.0** extra.  
 ASSEMBLED AND TESTED **£16.0.0** (Carr. & Ins. 7/6).  
 Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

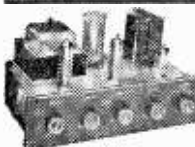


## THE MULLARD 3-3RC

A HIGH QUALITY AMPLIFIER DEVELOPED FROM THE VERY POPULAR 3-WATT MULLARD "3-3" DESIGN.

KIT OF PARTS **£8.8.0** ASSEMBLED AND TESTED **£11.10.0** (Carr. & Ins. 6/6).

Complete to the MULLARD specification including PARMEKO OUTPUT TRANSFORMER. Switched inputs for 78 and



L.P. records plus a Radio position. Extra power to drive a Radio Tuning Unit is also available. Please state L.S. impedance.  
 Instruction book and detailed price list (free with kit) available separately at 2/- Post Free.

## TAPE PRE-AMPLIFIER MULLARD Type "C"

Suitable for most 1 track. Mono Tape Decks. Incorporates Ferroxcube Push-Full Oscillator, Treble Inductor and 3-sp. Equalisation. Includes separate Power Unit.

KIT OF PARTS **£14.0.0** (Carr. & Ins. 7/6). ASSEMBLED AND TESTED **£19.10.0**  
 Instruction book and detailed price list (free with kit) available separately at 3/6 Post Free.



## THE "MONO-GRAM"

A small Amplifier of genuine high quality performance. Incorporates MULLARD ECL86 Valve, separate BASS and TREBLE controls. PARTRIDGE output Transformer producing up to 3 watts undistorted output.



KIT OF PARTS **£4.10.0** (Carr. & Ins. 3/6). ASSEMBLED AND TESTED **£6.0.0**  
 Instruction book and detailed price list (free with kit) available separately at 2/6 Post Free.

Perfectly suited for Portable Installations for which purpose we offer PORTABLE CASE (£3.10.0), the AMPLIFIER (Kit £4.10.0) and 8" x 5" SPEAKER (£1.0.0). All for.. **£9.0.0**  
 Alternately with ASSEMBLED AMPLIFIER **£10.0.0** (Carr. & Ins. 5/-).  
 The Case quoted above will accommodate some 4-speed Single Record Units. A larger model is available for extra 10/- With this Equipment a COMPLETE PORTABLE RECORD PLAYER can be built for **£14.0.0**



## MODEL CR3/S TAPE RECORDER

MODEL CR3/S incorporates the HF/TR3 Mk. II Tape Amplifier (described below) and the Collaro "Studio" Twin-Track 3-speed Deck operating at 11in., 3 1/2in. and 7 1/2in. speeds. Complete with microphones and 1,200ft. tape.

KIT OF PARTS **£33.8.0** ASSEMBLED AND TESTED **£43.0.0** (Carr. & Ins. 15/- extra).



## STEREO TAPE PRE-AMPLIFIER

MODEL STP-1. For use with current TRUVOX BRENNELL or COLLARO "STUDIO" 1 and 1 track Stereo Decks. Incorporates Ferroxcube Oscillator, 4-speed Equalisation Signal Lever Meter and separate Gain Control. Includes separate Power Unit. KIT OF PARTS **£22.0.0** (Carr. & Ins. 8/6) ASSEMBLED AND TESTED **£28.20.0**

Instruction book and detailed price list (free with kit) available separately at 5/- Post Free.



## MULLARD TAPE AMPLIFIER

MODEL HF/TR3/MK. II Based on Mullard's Type "A" design and suitable for most 1 track Mono Tape Decks. Incorporates Ferroxcube Treble Inductor, Gilson Output Transformer, and 3-speed Equalisation. Includes separate Power Unit, using PARTRIDGE Mains Transformer.

KIT OF PARTS **£13.13.0** (Carr. & Ins. 7/6). ASSEMBLED AND TESTED **£19.0.0**  
 Instruction book and detailed price list (free with kit) available separately at 3/- Post Free.



## COMBINATION TAPE UNITS

All our Tape Units can be supplied specially matched to any Tape Deck such as Collaro, Mk.5 Series II, also the Wearite. Specimen prices as below.

	Kit	Assembled
STP-1 Pre-amp with Collaro Studio Tape Deck.....	£88. 0.0	£42. 0.0
Assembled with track switch fitted, £44.2.0		
STP-1 with Brenell Mk. 5 Series II with Track Switch fitted.....	£88. 4.0	
STP-1 with Brenell Mk. 5 Series II, 1 Track Deck.....		£74.15.0
Type "C" Pre-amp with Collaro Studio Tape Deck.....	£24.10.0	£30. 0.0
Assembled with deck wired and matched, £22.2.0		
Type "C" Pre-amp with Brenell Mk. 5 Series II Deck.....	£48.11.0	£53. 1.0
Assembled with deck wired and matched, £55.3.0		
HF/TR3 with Collaro studio Tape Deck.....	£24. 3.0	£39.10.0
Assembled with deck wired and matched, £31.12.0		
HF/TR3 with Brenell Mk. 5 series II Deck.....	£48. 4.0	£51.11.0
Assembled with deck wired and matched, £53.13.0		
Carr. & Ins. 15/- on above units. Send S.A.E. for comprehensive price list.		

SEE PRECEDING PAGE FOR OTHER STERN-CLYNE PRODUCTS

SEND FOR CURRENT PRICE LIST OF ALL LEADING RECORDING TAPES AND ACCESSORIES



# STERLING-CLYNE

Electronics Centres throughout Great Britain

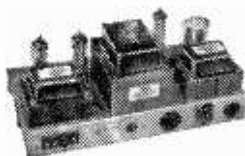
## THE TUDOR STEREO HI-FI SYSTEM



Comprising a Self Powered AM/FM Tuner, Stereo Pre-amplifier, 12 watt per channel Stereo Power Amplifier. The Tuner and Pre-amplifier are housed in matching black crackle finish metal cabinets for shelf mounting, with silver metal dials and matching knobs. Specifications: **Tuner**—Outstanding quality providing full V.H.F. FM long and medium waveband coverage, frequency range FM 87.5-108.5 Mc/s, AM/MW 522-1630 Kc/s, LW 145-270 Kc/s, 100mV output mains supply 105/240 A.C. Valve line-up: ECC33, ECH81, EBF49, EB91, EM84, ECC33. Multiplex outlet provided. **Pre-amplifier**—Designed for use with Tudor Stereo Power Amplifier with inputs for most types of Pickups, direct play from Tape-Heads and ample sensitivity for either Crystal or Moving Coil Microphone. Distortion 0.1%. tape outputs 100mV from 90K, ohm source inputs—Microphone 5 mV, Tape 5.3 mV. R.I.A.A. 4.3 mV flat 250 mV. Tuner 100 mV. Valve line-up: 2—EF86, 4—ECC83. **Power Amplifier**—14 watts per channel, sensitivity 1 volt f.m.e. for 14 watts output, frequency response  $\pm 0.5$ dB 20 c/s. —20Kc/s. Speaker impedance 4, 8, or 16 ohms, surplus power available for Tape Pre-Amp. mains supply 105/240 v. A.C. Valve line-up: 2—ECC83, 4—EL84, 1—CZ34. **AM/FM TUNER AVAILABLE AT 24 GNS. P. & P. 7/6. STEREO PRE-AMPLIFIER AND POWER AMPLIFIER TOGETHER AT 24 GNS. P. & P. 10/-.**

## DUE TO PRODUCTION STREAMLINING WE ARE PLEASED TO ANNOUNCE REDUCTIONS IN PRICE!

### ★ J.L.10 POWER AMPLIFIER



Incorporates the latest triode-pentode ECL86 valves in push-pull, PARTRIDGE ultra linear output transformer. PARTRIDGE mains transformer and smoothing choke. 10 watts power output, surplus power available for tuner. Output impedance 3—7.5—15 ohms.

KIT OF PARTS **£10.00** C. & L. 7/6  
 READY BUILT **£13.13.0**

### ★ DOUBLE FEATURE PRE-AMPLIFIER



Inputs for microphone, crystal or magnetic Pickups, tuner unit, and in addition offers full facilities for tape recording and high fidelity replay. This unique feature means that, should you wish to include tape in your hi-fi system at a later date all that is required is a suitable tape deck. Push-button switching for 3 tape speeds equalised. Tape erase Bias Oscillator circuit incorporating ferro-cube transformer. Function switch, separate base, treble and volume controls, level control and latest EM87 magic eye level indicator. The pre-amplifier is totally enclosed in a silver hammer finish steel case, and an attractive perspex front panel completes the presentation.

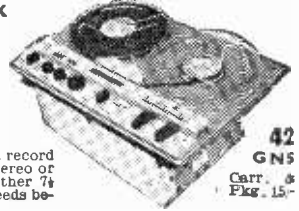
KIT OF PARTS **£13.13.0** READY BUILT **£19.19.0** C. & L. 5/-  
 PRICES: If both above units are purchased together:  
 KIT OF PARTS **£23.13.0** READY BUILT **£32.0.0** C. & L. 10/-.

WEST END:	18 Tottenham Court Road, W.1.	MUSEum 5929/0095	Half-day Sat
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CITY:	109 Fleet Street, E.C.4.	FLEet St. 5812/3	Half-day Sat
NORTH LONDON:	162 Holloway Road, N.7.	NORth 7941	Half-day Thurs
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CROYDON:	12 Suffolk House, George Street.	MUNicipal 3250	Half-day Wed
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## SEND STAMP FOR COPY OF OUR INTERESTING LITTLE BOOKLET "What is High Fidelity?"

### STEREO TAPE DECK WITH BUILT-IN PRE-AMPLIFIER



A Professional addition to your Hi-Fi Stereo System consisting of two basic units, the Tape Deck and Pre-amplifier, which employs 4 Transistors and 4 Valves. The Unit with record and playback 1 track stereo or 1 track mono at either 7 1/2 i.p.s. or 3 1/2 i.p.s. both speeds being fully equalised.

Features: Track System: 1 track 2 channel stereo or monaural record and playback. Independent single channel recording on either channel while playback on other channel. Head Type: 1 track 2 channel inline stereo and associated erase heads. Low loss laminated pole pieces. Level indicators: 2 Meters, 1 per channel. Digital Counter: 3 digit tape position indicator. Automatic Stop: When tape runs out or breaks. Inputs: Microphone 1mV (50K, ohms impedance) Gram/Tuner 50mV (high impedance). Output: (cathode follower). Monitor Sockets: 2 x 5 K. ohms impedance. Audio Output: 500mV. Oscillator: Push-pull 80 Kc/s, S/N Ratio—45dB or better at 7in. tape speed. Separation: 45dB or more between stereo channels. Frequency Response: 40 to 15,000 cycles per sec. at 7 1/2 i.p.s., 40 to 9,000 cycles per sec. at 3 1/2 i.p.s. Single Motor: 4 pole heavy duty induction type. Power Supply: 240v. A.C. 50 cycles. Size 6 1/2 x 10 1/2 x 15 1/2. Tape Size: Up to 7in. Line Up: 4-2SB173 Transistors, 2-12AT7, 1-1AU7, 1-12BH7 Valves.

42 GNS Carr. & Pkg. 15/-

### THE 'HIGHWAYMAN'



OUR QUALITY CAR RADIO TO BUILD YOURSELF AT A NEW LOW PRICE

Look at these features:

- ★ Attractive styling.
- ★ Push-pull output.
- ★ Three latest Mullard transistors plus valves types EF86 and ECH81.
- ★ No Buzz, high output and sensitivity.
- ★ Printed circuit (latest type), 7 x 4in. high flux p.m. speaker and baffle.
- ★ Medium and Long Waves.
- ★ Push button for fingertip control.
- ★ Extremely low battery consumption (less than 1 amp).
- ★ Easy to fit any make car (Positive earth only).
- ★ 12-volt operation.
- ★ Compact size, measures only 7 x 7 x 2 1/2in. deep.
- ★ Easy assembly, supplied with dial and drive already mounted.

Special inclusive price of ONLY **£7.19.6** Plus 5/- P. & P. All parts available separately. Individually priced parts list and comprehensive instruction booklet 2/6 post free. (Deducted from cost if complete parcel purchased later). **Optional extras:** 3 section chromium plated weatherproof telescopic aerials type 1 17/44", 19/6; type 2, 27/44", 29/6, both plus P. & P. 3/6 if purchased separately.

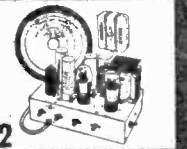
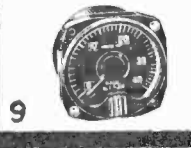
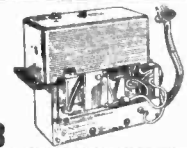
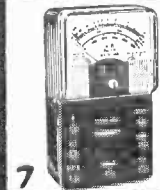
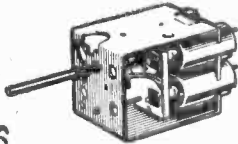
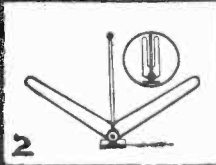
**ACOS MONAURAL STETHOSCOPE HEADSETS** Suitable for Tape Recorders, or monitoring tape recorders, 100 ohm impedance magnetic. Complete with lead. **OUR PRICE 12.6 P. & (Originally 21/-).**

## NEWS FLASH !!

### YET ANOTHER NEW ELECTRONICS CENTRE NOW OPEN AT 52, LORD STREET, LIVERPOOL.



# Just a few of our **BARGAINS**



**FREE OFFER**  
ELECTRIC  
SOLDERING IRON  
with the  
POCKET  
MULTI-METER  
See item No. 7  
for further details

14

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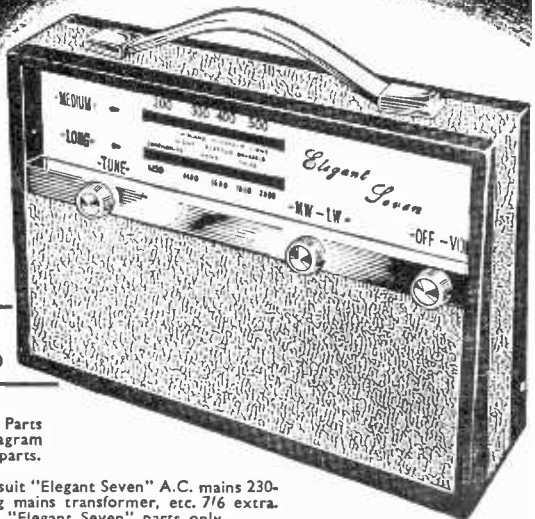
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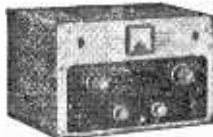
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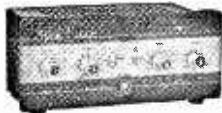


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TAPE AMPLIFIER FOR STUDIO DECK with ready wired printed circuit, control and input panels, mains and output transformers, knobs, pliers, screws, etc.			
EF86, ECC83, EZ80, EM85 and 2 EL84, 3 watts output, Magio eye, Radio and Mic. inputs, ext. speaker socket, tone and monitor controls. Can be used as an amplifier	24/-	12	19/-
COLLARO STUDIO DECK. Very latest model, 3 speeds, 7in. spools	22/-	8	27/3
CASE for above with 8 x 5in. speaker, two-tone grey			25.50
COMPLETE KIT with tape and microphone	229.19.8	60/-	18
<b>QUARTER TRACK</b>			
COLLARO STUDIO DECK fitted with Marriot "X" heads			
TAPE AMPLIFIER FOR STUDIO DECK as described above but quarter track	28/-	12	23/8
CASE with speaker, two tone grey	27/-	12	20/8
COMPLETE KIT with tape and microphone	238.19.6	68/-	12
<b>TAPE PRE-AMPLIFIERS</b>			
HALF TRACK for studio deck, 400m/Volts output	20/-	8	21/-
QUARTER TRACK as above	20/-	9	21/-

### MARTIN AUDIOKITS

	Dep.	&	Mthly pmt. of
The new Martin All Transistor Ten Watt Amplifier Kits represent excellent value for money. Each unit is complete, requiring only to be connected to the next. We show the most popular units here. Others are available. Leaflets on request.			
UNIT 1—FIVE INPUT SELECTOR, Size 3 1/2 x 3in. Mag. PU, Crystal PU, Radio, Mic. Tape Head, 9-15 Volts. Must be used with Unit 4			
UNIT 4—PRE-AMPLIFIER AND CONTROL, 6 1/2 x 2 1/2in. Volume on off, bass and treble controls, 9-15 volts. Must be used with unit 1	—	—	—
UNIT 7—MAIN AMPLIFIER 10 WATTS 6 transistor transformerless push-pull output. Mounted on heat sink. 15 ohms output, 24 Volts	—	—	—
UNIT 8 POWER SUPPLY, 24 and 9 Volts. Heavy duty transformer, rectifier and smoothing	—	—	—
CONTROL PANEL for units 1 and 4	—	—	—
ALL FOUR ABOVE UNITS WITH PANEL, 15 ohms output	33/6	12	25/3
UNIT 5 MAIN AMPLIFIER as Unit 7, 3 ohms output, 24 Volts	—	—	—
UNIT 6 POWER SUPPLY as Unit 8 for use with Unit 5	—	—	—
ALL FOUR UNITS (1456) WITH PANEL output	28/6	12	23/7
STEREO VERSIONS NOW AVAILABLE. DETAILS ON REQUEST.			

## GRAMOPHONE UNITS, MOTORS, PICK-UPS

Decca Deram Arm and Plug-in Shell	—	—	—
Decca Deram Transcription Cartridge	—	—	—
Decca Deram Auto Cartridge	—	—	—
Garrard 8P10 with Mono cartridge, single player	—	—	—
R.S.E. UA14 with TCS Mono Cartridge, 4-speed changer	20/-	6	22/8
Garrard Antolium, Mono cartridge, 4 speed changer	20/-	7	22/8
Garrard AT6 Autolium de Luxe, TCS Mono cartridge	26/6	9	24/8
Garrard 4H/F with Mono cartridge	24/-	12	22/8
Garrard Lab Type "A" Transcription auto-changer, with Mono cartridge	39/6	12	32/9
Garrard 301 Stereo	44/-	12	36/6
Philips AG1016, Stereo cartridge, will change 7 in. records (adaptor 10/- extra)	27/-	12	20/8
Goldring GL58 with arm, less cartridge	36/-	12	28/2
Goldring GL70 with arm, no cartridge	55/-	12	45/8
Goldring "89" Transcription, no arm	41/-	12	31/1

## MONO AMPLIFIERS

Linear L45, 3 watt, 3 valve	—	—	—
Linear Dionole, 12 watts, suitable Mic or guitar	28/6	12	21/6
Linear Couchord, 30 watts, ideal guitar amp. with cover	40/-	12	31/6
Dulci GA5, integrated amp., 5 watt. ECL86 valve	28/6	12	21/6
Dulci DPA15, 15 watt with 2-valve pre-amp.	52/6	12	43/6
Tripletone Hi-Fi Master with pre-amp. Suitable for Guitar or Mic. etc.	35/3	12	26/1
Leak TL12 10 watt Main amp. only	40/6	12	23/1
Leak Varislope Mono pre-amplifier	31/8	12	26/1
Quad, 15 watt Main amplifier only	45/-	12	37/4
Quad, pre-amplifier, Mono	39/-	12	22/4

## ARMSTRONG - NEW TUNER AMPLIFIERS

### MONO

227M A.M./F.M. Radio chassis, 10 watts	70/6	12	56/1
228 A.M./F.M. Self-powered (Tuner only)	57/6	12	47/9
224 F.M. only, Self-powered Tuner	45/-	12	37/4

### STEREO

227 A.M./F.M. Radio chassis, Stereo gram, 10 watts each channel	97/6	12	81/1
226 A.M./F.M. Radio chassis, Stereo gram, 10 watts each channel, Filter, Magnetic pick-up, etc.	112/-	12	93/2
Shelf mounting Teak cases for all above units available.	—	—	—
State unit	—	—	—

### OTHER TUNERS

Tripletone F.M. Tuner, less power	28/-	12	23/2
Tripletone F.M. Tuner, self-powered	31/6	12	26/1

## STEREO AMPLIFIERS—VARIOUS

Armstrong 222 Integrated, 10W per channel	55/-	12	45/8
Dulci GA505, Integrated	40/6	12	31/1
Bofers Cadet, Mk. 2 with pre-amplifier, 4 ECL86 valves	58/6	12	44/5
Leak Stereo 20 Main amplifier	54/6	12	50/8
Leak Varislope 2 stereo pre-amplifier	50/-	12	41/8
Quad 22 Stereo Control Unit	50/-	12	41/6
For Quad Main Amplifiers see Mono section.			

## JASON F.M. AND TV SOUND TUNER KITS

FMT1, complete with 4 6F91 valves	21/-	7	20/6
FMT2, less power, complete with 4 6F80 valves	—	—	—
FMT2, with power, complete with 4 6F80	20/-	9	20/6
FZ/S	22/6	9	24/9
FMT3, Fringe, complete with valves, less power	22/-	8	27/3
FMT3, with power, complete with all valves	26/-	12	21/6
JTV/2, switched F.M. and TV sound self-powered, all valves	33/6	12	25/8
Mercury II, as JTV/2 but less power, all valves	22/-	8	27/3
Instruction book included in all kits. Available separately.			
2/8 switched 3/8	—	—	—
JTV/2 ready built, state channels	44/6	12	36/11
Monitor, ready built as Mercury II	33/6	12	27/9

## LOUDSPEAKERS

Goodmans Axlette	—	—	—
Goodmans Axion 10	—	—	—
Goodmans 5K/20/XL	—	—	—
Goodmans XO 5000 crossover	—	—	—
Goodmans Axion 20L, 12in. unit	22/5	12	17/11
Goodmans Axion 30L, 12in. unit	20/8	12	25/8
Wharfedale Super S/RS/DD	—	—	—
W.B. HF101B 10in.	—	—	—
FANE 12in. Unit, 30 watt.	—	—	—
Wharfedale W12/EG 12in. 15 watt Lead Guitar speaker	21.0.0.	—	—
Wharfedale W15/EG 15in. 15 watt Bass Guitar speaker	21.0.0.	—	—
Wharfedale Super 10/RS/DD 10in. high quality unit	—	—	—
Wharfedale RS/12/DD 12in. 15 watt Hi-Fi.	23/8	12	17/11
	37/6	9	24/9

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# THE R.S.C. BASS-MAJOR 30 WATT GUITAR AMPLIFIER



**A MULTI-PURPOSE HIGH FIDELITY, HIGH OUTPUT UNIT  
FOR VOCAL AND INSTRUMENTALIST GROUPS**  
*Eminently suitable for bass, lead or rhythm guitar and all other musical instruments*

- ★ Incorporating two 12in. heavy duty 25-watt high flux (17,000 lines) loudspeakers with 2in. diameter speech coils. Designed for efficiently handling full output of amplifier at frequencies down to 25 c.p.s.
- ★ Dual Cone in second speaker reproduces frequencies up to 17,000 c.p.s.
- ★ Heavily made cabinet of convenient size 24 x 21 x 14in. has an exceptionally attractive covering in two contrasting tones of Vynair.
- ★ For 200-250 v. to 50 c.p.s. A.C. mains operation.
- ★ Four jack socket inputs and two independent vol. controls for simultaneous connection of up to four instrument pick-ups or microphones.
- ★ Separate bass and treble controls providing more than adequate "Boost" or "Cut".
- ★ LEVEL frequency response throughout the audible range.
- ★ SUPERIOR TO UNITS AT TWICE THE COST.

**39<sup>1</sup>/<sub>2</sub> Gns.** Send S.A.E. for leaflet.  
OR DEPOSIT of £43.0 and 12 monthly payments of £3.9.11. Carr. 17/6.

**R.S.C. G5 GUITAR AMPLIFIER**  
5-watt high quality output. Incorporating high flux 12in 10 watt 12,000 line loudspeaker. Sensitivity 60 m.v. High impedance jack input. Handsome strongly made cabinet (size 14 x 14 x 7in. approx.) finished in complimentary shades of Rexine/Tygan. 200-250 A.C. mains.  
**29.19.6** Or DEPOSIT 22/3 and 9 monthly payments of £2.3 Carr. 7/6.

**LINEAR TREMOLO/PREAMP. UNIT**  
Designed for introducing the Tremolo effect to any amplifier which is fitted with a reserve power supply point for smoothed H.T. and 6.3 v. A.C. L.T. This applies to practically all amplifiers of our manufacture, and to those of several other manufacturers. The unit plugs into power supply point and any input socket or amplifier. Controls are Speed (frequency of interruptions) Depth (for heavy or light effect). Volume and Switch. Three sockets are for two inputs and Foot Switch.  
**ONLY 4 Gns.**

## R.S.C. SENIOR 15 WATT LEAD or RHYTHM GUITAR AMPLIFIER

High-fidelity push-pull output. Separate bass and treble "cut" and "boost" controls. Two separately controlled inputs so that two instruments or "mike" and pick-ups can be used at the same time. Loudspeaker is a heavy duty high flux 12in. 20 watt model with cast chassis. Cabinet is well made and finished as Junior Model. Size approx. 18 x 18 x 8in.  
**Only 19 Gns.** Carr. 10/-



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## R.S.C. B20 BASS GUITAR AMPLIFIER

A highly efficient unit incorporating a massive 15in. high flux loudspeaker specially constructed to withstand heaviest load conditions. Rating 25 watts. Individual bass and treble controls give ample "boost" and "cut". Two high impedance jack socket inputs are separately controlled. All controls are conveniently positioned in a recess on top of the cabinet. Cabinet is of substantial construction and attractively finished in two contrasting tones of Rexine and Vynair. Size approx. 24 x 21 x 13in. Operation from 200-250 v. 50 c.p.s. A.C. mains.  
**29<sup>1</sup>/<sub>2</sub> Gns.** Or Deposit £32.0 and 12 monthly payments of 51/8. Carr. 17/6.

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**29<sup>1</sup>/<sub>2</sub> Gns.** Or Deposit £32.0 and 12 monthly payments of 51/8. Carr. 17/6.

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200 mA, 3-5 H, 50 ohms 9/6; 80 mA, 20 H, 900 ohms 5/8; 120 mA, 12 H, 100 ohms 8/8; 50 mA, 50 H, 1,000 ohms 6/8; 100 mA, 10 H, 100 ohms 6/8; 60 mA, 5-10 H, 250 ohms 2/11

**COMPLETE POWER PACK KIT, 19/11**  
Consisting of Mains Trans., Metal Rectifier, Double electrolytic, smoothing choke chassis and circuit. For 200-250 v. A.C. mains. Output 250 v., 60 mA, 6.3 v., 2 a.

**R.S.C. POWER PACK, 39/9.** Louvred metal case only 8 x 5 1/2 x 2 1/2in. Stove enamelled. For 200-250 v. A.C. mains. Output at 4 pin plug and socket 250 v. 60 mA, fully smoothed and 6.3 v. 2a. Suitable or power requirements of almost any Pre-amp. or Radio Tuner.

**R.S.C. BABY ALARM or INTER-COMM. KIT.** Complete set of parts with diagrams, etc. Housed in two polished walnut finished cabinets of pleasing design. High sensitivity. For 200-250 v. A.C. mains. Fully isolated. Controllable at both units. An intercomm. of this class would normally cost £20-£30. Only 69/8. carr. 5/- or assembled ready for use 6 gns.



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6/12 v. 4 a. .. 12/3 250 v. 50 mA. .. 3/11  
6/12 v. 5 a. .. 15/3 250 v. 60 mA. .. 4/11  
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**CONTACT COOLED.** 250 v. 75 mA. F.W. (Bridge), 10/11. 250 v. 50 mA. F.W. (Bridge) 8/11. H.W. 250 v. 60 mA. 5/11.

**11-11 10-WATT AMPLIFIERS.**  
Brand New Complete £7.19.6 Carr. 5/6.  
Units. 5/6.  
Manufacturers discontinued Model. Push-pull output. Latest high efficiency valves. Dual, separately controlled inputs for "Mike". Separate Bass and Treble Controls. High sensitivity. Output for 3 or 15 ohm speaker. Guaranteed tested and in perfect working order.

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**FANE HEAVY DUTY HI-FI SPEAKERS**

12in. 15 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies. 122/10 20watt, 5 gns. 122/10A 20watt, 6 gns. 122/12 20watt, 6 gns. 122/12A 20watt, 5 gns. 122/14 22watt, 9 gns. 122/14A 22watt, 10 gns. 122/17 25watt, 11 gns. 122/17A 25watt, 12 gns. 15in. 17 ohms. Cast chassis. Exceptionally robust 2in. diam. Voice Coil Assemblies. 152/12 20watt, 12 gns. 152/12A 20watt, 13 gns. 152/14 27watt, 14 gns. 152/14A 27watt, 15 gns. 152/17 35watt, 16 gns. 152/17A 35watt, 17 gns. "A" indicates dual cone type, 30-17,000 c.p.s. Send S.A.E. for leaflets. Terms available.

**R.S.C. 30-WATT ULTRA LINEAR HIGH FIDELITY AMPLIFIER A10**

A highly sensitive Push-Pull high output unit with self-contained Pre-amp. Tone Control Stages. Certified performance figures compare equally with most expensive amplifiers available. Hum level 70 dB down. Frequency response  $\pm 3$  dB 30-20,000 c/s. A specially designed sectionally wound ultra linear output transformer is used with 807 output valves. All components are chosen for reliability. Six valves are used EF86, EF86, ECC83, 807, 807, GZ34. Separate Bass and Treble Controls are fitted. Minimum input required for full output is only 12 millivolts so that ANY KIND OF MICROPHONE OR PICK-UP IS SUITABLE. The unit is designed for CLUBS, SCHOOLS, THEATRES, DANCE HALLS or OUT-DOOR FUNCTIONS, etc. For use with Electronic ORGAN, GUITAR, STRING BASS, etc. For standard or long-playing records. OUTPUT SOCKET PROVIDES L.T. and H.T. for RADIO FEEDER UNIT. An extra input with associated vol. control is provided so that two separate inputs such as Gram and "Mike" can be mixed. Amplifier operates on 200-250 v. 50 c/s. A.C. Mains and has output for 3 and 15 ohm speakers. Complete Kit of parts with fully illustrated instructions and point-to-point wiring diagrams and full instructions. If required perforated cover with carrying handles can be supplied for 19/9. The amplifiers can be supplied, factory built with EL34 output valves and 12 months' guarantee, for 14 Gns. Send S.A.E. for leaflet.

**11 Gns.** Carr. 10/-  
 Suitable microphones and speakers available at competitive prices.

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**SUPERHET FEEDER UNIT.** Design of a high quality Radio Tuner (specially suitable for use with our Amplifiers. Delayed A.V.C. mains controls and Tuning, W/C.H. and Vol. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size approx. 9 x 6 x 7in. high. Simple alignment procedure. Point-to-Point wiring diagrams, instructions and priced parts list with illustrations. 2/6. Total building cost £5.50. S.A.E. for leaflet.

**R.S.C. BATTERY TO MAINS CONVERSION UNITS**

R.S.C. BATTERY TO MAINS Type BM1. An all-dry battery eliminator. Size 5 1/2 x 4 1/2 x 2in. approx. Completely replaces battery supplying 1.4 v. and 90 v. where A.C. mains are 230 v. 50 c/s is available. Suitable for all battery portable receivers requiring 1.4 and 90 v. This includes low consumption types. Complete kit with diagrams, 39/9, or ready to use, 46/6.



kit of parts with diagrams and instructions, 49/9, or ready for use, 59/6.

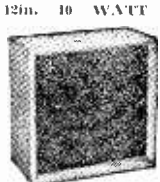
**P.M. SPEAKERS.** 10in. W.B. "Stentorian" 3 or 15 ohms type HF1012 10 watts, hi-fidelity type. Recommended for use with our A11 Amplifier. £4.12.6. 12in. R.A. 3 ohms 10 watts (12,000 lines), 59/9.

**TWEETERS.** R.A. 3 ohm, 25/9; 15 ohm, 25/9

**R.A. Bin. DUAL CONE 3 ohm 8 watt Speakers.** Ideal for Stereo. Only 39/9 ea.

**Jason PM11 V.H.F./F.M. Radio Tuner design.** Total cost of parts including valves-Tuning dial, Escutcheon, etc., £6.19.6.

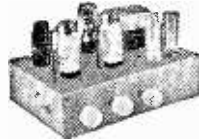
**LINEAR L45 MINIATURE 4.5 WATT QUALITY AMPLIFIER.** Suitable for any record playing unit and most microphones. Negative feed-back 12 dB. Separate Bass and Treble Controls. For mains 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Mullard valves E290, ECC83, EL84. Size only 7 x 5 x 5 1/2in. high. Guaranteed 12 months. Only 6 gns. Send S.A.E. for leaflet. Terms: Deposit 23/9 and 5 monthly payments of 2/9.



12in. 10 WATT HIGH QUALITY LOUDSPEAKER In walnut veneered cabinet. Gauss 12,000 lines. Speech coil 3 ohms or 15 ohms. Only £4.19.6 Carr. 5/- Terms: Deposit 11/3 and 9 monthly payments of 11/3. 12in. 20 WATT HI-FI LOUD-SPEAKERS IN CABINETS. Size 17 x 18 x 10in. Finish as above. Terms: Deposit 17/9 and 9 monthly payments of 17/9. Only £7.19.6. Carr. 8/6. For larger types see preceding page.

**LINEAR LG34 GRAM AMPLIFIER.** High quality. Separate Bass and Treble controls. Handsome appearance. Completely enclosed. Black/Gold Frontplate £5.10.0

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A highly sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high fidelity pick-up heads, in addition to all other types of pick-ups and practically all "mikes" and Treble Controls are provided. These give full long-playing record equalisation. Hum level is negligible being 71 dB down. 15 dB of Negative feedback is used. H.T. of 300 v. 25 mA and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit, or Tape Deck pre-amplifier. For A.C. mains input of 200-250 v. 50 c/s. Output for 2-3 ohm speaker. Chassis is not fitted. Kit is complete in every detail and includes fully punched chassis (with baseplate) with Blue Hammer finish and point-to-point wiring diagrams and instructions. Exceptional value at only £4.15.0, or assembled ready for use 25/- extra. Plus 3/6 carr., or deposit 22/6 and 5 monthly payments of 22/6 for assembled unit.

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**R.S.C. BASS REFLEX CABINETS, JUNIOR MODEL.** Specially designed for W.B. HF1012 Speaker, but suitable for any good quality 10in. speaker. Acoustically lined and ported. Polished walnut veneer finish. Size 18 x 12 x 10in. Handsome appearance. Ensure superb reproduction for only £3.19.6.

**STANDARD MODEL.** As above but for 12in. speakers. Size 20 x 15 x 13in. For vertical or horizontal use, £5.19.6. Set of legs with brass ferrules, 19/6.

**R.S.C. JUNIOR HI-FI REPRODUCER.** The very latest Goodman Axiote 8 High Fidelity loudspeaker (retailing at approx. 5 gns.) fitted in a specially designed Bass Reflex cabinet size 12 x 18 x 10in. Acoustically lined and ported and finished in polished walnut veneer. Matching impedance 15 ohms. Frequency range 40-15,000 c.p.s. Power handling 10 watts nominal. Ideal for Stereo. Carr. 4/6.

**8 Gns.**

**MULTI-METER CABY M1.** Sensitivity 2,000 ohms per volt. A.C. and D.C. 54/- A.10. Basic Meter sensitivity 155 microamps A.C. and D.C. ranges £4.11.6. B.40. Sensitivity up to 10,000 ohms per volt A.C. and D.C. £6.2.6. 50,000 ohms per volt, with overload buzzer, £8.19.6.

**R.S.C. CORNER CONSOLE CABINETS**

Polished walnut veneer finish. Pleasing design. **JUNIOR MODEL.** Size 20 x 11 x 8in. for 8 x 5in. or 10 x 6in. speakers, £2.9.9. **STANDARD MODEL.** Size 27 x 18 x 12in. for 8 or 10in. speakers, £4.11.9. **SENIOR MODEL.** Size 30 x 20 x 15in. for 12in. Speaker. Suitable for speaker systems below. Only 7 gns.



**AUDIOTRINE HI-FI SPEAKER SYSTEMS.** Consisting of matched 12in. 12,000 line, 15 ohm high quality speaker; cross-over unit (consisting of choke, condenser, etc.) and Tweeter. The smooth response and extended frequency range ensure surprisingly realistic reproduction. Standard 10 watt rating £4.19.9. Carr. 5/- Or Senior 15 watt, £6.19.9. Carr. 7/6.

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Size 34 x 15 x 18in. Beautifully finished in polished walnut veneer. Elegant and contemporary design. Robust construction. Uncut, removable baseboard. Depth above baseboard 5 1/2in. Only 12/9 gns. Carr. 13/- Terms: Dep. 29/9, and 9 mthly. pymts. 29/9.

Only 12/9 gns. Carr. 13/- Terms: Dep. 29/9, and 9 mthly. pymts. 29/9.



# AUDIOTRINE HI-FI TAPE RECORDER KIT 25<sup>1</sup>/<sub>2</sub> GNS. Carr. 17/6

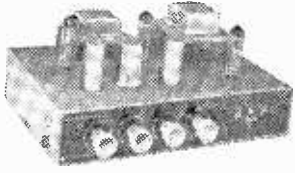
**REALISM AT INCREDIBLY LOW COST, CAN BE ASSEMBLED IN AN HOUR**  
 Incorporating the latest Collaro Studio Tape Transcriber, The Audiotrine High Quality Tape Amplifier with negative feedback equalisation for each of 3 speeds, High Flux P.M. Speaker, empty Tape Spool, a Real of Best Quality Tape and a Handsome Portable Carrying Cabinet tastefully covered in two contrasting shades of Rexine and Vynair, size 14 1/2 x 15 x 8 1/2 in. high and circuit. Total cost if purchased individually approximately £40. Performance equal to units in the £60-£80 class. S.E.A. for leaflets. TERMS. Deposit £2.13.9 and 12 monthly payments of 44/-. Cash price if settled in 3 months.



## HIGH FIDELITY 12-14 WATT AMPLIFIER TYPE A11

**PUSH-PULL ULTRA LINEAR OUTPUT 'BUILT-IN' TONE CONTROL PRE-AMP STAGES**

Two input sockets with associated controls allow mixing of "mike" and gram., as in A10 High sensitivity. Includes 5 valves, ECC83, ECC83, EL84, EL84, EZ81. High Quality sectionally wound output transformer specially designed for Ultra Linear operation and reliable small condensers of current manufacture. **INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut".** Frequency response  $\pm 3$  dB 30-30,000 c/s. Six negative feedback loops. Hum level 1 dB down. **ONLY RADIO FEEDER UNIT.** Size approx. 12 9/16 in. For A.C. mains 200-250 v. 50 c.p.s. Output for 3 and 15 ohm speakers. Kit is complete to last nut. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied. **Only 8 Gns. Carr. 10/-** (Or factory built 51/- extra.)  
 If required louvered metal cover with 2 carrying handles can be supplied for 18/9. TERMS ON ASSEMBLED UNITS. DEPOSIT 24/9 and 9 monthly payments of 24/9. Send S.A.E. for illustrated leaflet detailing Cabinets, Speakers, Microphones, etc., with cash and credit terms.



**LINEAR TAPE PRE-AMPLIFIER.** Type LP/1. Switched Negative feedback equalisation. Positions for Record (lin., 3in., 7in. and Playback, EM84 Recording Level Indicator. Designed primarily as the link between a Collaro Tape Transcriber and a high fidelity amplifier, but suitable for almost any Tape Deck. **Only 9 gns. S.A.E. for leaflet.**

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

A complete set of parts for the construction of a stereo amplifier giving 6 watts high quality output on each channel (total 10 watts). Sensitivity is 50 millivolts. Suitable for all crystal stereo heads. Ganged Bass and Treble Control give equal variation for "Lift" and "cut". 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. **8 Gns. Carr. 10/-**. Full constructional details and price list 2/6. Carr. 10/-.



Kit can be supplied assembled and ready to use for 59/8 extra.

**ONLY 5 POUNDS OF SOLDERED JOINTS PLUS MAINS**

**R.S.C. GRAM. AMPLIFIER KIT.** 3 watts output. Negative feedback. Controls Vol., Tone and Switch. Mains operation 200-250 v. A.C. Fully isolated chassis. Circuit, etc., supplied. **Only 39/9. Carr. 3/9.**  
**HI-FI CRYSTAL PICK-UP HEADS.** (Cartridges) Acos Standard replacement for Garrard B.S.R. and Collaro 19/9. Acos Stereo-Monaural 39/9. Ronette Stereo-Monaural 39/6. B.S.R. Stereo 39/9.  
**BRADMATIC RECORDING HEADS.** High Impedance Record/Playback 22/- Low impedance. In case ... 12/6.  
**MARRIOTT RECORDING HEADS.** High Impedance. Record/Playback 15/- Low impedance. Erase, 10/-.  
**PICK-UP ARMS.** Complete and with latest Acos/hi-fi Turnover Cartridge 29/11.  
**CRYSTAL MICROPHONES.** Hamt type NP110 14/9. R.T.C. 19/9. Acos Mic 40 25/9. Acos Mic 45 29/9. Stick type Acos 39-1 39/9. BM3 with neck band and heavy stand 59/9. Label type 29/9.  
**COLLARO JUNIOR.** 4-speed Single Player Unit and Crystal Pick-up with hi-fi Turnover head. **Only 83.19.6.**  
**B.S.R. UA14 4-sp/d AUTO-CHANGERS** with hi-fi turnover head. 86.19.6. Carr. 4/6.  
**GARRARD AUTO-SLIM 4-SPEED AUTO-CHANGER** with high fidelity pick-up. Latest model. For 200-250 v. A.C. mains. 87.17.6. Carr. 4/6.  
**GARRARD AT6 AUTO-SLIM DELUXE 4-SPEED AUTOCHANGERS.** Turnover GCB head, for 200-250 v. A.C. mains. 81.1.0.  
**GRAM MINIATURE 2-3 WATT GRAM AMPLIFIER.** For use with any single or auto-change unit. Output for 2-3 ohm speaker. For 200-250 v. A.C. mains. Size 1 1/2 x 2 1/2 in. Controls: Vol. and Tone with Switch. **Only 59/8.**

## SENSATIONAL STEREO OFFER

A complete set of parts to construct of a good quality Stereo amplifier with an undistorted output total 8 watts. For A.C. mains input of 200-250 v. Sensitivity 130 m.v. Ganged Volume and Tone Controls. Preset balance control. Full instructions and wiring diagrams supplied. Stereo Pick-up Head 19/9 extra with above only. **4 Gns. Carr. 10/-**

## R.S.C. BATTERY CHARGING EQUIPMENT

Guaranteed 12 months.

All or A.C. Mains 200-250v., 50 c/s.  
**ASSEMBLED 4 amps 6/12 v.** Fitted Ammeter and 2 and 4 v. a r a b l e charge rate selector. Also selector plug for 6 v. or 12 v. **59/9 Carr. 3/4.**  
**ASSEMBLED 2 amps.** Fitted Ammeter and selector plug for 6 v. or 12 v. Louvered metal case finished with hammer blue. Fused, ready for use with mains and output leads. **39/9 Carr. 3/4.**  
 charging. Louvered steel case with stoved grey hammer finish. Fused and ready for use with mains and output 59/9 leads and battery clips. Carr. 4/6.  
 Terms: Deposit 12/- and 5 monthly payments of 12/-.

**BATTERY CHARGING KITS** Consisting of Mains Transformer, F.W. Bridge, Metal Rectifier, well ventilated steel case. Fuses. Fuse-holders. Grommets, panels, Heavy Duty Clip circuit. Carr. 3/8 extra. 6v. or 12v. lamp. ... 25/9  
 As above, with Ammeter. ... 28/9  
 6 v. or 12 v. 2 amps. ... 19/9  
 6 v. or 12 v. 2 amps. ... 25/9  
 6 v. or 12 v. 2 amps. inclusive of Ammeter. ... 35/9  
 6 v. or 12 v. 4 amps. with Ammeter and variable charge rate selector. ... 52/9

## HEAVY DUTY CHARGER KIT

6/12 v. 8 amps., variable output. Consisting of Mains Transformer 0-200-250 v.; F.W. (Bridge) Selenium Rectifier; Ammeter, Variable Charge Rate Selector, Panels, Fuses, Fuses, Fuseholder and circuit. 59/9. Carr. 4/8.

**CHARGER KIT. 12 v. 14 AMP or 24 v. 7 AMP**  
 Consisting of mains trans. 200-250-250 v. F.W. (Bridge) selenium Rectifier, Ammeter, Fuses, Variable Resistor, Heavy Stove enamelled case and Circuit. **Only 89.19.6. Carr. 15/-.** Please state if 12 v. or 24 v. kit required.

**CHARGER AMMETERS** 0-1.5 a., 0-4 a., 0-7 a. 8/9 ea.  
**CHARGER KIT. 12v. 10 Amp.** with variable charge rate adjustment and ammeter. 44.19.6. Carr. 10/-.

## R.S.C. MAINS TRANSFORMERS (FULLY GUARANTEED)

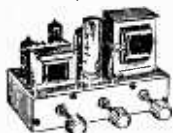
Interleaved and Impregnated. Primaries 200-230-250 v. 50 c/s. Screened  
**TOP SHROUDED DROP THROUGH**  
 250-0-250v. 70mA. 6.3v. 2a. 0-5-6.3v. 2a. 17/9  
 350-0-350v. 60mA. 6.3v. 2a. 0-5-6.3v. 2a. 19/9  
 250-0-250v. 100mA. 6.3v. 2a. 0-5-6.3v. 1a. 21/9  
 250-0-250v. 130mA. 6.3v. 4a. C.T. 6.3v. 19/9  
 250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 27/9  
 300-0-300v. 130mA. 6.3v. 4a. 6.3v. 1a. for Mullard 510 Amplifier. 38/9  
 300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 27/9  
 350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 27/9  
 350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a. 35/9  
**FULLY SHROUDED UPRIGHT**  
 250-0-250v. 60mA. 6.3v. 2a. 0-5-6.3v. 2a. Midget type 2 1/2 x 3 1/2 in. 17/11  
 250-0-250v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 28/9  
 300-0-300v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 28/9  
 300-0-300v. 130mA. 6.3v. 4a. C.T. 6.3v. 1a. for Mullard Amplifier. 35/9  
 350-0-350v. 100mA. 6.3v. 4a. 0-5-6.3v. 3a. 28/9  
 350-0-350v. 150mA. 6.3v. 4a. 0-5-6.3v. 3a. 37/9

**FULLY SHROUDED (continued)**  
 425-0-425v. 200mA. 8.3v. 4a. C.T. 5v. 3a. 57/9  
 425-0-425v. 200mA. 6.3v. 4a. C.T. 6.3v. 4a. C.T. 5v. 3a. 59/9  
 450-0-450v. 250mA. 6.3v. 4a. C.T. 5v. 3a. 69/9  
**OUTPUT TRANSFORMERS**  
 Midget Battery Pentode 66:1 for 384. etc. ... 4/6  
 Small Pentode 5,000  $\Omega$  to 3  $\Omega$  ... 4/6  
 Small Pentode 778,000  $\Omega$  to 8  $\Omega$  ... 4/6  
 Standard Pentode 5,000  $\Omega$  to 3  $\Omega$  ... 5/9  
 Standard Pentode 7,000  $\Omega$  to 3  $\Omega$  ... 5/9  
 10,000  $\Omega$  to 3  $\Omega$  ... 5/9  
 Push-Pull 8 watts. EL84, or 6V6 to 3  $\Omega$  or matched to 15  $\Omega$  ... 9/9  
 Push-Pull 10-12 watts to match 6V6 or EL84 to 3-5-8 to 15  $\Omega$  ... 19/9  
 Following types for 3 and 15  $\Omega$  speakers:  
 Push-Pull 10-12 watts 6V6 or EL84 ... 18/9  
 Push-Pull 15-18 watts. 6L6 KT66 ... 22/9  
 Push-Pull Mullard 510 Ultra Linear ... 29/9  
 Push-Pull 20 watts. sectionally wound. 6L6, KT66, EL31, etc. ... 49/9

**MIDGET MAINS PRIMARIES 240-250 v**  
 50 c/s. 250v. 60mA. 6.3v. 2a. ... 11/9  
 250-0-250v. 60mA. 6.3v. 2a. ... 12/11  
 Both above size 2 1/2 x 2 1/2 in.  
**FILAMENT TRANSFORMERS**  
 All with 200-250v. 50 c/s primaries 6.3v.  
 100mA. 10H. 350 ohms ... 7/9  
 12v. 1a. 7/11; 6.3v. 3a. 8/11; 6.3v. 6a. 17/6  
 12v. 1.5a. twice, 17/8.  
**SMOOTHING CHOKES**  
 150mA. 7-10 H. 250 ohms ... 11/9  
 100mA. 17H. 200 ohms ... 3/9  
 80mA. 10H. 350 ohms ... 5/9  
 80mA. 10H. 400 ohms ... 4/11  
**CHARGER TRANSFORMERS**  
 All with 200-230-250v. 50 c/s Primaries:  
 0-9-15v. 11a. 12/9; 0-9-15v. 2a. 14/8; 0-9-15v. 3a. 16/9; 0-9-15v. 5a. 19/9; 0-9-15v. 6a. 23/9;  
 0-9-15v. 8a. 28/9.  
**AUTO STEP UP/STEP DOWN TRANS.**  
 0-110-120-230-250v. 50-80 ohms. 13/9;  
 250 watts. 39/9; 150 watts. 27/9.  
**MICROPHONE TRANSFORMERS**  
 120:1 high grade. clamped. 8/9.



**3-VALVE AUDIO AMPLIFIER  
MODEL HA34**



Designed for Hi-Fi reproduction of records A.C. Mains operation. Ready built on plated heavy gauge metal chassis, size 7 1/2 in. x 4 in. d. x 4 1/2 in. h. Incorporates ECC83, EL84, EZ80 valves, heavy duty double-output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 4 1/2 watts. Front panel can be detached and leads extended for remote mounting of controls.  
The HA34 has been specially designed for us and our quantity order enables us to offer them complete with knobs, valves, P. & P. etc., wired and tested for only **£4.50** P. & P. 5/-

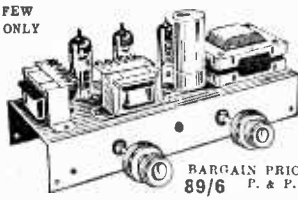
**TAPE DECKS**

**COLLARO STUDIO DECK** £10.10.0 plus 5/6 carr. and ins.  
**B.S.E. MONARDECK** Single speed, 3 1/2 in. per sec., simple control using 5 1/2 in. spools, £6.15.0 plus 5/6 carr. and ins. (Tapes extra only).

**STEREO AMPLIFIERS**

Incorporating 2 ECC82's and 1 EZ80 heavy duty double-wound mains transformer. Output 4 watts per channel. Full tone and volume controls. Absolutely complete.

**FEW ONLY**



**BARGAIN PRICE  
89/6 P. & P. 5/-**

**6 TRANSISTOR AND DIODE SUPERHET**

A first-class 2 waveband transistor superhet  
● Printed circuit panel (size 8 1/2 x 2 1/2 in.). ● 3 pre-aligned I.F. transformers. ● High-grain Ferrite rod aerial. ● All First-trade transistors. ● Car aerial winding. ● Push-pull output. ● All parts supplied with simple instructions.  
All parts sold separately. Set of parts if purchased at one time.

**ONLY £4.50** P. & P. 2/6

**35 OHM SPEAKERS**

Suitable for use with above. 3 in. Goodmans. Ideal replacement for most bookie portables, 8/6 3 1/2 in., 12/6; 5 in., 17/6; 7 x 4 in. 21/-.  
P. & P 1/6 per speaker.

**PORTABLE CABINET**

Size approx. 9 1/2 x 6 1/2 x 3 1/2 in. Suitable for above using 3 1/2 in. speaker, 25/- P. & P. 2/-.

**COIL AND TRANSFORMER SET FOR TRANSISTOR SUPERHET**

3 I.F. transformers, one oscillator coil, one driver transformer and wound Ferrite aerial (med., long and aerial coupling). 3 1/2" complete, post 1/-.  
2 transistor printed circuit board to match, 8/6. Post 9d. Circuit diagram 1/6 extra.

**SPECIAL TRANSISTOR BARGAINS ALL BRAND NEW**

(GET 15 Matched pair 15/-)  
OC71 5/- OC81 8/- OC78 6/-  
PX101 6/6 XA103 6/6 V16/10p 12/6  
Set of Mullard 4 transistors, OC44, 2-OC45, OC81D matched pair OC81, 25/-.  
**EDWARDS MAZDA**  
R.F. 1 Pack: 1-PXA102 Mixer; 2-PXA101 I.F. Amp.; (Equip. OC44 and OC45) 12/6  
R.F. 2 Pack: 2-PXA101 I.F.; PXA102 Osc.; PXA102 Mixer 12/6  
L.P.F. Pack: Consisting of PXB113 Driver, Matched pair FXC171, mounted complete with heat sink (Equip. OC81D and OC81) 12/6  
ALL TRANSISTORS POST FREE

**QUALITY RECORD PLAYER AMPLIFIER**

A top-quality record player amplifier. Size 7 in. w. x 2 1/2 in. d. x 6 1/2 in. h. This amplifier (which is used in a 28 gm. record player) employs ECC83 EL84, EZ80 valves. Bass treble and volume controls. Complete with output transformer matched for 3 ohm speaker. Ready built and tested.

**PRICE 69/6 P. & P. 3/6**

**ALSO AVAILABLE.** Mounted on board with output transformer and 6 in. speaker, ready to fit into cabinet below. **PRICE 89/6 P. & P. 4/6**

**QUALITY PORTABLE RECORD PLAYER CABINET**

Uncut motor board. Will take above amplifier and B.S.R. or GARRARD Autochanger or single Record Player Unit. Size 18 x 14 x 3 1/2 in.

**PRICE £3.6 Carr. 5/-**

**Superior CABINET** To take 8 x 5 in. speaker, with motor board will accommodate BSR UA14 or UA16, £8.9.6. Carr. 5/6. speaker 10/6 extra. P. & P. 1/6 extra.  
**LARGE CABINET** Similar to above with 3 ohm speaker. £8.9.6. Carr. 5/-.

**4-SPEED PLAYER UNIT BARGAINS**

All Brand New in Makers' Original Packing  
**SINGLE PLAYERS**  
B.S.R. TU/12..... £2.10.0 Carr. 3/6.  
B.S.R. GU7 with unit mounted pick-up arm £4.18.8 Carr. 4/-

**AUTO CHANGERS**

B.S.R. TA14..... £5.18.6  
Latest B.S.R. TA10..... £6.15.6  
Garrard 45 Mono..... £10.10.0  
**LATEST GARRARD AUTO-SLIM.** With heavy duty, 4-motor motor. FEW ONLY £7.7.0. (Standard Auto-Slim £8.10.0). Carr. 5/- on each.

**NEW CARTRIDGE BARGAINS!**

B.S.R. TCS8. High output compatible Stereo Cartridge. Brand new. Complete with Stereo/LP/78 sapphire stylus and universal mounting bracket. Original price 44/11. OUR PRICE 22/8. P. & P. 1/-.  
**RONETTE STEREO 105 CARTRIDGE.** Stereo/LP/78. Complete with two saphires. Original list price 67/9. OUR PRICE 24/- P. & P. 1/-.  
**COLLARO HI-FI STEREO TFO CARTRIDGE.** Type "C". Complete with universal bracket and stylus for Stereo, L.P. and 78. Original list price 59/8. OUR PRICE 25/- P. & P. 1/-.

**E.M.T. 4-speed Player and P.U.**

**FURTHER HUGE PURCHASE** enables us to offer these at  
**67/6** P. & P. 4/8

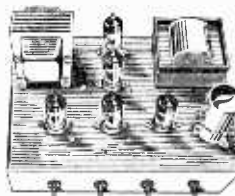
Heavy 8 1/2 in. metal turntable. Low Butter performance 200/2500 r.p.m. shaded motor with tap at 45v. for amplifier valve filament if required. Turnover LP/78 head.

**THE NEW HARVERSON KIT FOR THE HOME CONSTRUCTOR**

A really excellent all purpose A.C. maine 200/240V. **AMPLIFIER KIT TYPE HSL "FOUR" 3 VALVE, 4 WATT USING ECC83, EL84, EZ80 VALVES**  
Special features include:  
● 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. ● All this builds on to a chassis size only 7 in. wide x 4 in. deep. Overall height 4 1/2 in. ● 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 ohm only), screened lead, wire nuts, bolts, solder etc. (No extra bits to buy) P. & P. **79/6** 5/-  
Comprehensive circuit diagram, practical layout and parts list 2/6. (Free with Kit)

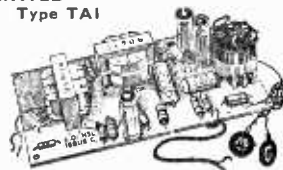
**10 14 WATT HI-FI AMPLIFIER KIT**

A stylishly finished monaural amplifier with an output of 14 watts, from 2 EL84s in push-pull Super reproduction of both music and speech, with negligible hum, separate inputs for mike and gram, allow records and announcements to follow each other Fully shrouded section wound output transformer to match 3-15 ohm speaker and independent volume controls and separate bass and treble controls are provided giving good hit and cut. Valve line-up 2 EL84s, ECC83, EF86 and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts). All parts sold separately. **ONLY £6.19.6** P. & P. 6/6.  
Also available ready built and tested complete with standard input jack sockets. £8.15.0. P. & P. 6/6.

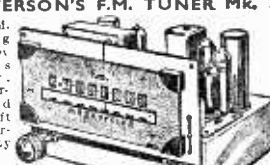


**HIGH GAIN 4-TRANSISTOR PRINTED CIRCUIT AMPLIFIER KIT**

Type TAI  
● Peak output in excess of 14 watts. ● All standard British components. ● Built on printed circuit panel size 6 x 3 in. ● Generous size Driver and Output Transformers. ● Output transformer tapped for 3 ohm and 15 ohm speakers. ● Transistors (OC7113 or ST Mullard OC81D) and matched pair of OC81 (p/p) battery clips, solder, etc. ● Comprehensive, easy to follow instructions and circuit diagram 1/6 (Free with Kit). All parts sold separately.  
**SPECIAL PRICE 45/- P. & P. 2/6**  
Also ready built and tested. £2/8. P. & P. 2/6. A pair of TAI's are ideal for stereo.



**HARVERSON'S F.M. TUNER Mk. 1**  
● P.M. tuning in 1/6 famous maker. ● Guaranteed non-drift. ● Permanently tuning. ● Frequency coverage 88-100 Mc/s. (9A8) balanced diode output. ● Two I.F. stages and discriminator. ● Attractive maroon and gold dial (7 x 3 in. glass). ● Self powered, using a good quality mains transformer and valve rectifier. ● Valves used ECC85, two EF50's, and EL280 (rectifier). ● Fully drilled chassis. ● Size of completed tuner 8 x 6 x 3 1/2 in. ● All parts sold separately. Set of parts if purchased at one time £5.19.6, plus 8/6 P.P. and ins. Circuit diagram and instructions 1/6 post free. Mark II Version as above but complete with made extra front panel and brackets. £6.12.6. P. & P. 4/6.  
Mark III Version as Mark I but with output stage (PC182) and tone control. £7.7.0. P. & P. 6/6.  
Harrison Metal Cabinets. Choice of Grey, Black or Green. To fit Mark I, 25/-, P. & P. 2/6. To fit Mark II, 17/6. P. & P. 2/6.



**SPECIAL PURCHASE! TURRET TUNERS**

By famous maker. Brand new and unused. Complete with PCC84 and PCP90 valves 34-38 Mc/s I.F. Rescues or Channels 1 to 5 and 8 to 9. Circuit diagram supplied. **ONLY 25/-** each. P.P. 2/6  
**BRAND NEW CYLON F.M. TUNER HEAD**  
Permanently tuned. 88-100 Mc/s. Printed circuit. A completely screened unit ready for direct mounting in chassis. 10.7 Mc/s. I.F. O.P. Supplied complete with ECC85 valve and full circuit diagram. Aerial input circuit suitable for either 75 ohm unbalanced or 300 ohm balanced. Size only 3 in. w x 2 1/2 in. d x 1 1/2 in. h (2 1/2 in. high with valve). Limited number only at 27/6. P. & P. 1/6.  
Also available 16.7 Mc/s. I.F. trans. and disc. trans. 11/6 post. P. & P. 1/6.

**GÖRLER F.M. TUNER HEAD**  
88-100 Mc/s. 10.7 Mc/s. I.F. 15/-, plus 1/9 P. & P. (ECC85 valve, 8/6 extra)

**HARVERSON SURPLUS CO. LTD.**  
170 HIGH ST., MERTON, S.W.19 CHerrywood 3985  
Open all day Saturday Early closing Wed. 1 p.m.  
A few minutes from South Wimbledon Tube Station (Please write clearly)  
PLEASE NOTE: P. & P. CHARGED QUOTED APPLY TO U.K. ONLY. P. & P. ON OVERSEAS ORDERS CHARGED EXTRA.  
SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES.

THE TRIPLETONE HI-FI MAJOR

PRICE ONLY \$15.18.9 COMPLETE  
Guaranteed 12 Months



A 12 watt quality amplifier incorporating negative feedback, with a pre-amp for mic. and provision for microgram mixing. Frequency response  $\pm 1$  dB 15-20,000 c/s. Distortion only 0.15%, with noise and hum  $\sim 80$  dB. Separate Bass, Middle and Treble line controls. Valve line-up: 12AX7, 12AN7, 6X4, 6L4 and E81. Push-pull output with matching to 3 or 15  $\Omega$ . Fully isolated power supply from 200/250 v. A.C. input, with take-off for tuner etc. Size 12 x 6 1/2 x 6 in. high.

De Luxe Case: 14in. x 9in. x 7 1/2in., 30/- extra.

New R.C.S. VALVES 90-day Guarantee

Table listing various vacuum tube types and their specifications, including 1R5, 6A6M, 6A7E, 6BA6, 6BE6, 6BE8, 6C6, 6C7G, 6E6G, and 6N7M.

L.F. TRANSFORMERS 7/6 pair  
405 K/sig Tuning Miniature Can, 2 x 1 x 1/4 in.  
High Q and good bandwidth. Data Sheets.

NEW ELECTROLYTICS

Table listing electrolytic capacitor specifications, including tubular and can types with values like 1/350V, 2/350, 4/450V, etc.

TELESCOPIC CHROME AERIALS, 12 to 39in., 1/8  
TRIPLEXERS Bands I, II, III, 12/6. COAX PLUGS, 1/  
LEAD SOCKET, 2/- . PANEL SOCKETS, 1/  
OUTLET BOXES (Surface or flush), 4/- ea.  
BALANCED TWIN FEEDER rd. 6d. 50 or 300 ohms.  
TWIN SCREENED per rd. 1/- . 50 ohms only.  
Wirewound Euf Speaker Control, 10  $\Omega$  3/-, 25  $\Omega$  6/6  
WIRE-WOUND POTS, 3 WATT. Pre-set Min. Type Types. All values to 10 ohms to 25 K., 3/- ea.  
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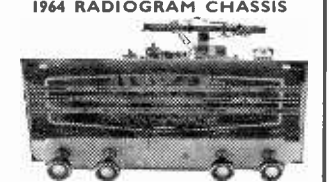
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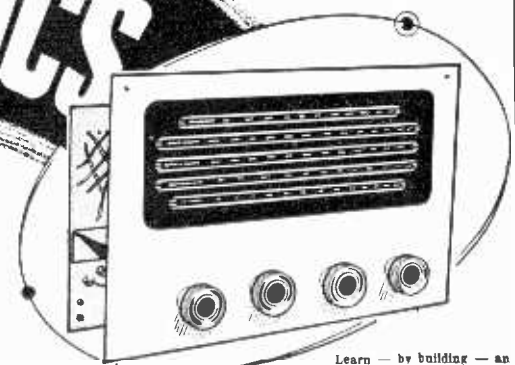
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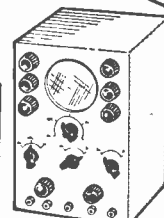
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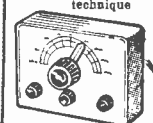
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# British National Radio School

# Practical Wireless

Vol. XL No. 691 SEPTEMBER, 1964

Editorial and Advertisement  
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**PRACTICAL WIRELESS**

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The Editor will be pleased to consider articles of a practical nature. Such articles should be written on one side of the paper only and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed: The Editor, PRACTICAL WIRELESS, George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Owing to the rapid progress in the design of wireless apparatus and to our efforts to keep readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

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## Columns and all that

VARIOUS speculations are rife concerning the possible whereabouts of columnist Thermion. Of these, we can state quite categorically that there is no truth in the rumours that (a) he has emigrated, pursued hotly by seething readers, (b) he is in jail for not paying his wireless licence, and (c) that he has joined Radio Caroline as a disc jockey!

In actual fact, he has now taken up a position on another technical journal which precludes the continuance of his column. He was, of course, the last in a line of "Thermions", the first of whom burst into print in the early 20's.

In thanking him for his regular contributions in the past, we are sure that all readers will want to join us in wishing him every success in his new appointment—even those whose rage he invariably invoked. He, in turn, asks us to pass on his kind regards to all his old fans (and enemies), hoping that by his forthright views he at least provided the raw material for many discussions—if not open combat!

As we say farewell to Thermion, let us welcome a new columnist, whose pseudonym "Henry" covers the identity of a well-known technical author and consultant and who makes his debut in this issue, ably assisted by "Pax"—who has illustrated his work for many years.

Our new contributor will draw on his wide and lifelong experience in the radio business—both as an amateur and a professional—to instruct, amuse and—we hope—provoke. His approach will be different from that emanating from the pen of Thermion, but his apparent lighthearted touch will be found to hide many sly digs and shrewd observations. His basically humorous treatment is underlain with gentle satire. We think you will enjoy his regular commentary.

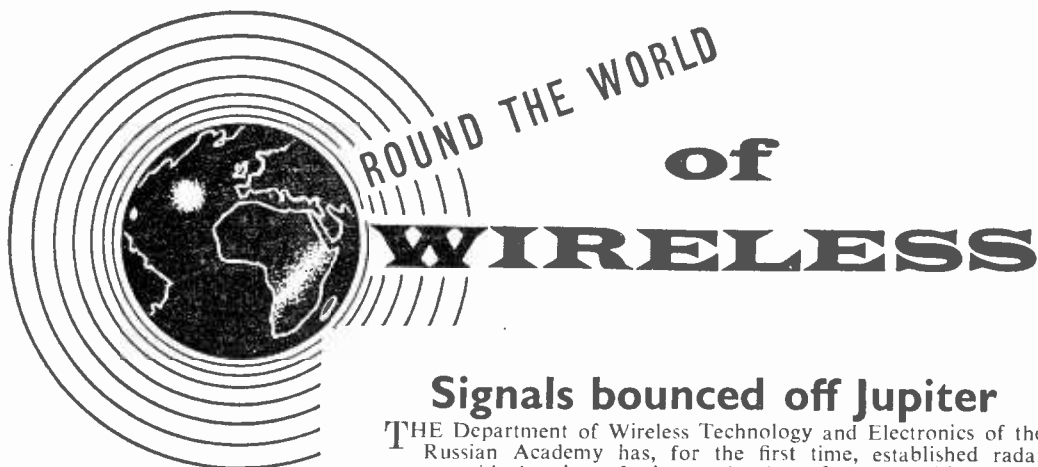
While on the subject of columnists, many readers have written to express appreciation of the John Guttridge feature "On the Short Waves". For although there are various newsletters and magazines available from societies to their members, we are the only magazine on general sale in this country, providing both amateur and broadcast band DX news.

Until comparatively recent years, there was always a selection of magazines catering for the short wave listener. Their untimely demise was largely due to that boggy of modern publishing, an uneconomical circulation—despite a consistent interest in short wave DX.

PRACTICAL WIRELESS has the right sort of circulation and we are thus able, in a small measure, to provide a monthly budget of DX news even though the bulk of the magazine must, of course, consist of practical constructional material.

Whether we are able to increase the editorial allocation for such topics depends on the response from readers. If you are interested in seeing more short wave DX news, please write and let us know. Logically there should be a great demand for such information, judging from the number of short wave sets being built. We hope you are all making the most of them!

Our next issue dated October will be published on September 4th



## NEWS AT HOME AND ABROAD

### G.P.O. INTRODUCE DATEL SERVICE

A TELEGRAPH private circuit service which will transmit data to and from computers at 14 characters per second—twice the existing rate—is to be introduced by the Post Office, stated the Postmaster General, the Rt. Hon. Reginald Bevins, M.P. The cost of this service would be only about one-third more.

Data can already be transmitted over Post Office telex and private telegraph circuits at about seven characters a second. All these services are being grouped and will be known as Dattel 100 Service.

Next year facilities for data transmission over telephone circuits up to 150 characters per second will be supplemented by the provision of a new Data Set No. 1A for the modulation of signals. This service will then be known as Dattel 600 Service.

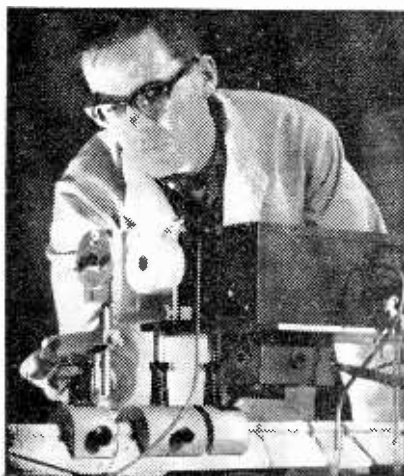
Other Dattel services planned for the future are Dattel 200 and Dattel 300 which, respectively, will provide facilities for two-way data transmission at up to 25 characters per second and one-way data collection at up to 20 characters per second.

### Signals bounced off Jupiter

THE Department of Wireless Technology and Electronics of the Russian Academy has, for the first time, established radar contact with the planet Jupiter at the time of the opposition of the planet in September/October 1963. The Director of the Department, W. A. Kotelnikow, reported that wireless echoes have been successfully received upon their return to Earth from Jupiter. A distance of over 400 million miles was spanned in this experiment.

A mere 13W of r.f. power reached the entire surface of the mammoth planet, of which some 1,300 milliwatts were reflected and a minute portion thereof finally reached the Earth again. The time elapse between transmission and reception of the echo was one hour and six minutes.

Frequency analysis of the radar pulse broadening in the received echo compared to the sharp pulse originally transmitted confirmed the extremely rapid rotation of Jupiter (one day on Jupiter has a length of only ten hours) and was used as one characteristic to identify the returning echo.



Highest power levels yet reported for a high repetition rate laser have been achieved with this combination of Raytheon LHB laser (black box at right) and Baird-Atomic electro-optic light modulator (white circular device in centre). August Graf, engineer at Raytheon Company's Laser Advanced Development Center in Waltham, Mass., aligns elements along an optical bench in tests that produced 100 million watts of peak power in flashes at one second intervals, combination of devices is more than 100 times more powerful than any reported previously.

### Semiconductors Research—New grant

A THREE-YEAR research project to seek experimental confirmation of recent theory on electrical conduction in certain materials on the borderline between insulators and semiconductors, is to be carried out by the Electrical Research Association with the support of a DSIR grant of up to £17,400.

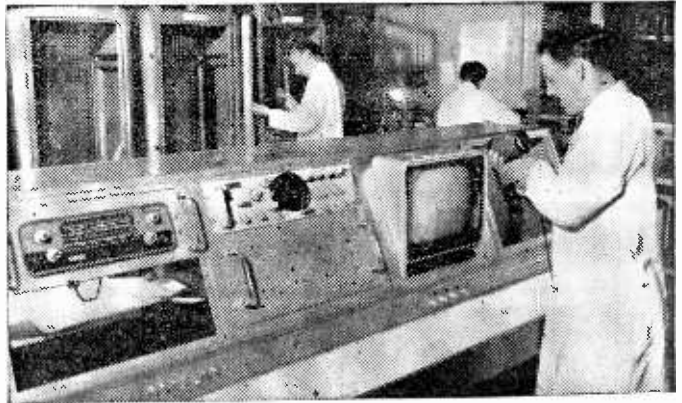
The work proposed in the present project will start from the basis of theoretical work done at Liverpool University which has yet to be confirmed experimentally.



## RADIO SHOW CONTROL ROOM

**B**ELLING AND LEE LTD. have been appointed as main contractors for all the Television and Radio signal services required at this year's Radio Show. The project entails the complete design, supply, and installation of all the control room equipment.

Belling-Lee will supply and install the receiving aerials, and be responsible for the distribution of these signals to some 400 outlets, and the equipment will enable a signal to be received off the air and overland; from both BBC and ITA on 405 and 625 lines. In addition, two telecine units will be in operation, feeding 405 and 625 line signals (derived



from films or slides) into the system.

The outgoing signal to the receiver at the exhibition will comprise of one 405 line, and

one 625 line transmission, selected from the available incoming feeds. In addition, an f.m. signal will also be distributed to the stands.

## Mullard Develop Image Intensifier

**M**ULLARD Research Laboratories, in conjunction with the Atomic Energy Research Establishment, have developed a high-sensitivity image intensifier tube for use in experiments involving sub-atomic particles.

In many experiments involving sub-atomic particles it is necessary to photograph one event of special interest among a million or so others. For example, it may be necessary to record the light track of a single particle involved in a collision process, or to determine the energy of the particle by means of the Cerenkov radiation it causes.

In the example quoted, the small amount of light produced would barely affect one grain of the emulsion on a photographic plate. Therefore, if useful photographs are to be obtained, the light must be intensified without its pattern being distorted. This can be done by means of image intensifier tubes incorporating photo-emitters which have a much higher quantum efficiency than photographic emulsions.

The Mullard two-stage image intensifier being supplied to the A.E.R.E. is such a device. It intensifies the light from a single particle into an image that provides a suitable input for a high-gain image amplifier.

## Silver Jubilee of RAFARS

**S**ILVER jubilee celebrations of the R.A.F. Amateur Radio Society—postponed from last year—were held during July 4-5. A dinner at the Grand Atlantic Hotel, Weston-Super-Mare was attended by members of the society, representatives of affiliated organisations and other amateur radio enthusiasts.

On July 5 the society's headquarters at No. 1 Radio School, R.A.F., Locking, near Weston-Super-Mare, and the school training laboratories were open to the public. In the afternoon, a rally was held in conjunction with the Weston-Super-Mare Amateur Radio Mobile Group.

## New I.E.E. Publication

**T**HE I.E.E. announces that the first issue of a new monthly publication "Current Papers" will appear in August 1964. Each issue will list about 700 titles (with authors and references) covering electrical and electronic engineering selected from several hundred British and foreign periodicals.

Voucher copies of the first issue are available from the Secretary, The Institution of Electrical Engineers, Savoy Place, London, W.C.2.

## R/T SYSTEM FOR B.R.

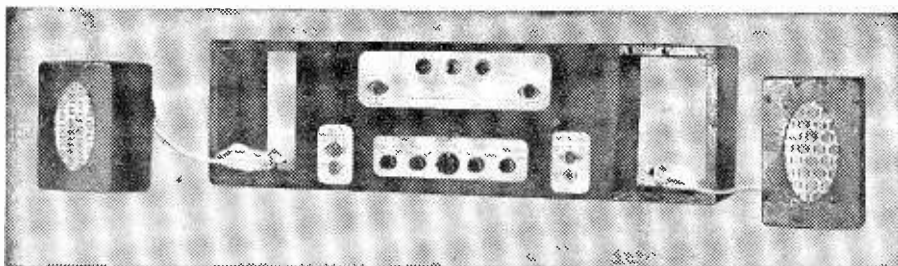
**A** MARCONI microwave radio relay system, providing initially a maximum of 159 telephone channels between York, Darlington and Newcastle, will come into service with British Railways on May 31st. This expansion of telephone communications forms part of the main London to Glasgow railway communication link.

During the initial planning stage, British Railways found that a considerable financial saving could be made by operating a private tele-communications link, using microwave radio.

The overall length of the link from York to Newcastle, is 75 miles. Between York and Darlington, where the radio terminal is sited in the railway station, there is a repeater station at Woolmoor, and again, between Darlington and Newcastle, there is a repeater at Ferryhill.

The radio equipment, Type MH140B, is manufactured by Marconi Italiana, the Italian subsidiary of The Marconi Company. It operates in the super high frequency band at 7500Mc/s and frequency modulation is employed. The capacity of the system is 300 channels, although only 159 will be available during the initial period of operation.

# THE "MULTIPHONIC"



## A 13-STAGE STEREO AMPLIFIER

BY MARTIN L. MICHAELIS

**T**HIS unit is designed to provide a complete and economical 2.5W per channel stereo system with good tone quality. It also incorporates some unusual features.

In addition to the two identical channel amplifiers a 3V input/output matrix is incorporated. One valve of this matrix splits an ordinary monaural input, fed in at the coaxial socket provided, into two equal signals for simultaneous drive of the two stereo channels. Tone and volume may thereby be set equal or controlled individually on the two channels, enabling a maximum of "room-dimension" effect to be realised even on a monaural signal.

The total power of the two channels together used in this fashion is 5W, yet the maximum realisable undistorted "apparent" volume is greater than that normally associated with a 5W conventional amplifier. This is because the physical intensity of sound produced by the same electrical power is always greater when coming from two speakers separated in space than when coming from a single speaker at one point in space.

Moreover, the use of two speakers in this fashion, especially when fed from separate amplifiers as here, combats the sensation of sound coming out of a speaker speech cone, projecting it instead into the room bodily.

Another valve of the matrix combines signals from the two main amplifier channels—whether these are running on stereo or monaural—and gives a monaural output for monitor headphones or for a third additional amplifier for a central bass speaker, proving useful in large base-line stereo reproduction. There is also a stereo output suitable for feeding stereophonic headphones.

A fundamental feature of this input/output matrix arrangement is its "simultaneousness", freedom from cross-talk between channels and freedom from switching. Thus all functions can be operated simultaneously. There are two main input sockets, one for two-channel stereo signals and one for ordinary monaural signals.

If signals of both kinds are simultaneously fed in at the respective sockets the stereo signal will be heard with full stereo effect, and the monaural signal will in addition appear on both channels in such a way that it seems to be located fixed in the middle of the stereo field without otherwise disturbing it.

At the same time monaural and stereo versions of the complete signals may be taken from the respective output sockets for any purpose, simultaneously if required.

### Controls

Conventional stereo amplifiers often have ganged controls for volume and tone and a single balance control. A rather different arrangement has been adopted here to achieve maximum useful control of room-dimension effects on monaural signals and a maximum of independent control of signal levels at the speakers and the output sockets without unduly increasing the number of controls.

A ganged main volume control is retained but each channel has, in addition, another volume control situated later in the amplifier chain beyond the point of extraction of signals for the output matrix. These individual volume controls are thus operative only for the main speakers, and enable the speaker volume to be reduced to zero when listening on headphones or searching for a programme (e.g. searching for the start of a

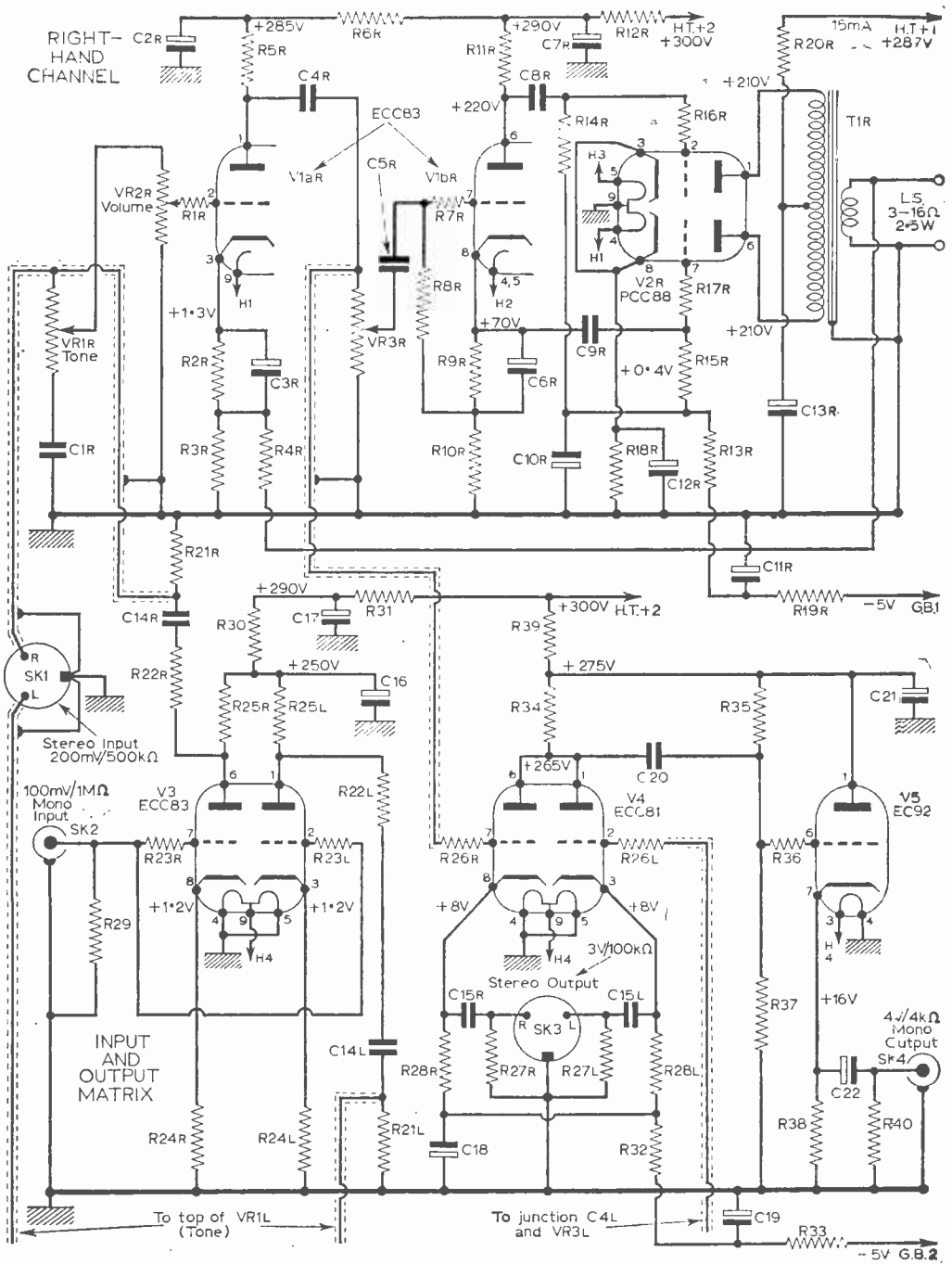


Fig. 1: The circuit of the right-hand channel and the input/output matrix. The left-hand channel (not shown) is identical to the right.

required item on a stereo record or tape, using headphones, turning up the volume on the speakers for the general audience only when found). Suitable relative settings of ganged main volume control (controlling everything) and individual volume controls also enable any desired relative volume on headphones and speakers to be obtained simultaneously.

The remaining two controls consist of individual tone controls for each channel in the popular treble-integrator arrangement. These tone controls are operative on everything passing through the amplifier, for all inputs and outputs. Normally equal settings are required on both channels but individual adjustment may be beneficial in correcting poor stereo recordings—e.g. ones made with a stereo microphone in a room with asymmetric acoustics. Individual adjustment of the tone controls may also be beneficial on monaural

signals consisting of certain kinds of music when a measure of pseudo-stereo is required to give better differentiation of various instruments.

#### Main Amplifier Channels—Circuit Principles

Each main amplifier channel uses two double-triodes. The first stage of each amplifier is a conventional voltage preamplifier using half of an ECC83. The other half of each ECC83 is used as a conventional split-load phase-splitter for obtaining push-pull drive for the output stages.

The only new feature is the incorporation of the individual volume controls between the preamplifier output and phase-splitter input grid. The latter is driven from the slider of the individual volume control, whereas the entire output of the preamplifier is taken to the output matrix, so that the individual volume control is therefore not operative.

### COMPONENTS LIST

#### Resistors:

R1	10k $\Omega$	R23	10k $\Omega$
R2	2.2k $\Omega$	R24	2.2k $\Omega$
R3	100 $\Omega$	R25	220k $\Omega$
R4	6.8k $\Omega$	R26	10k $\Omega$
R5	220k $\Omega$	R27	1M $\Omega$ , 1W
R6	10k $\Omega$	R28	27k $\Omega$ , 1W
R7	10k $\Omega$	R29	1M $\Omega$
R8	1M $\Omega$	R30	33k $\Omega$ , 1W
R9	1k $\Omega$	R31	10k $\Omega$
R10	47k $\Omega$ , 1W	R32	1k $\Omega$
R11	47k $\Omega$ , 1W	R33	1k $\Omega$
R12	4.7k $\Omega$ , 1W	R34	10k $\Omega$ , 1W
R13	10k $\Omega$	R35	22M $\Omega$ , 1W
R14	680k $\Omega$	R36	10k $\Omega$
R15	680k $\Omega$	R37	1M $\Omega$
R16	10k $\Omega$	R38	10k $\Omega$ , 1W
R17	10k $\Omega$	R39	10k $\Omega$ , 1W
R18	27 $\Omega$ , 1W	R40	1M $\Omega$
R19	10k $\Omega$	R41	6.8 $\Omega$ , 1W
R20	5k $\Omega$ , 5W	R42	6.8 $\Omega$ , 1W
R21	22M $\Omega$	R43	6.8 $\Omega$ , 1W
R22	4.7M $\Omega$ , 1W	R44	6.8 $\Omega$ , 1W

All  $\pm 10\%$ ,  $\frac{1}{2}$ W Carbon, unless otherwise stated.

#### Potentiometers:

VR1	500k $\Omega$ lin.	VR3	500k $\Omega$ lin.
VR3	500k + 500k $\Omega$ log. dual ganged		

#### Valves:

V1	ECC83	V3	ECC83	V5	EC92
V2	PCC88	V4	ECC81		

#### Rectifiers and Diodes:

MRI, 2	E250C50 selenium
DI, 2	S36 silicon (Brush Crystal Co., Southampton)

#### Transformers:

- T1 Push-pull output transformer for 10k $\Omega$  anode-to-anode secondary to match speakers used
- T2 Mains transformer. Secondaries 0-240V, 75mA; 6.3V, 1.5A tapped at 4V; 6.3V, 1.5A tapped at 4V. (A Douglas MT1 is suitable, with h.t. centre-tap earthed. Operate MRI/MR2. one off each 250V end of the winding. LT1 of MT1=6, 7, 8 (Fig. 2); LT2 of MT1=3, 4, 5 (Fig. 2). Run only pilot lamp off H2 as shown. Move VIL, R heaters to H4-chassis.)

#### Capacitors:

C1	500pF paper 500V
C2	8 $\mu$ F electrolytic 350V
C3	50 $\mu$ F electrolytic 25V
C4	0.05 $\mu$ F paper 500V
C5	0.05 $\mu$ F paper 500V
C6	50 $\mu$ F electrolytic 25V
C7	8 $\mu$ F electrolytic 350V
C8	0.05 $\mu$ F paper 500V
C9	0.05 $\mu$ F paper 500V
C10	100 $\mu$ F electrolytic 15V
C11	100 $\mu$ F electrolytic 15V
C12	25 $\mu$ F electrolytic 25V
C13	8 $\mu$ F electrolytic 350V
C14	0.025 $\mu$ F paper 500V
C15	0.05 $\mu$ F paper 500V
C16	8 $\mu$ F electrolytic 350V
C17	8 $\mu$ F electrolytic 350V
C18	100 $\mu$ F electrolytic 15V
C19	50 $\mu$ F electrolytic 15V
C20	0.025 $\mu$ F paper 500V
C21	8 $\mu$ F electrolytic 350V
C22	50 $\mu$ F electrolytic 25V
C23	16 $\mu$ F electrolytic 350V
C24	16 $\mu$ F electrolytic 350V
C25	32 $\mu$ F electrolytic 350V
C26	50 $\mu$ F electrolytic 25V
C27	100 $\mu$ F electrolytic 15V

#### Sockets:

SK1,3	Stereo panel sockets
SK2,4	Coaxial panel sockets
SK5,6	Mains outlet 3-pin panel sockets

#### Miscellaneous:

- L1 15H 30mA smoothing choke
- S1 S.P.S.T. mains on/off switch
- F1 1A mains fuse
- LPI 8V 0.15A pilot lamp
- Two elliptical loudspeakers. 6 noval and one B7G valveholders, preferably ceramic with screening cans. Chassis 16in. x 6in. x 2in. 5 control knobs. One pilot lampholder. One fuse holder. Screened and mains cable. Wander plugs and sockets and flex for speakers. Quantity of wood for cabinets. Tagstrip, solder tags, wire, etc.

The really unusual point about this design is the PCC88 push-pull output triode in each amplifier. Few readers are likely to have been previously aware of the possibilities available for the use of this valve as audio power output stage as it is normally found only in television tuners. Most valve data lists specify the valve for no other purpose but some official manufacturers' notes do point out possible uses as power amplifier.

The achievable power output in the type of arrangement described is comparable to that of small conventional power pentodes such as the ECL82 in single-ended Class A, yet operating in push-pull here the distortion is very considerably less.

pentode is generally much smaller than the internal anode impedance of the valve at the operating point, so that a pentode gives no useful damping of any speaker resonances, etc. However, the internal impedance of a triode is generally less than the optimum anode load (internal anode resistance about 3kΩ, optimum load 10kΩ, in the present case), so that good damping of spurious resonances is obtained.

Furthermore, even moderate mismatch into the anode circuit of a power pentode rapidly leads to marked increase of distortion except at very low power, whereas with a triode this effect is much less, especially in a push-pull arrangement as here used.

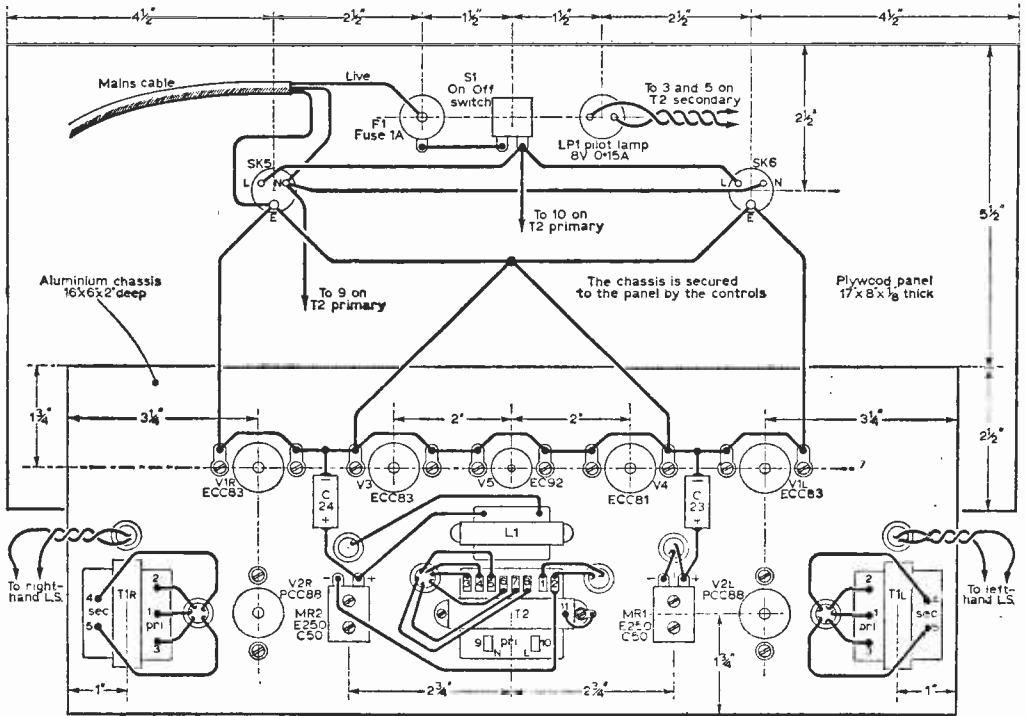


Fig. 2: The above-chassis layout and wiring between major components.

Moreover, the power efficiency is very good, being about 65% at full volume in the present design. The standing total anode current is, furthermore, for both channels together, here less than that of the equivalent pentode for a single channel. The h.t. voltage for this stage is also less than that normally required for a pentode output stage.

All these facts lead to simplifications in the power supply as quite small, low-capacity items can be used, and they lead to the production of less heat, a great advantage when housing two amplifiers in one cabinet. There are still further advantages. The optimum anode load for a

Thus, apart from the novelty of using a PCC88 television tuner valve as push-pull audio output stage, there are clearly many reasons of a much more practical nature favouring the adoption of such an arrangement for *low-power* amplifiers.

**Critical Ratings**

The only serious problem with such an output stage is that the PCC88 is being driven close to the maximum permissible limits of anode dissipation and anode voltage. It is *most important* indeed that the no-signal h.t. voltage measured between each anode and chassis does not exceed

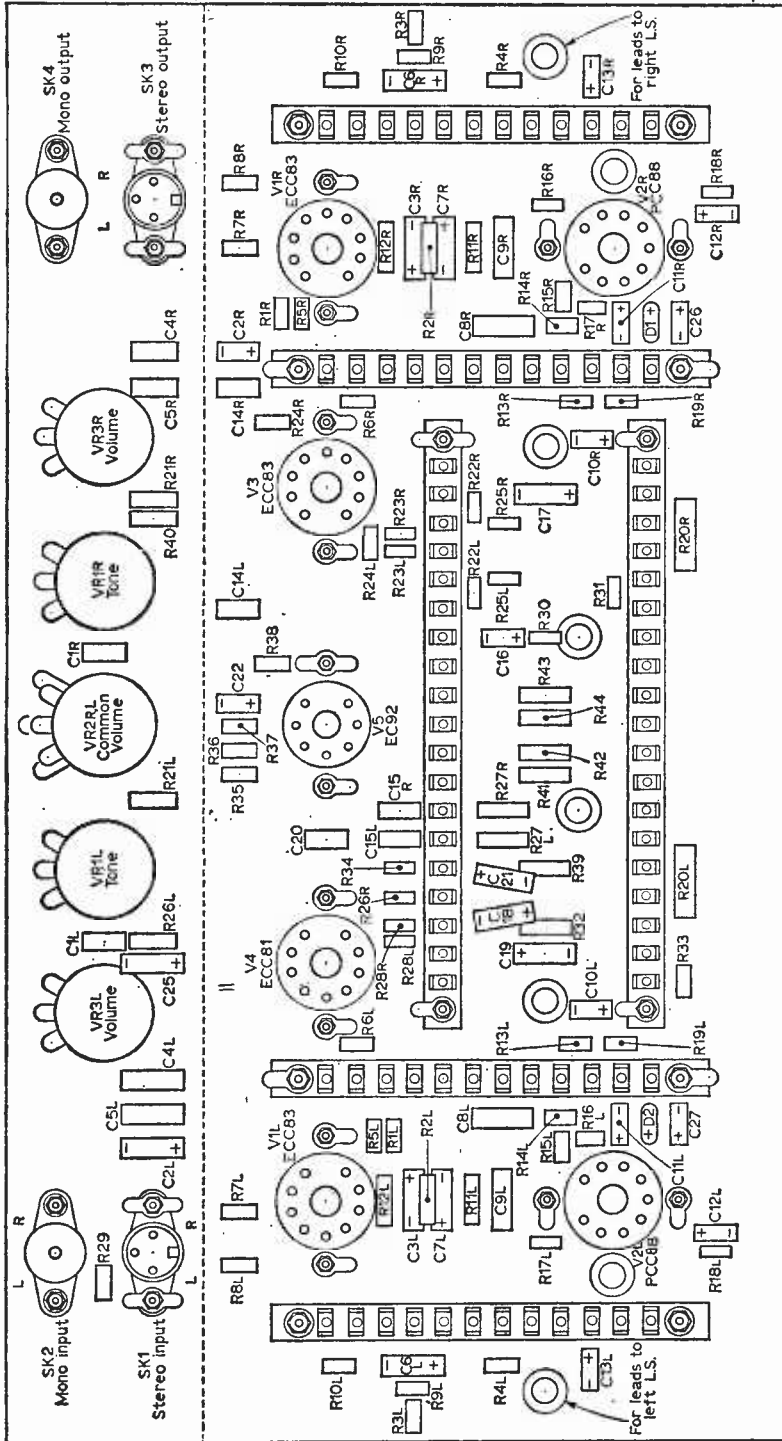


Fig. 3. An underchassis view showing the layout of components.

the specified value of 210V. Use a meter of at least 4,000 ohms per volt when testing to avoid falsification. If the slightest excess is used early failure of the PCC88 is possible.

The voltage should definitely lie between 200 and 210V and if outside this range, e.g. when using modified power supply arrangements in using alternative components to those specified, it must be corrected by appropriate adjustment of the value of R20 in each amplifier, using series or parallel resistors if necessary. If large corrections are required the possibilities of shunting C13 with a suitable resistor can also be exploited.

Whilst it is in principle possible to use almost any form of h.t. rectifier and smoothing arrangement with available components, the specified input voltage at the top end of R20 *must* be approximately maintained. Thus under no circumstances use an h.t. supply of 210V and omit R20—this would lead to overshoot of peak anode ratings of the PCC88 on sustained loud signal passages.

The manufacturer's specification, which prompted experimental work leading to the present article, stipulated that the cathodes of the PCC88 should be earthed direct to chassis and a fixed negative grid bias of about 6V should be used, giving a total h.t. current of 10mA for both anodes together at 200V h.t. The specified output power is then 1.5W for 4% distortion.

The author developed the present modification, using slightly reduced fixed bias and consequently greater standing current. The small cathode

is sufficient, the more conservative rating at higher grid bias may be returned to.

An elegant and modern method of achieving this would be to remove the existing grid bias arrangement, returning both grid leaks R14 and R15 to chassis. The combination C12, R18 is also removed, being replaced by a 6V Zener diode. If adopting these measures make sure that a matched pair of such Zener diodes are obtained for the two channels and that the Zener voltage really does lie between 5.8 and 6.0V.

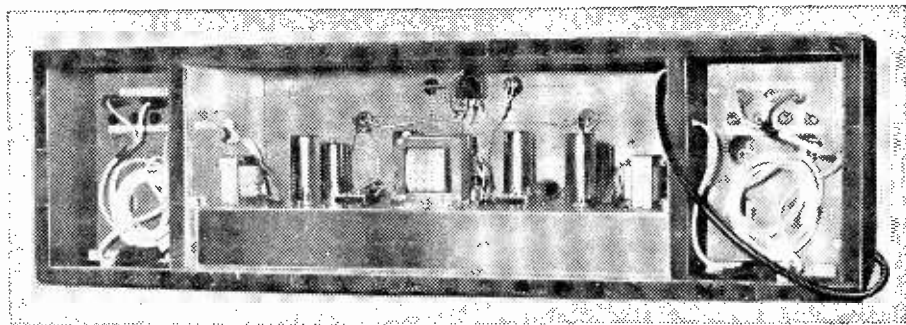
The Zener diode is to be connected with anode to chassis and cathode to the commoned cathodes of the PCC88. A bypass capacitor is not generally necessary.

#### Negative Feedback

The combination R3/R4 provides overall negative feedback for each amplifier. The values shown give relatively mild action, keeping the amplifier gain high enough for operation off low-input pick-ups. If the pick-up or other signal source used has ample output (VR2 and VR3 seldom operated anywhere near full gain) it may be of advantage to reduce the value of R4, possibly as far as down to about  $1k\Omega$ .

This increases negative feedback, reduces gain and reduces distortion. If R4 is made too small a high-pitched whistle may commence (this may be supersonic and only visible on an oscilloscope) due to phase-shift oscillation of the amplifier.

This condition should be checked and R4 made at least twice as large as that value for which such



A rear view inside the finished amplifier, with the two speaker units in place.

combination R18, C12 was added for safety to give a measure of stabilisation through additional automatic bias as the valve is being run very close to the tolerance limits.

As well as paying attention to the above-described question of correct anode voltage the total h.t. current should also be checked. It must not exceed 15mA at no-signal. Discrepancies are corrected by adjusting the value of R18; a higher value reduces anode current.

The circuit as shown provides a measured output power of 2.5W at about 1% distortion measured for a 1kc/s continuous signal and a  $10\Omega$  carbon resistor as load in place of a speaker. If large and efficient speakers are used, where 1.5W

oscillation commences. If, upon drastically reducing R4 or short-circuiting it, an oscillation at medium frequency, or motor-boating, starts, the phasing is incorrect. The secondary winding of T1 should be reversed.

When making such alterations—and in general throughout the entire amplifier—observe closest possible equality and symmetry for the two amplifiers to maintain equality of response and phasing for the two channels. In particular use a pair of identical speakers and observe identical polarities of the speech-coils.

**TO BE CONCLUDED IN THE OCTOBER  
ISSUE**

# COMMUNICATIONS RECEIVER DESIGN CONSIDERATIONS

By R. N. Clasper

**A** GREAT design problem in communications receivers is that of producing a receiver with a large frequency coverage, consistent with low r.f. losses. With modern coil design, the greatest losses now occur in switching circuits.

The use of turret tuning greatly reduces these losses, and thus enables a much wider range of frequencies to be covered. Turret tuners capable of switching two sets of tuned circuits are readily available as television components. However, an amateur communications receiver worthy of the

If the tuners available have too short spindle extensions at the rear to enable couplings to be attached, the following method is effective.

A hole about  $\frac{3}{8}$  in. diameter is cut in the back-plate of the tuner chassis, with the coil drum bearing as centre. Thus the rear bearing of the first tuner is removed completely. Again, a  $\frac{1}{4}$  in. I.D. bush is attached to the drum spindle. The second tuner shaft is coupled to this as before. When both tuner chassis are mounted rigidly to the communications receiver chassis, and the coupling between

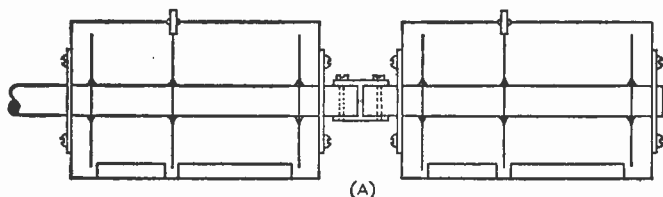


Fig. 1 (a and b): Two arrangements for combining turret tuners to provide extra switching-in of tuned circuits.

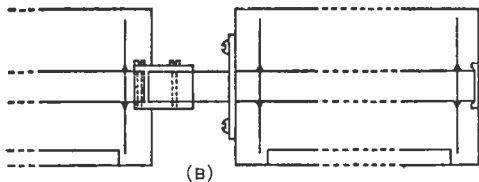
name will require at least three tuned circuits— aerial r.f., and oscillator tuning—to provide good second channel rejection and improve signal/noise ratio.

Fortunately, it is a relatively easy matter to combine two television turret tuners, to provide switching for up to four tuned circuits. The type of tuner needed is that which carries sets of coils on "biscuits", on a revolving drum. Such tuners, which are generally fitted with two B9A valve-holders, have a chassis 3 or  $3\frac{1}{2}$  in. deep. They should not be confused with the permeability tuned units, which have a chassis only  $1\frac{1}{2}$  or 2 in. deep; as these are useless for this purpose.

## Tuner Modifications

On many turret tuners, the shaft carrying the coil drum extends a small way behind the tuner chassis. A  $\frac{1}{4}$  in. coupling should be attached to this shaft, by drilling both shaft and coupling, and inserting a taper pin, or a bolt, after tapping both fittings. It is unlikely that a coupling bush attached by grub screws would be strong enough for the purpose.

The second turret is connected directly to the bush by the same method. Care must be taken to allow sufficient space between the turrets to provide access for a trimming tool during the alignment of the r.f. stages.



the two shafts is secure, the removal of one bearing does not affect the operation of the drum and coil contacts.

## The Coils

Of the many coil designs available, it was considered that the "Weyrad" range was the most suitable, because of their physical size. They are mounted in the coil carrying "biscuits", already present on the drum, as follows:

The original TV coil, complete with former, is removed from the biscuit, and the connections unsoldered. The coil is generally held by two spring clips, which should be retained.

Modifications must now be carried out to the new coil, to fit it in the space available. The coil connection ring must be removed, taking care to be able to identify the wires remaining at a later time. A method suggested is to colour code the



wires, retaining the code used by the manufacturers for the solder tags. During this part of the work, take great care not to damage the wires, or unwind the coils even a small part of a turn.

The four leads from the new coil are attached to four of the contacts on the tuner biscuit, in a predetermined order, which must be maintained for each set of coils. When the oscillator coils are fitted, the padders (if any) should be connected between the coil and contacts. The coils should be orientated so that the trimming core is accessible through the holes provided in the drum.

It will fit reasonably well into the mounting brackets on the biscuit, in the position occupied by the previous coil. One of the original spring clips may be used to hold the coil in place. Wax

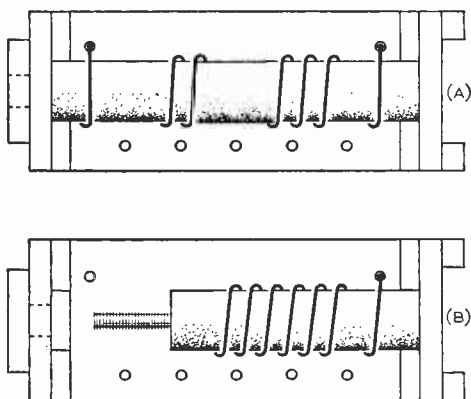


Fig. 2: Coil modifications; (a) before and (b) after.

poured over the mountings will finally secure it.

The completed coil selection assembly is mounted beneath the chassis of the communications receiver. Clearance holes are cut in the chassis for the B9A valveholders on the tuner assembly, which may be used for the r.f. and f.c. valves. The entire r.f. and f.c. circuitry can now be housed in the tuner chassis.

**Variable Tuning**

The use of a large value of variable capacitor in parallel with a low trimmer enables fine tuning to be carried out accurately, but this method is rather cumbersome in practice; the following method provides accurate, reliable tuning, without the difficulties, such as the inability to return quickly and accurately to a required frequency, inherent in the use of trimmers.

The frequency band is sub-divided into fixed bands, and only a small variable capacitor is needed for variable tuning. A rotary switch back-plate is attached to the 300pF, linear sweep, main tuning capacitor. This enables the main tuning capacitor to be locked in seven positions, at 50pF intervals, from 0pF to 300pF. Variable tuning was by means of a 50pF variable capacitor, in parallel with this, fitted with a good slow-motion drive and

calibrated scale. This system enabled tuning to be carried out rapidly and accurately.

**Further Uses of the Tuning Head**

Because of the reduced stray capacitance losses in the turret tuner, operation at much higher frequencies is possible. A proprietary make of tuning coils covers the range 30 to 200Mc/s in two ranges, using a 50pF tuning capacitor. A 5Mc/s i.f. frequency is used. These coils can also be fitted to the tuner assembly, as previously described. No modifications to the circuitry are required in the

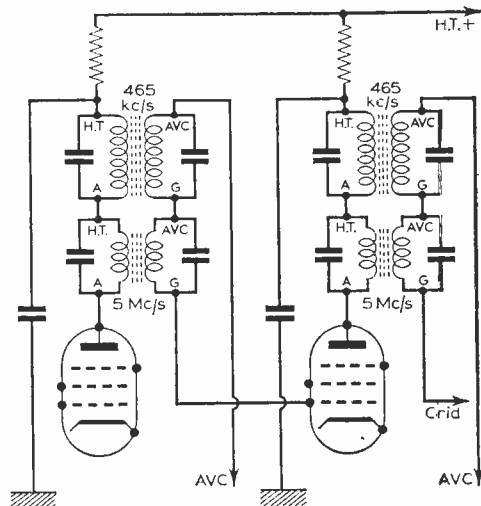


Fig. 3: Modifying the i.f. system by the inclusion of 5Mc/s i.f.t.'s.

r.f. and oscillator stages, provided these are well designed. The main tuning capacitor is left switched to zero capacitance, and tuning is carried out by the 0 to 50pF variable capacitor.

The tuner now gives an i.f. frequency of either 465kc/s or 5Mc/s, depending on the coils in use. The i.f. stages can easily be modified to cater for this.

The only modification necessary to the original 465kc/s i.f. stages is the inclusion of 5Mc/s i.f.t.'s in series with the original ones. To keep losses to a minimum, they should be connected as shown in Fig. 3.

At 465kc/s the additional inductance provided by the 5Mc/s i.f.t.'s will not affect the i.f. resonant frequency by an appreciable amount. I.F.T. core adjustment will compensate for this. At 5Mc/s, the parallel capacitor present in the 465kc/s i.f.t. will effectively short-circuit this component.

In practice, the efficiency of the i.f. stages will be rather lower at 5Mc/s. This is surely a small price to pay for such a wide frequency coverage.

Thus, by the use of turret tuning, and the capacitor arrangement described, it is possible to obtain better performance over the normally used ranges, and also, reasonable performance up to 200Mc/s. ■

# simple Noise generator

BY CHRISTOPHER P. GUY

**M**ANY home constructors often find the need for some sort of noise generator when building or repairing their equipment, particularly those who haven't been "In the business" very long, and are consequently beginning to find the need for various test equipment.

The circuit to be described is that of the versatile multivibrator: it uses only a minimum of components, none of which is particularly critical. The unit can be used as an alignment aid, a fault

tracer in amplifiers and receivers, and as a Morse Code practice oscillator.

The circuit is straightforward and should present no difficulties even for the beginner. Layout is by no means critical, but wiring should be as direct as possible and the unit should be constructed on a four-sided metal chassis to avoid interference with nearby receivers. The unit emits an audio tone of about 10kc/s, this frequency being determined by the values of R1/R2 and C2/C3.

The waveform is very nearly square, but slight inequalities in the effective capacities of C2 and C3 and the resistances of R1 and R3 will produce a slightly unsymmetrical waveform which is rich in harmonics and may stretch up as far as 5Mc/s or further, and are spaced 10kc/s apart.

Hence, by injecting the output into the aerial circuit of a receiver and tuning the set over the medium or long waveband, a number of pips right across the band should be heard, all of which should be of equal amplitude. If the pips should fade in amplitude at either end of the band, then the set requires alignment.

When the unit is used as a fault tracer, the signal is first injected into the anode circuit of the output valve, then into the grid circuit, and similarly with the preceding circuits until the fault has been localised. For use as a Morse Code practice oscillator, a key (which must be normally closed until depressed) is connected across R3. This normally involves the use of a key with a backstop.

If for some reason a variable note is required, then R1 can be replaced by a 250kΩ variable resistor in series with a 68kΩ fixed resistor. The variable component should be wired on the earthy side of the fixed resistor to minimize hum pick up.

Although a 6J6 valve was

—continued on page 431

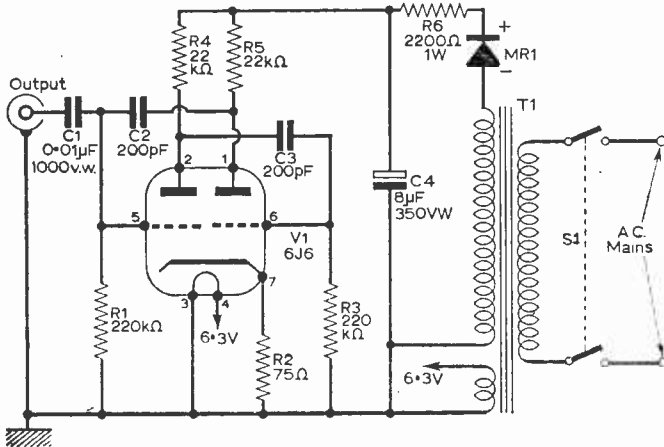
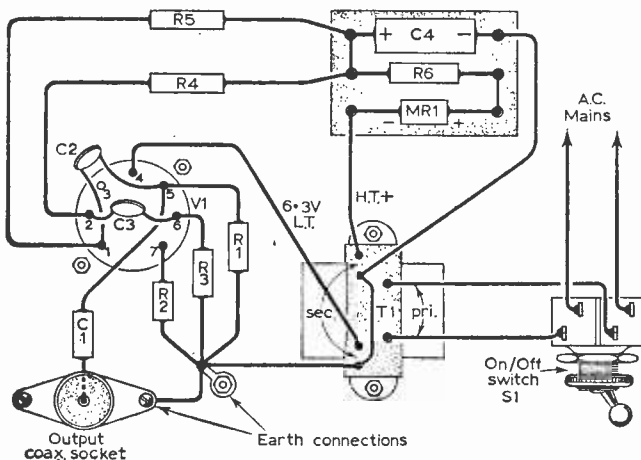
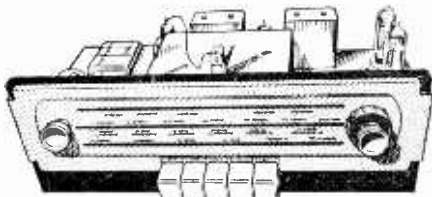


Fig. 1 (above): The circuit of the a.f./r.f. noise generator.

Fig. 2 (below): The practical layout and wiring of components.



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**PUSH-PULL O.P. AMPLIFIER £5.5.0**

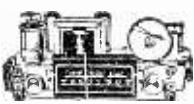
(6/- Carr.) Brand new 200-240 A.C. mains. Bass, treble and vol. controls, with valves EZ80, ECC83 and 2-EL84 giving full 8 w. (chassis 12 x 3 1/2 x 3 1/2 in. With o.p. trans. for 2-ohm speaker. Front panel (normally screwed to chassis) may be removed and used as "8yln panel".

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7in. Stand play, 1,200 ft. . . . .	12/6	<b>ACETATE BASE</b>	
7in. Long play, 1,800 ft. . . . .	19/6	5in. Long play, 800ft. . . . .	10/-
7in. Double play, 2,400 ft. . . . .	25/-	5 1/2 in. Long play, 1,200ft. . . . .	12/6
<b>TRIPLE PLAY</b>		7in. Long play, 1,800ft. . . . .	15/-
3in. 450 ft. . . . .	12/6	<b>MESSAGE TAPES</b>	
4in. 900 ft. . . . .	22/6	3in.—150ft. . . . .	3/6
5in. 1,800ft. . . . .	42/6	3in.—225ft. . . . .	4/11
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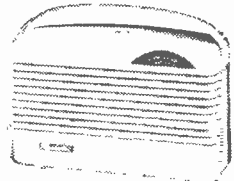
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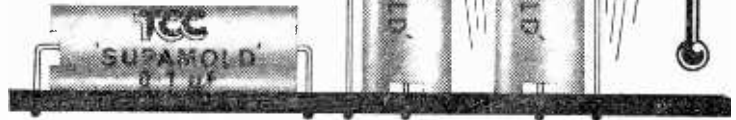
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# on the Short Waves

## A MONTHLY COMMENTARY BY J. GUTTRIDGE

**A**MONGST shortwave listeners, the most popular way of reporting on a particular signal is to use the SINPO code. As mentioned last month, the letters stand for Signal strength, Interference, Noise, Propagation disturbance and Overall merit. Each of these is marked out of five.

In the case of signal strength, the five grades are: 5 excellent, 4 good, 3 fair, 2 poor and 1 barely audible. If your set has an S-meter, determination is easy. On a set with a "magic eye" tuning device you can adopt an arbitrary measurement depending on the degree of closure of the eye. However, if your set has none of these devices you will have to estimate the signal by comparison with others. Remember when doing this leveling out effect of the automatic volume control.

Degrees of interference are, 5 nil, 4 slight, 3 moderate, 2 severe and 1 extreme. As a guide, 4 is often given by a station on the next channel (5kc/s away) although a very powerful neighbouring signal or jammer splash might rate 3. Where two stations of about the same strength are operating on the same channel, they often rate 2. Complete blotting out of a weak signal by a very strong one of course gives a rating of 1 for the weak signal.

Noise is rated on the same basis as interference, with which, however, it must not be confused. Two main types of noise affect the short wave listener. The first of these is "hiss". You will find this to be strongest on a band not supporting propagation—e.g. the 13m band after dark. The other is "atmospheric" or "static noise". This is produced by lightning. It can be quite strong even when there is no storm in your vicinity as it can be propagated over great distances like broadcast waves. Noise can also be man made. Examples of this are produced by car ignition and electric motors. However, as this is purely local it can be disregarded when reporting to stations.

Propagation is also marked on the same scale as interference and noise. Because of the difficulty for the listener of estimating this accurately, F for fading (SINPO) code is becoming used more and more here. Fading is rated 5, 0-1 fades per minute; 4, 1-5 fades per minute; 3, 5-20 fades per minute; 2, 20-60 fades per minute; 1, 60 or more fades per minute.

Finally we have overall merit which is really self explanatory and could almost be termed "listenability". Here the ratings are 5, excellent, 4 good, 3 fair, 2 poor and 1 unusable.

### Jamming Relief

Further good jamming news from the BBC is that its Bulgarian transmissions are now free of deliberate interference.

### 28 Mc/s Opening

In the evenings the 10m amateur band is now opening up a bit, enabling European stations to break through. On a recent evening, hams in Germany, Hungary, Portugal and the Ukraine were audible in London.

### BC News

A. M. Woodlands, of 7 St. Michaels Avenue, Clevedon, Somerset, has reminded me of La Voz de los Andes, Ecuador, and Radio 4VEH, Haiti, which I omitted from the list of stations having DX programmes. He says also that Radio Lisbon and the Korean Broadcasting System are to start such programmes. Peruvian stations he has logged recently around 2300GMT include Radio Universidad and 6,235kc/s, Radio Cuzco on 6,250kc/s and Radio Tuantisuyo on 6,265kc/s. Mr. Woodlands, incidentally, is the British representative of the Benelux DX club, which he says aims to cater especially for the newcomer to shortwave listening.

La Voz de los Andes, call HCJB, mentioned above, is one of the easiest South American stations for the newcomer. Try listening on 15,115/17,890kc/s from 1900-2030 when there is English, 2030-2100 when there is Swedish and 2100-2130 when there is German. Address of this station is Casilla 691, Quito, Ecuador.

Further North, in Cuba, Radio Habana Cuba, Apt. Postal 7026, Habana, has a programme in French from 2110-2140 on 17,855kc/s.

Most of the main American baseball games are transmitted by AFRS, New York, using Voice of America transmitters. The station's schedule is 1430-2245 on 15,225/15,280 kc/s and 1800-2245 on 17,845kc/s.

A lesser known North American station is WINB, P.O. Box 8828, Philadelphia. From 2000-2200 it is now using 11,795kc/s. Reception reports are being requested for this transmission.

A rearranged European service is now being aired by the Canadian Broadcasting Corporation, P.O. Box 6000, Montreal, Canada. English and combined English and French transmissions are at 1100-1230, 1515-1530, 1630-1700 on 17,820/15,320kc/s, 1230-1315 on 17,820/15,320/11,720kc/s and 2045-2100 on 15,320/11,720/9,630kc/s.

Because of interference, Radio New York Worldwide is now using 11,800kc/s instead of 11,825kc/s from 1200-1815, and 15,440kc/s in place of 15,445kc/s from 1200-2154.

### Readers' Reports

We welcome reports from readers on ham or BC DX for inclusion in this column. May we hear from you?

# A MULTIMETER design incorporating an Electronic OHMMETER

BY  
M. SAUNDERSON

THE meter to be described here was designed with a number of points in view. It had to be easily and fairly cheaply constructed and its accuracy had to compare favourably with commercial units of similar design. The finished meter has a sensitivity of  $1,000\Omega$  per volt and has 24 ranges. It covers 0-3,000V a.c. and d.c.; 0-1A d.c., and can measure up to  $10M\Omega$  on the resistance ranges.

Two circuits are given for the ohms ranges and the constructor may choose which circuit he

prefers. The electronic unit provides a linear, forward-reading scale and can measure up to  $10M\Omega$  with only a small battery voltage applied. The other ohmmeter unit to be described is of the more usual variety and will read up to about  $40k\Omega$  or so. This latter unit has not actually been constructed by the author but the circuit is included for the benefit of those who do not require the electronic version.

Layout and construction are not important and the meter may be built in any form the constructor chooses. For those who wish to follow the author's design, however, the accompanying diagrams give all the necessary measurements and information.

It will be seen that the wiring is done on a number of small panels, these should be of paxolin or some other plastic insulating material.

This sub-wiring method is adopted to simplify overall construction. In the prototype meter one long tag panel was used originally but this was found to complicate rather than simplify wiring and so this method has been abandoned in preference to the smaller units.

### Electronic Ohmmeter Panel

In Fig. 1 details are shown of the panel on which the electronic ohmmeter is constructed. Those constructors who do not wish to use this unit will need to use a different instrument front panel layout to that shown in Fig. 3. No detailed wiring instructions are given for this unit as it is thought that anyone wanting a multi-meter would be able to wire it from the circuit diagram.

It is recommended that colour coded leads about 8in. long should be left "floating" for the input and output connections to the electronic ohmmeter panel. These will be wired to the function switch after the other panel and switches have been fixed in position. A recommended colour code is: Input positive—blue, Input negative—white, Output positive—red, Output negative—black.

The standard resistors, i.e. those marked Ra, Rb, etc. should preferably be 1% high stability types although this is not imperative.

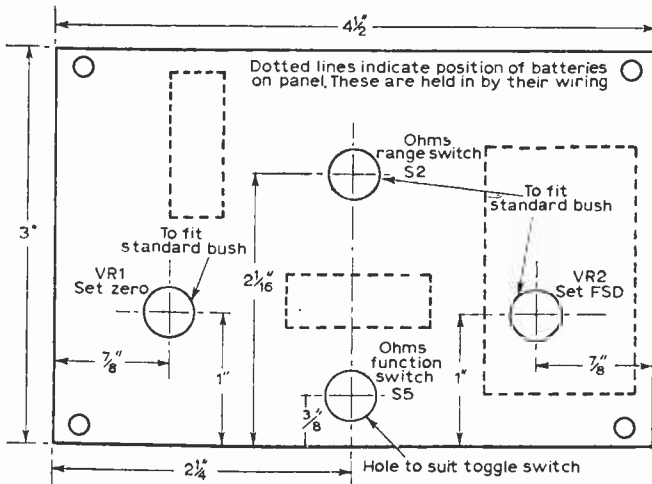
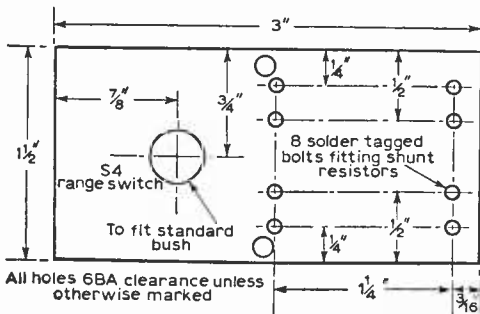


Fig. 1 (above): Details of the paxolin ohmmeter (electronic) panel.

Fig. 2 (below): The voltage and current ranges panel.



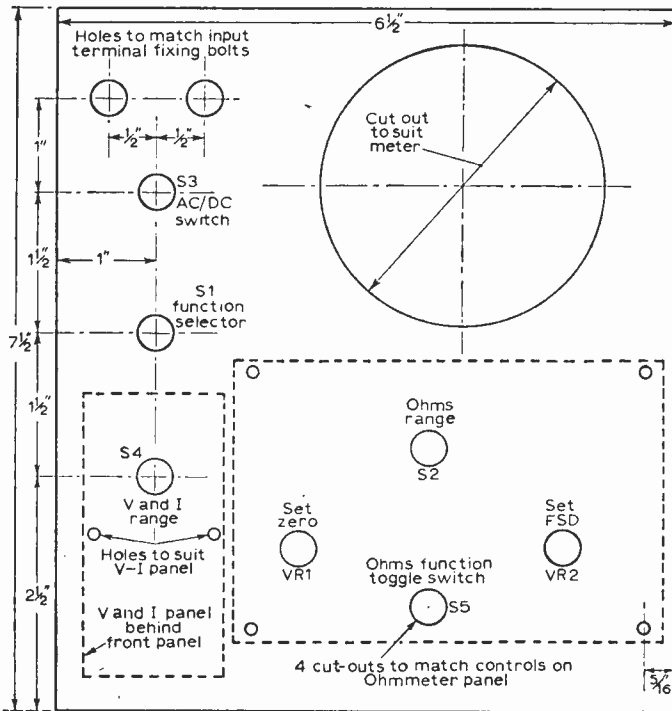


Fig. 3: Main front panel with positions of sub-panels.

**Voltage and Current Panel**

The second sub-stage is the voltage and current unit, and this should also have colour-coded leads as previously described. The series resistors in this stage must be 1% types, as it is on these components that the accuracy of the voltage ranges will depend. The shunt resistors need not necessarily be high tolerance types as they are used in the universal shunt arrangement. Of course, the higher tolerance components used, the greater will be the final accuracy of the completed instrument.

When these two sub-assemblies have been wired they may be mounted on to the front panel as shown in Fig. 4.

The next step is to wire the function selector switch S1. This is probably the most difficult part of the whole construction. The switch used in the prototype model had the connections to the four poles in the centre of the switch wafer. If this type

of switch is used connections may be made in the following way. Turn the switch anti-clockwise and carefully examine to determine which fixed contact the moving contact comes to rest on. The four fixed contacts thus identified will be referred to later as the "x" contacts.

Now turn the switch one position clockwise and note which fixed contacts are selected this time. These will be referred to later as the "y" contacts. The remaining four fixed contacts in later reference will be called the "z" contacts. The four poles will be called 1, 2, 3, 4, counting clockwise, in the wiring instructions, which follow: Short tag 1x to tag 2, and tag 4x to tag 3x. Solder the positive input lead to the V1 unit to tag 1y. Solder the negative input lead to the V1 unit to tag 4y. Next solder the output leads from the same unit, positive and negative to tags 2y and 3y respectively. This completes the wiring of the voltage and current assembly.

The next stage is the wiring of the ohmmeter section. Solder the input leads to tags 1z and 4z (the polarity of the connections is irrelevant in this case) and the output leads to tags 2z and 3z with the positive lead going to tag 2z. This completes the ohmmeter wiring.

The a.c./d.c. switch S3 is the next to be wired into the circuit. The operation of the switch should again be studied to see which fixed contacts are in circuit in which switch position. When the switch is turned anti-clockwise the two contacts selected should be marked in some way to facili-

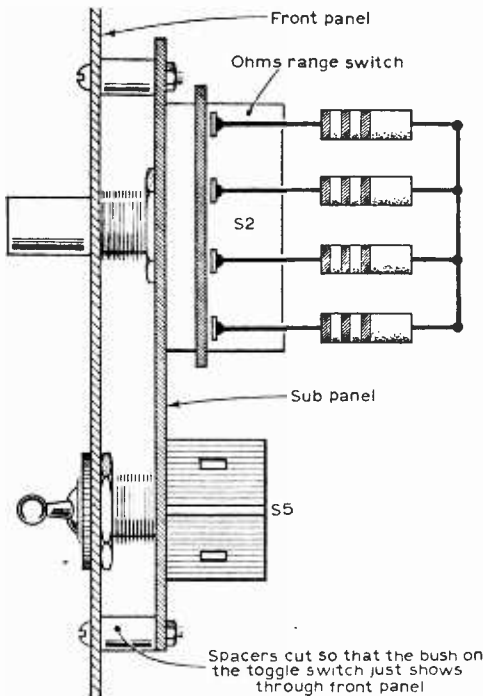


Fig. 4: Mounting details of the electronic ohmmeter panel.

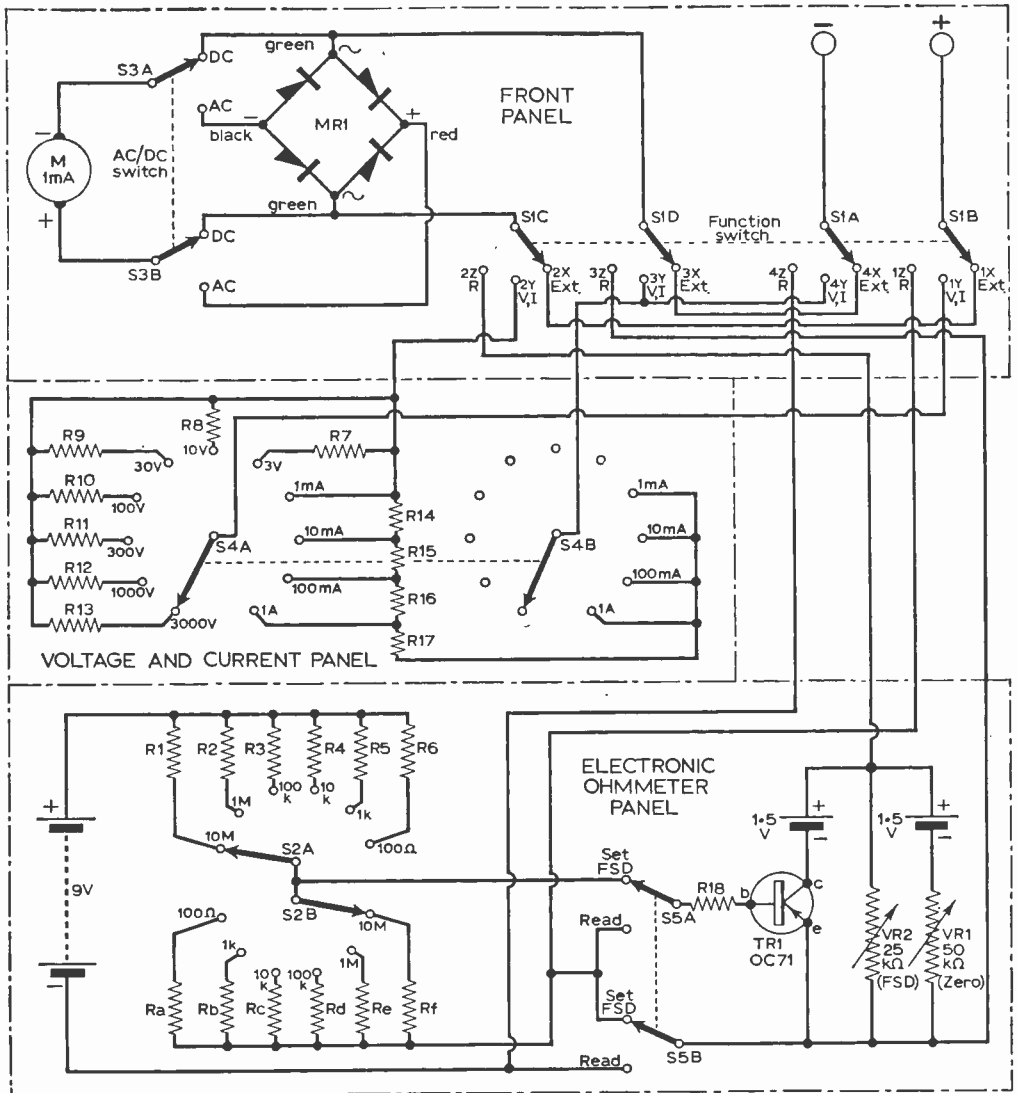


Fig. 5: The complete multimeter circuit.

tate identification later. The switch may now be wired.

If the constructor has a commercially made meter rectifier to hand this should be used; however an improvised rectifier may be made by wiring four germanium diodes in a bridge circuit. This will not be as accurate as a commercial component but it will function reasonably well.

Wire the a.c. sides of the rectifier to the two fixed contacts previously marked. Wire the positive and negative sides to the other fixed contacts. Study the switch again and see which moving contact makes on the positive side of the rectifier.

Wire this pole to the positive meter terminal and wire the other pole to the negative side of the meter. The a.c. side of the rectifier which connects to the positively wired pole should now be wired to pole 2 on the function selector switch. The other a.c. connection to the rectifier should be wired to pole 3 on the function switch. When the switch is turned so that the moving contacts are making on the a.c. side of the rectifier the meter is connected for d.c. measurement. All that now remains is to connect pole 1 on the function switch to the positive input terminal and pole 4 on the function switch to the negative input terminal and the meter



is complete.

When using the electronic ohmmeter a certain order of switching must be followed. This order is:

- 1 Switch function switch S1 to "R" and toggle switch S5 to "Set F.S.D.";
- 2 Short input and put toggle switch to "Read". Set zero by adjusting VR1;
- 3 Set toggle switch to "Set F.S.D." Remove short. Insert resistor to be tested and adjust VR2 potentiometer for F.S.D. on the meter scale;
- 4 Put toggle switch to "Read" and read off value of resistor directly on the scale;
- 5 Switch function switch from the "R" position, and remove test resistor.

This may seem long and complicated but in actual practice the setting up operations take only a few seconds and after operating the unit a few times one does it automatically anyway.

When reading un-marked resistors it is essential to start on the highest range and to work down, as a test resistance greater than the internal standard will cause a current greater than one milliamp to flow through the meter and damage may occur to the meter. If when testing a resistor a full scale reading is obtained when switched to "Read", this is an indication that either the meter is not switched to a high enough range or else that the resistance is open circuit. Similarly a reading of zero when switched to "Read" indicates that the resistor is short circuit.

When constructing the ohmmeter the values of the resistors in series with the standard resistors have to be found by trial and error as these will depend on the transistor used. To find the value required insert a test resistor of equal value to that of the standard resistor. Adjust the "Set F.S.D." control VR2 to its half-way position and vary the value of the series resistor until a full scale reading is obtained. It is best to start with a resistor about ten times greater than the standard and to work downwards in value until f.s.d. is obtained.

#### Overload Cut-out

It may be good idea to fit some form of overload cut-out to the meter. Although the author has

## SIMPLE NOISE GENERATOR

—continued from page 424

used in the original design, there is no reason why other double triodes such as the octal based 6SL7, or the 6SN7 should not be tried. If required, a battery version could be built around a DCC90, or a similar valve, in which case, R2, R6, C4, MR, and T1 become unnecessary.

In the author's model, the unit was built into a wooden box 2½ in x 5 in. x 6 in. with the tone control, on/off switch, sockets for key, and coaxial and jack output sockets mounted on a front panel made of "Formica". However, this was rather cramped, and a slightly larger cabinet is advised.

It is important that an isolated power supply is used, and not the "live chassis" type of power supply where one side of the mains is connected to the chassis. Such an arrangement would prove extremely dangerous if the unit were to be used in conjunction with a.c./d.c. set. Mains transformers

## COMPONENTS LIST

### Switches:

- S1 1 4p, 3w, wafer switch (see text)  
 S2 12p, 6w, wafer switch (only for electronic ohmmeter)  
 S3 1 2p, 2w, wafer switch  
 S4 1 2p, 11w, wafer switch  
 S5 1 2p, 2w, toggle switch (only for electronic ohmmeter)

### Potentiometers:

- VR1 50kΩ Lin. VR2 25kΩ Lin.

### Meter:

- 1mA, F.S.D. 100Ω

### Resistors:

- |                           |         |
|---------------------------|---------|
| Ra 100Ω, 1%               | R1* 20% |
| Rb 1kΩ, 1%                | R2* 20% |
| Rc 10kΩ, 1%               | R3* 20% |
| Rd 100kΩ, 1%              | R4* 20% |
| Re 1MΩ, 1%                | R5* 20% |
| Rf 10MΩ, 1%               | R6* 20% |
| R7 3kΩ, 1% high stab      |         |
| R8 10kΩ, 1% high stab     |         |
| R9 30kΩ, 1% high stab     |         |
| R10 100kΩ, 1% high stab   |         |
| R11 300kΩ, 1% high stab   |         |
| R12 1MΩ, 1W, 1% high stab |         |
| R13 3MΩ, 3W, 1% high stab |         |
| R14 9kΩ, 1%               |         |
| R15 900Ω, 1%              |         |
| R16 90Ω, 1%+              |         |
| R17 10Ω, 1%+              |         |
| R18 22kΩ, 20%             |         |

\* see text

† wirewound

All resistors ½W unless otherwise stated

### Transistor:

- Tr1 Mullard, OC71 or equivalent

### Miscellaneous:

- Knobs, connecting wire, solder etc.

not actually tried this it is imagined that a relay designed to operate at 1mA could be utilized by wiring it as a switch in series with the coil in the instrument. This, of course, would be in effect a resistor in series with the coil and different series and shunt resistors would have to be used in order to counteract this.

## A SIMPLE AF RF NOISE GENERATOR COMPONENT LIST

- V1 6J6, 6SL7, 6SN7, DCC 90 etc. (see text)  
 C1 0.01mF 1000V paper  
 C2, 3 200pF ceramic  
 C4 8μF 350V electrolytic  
 R1, 3 220kΩ (see text)  
 R2 75Ω  
 R4, 5 22kΩ  
 R6 2.2kΩ  
 MR Any metal rectifier with a rating of 250V 20mA (or higher)  
 T1 Secondary: 175-250V, 20mA 6.3V, 0.6A  
 S1 Double pole on/off switch  
 Case, chassis, output sockets, etc.  
 All resistors + 20%, ½W carbon

suitable for the unit are often advertised as converter transformers in the columns of this magazine.

# efficient HEAT SINKS for transistor work

By E. H. Green

ONE of the main difficulties encountered in soldering transistors and other semi-conducting devices, is ensuring that the device is not damaged by heat, either being radiated from the soldering iron, or conducted by the lead wires to the device. The former is easily overcome if the iron is held above the transistor and as far away from it as possible, as shown in Fig. 1.

It is usual, unless the leads are reasonably long and a low-power iron is used, to use a heat sink on the lead being soldered. The most commonly

used heat sink is a pair of thin-nosed pliers which are used to grip the lead being soldered as shown in Fig. 2. The disadvantage in using pliers is that it is difficult to hold the pliers and transistor steady while at the same time holding up a circuit board and applying the soldering iron.

The only commercial heat sink I have seen is the one made by X-Acto, USA, which clips on to the lead and is made of high-conductivity aluminium-copper alloy, as shown in Fig. 3. Although the force applied in holding the lead is not so great as that used with the pliers, it is nevertheless quite an efficient heat sink.

A simple, yet highly efficient heat sink can be made from a standard or miniature crocodile clip by first filing off the teeth and then gluing pieces of thick felt in the jaws, one on each as shown in Fig. 4. Bostik or any other similar glue may be used. In use the heat sink is dipped into water to soak the felt and then simply clipped on to the lead being soldered, as shown in Fig. 5. It thus provides intimate contact with the lead and cools by evaporation of the water as the lead heats up. Provided the pads are kept reasonably damp, the sink is many more times efficient than many of the usual devices. ■

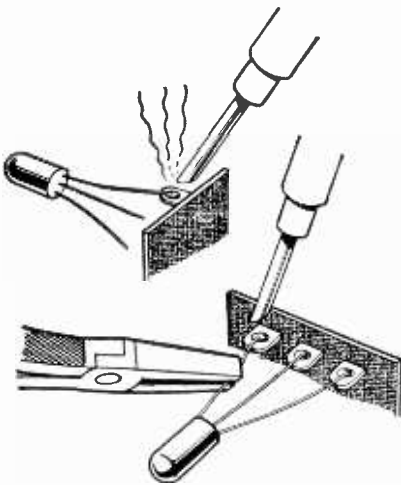


Fig. 1 (top): With an unprotected transistor, the iron should be kept as far from the body of the component as possible. Fig. 2 (bottom): Using pliers as a heat sink.

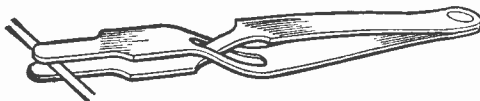


Fig. 3: A commercial heat sink.

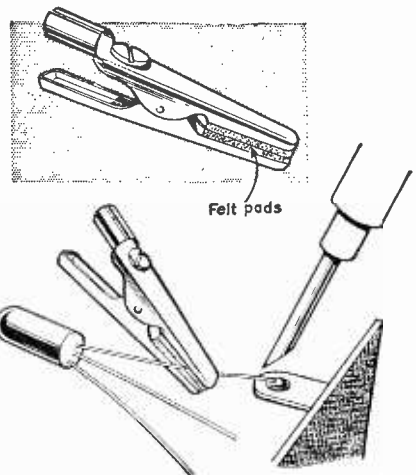
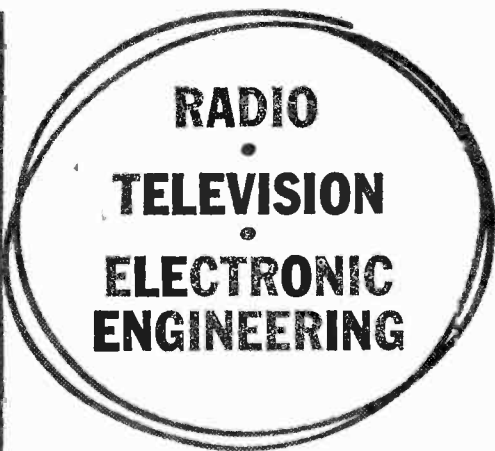


Fig. 4 (top): A crocodile clip fitted with felt pads. Fig. 5: The heat sink in use.

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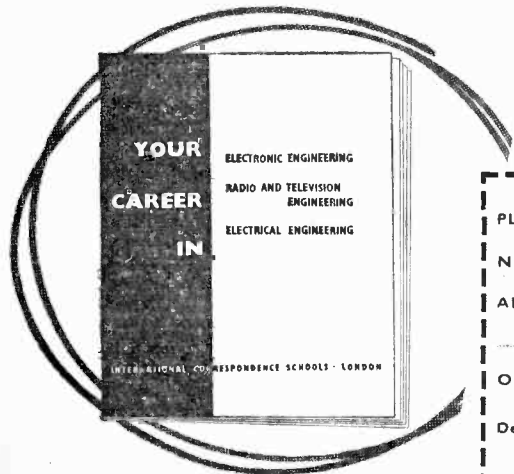
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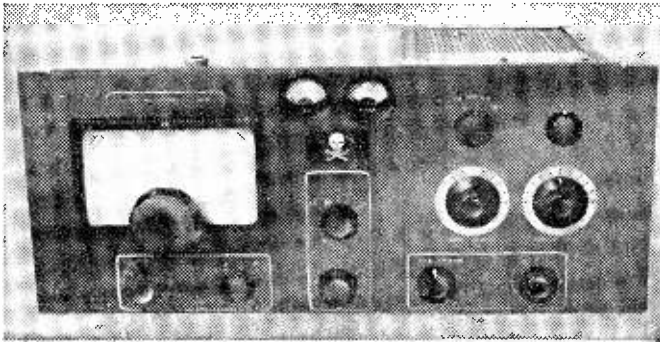
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# The BUCCANEER

## MULTI-BAND TRANSMITTER

By J. E. Alban G3JEA

**A**FTER many years of successful amateur operating, during which time the writer has had the opportunity to build and use transmitters from QRP to full 150W level, it was observed that little difference in signal strength reports received, existed between 25W rigs and those which ran at the maximum permissible level.

Commercial transmitter manufacturers, and kit suppliers, have recently arrived at the same conclusion, hence the popularity of the medium-powered transmitter now in use with a d.c. input to the final in the region of 60W. By keeping the power around this level, it is possible to produce a reasonably-priced TX, with unwanted harmonic output content reduced to an absolute minimum, obviating TV and BBC interference to some degree.

It was assumed that when built, the transmitter to be described would be used for a number of years, thus the valve types specified are in the main taken from the current lists, with the probability that they will remain popular for many years to come. The only exception to the rule is the 807, but here price was the governing factor and with these valves still available on the surplus market laying in a small stock should not prove any problem. The modern miniature 5B254M can, of course, be used in place of the 807 where the h.t. supply is not in excess of 700V. Octal based equivalents for the miniature valves quoted can be used satisfactorily, but more chassis space will be required to accommodate them.

Use of ex-government parts, or others of doubtful replacement has been deliberately avoided, all those listed are of standard manufacture and are readily available.

The photo depicts the Labgear Wide Band Multiplier Unit used in the current version of the transmitter, but equally good results have been achieved in prototype versions using home-made

wide band couplers wound on standard Aladdin  $\frac{1}{2}$  in. formers.

### CIRCUIT DESCRIPTION

#### V.F.O. and Buffer Stages—Fig. 1

The v.f.o. is of the standard Clapp pattern, output being taken to the buffer amplifier from the cathode via the variable capacitor TC2. Cathode coupled Clapp oscillators are of the most stable kind in the opinion of the writer, and variable coupling to the following stage allows adjustment of drive to the buffer and less "pulling effect" on the v.f.o. as the multiplier stages are tuned up. With the TC1 the 15pF bandspread capacitor, a nice open spread is obtained, facilitating good netting, but at the expense of a slight loss of coverage on the 80 metre phone band; v.f.o. drift is very slight during the warming-up period and soon settles down, a clean, sharp note should be heard in the monitor.

The second half of the buffer valve is used as a cathode follower stage giving greater stability and isolation to the previous stages. It should be noted that the oscillator stage is left running continuously, and is not audible in the station receiver at 7Mc/s and above. Even on its basic frequency it is barely detectable if the co-axial cable from the v.f.o. box to the buffer grid is kept down to absolute minimum. In the "net" position of the "Send-Receive" switch, anode volts (255 stabilised) are applied to both halves of the buffer/cathode follower valve, enabling the v.f.o. to be heard at a reasonable level in the receiver without depressing the key.

#### Frequency Multiplier Stages—Fig. 2

Drive to the multipliers and final stages is controlled by the potentiometer in the screen of the first 6CL6 stage. More than sufficient drive is

available on all bands (6BW6 and 6AQ5 can be used, but will result in slightly reduced drive to other stages). Keying is carried out in the cathode of this same stage, the only click filter found necessary being the usual 2.5 millihenry r.f. choke in series with the key contacts, and decoupled to earth by a 0.005 $\mu$ F disc ceramic condenser. Both should be fitted as close as possible to the actual key contacts.

It will be observed that the three multiplier stages do not have a d.c. potential applied to their screen grids, obviating the use of further dropping resistors and decoupling condensers. Feeding the screen grids with r.f. is an idea "borrowed" from a fellow amateur G3JAM, and, although published some years ago, does not enjoy the popularity one would expect. Having experimented for some years with various methods of frequency doubling and tripling, the writer is of the opinion that this method is by far the best so far as the elimination of unwanted harmonics is concerned. Experience has shown that a high level of unwanted harmonics is generated in the screen grid circuits of beam tetrode and pentode valves, and, unfortunately, appears in the anode circuits, despite the use of wide-band tuned couplers. The anode current taken by the switched-out multipliers is very low.

The unwanted harmonic content from the multipliers is so low that adjustments can be made to the final amplifier without the side and other screening covers being fitted, and no TVI was observed on a monitor, not two feet away.

The Philips trimmers in the grid stages of the multipliers are to compensate for the grid impedance changes between the following multiplier and p.a. stages.

### P.A. and Modulator Stages—Fig. 3

The final stage follows normal practice, the stand-by anode current being held to a safe level by the clamper valve in the screen grid circuit. Output is via the conventional pi-network, and, although a TVI harmonic trap has been included across the antenna terminals, it has not been found necessary to use it in the London area, neither has it been found necessary to use a low pass filter, even on the 21Mc/s band.

At the writer's QTH the transmitter is run at 90W input, that is, 900V to the 807 anode at 100mA. Readers may have their doubts as to the life of an 807 under these conditions, but, if the tuning-up time is kept to an absolute minimum, and the key should not be depressed for more than

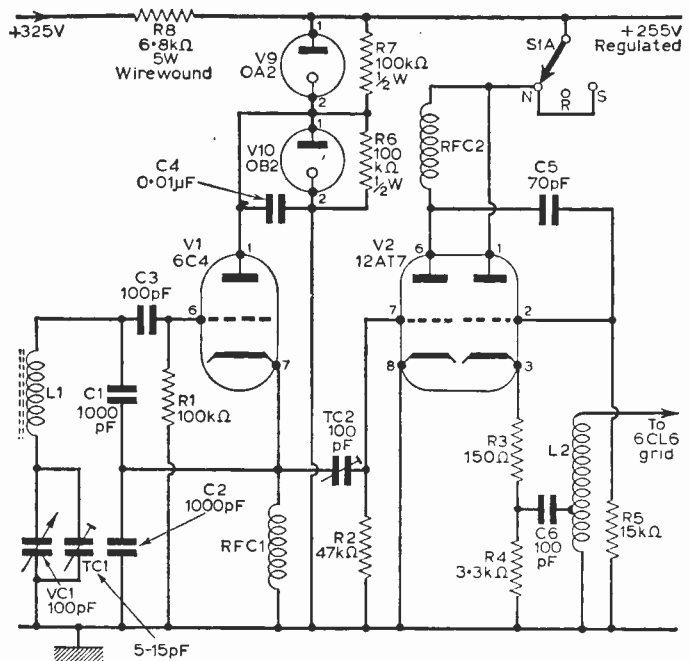


Fig. 1: The v.f.o. and buffer stages of the circuit. C6 is tapped into L2, nine turns from lower end.

### COMPONENTS LIST FOR V.F.O. AND BUFFER STAGES

#### Resistors:

R1	100k $\Omega$	R5	15k $\Omega$
R2	47k $\Omega$	R6	100k $\Omega$
R3	150 $\Omega$	R7	100k $\Omega$
R4	3.3k $\Omega$	R8	6.8k $\Omega$ , 5W w.w.
All $\pm 20\%$ $\frac{1}{2}$ W carbon, unless otherwise stated			

#### Capacitors:

C1	1000pF silver mica $\pm 1\%$
C2	1000pF silver mica $\pm 1\%$
C3	100pF silver mica $\pm 1\%$
C4	0.01 $\mu$ F disc ceramic
C5	70pF silver mica
C6	100pF silver mica $\pm 1\%$
TC1	5-15pF air spaced trimmer
TC2	100pF air spaced trimmer
VC1	100pF air spaced tuning

#### Valves:

V1	6C4	C9	OA2
V2	12AT7	C10	OB2

#### Other Items:

- L1, 34t, 28 s.w.g. enam. copper wire closewound on  $\frac{3}{8}$ in. dia. Aladdin former
- L2, 42t, 32 s.w.g. enam. copper wire closewound on  $\frac{1}{2}$ in. dia. Aladdin former—tapped at 9 turns from low end for C6
- RFC1, 2 1.5 mH r.f. chokes (Eddystone)
- S1, 3-pole, 3-way rotary ceramic switch

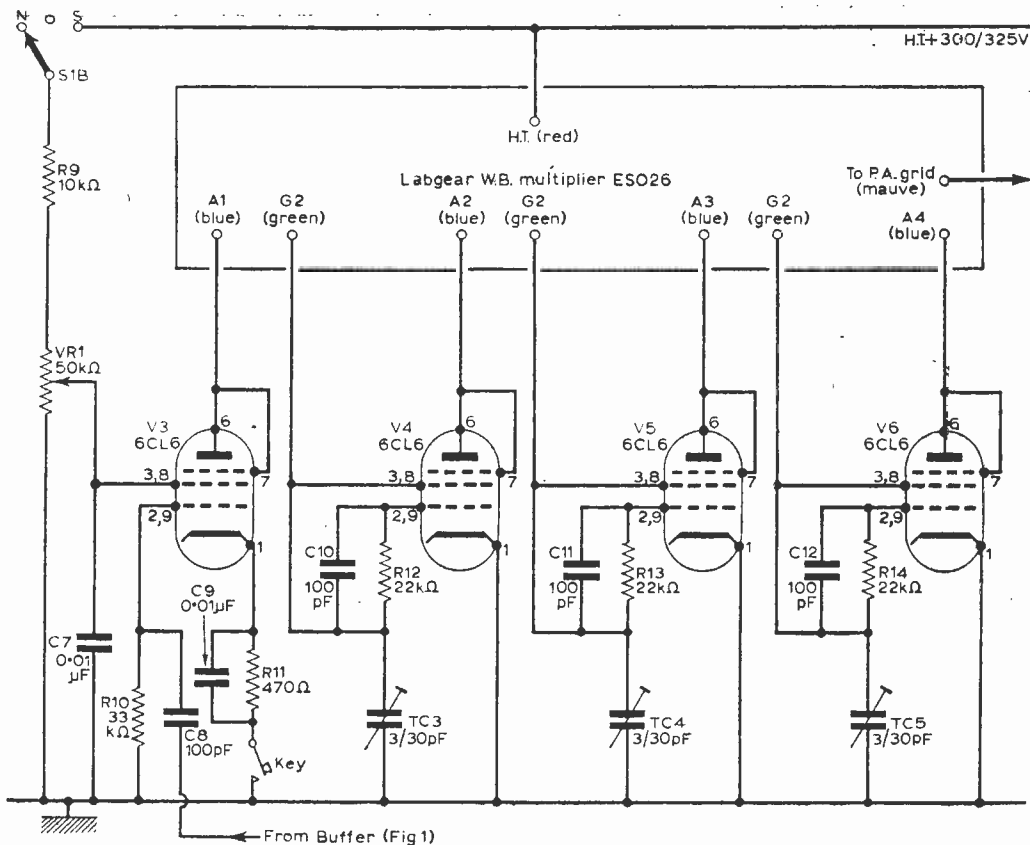


Fig. 2: Frequency multiplier stage.

**COMPONENTS LIST FOR EXCITER STAGE**

**Resistors:**

- R9 10kΩ, 2W w.w.
- R10 33kΩ
- R11 470Ω, 1W
- R12 22kΩ
- R13 22kΩ
- R14 22kΩ
- All ±20% ½W carbon, unless otherwise stated
- VR1 50kΩ 5W w.w. potentiometer (drive control)

**Capacitor:**

- C7 0.01μF disc ceramic
- C8 100pF mica
- C9 0.01μF disc ceramic
- C10 100pF tubular ceramic
- C11 100pF tubular ceramic
- C12 100pF tubular ceramic
- TC3 3/30pF Philips trimmer
- TC4 3/30pF Philips trimmer
- TC5 3/30pF Philips trimmer

**Valves:**

- V3 6CL6
- V4 6CL6
- V5 6CL6
- V6 6CL6

**Other Item:**

Wide-band multiplier unit, type E5026 (Labgear)

10 seconds or so at a time, running the p.a. at 75W input under conditions of correct loading would mean that the life of the valve is considerably extended.

Series gate modulation is employed in the transmitter, mainly because of the ability to obtain a reasonably high level of modulation without the necessity of bulky modulating transformers and duplicated power supplies. In practice it has been found to be most satisfactory.

Using the gating method does allow the 807 to run at a full 90W input on peaks, whilst with the high efficiency methods this is reduced to 60W.

The audio pre-amplifiers are connected to the 255V stabilised line, and are unaffected by current drain on the main exciter h.t. rail. Although valve types 12AU7 or 12BH7 may be employed as clamper/gating controls, in practice the latter type has been found to be more effective, allowing 20% greater anode current swing on voice peaks.

The external power supply is not shown, but is quite conventional. Bias for the clamper stage is obtained from an instrument type transformer which has its 6.3V heater connections taken to the transmitter heater rail and is, in fact, run

**COMPONENTS FOR P.A. AND MODULATOR STAGES**

**Resistors:**

- R15 4.7kΩ
- R16 2.2MΩ
- R17 4.7kΩ
- R18 470kΩ
- R19 470kΩ
- R20 47kΩ
- R21 47kΩ
- R22 1.5MΩ
- R23 220kΩ
- R24 220kΩ
- R25 100Ω
- R26 15kΩ

All ±10% ½W carbon, unless otherwise stated  
 VR2 500kΩ lin. potentiometer  
 VR3 25kΩ, 5W w.w. potentiometer

**Inductors:**

- L3 Geloso, Codar or KW pi-coil
- L4 TVI trap coil: 9t. 18 s.w.g. ½in. dia. 1½in. long
- RFC3, 4 1.5mH r.f. chokes (Eddystone)
- RFC5 P.A. r.f. choke (Labgear or Minimitter)
- RFC6 5A TV suppressor choke (Radiospares)
- RFC7 1A TV suppressor choke (Radiospares)
- RFC8 V.H.F. choke (Eddystone)

**Valves:**

- V7 12AX7
- V8 12BH7
- V11 807

**Capacitors:**

- C13 10pF ceramic
- C14 25µF electrolytic 25V
- C15 8µF electrolytic 300V
- C16 8µF electrolytic 300V
- C17 0.005µF moulded mica
- C18 0.005µF moulded mica
- C19 0.01µF disc ceramic
- C20 470pF disc ceramic
- C21 470pF disc ceramic
- C22 0.002µF mica 2kV
- C23 500pF mica 500V
- C24 0.005µF disc ceramic
- C25 500pF mica 2kV
- TC6 60pF mica trimmer
- VC2 200pF air spaced variable
- VC3/VC4 500pF air spaced twin-gang variable

**Other Items:**

- M1 0.5mA movement
- M2 0.150mA movement
- S2 3-pole, 2-way rotary switch

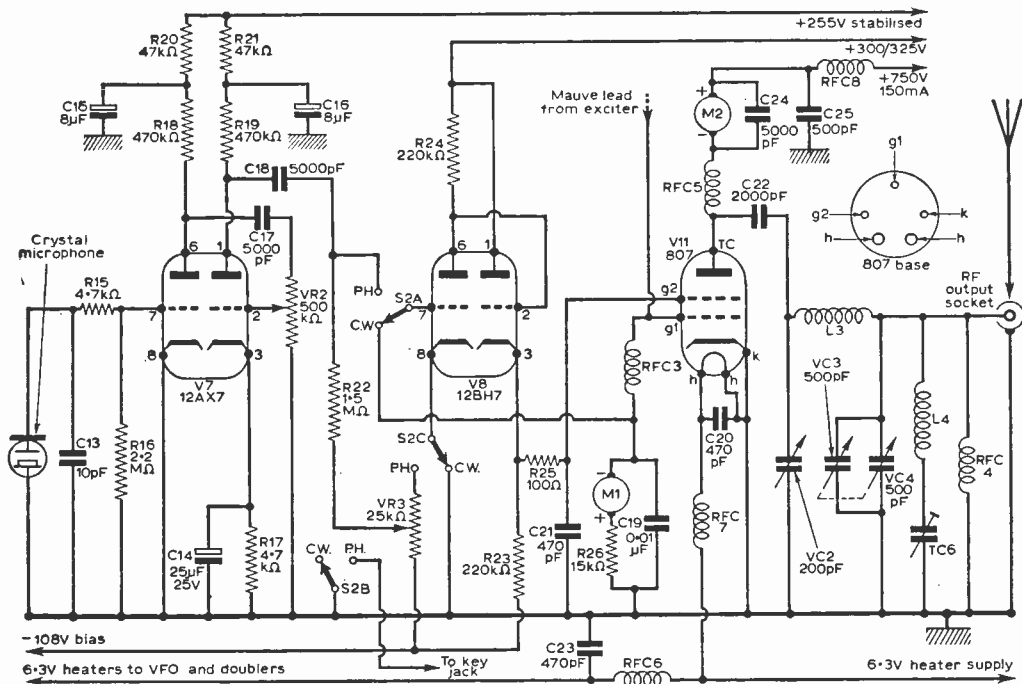


Fig. 3: P.A. and modulator section of the circuit.

“backwards”. By so doing, it is not necessary to take a 240V a.c. line under the chassis. To avoid accidents, the mains primary windings should be disconnected and sealed off. Care should be taken to see that the bias smoothing capacitor is connected in the correct sense, that is positive end to chassis. The potentiometer VR3 in the bias voltage

rail, enables a variation to be made when lower anode voltages are used on the 807 p.a. valve. For normal 750 to 800V h.t. rails, the bias should be adjusted to give approximately 108V negative.

**CONTINUED NEXT MONTH**



# A COMMENTARY BY HENRY PRACTICALLY WIRELESS

## No. 1 Kitmanship

**DO-IT-YOURSELF** is the trend of the era. There is an ineffable thrill in seeing something one has lovingly fashioned reach a triumphant completion. No matter that one leg has to be propped with a telephone directory, that the patched-on panel conceals a mass of twisted wires, or even that the results do not sound as hi-fi as we wish. We have made it ourselves—our own Galatea, a darn sight cheaper than she could be bought.

Wireless began with the kit, but grew to the sort of complexity that demanded mass production. Mass production begat standardisation, standardisation begat simplicity, simplicity begat cheapness. Now we can construct as good a piece of equipment on the kitchen table as can be obtained in the shops.

It is certainly cheaper to build and the expectation of success is in direct proportion to our common sense. We have the kit designers to thank for that.

These boys not only know their opinions: they plant, water, dig, peel and cook them for us. Every smallest detail is considered. Each screw, each connection, each guide mark is vetted to make our labour easier. But behind the simplicity lies a complicated feat of organisation. The kit-maker's factory is as meticulously regimented as the Brigade of Guards. The buying department, which ensures that we can

obtain an immediate replacement of the part we ruined with our clumsy soldering, is as complex as in the works producing the "normal" commercial set.

In the immediate post-war days, kits were often thrown together from Surplus Government equipment. Those were the days of the ingenious modification. We built upon the basic contents of our spares box. The advertisement columns of PRACTICAL WIRELESS were avidly scanned for the elusive alternative spare part.

When some far-sighted gentry saw the renewed prospects of kit construction, we were offered some weird and wonderful bargains. Many atrocities were committed in the sacred name of "construction". A parcel of tatty pieces would plonk through the letter-box, they often bore small resemblance to the list of instructions.

Oh, those instructions! At times, they were apparently drawn up by hieroglyphic experts, translatable only by students of Coptic. The drawings, where hasty duplication had allowed the lines to be reproduced at all, seemed to have been scratched on the stencil by an art-loving chimpanzee.

But we soldiered on. Slowly, the conglomeric of components spread over the table assumed some sort of shape. Then came the catch.

Just as we were congratulating ourselves that success lay around a not-too-distant corner, the unbeatable snag would occur. "Fit member A from slot B to hole C, passing over spigot D and the three red wires X, Y and Z." the instructions said, dogmatically. But member A would not reach from B to C, and spigot D protruded half an inch more than we expected, and as for three red wires—all we had, at this stage, was a bunch of multi-coloured ends.

However, it was all good



*Mrs Harry's seed pearls.*

experience, and helped swell the contents of our spares box. It is interesting to resurrect some of those early attempts. Soldered joints had more quantity than quality about them. Capacitors had long since lost both identification and outer wax. Where wires had been too long, they were twisted into pretty coils. Common earth tags had been used as convenient anchor points. Paxolin strips were cracked, panels split, screw heads burred and threads stripped. In fact, the only strong part about the set was an irremovable mounting board, which had to be dismantled before we could reconstruct. Ah well, back into the spares box.

Back, to join some of those old essays into the mini-world of early transistor radios. These were utterly impossible for the Ham-Fisted Harry who had tried to build them, and passed them over to us. The kit supplier stinted on strength to scale down proportions. Harry had as much hope of finishing the construction as of threading Mrs Harry's seed pearls.

Today, we have a very different situation. Although a delicate touch is still necessary, the technique of kit preparation has reached a high level. It is almost literally true that "even a child could build it."



*... by an art loving chimpanzee.*

# a 'high compression front end

**T**HE mathematical approach to a practical problem can be extremely elegant, but there are occasions when incomplete data can lead to a discouraging conclusion. In particular, much of the available information about transistors suggests that they do not make efficient simple "front ends" for receivers, and perform best as superhets. Having tried out many published circuits, the writer must sadly agree that, despite considerable ingenuity in their design, reflex circuits tend to be unstable and to lack sensitivity in weak signal areas.

By prolonged trial and error, the writer has evolved a simpler circuit which is stable, smoothly controllable and gives excellent sensitivity over the medium wave-band. It may seem to fly in the face of accepted transistor practice, but its efficiency has been confirmed by several specimens giving consistent performance over a period of four years, throughout freezing and summer conditions alike.

Perhaps it should here be explained that the writer's principal interest in this field lies in really tiny receivers, driving an earpiece and working off a single cell, yet providing good volume with easily adjusted and *stable* controls. Using the basic circuit in question, the smallest complete set (so far) fits in a case considerably smaller than a matchbox. Yet with its ferrite rod aerial just over an inch long, it can get as many stations and as clearly as a typical commercial superhet.

Probably the most striking feature of this circuit is that its aerial does *not* have a step-down tapping into the base: the entire winding is used. This—contrary to expectations—provides a much stronger signal than the conventional tapped winding (which is designed for the different function of feeding into crystal, reflex or superhet circuits).

However, when the whole aerial is shunted in this way, tuning can be completely upset by changing transistor characteristics; especially those due to thermal drift or variations in the supply voltage. This is very marked with the early types of r.f. transistor—such as the familiar red and yellow spot—but much less so with the more recent surface-barrier or micro-alloy types (e.g. SB 305 or MAT 101).

However, with direct coupling, even these last

give far more thermal drift than is tolerable in a practical receiver. Not only does tuning alter; the gain varies so the regeneration ("reaction") cannot be set with any degree of stability.

The immediate essentials therefore are: (a) thermal compensation, and (b) voltage constancy. The first can be provided by a thermistor in a suitable voltage-dividing circuit to control the base bias. Thermal compensation is probably the most vital necessity for a "high compression" set to be carried in the pocket. Supply voltage can be kept adequately constant either by using an ordinary dry cell with capacity large in relation to the load, or by using a mercury cell.

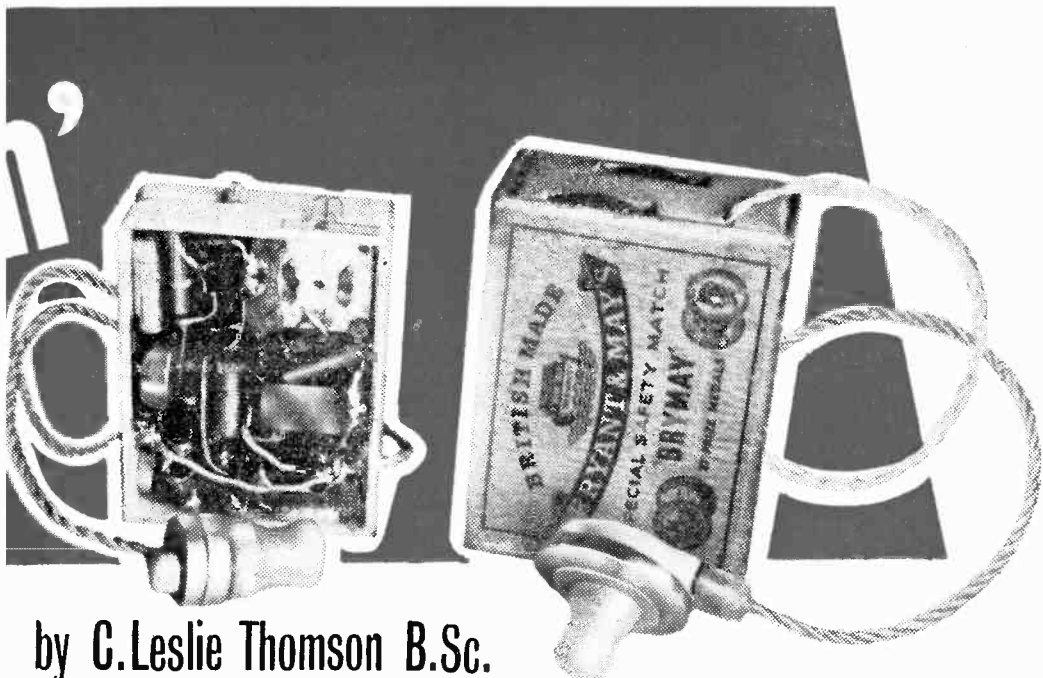
To obtain adequate sensitivity, without recourse to complex circuitry or to a second tuned stage, old-fashioned "reaction" proved to be far and away the most rewarding. It gives at the same time enormously increased gain and ample selectivity.

The reported failure of other experimenters to obtain useful degrees of regeneration with transistors may well be due to their use of step-down coupling of aerial to base. The writer has found a variety of control circuits, either using a variable resistor or a variable capacitor, to give excellent gain and thoroughly practical performance.

The regeneration characteristics can be varied over a wide range by adjusting and balancing the values of the components; the most important desiderata being "non-ploppy" action and uniform setting over at least the greater part of the tuning range. In addition, there should be no detuning as the reaction is varied.

The stronger the signal that can be obtained from the "detector" stage, the less the a.f. amplification necessary, and the less the background noise. However, if the "front end" is too complex, the bulk of the components makes a compact construction difficult or impossible, and stray capacity and induction effects make placing much too critical. This is especially true if more than one tuned circuit is involved, or if r.f. chokes are used.

This brings us to the next essential feature of the circuit—a transformer output. This provides an adequate impedance to r.f. signals, so allowing these to be by-passed into the reaction coil. It also effectively blocks the passage of r.f. into the ampli-



by C. Leslie Thomson B.Sc.

fier stages and allows one to reverse polarity so that a.f. feed-back can be kept negative overall, no matter how compact the set. (This eliminates the need for decoupling in multi-stage amplifiers, so keeping the number of components to a minimum.)

By no means least of its virtues, a transformer gives a much stronger a.f. signal than resistance capacity coupling with limited supply voltage. A suitable transformer—such as the Ardenite D 1001—is only slightly bulkier than the smallest effective r.f. choke, which would otherwise be an essential component.

Regeneration control can be provided in two ways, depending on the particular needs. For maximum compactness, and combining on-off with volume control, a sub-miniature potentiometer with switch seems to be ideal. Taking a little more space, a variable capacitor (e.g. a 30pF trimmer) and a separate switch should give greater freedom from crackle over the years!

The process of adjusting the base bias and the reaction capacitors for optimum performance must be set about in a methodical fashion. It is well worth the seeming delay of assembling the entire circuit on a "bread board" (or should one say "biscuit block"?) before attempting to fit it into the eventual case. It takes only minutes to do so, and it is quick and easy to substitute various values of resistor or capacitor—with full-length wires and using tag-boards as anchorages—but tedious and wasteful to perform the same operation with trimmed and shaped component wires inside a tiny box.

The resistors shown are a good starting point, but individual transistors may give even better performance with slightly different values. The degree of thermal stabilisation is controlled by the shunting resistor R3; without it, the thermistor would "overcompensate". If, with the values shown, regeneration is stronger in a warm room than in the cold, R3 should be increased in value; if the converse, reduced. The thermistor—a Brimar CZ

10—has a resistance of about 15k $\Omega$  at room temperature; when colder the resistance is higher, and when warmer it is lower, thus altering the bias voltage. If R3 has to be less than half or more than double the value shown, R1 may also have to be altered correspondingly to maintain the same average value of bias.

When the bias is correct, regeneration is free from "ploppiness" and sensitivity is at a maximum. For sensitivity, the voltage is not critical, but for smoothness of control it is well worth spending a little time on preliminary checks.

The next requirement for practical regeneration is that it should be substantially uniform over the tunable range. This makes it possible to bring in all stations at the same setting of the gain control, near to the oscillation point.

Incidentally, one need have no fear of oscillation being a nuisance to neighbours; the very low power involved and the tiny size of the aerial limit the range of possible interference to a few feet.

It is usually enough to make regeneration equal on Light and Home, although local conditions may make a different arrangement preferable. For example, if Light—or Luxembourg—has a much weaker signal than Home, a greater sensitivity at the high-frequency end will give similar volume on each station without re-setting the control. With an SB 305 or MAT 101, uncompensated regeneration is stronger at the high frequency end, and this is reduced by the shunt resistor R2; if too high in value, Home will require a higher setting than Light or Luxembourg; if too low, the converse.

Depending on individual layout, it may be found that the regeneration coupling capacitor C2 may have to be larger or smaller than shown—due to stray feedback. This will be indicated by harsh control if it is too large, and inability to produce oscillation if too small. The thermistor should be mounted close to the transistor, so that they are warmed or cooled together. If there is a rapid change in temperature, the thermistor responds the

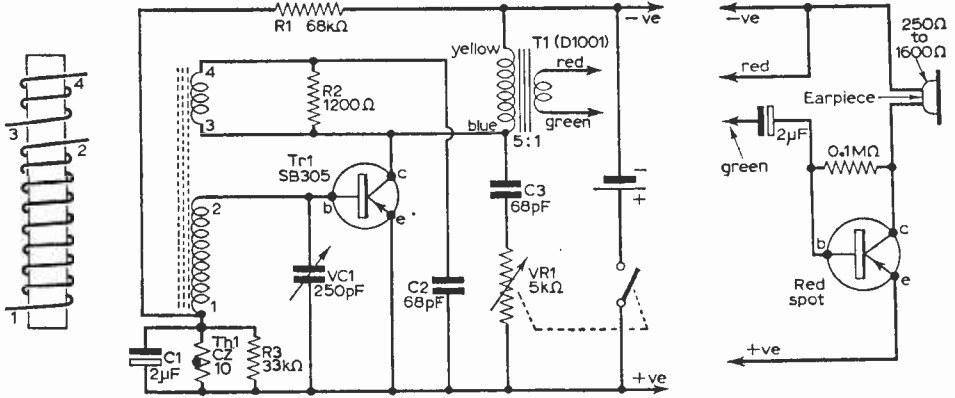


Fig. 1 (left): Windings 1-2=70-80t. 36s.w.g. enamelled wire; 3-4=25t. 36s.w.g. or 30t. 40s.w.g. depending on rod length. Fig. 2 (centre): Temperature-compensated regenerative receiver. With a good signal, it will drive a high-resistance magnetic earpiece, or it may be fed into an a.f. amplifier. Fig. 3 (right): Single-stage a.f. amplifier.

more quickly. This is most noticeable when soldering in trial components: radiant heat from the iron can knock the balance out for a full minute. Patience is particularly called for in making adjustments to resistors R1 and R3, which have metallic links with the thermistor, and it may take two or three minutes for thermistor and transistor to drop back to the general temperature of the set.

The aerial is in no way critical as to dimensions or the placing of its windings, other than that they must be in the relationship shown in Fig. 1. With the smallest aerial rod— $\frac{1}{8}$ in. x  $1\frac{1}{2}$ in.—the windings occupy the full length, in the form of a single layer, close wound, of enamelled wire.

The aerial winding consists of 80 turns of gauge 36, and the reaction of 30 turns of gauge 40. With a rod of between 2 and 3in. in length, about 70 and 25 turns, respectively, of gauge 36 are suitable. These cover a range of at least 200 to 500 metres with a 250pF tuning capacitor.

The a.f. requirements depend upon locality and the volume required. The basic unit will happily feed into any form of amplifier, whether with one "earthed" input terminal or with both terminals "live". For most needs, a single stage is ample; that shown in Fig. 3 adds only a transistor, one capacitor and one resistor to the basic circuit. Using an earpiece of 250 to 1600Ω, good quality and volume to spare can be obtained with less than half a milliamp of battery current.

Audio negative-feedback is provided by biasing the base through a high resistance from the collector, as shown. This is probably the simplest practical circuit for an amplifier, and gives an excellent performance.

In favoured localities, fair volume can be obtained from the basic circuit alone, with a 250 to 1600Ω earpiece across the transformer secondary. The consumption then is only about one fifth of a milliamp, and this naturally limits the undistorted power output.

For really generous reserve—giving a daylight signal which is clearly audible even in high wind, and at many miles from the station—a two stage

amplifier (Fig. 4) takes about one milliamp. A 250Ω earpiece takes a little more current and gives rather less volume than a 1600Ω.

The physical size of the finished set depends mostly on the components one can obtain (or make) for tuning, switching and reaction control. The writer's three models are: Mk I, occupying the popular black-and-white plastic case measuring 2in. x 3in. x  $\frac{1}{2}$ in. with  $\frac{1}{2}$ in. square tuner and trimmer reaction control; Mk II, literally in a matchbox, with a compression-trimmer for tuning and resistance reaction control; Mk III, in a plastic box as sold for storing watchmakers'

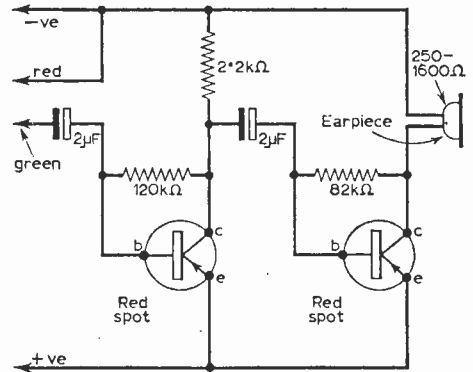
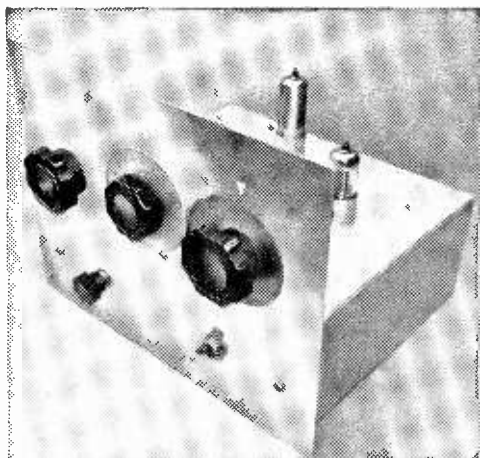


Fig. 4: Two-stage a.f. amplifier. Resistors between base and collector give negative-feedback and help to keep gain constant despite temperature variations.

materials, measuring  $1\frac{1}{2}$ in. x  $1\frac{1}{2}$ in. x  $\frac{1}{2}$ in. ( $\frac{1}{2}$ in. square tuner, "pared down", and hearing-aid volume-control-and-switch). The first is powered by single pencil cell, the second by a Mallory 625 and the third by a 675.

As an alternative to the variable resistor gain control VR1 shown in Fig. 2, the fixed capacitor C2 may be replaced by a 30pF variable, and both capacitor C3 and VR1 omitted.



# A Medium Wave and Short Wave Receiver

BY F. G. RAYER

THIS receiver is a 3-valver (plus rectifier) and covers approximately 19-60 metres, and 200-550 metres. It thus tunes the most interesting short wave bands, in addition to providing medium wave coverage. Bandspread tuning is fitted, and greatly eases operating on the SW bands. The whole receiver is quite compact, with a 7 x 8in. chassis and 7 x 9in. panel. The loudspeaker is not included, but is fitted in a separate cabinet, or to a baffle board.

Fig. 1 is the receiver circuit. Easily obtained miniature valves are used. The 6AM6, V1, is a high gain pentode. Regeneration is obtained by cathode taps on the coils, and is controlled by the screen grid potentiometer VR1. This is a very efficient and satisfactory method. VC1, of about 500pF. is the main tuning capacitor. VC2, of about 15pF, breaks up each tuning range into a number of small bands, and thus acts as the bandspreading capacitor. This simplifies tuning on the congested SW bands.

Two 6C4 valves are used as amplifier and output, with a 6X4 as full-wave rectifier. With this arrangement, a somewhat simplified smoothing circuit can be employed.

### Chassis and Panel

Four holes  $\frac{1}{4}$ in. in diameter are necessary for the valveholders, and these are in the positions shown in Fig. 2. A hole is drilled directly under the position to be occupied by VC1, for the lead to C1 and R1. Valveholders, tag-strips, and other items are fixed with 6BA bolts, and all holes are drilled before wiring begins. Valveholders have extra spacing between pins 1 and 7, and are arranged as shown in the under-chassis diagram.

The type of chassis listed can be used without a front runner, and the panel is then held to the side runners by short 4BA bolts through panel and side runner flanges. If a complete box type chassis is used, the two switches will secure the panel and chassis together, but bolts should also be used near the chassis corners, to add strength.

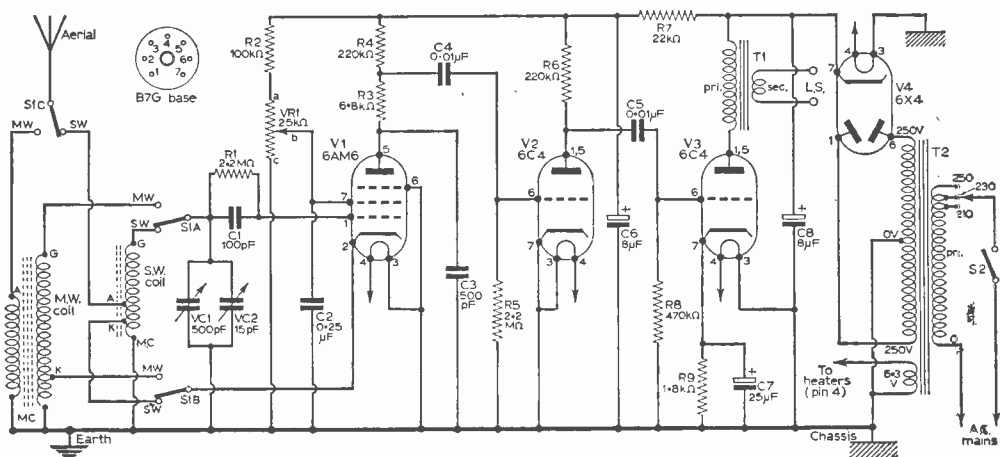


Fig. 1: The receiver circuit.

The panel has  $\frac{1}{4}$  in. holes for VR1, VC1 and VC2. VC1 may be of the type which is screwed to the panel, or it may have feet and be bolted to the chassis. The lead for C1 and R1, and VC2, is soldered to VC1 before mounting the capacitor. Though VC1 is given as 500pF, any capacity from roughly 365pF to 500pF is suitable.

VC2 is about 10pF to 15pF maximum capacity. Here, 15pF is shown, but if a 10pF, 12pF or simi-

6AM6 holder by the shortest possible leads. The lead from VC1 passes down through the chassis, to C1 and R1, and to tag 1 of the wavechange switch. All wiring should be reasonably short and direct, especially in the detector, wavechange switch and coil circuits. Connections should run approximately as in Fig. 3

Tag 7 of the 6AM6 holder is wired to tag B of VR1, Fig. 2. Tag A of VR1 is connected to R2, Fig. 3. Tag C of VR1 is wired to the chassis.

The ratio of the small output transformer T1 is not very critical, but best about 40:1 to 60:1 or so, as listed. The anode current is small, and a battery valve type transformer intended for currents of 10-12mA can be fitted, if to hand. A 2 to 3Ω speaker is required.

The total heater consumption is 1.2A, so a mains transformer (T2) with 6.3V 1½A heater secondary is satisfactory. HT consumption is under 20mA, so small transformers, as made for tuners preamplifiers, etc., are suitable. The h.t. secondary should be for full-wave rectification, and has 250/0/250V tags. If a 40mA, 60mA or other 250/0/250V transformer is to hand, it can be used, and if necessary it can be placed above the chassis.

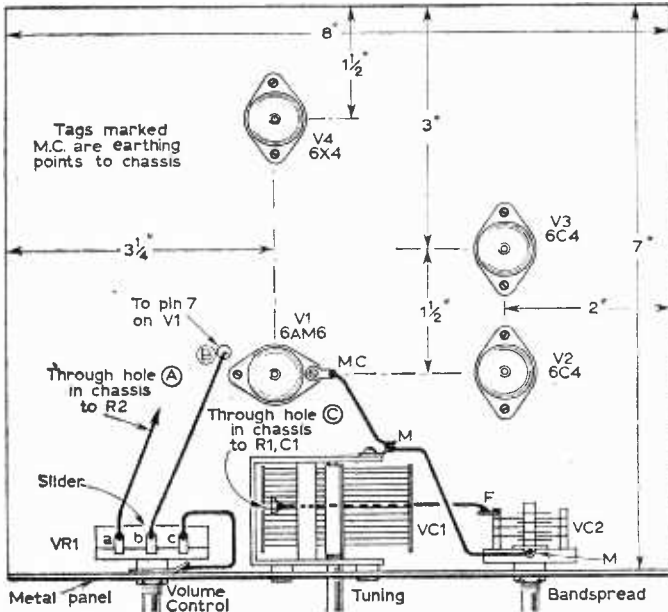


Fig. 2: Layout above the chassis.

**Wavechange Switch and Coils**

The wavechange switch has three poles. Pole 1 (Figs. 1, 3 and 4) is for the grid circuit, pole 2 is for cathode, and pole 3 is for aerial. The medium wave

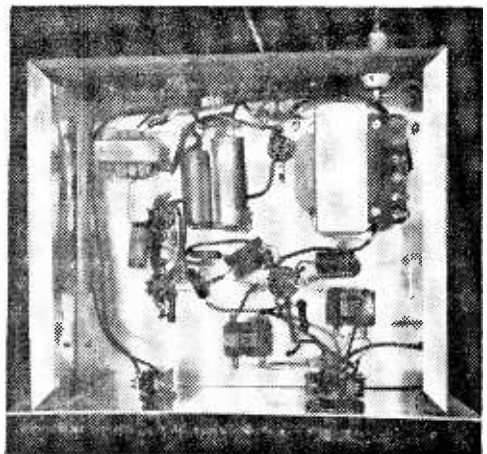
lar capacitor is to hand, this is equally satisfactory. The capacitors are connected in parallel with short leads, and earthed to a tag at the valveholder, as shown. The rear runner has speaker sockets, and an insulated aerial terminal, or sockets for aerial and earth. Earth is joined to the chassis. Mains leads pass through the rear runner, as in the underside diagram. A grommet should be fitted if the runner is metal.

**Under Chassis**

Wiring is shown in Fig. 3, coils and wavechange switch being left until last. All the points MC are 6BA tags securely bolted to the chassis. One strip with two insulated tags provides anchor points for the mains leads, connections passing to mains transformer primary and on/off switch. A similar strip anchors R7, C6 and C8. A strip with a single insulated tag provides a wiring point for R2, R4 and R6.

Heater connections, to tags 4 of each valveholder, are kept close against the chassis. With the 6C4 valves, pins 1 and 5 are both anode, so the most convenient tags are used in Fig. 3.

C1 and R1 should be connected to tag 1 of the



An underside view of the completed receiver.

Tags marked M.C. are earthing points to chassis

200/250V AC.

Aerial

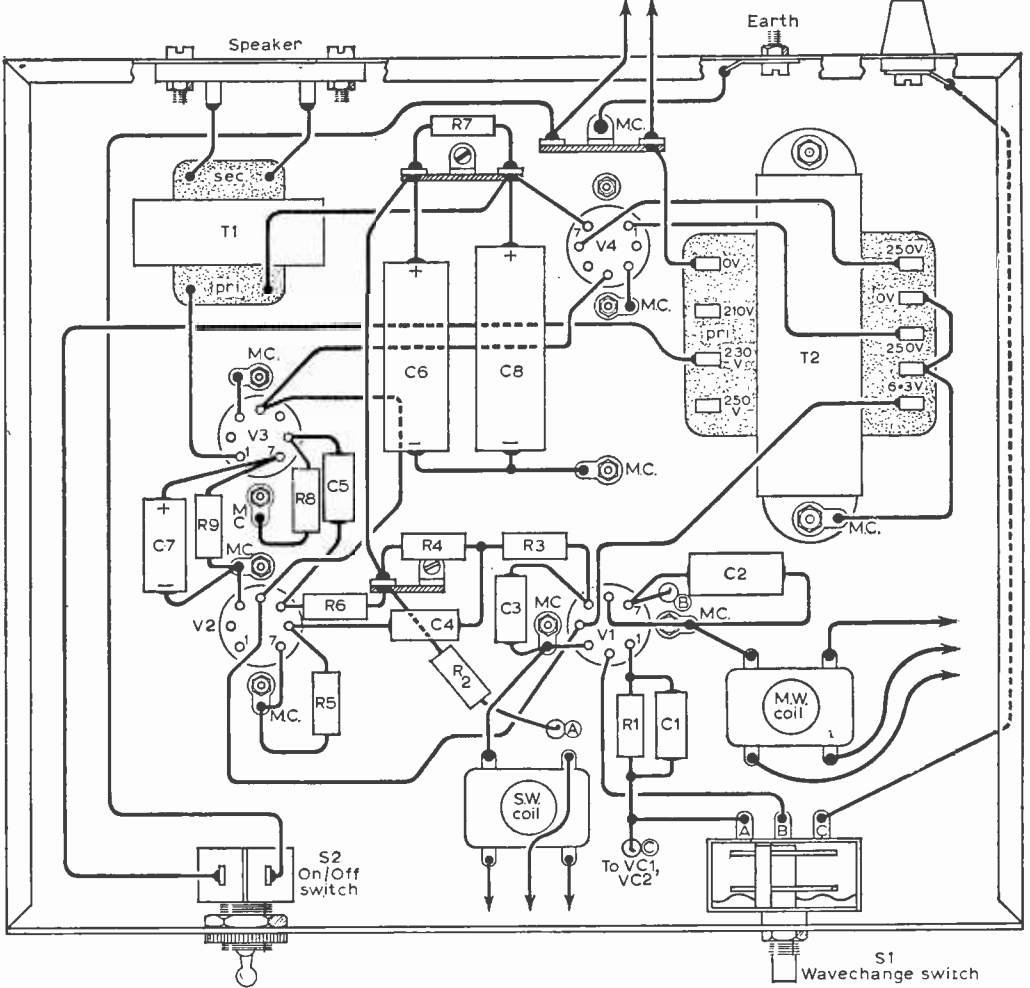


Fig. 3: The complete underchassis wiring diagram.

coil and s.w. coil are quite separate. The set may be wired up with the m.w. coil only, and tested, to avoid any confusion over coil connections. The s.w. coil can then be added afterwards.

Any dust cored or air cored m.w. coil, with aerial coupling winding, is satisfactory. The aerial coupling winding is connected from switch section 3 (aerial) to chassis. The grid end of the grid coil is taken to section 1 of the switch. A piece of 36s.w.g. silk covered or enamelled wire is soldered to the "earth" tag of the grid coil, and three turns are wound on top of the grid coil. These turns are in the same direction as the existing winding, so that they act as a continuation of the

grid coil. The junction of grid coil and extra turns is wired to section 2 of the switch. The end of the extra winding goes to chassis. Touches of wax or adhesive will hold the extra turns in place.

The s.w. coil is wound with 26s.w.g. enamelled wire, turns side by side on a 1/4 in. diameter former with dust core. Winding is begun at the earthed end, marked MC in Figs. 1 and 4. One turn is put on, and the cathode tap K is made. After one further turn, the aerial tapping A is made. Winding is then continued for 7 1/2 turns, so that the whole coil has 9 1/2 turns. The end of the coil goes to section 1 of the switch.

If a home-wound m.w. coil is wanted, this can

use 38s.w.g. silk covered wire, pile wound on a  $\frac{1}{2}$ in. diameter cored former. Ninety turns are wound from point G, and the tap K is made. A further three turns are then wound on in the same direction, the end going to chassis. Aerial coupling is 45 turns about  $\frac{1}{4}$ in. from the grid coil.

If the receiver is wanted for s.w. reception only the switch can be omitted, and the s.w. coil may be permanently wired in. It is also extremely easy to provide other bands. A 3-way 3-pole switch would allow long, medium and short waves to be tuned. The L.W. coil will have to be modified as described, about 5 extra turns being added.

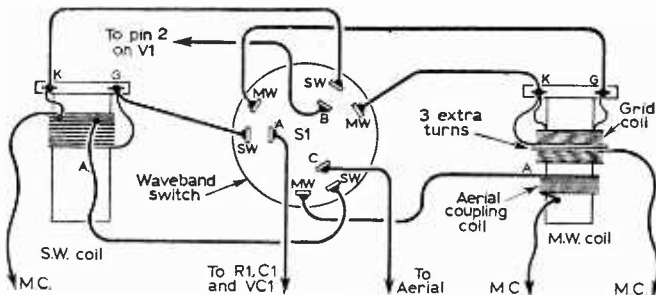


Fig. 4: Detailed wiring of the wavechange switch and coils.

### COMPONENTS LIST

#### Resistors:

R1	2.2M $\Omega$	R6	220k $\Omega$
R2	100k $\Omega$	R7	22k $\Omega$
R3	6.8k $\Omega$	R8	470k $\Omega$
R4	220k $\Omega$	R9	1.8k $\Omega$
R5	2.2M $\Omega$		
All $\pm 20\%$ , $\frac{1}{4}$ W carbon			
VR1	25k $\Omega$ lin. potentiometer		

#### Capacitors:

C1	100pF mica or ceramic
C2	0.25 $\mu$ F 150V
C3	500pF mica or ceramic
C4	0.01 $\mu$ F mica or ceramic
C5	0.01 $\mu$ F mica or ceramic
C6	8 $\mu$ F electrolytic 350V
C7	25 $\mu$ F electrolytic 25V
C8	8 $\mu$ F electrolytic 450V
VC1	500pF or similar air spaced variable
VC2	15pF or similar air spaced variable

#### Valves:

V1	6AM6	V3	6C4
V2	6C4	V4	6X4

#### Transformers:

T1	Output transformer: between 40 : 1 and 60 : 1 ratio
T2	Mains transformer: Secondaries 250-0-250V; 6.3V, 1.5A

#### Miscellaneous:

S1 3-pole, 2-way rotary switch  
 S2 Mains on/off toggle switch  
 Medium wave and short wave coils (see text).  
 4 B7G valveholders. Twin loudspeaker socket strip. Aerial socket strip or terminal and insulator. Tag strips, two with 2 insulated tags and one with 1 insulated tag. "Universal Chassis" parts: plate 9in. x 7in., plate 8in. x 7in., two sides 7in. x 3in., back runner 8in. x 3in. side or 8in. x 3in. paxolin, plywood or hardboard (Home Radio, Mitcham). Knobs, connecting wire, etc.

### Regeneration

For long distance reception of weak stations, proper regeneration is essential. When VR1 is rotated, a point should be reached where oscillation is heard when tuning through a station. VR1 should then be turned back very slightly, so that the receiver is not quite oscillating. In these conditions, sensitivity is very high. Any ordinary coils are capable of good results in this type of circuit. The winding from G to MC must have turns all in the same direction, and the tapping K should be as near the earthed end of the coil as possible, provided oscillation can be obtained. The extra turns added in Fig. 4 are only necessary because it is generally difficult to tap a ready-made coil.

### Operating Details

A reasonably large permanent magnet speaker, fitted in a cabinet will be most satisfactory. The transformer ratio mentioned is for 2/3 $\Omega$  speakers.

Reception over great distances is possible with a short, indoor aerial, though an efficient aerial system will naturally increase volume. If the aerial is extremely short (under about 3ft.) it can be taken directly to the fixed plates of VC1. If the aerial is long, a 50pF pre-set capacitor should be included between the aerial lead and receiver aerial terminal.

For strong m.w. signals, VR1 will act as a volume control. But for weaker signals, this control must be adjusted as explained. On the s.w. band, careful adjustment of VR1 is necessary, or weak signals will not be heard.

Coverage is modified to some extent by the positions of the coil cores. A coverage of about 200 500m on m.w., and about 19-60m on s.w., will be satisfactory.

VC1 and VC2 are best fitted with fairly large knobs, with dials. (This type is available from Bulgin, Eddystone, and other makers.) On medium waves, VC2 may be used for fine tuning. On short waves, the full 180 degree rotation of VC2 covers a narrow segment of frequencies. The positions of 19, 20, 25, 31, 40m, and other bands can be noted for VC1, and each band is then tuned with VC2. For best long distance reception, the band used will depend on the time of day, season, and other factors, in the usual manner.



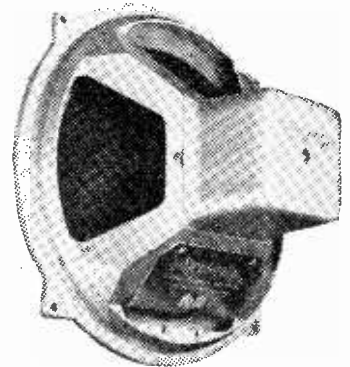




# Stentorian

## MODEL H.F. 1016 'MAJOR'

This unit makes use of the high flux density available in the magnet system of the previous H.F.1016 unit. A curved diaphragm is used with a rigid centre section coupled to the voice coil. The rigid coupling and the design of the cone termination give a balanced response over the whole audio range. The unit is specially suitable for use in the smaller type of enclosure having a volume of approximately 1½ cubic feet.



**Specification:**

Chassis—die cast aluminium  
 Cone—graded pulp cambric surround; Cone dia.—10 ins., Pole dia.—1 in.; Flux density—16,000 gauss; Total flux—64,000 maxwells; Impedance—15 ohms.

**Price: £9.8.6 (inc. tax)**

Type	Flux Density	Price	Type	Flux Density	Price
8" H.F.816*	16,000 gauss	£6.6.0	T.816	16,000 gauss	£5.19.3
8" H.F.812*	12,000 gauss	£3.16.6	T.12 tweeter	16,000 gauss	£13.17.9
8" H.F.810	10,000 gauss	£2.17.0	T.10 tweeter	14,000 gauss	£4.12.9
6" H.F.610	10,000 gauss	£2.7.3 Steel £2.9.3 diecast	T.359 tweeter	9,000 gauss	£1.12.3

\*These two speakers incorporate a universal impedance speech coil.

**WHITELEY ELECTRICAL RADIO CO. LTD. MANSFIELD, NOTTS.**

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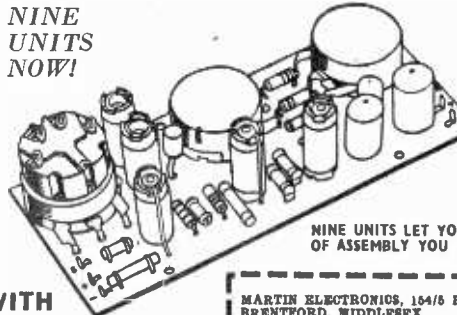
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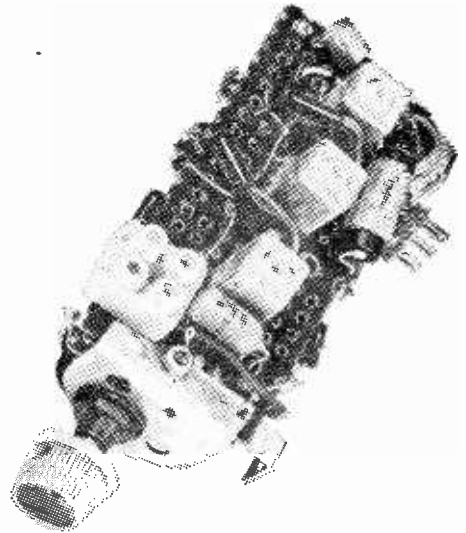
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# Transistor Tuner/Converter

## 1, 2 or 5 Transistors Optional i.f. Strip Plug-in Coils

BY F. NEVILLE HART

CONTINUED FROM PAGE 369 OF THE AUGUST ISSUE



The finished i.f. strip ready for mounting to the main tuner assembly.

THIS month the construction of the i.f. strip is described. This is made on a strip of paxolin screwed to double tag strip (18 tags). This measures 4in. by 1½in. The tag strip can be obtained at many dealers. On to this is screwed a blank Denco B9A coil former similar to those used for the coils. This forms the plug to fit the output valve holder on the tuner section, and is cut in half down to the pin rim and drilled for fixing to

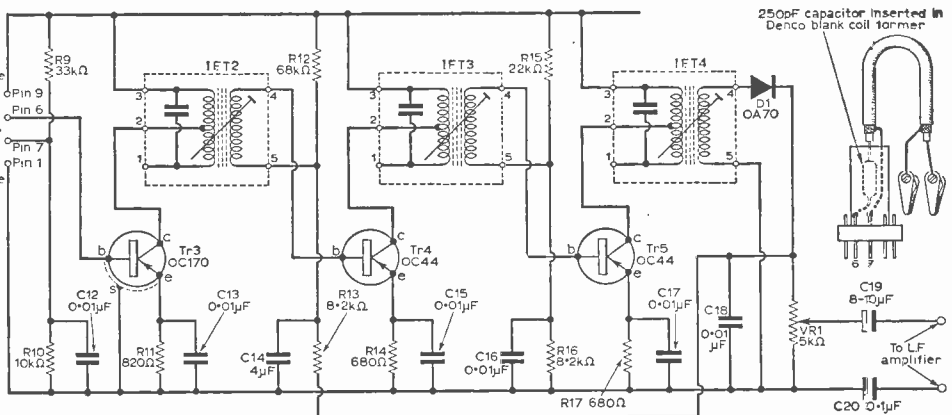


Fig. 4 (pictorial inset): The modified coil former for an output plug to the two-transistor tuner.

Fig. 5: The circuit of the i.f. strip.

the strip. The i.f. strip can be plugged into the tuner output socket at will, it only being necessary to slip the volume control through the hole on the front panel with the usual nut and knob.

In Denco's original circuit for this, three OC44 transistors are specified but the price of OC170's are much reduced now, and it was found that there is a great increase in amplification if one of these is used in the first i.f. position.

Cut the paxolin to the same size as the tag strip, making three square holes just a fraction smaller than the i.f. cans, i.e. 1/16in. Drill holes, as shown in Fig. 6, for leads from the transistors.

These will lie on the reverse side to the capacitors and resistors.

Cut a bracket out of aluminium to hold the volume control so that the knob will be at right-angles to the i.f. strip and coincide with the hole for it in the front panel, at the same time ensuring that the Denco blank plug pins fall into the right position to plug into the output valveholder.

Drill the tag strip metal support to take this bracket. Mount the i.f. cans as follows: IFT2—IFT3—IFT4, this last being nearest the volume control.

Wire up in the order as before with positive

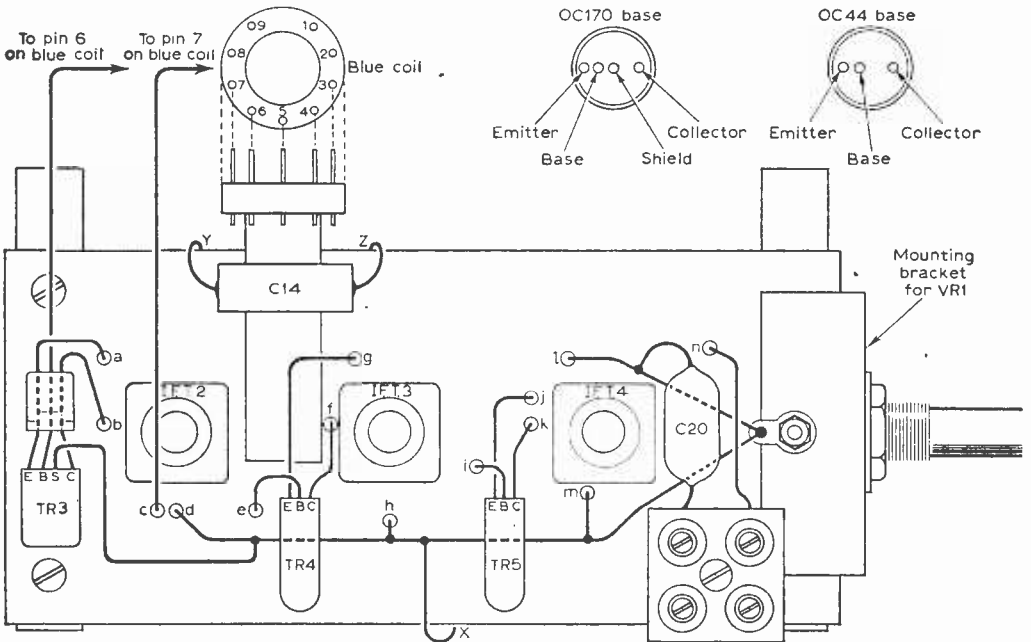


Fig. 6: The component layout on the top-side of the "chassis".

leads, negative leads, resistors, capacitors, i.f. cans and, finally, transistors. Referring to Fig. 7, on the reverse side will be located the three transistors, the 4μF capacitor and the 0.1μF capacitor.

Also optional, a two-way plastic connector for the output leads to the audio amplifier it is proposed to use. On this side will be bolted the blank former as described. This connects the battery

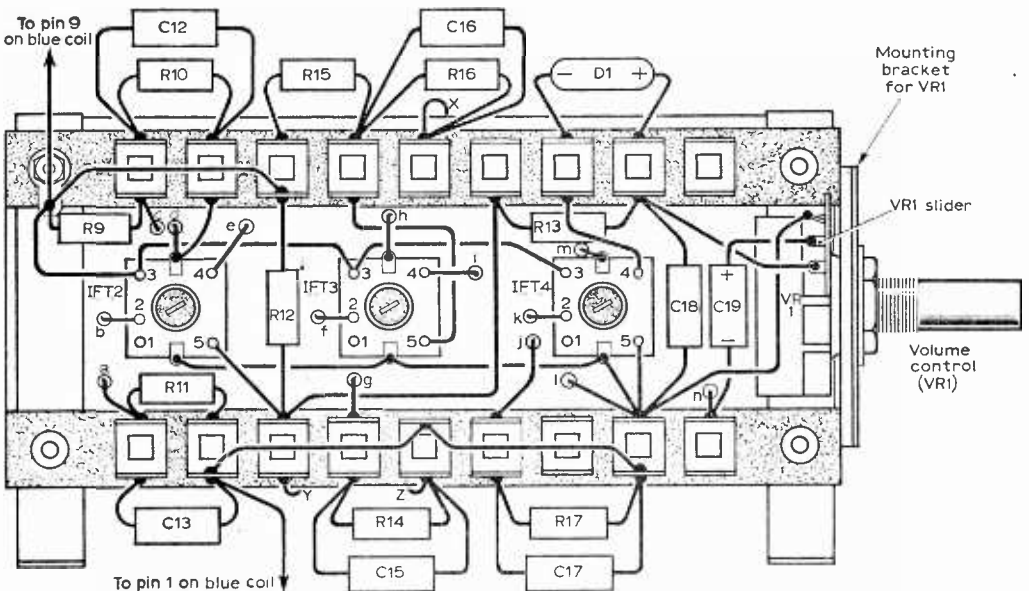


Fig. 7: The underside view showing wiring.

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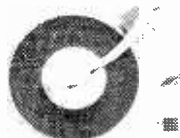
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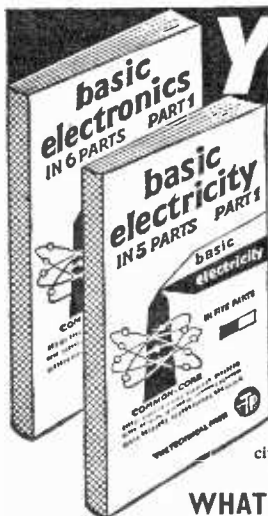
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C16	0.01 $\mu$ F mica
C17	0.01 $\mu$ F mica
C18	0.01 $\mu$ F mica
C19	8 $\mu$ F 15V electrolytic
C20	0.1 $\mu$ F paper

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Tr4	OC44
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**Diode:**

D1 OA70

**Transformers:**

IFT2	Denco Maxi-Q Type IFT16
IFT3	Denco Maxi-Q Type IFT16
IFT4	Denco Maxi-Q Type IFT17

**Miscellaneous:**

One blank Denco 9-pin coil former; Paxolin ( $4'' \times 1\frac{3}{4}''$ ); Double 18-way tag strip  $4''$  long on  $2''$  metal brackets; two miniature clips or plugs for output.

Alignment with a signal generator, on 1.6Mc/s should start with IFT4 and work back, and should be done through a 1k $\Omega$  resistor. If the generator has no incorporate series capacitor, one should be used. Usually, however, it is only necessary to lay the generator output lead near the collector lead of the IFT being aligned, for sufficient note to be heard.

If it is required to try the complete unit as the front portion of a double superhet into an existing radio, the output would be taken from pins 4 and 5 of IFT4, disconnecting the diode and thereby the volume control.

**Final Notes**

When alignment of coils is satisfactorily completed, it is as well to put a drop of Durafix on the screws of the coil slugs, as it is found that if the unit is shaken about much, such as in a car, at the end of the journey they have screwed themselves down to the bottom! Should it ever be desired to alter them again, brush them with a little acetone solution which will melt the Durafix.

Since the white coils are much alike, it is a good plan to mark each with small spots of paint or the appropriate figures of the range. Also a blob on one side of each trimmer top will be of some assistance in alignment.

**Performance**

The tuner section feeding into a radio, is perhaps noisier than both sections into an audio amplifier. The latter arrangement is more accurate, being independent of the tuning of some

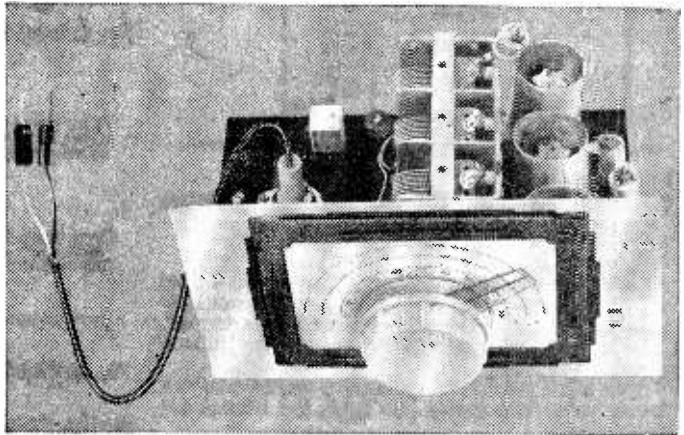
leads and the first transistor to the tuning unit.

**Use and Alignment of I.F. Strip**

If a signal generator is available, after plugging unit into place and fixing up volume control and connecting to an audio amplifier, align the cores of all IFT's to 1.6Mc/s. If the tuner has been used on its own do not forget to realign IFT1 on the main baseplate. If the latter was working on a frequency other than 1.6Mc/s the aerial and r.f. coils and possibly the mixer coil of all ranges, particularly 3 and 4, will have to be realigned. The lower the frequency the greater the difference caused by a change in i.f. between mixer and signal frequency.

If no signal generator is available and the first part has been aligned to match a radio, it will be easier to line up the i.f. strip to match the IFT on the tuner unit, since little adjustment will be needed to the tuning coils. As these will have been aligned already, a signal will be probably found on which to adjust the i.f. strip.

other radio. But the tuner section, when used in the double superhet manner, is so selective and powerful, that it is hard to say that, apart from the quieter background, the i.f. strip into audio amplifier is much more sensitive. However, as a result of making this unit, the writer's valves have been finally banished to the junk box! ■



The tuner, which was described in last month's issue.

# MODIFICATIONS TO THE VOICE-OPERATED Baby ALARM

By J. L. Moughton

IN its present form, the "Voice-operated Baby Alarm", featured in the July issue of P.W., is unsuitable for connection to certain TV receivers such as the Murphy V134C and some Ultra models. In these models the neutral side of the mains supply is not connected to the TV chassis.

In the Murphy model a centre-tapped mains transformer is used (Fig. 1) the tap being connected to chassis and the mains connections being disposed symmetrically about this on each side. Thus, whichever way round the mains plug is inserted, the chassis is always live to the extent of about

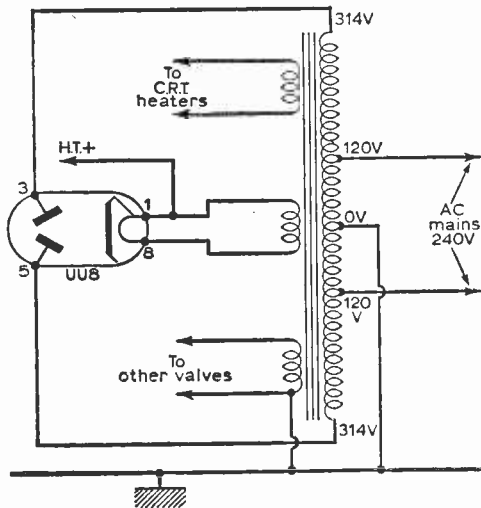


Fig. 1: The power pack of the Murphy V134C somewhat simplified.

120V. The winding continues beyond the mains connections on each side to form an auto-transformer from which a full-wave h.t. supply is derived. The heaters are connected in parallel to isolated secondary windings.

The Ultra models incorporate a rather complex voltage-doubling system and again the heaters are in parallel.

In these and in similar cases, it would be necessary to use a mains transformer with isolated h.t. and heater secondaries or else it might be possible to run the alarm off the TV power-pack, if the heaters were parallel connected.

In some receivers, the volume control is at a d.c. potential above that of the chassis, e.g. some Ferranti models. Here it would be necessary to isolate the output from the alarm as shown in Fig. 2.

A few models (e.g. Ekco T164) have a different kind of volume control—a variable h.t. potential divider feeding the cathode of a sound i.f. valve; like a vision contrast control. In such sets the output of the detector is via the noise limiter and a capacitor to the grid of the sound output valve. A suitable circuit is shown in Fig. 3.

While on the subject of volume controls it might be mentioned that if the output of the alarm is too great and overloads the sound output valve, it can be reduced by substituting a 1MΩ preset potentiometer for R9, the slider being taken to RLA1.

If the television set and/or alarm are fed from separate reversible two-pin plugs, it is possible for the chassis of one to be connected to mains neutral and that of the other to mains live. Since the two chassis are connected together, one can either use the circuit of Fig. 2 with a 1,000V d.c. capacitor

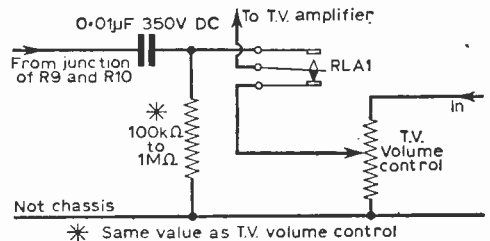


Fig. 2: Suitable circuitry for a set with a volume control above chassis potential.

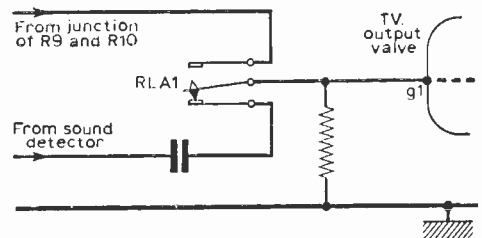


Fig. 3: Circuit for set with unconventional volume control

in the signal lead and a similar one in the earth lead and fuses in the mains leads to the alarm, or better still, connect both alarm and receiver correctly to the same two pin plug.

Since it is possible to have the chassis of the alarm at mains live potential it is also advisable to include a 0.01µF 1,000V d.c. capacitor in each microphone lead.

Finally it is suggested that the receiver circuit diagram be obtained before constructing the alarm, so that the above points can be checked.



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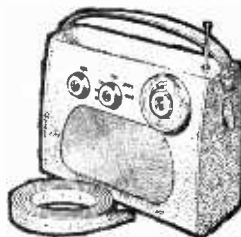
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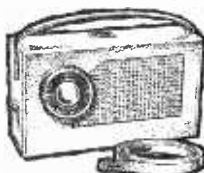


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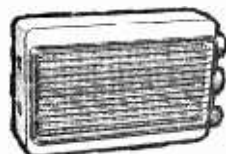
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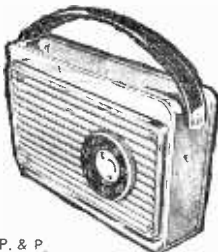


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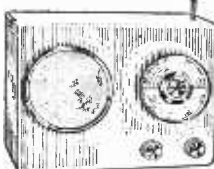
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UF/H5	5-ELEMENT, HEAD ONLY with CLAMP	8-25	19-5	36/6
UF/H7	7-ELEMENT, HEAD ONLY with CLAMP	10-5	24-5	41/-
UF/H10	10-ELEMENT, HEAD ONLY with CLAMP	12-5	26-0	47/-
UF/H12	12-ELEMENT, HEAD ONLY with CLAMP	13-5	28-0	51/-
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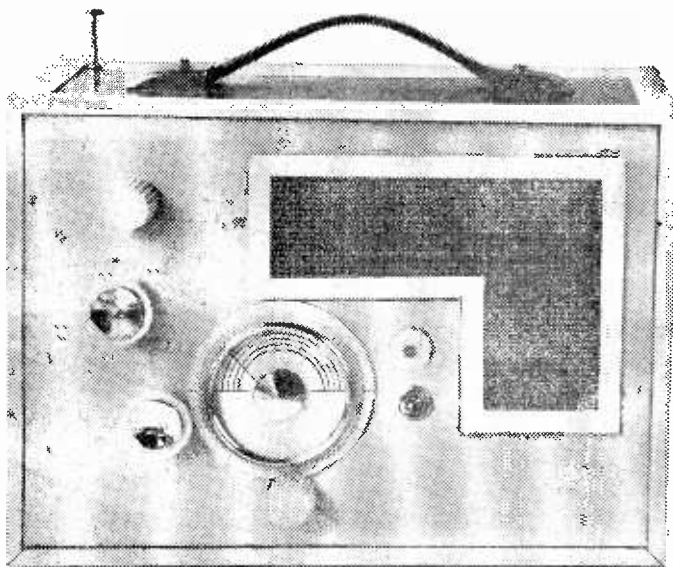
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By L. R. Repage

CONTINUED FROM  
PAGE 369 OF THE  
AUGUST ISSUE



## The CHELMER 4

**T**HE frame aerial has been made in the form shown to permit quick modifications to the windings during experimental work.

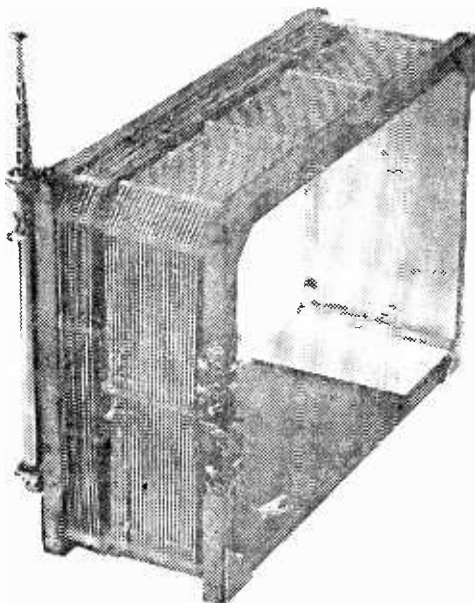
The windings have been made to match the Osmor oscillator coils, and as the wire used may differ in gauge the constructor will also have to do a little experimenting. As a basis, however, the medium wave winding has approximately 21 turns, and these should be spaced, not too widely, by use of the perspex strip spacers. These are quite easily cut out, but the grooving is difficult unless a suitable tool is made up.

The author has a Litz-wire winding, but care is required as regards soldering this wire, each strand having to be carefully cleaned before solder is applied.

The photograph shows the completed frame aerial unit. Formica is a light and strong material, and the two outside surrounds of  $\frac{1}{8}$  in. square strip-wood allow the windings to be recessed and protected from damage during experiments. When this frame is inserted in the cabinet, the frame aeriels are, of course, completely enclosed and hidden.

The top, bottom and end pieces of Formica can be dovetailed, and this is worth while for a good job. Evo-stik contact adhesive is the adhesive to use. Make certain that the framework is truly square, using a small set square to check. When this is ascertained the small Formica angle pieces can be fixed on.

The perspex spacer strips can then be glued as



*The finished frame aerial, ready to be connected to the rest of the receiver.*

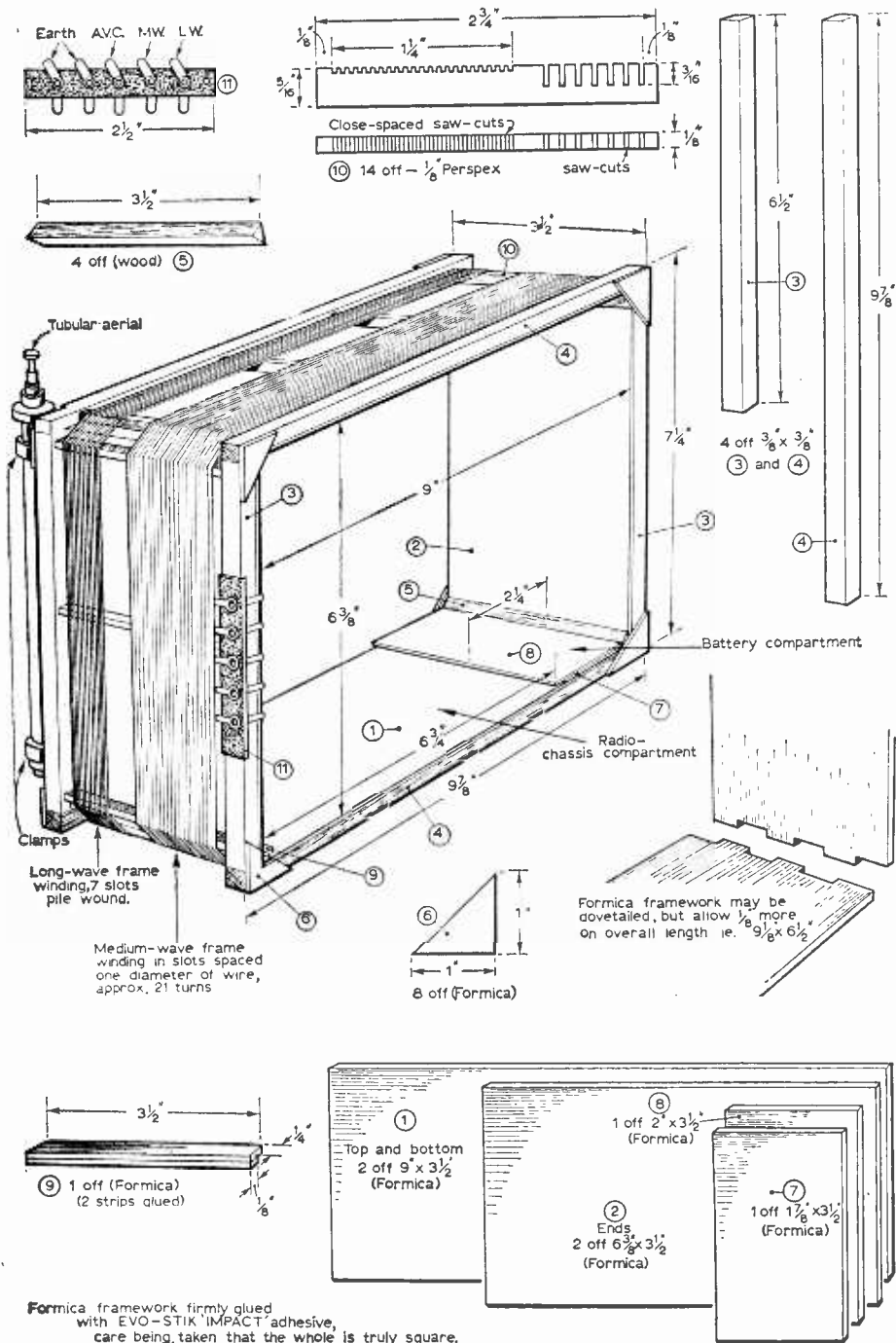


Fig. 6: The frame aerial. Component parts and assembly details of the aerial.

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shown, making sure the eight end ones are close enough to the ends to avoid wire turns touching the square ends of the box.

The long wave winding is pile wound in the slots arranged. The number of turns is approximately 25 in each slot, making a total of 175 approximately, but the reader should experiment for best results. Frame aerials are, of course, directional, and should be rotated until the best results are obtained.

All four ends of the frame windings are soldered to the tag board (11). The two earths "E" are for convenience (one would do), and go to the chassis via C2. It is best to make rough experiments with the frame windings outside the set by short temporary wires.

It is a good plan to drill a number of holes across the end formica panel, to allow several points for the wire of the frame aerial to go

through. These should be approximately in line with the tags on the small tag-board. Plenty of holes are better than one or two, and allows a free choice when winding the frame without having to delay work for drilling.

**The Cabinet—Fig. 7**

The drawing, which is an exploded view, is self explanatory, but there are one or two points of construction worth special mention.

The material chosen for strength, as well as thinness was Formica. It is cut quite easily with a fret-saw, and the material is available in a wide range of colours. And it is easily cleaned.

To give added stiffness, the bottom, was formed from two thicknesses stuck together. Similarly, the top (as lifting with handle fitted will take the full weight) was strengthened by three wood strips. Top, bottom and end pieces can be dove-

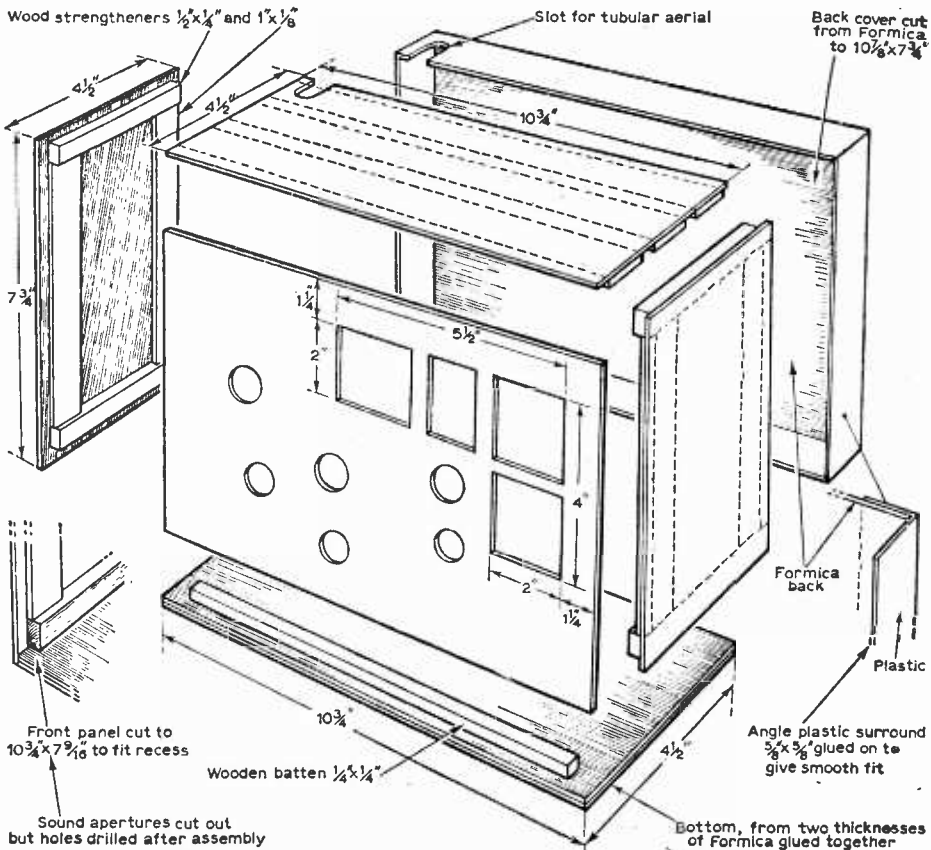


Fig. 7: An exploded view of the Chelmer 4 cabinet, giving dimensions.

tailed, if extra strength and neatness, is desired. Dovetailing does, indeed, help in the assembling into box-form. Evo-stik should be used as adhesive.

The front wood strips on end pieces and top, are slightly set back from the front edge, and with the bottom batten ( $\frac{1}{4}$ in.) also set back, form a slight recess for the front panel to fit into. This, in effect, ensures that the whole cabinet is truly squared up when finally fixed.

However this front panel should be merely inserted for the moment. With all the spindles free of knobs, push the chassis along its slide, or grooves until the spindles *touch* the inside of the panel. If the spindles have previously been spotted with white or black drawing ink, they will clearly leave their marks. This gives the exact centres.

The panel can then be lifted out, the various diameters described by a compass, and then drilled out. The potentiometer and toggle switch positions may have to be measured.

If the back panel is made to fit a similar recess, the plastic surround can be fixed to it when the

back is on, and allows a very snugly fitting back. A small slot will have to be cut in the top plastic surround afterwards to allow clearance for the tubular aerial fixed to the set.

The sound aperture holes can be cut to any shape one fancies, and covered with the speaker fabric as a final finish.

Another very effective but simple method of finding the exact centres for drilling the holes in the front panel is as follows.

Obtain a sheet of ordinary tracing paper as used by draughtsmen. Cut slightly larger than the cabinet size (now in box form) and stick over the opening. If the chassis is now pushed into its grooves until spindles touch the paper, a very accurate "tracing" can be marked out, including toggle and pot button.

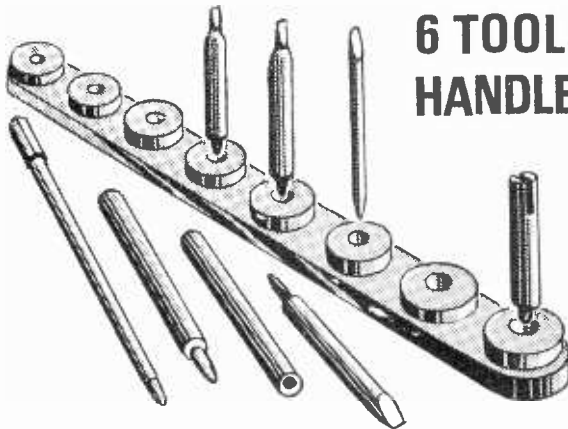
Be careful that corners of the box form (inside distance) are marked, and that the "tracing" is used the correct way round for marking out!

A lifting strap can be fixed, provided this has strong brackets (preferably non-metallic) to the central wood strip which will hold this firmly. ■

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- Operates from a 9V battery (3/9 ext)
- Available in two colours—cream/red or cream/blue.
- A real "FAMILY FAVOURITE".
- Ideal for Teenagers.
- For use ANYWHERE.
- Hours of amusement for the younger members of the family.
- Assemble one of these amazing Players in less than 30 minutes; supplied in 3 complete units with only 10 connections to make. Approximate dimensions 9x8 1/2 x 4 1/2 in.

- A** Motor and pick-up deck.....(2/6 P. & P.) **39/6** ONLY **79/6**
- B** Ready-built 4-transistor amplifier, complete with volume control and L'speaker (2/- P. & P.) **35/-** the complete Pkgs. (plus 5/- P. & P.) or any unit sold separately.
- C** Portable two-tone case with handle, and expanded metal fret.....(2/- P. & P.) **5/-**

## Loudspeaker Bargains Still Available

Enormous purchases of brand New and Guaranteed Pleas-y loud-speakers enable us to offer these units at THE LOWEST PRICES EVER! Don't miss this golden opportunity to obtain a first-grade permanent-magnet LOUDSPEAKER off the production line at LESS THAN THE MANUFACTURER'S COST! Read carefully the prepared list below and choose just the right speaker for the job—COMPARE THE PRICES ANYWHERE! SELLING FAST—STOCKS CHANGING RAPIDLY.

**SCHEDULE OF LOUDSPEAKERS AVAILABLE**

Diameter in inches	Gauss in lines	Imped. in ohms	Price	Diameter in inches	Gauss in lines	Imped. in ohms	Price	Diameter in inches	Gauss in lines	Imped. in ohms	Price	Diameter in inches	Gauss in lines	Imped. in ohms	Price	
2 1/2	7000	8 1/2	8/6	3 1/2	9500	3	10/8	4	Twtr.	10000	3	1 1/8	5	9500	5	10/8
2 1/2	7000	35	8/6	3 1/2	9500	8	10/8	4	Twtr.	9500	15	1 1/8	5	9000	5	10/8
2 1/2	7000	50	8/6	3 1/2	7000	35	8/6	5	6000	3	8/6	5	9500	15	12/8	
2 1/2	7000	80	8/6	3 1/2	9500	50	10/8	5	6000	5	8/6	5	8500	25	10/8	
3	8500	3	10/8	4	7000	25	11/8	5	7000	3	8/6	5	9500	35	11/8	
3	9500	5	8/6	4	8000	35	10/8	5	7000	5	8/6	6 1/2	7000	3	11/8	
3	7000	5	9/6	4	7000	35	11/8	5	7500	3	9/6					
3	7000	35	9/6	4	9500	35	11/8	5	8500	3	9/6					
Elliptical				Elliptical				Elliptical				Elliptical				
Size in inches	Gauss in lines	Imped. in ohms	Price	Size in inches	Gauss in lines	Imped. in ohms	Price	Size in inches	Gauss in lines	Imped. in ohms	Price	Size in inches	Gauss in lines	Imped. in ohms	Price	
5 x 3	9500	3	9/6	7 x 3 1/2	9500	3	10/8	8 x 2 1/2	7000	5	9/6	8 x 2 1/2	7000	5	9/6	
6 x 4	8000	3	8/6	7 x 4	9500	3	11/8	8 x 2 1/2	8500	5	10/8	8 x 2 1/2	8500	5	9/6	
6 x 4	7000	3	9/6	7 x 4	10000	3	12/8	8 x 2 1/2	9500	5	10/8	8 x 2 1/2	9500	5	10/8	
6 x 4	8500	3	9/6	7 x 4	10000	3	13/8	8 x 2 1/2	9500	5	10/8	8 x 2 1/2	9500	5	10/8	
6 x 4	9500	3	10/8	7 x 4	9500	35	12/8	8 x 5	8500	3	11/8					
6 x 4	8500	35	12/8	8 x 2 1/2	6000	3	8/6									
7 x 3 1/2	7000	3	9/6													

ALLOW 2/- each Speaker for postage and packing, and please specify the exact requirements—the nearest available will be sent.

## BOTH SETS STILL AVAILABLE HERE!

Ask for a demonstration in the shop.

### "CAPRI"

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Super-selective!  
Superb Speaker!

NOW ONLY **79/6**

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Pocket "Superhet"  
MW and Drotwisch LW  
Size 4 1/2 x 2 1/2 x 1 1/2 in.  
Constructional data 1/9 Post free.



The best and easiest transistor built-yourself sets available.

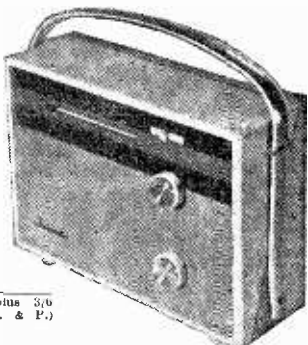
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6 First Grade MULLARD Transistors  
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TO ORDER BEST-SELLING STOCK ONLY **£7.19.6** (3/6 P. & Pkg.)  
PORTABLE and CAR RADIO 2 WAVEBAND SUPERHET  
Construction manual 2/0 Post Free.



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TRANSISTORS: OC45 4/6, FXA101 3/9, AF115 4/6. Sub min. Germanium diode 1/3, M1 diode 6d. each. Silicon diodes, 200 p.i.v., 200 mA 1/- each, 500 p.i.v., 330 mA, 9/6 each.

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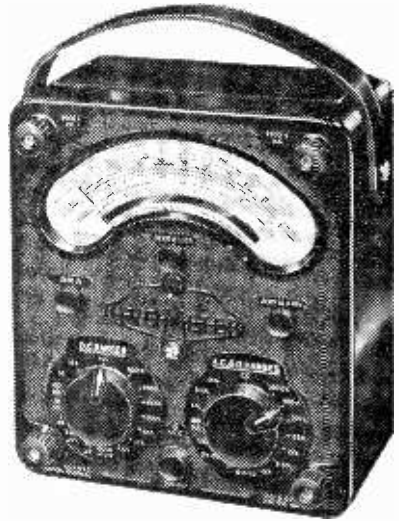
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Transistorised Portable Receiver made to the highest professional standard. Comprises Mullard Transplus Crystal Diode, 350 milliwatt output to 4in. speaker.—I.F. frequency 470 Kc/s.—fully tunable over medium and long wavebands. Two-tone plastic cabinet with handle—size 7 x 10 x 3 1/2 in. fitted socket for car aerial. Complete with full instructions.



**MAY BE BUILT FOR £5.19.6** All parts sold separately Battery 3/9 extra.  
**P. & P. 4/6 extra.** (Circuit diagram 2/6; free if all parts bought.)  
**Also De Luxe Model** with superior PVC covered wood cabinet and full view tuning dial.  
**ONLY \$1 EXTRA** All parts sold separately Battery 3/9 extra. P. & P. 4/6

#### "THE SPRITE"

6 transistor mini pocket receiver. Full L and M. waveband coverage. Size only 4 x 2 1/2 x 1 in. In sub assemblies. 3in. speaker. **CAN BE BUILT FOR 79/6** phone and battery **12/6 extra**  
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P. & P. 1/- extra per reel. 4 reels and over Post Free.

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Ready made as illustrated—complete with personal earpiece, telescopic aerial, battery and carrying case! Wonderful value and performance—full medium waveband coverage—built in 2 1/2in. speaker gives full tone reproduction. Works on single PP3 9 v. battery. In attractive plastic case—size only 4 x 2 1/2 x 1 in. All accessories included in the price. Not a toy.

**WIRECOMP'S PRICE COMPLETE 42/- POST FREE**

Also 6 transistor model. Full medium waveband cover. Fully built complete with earpiece, battery and leather 69/6 Post Free carrying case.

### IT'S FABULOUS !!

#### THE TRANSISTORGRAM



A portable battery operated fully transistorised Record Player—for the music of your choice—any time any place! Made by famous British manufacturer, fully guaranteed. Size only 6 1/2 x 12 x 10 1/2 in. weight 10 lbs. Operates on 6 U2 torch batteries. 4 speeds—16 2/3, 33 1/3, 45 and 78 r.p.m. Goldring Sygnet record player unit with light weight pick-up fitted with CM-60 turn over ceramic cartridge. Output 500 mw to 5 in. ceramic magnet loudspeaker fitted into lid for maximum sound distribution. Cabinet constructed of wood, covered in two tone (pale blue/gray) leather cloth. Fitted carrying handle and strong lid catches. High quality amplifier with tone and vol. controls gives excellent reproduction at all speeds. Plays 7, 10 and 12 in. records. Today's value 12 Gns.

**WIRECOMP'S £6.19.6 PRICE**

Carr. & Ins. 7/6  
 New, boxed and guaranteed—exc. batts.

#### Transistor TELEPHONE AMPLIFIER

A must for business or pleasure. This neat little transistorised amplifier powerfully amplifies the incoming call and at last leaves you with both hands free while continuing your conversation normally. The pick-up is suction fixed to phone. Battery-operated at negligible cost. Fitted on switch for private conversation. Size 4 1/2 x 3 x 1 1/2 in. Complete with battery.

**WIRECOMP'S PRICE 69/6 P. & P. 2/6.**

# T rade N ews

## Transformer Design Kits

**BELCLERE** Transformers announce their Transformer Design Kits, which enable designers to make their own prototypes. Nineteen sizes (in three lamination materials) are available as kits of parts. From these, transformer designers can produce their own prototype windings. Each kit is packed separately, and includes a bobbin, sufficient laminations and, where applicable, a mounting clamp.

Belclere will produce small or large quantities developed on these materials, or will design transformers and similar windings on receipt of circuit details. Delivery can normally be effected from stock. *The Belclere Company Limited, 385/387 Cowley Road, Oxford, England.*

## Heathkit Guitar P.A. Amplifier

**THE** Heathkit Public Address/Guitar Amplifier, Model PA1, is a multi-purpose, high power amplifier for general public address work and is particularly suitable for vocal and instrumental groups. This amplifier, say the makers, is designed so that a complete novice can easily build it.

The features include 50W output, two heavy duty 12in. Goodmans speakers, "Magic-eye" volume indicator, variable tremolo speed and depth controls and an elegant cabinet covered with black and gold vinair material.

The amplifier is split into two separate sections: one incorporates two inputs, volume control and simple but effective tone control to produce bass boost; the other incorporates two inputs, volume control and a more complex tone control circuit consisting of separate bass and treble controls, which make possible an infinitely variable selection of tonal effects. Also added is a tremolo oscillator which can be switched in or out as required.

This piece of apparatus is easily transported, being fitted with two carrying handles, and is available in kit form at £54 15s. or assembled at £74. *Daystrom Ltd., Gloucester, England.*

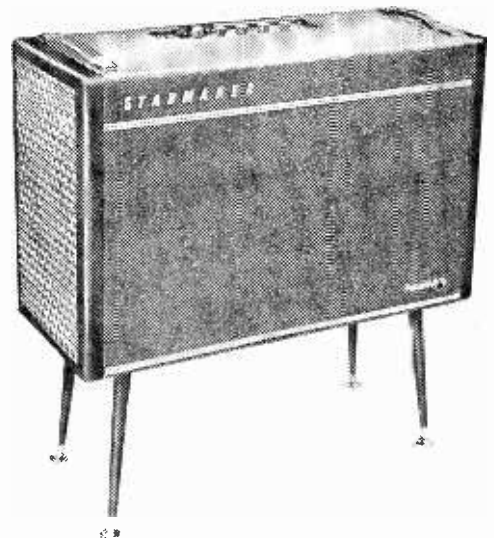
## Automatic Record Player

**BAIRD** have announced the release of their latest automatic record-player. It has a four-speed autochanger with turnover pickup cartridge and manual control if required. Model 288 is a mains portable record-player and will play ten intermixed-sized records at one loading and in any order.

The cabinet is fitted with snap fasteners and carrying handle, and measures 18½in. x 8½in. x 14½in. Weight is 13½lbs., and the price is fixed at £16 5s. 6d., including purchase tax. *Baird TV Distributors, 414 Chiswick High Road, London, W.4.*



*The latest record player from Baird.*



*This is the Heathkit guitar amplifier, which can be built from a kit costing £54 15s.*



#### ACTON, BRENTFORD AND CHISWICK RADIO CLUB

Hon. Sec.: W. G. Dyer, G3GEH, 188 Gunnersbury Avenue, London W.3.

During August the Club will meet at its headquarters, to see a demonstration of two metre equipment. This will be on the 18th and begin at 7.30 p.m.

#### CHESTER AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: P. J. Holland, Field House, 19 Kingsley Road, Great Boughton, Chester, Cheshire.

"Antennae, Mobile and Otherwise", was the title of the talk given by H. Morris (G3ATZ) on July 14th. A week later members enjoyed a radio quiz. The lecture for the meeting of July 28th was delivered by G3DRB.

#### DERBY AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: F. C. Ward, G2CVV, 5 Uplands Avenue Littleover, Derby.

Under discussion at the Meeting for July 8th, was a forthcoming mobile rally. On 15th of the month, the fourth d.f. practice run was held.

R. Chambers (G3RTG) gave the talk at the July 22nd meeting, his subject being "Vehicle Electrics". Junior members enjoyed the opportunity to seek answers to their problems at the open evening of July 29th.

The following month began, as usual, with a sale of surplus gear.

#### GUILDFORD AND DISTRICT RADIO SOCIETY

Hon. Sec.: H. Mead, G3OXI, Egley Road, Woking, Surrey

Stoke Park was the venue for a direction finding contest, organised for members on 10th July. Later in the month, "Test Equipment" was the topic for discussion at the meeting for July 24th.

This Society has been asked by the organisers of the Guildford Town Show (which is being held later this year), to arrange an exhibit depicting amateur radio activity and to run the club station. This matter will form the subject for discussion at a forthcoming meeting.

#### HUDDERSFIELD RADIO SOCIETY

R. Ellis, G3BKM, 24 Pymroyd Lane, Cowlersley, Huddersfield, Yorkshire.

This Society was formed at the beginning of this year and has already attracted a membership of 45 with 25 licensed amateurs on the list. Talks on R.A.E. and Morse classes are currently being given for beginners and a programme of lectures has been arranged. Visits of technical interest are also planned for the future.

Any local enthusiasts who are interested in joining the club are invited to attend the next meeting which will be on 13th August. Meetings are held at the Lockwood Conservative Club in Huddersfield and begin at 7 p.m.

#### NORTHERN HEIGHTS AMATEUR RADIO SOCIETY

Hon. Sec.: A. Robinson, G3MDW, Candy Cabin, Ogden, Halifax, Yorkshire.

During July, groups of members made two further visits to the BBC transmitting station at Moorside Edge. These visits were on the 15th and 29th of the month, both following the Civil Defence talk and demonstration given to members on the 8th. A ragchew night on 22nd July was also the date of a Committee meeting.

After a whole month free of commitments to provide demonstration stations, this Society began August by manning transmitting and receiving equipment at Warley Charity Gala held on the 1st. This was followed a few days later by an "Any Questions?" night.

#### ROYAL AIR FORCE AMATEUR RADIO SOCIETY

This year sees the 25th anniversary of RAFARS and on the weekend of July 4th and 5th members, past members and amateurs from many parts, travelled to Weston-super-Mare to take part in the various celebration activities which had been arranged. The main event for the Saturday was a celebration dinner held at the Grand Hotel Atlantic at which the No. 5 Regional Band of the Royal Air Force provided the music.

On the Sunday visitors travelled out to RAF Locking (No. 1 Radio School of the Air Force) where a mobile rally and contest and tours of the camp were highlights among a host of events and entertainments which had been arranged for the XYLs and children as well as the licensed amateurs.

#### READING AMATEUR RADIO CLUB

Hon. Sec.: R. G. Nash, G3EJA, "Peacehaven", 9 Holybrook Road, Reading, Berkshire.

This society's first mobile picnic of the year was held on July 12th in conjunction with the Mortimer and District Motor Cycle

Club's Scramble. The venue for this occasion was Padworth Common, near Aldermaston.

At a meeting later in the month, G5TP, G5HZ and G3OLA led the discussion on "Simple S.S.B. Gear", which formed the topic for the evening.

#### SCARBOROUGH AMATEUR RADIO SOCIETY

Hon. Sec.: P. B. Briscoombe, G8KU, "Roseacre", Irton, Scarborough, Yorkshire.

Scarborough has announced that it has moved to new club rooms at the rear of 7 Trinity Road, Scarborough, where its weekly meetings continue to be held on Thursdays.

#### SLADE RADIO SOCIETY

John Smith, G3JZF/T, 53 Woolmore Road, Erdington, Birmingham, 23.

On 18th September, members of this Society are presenting an evenings entertainment at their headquarters, to be relayed over a closed circuit television system. Local organisations have promised support for the programme material which will be seen by visitors either in a large "studio" or in a separate viewing room. Telecine and three- or four-camera coverage has been arranged for the show.

The Society is looking forward to welcoming many visitors to their headquarters at The Church House, High Street, Erdington, Birmingham. Further details may be obtained from G3JZF/T—see above.

#### WEST KENT AMATEUR RADIO SOCIETY

Hon. Sec.: H. F. Richards, 17 Reynolds Lane, Tunbridge Wells, Kent.

At the meeting for July 10th, members were entertained by a selection of films, and on the 24th they took part in discussions on audio when demonstrations of equipment were also given.

### TRANSCIVERS - A WARNING!

From time to time, various advertisers offer for sale transceivers (or "walkie-talkies"). We must point out to prospective purchasers that (a) it is illegal to operate this or any other type of transmitting equipment without having first obtained a transmitting licence, and (b) in any case, these transceivers are often crystal controlled at frequencies not allocated in the U.K. for amateur transmitting, such as those operating at 27Mc/s. Such equipment must, therefore, be modified to operate on legitimate frequencies even if the user holds a transmitting licence.

### SHORT WAVE ONE

This article, which appeared in the March 1964 issue, omitted the connections to the Osmor coil SWQ2. These are as follows; 2 aerial; 3 earth; 6 reaction anode; 5 reaction capacitor; 4 grid; 1 earth.

Also in Fig. 4 of this article, the 955 base connections are shown correctly from the underside but the valve has a flat top. The 954 is shown correctly from above.

### A.B.C. TRANSISTOR GUIDE

This comprehensive reference guide published by Messrs Newmarket Transistors Ltd., covers the essential characteristics of their wide range of transistors. This publication is a tabular presentation of their current range of devices in sufficient detail to provide users with all information they would normally require to select units for a given project.

For further information, write or telephone Sales Office Manager, Newmarket Transistors Ltd., Exning Road, Newmarket, Cambs.

Brand new individually checked and guaranteed VALVES

Table listing various vacuum tube valves with their types, manufacturers, and prices. Columns include valve type (e.g., AC/R1, AC/P4), manufacturer (e.g., DL99, EF85), and price (e.g., 5/6, 8/6).

MANY OTHERS IN STOCK include Cathode Ray Tubes and Special Valves. All U.K. orders below £1 P. & P. 1/11. Orders over £1 2/6; over £3, P. & P. free C.O.D. 2/6 extra. Overseas postage extra at post.

MARCONI COMMUNICATION RECEIVERS. CR.150. Frequency coverage 2-60 Mc/s in 5 bands. Two l.f.s. 1st 1,600 kc/s, 2nd 463 kc/s. Image signal protecting over 40 dB up to 30 Mc/s and 20-40 dB from 30-60 Mc/s. Self-checking calibration (built in calibrator). Stabilisation of supply and temperature compensation. Electrical and mechanical bandspread. Metering and visual tuning indicator. Bandpass from 100 c/s to 10 kc/s in 5 stages. Acoustic filter associated with 100 c/s. Bandpass position for CW reception. Facilities for diversity reception. Excellent checked condition, £49. Mains P.S.U. by P.C. Radio, £4.10.0. Carriage 30/-.

CR.150/2. Frequency coverage 1.5-22 Mc/s in 4 bands, all other features as in CR.15. Price £35. Carriage 30/-.

P.C. RADIO'S mains P.S.U. for above, 90/-.

R.209 RECEPTION SET. A 10-valve high-grade superhet receiver with facilities for receiving R/T (A.M. or F.M.) and CW frequency 1 Mc/s-20 Mc/s. Hermetically sealed. Built on miniature valves and incorporating its own vibrator power-supply unit driven by a 6 v. battery (2) point connector included. The set provides for reception from the od, open-wire or dipole aerial with built-in loudspeaker, or phone output. Dimensions: Length 12in., width 8in., depth 9in. Weight 23 lb. In as new, tested and guaranteed condition, £23.10.0, including special head-phone and supply leads. Carr. £1.

ROTARY TRANSFORMER. 11.5-12.5 v. D.C. Input 300 v. 200 mA DC Output, 30/-, P. & P. 15/-.

RECEIVER TYPE R.206. Frequency 0.55 Mc/s to 30 Mc/s in 6 bands, 100-250 v. A.C. or 12 v. D.C. Loudspeaker in power supply unit. High performance superheterodyne, eleven valves including a separate local oscillator valve, beat oscillator valve and two valves (Amplifier and Detector) in the A.B.C. system. In very good condition, £20.10.0, including power pack. Carriage and Packing 15/-.

H.R.O. Senior. Table Model. In excellent, fully checked, and tested condition (without coils and power pack), £15.10.0. As above but rack mounted model, £14.10.0.

Original mains power pack for H.R.O. 110/220 v. A.C. Brand new in original packing, 45/-, P. & P. 4/-.

CONNECTORS FOR TCS RECEIVER, TRANSMITTER AND REMOTE CONTROL, with original plugs on both ends. New £1.17.6 each, P. & P. 2/6.

TRANSMITTER RECEIVER. TYPE 68T. 3-5 Mc/s netting facilities. Low power consumption. Requires 150 v. h.t. and 3 v. l.t. dry batteries. In good condition, 35/-, Carriage 8/-.

CARBON INSET MICROPHONE. G.P.O. type, 2/6, P. & P. 1/6.

P.C. RADIO LTD 170 GOLDHAWK ROAD, W.12 Shepherd's Bush 4946 Open 9-5.30 p.m. Thursday 9-1 p.m.

EVERSHED MEGGER CIRCUIT TESTER. 2 ranges 0 to 1000 Ω, 100 Ω to 200,000 Ω. With test leads, leather carrying case. Tested £4.19.6. F. & P. 3/6.

ARB8D RECEIVERS. Fully reconditioned, £55; rebuilt models, £85; brand new, £95. Carriage paid U.K.

CHR HIGH RESISTANCE HEAD- PHONES. New, 16/-, P. & P. 1/6. 32/44ft. AERIALS each consisting of ten 3ft., 3/4in. dia. tubular screw-in sections, 14ft. (7 section) whip aerial with adaptor to fit the 3/4in. rod, insulated base, stay plate and stay assemblies, pegs, reamer, hammer etc. Absolutely brand new and complete, ready to erect, in canvas bag, £2.19.6, P. & P. 10/6.

PANEL METERS (round) table listing meter types (e.g., 0-20 microamps, 0-50 microamps) and their prices (e.g., 2 1/2 D.C., 79/-).

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# LETTERS TO THE EDITOR

## CONSOLE COLOSSUS

SIR,—I am enclosing some photographs of my hi-fi stereo console, built mainly from P.W. designs. You will note at top left the P.W. Short Wave Two. That is the original piece of equipment that started me off on this giant! It has quite a few extras now, however, including twelve sets of coils all wired in with a 12-way coil selection switch, which can be seen on the front panel to the right of the on-off switch. There is also a signal strength meter mounted on the first amplifier.

The only two pieces not built by me are the TV set and the stereo amplifier (right). The TV is covered by my first attempt at a roller blind type door, which works very well and was made from  $\frac{1}{2}$  in. half-round beading and varnished in its natural state to match the surrounding beading on the speaker cabinets and main gram unit.

The end speaker units are hinged and swing out to obtain optimum stereo effect and can also be lifted off to be placed wherever required. Record storage spaces are provided, as can be seen.

The latest addition is a kit-built f.m. tuner. There is also an a.m. tuner built into the lower preamplifier unit, converted from an old transistor portable radio. Everything, including the deck and all amplifiers, are fed from their own power supplies, a stabilised power pack is seen under the stereo amplifier (top right). Lighting is provided for the player deck compartment and a remote control unit is available selecting TV, f.m. and amplifiers, or record deck to amplifiers. The transcription arm is home-made, too.

It has taken me about 12 months to build all this and put it together. Thirty-eight feet of solder has gone into it! A tape deck is to be added as soon as possible. During the construction I think I must have run into just about every conceivable kind of teething trouble and I have had to redesign a great deal and I have learned a lot from this.

Beginners will be interested to know that I have very little theoretical knowledge and, in fact, all I have learned has come from PRACTICAL WIRELESS in the last year. I felt so confident from reading your articles and building some items, that I decided by trial and error to build a composite

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying commercial or surplus equipment. We cannot supply alternative details for receivers described in these pages. **WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE.** If a postal reply is required a stamped and addressed envelope must be enclosed with the coupon from page iii of the cover.

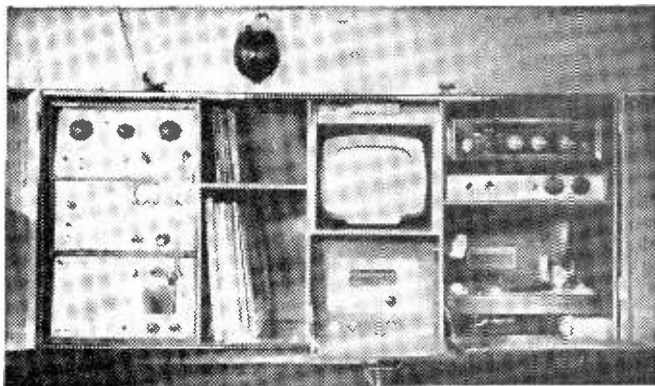
The Editor does not necessarily agree with the opinions expressed by his correspondents.

unit using mainly P.W. amplifiers, etc and ideas. Thank you for all your help (although you were unaware of it). Without P.W. I could not have made it—J. F. B. OSBORNE (Shootash, nr. Romsey, Hampshire).

## VOLUNTARY SERVICE

SIR,—I am hoping this letter will interest any radio and television repairmen among your readers, who feel they would like to help old and disabled folk by servicing their radio and television receivers free of charge.

It was seven years ago when, after a serious operation had left me with deafness and a throat disability, a district nurse asked me to repair the



Mr. Osborne's mammoth stereogram-cum-television.

television set of a very old invalid lady. After I had repaired the set free of cost, I began to think of the many other elderly and disabled people for whom servicing charges must preclude their listening or viewing, and subsequently I began offering my spare time services free to local people. I wrote to welfare services and the local newspaper of my intentions, and the orders have been coming in ever since.

During these seven years I have, at the time of writing, completed repairs to 688 sets and reconditioned for the use of old folk more than 100 radio and TV receivers, hearing aids, etc., which have been given to me by Bristol people after hearing of my service.

Although I receive no payment for this work, I have received many hundreds of letters of thanks

over the years, which makes it seem to me, a very worthwhile occupation for my spare time and if there are other readers who feel they could help provide a similar service in their own towns, I would be pleased to hear from them with a view to forming an organised service throughout the country, to exchange ideas, help out with component parts, etc. I'm sure it would be a great asset.—STEPHEN FREETH, (6 Buxton Walk, Horfield, Bristol, 7).

### RELAY ECONOMIES

SIR,—I was interested in the article you published on relay circuits. I should like to comment that for those, who, like myself, are permanently short of cash and have nearly empty junk boxes, the idea of a separate power supply for each relay circuit is rather alarming. There are probably ways round this however.

Some of your readers may be interested to know that in the June 1953 issue of P.W. there was an article describing a "Valveless Radio Control Receiver". (No transistors then, remember). This was a crystal set tuned to the 27Mc/s band, the output of which fed a sensitive relay. The part of the article relevant at the moment concerns the relay. This consisted of a 50 $\mu$ A meter movement to which small silver contacts were attached. As the contacts were very small they would only handle sufficient current to switch a slave relay. This receiver has the merit of consuming no power until a signal is received, though the range is not very great.

This leads me to another idea for making sensitive relays. If a small mirror is attached to a meter movement, it can be used as a spot galvo. The light beam is made to cross a photo-transistor, light-dependent resistor or similar device, which is arranged to trigger a bi-stable circuit and this switches the slave relay. When a suitable current is passed through the movement, the slave circuit is triggered. When the current is removed, the light beam again crosses the photocell and again triggers the slave circuit which returns to its original condition. This circuit would have at least four merits. Firstly, it could be very sensitive, depending on the movement used and the optical design. Secondly, the switch-on and switch-off currents would be very close, depending again on the optical design. Thirdly, if provision is made for manually triggering the bi-stable circuit, the slave relay may be normally off or normally on as desired. Fourthly, the actuating current can be altered by changing the position of the photocell.—J. N. MANN (High Wycombe, Buckinghamshire).

### NUMBER FACTORS FOR NIM GAMES

One of our readers, Mr. Leonard Andersen, has produced a chart showing the factors of 2 for all numbers to 500 (even numbers). This design is related to an electrical apparatus for the game of "NIM" which appeared in the October, 1963, issue of PRACTICAL WIRELESS.

The chart also gives the complementative factors at a glance. For chart and instructions send 2s. to L. Andersen, 127 Alexandra Road, London, S.W.19.

### COMMENTS ON THERMION'S CAROLINE VIEWS

By what right does Thermion so aggressively condemn these "pirate" radio stations? Why can't the BBC stand some competition for a change and then maybe the public will get what it wants—not what a few think it wants!—J. GRIFFITHS (South Benfleet, Essex).

My good Thermion, get your head out of the sand. Does every taxi driver working in a radio-cab hold an RAE licence for radio communication with his depot? You describe us as "weak-willed and disgruntled" just because we think that the P.O. regulations on transmitting should make room for people who have not passed the RAE etc. If piracy is on the increase as you say, don't shut your eyes to the need for this revision, but get a sense of proportion, as your Editor says on Page 125.—W. JENKINS (Dymock, Gloucestershire).

I can only think how right Thermion's article is in every detail, as it shows how outdated we are in this country in the field of wireless communication for the man in the street.

In the USA any person over 18 can get a licence permitting him to use Citizen's Band equipment. Why should we be denied it in this country. Ironically, such equipment is becoming available over here, but apparently anyone buying and using it lays himself open to prosecution. If America, with a population of over 150 million has enough air space, so surely have we!—A. SIDR (Guiseley, Yorkshire).

The answer to these "Pirate" radio stations seems to me to be in the hands of the Postmaster General himself. I think everyone will agree that the annoying thing about these stations is their frequency and their proneness to fading. Surely then, all the Postmaster has to do is to make use of a frequency less prone to fading, and broadcast competitive "pop" programmes. He already has a frequency available in the Third Programme, and could open broadcasting at 6 a.m. instead of 6 p.m. yet still use this station for the interesting programmes that it relays in the evenings.—D. BARRINGTON (Leyton, London, E.10).

[We have received many letters on the subject of Radio Caroline and her sister ships—most of them in favour. But against any arguments, one way or another, the following observations should be considered:

(1) The wireless receiving licence issued in this country permits the holder to listen only to authorised broadcasting stations (and, incidentally, only to licensed amateur stations).

(2) The International Telecommunication Union Radio Regulations (1959) state—*vide* Article 7, Section 1, ¶1, (422): "The establishment and use of broadcasting stations . . . on board ships, aircraft or any other floating or airborne objects outside national territories is prohibited".

It becomes clear, therefore, that transmissions such as those emanating from Radio Caroline are illegal, as is the act of listening to such programmes (though this would indeed be virtually impossible to enforce). However, whether such regulations are justified or not, so long as they exist we have no option but to take the view that these floating stations are illegal.

As to amateur radio pirates and licensing, we will be having something to say on these subjects in a forthcoming issue.—Editor.]



# Read what Constructors say about the Micro-6

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From Abbey Wood, London, S.E.2

"I think you may be interested to know that the Micro-6 will receive the Home Programme 20ft. inside the North entrance to Blackwall Tunnel. Please find enclosed order and cheque for my 4th Micro-6".

(Signed) D.B.P.

## Built in record time!

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(Signed) J.L.P.

## Good reception in Bristol

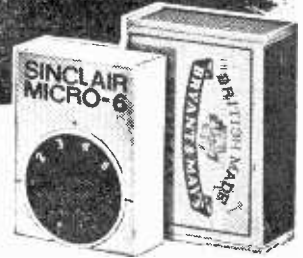
"Was very pleased with the performance, the local stations coming in loud and clear with a fair sprinkling of foreign stations as well as including Luxembourg."

(Signed) L.W.A.

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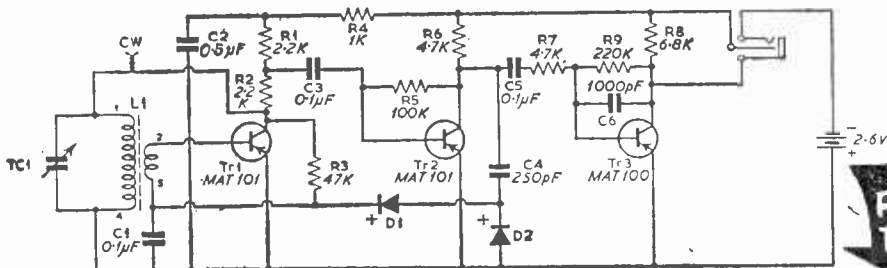
The Secret is in the Circuit See next pages

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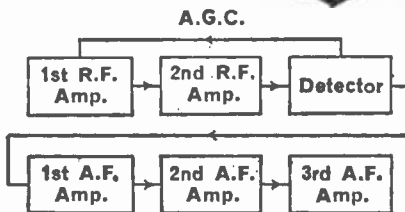
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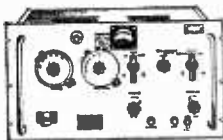
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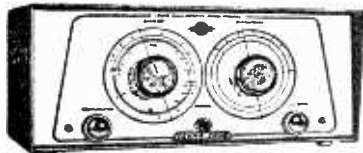


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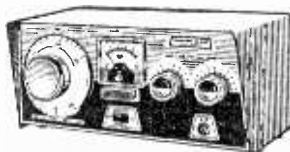
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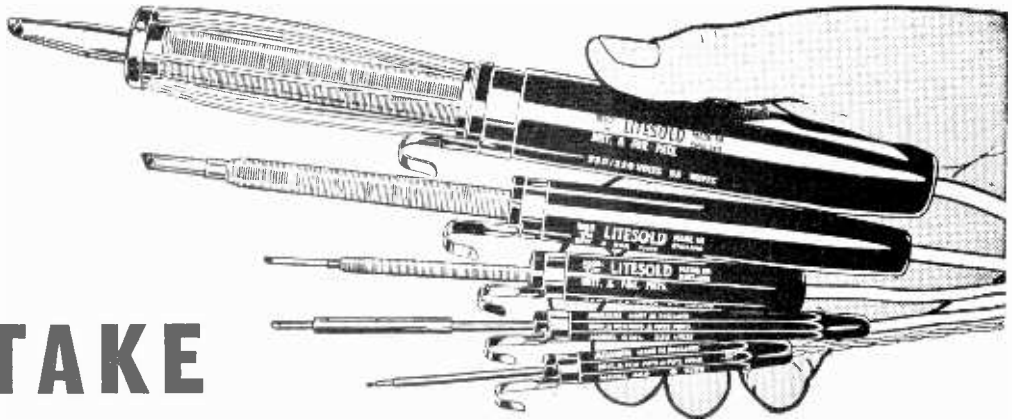
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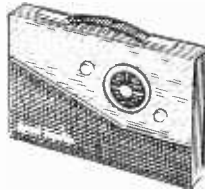
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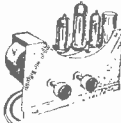
### Good Companion

6 Transistor superhet with remarkable performance over medium and long wave. Opportunity occurs to make this very fine receiver, which uses many standard parts at a very low price. Constructors parcel comprises: 2 tone cabinet as illustrated printed circuit board, wave-change switch, volume control with on/off switch, self adhesive scale pointer, 2 small knobs, 1 cold embossed tuner. Full constructional data. Retail value of this parcel 69/6. This month offered for 39/6 post and packing 3/6.



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**MAINS POWER PACK** designed to operate transistor sets and amplifiers. Adjustable output 6v-9 to 12 volts (or up to 500ma (class B working)). Takes the place of any of the following batteries: PP1-PP4-PP6-PP7-PP8 and others. Kit comprises: mains transformer, filter, smoothing and load resistor, 5000 and 2500 mfd condensers, zener diode and instructions. Real snip at only 14/6 plus 2/6 post.



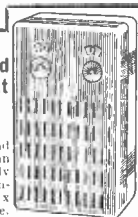
### Amplifier for Portable Player —

uses three valves. Has push pull output for quality and power and mains transformer for safety. Real bargain at 29/6 plus 2/6 post (less valves).

### OUR BARGAIN OF THE YEAR Complete kit of parts to build transistor 2 wave receiver at only 39/6.

#### "CORONET" Mk. III

It fully covers the medium waveband and that part of the long waveband to bring in B.B.C. Light. The circuit includes a high efficiency slab aerial and Plessey tuning condenser. Overall size approximately 4 1/2 x 2 1/2 x 1 1/2 in. Supplied complete with carrying case.



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Table listing metal rectifier tubes such as RM1, RM2, RM3, RM4, RM5 with their respective specifications.

BRAND NEW TRANSISTORS

Table listing various transistor models including OC35, OC42, OC44, OC45, OC71, OC72, OC75, OC77, OC81, OC82, OC81D, OC81M/pr, OC82D, OC170.

SILICON RECTIFIERS

400 volts 350 mA ... .. 7 1/2 each

SETS OF VALVES

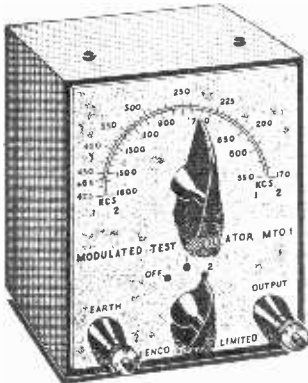
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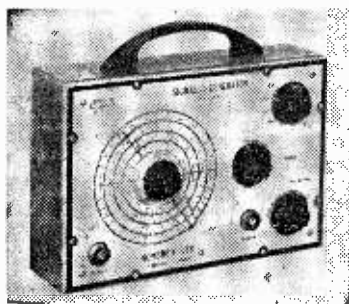
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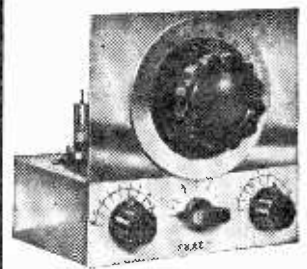
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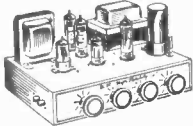
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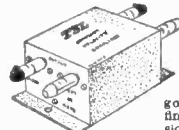
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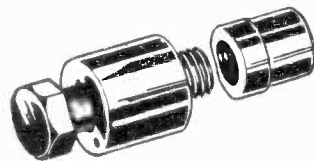
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# Practical Wireless

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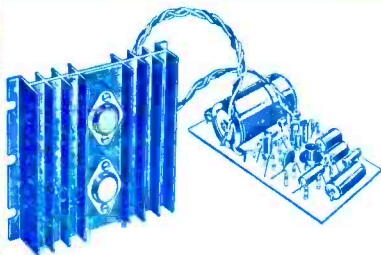
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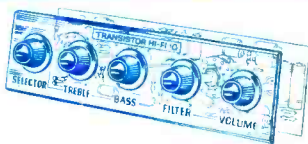
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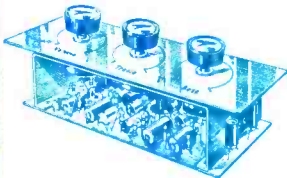
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