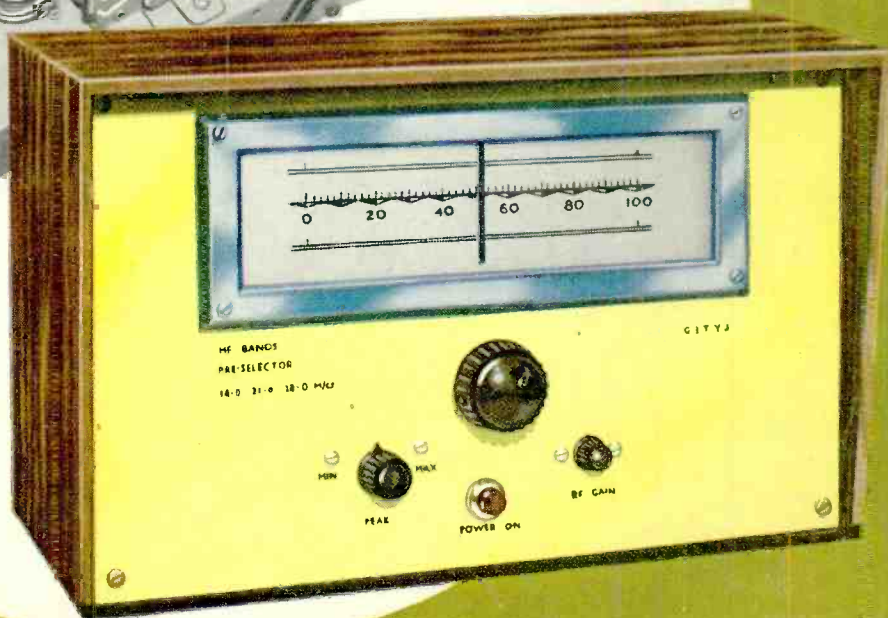


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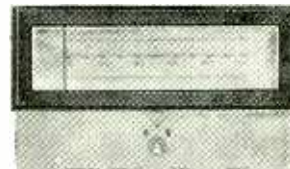
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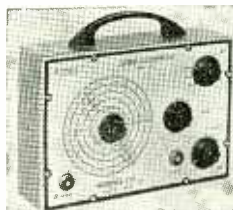


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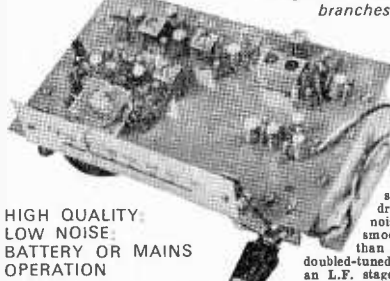
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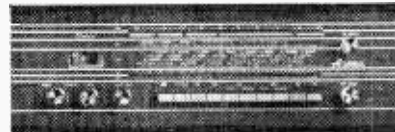


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6G7G	5/6	20A5	9/6	ECC81	4/9	EZ41	8/6	PY32	5/6	UY41	7/-
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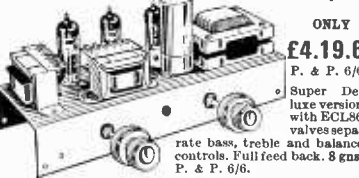
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88-100, Mc/s 10.7 Mc/s I.F. 15/-, plus 2/- P. & P. (ECC85 valve 8/6 extra).

3-VALVE AUDIO AMPLIFIER

MODEL HA34

Designed for Hi-Fi reproduction of records. A.C. Main operation. Really built on plated heavy gauge metal chassis, size 7½in. w x 4in. d x 4½in. h. Incorporates ECC83, EL84, EZ80 valves. Heavy duty, double wound mains transformer and output transformer matched for 3 ohm speaker, separate Bass, Treble and volume controls. Negative feedback line. Output 4½ watts. Front panel can be detached and leads extended for remote mounting of controls.
The HA34 has been specially designed for us and our quantity order enables us to offer them **£45.0** complete with knobs, valves, etc., wired and tested for only P. & P. 6/6.

HSL 'FOUR' AMPLIFIER KIT

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

● Heavy duty double-wound mains transformer with electrostatic screen.
● Separate Bass, Treble and Volume controls, giving fully variable boost and cut with minimum insertion loss.
● Heavy negative feedback loop over 2 stages ensures high output at excellent quality with very low distortion factor. ● Suitable for use with guitar, microphone or record player. ● Provision for remote mounting of controls or direct on chassis. ● Chassis size only 7½in. wide x 4in. deep. Overall height 4½in. ● All components and valves are brand new. ● Very clear and concise instructions enable even the inexperienced amateur to construct with 100% success. ● Supplied complete with valves, output transformer (3 ohms only), screened lead, wire, nuts, bolts, solder, etc. (No extras to buy). PRICE 79/6. P. & P. 6/6.

Comprehensive circuit diagram, practical layout and parts list 2/8 (free with kit).
This kit almost similar in appearance to HA34 employs entirely different and advanced circuitry.

10/14 WATT HI-FI AMPLIFIER KIT

A Stylishly finished monaural amplifier with an output of 14 watts from 2 EL84s in push-pull. Super reproduction of both music and speech, with negligible hum. Separate inputs for mike and gram and announcements to follow each other. Fully shrouded section wound output transformer to match 3-15Ω speaker and 2 independent volume controls, and separate bass and treble controls are provided giving good lift and cut. Valve line-up 2 EL84s, ECC83, EF86, and EZ80 rectifier. Simple instruction booklet 1/6. (Free with parts.) All parts sold separately. ONLY 27.9.6. P. & P. 8/6. Also available ready built and tested complete with std. input sockets, 29.5.0. P. & P. 8/6. Carrying case for above 28/6. P. & P. 7/6.

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

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170 HIGH ST., MERTON, S.W.19 CHerrywood 3985
SEND STAMPED ADDRESSED ENVELOPE WITH ALL ENQUIRIES

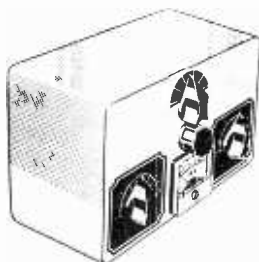
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VFA ONLY 7'6" LONG

AERIAL PROBLEMS SOLVED!

The revolutionary JOYSTICK AERIAL SYSTEMS present a satisfactory solution to all the problems of restricted space receiving (and transmitting) aerials. A completely new range of tuning units have been designed to allow the maximum possible efficiency with absolute simplicity of tuning and operation. For reception on all amateur bands from 1.8 Mc/s to 30 Mc/s. for general short wave and broadcast reception including the medium wave band. This variable frequency aerial system has been acknowledged as the most successful solution to a host of aerial problems. Over 10,000 are in use all over the world. Hundreds and hundreds of terrific testimonials may be seen at the Joystick Office.



Above: One of the new JOYMATCH 'EASY-TO-USE' units with built-in RF indicator for transmission

SWL JOHN D. THOMPSON SAYS:

"Yesterday evening I was tuning in YV's on 15m. band with the HF tuner and later on switched round to the 160m. band and a couple of GM stations rolled in like the home service. Frankly, I am astonished by the ability of the Joystick—surrounded as I am in a built up area—well within a town and in a valley with considerable hills around me". (JOYSTICK INDOORS!) 13 Old Park Road, Dover, Kent.

OUTSTANDING SIGNALS FROM THE JOYSTICK VFA CAN BE HEARD EVERY DAY ON THE AMATEUR AND MARINE BANDS.

UK AGENTS: G. W. Smith & Co. (Radio) Ltd., 3 Lisle Street, London, W.C.2;
Stephens-James Ltd., 70 Priory Road, Liverpool 4;
Chas. H. Young Ltd., 170/172 Corporation Street, Birmingham, 4;
R.S.C. (Manchester) Ltd., 326 Argyle Street, Glasgow, C1; (and all branches)
or ask your local dealer.

France: Vareduc-Comimex, 2 Rue Joseph-Riviere, Paris.
Courbevoie, France.

Scandinavia: Permo, Nygaardsgaten 42, Fredrikstad, Norway.

West Germany: Ing. Hannes Bauer, 86 Bamberg, Hornthalstrasse 8,
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NEW FULLY TRANSISTORISED PORTABLE RADIOS

with Full Variable waveband. NOW A FRACTION OF THE NORMAL PRICE

ONLY **39/6**

WHY PAY MORE? All the latest refinements are packed into this new MULTI-STATION ALL Transistor radio—the internal aerial picks up even the remote stations and the powerful built-in speaker gives room filling volume. Individual tuning, first-class reception. Purchase with confidence—packed in original manufacturer's cartons. (Personal carpiece and battery 4/6). Send 39/6 plus 4/6 p. & p.

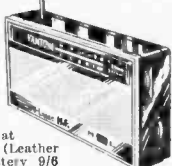


10 SEMI CONDUCTORS

2 WAVEBAND RADIO

Brand new in well-known manufacturers cartons (whose name we have agreed not to mention). Latest 1967 model with multi-section telescopic aerial in addition to internal ferrite interceptor aerial. This full size radio pulls in 100s of English and Continental stations. Works in car, plane or boat. Superb high fidelity tone from big speaker at half-filling volume. Once sold never repeatable price at 88/6 plus 4/6 carriage etc. (Leather case sling, earphone & battery 9/6 extra). Money back if not worth double—try at home for 7 days.

Famous make 750 only bought at £2's below actual value **88/6**



Miraculous Scoop from Swiss Manufacturer Limited Shipment NEW 21 JEWELLED DIVER'S WATCH with Rotating Timing Bezel. Staggering price reduction—compare prices locally. 950 only at **97/6**

Make a genuine LARGE CASH SAVING on this high-quality watch, 200 vacuum tested for depth, 21 Jewelled movement. Shock-proof, electronically timed, lum. dial and hands. Ideal for skin-divers, sailing, motorcycling, research work for accuracy. FULLY GUARANTEED. Send only 97/6 plus 4/6 p. & p. TEST AT HOME. Money back g'ee. STAINLESS STEEL expanding bracelet 12/6 extra.



SAVE YOUR LEGS! INTERCOM OUTFIT & BABY ALARM Ready Built Only **49/6**

Robustly made, brand new current models. You get 2 separate fully transistorised intercommunicating sets—each can speak or listen to the other—complete with 60ft. connecting wire. Fixed in a flash. Ends baby crying worries. Ideal for Workshop to House, Sickroom, hundreds of uses! Hangs on wall or stands up. Our price 49/6, battery 2/6 ex. Post. etc. 4/6. Money back guarantee.

Profit from the credit squeeze! Importers stock bought at miles below actual value

4 TURRET SUPER 500X POWER MICROSCOPE only 39/6

not a penny more to pay. Full size 9" high—don't confuse with miniatures. Grade A.1 all metal construction in black chrome with plated parts. Accurate rack and pinion focusing giving crystal clear definition. A optically polished lenses on revolving turret, giving 100x, 200x, 300x and 500x. Magnification powers. Adjustable mirror light reflector and tilting joint. Ideal for home, hobbyist, nature study, etc. Brand new in box complete with slides at fraction of real worth—ONLY 39/6 plus 4/6 post, carriage, etc. Money back g'ee.

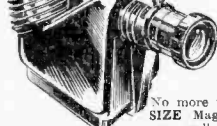


Frustrated Import Shipment OFFERED BELOW HALF PRICE TO CLEAR 500 only 5 TRANSISTOR PERSONAL TRANSCEIVER SETS

OUR PRICE **£6.19.6**

You've heard about them—You've read about them. NOW'S YOUR CHANCE TO OWN THEM. Highly sensitive two-way transistor transceiver sets have individual volume control and talk-listen switch. Telescopic aerial pulls in the voice from the other set over tremendous distances—no wires—a genuine transceiver as used by official bodies and forces. 500 sets only at £6.19.6 plus 5/6 p. & p. (Batteries, leather cases, etc. 10/6 extra). Money back if not delighted with the performance. These cannot be operated in U.K.

3500 Bought at "Rock Bottom" Off Leading British Maker REAL EPISCOPÉ PROJECTOR



ONLY **45/-**

No more to pay! Projects FULL SIZE Magnified PICTURE onto your wall or screen in BLACK & PHOTOGRAPH. DOCUMENT, picture drawing, stamp etc. Entertaining and educational—hundreds of uses in home, office, schoolroom, etc. A FULL SIZE precision made scientific instrument WITH REAL GLASS REFLEX LENS. Sturdy, reliable. So simple even a child can use it—plugs into standard mains. BRAND NEW complete with cable, lamp, etc. Offered at fraction of real worth at 45/- plus 5/- p. & p. Satisfaction or money back.

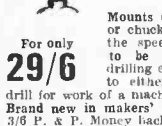


This is truly a wonder purchase. Limited quantity only of FABULOUS EVER-GOLD POCKET WATCHES

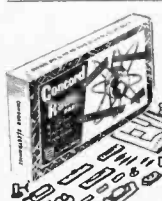
Now at the lowest ever price. ONLY **25/-** No More To Pay

Now offered at well below clearance price these remarkably reliable EVERGOLD pocket watches. Designed to withstand years of constant use with high resistant unbreakable glass. Luminous face markings so easy to see in the darkest time at a glance. Fully guaranteed. DON'T MISS THIS ONCE IN A LIFETIME BARGAIN. Send only 25/- plus 3/6 p. & p. for 7 days' free home trial. Money back if not your best ever bargain.

2,000 only being cleared regardless of loss because of over production MAKE YOUR ELECTRIC DRILL 3 SPEED WITH THIS RIGHT ANGLE VARIABLE DRIVE



Mounts directly on to your drill spindle or chuck in seconds. Doubles or halves the speed of drill. Allows larger bits to be used. Makes metal, masonry drilling easier. Easy-grip handle attaches to either side of unit. Converts your drill for work of a machine costing ten times the price! Brand new in makers' carton. 2,000 only at 29/6 plus 3/6 p. & p. Money back guarantee.



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39/6 No Experience Necessary

No soldering. Only 8 connections for first radio to work. Just look, you get Easy ABC Plans, Cabinet, Loudspeaker (alone 17/6). Earphone, 4 Semi-conductors. Coils. Condensers. Resistors, Tuner, Switch, Screws, etc. YES—EVERYTHING! Loud clear English and Foreign reception. As supplied to Educational Institutions. Etc. Etc. Etc. TESTIMONIALS GALORE. Complete course—originally £6. Now only 39/6 plus 4/6 Post etc.

NO SOLDERING AMAZING CIGARETTE RADIO

ONLY **25/-**



Yes a perfectly ordinary packet of cigarettes! Just watch your friends and astonishment on hearing it fetch in station after station, loud and clear! Still holds 10 cigarettes yet cleverly conceals highly sensitive, fully transistorised circuit (including battery). Even a young boy can assemble it under 2 hours. No soldering. No experience necessary. Only 16 connections to make. Ideal for taking to work with you. From our bulging testimonial file Mr. D. B. of Huddersfield, writes: "... I have fitted the parts in it and it is working wonderfully..." ALL PARTS including Semi-Conductors, ABC Plans, etc. ONLY 25/- plus 2/6 post. etc. Parts Available Separately.



Test this SELF-WINDING WATCH on your wrist for 7 days—FREE! 1,000 purchased at miles below actual value. Our amazing discount price **£5.7.6**

YOU NEVER WIND IT! Famous Timoroy—the ultimate in Swiss Automatics. Unbeatable. Specification: 1967 Gent's Slimline 21 jewels, diamond tooled, automatic date-change, unbreakable mainspring, waterproof, electronically timed, luxurious gold finish, screw back, tropicalised, shockproof, mathematical hairspring gives uncanny accuracy. Brand new with guarantee. Send 55/6 + 4/6 p. & p. (bracelet 17/6 ex.) for TRIAL—Refund in full without question, if not delighted!

NEW RADIO No soldering

VOLKS RADIO ANYONE CAN BUILD IN 2-3 HOURS ONLY 25/-



EVEN THE OLDER CHILDREN BUILD THEM—no soldering—only 16 connections then hear it reach out bringing in station after station, loud and clear. Palm-of-hand size 4 1/2 x 2 1/2 x 1 1/2 in. Many Testimonials: M.H. of London writes: "I have just completed one of your sets successfully, it is the first time I have ever tickled anything like radio, and I must state here and now, I am amazed how easy it is to a layman like me. Your instructions and plan have obviously been very carefully thought out so that even the most dim can follow them." Direct from Manufacturers to You. Send 25/- plus 3/6 post. etc. PARTS AVAILABLE SEPARATELY.

Scoop purchase, save £££ NEW DOUBLE LENS REFLEX CAMERA ONLY 19/6 Plus 3/6 P. & P.



You'll never get another bargain like this! Advantageous purchase from distressed importer offered at fraction of real worth—unrepeatable once this batch is sold. Full size double lens reflex camera that even a child can use. Takes 12 full size 127 pictures in Full colour or black/white. You'll marvel at your professional pictures. Beautifully made and finished, size 4 1/2 in. high (6 in. high with focusing hood raised), 3 1/2 in. x 3 1/2 in. Speeds 1/30th sec. F8. Should last a lifetime. Brand new in maker's cartons—our giveaway price 19/6 plus 3/6 p. & p.

Undoubtedly our finest ever Radio Offer.

9 TRANSISTOR A.M./F.M.

Crazy price ONLY **£7.10.0**



We invite you to test it at home for 7 days & guarantee your money back in full if not 100% delighted. This FULL SIZE Electronic Marvel even pulls in private broadcasts and streaming stations you wouldn't dream of getting plus B.B.C., Lux, Pirates and Continentals. The multi-angle, swivel, telescopic aerial ensures finest directional reception in all regions. The Hi-Fi quality and tone, coupled with its high sensitivity tuning, guarantees perfect clarity. FULLY GUARANTEED. Don't miss this limited period offer. Send £7.10.0 for 7 days' home test plus 5/6 p. & p. (Leather carrying case, earpiece, batteries, etc., 8/6 extra.)

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ANOTHER CODAR TRIUMPH!

THE CR-70A COMMUNICATION RECEIVER.

This completely new receiver sets a new high standard for performance and finish unequalled at the price, and is a worthy addition to the outstanding range of CODAR quality communication equipment. Frequency range: 580 Kc/s-30 Mc/s (540-10 metres) in four ranges; 580 Kc/s-1.5 Mc/s; 1.5 Mc/s-4.2 Mc/s; 4.2 Mc/s-11.5 Mc/s; 11.5 Mc/s-30 Mc/s. Slide rule scales for each band calibrated in frequencies plus an additional logging scale in degrees. Two speed vernier tuning control with reverse slow tune action. Unique aerial input stage exclusive to the CR-70A employing High 'Q' Air-spaced CODAR-COIL Inductor giving extremely high gain with low noise level. Panel aerial trimmer for peaking weak signals. Double tuned I.F. Iron cored transformers. 470 Kc/s with EF183 frame grid valve for maximum gain and selectivity. 5 valves (including two twin triodes) giving 7 valve line-up. Separate B.F.O. stage for CW and SSB reception. Calibrated signal strength 'S' meter, illuminated. Automatic Volume control. Panel phone jack for 'private' listening. 2-3 ohm output for external speaker. (Matching unit optional extra.) Superb styling, metal cabinet in the new Oransol Satin lustre finish. Size: 13" x 5 1/2" x 7 1/2". For A.C. 200/250v. Ready built. Not a Kit at the fantastic low price of £19.10.0. Carr. 7/6.

CODAR R.F. PRE-SELECTOR MODEL P.R.30. Considerably improves the performance of any superhet receiver over 1.5-30 Mc/s. Uses EF183 Frame Grid Valve, and provides up to 20dB gain plus substantial image rejection, improved signal/noise ratio and selectivity. Selector switch for either dipole or single wire antenna. Power requirements 180-250 volts 12mA H.T. 6.3 volts, 3 amp L.T. Size 8 1/2 x 5 x 4 1/2 in. Ready built, complete with cables, plugs and instructions. £5.10.0. Carr. 4/6. **MODEL P.R.30X.** Self powered model for 200/250v. A.C. Also provides 25mA at 200v. H.T. and 6.3v. 1 amp L.T. for other accessories £7.4.0. Carr. 4/6.

CODAR "Q" MULTIPLIER MODEL R.Q.10. For use with any superhet receiver with an I.F. between 450 and 470 Kc/s. Provides considerable increase in selectivity for either peaking or rejecting a signal on AM, CW, or SSB, BFO. Size 8 1/2 x 5 x 4 1/2 in. Power requirements 180-250v. H.T. at 5mA 6.3v. 3 amp L.T. Ready built, complete with cables, plugs and instructions. £6.15.0. Carr. 4/6. **MODEL R.Q.10X.** Self powered version for 200-250v. A.C. and also provides 25mA at 200v. H.T. and 6.3v. 1 amp L.T. for other accessories £8.8.0. Carriage 4/6.

CODAR A.T.5 12 WATT 2 BAND TRANSMITTER. The newest most compact transmitter for fixed or mobile use on 180-80 metres. "The tiny TX with the BIG voice". Size only 8 1/2 x 5 x 4 1/2 in. (Base area is less than two-thirds of this page!) High stability new type calibrated VFO. 1.8-2.0 Mc/s and 3.5-3.8 Mc/s (up to 4 Mc/s export). Air-spaced CODAR COIL Pi-net output, P.A. Plate current meter plus neon indicator. Plate-Screen modulator. AM/CW switch and Panel key jack. Plus change over for 6 or 12 volts heater supply. Ready built £16.10.0. Carr. 4/6. **A.T.5 POWER SUPPLY UNITS.** For 200-250v. A.C. and 12v. Solid state for Mobile use, complete with all Transmit/Receive changeover switching available.

CODAR-KIT CR.45K MAINS T.R.F. SHORT-WAVE RECEIVER. World wide reception—North and South America, Russia, India, Australia, Far East, Amateurs, Shipping, etc. ★ Separate electrical bandspread. ★ 3 slow motion vernier drives. ★ Low loss polystyrene plug-in coils, factory aligned ★ Dials calibrated in frequencies and degrees. ★ Power output 3 watts for 2/3 ohm speaker. ★ Valve line-up: ECC81, EL84, EZ80. Size 12 x 5 1/2 x 7 in. **CODAR-KIT CR.45K** complete with valves, 3 coils (10-28, 25-75, 60-175 metres) and 11 page instruction manual. £9.10.0. Carr. 6/-. Extra coils 5/- each. Instruction manual only 4/- (credited on order). (Can also be supplied ready built—price on request).

CODAR-KIT MINI-CLIPPER—OUR FAMOUS SHORT-WAVE RECEIVER ★ Can be built in one evening ready to switch on and bring the World to your fingertips at very low cost. ★ Supplied complete with valve, one coil 25-75 metres and 4-page instruction manual. PRICE 39/6. Carr. 3/-. Extra coils 5/- each. Instruction manual only 2/- (credited on order). Electrical bandspread available. Provision to add 2 transistor amplifier.

Send 6d. in stamps for illustrated leaflets of the Codar range

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VIKING TRANSISTOR

40-50 WATT AMPLIFIER

OPERATING INSTRUCTIONS GENERAL. An extremely reliable lightweight amplifier capable of giving 40-50 watts of undistorted sound, made possible by the use of the latest semi-conductors (transistors) and techniques which ensure space-age reliability under the most rugged conditions. It is designed as a general purpose amplifier particularly suitable for use with musical instruments that require exceptionally high treble response (not recommended for Bass Guitar). Tremolo facilities are available on Channel 1 only. **INPUTS—CONTROLS—CHANNEL 1** (Tremolo): this contains two high gain input jack sockets controlled by **Volume Control 1** which is mounted directly above the two sockets marked tremolo. **BASS 1:** gives a controlled boost to the lower frequencies on Channel 1 only. **TREBLE 1:** gives a controlled boost to the high frequencies on Channel 1 only. **TREMOLO:** this operates on Channel 1 only and the variations of intensity and speed of the Tremolo beat is adjusted by the controls **DEPTH** and **SPEED**. A socket is provided in the rear of the amplifier so that the Tremolo may be switched on and off by the use of a footswitch plugged into the socket. If you wish the Tremolo to be used without the foot-switch, this is possible as the footswitch is only used to short out the effect. **INPUTS AND CONTROLS—CHANNEL 2** (Normal): this contains two high gain input jack sockets controlled by **Volume Control 2** which is mounted directly above the sockets marked Normal. **TREBLE 2:** gives a controlled boost to the treble frequencies on Channel 2 only. **MAINS VOLTAGE:** fully adjustable. 200-250 volts. A.C. 50 cycles. **POWER OUTPUT:** 40-50 watts sine wave British rating. Very little distortion. **OUTPUT IMPEDANCE:** 3 ohms. Price **21 gns.** plus 41 postage and packing.



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

MAINS TRANSFORMER, primary 200/250 volt, secondary 425/425 volt, 250 mA, 6.3 volt 4 amp, 5 volt 3 amp; fully shrouded, chassis mounting. Price **£25.00** plus 7/6 postage and packing. Auto transformer step-up-step-down, 240/110 volt 400 watt. Price **£15.50** plus 7/6 postage and packing.

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POCKET MULTI-METER

Size 3½ x 2½ x 1½ in. Meter size 2½ x 1½ in. Sensitivity 1000 O.P.V. on both A.C. and D.C. volts. 0-15, 0-150 0-1000. D.C. current 0-150mA. Resistance 0-100kΩ. Complete with test leads, battery and full instructions, **42/6**. P. & P. 3/6. **FREE GIFT** for limited period only. 30 watt Electric Soldering iron value 15/- to every purchaser of the Pocket Multi-Meter.

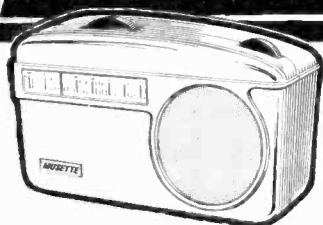
40W FLUORESCENT LIGHT KIT



Incorporating GEC Choke size 8½ in. x 1½ in., 2 bi-pin holders, starter and starter-holder. P. & P. 5/6. **11/6**
Similar to above: 80W. Fluorescent Light Kit incorporating GEC choke size 11½ in. x 1½ in. x 1½ in. 2 bi-pin holders, starter and starter holder. P. & P. 6/6 **17/6**

Twin 40W Choke instant start for 2 x 2ft tubes 17/6. P. & P. 3/6.

MUSETTE 6 TRANSISTOR SUPERHET PORTABLE RADIO



39/6

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

INCLUDING CARRYING STRAP

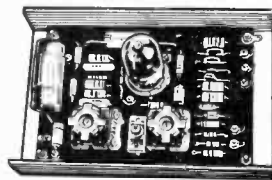
- 2½" Speaker.
- 6 Transistors Superhet Output 200mW.
- Plastic Cabinet in red, size 4½" x 3" x 1½" and gold speaker grille.
- Horizontal Tuning Scale.
- Ferrite Rod Internal Aerial.
- IF 470 kc.

- All components, Ferrite Rod and Tuning Assembly mount on printed board.
- Operated from PP3 Battery.
- Full comprehensive instructions and point-to-point wiring diagram.
- Printed Circuit Board.
- Tunable over medium and long wave-band. Car aerial and ear piece socket.

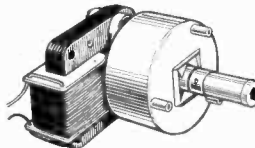
MULTIPLEX DECODER

For receiving Stereo FM

Now is your chance to benefit in full from the new B.B.C. stereo transmissions with our Multiplex Decoder. Design features: Highly efficient Mullard vinkor pot cores. Two semi-conductor diodes. Double purpose valve. Printed circuit type construction high input impedance. Specification: Cross talk minus 26 dB at 1 kc/s. Input requirements 0.5-1.5 RMS. Stability plus or minus 0.1%. Voltage requirements H.T. 190-250 volts. D.C. at 5 mA. heaters 6.3 volts. A.C. at 300 mA. Self powered unit shortly available, price to be announced. Size 6½" x 3½" x 1". Fully built and tested.



Price **£4.4.0** P. & P. 3/-



Type E MOTOR

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



FIRST QUALITY P.V.C. TAPE

5½ in. Std. 850ft. ...	9/-	5 in. L.P. 850ft. ...	10/6
7 in. Std. 1800ft. ...	11/6	3 in. T.P. 600ft. ...	10/6
3 in. L.P. 240ft. ...	4/-	5 in. T.P. 1800ft. ...	25/6
5½ in. L.P. 1200ft. ...	11/6	5½ in. T.P. 2400ft. ...	32/6
7 in. L.P. 1800ft. ...	18/6	7 in. T.P. 3600ft. ...	42/6
5½ in. D.P. 1800ft. ...	18/6	4 in. T.P. 900ft. ...	15/-

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



"MAYFAIR" 5-Transistor TAPE RECORDER

Capstan-driven, battery operated 7½ and 3½ i.p.s. Precision made. Push-button controls. High quality 2½ in. speaker. Push-pull circuit. Output 400mW. Frequency response: 200-7,000 kc/s. Fast rewind. Up to 1 hour twin track playing time. Automatic erasing for re-recording. Dimensions: 8 in. x 11 in. x 3½ in. Weighs only 7½ lb. Takes 5 in. spools. plus 9/- P. & P.

£11.11.0

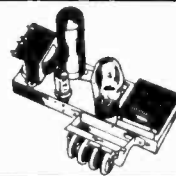
SILICON RECTIFIERS

250 v. P.I.V. 750 milliamps. Six for 7/6 post paid.

3 to 4 WATT AMPLIFIER

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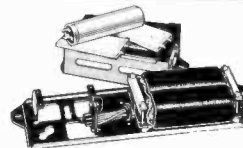
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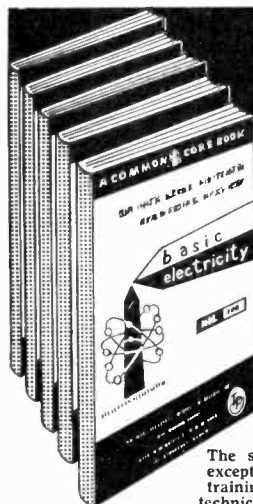
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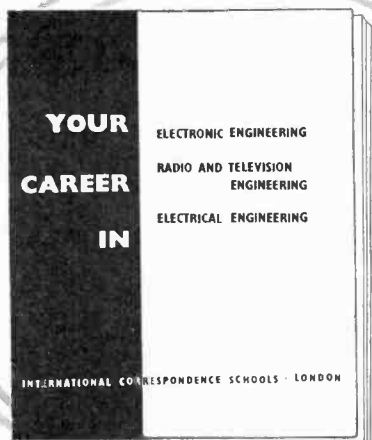
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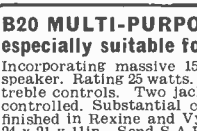
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SPECIAL PURCHASE! 12in. 30 WATT HEAVY DUTY 15 ohm LOUDSPEAKERS 7 Gns.

Flux Density 17,000 lines. Fully Guaranteed. Outstanding value at normal price of approx. £12. Or deposit 23/10 and 9 monthly payments of 15/6 (Total £28.3.4).

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HEAVY DUTY BATTERY CHARGER KITS 6/12 v.

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Covered in two-tone Rexine/Vynair. Ideal for vocalists and Public Address. 15 ohm matching.

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Or Deposit £3.11.0 and 9 monthly payments of 46/7 (Total £24.10.3).

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for Guitar, Vocal or Instrumental Group

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ers. Send S.A.E. for leaflet. Deposit 23 and 9 monthly payments of 37/5 (Total £19.16.9).

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Speech coil 3 or 15 ohms. Carr. 7/6

30 Watt Model. 15 ohm. Size 18x18x10in. Gauss 12,000 lines. £7.19.11

Carr. 10/6

30 Watt Model. 15 ohms. Gauss 17,000 lines. Carr. 12/6

Credit Terms available on all above units.

FANE HEAVY DUTY HI-FI SPEAKERS 5 Gns.

12in. 20 watt. Type 122/10. Post 7/6.

R.S.C. GRAM AMPLIFIER KIT. 3 watts output. Negative feedback. Controls: Vol., Tone and Switch. Fully isolated chassis. Circuit. etc. supplied. Only 44/9. Carr. 3/9.

HIGH QUALITY 12in. 10 WATT SPEAKERS 59/11

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

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

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300-0-300v. 130mA. 6.3v. 4A c.t. 6.3v. 1A. 41/9

For Mullard 510 Amplifier

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425-0-425v. 200mA. 6.3v. 4A. c.t. 5v. 3A. 67/9

425-0-425v. 200mA. 6.3v. 4A. c.t. 5v. 3A. 69/9

450-0-450v. 250mA. 6.3v. 4A. c.t. 5v. 3A. 79/9

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300-0-300v. 100mA. 6.3v. 4A. 0-5-6.3v. 3A. 32/9

300-0-300v. 130mA. 6.3v. 4A. 0-5-6.3v. 1A. 32/9

Suitable for Mullard 510 Amplifier

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0-25-35-42v. 2A 27/9

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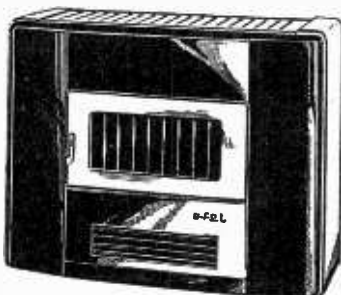


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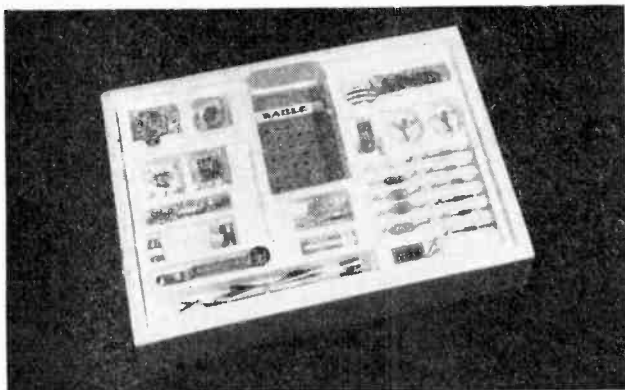
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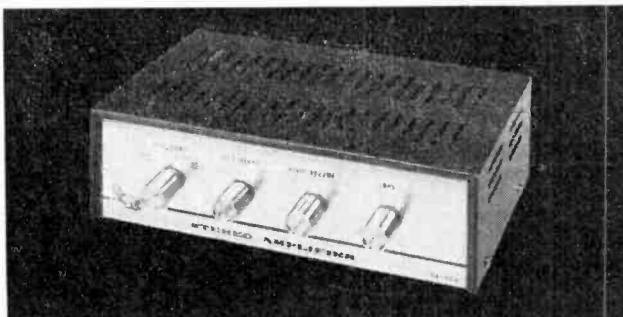
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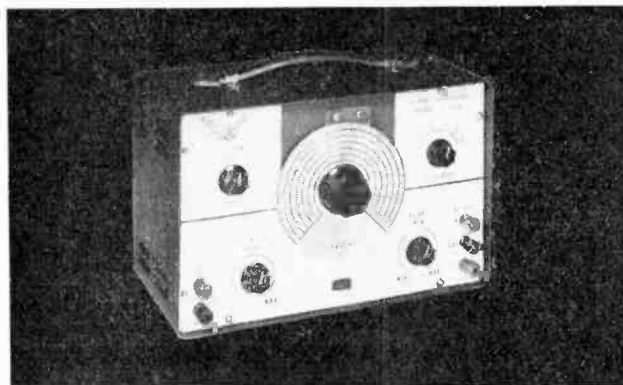
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HI-FI AMPLIFIERS — TUNERS — RECORD PLAYERS

20+20
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AMP.
AA-22U



GARRARD
PLAYER
AT-60



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

20+20W TRANSISTOR STEREO AMPLIFIER. Model AA-22U. Outstanding performance and appearance. 5 stereo inputs each channel, 20 transistor, 10 diode circuit. Kit £39.10.0 Assembled £57.10.0 (Cabinet £25.0 extra).

GARRARD AUTO/RECORD PLAYER. Model AT-60, less cartridge £13.1.7 With Decca Deram pick-up £17.16.1 incl. P.T. Many other Garrard models available, ask for Lists.

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10W
POWER
AMP.
MA-12



9+9W
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S-99



HI-FI MONO AMPLIFIER. Model MA-12. 10W output, wide freq. range, low distortion. Use with control units. Models UMC-1 (Mono) or USC-1 (Stereo). Kit £12.18.0 Assembled £16.18.0

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

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POWER SUPPLY UNIT. Model MGP-1. Input 100/120V, 200/250V, 40-60 c/s. Output 6-3V, 2-5A A.C. 200, 250, 270V, 120mA max. D.C. Kit £5.12.6 Assembled £7.2.6



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RADIOS



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

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TOTAL PRICE KIT (STEREO) £24.18.0 incl. P.T. Cabinet £2.5.0 extra. (MONO) version £20.19.0 Kit.

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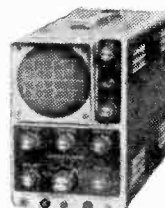
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OS-2

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

DE LUXE LARGE-SCALE VALVE VOLTMETER. Model 1M-13U. Circuit and specification based on the well-known model V-7A but with many worth-while refinements. 6" Ernest Turner meter. Unique gimbal bracket allows operation of instrument in many positions. Modern styling. Kit £18.18.0 Assembled £26.18.0



VVM, 1M-13U

AUDIO SIGNAL GENERATOR. Model AG-9U. 10 c/s to 100 kc/s, switch selected. Distortion less than 0.1%. 10V sine wave output metered in volts and dB's. Kit £23.15.0 Assembled £31.15.0

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



V-7A

MULTIMETER. Model MM-1U. Ranges 0-1.5V to 1,500V a.c. and d.c.; 150 μ A to 15A d.c.; 0-2 Ω to 20M Ω 4 1/2" 50 μ A meter. Kit £12.18.0 Assembled £18.11.6



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R.F. SIGNAL GENERATOR. Model RF-1U. Up to 100 Mc/s fundamental and 200 Mc/s on harmonics. Up to 100mV output. Kit £13.18.0 Assembled £20.8.0

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Prices and specifications subject to change without notice

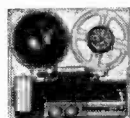
TAPE AMPLIFIERS — TAPE DECKS — CONTROL UNITS



FM
TUNER
FM-4U



STUDIO-
MATIC
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AM/FM
TUNER

HI-FI FM TUNER. Model FM-4U. Available in two units. R.F. tuning unit (£2.15.0 incl. P.T.) with I.F. output of 10.7 Mc/s and I.F. amplifier unit, with power supply and valves (£13.13.0). For free standing or cabinet mounting. Total Kit **£16.8.0** (Multiplex adaptor available, as extra).

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Mono Model TA-1M Kit **£19.18.0** Assembled **£28.18.0**
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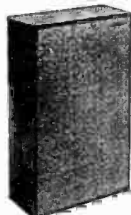


SD-1

SPEAKER SYSTEMS



SSU-1



Berkeley

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

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DX-40U



RA-1



HM-11U



80M Transceiver
HW-12

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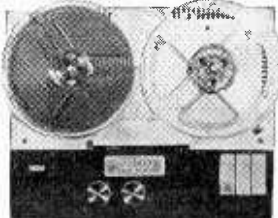
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5in. Standard play, 600ft. PVC	8 6	7in. Double play, 2400ft. Mylar 25 0
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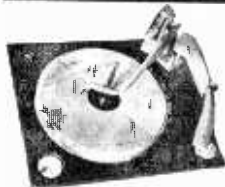
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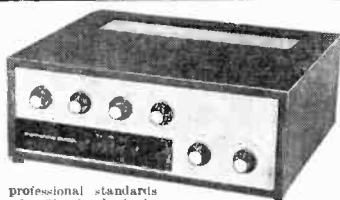
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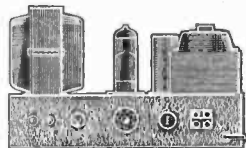
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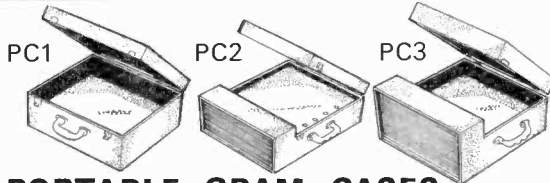
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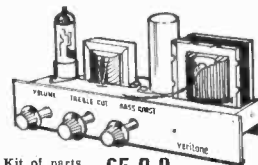
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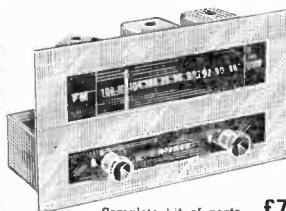
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PRACTICAL WIRELESS

VOL 42 No 10

issue 720

FEBRUARY 1967

TOPIC OF THE MONTH

Troubled Waters

THE first blow was struck against the radio 'pirates' on Friday, 25th November, 1966, when Radio 390 were fined £100 for using a transmitter without a licence, at Red Sands Tower on 16th August, 1966. Mr. Edward Allbeury and Mr. David Beresford Lye, directors of Radio 390, who were found guilty of the same offences, were each given an absolute discharge.

The second blow came just five days after the Radio 390 case, when Mr. Roy Bates, proprietor and operator of Radio Essex (now known as Radio BBMS) was fined the maximum of £100 at Rochford Magistrates' Court, Southend. Both 'pirate' radio stations are to appeal against the findings.

Radio City who also operate from one of the war-time forts in the Thames Estuary have not so far been prosecuted under the Wireless Telegraphy Act of 1949 for illegal broadcasting. On the findings of the Canterbury and Rochford Magistrates (court reports inside), Radio City is within territorial waters and it would appear that the Crown could get a conviction. So why have they been missed? Could it be something to do with ownership, or is it that they are not big enough to worry about?

Radio BBMS has openly defied the Government by continuing to broadcast from Knock John Tower in the Thames Estuary, and Radio 390 admits that it will broadcast from another country on the Continent if it loses the pending High Court appeal.

The Marine and Broadcasting (Offences) Bill will give the Government powers to silence all the 'pirates' in one swoop when it becomes an Act of Parliament. But, how long is this going to take? The Government have many Bills on the Statute Book, a number of which they consider to be of more importance. However, even this legislation cannot prevent commercial operators setting-up high power stations on the Continent, which could be beamed to this country.

Realising that the Marine and Broadcasting (Offences) Bill is already in the pipeline, was it worth prosecuting Radio 390 and Radio Essex? The first case took two days to hear and the second one a full day, and cost us—the tax-payer—hundreds, if not thousands, of pounds sterling.

W. N. STEVENS, Editor.

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MARCH ISSUE WILL BE PUBLISHED ON
FEBRUARY 3rd

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Imported Communications Receivers

It has come to our notice that a letter appeared in the December 1966 issue of PRACTICAL WIRELESS stating that service and spares were not available for imported communication receivers.

We sell considerable amounts of imported communication receivers, many through the medium of advertisements in this magazine, for all of which we carry spares and have full servicing facilities.

G. W. Smith & Co. 3 Lisle Street,
London, W.C.2.

[As you are probably aware, these servicing and spares facilities are not always available from radio dealers, which inspired the letter from a reader. We are glad, therefore, to hear that at least one company is able to offer such facilities.]—Editor.

Buy British?

I HAVE a Lafayette catalogue which shows several models of the H.E. range of receivers and all are quoted as being "imported" into the U.S. So that those on the U.K. market are presumably re-exports from the U.S.

I have also been called upon to repair a Sharpe radio of Japanese manufacture which was purchased in Hong Kong and have found that the valves used cannot be purchased in the U.K., there are no equivalents and that letters to agents in Japan and Germany have not produced any results.

I agree with Mr Pryse, one must by very careful what one buys. But beggars cannot be choosers; after all, what British sets are available at such moderate cost as the Jap jobs with the same specifications?

A. Parry. South Oxhey,
Hertfordshire.

Transistor Terminology

I USED to use valves. However, I have now graduated to transistors. What an utterly wretched mess. Every manufacturer has his own numbering system and, it would appear, his own set of notations. One maker's Ico is another's Alpha dash, and mistaking one manufacturer's beta for another's hybrid pi can cause a very nasty accident. How about all the "big-boys" sitting round a table and settling on a simple standard notation we can all understand?

Martin Jessopp. Leyton,
London, E10.

NEWS AND..

A.A. MEMBERS GO ON THE AIR

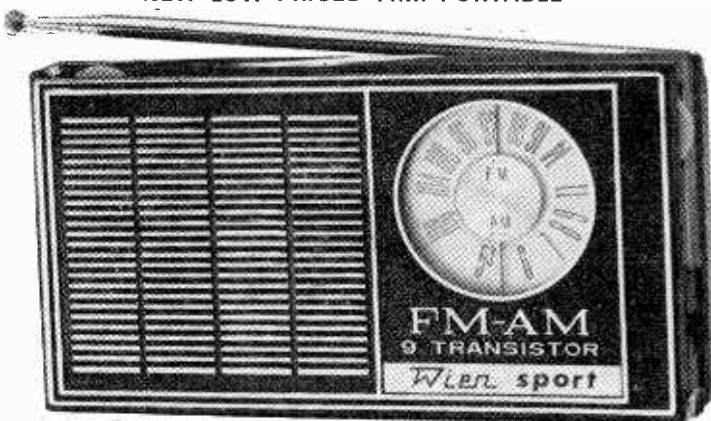
The world's first 24-hour two-way v.h.f. car radio link between a motoring organisation and its members on the road—the A.A. Linkline Service—has been introduced. Under the new service, A.A. members in and around London and Birmingham and travelling up the M1 will be able to keep continuous two-way contact with A.A. operations rooms and will be able to radio direct for the breakdown service, pass urgent messages to and receive messages from anyone, receive warnings of traffic jams etc., obtain weather reports and even find out the correct time. Linkline rental of £180 per year includes all equipment and installation costs, set hire, licence fees, servicing, all radio calls and certain emergency calls connected with a breakdown or accident.

COURSE ON AMATEUR RADIO THEORY AND PRACTICE

Interested persons are invited to find out more about a proposed course on Amateur Radio and Electronics, to begin shortly. The course will be held in the London Borough of Waltham Forest, and is designed for those who missed the beginning of the normal courses, or who find the location of the R.A.E. courses difficult to reach.

The scheme should be suitable for persons wishing to try the Winter 1967 Radio Amateurs' Exam and for persons who would like to brush up on the subject. Young people and beginners will be made very welcome. K. L. Smith, G3JIX, 82 Granville Road, Walthamstow, E.17.

NEW LOW PRICED F.M. PORTABLE



H. O. Thomas Electronics announce two new models, bringing their total range of Wien radios up to six. They are the Wien "Sport" retailing at 7½ guineas and a mains/transistor am/fm set—the M1—at 16 guineas.

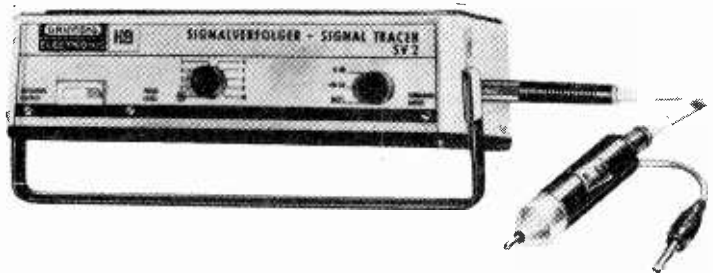
The M1 is a table model in teak cabinet, embodies 8 transistors, covers medium and f.m. bands. The "Sport" (see photograph) covers f.m. and medium waves, has 9 transistors and comes complete with earpiece, strap and batteries. Further information from H. O. Thomas Ltd., 4 Vernon Place, London, W.C.1.

SCHOOLBOYS AND GIRLS EXHIBITION

Opened in the Empire Hall, Olympia on December 27 this exhibition features among its exhibits a TV videotape studio presented by Ampex Ltd., where children are able to mime an action or play a charade and see their performance played back immediately on a TV monitor screen.

...COMMENT

GRUNDIG A.F. SIGNAL TRACER



Among the new Grundig range of test instruments is the SV2 a.f. signal tracer. The use of transistors and battery operation make the instrument ideal for lab. or field work. The test probe type UK2 supplied is switchable between a.f. and r.f. In the r.f. position, it operates as a demodulator for frequencies between 100kc/s and 300Mc/s whilst the low capacity ensures no detuning of the circuit under test.

Frequency response is 200c/s to 8kc/s -3dB. Input for 160mW output in the 0dB position is 1mV and in the -40dB position 100mV. Input impedance is 50Ω on the 0dB position and 5MΩ in the -40dB position. Output voltage is 0.9V and output impedance is 1kΩ. For further details contact Grundig (Great Britain) Ltd., Newlands Park, Sydenham, S.E.26.

SANSUI PRODUCTS

Lasky's Radio Limited have now been appointed sole distributors in the U.K. for Sansui High Fidelity equipment.

The range comprises a complete selection of high quality stereo amplifiers, tuners and combined tuner/amplifiers.

Price list and details are available on application to Lasky's Radio Limited, 3/15 Cavell Street, London, E.1. Demonstrations can be provided at 42 Tottenham Court Road, London, W.1.

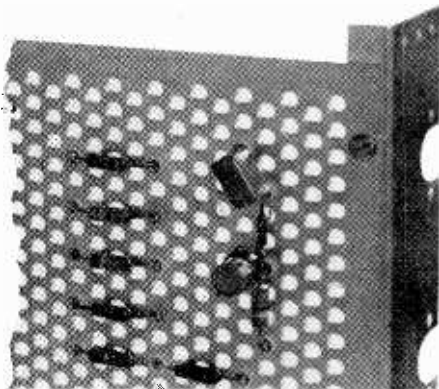
10,000 POLICEMEN TO HAVE POCKETPHONES

A major contract worth £500,000 has been awarded by the Home Office to Pye Telecommunications for the supply of Pocketphone u.h.f. transceivers. One hundred police forces will shortly be using these units.

TWO ADDITIONS FOR LEKTROKIT

A.P.T. Electronic Industries Ltd., Chertsey Road, Byfleet, Surrey, announce the availability of Chassis Plate No. 7 and Insulator Lead-through No. 2 in the Lektrokit Chassis Construction System.

Lead-through insulators are connection devices for insertion into the Lektrokit No. 7 chassis plate for circuit wiring. They are made of PTFE high grade insulant and the Sealectro "Clover Leaf" connection insert, which provides a multi-aperture insulated terminal point for use in circuit wiring on metal chassis and provides five connection wires. Price of No. 7 Chassis Plate is 12s. per pack of 2 and No.2 Insulators, 3s. per pack of 6.



Way-Out Style

As a young boy I was always being caught out by my elder sister. She would plague the life out of me with a series of classic "When is a so-and-so not a so-and-so". As the years drifted merrily by I came to be free of these irritating conundrums, and indeed I had forgotten all about the wretched things until I started to read PRACTICAL WIRELESS and then, bless me, there they were again. I refer to these drifting standards which never seem quite what they are supposed to, and vary from one designer or advertiser to another. Take signal to noise ratio. Now there's plain signal-to-noise, or there's signal-to-noise-plus-noise and so it goes on with a few handfuls of dB's thrown in for good measure. Audio amplifiers are notorious for this sort of treatment. Not only do we have noise figures (no mention of the signal now, only the noise), we have hum, input sensitivity, outputs, impedances and Uncle Tom Cobley ad infinitum. Of course all this information may be very useful but the standard references to which all these figures are referred seem to alter with each item one reads about. One manufacturer assures that his amplifier will supply 12 watts output. Now a friend of mine bought one of these and, as he worked as an apprentice in an electronics laboratory, took the unit in for a test. It was found that the unit actually provided four watts output. These results were checked by a senior member of the staff, and I have no doubt that the tests were valid. So how about a definite standard rating on these things to which all units are related. Then when we buy a ten watt audio amplifier we will get ten watts and not five or two. These glowing adjectives beloved by advertising agents should be made to be accurate. Could not the magazine accepting the advert check first? If you raise anything with the advertisers they invariably blind you with science. "Ah, that's under quiescent conditions, and assuming that the signal does not exceed one millivolt, of course you could calculate for the input transistor bottoming but then the hum level will be up by about, Ooh let's see now 25, yes about 25dB so you can't have it both ways can you?" So how about some standards and every one sticking to them. At the moment I'm back in my childhood memories again. When is a 12 watt amplifier not a 12 watt amplifier—when it's advertised as such?

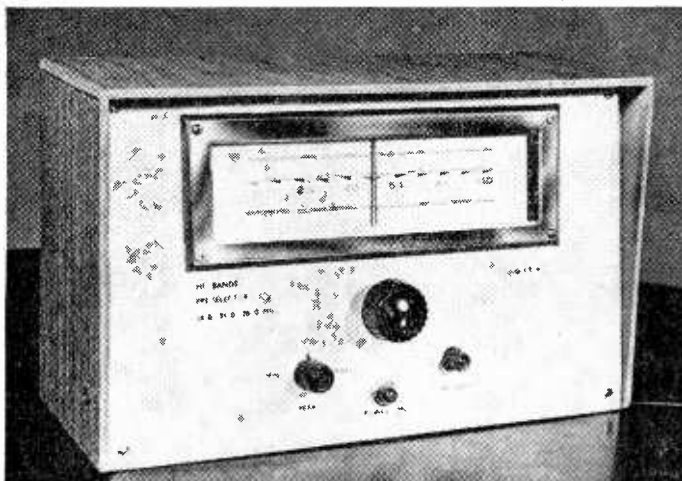
R. Farjohn.

Kettering,
Northants.

More News and Comment on Page 760

a short wave PRESELECTOR for the HF BANDS

A.S. CARPENTER



G3TYJ

THE practical preselector design to be described is continuously tunable over the frequency range 14–30Mc/s thereby embracing the three high frequency Amateur bands, viz., 10, 15 and 20 metres.

The prototype preselector is used primarily in c.w. connections; it is attractive physically and may be powered from the station receiver. Tuning is carried out via a slide-rule type drive with '10' and '20' occupying the scale ends. Ample space does exist for the inclusion of a small mains transformer plus rectifier circuit capable of supplying 200-250V d.c. at 20mA and 6.3V a.c. at 1A.

It is desirable to be able to mute the preselector when an associated transmitter is to be used nearby, and a self-shorting jack-socket is fitted via which a muting circuit may be introduced. The preselector may be muted very conveniently, either fully or partially, by arranging for a 50k Ω variable resistor

to be automatically switched in and out of circuit by the transmitter 'Send/Receive' switch. No provision is made for bypassing the unit—by means of a switch perhaps—since this is carried out manually.

Some communications-type receivers used at Amateur and SWL stations use valves that are considered to be 'noisy' by modern standards: by using a preselector between the aerial and the receiver a considerable improvement results particularly on the higher frequency bands. This is understandable since when a strong signal is fed to a 'noisy' receiver the a.v.c. system is loaded adequately and the valves are biased back heavily; the received signal then sounds clean and 'punchy'. It should be noted however that a preselector should not be considered as an alternative to a good aerial but merely an addition.

The complete circuit diagram is shown in Fig. 1

where V1 functions as a high-gain r.f. amplifier with V2 operating as a conventional cathode-follower output stage. The station aerial is plugged in at socket Sk1, either direct or via the transmitter/receiver change-over switch or relay, and a short screened lead from socket Sk3 is connected to the receiver aerial socket. Band coverage is effected by means of VC1, the shaft of which is in connection with the panel-fitted drive and scale. Variable r.f. gain results from fitment of VR1. Amp-

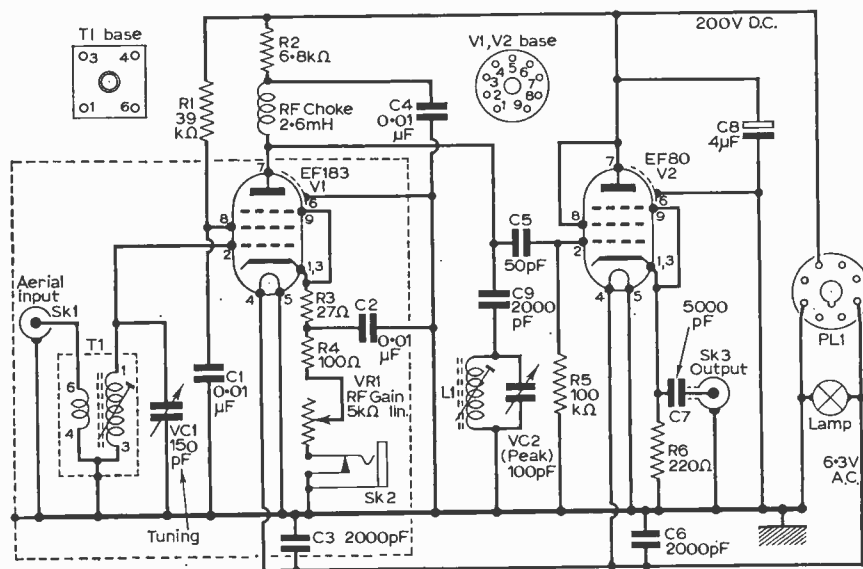


Fig. 1: The theoretical circuit diagram.

lified r.f. appearing at pin 7, V1 'sees' considerable opposition from the r.f. choke whereupon it passes more readily to the cathode-follower output stage via capacitor C5 to re-appear at socket Sk3.

Normally the anode circuit of V1 is operated in a non-resonant state, grid circuit tuning being adopted. Extra gain may be obtained however by resonating the anode circuit close to the operating frequency and to this end coil L1 and panel-fitted VC2 are provided. Although, in theory, maximum gain occurs when both grid and anode circuits are

associated with T1 are bent outward (not inward) to permit the can to be removed without disturbing the coil itself.

Coil Details

Both T1 and L1 are home-brew dust-cored items. Considering T1, and assuming approximately 30pF for circuit 'strays', a tuned circuit inductance of some 0.9μH used in conjunction with a 150pF variable capacitor will enable the desired band coverage to be obtained. T1 consists of 10 turns 28 s.w.g. enamelled copper wire close wound on a 0.3in. former, and 6 turns of 36 s.w.g. d.s.c. copper wire close wound, for the aerial winding. The two windings are separated from each other by 0.05in. L1 is 12 turns of 28 s.w.g. enamelled copper wire, turns close. Later, a turn per coil may need to be removed to ensure correct band coverage, coils being tested either by using a g.d.o. when they are *in situ*, or via received signals. When finding the frequency range afforded by the T1/VC1 combination with a g.d.o. it will normally be necessary to remove the screening can although it should be remembered that re-fitting of this will cause the circuit to resonate at a slightly different frequency to that measured. Fortunately the dust cores permit considerable inductance variation.

The size of the chassis used is also shown in Fig. 2 but when self-powering items are to be used this should be made 2in. longer.

Details regarding the front panel are given in Fig. 4, matters being so arranged that when the completed assembly is placed on the table the front panel slopes backwards slightly to assist operation of the controls; the appearance also benefits.

tuned to the same frequency such exact tuning is rarely practical since oscillation takes over. Under certain conditions—maladjustment of VC2 for example—oscillation can be instigated; it becomes very important therefore to include adequate screening. In the prototype the grid and anode circuits of V1 are well screened from each other; a 'can' is fitted to T1 and the chassis box is also made use of. Screening is indicated by the broken lines in Fig. 1.

Normally VC2 is set to minimum capacitance and is used only under difficult copying conditions. The circuit is useful c.w.-wise for as VC2 is manipulated tuning tends to sharpen due to positive feedback. The benefits are somewhat less apparent on 'fone' for the extra gain secured is at the cost of an increased noise level. In this part of the circuit it should be noted that capacitor C9 is a d.c. 'blocker' and it must on no account be omitted!

The layout and most of the wiring is shown in Figs. 2 and 3. No chassis drilling diagram is given since constructors may vary things to suit items to hand. The type of capacitor used for VC1 for example is not over-critical and any small single-gang item of about 150pF maximum capacitance is suitable. Note in Fig. 2 that the lugs of the can

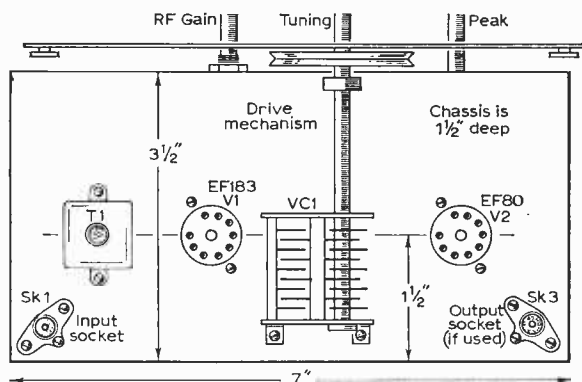


Fig. 2: Above-chassis layout and dimensions.

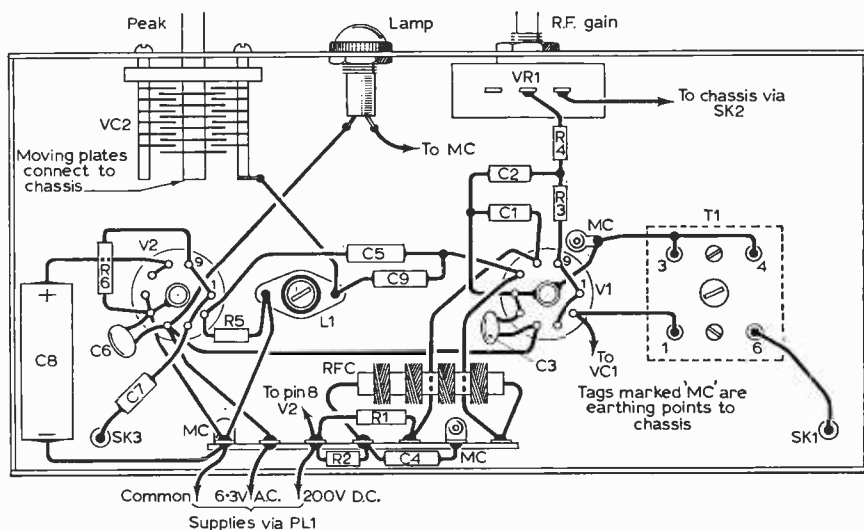


Fig. 3: Wiring and layout below chassis.

Casing details are given in Fig. 5 to agree with the prototype which is fashioned from faced hardboard and held together with pins and impact adhesive.

When the preselector is not self-powered a suitable power pick-up socket should be fitted to the main receiver. An international-octal (I.O.) valve holder is ideal for the purpose rigidly situated so

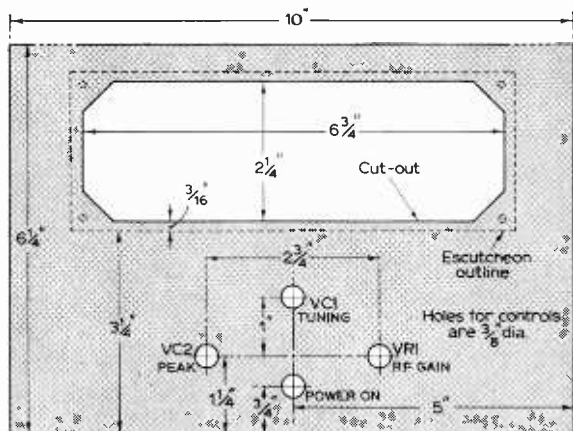
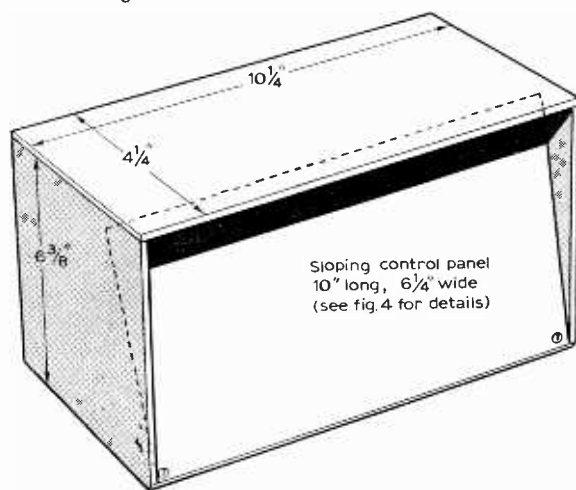


Fig. 4: Panel details.

Fig. 5: Dimensions of the main casing.



that plug P11 carrying the 3-core supply cable from the preselector can be engaged.

Tests should then be carried out, using an ohmmeter, to ensure that no h.t.-chassis short circuit exists after which a short screened lead from socket Sk3 may be connected to the receiver aerial socket. The receiver may have separate aerial/earth sockets in which case the braid of the screened cable should be connected to the earth socket and the lead associated with capacitor C7 connected to the aerial socket. The receiver is then switched on and this will bring the preselector warning lens to life.

Alignment

A weak signal is now sought around 14Mc/s and the preselector pointer moved fully right to completely enmesh the vanes of VC1. The vanes of VC2 should be fully disengaged and the dust core of L1 removed. The core of T1 should next be carefully adjusted to increase the strength of the signal tuned using the receiver 'S' meter as a visual guide.

The receiver is now tuned to the 15-metre band and a weak signal sought, after which the scale

pointer of the preselector is moved toward mid-scale—or to where the signal sounds strongest. The same procedure is adopted on the 10-metre band when the preselector pointer should be almost fully to the left of the scale for maximum received signal strength.

Should it seem however that the preselector cannot be tuned down far enough to peak the signal then too much inductance is in circuit and the core of T1—or the number of turns—requires adjustment. Without the aid of frequency measuring gear some experimenting is inevitable but the aim should be to get '10' and '20' peakable at the opposite ends of the preselector scale. VC1 plays a major part in the band coverage and an electrically over-large item is undesirable. Where a good quality variable capacitor is to hand but which possesses excess capacitance, a fixed-value item may be wired in series with it. For example a 250pF variable may be suitably 'reduced' by including a 470pF capacitor in series with it—or, alternatively, vanes may be removed.

When the T1/VC1 combination has been dealt with attention may be given to the 'Peaking' circuit, L1/VC2. The core should be lightly inserted in the coil and first tests made on '20' as before. The normally weak signal, already being amplified by the preselector should be further peakable as VC2 is carefully rotated when L1 is of the correct inductance value.

Although signals are likely to be heard at almost any time of day or night on '20' none may materialise on '10', or even '15' for lengthy periods solely due to unfavourable propagation conditions. ■

★ components list

Resistors:

R1 39kΩ
R2 6.8kΩ
R3 27Ω
R4 100Ω
R5 100kΩ
R6 220Ω
VR1 5kΩ pot. (Lin.)

Valves:

V1 EF183
V2 EF80

Sockets:

Sk1, Sk3—Coaxial type, surface mounting
Sk2—Miniature closed-circuit jack type

Dial and Drive:

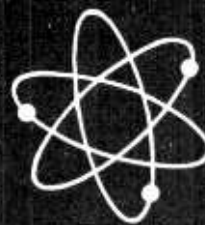
Jackson type SL16 5191 complete

Miscellaneous:

R.F. choke, 2.6mH (Denco type RFC5), 0.3 in. Bakelite coil former with dust iron core and screening can (Denco Ref. 5000A/4PL), Coil former with dust iron core (Denco—Ref. 351/8BA), Miniature panel lamp (Eagle PL), Octal plug, Knobs (3), Valveholders B9A (2), Chassis 7 x 3 1/2 x 1 1/2 in. etc. and casing materials.

Capacitors:

C1 10,000pF ceramic
C2 10,000pF ceramic
C3 2000pF ceramic
C4 10,000pF ceramic
C5 50pF silver mica
C6 2000pF ceramic
C7 5000pF ceramic
C8 4μF electrolytic, 350V
C9 2000pF ceramic
VC1 150pF variable (see text)
VC2 100pF variable
Jackson 'Air tune'



TRANSISTORISED COMPUTER

S. BENDA

THIS computer uses 20 transistors and 30 diodes. It adds and subtracts, the number input being fed in by a 'phone dial. The answer is read off 10 light-bulbs, which are mounted on top of the case. The answer is of course in binary form, with which the constructor should become familiar. The unit is small compared to anything else of similar function.

Theory

The computer consists of 10 bi-stable circuits called flip-flops, and the circuit of one is shown in Fig. 1. The circuit works in the following way.

Suppose that Tr1 is conducting and therefore Tr2 is cut off, almost all the supply voltage will be across R1 and B. This means that the collector of Tr1 is nearly at earth potential. However the collector of Tr2 is nearly 12 volts negative. This means that D1 has only a small negative voltage across it in the reverse direction, but that D2 has

nearly 12 volts across it in the reverse direction.

Now suppose that a positive pulse appears across the input bar. The pulse will not overcome the 12 volts across D2, but it will overcome the small negative voltage across D1. Thus D1 will conduct

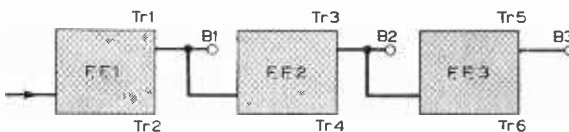
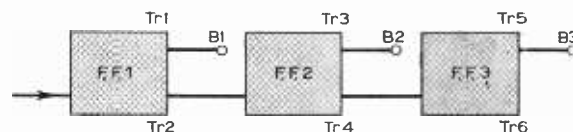


Fig. 3: (Above) Block schematic of "Adding".

Fig. 4: (Below) Block schematic of "Subtracting".



and since the pulse is positive it will reduce the base current of Tr1.

This will reduce the collector current of Tr1 which will make its collector more negative. This increases the base current of Tr2. Thus the collector current of Tr2 increases making the negative voltage on it decrease. This decreases the base current of Tr1, until it is cut off and Tr2 is conducting. Fig. 2 shows the voltage wave forms in the flip-flop.

N.B.: Negative pulses at the input of a flip-flop have no effect upon it, since they reinforce the reverse negative voltage across D1 and D2. In Fig. 2.

To begin with, the bulb B, which is connected to Tr1, is not conducting. A pulse in the base switches it on. Another pulse switches it off and so on. The collector of Tr2 is, of course, always in the opposite state to the collector of Tr1. So it can be seen that a flip-flop can be represented by a little box with a bulb on top of it.

It needs two pulses to switch the bulb through a whole cycle. This shows that the number of pulses which can be obtained from either of the collectors of a flip-flop is exactly half those appearing at the input. This can be verified from Fig. 2. Because each flip-flop divides the number of pulses by two, in the computer each flip-flop will represent twice the number of the preceding one.

So if F.F.1 represents one, F.F.2 will represent two, F.F.3 will represent four and so on. In the actual computer there are ten flip-flops so that the last flip-flop will represent 512. In Fig. 3 there are, for the sake of simplicity, only three flip-flops. The input of each flip-flop (except for the

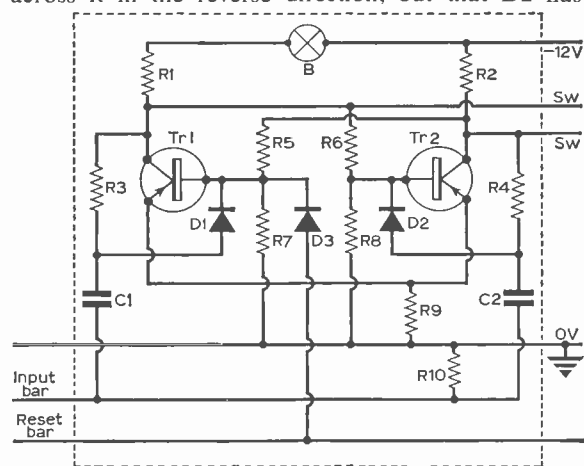
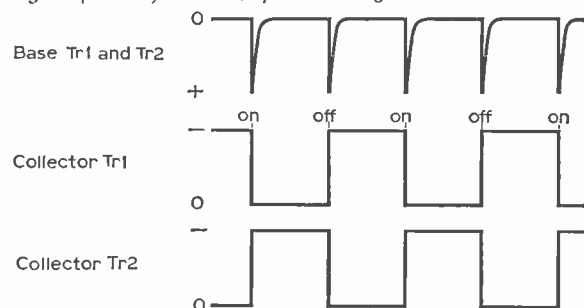


Fig. 1: (Above) Circuit diagram of one flip-flop.

Fig. 2: (Below) Pulses at points in Fig. 1.



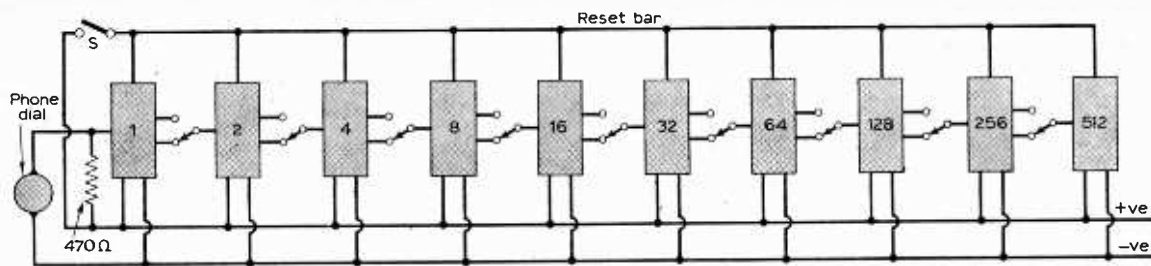


Fig. 5: Block schematic of the computer. Each box represents one flip-flop as in Fig. 1.

first one) is connected to the preceding collector corresponding to Tr2 in Fig. 1.

Suppose we start with all the bulbs off, in other words nought. If we dial a pulse into F.F.1 this will switch on B1. A negative pulse will be sent to F.F.2 (since the input of F.F.2 is connected to Tr2) and nothing will happen to F.F.2. We have added nought plus 1. Now if we dial another pulse into F.F.1 we will switch B1 off. However a positive pulse will be sent to F.F.2 and this will switch on B2 which represents 2. We have added 1 plus 1.

The reader will then be able to work out for himself, that it is possible to add up to 7 on this circuit, but upon adding 7 plus 1, he will get the answer of nought. The actual explanation of this is that if there were a fourth flip-flop a positive pulse would be sent to this, registering the number 8.

Fig. 4 is similar to Fig. 3 except that it is connected for subtracting. The input of each flip-flop is connected to the preceding collector corresponding to Tr1 in Fig. 1. Suppose we start with the number 7, that is all the three bulbs on. If we dial a pulse to F.F.1, B1 will be turned off and a negative pulse will be sent to flip-flop 2, B2 and B3 will be left on corresponding to 2 plus 4 which is 6. We have subtracted 1 from 7.

If we dial in another pulse we will switch on B1. This will send a positive pulse to F.F.2. This will switch B2 off which will send a negative pulse to F.F.3. So B3 and B1 will be left on corresponding to 4 plus 1, which is 5. We have subtracted 1 from 6. Thus, to sum up, we have seen that:

- (1) A flip-flop is a circuit which can only be in two states, on and off.
- (2) A flip-flop effectively divides the number of pulses appearing at its input by two.
- (3) If a number of flip-flops are connected together, the number of each flip-flop is twice that of the preceding one. The total on the computer is of course obtained by adding together the corresponding value of all the bulbs which are on.
- (4) The flip-flops can be connected in an adding circuit or a subtracting circuit depending upon whether the input of each flip-flop is connected to the collector corresponding to Tr2 or Tr1, in Fig. 1 of the preceding flip-flop.

Construction

Details of construction are left to the individual constructor since there are numerous variations and these are simple enough to work out. The recommended order of construction is as follows: the case is built, the power-pack is made, the flip-flops are constructed.

Note: A reset bar is included. This makes it possible to set the computer to zero just by pressing a switch. D3, in Fig. 1, is included in each flip-flop so that the flip-flops do not interfere with each other.

The case

It is clear from the size of the bits which ones fit on top of each other. The first step is to glue and nail A, B, C and G together. A, B and C are all made from $\frac{3}{16}$ in ply, A and B being identical. When these have been assembled, D, E and F are

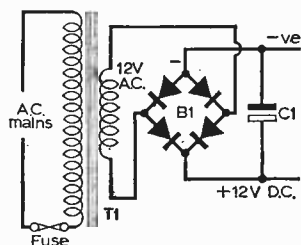


Fig. 6: Suggested power supply.

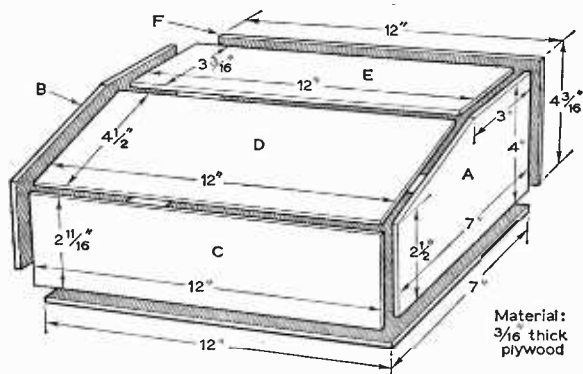


Fig. 7: Constructional details of the case.

bracketed together by aluminium strips to the shape which they will have when screwed to the sides.

Next, two flip-flops are constructed on a single printed circuit board. The lay-out of the flip-flops is left to the constructor. The printed circuit board is divided roughly in half and each flip-flop is constructed in it. The earth bar, the negative supply, the output to the two bulbs, and the reset bar are connected to the connections which go to the sockets.

The sockets which are the mechanical suspensions for the flip-flops are screwed to the back F about an inch apart from each other, starting an

inch inside the left side. The bulbs are then mounted on the top E. The connections to the appropriate bulbs are made from the plugs connecting the extreme right plug to the extreme right bulb. This will be the first flip-flop, so that the numbers will go up from right to left as is conventional. All the bulbs are connected to the negative bar. Switch S is a push to test switch, used to reset to zero.

Fig. 5 is a schematic diagram of the computer. When the five plugs have been wired together and to their appropriate bulb connections, only the negative and positive bars which go to the power pack will be left. There will also be the connections to the switch which will be wired later.

The reset switch S and the phone dial circuit are wired in as shown in Fig. 6. The phone dial circuit is so designed that it feeds positive pulses into the first flip-flop by breaking the negative line from the input. (The phone dial is normally shorted but when dialling, it opens.) The reset switch is mounted roughly in the middle of D in Fig. 5.

★ components list

Resistors:

R1 100Ω	R6 1.2kΩ
R2 220Ω	R7 1.2kΩ
R3 10kΩ	R7 1.2kΩ
R4 10kΩ	R9 10Ω
R5 1.2kΩ	R10 33kΩ

Capacitors:

C1 0.05μF, 30V	C2 0.05μF, 30V
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Semiconductors:

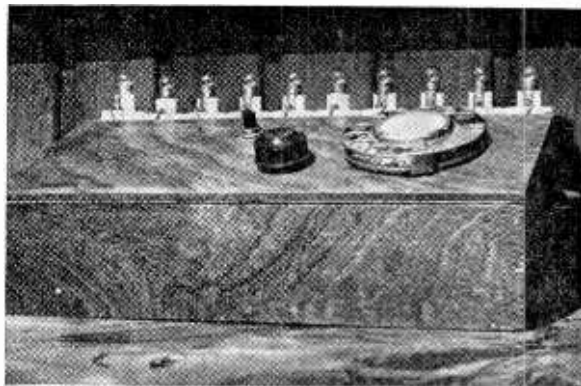
Tr1 OC81	D2 OA81
Tr2 OC81	D3 OA81
D1 OA81	

Bulbs: 6V 0.06A

The above parts are those required for one flip-flop unit. Therefore, ten of each item listed above are required. The resistors are all $\frac{1}{4}$ W 10%.

Other parts:

Ten bulb holders. Five transistors printed circuit panels (Radiospares). One 12-pole 2-way switch. One telephone dial. One 12V 1A transformer. Four silicon diodes (at least 50V peak reverse voltage and 1 amp). One 1,000μF 15V capacitor. One 1 amp fuse. Five edge connectors for printed circuit panels.



Photograph of the completed prototype computer.

The next thing to do is to construct the power pack in the right hand corner of the case.

The first printed circuit (the first two flip-flops) is plugged in and the input to the first flip-flop is wired up. The power supply is connected and switched on. The bulb of the first flip-flop ought to switch on and off alternately as each pulse is dialled in. If it does not work, the flip-flop should be checked, especially for such things as the polarity of the diodes. When this is working, the second flip-flop should be connected to the first through the switch checking that this works. We should now be able to subtract and add up to two. The rest of the flip-flops are made, plugged in and wired to the switch in a similar fashion. It is important to check that when the switch is in one position all the inputs of the flip-flops are connected to the collectors of the preceding flip-flops corresponding to Tr2 and when it is in the other position all are connected to Tr1 (see Fig. 1).

Conclusion

The computer should function well. The phone dial gave a little trouble and the constructor is advised to be careful in the type which he buys. The wiring should be of thin single core type wire.

The uses of this computer are mainly demonstrational and educational. It can be used as a counter of pulses, it being able to count up 2,000 pulses a second. However, when it is used as a counter of low repetition frequency pulses, a "squarer" has to be inserted before the input.

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RADIO 390 & RADIO ESSEX

**Both fined £100 for
illegal broadcasting**

**390 switched-off pending
appeal**

Essex (BBMS) carry-on

ON Friday, 25th November, Nineteen Hundred and Sixty Six, Estuary Radio Ltd., who up to that time operated Radio 390 from a fort in the Thames Estuary, were fined the maximum of £100 at St. Augustine Magistrates' Court, Canterbury, Kent, for unlawfully "using apparatus for wireless telegraphy, namely a transmitter without a licence, at Red Sands Tower on 16th August, 1966". Estuary Radio's managing director, Mr. Edward Allbeury, and company secretary, Mr. David Beresford Lye, were found guilty of the same offences, but were each given an absolute discharge.

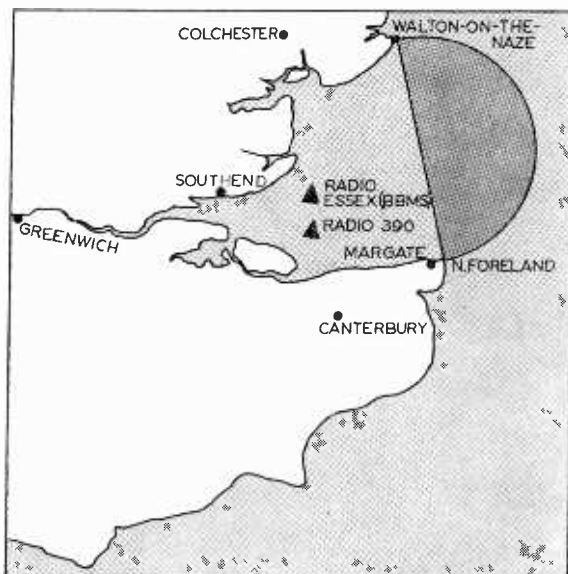
BROADCAST ON 773KC/S

The Post Office had no difficulty in proving that Radio 390 had broadcast on approximately 773kc/s on 16th August, 1966, without a licence. Four Post Office engineers were called upon to give evidence: one to substantiate no licence had been allocated, and three to give evidence of monitoring the station and making tape recordings of the transmission—from Shoeburyness in Essex, Morden Point on the Isle of Sheppey and Herne Bay in Kent.

UNDER BRITISH JURISDICTION

Establishing whether the former anti-aircraft tower on Red Sands, from which Radio 390 operates, came under British jurisdiction was an extremely complex matter. Sir Peter Rawlinson, Q.C., representing the defendants, told the court that Radio 390 is situated at least six nautical miles off the Kent coast and is thus well outside British territorial waters. John Newey, prosecuting for the Post Office, in this criminal case, did not agree and gave two main reasons to substantiate his claim.

Firstly, under the terms of the Geneva International Convention of Sea, 1958, which was ratified in September 1964 by the British Government the Thames Estuary may be considered as a bay. But only if the amount of water (in area) within the bay exceeds that in a semi-circle drawn—with a 24-



mile base-line—across the indentation in the coast. Lieutenant-Commander P. B. Beasley, head of Territorial Waters in the Hydrographic Department of the Ministry of Defence, told the court that in his capacity as a naval surveyor he had calculated the amount of water in the bay, with a base-line drawn across the indentation from Walton-on-the-Naze to North Foreland, and found that there are 683 sq. miles in the 'bay' and five less in the semi-circle. His calculations, however, took in water in the Thames up to Greenwich and to Rochester Bridge in the Medway. Defence was not satisfied that this was permissible and laughter accompanied Sir Peter's suggestion of using Greenwich-on-Sea as a holiday attraction for a town situated in Greater London.

The other factor, also based on the Geneva Convention, concerned low-tide elevations, which includes all islands that are un-covered at normal low water. Prosecution claimed that Middle Bank, one of the sandbanks off the Isle of Sheppey, is one and as such forms the inner limit of territorial waters. Although it is marked on Admiralty charts, Mr. V. Davis, master of the *Mallard* which has been supplying the forts for some time, stated that he had not seen Middle Sands uncovered for at least twelve months and is only uncovered after an abnormal tide.

CUSTOMS AND EXCISE

Appearing upon a subpoena to give evidence for Radio 390, Mr. R. Stiff, a customs and excise officer based at Whitstable, Kent, told the court that his superiors had ordered the master of the supply ship *Mallard* to report before and after visiting the forts in the Thames Estuary. This order, he told the court, had been withdrawn in May 1966; under instructions from the Commissioners of Customs and Excise. He also told the court, under cross-examination, that no duty was levied on the transmitting equipment brought to Red Sands Tower from Rotterdam, and that the customs only require masters' to visit them and fill up a form when they are leaving for the high seas.

MARINE & BROADCASTING BILL

Sir Peter Rawlinson, the former Solicitor-General, made reference to the Marine and Broadcasting Offences Bill, which has been introduced by the Government to suppress broadcasting from ships, aircraft and certain marine structures. It has not been through all the necessary stages to become an Act, he told the court, but it is a provision to deal with the problem you are faced with today. "If the present laws satisfy you that you have powers to deal with this case, what is the point of wasting the time of the Parliamentary draftsmen?"

Sir Peter explained that territorial waters could be extended by an Act of Parliament. However, The Territorial Waters Order in Council of 1964 had been made under the Queen's prerogative and is not an Act of Parliament. "If you accept that the Order in Council is not good law and is to be treated as if it were in the wastepaper basket, I suggest that you look at the International Convention which says the same thing."

CHANGING THE BOUNDARIES

Summing-up, Sir Peter Rawlinson said that it was a remarkable thing that this matter which affects the sovereignty of the realm should turn on the evidence of a distinguished officer (Lt.-Cdr. Beasley), but who only held the rank of a Lieutenant-Commander in the Royal Navy. He also made reference to the fact that no official map or chart indicated changes in territorial waters, concerning this case, and that under the terms of the Geneva Convention the general public must be informed of such changes.

VERDICT

After a second adjournment of thirty minutes (recall for further technical evidence from Lt.-Cdr. Beasley), Mr. Donald Andrews, Chairman of the Bench, read from a prepared statement: "We find that Red Sands is situated in territorial water. The Wireless Telegraphy Act of 1949 is silent on the question of local jurisdiction, but the territorial waters in question join the coast of Kent and for that reason we are of the opinion that the justices of the County of Kent have jurisdiction in this matter. On the evidence before us, we find the evidence proved."

EQUIPMENT NOT CONFISCATED

The Post Office made application to the court to confiscate the transmitting equipment, worth approximately £12,000, and for costs. John Newey, prosecuting for the Post Office told how easy it is to form a new company and start all over again.

After a third retirement, the Bench passed sentence and refused the Post Office the right to confiscate the equipment, and their application for costs.

NOT GIVEN UP

Immediately after the case had been heard, the Mallard supply ship carried a pre-record tape to Red Sands, on which Mr. Allbeury gave the station's reasons for shut down and notice of appeal. "If we win the appeal", Mr. Allbeury told reporters, "we shall start broadcasting immediately. If it goes against us, we shall operate from another country on the

Continent." He would not say which, but indicated the suggestion to be a last resort.

Radio 390 was founded in September 1965 and was not a 'pop pirate', but broadcast—to quote Mr. Allbeury—"sweet music" for housewives. It had a claimed audience of four million and its profits were said to be in the region of £15,000 monthly.

RADIO ESSEX

On Wednesday, 30th November, just five days after the Radio 390 case, Mr. Roy Bates the owner and operator of Radio Essex was summoned under the Wireless Telegraphy Act of 1949 for using a transmitter without a licence at Knock John Tower in the Thames Estuary. He was also found guilty and fined a maximum of £100 at Rochford Magistrates' Court, Southend.

Mr Bates, who now calls his station Radio BBMS (Britain's Better Music Station), appeared without council and pleaded that the court has no jurisdiction over the Knock John Tower, since it is more than three nautical miles off the coast of Essex. John Newey, prosecuting for the Post Office, followed the same lines as he used in the Radio 390 case over the Thames Estuary being a 'bay'. He also introduced low-tide elevations, claiming that West Barrow is one. This lies within three nautical miles of Knock John Tower and is marked as a low-tide elevation on Admiralty Charts.

Mr. R. H. Dalton, Mr. J. F. Woods (Assistant Executive Engineers in the Post Office) and Mr. J. H. Ainley (an Executive Engineer in the Post Office) gave evidence of monitoring Radio Essex on 222 metres and locating the station on 16th August 1966, from Herne Bay in Kent, Shoeburyness in Essex and Morden Point on the Isle of Sheppey respectively. The same three men gave evidence in the Radio 390 case. Also as in the Radio 390 case, Mr. W. Goldsmith, a Higher Executive Officer in the Radio Service Department of the Post Office, stated that although application for a licence had been made, no licence had been issued.

Mr. Bates did not cross-examine any of the witnesses and before the magistrate retired told the court "I do not wish to make any statement at all." He did, however, after the decision (and the Post Office's application to confiscate the equipment and for a portion of the costs), state that he wished to make an appeal against the decision and that the question of forfeiture should not be considered until after the appeal. The court made no order about costs or forfeiture.

STILL ON THE AIR

After the case was heard, Mr. Bates told PRACTICAL WIRELESS that he could not accept the jurisdiction of the court and that he planned to carry on broadcasting from Knock John Tower with his 25kW Medium Wave transmitter.

APPEAL

It is possible that during the interval between going to press and publication of this issue, one or both of these cases will come up before a higher court. Details will, of course, be published in a later issue.

THE MW COLUMN

A San experiment, we are going to run this column for the next few months, during the main MW DX season.

Over the last few weeks conditions have been good for North America, with occasional West Coast openings—notably KING Seattle on 1090kc/s and KOMO Seattle 1000kc/s. Best times for West Coast is from 0300-0700. As these notes are written, North America is going through a poorer patch, but the South Americans are more prominent and numerous.

Asia has been quite good in the afternoons and late evening periods, examples being Voice of America, Hue (Vietnam), and Lucknow (India) both on 760 between 1600-1700, Kaifeng (China) on 930 and Anwei (China) on 940 (together with the Brazilian PRF4) around 2130, and Hanoi (North Vietnam) on 1010 at 2200. The best times to listen for Asia are 1330-1730 and 2030-2300 from October to March.

One interesting aspect of MW DX is that you have the opportunity to hear countries you would not normally hear on short waves, such as Bermuda, Bahamas, Gibraltar, Greenland, Jamaica, British Honduras, Liberia, Surinam, Okinawa, and others.

One word of warning to newcomers. Identification of stations is generally more difficult (apart, of course, from Canadian, USA stations, etc.) since English is not usually employed at all. And since "openings" to certain areas and the reception of particular stations are far less consistent than on short waves, and are therefore far more important in a serious study of propagation, it is *essential* to be absolutely positive when claiming reception from a particular station. Should any doubt exist, it is important to state that the reception claim is tentative.

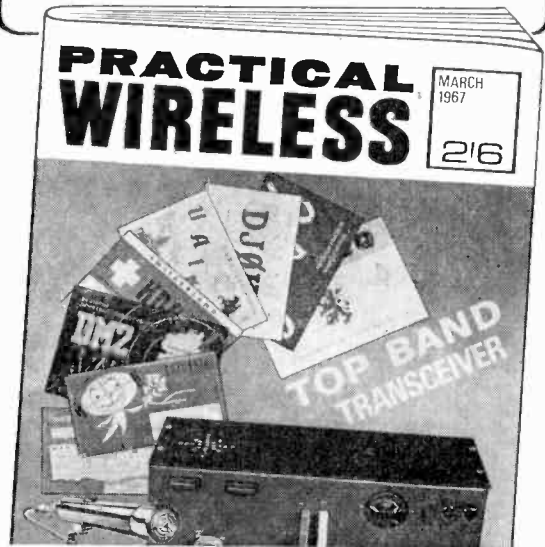
As in all hobbies there are occasional black sheep. We get them in short-wave listening—the spasmodic appearance of a reporter who claims reception of difficult or virtually impossible stations. Such antics usually betray the "reporter" but in MW work fictitious claims are much more readily apparent. Fictitious reporting is usually obvious to the experienced DX'er and the culprit is made unwelcome in clubs or asked to leave. Equally true is the fact that an innocent reporter making an improbable claim may easily find himself viewed with suspicion. The answer is easy: make sure of the facts and if doubt exists add the word "tentative".

Most MW DX enthusiasts use some form of loop, which has the great advantage of high directivity. Such a loop was described in the November issue of PRACTICAL WIRELESS, but readers without this issue may obtain details of my own loop on request. All I ask is for return postage to be included (or where applicable overseas, an IRC).

Next month we will give details of recent station changes which have come to hand. In the meantime I would like to hear from readers interested in MW activity and in particular from Asia, the Pacific area or Latin America not only in stations heard but news of any important changes or new stations on the air.

Alastair Woodland

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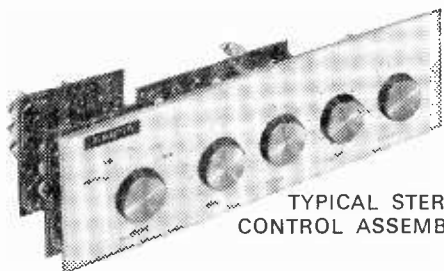
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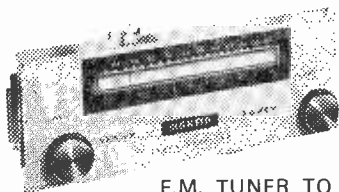
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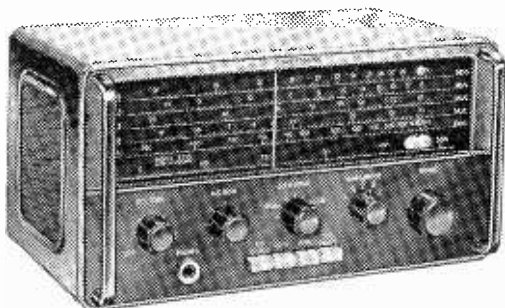
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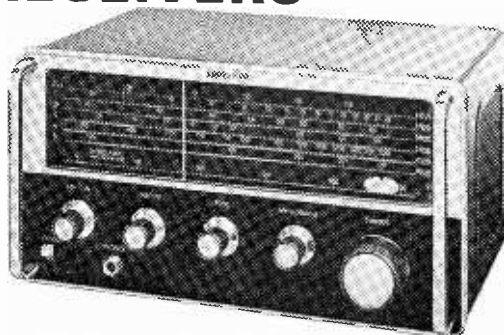
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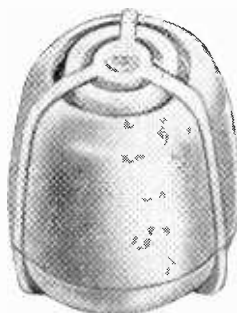
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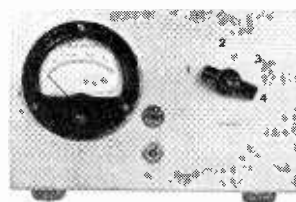
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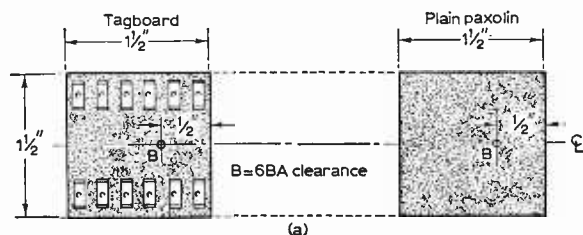
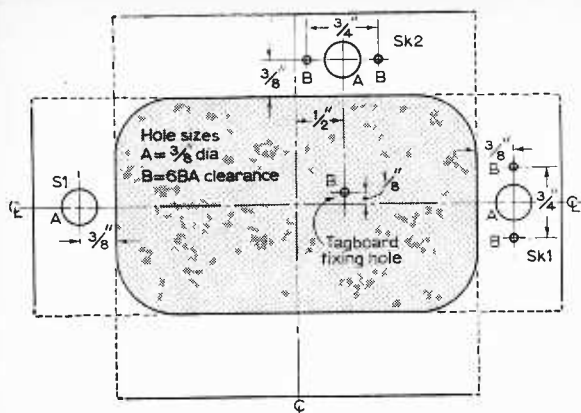
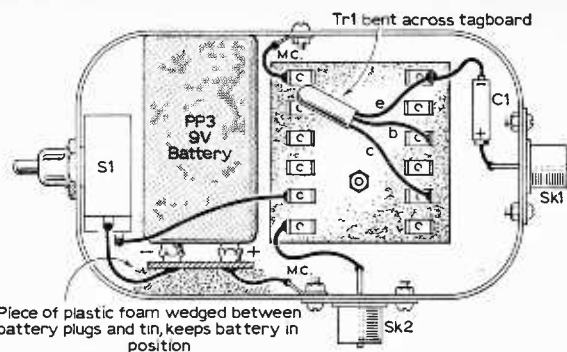


Fig. 4: (Top left) Drilling instructions for the case.

Fig. 5: (Above and left) Dimensional data (a) and mounting details (b) of the paxolin panel.

Fig. 6: (Top right) Layout of the finished unit.



Final assembly

Layout of the major components within the case are shown in Fig. 6. The tagboard is mounted by means of a 6 B.A. nut, bolt and shakeproof washer. A piece of paxolin, the same size as the tagboard ($1\frac{1}{2}$ in. x $1\frac{1}{2}$ in.) is suitably drilled to receive the 6 B.A. bolt, and is placed immediately between the tagboard and the tin so as to act as an insulator (see Fig. 5). It may be found that the centre-conductor of SK1 requires shortening by about $\frac{1}{8}$ in. in order to prevent it fouling the tagboard.

Once the tagboard has been secured within the tin, the final wiring details shown in Fig. 6 may be completed. Earthing connections to the tinplate casing are easily made by soldering direct. Finally, the transistor is bent across the tagboard (see Fig. 6). Care is essential here to ensure that the leads are not bent too near the transistor envelope.

Testing

Having checked all wiring, and ensured that the battery polarity is correct, a low impedance microphone (between 50 and 200Ω) is connected to SK1 via screened cable (coaxial type), and a similar connection is made from SK2 to the valve-amplifier high impedance input. For those new to the principles of amplifying microphone signals, a loud howling sound may result if the gain control is advanced too far, or if the microphone is too near the loudspeaker. This is known as acoustic feedback, and can be arrested by retarding the main amplifier gain control. However, this is not an altogether satisfactory solution, since to prevent feedback it may be necessary, in extreme cases, to turn the control to such a position that gain is so low as to be of little use. Alternatively, and if space is available, the microphone can be kept well away from the loudspeaker. This is the most generally used solution. The most reliable method of all is to employ a uni-directional microphone which will not pick up signals from the loudspeaker when directed away from it. This, however, is a rather more costly solution.

It will be found that long input leads to the unit will give no trouble, but since the output is at high impedance, the lead joining the unit to the main amplifier should be no longer than is absolutely necessary. Hum troubles may arise if this precaution is not taken.

★ components list

Resistors:

R1 470Ω R3 1kΩ
R2 33kΩ R4 10kΩ
All 10%, $\frac{1}{2}$ W carbon

Capacitors:

C1 8μF, 15V electrolytic C3 0.1μF
C2 25μF, 15V electrolytic

Transistor:

Tr1 OC71 (see text)

Miscellaneous:

Two coaxial sockets; single-pole, single-throw switch; six-way miniature tagboard; paxolin panel measuring $1\frac{1}{2}$ x $1\frac{1}{2}$ x $\frac{1}{16}$ in.; 6 B.A. nuts, bolts and shakeproof washers; PP3 or equivalent battery; battery terminals; small piece of plastic foam; and a tin container (such as a tobacco tin) measuring approximately $3\frac{3}{4}$ x $2\frac{1}{4}$ x 1 in.

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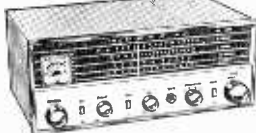
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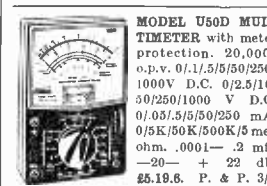
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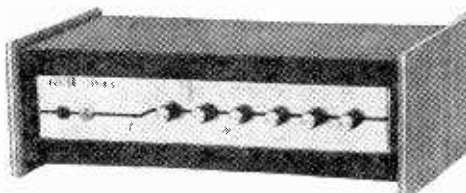
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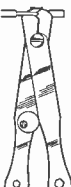
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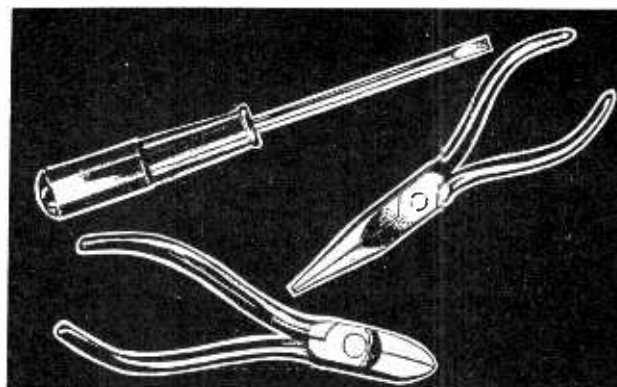


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the home workshop

BY G.T. THEASBY

THIS article is intended for the beginner, who needs some idea of how to set out his space and equipment before actually beginning to build, and for the established amateur who feels that perhaps he isn't using the area at his disposal as well as he might, and yet does not quite know where to start. The actual layout is, in the end, dependent on the floor and wall space available, but the ideal is a room apart from the rest of the family, in the interests of peace and quiet, this also offers complete freedom from danger to the rest of the family and any visitors. If a separate room is not available, then half a room, a shed in the garden, or a

doing some home building, and consequently deals with power, tools, equipment, light and space.

Power

Power may be broadly divided into three groups: (1) A.C. mains; (2) D.C., filtered and smoothed; and (3) Low voltage power, (9—12 volts).

First A.C. mains, 15 amps should be enough for most workshops, but make sure the house wiring can stand the load. If the amateur decides to wire his own sockets and distribution board (see Figs. 1 & 2), it should be tested by the local Electricity Board before being connected to the mains. Fit a fuse-box or contact breaker in a prominent position, wired so that it cuts power to all the workshop, so that in case of an accident anyone can shut off the power. (It is suggested at this point that the station is insured against fire, theft, or accident to visitors, and also damage caused by aerial collapse, etc.) Try to fit at least one mains outlet socket on the distribution board with an isolating transformer of adequate rating, suitably fused. All sockets, transformers and built-in equipment should be fitted with individual fuses, in addition to the main cut-out. All equipment should be fitted with indicator lamps to show when they are switched on. Each socket and unit of mains-operated equipment should be efficiently earthed. *NOT* to a gas pipe, or to a water pipe,

because many houses now have plastic water pipes, and this plastic will render the water-pipe earthing circuit useless.

To obtain a good and reliable earth, obtain a length of motor car ignition cable, and bolt and solder the wire to a copper spike. This joint is then painted over with bituminous paint to prevent corrosion, and the spike buried in three to four feet of

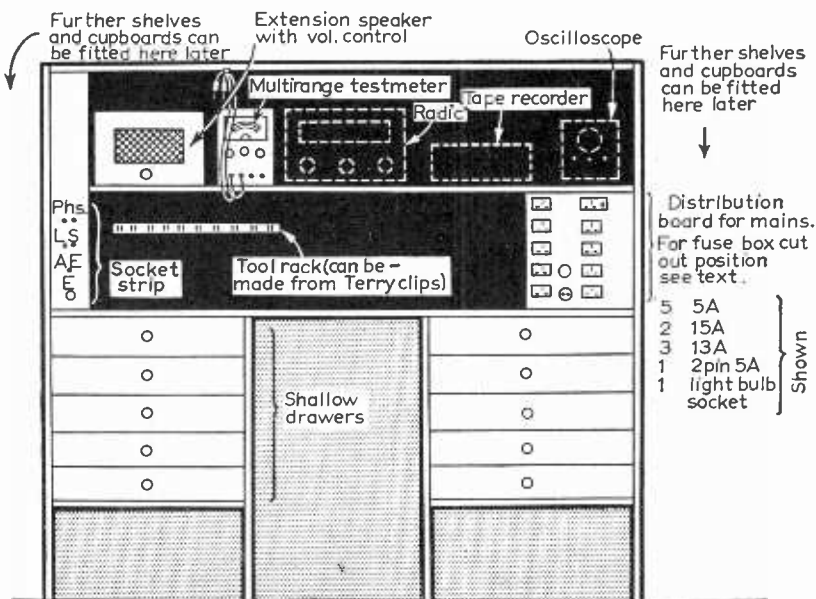


Fig. 1: Suggested layout for the constructor.

fold-out bench, built into the wall or an old cupboard. It should offer reasonable comfort all the year round, being neither too warm, too cold, or too damp. It all depends on what use the workshop will get. An amateur using commercial equipment will need less space than one who is building his own, or seeking to improve existing equipment.

This article assumes that the enthusiast will be

damp soil. The wire is then taken into the workshop in the normal way. It is best not to use the electricity mains earth at all, as it can be dangerous. Instead connect all station equipment to this earth, *except* the receiver and transmitter, if any. Give this a separate earth as far as possible from the first earth, as the earth for a transmitter or receiver can form a part of the aerial system, and thus carry radio frequency power.

A power unit supplying d.c. filtered and smoothed can be provided for equipment without a built-in power pack. Suggested ratings are 250-300 volts and 6-3 volts, at 200mA and 4 Amps respectively. All wiring should be kept neat and tidy. Mains wiring should be as far removed as possible from aerial and earth wires for minimum hum pickup, and test equipment leads should not be left dangling, or one day you may be a test meter short! Wire should be of adequate current carrying capacity, and run underneath shelves where possible.

Lastly, low voltage supplies. These should be completely isolated from the mains, and be suitably fused.

Tools

Buy the best tools available; not only will they last longer and keep their edge longer, but will not slip or become loose fitting in their handles. Multiple screwdrivers are not to be recommended, as the quality is sacrificed for the novelty, and the separate blades are soon lost. A basic tool kit could be as follows:—one 8in. screwdriver $\frac{1}{4}$ in. blade; one 4in. screwdriver $\frac{1}{4}$ in. blade; one neon screwdriver 500 volt rating; three Phillips (crossed head) screwdrivers, small, medium and large tips; one pair insulated electricians' heavy duty pliers; one pair long nose pliers; one pair side cutters; one pair "Bib" wire strippers; one good pocket knife; one set B.A. spanners. These tools should have a rack made for them and should be returned to this rack immediately after use, to stop them rolling under equipment being used, tested or constructed. (See Fig. 1.) An excellent rack can be made from a strip of wood and some Terry clips.

Equipment

Here again buy the best available. However in this section price alone is not a good guide to the equipment's quality. Buy a well-known make, and the quality will speak for itself. The actual equipment will depend on what the enthusiast decides to concentrate, so only a basic list is given.

(1) A multirange testmeter. Here, ranges offered is a secondary consideration to the input resistance. No less than 20,000 ohms/volt for accurate readings; better still 50,000 or 100,000 ohms/volt. Best of all is an accurate valve voltmeter, with an input resistance of many megohms/volt.

(2) A signal source. If possible a signal generator with outputs at a.f., r.f. and i.f. frequencies. If not, a microphone for a.f., and an aerial for r.f. will suffice.

(3) A signal tracer, which can be used in conjunction with the above for fault finding is a good (and cheap) piece of equipment.

(4) A gramophone turntable, arm, and loud, quiet, fast and slow music records could be provided for testing audio amplifiers.

(5) Last, but by no means least, a soldering iron. The author uses a 25 watt instrument soldering iron costing 25s. and having interchangeable bits, and a replaceable element. In the author's opinion a "quick-heat" iron rated at about 250 watts is not a good bargain, especially when using it with transistors, and, of course the price is much higher. If a 25 watt iron is thought too light as in the case of

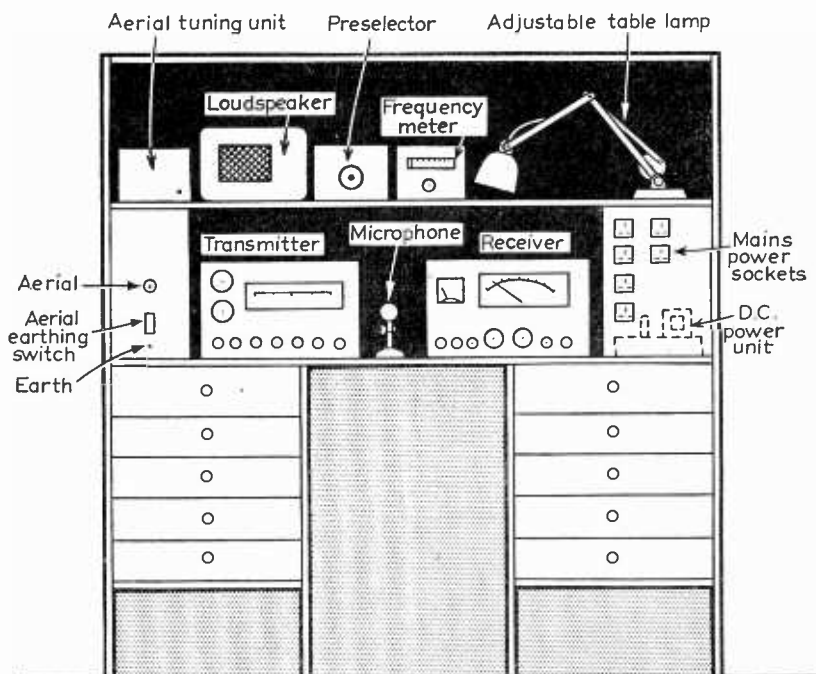


Fig. 2: Possible arrangement for the SWL or "Ham".

constructors making up their own chassis, then a 65 watt iron will be large enough.

The best position is with the light on one side of the bench to avoid glare, especially with a window. Lighting should not be fluorescent, as this type of lighting can cause severe radio interference. The author considers that a light of the "Anglepoise" type is almost as good as the fluorescent light, as the fact that it will throw a shadow is offset by its "manoeuvrability". A window along the adjacent wall will give a good light during the

day, and, perhaps more important, aerial and earth leads can be taken straight outside instead of trailing round the room to the window, picking up hum on the way. The proximity of a window will be very helpful when trying new aereals.

Space

The efficient use of space requires much thought, and as everyone's taste is different, again only a basic idea is presented. With today's miniature transistor equipment, it may be possible to operate a transceiver from a floor-standing ashtray, but most of us will need more space. Two suggested layouts are in Figs. 1, 2 and 3. Fig. 1 is for the home constructor, and Fig. 2 for the licensed amateur, or, without the transmitter, for the s.w.l. If commercial only gear is used, then the drawers and shelves can be left out, except those needed for books, etc., and the rig placed on a small table against the wall, with enough space for books and charts.

If the bench is to be made from scratch, the best height will be determined by the chair with which it is intended to be used. The chair should be comfortable without causing backache when used for considerable periods! The bench should be well made, as it will have to support a lot of weight, and a few shillings saved now may be pounds spent later when the bench collapses with costly equipment on it. The main point in most stations is the receiver, and this should be placed so that it can be operated for long periods without eye or arm strain. To this end, the receiver tuning dial should be directly in front of the eyes, to avoid parallax error, and should be evenly lit, to avoid eye-strain. The tuning knobs should be about four inches from the bench, and operated with the elbow resting flat on the bench, this position being much less tiring than any other. To make the best of this the receiver should be about one to two feet back on the table. Space should be left for the log, microphone, key, etc., without being cramped. All dials and meters should be within reach while sitting at the bench, and all readable. To achieve this try to get the radio equipment in the right angle of the joint of two walls (see Fig. 3). The bench top should be covered with hard rubber to guard against shock, and should be jointless, to stop dust, bits of solder, and small bolts and screws being lost.

Storage space is most important, and one soon accumulates parts such as nuts, bolts, springs, washers, resistors, coils, switches, etc., and a way must be found to keep them tidy. Small boxes can be stacked on a shelf, a nest of component drawers

bought, and stood on the floor or a table, or if the bench is home made, a number of shallow drawers (4in.—6in.) should be constructed. This last method is the method used by the author, and if compartments are added to some drawers, then almost anything can be kept within reach. If the floor space is available, by all means expand outwards, but the only way for many amateurs is up, so make sure all shelving is really safe to carry what is placed on them. Oscilloscopes are cheap compared to the price of human life and limb! Keep the heavy stuff down near the floor, and put only the lighter equipment and boxes on the higher shelves. There is no point in wasting space by having deep shelves and then stacking only at the front, so make the shelves about 6in. wide, bearing in mind what is written above. Some wall space should be left free for charts, maps (great circle maps are best for "DX'ers"), and QSL cards.

Surplus

Spare components can be obtained very cheaply by cannibalising old receivers and ex-Government equipment. Chassis and old parts such as resistors and small capacitors can be re-used, but beware of re-using old electrolytics, these are best bought new. If a use can be found for 3-phase 400c/s motors, all the better, but the experience gained in dismantling old equipment is much more valuable, especially with regard to component layout. If receivers and other equipment are repaired, space

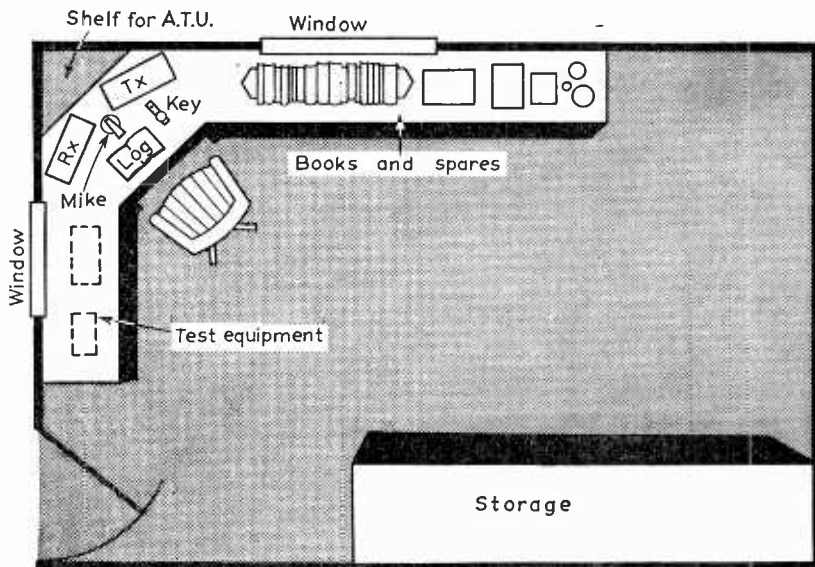


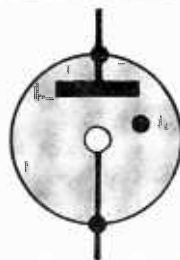
Fig. 3: Layout for a "shack" in the house.

should be left in the workshop for these also. Note to the beginners, now. Don't work on a live or even plugged in set, either with soldering iron or screw-driver, it can be dangerous to the extent of killing you!

Secondly, don't be too miserly with cannibalised equipment, or the workshop will look more like a wholesalers than a place for one of the most interesting hobbies there is. ■

PUSH PULL NEON DRIVER

A. J. BASSETT



SINCE publication of the "Low Voltage Neon Indicator" article in the June, 1966 issue of *Practical Wireless*, several readers have enquired as to the feasibility of a more powerful push-pull transistor circuit whose output would be sufficient to drive a neon bulb. A further suggestion from one reader was that the device should

cause a glow around both electrodes of the neon tube. One or two readers sent along their own suggestions for such a circuit and these were quite good, but unlike that submitted here, used capacitive cross-coupling of the transistors, and were thus more expensive to build.

The device consists of an inductance/resistance tuned oscillator, whose circuit is shown in Fig. 1; no

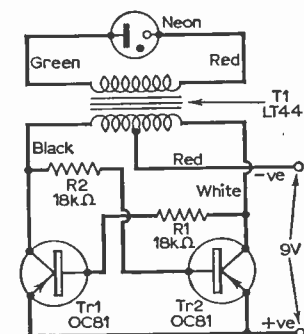


Fig. 1: Complete circuit of the push-pull neon driver.

capacitors are necessary for tuning purposes. This type of oscillator is sometimes used for "battery-to-mains" transistor inverters, for which purpose the components used have larger power-handling capacities than those specified in this article.

The output waveform is a square-wave with plenty of overshoot as Fig. 2a depicts. Fig. 2b shows the waveform after it has been "clipped" by the firing of the neon. The small "pip" on the leading edge is due to the fact that the neon does not fire until a voltage is reached which is slightly higher than the steady burning voltage of the lamp.

In comparison with the device described in the June issue, this push-pull neon driver is more powerful, and so consumes a lot more current; 20 to 50 mA or more according to the load and other operating conditions. This is sufficient to light

several neon indicators in parallel if series resistors are used, or one neon without a series-resistor will light up quite brilliantly, with illumination provided at both electrodes. By using the circuit of Fig. 3 it is possible to light two neon tubes, each at one electrode. The peak voltage available from the oscillator when off load is over 150 volts; more

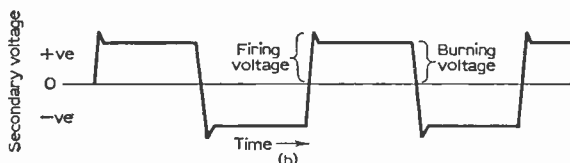
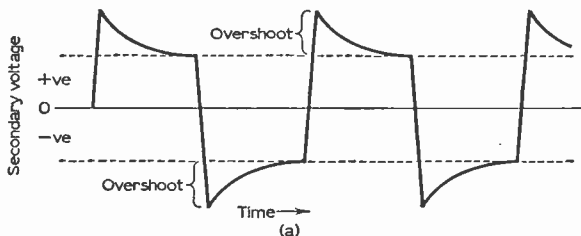


Fig. 2a: Output waveform showing clearly the overshoot on both peaks.

Fig. 2b: The same waveform after clipping.

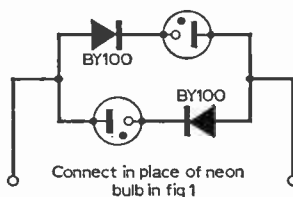


Fig. 3: Modification allowing the use of two neons.

than adequate to fire most of the miniature neon bulbs which are available.

As with the previous article, component layout is left to the ingenuity of the reader, and should present few problems. Due to the simplicity of the circuit, the small size of the components, and the fact that the layout is not critical, the neon driver may be built into quite a small space.

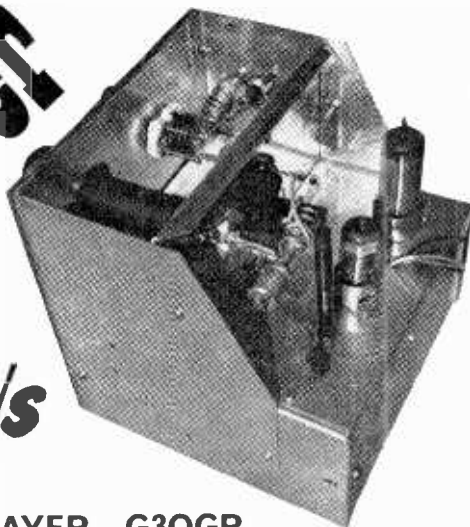
RECEIVING THE BBC STEREO PROGRAMMES

For some inexplicable reason, the grid of the triode of the circuit in Fig. 7 and the collector of Tr4 in Fig. 8 (article of the above title, December, 1966 issue, page 857) are labelled respectively "from collector of Tr4" and "to triode grid of ECF80".

These markings are, of course, incorrect, and the corresponding points relate to suitable connections

for a stereo indicator, which in the article are referred to as points "A".

While the error will be obvious to most readers, some may be confused and think that, perhaps, the valve circuit must be partnered with the transistor circuit. This, of course, is not true as the two circuits are entirely separate.—K. Royal.



ably obtained from a voltage regulator, but satisfactory results are possible by voltage dropping from the 250V line as shown in Fig. 6.

Chassis layout

The prototype chassis was 6 x 6 x 3 in. deep. The panel is supported by large brackets, and these also brace the vertical screen carrying V1, V2 and VC2 (see Fig. 2). This provides a front section with V1 grid and other circuits, while V1 anode and V2 holder tags are behind. The audio stages V3 and V4 are on the chassis.

The vertical screen can be largely wired in advance. Punch holes for VC2, V2 holder, and a clearance hole for V1 (Figs. 3 and 4). The connections in Fig. 3 are when viewing the acorn valve from its shorter or grid end (also see Fig. 2). Care *must* be taken when soldering, or the valve seal will be broken by heat. Leads are shaped and cut so that there will be no strain on the valve pins, and they are tinned with solder. C1 and C2 have

IN a super-regenerative receiver regeneration is advanced far beyond the point where oscillation commences, but is interrupted at a frequency above audibility. This provides very high sensitivity. The super-regenerative receiver described here uses easily obtainable valves, and tunes approximately 142-150 Mc/s with the coils employed. Coverage can readily be modified by altering the coils.

A 954 acorn valve is used for r.f. amplification, and to help isolate the oscillating stage from the aerial. Output is coupled to L4 by L3. V2 is the detector. Grid rectification causes a negative grid potential which stops oscillation until the charge has leaked away through R3, when oscillation recommences. The values of R3 and C4 allow this to happen at above audible frequency.

V_{R1} adjusts regeneration by varying the h.t. voltage applied to V₂. In a super-regenerative detector a loud hiss is heard when no signal is present, but this almost ceases when a signal is tuned in. V₃ is an audio amplifier, and V₄ the output stage.

For smooth regeneration and lack of various feedback effects, a separately decoupled h.t. supply was found necessary for V1 and V2. This is prefer-

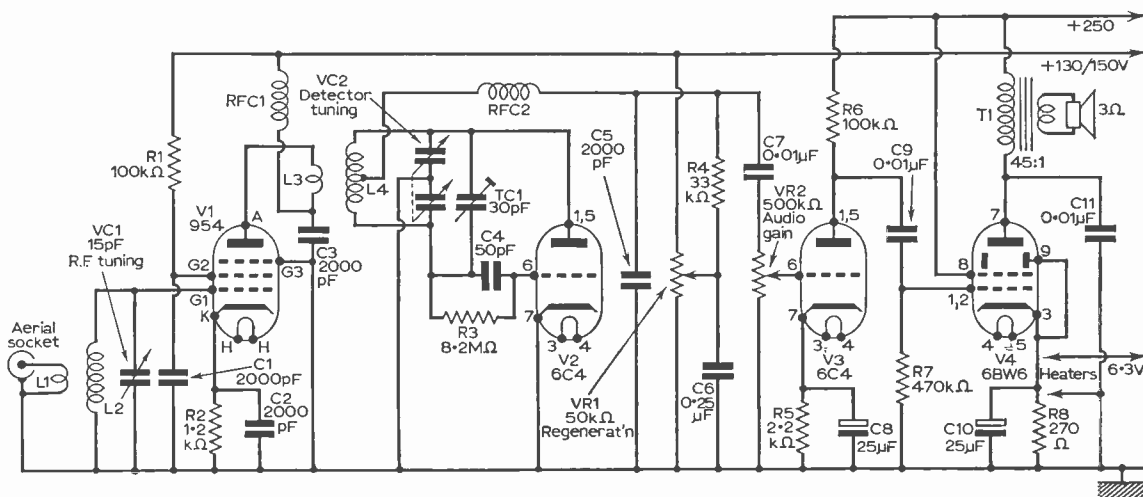


Fig. 1: Circuit diagram of the receiver section.

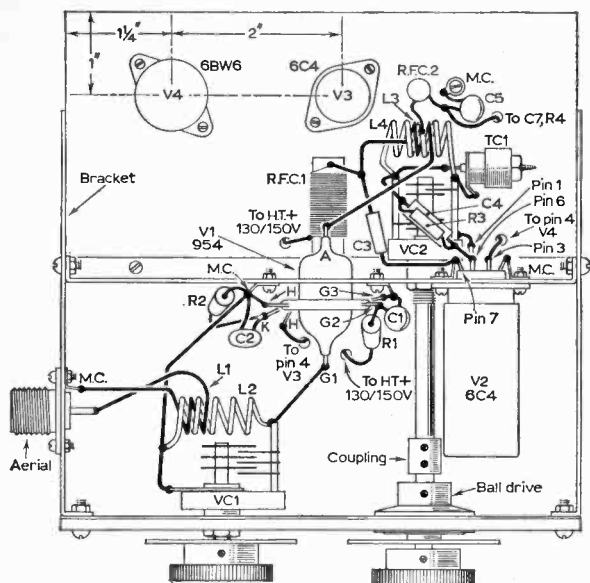


Fig. 2: Top view of chassis layout. Note the positioning of the components. At these high frequencies the shortest possible leads should be used.

the shortest possible wires. Clean the valve pins, if necessary, and tin the *extreme ends* with cored solder and a hot iron, which is removed *immediately* the solder flows. The valve is then soldered in as in Fig. 3, with equal care.

Fig. 4 shows the rear of the screen, leads to V2 and the items in the tuned circuit are kept as short as possible. Fit soldering tags so that tags 4 and 7 of V2 holder may be soldered to them without wire, (Fig. 2). Tag 1 goes to VC2 at its nearest point (Fig. 2).

Capacitor modification

VC2 has four moving plates, and two fixed plates, isolated from each other. It was made from a 75pF short wave variable capacitor. The spindle retaining clip was pulled out with a pointed tool, and the spindle and moving plates withdrawn. Unwanted plates were removed from the spindle by bending them from side to side with small flat nosed pliers. If the capacitor has plates assembled on threaded rods, with spacers, it should be taken apart to remove the plates. The rotor had nine moving plates. Counting from the back, leave plates 1, 3, 6 and 8, and remove the others. Remove all the fixed plates one at a time, and note that the capacitor is not a type with the two fixed plates supports joined by a metal strip in front. Replace the spindle. Prepare two fixed plates by cutting off one lug of each. Put one such plate between the front pair of moving plates, and solder it to one support. Put the other plate between the rear moving plates, and solder it to the other support. Each section of VC2 is thus a single fixed plate between two moving plates, double spaced. The capacity is approximately 5pF each section.

The screen is bolted as in Fig. 2. A coupling and piece of $\frac{1}{4}$ in. rod couples VC2 to the ball

drive, which occupies a hole in the panel. The latter was varnished hardboard backed by aluminium sheet. VC1 has no reduction drive.

Details of winding the coils are as follows: L1; 2 turns of 18 or 20 s.w.g. insulated wire, and placed between the turns of L2. L2; $4\frac{1}{2}$ turns of 16 s.w.g. enamelled or bare wire, spaced to $\frac{1}{4}$ in. long. L3; 2 turns of insulated wire at the centre of L4. L4; 5 turns of 16 s.w.g. wire spaced $\frac{7}{8}$ in. long. All coils are $\frac{7}{16}$ in. outside diameter.

To make L2 and L4, straighten the wire and wind turns side by side on a suitable object. Run a small tool round and round between turns, or stretch the coil to the required length. Shape and cut the ends and solder them to the appropriate points. L1 and L3 are made in the same way and fitted as in Fig. 2.

RFC1 is 70 turns of 34 s.w.g. enamelled wire, close wound on a $\frac{5}{16}$ in. diameter former. It was a push fit on a bolt attached to the vertical screen. Adhesive is applied to the ends of the winding only.

RFC2 is wound on a $2\frac{1}{2}$ in. piece of $\frac{1}{4}$ in. diameter insulated rod. Secure 34 s.w.g. enamelled wire near the top. Wind 70 turns side by side and again secure with adhesive or tape. Bind the extreme bottom of the rod with a few turns of bare wire, and solder on a tag bent at right angles. This tag is bolted to the chassis, and is an earthing point for C5 (Fig. 2). Solder the top choke lead to the centre of L4. Other v.h.f. type chokes should be satisfactory.

Audio amplifier

The audio and output stages are wired as in Fig. 5. Any slight leakage in C7 or C9 will upset the audio stage grid voltages, therefore these capacitors should be tested if not new. A tag strip anchors the two h.t. positive supply leads. Insulated leads for power supplies and speaker pass through a

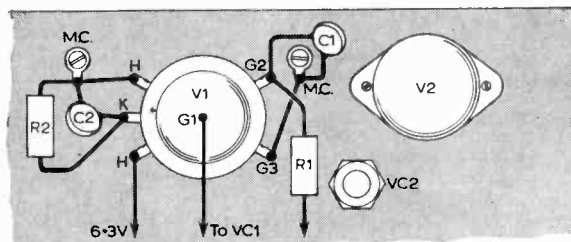
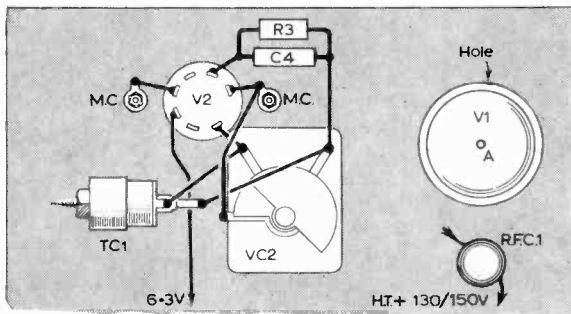


Fig. 3 (above): Top chassis screen viewed from the front.

Fig. 4 (below): Top chassis screen viewed from the rear.



hole in the chassis. If the speaker transformer is separate, and not attached to the speaker, the transformer could be bolted to the chassis underneath, near V4. When using a speaker with transformer attached, remember that the h.t. voltage is present on connections from receiver to transformer primary.

Current can probably be taken from an existing power pack. The heaters require 0.9A at 6.3V. The audio stages draw approximately 60mA at 250V. Current required at the 130-150V point is small, depending on the setting of VR1, and averages about 4-6mA.

Power supply

A suitable power supply circuit is shown in Fig. 6, and can be modified in some cases to suit items to hand. The 6.3V winding may be rated at more than 1A. If this winding can supply 2A or more,

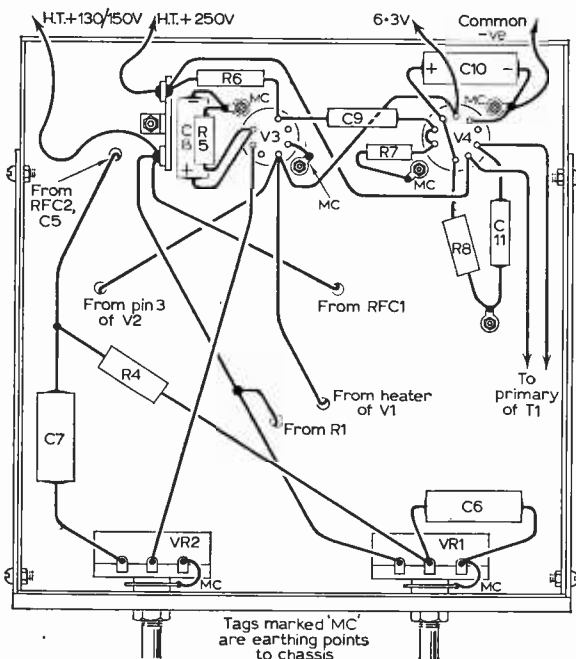
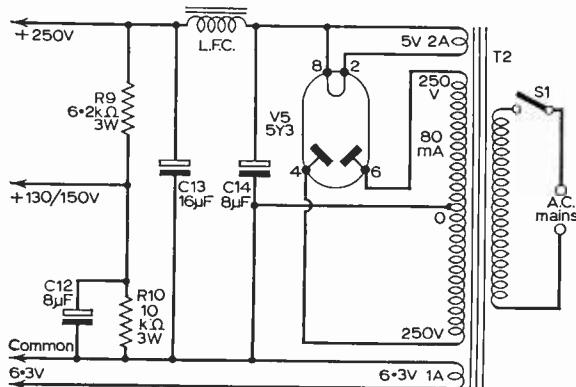


Fig. 5 (above): Under chassis wiring of the receiver.

Fig. 6 (below): Circuit of a suitable power supply.



★ components list

Capacitors:

C1	2000pF 150V disc ceramic
C2	2000pF 150V disc ceramic
C3	2000pF 250V disc ceramic
C4	50pF mica
C5	2000pF 250V disc ceramic
C6	0.25μF 250V paper tubular
C7	0.01μF ceramic or mica
C8	25μF 12V or similar electrolytic
C9	0.01μF ceramic or mica
C10	25μF 25V or similar electrolytic
C11	0.01μF 350V
C12	8μF 350V electrolytic
C13	16μF 350V electrolytic
C14	8μF 350V electrolytic
VC1	15pF variable
VC2	5 + 5pF variable (see text)
TC1	30pF air spaced concentric trimmer
VR1	50kΩ linear pot.
VR2	500kΩ log pot.

Resistors:

R1	100kΩ ½W	R6	100kΩ ½W
R2	1.2kΩ ½W	R7	470kΩ ½W
R3	8.2MΩ ½W	R8	270Ω 1W
R4	33kΩ ½W	R9	6.2kΩ 3W
R5	2.2kΩ ½W	R10	10kΩ 3 watt

Valves:

V1	954 acorn	V4	6BW6
V2	6C4	V5	5Y3
V3	6C4		

Miscellaneous:

Two B7G holders, One B7G screen, B9A holder, L1, L2, L3 and L4, RFC1 and RFC2, see text, Ball drive, Co-axial socket, 10H 80mA choke, Mains transformer 250-0-250 at 80mA, 5V at 2A, 6.3V at 1A, Switch 1 pole 2 way, 4-sided chassis 6 x 6 x 3in., 6 x 3in. flanged runner (Home Radio), 6 x 6in. panel, Two panel brackets about 5 x 5in., Knobs, tag strip, etc.

and there is no 5V winding, a 6.3V rectifier such as the EZ81 can be used, in which case the rectifier cathode is taken to the h.t. smoothing choke only, and all heaters are then in parallel.

H.T. drain can be kept down to a suitable level for a 60mA transformer by using 12kΩ and 20kΩ resistors instead of 6.2kΩ and 10kΩ, and by increasing R8 to 330Ω. Smoothing capacitors need not be the values shown, and can be 350V or 450V. The choke is any small 60mA or 80mA smoothing type. The power supply is built on a separate chassis, size to suit individual components.

Receiver adjustment

With L4 wound as described, TC1 is almost completely open for the 144Mc/s. band. A very small adjustment of TC1 has considerable influence on waveband coverage. Later, it can be rotated

—continued on page 773

WIDE RANGE SIGNAL

95 KC/S — 85 MC/S

THIS generator is suitable for receiver calibration and alignment, and for quick stage-by-stage checks of r.f., i.f. and audio circuits. Unmodulated (c.w.) or modulated r.f. output is available on fundamentals through all frequencies from 100kc/s to 80Mc/s, and harmonics may be used up to 160Mc/s.

Figure 1 shows the circuit, which is for a.c. mains operation. The 6-way switch S1A and S1B selects any of six coils (L1 to L6) which are tuned by VC1. The coverage obtained by the author was as follows, but the extreme ends of each band are unused: Band 1, 95-360kc/s; Band 2, 280-1050 kc/s; Band 3, 890kc/s-3.3Mc/s; Band 4, 2.4-10.5Mc/s; Band 5, 7.25-36Mc/s; and Band 6, 30-85Mc/s. All ranges are with the full 180-degrees rotation of VC1, except for Band 6, which is covered by approximately half-capacity (90-degrees rotation). All the coils are of fixed inductance, to avoid possible loss of calibration.

One triode section of the 12AU7 acts as r.f. oscillator, with output from the cathode via C3 to the 6BA6 amplifier and mixer. The remaining triode section functions as an audio oscillator, with injection to the 6BA6 suppressor grid; VR1 allows control of the output. The 3-way switch S2A and S2B provides oscillator switching.

A small convertor type mains transformer supplies h.t., the drain being about 20mA at 165V. The two heaters need 6.3V, 0.6A. The h.t. line voltage is not too important, but oscillation may cease on Range 6 if this is much under 160V.

Case

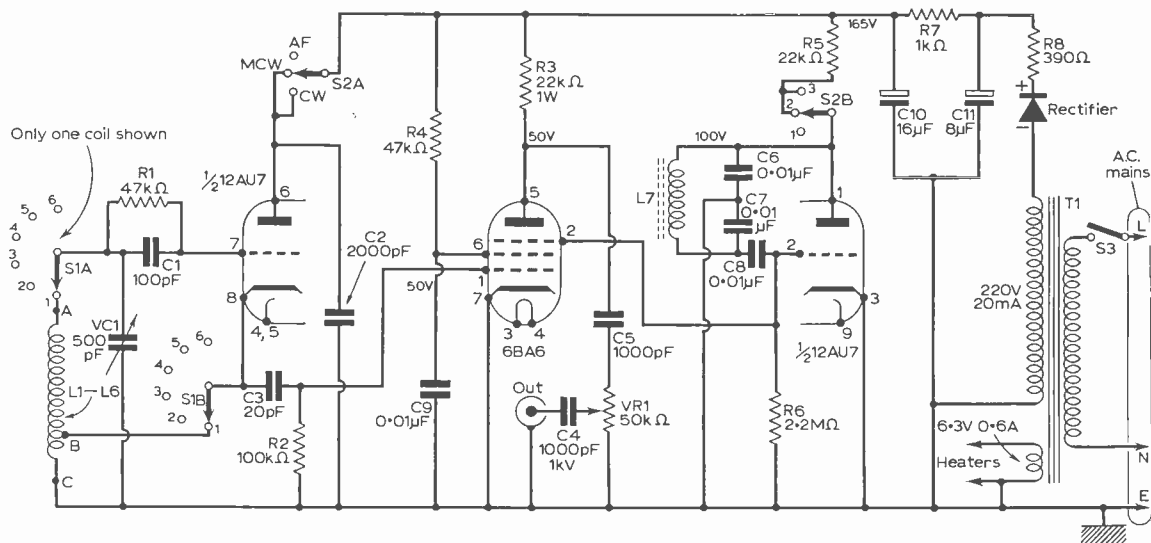
A neat, strong and inexpensive aluminium case was made by the author from "Universal Chassis" members; using two 10 in. x 3 in. runners, two 8 in. x 3 in. runners and two 10 in. x 8 in. plates. Assembled, these provide a cabinet measuring 10 in. x 8 in. x 3 in. A further 10 in. x 3 in. runner acts as chassis.

A different cabinet or case already to hand could probably be used and the layout is not likely to prove critical except for the r.f. oscillator.

The 10 in x 3 in. runner has its corners cut so that the case sides will fit (Figs. 2 and 3) and it is bolted to the panel so that its surface is $2\frac{1}{4}$ in. from the lower edge. The valveholders and mains transformer are fixed as in Fig. 2. VC1 is attached to the panel with three countersunk bolts; spacers being placed between panel and capacitor. A well insulated lead is soldered to the lower fixed plates tag before mounting the capacitor, and this passes directly through a hole in the chassis. A short lead also connects the rotor contact tag to another bolted to the chassis. Nearly all wiring is done before fixing the case sides.

Under the chassis

Wiring and components are shown in Fig. 3. Place the bandswitch so that the shortest possible leads may be used from S1A to R1, C1, and tag 7 of the valveholder. Leads to C2 should be very short, and also from tag 8 (cathode) to S1B.



GENERATOR

R. F. GRAHAM

Heater and h.t. lines can run against the chassis. A tag strip was used as anchor points for C7 and the leads from L7. All wiring should be rigid, the coils being left until last.

The function switch can be wired from Fig. 4. Section S2A applies h.t. to the r.f. oscillator in both "CW" and "MOD" positions. Section S2B supplies the audio oscillator with h.t. in both "MOD" and "AF" positions.

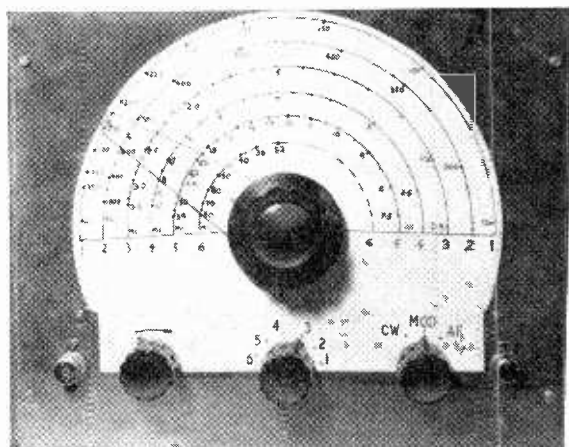
Audio choke

L7 is an audio choke, the capacitors C6 and C7 providing an effective centre-tap. A small transistor receiver output coupling transformer was used by the author, whilst almost any transistor driver transformer or other small audio choke or transformer could be employed. The winding carries no direct current.

If the component has more than one winding, each winding can be tried separately, or both can be used in series, reversing connections to one if necessary. This allows the tone produced to be modified. It is also possible to lower the pitch by increasing the values of C6 and C7, or raise it by reducing these values. When first testing the generator, it is best to listen to the audio output with headphones.

Coils

In view of the large number of turns, ready-made coils were used for Bands 1 and 2. The coils for Bands 3 to 6 were home wound. Each coil has a single winding (or easily-arranged equivalent) with A going to S1A, tapping B to S1B, and the end to chassis (see Fig. 5).



As it is difficult to tap small ready-made coils, extra turns were added for Bands 1 and 2. These extra turns can be looked on as a continuation of the main winding, and are in the same direction. Therefore the earth end of the original winding is now joined to the beginning of the extra coil, and forms the cathode tap B. The end of the new winding C goes to chassis.

Band 1 (100-350kc/s) This was a surplus long wave aerial type coil, with 6 turns added to provide a tapping, as already described. A piece of ferrite rod $\frac{3}{8}$ in. in diameter and $1\frac{1}{2}$ in. long was pushed into the coil and cemented. Another coil was also found suitable, with tuned and coupling windings connected in series to increase the inductance. An unmodified l.w. coil can be expected to give coverage to about 150kc/s.

Band 2 (300-1,000kc/s) This was also an old long wave aerial coil with the coupling winding and core removed, and some turns unwound until suitable coverage was obtained. Five turns are re-wound to give a tapping five turns from earth.

Band 3 (Calibrated 0.9Mc/s to 3.3Mc/s) This is 74 turns of 32 s.w.g. d.s.c. wire, found in a compact pile on a $\frac{1}{2}$ in. diameter former (Fig. 3); tapping B is six turns from C.

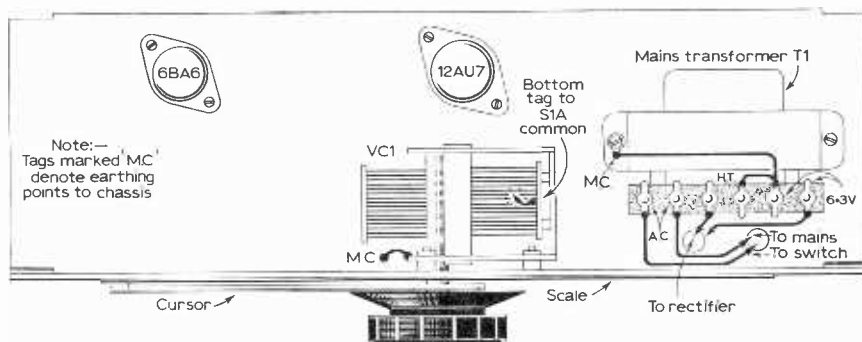
Band 4 (2.5-10Mc/s) This coil has 50 turns of 32 s.w.g. enamelled wire, side by side on a $\frac{1}{2}$ in. diameter former, with tapping B two turns from C.

Band 5 (7.5-34Mc/s) This is also on a $\frac{1}{2}$ in. former, and has seven turns of 24 s.w.g. enamelled wire side by side, with tapping B one turn from C.

Band 6 (32-80Mc/s) This is $3\frac{1}{2}$ turns of 16 s.w.g. wire $\frac{1}{2}$ in. outside diameter and $\frac{5}{8}$ in. long. End A

Fig. 1: (Left) Complete circuit diagram of the wide range signal generator.

Fig. 2: (Right) Top view of the chassis.



All the coils, except that for Band 1, are aircored. Various ready-made coils are likely to be satisfactory. If those with cores are employed, it makes it easier to obtain correct coverage, but the cores must be sealed before calibrating the generator.

Connections are shown in Figs. 3 and 4. Leads to the Band 5 coil should be as short as possible. For Band 6, the coil is placed and connected as shown in Fig. 5. The switch has two wafers, and should be connected as in Fig. 4 so that the shortest possible circuit is obtained for Band 6.

It was found that with a smaller coil for Band 6, giving coverage up to 100Mc/s, r.f. oscillation tended to cease towards the top end. Oscillation was maintained up to over 85Mc/s with the coil shown and thus the second harmonic allows output up to 170Mc/s.

Each coil is electrically separate from the others, so can be checked or modified individually, if necessary. No changes should be made after calibration, of course, and the whole instrument should be kept in its case.

A semicircular scale of thin white card ($7\frac{1}{2}$ in. in diameter) cemented to the panel was used by the author. The cursor was cut from perspex and fixed to a large knob by three self-tapping screws. A hair-line was scribed along the underside of the cursor and six equally-spaced $1/16$ th in. holes drilled on this line, so that calibration marks could be made by placing a pencil point in them.

The knob, with cursor, is locked to the capacitor spindle. The six semicircles can then be drawn by placing a pencil or "Uno" type pen in the appropriate holes. Mark with dots maximum and minimum settings on the outer scale, so that the cursor can be replaced correctly if removed.

The holes were also found very helpful when calibrating the generator. Markings were made in

pencil, then in ink after a final check. With care, the accuracy should be at least equal to that of the popular type of "off-the-shelf" generator. There are several methods of providing calibration, depending on the equipment to hand.

Calibration of the generator (or a receiver) may be aided by employing generator harmonics; multiples of frequency. If a receiver is tuned to the long wave Light Programme, this is 200kc/s. With the switch at CW, tune the generator until its output heterodynes with the Light Programme signal. This is easily done by using Range 1, closing VCI from minimum position. The heterodyne whistle on the receiver falls in pitch towards the correct generator tuning point, rising again as this point is passed. This will also happen with harmonics. The receiver merely compares the generator and Light Programme (or other frequency standard) signals. The generator can thus be calibrated at 200kc/s. Further rotation of VCI will produce a similar heterodyne. This is 100kc/s (VCI nearly closed) and can be marked.

With the generator returned to 200kc/s (zero beat with Light Programme) its output can be tuned in on the receiver at multiples. That is, 400, 600, 800kc/s, and so on. If the generator is tuned to 100kc/s as described, its harmonics appear at 200, 300, 400, 500, 600, 700kc/s, and so on. This allows accurate calibration of a receiver at 100kc/s points.

By tuning the generator to 200kc/s (zero beat with Light Programme) 1Mc/s can be found accurately on the receiver (5th harmonic, 300 metres on medium waves). If receiver tuning is then left untouched, the generator can be tuned to 1Mc/s in Ranges 2 and 3. This can be marked. So can generator frequencies providing harmonics on 1Mc/s. That is, 500kc/s, 250kc/s and 125 kc/s. The receiver can also be tuned to harmonics 1Mc/s, allowing calibration at 2, 3, 4, 5, 6Mc/s, and so on.

When proceeding in this way, an all-wave receiver with a large dial is very useful. A t.r.f. receiver with regeneration just sufficiently advanced to cause a heterodyne is perfectly satisfactory. A superhet should have some form of tuning indicator, or a b.f.o.



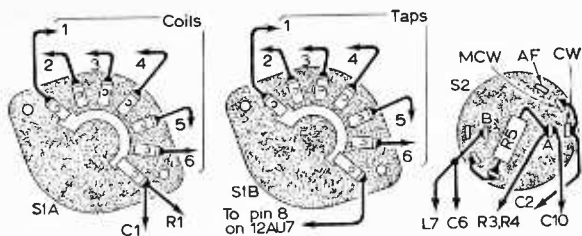


Fig. 4: S1A & S1B switch connections.

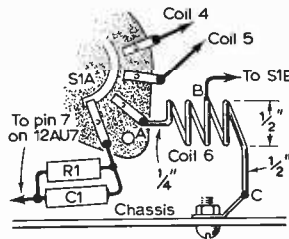
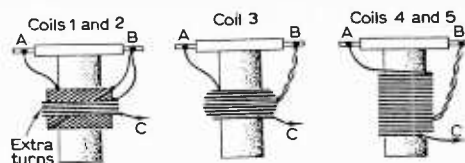


Fig. 5: Coil details for L1 to L6.

To avoid errors, calibrate the generator by beating its output (at a harmonic, if necessary) with a known signal. Working from 200kc/s as described will locate 2.5Mc/s so that M.S.F. on this frequency can be heard (most of the transmission is one second pulses). This allows 2.5Mc/s to be confirmed on the generator, and with its tuning untouched allows, 5 7.5, 10Mc/s and other harmonics to be found on the receiver with great accuracy.

Crystal marker

A 100kc/s or 1Mc/s crystal marker is used by many short wave enthusiasts, and permits quick calibration. Adjust the receiver to marker pips in turn, tune the generator, and mark its scale. By beating generator harmonics with marker harmonics, the scale can be sub-divided as necessary. For example, 50kc/s markings may be found with

a 100kc/s crystal if the receiver is tuned to the generator's 2nd harmonic. Then 150kc/s on the generator is 300kc/s on the receiver, while 250 kc/s on the generator is 300kc/s on the receiver, while 250kc/s on the generator is 500 kc/s on the receiver, and so on, the 100kc/s multiples being from the crystal.

To avoid counting off 100kc/s intervals over high frequency bands if a 1Mc/s crystal is not available, the 1Mc/s point can be found from the 100kc/s crystal, then used to mark 1Mc/s points, later confirmed if necessary with the 100kc/s harmonics.

Accuracy

Any equipment should be switched on for 20 minutes or so, before using it to calibrate the generator, which should have also thoroughly warmed up. As the calibration procedure only has to be done once, care should be exercised. There is usually no need to rely on visual re-setting of the receiver or generator, during calibration, because settings are found by heterodyning the signal or its harmonics.

Wavemeter or G.D.O.

Various surplus and other wavemeters of good accuracy are available. If one is to hand, and has a milliammeter indicator, it can be used by coupling it as loosely as possible to the generator coil. This gives a quick method of calibrating the scales lightly in pencil, as a useful guide to subsequent more accurate calibration as previously described.

A grid dip oscillator can be used in the same way, the signal generator being switched off. Couple the g.d.o. lightly to the appropriate coil. If this is done carefully, with an accurate g.d.o., results will agree very nearly with final calibration, and are thus a useful guide to avoid counting harmonics.

Calibrated generator

If a calibrated generator of sufficient accuracy can be brought into use, tune it in on a receiver, and tune the home-built generator to the same frequency, marking the scale. Remember that the

—continued on page 769

★ components list

Resistors: ($\frac{1}{2}$ -watt except where stated)

R1 47k Ω	R5 22k Ω
R2 100k Ω	R6 2.2M Ω
R3 22k Ω (1-watt)	R7 1k Ω
R4 47k Ω	R8 390 Ω
VR1 50k Ω potentiometer	

Capacitors:

C1 100pF	C7 0.01 μ F
C2 2000pF	C8 0.01 μ F
C3 20pF	C9 0.01 μ F
C4 1000pF, 1kV	C10/C11 16/8 μ F or similar 350V electrolytic
C5 1000pF	
C6 0.01 μ F	
VC1 500pF air spaced	

Switches:

S1A/S1B 2-wafer, 2-pole 6-way
S2A/S2B 2-pole 3-way

Valves:

12AU7 (or ECC82) and 6BA6

Miscellaneous:

L1-L7 as described, B9A holder, B7G holder, coaxial socket, mains on/off switch, 250V 25mA contact cooled or similar rectifier ($\frac{1}{2}$ -wave), mains transformer (220V 20mA HT $\frac{1}{2}$ -wave, 6.3V 0.6A), Universal Chassis box 10 x 8 x 3 in., 10 x 8 in. back plate, 10 x 3 in. extra runner, mains cord, tag strip, etc.

Imported Receivers

WITH reference to Mr. Pryse's letter on page 564 of the December issue of PRACTICAL WIRELESS, I should like to clarify a few points.

Lafayette receivers are NOT manufactured in New York, they are made in Tokyo, Japan, for their own subsidiary in New York which merely acts as an outlet to the trade. However, I do feel that the retailers in the U.S. could have replied though Mr. Pryse states to the contrary. This may be due to his letter having been referred to Japan.

Further to the above remarks, I think that the British dealers who sell knowingly Japanese products under the guise of American ones deserve exposure, and do not accept ignorance of facts as an excuse. No self-respecting dealer buys from an unknown source—though with what I think is junk being offered in the way of so-called kits, I do not believe that there can be many self-respecting radio component dealers in this country.

Cpl. T. K. Offord.

Shrewsbury,
Shropshire.

Communications through the ground

SOME time ago I made some experiments with 4 watt amplifiers for ground communications. I found that 200 yards was about the limit of these amplifiers. I then tried using a pair of AC2PEN DD valves in push-pull; this being little better. When I added a d.c. bias to the signal, I was received slightly more than half a mile away. (My earths are about 30 yards apart.)

I then thought of discarding my equipment which was made up of bits and pieces from the junk box and investing in some new components with which to build a somewhat more powerful circuit suited better to ground communications.

Before taking this step, I thought it wise to make sure that the use of high-power transmitters would not contravene any of the GPO licensing laws, so I wrote to the GPO at St. Martin's-Le-Grand, who informed me, and I quote, "that this particular system is licensable under the Wireless Telegraphy Act of 1949. Before we could consider an application for a licence authorising its use, we should need to know the purpose of the installation and the type of messages you would propose to pass."

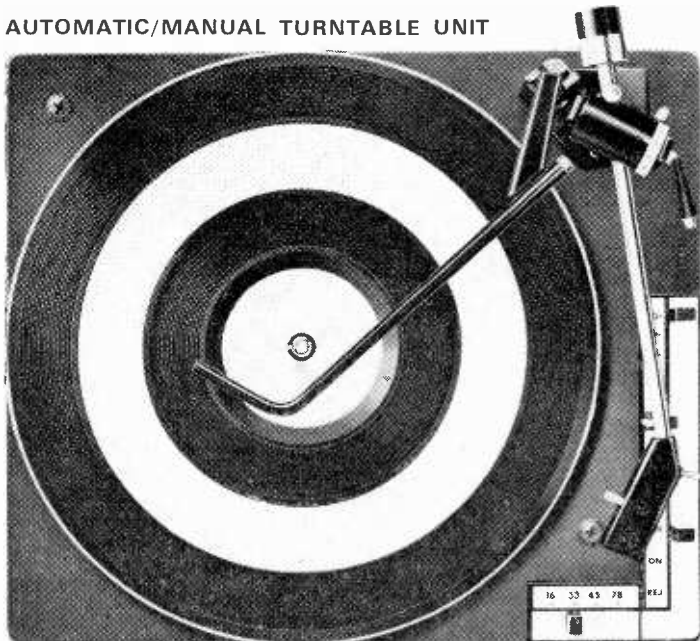
I hope that this information may be of use to those readers who may dabble in the fascinating subject of Ground Communication.

A. J. Clapton.

Trowbridge,
Wiltshire.

NEWS AND..

AUTOMATIC/MANUAL TURNTABLE UNIT



The UA70 is a new auto/manual unit designed by BSR. The 11in. diameter turntable is driven from a dynamically balanced, four pole induction motor located on butyl rubber mountings. The low mass pickup arm, supported on horizontal ball bearing pivots, is of lightweight tubular aluminium and is counter-balanced vertically and laterally. After balancing, the stylus pressure is set by a rotary stylus pressure control calibrated from 0—6 grammes. A mechanical cueing device allows the pickup to be raised or lowered at any selected point on a record when it is played manually.

Another feature is the automatic pickup lock which secures the arm to its rest when a record has been played.

Any standard mono or stereo cartridge may be fitted but the BSR C1 ceramic cartridge is ideally suited to this unit. Wow is below 0.2% r.m.s. Flutter, below 0.06% r.m.s. and rumble is -29dB at 1kc/s. Finish is in satin black with black turntable mat inlaid with brushed aluminium rings. Price is £12.18s.3d. without cartridge.

"BUYING SECONDHAND"

"Buying Secondhand" is one of the newest in the Consumers' Association paperback Consumer Publications series. It suggests where to look and what to look for when you are buying anything from a camera to a sewing machine and from a television set to a golf club. The section that deals with the buying of secondhand radios and TV's is of great value to the non-technical as it points out all the snags and pitfalls that one may fall into. It makes clear all the points that one may not at first look for and think of when making a purchase and we think that this book would be an invaluable addition to most people's bookshelves. The price is 8s. and it is obtainable from any bookseller or from the Consumers' Association, 14 Buckingham Street, London, W.C.2.

...COMMENT

THE EXHIBITION THAT WASN'T!

Britain's first National Hobbies Fair opened at the Royal Horticultural Society's Hall in London on November 12th. The exhibition terms of reference was hobbies in general—collecting of coins, stamps, models, etc., stands for the do-it-yourself enthusiast; boat building; pottery; marquetry; orchid growing—and amateur radio.

Fired with enthusiasm we went along, principally to have a look at two exhibits of particular interest—the British Amateur Television Club and the Paddington Amateur Radio Society. When we arrived, on the afternoon of November 16, we found that the BATC had fled the scene due, so we were told to "lack of interest by visitors", leaving behind nothing but an empty stand. Shaken but philosophical we looked in on the display of the Paddington radio club. The stand was there all right, complete with the club transmitting station G3PAD/A, but the stand was unattended and draped in a shroud!

Instead we went to see a demonstration of hand-operated printing machines which, if not of radio or TV interest, was at least still alive and kicking.

A NOTE FROM MARTIN ELECTRONICS

Martin Electronics Ltd., regret that they have fallen rather behind with replying to letters from customers.

They apologise for any inconvenience that this may have caused readers and hope the delay will not be too long.

NAVAL OFFICER WINS FOURTH PLACE



Sub. Lt. D. Davies, R.N. won fourth place in an international amateur radio contest organised by the Certificate Hunters Club. In addition to winning fourth place, he won the European title in the contest, open to amateur radio operators throughout the world. During the 54 hours of the contest, Sub. Lt. Davies made contact with 348 stations. The photograph shows Sub. Lt. Davies operating his radio station at his home in Msida, Malta.

S.W. Broadcast Stations

I REFER to Mr. R. Ronai's letter in the December issue on page 588 attacking my letter.

In my opinion he appears to have got hold of the wrong end of the stick. I was not talking about non-broadcast assigned frequencies when referring to Radio Moscow and the like.

The point is that Radio Moscow and others are deliberately filling up the Broadcast Bands with distorted modulation jammers which instantly wipe out stations on at least two adjacent channels—in Cyprus, for most of the time the 25m band was completely useless.

I do not care what frequency a s.w. broadcast station uses so long as it is not in any Amateur Band and in this respect I boycott the 7.0—7.1Mc/s frequencies of Radio Pakistan, Radio Peking, Cairo Radio and any others who have the nerve to use Amateur Band frequencies.

As for the 18150 and 12095kc/s frequencies of the BBC, I immediately spring to their defence as I find in winter that these are the only channels usable.

I am not demanding that you should stop mentioning these stations, but I feel that if you really cared you would.

N. D. Mugford, A4713 Anglesey,
(ex ZC4) North Wales.

Ancient and Modern

I WOULD be interested to learn if any other readers have successfully fitted a modern pickup to an early cylinder-type gramophone. I have an Edison model circa 1890 with a number of wax cylinders, most of which are in mint condition.

A.W. Jenner. 53 Clifford Way,
Hounslow,
Middlesex.

Wireless Set 31

I WILL shortly be getting a 31 set, and I would like to ask other readers if they have any useful data on this unit that they could lend me. These sets are advertised as breakdown units, but I would like to get one working rather than break it down for spares.

Charles Cawley. 15 Willow Walk,
Dog In Tree Estate,
Huntington Cannock,
Staffordshire.

practically wireless

commentary by HENRY

No. 30

"Whobody
did it"

THE prime advantage of sitting on a fence is the all-round view one gets. A service mechanic who is also an inveterate spare-time dabbler treats with greater sympathy the customer bringing electronic oddments for repair after having had a go—and failing. He knows too well the pitfalls and frustrations of kitchen-table surgery.

Not so sympathetic the super-professional, with his spot-checks, stock faults and instant diagnosis. Between him and the amateur there is a constant love-hate relationship. From his position on the rails, like a cowpoke at the rodeo, Henry watches them react with an air of detachment.

The pathetic, defunct receiver lands on the workshop bench



Like a cowpoke at the rodeo.

and A. sniffs around it like a mongrel who scents an unwelcome visitor. He removes the back as if expecting some pop-eyed golliwog to spring up and surprise him. He glares at the works then: "Someone's been at it," he yells.

True enough. Very often someone *has*; the unfortunate owner, in an attempt to circumvent the crippling charges that

service carries in these times.

Without test equipment, spares and experience he is handicapped. While he may make his preliminary tests with confidence, there comes a stage when he is beaten. It is easy enough in a well-equipped workshop to whip a valve from the rack to make a proving test—not so simple for the chap who has to justify the inroads into the family budget. And then discover the fault lies a lot deeper and the expense was not justified after all!

★ ★ ★

It sometimes seems that the chief enemy of A. is the bloke who ultimately pays his wages, the customer. He is angered by the substitute component dangling precariously from a tag-strip, affronted by an obviously "surplus" valve, offended by crystalline solder joints while one of those emergency circuit alterations (which may even be an improvement on original design) he regards as a personal insult.

But while A. is aggrieved at the outsider's attempts, B. is almost apoplectic. He has the "Whobody did it?" complex developed to a fine degree. At the first sign of tampering, he is likely to threaten to down tools. Something of a perfectionist himself, he cannot bear the sight of someone else's bungling. It takes all the Service Manager's diplomatic guile ("Get at it, mate!") to make him deal with a radio set that has "bounced".

For the benefit of innocent readers who imagine that the radio workshop is a magic cave whence issue perfectly rejuvenated receivers it should be explained that the "bouncer", the "reject", the "comeback" the "second complaint" or "twicer" is the repair job that has been delivered and subsequently fails.

It does happen—yes, really, even in the best organised department. Knowing the bits and pieces that go into the average item of electronic equipment, it is not surprising that the occasional failure crops up. But the customer whose precious tune-box develops apparently similar symptoms is likely to be querulous when bringing the bouncer back.



'B' is almost apoplectic.

Listening to B. argue that the trouble is an Act of God is a treat the rest of the workshop rarely likes to miss. But hearing his remarks afterwards, when he discovers that the knobs are screwed on askew, the fastening bolts cross-threaded and maybe the valves plugged into the wrong sockets is a banquet of outraged invective. "The blighter isn't getting this done for nothing," he fumes.

Again for the benefit of the innocent, remember that repairs carry a limited guarantee. Limited, that is, to the work that has actually been done. When you take your car to the garage for a carburettor job and get a puncture as you drive home, you would hardly expect a sympathetic response if you rang up the mechanic to complain.

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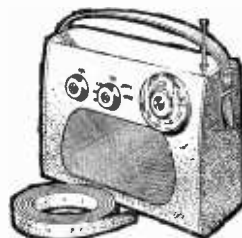
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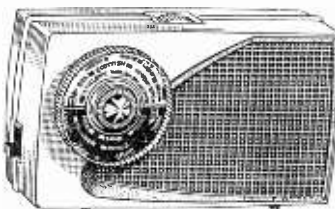
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Fully tunable over Medium and Long Waves and Trawler Band. Incorporates Ferrite rod aerial, tuning condenser volume control, new type fine tone super

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POCKET FIVE Now with 3in. Speaker!

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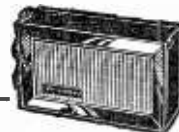
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TRANSONA SIX

● 8 stages—6 transistors and 2 diodes

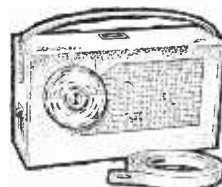
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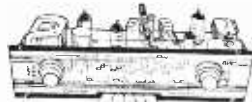
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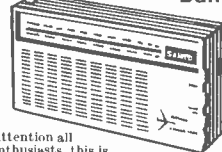
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MONTHLY NEWS FOR DX LISTENERS

Times in GMT
Frequencies in kc/s

THE BROADCAST BANDS

by JOHN GUTTRIDGE

IF you want the real DX contact you will have to work for it this month, especially after dark. From 1900/2000 onwards you can forget the 13, 16, 19 m. bs. If you wait for the late evening the 49 m.b. can produce surprising results with low-powered South Americans breaking through the strong European signals. If your ears can stand straining through c.w. the 90 m.b. is providing some rare catches.

MIDDLE EAST

Israel: *Kol Israel* (Broadcasting House, Jerusalem), has dropped its Sunday morning English transmissions. The evening transmission to the U.K. has been re-timed to 2115-2120 on 9,009/9,725. The African English transmission remains 2015-2030 on 9,009.

Turkey: *Radio Ankara* (Ankara), has been heard signing on at 2330 on 9,745 in an unidentified language.

ASIA

Afghanistan: *Afghan Broadcasting System* (Ansari Wat, Kabul), has restarted its evening English transmission after a lapse of several years. The transmission from 1900-1930 has been reported on 15,225 and 11,865 although some say the 25 m.b. outlet is 11,760. Other reports say the 19 m.b. has been replaced by one in the 31 m.b.

Indonesia: *Radio Republik Indonesia* (P.O. Box 157, Djakarta) now appears to use only 9,865 between 1615 and 2000. English is at 1900-2000.

Korea (P.D.R.): *Radio Pyongyang* (Pyongyang), has replaced 6,650 by 6,480 for its 1100-1200 and 1400-1500 English transmissions. The other frequency for these transmissions remains 7,580. The station's home service may be faintly heard during the evening on 6,290/6,600.

Malaysia: *BBC Far Eastern Relay Station* (P.O. Box 716, Johore Bahru), now has its own QSL card which is far superior to that issued by the BBC, London. Indeed this BBC relay outlet will give full verification details on the card if asked, something that London will not do.

Philippines: *Far East Broadcasting Company* (Box 2041, Manila), now using 11,855 instead of 15,385 from 2330-0030. In the morning DZH8 has been heard signing on in English before 0900 on 11,855.

NORTH AMERICA

U.S.A.: *Voice of America* (U.S. Information Agency, 330 Independence Avenue, S.W., Washington 20547, DC), now has the following English schedule to Europe: 0300-0730 3,980/5,965/5,995/7,200/7,250/9,540/9,635/9,740/11,790; 0500-0730 6,040/15,295/1,196; 1400-2330 3,980/7,205/9,760; 1500-2215 5,965; 1900-2215 9,710/11,760; 1830-2330 11,805; 1400-2215 15,205; 1400-2000 15,290; 1400-1830 17,780; 1600-1800, 2100-2130, 2200-2330 1,196. On Sundays read 2345 for 2330.

A new programme format is being used by the V.O.A.

U.S.A.: *Radio New York Worldwide* (485 Madison Avenue, New York, N.Y., 10022), now uses the following frequencies to Europe in English: 1200-1400 15,265/17,845; 1400-1600 15,440/17,845; 1600-2100 15,440/17,755; 2100-2130 15,440/11,970; 2130-2330 (-0030 Sundays) 9,655/11,970; 0030-0100 Sundays 9,655.

CENTRAL AMERICA

Cuba: *Radio Habana Cuba* (Apartado Postal 7026, Habana), now transmits in English as follows: 2010-2140 (Northern Europe) 6,015; 2050-2150 15,270/15,300; 0100-0600 11,760/6,170; 0330-0600 6,135; 0630-0800 9,655; 1800-1900 15,340.

Netherlands Antilles: *Trans World Radio* (SC Zout-pannenweg, Bonaire) has English as follows: 0035-0105, 0230-0400, 1105-1235 (-1530 Sundays) on 11,815 or 11,820; 2100-2130 (Europe) 15,130 or 15,245 or 11,815 or 11,820.

Windward Islands: *Windward Islands Broadcasting Service* (St. George's, Grenada). The European frequency used from 2000-2145 has been variously reported as 11,895 or 11,920.

SOUTH AMERICA

Brazil: *Radio Ailtina de Bahia* (Avenue 7 de Setembro 311, Salvador, Bahia), has reactivated ZYN30 on 15,225. Has been heard from around 2300-0130.

Ecuador: *La Voz de los Andes* (HCJB), (Casilla 691, Quito), is again using 15,115 during its 1845-2000 and 2100-2130 English transmissions. The parallel frequency is 17,890.

EUROPE

Austria: *Osterreichischer Rundfunk* (Wien IV, Argentinierstrasse 30a). Frequency schedule valid to 0100 on 5th March is as follows: on 6,000 0430-2300; 6,155 0500-1100, 1700-2200, 2300, 0430; 7,245 0500-1300, 1800-2000; 9,525 0000-0300; 9,610 1700-1900; 9,770 0500-0800, 1100-1700, 2300-0400; 11,760 0300-0400; 11,895 1200-1400; 11,900 1100-1400; 15,210 1900-2100; 15,410 0600-0900; 15,430 0000-0200; 17,730 1400-1600; 17,750 1600-1800; 17,755 1000-1200; 17,855 0400-0500, 0800-1000.

Belgium: *Belgian National Broadcasting System* (Overseas Service, 18 Place Eugene Flagey, Brussels 5), has replaced 17,860 by the new outlet of 11,715 from 1600-1715. At this time 9,740 is also in use. Another new outlet heard is 9,660 from 1830-2100.

Thanks go this month to the Swiss Broadcasting Corporation, A. B. Thompson, the World Communications Club of G.B., B. Bunting, Roy Patrick, A. E. Roxburgh, the International Short Wave Club, B. Lowe, J. D. Ashworth, J. W. Smith, B. Garvey and D. G. Hobro.

AUSTRALIAN and New Zealand hams at 5 and 9 plus on topband or just a few local G stations? Well, your guess is as good as mine for the coming year. Theoretically 28Mc/s should be really something and 21 should also provide hoards of DX. Fourteen will doubtless continue to provide most distant signals at one time or another, and of course 7Mc/s will seem noisier than ever. Topband and Eighty may well go down into the doldrums with the seasonal changes and the sunspot activity increase.

What about those New Year resolutions? All those not making any are banished to 7Mc/s. Still stuck for ideas? How about the station itself. Does your antenna go to ground when you switch off? How about fuses, and those mains plugs, are they 100%? Has the earth lead corroded? This can be a source of noise. First resolution then, check the entire installation from mains right through to the aerial itself. If you do this just once a year it will avoid your wondering why you don't hear the DX too well, only to find when you do check, that the antenna wire broke off at the window, giving you an effective length of 3½ft. (Pauses, titters behind fan, and remembers case of the '3JDG "longwire" which wouldn't load.) This month there appears to be a mass migration to ten metres. Certainly the band has been wide open most days although it does fall off at night. If things continue we will doubtless end up with the spottiest sun for decades. In view of the many very fine logs which arrived I propose to move on to my New Year resolution—cutting of the cackle.

TEN

Reports from all over, from Scotland to Worcestershire, all reporting the same story, DX on Ten. All modes, all continents too, with the best time to listen still during daylight hours.

C. Clarke (Surrey), 12 valve single conversion s/het, phased verticals logged—K2RFZ/MM, K3BEQ, K8ERD, LU7ABV, MP4BBA, MP4TBO, OD5CN, PY2ARV, SV1AN, SV0WL, UA1AVM, UA3AJT, UA6LIV, UA9FFB, UB5APK, UW9CR, VE3FIT, VK3AHT, VK3HW, VK6CF, VP9FB, VS9AJC, W1FQA, W8CNC, W9ARK, W0GYM, ZC4MO, ZS4OI, ZS5DC, 4X4HJ, 9J2BK. Chris reckons it won't be long before we start hearing JA and UA0 on ten metres. Anyone been lucky yet?

P. Baker (South Wales), HE30, 45ft. l.w. raised—CR4BC, many CR6's, CR7DS, CT3AM, EA6BH, EA8AE, JA1TRD (sorry I spoke!), K2GL, MP4BBA, OD5BU, PY1LW, SV1AL, UA9FB, UF6DV, UG6AZO, UY5HF (Ukraine—new prefix issue), VO1HB, VS9APW, W5GQG, W0IMC, XE2BM (Mexico), ZB2AJ, ZC4KF, ZE1JA, ZS1JH, ZS8L, ZS9G, 5A1TK, 5N2AAF, 9H1A, 9Q5EB.

George Owen (Somerset), GC1U, Joystick, heard—CR4BC, CT3AM, CX1AAM, EA8EV, IT1ALD, K3AAG, LU2DED, PY8MA, PZ1BK, VE2BT, W1CLP, W5GQG, ZE1BP, ZS1BS, 9Y4VS, all these on a.m.

Colin Morris (Worcestershire), double s/het home-

brew, Joystick, hooked—CR6HF, CX2CO, CX4AW, ET3AC, FH8CD, HK3AVK, KR6LL, KG6AAY, KV4CX, KP4BJM, LU1DAB, MP4TBO, OA4PQ, UL7JA, VK4HC, VK5QR, VK6GP, VK0KM (Antarctica), VP5RB, VS9AJC, all W prefixes, YV9AA, ZB2AM, numerous ZC4's and ZS's, 4X4GV, 4Z4HQ, (new prefix—State of Israel), 5A3TN, 5N2AAF, 5R8CQ, 5Z4AA, W0GTA/8F4 (Sumatra), 9Q5BD. Colin informs that Don Miller has permission to operate from Albania, Rio de Oro, and Annobon Island. Also reported is great activity anticipated on Easter Island (CE0). W0GTA/8F4 is also trying topband.

Many more logs for 28Mc/s but the picture can be seen from those quoted, so let's wander downscale to—yes, the dreaded l.f. bands, 80 and 40.

L.F. END

C. Claydon (Scotland), 840C + preselector, 12ft. vertical groped in the 7Mc/s darkness for—EA4CR, K1HVV, SV1CX, UL7QG, 9X5MH (Rwanda), W1FJJ, WB2NDS.

D. Harvey and **T. Cowpe** (Salop), R107, 80ft. wire, both assure that persistent scanning of the dreaded segment brings rewards. Proof offered—HB9ABM, I0RB/4U, JA4BJO (yes, Japan), JA6YB, K8ARW, KP4BRX, LX4JB, OA3KCB, OX3KV, UA3KBD, UA6KE, UD6BV, VP6KL, VK2AVA (nearly always on 40), VK3BM, W0GTA/A, ZC4MO.

F. Simpson (Yorkshire), claims that 40 is like someone sawing an endless plank. (I wooden be surprised!). On the other hand 80 proved very fruitful with—KG4AA, OA8V, OX3JV, TF3EA, VO1FG, VE1IE, VE2XO, VE3WV, VP1PV, VP2AA, VP7DL, VP9BO, VS9AJC, VS9ALV, W1HKK, W2ZPO, YS1DHE, YV5BOI, ZF1GC, 6Y5EM. It's almost as good as my 21Mc/s log!

N. Henbry (Sussex), strikes again! Armed with an EA12 and a 20 metre dipole on 3.5Mc/s, Norman logged K2DXV, K8YWG, VE1ADA, VE3AYS, VS9AJC, W1AQH, W2APU, W3BMS, W4SIB, W9JLH, YV5BTS, ZB2AJ, ZL3ACJ, ZL3GS, ZL4KE, ZL4LM, 7X0AH. On 7M/cs the best were CN8AW, CR6IV, PY1BDX, VE3LZ, VK2AVA, VK0AA, VP2AA, W3BMS, W4BYB, WA8DNQ, W0GTA/8F4, 5A1TS.

14 AND 21

Very, very few reports for the favourites, everyone seems split into two groups. The "let's listen on ten" brigade, and the real expert DXers trying their skills on 3.5 and 7.

R. Garvey, back from Cyprus (get the umbrella out of pawn again, Bob) had a quick listen with his S640 and heard VK's on 14Mc/s at 589. His best for the session—EP2RV, JT1KAA, OY3L, TA2AC, VK2EO, VK0NB, W6MQT/OX3, ZA1BB.

CONTESTS

Sparse month for contest types. Only two down in my diary—14-15th, Affiliated Societies' Contest (quite lively this one), 29th, 144Mc/s c.w. Contest. Many thanks for the fine logs, deadline for January is the 24th.

LOOK!

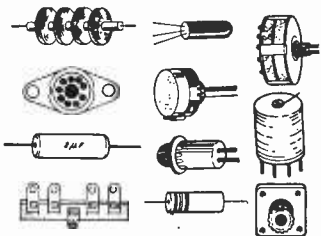
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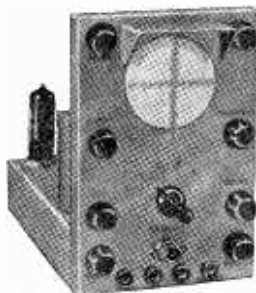
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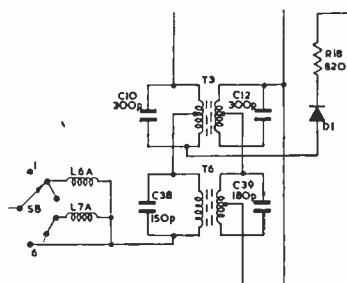
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DK91	5/6	PC84	6/-	25L6GT	6/6	AFZ12	12/6	OA2306	8/6	OC70	4/-
DK92	8/-	PC89	11/-	30L15	10/-	ASV26	6/6	OA2307	8/6	OC71	4/-
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DL92	5/-	PCF80	7/-	30PL14	11/-	ASZ20	7/6	OA2309	8/6	OC73	7/6
DL94	5/9	PCF86	8/6	30L15	11/-	GET20	10/-	OA2310	8/6	OC75	6/-
DL96	7/-	PC182	9/-	30P12	9/-	GET102	6/-	OA2311	8/6	OC76	5/-
DY86	6/4	PC183	8/6	30P19	13/6	GET103	4/6	OA2312	8/6	OC77	7/-
EBC41	7/6	PC184	7/6	30PL12	10/6	GET105	8/6	OA2313	8/6	OC78	5/-
EBC81	6/3	PC185	9/-	30PL13	12/-	GET113	5/-	OA2322	4/6	OC81	5/-
EBC90	4/3	PC186	8/6	33L6GT	6/-	GET114	4/-	OA2324	4/6	OC82	5/-
EBC98	6/9	PC187	9/-	33Z5GT	5/6	GET115	9/-	OA2325	4/6	OC83	5/-
ECC81	4/-	PL36	9/-	50L6GT	6/6	GET116	12/6	OA2326	4/6	OC84	5/-
ECC82	5/-	PL81	7/-	AC107	10/-	NKT213	6/-	OA2327	4/6	OC85	5/-
ECC83	5/6	PL82	6/6	AC126	8/6	NKT216	7/6	OA2329	9/6	OC86	5/-
ECC85	5/-	PL83	6/6	AC127	7/6	NKT251	9/-	OA2331	9/6	OC87	5/-
ECC90	7/-	PL84	6/6	AC127	9/6	NKT255	9/6	OA2332	9/6	OC88	5/-
ECH35	10/6	PL500	13/6	AC128	8/6	NKT304	8/-	OC16	20/-	OC89	5/-
ECH42	9/-	PY32	8/6	AC176	7/6	NKT403		OC19	7/6	OC94	6/-
ECH81	5/8	PY81	8/-	ACV17	8/6		17/8	OC22	10/-	OC122	15/-
ECH84	8/10	PY82	8/-	ACV18	5/6	OA5	4/-	OC23	12/6	OC139	7/6
ECL86	7/-	PY83	6/-	ACV19	6/6	OA7	4/-	OC24	17/6	OC140	9/6
ECL87	6/6	PY88	7/3	ACV20	5/-	OA10	3/-	OC25	9/6	OC169	5/-
ECL86	9/-	UBC41	7/6	ACV21	6/-	OA47	3/-	OC26	7/6	OC170	5/-
EF80	5/-	UBC81	7/6	AD140	16/-	OA70	2/-	OC28	12/6	OC171	6/-
EF86	6/8	UCC85	6/6	AD149	16/-	OA73	2/6	OC29	15/6	OC200	7/6
EF183	6/4	UCH82	8/6	AD161	11/-	OA79	2/6	OC35	12/6	OC201	11/6
EF184	6/4	UCH81	8/6	AD162	11/-	OA81	2/6	OC36	12/6	OC202	13/6
EL34	8/6	UCL82	7/3	ADT140	15/-	OA83	3/-	OC41	6/-	OC203	10/6
EL41	8/6	UL41	8/6	AF102	18/-	OA86	4/-	OC42	5/-	OC204	15/-
EL84	4/9	UL84	6/3	AF114	6/6	OA90	2/6	OC43	9/-	OC205	15/-
EM84	7/-	UY85	5/8	AF115	6/-	OA91	2/6	OC44	5/-	OC206	22/6
EY51	7/-	U25	9/6	AF116	6/6	OA96	3/6	OC44M	5/6	ORP12	8/6
EY86	6/6	U26	8/6	AF117	5/-	OA200	3/3	OC45	4/-	ORP60	5/-
EZ40	7/6	5U4GB	6/6	AF118	12/6	OA202	4/3	OC45M	4/-	18202	4/6
EZ80	5/-	5Y3GT	5/-	AF124	9/-	OA210	7/6	OC46	5/6	28012	20/-
EZ81	5/-	5Z4GT	8/-	AF125	8/6	OA211	9/6	OC47	7/6	28012A	25/-
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Wide Range Signal Generator

—continued from page 759

receiver will respond if tuned to the same frequency. But there is no response if the generator is tuned to multiples of the receiver frequency. So the fundamental frequency is the first one causing a response if the generator is tuned from a high frequency downwards.

HARMONIC STRENGTH

Harmonics grow progressively weaker. With a sensitive receiver, 1Mc/s harmonics may be heard up to 30Mc/s or higher, while 100kc/s harmonics can be tuned in up to about 5Mc/s.

With a t.r.f. receiver, any response will be at

the generator frequency, or multiples of this frequency.

When using a superhet, various spurious responses arise. They can usually be identified because they are weaker. Second channel effects are heard at a frequency which corresponds to an error of *intermediate frequency* $\times 2$ (940kc/s for an i.f. of 470kc/s). This is likely to be noticed at high frequencies, but not at medium or low frequencies.

Weak spurious responses also arise from receiver-oscillator harmonics beating with the generator-signal. This is also usual.

VR1 is used to adjust signal strength as required, but ceases to be wholly effective at high radio frequencies. This is unavoidable with a simple potentiometer. Enough signal is often secured merely by placing an unscreened generator output lead near the receiver aerial.

TESTING and ALIGNMENT PROCEDURES

The wide range signal generator can be used for many purposes, such as the quick location of faulty stages in audio amplifiers, or complete receivers. If an audio amplifier gives no results, for example, the source of the fault can often be found quickly by injecting an a.f. signal. A typical two-stage amplifier is shown in Fig. 6.

With battery-operated valve receivers, or those having heater and h.t. from a transformer, a direct connection can be made to the chassis or earth line at A by clipping on a lead from the generator earth, or coaxial outer conductor. With a.c./d.c. or other sets alive to the mains, first check that the chassis goes to mains Neutral. Also include an isolating capacitor in the earth mentioned.

AUDIO STAGES

Then set the generator to give an audio output, and feed it into point B. If the signal is not heard, the output transformer or speaker is defective or disconnected.

If the signal is heard, transfer the generator prod to C. If there is a considerable increase in volume, the output stage is obviously working. Then transfer the prod to D. If the signal disappears, the coupling capacitor or connections here are defective.

Should output be obtained from injecting at D, take the prod to E. Volume should again increase greatly, if the triode amplifier stage is functioning correctly. Then take the prod to F. If the signal disappears, the 1M Ω volume control or a connection to it is suspected. If results are in order, move the prod to take in any pick-up or other lead included.

Thus, the method is to work backwards stage by stage, until results cease. The last part of the circuit just introduced is then faulty. When the faulty stage is found, a meter is generally brought in to check resistors and other items in the defective stage. Generator output is reduced as necessary with the output control. Pre-amplifier and other stages can be dealt with in the same way.

I.F. CIRCUIT TESTS

Exactly the same method can be used to locate a faulty stage in an intermediate frequency amplifier, the generator being adjusted to deliver modulated r.f. at the intermediate frequency. With many receivers the i.f. is around 470kc/s. First test the audio amplifier as described, if necessary. Audio is also injected at points A and B, Fig. 7, to check the anode coupling capacitor. Then inject audio at C, D, E and F in turn, to check the triode section of the double-diode-triode, grid capacitor, potentiometer and 33k Ω diode filter-resistor.

Modulated r.f. can now be injected at G, and the generator tuning swung around the i.f. Output at one frequency shows that i.f.t.2 is in order. Lack of output shows this component, or connections, to it, are faulty.

With output obtained, move to point H, to check the i.f. stage. Output should be much increased. Taking the prod to I tests i.f.t.1. Results should also be obtained with a signal at the i.f. injected at J.

When a faulty stage is found, a meter test will show if normal voltages are present. If not, the connection or resistor in circuit should be checked.

I.F. ALIGNMENT

With a new home built receiver, set the generator at the specified intermediate frequency (modulated). Should the i.f.t.'s be pre-aligned or not badly off tune, inject at J and adjust their cores for best results.

If the cores are badly off tune, often it is necessary to inject at G and tune i.f.t.2, then at I and deal with i.f.t.1. Afterwards inject at J (to remove stray capacity from i.f.t.1) and re-adjust both i.f.t.1 and i.f.t.2.

R.F. STAGES

If a defective receiver has been tested as far as I and J, Fig. 2, this shows that the i.f. and a.f.

sections are working. Modulated r.f. of the frequency to which the receiver is tuned can then be injected at J. Lack of results shows that the mixer stage is defective. Moving the prod to K (with results from injecting at J) allows the individual coils to be checked.

When an r.f. amplifier is present, this can be checked with the appropriate r.f., exactly as with the aerial circuit of the mixer, Fig. 7.

To align aerial and oscillator circuits of a newly made receiver it is usually convenient to set band coverage, adjust the aerial circuit to agree, then trim and adjust cores for best sensitivity. For a typical medium waveband of about 550-1500kc/s this could be done as follows:

- (1) Switch to medium waves, inject 1500kc/s at aerial and adjust oscillator trimmer for correct dial reading.
- (2) Roughly adjust aerial trimmer for best results.
- (3) Inject 550kc/s and adjust oscillator coil core for correct dial reading.
- (4) Roughly adjust aerial core for best results.
- (5) Inject at 1300kc/s, and adjust oscillator and aerial trimmers for best sensitivity.
- (6) Inject at 750kc/s and adjust oscillator core and aerial core for best sensitivity.

Steps (5) and (6) are repeated until no further improvement can be obtained. The actual trimming point (5) and tracking point (6) will vary somewhat in actual receivers, but are generally a little clear of the extreme ends of a band. At these steps the oscillator trimmer and core need not be altered unless a compromise is needed with the accuracy of dial readings.

Any r.f. stage coils can be dealt with in the same way as the mixer aerial coils, Fig. 7. With completely separate coils for each waveband, deal with each band individually, afterwards checking all bands. With long/medium wave coverage by dual-band coils or ferrite aerials, it is usually necessary to adjust medium waves first.

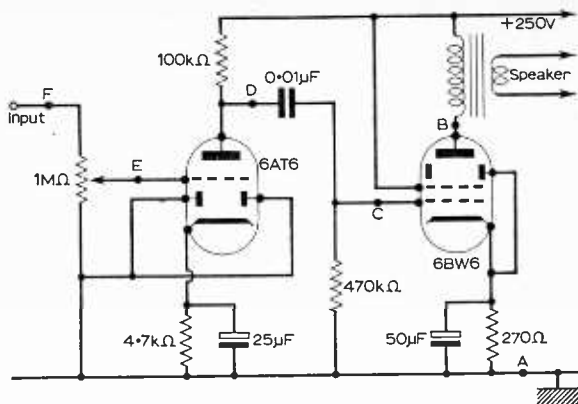


Fig. 6: Test points on a typical audio amplifier.

OUTPUT INDICATION

If tuning is by ear, keep the generator output as low as possible for final adjustments, with the receiver audio gain at maximum. Otherwise the any a.g.c. circuits will mask the effect of adjustments.

An audio output meter is often handy. The simplest comprises a crystal diode in series with a multi-range meter, which is connected across the output transformer primary or secondary. Set the meter to a suitable d.c. range. Some meters can be used without the diode by switching to an a.c. range.

It is sometimes convenient to adjust tuning or i.f.t.'s. for minimum anode current in an a.g.c. operated stage. To avoid interrupting permanent wiring, a multi-range meter can be clipped across one of the cathode resistors in Fig. 7. Either 2.5, 5 or 10V range is usually satisfactory, according

—continued on page 773

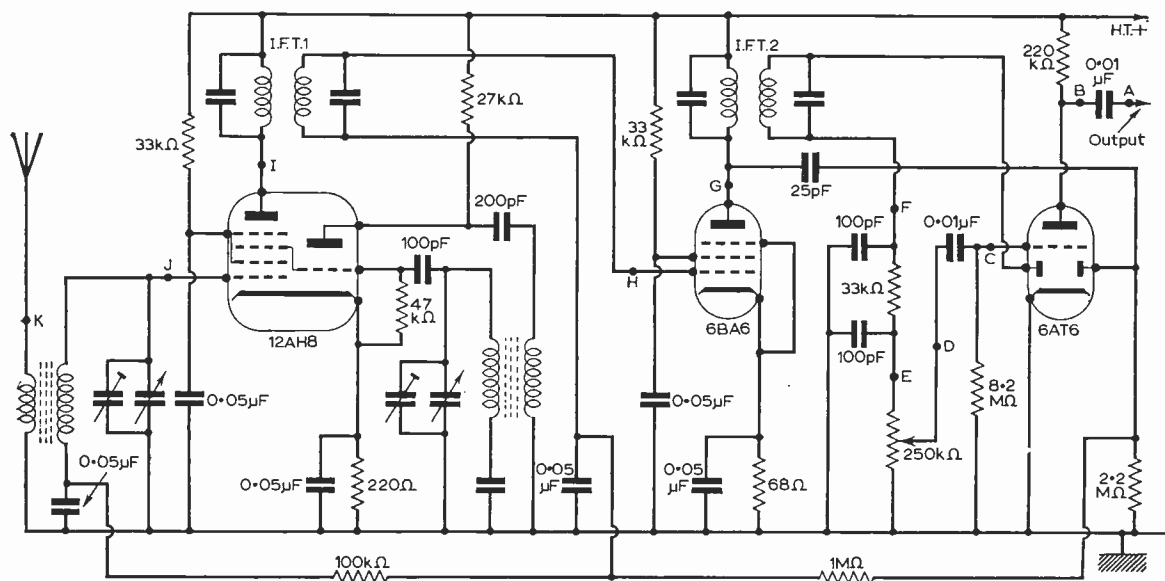


Fig. 7: Test points on a typical radio receiver. See text for details.

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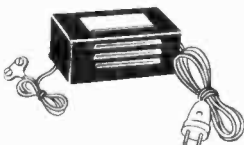
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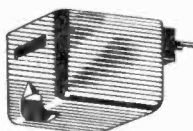
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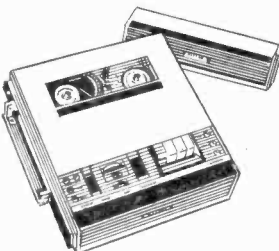


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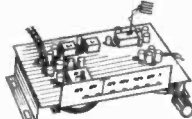


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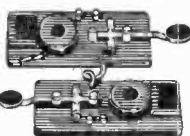
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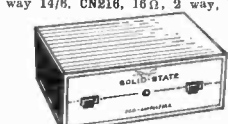
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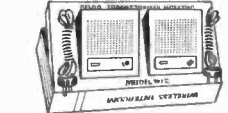


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Wide Range Signal Generator

—continued from page 770

to the valve and bias resistor. All trimming, core and i.f.t. adjustments are then directed towards minimum anode current, corresponding to minimum voltage on the meter. Unnecessarily strong signals should not be used.

When a.g.c. is from the i.f. anode, as in Fig. 7, the secondary of i.f.t.2 does not usually peak for maximum a.g.c. voltage (minimum i.f. stage anode current). It should then be peaked for maximum audio output. With some circuits this agrees with a slight dip in a.g.c. voltage.

COUPLING TO RECEIVER

For accurate alignment, coupling must be very loose. Enough input may be obtained for final adjustments by placing the output lead near the receiver aerial. Some receivers are supposed to be aligned with particular aerial pads or loads, such as a 400 Ω carbon resistor. Or the aerial trimming can be touched up, if necessary, when the aerial is connected. The generator lead should not be taken directly to any i.f.t. or tuned circuit which is being finally adjusted because the stray capacity will cause errors. Proper trimming tools should be used, not screwdrivers having only an insulated handle.

DIAL CALIBRATION

Tuning scales can be marked up for home built receivers by setting the generator to various frequencies, adjusting the receiver to them, and marking the dial. If the procedure detailed for calibrating the generator originally is noted, there will be little chance of errors from tuning in harmonics, or similar mistakes.

It is sometimes required to calibrate a narrow band on the receiver with great accuracy. This can be done by tuning the generator to a much lower frequency, and multiplying its output by the appropriate figure.

The 80 metre Amateur band provides an example of this method. This band is 3.5-3.8Mc/s. Locate 3.5Mc/s on the receiver by setting the generator to this frequency. Some error, due to visual reading, is most likely, but this 3.5Mc/s point is only temporary. The generator can then be tuned to 100kc/s so that its second harmonic is at zero beat with the BBC Light Programme on 200kc/s. A transistor portable or any convenient receiver can be used for this comparison of generator harmonic and BBC. The generator is now providing 100kc/s to a high degree of accuracy (so long as it remains at zero beat with the Light Programme) and harmonic marker pips will be tuned in at 3.5, 3.6, 3.7 and 3.8Mc/s with the Amateur band receiver, and can be written on its scale.

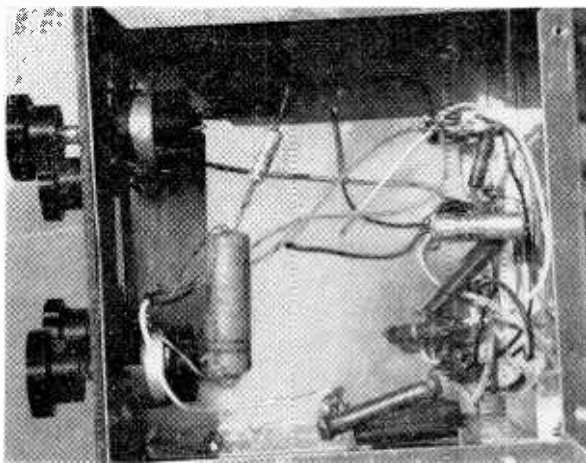
The upper limit to which low frequency harmonics may be detected depends on the receiver. For normal accuracy, harmonics need not be employed and the generator is tuned directly to the wanted frequency. ■

RECEIVER FOR 144 M/cs

—continued from page 755

slowly with an insulated tool, while checking coverage.

With VR2 near maximum, slowly turn up VR1 from its minimum position. When super-regeneration commences, a loud hiss will be produced. Turning back VR1 a little reduces this hiss, but if VR1 is rotated too far, super-regeneration will cease. With VR1 in the best position, VC1 can be peaked for maximum noise even with no aerial connected. With an aerial on, tuning VC1 should give quite a high noise level. With TC1 nearly open,



Under chassis view of the completed receiver.

resonance with VC1 can be expected around minimum capacity, increasing slightly as VC2 is closed.

When a usable signal is tuned in, the hiss should almost completely cease, and in these circumstances, peaking VC1 for maximum signal strength corresponds to minimum noise. With careful adjustment, very weak signals can be resolved.

If super-regeneration is not satisfactory, it may be worth changing R4 since surplus 6C4 valves seem to vary somewhat. If super-regeneration is absent, reduce R4 slightly in value. Alternatively, slightly increase the h.t. voltage by increasing the value of R10, or reduce the value of R9. On the other hand, should super-regeneration be difficult to control, slightly increase R4 in value, or reduce the h.t. voltage.

For a range of some miles, a vertical $\frac{1}{4}$ -wave aerial will do. This is about 19in. long. Signal strength at other than short range will be much improved by using a dipole. It may be wire supported from convenient points, or attached to insulators on a strip of wood, or self-supporting rods. The overall length is about 38in. In view of the very small size, a simple "X" or "H" aerial is also easily constructed, but some means of rotating it will then be needed. Various ready made or adjustable aeralis, and multi-element aeralis giving increased signal strength, can be obtained. At first, a dipole may be preferred. This is less effective, but has little directivity, so signals can be picked up from all directions. ■

PULSE COUNTING VHF RECEIVERS

DURING the past few years a number of circuits have been published describing the detection of f.m. signals using pulse counter discriminators. The purpose of this article is not to go over the already well trod ground of theoretical considerations, but to put forward a practical front-end. Figure 1 shows in block form the various stages needed for a pulse counting type of v.h.f. receiver.

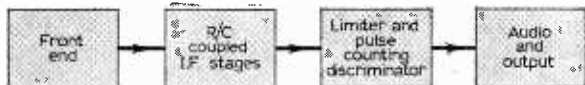


Fig. 1: Block schematic diagram of a pulse counting type of v.h.f. receiver.

Most of the circuits that have already been published employ crystal controlled oscillators in the front ends. These come rather expensive for the amateur—and for that matter the author. However, a circuit employing an autodyne frequency changer was located and found to be successful. This is shown in Figure 2.

FREE RUNNING OSCILLATOR

In simple terms, the autodyne frequency changer mixes the incoming signal with oscillations generated within the valve itself to produce an intermediate frequency. One of about 150 kc/s is required and is obtained fairly easily, since the bandwidth of most f.m. transmissions is in excess of this. As far as the operator is concerned, it's

The circuit shown in Figure 2 hooked-up to a direct-coupled amplifier worked first time and gave a good account of itself on all three v.h.f. sound transmissions put out by the BBC.

A small amount of drift did occur during the initial warming-up period but subsequently the oscillator held very firmly. The degree of oscillation controlled by VR1 is critical and may require a little patience to find the optimum point of working, but once set it can be forgotten.

It is possible that the oscillator could set up interference with neighbouring sets, although no trouble has been experienced in this direction by the author. Should this occur, a buffer r.f. amplifier ought to be fitted to isolate the oscillator from the aerial.

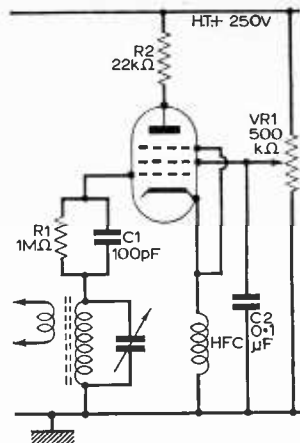


Fig. 2: Autodyne frequency changer.

PROTOTYPE CIRCUIT

For the sake of completeness, the original prototype circuit is shown in Figure 3. From a quick glance, one can see inexpensive EF91 valves have been used and tuned circuits have been kept to a minimum.

The inductance which may cause a little trouble is the main tuning coil. The author used a quarter-inch former, with an iron dust core, upon which he wound six turns of 20 s.w.g. enamelled copper

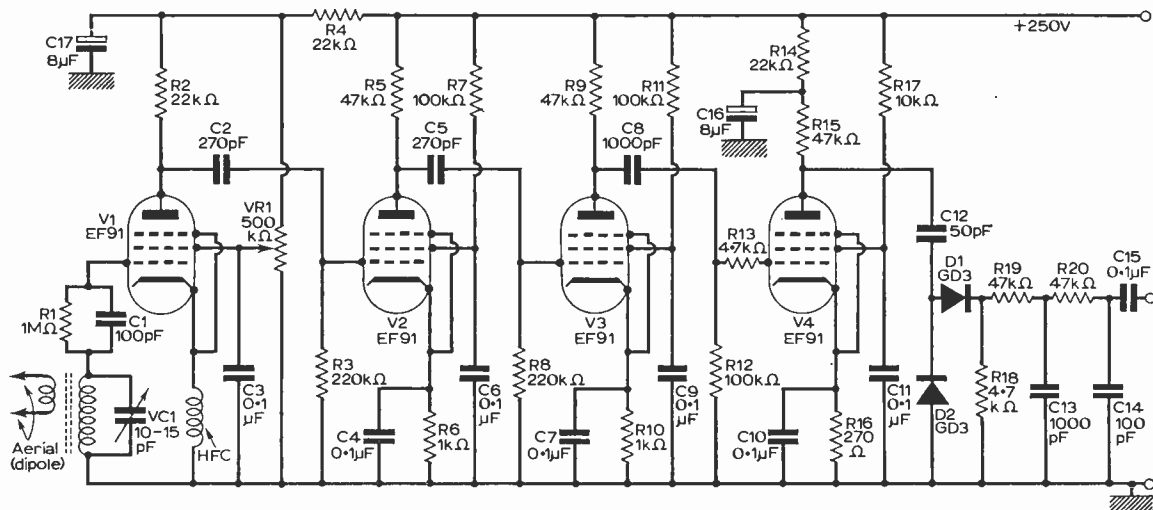


Fig. 3: Complete circuit of a pulse counting type of v.h.f. tuner.

a matter of de-tuning to one side of the centre frequency. It is, of course, much easier to tune-in a receiver with a slow-motion drive. The reason for selecting a low i.f. is that one can employ direct coupled amplifiers and dispense with all the usual tuned circuits.

wire. Due to the stray capacities, which play such an important part at these frequencies, it may be necessary to experiment by adding an extra turn or subtracting one to obtain the correct coverage. The r.f. choke in the cathode of V1 has a value of 1.5mH.

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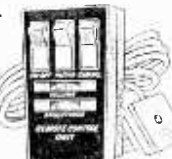
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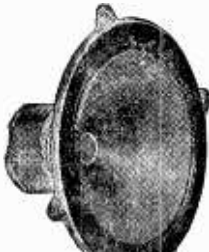
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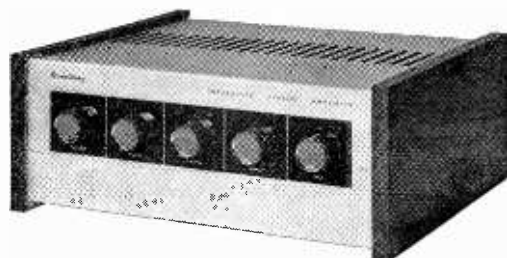
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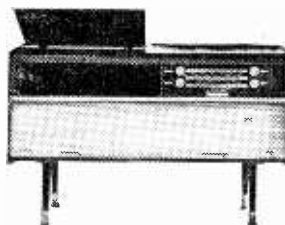


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There is a limit to the voltage that can be applied to the cathode of a valve when the heater is at chassis potential. In the case of the series regulator valves, the cathodes will be several hundred volts above chassis potential, and any attempt to run the heaters of these valves from an earthed heater supply is doomed to failure as the heater to cathode insulation will break down, leading to premature, and possibly violent, valve failure. It is therefore customary to run the heaters of such valves from a separate heater winding, well insulated from chassis and all points having a PD differing from the cathode. If this separate winding is centre tapped it can be connected to the cathode of the regulator valve. If not, it can be left floating or one side connected to a potential divider across the h.t. supply so that the heater is at or near the same potential, above chassis, as the cathode of the regulator valve. The cathode of the error amplifier will be from 85V to possibly 100V, or fractionally higher, above earth potential, a figure that is within the heater cathode rating of most valves likely to be used in this position, so that a separate heater winding will not be required.

E.H.T. SUPPLIES

The high e.h.t. voltages required by many oscilloscopes cannot always be supplied by voltage multiplying circuits. For instance, a common e.h.t. value is 2kV, and a common h.t. transformer secondary voltage is 350V, so that a X6 voltage multiplier would be necessary. Higher e.h.t. and/or lower transformer voltages would require even more multiplying elements, an uneconomical situation both electrically and financially. Under these circumstances alternative methods have to be adopted. The use of a mains transformer having the requisite voltage output is one possibility, but such transformers are not only expensive but potentially dangerous, in more ways than one. Although the smoothing capacitors rarely exceed 1 μ F, they are capable of delivering a considerable amount of instantaneous power which is measured in joules, a joule being equal to $\frac{1}{2} CV^2$ where C is capacity in farads and V the voltage they are charged to. The initial shock would be severe enough, but unfortunately, in this context, the current delivered by the transformer is sufficiently high to speedily recharge the capacitors. Continued contact with such a supply would cause local burning of the flesh and possibly death. Considerable care *must* be exercised when dealing with such a supply, and it should be carefully discharged before

being handled. The discharging of capacitors by means of a screwdriver should be avoided if at all possible, because the resulting bang is not good for people's nerves—and it certainly isn't good for the capacitor, as it is liable to fracture the dielectric. Instead, capacitors should be discharged by means of a resistor connected across them, values from a few kohms to a few hundred kohms being suitable. It is an excellent idea to fit high resistance bleeder resistors across all high voltage capacitors to automatically discharge them when the supply is disconnected. The working voltage—not current—of such resistors must be adequate. If in doubt, a number of series connected resistors could be used.

R.F. HIGH VOLTAGE SUPPLIES

The use of r.f. e.h.t. supplies have much in their favour, for although the voltage levels are comparable with transformer supplies, the current levels are very much lower. Although the initial shock will be as unpleasant as before, the r.f. oscillator will either cease working or, if it continues working, will do so at a much reduced efficiency. Continued contact with such a supply will therefore be far less hazardous than from a mains transformer supply. The r.f. supply will either consist of two valves, an oscillator and a power amplifier stage, or just one valve functioning as a self-oscillating power output stage, and this is the circuit shown in skeleton form in Fig. 11. The transformer for this consists of three coils, L1, L2, L3, which are usually wound on a Ferroxcube core. L1 and L2 comprise the anode to grid feedback windings which cause the valve to oscillate, L3 is the e.h.t. winding. The inductance of L1 in conjunction with C1 determines the oscillator frequency. The number of turns of L2 and their spacing from L1 determines the feedback voltage which should not be excessive, otherwise severe waveform deformation will occur. The number of turns for L3 determine the e.h.t. voltage. The operating frequency is a matter of compromise. The efficiency of the Ferroxcube transformer falls with decreasing frequency, whilst too high a frequency is liable to cause interference with nearby receivers. It is usual to choose a frequency in the 50kc/s to 100kc/s range and to enclose the e.h.t. unit in a screened box, with adequate decoupled h.t. and heater feeds. The valve must be a power type; EL84, EL34, 6L6 types being commonly used.

The components in a power supply are amongst the hardest working of any and it is therefore essential to devote care when selecting these components and assembling them together.

The smoothing capacitors are often electrolytics,

because these offer a greatly increased capacity, size for size, than paper capacitors, which makes them an attractive proposition where space is restricted. In some other respects they are inferior to paper capacitors, particularly where polarity and internal noise level is concerned. Connecting an electrolytic with reversed polarity or across an AV supply is almost certain to end in the capacitors explosive destruction. The leakage current of electrolytic capacitors is appreciably greater than paper capacitors, but even worse, from some aspects, is that the leakage current is not constant, but varies sporadically—hence the “noisy” capacitor. This current also increases with increasing voltage across the capacitor, with the result that the DV output contains not only a percentage of mains ripple, but also a percentage of capacitor noise. Capacitors that have been stored for any length of time are apt to have a low internal resistance, and will pass excessive current, which causes overheating, if connected across a source of high DV potential. This excessive current/overheating phenomenon is likely to be cumulative, culminating in another explosion. Such capacitors should be “formed” for a short while by connecting them to the DV potential via a moderate resistance of 10k Ω or so. This resistor will limit the flow of current so that the capacitor cannot overheat due to passing excessive current. An interesting way of demonstrating this would be to connect a high resistance (20k Ω /V) voltmeter across the capacitor and note the voltage across it on switching on, and then at fairly frequent intervals. At first the capacitor would pass a fairly heavy current (this could also be monitored by connecting a milliammeter in series with the capacitor) and the voltage would be low. As the capacitor was “formed”, its current leakage would decrease, and the voltage would increase, until a state was reached when the voltage and/or current remained constant. At this stage the capacitor could be considered to be fully formed. The practice of using an expensive multimeter to measure leakage current directly is fraught with danger, because should the capacitor suddenly go s/c or pass an excessive leakage current, the chances are that the meter movement will suffer.

WATCH THE CAPACITOR RIPPLE RATING

One aspect of capacitors that is often overlooked is that in the process of smoothing the pulsating or raw DV from the rectifier, they have to pass what may easily be an appreciable AV current. In this respect, the reservoir capacitor, i.e. the capacitor following the rectifier, has to pass the greatest current, and the smoothing capacitor, i.e., the capacitor on the load side of the smoothing choke or resistor, the least current. This can be easily visualised if one remembers that the unwanted ripple voltage has to be “lost” somehow, and the only way of doing this is to short circuit it to earth via the reservoir and smoothing capacitors. These components must therefore possess an adequate a.c. ripple rating which will be greater than the mean DV current by a factor of $\sqrt{2}$.

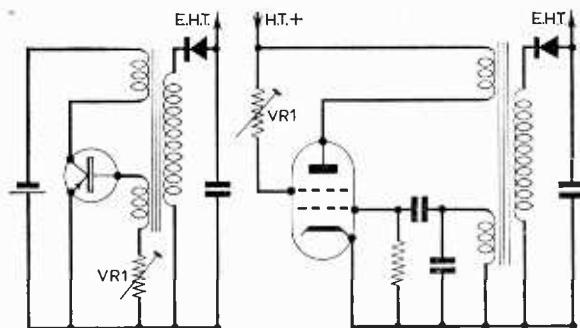


Fig. 11: Transistor and valve e.h.t. oscillators.

In the part of the article dealing with stabilised power supplies it was stated that the series regulator valve could consist of several valves in parallel if the current capacity of a single valve was inadequate. This, of course, is perfectly true, but needs a little further elaboration. Since the combined slope of a number of valves in parallel is the sum of the individual valves' slopes, the chances of instability increase with every additional valve. Generous use of grid stoppers around 1k Ω to 10k Ω plus anode and screen stoppers at 10 Ω and 100 Ω or thereabouts respectively would minimise the chances of instability. It is essential that these stoppers are wired as close to their respective pins as possible.

SITING COMPONENTS

The positioning of components on a chassis must also be considered. Rectifiers in common with other valves have an aversion to being in a strong magnetic field and should therefore be positioned as far from the mains transformer as is practicable. Failing this they should be positioned where the magnetic field is least, i.e. at right angles to the core. Wherever possible other inductors should be positioned with their cores at right angles so that mutual coupling is at a minimum.

Finally, we come to heat, and lots of it, too, for

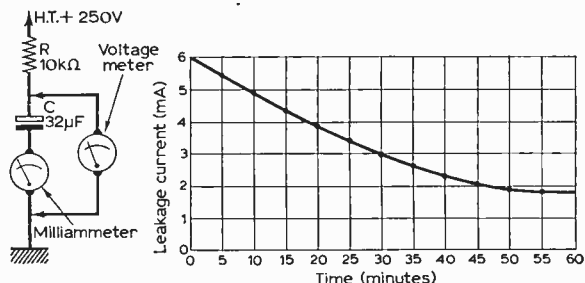


Fig. 12: Simple method showing how to measure leakage current and voltage.

much of the energy in a power pack is dissipated as heat. If the power pack is to give long and trouble free service, adequate ventilation is absolutely essential. Without it, all the care taken in the choice of components, and in their integration as a working whole, will be set at naught. ■

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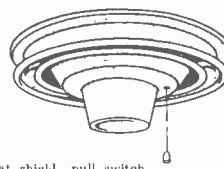
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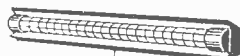
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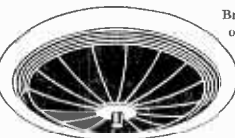
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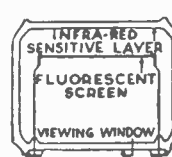
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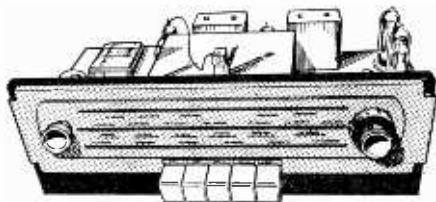
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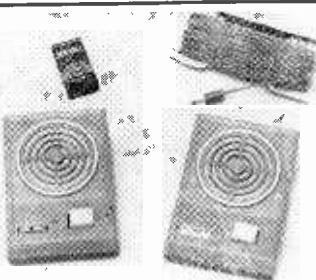
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No. 14

FAREHAM & DISTRICT AMATEUR RADIO CLUB

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FAREHAM'S radio club was formed, like so many others, by two or three amateurs meeting informally and "chewing the rag". Just two years ago an inaugural meeting was arranged and well over a dozen potential members crammed into the lounge of the first elected Secretary's QTH. From this encouraging response it was obvious that there was sufficient local interest to put things on a proper basis and so the Club was born.

Just one week later saw the first activity in the form of a world wide contest for which a station was set up on the stage of a disused school hall. This venture, apart from being the first introduction to "ham radio" for several members, was nearly a full scale disaster. Hooligans tore down the antenna, the weather was bitterly cold and the mains power supply all but melted. Far from being disheartening, the experience cemented all those who froze through the night into a club with spirit.

The first problem was that of accommodation and it was decided to hold monthly meetings in the back room of one of the local hostelrys. With an equal membership of licensed amateurs and SWL's the pattern of these enjoyable evenings was soon established with slow morse for beginners, talks by the older hands on some of the mysteries, or perhaps a demonstration of someone's latest acquisition, followed by the inevitable natter over a "jar".

The Sunday morning net helped a good deal in the early days to catch many SWL's and others so that within a few short months the membership exceeded thirty. Biggest trouble was the provision



Club President G2QK directs operations. Left to right—G3PMM, G3VFI, Junior Op, G3VLY, G3TZM, G3VOR, SWL Brian.

of transmitting facilities and more suitable accommodation was sought by the Club's President.

After much negotiation and effort the club found its permanent QTH at the Portchester Community Association. This meant a move away from the town centre and it was decided to change the Club's name to one more in keeping with the new circumstances. Meetings were now held every Sunday and before long such was the demand that an additional evening for practical work was arranged. Once again members rallied to the cause and workshop facilities were obtained together with an adequate supply of the usual tools.

Sundays are now set aside for more organised activities and a full and varied winter programme is under way. This takes the form of a monthly lecture or demonstration, the remaining evenings being reserved for discussions, informal talks and quizzes.

Memorable occasion recently was when a new call-sign broke into the Sunday morning net. The newcomer turned out to be not only a club member but the Chairman himself.

Regular features in the club calendar are the Fareham Fair and the local Gymkhana. These give club members the opportunity to set up a temporary station, younger members looking after the usual tree climbing.

The Club now has a membership of over 40 with 16 licences, interests ranging from Top Band DX to the technicalities of u.h.f. Now with its own AR88D, a respectable antenna system almost completed and a newly acquired all band transmitter, the club is well and truly "on the air".



The club station in action. Left to right—G3VEL, G3TZM, and SWL Jack.



TAPE RECORDING YEARBOOK—1966
Published by Print and Press Services Ltd.
128 pages, 9 × 5½in. paperback. Price 7s. 6d.

FOR those who, like the reviewer, spend their working days immersed in the technicalities of tape recording, this annual collection of facts and figures is an indispensable reference. The current issue is no simple reprint, but has been brought as nearly up-to-date as publication times allow, thus providing current information on tape recorders, decks, mixers, microphones, radio tuners and miscellaneous accessories. In addition, the important section on manufacturers and agents has been revised and is a directory of real value.

For the ordinary enthusiast, the Yearbook offers comprehensive data on many different machines, plus articles of interest by well-known writers in this field dealing with recording, using microphones and tape-plus-cine respectively.

The catalogue section follows the same form as in previous years. The only omission we would like to see rectified is the input and output impedance and sensitivity specification—but, after all, for 7s. 6d., one cannot expect everything. As it is, we certainly get our money's worth.—HWH.

TAPE RECORDERS—HOW THEY WORK
By Charles G. Westcott and Richard F. Dubbe
Published by Foulsham-Sams Technical Books Ltd.
177 pages, 8½ × 5½in., hard covers. Price 24s.

SLIMMER, neater, and two shillings cheaper, this is the latest edition of the successful volume reviewed in the September 1965 issue of *Practical Wireless*.

To achieve the fining down, the publishers have used a cleaner type, omitted the final chapter on Special Applications, and small parts of other chapters, whittled the less necessary diagrams and applied the blue pencil to some of the text.

One could argue with the choice of material to be omitted: Chapter 5, on Recording Level Indicators, renamed *Volume Indicators* has some useful information expunged and five whole pages on pre-amplifier design have been dropped from Chapter 8. It is perhaps fortunate that the excellent chapter on motors has been tidied and retained.

More serious is the information that should have found its way into a new edition to bring it more up-to-date. There is still no admission that alternative systems to NARTB exist. DIN/CCIR would seem to be a myth, and in the chapter on equalisation this error is compounded by a complete avoidance of explanation of the time-constant specification of recording characteristics: quite unforgivable in a semi-technical work such as

this. Again, quarter-track recording and the various facilities it affords are not mentioned, neither is videotape, and a passing reference to head-gaps gives a limitation of 0.00025in., now regarded as "barn-door" dimensions by the better manufacturers.

This is a pity, for the book as a whole is a commendable addition to the enthusiast's library. Despite which, this reviewer will cling to his original copy and hanker after the book that some British authority will some day produce along the same lines. Recommended—but with reservations.—HWH.

INSTRUCTIONS TO RADIO CONSTRUCTORS.
By R. H. Warring. Second edition, published by Museum Press Ltd. 144 pages. Size 8½ × 5½in. Price 15s.

WHEREAS the first edition covered basic radio theory and the design and construction of simple receivers, the second edition is more ambitious and includes quite a lot more information. For instance, a chapter on the design and construction of home printed circuits has been added. Another new chapter deals with the design and construction of the smaller transistor receivers. The original series of circuit designs have been retained, as these are—to quote the author—well proven in performance.

Some thirty pages of this book are devoted to appendices, which range from broadcast frequency details and how to calculate circuit component values to data on the valves and transistors specified in the various circuits. An appendix is also included on receiver faults, but is not very comprehensive.

This book would make suitable reading for those who would like to begin constructing, yet have no knowledge whatever of the subject.—JRC.

TRANSISTOR ETCHED-CIRCUIT PROJECTS
By James Kyle. Published by W. Foulsham & Co. Ltd.
144 pages. Size 8½ × 5in. Price 24s.

THIS novel publication deals with the use of printed circuits in home constructed gear and contains a number of actual negatives for the boards used in the various circuits given in the body of the book. These circuits range from an extremely simple potential divider network—called the volter—to an 80 metre c.w. transmitter.

The first chapter contains a lot of information on printed circuits, from which the average home constructor should be able to knock-up his own circuits at little expense. The following chapters deal with various projects, some very simple and which could be put together with a minimum of knowledge.—JRC.

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6BA6	5/-	68Q7GT	6/-	2166GT	5/-	81J	35/-	
6BA7	5/-	68S9	2/-	22V5	6/-	81B	35/-	
6BB7	7/-	68T7	3/6	22Z6	6/-	81B	35/-	
6BJ6	7/6	6V6G	5/-	25T5	7/6	830B	4/-	
6BJ7	7/-	6V6GT	7/6	25Z6GT	8/6	832A	45/-	
6BQA7	3/-	6V6M	8/-	30I7	0/-	844	5/-	
6BWB	7/-	6X4	3/-	30	5/-	950A	14/-	
6C3W	7/-	6C3GG	5/-	30P15	11/-	954	10/-	
6C	9/2	6C4	5/3	30P19	11/-	954	4/-	
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6CL6	9/-	7H17	7/3	30P12	9/-	1626	0/-	
6CW4	12/-	7Q7	7/-	30P19	13/-	1626	3/-	
6C36	6/-	7Q7	10/-	30P19	13/-	1629	4/-	
6E5	6/-	7T7	5/-	30P13	15/-	2043	3/-	
6F5GT	5/9	7Y4	8/-	30PL14	15/-	4063G	35/-	
6F6G	4/-	7Z4	4/6	3516GT	7/-	4063	8/-	
6F7	6/-	8D2	2/6	35T	17/8	4313G	20/-	
6F8G	6/6	9D2	3/-	35W4	5/-	6704	5/-	
6F12	4/-	9D2	3/-	35B6	6/-	6706	5/-	
6F13	5/-	10F9	9/-	35Z4GT	6/-	7276	7/-	
6F14	5/-	12A6	2/6	35Z5GT	6/-	6064	7/-	
6F32	4/-	10P14	15/-	37	4/-	6065	0/-	
6F33	20/-	12A7	5/-	37	4/-	6080	23/-	
6F36	1/6	12A7	4/-	50B6	6/-	6080	23/-	
6H6M	1/6	12A7	4/-	50CDE6C27	7/-	7193	13/-	
6J4WA	1/-	12AV6	5/6	50L6GT	8/-	7475	2/-	
6J5	6/-	12A7	5/-	53A	7/8	8013A	25/-	
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6J8G	3/6	6/-	12A7	5/8	58	6/-	8061	3/-
6J9W	5/-	6/-	12A7	5/8	59	6/-	8002	15/-
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6J7M	5/-	12BA6	5/-	76	5/-	9004	2/6	
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68J7	7/6	19G7	10/-	717A	15/-	25.10A		
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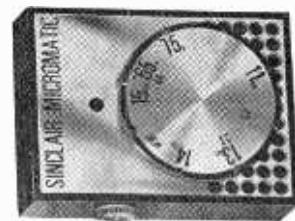
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Complete kit of parts to build Sinclair Micromatic as described including lightweight earpiece, instructions and guarantee.

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READY BUILT

Sinclair Micromatic as described with lightweight earpiece, complete in presentation case and guaranteed.

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THE SINCLAIR MICROMATIC is a brand new design from an organisation world-famous for its production of micro-electronic equipment for the constructor. It has behind it the Sinclair tradition of specialisation in micro-radio circuitry which in the MICROMATIC reaches fantastically high levels of performance. We have combined new circuitry with new elegance to make the SINCLAIR MICROMATIC professionally right in every detail, whether you build it yourself or buy it complete in presentation case.

It is the perfect personal radio, ready to serve wherever and whenever required. Its minutely proportioned case houses

transistors, ferrite rod aerial and batteries and yet is considerably smaller than an ordinary matchbox. It has an elegantly designed aluminium front panel with matching calibrated slow motion dial. New circuitry assures reception from a wide range of stations over the medium waveband, with excellent selectivity and audio quality. This is a set you will be proud to be seen using; you will also find it an ideal gift to give anyone. YET THIS BRILLIANT NEW SINCLAIR DESIGN IS THE EASIEST OF ALL SINCLAIR RADIO SETS TO BUILD—AND IT IS 100% BRITISH!

SINCLAIR MICROMATIC

TECHNICAL SPECIFICATION

The micromatic employs a newly developed six stage transistor circuit of exceptional power and sensitivity. Two stages of powerful R.F. amplification are followed by a double diode detector from which the signal tuned in is passed to a high gain three stage audio amplifier. Automatic Gain Control counteracts fading from distant stations and maintains signal strength. The set is powered by two Mallory Mercury Cells Type ZM.312 which are readily obtainable from radio shops, Boots Chemists, etc., and cost 1/7 each. They will give approximately 70 hrs. continuous working life. Inserting the earpiece plug switches the set on, withdrawing it switches off. The Sinclair Micromatic is housed in a neat plastic case with attractive aluminium front panel and spun aluminium tuning dial to match, calibrated in kc/s.

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SINCLAIR MICRO FM

The only set of its kind in the world

- 7 Transistors
- For use both as an FM Tuner and pocket receiver
- Needs no alignment
- Pulse counting discriminator
- Tunes 88-108 Mc/s
- Signal to noise ratio: 30db at 30 micro V
- Sizes: $2\frac{1}{16} \times 1\frac{1}{16} \times \frac{3}{4}$ in.
- Anyone can build it

This unique, superbly engineered super-het FM set is completely professional in styling inside and out. Designed essentially for the listener seeking the best possible quality, the performance of the Micro FM is fantastic. It is the only set in the world which can be used both as an FM tuner and as an independent FM pocket receiver just whenever you wish. Where problems of alignment have previously made it impossible for a constructor to complete an FM set for himself have been completely eliminated in this unit, and it is ready to use the moment you have built it. The pulse counting discriminator ensures best possible audio quality; sensitivity is such that the telescopic aerial included with the kit assures good reception in all but the very poorest reception areas. The Sinclair Micro FM will give you all you want in FM quality reception as well as the satisfaction of building a unique design that will save you pounds.

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Complete kit inc. telescopic aerial, case, earpiece and instructions.

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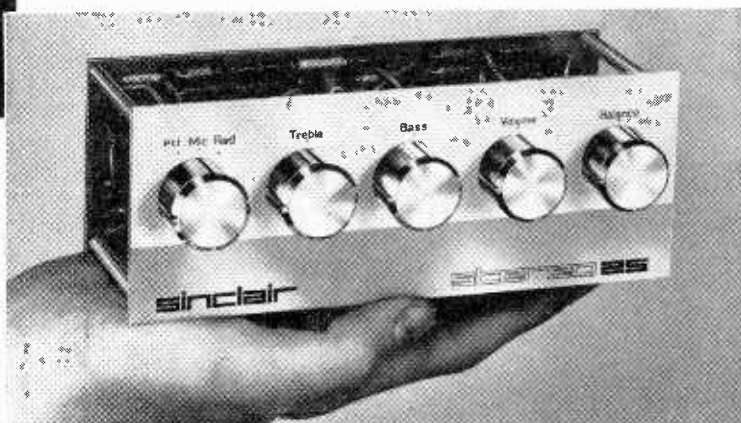
SINCLAIR STEREO 25 ALL-PURPOSE DE-LUXE PRE-AMP/CONTROL UNIT

Here is a pre-amp/control unit designed for the exacting enthusiast wishing to have the very best. It incorporates the finest possible matched components in circuitry developed specially by Sinclair Radionics own research laboratories. The SINCLAIR STEREO 25 Pre-amplifier and Tone Control Unit is ideal in any stereo system where it is intended to take fullest advantage of today's best amplifier and auxiliary equipment systems. When the output from the stereo 25 is fed to two Z.12s, there is even great advantage in the appreciable saving in what you need spend to get first class hi-fi. In appearance, the Stereo 25 reflects the professional elegance which characterises all Sinclair designs. The front panel is in solid aluminium brush finished and polished in horizontal sections. Solid aluminium knobs are fitted. Mounting the unit is simple and it will enhance any hi-fi furnishing scheme in which it is used. A PZ.3 is recommended for powering the Stereo 25 and two Z.12s stereo assembly. For complete hi-fi coverage a Sinclair Micro FM should be used for the radio section.

TECHNICAL DESCRIPTION

Double-purpose FM unit using 7 transistors and 2 diodes. R.F. amplifier is followed by a self-oscillating mixer and three stages of I.F. amplification. The low I.F. employed in this set enables the problems of I.F. transformers and alignment to be eliminated. A pulse-

counting discriminator ensures better audio quality. One output is for feeding to amplifier or recorder and the other enables the Micro FM to be used as a pocket receiver. A.F.C. "locks" the programme tuned in. The telescopic aerial included is sufficient in all but the worst signal areas.



TO BRING THE BEST OUT OF ANY HI-FI EQUIPMENT

TECHNICAL DESCRIPTION

Performance figures obtained with the Stereo 25 fed to two Z.12s, powered by a PZ.3.

- **SENSITIVITY** for 10 watts into 15. ohms load per channel.
Mic.—2 mV into 50K ohms.
Pick-up—3 mV into 50K ohms.
Radio—20 mV into 4.7K ohms.
- **FREQUENCY RESPONSE** (Mic. and Radio)—25 c/s to 30 kc/s ± 1 dB extending to 100 kc/s ± 3 dB.
- **EQUALISATION**—Correct to within ± 1 dB on RIAA curve from 50 c/s to 20 kc/s.

- **● TONE CONTROLS**
Treble + 12dB to -10dB at 10 kc/s.
Bass + 15dB to -12dB at 100 c/s.
- **● SIZE**—6 $\frac{1}{2}$ in. $\times$ 2 $\frac{1}{2}$ in. $\times$ 2 $\frac{1}{2}$ in. overall, plus knobs.
- **● FINISH**—Front panel sectioned in brushed and polished solid aluminium with solid aluminium knobs. Black figuring on front panel.

Ready built, tested and guaranteed.

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SINCLAIR PZ.3 POWER SUPPLY UNIT

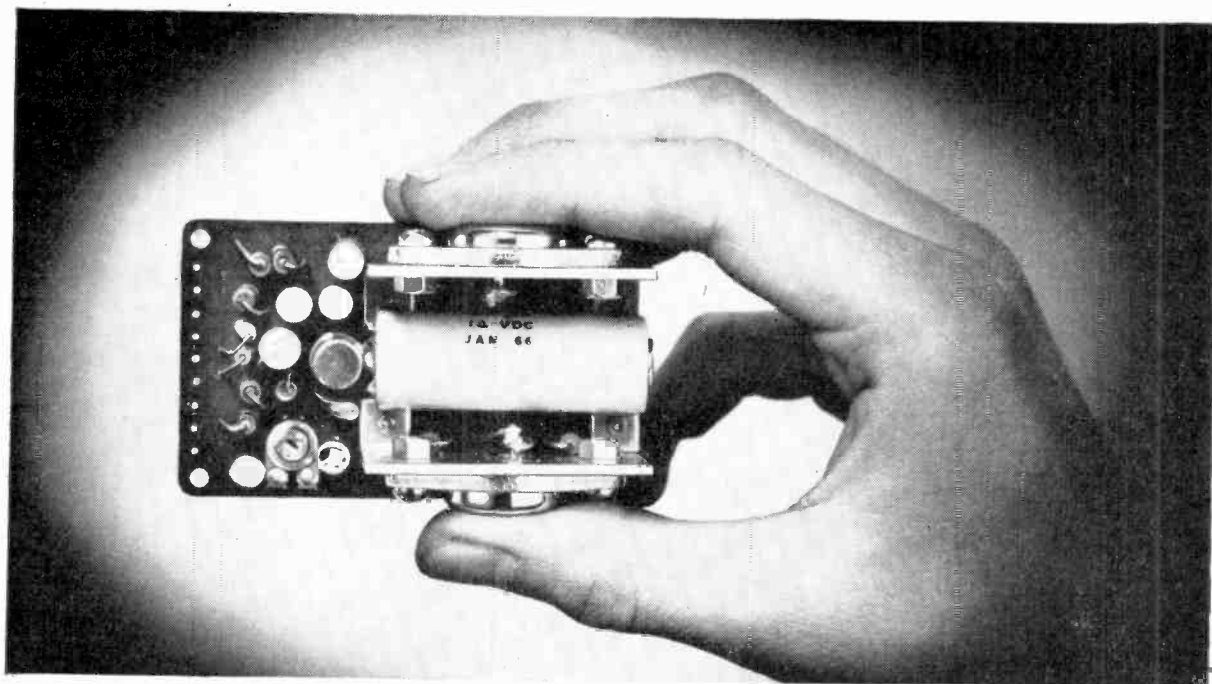
Transistorised techniques are used to achieve phenomenally good smoothing, thus assuring ideal operating conditions. Ripple is a barely measurable 0.05 v. Will power two Z.12s and the Stereo 25 with ease.

79/6

★ **SINCLAIR MICROMATIC** See previous two pages



SINCLAIR RADIONICS LTD, 22 Newmarket Rd., CAMBRIDGE
Telephone 52996 (STD Code OCA3)



SINCLAIR Z.12

12 WATT HI-FI AMPLIFIER AND PRE-AMP

12 WATTS R.M.S. OUTPUT (24 w. peak)
15 WATTS R.M.S. Music Power (30 watts peak)

IDEAL FOR HI-FI, GUITAR, CAR RADIO, P.A., INSTRUMENTATION, INTERCOM, Etc.

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

89/6

Constructors and experimenters find that the amazing adaptability and rugged construction of this very powerful and exceptionally compact amplifier make it possible to use just one type of unit with outstanding success in an unusually wide variety of applications. Eight special H.F. transistors are used in a highly original circuit to achieve the characteristics demanded of any quality amplifier irrespective of price, yet this Sinclair unit costing only 89/6 includes its own integrated pre-amplifier. The Z.12 accepts radio, microphone and pick-up inputs. Detailed instructions for connecting them, matched for mono and stereo, are given in the manual supplied with every unit. The Z.12 can be operated from any supply between 6 and 20V., but where it is required to run the Z.12 from mains supply, the PZ.3 is recommended. Those wishing to have a ready-made pre-amp control unit can feed inputs via the Stereo 25 which, with two Z.12s, will provide the finest stereophonic hi-fi possible—and the saving cost is considerable.

TECHNICAL DESCRIPTION

- Size 3in. X 1½in. X 1½in.
- Class "B" ultra-linear output.
- **RESPONSE** 15-50,000 c/s ± 1 dB.
- Suitable for 3, 7.5 or 15Ω speaker. Two 3Ω speakers may be used in parallel.
- **INPUT**—2mV into 2kΩ.
- **OUTPUT**—12 watts R.M.S. continuous sine wave (24 w. peak); 15 watts music power (30 w. peak)
- Signal to noise ratio better than 60dB.
- Quiescent current consumption—15mA.

"May I congratulate you on your Z.12 amplifier. I find it excellent."
M.C., Lancing Sussex.

"I should like to express my very considerable satisfaction with the micro F.M. (It) worked perfectly from the moment the battery was connected. (It) is equally as good as one which I have also used and costs over five times as much."
L.E.H., Harrogate, Yorks.

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Should you not be completely satisfied with your purchase when you receive it from us, your money will be refunded in full and at once without question. In addition, the Sinclair Micromatic is guaranteed for 5 years.

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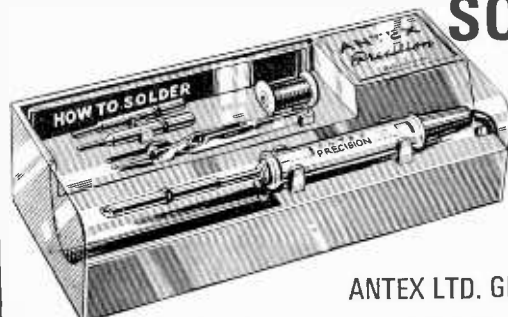
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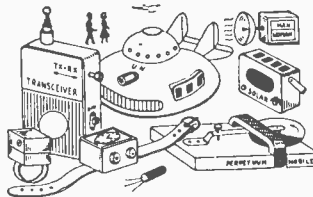
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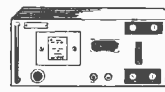
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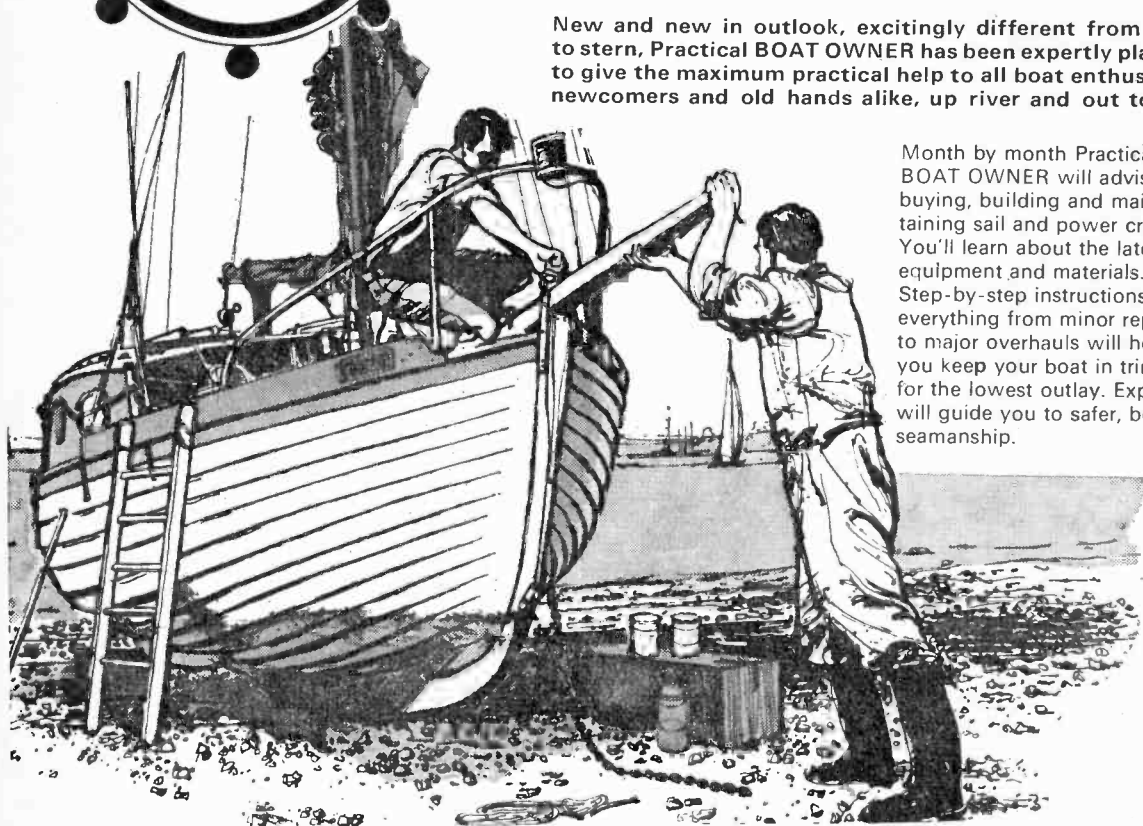
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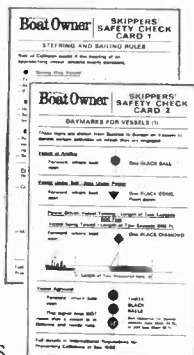


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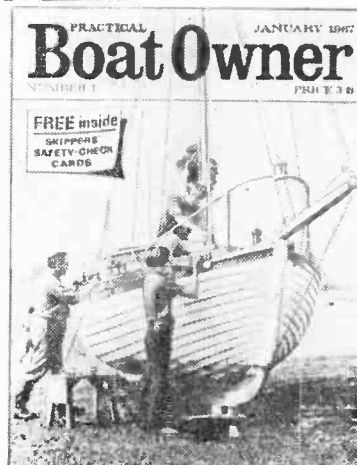
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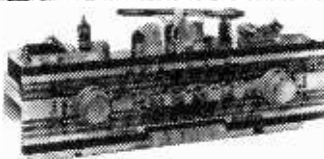
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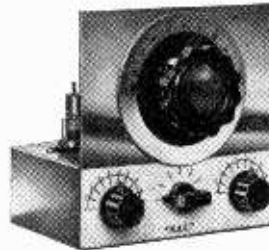
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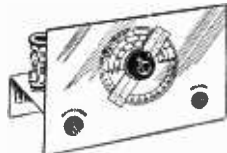
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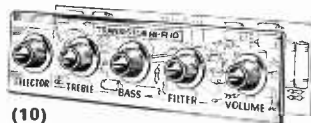
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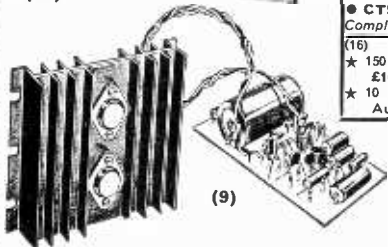
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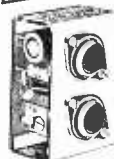
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